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AMERICAN PRACTICAL NAVIGATOR,

BEING AN

EPITOME

OF

NAVIGATION AND NAUTICAL ASTRONOMY.

 $\mathbf{B}\mathbf{Y}$

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> Revised in 1880, under the direction of the Bureau of Navigation, Navy Department,

> > BY

COMMANDER P. H. COOPER, U. S. NAVY.

Revised in 1903, under the direction of the Bureau of Equipment, Navy Department,

BY

LIEUTENANT G. W. LOGAN, U. S. NAVY.

WASHINGTON: GOVERNMENT PRINTING OFFICE.



ORDERS RELATING TO REVISION.

BUREAU OF NAVIGATION, Navy Department, January 1, 1881.

In accordance with the purpose contemplated in the purchase of the copyright of the NEW AMERICAN PRACTICAL NAVIGATOR, a thorough and complete revision has been made by Commander P. H. Cooper, U. S. Navy, acting under the direction of the Bureau. The revision eonsists principally in the substitution of the more concise and convenient methods of the present day for the obsolete methods of the past, and a complete rearrangement under proper chapters and paragraphs for ready reference, keeping in view, however, the character of the work as a Practical Navigator.

The revision having been completed, it was submitted to Capt. Ralph Chandler, U. S. Navy, for a final review, and having received a satisfactory report from that officer it has been accepted by the Bureau and will hereafter be substituted for the former editions of the work.

> WILLIAM D. WHITING, Chief of Bureau.

BUREAU OF EQUIPMENT, Nary Department, March 18, 1903.

A revision of Bowditch's AMERICAN PRACTICAL NAVIGATOR having become necessary, the work has been completed by Lieut. G. W. Logan, U. S. Navy, under the supervision of the Hydrographer to the Bureau of Equipment. The revision was approved by a Board consisting of Capt. Colby M. Chester, U. S. Navy, Commander C. J. Badger, U. S. Navy, and Lieut. Commander C. C. Rogers, U. S. Navy. It is directed that this revised edition be substituted for all former editions.

> R. B. BRADFORD, Chief of Bureau.

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PREFACE.

The copyright of the NEW AMERICAN PRACTICAL NAVIGATOR, by the late Dr. Bowditch, became the property of the United States Government under the provision of an act of Congress to establish a Hydrographic Office in the Navy Department, approved June 21, 1866.

Under the direction of the Bureau of Navigation, at that time charged with such publications, the work was revised in 1880 by Commander P. H. Cooper, U. S. Navy, certain chapters being contributed by Lieuts. Richard Wainwright and Charles H. Judd, U. S. Navy, and the whole being reviewed by Capt. Ralph Chandler, U. S. Navy. The object of this revision was to improve the general arrangement, and to introduce the more convenient and precise methods of navigation that had come into practice since the book was originally written.

The progress that has been made in the science of navigation since 1880 has rendered necessary a second extensive revision, to take cognizance of the changes of methods and instruments that have accompanied the general introduction of high-speed vessels built of iron and steel. This work has been carried out, under the direction of the Bureau of Equipment, by Lieut. G. W. Logan, U. S. Navy, who was aided in the collection of data and preparation for publication by Lieut. T. A. Kearney, U. S. Navy; the chapters on Winds and Cyclonic Storms were contributed by Mr. James Page, nautical expert, Hydrographic Office.

There has been an extensive rewriting of the text, with the object of amplifying those matters that are of the greatest importance in the modern practice of navigation, and of omitting or condensing those of lesser importance; and the revision of the tables has proceeded along similar lines. This has involved, among other things, a much wider treatment of the subject of the compass; an extension of the traverse table for degrees to distances up to 600 miles; an improved table for reducing circummeridian altitudes; the combination of the tables of maritime positions and tidal data; the omission of certain special methods for finding position by two observations; the addition of a series of annotated forms for the working of all sights, and the introduction of a number of new tables of use to the navigator.

The explanation of the method of lunar distances, with its accompanying tables, has been retained, in order to be available for use when required; but since this observation is so rarely employed in modern navigation, everything pertaining thereto has been incorporated in an appendix, that it may be distinct from matter of every-day use to the navigator.

For convenience in use the work has been divided into two parts, of which the first comprises the text and its appendices, and the second the tables.

> W. H. H. SOUTHERLAND, Commander, U. S. Navy, Hydrographer.

HYDROGRAPHIC OFFICE,

BUREAU OF EQUIPMENT, NAVY DEPARTMENT, Washington, D. C., March 19, 1903.

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PART I.

TEXT AND APPENDICES.

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ABBREVIATIONS USED IN THIS WORK.

Alt. (or h)	.Altitude.
A. M	Ante meridian.
Amp	. Amplitude.
App	Apparent.
App. t	Apparent time.
Ast	Astronomical.
Ast. t	Astronomical time.
Aug	Augmentation.
Az. (or Z) \ldots	Azimuth.
C	.Course.
<u>C.</u> C.	Chronometer correction.
<u>C</u> –W	Chronometer minus watch.
Chro. t.	Chronometer time.
Co. L	.Co. latitude.
Col	.Column.
Corr	Correction.
Cos	Cosine.
Cosec	.Cosecant.
Cot.	Cotangent.
d (or Dec.)	Declination.
D (or DLo)	Difference longitude.
Dep	Departure.
Dev	Deviation.
Diff	Difference.
Dist	Distance.
	Difference latitude.
D. K.	Dead reckoning.
E., Ely	East, easterly.
Elap. t.	Elapsed time.
Eq. eq. alt	Equation equal altitude
Γ_{q} , t_{1}	Figuration of time.
G. (or Gr.)	Greenwich.
С. М. Т.	Greenwich apparent .ne.
С. М. 1	Greenwich mean time.
G. S. 1	Altitude
и	Moridian altituda
$\mathbf{H} = \mathbf{H} + $	Homonale
\mathbf{H} \mathbf{A} . (or t)	Hourly difference
$\mathbf{H} \mathbf{P} \left(\mathbf{o} \mathbf{H} \mathbf{H} \mathbf{o} \mathbf{n} \mathbf{h} \mathbf{o} \mathbf{n} \right)$	Horigontal paraller
Hra	Houng
нн	High water
I C	Index connection
$\mathbf{I} (\text{or } \mathbf{I} \text{ ot })$	Latitudo
и. (ог цан.) Т А Т	Laural apparent time
	Local apparent time.

L. M. T	Local mean time.
L. S. T	Local sidereal time.
Lo. (or Long)	Longitude.
Log	Logarithm.
Lun. Int.	Lunitidal interval.
L. W	Low water.
m	Meridional difference
Marid	Meridian or noon
Mag	Magnetic
M D	Minuto's difference
Mid Mid	Middle
Mil I	Middle letitude
MIG. L.	Middle latitude.
M. T	Mean time.
N., NIY	North, northerly.
N. A. (or Naut. Alm.).	Nautical Almanac.
Np	Neap.
Obs	.Observation.
p (or P. D.)	Polar distance.
p. c	Per compass.
P. D. $(or p)$	Polar distance.
P. L. (or Prop. Log.).	Proportional logarithm.
P. M.	Post meridian.
p. & r	Parallax and refraction.
Par	Parallax.
R A	Right ascension.
RAMS	Right ascension mean sun.
Red	Reduction
Ref	Refraction
S Sly	South southerly
S D	Semi-diameter
5. D	Soont
e; J	Sidoroal
610	Sino
Sin	Sine.
ppg	. Spring.
<i>l</i>	nour angle.
T	m. lime.
Tab	Table.
Tan	Tangent.
Tr. (or Trans.)	Transit.
Var	Variation.
Vert	Vertex or vertical.
W., Wly	. West, westerly.
W. T	. Watch time
<i>z</i>	.Zenith distance.
Z	Azimuth.

SYMBOLS.

0	Degrees.

- Minutes of Arc.
- // Seconds of Arc.

h Hours.

- Minutes of Time. m
- s Seconds of Time.

GREEK LETTERS.

The Sun. The Moon. A Star or Planet. Alt. upper limb. Alt. lower limb.

Azimuthal angle.

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 $\begin{array}{l} N \ \nu & \dots & \mathrm{Nu.} \\ \Xi \ \xi & \dots & \mathrm{Xi.} \\ O \ o & \dots & \mathrm{Omieron.} \\ \Pi \ \pi & \dots & \mathrm{Pi.} \\ P \ \rho & \dots & \mathrm{Rho.} \\ \Sigma \ \sigma \ (\varsigma) & \dots & \mathrm{Sigma.} \\ T \ \tau & \dots & \mathrm{Tau.} \\ T \ \tau & \dots & \mathrm{Upsilon.} \\ \varphi \ \phi & \dots & \mathrm{Phi.} \\ X \ \chi & \dots & \mathrm{Chi.} \\ \Psi \ \psi & \dots & \mathrm{Psi.} \\ \Omega \ \omega & \dots & \mathrm{Omega.} \end{array}$

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CHAPTER L

DEFINITIONS BELATING TO NAVIGATION.

1. That science, generally termed Navigation, which affords the knowledge necessary to conduct a ship from point to point upon the earth, enabling the mariner to determine, with a sufficient degree of accuracy, the position of his vessel at any time, is properly divided into two branches: Navigation and Nautical Astronomy.

2. Navigation, in its limited sense, is that branch which treats of the determination of the position of the ship by reference to the earth, or to objects thereon. It comprises (a) *Piloting*, in which the position is ascertained from visible objects upon the earth, or from soundings of the depth of the sea, and (b) Dead Reckoning, in which the position at any moment is deduced from the direction and amount of a vessel's progress from a known point of departure.

3. Nautical Astronomy is that branch of the science which treats of the determination of the

4. Navigation and Nautical Astronomy have been respectively termed Geo-Navigation and Celo-Navigation, to indicate the processes upon which they depend.

5. As the method of piloting can not be employed excepting near land or in moderate depths of water, the navigator at sea must fix his position either by dead reckoning or by observation (of celestial objects); the latter method is more exact, but as it is not always available, the former must often be depended upon.

6. THE EARTH.—The Earth is an oblate spheroid, being a nearly spherical body slightly flattened at the poles; its longer or equatorial axis measures about 7,927 statute miles, and its shorter axis, around which it rotates, about 7.900 statute miles.

The Earth (assumed for purposes of illustration to be a sphere) is represented in figure 1.

The Axis of Rotation, usually spoken of simply as the

Avis, is PP'. The Poles are the points, P and P', in which the axis intersects the surface, and are designated, respectively, as the North Pole and the South Pole. The Equator is the great circle EQMW, formed by the

intersection with the earth's surface of a plane perpendicular to the axis; the equator is equidistant from the poles, every point upon it being 90° from each pole.

Meridians are the great circles PQP', PMP', PM'P', formed by the intersection with the earth's surface of planes secondary to the equator (that is, passing through its poles and therefore perpendicular to its plane)

Parallels of Latitude are small circles NTn, N'n'T', formed by the intersection with the earth's surface of planes passed parallel to the equator.

The Latitude of a place on the surface of the earth is the are of the meridian intercepted between the equator and

that place. Latitude is reckoned North and South, from the Fig. 1. equator as an origin, through 90° to the poles; thus, the latitude of the point T is MT, north, and of the point T', M'T', north. The Difference of Latitude between any two places is the arc of a meridian intercepted between their parallels of latitude, and is called North or South, according to direction; thus, the difference of latitude between T and T' is Tn' or T'n, north from T or south from T'.

The Longitude of a place on the surface of the earth is the arc of the equator intercepted between its meridian and that of some place from which the longitude is reckoned. Longitude is measured East The intervaluation and that of some place from which the iongridule is reconcided. Longridule is measured Law or West through 180° from the meridian of a designated place, such meridian being termed the Prime Meridian; the prime meridian used by most nations, including the United States, is that of Greenwich, England. If, in the figure, the prime meridian be PGQP', then the longitude of the point T is QM, east, and of T', QM', east. The Difference of Longitude between any two places is the are of the equator inter-cepted between their meridians, and is called East or West, according to direction; thus, the difference of longitude between T and T' is MM', east from M or west from M'. The Departure is the linear distance, measured on a parallel of latitude between the meridian being upplied by the prime meridian being the the prime meridian being the prime me measured on a parallel of latitude, between two meridians; unlike the various quantities previously defined, departure is reckoned in miles; the departure between two meridians varies with the parallel of latitude upon which it is measured; thus, the departure between the meridians of T and T' is the number of miles corresponding to the distance Tn in the latitude of T, or to n'T' in the latitude of T'.



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The curved line which joins any two places on the earth's surface, cutting all the meridians at the same angle, is called the *Rhumb Line, Loxodromic Curre,* or *Equiangular Spiral.* In the figure, this line is represented by TrT'. The constant angle which this line makes with the meridians is called the *Course*, and the length of the line between any two places is called the *Distance* between those places

is represented by 1717. The constant angle which this line haves with the meridaans is called the *Course*; and the length of the line between any two places is called the *Distance* between those places. The unit of linear measure employed by navigators is the *Nautical* or *Sea Mile*, or *Knot*. It is equal to one minute of latitude—that is, to the length of that portion of a meridian which subtends at the earth's center the angular measure of one minute; since, however, on account of the fact that the earth is not a perfect sphere, this distance is not exactly the same in all latitudes, a mean value is adopted for the length of the knot, and it is regarded as equal to 6,080.27 feet. For the purposes of navigation, the variation from this value in different latitude in all parts of the earth; hence, when a vessel changes her position to the north or south by one nautical mile, it may always be considered that the latitude has changed 17. Owing to the fact that the meridians all converge toward the poles, the difference of longitude produced by a change of position of one mile to the east or west will vary with the latitude; thus a departure of one mile will equal a difference of longitude of 17.0 at the equator, of 17.1 in the latitude of 30°, and of 27.0 in the latitude of 60°.

The Great Circle Track or Course between any two places is the route between those places along the circumference of the great circle which joins them. In the figure, this line is represented by T_gT' . From the properties of a great circle (which is a circle upon the earth's surface formed by the intersection of a plane passed through its center) the distance between two points measured on a great circle track is shorter than the distance upon any other line which joins them. Except when the two points are on the same meridian or when both lie upon the equator, the great circle track will always differ from the rhumb line, and the great circle track will intersect each intervening meridian at a different angle.

CHAPTER II.

INSTRUMENTS AND ACCESSORIES IN NAVIGATION.

DIVIDERS OR COMPASSES.

7. This instrument consists of two legs movable about a joint, so that the points at the extremities of the legs may be set at any required distance from each other. It is used to take and transfer distances and to describe arcs and circles. When used for the former purpose it is termed *dividers*, and the extremities of both legs are metal points; when used for describing arcs or circles, it is called a *compass*, and one of the metal points is replaced by a pencil or pen.

PARALLEL RULERS.

8. Parallel rulers are used for drawing lines parallel to each other in any direction, and are particularly useful in transferring the rhumb-line on the chart to the nearest compass-rose to ascertain the course, or to lay off bearings and courses.

PROTRACTOR.

9. This is an instrument used for the measurement of angles upon paper; there is a wide variation in the material, size, and shape in which it may be made. (For a description of the *Three Armed Protractor*, see art. 432, Chap. XVII.)

THE CHIP LOG.

10. This instrument, for measuring the rate of sailing, consists of three parts; viz, the *log-chip*, the *log-line*, and the *log-glass*. A light substance thrown from the ship ceases to partake of the motion of the vessel as soon as it strikes the water, and will be left behind on the surface; after a certain interval, if the distance of the ship from this stationary object be measured, the approximate rate of sailing will be given. The *log-chip* is the float, the *log-line* is the measure of the distance, and the *log-glass* defines the interval of time.

The log-chip is a thin wooden quadrant of about 5 inches radius, loaded with lead on the circular edge sufficiently to make it swim upright in the water. There is a hole in each corner of the log-chip, and the log-line is knotted in the one at the apex; at about 8 inches from the end there is seized a wooden socket; a piece of line of proper length, being knotted in the other holes, has seized into its bight a wooden peg to fit snugly into the socket before the log-chip is thrown; as soon as the line is checked this peg pulls out, thus allowing the log-chip to be hauled in with the least resistance. The log-line is about 150 fathoms in length, one end made fast to the log-chip, the other to a reserver of the log chip is is a constrained. At a distance of forum 15 to 20 fathoms from the log-chip is programmed.

The log-line is about 150 fathoms in length, one end made fast to the log-chip, the other to a reel upon which it is wound. At a distance of from 15 to 20 fathoms from the log-chip a permanent mark of red bunting about 6 inches long is placed to allow sufficient stray line for the log-chip to clear the vessel's eddy or wake. The rest of the line is divided into lengths of 47 feet 3 inches called knots, by pieces of fish-line through the strands, with one, two, three, etc., knots, according to the number from stray-line mark; each knot is further subdivided into five equal lengths of two-tenths of a knot each, marked by pieces of white rag.

The length of a knot depends upon the number of seconds which the log-glass measures; the length of each knot must bear the same ratio to the nautical mile $(\frac{1}{60}$ of a degree of a great circle of the earth or 6,080 feet) that the time of the glass does to an hour.

In the United States Navy all log-lines are marked for log glasses of 28 seconds, for which the proportion is:

$$3600:6080=28^{\circ}:x,$$

x being the length of the knot. Hence.

$x = 47^{\text{ft}}.29$, or $47^{\text{ft}} 3^{\text{in}}$.

The speed of the ship is estimated in knots and tenths of a knot.

The *log-glass* is a sand glass of the same shape and construction as the old hour-glass. Two glasses are used, one of 28 seconds and one of 14 seconds; the latter is employed when the ship is going at a high rate of speed, the number of knots indicated on a line marked for a 28-second glass being doubled to obtain the true rate of speed.

to obtain the true rate of speed. **11.** The log in all its parts should be frequently examined and adjusted; the peg must be found to fit sufficiently tight to keep the log-chip upright; the log-line shrinks and stretches and should often be verified; the log-glass should be compared with a watch. One end of the glass is stopped with a cork, by removing which the sand may be dried or its quantity corrected.

12. A ground log consists of an ordinary log-line, with a lead attached instead of a chip; in shoal water, where there are no well-defined objects available for fixing the position of the vessel and the course and speed are influenced by a tidal or other current, this log is sometimes used, its advantage being that the lead marks a stationary point to which motion may be referred, whereas the chip would drift with the stream. The speed, which is marked in the usual manner, is the speed over the ground, and the trend of the line gives the course actually made good by the vessel.

THE PATENT LOG.

13. This is a mechanical contrivance for registering the distance actually run by a vessel through the water. There are various types of patent logs, but for the most part they act upon the same principle, consisting of a registering device, a fly or rotator, and a log or tow line; the rotator is a small spindle with a number of wings extending radially in such manner as to form a spiral, and, when drawn through the water in the direction of its axis, rotates about that axis after the manner of a screw propeller; the rotator is towed from the vessel by means of a log or tow line from 20 to 50 fathoms in length, made fast at its apex, the line being of special make so that the turns of the rotator are transmitted through it to the worm shaft of the register, to which the inboard end of the line is attached; the registering device is so constructed as to show upon a dial face the distance run, according to the number of turns of its worm shaft due to the motion of the rotator; the register is carried at some convenient point on the vessel's quarter; it is frequently found expedient to rig it out upon a small boom, so that the rotator will be towed clear of the wake.

14. Though not a perfect instrument, the patent log affords the most accurate means available for determining the vessel's speed through the water. It will usually be found that the indications of the log are in error by a constant percentage, and the amount of this error should be determined by careful experiment and applied to all readings.

Varions causes may operate to produce inaccuracy of working in the patent log, such as the bending of the wings of the rotator by accidental blows, fouling of the rotator by sea weed or refuse from the ship, or mechanical wear of parts of the register. The length of the tow-line has much to do with the working of the log, and by varying the length the indications of the instrument may sometimes be adjusted when the percentage of error is small; it is particularly important that the line shall not be too short. The readings of the patent log can not be depended upon for accuracy at low speeds, when the rotator does not tow horizontally, nor in a head or a following sea, when the effect depends upon the wave motion as well as upon the speed of the vessel.

15. Electrical registers for patent logs are in use, the distance recorded by the mechanical register being communicated electrically to some point of the vessel which is most convenient for the purposes of those charged with the navigation.

16. A number of instruments based upon different physical principles have been devised for recording the speed of a vessel through the water and have been used with varying degrees of success.

17. The revolutions of the screw propeller afford in a steamer a valuable check upon the patent log and a means of replacing it if necessary. To be of service the number of revolutions per knot must be carefully determined for the vessel by experiment under varying conditions of speed, draft, and fourness of bottom.

THE LEAD.

18. This device, for ascertaining the depth of water, consists essentially of a suitably marked line, having a lead attached to one of its ends. It is an invaluable aid to the navigator in shallow water, particularly in thick or foggy weather, and is often of service when the vessel is out of sight of land.

Two leads are used for soundings—the *hand-lead*, weighing from 7 to 14 pounds, with a line marked to about 25 fathoms, and the *deep-sea lead*, weighing from 30 to 100 pounds, the line being 100 fathoms or upward in length.

Lines are generally marked as follows:

2 fathoms from the lead, with 2 strips of leather.	17 fathoms from the lead, same as at 7 fathoms.
3 fathoms from the lead, with 3 strips of leather.	20 fathoms from the lead, with 2 knots.
5 fathoms from the lead, with a white rag.	25 fathoms from the lead, with 1 knot.
7 fathoms from the lead, with a red rag.	30 fathoms from the lead, with 3 knots.
10 fathoms from the lead, with leather having a	35 fathoms from the lead, with 1 knot.
hole in it.	40 fathoms from the lead, with 4 knots.
13 fathoms from the lead, same as at 3 fathoms.	And so on.

13 fathoms from the lead, same as at 3 fathoms. 15 fathoms from the lead, same as at 5 fathoms.

to fathoms from the lead, same as at o fathoms.

Fathoms which correspond with the depths marked are called *marks*; the intermediate fathoms are called *deeps*; the only fractions of a fathom used are a half and a quarter.

A practice sometimes followed is to mark the hand-lead line in feet around the critical depths of the vessel by which it is to be used.

Lead lines should be measured frequently while wet and the correctness of the marking verified. The distance from the leadsman's hand to the water's edge should be ascertained in order that proper allowance may be made therefor in taking soundings at night.

19. The deep-sea lead may be *armed* by filling with tallow a hole hollowed out in its lower end, by which means a sample of the bottom is brought up.

THE SOUNDING MACHINE.

20. This machine possesses advantages over the deep-sea lead, for which it is a substitute, in that soundings may be obtained at great depths and with rapidity and accuracy without stopping the ship. It consists essentially of a stand holding a reel upon which is wound the sounding wire, and which is controlled by a suitable brake. Crank handles are provided for reeling in the wire after the sounding has been taken. Attached to the outer end of the wire is the lead, which has a cavity at its lower end for the reception of the tallow for arming. Above the lead is a cylindrical case containing the depth-registering mechanism; various devices are in use for this purpose, all depending, however, upon the increasing pressure of the water with increasing depths.
21. In the Lord Kelvin machine a slender glass tube is used, sealed at one end and open at the

21. In the Lord Kelvin machine a slender glass tube is used, sealed at one end and open at the other, and coated inside with a chemical substance which changes color upon contact with sea water; this tube is placed, closed end up, in the metal cylinder; as it sinks the water rises in the tube, the contained air being compressed with a force dependent upon the depth. The limit of discoloration is marked by a clearly defined line, and the depth of the sounding corresponding to this line is read off from a scale. Tubes that have been used in comparatively shallow water may be used again where the water is known to be deeper.

22. A tube whose inner surface is *ground* has been substituted for the chemical-coated tube, ground glass, when wet, showing clear. The advantage of these tubes is that they may be used an indefinite number of times if thoroughly dried. To facilitate drying, arubber cap is fitted to the upper end, which, when removed, admits of a circulation of the air through the tube.

23. As a substitute for the glass tubes a mechanical *depth recorder* contained in a suitable case has been used. In this device the pressure of the water acts upon a piston against the tension of a spring. A scale with an index pointer records the depth reached. The index pointer must be set at zero before each sounding.

24. Since the action of the sounding machine, when glass tubes are used, depends upon the compression of the air, the barometric pressure of the atmosphere must be taken into account when accurate results are required. The correction consists in *increasing* the indicated depth by a fractional amount according to the following table:

Bar. reading.	Increase.
"	
29.75	One-fortieth.
30.00	One-thirtieth.
30.50	One-twentieth.
30.75	One-fifteenth.

THE MARINER'S COMPASS.

25. The Mariner's Compass is an instrument consisting either of a single magnet, or, more usually, of a series of magnets, which, being attached to a graduated circle pivoted at the center and allowed to



F1G. 2.

swing freely in a horizontal plane, has a tendency to lie with its magnetic axis in the plane of the earth's magnetic meridian, thus affording a means of determining the azimuth, or horizontal angular distance from that meridian, of the ship's course and of all visible objects, terrestrial or celestial.

26. The circular card of the compass (fig. 2) is divided on its periphery into 360°, numbered from 0° at North and South to 90° at East and West; also into thirty-two divisions of 114° each, called *points*, the latter being further divided into *half-points* and *quarter-points*; still finer subdivisions, *eighth-points*, are sometimes used, though not indicated on the card. A system of numbering the degrees from 0° to 360°, always increasing toward the right, is shown in the figure. This system is in use by the mariners of some nations, and its general adoption would carry with it certain undoubted advantages. **27.** Boxing the Compass is the process of naming the points are called *cardinal points* and are named North, South, East, and West; each differs in direction from the adjacent one by 90°, or 8 points.

27. Boxing the Compass is the process of naming the points in their order, and is one of the first things to be learned by the young mariner. The four principal points are called *cardinal points* and are named North, South, East, and West; each differs in direction from the adjacent one by 90°, or 8 points. Midway between the cardinal points, at an angular distance of 45° , or 4 points, are the *inter-cardinal* points, named according to their position Northeast, Southeast, etc. Midway between each cardinal and inter-eardinal point, at an angular distance of $22\frac{3}{2}^\circ$, or 2 points, is a point whose name is made up of a combination of that of the cardinal with that of the inter-cardinal point. North-east, East-Southeast, etc. At an angular distance of 1 point, or $11\frac{3}{2}^\circ$, from each cardinal and inter-cardinal point (and therefore midway between it and the $22\frac{3}{2}^\circ$ -division last described), is a point which bears the name of that cardinal or inter-cardinal point by the word by to that of the cardinal point is in the Aircording by the weat the vortheast by Northeast by Northe

which bears the name of that cardinal of inter-cardinal point joined by the word by to that of the cardinal point in the direction of which it lies: North by East, Northeast by North, Northeast by East, etc. In boxing by fractional points, it is evident that each division may be referred to either of the whole points to which it is adjacent; for instance, NE. by N. $\frac{1}{2}$ N. and NNE. $\frac{1}{2}$ E. would describe the same division. It is the custom in the United States Navy to box from North and South toward East and West, excepting that divisions adjacent to a cardinal or inter-cardinal point are always referred to that point; as N. $\frac{1}{2}$ E., N. by E. $\frac{1}{2}$ E., NE. $\frac{1}{2}$ N., etc. Some mariners, however, make it a practice to box from each cardinal and inter-cardinal point toward a 22 $\frac{1}{2}$ -point (NNE., ENE., etc.); as N. $\frac{1}{2}$ E., N. by E. $\frac{1}{2}$ E., NE. by N. $\frac{1}{2}$ N., NE. $\frac{1}{2}$ N., etc. The names of the whole points, together with fractional points (according to the nomenclature of the United States Navy is the first of the market of the united States Navy is the state of the whole points is for the names of the whole points is for the name of the name of the whole points is for the name of the n

The names of the whole points, together with fractional points (according to the nomenclature of the United States Navy), are given in the following table, which shows also the degrees, minutes, and seconds from North or South to which each division corresponds:

		•		in .	
N. to E.	N. to W.	S. to E.	S. to W.	Pts.	Angular measure.
North: N. ½ E N. ½ E N. ½ F N. by F N. by E	North: N. ½ W N. ½ W N. ½ W N. by W N. by W N. by W	South: S. 4 E. S. 2 E. S. 4 E. S. 4 E. S. 4 E. S. by E. S. by E. S. by E. 4 E.	South: S. ½ W S. ½ W S. ½ W S. by W S. by W S. by W. ½ W		 <i>i</i> / <i>i</i> <i>i</i> 2 48 45 <i>i</i> 37 30 <i>i</i> 26 15 <i>i</i> 1 15 00 <i>i</i> 03 45
N. by E. $\frac{1}{2}$ E N. by E. $\frac{3}{4}$ E NNE. NNE. $\frac{1}{4}$ E NNE. $\frac{1}{2}$ E NNE. $\frac{3}{4}$ E NE. by N	N. by W. ½ W N. by W. ¾ W NNW NNW. ½ W NNW. ½ W NNW. ¼ W NNW. ¾ W	S. by E. $\frac{1}{2}$ E S. by E. $\frac{3}{4}$ E SSE. SSE. $\frac{1}{2}$ E SSE. $\frac{3}{4}$ E SSE. $\frac{3}{4}$ E SSE. by S	S. by W. ½ W S. by W. ¾ W SSW SSW. ½ W SSW. ½ W SSW. ¼ W SSW. ¾ W	$\begin{array}{c}1\frac{1}{2}\\1\frac{3}{4}\\2\frac{1}{4}\\2\frac{3}{4}\\2\frac{3}{4}\\3\end{array}$	$\begin{array}{cccccccccccccccccccccccccccccccccccc$
NE. 4 N NE. 2 N NE. 4 N NE. 4 N NE. 4 E NE. 4 E	NW. 4 N NW. ½ N NW. ½ N NW. ¼ N NW. ¼ N NW. ¼ N NW. ¼ W NW. ¼ W	$\begin{array}{c} \text{SE. $\frac{3}{4}$S}\\ \text{SE. $\frac{1}{2}$S}\\ \text{SE. $\frac{1}{4}$S}\\ \text{SE. $\frac{1}{4}$S}\\ \text{SE. $\frac{1}{4}$E}\\ \text{SE. $\frac{1}{4}$E}\\ \text{SE. $\frac{1}{4}$E}\\ \end{array}$	SW. 4 S SW. 4 S SW. 4 S SW. 4 S SW. 4 S SW. 4 W SW. 4 W	$ \begin{array}{c} 3_{4} \\ 3_{2} \\ 3_{4} \\ 4_{4} \\ $	$\begin{array}{cccccccccccccccccccccccccccccccccccc$
NE. ⁵ / ₄ E NE. by E. NE. by E. ¹ / ₄ E NE. by E. ¹ / ₄ E NE. by E. ¹ / ₄ E ENE	NW. ¹ / ₄ W. NW. by W. NW. by W. ¹ / ₄ W. NW. by W. ¹ / ₄ W. NW. by W. ¹ / ₄ W. WNW.	SE. \$\frac{3}{4} E. SE. by E SE. by E. \$\frac{1}{2} E. SE. by E. \$\frac{1}{2} E. SE. by E. \$\frac{1}{4} E. SE. by E. \$\frac{1}{4} E. ESE	SW. ³ / ₄ W SW. by W SW. by W. ¹ / ₄ W SW. by W. ¹ / ₄ W SW. by W. ³ / ₄ W WSW	44 5 5 5 5 5 5 4 1 2 3 4 5 5 5 5 5 6 6	$\begin{array}{cccccccccccccccccccccccccccccccccccc$
ENE. 4 E ENE. 4 E ENE. 4 E E. by N E. 4 N. E. 4 N. E. 4 N.	W N W. 4 W W NW. 4 W W NW. 4 W W. by N W. 4 N W. 4 N W. 4 N	ESE. 4 E. ESE. 5 E. ESE. 4 E. E. by S. E. 4 S. E. 4 S.	$ \begin{array}{c} WSW, \frac{3}{4} W, \\ WSW, \frac{3}{2} W, \\ WSW, \frac{3}{4} W, \\ WSW, \frac{3}{4} W, \\ W, \frac{3}{2} S, \\ W, \frac{3}{4} S, \\ W, \frac{3}{4} S, \\ W, \frac{3}{4} S, \\ W, \frac{3}{4} S, \\ \end{array} $	$\begin{array}{c} 0^{\frac{1}{4}} \\ 6^{\frac{1}{2}} \\ 6^{\frac{3}{4}} \\ 7 \\ 7^{\frac{1}{4}} \\ 7^{\frac{1}{2}} \\ 7^{\frac{3}{4}} \end{array}$	$\begin{array}{cccccccccccccccccccccccccccccccccccc$
East	West	East	West	8	90 00 00

28. The compass card is mounted in a bowl which is carried in *gimbals*, thus enabling the card to retain a horizontal position while the ship is pitching and rolling. A vertical black line called the *lubber's line* is marked on the inner surface of the bowl, and the compass is so mounted that a line joining its pivot with the lubber's line is parallel to the keel line of the vessel; thus the lubber's line always indicates the compass direction of the ship's head.

29. According to the purpose which it is designed to fulfill, a compass is designated as a *Standard*, *Steering*, *Check*, or *Boat Compass*.

30. There are two types of compass in use, the *wet* or *liquid* and the *dry*; in the former the bowl is filled with liquid, the eard being thus partially buoyed, with consequent increased ease of working on the pivot, and the liquid further serving to decrease the vibrations of the card when deflected by reason of the motion of the vessel or other cause. On account of its advantages the liquid compass is used in the United States Navy.

31. The NAVY SERVICE 7½-INCH LIQUID COMPASS.—This consists of a skeleton card 7½ inches in diameter, made of tinned brass, resting on a pivot in liquid, with provisions for two pairs of magnets symmetrically placed.

The magnet system of the card consists of four cylindrical bundles of steel wires; these wires are laid side by side and magnetized as a bundle between the poles of a powerful electromagnet. They are afterwards placed in a cylindrical case, sealed, and secured to the card. Steel wires made up into a bundle were adopted because they are more homogeneous, can be more perfectly tempered, and for the same weight give greater magnetic power than a solid steel bar.

Two of the magnets are placed parallel to the north and south diameter of the card, and on the chords of 15° (nearly) of a circle passing through their extremities. These magnets penetrate the air vessel, to which they are soldered, and are further secured to the bottom of the ring of the card. The other two magnets of the system are placed parallel to the longer magnets on the chords of 45° (nearly) of a circle passing through their extremities, and are secured to the bottom of the ring of the card.

The card is of a curved annular type, the outer ring being convex on the upper and inner side, and is graduated to read to one-fourth point, a card circle being adjusted to its outer edge and divided to half-degrees, with legible figures at each 3°, for use in reading bearings by an azimuth circle or in laying the course to degrees.

The card is provided with a concentric spheroidal air vessel, to buoy its own weight and that of the nagnets, allowing a pressure of between 60 and 90 grains on the pivot at 60° F.; the weight of the card in air is 3,060 grains. The air vessel has within it a hollow cone, open at its lower end, and provided with the pivot bearing, or cap, containing a sapphire, which rests upon the pivot and thus supports the card; the cap is provided with adjusting screws for accurately centering the card. The pivot is fastened to the center of the bottom of the bowl by a flanged plate and screws. Through this plate and the bottom of the liquid between it and the bowl. The pivot is of gun metal with an iridium cap.

The card is mounted in a bowl of cast bronze, the glass cover of which is closely packed with rubber, preventing the evaporation or leakage of the liquid, which entirely fills the bowl. This liquid is composed of 45 per cent pure alcohol and 55 per cent distilled water, and remains liquid below --10° F.

The lubber's line is a fine line drawn on an enameled plate on the inside of the bowl, the inner surface of the latter being covered with an insoluble white paint.

Beneath the bowl is a metallic self-adjusting expansion chamber of elastic metal, by means of which the bowl is kept constantly full without the show of bubbles or the development of undue pressure caused by the change in volume of the liquid due to changes of temperature.

The rim of the compass bowl is made rigid and its outer edge turned strictly to gauge to receive the azimuth circle.

32. THE DRY COMPASS.—The Lord Kelvin Compass, which may be regarded as the standard for the nonliquid type, consists of a strong paper card with the central parts cut away and its outer edge stiffened by a thin aluminum ring. The pivot is fitted with an iridium point, upon which rests a small light aluminum boss fitted with a sapphire bearing. Radiating from this boss are 32 silk threads whose outer ends are made fast to the inner edge of the compass card; these threads sustain the weight of the suspended card, and, as they possess some elasticity, tend to decrease the shocks due to motion.

Eight small steel wire needles, 34 to 2 inches long, are secured normally to two parallel silk threads, and are slung from the aluminum rim of the card by other silk threads which pass through eyes in the ends of the outer pair of needles. The needles are below the radial threads, thus keeping the center of gravity low.

33. THE AZIMUTH CHRCLE.—This is a necessary fitting for all compasses employed for taking bearings—that is, noting the directions—of either celestial or terrestrial objects. The instrument varies widely in its different forms; the essential features which all share consist in (a) a pair of sight vanes, or equivalent device, at the extremities of the diameter of a circle that revolves concentrically with the compass bowl, the line of sight thus always passing through the vertical axis of the compass; and (b) a system, usually of mirrors and prisms, by which the point of the compass card cut by the vertical plane through the line of sight—in other words, the compass direction—is brought into the field of view of the person making the observation. In some circles, for observing azimuths of the sun advantage is taken of the brightness of that body to reflect a pencil of light upon the card in such a manner as to indicate the bearing; such an azimuth circle is used in the United States Navy.

34. BINNACLES.—Compasses are mounted for use in stands known as *Binnacles*, of which there are two principal types—the *Compensating* and the *Non-Compensating Binnacle*, so designated according as they are or are not equipped with appliances by which the deviation of the compass, or error in its indications due to disturbing magnetic features within the ship, may be compensated.

indications due to disturbing magnetic features within the ship, may be compensated. F Binnacles may be of wood or of some nonmagnetic metal; all contain a compass chamber within which the compass is suspended in its gimbal ring, the knife edges upon which it is suspended resting in V-shaped bearings; an appropriate method is supplied for centering the compass. A hood is provided for the protection of the compass and for lighting it at night. Binnacles must be rigidly secured to the deck of the vessel in such position that the lubber's line of the compass gives true indications of the direction of the ship's head.

The position of the various binnacles on shipboard and the height at which they carry the compasmust be chosen with regard to the purpose which the compass is to serve, having in mind the magnetic conditions of the ship.

Compensating binacles contain the appliances for carrying the various correctors used in the compensation of the deviation of the compass. These consist of (a) a system of permanent magnets for

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semicircular deviation, placed in a magnet chamber lying immediately beneath the compass chamber, so arranged as to permit variation in the height and direction of the magnets employed; (b) a pair of arms projecting horizontally from the compass chamber and supporting masses of soft iron for quadrantal deviation; (c) a central tube in the vertical axis of the binnacle for a permanent magnet used to correct the heeling error, and (d) an attachment, sometimes fitted, for securing a vertical soft iron rod, or "Flinders bar," used in certain cases for correction of a part of the semicircular deviation. An explanation of the various terms here used, together with the method of compensating the compass, will be given in Chapter III.

THE PELORUS.

35. This instrument consists of a circular plate, mounted horizontally in gimbals upon a vertical standard, at some point on board ship affording a clear view for taking bearings; radial scores upon a raised flange on the periphery of this plate indicate true directions from its center parallel with the keel line of the vessel and perpendicular thereto—in other words, lines of bearing directly ahead, astern, and abeam. Revolving about a common center, which is also the center of the plate, are (a) a dumb compass card, usually engraved on metal, whose face is level with the raised periphery of the plate on which are marked the scores, and (b) a pivoted horizontal bar carrying at its extremities a pair of sight vanes so arranged that the line of sight always passes through the vertical axis of the instrument, and having an index showing the point at which the line of sight cuts the dumb compass. The dumb compass and the sight-vane bar can each be rigidly clamped.

The instrument is used for taking bearings, and may be more convenient than the compass for that purpose because of the better view that it alfords, as well as because it may be made to eliminate the compass error from observed bearings. Suppose that the dumb compass be revolved until the degree or division which is coincident with the right-ahead score of the plate is the same as that which is abreast the lubber's line of the ship's compass. Then all directions indicated by the dumb compass will be parallel to the corresponding directions of the live one, and all bearings taken by the pelorus will be identical with those taken by the compass (leaving out of the question the diffence due to the distance that separates them). Suppose, now, that it is known that the ship's compass has a certain error and that the correct direction that we seek (which is the one indicated on the charts) is a certain angular distance to the right or left of that which the compass shows; if, in such a case, instead of setting the pelorus for the direction indicated by compass, we set it for the correct direction in which we know the ship to be heading, all bearings observed by the pelorus will be correct bearings as given by the chart and may be plotted directly thereon without the necessity for the intermediate process of correction to which the bearings shown by compass are subject. It will at once be evident that the indications of the pelorus will be accurate only when bearings are taken at an instant when the ship is heading exactly in the direction for which it is set, and care must be taken accordingly in its use.

The most modern types of pelorus are fitted for illuminating the dumb compass, thus greatly facilitating night work.

THE CHART.

36. A nautical *chart* is a miniature representation upon a plane surface, in accordance with a definite system of projection or development, of a portion of the navigable waters of the world. It generally includes the outline of the adjacent land, together with the surface forms and artificial features that are useful as aids to navigation, and sets forth the depths of water, especially in the near approaches to the land, by soundings that are fixed in position by accurate determinations. Except in charts of harbors or other localities so limited that the curvature of the earth is inappreciable on the scale of construction, a nautical chart is always framed over with a network of parallels of latitude and meridians of longitude in relation to which the features to be depicted on the chart are located and drawn; and the mathematical relation between the meridians and parallels of the chart and those of the terrestrial sphere determines the method of measurement that is to be employed on the chart and the special uses to which it is adapted.

37. There are three principal systems of projection in use: (a) the *Mercator*, (b) the *polyconic*, and (c) the *gnomonic*; of these, the Mercator is by far the most generally used for purposes of navigation proper, while the polyconic and the gnomonic charts are employed for nautical purposes in a more restricted manner, as for plotting surveys or for facilitating great circle sailing.

38. THE MERCATOR PROJECTION.—The Mercator Projection, so called, may be said to result from the development, upon a plane surface, of a cylinder which is tangent to the earth at the equator, the various points of the earth's surface having been projected upon the cylinder in such manner as they would appear to an observer at the earth's center; this method of projection and development results in a characteristic feature—namely, that the *loxodromic curve* or *rhumb line* (art. 6, Chap. I) appears as a right line preserving the same angle of bearing with respect to the intersected meridians as does the ship's track.

In order to realize this condition, the line of tangency, which coincides with the earth's equator, being the circumference of a right section of the cylinder, will appear as a right line on the development; while the series of elements of the cylinder corresponding to the projected terrestrial meridians will appear as equidistant right lines, parallel to each other and perpendicular to the equator of the chart, maintaining the same relative positions and the same distance apart on that equator as the meridians have on the terrestrial spheroid. The series of terrestrial parallels will also appear as a system of right lines parallel to each other and to the equator, and will so intersect the meridians as to form a system of rectangles whose altitudes, for successive intervals of latitude, must be variable, increasing from the equator in such manner that the angles made by the rhumb line with the meridian on the chart may maintain the required equality with the corresponding angles on the spheroid.

39. MERIDIONAL PARTS.—At the equator a degree of longitude is equal to a degree of latitude, but in receding from the equator and approaching the pole, while the degrees of latitude remain always of the same length (save for a slight change due to the fact that the earth is not a perfect sphere), the degrees of longitude become less and less.

Since, in the Mercator projection, the degrees of longitude are made to appear everywhere of the same length, it becomes necessary, in order to preserve the proportion that exists at different parts of the earth's surface between degrees of latitude and degrees of longitude, that the former be increased from their natural lengths, and such increase must become greater and greater the higher the latitude.

The length of the meridian, as thus increased, between the equator and any given latitude, expressed in minutes at the equator as a unit, constitutes the number of *Meridional Parts* corresponding to that latitude. The Table of Meridional Parts or Increased Latitudes (Table 3), computed for every minute of latitude between 0° and 80°, affords facilities for constructing charts on the Mercator projection and for solving problems in Mercator sailing.

40. To CONSTRUCT A MERCATOR CHART.—If the chart for which a projection is to be made includes the equator, the values to be measured off are given directly by Table 3. If the equator does not come upon the chart, then the parallels of latitude to be laid down should be referred to a *principal parallel*, preferably the lowest parallel to be drawn on the chart. The distance of any other parallel of latitude from the principal parallel is then the difference of the values for the two taken from Table 3.

The values so found may either be measured off, without previous numerical conversion, by means of a diagonal scale constructed on the chart, or they may be laid down on the chart by means of any properly divided scale of yards, meters, feet, or miles, after having been reduced to the scale of proportions adopted for the chart.

If, for example, it be required to construct a chart on a scale of one-quarter of an inch to five minutes of arc on the equator, a diagonal scale may first be constructed, on which ten meridional parts, or ten minutes of arc on the equator, have a length of half an inch.

It may often be desirable to adapt the scale to a certain allotment of paper. In this case, the lowest and the highest parallels of latitude may first be drawn on the sheet on which the transfer is to be made. The distance between these parallels may first be drawn on the sheet on which the transfer is to be made. The distance between these parallels may then be measured, and the number of meridional parts between them ascertained. Dividing the distance by this number will then give the length of one meridional part, or the quantity by which all the meridional parts taken from Table 3 must be multi-plied. This quantity will represent the scale of the chart. If it occurs that the limits of longitude are

a governing consideration, the case may be similarly treated. EXAMPLE: Let a projection be required for a chart of 14° extent in longitude between the parallels of latitude 20° 30' and 30° 25', and let the space allowable on the paper between these parallels measure 10 inches

Entering the column in Table 3 headed 20°, and running down to the line marked 30' in the side column, will be found 1248.9; then, entering the column 30°, and running down to the line of 25′, will be found 1905.5. The difference, or 1905.5 - 1248.9 = 656.6, is the value of the meridional arc between these latitudes, for which 1' of arc of the equator is taken as the unit. On the intended projection, therefore, 1' of arc of longitude will measure $\frac{10^{\text{m}}}{656.6} = 0.0152$ inch, which will be the scale of the chart.

For the sake of brevity call it 0.015. By this quantity all the values derived from Table 3 will have to be multiplied before laying them down on the projection, if they are to be measured on a diagonal scale of one inch.

Draw in the center of the sheet a straight line, and assume it to be the middle meridian of the chart. Construct very carefully on this line a perpendicular near the lower border of the sheet, and assume this perpendicular to be the parallel of latitude 20° 30'; this will be the southern inner neat line of the chart. From the intersection of the lines lay off on the parallel, on each side of the middle meridian, seven degrees of longitude, or distances each equal to $0.015 \times 60 \times 7 = 6.3$ inches; and through the points thus obtained draw parallel lines to the middle meridian, and these will be the eastern and western neat lines of the chart.

In order to construct the parallel of latitude for 21° 00′, find, in Table 3, the meridional parts for 21° 00′, which are 1280.8. Subtracting from this number the number for 20° 30′, and multiplying the difference by 0.015, we obtain 0.478 inch, which is the distance on the chart between 20° 30′ and 21° 00'. On the meridians lay off distances equal to 0.478 inch, and through the three points thus obtained draw a straight line, which will be the parallel of 21° 00'.

Proceed in the same manner to lay down all the parallels answering to full degrees of latitude: the distances will be respectively:

 $0^{in}.015 \times (1344.9 - 1248.9) = 1.440$ inches, $0^{in}.015 \times (1409.5 - 1248.9) = 2.409$ inches, $0^{in}.015 \times (1474.5 - 1248.9) = 3.384$ inches, etc.

Thus will be shown the parallels of latitude 22° 00′, 23° 00′, 24° 00′, etc. Finally, lay down in the same way the parallel of latitude 30° 25′, which will be the northern inner neat line of the chart.

A degree of longitude will measure on this chart $0^{in}.015 \times 60 = 0^{in}.9$. Lay off, therefore, on the lowest parallel of latitude drawn on the chart, on a middle one, and on the highest parallel, measuring from the middle meridian toward each side, the distances of 0ⁱⁿ.9, 1ⁱⁿ.8, 2ⁱⁿ.7, 3ⁱⁿ.6, etc., in order to determine the points where meridians answering to full degrees cross the parallels drawn on the chart. Through the points thus found draw the meridians. Draw then the outer neat lines of the chart at a convenient distance outside of the inner neat lines, and extend to them the meridians and parallels. Between the inner and outer neat lines of the chart subdivide the degrees of latitude and longitude as minutely as the scale of the chart will permit, the subdivisions of the degrees of longitude being found by dividing the degrees into equal parts, and the subdivisions of the degrees of latitude being accu-rately found in the same manner as the full degrees of latitude previously described, though it will generally be found sufficiently exact to make even subdivisions of the degrees, as in the case of the longitude.

The subdivisions between the two eastern as well as those between the two western neat lines will serve for measuring or estimating terrestrial distances. Distances between points bearing North and South of each other may be ascertained by referring them to the subdivisions between the same parallels. Distances represented by lines at an angle to the meridian (loxodromic lines) may be measured by taking between the dividers a small number of the subdivisions near the middle latitude of the line to be measured, and stepping them off on that line. If, for instance, the terrestrial length of a line running at an angle to the meridians between the parallels of latitude of 24° 00' and 29° 00' be required, the distance shown on the neat space between 26° 15' and 26° 45' (=30 nautical miles) may be taken between the dividers and stepped off on that line.

41. Coast lines and other positions are plotted on the chart by their latitude and longitude. A chart may be transferred from any other projection to that of Mercator by drawing a system of corresponding parallels of latitude and meridians over both charts so close to each other as to form minute squares, and then the lines and characters contained in each square of the map to be transferred may

be copied by the eye in the orresponding squares of the Mercator projection. Since the unit of measure, the mile or minute of latitude, has a different value in every latitude, there is an appearance of distortion in a Mercator chart that covers any large extent of surface; for instance, an island near the pole will be represented as being much larger than one of the same size near the equator, due to the different scale used to preserve the character of the projection. **42.** The Polyconic Projection.—This projection is based upon the development of the earth's

surface on a series of cones, a different one for each parallel of latitude, each one having the parallel as its base, and its vertex in the point where a tangent to the earth at that latitude intersects the earth's axis. The degrees of latitude and longitude on this chart are projected in their true length, and the general distortion of the figure is less than in any other method of projection, the relative magnitudes being closely preserved.

A straight line on the polyconic chart represents a great circle, making a slightly different angle with each successive meridian as the meridians converge toward the pole and are theoretically curved lines; but it is only on charts of large extent that this curvature is apparent; the parallels are also curved, this fact being apparent to the eve upon all excepting the largest scale charts.

This method of projection is especially adapted to the plotting of surveys; it is also employed for nearly all of the charts of the United States Coast and Geodetic Survey.

43. GNOMONIC PROJECTION.—This is based upon a system in which the plane of projection is tangent to the earth at some given point; the eye of the spectator is situated at the center of the sphere, where, being at once in the plane of every great circle, it will see all such circles projected as straight lines where the visual rays passing through them intersect the plane of projection. In a gnomonic chart, a straight line between any two points is projected as an arc of a great circle, and is therefore the shortest line between those points.

Excepting in the Polar regions, for which latitudes the Mercator projection can not be constructed, the gnomonic charts are not used for general navigating purposes. Their greatest application is to afford a ready means of finding the course and distance at any time in great circle sailing, the method of doing

a ready incars of many the course and distance at any time in great circle sailing, the method of doing which will be explained in Chapter V.
44. MERIDIANS EMPLOYED IN CHART CONSTRUCTION.—The United States, England, Germany, Italy, Russia, Norway, Sweden, Denmark, Holland, Austria, Portugal, and Japan adopt as a prime meridian the meridian of Greenwich.

France adopts the meridian of Paris in Long. 2° 20' 14".5 E. of Greenwich. Spain adopts the meridian of San Fernando, Cadiz, in Long. 6° 12' 20" W. of Greenwich. The Pulkowa Observatory of St. Petersburg (sometimes referred to in Russian charts) is in Long. 30° 19′ 39″.6 E. of Greenwich.

The Royal Observatory of Naples (sometimes referred to in Italian charts) is in Long. 14° 14′ 06″ E. of Greenwich.

The meridian of Genoa is 8° 55′ 21″ E.; of Lisbon, 9° 08′ 36″ W.; of Rio de Janeiro, 43° 10′ 21″.2 W.; of Amsterdam, 4° 53′ 03″.8 E.; of Washington, 77° 03′ 56″.7 W. **45.** QUALITY OF BOTTOM.—The following table shows the qualities of the bottom, as expressed on

charts of various nations:

United States.	English.	French.	Italian.	Spanish.	German.
ClayC. CoralCo. GravelG. MudM. Rockyrky. SandS. ShellsSh. StoneSt. WeedWd. Finefine Coarsecrs. Stiffsft. Stiffsft. Softsft. Blaekbk. Redrd. Yellowyl. Graygy	Clay	Argile A. Corail Cor. Gravier Gr. Wase V. Roche R. Sable So Coquille Coq Pierre P. Herb H. Fin fin. Gros g. Dure d. Molle m. Noire n. Jaune j.	Argila Corállo Rena or Ghiaja Fango Roccia Sibia or Aréna Conchíglia Pietre Alga Fino Grosso Tenace Molle Nero Rosse Giallo	Arcillo or Barro Coral	Lehm L. Korallen K. Grob sand g. s. Schlemm Sch. Fels F. Sand S. Muschel M. Stein. G. Gras G. Fein f. Grob g. Zahe Z. Weich W. Schwarz schw. Roth. Gelb.

20

46. MEASURES OF DEPTH.—The following table shows the measures of depth employed in the charts of certain foreign nations, with their equivalents in English measures:

·	English feet.	English fathoms.
Austrian	·) 6, 222	1.03
Danish and Norwegian	() 6.175	1.02
Dutch	5. 575	0.92
French (fathom (brasse	e) 5.329	0.88
meter (meter)	3.281	0.54
Portuguese	ı) 6.004	1.00
Prussianfathom (fader	i) 5.906	0.98
Russian	ú) 6.000	1.00
Spanish	5. 492	0.91
Swedish	5. 843	0.97

The Dutch elle, the Spanish, Portuguese, and Italian metro, and the French mitre are identical. A pied usuel=13.124 inches, or 1.094 feet. A mitre is 3 pieds; a pied du roi=12.7896 inches; brasse is used upon old French charts instead of *mètre*. Upon some Italian charts soundings are in French pieds.

THE BAROMETER.

47. The barometer is an instrument for measuring the pressure of the atmosphere, and is of great service to the mariner in affording a knowledge of existing meteorological con-ditions and of the probable changes therein. There are two classes of barome-*-mercurial* and *aneroid*. ter

48. THE MERCURIAL BAROMETER. - This instrument, invented by Torricelli in 1643, indicates the pressure of the atmosphere by the height of a column of mercury.

If a glass tube of uniform internal diameter somewhat more than 30 inches in length and closed at one end be completely filled with pure mercury, and then placed, open end down, in a cup of mercury (the open end having been temporarily sealed to retain the liquid during the process of inverting), it will be found that the mercury in the tube will fall until the top of the column is about 30 inches above the level of that which is in the cup, leaving in the upper part of the tube a perfect vacuum. Since the weight of the column of mercury thus left standing in the tube is equal to the pressure by which it is held in position-namely, that of the atmospheric air-it follows that the height of the column is subject to variation upon variation of that pressure; hence the mercury falls as the pressure of the atmosphere decreases and rises as that pres-sure increases. The mean pressure of the atmosphere is equal to nearly 15

49. In the practical construction of the barometer is about 30 inches. contains the mercury is encased in a brass tube, the latter terminating at the top in a ring to be used for suspension, and at the bottom in a flange, to which the several parts forming the cistern are attached. The upper part of the brass tube is partially cut away to expose the mercurial column for observation; abreast this opening is fitted a scale for measuring the height, and along the scale travels a *reruler* for exact reading; the motion of the vernier is controlled by a rack and pinion, the latter having a milled head accessible to the observer, by which the adjustment is made. In the middle of the brass tube is fixed a thermometer, the bulb of which is covered from the outside but open toward the mercury, and which, being nearly in contact with the glass tube, indicates the temperature of the mercury and not that of the external air; the central position of the column is selected in order that the mean temperature may be obtained—a matter of importance, as the temperature of the mercurial column must be taken into account in every accurate application of its reading.

50. In the arrangement of further details mercurial barometers are divided into two classes, according as they are to be used as Standards (fig. 4) on shore, or as Sea Barometers (fig. 3) on shipboard.

In the Standard Barometer the scale and vernier are so graduated as to enable an observer to read the height of the mercurial column to the nearest 0.002 inch, while in the Sea Barometer the reading can not be made closer than 0.01 inch.

The instruments also differ in the method of obtaining the true height of the mercurial column at varying levels of the liquid in the cistern. It is evident that as the mercury in the tube rises, upon increase of atmospheric pressure, the mercury in the cistern must fall; and, conversely, when the mercurial column falls the amount of fluid in the cistern will thereby be increased and a rise of level will occur. As the height of the mercurial column is required FIG. 4.



FIG. 3. above the existing level in the cistern, some means must be adopted to obtain the true height under varying conditions. In the Standard Barometer the mercury of the cistern is contained in a leather bag, against the bottom of which presses the point of a vertical screw, the milled head of the screw projecting from the bottom of the instrument and thus placing it under control of the observer. By this means the surface of the mercury in the eistern (which is visible through a glass casing) may be raised or lowered until it exactly coincides with that level which is chosen as the zero of the scale, and which is indicated by an ivory pointer in plain view. In the Sea Barometer there is no provision for adjusting the level of the eistern to a fixed point,

In the Sea Barometer there is no provision for adjusting the level of the cistern to a fixed point, but compensation for the variable level is made in the scale graduations; a division representing an inch on the scale is a certain fraction short of the true inch, proper allowance being thus made for the rise in level which occurs with a fall of the column, and for the reverse condition.

Further modification is made in the Sea Barometer to adapt it to the special use for which intended. The tube toward its lower end is much contracted to prevent the oscillation of the mercurial column known as "pumping," which arises from the motion of the ship; and just below this point is a trap to arrest any small bubbles of air from finding their way upward. The instrument aboard ship is suspended in a revolving center-ring, in gimbals, supported on a horizontal brass arm which is screwed to the bulkhead; a vertical position is thus maintained by the tube at all times.

51. The vernier is an attachment for facilitating the exact reading of the scale of the barometer, and is also applied to many other instruments of precision, as, for example, the sextant and theodolite. It consists of a metal scale similar in general construction to that of the instrument to which it is fitted, and arranged to move alongside of and in contact with the main scale.

The general principle of the vernier requires that its scale shall have a total length exactly equal to some whole number of divisions of the scale of the instrument and that this length shall be subdivided into a number of parts equal to 1 more or 1 less than the number of divisions of the instrument scale which are covered; thus, if a space of 9 divisions of the main scale be designated as the length of the vernier, the vernier scale would be divided into either 8 or 10 parts.

Suppose that a barometer scale be divided into tenths of an inch and that a length of 9 divisions of such a scale be divided into 10 parts for a vernier (fig. 5); and suppose that the ³¹ divisions of the vernier be numbered consecutively from zero at the origin to 10 at the upper extremity. If, now, by means of the movable rack and pinion, the bottom or zero division of the vernier be brought level with the top of the mercurial column, and that division falls into exact coincidence with a division, but none of the intermediate divisions will be evenly abreast of such a division; the division, but none of the intermediate divisions will be evenly abreast of such a division; the division marked "1" will fall short of a scale division by one-tenth of 1 divison of the scale, or by 0.01 inch; that marked "2" by two-tenths of a division, or 0.02 inch, and so on. If the vernier, instead of having the zero; for the division "2," at 0.02 inch; and similarly for the others. In the case portrayed in figure 5, the reading of the column is 29.81 inches, the scale division next below the zero being 29.80 inches, while the fact that the first division is abreast a mark of the scale shows that 0.01 inch must be added to this to obtain the exact reading.

Had an example been chosen in which 8 vernier divisions covered 9 scale divisions—that is, where the number of vernier divisions was 1 less than the number of scale divisions covered—the principle would still have applied. But, instead of the length of 1 division of the vernier falling short of a division of the scale by one-tenth the length of the latter, it would have fallen beyond by one-eighth. To read in such a case it would therefore be necessary to number the vernier divisions from up downward and to regard the subdivisions as $\frac{1}{80}$ instead of 0.01 inch.

FIG. 5. of 0.01 inch. It is a general rule that the smallest measure to which a vernier reads is equal to the length of 1 division of the scale divided by the number of divisions of the vernier; hence, by varying either the scale or the vernier, we may arrive at any subdivision that may be desired.

either the scale or the vernier, we may arrive at any subdivision that may be desired. 52. The Sea Barometer is arranged as described for the instrument assumed in the illustration; the scale divisions are tenths of an inch, and the vernier has 10 divisions, whence it reads to 0.01 inch. It is not necessary to seek a closer reading, as complete accuracy is not attainable in observing the height of a barometer on a vessel at sea, nor is it essential. The Standard Barometer on shore, however, is capable of very exact reading; hence each scale division is made equal to half a tenth, or 0.05 inch, while a vernier covering 24 such divisions is divided into 25 parts; hence the column may be read to 0.002 inch.

53. To adjust the vernier for reading the height of the uncruinal column may be read to 0.002 ment. 53. To adjust the vernier for reading the height of the uncruinal column the eye should be brought exactly on a level with the top of the column; that is, the line of sight should be at right angles to the scale. When properly set, the front and rear edges of the vernier and the uppermost point of the mercury should all be in the line of sight. A piece of white paper, held at the back of the tube so as to reflect the light, assists in accurately setting the vernier by day, while a small bull's-eye lamp held behind the instrument enables the observer to get a correct reading at night. When observing the barometer it should hang freely, not being inclined by holding or even by touch, because any inclination will cause the column to rise in the tube.

54. Other things being equal, the mercury will stand higher in the tube when it is warm than when it is cold, owing to expansion. For the purposes of comparison, all barometric observations are reduced to a standard which assumes 32° F. as the temperature of the mercurial column, and 62° F. as that of the metal scale; it is therefore important to make this reduction, as well as that for instrumental error (art. 56), in order to be enabled to compare the true barometric pressure with the normal that may be expected for any locality. The following table gives the value of this correction for each 2° F.,



Tempera- ture.	Correction.	Tempera- ture.	Correction.	Tempera- ture.	Correction.	Tempera- ture.	Correction.
$ \begin{array}{c} \circ \\ 20 \\ 22 \\ 24 \\ 26 \\ 28 \end{array} $	$ \begin{array}{ c c c c c }\hline & Inch. \\ +0.02 \\ +0.02 \\ +0.01 \\ +0.01 \\ 0.00 \end{array} \end{array} $	\circ 40 42 44 46 48	$\begin{array}{c} Inch. \\ -0.03 \\ -0.04 \\ -0.04 \\ -0.05 \\ -0.05 \end{array}$	$^{\circ}$ 60 62 64 66 68	$ Inch. \\ -0.09 \\ -0.09 \\ -0.09 \\ -0.10 \\ -0.10 $	$^{\circ}$ 80 82 84 86 88	$\begin{array}{c} Inch. \\ -0.14 \\ -0.14 \\ -0.15 \\ -0.15 \\ -0.16 \end{array}$
- 30 32 34 36 38.	$\begin{array}{c} 0.00\\ -0.01\\ -0.02\\ -0.02\\ -0.03 \end{array}$	$50 \\ 52 \\ 54 \\ 56 \\ 58$	$ \begin{array}{c} -0.06 \\ -0.06 \\ -0.07 \\ -0.07 \\ -0.08 \end{array} $	$70 \\ 72 \\ 74 \\ 76 \\ 78$	$\begin{array}{c} -0.11\\ -0.12\\ -0.12\\ -0.13\\ -0.13\end{array}$	90 92 94 96 98	$\begin{array}{c} -0.16 \\ -0.17 \\ -0.17 \\ -0.18 \\ -0.18 \end{array}$

the plus sign showing that the correction is to be added to the reading of the ship's barometer and the minus sign that it is to be subtracted:

As an example, let the observed reading of the mercurial barometer be 29.95 inches, and the temperature as given by the attached thermometer 74° ; then we have:

Observed height of the mercury	29.95
Correction for temperature (74°)	-0.12
	00 00

Height of the mercury at standard temperature 29.83

55. THE ANEROID BAROMETER.—This is an instrument in which the pressure of the air is measured by means of the elasticity of a plate of metal. It consists of a cylindrical brass box, the metal in the sides being very thin; the contained air having been partially, though not completely, exhausted, the box is hermetically sealed. When the pressure of the atmosphere increases the inclosed air is compressed, the capacity of the box is diminished, and the two flat ends approach each other; when the pressure of the atmosphere decreases, the ends recede from one another in consequence of the expansion of the inclosed air. By means of a combination of levers, this motion of the ends of the box is communicated to an index pointer which travels over a graduated dial plate, the mechanical arrangement being such that the motion of the ends of the box is magnified many times, a very minute movement of the box making a considerable difference in the indication of the pointer. The graduations of the aneroid scale are obtained by comparison with the correct readings of a standard mercurial barometer under normal and reduced atmospheric pressure.

The thermometer attached to the aneroid barometer is merely for convenience in indicating the temperature of the air, but as regards the instrument itself, no correction for temperature can be applied with certainty. Aneroids, as now manufactured, are almost perfectly compensated for temperature by the use of different metals having unequal coefficients of expansion; they ought, therefore, to show the same pressure at all temperatures.

The aneroid barometer, from its small size and the ease with which it may be transported, can often be usefully employed under circumstances where a mercurial barometer would not be available. It also has an advantage over the mercurial instrument in its greater sensitiveness, and the fact that it gives earlier indications of change of pressure. It can, however, be relied upon only when frequently compared with a standard mercurial barometer; moreover, considerable care is required in its handling; while slight shocks will not ordinarily affect it, a severe jar or knock may change its indications by a large amount.

When in use the aneroid barometer may be suspended vertically or placed flat, but changing from one position to another ordinarily makes a sensible change in the readings; the instrument should always, therefore, be kept in the same position, and the errors determined by comparisons made while occupying its customary place. **56.** COMPARISON OF BAROMETERS.—To determine the reliability of the ship's barometer, whether

56. COMPARISON OF BAROMETERS.—To determine the reliability of the ship's barometer, whether mercurial or aneroid, comparisons should from time to time be made with a standard barometer. Nearly all instruments read either too high or too low by a small amount. These errors arise, in a mercurial barometer, from the improper placing of the scale, lack of uniformity of caliber of the glass tube, or similar causes; in an aneroid, which is less accurate and in which there is even more necessity for frequent comparisons, errors may be due to derangement of any of the various mechanical features upon which its working depends. The errors of the barometer should be determined for various heights, as they are seldom the same at all parts of the scale.

In the principal ports of the world standard barometers are observed at specified times each day, and the readings, reduced to zero and to sea level, are published. It is therefore only necessary to read the barometer on shipboard at those times, and, if a mercurial instrument is used, to note the attached thermometer and apply the correction for temperature (art. 54). It is evident that a comparison of the heights by reduced standard and by the ship's barometer will give the correction to be applied to the latter, including the instrumental error, the reduction to sea level, and the personal error of the observer. In the United States, standard barometer readings are made by the Weather Bureau and Branch Hydrographic offices.

Aneroid barometers may be adjusted for instrumental error by moving the index hand, but this is usually done only in the case of errors of considerable magnitude.

57. DETERMINATION OF HEIGHTS BY BAROMETER.—The barometer may be used to determine the difference in heights between any two stations by means of the difference in atmospheric pressure

between them. An approximate rule is to allow 0.0011 inch for each difference in level of one foot, or, more roughly, 0.01 inch for every 9 feet.

A very exact method is afforded by Babinet's formula. If B_0 and B represent the barometric pressure (corrected for all sources of instrumental error) at the lower and at the upper stations respectively, and t_0 and t the corresponding temperatures of the air; then,

Diff. in height=
$$C \times \frac{B_o - B}{B_o + B}$$
;

if the temperatures be taken by a Farhenheit thermometer,

C (in ieet)=52,494
$$\left(1+\frac{t_0+t-64}{900}\right);$$

if a centigrade thermometer is used,

C (in meters) = 16,000
$$\left(1 + \frac{t_0 + t}{1000}\right)$$
.

THE THERMOMETER.

58. The *Thermometer* is an instrument for indicating temperature. In its construction advantage is taken of the fact that bodies are expanded by heat and contracted by cold. In its most usual form the thermometer consists of a bulb filled with mereury, connected with a tube of very fine cross-sectional area, the liquid column rising or falling in the tube according to the volume of the mercury due to the actual degree of heat, and the height of the mercury indicating upon a scale the temperature; the mercury contained in the tube moves in a vacuum produced by the expulsion of the air through boiling the mercury and then closing the top of the tube by means of the blowpipe.

There are three classes of thermometer, distinguished according to the method of graduating the scale as follows: the *Fahrenhed*, in which the freezing point of water is placed at 32° and its boiling point (under normal atmospheric pressure) at 212° ; the *Centigrade*, in which the freezing point is at 0° and the boiling point at 100° ; and the *R'aumar*, in which these points are at 0° and 80° , respectively. The Fahrenheit thermometer is generally used in the United States and England. Tables will be found in this work for the interconversion of the various scale readings (Table 31).

59. The thermometer is a valuable instrument for the mariner, not only by reason of the aid it affords him in judging meteorological conditions from the temperature of the air and the amount of moisture it contains, but also for the evidences it furnishes at times, through the temperature of the sea water, of the ship's position and the probable current that is being encountered.

60. The thermometers employed in determining the temperature of the air (wet and dry bulb) and of the water at the surface, should be mercurial, and of some standard make, with the graduation



Fig. 6.

urial, and of some standard make, with the graduation etched upon the glass stem; they should be compared with accurate standards, and not accepted if their readings vary more than 1° from the true at any point of the scale.

61. The dry-bulb thermometer gives the temperature of the free air. The wet-bulb thermometer, an exactly similar instrument the bulb of which is surrounded by an envelope of moistened cloth, gives what is known as the *temperature of evaporation*, which is always somewhat less than the temperature of the free air. From the difference of these two temperatures the observer may determine the proximity of the air to saturation; that is, how near the air is to that point at which it will be obliged to precipitate some of its moisture (water vapor) in the form of liquid. With the envelope of the wet bulb removed, the two thermometers should read precisely the same; otherwise they are practically useless.

The two thermometers, the wet and the dry bulb, should be hung within a few inches of each other, and the surroundings should be as far as possible identical. In practice the two thermometers are generally inclosed within a small lattice case, such as that shown in figure 6; the case should be placed in a position on deck remote from any source of artificial heat, sheltered from the direct rays of the sun, and from the rain and spray, but freely exposed to the circulation of the air; the door should be kept closed except during the process of reading. The cloth envelope of the wet bulb should be a single thickness of fine muslin, tightly stretched over the bulb, and tied with a fine thread. The wick which serves to carry the water from the cistern to the bulb should consist of a few threads of

lamp cotton, and should be of sufficient length to admit of two or three inches being coiled in the eistern. The muslin envelope of the wet bulb should be at all times thoroughly moist, but not dripping.

When the temperature of the air falls to 32° F. the water in the wick freezes, the capillary action is at an end, the bulb in consequence soon becomes quite dry, and the thermometer no longer shows the temperature of evaporation. At such times the bulb should be thoroughly wetted with ice-cold water shortly before the time of observation, using for this purpose a camel's hair brush or feather; by this process the temperature of the wet bulb is temporarily raised above that of the dry, but only for a brief time, as the water quickly freezes; and inasmuch as evaporation takes place from the surface of the ice thus formed precisely as from the surface of the water, the thermometer will act in the same way as if it had a damp bulb. The wet-bulb thermometer can not properly read higher than the dry, and if the reading of the wet bulb should be the higher, it may always be attributed to imperfections in the instruments.

62. Knowing the temperature of the wet and dry bulbs, the relative humidity of the atmosphere at the time of observation may be found from the following table:

Tempera- ture of the	Difference between dry-bulb and wet-bulb readings.									
bulb ther- mometer.	10	20	30	4 ⁰	5°	6 ⁰	7 °	. 8°	цo	100
0	Per et.	Per et.	Per ct.	Per et.	Per ct.	Per et.	Per ct.	Per ct.	Per ct.	Per ct
24	87	75	62	50	38	-26				
26	88	76	65	53	42	- 30				
28	89	78	67	56	45	34	24			
30	90	79	68	58	-48	- 38	28			
32	90	80	70	61	51	41	32	23		
34	-90	81	72	63	53	44	35	-27		
36	91	82	73	64	55	47	38	- 30	22	
38	92	83	75	66	57	50	42	34	26	
-40	92	84	76	68	59	52	44	37	30	22
42	92	84	77	69	61	54	47	40	- 33	26
44	92	85	78	70	63	56	-49	43	36	29
46	93	85	79	72	65	58	51	45	38	32
48	93	86	79	73	66	60	53	47	41	35
50	93	87	80	74	67	61	55	49	43	37
52	94	87	81	75	69	63	57	51	46	40
54	94	88	82	76	70	64	59	53	48	42
56	94	88	82	77	71	65	60	55	50	44
58	94	89	83	78	72	67	61	56	51	46
60	94	89	84	78	73	68	63	58	53	48
62	95	89	84	79	74	69	64	59	54	50
64	95	90	85	79	74	70	65	60	$\overline{56}$	51
66	95	90	85	80	75	71	66	61	57	53
68	95	90	85	61	76	71	67	63	58	54
70	95	90	86	81	77	72	68	64	60	55
72^{-10}	95	91	86	82	77	73	69	65	61	57
74	95	91	86	82	78	74	70	66	62	58
76	95	91	87	82	78	74	70	66	63	59
78	96	91	87	83	79	75	71	67	63	60
80	96	92	87	83	79	75	72	68	64	61
82	96	99	88	84	80	76	72	69	65	62
84	96	92	88	84	80	77	73	69	66	63
86	96	92	88	84	81	77	73	70	67	63
88	96	92	88	85	81	77	74	71	67	64
90	96	$92^{0.2}{92}$	88	85	81	78	74	71	68	65

The table may be readily understood. For example, if the temperature of the air (dry bulb) be 60°, and the temperature of evaporation (wet bulb) be 56°, the difference being 4°, look in the column headed "Temperature of the air" for 60°, and for the figures on the same line in column headed 4°; here 78 will be found, which means that the air is 78 per cent saturated with water vapor; that is, that the anount of water vapor present in the atmosphere is 78 per cent of the total amount that it could carry at the given temperature (60°). This total amount, or saturation, is thus represented by 100, and if there occurred any increase of the quantity of vapor beyond this point, the excess would be precipitated in the form of liquid. Over the ocean's surface the relative humidity is generally about 90 per cent, or even higher in the doldrums; over the land in dry winter weather it may fall as low as 40 per cent.

63. The sea water of which the temperature is to be taken should be drawn from a depth of 3 feet below the surface, the bucket used being weighted in order to sink it. The bulb of the thermometer should remain immersed in the water at least three minutes before reading, and the reading should be made with the bulb immersed.

THE LOG BOOK.

64. The *Log Book* is a record of the ship's cruise, and, as such, an important accessory in the navigation. It should afford all the data from which the position of the ship is established by the method of dead reckoning; it should also comprise a record of meteorological observations, which should be made not only for the purpose of fortelling the weather during the voyage, but also for contribution to the general fund of knowledge of marine meteorology.

65. A convenient form for recording the data, which is employed for the log books of United States naval vessels, is shown on page 26; beside the tabulated matter thus arranged, to which one page of the book is devoted, a narrative of the miscellaneous events of the day, written and signed by the proper officers, appears upon the opposite page.

	State of sea by symbols.		
	Amount, scale 0 to 10.	ø	
Clouds.	Moving from.		, true. true. mots. gals. gals. tons. tons.
5	Form by symbols.		
	State of weather by symbols.		
.e.	Water at sur- face.		
nperatui	Air, wet bulb.		
Ten	Air, dry bulb.		
eter.	Ther- mom- eter attd.		
Barom	Height in inches.		
	Lee- way.		.er
	Heel.		+ + + + + + + + + + + + + + + + + + +
	Force.		on
Wind.	Direction by standard compass.		t. by Obs t. by Obs ng. by Obs ng. by D. R. ng. by D. R. preceding noon nots; setting t. by nds; setting t. by ng. by ng. by id at preceding 24 preceding 24 preced
Course steered by standard compass.			t 8.00 a. m. [La Lo t noon [Lo t noon [Lo lo de good since y log since pre ar hourk t 8.00 p. m. [La t 8.00 p. m. [La t 8.00 p. m. [La t 8.00 p. m. [La t annass observe of compass on- ended during anned during pr med during pr
	Keading of patent log.		Position a Position a Jourse ma Distance h Distance h Distance h Oristion a Position a Variation Vater exT Vater rem Vater rem Vater rem Vater rem Vater rem Vater rem
ed.	Tenths.		
Spe	Knots.		
	Hour.	A. M. 1 5 6 6 6 7 7 8 6 6 7 8	

26 INSTRUMENTS AND ACCESSORIES IN NAVIGATION.

66. For the most part, the nature of the information called for, with the method of recording it.

60. For the method part of the internation is here given of such points as seem to require it.
67. The WIND.—In recording the force of the wind the scale devised by the late Admiral Sir F. Beaufort is employed. According to this scale the wind varies from 0, a calm, to 12, a hurricane, the greatest velocity it ever attains. In the lower grades of the scale the force of the wind is estimated from the speed imparted to a man-of-war of the early part of the nineteenth century sailing full and by; in the higher grades, from the amount of sail which the same vessel could carry when closehauled. The scale, with the estimated velocity of the wind in both statute and nautical miles per hour, is as follows

		Velo	Mean pressure	
Force of wind.	Conditions.	Statute miles per hour.	Nautical miles per hour.	in pounds per square foot.
0.—Calm. 1.—Light air. 2.—Light breeze. 3.—Gentle breeze. 4.—Moderate breeze. 5.—Fresh breeze. 6.—Strong breeze. 7.—Moderate gale 8.—Fresh gale	Full-rigged ship, all sails set, no beadway. Just sufficient to give steerage way Speed of 1 or 2 knots, "full and by" Speed of 3 or 4 knots, "full and by" Speed of 5 or 6 knots, "full and by" All plain sail, "full and by" Topgallantsails over single-reefed topsails Double-reefed topsails Treble-reefed topsails (or reefed upper-	0 to 3 8 13 23 25 34 40 48	0 to 2.6 6.9 11.3 15.6 20.0 24.3 29.5 34.7 41.6	$\begin{array}{c} 0.03\\ 0.23\\ 0.62\\ 1.2\\ 1.9\\ 2.9\\ 4.2\\ 5.9\\ 8.4 \end{array}$
9.—Strong gale 10.—Whole gale	topsails and courses). Close-reefed topsails and courses (or lower topsails and courses). Close-reefed main topsail and reefed fore-	56 65	48.6 56.4	11.5 15.5
11.—Storm 12.—Hurricane	sali (or lower main topsali and reeled foresall). Storm staysails	75 90 and over.	65.1 78.1 and over.	20.6 29.6

68. When steaming or sailing with any considerable speed, the apparent direction and force of the wind, as determined from a vane, flag, or pennant aboard ship, may differ materially from the true direction and force, the reason being that the air appears to come from a direction and with a force dependent, not only upon the wind itself, but also upon the motion of the vessel. For instance, suppose that the wind has a velocity of 20 knots an hour (force 4), and take the case of two vessels, each steaming 20 knots, the first with the wind dead aft, the second with the wind dead ahead. The former vessel will be moving with the same velocity as the air and in the same direction; the velocity of the wind relatively to the ship will thus be zero; on the vessel an apparent calm will prevail and the pennant will hang up and down. The latter vessel will be moving with the same velocity as the air, but in the opposite direction; the relative velocity of the two will thus be the sum of the two velocities, or 40 knots an hour, and on the second vessel the wind will apparently have the velocity corresponding very nearly with a fresh gale. Again, it might be shown that in the case of a vessel steaming west at the rate of 20 knots, with the wind blowing from north with the velocity of 20 knots an hour, the velocity with which the air strikes the ship as a result of the combined motion will be 28 knots an hour, and the direction from which it comes will be NW. If, therefore, the effect of the the speed of the ship is neglected the wind will be recorded as NW., force 6, when in reality it is north, force 4. In order to make a proper allowance for this error and arrive at the true direction and force of the

wind, Table 32 may be entered with the ship's speed and the apparent direction and force of the wind as arguments, and the true direction and force will be found.

69. WEATHER.—To designate the weather a series of symbols devised by the late Admiral Beaufort is employed. The system is as follows:

b.—Clear blue sky.	p.—Passing showers of rain.
c.—Clouds.	q.—Squally weather.
d.—Drizzing, or light rain.	r.—Rainy weather, or continuous rain.
f.—Fog, or foggy weather.	s.—Snow, or snowy weather.
g.—Gloomy, or dark, stormy-looking weather.	t.—Thunder.
h.—Hail.	u.—Ugly appearances, or threatening weather.
l.—Lightning.	v.—Visibility of distant objects.
m.—Misty weather.	w.—Wet, or heavy dew.
oOvercast.	z.—Hazy.
To indicate great intensity of any feature, its	umbel may be underlined, thus a beauty rain

70. CLOUDS.—The following are the principal forms of clouds, named in the order of the altitude above the earth at which they usually occur, beginning with the most elevated. The symbols by which each is designated follows its name:

1. CHRRUS, (Ci.).—Detached clouds, delicate and fibrous looking, taking the form of feathers, generally of a white color, sometimes arranged in belts which cross a portion of the sky in great circles, and, by an effect of perspective, converging toward one or two opposite points of the horizon.

2. CIRRO-STRATUS, (Ci.-S.).—A thin, whitish sheet, sometimes completely covering the sky and only giving it a whitish appearance, or at others presenting, more or less distinctly, a formation like a tangled web. This sheet often produces halos around the sun and moon. 3. CIRRO-CUMULUS, (Ci.-Cu.).—Small globular masses or white flakes, having no shadows, or only very slight shadows, arranged in groups and often in lines.

very slight shadows, arranged in groups and often in lines. 4. ALTO-CUMULUS, (A.-Cu.).—Rather large globular masses, white or grayish, partially shaded,

arranged in groups or lines, and often so closely packed that their edges appear confused. The detached masses are generally larger and more compact at the center of the group; at the margin they form into finer flakes. They often spread themselves out in lines in one or two directions.

5. ALTO-STRATUS, (A.-S.).—A thick sheet of a gray or bluish color, showing a brilliant patch in the 5. ALIO-STRATCS, (A.-S.).—A thick sheet of a gray of obtain color, showing a bifmath fatter in the neighborhood of the sun or moon, and which, without causing halos, may give rise to corone. This form goes through all the changes like the Cirro-Stratus, but its altitude is only half so great.
6. STRATO-CUMULUS, (S.-Cu.).—Large globular masses or rolls of dark cloud, frequently covering the whole sky, especially in winter, and occasionally giving it a wavy appearance. The layer of Strato-

Cumulus is not, as a rule, very thick, and patches of blue sky are often visible through the intervening spaces. All sorts of transitions between this form and the Alto-Cumulus are noticeable. It may be

distinguished from Nimbus by its globular or rolled appearance and also because it does not bring rain. 7. NIMBUS, (N.).—Rain clouds; a thick layer of dark clouds, without shape and with ragged edges, from which continued rain or snow generally falls. Through the openings of these clouds an upper laver of Cirro-Stratus or Alto-Stratus may almost invariably be seen. If the laver of Nimbus separates

layer of Cirro-Stratus or Alto-Stratus may almost invariably be seen. If the layer of Nimbus separates into shreds or if small loose clouds are visible floating at a low level underneath a large nimbus, they may be described as Fracto-Nimbus (Fr.-N.), the "seud" of sailors. 8. CUMUUS, (Cu.).—Wool-pack clouds; thick clouds of which the upper surface is dome-shaped and exhibits protuberances, while the base is horizontal. When these clouds are opposite the sun the surfaces usually presented to the observer have a greater brilliance than the margins of the protuber-ances. When the light falls aslant, they give deep shadows; when, on the contrary, the clouds are on the same side as the sun, they appear dark, with bright edges. The true Cumulus has clear superior and inferior limits. It is often broken up by strong winds, and the detached portions undergo continual changes. These may be distinguished by the name of Fracto-Cumulus (Fr.-Cu.). 9. CUMUO-NUMERS (Cu. N.)—The thunder-cloud or shower-cloud beaver prove the supersection of the protuber is not provide the supersection of the shower cloud is proved to be been the supersection of the strong is not provide the supersection of the protuber is the supersection of the supersecti

9. CUMULO-NIMBUS, (Cu.-N.).—The thunder-cloud or shower-cloud; heavy masses of clouds rising in the form of mountains, turrets, or anvils, generally having a sheet or screen of fibrous appearance above, and a mass of clouds similar to Nimbus underueath. From the base there usually fall local showers

of rain or of snow (occasionally hail or soft hail). 10. STRATES, (S).—A horizontal sheet of lifted fog; when this sheet is broken up into irregular shreds by the wind or by the summits of mountains, it may be distinguished by the name of Fracto-

Stratus (Fr.-S.). **71.** In the scale for the amount of clouds 0 represents a sky which is cloudless and 10 a sky which is completely overcast.

72. STATE OF SEA.—The state of the sea is expressed by the following system of symbols:

B.—Broken or irregular sea.

C.—Chopping, short, or cross sea.

G.-Ground swell. H.-Heavy sea.

L.-Long rolling sea.

M.—Moderate sea or swell. R.-Rough sea. S.-Smooth sea. T.-Tide-rips.

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CHAPTER III

THE COMPASS ERROR.

CAUSES OF THE ERROY.

73. When two magnets are near enough together to exert a mutual influence, their properties are such as to cause those poles which possess similar magnetism to repel, and those which possess magnetism of opposite sorts to attract one another.

The earth is an immense natural magnet, having in each hemisphere a pole lying in the neighborhood of the geographical pole, though not exactly coincident therewith; consequently, when a magnet, such as that of a compass, is allowed to revolve freely in a horizontal plane, it will so place itself as to be parallel to the lines of magnetic force in that plane created by the earth's magnetic poles, the end which we name north pointing to the north, and the south end in the opposite direction. The north end of the compass—north-seeking, as it is sometimes designated for clearness—will be that end which has opposite polarity to the earth's north magnetic pole, this latter possessing the same sort of magnetism as the so-called south pole of the compass.

74. By reason of the fact that the magnetic pole differs in position from the geographical pole, the compass needle will not indicate true directions, but each compass point will differ from the corresponding true point by an amount dependent upon the angle between the geographical and the magnetic pole at the position of the observer. The amount of this difference, expressed in angular measure, is the *Variation of the Compass* (sometimes called also the *Declination*, though this term is seldom employed by navigators).

The variation not only changes as one travels from point to point on the earth, being different in different localities, but, as it has been found that the earth's magnetic poles are in constant motion, it undergoes certain changes from year to year. In taking account of the error it produces, the navigator must therefore be sure that the variation used is correct not only for the *place*, but also for the *time* under consideration. The variation is subject to a small diurnal fluctuation, but this is not a material consideration with the mariner.

75. Besides the error thus produced in the indications of the compass, a further one, due to *Local Attraction*, may arise from extraneous influences due to natural magnetic attraction in the vicinity of the vessel. Instances of this are quite common when a ship is in port, as she may be in close proximity to vessels, docks, machinery, or other masses of iron or steel. It is also encountered at sea in localities where the mineral substances in the earth itself possess magnetic qualities—as, for example, at certain places in Lake Superior and at others off the coast of Australia. When due to the last-named cause, it may be a source of great danger to the mariner, but, fortunately, the number of localities subject to local attraction is limited. The amount of this error can seldom, if ever, be determined; if known, it might properly be included with the variation and treated as a part thereof.

76. In addition to the variation, the compass ordinarily has a still further error in its indications, which arises from the effect exerted upon it by masses of magnetic metal within the ship itself. This is known as the *Deviation of the Compass.* For reasons that will be explained later, it differs in amount for each heading of the ship, and, further, the character of the deviations undergo modification as a vessel proceeds from one geographical locality to another.

APPLYING THE COMPASS ERROR.

77. From what has been explained, it may be seen that there are three methods by which bearings or courses may be expressed: (a) true, when they refer to the angular distance from the earth's geographical meridian; (b) magnetic, when they refer to the angular distance from the earth's magnetic meridian, and must be corrected for variation to be converted into true; and (c) by compass, when they refer to the angular distance from the earth's magnetic meridian, and must be corrected for the deviation on that heading for conversion to magnetic, and for both deviation and variation for conversion to true bearings or courses. The process of applying the errors under all circumstances is one of which the navigator must make himself a thorough master; the various problems of conversion are constantly arising; no course can be set nor bearing plotted without involving the application of this problem, and a mistake in its solution may produce serious consequences. The student is therefore urged to give it his most careful attention.

78. When the effect of a compass error, whether arising from variation or from deviation, is to draw the north end of the compass needle to the right, or eastward, the error is named east, or is marked +: when its effect is to draw the north end of the needle to the left or westward, it is named west, or marked -

Figures 7 and 8 represent, respectively, examples of easterly and westerly errors.



In both cases consider that the circles represent the observer's horizon. N and S being the correct north and south points in each case. If N' and S' represent the corresponding points indicated by a compass whose needle is deflected by a compass error, then in the first case, the north end of the needle being drawn to the right or east, the error will be easterly or positive, and in the second case, the north end of the needle being drawn to the left or west, the compass error will be westerly or negative.

Fig. 7. Fig. 8. Considering figure 7, if we assume the easterly error to amount to one point, it will be seen that if a direction of N. by W. is indicated by the compass, the correct direction should be north, or one point farther to the right. If the compass indicates north, the correct bearing is N. by E.; that is, still one point to the right. If we follow around the whole card, the same relation will be found in every case, the corrected bearing being always one point to the right of the compass bearing. Conversely, if we regard figure 8, assuming the same amount of westerly error, a compass bearing of N. by E. is the equivalent of a correct bearing of north, which is one point to the left; and this rule is general throughout the circle, the corrected direction being always to the left of that shown by the compass.

79. Having once satisfied himself that the general rule holds, the navigator may save the necessity of reasoning out in each case the direction in which the error must be applied, and need only charge his mind with some single formula which will cover all cases. Such a one is the following:

When the CORRECT direction is to the RIGHT, the error is EAST. The words correct-right-east, in such a case, would be the key to all of his solutions. If he had a compass course to change to a corrected one with easterly deviation, he would know that to obtain the result the error must be applied to the right; if it were desired to change a correct course to the one indicated by compass, the error being westerly, the converse presents itself—the correct must be to the left—the uncorrected will therefore be to the right; if a correct bearing is to be compared with a compass bearing to find the compass error, when the correct is to the right the error is east, or the reverse.

S0. It must be remembered that the word *east* is equivalent to *right* in dealing with the compass error, and west to left, even though they involve an apparent departure from the usual rules. If a vessel steers NE. by compass with one point easterly error, her corrected course is NE. by E.; but if she steers SE., the corrected course is not SE. by E., but SE. by S. Another caution may be necessary to avoid confusion; the navigator should always regard himself as facing the point under consideration when he applies an error; one point westerly error on South will bring a corrected direction to S. by E.; but if we applied one point to the left of South while looking at the compass card in the usual way—north end up—S. by W. would be the point arrived at, and a mistake of two points would be the result.

\$1. In the foregoing explanation reference has been made to "correct" directions and "compass errors" without specifying "magnetic" and "true" or "variation" and "deviation." This has been done in order to make the statements apply to all cases and to enable the student to grasp the subject in its general bearing without confusion of details.

Actually, as has already been pointed out, directions given may be true, magnetic, or by compass. By applying variation to a magnetic bearing we correct it and make it true, by applying deviation to a compass bearing we correct it to magnetic, and by applying to it the combined deviation and variation we correct it to true. Whichever of these operations is undertaken, and whichever of the errors is considered, the process of correction remains the same; the correct direction is always to the right, when the error is east, by the amount of that error.

Careful study of the following examples will aid in making the subject clear:

EXAMPLES: A bearing taken by a compass free from deviation is N. 76° E.; variation, 5° W.;

EXAMPLES: A bearing taken by a compass free from deviation is N. 76° E.; variation, 5° W.; required the true bearing. N. 71° E.
A bearing taken by a similar compass is NW. by W. ½ W.; variation, ¼ pt. W.; required the true bearing. NW. by W. ¾ W.
A vessel steers S. 27° E. by compass; deviation on that heading, 3° W.; variation in the locality, 12° E.; required the true course. S. 18° E.
A vessel steers S. by W. ½ W.; deviation, ¼ pt. W.; variation, 1 pt. E.; required the true course.

SSW. 1 W.

It is desired to steer the magnetic course N. 38° W.; deviation, 4° E.; required the course by com-N. 42° W.

pass. N. 42° W. The true course between two points is found to be W. $\frac{1}{8}$ N.; variation $1\frac{1}{4}$ pt. E.; no deviation; required the compass course. W. $\frac{3}{8}$ S. True course to be made, N. 55° E.; deviation, 7° E.; variation, 14° W.; required the course by

compass. N. 62° E.

A vessel passing a range whose direction is known to be S. 20° W., magnetic, observes the bearing by compass to be S. 2° E.; required the deviation. 22° E. The sun's observed bearing by compass is S. 89° E.; it is found by calculation to be N. 84° E. (true); variation, 8° W.; required the deviation. 1° E.

FINDING THE COMPASS ERROR.

82. The variation of the compass for any given locality is found from the charts. A nautical chart always contains information from which the navigator is enabled to ascertain the variation for any place within the region embraced and for any year. Beside the information thus to be acquired from local charts, special charts are published showing the variation at all points on the earth's surface.

\$3. The deviation of the compass, varying as it does for every ship, for every heading, and for every geographical locality, must be determined by the navigator, for which purpose various methods are available.

Whatever method is used, the ship must be swung in azimuth and an observation made on each of the headings upon which the deviation is required to be known. If a new iron or steel ship is being swung for the first time, observations should be made on each of the thirty-two points. At later swings, especially after correctors have been applied, or in the case of wooden ships, sixteen points will suffice—or, indeed, only eight. In case it is not practicable to make observations on exact compass points, they should be made as near thereto as practicable and platted on the Napier diagram (to be explained hereafter), whence the deviations on exact points may be found.

84. In swinging ship for deviations the vessel should be on an even keel and all movable masses of iron in the vicinity of the compass secured as for sea. The vessel, upon being placed on any heading, should be steadied there for three to four minutes before the observation is made in order that the compass card may come to rest and the magnetic conditions assume a settled state. To assure the greatest accuracy the ship should first be swung to starboard, then to port, and the mean of the two deviations on each course taken. Ships may be swung under their own steam, or with the assistance of a tug, or at anchor, where the action of the tide tends to turn them in azimuth (though in this case it is difficult to get them steadied for the requisite time on each heading), or at anchor, by means of springs and hawsers.

So. The deviation of all compasses on the ship may be obtained from the same swing, it being required to make observations with the standard only. To accomplish this it is necessary to record the ship's head by all compasses at the time of steadying on each even point of the standard; applying the deviation, as ascertained, to the heading by standard, gives the magnetic heads, with which the direction of the ship's head by each other compass may be compared, and the deviation thus obtained. Then a complete table of deviations may be constructed as explained in article 94.

S6. There are four methods for ascertaining the deviations from swinging; namely, by reciprocal bearings, by bearings of the sun, by ranges, and by a distant object. 87. RECIPROCAL BEARINGS.—One observer is stationed on shore with a spare compass placed in a

position free from disturbing magnetic influences; a second observer is at the standard compass on board ship. At the instant when ready for observation a signal is made, and each notes the bearing of the other. The bearing by the shore compass, reversed, is the magnetic bearing of the shore station from the ship, and the difference between this and the bearing by the ship's standard compass represents the deviation of the latter.

In determining the deviations of compasses placed on the fore-and-aft amidship line, when the distribution of magnetic metal to starboard and port is symmetrical, the shore compass may be replaced by a dumb compass, or pelorus, or by a theodolite in which, for convenience, the zero of the horizontal graduated circle may be termed north; the reading of the shore instrument will, of course, not represent magnetic directions, but by assuming that they do we obtain a series of fictitious deviations, the mean value of which is the error common to all. Upon deducting this error from each of the fictitious deviations, we obtain the correct values.

If ship and shore observers are provided with watches which have been compared with one another, the times may be noted at each observation, and thus afford a means of locating errors due to misunderstanding of signals.

S8. BEARINGS OF THE SUN.—In this method it is required that on each heading a bearing of the sun be observed by compass and the time noted at the same moment by a chronometer or watch. By means which will be explained in Chapter XIV, the true bearing of the sun may be ascertained from the known data, and this, compared with the compass bearing, gives the total compass error; deducting from the compass error the variation, there remains the deviation. The variation used may be that given by the chart, or, in the case of a compass affected only by symmetrically placed iron or steel, may be considered equal to the mean of all the total errors. Other celestial bodies may be observed for this purpose in the same manner as the sun.

This method is important as being the only one available for determining the compass error at sea. 89. RANGES. -- In many localities there are to be found natural or artificial range marks which are clearly distinguishable, and which when in line lie on a known magnetic bearing. By stearing about on different headings and noting the compass bearing of the ranges each time of crossing the line that they mark, a series of deviations may be obtained, the deviation of each heading being equal to the difference between the compass and the magnetic bearing.

90. DISTANT OBJECT.-A conspicuous object is selected which must be at a considerable distance from the ship and upon which there should be some clearly defined point for taking bearings. The direction of this object by compass is observed on successive headings. Its true or magnetic bearing is then found and compared with the compass bearings, whence the deviation is obtained.

The true or the magnetic bearing may be taken from the chart. The magnetic bearing may also be found by setting up a compass ashore, free from foreign magnetic disturbance, in range with the object and the ship, and observing the bearing of the object; or the magnetic bearing may be assumed to be the mean of the compass bearings.

In choosing an object for use in this method care must be taken that it is at such a distance that its bearing from the ship does not practically differ as the vessel swings in azimuth. If the ship is swung at anchor, the distance should be not less than 6 miles. If swung under way, the object must be so far that the parallax (the tangent of which may be considered equal to half the diameter of swinging divided by the distance) shall not exceed about 30'.

 $\mathbf{91}$. In all of the methods described it will be found convenient to arrange the results in tabular . In one column record the ship's head by standard compass, and abreast it in successive columns form the observations from which the deviation is determined on that heading, and finally write the deviation itself. When the result of the swing has been worked up another table is constructed showing simply the headings and the corresponding deviations. This is known as the *Deviation Table* of the compass. If compensation is to be attempted, this table is the basis of the operation; if not, the deviation tables of the standard and steering compass should be posted in such place as to be accessible to all persons concerned with the navigation of the ship.

92. Let it be assumed that a deviation table has been found and that the values are as follows:

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1 1011	at)	O11 1	tai	10
12000		(m)		nr.

Ship's head by standard compass.	Devia- tion.	Ship's head by standard compass.	Devia- tion.	Ship's head by standard compass.	Devia- tion,	Ship's head by standard compass.	Devia- tion.
North N. by E NE NE NE ENE E. by N	$\begin{array}{c} \circ & i \\ -1 & 00 \\ -1 & 50 \\ -3 & 00 \\ -5 & 15 \\ -7 & 10 \\ -10 & 15 \\ -13 & 05 \\ -17 & 10 \end{array}$	East E. by S ESE SE. by E . SE. by S SE. by S SSE S. by E	$\begin{array}{c} \circ & ,\\ -19 & 55 \\ -22 & 00 \\ -23 & 30 \\ -24 & 00 \\ -23 & 30 \\ -20 & 30 \\ -16 & 00 \\ -8 & 50 \end{array}$	South SSW SW. by S SW. by S SW. by W. WSW W. by S	$\begin{array}{c} \circ & , \\ 0 & 00 \\ +10 & 20 \\ +17 & 00 \\ +21 & 50 \\ +24 & 30 \\ +26 & 20 \\ +25 & 00 \\ +23 & 30 \end{array}$	West W. by N WNW NW. by W. NW. NW. by N. NNW N. by W	$\begin{array}{c} & & & \\ & +19 & 36 \\ & +17 & 06 \\ & +13 & 06 \\ & +11 & 16 \\ & +7 & 46 \\ & + & 5 & 06 \\ & + & 3 & 0 \\ & + & 1 & 0 \end{array}$

We have from the table the amount of deviation on each compass heading; therefore, knowing the ship's head by compass, it is easy to pick out the corresponding deviation and thus to obtain the magnetic heading. But if we are given the magnetic direction in which it is desired to steer and have to find the corresponding compass course, the problem is not so simple, for we are not given deviations on magnetic heads, and where the errors are large it may not be assumed that they are the same as on

on magnetic heads, and where the errors are large it may not be assumed that they are the same as on the corresponding compass headings. For example, with the deviation table just given, suppose it is required to determine the compass heading corresponding to N. 79° W., magnetic. The deviation corresponding to N. 79° W., per compass, is + 17° 00′. If we apply this to N. 79° W., magnetic, we have S. 84° W. as the compass course. But, consulting the table, it may be seen that the deviation corresponding to S. 84° W., per compass, is + 21½°, and therefore if we steer that course the magnetic direction will be N. 74½° W., and not N. 79° W., as desired.

A way of arriving at the correct result is to make a series of trials until a course is arrived at which fulfills the conditions. Thus, in the example given:

First	rial.	Second trial.
Mag. course required. N. 79 Try dev. on N. 79° W., p. c 17'	W. Mag. course requiredE. Try dev. on S. 79° W., p.	e N. 79° W. 23½° E.
S. 84° Dev. on S. 84° W., p. c	W. Trial comp. course ^o E. Dev. on S. 77 ¹ / ₂ ° W., p. c.	S. 77 ¹ ° W. 24° E.
Mag. course made good. N. 74. Since this assumption carries the course 4	W. Mag. course made good too This is as close to the re	N. 78½° W. quired course as the ship

far to the right, assume next a deviation on a can be steered. It may occur course 5° farther to the left than the one used here. will be necessary in some cases.

It may occur that further trials

93. THE NAPLER DIAGRAM.—A much more expeditious method for the solution of this problem is afforded by the Napier Diagram, and as that diagram also facilitates a number of other operations connected with compass work it should be clearly understood by the navigator. This device admits of a graphic representation of the table of deviations of the compass by means of a curve; besides furnishing a ready means of converting compass into magnetic courses and the reverse, one of its chief merits is that if the deviation has been determined on a certain number of headings it enables one to obtain the most probable value of the deviation on any other course that the ship may head. The last-named feature renders it useful in making a table of deviations of compasses other than the standard when their errors are found as described in article 85.
94. The Napier diagram (fig. 9) represents the margin of a compass card cut at the north point and straightened into a vertical line; for convenience, it is usually divided into two sections, representing, respectively, the eastern and western semicircles. The vertical line is of a convenient length and divided into thirty-two equal parts corresponding to the points of the compass, beginning at the top with North and continuing around to the right; it is also divided into 360 degrees, which are appropriately marked.



The vertical line is intersected at each compass point by two lines inclined to it at an angle of 60°, that line which is inclined upward to the right being drawn plain and the other dotted.

To plot a curve on the Napier diagram, if the deviation has been observed with the ship's head on given compass courses (as is usually the case with the standard compass), measure off on the vertical scale the number of degrees corresponding to the deviation and lay it down—to the right if easterly and to the left if westerly—on the dotted line passing through the point representing the ship's head; or, if the observation was not made on an even point, then lay it down on a line drawn parallel to the dotted ones through that division of the vertical line which represents the compass heading; if the deviation has been observed with the ship on given magnetic courses (as when deviations by steering compass are obtained by noting the ship's head during a swing on even points of the standard), proceed in the same way, excepting that the deviation must be laid down on a plain line or a line parallel thereto. Mark each point thus obtained with a dot or small circle, and draw a free curve passing, as nearly as possible, through all the points.

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To obtain a complete curve, a sufficient number of observations should be taken while the ship swings through an entire circle. Generally, observations on every alternate point are enough to establish a good curve, but in cases where the maximum deviation reaches 40° it is preferable to observe on every point.

The curve shown in the full line on figure 9 corresponds to the table of deviations given in article 92. From a given compass course to find the corresponding magnetic course, through the point of the vertical line representing the given compass course, draw a line parallel to the *dotted* lines until the curve is intersected, and from the point of intersection draw another line parallel to the plain lines; the point on the scale where this last line cuts the vertical line is the magnetic course sought. The correctness of this solution will be apparent when we consider that the 60° triangles are equilateral, and therefore the distance measured along the vertical side will equal the distance measured along the inclined sides that is, the deviation; and the direction will be correct, for the construction is such that magnetic directions will be to the right of compass directions when the deviation is easterly and to the left if westerly.

From a giren magnetic course to find the corresponding compass course, the process is the same, excepting that the first line drawn should follow, or be parallel to, the *pluin* lines, and the second, or return line, should be parallel to the dotted; and a proof similar to that previously employed will show the correctness of the result. As an example, the problem given in article 92 may be solved by the diagram, and the result will be found to accord with the solution previously given.

THE THEORY OF DEVIATION.«

95. FEATURES OF THE EARTH'S MAGNETISM.—It has already been stated that the earth is an immense natural magnet, with a pole in each hemisphere which is not coincident with the geographical pole; it has also a magnetic equator which lies close to, but not coincident with, the geographical equator.

A magnetic needle freely suspended at a point on the earth's surface, and undisturbed by any other than the earth's magnetic influence, will lie in the plane of the magnetic meridian and at an angle with the horizon depending upon the geographical position.

The magnetic elements of the earth which must be considered are shown in figure 10. The earth's *total force* is represented in direction and intensity by the line AB. Since compass needles are mechan-



Inclusively by the line of the complex inclusive the transically arranged to move only in a horizontal plane, it becomes necessary, when investigating the effect of the earth's magnetism upon them, to resolve the total force into two components which in the figure are represented by AC and AD. These are known, respectively, as the *horizontal* and *retical components* of the earth's total force, and are usually designated as H and Z. The angle CAB, which the line of direction makes with the plane of the horizon, is called the *magnetic inclination* or *dip*, and denoted by θ .

It is clear that the horizontal component will reduce to zero at the magnetic poles, where the needle points directly downward, and that it will reach a maximum at the magnetic equator, where the free needle hangs in a horizontal direction. The reverse is true of the vertical component and of the angle of dip.

of dip. Values representing these different terms may be found from special charts.

96. INDUCTION; HARD AND SOFT IRON.—When a piece of unmagnetized iron or steel is brought within the influence of a magnet, certain magnetic properties are immediately imparted to the former, which itself becomes magnetic and continues to remain so as long as it is within the sphere of influence of the permanent magnet; the magnetism that it acquires under these circumstances is said to be *induced*, and the properties of *induction* are such that that end or region which is nearest the pole

tion are such that that end or region which is nearest the pole of the influencing magnet will take up a polarity opposite thereto. If the magnet is withdrawn, the induced magnetism is soon dissipated. If the magnet is brought into proximity again, but with its opposite pole nearer, magnetism will again be induced, but this time its polarity will be reversed. A further property is that if a piece of iron or steel, while temporarily possessed of magnetic qualities through induction, be subjected to blows, twisting, or mechanical violence of any sort, the magnetism is thus made to acquire a permanent nature.

The softer the metal, from a physical point of view, the more quickly and thoroughly will induced magnetism be dissipated when the source of influence is withdrawn; hard metal, on the contrary, is slow to lose the effect of magnetism imparted to it in any way. Hence, in regarding the different features which affect deviation, it is usual to denominate as hard iron that which possesses retained magnetism of a stable nature, and as soft iron that which rapidly acquires and parts with its magnetic qualities under the varying influences to which it is subjected.

97. MAGNETIC PROPERTIES ACQUIRED BY AN IRON OR STEEL VESSEL IN BUILDING.—The inductive action of the earth's magnetism affects all iron or steel within its influence, and the amount and permanency of the magnetism so induced depends upon the position of the metal with reference to the earth's total force, upon its character, and upon the degree of hammering, bending, and twisting that it undergoes.

a As it is probable that the student will not have practical need of a knowledge of the theory of deviation and the compensation of the compass until after he has mastered all other subjects pertaining to Navigation and Nautical Astronomy, it may be considered preferable to omit the remainder of this chapter at first and return to it later.

An iron bar held in the line of the earth's total force instantly becomes magnetic; if held at an angle thereto it would acquire magnetic properties dependent for their amount upon its inclination to the line of total force; when held at right angles to the line there would be no effect, as each extremity would be equally near the poles of the earth and all influence would be neutralized. If, while such a bar is in a magnetic state through inductive action, it should be hammered or twisted, a certain magnetism of a permanent character is impressed upon it, which is never entirely lost unless the bar is subjected to causes equal and opposite to those that produced the first effect.

subjected to causes equal and opposite to those that produced the first effect. A sheet of iron is affected by induction in a similar way, the magnetism induced by the earth diffusing itself over the entire plate and separating itself into regions of opposite polarity divided by a neutral area at right angles to the earth's line of total force. If the plate is hammered or bent, this magnetism takes up a permanent character.

If the magnetic mass has a third dimension, and assumes the form of a ship, a similar condition prevails. The whole takes up a magnetic character; there is a magnetic axis in the direction of the line of total force, with poles at its extremities and a zone of no magnetism perpendicular to it. The distribution of magnetism will depend upon the horizontal and vertical components of the earth's force in the locality and upon the direction of the keel in building; its permanency will depend upon the amount of mechanical violence to which the metal has been subjected by the riveting and other ineidents of construction, and upon the nature of the metal employed. **98.** CAUSES THAT PRODUCE DEVIATION.—There are three influences that operate to produce devia-

98. CAUSES THAT PRODUCE DEVIATION.—There are three influences that operate to produce deviation; namely, (a) subpermanent magnetism; (b) transient magnetism induced in vertical soft iron, and (c) transient magnetism induced in horizontal soft iron. Their effect will be explained.

Subpermanent magnetism is the name given to that magnetic force which originates in the ship while building, through the process explained in the preceding article; after the vessel is launched and has an opportunity to swing in azimuth, the magnetism thus induced will suffer material diminution until, after the lapse of a certain time, it will settle down to a condition that continues practically unchanged; the magnetism that remains is denominated subpermanent. The vessel will then approximate to a permanent magnet, in which the north polarity will lie in that region which was north in building, and the south polarity (that which exerts an attracting influence on the north pole of the compass needle), in the region which was south in building.

Transient magnetism induced in vertical soft iron is that developed in the soft iron of a vessel through the inductive action of the vertical component only of the earth's total force, and is transient in nature. Its value or force in any given mass varies with and depends upon the value of the vertical component at the place, and is proportional to the sine of the dip, being a maximum at the magnetic pole and zero at the magnetic equator.

Transient magnetism induced in horizontal soft iron is that developed in the soft iron of a vessel through the inductive action of the horizontal component only of the earth's total force, and is transient in nature. Its value or force in any given mass varies with and depends upon the value of the horizontal component at the place, and is proportional to the cosine of the dip, being a maximum at the magnetic equator and reducing to zero at the magnetic pole.

The needle of a compass in any position on board ship will therefore be acted upon by the earth's total force, together with the three forces just described. The poles of these forces do not usually lie in the horizontal plane of the compass needle, but as this needle is constrained to act in a horizontal plane, its movements will be affected solely by the horizontal components of these forces, and its direction will be determined by the resultant of those components.

The earth's force operates to retain the compass needle in the plane of the magnetic meridian, but the resultant of the three remaining forces, when without this plane, deflects the needle, and the amount of such deflection constitutes the deviation.

99. CLASSES OF DEVIATION.—Investigation has developed the fact that the deviation produced as described is made up of three parts, which are known respectively as *semicircular*, quadrantal, and constant deviation, the latter being the least important. A clear understanding of the nature of each of these classes is essential for a comprehension of the methods of compensation.

100. Semicircular Deriation is that due to the combined influence, exerted in a horizontal plane, of the subpermanent magnetism of a ship and of the magnetism induced in soft iron by the vertical component of the earth's force. If we regard the effect of these two forces as concentrated in a single resultant pole exerting an attracting influence upon the north end of the compass needle, it may be seen that there will be some heading of the ship whereon that pole will lie due north of the needle and therefore produce no deviation; now consider that, from this position, the ship's head swings in azimuth to the right; throughout all of the semicircle first described an easterly deviation will be produced, and, after completing 180°, the pole will be in a position diametrically opposite to that from which it started, and will again exert no influence that tends to produce deviation. Continuing the swing, throughout the next semicircle the direction of the deviation produced will be always to the westward, until the circle is completed and the ship returns to her original neutral position. From the fact that this disturbing cause acts in the two semicircles with equal and opposite effect it is given the name of *semicircular* deviation.

In figure 9, a curve is depicted which shows the deviations of a semicircular nature separated from those due to other disturbing eauses, and from this the reason for the name will be apparent.

101. Returning to the two distinct sources from which the semicircular deviation arises, it may be seen that the force due to subpermanent magnetism remains constant regardless of the geographical position of the vessel; but since the horizontal force of the earth, which tends to hold the needle in the magnetic meridian, varies with the magnetic latitude, the deviation due to subpermanent magnetism

varies inversely as the horizontal force, or as $\frac{1}{H}$; this may be readily understood if it is considered that

the stronger the tendency to eling to the direction of the magnetic meridian, the less will be the deflection due to a given disturbing force. On the other hand, that part of the semicircular force due to magnetism induced in vertical soft iron varies as the earth's vertical force, which is proportional to the

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sine of the dip; its effect in producing deviation, as in the preceding case, varies inversely as the earth's horizontal force—that is, inversely as the cosine of the dip; hence the ratio representing the change of deviation arising from this cause on change of latitude is $\frac{\sin \theta}{\cos \theta}$, or $\tan \theta$. If, then, we consider the element of the second se

If, then, we consider the change in the semicircular deviation due to a change of magnetic latitude, it will be necessary to separate the two factors of the deviation and to remember that the portion produced by subpermanent magnetism varies as $\frac{1}{H}$, and that due to vertical induction as tan θ . But for any consideration of the effect of this class of deviation in one latitude only, the two parts may be joined together and regarded as having a single resultant.

102. If we now resume our former assumption, that all the forces tending to produce semicircular deviation are concentrated in a single pole exerting an attracting influence upon the north pole of the compass, we may consider a line to be drawn joining that theoretical pole with the center of the compass, then the argle made by this line with the keel line of the vessel, measured from right ahead, around to the right is called the *starboard angle*. From this it follows that the disturbing force producing semicircular deviation may be considered to have the same effect as a single magnet whose center is in the vertical axis of the compass, and whose south pole (attracting to the north pole of the compass) is in the direction given by the starboard angle; if, therefore, a magnet be placed with its center in the vertical axis of the compass, its *north* (or repelling) pole in the direction of the starboard angle, and its distance so regulated that it exerts upon the compass a force equal to that of the ship's combined subpermanent magnetism and vertical induced magnetism, the disturbing effect of these two forces will be counterbalanced, and, so far as they are concerned, the compass deviations will be corrected, provided that the ship does not change her magnetic latitude.

103. It is evident that the force of the single magnet may be resolved into two components—one fore-and-aft, and one athwartship; in this case, instead of being represented by a single magnet with its south pole in the starboard angle, the semicircular forces will be represented by two magnets, one fore-



Fig. 11.

and-aft and the other athwartship, and compensation may be made, by two separate magnets lying respectively in the directions stated, but with their north or repelling poles in the position occupied by the south or attracting poles of the ship's force.

Figure 11 represents the conditions that have been described. If O be the center of the compass, XX' and YY', respectively, the fore-and-aft and athwartship lines of the ship, and OS the direction in which the attracting pole of the disturbing force is exerted, then XOS is the starboard angle, usually designated α . Now, if OP be laid off on the line OS, representing the amount of the disturbing force according to some convenient scale, then Ob and Oc, respectively, represent, on the same scale, the resolved directions of that force in the keel line and in the transverse line of the ship. Each of these resolved forces will exert a maximum effect when acting at right angles to the needle, the athwartship one when the ship heads north or south by compass, and the longitudinal one when the heading is east or west. On any

other heading than those named the deviation produced by each force will be a fraction of its maximum whose magnitude will depend upon the azimuth of the ship's head. The maximum deviation produced, therefore, forms in each case a basis for reekoning all of the various effects of the disturbing force, and is called a coefficient.

The coefficient of semicircular deviation produced by the force in the fore-and-aft line is called B, and is reckoned as positive when it attracts a north pole toward the bow, negative when toward the stern; that produced by the athwartship force is C, and is reckoned as positive to starboard and negative to port. These coefficients are expressed in degrees.^a

Referring again to figure 11, it will be seen that:

$$\tan \alpha = \frac{Oc}{Ob};$$

or (what may be shown to be the same thing):

$$\tan \alpha = \frac{\sin C}{\sin B};$$

and when the maximum deviations are small, this becomes:

$$\tan \alpha = \frac{C}{B}$$

Since the starboard angle is always measured to the right, it will be seen that, for positive values of B and C, α will be between 0° and 90°; for a negative B and a positive C, between 90° and 180°; for

^{α} It should be remarked that in a mathematical analysis of the deviations, it would be necessary to distinguish between the *approximate coefficients*, B and C, here described, as also A, D, and E, to be mentioned later, and the *cxuet coefficients* denoted by the corresponding capital letters of the German alphabet. In the practical discussion of the subject here given, the question of the difference need not be entered into.

negative values of both B and C, between 180° and 270°; and for a positive B and negative C, between

104. The coefficient B is approximately equal to the deviation on East; or to the deviation on West with reversed sign; or to the mean of these two. Thus in the ship having the table of deviations previously given (art. 92), B is equal to $-19^{\circ} 55'$, or to $-19^{\circ} 30'$, or to $\frac{1}{2} (-19^{\circ} 55' - 19^{\circ} 30') = -19^{\circ} 43'$. The coefficient C is approximately equal to the deviation on North; or to the deviation on South with reversed sign; or to the mean of these two. In the example C is equal to $-1^{\circ} 00'$ or $0^{\circ} 00'$, or $\frac{1}{2} (-1^{\circ} 00' \pm 0^{\circ} 00') = -0^{\circ} 30'$.

105. The value of the subpermanent magnetism remaining practically constant under all conditions, it will not alter when the ship changes her latitude; but that due to induction in vertical softiron undergoes a change when, by change of geographical position, the vertical component of the earth's force assumes a different value, and in such case the correction by means of one or a pair of permanent magnets will not remain effective. If, however, by series of observations in two magnetic latitudes, the values of the coefficients can be determined under the differing circumstances, it is possible, by solving equations, to determine what effect each force has in producing the semicircular deviation; having done which, the subpermanent magnetism can be corrected by permanent magnets after the method previously described, and the vertical induction in soft iron can be corrected by a piece of vertical soft iron placed in such a position near the compass as to produce an equal but opposite force to the ship's vertical soft iron. This last corrector is called a *Flinders bar*.

Having thus opposed to each of the component forces a corrector of magnetic character identical with its own, a change of latitude will make no difference in the effectiveness of the compensation, for in every case the modified conditions will produce identical results in the disturbing and in the correcting force.

106. Quadrantal Deviation is that which arises from horizontal induction in the soft iron of the vessel through the action of the horizontal component of the earth's total force. Let us consider, in figure 12, the effect of any piece of soft iron which is symmetrical with respect to the compass-that is, which lies wholly within a plane passing through the center of the needle in either a fore-and-aft or an athwartship direction. It may be seen (a) that such iron produces no deviation on the cardinal points (for on north and south headings the fore-and-aft iron, though strongly magnetized, has no tendency to draw

the needle from a north-and-south line, while the athwartship iron, being at right angles to the meridian, receives no magnetic induction, and therefore exerts no force; and on east and west headings similar conditions prevail, the athwartship and the fore-and-aft iron having simply exchanged positions); and (b)the direction of the deviation produced is opposite in successive quadrants. The action of unsymmetrical soft iron is not quite so readily apparent, but investigation shows that part of its effect is to produce a deviation which becomes zero at the inter-cardinal points and is of opposite name in successive quadrants. From the fact that deviations of this class change sign every 90° throughout the circle, they gain the name of quadrantal derivations. One of the curves laid down in the Napier diagram (fig. 11) is that of quadrantal deviations, whence the nature of this disturbance of the needle may be observed.

107. All deviations produced by soft iron may be considered as fractions of the maximum deviation due to that disturbing influence; and consequently the maximum is regarded as a coefficient, as in the case of semicircular deviations. The coefficient due to symmetrical soft iron is designated as D, and is considered positive when it produces easterly deviations in the

quadrant between North and East; the coefficient of deviations arising from unsymmetrical soft iron is called E, and is reekoned as positive when it produces easterly deviations in the quadrant between NW. and NE.; this latter attains importance only when there is some marked inequality in the distribution

of metal to starboard and to port, as in the case of a compass placed off the midship line. **108.** D is approximately equal to the mean of the deviations on NE. and SW.; or to the mean of those on SE. and NW., with sign reversed; or to the mean of those means. In the table of deviations given in article 92, D is equal to $\frac{1}{2}(-7^{\circ} 10' + 24^{\circ} 30') = +8^{\circ} 40'$; or to $\frac{1}{2}(+23^{\circ} 30' - 7^{\circ} 40') = +7^{\circ} 55'$; or to $\frac{1}{2}(+8^{\circ} 40' + 7^{\circ} 55') = +8^{\circ} 23'$. By reason of the nature of the arrangement of iron in a ship, D is almost invariably positive.

E is approximately equal to the mean of the deviations on North and South; or to the mean of those on East and West with sign reversed; or to the mean of those means. In the example, E is equal to $\frac{1}{2}(-1^{\circ}00' \pm 0^{\circ}00') = -0^{\circ}30'$; or to $\frac{1}{2}(+19^{\circ}55' - 19^{\circ}30') = +0^{\circ}13'$; or to $\frac{1}{2}(-0^{\circ}30' + 0^{\circ}13')$ - 0° 09′.

109. Quadrantal deviation does not, like semicircular, undergo a change upon change of magnetic latitude; being due to induction in horizontal soft iron, the magnetic force exerted to produce it is proportional to the horizontal component of the earth's magnetism; but the directive force of the needle likewise depends upon that same component; consequently, as the disturbing force exerted upon the needle increases, so does the power that holds it in the magnetic meridian, with the result that on any given heading the deflection due to soft iron is always the same.

110. Quadrantal deviation is corrected by placing masses of soft iron (usually two hollow spheres in the athwartship line, at equal distances on each side of the compass), with the center of mass in the horizontal plane of the needle. The distance is made such that the force exerted exactly counteracts that of the ship's iron. As the correcting effect of this iron will, like the directive force and the quadrantal disturbing force, vary directly with the earth's horizontal component, the compensation once properly made will be effective in all latitudes.

In practice, the quadrantal deviation due to unsymmetrical iron is seldom corrected; the correction may be accomplished, however, by placing the soft iron masses on a line which makes an angle to the athwartship line through the center of the card.



Fig. 12.

111. Constant Deviation is due to induction in horizontal soft iron unsymmetrically placed about the compass. It has already been explained that one effect of such iron is to produce a quadrantal deviation, represented by the coefficient E; another effect is the constant deviation, so called because it is uniform in amount and direction on every heading of the ship. If plotted on a Napier diagram, it would appear as a straight line parallel with the initial line of the diagram.

112. Like other classes of deviation, the effect of the disturbing force is represented by a coefficient; this coefficient is designated as A, and is considered *plus* for easterly and *minus* for westerly errors. It is approximately equal to the mean of the deviations on any number of equidistant headings. In the case previously given, it might be found from the four headings, North, East, South, and West, and would then be equal to $\frac{1}{4}(-1^\circ 00'-19^\circ 55'\pm0^\circ 00'+19^\circ 30')=-0^\circ 21'$; or from all of the 32 headings, when it would equal $+0^\circ 16'$.

For the same reason as in the case of E, the value of A is usually so small that it may be neglected; it only attains a material size when the compass is placed off the midship line, or for some similar cause.

113. Like quadrantal deviation, since its force varies with the earth's horizontal force, the constant deviation will remain uniform in amount in all latitudes.

No attempt is made to compensate this class of error.

114. COEFFCIENTS.—The chief value of coefficients is in mathematical analyses of the deviations and their causes. It may, however, be a convenience to the practical navigator to find their approximate values by the methods that have been given, in order that he may gain an idea of the various sources of the error, with a view to ameliorating the conditions, when necessary, by moving the binnacle or altering the surrounding iron. The following relation exists between the coefficients and the deviation:

$d=A + B \sin z' + C \cos z' + D \sin 2z' + E \cos 2z',$

where d is the deviation, and z' the ship's heading by compass, measured from compass North. **115.** MEAN DIRECTIVE FORCE.—The effect of the disturbing forces is not confined to causing devi-

115. MEAN DIRECTIVE FORCE.—The effect of the disturbing forces is not confined to causing deviations; it is only those components acting at right angles to the needle which operate to produce deflection; the effect of those acting in the direction of the needle is exerted either in increasing or diminishing the directive force of the compass, according as the resolved component is northerly or southerly.

It occurs, with the usual arrangement of iron in a vessel, that the mean effect of this action throughout a complete swing of the ship upon all headings is to reduce the directive force—that is, while it varies with the heading the average value upon all azimuths is *minus* or southerly. The result of such a condition is unfavorable from the fact that the compass is thus made more "sluggish," is easily disturbed and does not return quickly to rest, and a given deflecting force produces a greater deviation when the directive force is reduced. The usual methods of compensation largely correct this fault, but do not entirely do so; it is therefore the case that the mean combined horizontal force of earth and ship to north is generally less than the horizontal force of the earth alone; but it is only in extreme cases that this deficiency is serious.

116. HEELING ERROR.—This is an additional cause of deviation that arises when the vessel heels to one side or the other. Heretofore only those forces have been considered which act when the vessel is on an even keel; but if there is an inclination from the vertical certain new forces arise, and others previously inoperative become effective. These forces are (a) the vertical component of the subpermanent magnetism acquired in building; (b) the vertical component of the induced magnetism in vertical soft iron, and (c) the magnetism induced by the vertical component of the earth's total force in iron which, on an even keel, was horizontal. The first two of these disturbing causes are always present, but, when the ship is upright, have no tendency to produce deviation, simply exerting a downward pull on one of the poles of the needle; the last is a new force that arises when the vessel heels.

The maximum disturbance due to heel occurs when the ship heads North or South. When heading East or West there will be no deviation produced, although the directive force of the needle will be increased or diminished. The error will increase with the amount of inclination from the vertical.

117. For the same reason as was explained in connection with semicircular deviations, that part of

the heeling error due to subpermanent magnetism will vary, on change of latitude, as $\frac{1}{H}$, while that

due to vertical induction will vary as tan \emptyset . In south magnetic latitude the effect of vertical induction will be opposite in direction to what it is in north. **118.** The heeling error is corrected by a permanent magnet placed in a vertical position directly

118. The heeling error is corrected by a permanent magnet placed in a vertical position directly under the center of the compass. Such a magnet has no effect upon the compass when the ship is upright; but since its force acts in an opposite direction to the force of the ship which causes heeling error, is equal to the latter in amount, and is exerted under the same conditions, it affords an effective compensation. For similar reasons to those affecting the compensation of B and C, the correction by means of a permanent magnet is not general, and must be rectified upon change of latitude.

PRACTICAL COMPENSATION.

119. In the course of explanation of the different classes of deviation occasion has been taken to state generally the various methods of compensating the errors that are produced. The practical methods of applying the correctors will next be given.

120. ORDER OF CORRECTION.—The following is the order of steps to be followed in each case. It is assumed that the vessel is on an even keel, that all surrounding masses of iron or steel are in their normal positions, all correctors removed, and that the binnacle is one in which the semicircular deviation is corrected by two sets of permanent magnets at right angles to each other.

1. Place quadrantal correctors by estimate.

2. Correct semicircular deviations.

3. Correct quadrantal deviations.

4. Swing ship for residual deviations.

The heeling corrector may be placed at any time after the semicircular and quadrantal errors are corrected. A Flinders bar can be put in place only after observations in two latitudes.

121. The ship is first placed on some magnetic cardinal point. If North or South, the only force (theoretically speaking) which tends to produce deflection of the needle will be the athwartship component of the semicircular force, whose effect is represented by the coefficient C. If East or West, the only deflecting force will be the fore-and-aft component of the semicircular force, whose effect is represented by the coefficient B. This will be apparent from a consideration of the direction of the forces producing deviation, and is also shown by the equation connecting the terms (where A and E are zero):

$d = B \sin z' + C \cos z' + D \sin 2z'.$

If the ship is headed North or South, z' being equal to 0° or 180°, the equation becomes $d = \pm C$. If on East or West, z' being 90° or 270°, we have $d = \pm B$. This statement is exact if we regard only the forces that have been considered in the problem, but

This statement is exact if we regard only the forces that have been considered in the problem, but experience has demonstrated that the various correctors when in place create certain additional forces by their mutual action, and in order to correct the disturbances thus accidentally produced, as well as those due to regular causes, it is necessary that the magnetic conditions during correction shall approximate as closely as possible to those that exist when the compensation is completed; therefore the quadrantal correctors should first be placed on their arms at the positions which it is estimated that they will occupy later when exactly located. An error in the estimate will have but slight effect under ordinary conditions. It should be understood that the placing of these correctors has no corrective effect while the ship is on a cardinal point. Its object is to create at once the magnetic field with which we shall have to deal when compensation is perfected.

This having been done, proceed to correct the senicircular deviation. If the ship heads North or South, the force producing deflection is, as has been stated, the athwartship component of the senicircular force, which is to be corrected by permanent magnets placed athwartships; therefore enter in the binnacle one or more such magnets, and so adjust their height that the heading of the ship by compass shall agree with the magnetic heading. When this is done all the deviation on that azimuth will be corrected.

Similarly, if the ship heads East or West, the force producing deviation is the fore-and-aft component of the semicircular force, and this is to be corrected by entering fore-and-aft permanent magnets in the binnacle and adjusting the height so that the deviation on that heading disappears.

With the deviation on two adjacent cardinal points corrected, the semicircular force has been completely compensated. Next correct the quadrantal deviation. Head the ship NE., SE., SW., or NW. The coefficients B and C having been reduced to zero by compensation, and 2z', on the azimuths named, being equal to 90° or 270°, the equation becomes $d = \pm D$. The soft-iron correctors are moved in or out from the positions in which they were placed by estimate until the deviation on the heading (all of which is due to quadrantal force) disappears. The quadrantal disturbing force is then compensated.

122. DETERMINATION OF MAGNETIC HEADINGS.—To determine when the ship is heading on any given magnetic course, and thus to know when the deviation has been corrected and the correctors are in proper position, four methods are available:

(a) Swing the ship and obtain by the best available method the deviations on a sufficient number of compass courses to construct a curve on the Napier diagram for one quadrant, and thus find the compass headings corresponding to two adjacent magnetic cardinal points and the intermediate intercardinal point, as North, NE., and East, magnetic.^a Then put the ship successively on these courses, noting the corresponding be some other compass, and when it is desired to head on the various magnetic azimuths during the process of correction the ship may be steadied upon them by the auxiliary compass. Variations of this method will suggest themselves and circumstances may render their adoption convenient. The compass courses corresponding to the magnetic directions may be obtained from observations made with the auxiliary compass itself, or while making observations with another compass the headings by the auxiliary may be noted and a curve for the latter constructed, as explained in article 94, and the required headings thus deduced.

(b) By the methods to be explained hereafter (Chap. XIV), ascertain in advance the true bearing of the sun at frequent intervals during the period which is to be devoted to the compensation of the compasses; apply to these the variation and obtain the magnetic bearings; record the times and bearings in a convenient tabular form; set the watch accurately for the local apparent time; then when it is required to steer any given magnetic course, set that point of the pelorus for the ship's head and set the sight vanes for the magnetic bearing of the sun corresponding to the time by watch. Maneuver the ship with the helm until the sun comes on the sight vanes, when the azimuth of the ship's head will be that which is required. The sight vanes must be altered at intervals to accord with the table of times and bearings.

(c) Construct a table showing times and corresponding magnetic bearings of the sun, and also set the watch, as explained for the previous method. Then place the sight vanes of the azimuth circle of the compass at the proper angular distance to the right or left of the required azimuth of the ship's head; leave them so set and maneuver the ship with the helm until the image of the sun comes on with the vanes. The course will then be the required one. As an example, suppose that the table shows that the magnetic azimuth of the sun at the time given by the watch is N. 87° E., and let it be required to head magnetic North; when placed upon this heading, therefore, the sun must bear 87° to the right, or east, of the direction of the ship's head; when steady on any course, turn the sight vane to the required bearing relative to the keel. If on N. 11° W., for example, turn the circle to N. 76° E.; leave the vane

^a This is all that is required for the purposes of compensation, but if there is opportunity it is always well to make a complete swing and obtain a full table of deviations, which may give interesting information of the existing magnetic conditions.

undisturbed and alter course until the sun comes on. The magnetic heading is then North, and adjust-(d) When ranges are available, they may be utilized for determining magnetic headings.
 123. SUMMARY OF ORDINARY CORRECTIONS.—To summarize, the following is the process of correct-

ing a compass for a single latitude, where magnets at right angles are employed for compensating the semicircular deviation and where the disturbances due to unsymmetrical soft iron are small enough to be neglected:

First. All correctors being clear of the compass, place the quadrantal correctors in the position which it is estimated that they will occupy when adjustment is complete. The navigator's experience will serve in making the estimate, or if there seems no other means of arriving at the probable position they may be placed at the middle points of their supports.

Second. Steady the ship on magnetic North, East, South, or West, and hold on that heading by such method as seems best. By means of permanent magnets alter the indications of the compass until the heading coincides with the magnetic course. If heading North, magnets must be entered N. ends to starboard to correct easterly deviation and to port to correct westerly, and the reverse if heading South. If heading East, enter N. ends forward for easterly and aft for westerly deviations, and the reverse if heading West. (Binnacles differ so widely in the methods of carrying magnets that late?) (Binnacles differ so widely in the methods of carrying magnets that details It may be said, however, that the magnetic intensity of the correctors may on this point are omitted. be varied by altering either their number or their distance from the compass; generally speaking, several magnets at a distance are to be preferred to a small number close to the compass.)

Third. Steady the ship on an adjacent magnetic cardinal point and correct the compass heading by permanent magnets to accord therewith in the same manner as described for the first heading.

Fourth. Steady the ship on an intercardinal point (magnetic) and move the quadrantal correctors away from or toward the compass, keeping them at equal distances therefrom, until the compass and magnetic headings coincide.

124. The compensation being complete, the navigator should proceed immediately to swing ship and make a table of the residual deviations. Though the remaining errors will be small, it is seldom that they will be reduced to zero, and it must never be assumed that the compass may be relied upon without taking the deviation into account. Observations on eight equidistant points will ordinarily suffice for this purpose.

125. To CORRECT SEMICIRCULAR DEVIATION WITH A SINGLE MAGNET.—In certain binnacles provision is made for correcting the semicircular deviation by a single magnet (or series of magnets) in the starboard angle, the magnet tray having motion in azimuth as well as vertically. In this case the process of correcting semicircular deviation is somewhat different from that described for correction by rectangular

magnets. Either of the two following methods may be employed: (a) By computation determine the starboard angle. An approximate method for doing this is given in article 103, and a more exact one may be found in works treating this subject mathematically. Head the ship on a cardinal point (magnetic); enter the magnets in the tray and revolve it until their N. ends lie at an angular distance from ahead (measured to the right) equal to the starboard angle; raise or lower the tray until the deviation disappears.

(b) Head the ship on a cardinal point (magnetic), enter the magnets, and turn the tray to an east-and-west position, the N. ends in such direction as will tend to reduce the deviation; raise or lower the tray until the deviation disappears. Alter course 90° and head on an adjacent magnetic cardinal point; observe the amount of deviation that the compass shows; correct half of this by altering the starboard angle and the other half by raising or lowering the tray. Return to first course, note deviation, and correct one-half in each way, as before. Continue the operation, making a series of trials until the deviations disappear on both headings, when the compensation will be correct. This operation may be considerably hastened by finding the first position of the magnets from a rough calculation of the starboard angle (art. 103).

126. CORRECTING THE HEELING ERROR.—The heeling error may be corrected by a method involving computation, together with certain observations on shore. A more practical method, however, is usually followed, though its results may be less precise. The heeling corrector is placed in its vertical tube, N. end uppermost in north latitudes, as this is almost invariably the required direction; the ship being on a course near North or South and rolling, observe the vibrations of the card, which, if the error is material, will be in excess of those due to the ship's real motion in azimuth; slowly raise or lower the corrector until the abnormal vibrations disappear, when the correction will be made for that lalitude; but it must be readjusted upon any considerable change of geographical position.

In making this observation care must be taken to distinguish the vessel's "yawing" in a seaway, from the apparent motion due to heeling error; for this reason it may be well to have an assistant to watch the ship's head and keep the adjuster informed of the real change in azimuth, by which means the latter may better judge the effect of the heeling error.

In the case of a sailing vessel, or one which for any reason maintains a nearly steady heel for a continuous period, the amount of the heeling error may be exactly ascertained by observing the azimuth of the sun, and corrected with greater accuracy than is possible with a yessel which is constantly rolling

127. FLINDERS BAR.—The simplest method that presents itself for the placing of the Flinders bar is one which is available only for a vessel crossing the magnetic equator. Magnetic charts of the world show the geographical positions at which the dip becomes zero—that is, where a freely suspended needle is exactly horizontal and where there exists no vertical component of the earth's total magnetic In such localities it is evident that the factor of the semicircular deviation due to vertical inducforce. tion disappears and that the whole of the existing semicircular deviation arises from subpermanent magnetism. If, then, when on the magnetic equator the compass be carefully compensated, the effect of the subpermanent magnetism will be exactly opposed by that of the semicircular correcting magnets. Later, as the ship departs from the magnetic equator, the semicircular deviation will gradually acquire a material value, which will be known to be due entirely to vertical induction, and if the Flinders bar be so placed as to correct it, the compensation of the compass will be general for all latitudes.

In following this method it may usually be assumed that the soft iron of the vessel is symmetrical with respect to the fore-and-aft line and that the Flinders bar may be placed directly forward of the compass or directly abaft it, disregarding the effect of components to starboard or port. It is therefore merely necessary to observe whether a vertical soft iron rod must be placed forward or abaft the compass to reduce the deviation, and, having ascertained this fact, to find by experiment the exact distance at which it completely corrects the deviation.

The Flinders bar frequently consists of a bundle of soft iron rods contained in a case, which is secured in a vertical position near the compass, its upper end level with the plane of the needles; in this method, the distance remaining fixed, the intensity of the force that it exerts is varied by increasing or decreasing the number of rods; this arrangement is more convenient and satisfactory than the employment of a single rod at a variable distance.

128. When it is not possible to correct the compass at the magnetic equator there is no ready practical method by which the Flinders bar may be placed; the operation will then depend entirely upon computation, and as a mathematical analysis of deviations is beyond the scope laid out for this work the details of procedure will not be gone into; the general principles involved are indicated, and students seeking more must consult the various works that treat the subject fully.

It has been explained that each coefficient of semicircular deviation (B and C) is made up of a subpermanent factor varying as $\frac{1}{H}$ and of a vertical induction factor varying as tan θ . If we indicate by the subscripts, and ,, respectively, the parts due to each force, we may write the equations of the coefficients:

$$B=B_{s} \times \frac{1}{H} + B_{v} \times \tan \theta; \text{ and}$$
$$C=C_{s} \times \frac{1}{H} + C_{v} \times \tan \theta.$$

Now if we distinguish by the subscripts $_1$ and $_2$ the values in the first and in the second position of observation, respectively, of those quantities that vary with the magnetic latitude, we have:

$$\begin{split} \mathbf{B}_{1} &= \mathbf{B}_{s} \times \frac{t}{\mathbf{H}_{1}} + \mathbf{B}_{v} \times \tan \theta_{1}, \\ \mathbf{B}_{2} &= \mathbf{B}_{s} \times \frac{1}{\mathbf{H}_{2}} + \mathbf{B}_{v} \times \tan \theta_{2}; \text{ and} \\ \mathbf{C}_{1} &= \mathbf{C}_{s} \times \frac{1}{\mathbf{H}_{1}} + \mathbf{C}_{v} \times \tan \theta_{1}, \\ \mathbf{C}_{2} &= \mathbf{C}_{s} \times \frac{1}{\mathbf{H}_{s}} + \mathbf{C}_{v} \times \tan \theta_{2}. \end{split}$$

The values of the coefficients in both latitudes are found from the observations made for deviations; the values of the horizontal force and of the dip at each place are known from magnetic charts; hence

the values of the horizontal force and of the dip at each place are known from magnetic charts; hence we may solve the first pair of equations for B_s and B_v , and the second pair for C_s and C_v ; and having found the values of these various coefficients, we may correct the effects of B_s and C_s by permanent mag-nets in the usual way and correct the remainder—that due to B_v and C_v —by the Flinders bar. Strictly, the Flinders bar should be so placed that its repelling pole is at an angular distance from ahead equal to the "starboard angle" of the attracting pole of the vertical induced force, this angle depending upon the coefficients B_v and C_v ; but since, as before stated, horizontal soft iron may usually be regarded as symmetrical, C_v is assumed as zero and the bar placed in the midship line. **129.** To CORRECT ADJUSTMENT ON CHANGE OF LATITUDE.—The compensation of quadrantal devia-tion, once properly made, remains effective in all latitudes; but unless a Flinders bar is used a correction of the semicircular deviation made in one latitude will not remain accurate when the vessel has

of the semicircular deviation made in one latitude will not remain accurate when the vessel has materially changed her position on the earth's surface. With this in mind the navigator must make frequent observations of the compass error during a passage and must expect that the table of residual deviations obtained in the magnetic latitude of compensation will undergo considerable change as that

latitude is departed from. The new deviations may become so large that it will be found convenient to readjust the semicircular correcting magnets. This process is very simple. When correctors at right angles are used, provide for steadying the ship, by an auxiliary compass or by the pelorus, upon two adjacent magnetic cardinal points (art. 122). Put the ship on heading North or South (momentic) and mice on heaving the athenestic and the ship on heading North or South (magnetic), and raise or lower the athwartship magnets or alter their number until the deviation disappears; then steady on East or West (magnetic) and similarly adjust the fore-and-aft magnets. Swing ship for a new table of residual deviations.

When correctors in the starboard angle are used, arrange as before for heading on two adjacent cardinal magnetic courses. Steady on one of these, observe amount of compass error, correct half by changing the starboard angle and half by raising or lowering magnets; steady on the adjacent cardinal point and repeat the operation. Continue until adjustment is made on both headings, then swing for residual deviations.

CHAPTER IV.

PILOTING.

130. DEFINITION.—*Piloting*, in the sense given the word by modern and popular usage, is the art of conducting a vessel in channels and harbors and along coasts, where landmarks and aids to navigation are available for fixing the position, and where the depth of water and dangers to navigation are such as to require a constant watch to be kept upon the vessel's course and frequent changes to be made therein.

131. REQUISITES.—As requisites to successful piloting, the navigator should be provided with the best available chart of the locality to be traversed, together with the sailing directions and descriptions of aids to navigation; and all of these should be corrected for the latest information, published in notices to mariners or otherwise, that bear upon the locality. The vessel should be equipped with the usual instruments employed in navigation. The deep-sea sounding-machine, if provided, should be ready for use when there is a chance that it may be needed. The lead lines should be correctly marked, and as shoal water is entered one or two men should be stationed to sound. The index errors of the sextants should be known, and, above all, there should be at hand a table showing correctly the deviation of the compass on each heading.

132. LAYING THE COURSE.—Mark a point upon the chart at the ship's position; then mark another point for which it is desired to steer; join the two by a line drawn with the parallel ruler, and, maintaining the direction of the line, move the ruler until its edge passes through the center of the compass rose and note the direction. If the compass rose indicates *true* directions, this will be the true course, and must be corrected for variation and deviation (by applying each in the *opposite* direction to its name) to obtain the compass course; if it is a *magnetic* rose, the course need be corrected for deviation only.

Before putting the ship on any course a careful look should be taken along the line over which it leads to be assured that it clears all dangers.

133. METHOPS OF FIXING POSITION.—A navigator in sight of objects whose positions are shown upon the chart may locate his vessel by either of the following methods: (a) cross bearings of two known objects; (b) the bearing and distance of a known object; (c) the bearing of a known object and the angle between two known objects; (d) two bearings of a known object separated by an interval of time, with the run during that interval; (e) sextant angles between three known objects. Besides the foregoing there are two methods by which, without obtaining the precise position, the navigator may assure himself that he is clear of any particular danger. These are: (f) the danger angle; (g) the danger bearing.

The choice of the method will be governed by circumstances, depending upon which is best adapted to prevailing conditions.

134. Cross BEARINGS OF TWO KNOWN OBJECTS.—Choose two objects whose position on the chart can be unmistakably identified and whose respective bearings from the ship differ, as nearly as possible, by 90°; observe the bearing of each, either by compass or pelorus, taking one as quickly as possible after the other; see that the ship is on an even keel at the time the observation is made, and, if using the pelorus, be sure also that she heads exactly on the course for which the pelorus is set. Correct the bearings so that they will be either true or magnetic, according as they are to be plotted by the true or magnetic compass rose of the chart—that is, if observed by compass, apply deviation and variation to obtain the true bearing, or deviation only to obtain the magnetic; if



obtain the true bearing, or deviation only to obtain the magnetic; if observed by pelorus, that instrument should be set for the true or magnetic heading, according as one or the other sort of reading is required, and no further correction will be necessary. Draw on the chart, by means of the parallel rulers, lines which shall pass through the respective objects in the direction that each was observed to bear. As the shift's position on the chart is known to be at some point of each of these lines, it must be at their intersection, the only point that fulfills both conditions.

In figure 13, if A and B are the objects and OA and OB the lines passing through them in the observed directions, the ship's position will be at O, their intersection.

135. If it be possible to avoid it, objects should not be selected for a cross bearing which subtend an angle at the ship of less than 30° or more than 150°, as, when the lines of bearing approach parallelism, a small error in an observed bearing gives a large error in the result. For a similar reason objects near the ship should be taken in preference to those at a distance.

136. When a third object is available a bearing of that may be taken and plotted. If this line intersects at the same point as the other

two (as the bearing OC of the object C in the figure), the navigator may have a reasonable assurance that his "fix" is correct; if it does not, it indicates an error somewhere, and it may have arisen from inaccurate observation, incorrect determination or application of the deviation, or a fault in the chart.

137. What may be considered as a form of this method can be used when only one known object is in sight by taking, at the same instant as the bearing, an altitude of the sun or other heavenly body and noting the time; work out the sight and obtain the Sunner line (as explained in Chapter XV), and the intersection of this with the direction-line from the object will give the observer's position in the same way as from two terrestrial bearings.

138. BEARING AND DISTANCE OF A KNOWN OBJECT.—When only one object is available, the ship's position may be found by observing its bearing and distance. Follow the preceding method in the matters of taking, correcting, and plotting the bearing; then, on this

line, lay off the distance from the object, which will give the point occupied by the observer. In figure 14, if A represents the object and AO the bearing and distance, the position sought will be at O.

139. It is not ordinarily easy to find directly the distance of an object at sea. The most accurate method is when its height is known and it subtends a fair-sized angle from the ship, in which case the angle may be measured by a sextant, " and the distance computed or taken from a table. Table 33 of this work gives distances up to 5 miles, corresponding to various heights and angles. Captain Lecky's "Danger Angle and Offshore Distance Tables" carries the computation much further. The use of this method at great distances must not be too closely relied upon, as small errors, such as those due to refraction, may throw



FIG. 16.

out the results to a material extent; but it affords an excellent approximation, and as this method of fixing position is employed only when no other is available the best possible approximation has to suffice.





error is material—that shown in figure 16, where the visible shore-line is at M', a considerable distance from M, the point vertically below the summit. In this case there is nothing to mark M in the observer's eve, and it is essential that all angles be measured from a point close down to the water-line.

If a choice of objects can be made, the best results will be obtained by observing that one which subtends the greatest angle, as small errors will then have the least effect.

There is another method for determining the distance of an object, which is available under certain circumstances. This consists in observing, from a position

aloft, the angle between the object and the line of the sea horizon beyond. By reference to Table 34 will be found the distance in yards corresponding to different angles for various heights of the observer from 20 to 120 feet. The method is not accurate beyond moderate distances (the table being limited to 5,000 yards) and is obviously only available for finding the distance of an isolated object, such as an islet, vessel, or target, over which the horizon may be seen. In employing this method the higher the position occupied by the observer the more precise will be the results.

140. In observing small angles, such as those that occur in the methods just described, it is sometimes convenient to measure them on and off the limb of the sextant. First look at the bottom of the object and reflect the top down into coincidence; then look through the transparent part of the horizon glass at the top and bring the bottom up by its reflected ray. The mean of the two readings will be the true angle, the index correction having been eliminated by the operation. **141.** When the methods of finding distance by a vertical or a horizon angle are not available, it

must be obtained by such means as exist. Estimate the distance by the appearance; take a sounding, and note where the depth falls upon the line of bearing; at night, if atmospheric conditions are normal, consider that the distance of a light when sighted is equal to its maximum range of visibility, remembeing that its range is stated for a height of eye of 15 feet; or employ such method as suggests itself

under the circumstances, regarding the result, however, as an approximation only. 142. THE BEARING OF A KNOWN OBJECT AND THE ANGLE BETWEEN TWO KNOWN OBJECTS.—This method is seldom employed, as the conditions always permit of cross bearings being taken, and the latter is generally considered preferable.

Take a bearing of a known object by compass or pelorus and observe the sextant angle between some two known objects. The line of bearing is plotted as in former methods. In case one of the objects of the observed angle is that whose bearing is taken, the angle is applied, right or left as the case may be, to the bearing, thus giving the direction of the second object, which is plotted from the compass rose and parallel rulers. If the object whose bearing is taken is not one of the objects of the angle, lay off the angle on a three-armed protractor, or piece of tracing paper, and swing it (keeping the legs or lines always over the two objects) until it passes over the line of bearing, which defines the position of the at a ways over the two objects) with a passes over the the of bearing, which defines the position of the ship; there will, except in special cases, be two points of intersection of the line with the circle thus described, and the navigator must know his position with sufficient closeness to judge which is correct. **143.** Two BEARINGS OF A KNOWN OBJECT.—This is a most useful method, which is frequently employed, certain special cases arising thereunder being particularly easy of application. The process

PILOTING.

is to take a careful bearing and at the same moment read the patent log; then, after running a convenient distance, take a second bearing and again read the log, the difference in readings giving the intervening run; when running at a known speed, the time interval will also afford a means for determining the distance run.

The problem is as follows: In figure 17, given OA, the direction of a known object, A, at the first \swarrow observation; PA, the direction at the second observation; and OP, the distance

traversed between the two; to find AP, the distance at the second observation. Knowing the angle POA, the angular distance of the object from right ahead at the first bearing; OPA, the angular distance from right astern at the second bearing; and OP, the distance run; we have by Plane Trigonometry:

$$PAO = 180^{\circ} - (POA + OPA)$$
; and
 $AP = OP \times \frac{\sin POA}{\sin PAO}$.

If, as is frequently the case, we desire to know the distance of passing abeam. we have

 $AQ = AP \times \sin QPA$.

Tables 5A and 5B give solutions for this problem, the former for intervals of bearing of quarter points, the latter for intervals of two degrees. The first column of each of these tables gives the value of AP, the distance of the ship from the observed object at the time of taking the last bearing, for values of OP equal to unity; that is, for a run between bearings of 1 mile. The second column gives AQ, the distance of the object when it bears abeam, likewise for

FIG. 17.

a value of OP of 1 mile. When the run between bearings is other than 1 mile, the number taken from the table must be used as a multiplier of that run to give the required distance. EXAMPLE: A vessel steering north takes a bearing of a light NW. $\frac{1}{2}$ W.; then runs 4.3 miles, when the bearing is found to be WSW. Required the distance of the light at the time of the second bearing.

Difference between course and first bearing, 4½ pts. Difference between course and second bearing, 10 pts.

Multiplier from first column, Table 5A, 0.88. 4.3 miles × 0.88 = 3.8 miles, distance at second bearing. EXAMPLE: A vessel on a course S. 52° E. takes the first bearing of an object at S. 26° E., and the second at S. 2° W., running in the interval 0.8 mile. Required the distance at which she will pass abeam.

Difference between course and first bearing, 26°.

Difference between course and second bearing, 54°.

Multiplier from second column, Table 5B, 0.79.

 $0.8 \text{ mile} \times 0.79 = 0.6 \text{ mile}$, distance of passing abeam.

144. As has been said, there are certain special cases of this problem where it is exceptionally easy of application; these arise when the multiplier is equal to unity, and the distance run is therefore equal to the distance from the object. When the angular distance on the bow

at the second bearing is twice as great as it was at the first bearing, the distance of the object from the ship at second bearing is equal to the run, the multiplier being 1.0. For if, in figure 18, when the ship is in the first position, O, the object A bears α° on the bow, and at the second position P, $2\alpha^{\circ}$, we have in the triangle APO, observing that APO = $180^{\circ} - 2\alpha$, and POA = α :

$$PAO = 180^{\circ} - (POA + APO),$$

= 180^{\circ} - (\alpha + 180^{\circ} - 2\alpha),
= \alpha

Or, since the angles at O and at A are equal to each other, the sides OP and AP are equal, or the distance at second bearing is equal to the run. This is known as doubling the angle on the bow.

145. A case where this holds good is familiar to every navigator as the bow and beam bearing, where the first bearing is taken when the object is broad on the bow (four points or 45° from ahead) and the second when it is abeam (eight points or 90° from ahead); in that case the distance at second bearing and the distance abeam are identical and equal to the run between bearings. **146.** When the first bearing is $26\frac{1}{2}^{\circ}$ from ahead, and the second 45° , the

distance at which the object will be passed abeam will equal the run between bearings; this may be proved by computation or by reference to the tables and is a

very convenient fact to remember, as it shows the navigator at once, if about to pass a point, how wide a berth he is going to give the offlying dangers.

147. There is a graphic method of solving this problem that is considered by some more convenient than the use of multipliers. Draw upon the chart the lines OA and PA (fig. 19), passing through the object on the two observed bearings; set the dividers to the distance run, OP; lay down the parallel rulers in a direction parallel to the course and move them toward or away from the observed object until some point is found where the distance between the lines of bearing is exactly equal to the distance between the points of the dividers; in the figure this occurs when the rulers lie along the line



F1G. 18.

44 .

OP, and therefore O represents the position of the ship at the first bearing and P at the second. For any other positions O'P', O''P'', the condition is not fulfilled.

148. Another graphic solution is given by the *Distance Finder*, devised by Lieut. J. B. Blish, U. S. Navy. This consists of a semicircle whose circumference is graduated in degrees. Two pieces of thread, made to swing about a pin-head at the center, are laid down to

made to swing about a pin-nead at the center, are had down to represent the lines of bearing, and ease in measuring distances is afforded by series of cross lines similar to those on a piece of profile \mathbf{A} paper.

149. The method of obtaining position by two bearings of the same object is one of great value, by reason of the fact that it is frequently necessary to locate the ship when there is but one landmark in sight. Careful navigators seldom, if ever, miss the opportunity for a bow and beam bearing in passing a light-house or other well-plotted object; it involves little or no trouble, and always gives a feeling of added security, however little the position may be in doubt. If about to pass an object abreast of which there is a danger—a familiar example of which is when a light-house marks a point off which are rocks or shoals—a good assurance of clearance should be obtained before bringing it abeam, either by doubling the angle on the bow, or by using the $26\frac{1}{2}$ — 45° bearing; the latter has the advantage over the former if the object is sighted in time to permit of its use, as it may be assumed that the 45° (bow) bearing will always be observed in any event, and this gives the distance abeam directly, saving the necessity of plotting the position at second bearing (as obtained by doubling the angle) and then carrying it forward.

150. It must be remembered that, however convenient, the fix obtained by two bearings of the same object will be in error unless the course and distance are correctly estimated, the course "made

good" and the distance "over the ground" being required. Difficulty will occur in estimating the exact course when there is bad steering, a cross current, or when a ship is making leeway; errors in the allowed run will arise when she is being set ahead or back by a current or when the logging is inaccurate. To take a not extreme case, a vessel making 10 knots through the water, running against a 2-knot tide, will overestimate her distance one-fifth of its true amount in taking a bow and beam bearing if no allowance is made for the tide, or she will underestimate her distance by one-fifth of its apparent amount if going with the same tide. Therefore, if in a current of any sort, due allowance must be made, and it should be remembered that more dependence can be placed upon a position fixed by simultaneous bearings or angles, when two or more objects are available, than by two bearings of a single object.

151. SEXTANT ANGLES BETWEEN THREE KNOWN OBJECTS.—This method, involving the solution of the *three-point problem*, will, if the objects be well chosen, give the most accurate results of any. It is largely employed in surveying, because of its precision; and it is especially valuable in navigation, because it is not subject to errors arising from imperfect knowledge of the compass error, improper log-ging, or the effects of current, as are the methods previously described.

ging, or the effects of current, as are the methods previously described. Three objects represented on the chart are selected and the angles measured with sextants of known index error between the center one and each of the others. Preferably there should be two observers and the two angles be taken simultaneously, but one observer may first take the angle which is changing more slowly, then take the other, then repeat the first angle, and consider the mean of the first and last observations as the value of the first angle. The position is usually plotted by means of the three-armed protractor, or station-pointer (see art. 432, Chap. XVII). Set the right and left angles on the instrument, and then move it over the chart until the three beveled edges pass respectively and simultaneously through the three objects. The center of the instrument will then mark the ship's position, which may be pricked on the chart or marked with a pencil point through the center hole. When the three-armed protractor is not at hand, the tracing-paper protractor will prove an excellent substitute, and may in some cases be preferable to it, as, for instance, when the objects angled on are so near the observer as to be hidden by the circle of the

so near the observer as to be hidden by the circle of the instrument. A graduated circle printed upon tracing paper permits the angles being readily laid off, but a plain piece of tracing paper may be used and the angles marked by means of a small protractor. The tracingpaper protractor permits the laying down, for simultaneous trial, of a number of angles, where special accuracy is sought.

152. The three-point problem, by which results are obtained in this method, is: "To find a point such that three lines drawn from this point to three given points shall make given angles with each other.

Let A, B, and C, in figure 20, be three fixed objects on shore, and from the ship, at D, suppose the angles CDB and ADB are found equal, respectively, to 40° and 60°.

and ADB are found equal, respectively, to 40° and 60°. With the complement of CDB, 50°, draw the lines BE and CE; the point of intersection will be the center of a circle, on some point of whose circumference the

of a circle, on some point of whose circumference the FiG. 20. ship must be. Then, with the complement of the angle ADB, 30°, draw the lines AF and BF, meeting at F, which point will be the center of another circle, on some point of whose circumference the ship must be. Then D, the point of intersection of the circumference of the two circles, will be the position of the ship.





FIG. 19.

The correctness of this solution may be seen as follows: Take the first circle, DBC; in the triangle EBC, the angle at E, the center, equals $180^{\circ}-2\times50^{\circ}=2$ ($90^{\circ}-50^{\circ}$), twice the complement of 50°, which is twice the observed angle; now if the angle at the center subtended by the chord BC equals twice the observed angle, then the angle at any point on the circumference subtended by that chord, which equals half the angle at the center, equals the observed angle; so the required condition is fulfilled. Should either of the angles exceed 90°, the excess of the angle over 90° must be laid off on the opposite side of the lines joining the stations.

153. It may be seen that the intersection of the circles becomes less sharp as the centers E and F approach each other; and finally that the problem becomes indeterminate when the centers coincide, that is, when the three observed points and the observer's position all fall upon the same circle; the two circles are then identical and there is no intersection; such a case is called a "revolver," because the protector will revolve around the whole circle, everywhere passing through the observed points. The avoidance of the revolver and the employment of large angles and short distances form the keys to the selection of favorable objects.

Generally speaking, the observer, in judging which objects are the best to be taken, can picture in his eye the circle passing through the three points and note whether it comes near to his own position. If it does, he must reject one or more of the objects for another or others. It should be remembered that he must avoid not only the condition where the circle passes exactly through his position (when the problem is wholly indeterminate), but also all conditions approximating thereto, for in such cases the circles will intersect at a very acute angle, and the inevitable small errors of the observation and plotting will produce large errors in the resulting fix.

Without giving an analysis of reasons, which may be found in various works that treat the problem in detail, the following may be enumerated as the general conditions which result in a *good* fix: (a) When the center object of the three lies between the observer and a line joining the other two,

or lies nearer than either of the other two.

- (b) When the sum of the right and left angles is equal to or greater than 180°. (c) When two of the objects are in range, or nearly so, and the angle to the third is not less than 30°. (d) When the three objects are in the same straight line.

position.

A condition that limits all of these is that angles should be large—at least as large as 30°—excepting in the case where two objects are in range or nearly so, and then the other angle must be of good size. When possible, near objects should be used rather than distant ones. The navigator should not fall into the error of assuming that objects which would give good cuts for a cross bearing are necessarily favorable for the three-point solution.

In a revolver, the angle formed by lines drawn from the center object to the other two, added to the sum of the two observed angles, equals 180°. A knowledge of this fact may aid in the choice of objects.

If in doubt as to the accuracy with which the angles will plot, a third angle to a fourth object may



F1G. 21.

circle by the chord AB, are equal.

156. The vertical danger angle is an application of the same principle where there is in sight only one well-charted object and that is of known height. Draw a circle with that object as a center and of such radius that no neighboring dangers lie beyond its circumference; note, from Table 33, the vertical angle which is subtended by the known height at the distance chosen as a radius, and, by frequent observations in passing, make sure that this danger angle is not exceeded. By a simple modification, a ship passing *inshore* of an isolated zrock or shoal could be navigated clear by means of a vertical danger angle which was not allowed to decrease below that corresponding to a safe distance.

Considerations governing the taking of vertical angles are given in the

within a certain distance, the landmark A being a guide. Let the navigator draw through A the line



be taken. Another way to make sure of a doubtful fix is to take one compass bearing, by means of which even a revolver may be made to give a good 154. THE DANGER ANGLE .- When running in sight of the land, it is

frequently of the greatest importance for the navigator to assure himself that the course leads clear of outlying dangers, and the *Danger Angle* affords a con-venient means of so doing. There are two sorts of danger angles—the horizontal angle taken between two objects, and the vertical angle of a single one. The former will be first described.

155. Suppose, in figure 21, that a vessel standing along the coast on the course indicated must pass an offshore danger between two well-marked objects, A and B, and that, allowing a safe margin, it is desired to approach no closer than the point O. Through the points A, B, and O draw a circle, by the usual methods of geometry, and observe that no portion of the danger lies without the circle. Measure the angle AOB with a protractor, and consider this the danger angle; as the ship draws near, take frequent observations with a sextant of the angle subtended by the objects A and B. As

long as the angle is less than the danger angle the ship is without the circle; but if the angle increases to the amount of the danger angle, she is on the circle, and should at once sheer off to avoid approach-The reason will be evident from the coning closer. sideration that all angles AOB, AO'B, AO''B, AO'''B, subtended at points on the circumference of the XA, clear of the danger at all points, and note its direction by the compass rose; then let frequent bearings be taken as the ship proceeds, and so long as the bearings, YA, ZA, are to the *right* of XA he may be assured that he is on the *left* or safe side of the lines.

If, as in the case given, there is but one object in sight and that nearly ahead, it would be very difficult to get an exact position, but this method would always show whether or not the ship was on a good course, and would, in consequence, be of the greatest value. And even if there were other objects visible by which to get an accurate fix it would be a more simple matter to note, by an occasional glance over the sight-vane of the pelorus or compass, that the ship was making good a safe course than to be put to the necessity of plotting the position each time.

158. It will occasionally occur that two natural objects will so lie that when in range they mark a danger bearing; advantage should be taken of all such, as they are easier to observe than a compass bearing; but if in a locality with which the navigator has not had previous acquaintance the compass bearing of all ranges should be observed and compared with that indicated on the chart in order to make sure of the identity of the objects. The utility of ranges, either artificial or natural, as guides in navigation is well recognized.

159. SOUNDINGS.—The practice should be followed of employing one or two leadsmen to take and report soundings continuously while in shoal water or in the vicinity of dangers. The soundings must not be regarded as fixing a position, but they afford a check upon the positions obtained by other methods. An exact agreement with the soundings on the chart need not be expected, as there may be some little inaccuracies in reporting the depth on a ship moving with speed through the water, or the tide may cause a discrepancy, or the chart itself may lack perfection; but the soundings should agree in a general way, and a marked departure from the characteristic bottom shown on the chart should lead the navigator to verify his position and proceed with caution; especially is this true if the water is more shoal than expected.

160. But if the soundings in shallow water when landmarks are in sight serve merely as an auxiliary guide, those taken (usually with the patent sounding machine or deep-sea lead) when there exist no other means of locating the position, fulfill a nuch more important purpose. In thick weather, when approaching or running close to the land, and at all times when the vessel is in less than 100 fathoms of water and her position is in doubt, soundings should be taken continuously and at regular intervals, and, with the character of the bottom, systematically recorded. By laying the soundings on tracing paper, along a line which represents the track of the ship according to the scale of the chart, and then moving the paper over the chart, keeping the various courses parallel to the corresponding directions on the chart, until the observed soundings agree with those laid down, the ship's position will in general be quite well determined. While some localities, by the sharpness of the characteristics of their soundings, lend themselves better than others to accurate determinations by this method, there are few places where the mariner can not at least keep out of danger by the indications, even if they tell him no more than that the time has come when he must anchor or lie off till conditions are more favorable.

161. Lights.—Before coming within range of a light the navigator should acquaint hinself with its characteristics, so that when sighted it will be recognized. The charts, sailing directions, and light lists give information as to the color, character, and range of visibility of the various lights. Care should be taken to note all of these and compare them when the light is seen. If the light is of the flashing, revolving, or occulting variety the duration of its periods should be noted to identify it. If a fixed light, a method that may be employed to make sure that it is not a vessel's light is to descend several feet immediately after sighting it and observe if it disappears from view; a navigation light will usually do so, excepting in misty weather, while a vessel's light will not. The reason for this is that navigation lights are as a rule sufficiently powerful to be seen at the farthest point to which the ray can reach without being interrupted by the earth's curvature. They are therefore seen at the first moment that the ray reaches an observer on a ship's deck, and are cut off if he lowers the eye. A vessel's light, on the other hand, is usually limited by its intensity and does not carry beyond a distance within which it it is visible at all heights.

Care must be taken to avoid being deceived on first sighting a light, as there are various errors into which the inexperienced may fall. The glare of a powerful light is often seen beyond the distance of visibility of its direct rays by the reflection downward from particles of mist in the air; the same mist may also cause a white light to have a distinctly reddish tinge, or it may obscure a light except within short distances. When a light is picked up at the extreme limit at which the height of the observer will permit, a fixed light may appear flashing, as it is seen when the ship is on the crest of a wave, and lost when in the hollow.

Many lights are made to show different colors in different sectors within their range, and by consulting his chart or books, the navigator may be guided by the color of the ray in which he finds himself; in such lights one color is generally used on bearings whence the approach is clear, and another covers areas where dangers are to be encountered.

The visibility of lights is usually stated for an assumed height of the observer's eye of 15 feet, and must be modified accordingly for any other height. But it should be remembered that atmospheric and other conditions considerably affect the visibility, and it must not be positively assumed, on sighting a light, even in perfectly clear weather, that a vessel's distance is equal to the range of visibility; it may be either greater or less, as the path of a ray of light near the horizon receives extraordinary deflection under certain circumstances; the conditions governing this deflection are discussed in article 301. Chapter X.

162. Broxs.—While buoys are valuable aids, the mariner should always employ a certain amount of caution in being guided by them. In the nature of things it is never possible to be certain of finding buoys in correct position, or, indeed, of finding them at all. Heavy seas, strong currents, ice, or collisions with passing vessels may drag them from their places or cause them to disappear entirely, and they are especially uncertain in unfrequented waters, or those of nations that do not keep a good lookout upon their aids to navigation. When, therefore, a buoy marks a place where a ship must be navigated with caution, it is well to have a danger angle or bearing as an additional guide instead of placing too much dependence upon the buoy being in place.

Different nations adopt different systems of coloring for their buoys; an important feature of many such systems, including those adopted by the United States and various other great maritime

nations (though not all), consists in placing black buoys to be left on the starboard hand of a vessel *going out* of a harbor or fairway, and red buoys (the color of the port side light) on the port hand. In these various systems the color and character of the buoy are such as to denote the special purpose for which it is employed.

163. FOGS AND FOG SIGNALS.—As with lights, the navigator should, in a fog, acquaint himself with the characteristics of the various sound signals which he is likely to pick up, and when one is heard, its periods should be timed and compared with those given in the light lists to insure its proper identity.

Experiment has demonstrated that sound is conveyed through the atmosphere in a very uncertain way; that its intensity is not always increased as its origin is approached, and that areas within its range at one time will seem silent at another. Add to these facts the possibility that, for some cause, the signal may not be working as it should be, and we have reason for observing the rule to proceed with the utmost caution when running near the land in a fog.

The best guide is the lead, and that should be kept going constantly. The method of plotting soundings described in article 160 will give the most reliable position that is obtainable. Moreover, the lead will warn the navigator of the approach to shallow water, when, if his position is at all in doubt, it is wisest to anchor before it becomes too late.

When running slowly in a fog (which caution, as well as the law, requires that one should do) it must be borne in mind that the relative effect of current is increased; for instance, the angle of deflection from the course caused by a cross-set is greater at low than at high speed.

It is worth remembering that when in the vicinity of a bold bluff shore vessels are sometimes warned of a too close approach by having their own fog signals echoed back from the cliffs; indeed, from a knowledge of the velocity of sound (art. 314, Chap. XI) it is possible to gain some rough idea of the distance in such a case.

164. TIDES AND CURRENTS. "-The information relating to the tides given on the chart and in other publications should be studied, as it is of importance for the navigator to know not only the height of the tide above the plane of reference of the chart, but also the direction and force of the tidal current.

The plane of reference adopted for soundings varies with different charts; on a large number it is that of mean low water, and as no plane of reference above that of mean low water is ever employed, the navigator may with safety refer his soundings to that level when in doubt.

When traversing waters in which the depth exceeds the vessel's draft by but a small margin, account must be taken of the fact that strong winds or a high barometer may cause the water to fall below even a very low plane of reference. On coasts where there is much diurnal inequality in the tides, the amount of rise and fall can not be depended upon, and additional caution is necessary.

A careful distinction should be made between the vertical rise and fall of the tide, which is marked at the transition periods by a stationary height, or stand, and the tidal current, which is the horizontal transfer of water as a result of the difference of level, producing the *flood and ebb*, and the intermediate condition, or *slack*. It seldom occurs that the turn of the tidal stream is exactly coincident with the high and low water, and in some channels the current may outlast the vertical movement which produces it by as much as three hours, the effect being that when the water is at a stand the tidal stream is at its maximum, and when the current is slack the rise or fall is going on with its greatest rapidity. Care must be taken to avoid confounding the two. Usually, more complete data is furnished in charts and tide tables regarding the rise and fall, and it frequently occurs that the information regarding the tidal current is comparatively meager; the mariner must therefore take every means to ascertain for himself the direction and force of the tidal and other currents, either from the set shown between successive well-located positions of the ship, or by noting the ripple of the water around buoys, islets, or shoals, the direction in which vessels at anchor are riding, and the various other visible effects of the current.

Current arrows on the chart must not be regarded as indicating absolutely the conditions that are to be encountered. They represent the mean of the direction and force observed, but the observatious upon which they are based may not be complete, or there may be reasons that bring about a departure from the normal state.

Generally speaking, the rise and fall and strength of current are at their minimum along straight stretches of coast upon the open ocean, while bays, bights, inlets, and large rivers operate to augment the tidal effects, and it is in the vicinity of these that one finds the highest tides and strongest currents. The navigator need therefore not be surprised, in cruising along a coast, to notice that his vessel is set more strongly toward or from the shore in passing an indentation, and that the evidences of tide will appear more marked as he nears its mouth.

165. CHARTS. b—The chart should be carefully studied, and among other things all of its notes should be read, as valuable information may be given in the margin which it is not practicable to place upon the chart abreast the locality affected.

The mariner will do well to consider the source of his chart and the authority upon which it is based. He will naturally feel the greatest confidence in a chart issued by the Government of one of the more important maritime nations which maintains a well-equipped office for the especial purpose of acquiring and treating hydrographic information. He should note the character of the survey from which the chart has been constructed; and, finally, he should be especially careful that the chart is of recent issue or bears correction of a recent date—facts that should always be clearly shown upon its face.

It is well to proceed with caution when the chart of the locality is based upon an old survey, or one whose source does not carry with it the presumption of accuracy. Even if the original survey was a good one, a sandy bottom, in a region where the currents are strong or the seas heavy, is liable to undergo in time marked changes; and where the depth is affected by the deposit or removal of silt, as in the vicinity of the estuaries of large river systems, the behavior is sometimes most capricious. Large blank spaces on the chart, where no soundings are shown, may be taken as an indication that no sound-

^aSee also Chapter XX.

ings were made, and are to be regarded with suspicion, especially if the region abounds in reefs or pinnacle rocks, in which case only the the closest sort of a survey can be considered as revealing all the dangers. All of these facts must be duly weighed.

When navigating by landmarks the chart of the locality which is on the largest scale should be used. The hydrography and topography in such charts appear in greater detail, and—a most important consideration—bearings and angles may be plotted with increased accuracy.

166. RECORDS.—It will be found a profitable practice to pay careful attention to the recording of the various matter relating to the piloting of the ship. A notebook should be kept at hand on deck or on the bridge, in which are to be entered all bearings or angles taken to fix the position, all changes of course, important soundings, and any other facts bearing upon the navigation. (This book should be different from the one in which astronomical sights and offshore navigation are worked.) The entries, though in memorandum form, should be complete; it should be clear whether bearings and courses are true, magnetic, or by compass; and it is especially important that the time and patent log reading should be given for each item recorded. The value of this book will make itself apparent in various directions; it will afford accurate data for the writing of the ship's log; it will furnish interesting information for the next run over the same ground; it will provide a means by which, if the ship be shut in by fog, rain, or darkness, or if there be difficulty in recognizing landmarks ahead, the last accurate fix can be plotted and brought forward; and, finally, if there should be a mishap, the notebook would furnish evidence as to where the trouble has been.

The chart on which the work is done should also be made an intelligible record, and to this end the pencil marks and lines should not be needlessly numerous, heavy, or long. In plotting bearings, draw lines only long enough to cover the probable position. Mark intersections or positions by drawing a small circle around them, and writing neatly abreast them the time and patent log reading. Indicate the courses and danger bearings by full lines and mark them appropriately, preferably giving both magnetic (or true) and compass directions. A great number of lines extending in every direction may lead to confusion; however remote the chance may seem, the responsibilities of piloting are too serious to run even a small risk.

Finally, on anchoring, record and plot the position by bearings or angles taken after coming to; observe that the berth is a safe one, or, if in doubt, send a boat to sound in the vicinity of the ship to make sure.

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CHAPTER V.

THE SAILINGS.

167. In considering a ship's position at sea with reference to any other place, either one that has been left or one toward which the vessel is bound, five terms are involved—the Course, the Distance, the Difference of Latitude, the Difference of Longitude, and the Departure.^a The solutions of the various problems that arise from the mutual relation of these quantities are called Sailings.
168. KINDS OF SAILINGS.—When the only quantities involved are the course, distance, difference of the course of the course of the course, distance, difference of the course of t

168. KINDS OF SALLINGS.—When the only quantities involved are the course, distance, difference of latitude, and departure, the process is denominated *Plane Sailing*. In this method the earth is regarded as a plane, and the operation proceeds as if the vessel sailed always on a perfectly level surface. When two or more courses are thus considered, they are combined by the method of *Traverse Sailing*. It is evident that the number of *miles* of latitude and departure can thus be readily deduced; but, while one mile always equals one minute in difference of latitude, one mile of departure corresponds to a difference of longitude that will vary with the latitude in which the vessel is sailing. Plane sailing, therefore, furnishes no solution where difference of longitude is considered, and for such solution resort must be had to one of several methods, which, by reason of their taking account of the spherical figure of the earth, are called *Spherical Sailings*.

When a vessel sails on an east or west course along a parallel of latitude, the method of converting departure into difference of longitude is called *Parallel Sailing*. When the course is not east or west, and thus carries the vessel through various latitudes, the conversion may be made either by *Middle Latitude Sailing*, in which it is assumed that the whole run has been made in the mean latitude, or by *Mercator Sailing*, in which the principle involved in the construction of the Mercator chart (art. 38, Chap. II) is utilized.

Great Circle Sailing deals with the courses and distances between any two points when the track followed is a great circle of the terrestial sphere. A modification of this method which is adopted under certain circumstances is called *Composite Sailing*.

PLANE SAILING.

169. In Plane Sailing, the curvature of the earth being neglected, the relation between the elements



of the rhumb track joining any two points may be considered from the plane right triangle formed by the meridian of the place left, the parallel of the place arrived at, and the rhumb line. In figure 23, T is the point of departure; T', the point of destination; Tn, the meridian of departure; T'n, the parallel of destination; and TT', the rhumb line between the points. Let C represent the course, T'Tn; Dist., the distance, TT'; DL, the difference of latitude, Tn; and Dep., the departure, T'n. Then from the triangle TT'n, we have the following:

$\sin C = \frac{Dep.}{Dist.};$
$\cos C = \frac{D L}{Dist.};$
$\tan C = \frac{\text{Dep.}}{D L}.$

From these equations are derived the following formulæ for working the various problems that may arise in Plane Sailing:

Given.	Required.		Formulæ.
Course and distance	{Difference of latitude Departure	$\begin{array}{llllllllllllllllllllllllllllllllllll$	$\begin{array}{l} \text{Log D L =} \log \text{Dist.} + \log \cos \text{C.} \\ \text{Log Dep.} = \log \text{Dist.} + \log \sin \text{C.} \end{array}$
Difference of latitude and departure.	Course Distance	$Tan C = \frac{Dep.}{D L}.$ Dist. = $\frac{Dep.}{\sin C}$.	$\log \tan C = \log \text{Dep.} - \log D L.$ Log Dist. = $\log \text{Dep.} - \log \sin C.$
Course and difference of latitude.	Distance	Dist. $= \frac{D L}{\cos C}$. Dep. =D L tan C.	Log Dist. = log D L $-\log \cos C$. Log Dep. = log D L $+\log \tan C$.

Given.	Required.		Formulæ.
Course and departure	Distance	Dist. = $\frac{\text{Dep.}}{\sin C}$.	$\log \text{Dist.} = \log \text{Dep.} - \log \sin C.$
	Difference of latitude	D L = $\frac{\text{Dep.}}{\tan C}$.	$\log D L = \log \text{Dep.} - \log \tan C.$
Distance and difference	Course	$Cos C = \frac{D L}{Dist.}$	Log cos C=log D L -log Dist.
of latitude.	Departure	Dep. = Dist. sin C.	Log Dep.=log Dist.+log sin C.
Distance and departure	Course Difference of latitude	$\begin{array}{l} \text{Sin C} = \frac{\text{Dep.}}{\text{Dist.}} \\ \text{D L} = \text{Dist. } \cos \text{C.} \end{array}$	Log sin C = log Dep log Dist. Log D L = log Dist. + log cos C.

170. The solution of the plane right triangle may be accomplished either by Plane Trigonometry, by Traverse Tables, or by construction. If the former method is adopted, the logarithms of numbers may be found in Table 42, and of the functions of angles in Table 44. A more expeditions method is avail-able, however, in the Traverse Tables, which give by inspection the various solutions. Table 1 contains values of the various parts for each unit of Dist. from 1 to 300, and for each quarter-point (2° 49'), of C; Table 2 contains values for each unit of Dist. from 1 to 600, and for each degree of C. The method of solving by construction consists in laying down the various given terms by scale upon a chart or plain

paper, and measuring thereon the terms required. **171.** Of the various problems that may arise, the first two given in the foregoing table are of much the most frequent occurrence. In the first, the given quantities are course and distance, and those to be found are difference of latitude and departure; this is the case where a navigator, knowing the distance run on a given course, desires to ascertain the amount made good to north or south and to east or west. In the second case the conditions are reversed; this arises where the course and distance between two points are to be obtained from their known difference of latitude and departure.

EXAMPLE: A ship sails SW. by W., 244 miles. Required the difference of latitude and the departure made good.

By Commutation.

log sin 9.91985

2.30724

102

56° 15′

202.9

· C

Dep.

By Inspection.

Dist. C	244 56° 15′	$\log \log \cos $	$2.38739 \\ 9.74474$	In Table 1, find the course SW. by W. (5 points); it occurs at the bottom of the page, therefore take the names
$\mathbf{D}\mathbf{L}$	135.6	\log	2.13213	the Dist. column will be seen Lat. 135.6 and Dep. 202.9.
Dist.	244	109	2.38739	

EXAMPLE: A ship sails N. 5° E., 188 miles. Required the difference of latitude and the departure.

By Inspection.

By Computation.				By Inspection.
Dist. C	188 5°	log log cos	$2.27416 \\ 9.99834$	In Table 2, find the course 5°; it occurs at the top of the page, therefore take the names of the columns from the top: opposite 188 in the Dist column will be seen Lat
\mathbf{DL}	187.3	\log	2.27250	187.3 and Dep. 16.4.
Dist. C	188 5°	log log sin	$2.27416 \\ 8.94030$	
Dep.	16.4	log	1.21446	

EXAMPLE: A vessel is bound to a port which is 136 miles to the north and 203 miles to the west of her position. Required the course and distance.

By Computation.

2032.30750Dep. 109 2.13354DL136100 \mathbf{C}^{-} (N.) 56° 11′ (W.) log tan 0.17396 2.30750203Dep. log 56° 11′ C log sin 9.91951 Dist. 244.32.38799log

Enter Table 1 and turn the pages until a course is found whereon the numbers 136 and 203 are found abreast each other in the columns marked respectively Lat. and Dep. This occurs most nearly at the course for 5 points, the angle being taken from the bottom, because the appropriate names of the columns are found there. The course is therefore NW. by W. Interpolating for interme-diate values, the corresponding number in the Dist. column is about 244.3.

By Inspection.

EXAMPLE: As the result of a day's run a vessel changes latitude 244 miles to the south and makes a departure of 171 miles to the east. What is the course and distance made good?

By Computation.

Dep. DL	171 • 244	\log	$2.23300 \\ 2.38739$
C (S.)	35° 02′ (E.)	log tan	9.84561
Dep. C	$171 \\ 35^{\circ} 02'$	$\log \log \sin$	$2.23300 \\ 9.75895$
Dist.	297.9	log	2.47405

By Inspection.

Enter Table 2 and the nearest agreement will be found on course (S.) 35° (E.), the appropriate names being found at the top of the page. The nearest corresponding Dist. is 298 miles.

TRAVERSE SAILING

172. A *Traverse* is an irregular track made by a ship in sailing on several different courses, and the method of *Traverse Sailing* consists in finding the difference of latitude and departure corresponding to several courses and distances and reducing all to a single equivalent course and distance. This is done by determining the distance to north or south and to east or west made good on each course, taking the algebraic sum of these various differences of latitude and departure and finding the course and distance corresponding thereto. The work can be most expeditiously performed by adopting a tabular form for the computation and using the traverse tables.

EXAMPLE: A ship sails SSE., 15 miles; SE., 34 miles; W. by S., 16 miles; WNW., 39 miles; S. by E., 40 miles. Required the course and distance made good.

Courses.	Dist,	N.	s,	E.	W.
SSE.	15		13.9	5.7	
SE. W. by S.	$\frac{34}{16}$		$\begin{array}{c} 24.0\\ 3.1 \end{array}$	24.0	15.7
WNW. S. by E.	39 40	14.9	39.2	7.8	36.0
		14.9	$\begin{array}{r} 80.2\\14.9\end{array}$	37.5	51.7 37.5
S. by W.	66.8		65.3		14.2

The result of the various courses is, therefore, to carry the vessel S. by W., 66.8 miles from her original position.

PARALLEL SAILING.

173. Thus far the earth has been regarded as an extended plane, and its spherical figure has not been taken into account; it has thus been impossible to consider one of the important terms involved namely, difference of longitude. Parallel Sailing is the simplest of the various forms of Spherical Sailing, being the method of interconverting departure and difference of longitude when the ship sails upon an



east or west course, and therefore remains always on the same parallel of latitude. In figure 24 T and T' are two places in the same latitude: P, the adjacent pole; TT', the arc of the parallel of latitude through the two places; MM', the corre-sponding arc of the equator intercepted between their meridians PM and PM'; and TT', the departure on the parallel whose latitude is TCM = OTC, and whose radius is OT.

Let DLo represent the arc of the equator MM', which is the measure of MPM', the difference of longitude of the meridians PM and PM'; R, the equatorial radius of the earth, CM = CT; r, the radius OT of the parallel TT'; and L, the latitude of that parallel. Then, since TT' and MM' are similar arcs of two circles, and are therefore

proportional to the radii of the circles, we have:

$$\frac{\mathbf{TT'}}{\mathbf{MM'}} = \frac{\mathbf{OT}}{\mathbf{CM}}; \text{ or, } \frac{\mathbf{Dep.}}{\mathbf{DLo}} = \frac{r}{\mathbf{R}}.$$

From the triangle COT, $r = R \cos L$; hence

 $\frac{\text{Dep.}}{\text{DLo}} = \frac{\text{R}\cos \text{L}}{\text{R}}; \text{ or, DLo} = \text{Dep. sec. L; or, Dep.} = \text{DLo}\cos \text{L}.$

Thus the relations are expressed between minutes of longitude and miles of departure.

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174. Two cases arise under Parallel Sailing: First, where the difference of longitude between two places on the same parallel is given, to find the departure; and, second, where the departure is given, to find the difference of longitude.

In working these problems, the computation can be made by logarithms; but the traverse tables may more conveniently be employed. Remembering that those tables are based upon the formula.

$$DL=Dist. \cos C$$
, and $Dist.=DL \sec C$,

we may substitute for the column marked Lat. the departure, for that marked Dist. the difference of longitude, and for the courses at top and bottom of the page the latitude. The tables then become available for making the required conversions.

EXAMPLE: A ship in the latitude of 49° 30′ sails directly east until making good a difference of longitude of 3° 30′. Required the departure.

By Computation. By Inspection. 49° 30/ $\log \cos 9.81254$ Enter Table 2 with the latitude as C and the difference Τ. DLo 2.32222 of longitude as Dist. As the table is calculated only to 210'log single degrees, we must find the numbers in the pages of Dep. 136.4 100 2.1347649° and 50° and take the mean. Corresponding to Dist. 210 in the former is Lat. 137.8, and in the latter Lat. 135.0. The mean, which is the required departure, is 136.4.

EXAMPLE: A ship in the latitude of 38° sails due west a distance of 215.5 miles. Required the difference of longitude.

	By Co	mputation		By Inspection.	
L Dep. DLo {	38° 215.5 273′.5	log sec log log	$\frac{0.10347}{2.33345}$ $\overline{2.43692}$	Entering Table 2 with the latitude, 38°, as a cours corresponding with the number 215.5 in column of La is 273.5 in the column of Dist. This is therefore t required difference of longitude, being equal to 4° 33'.5.	se, t., he
l	4 00',0		MIDDLE	LATITUDE SAILING.	

175. When a ship follows a course obliquely across the meridian the latitude is constantly changing, and the method of converting departure and difference of longitude by Parallel Sailing, just described, ceases to be applicable.

In figure 25, T is the point of departure; T', the point of destination; P, P the earth's pole; TT', the rhumb track; n_1 TT', the course; Tn, u_1 T', the respective parallels of latitude; and MM', the equator. The difference of longitude between T and T' is MPM', which may

be measured by the arc of the equator, MM', intercepted between their meridians. This corresponds to a departure T_n in the latitude of T, and to the smaller departure $T'n_1$ in the higher latitude of T'; but since the vessel neither makes all of the departure in the latitude T, nor all of it in the latitude T', the departure actually made in the passage must have some intermediate value between these extremes. Dividing the total of such small extent that, for the purposes of conversion, the change of latitude corresponding to each may be neglected, we have the total departure made up of the sum of a number of small departures, each equal to the same difference of longitude, but each different from the other. These will be $d_1 r_1$ in the latitude T, $d_2 r_2$ in the latitude r_1 , etc.

Hence we have: Hence we have: $MM'=d_1 r_1 \sec MT + d_2 r_2, \sec m_1 r_1 + d_3 r_3, \sec m_2 r_2, + \text{etc.}$ $MM'=d_1 r_1 \sec MT + d_2 r_2, \sec m_1 r_1 + d_3 r_3, \sec m_2 r_2, + \text{etc.}$ Now, if LL' be a parallel of latitude lying midway between Tn and T'n₁, since there will be as many Now, if LL' be a parallel of latitude lying midway between Tn and T'n₁, since there will be as many of the small parts lying above as below it, and since for moderate distances the ratio to be employed in the conversion of departure and difference of longitude may be regarded as varying directly with the latitude, it may be assumed for such distances that the sum of all of the different small departures equals the single departure between the meridians measured in the latitude LL', and therefore that the departure obtained by the method of plane sailing on any course may be converted into difference of longitude by multiplying by the secant of the Middle Latitude.

The method of conversion based upon this assumption is denominated Middle Latitude Sailing, and by reason of its convenience and simplicity is usually employed for short distances, such as those covered by a vessel in a day's run.

176. In Middle Latitude Sailing, having found the mean of the latitudes, the solution is identical with that of Parallel Sailing (art. 173), substituting the Middle Latitude for the single latitude therein employed.

177. It may be remarked that the Middle Latitude should not be used when the latitudes are of opposite name; if of different names and the distance is small, the departure may be assumed equal to the difference of longitude, since the meridians are sensibly parallel near the equator; but if the distance

is great the two portions of the track on opposites of the equator must be treated separately. EXAMPLE: A ship in Lat. 42° 30' N., Long. 58° 51' W., sails SE. by S., 300 miles. Required the latitude and longitude arrived at.

From Table 1: Course SE. by S., Dist., 300, we find Lat., 249.4 S. (4° 09'.4), Dep., 166.7 E.

Latitude left,	42° 4	$30'.0 \\ 09.4$	N. S.	Latitude left, Latitude arrived	42° at, 38	$^{\circ} 30' 21$	N. N.
Latitude arrived at,	38	20.6	N.		2)80	51	
				Mid. latitude.	40	25	N.





THE SAILINGS.

Enter Table 2 with the middle latitude, 40°, as a course; the difference of longitude (Dist.) corresponding to the departure (Lat.) 166.7 is 217.6; entering with 41°, it is 220.9; the mean is 219.2 (3° 39'.2). 58° 51′.0 W. Longitude left. DLo. 3 39.2 E.

Longitude arrived at. 55 11.8 W.

EXAMPLE: A ship in Lat. 39° 42′ S., Long. 3° 31′ E., sails S. 42° W., 236 miles. Required the latitude and longitude arrived at.

From Table 2: Course, S. 42° W., Dist., 236 miles; we find Lat., 175.4 S. (2° 55'.4), Dep., 157.9 W. 39° 42′.0 S. Latitude left. Latitude left. 39° 42′ S. 2 55.4 S. DL. Latitude arrived at, 42 37 S Latitude arrived at, 42 37.4 S. 2)8219 Mid. latitude. 41 09 S. From Table 2: Mid. Lat. (course), 41°, Dep. (Lat.), 157.9; we find DLo (Dist.), 209.3 (3° 29'.3). 3° 31′.0 E. · 3 29 .3 W. Longitude left. DLo.

Longitude arrived at, 0 01.7 E.

EXAMPLE: A vessel leaves Lat. 49° 57' N., Long. 15° 16' W., and arrives at Lat. 47° 18' N., Long. 20° 10' W. Required the course and distance made good.

Latitude left, 49° 57′ N.	Longitude left, 15° 16' W.
Latitude arrived at, 47 18 N.	Longitude arrived at, 20 10 W.
DL, $\begin{cases} 2^{\circ} 39' \\ 159' \end{cases} $ S.	DLo, $\left\{ \begin{array}{c} 4^{\circ} 54' \\ 294' \end{array} \right\} W$
$\frac{2)97^{\circ}15'}{48^{-29}}$ N	

From Table 2: Mid. Lat. (course), 49°, DLo (Dist.), 294; we find Dep. (Lat.), 192.9. From Table 2: DL 159 S., Dep. 192.9 W., we find course S. 51° W., Dist., 251 miles.

178. The assumption upon which Middle Latitude sailing is based—that the conversion may be made as if the whole distance were sailed upon a parallel midway between the latitudes of departure and destination—while sufficiently accurate for moderate distances, may be materially in error where the distances are large. In such case, either the method of Mercator Sailing (art. 179) must be employed, or else the correction given in the following table should be applied to the mean latitude to obtain what may be termed the latitude of conversion, being that latitude in which the required conditions are accurately fulfilled. The table is computed from the formula:

$$\cos L_c = \frac{l}{m},$$

where L_c represents the latitude of conversion, and l and m are respectively the differences of latitude and of meridional parts (art. 39, Chap. II) between the latitudes of departure and destination."

	Difference of latitude.															
Mid. Lat.	I°	2 0	3°	4 °	5°	6°	70	8°	90	10°	12°	140	16°	18°	200	Mid. Lat.
0	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	0
15	-86	-85	-84		-81	-79	-76	-73	-69	-65	56	-46	-34	-21	- 6	15
18	-67	-67	-66	-65	-63	-61	-59	-56	-53	-50	-43	-34	-23	-12	1	18
21	54	-54	-53	-52	-51	-49	-47		-42	-39	32	-24	-15	-5	7	21
24	-44	-44	-44	-42	41	-40	-38	-36	-33	-31	-24	-17	- 8	1	12	24
- 30	-31	-30	-29	-29	-28	-26	-24	-23	-20	-18	-12	- 6	1	11	21	30
35	-23	-22	-21	-21	-19	-18	-17	-15	-12	-10	- 5	2	10	18	28	35
40	-17	-16	-15	-14	-13	-12	-10	- 8	- 6	- 4	2	8	16	25	34	40
45	-12	-11	-11	-10	-8	-7	- 5	-3	·- 1	1	7	14	22	31	41	45
50	8	- 8	- 7	- 6	- 5	-3	-1	1	3	6	12	20	28	38	49	50
55	- 5	- 5	- 4	- 3	-2	0	2	5	7	10	17	25	- 35	46	58	55
58	- 4	- 3	- 3	- 1	0	2	4	7	10	13	20	29	39	51	64	58
60	- 3	- 3	-2	-1	1	3	5	8	11	14	22	32	43	55	69	_60
62	- 3	- 2	-1	0	2	4	7	9	13	17	25	35	46	60	75	62
64	- 2	- 1	0	1	3	5	8	11	14	18	27	38	50	65	81	64
_66	-2	- 1	0	2	4	6	- 9	12	16	20	30	42	55	71	89	66
68	- 1	0	1	2	5	7	10	14	18	22	33	46	61	78	98	68
70	-1	0	1	3	5	8	12	16	20	25	37	51	67	87	109	70
72	0	0	2	4	6	10	13	18	23	28	41	57	76	97	123	72

^a The statement often made, that the latitude of conversion is always greater than the middle latitude, is not correct when the compression of the earth is taken into account, as an inspection of the table will show; that statement is based upon an assumption that the earth is a perfect sphere, and it was upon that assumption that a table which appeared in early editions of this work was computed. The value of the compression adopted for this table is $\frac{1}{293.465}$

EXAMPLE: A vessel sails from Lat, 10° 13' S, to Lat, 20° 21' S, making a departure of 432 miles. Required the difference of longitude.

Latitude left, Latitude arrived :	10° 13 at, 20 21	/ S. S.					
	2)30 34]	For Mid.	Lat. 15° a	nd Diff. of I	at. 10°, Correction, -65′.
Mid. latitude, Correction,	$-{15 17 \\ -1 05}$	s.					
L _c ,	14	s.					
		L _e Dep.	14°	12^{\prime} 432^{\prime}	log sec log	$.01348 \\ 2.63548$	
		DLo		4454.6	log	2.64896	

MERCATOR SAILING.

179. Mercator Sailing is the method by which values of the various elements are determined from considering them in the relation in which they are plotted upon a chart constucted according to the Mercator projection.

180. Upon the Mercator chart (art. 38, Chap. II), the meridians being parallel, the arc of a parallel of latitude is shown as equal to the corresponding arc of the equator; the length of every such arc is, therefore, expanded; and, in order that the rhumb line may appear as a straight line, the meridians are also expanded by such amount as is necessary to preserve, in any latitude, the proper proper-tion existing between a unit of latitude and a unit of longitude. The lengths of small portions of the meridian thus increased are called *meridional parts* (art. 39, Chap. II), and these, computed for every minute of latitude from 0° to 80°, form the Table of Meridional Parts (Table 3), **E**

by means of which a Mercator chart may be constructed and all problems of Mercator Sailing may be solved.

In the triangle ABC (fig. 26), the angle ACB is the course, C; the side AC, the \mathbf{B} distance, Dist.; the side BC, the difference of latitude, DL; and the side AB, the departure, Dep. Then corresponding to the difference of latitude BC in the latitude under consideration, if CE be laid off to represent the meridional difference of latitude, m, completing the right triangle CEF, EF will represent the differ-ence of longitude, DLo. The triangle ABC gives the relations involved in Plane mSailing as previously described; the triangle CEF affords the means for the conversion of departure and difference of longitude by Mercator Sailing.

181. To find the arc of the expanded meridian intercepted between any two parallels, or the *meridional difference of latitude*, when both places are on the same side of the equator, subtract the meridional parts of the lesser latitude, as given by Table 3, from the meridional parts of the greater; the remainder will be the meridional difference of latitude; but if the places are on different sides of the equator, the sum of the meridional parts will be the meridional difference of latitude.



$$\Rightarrow$$
 tan C= $\frac{DLo}{m}$; DLo=m tan C; m=DLo cot C.

EXAMPLE: A ship in Lat. 42° 3(' N., Long. 58° 51' W., sails SE. by S., 300 miles. Required the latitude and longitude arrived at.

From Table 1: Course, SE. by S., Dist., 300; we find Lat. 249.4 S. (4° 09.'4).

Latitude left. DL.

m,

6.44 09.4 S.

326.0

By Inspection.

Merid. parts, -2480.4 Latitude arrived at, 38 20.6 N.

By Computation.

Enter Table 1, course 3 points; since the quantities involved exceed the limits of the table, divide by 2; abreast $\frac{m}{2}$ (Lat.), 163.0, find $\frac{\text{DLo}}{2}$ (Dep.), 108.9; hence 326.0log 2.51322m33° 45′ log tan 9.82489 С 217'.8 2.33811log 130 37/.8 DLoDLo=217.8 or 3° 37.8. 58° 51′.0 W. Longitude left, 3 37.8 E. DLo.

Longitude arrived at, 55 13.2 W.



nLo

Dep.

6. +

F1G. 26.

EXAMPLE: A ship in Lat. 4° 37′ S., Long. 21° 05′ W., sails N. 14° W., 450 miles. Required the latitude and longitude arrived at. From Table 2: Course, (N.) 14° (W.), Dist., 450; we find Lat. 436.6 N. (7° 16′.6).

Latitude left, DL,	4° 7	37′.0 S. 16 .6 N.	Merid. parts,	+275.4
Latitude arrived at,	$\overline{2}$	39.6 N.	Merid. parts,	+159.0
			т,	434.4
ation.			Bu	Inspection.

By Computation.

log

2.63789

log tan 9.39677

From Table 2: Course, 14°, *m* (Lat.), 434.4, we find DLo (Dep.) 108'.3 W., or 1° 48'.3.

DLo $\begin{cases} 108'.3 & \log & 2.03466 \\ 1^{\circ} 48'.3 & & \end{cases}$

434.4

110

1

I

Longitude left,	21° 05′.0 W.
DLo,	1 48.3 W.

Longitude arrived at, 22 53.3 W.

EXAMPLE: Required the course and distance by rhumb line from a point in Lat. 42° 03′ N., Long. 70° 04′ W., to another in Lat. 36° 59′ N., Long. 25° 10′ W.

Lat Lat	departu destinat	re, 42° 03′ N. tion, 36 59 N.	Merid. pts., +2770.1 Merid. pts., -2377.3	Long. depart Long. destina	are, 70° 04′ W. ation, 25 10 W.
	DL	$\left\{\begin{array}{c} 5^{\circ} 04' \\ 304' \end{array}\right\} S.$	<i>m</i> , 392.8	DLo	${ {44^{\circ} 54'} \\ {2694'} } E.$
		$\begin{array}{ccc} {\rm DLo} & 2694 \\ m & 392.8 \end{array}$	$\begin{array}{rl} \log & 3.43040 \\ \log & 2.59417 \end{array}$		
		C (S.) 81° 42′ (I DL 304′	E.) log tan .83623	$\log \sec84056 \ \log 2.48287$	
		Dist. 2106		log 3.32343	

The course is therefore S. $81^{\circ} 42'$ E., and the distance is 2,106 miles. Since the figures involved are so large, it is best to employ only the method by computation. The formula by which the Dist. is obtained comes from Plane Sailing.

GREAT CIRCLE SAILING.

183. The shortest distance between any two points on the earth's surface is measured by the arc of the great circle which passes through those points; and the method of sailing in which the arc of a great circle is employed for the track of the vessel, taking advantage of the fact that it is the shortest route possible, is denominated *Great Circle Sailing*.

184. It frequently happens when a great circle route is laid down that it is found to lead across the land, or to carry the vessel into a region of dangerous navigation or extreme cold which it is expedient to avoid; in such a case a certain parallel should be fixed upon as a limit of latitude, and a route laid down such that a great circle is followed as far as the limiting parallel, then the parallel itself, and finally another great circle to the port of destination. Such a modification of the great circle method is called *Composite Sailing*.

185. The *rhumb line* (art. 6, Chap. I) also called the *loxodromic curre*, which cuts all the meridians at the same angle, has been largely employed as a track by navigators on account of the ease with which it may be laid down on a Mercator chart. But as it is a longer line than the great circle between the same points, intelligent navigators of the present day use the latter wherever practicable. On the Mercator chart, however, the arc of a great circle joining two points (unless both are on the equator or both on the same meridian) will not be projected as a straight line, but as a curve which seems to be longer than the rhumb line; hence the shortest route appears as a circuitous one, and this is doubtless the reason that a wider use of the great circle has not been made.

It should be clearly understood that it is the rhumb line which is in fact the indirect route, and that in following the great circle the vessel is always heading for her port, exactly as if it were in sight, while on the course which is shown as a straight line on the Mercator chart the vessel never heads for her port until at the very end of the voyage.

186. The method of great circle sailing is of especial value to steamers, as such vessels need not, in the choice of a route, have regard for the winds to the same extent as must a sailing vessel; but even in navigating vessels under sail a knowledge of the great circle course may prove of great value. For example, suppose a ship to be bound from Sydney to Valparaiso; the first great circle course is SE. by S., while the Mercator course is almost due east. The distance is 748 miles shorter by the former route (if the

m

C

great circle is followed throughout, though this would lead to a latitude of 61° S.). With the wind at E. 1 S. the ship would lie nearer to the Mercator course on the starboard tack, assuming that she sailed within six points of the wind; but if she took that tack she would be increasing her distance from the within six points of the wind, but it she took that tack she would be increasing her distance from the port of destination by 4½ miles in every 10 that she sailed; while on the port tack, heading one point farther from the rhumb, the gain toward the port would be 9½ miles out of every 10. Any course between East and SSW, would be better than the Mercator course; and if the wind were anything to the eastward of SE. by S., the ship would gain by taking the port tack in preference to the starboard. **187.** As the great circle makes a different angle with each meridian that is crossed, it becomes

necessary to make frequent changes of the ship's course; in practice, the course is a series of chords joining the various points on the track line.

If, while endeavoring to follow a great circle, the ship is driven from it, as by unfavorable weather, it will not serve the purpose to return to the old track at convenience, but it is required that another great circle be laid down, joining the actual position in which the ship finds herself with the port of destination.

188. The methods of determining the great circle course may be divided generally into four classes; namely, by Great Circle Sailing Charts, by Computation, by the methods of the Time Azimuth. and by Graphic Approximations. **189.** GREAT CIRCLE SAILING CHARTS.—Of the available methods, that by means of charts espe-

cially constructed for the purpose is considered greatly superior to all others.

A series of great circle sailing charts covering the navigable waters of the globe is published by the United States Hydrographic Office. Being on the gnomonic projection (art. 43, Chap. II), all great circles are represented as straight lines, and it is only necessary to join any two points by such a line to represent the great circle track between them. The courses and distance are readily obtainable by a method explained on the charts. The track may be transferred to a chart on the Mercator projection by plotting a number of its points by their coordinates and joining them with a curved line. The navigator who contemplates the use of great circle

tracks will find it of the greatest convenience to be provided with these gnomonic charts for the regions which his vessel is to traverse.

190. By Computation.-This method consists in determining a series of points on the great circle by their a Mercator chart, and tracing the curve that joins them. The first point determined is the vertex, or point of highest latitude, even when, as sometimes occurs, it falls without that portion of the great circle which joins the points of departure and destination.

In figure 27, A represents the point of departure; B, the point of destination; AVB, the great circle joining them, with its vertex at V; and P, the pole of the earth.

 $C_A = PAB$, the initial course;

 $C_{\rm B} = PBA$, the final course;

 L_A , L_V , L_B = the latitudes of the respective points A, V, B = (90° - PA), (90° - PV), (90° - PB). Lo_{AB}, Lo_{AV}, Lo_{BV} = the differences of longitude between A and B, A and V, B and V, respectively, = APB, APV, BPV.

D = the great circle distance between A and B; and

 $\varphi =$ an auxiliary angle introduced for the computation.

We then have:

Let

 $\tan \varphi = \cos \operatorname{Lo}_{AB} \cot \operatorname{L}_{B};$ $\cot \operatorname{C}_{A} = \cot \operatorname{Lo}_{AB} \cos \left(\operatorname{L}_{A} + \varphi\right) \operatorname{cosec} \varphi;$ $\cot D = \cos C_A \tan (L_A + \varphi);$ $\cos L_v = \sin C_A \cos L_A;$ $\cot Lo_{AV} = \tan C_A \sin L_A$.

By these formulæ are determined the initial course and the total distance by great circle; also the latitude of the vertex and its longitude with respect to Λ . By interchanging the subscript letters $_{\Lambda}$ and $_{\rm B}$ throughout, we should obtain the final course, and the longitude of the vertex with respect to B; also the same total distance and latitude of the vertex as before.

In performing this computation, strict regard must be had to the signs of the quantities. If the points of departure and destination are in different latitudes, the latitude of one of these points must be regarded as negative with respect to the other, and they must be marked with opposite signs. Should Lo_{AV} or Lo_{BV} assume a negative value, it indicates that the vertex does not lie between A and B, and is to be laid off accordingly.

To find other points of the great circle, M, N, etc., let their latitudes be represented by L_{M} , L_{N} , etc., and their longitudes from the vertex by Lovy, Lovy, etc.; then

 $\begin{array}{l} \tan \ L_{\rm M} = \tan \ L_{\rm Y} \ {\rm cos} \ {\rm Lo}_{\rm YM}; \ {\rm or,} \ {\rm cos} \ {\rm Lo}_{\rm YM} = \tan \ L_{\rm M} \ {\rm cot} \ L_{\rm Y}; \\ \tan \ L_{\rm S} = \tan \ L_{\rm Y} \ {\rm cos} \ {\rm Lo}_{\rm YN}; \ {\rm or,} \ {\rm cos} \ {\rm Lo}_{\rm YN} = \tan \ L_{\rm N} \ {\rm cot} \ {\rm L_{\rm Y}}; \end{array}$

and so on. By these formulæ intervals of longitude from the vertex of 5°, 10°, or any amount, may be assumed, and the corresponding latitudes deduced; or any latitude may be assumed and its correspond-ing interval of longitude from the vertex found. Two positions will result from each solution, and the appropriate ones may be chosen by keeping in mind the signs involved.



Fig. 27.

EXAMPLE: Given two places, one in Lat. 40° N., Long. 70° W., the other in Lat. 30° S., Long. 10° W., find the great circle distance between them; also the initial course, and the longitude of equator crossing.

$$L_{A} = +40^{\circ}; L_{B} = -30^{\circ}; L_{0AB} = 60^{\circ}.$$

LO _{AB} L _B L _A	+	60° 30° 40°		$\begin{array}{c} \cos & 9.69897 \dots \cot & 9.76144 \\ \cot & (-) & .23856 \\ \hline \\ \\ \hline \\ \\ \hline \\$
$\substack{\varphi \\ (L_A + \varphi)}$	_	40° 0°	54′ 54′	$\tan(-)$ 9.93753 $\csc(-)$.18393 \cos 9.99995 $\tan(-)$ 8.19616
C A		131°	24'	or S. 48°36′ Ecot (-)9.94532 cos (-) 9.82041 sin 9.87513 tan (-) .05472
D		89°	24'	or 5,364 miles cot . 8.01657
L_{v}	+	54°	56'	
LOAV		53°	54'	$\cot(-)9.86279$

The initial course is therefore S. 48° 36' E., and the distance 5,364 nautical miles. (It may be found that the course by rhumb line is S. 38° 45' E. and the distance 5,751 miles.) The vertex of the great circle is in Lat. 54° 56' N., and is 53° 54' in longitude from the point A, in a direction away from B; hence it is in Long. 123° 54' W. To find the longitude of equator crossing let $L_{\rm M} = 0^{\circ}$; then in the equation,

cos Lovm=tan Lm cot Lv,

since tan $L_{\rm M}$ equals zero, cos $L_{0_{\rm M}}$ also equals zero, or the longitude interval from the vertex is 90°, which is evident from the properties of the great circle; therefore the longitude of equator crossing is 123° 54′ W.—90°=33° 54′ W.

191. By TIME AZIMUTH METHODS.—A convenient method of obtaining the initial and final courses in great circle sailing is afforded by the tables and graphic methods which are prepared for the solution of the *Time Azimuth* problem (art. 359, Chap. XIV). It will be found by comparison that if the latitude of the point of departure be substituted for the latitude of the observer in that problem, the latitude of destination for the declination of the celestial body, and the longitude interval for the hour angle, the solution for the initial course will coincide with that for the azimuth; by interchanging the latitudes of the points of departure and destination the final course will be similarly obtained. Advantage may thus be taken of the various methods provided for facilitating the determination of the azimuth to ascertain the great circle courses from one point to another.

192. By GRAPHIC APPROXIMATIONS.—Of the numerous methods that fall within this class only two need be given.

193. By the use of a *Terrestrial Globe* the two given points between which the great circle track is required may be joined by the shortest line between them, either by means of a piece of thread or by moving the globe until they are brought to the fixed horizon which is usually provided; the coordinates of the various points of the track are then transferred to the chart. The number of minutes of arc, as measured on the scale of the horizon between the points, equals the number of miles of distance; if there be no horizon, the measure may be made by a thread along the equator or a meridian.

194. The *Method of Professor Airy* consists in drawing on the chart a rhumb line joining the two points, and erecting at its middle point a perpendicular; the following table should then be entered with the middle latitude as an argument, and the "corresponding parallel" of latitude taken out (noting whether it is the same or opposite in name to the middle latitude); where this parallel is intersected by the perpendicular that was drawn will be the center from which may be swept an arc approximately representing the great circle between the two points.

Name.	Correspond- ing parallel.	Middle lati- tude.	Name.	Correspond- ing parallel.	Middle lati- tude.
	0 /	0		0 /	o
Opposite.	11 33	52	Opposite.	81 13	20
Do.	6 24	54	Do.	$78 \ 16$	22
Do.	1 13	56	Do.	74 59	24
Same.	4 00	58	Do.	71 26	26
Do.	9 15	60	Do.	$67 \ 38$	28
Do.	14 32	62	Do.	$63 \ 37$	30
Do.	19 50	-64	Do.	$59 \ 25$	32
Do.	25 09	66	Do.	55 05	34
'Do.	30 30	68	Do.	$50 \ 36$	36
Do.	35 52	70	Do.	46 00	38
Do.	41 14	72	Do.	41 18	40
Do.	46 37	74	Do.	36 31	42
- Do.	52 01	76	Do.	$31 \ 38$	44
Do.	57 25	78	Do.	$26 \ 42$	46
Do.	62 51	80	Do.	21 42	48
		-	Do.	$16_{-}39$	50

THE SAILINGS.

COMPOSITE SAILING.

195. It has already been stated that when, for any reason, it is impracticable or unadvisable to follow the great circle track to its highest altitude, a limiting parallel is chosen and the route modified accordingly. This method is denominated Composite Sailing.

196. The shortest track between points where a fixed latitude is not exceeded is made up as follows:

1. A great circle through the point of departure tangent to the limiting parallel.

2. A course along the parallel.

3. A great circle through the point of destination tangent to the limiting parallel.

The composite track may be determined by Great Circle Sailing Chart, by Computation, or by Graphic Approximation.

197. On a *Great Circle Sailing Chart*, draw lines from the points of departure and destination, respectively, tangent to the limiting parallel; transfer these great circles to a Mercator chart in the usual manner, by the coordinates of several points, including in each case the point of tangency to the parallel. Follow the first great circle to the parallel; then follow the parallel; then the second great circle. Determine great circle courses and distances from the gnomonic chart as thereon described; determine the distance along the parallel by Parallel Sailing.

198. By computation, the problem consists in finding the great circles which pass, respectively, through the points of departure and destination and have their vertices in the latitude of the limiting parallel. Resuming the designation of terms already employed (art. 190), we have:

$$\cos L_{0_{VA}} = \tan L_A \cot L_V;$$

 $\cos L_{0_{VB}} = \tan L_B \cot L_V;$

where $L_{0_{YA}}$ and $L_{0_{YB}}$ represent the distances in longitude from A and from B to the respective points of

tangency; other features of each of the great circles may be determined in the usual manner. EXAMPLE: A vessel in Lat. 30° S., Long. 18° W., is bound to a point in Lat. 39° S., Long. 145° E., and it is decided not to go south of the parallel of 55° S. Find the longitude of reaching that parallel and the longitude at which it should be left.

> $L_{A} = 30^{\circ} \text{ S.}; \quad L_{B} = 39^{\circ} \text{ S.}; \quad L_{V} = 55^{\circ} \text{ S.}; \\ Lo_{A} = 18^{\circ} \text{ W.}; \quad Lo_{B} = 145^{\circ} \text{ E.}$ 30° L_{A} tan 9.76144 L_B 39° tan 9,90837 Ly 55° cot 9.84523 Liv 55° cot 9.84523 LovA 66° 09′ E. cos 9.60667 Lovb 55° 27' W. cos 9.75360 Lo_A 18 00 W. LOB 145 00 E. Lov 48 09 E. Lov 89 33 E.

199. A graphic approximation to the composite track may be obtained by drawing a straight line between the given points on a Mercator chart and erecting at its middle point a perpendicular, which should be extended until it intersects the limiting parallel. Then through this intersection and the two points describe the arc of a circle, and this will approximate to the shortest distance within the assigned limit of latitude.

200. A terrestrial globe may be employed for the determination of the composite track; the method of its use will suggest itself.

201. Another approximation is obtained by joining the two points with a single great circle, and following this to its intersection with the limiting parallel; thence sailing along the parallel until the great circle is again intersected; then resuming the circle and following it to the destination.

CHAPTER VI.

DEAD RECKONING.

202. Dead Reckoning is the process by which the position of a ship at any instant is found by applying to the last well-determined position the run that has since been made, using for the purpose the ship's course and the distance indicated by the log.

203. Positions by dead reckoning, also spoken of as positions by account, differ from those determined by bearings of terrestrial objects or by observations of celestial bodies in being less exact, as the correctness of dead reckoning depends upon the accuracy of the estimate of the run, and this is always liable to be at fault to a greater or less extent. The course made good by a ship may differ from that which it is believed that she is making good, by reason of imperfect steering, improper allowance for compass error and leeway, and the effects of unknown currents; the allowed distance over the ground may be in error on account of inaccurate logging and unknown currents.

Notwithstanding its recognized defects as compared with the more exact methods, the dead reckoning is an invaluable aid to the mariner. It affords him a means of plotting the position of the ship at any desired time between astronomical determinations; it also gives him an approximate position at the moment of taking astronomical observations which is a great convenience in working up those observations; and finally it affords the only available means of determining the location of a vessel at sea during those periods (which may continue for several days together) when the weather is such as to render the observation of celestial bodies an impossibility.

204. TAKING DEPARTURE.—Before losing sight of the land, and preferably while objects remain in good view, it is the duty of the navigator to *take a departure*; this consists in fixing the position of the ship by the best means available (Chap. IV), and using this position as the origin for dead reckoning. There are two methods of reckoning the departure. The first and simpler consists in taking from the chart the latitude and longitude of the position found, and applying the future run thereto. The other requires that the bearing and distance of an object of known latitude and longitude be found; the position of the object then forms the basis of the reckoning, and the *reversed* direction of the bearing, with the distance, forms the first course and distance; thus it may be considered that the ship starts from the position in such a case should be that due to the heading of the ship when the bearing was taken. Each time that a new position is determined it is used as a new departure for the dead reckoning.

This meaning of the term *departure* should not be confounded with the other, which refers to the distance run toward east or west.

205. METHODS.—The working of dead reckoning merely involves an application of the methods of Traverse Sailing (art. 172) and Middle Latitude Sailing (art. 175), as explained in Chapter V.

The various compass courses are set down in a column, and abreast each are written the errors by reason of which the course steered by compass differs from the true course made good over the ground; thence the true course made good is determined and recorded; next, the distance is written in, and afterwards, by means of Tables 1 or 2 (according as the courses are expressed in quarter points or degrees), the difference of latitude and departure are found, separate columns being kept for distances to the north, south, east, and west.

When the position of the ship at any moment is required, add up all the differences of latitude and departure, and write in the column of the greater the difference between the northing and southing, and the easting and westing. Apply the difference of latitude to the latitude of the last determined position, which will give the latitude by D. R., and from which may be found the middle latitude; with the middle latitude find the difference of longitude corresponding to the departure, apply this to the longitude of last position, and the result will be the longitude by D. R.

The employment of the tabular form will be found to facilitate the work and guard against errors. It will be a convenience to include in that form columns showing the hour, together with the reading of the patent log (if used) each time that the course is changed or the dead reckoning worked up.

The employment of minutes and tenths in dead reckoning rather than minutes and seconds is recommended.

EXAMPLE: A vessel under sail heading NE. $\frac{3}{4}$ E. (on which course deviation is $\frac{1}{4}$ pt. Easterly) takes departure from Cape Henry light-house (see Appendix IV for position), bearing SSW. $\frac{1}{2}$ W, per compass, distant 1.4 miles. She then sails on a series of courses, with errors and distances as indicated below; wind about SE. by E. Required the position by dead recokning; also the course and distance made good by dead recokning.

DEAD RECKONING.

Comp. course.	Var.	Dev.	Leeway.	Error.	True course.	Dist.	Ν.	s.	E.	W.	D.
NNE. ½ E. NE. ¾ E. S. by W. ENE. S. ¼ E. NE. ¼ N.	1211212 W. 121121W. 1211212 W. 12122 W. 12212234	$\begin{array}{c} \frac{1}{4} & \text{E.} \\ \frac{1}{4} & \text{E.} \\ 0 \\ \frac{1}{4} & \text{E.} \\ 0 \\ \frac{1}{4} & \text{E.} \end{array}$	14 W. 14 E. W. 12 L. W.	14 W. 14 W.	NNE. $\frac{1}{4}$ E. NE. $\frac{1}{4}$ E. S. $\frac{3}{4}$ W. NE. by E. $\frac{1}{4}$ E. S. $\frac{1}{4}$ E. NE. by N.	1.427.631.514.211.087.0	$ \begin{array}{r} 1.3 \\ 18.5 \\ 7.3 \\ 72.3 \end{array} $	31.2 11.0	$\begin{array}{c} 0.\ 6\\ 20.\ 5\\ 12.\ 2\\ 0.\ 5\\ 48.\ 3\end{array}$	4.6	
Made good,					NE. ³ / ₄ E.	96, 5	$99.4 \\ 57.2$	42.2		4.6	97.0

By D. R.

EXAMPLE: A steamer's position by observation at noon, patent log reading 27.3, is Lat. 49° 15′ N., Long. 7° 32′ W. Thence she steers S. 82° W. (per compass), the total compass error on that course being 20° W., until 12.30, at which time, patent log reading 33.9, the course is changed to S. 80° W. (p. c.), same error. At 4.12, patent log 80.5, sights are taken from which it is found that the true longitude is 8° 46′ W., and the compass error 19° W. At 6.15, patent log reading 6.1, a sight is taken from which it is found that the true latitude is 48° 34′ 30″ N. At 8 p. m. the patent log reads 27.5. Required the positions by D. R. at each sight and at 8 o'clock.

74 23.5 W.

37 52.8 N.

Time.	Comp. course.	Error.	True course.	Pat. Log.	Dist.	s.	W.	D.
Noon. 12.30 4.12	S. 82° W. S. 80° W.	20° W. 20° W.	S. 62° W. S. 60° W.	27.3 33.9 80.5	$\begin{array}{c} 6.6\\ 46.6\end{array}$	$3.1 \\ 23.3$	5.8 40.3	
$\begin{array}{c} 6.15\\ 8.00\end{array}$	S. 80° W. S. 80° W.	19° W. 19° W.	S. 61° W. S. 61° W.	$\begin{array}{c} 6.1\\ 27.5\end{array}$	$\begin{array}{c} 25.\ 6\\ 21.\ 4 \end{array}$	26.4 12.4 10.4	46. 1 22. 4 18. 7	$70. \ 3 \\ 34. \ 1 \\ 27. \ 9$

By obs. at noon, Run to 4.12 sight,	L 49°	atitude. 15′.0 N. 26.4 S.	Mid. L., 49°	$\frac{L}{7^{\circ}}$	ongitude. 32′.0 W. 10.3 W.
By D. R. at 4.12 sight,	48	48.6 N.		8	42.3 W.
By obs. at 4.12 sight, Run to 6.15 sight,		12.4 S.	Mid. L., 49°	8	46.0 W. 34.1 W.
By D. R. at 6.15 sight,	48	36.2 N.		9	20.1 W.
By obs. at 6.15 sight, Run to 8 p. m.,	48	34.5 N. 10.4 S.	Mid. L., 48°		27.9 W.
By D. R. at 8 p. m.,	48	24.1 N.		9	48.0 W.

206. ALLOWANCE FOR CURRENT.—When a vessel is sailing in a known current whose strength may be estimated with a fair degree of accuracy, a more correct position may be arrived at by regarding the set and drift of the current as a course and distance to be regularly taken account of in the dead reckoning.

EXAMPLE: A vessel in the Gulf Stream at a point where the current is estimated to set N. 48° E. at the rate of 1.8 miles an hour, sails S. 3° W. (true), making 9.5 knots an hour through the water for $3^{h} 30^{m}$. Middle latitude 35°. Required the course and distance made good.

	True course.	Dist.	Χ.	×.	E.	w.	D.
Run Current	S. 3° W. N. 48° E.	$33.3 \\ 6.3$	4.2'	33, 3	4.7	1.7	
Made good	S. 6° E.	29.3		29.1	3.0		3.6

207. FINDING THE CURRENT.—It is usual, upon obtaining a good position by observation (as the navigator usually does at noon), to compare that position with the one obtained by dead reckoning, and to attribute such discrepancy as may be found to the effects of current. It has already been pointed out that other causes than the motion of the water tend to make the dead reckoning inaccurate, so that it must not be assumed that currents proper are thus determined with complete correctness.

Current is said to have set and drift, referring respectively to the direction toward which it is flowing and the velocity with which it moves.

It is evident that, in calculating current by the method of comparing positions by observation with those by account, the navigator must limit himself to the periods during which the dead reckoning has been brought forward independently, without receiving any corrections due to new points of departure. In case it is desired to find the current covering a period during which fresh departures have been used, as from noon to noon, find the algebraical sums of all the differences of latitude and longitude from the table, and apply these to the latitude and longitude of original departure—that of the preceding noon; this gives the position from the ship's run proper, and the difference between this and the position by observation gives the set and drift for the twenty-four hours; if an allowance has been made for current, as explained in the preceding article, that must be omitted in bringing up the position which is to take account of the run only.

208. DAY'S RUN.—It is usual to calculate, each day at noon, the ship's total run for the preceding twenty-four hours. Having the positions at noon of each day, the course and distance between them is found as explained in article 175, Chapter V. The position by observation is used in each case, if such has been found; otherwise, the position by dead reckoning.

EXAMPLE: At noon, January 22, the position of a vessel by observation was Lat. 35° 10' N., Long. 134° 01' W. During the next 24 hours, the run by account was 60.1 miles north and 153.2 miles east. At noon, January 23, the position by observation was Lat. 36° 03' N., Long. 131° 14' W. Required the position by D. R. at the latter time; also the run and current for the 24 hours.

	Latitude.		Longitude.
By obs., noon, 22d, Run,	35° 10′.0 N. 1 00 .1 N.	Mid. L., 36° Dep., 153.2 E.	134° 01′.0 W. 3 09 .4 E.
By D. R., noon, 23d,	36 10.1 N.	JD, 189.4 E.	130 51.6 W.
By obs., noon, 23d,	36 03.0 N.	(D, 22.4 W.)	131 14.0W.
Current,	6.9 S.	Dep., 18.1 W.∫	22.4 W.

Current for 24 hours, 6.9 S., 18.1 W. = S. 69° W., 19.4 miles. Current per hour, S. 69° W., 0.8 mile.

	Latitude.		Longitude.
By obs., noon, 23d, By obs., noon, 22d,	36° 03′.0 N. 35 10 .0 N.	Mid. L., 36° D, 167.0 E.	131° 14′.0 W. 134 01 .0 W.
Run,	0 53.0 N.	Dep., 135.1	2 47.0 E.

Run for 24 hours, 53.0 N., 135.1 E. = N. 68° E., 146 miles.

CHAPTER VII.

DEFINITIONS RELATING TO NAUTICAL ASTRONOMY.

209. Nautical Astronomy, or Celo-Narigation, has been defined (art. 3, Chap. I) as that branch of the science of Navigation in which the position of a ship is determined by the aid of celestial objectsthe sun, moon, planets, or stars.

210. The Celestial Sphere — An observer upon the surface of the earth appears to view the heavenly bodies as if they were situated upon the surface of a vast hollow sphere, of which his eve is the center. In reality we know that this apparent vault has no existence, and that we can determine only the relative directions of the heavenly bodies—not their distances from each other or from the observer. But by adopting an imaginary spherical surface of an infinite radius, the eye of the observer being at the center, the places of the heavenly bodies can be projected upon this Celestial Sphere, or Celestial Concare, at points where the lines joining them with the center intersect the surface of the sphere. Since, however, the centre of the earth should be the point from which all angular distances are meas-ured, the observer, by transferring himself there, will find projected on the celestial sphere, not only the heavenly bodies, but the imaginary points and circles of the earth's surface. The actual position of the observer on the surface will be projected in a point called the *zenith*; the meridians, equator, and all other lines and points may also be projected.

211. An observer on the earth's surface is constantly changing his position with relation to the celestial bodies projected on the sphere, thus giving to the latter an apparent motion. This is due to three causes: first, the diurnal motion of the earth, arising from its rotation upon its axis; second, the annual motion of the earth, arising from its motion about the sun in its orbit; and third, the actual motion of certain of the celestial bodies themselves. The changes produced by the diurnal motion are different for observers at different points upon the earth, and therefore depend upon the latitude and longitude of the observer. But the changes arising from the other causes named are independent of the observer's position, and may therefore be considered at any instant in their relation to the center of the earth. To this end the elements necessary for any calculation are tabulated in the Nautical Almanac from data based upon laws which have been found by long series of observations to govern the actual and apparent motion of the various bodies.

212. The Zenith of an observer on the earth's surface is the point of the celestial sphere vertically

overhead. The Nudir is the point vertically beneath. **213.** The Celestial Horizon is the great circle of the celestial sphere formed by passing a plane through the center of the earth at right angles to the line which joins that point with the zenith of the

The celestial horizon differs somewhat observer. from the Visible Horizon, which is that line appearing to an observer at sea to mark the intersection of earth and sky. This difference arises from two causes: first, the eye of the observer is always elevated above the sea level, thus permitting him a range of vision exceeding 90° from the zenith; and second, the observer's position is on the surface, instead of at the center of the earth. These causes give rise, respec-tively, to *dip of the horizon* and *parallax*, which will be explained later (Chap. X).

214. In figure 28 the celestial sphere is considered to be projected upon the celestial horizon, represented by NESW.; the zenith of the observer is projected at Z, and that pole of the earth which is elevated above the horizon, assumed for illustration to be the north pole, appears at P, the Elevated Pole of the celestial sphere. The other pole is not shown in the figure. **215.** The Equinoctial, or Celestial Equator, is the

great eircle formed by extending the plane of the earth's equator until it intersects the celestial sphere. It is shown in the figure in the line EQW. The equi-noctial intersects the horizon in E and W, its east and west points.



216. Hour Circles, Declination Circles, or Celestial Meridians are great circles of the celestial sphere passing through the poles; they are therefore secondary to the equinoctial, and may be formed by extending the planes of the respective terrestrial meridians until they intersect the celestial sphere. In the figure, PW, PS, PE, are hour circles, and that one, PS, which contains the zenith and is therefore formed by the extension of the terrestrial meridian of the observer, intersects the horizon in N and S, its north and south points.

217. Vertical Circles, or Circles of Altitude, are great circles of the celestial sphere which pass through the zenith and nadir; they are therefore secondary to the horizon. In the figure, ZH, WZE, NZS, are projections of such eircles; the vertical circle NZS, which passes through the poles, coincides with the meridian of the observer. The vertical circle WZE, whose plane is at right angles to that of the meridian, intersects the horizon in its eastern and western points, and, therefore, at the points of intersection of the equinoctial; this circle is distinguished as the *Prime Vertical*.

215. The Declination of any point in the celestial sphere is its angular distance from the equinoctial, measured upon the hour or declination circle which passes through that point; it is designated as North cr South according to the direction of the point from the equinoctial; it is customary to regard north declinations as positive (+), and south declinations as negative (-). In the figure, DM is the declination of the point M. Declination upon the celestial sphere corresponds with latitude upon the earth. **219.** The Polar Distance of any point is its angular distance from the pole (generally, the elevated pole of an observer), measured upon the hour or declination circle passing through the point; it must

219. The *Polar Distance* of any point is its angular distance from the pole (generally, the elevated pole of an observer), measured upon the hour or declination circle passing through the point; it must therefore equal 90° minus the declination, if measured from the pole of the same name as the declination, or 90° plus the declination, if measured from the pole of opposite name. The polar distance of the point M from the elevated pole, P, is PM.

220. The Altitude of any point in the celest'al sphere is its angular distance from the horizon, measured upon the vertical circle passing through the point; it is regarded as positive when the body is on the same side of the horizon as the zenith. The altitude of the point M is HM.

5.21. The Zenith Distance of any point is its angular distance from the zenith, measured upon the vertical circle passing through the point; the zenith distance of any point which is above the horizon of an observer must therefore equal 90° minus the altitude. The zenith distance of M, in the figure, is ZM.

222. The Hour Angle of any point is the angle at the pole between the meridian of the observer and the hour circle passing through that point; it may also be regarded as the arc of the equinoctial intercepted between those circles. It is measured toward the west as a positive direction through the twenty-four hours, or 360 degrees, which constitute the interval between the successive returns to the meridian, due to the diurnal rotation of the earth, of any point in the celestial sphere. The hour angle of M is the angle OPD, or the arc QD.

223. The *Azimuth* of a point in the celestial sphere is the angle at the zenith between the meridian of the observer and the vertical circle passing through the point; it may also be regarded as the arc of the horizon intercepted between those circles. It is measured from either the north or the south point of the horizon (usually that one of the same name as the elevated pole) to the east or west through 180°, and is named accordingly; as, N. 60° W., or S. 120° W. The azimuth of M is the angle NZH, or the arc NH, from the north point, or the angle SZH, or the arc SH, from the south point of the horizon.

224. The Amplitude of a point is the angle at the zenith between the prime vertical and the vertical circle of the point; it is measured from the east or the west point of the horizon through 90° , as W. 30° N. It is closely allied with the azimuth and may always be deduced therefrom. In the figure, the amplitude of H is the angle WZH, or the arc WH. The amplitude is only used with reference to points in the horizon.

225. The *Ecliptic* is the great circle representing the path in which, by reason of the annual revolution of the earth, the sun appears to move in the celestial sphere; the plane of the ecliptic is inclined to that of the equinoctial at an angle of $23^{\circ} 27^{1}$, and this inclination is called the *obliquity of the ecliptic*. The ecliptic is represented by the great circle CVT.

226. The Equinoxes are those points at which the ecliptic and the equinoctial intersect, and when the sun occupies either of these positions the days and nights are of equal length throughout the earth. The Vernal Equinox is that one at which the sun appears to an observer on the earth when passing from southern to northern declination, and the Autumnal Equinox that one at which it appears when passing from northern to southern declination. The Vernal Equinox is also designated as the Farst Point of Aries, and is used as an origin for reckoning right ascension; it is indicated in the figure at V.
227. The Solstitual Points, or Solstices, are points of the celiptic at a distance of 90° from the equinoxes,

227. The Solstitial Points, or Solstices, are points of the ccliptic at a distance of 90° from the equinoxes, at which the sun attains its highest declination in each hemisphere. They are called respectively the Summer and the Winter Solstice, according to the season in which the sun appears to pass these points in its path.

228. The Right Ascension of a point is the angle at the pole between the hour circle of the point and that of the First Point of Aries; it may also be regarded as the arc of the equinoctial intercepted between those circles. It is measured from the First Point of Aries to the eastward as a positive direction, through twenty-four hours or 360 degrees. The right ascension of the point M is VD.

229. Celestial Latitude is measured to the north or south of the ecliptic upon great circles secondary thereto. Celestial Longitude is measured upon the ecliptic from the First Point of Aries as an origin, being regarded as positive to the eastward throughout 360°.

230. COORDINATES.—In order to define the position of a point in space, a system of lines, angles, or planes, or a combination of these, is used to refer it to some fixed line or plane adopted as the primitive; and the lines, angles, or planes by which it is thus referred are called *coordinates*.

231. In figure 29 is shown a system of rectilinear coordinates for a plane. A fixed line FE is chosen, and in it a definite point C, as the *origin*. Then the position of a point A is defined by CB = x, the distance from the origin, C, to the foot of a perpendicular let fall from A on FE; and by AB = y, the length of the perpendicular. The distance x is called the *abscissa* and y the *ordinate*. Assuming two intersecting right lines FE and HI as standard lines of reference, the location of the point A is defined by regarding the distances measured to the right hand of HI and above FE as *positive*; those to the left hand of HI and below FE as *negative*.

An exemplification of this system is found in the chart, on which FE is represented by the equator, HI by the prime meridian; the coordinates x and y being the longitude and latitude of the point A.



232. The great circle is to the sphere what the straight line is to the plane; hence, in order to define the position of a point on the surface of a sphere, some great circle must be selected as the primary, and some particular point of it as the origin. Thus, in figure 30, which represents the case of a

primary, and some fixed great circle, CBQ, is selected as the axis and called the *primary*; and a point C is chosen as the origin. Then to define the position of any point A, the abscissa x equals the distance from C to the point B, where the secondary great circle through A intersects the primary; the ordinate y equals the distance of A from the primary measured on the secondary—that is, x = CB and y = AB.

233. In the case of the earth, the primary selected is the equator (its \mathbf{Q} plane being perpendicular to the earth's axis), and upon this are measured the abscisse, while upon the secondaries to it are measured the ordinates of all points on the earth's surface. The initial point for reference on the equator is determined by the *prime meridian* chosen, West longitudes and North latitudes being called *positive*, East longitudes and South latitudes, *negative*.

234. In the case of the celestial sphere, there are four systems of coordinates in use for defining the position of any point; these vary according to the circle adopted as the primary and the point used as an origin. They are as follows:

- 1. Altitude and azimuth.
- 2. Declination and hour angle.
- 3. Declination and right ascension.
- 4. Celestial latitude and longitude.

235. In the system of *Altitude and Azimuth*, the primary circle is the celestial horizon, the secondaries to which are the vertical circles, or circles of altitude. The horizon is intersected by the celestial meridian in its northern and southern points, of which one—usually that adjacent to the elevated pole—is selected as an origin for reckoning coordinates. The azimuth indicates in which vertical circle the point to be defined is found, and the altitude gives the position of the point in that circle. In figure 28 the point M is located, according to this system, by its azimuth NH and altitude HM.

236. In the system of *Declination and Hour Angle*, the primary circle is the equinoctial, the secondaries to which are the circles of declination, or hour circles. The point of origin is that point of intersection of the equinoctial and celestial meridian which is above the horizon. The hour angle indicates in which declination circle the point to be defined is found, and the declination gives the position of the point in that circle. In figure 28 the point M is located, according to this system, by its hour angle QD and declination DM.

237. In the system of *Declination and Right Ascension*, the primary and secondaries are the same as in the system just described, but the point of origin differs, being assumed to be at the First Point of Aries, or vernal equinox. The right ascension indicates in which declination circle the point M is located by VD, the right ascension, and DM, the declination. It should be noted that this system differs from the preceding in that the position of a point is herein referred to a fixed point in the celestial sphere and is independent of the zenith of the observer as well as of the position of the earth in its diurnal motion, while in the system of declination and both of these are factors in determining the coordinates.

while, in the system of declination and hour angle, both of these are factors in determining the coordinates. **238.** In the system of *Celestial Latitude and Longitude*, the primary circle is the ecliptic; the point of origin, the First Point of Aries. The method of reckoning by this system, which is of only slight importance in Nautical Astronomy, will appear from the definitions of celestial latitude and longitude already given (art. 229).

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CHAPTER VIII.

INSTRUMENTS EMPLOYED IN NAUTICAL ASTRONOMY.

THE SEXTANT.

239. The sectant is an instrument for measuring the angle between two objects by bringing into coincidence at the eye of the observer rays of light received directly from the one and by reflection from the other, the measure being afforded by the inclination of the reflecting surfaces. By reason of its small dimensions, its accuracy, and, above all, the fact that it does not require a permanent or a stable mounting but is available for use under the conditions existing on shipboard, it is a most important instrument for the purposes of the navigator. While the sextant is not capable of the same degree of accuracy as fixed instruments, its measurements are sufficiently exact for navigation.

240. DESCRIPTION.—A usual form of the sextant is represented in figure 31. The frame is of brass or some similar alloy. The graduated arc, AA, generally of silver, is marked in appropriate divisions;



in the finer sextants, each division represents 10', and the vernier affords a means of reading to 10". A wooden handle, H, is provided for holding the instrument. The index mirror, M, and horizon mirror, m, are of plate glass, and are silvered, though the upper half of the horizon glass is left plain to allow direct rays to pass through unobstructed. To give greater distinctness to the images, a small *telescope*, E, is placed in the line of sight; it is supported in a ring, K, which can be moved by a screw in a direction at right angles to the plane of the sextant, thus shifting the axis of the telescope, and therefore the plane of reflection; this plane, however, always remains parallel to that of the instrument, the motion of the telescope being intended merely to regulate the relative brightness of

Fig. 31.

the direct and reflected images. In the ring K are small screws for the purpose of adjusting the telescope by making its axis parallel with the plane of the sextant. The vernier is carried on the end of an index bar pivoted beneath the index mirror, M, and thus travels along the graduated scale, affording a measure for any change of inclination of the index mirror; a reading glass, R, attached to the index bar and turning upon a pivot, S, facilitates the reading of vernier and scale. The index mirror, M, is attached to the head of the index bar, with its surface perpendicular to the plane of the instrument; an adjusting screw is fitted at the back to permit of adjustment to the perpendicular plane. The fixed glass m, half silvered and half plain, is called the *horizon glass*, as it is through this that the horizon is observed in measuring altitudes of celestial bodies; it is provided with screws, by which its perpendicularity to the plane of the instrument may be adjusted. At P and Q are colored glasses of different shades, which may be used separately or in combination to protect the eye from the intense light of the sun. In order to observe with accuracy and make the images come precisely in contact, a *tangent-screw*, B, is fixed to the index, by means of which the latter may be moved with greater precision than by hand; but this screw does not act until the index is fixed by the screw C at the back of the sextant; when the index is to be moved any considerable amount, the screw C is loosened; when it is brought near to its required position the screw must be tightened, and the index may then be moved gradually by the tangent-screw.

Besides the telescope, E, the instrument is usually provided with an inverting telescope, I, and a tube without glasses, F; also, with a cap carrying colored glasses, which may be put on the eye-end of the telescope, thus dispensing with the necessity for the use of the colored shades, P and Q, and eliminating any possible errors which might arise from nonparallelism of their surfaces. 241. The *remier* is an attachment for facilitating the exact reading of the scale of a sextant, by

241. The *remier* is an attachment for facilitating the exact reading of the scale of a sextant, by which aliquot parts of the smallest divisions of the graduated scale are measured. The principle of the sextant vernier is identical with that of the barometer vernier, a complete description of which will be found in article 51, Chapter II. The arc of a sextant is usually divided into 120 or more parts, each

division representing 1°; each of these degree divisions is further subdivided to an extent dependent upon the accuracy of reading of which the sextant is capable. In the instruments for finer work, the divisions, which is subdivided into 60 parts, thus permitting a reading of 10"; all sextants, however, are not so closely graduated.

Whatever the limits of subdivision, all sextants are fitted with verniers which contain one more division than the length of scale covered, and in which, therefore, scale-readings and vernier-readings increase in the same direction—toward the left hand. To read any sextant, it is merely necessary to observe the scale division next below, or to the right of, the zero of the vernier, and to add thereto the angle corresponding to that division of the vernier scale which is most nearly in exact coincidence with

a division of the instrument scale. **242.** OPTICAL PRINCIPLE.—When a ray of light is reflected from a plane surface, the angle of inci-

dence is equal to the angle of reflection. From this it may be proved that when a ray of light undergoes two reflections, in the same plane the angle between its first and its last direction is equal to twice the inclination of the reflecting surfaces. Upon this fact the construction of the sextant is based.

In figure 32 let B and C represent respectively the index mirror and horizon mirror of a sextant: draw EF perpendicular to B, and CF perpendicular to C; then the angle CFB represents the inclination of the two mirrors. Suppose a ray to proceed from A and undergo reflection at B and at C, its last direction being CD; then ADC is the angle between its first and last directions, and we desire to prove that ADC = 2 CFB. From the equality of the angles of incidence and

reflection:



From Geometry:

ADC = ABC - BCD = 2 (EBC - BCF) = 2 CFB,

which is the relation that was to be proved.

243. In the sextant, since the index mirror is immovably attached to the index arm, which also carries the vernier, it follows that no change can occur in the inclination between the index mirror and the horizon mirror, excepting such as is registered by the travel of the vernier upon the scale.

If, when the index mirror is so placed that it is nearly parallel with the horizon mirror, an observer direct the telescope toward some well-defined object, there will be seen in the field of view two separate images of the object; and if the inclination of the index mirror be slightly changed by moving the index bar, it will be seen that while one of the images remains fixed the other moves. The fixed image is the direct one seen through the unsilvered part of the horizon glass, while the movable image is due to rays reflected by the index and horizon mirrors. When the two images coincide these mirrors must be parallel (assuming that the object is sufficiently distant to disregard the space which separates the mirrors); in this position of the index mirror the vernier indicates the true zero of the scale. If, however, instead of observing a single object, the instrument is so placed that the direct ray from one object appears in coincidence with the reflected ray of a second object, then the true angle between the objects will be twice the angle of inclination between the mirrors, or twice the angle measured by the vernier from the true zero of the scale. To avoid the necessity of doubling the angle on the scale, the latter is so marked that each half degree appears as a whole degree, whence its indications give the whole angle directly

244. ADJUSTMENTS OF THE SEXTANT.—The theory of the sextant requires that, for accurate indications, the following conditions be fulfilled:

(a) The two surfaces of each mirror and shade glass must be parallel planes.

b The graduated arc or limb must be a plane, and it: graduations, as well as those of the vernier, must be exact.

(c) The axis must be at the center of the limb, and perpendicular to the plane thereof.

(d) The index and horizon glasses must be perpendicular, and the line of sight parallel, to the plane of the limb.

Of these, only the last named ordinarily require the attention of the navigator who is to make use of the sextant; the others, which may be called the *permunent adjustments*, should be made before the instrument leaves the hands of the maker, and with careful use will never be d ranged.

245. The Adjustment of the Index Mirror consists in making the reflecting surface of this mirror truly perpendicular to the plane of the sextant. In order to test this, set the index n' ar the middle of the arc, then, placing the eye very nearly in the plane of the sextant and close to the index mirror, observe whether the direct image of the arc and its image reflected from the mirror appear to form one continuous arc; if so, the glass is perpendicular to the plane of the sextant; if the reflected image appcars to droop from the arc seen directly, the glass leans backward; if it seems to rise, the glass leans for ard. The adjustment is made by the screws at the back of the mirror.

246. The *Adjustment of the Horizon Mirror* consists in making the reflecting surface of this mirror perpendicular to the plane of the sextant. The index mirror having been adjusted, if, in revolving it by means of the index arm, there is found one position in which it is parallel to the horizon glass, then the latter must also be perpendicular to the plane of the sextant. In order to test this, put in the tele-scope and direct it toward a star; move the index until the reflected image appears to pass the direct image; if one passes directly over the other the mirrors must be parallel; if one passes on either side of the other the bright adjustment which is geomalicated by means of the servery attrached the other the horizon glass needs adjustment, which is accomplished by means of the screws attached.





The sea horizon may also be used for making this adjustment. Hold the sextant vertically and bring the direct and the reflected images of the horizon line into coincidence; then incline the sextant until its plane makes but a small angle with the horizon; if the images still coincide the glasses are parallel; if not, the horizon glass needs adjustment.

247. The Adjustment of the Telescope must be so made that, in measuring angular distances, the line of sight, or axis of the telescope, shall be parallel to the plane of the instrument, as a deviation in that respect, in measuring large angles, will occasion a considerable error. To avoid such error, a telescope is employed in which are placed two wires, parallel to each other and equidistant from the center of the telescope; by means of these wires the adjustment may be made. Screw on the telescope, and turn the tube containing the eveglass till the wires are parallel to the plane of the instrument; then select two clearly-defined objects whose angular distance must be not less than 90°, because an error is more easily discovered when the distance is great; bring the reflected image of one object into exact coincidence with the direct image of the other at the inner wire; then, by altering slightly the position of the instrument, make the objects appear on the other wire; if the contact still remains perfect, the axis of the telescope is not parallel, and it must be rectified by turning one of the two screws of the ring into which the telescope is screwed, having previously unturned the other screw; by repeating this operation a few times the contact will be precisely the same at both wires, and the axis of the telescope will be parallel to the plane of the instrument.

Another method of making this adjustment is to place the sextant upon a table in a horizontal position, look along the plane of the limb, and make a mark upon a wall, or other vertical surface, at a distance of about 20 feet; draw another mark above the first at a distance equal to the height of the axis of the telescope above the plane of the limb; then so adjust the telescope that the upper mark, as viewed through the telescope, falls midway between the wires. Some sextants are accompanied by small sights whose height is exactly equal to the distance between the telescope and the plane of the limb; by the use of these, the necessity for employing the second mark is avoided and the adjustment can be very accurately made. **248.** The errors which arise from defects in what have been denominated the *permanent adjustments*

248. The errors which arise from defects in what have been denominated the *permanent adjustments* of the sextant may be divided into three classes, namely: Errors due to faulty centering of the axes, called *eccentricity;* errors of graduation; and errors arising from lack of parallelism of surfaces in index mirror and in shade glasses.

The errors due to eccentricity and faulty graduation are constant for the same angle, and should be determined once for all at some place where proper facilities for doing the work are at hand; these errors can only be ascertained by measuring known angles with the sextant. If angles of 10°, 20°, 30°, 40°, etc., are first laid off with a theodolite or similar instrument and then measured by the sextant, a table of errors of the sextant due to eccentricity and faulty graduation may be made, and the error at any intermediate angle found by interpolation; this table will include the error of graduation of the theodolite and also the error due to inaccurate reading of the sextant, but such errors are small. Another method for determining the combined errors of eccentricity and graduation is by measuring the angular distance between stars and comparing the observed and the computed are between them, but this process is liable to inaccurate is by reason of the uncertainty of allowances for atmospheric refraction.

is liable to inaccuracies by reason of the uncertainty of allowances for atmospheric refraction. Errors of graduation, when large, may be detected by "stepping off" distances on the graduated arc with the vernier; place the zero of the vernier in exact coincidence with a division of the arc, and observe whether the final division of the vernier also coincides with a division of the arc; this should be tried at numerous positions of the graduated limb, and the agreement ought to be perfect in every case.

The error due to a prismatic index mirror may be found by measuring a certain unchangeable angle, then taking out the glass and turning the upper edge down, and measuring the angle again; half the difference of these two measures will be the error at that angle due to the mirror. From a number of measures of angles in this manner, a table similar to the one for eccentricity and faulty graduation can be made; or the two tables may be combined. When possible to avoid it, however, no sextant should be used in which there is an index mirror which produces a greater error than that due to the probable error of reading the scale. Mirrors having a greater angle than 2" between their faces are rejected for use in the United States Navy. Index mirrors may be roughly tested by noting if there is an elongated image of a well-defined point at large angles.

Since the error due to a prismatic horizon mirror is included in the index correction (art. 249), and consequently applied alike to all angles, it may be neglected.

Errors due to prismatic shade glasses can be determined by measuring angles with and without the shade glasses and noting the difference. They may also be determined, where the glasses are so arranged that they can be turned through an angle of 180°, by measuring the angle first with the glass in its usual position and then reversed, and taking the mean of the two as the true measure.

249. INDEX ERROR.—The *Index Error* of a sextant is the error of its indications due to the fact that when the index and horizon mirrors are parallel the zero of the vernier does not coincide with the zero of the scale. Having made the adjustments of the index and horizon mirrors and of the telescope, as previously described, it is necessary to find that point of the arc at which the zero of the vernier falls when the two mirrors are parallel, for all angles measured by the sextant are reckoned from that point. If this point is to the left of the zero of the limb, all readings will be too great; if to the right of the zero, all readings should be zero when the mirrors are parallel, place the zero of the

If desirable that the reading should be zero when the mirrors are parallel, place the zero of the vernier on zero of the arc; then, by means of the adjusting screws of the horizon glass, move that glass until the direct and reflected images of the same object coincide, after which the perpendicularity of the horizon glass should again be verified, as it may have been deranged by the operation. This adjustment is not essential, since the correction may readily be determined and applied to the reading. In certain sextant work, however, such as surveying, it will be very convenient to be relieved of the
necessity of correcting each angle observed. The sextant should never be relied upon for maintaining a constant index correction, and the error should be ascertained frequently. It is a good practice to verify the correction each time a sight is taken.

250. The Index Correction may be found (a) by a star, (b) by the sea horizon, and (c) by the sun. (a) Bring the direct and reflected images of a star into coincidence, and read off the arc. The index correction is numerically equal to this reading, and is positive or negative according as the reading is on the right or left of the zero.

(b) The same method may be employed, substituting for a star the sea horizon, though this will be found somewhat less accurate.

(c) Measure the apparent diameter of the sun by first bringing the upper limb of the reflected image to touch the lower limb of the direct image, and then bringing the lower limb of the reflected image to touch the upper limb of the direct image.

Denote the readings in the two cases by r and r'; then, if S = apparent diameter of the sun, and R =the reading of the sextant when the two images are in coincidence, we have:

$$\begin{aligned} r &= \mathbf{R} + \mathbf{S}, \\ r' &= \mathbf{R} - \mathbf{S}, \\ \mathbf{R} &= \frac{1}{2} \left(r + r' \right). \end{aligned}$$

As R represents the error, the correction will be - R. Hence the rule: Mark the readings when on the arc with the *negative* sign; when off, with the *positive* sign; then the index correction is one-half the algebraic sum of the two readings.

EXAMPLE: The sun's diameter is measured for index correction as follows: On the arc, 31' 20"; off the arc. 33' 10". Required the correction.

On the arc,
$$-31' 20''$$

Off the arc, $+33 \ 10$
 $2) + 1 \ 50$
L. C., $+0.55$

251. From the equations previously given, it is seen that:

$$S = \frac{1}{2} (r - r');$$

hence, if the observations are correct, it will be found that the sun's semidiameter, as given in the Nautical Almanac for the day of observation, is equal to one-half the algebraic difference of the readings. If required to obtain the index correction with great precision, several observations should be taken and the mean used, the accuracy being verified by comparing the tabulated with the observed semidiameter. If the sun is low, the horizontal semidiameter should be observed, to prevent the error that may arise from unequal refraction.

252. Use of the SEXTANT.—To measure the angle between any two visible objects, point the telescope toward the lower one, if one is above the other, or toward the left-hand one, if they are in nearly the same horizontal plane. Keep this object in direct view through the unsilvered part of the horizon glass, and move the index arm until the image of the other object is seen by a double reflection from the index mirror and the silvered portion of the horizon glass. Having gotten the direct image of one object into nearly exact contact with the reflected image of the other, clamp the index arm and, by means of the tangent-screw, complete the adjustment so that the contact may be perfect; then read the limbs.

In measuring the altitude of a celestial body above the sea horizon, it is necessary that the angle shall be measured to that point of the horizon which lies vertically beneath the object. To determine this point, the observer should move the instrument slightly to the right and left of the vertical, swinging it about the line of sight as an axis, taking care to keep the object in the middle of the field of view. The object will appear to describe the arc of a circle, and the lowest point of this arc marks the true vertical.

The shade-glasses should be employed as may be necessary to protect the eye when observing objects of dazzling brightness, such as the sun, or the horizon when the sun is reflected from it at a low altitude. Care must be taken that the images are not too bright or the eve will be so affected as to interfere with the accuracy of the observations.

253. CHOICE OF SEXTANTS.-The choice of a sextant should be governed by the kind of work which is required to be done. In rough work, such as surveying, where angles need only be measured to the nearest 30" the radius may be as small as 6 inches, which will permit easy reading, and the instrument can be correspondingly lightened. Where readings to 10" are desired, as in nice astronomical work, the radius should be about $7\frac{1}{2}$ inches, and the instrument, to be strongly built, should weigh about $3\frac{1}{2}$ pounds.

The parts of an instrument should move freely, without binding or gritting. The eyepieces should move easily in the telescope tubes; the bracket for carrying the telescope should be made very strong. It is frequently found that the parallelism of the line of sight is destroyed in focusing the eyepiece, either on account of the looseness of the fit or because of the telescope bracket being weak. The vernier should lie close to the limbs to prevent parallax in reading. If it is either too loose or too tight at either extremity of its travel, it may indicate that the pivot is not perpendicular. The balls of the tangent-screw should fit snugly in their sockets, so that there may be no lost motion. Where possible, the sextant should always be submitted to expert examination and test as to the

accuracy of its permanent adjustments before acceptance by the navigator.

254. RESILVERING MIRRORS.—Occasion may sometimes arise for resilvering the mirrors of a sextant, as they are always liable to be damaged by dampness or other causes. For this purpose some

clean tin foil and mercury are required. Upon a piece of glass about 4 inches square lay a piece of tin foil whose dimensions exceed by about a quarter of an inch in each direction those of the glass to be silvered; smooth out the foil carefully by rubbing; put a small drop of mercury on the foil and spread it with the finger over the entire surface, being careful that none shall find its way under the foil; then put on a few more drops of mercury until the whole surface is fluid. The glass which is to be silvered having been carefully cleaned, it should be laid upon a piece of tissue paper whose edge just covers the edge of the foil and transferred carefully from the paper to the tin foil, a gentle pressure being kept upon the glass to avoid the formation of bubbles; finally, place the mirror face downward and leave it in an inclined position to allow the surplus mercury to flow off, the latter operation being hastened by a strip of tin foil at its lower edge. After five or six hours the tin foil around the edges may be removed, and the next day a coat of varnish made from spirits of wine and red sealing wax should be applied. For a horizon mirror care must be taken to avoid silvering the plain half. The mercury drawn from the foil should not be placed with clean mercury with a view to use in the artificial horizon or the whole will be spoiled.

255. OCTANTS AND QUINTANTS.—Properly speaking, a sextant is an instrument whose arc covers one-sixth of a complete circle, and which is therefore capable of measuring an angle of 120°. Other instruments are made which are identical in principle with the sextant as heretofore described, and which differ from that instrument only in the length of the arc. These are the octanit, an eighth of a circle, by which angles may be measured to 90°, and the quintant, a fifth of a circle, which measures angles up to 144°. The distinction between these instruments is not always carefully made, and in such matters as have been touched upon in the foregoing articles the sextant may be regarded as the type of all kindred reflecting instruments.

THE ARTIFICIAL HORIZON.

256. The *Artificial Horizon* is a small, rectangular, shallow basin of mercury, over which, to protect the mercury from agitation by the wind, is placed a roof consisting of two plates of glass at right angles



to each other. The mercury affords a perfectly horizontal surface which is at the same time an excellent mirror. The different parts of an artificial horizon are furnished in a compact form, a metal bottle being provided for containing the mercury when not in use, together with a suitable funnel for pouring.

If MN, in figure 33, is the horizontal surface of the mercury; S'B a ray of light from a celestial object, incident to the surface at B; BA the reflected ray; then an observer at A will receive the ray BA as if it proceeded from a point S', whose angular depression, MBS', below the horizontal plane is equal to the altitude, MBS', of the object above that plane. If, then, SA is a direct ray from the object parallel to S'B, an observer at A can measure with the sextant the angle SAS''= S'BS''= 2 S'BM, by bringing the image of the object reflected by the index mirror into coincidence with the image S'' reflected by the mercury and seen through the horizon glass. The instrumental measure, corrected for index error, will be double the apparent altitude of the body.

The sun's altitude will be measured by bringing the lower limb of one image to touch the upper limb of the other. Half the corrected instrumental reading will be the apparent altitude of the sun's *lower* or *upper* limb, according as the lower or upper limb of the *reflected* image was the one employed in the observation.

In observations of the sun with the artificial horizon, the eye is protected by a single dark glass over the cycpiece of the telescope through which direct and reflected rays must pass alike, thereby avoiding the errors that might possibly arise from a difference in the separate shade glasses attached to the frame of the sextant.

The glasses in the roof over the mercury should be made of plate-glass, with perfectly parallel faces. If they are at all prismatic, the observed altitude will be erroneous. The error may be removed by observing a second altitude with the roof reversed, and, in general, by taking one half of a set of observations with the roof in one position and the other half with the roof reversed. On the rare occasions when the atmosphere is so calm that the unsheltered mercury will remain undisturbed, most satisfactory observations may be made by leaving off the roof.

257. In setting up an artificial horizon, are should be taken that the basin is free from dust and other foreign matter, as small particles floating upon the surface of the mercury interfere with a perfect reflection. The basin should be so placed that its longer edge lies in the direction in which the observed body will bear at the middle of the observations. The spot selected for taking the sights should be as free as possible from causes which will produce vibration of the mercury, and precautions should be sufficient to accomplish this. Embedding the roof in earth serves to keep out the wind, while setting the whole horizon upon a thick towel or a piece of such material as heavy felt usually affords ample protection from wind, tends to reduce the vibrations from mechanical shoeks, and also aids in keeping out the moisture from the ground. In damp climates the roof should be kept dry by wiping, or the moisture deposited from the inclosed air will form a cloud upon the glass.

Molasses, oil, or other viscous fluid may, when necessary, be employed as a substitute for mercury.

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 \Im . Owing to the perfection of manufacture that is required to insure accuracy of results with the artificial horizon, navigators are advised to accept only such instrument as has satisfactorily stood the necessary tests to prove the correctness of its adjustment as regards the glasses of the roof.

THE CHRONOMETER.

259. The *Chronometer* is simply a correct time-measurer, differing from an ordinary watch in having the force of its main-spring rendered uniform by means of a variable lever. Owing to the fact that on a sea voyage a chronometer is exposed to many changes of temperature, it is furnished with an expansion balance, formed of a combination of metals of different expansive qualities, which produces the required compensation. In order that its working may not be deranged by the motion of the ship in a seaway, the instrument is carried in gimbals.

As the regularity of the chronometer is essential for the correct determination of a ship's position, it is of the greatest importance that every precaution be taken to insure the accuracy of its indications. There is no more certain way of doing this than to provide a vessel with several of these instruments preferably not less than three—in order that if an irregularity develop in one, the fact may be revealed by the others.

260. CARE OF CHRONOMETERS ON SHIPBOARD.—The box in which the chronometers are kept should have a permanent place as near as practicable to the center of motion of the ship, and where it will be free from excessive shocks and jars, such as those that arise from the engines or from the firing of heavy guns; the location should be one free from sudden and extreme changes of temperature, and as far removed as possible from masses of vertical iron. The box should contain a separate compartment for each chronometer, and each compartment should be lined with baize cloth padded with curled hair, for the double purpose of reducing shocks and equalizing the temperature within. An outer cover of baize cloth should be provided for the box, and this should be changed or dried out frequently in damp weather. The chronometers should all be placed with the XH mark in the same position.

For transportation for short distances by hand, an instrument should be rigidly clamped in its gimbals, for if left free to swing, its performance may be deranged by the violent oscillations that are imparted to it.

For transportation for a considerable distance, as by express, the chronometer should be allowed to run down, and should then be dismounted and the balance corked.

261. Since it is not possible to make a perfect instrument which will be uninfluenced by the disturbing causes incident to a sea voyage, it becomes the duty of the navigator to determine the *error* and to keep watch upon the variable *rate* of the chronometer.

The error of the chronometer is the difference between the time indicated and the standard time to which it is referred—usually Greenwich mean time.

The amount the chronometer gains or loses daily is the daily rate.

The indications of a chronometer at any given instant require a correction for the accumulated error to that instant; and this can be found if the error at any given time, together with the daily rate, are known.

262. WINDING.—Chronometers are ordinarily constructed to run for 56 hours without rewinding, and an indicator on the face always shows how many hours have elapsed since the last winding. To insure a uniform rate, they must be wound regularly every day, and, in order to avoid the serious consequences of their running down, the navigator should take some means to guard against neglecting this hole and push it home, steadying the instrument with the hand, and wind to the left, the last half turn being made so as to bring up gently against the stop. After winding, cover the keyhole and return the instrument to its natural position. Chronometers should always be wound in the same order to prevent omissions, and the precaution taken to inspect the indicators, as a further assurance of the proper performance of the operation.

After winding each day, the comparisons should be made, and, with the readings of the maximumand-minimum thermometer and other necessary data, recorded in a book kept for the purpose.

The maximum and minimum thermometer is one so arranged that its highest and lowest readings are marked by small steel indices that remain in place until reset. Every chronometer box should be provided with such an instrument, as a knowledge of the temperature to which chronometers have been subjected is essential in any analysis of the rate. To draw down the indices for the purpose of resetting, a magnet is used. This magnet should be kept at all times at a distance from the chronometers.

263. COMPARISON OF CHRONOMETERS.—The instrument believed to be the best is regarded as the *Standard*, and each other is compared with it. It is usual to designate the Standard as A, and the others as B, C, etc. Chronometers are made to beat half-seconds, and any two may be compared by following the beat of one with the ear and of the other with the eye.

To make a comparison, say of A and B, open the boxes of these two instruments and close all others. Get the cadence and, commencing when A has just completed the beat of some even 5-second division of the dial, count "half-one-half-two-half-three-half-four-half-five," glancing at B in time to note the position of its second-hand at the last count; the seconds indicated by A will be five greater than the number at the beginning of the count. The hours and minutes are also recorded for each chronometer, and the subtraction made. A good check upon the accuracy is afforded by repeating the operation, taking the tick from B.

Where necessary for exact work, it is possible to estimate the fraction between beats, and thus make the comparison to tenths of a second; but the nearest half-second is sufficiently exact for the purposes of ordinary navigation at sea.

264. The following form represents a convenient method of recording comparisons: STAND, A, NO, 777. CHRO, B, NO, 1509. CHRO, C. NO, 1802.

Dute 1903	Designation of	esignation of Chro. B		Chro. C with 2d diff		Therm.		Bar	Romerice	
Date, 1000.	comparisons.	Stand. A.		Stand, A.		Max. Mi	in. Air.			
Jan'uary 1	Stand. A. B and C. Difference.	$ \begin{array}{r} h. m. s. \\ 1 13 40 \\ 1 12 21.5 \\ \hline 1 18,5 \\ \end{array} $	8.	$\begin{array}{cccccccccccccccccccccccccccccccccccc$	8.	° 63 5	9 60	" 30. 07	Found errors by time- ball.	
2	Stand. A. B and C. Difference.	$ \begin{array}{r} 1 & 16 & 30 \\ 1 & 15 & 10 \\ \end{array} $ 1 20	+1.5	$ \begin{array}{r} 1 17 00 \\ 2 06 51.5 \\ \hline 11 10 08.5 \end{array} $	-0.5	64 5	8 57	30. 12	Left New York for San Juan, P. R.	

265. The second difference in the form is the difference between the comparisons of the same instruments for two successive days. When a vessel is equipped with only one chronometer there is nothing to indicate any irregularity that it may develop at sea—and even the best instruments may undergo changes from no apparent cause. When there are two chronometers, the second difference, which is equal to the algebraic difference between their daily rates, remains uniform as long as the rates remain uniform, but changes if one of the rates undergoes a change; in such a case, there is no means of knowing which chronometer has departed from its expected performance, and the navigator must proceed with caution, giving due faith to the indications of each. If, however, there are three chronometers, an irregularity on the part of one is at once located by a comparison of the second difference of A - B, $+1^{*}.5$, and of A - C, $-0^{*}.5$, suppose on a certain day those differences were $+4^{*}.5$ and $-0^{*}.5$, suppose on a certain day those differences were $+4^{*}.5$ and $-2^{*}.5$; it would then be apparent that A had gained 3^{*} . **266.** TEMPERATURE CURVES.—Notwithstanding the care taken to eliminate the effect of a change of the rates that an absolutely perfect comparison is a second difference.

266. TEMPERATURE CURVES.—Notwithstanding the care taken to eliminate the effect of a change of temperature upon the rate of a chronometer, it is rare that an absolutely perfect compensation is attained, and it may therefore be assumed that the rates of all chronometers vary somewhat with the temperature. Where the voyage of a vessel is a long one and marked changes of climate are encountered, the accumulated error from the use of an incorrect rate may be very material, amounting to several minutes' difference of longitude. Careful navigators will therefore take every means to guard against such an error. By the employment of a *temperature curve* in connection with the chronometer rate the most satisfactory results are arrived at.

267. There should be furnished with each chronometer a statement showing its daily rate under various conditions of temperature; and this may be supplemented by the observations of the navigator during the time that the chronometer remains on board ship. With all available data a temperature curve should be constructed which will indicate graphically the performance of the instrument. It is most convenient to employ for this purpose a piece of "profile paper," on which parallel lines are ruled at equal intervals at right angles to each other. Let each horizontal line represent, say, a degree of temperature, numbered at the left edge, from the bottom up; draw a vertical line in red ink to represent the zero rate, and let all rates to the right be *plus*, or gaining, and those to the left *minus*, or losing; let the intervals between vertical lines represent intervals of rate (as one-tenth of a second) numbered at the top from the zero rate; then on this scale plot the rate corresponding to each temperature; when there are several observations covering one height of the intersection of this curve with each temperature ture line gives the mean rate at that temperature. The mean temperature given by the maximum and minimum thermometer shows the rate to be used on any day.

268. HACK OR COMPARING WATCH.—In order to avoid derangement, the chronometers should never be removed from the permanent box in which they are kept on shipboard. When it is desired to mark a certain instant of time, as for an astronomical observation or for obtaining the chronometer error by signal, the time is marked by a "hack" (an inferior chronometer used for this purpose only), or by a comparing watch. Careful comparisons are taken—preferably both before and afterwards—and the chronometer time at the required instant is thus deduced. The correction represented by the chronometer time minus the watch time (twelve hours being added to the former when necessary to make the subtraction possible) is referred to as C - W.

Suppose, for example, the chronometer and watch are compared and their indications are as follows:

Chro. t.,
$$5^{h} 27^{m} 30^{s}$$

W. T., $-2 \ 36 \ 45.5$
C - W, $2 \ 50 \ 44.5$

If then a sight is taken when the watch shows $3^{h} 01^{m} 27.^{s}5$, we have:

W. T., $3^{h} 01^{m} 27^{s}.5$ C-W, +2 50 44.5

Chro. t., 5 52 12.0

It may occur that the values of C - W, as obtained from comparisons before and after marking the desired time, will vary; in that case the value to be used will be the mean of the two, if the time marked is about midway between comparisons, but if much nearer to one comparison than the other, allowance should be made accordingly.

Thus suppose, in the case previously given, a second comparison had been taken after the sight as follows:

Chro. t.,
$$6^{n} 12^{m} 45^{s}$$

W. T., $-3 21 59.5$
C - W, $2 50 45.5$

The sight having been taken at about the middle of the interval, the C – W to be used would be the mean of the two, or $2^{h} 50^{m} 45^{s}$.0.

Let us assume, however, that the second comparison showed the following:

Chro. t., W. T.,	 $rac{6^{h}}{3}$	38 ^m 47	25^{s} 39
C - W.	$\overline{2}$	50	46

Then, the sight having been taken when only about one-third of the interval had elapsed between the first and second comparisons, it would be assumed that only one-third of the total change in the C - W had occurred up to the time of sight, and the value to be used would be $2^{h} 50^{m} 45^{s} .0$.

269. It is considered a good practice always to subtract watch the from chronometer time whatever the relative values, and thus to employ C - W invariably as an additive correction. It is equally correct to take the other difference, W - C, and make it subtractive; it may sometimes occur that a few figures will thus be saved, but a chance for error arises from the possibility of inadvertently using the wrong sign, which is almost impossible by the other method. Thus, the following example may be taken:

Comparison -	$\begin{cases} C, \\ W, & - \end{cases}$	10 ^h -11	57 ^m 42	$\frac{38^{s}}{35}$	W, C,	$-10^{11^{h}}$	42 ^m 57	$\frac{35^{s}}{38}$
1	C-W,	11	15	03	W = 0	C, 0	44	57
Sight	$\begin{cases} W, \\ C-W, + \end{cases}$	11 -11	$\begin{array}{c} 50 \\ 15 \end{array}$	$\begin{array}{c} 21 \\ 03 \end{array}$	₩, ₩_C	$,-{}^{11}_{0}$	$\begin{array}{c} 50 \\ 44 \end{array}$	$\frac{21}{57}$
0	lc,	11	05	24	С,	11	05	24

CHAPTER IX.

TIME AND THE NAUTICAL ALMANAC.

270. The subjects of *Time* and the *Nautical Almanac* are two of the most important ones to be mastered in the study of Nautical Astronomy, as they enter into every operation for the astronomical determination of a ship's position. They will be treated in conjunction, as the two are interdependent.

METHODS OF RECKONING TIME.

271. The instant at which any point of the celestial sphere is on the meridian of an observer is termed the *transit, culmination,* or *meridian passage* of that point; when on that half of the meridian which contains the zenith, it is designated as *superior* or *upper* transit; when on the half containing the nadir, as *inferior* or *lower* transit. **272.** Three different kinds of time are employed in astronomy—(a) apparent or solar time, (b) mean

272. Three different kinds of time are employed in astronomy—(a) apparent or solar time, (b) mean time, and (c) sidered time. These depend upon the hour angle from the meridian of the points to which they respectively refer. The point of reference for apparent or solar time is the *Center of the Sun;* for mean time, an imaginary point called the *Mean Sun;* and for sidereal time, the *Vernal Equinox,* also called the *First Point of Aries.*

The unit of time is the *Day*, which is the period between two successive transits over the same branch of the meridian of the point of reference. The day is divided into 24 equal parts, called *Hours*; these into 60 equal parts, called *Minutes*, and these into 60 equal parts, called *Seconds*. **273.** APPARENT OR SOLAR TIME.—The hour angle of the center of the sun affords a measure of

273. APPARENT OR SOLAR TIME.—The hour angle of the center of the sun affords a measure of Apparent or Solar Time. An Apparent or Solar Day is the interval of time between two successive transits over the same meridian of the center of the sun. It is Apparent Noon when the sun's hour circle coincides with the celestial meridian. This is the most natural and direct measure of time, and the unit of time adopted by the navigator at sea is the apparent solar day. Apparent noon is the time when the latitude can be most readily determined, and the ordinary method of determining the longitude by the sun involves a calculation to deduce the apparent time first.

Since, however, the intervals between the successive returns of the sun to the same meridian are not equal, apparent time can not be taken as a standard. The apparent day varies in length from two causes: first, the sun does not move in the equator, the great circle perpendicular to the axis of rotation of the earth, but in the ecliptic; and, secondly, the sun's motion in the ecliptic is not uniform. Sometimes the sun describes an are of 57' of the ecliptic, and sometimes an are of 61' in a day. At the points where the ecliptic and equinoctial intersect, the direction of the sun's apparent motion is inclined at an angle of 23° 27' to the equator, while at the solstices it moves in a direction parallel to the equator. **274.** MEAN TIME.—To avoid the irregularity of time caused by the want of uniformity in the sun's

274. MEAN TIME.—To avoid the irregularity of time caused by the want of uniformity in the sun's motion, a fictitious sun, called the *Mean Sun*, is supposed to move in the *equinoctial* with a uniform velocity that equals the *mean velocity of the true sun in the ecliptic*. This mean sun is regarded as being in coincidence with the true sun at the vernal equinox, or First Point of Aries. *Mean Time* is the hour angle of the mean sun. A *Mean Day* is the interval between two successive

Mean Time is the hour angle of the mean sun. A Mean Day is the interval between two successive transits of the mean sun over the meridian. Mean Noon is the instant when the mean sun's hour circle coincides with the meridian.

Mean time lapses uniformly; at certain times it agrees with apparent time, while sometimes it is behind, and at other times in advance of it. It is this time that is measured by the clocks in ordinary use, and to this the chronometers used by navigators are regulated.

275. The difference between apparent and mean time is called the Equation of Time; by this quantity, the conversion from one to the other of these times may be made. Its magnitude and the direction of its application may be found for any moment from the Nautical Almanac. 276. SIDEREAL TIME.—Sidereal Time is the hour angle of the First Point of Aries. This point,

276. SIDEREAL TIME.—Sidereal Time is the hour angle of the First Point of Aries. This point, which is identical with the vernal equinox, is the origin of all coordinates of right ascension. Since the position of the point is fixed in the celestial sphere and does not, like the sun, moon, and planets, have actual or apparent motion therein, it shares in this respect the properties of the fixed stars. It may therefore be said that intervals of sidereal time are those which are measured by the stars.

A Sidereal Day is the interval between two successive transits of the First Point of Aries across the same meridian. Sidereal Noon is the instant at which the hour circle of the First Point of Aries coincides with the meridian. In order to interconvert sidereal and mean times an element is tabulated in the Nautical Almanac. This is the Sidereal Time of Mean Noon, which is also the Right Ascension of the Mean Sun.

277. CIVIL AND ASTRONOMICAL TIME.—The *Ciril Day* commences at midnight and comprises the twenty-four hours until the following midnight. The hours are counted from 0 to 12, from midnight to noon; then, again, from 0 to 12, from noon to midnight. Thus the civil day is divided into two periods of twelve hours each, the first of which is marked a. m. (ante meridian), while the last is marked p. m. (post meridian).

The Astronomical or Solar Day commences at noon of the civil day of the same date. It comprises twenty-four hours, reckoned from 0 to 24, from noon of one day to noon of the next. Astronomical time (apparent or mean) is the hour angle of the sun (true or mean) measured to the westward throughout its entire circuit from the time of its upper transit on one day to the same instant of the next.

The civil day, therefore, begins twelve hours before the astronomical day, and a clear under-standing of this fact is all that is required for interconverting these times. For example:

January 9, 2 a. m., civil time, is January 9, 2^h, astronomical time. January 9, 2 p. m., civil time, is January 9, 2^h, astronomical time. **278.** HOUR ANGLE.—The *hour angle* of a heavenly body is the angle at the pole of the celestial concave between the declination circle of the heavenly body and the celestial meridian. It is measured by the arc of the celestial equator between the decli-

nation circle and the celestial meridian.

In figure 34 let P be the pole of the celestial sphere, of which VMQ is the equator, PQ, the celestial meridian, and PM, PS, PV, the declination circles of the mean sun, a heavenly body, and the First Point of Aries, respectively. Then QPM, or its arc, QM, is the hour angle of the mean sun, or the mean sun, a heavenly body is the hour angle of the mean sun, or the mean sun of the mean sun or the

time; QPS, or QS, the hour angle of the heavenly body; QPV, or QV, the hour angle of the First Point of Aries, or the right ascension of the meridian, both of which are equivalent to the sidereal time; VPS, or VS, the right ascension of the heavenly body; and VPM, or VM, the right ascension of the mean sun.

279. TIME AT DIFFERENT MERIDIANS.—The hour angle of the true sun at any meridian is called the local apparent time; that of the mean sun, the local mean time; that of the First Point of Aries, the local sidereal time. The hour angles of the same body and points from Greenwich are respectively the Greenwich apparent, mean, and sidereal times. The difference between the local time at any meridian and the Greenwich time is equal to the longitude of that place from Greenwich expressed in time; the conversion from time to are may be effected by a simple mathematical calculation or by the use of Table 7.

In comparing corresponding times of different meridians the most easterly meridian may be distinguished as that at which the time is greatest or latest.

In figure 35 PM and PM' represent the celestial meridians of two places; the declination circle through the sun, and PG, the Greenwich meridian; let T_{G} = the Greenwich time = GPS;

 \bar{T}_{y} = the corresponding local time at all places on the meridian PM = MPS; $T_{M'}$ = the corresponding local time at all places on the meridian PM' = M'PS:

 $L_0 = west \ longitude \ of \ meridian \ PM = GPM; \ and$

Lo' = east longitude of meridian PM' = GPM'.

If west longitudes and hour angles be reckoned as positive, and east longitudes and hour angles as negative, we have:

 $\begin{array}{c} L \sigma \!=\! T_{6} - T_{M}; \text{ and } \\ L \sigma' \!=\! T_{G} - T_{M'}; \text{ therefore, } \\ L \sigma \! - L \sigma' \!=\! T_{M'} \! - T_{M}. \end{array}$

Thus it may be seen that the difference of longitude between two places equals the difference of their local times. This relation may be shown to hold for any two meridians whatsoever.

Both local and Greenwich times in the above formulæ must be reckoned westward, always from their respective meridians and from 0^{h} to 24^{h} ; in other words, it is the astronomical time which should be used in all astronomical computations.

The formula $L_0 = T_G - T_{\pi}$ is true for any kind of time, solar or sidereal; or, in general terms, T_{G} and T_{M} are the hour angles of any point of the sphere at the two meridians whose difference of longitude is Lo. S may be the sun (true or mean) or the vernal equinox.

280. FINDING THE GREENWICH TIME.—Since nearly every computation made by the navigator requires a knowledge of the Greenwich date and time as a preliminary to the use of the Nautical Almanac, the first operation necessary is to deduce from the local time the corresponding Greenwich date, either exact or approximate, and thence the Greenwich time expressed astronomically. The formula is:

$$T_{G} = T_{M} + Lo$$
,

remembering that west longitudes are positive, east longitudes are negative. Hence the following rule for converting local to Greenwich time:

Having expressed the local time astronomically, add the longitude if *west*, subtract it if east; the result is the corresponding Greenwich time.

EXAMPLE: In longitude 81° 15′ W. the local time is, 1879, April, 15^d 10^h 17^m 30^s a. m. Required the Greenwich time.

Local Ast. time, April,	14ª	22 ^h	17 ^m	$\frac{30^{\circ}}{00}$
Longitude,	+	5	25	
Greenwich time,	15	3	42	30

EXAMPLE: In longitude 81° 15' E. the local time is, August, 5^d 2^h 10^m 30^s p. m. Required the Greenwich time.

Local Ast. time, Longitude,	5ª	$2^{ m h}$ 5	10ա 25	$\frac{30^{8}}{00}$
Greenwich time,	4	20	45	30



M

FIG 34

EXAMPLE: In longitude 17° 28' W. the local time is, May, 1^d 3^h 10^m p. m. Required the Greenwich time.

Local Ast. time, Longitude,	$^{1^{d}}+$	1 3 ^h	10¤ 09	$ \begin{array}{c} 00^{s} \\ 52 \end{array} $
Greenwich time,	1	4	19	52

EXAMPLE: In longitude 125° 30' E. the local time is, May, 1^d 8^h 10^m 30^s a. m. Required the Greenwich time.

Local Ast. time, April,	30 ^d	20 ^h	10 ^m	30ª
Longitude,		8	22	00
Greenwich time	30	11	48	30

281. From the preceding article we have:

$$\begin{array}{l} T_G = T_M + Lo; \text{ hence,} \\ T_M = T_G - Lo; \end{array}$$

thus it will be seen that, to find the local time corresponding to any Greenwich time, the above process is simply reversed.

Since all observations at sea are referred to chronometers regulated to Greenwich mean time, and as these instruments are usually marked on the dial from 0^{h} to 12^{h} , it becomes necessary to distinguish whether it is a.m. or p.m. at Greenwich. Therefore, an approximate knowledge of the longitude and local time is necessary to determine the Greenwich date.

EXAMPLE: In longitude 5^{b} 00^m 00^s W., about 3^{h} 30^m p.m. April 15th, the Greenwich chronometer read $8^{\text{h}} 25^{\text{m}}$, and was fast of Gr. time $3^{\text{m}} 15^{\text{s}}$. Required the local astronomical time.

Aprox. local time, $15^{d} 3^{h} 30^{m}$	Gr. chro., $8^{h} 25^{m} 00^{s}$	Gr. Ast. time 15^d , $8^h 21^m 45$
Longitude, $+ 5 00$	Corr., $-3 15$	Longitude, $-5 00 00$
Approx. Gr. time, 15 8 30	Gr. Ast. time 15 ^d , 8 21 45	Local Ast. time 15 ^d , 3 21 45

EXAMPLE: In longitude $5^{h} 00^{m} 00^{s}$ E., about 8 a. m. May 3d, the Gr. chro. read $3^{h} 15^{m} 20^{s}$, and was fast of Gr. time $3^{m} 15^{s}$. Required the local astronomical time.

Approx. local time, May, Longitude,	$2^{d} 20^{h} - 5$	Gr. chro., Corr.,	${3^{ m h}}15^{ m m}20^{ m s}\315$	Gr. Ast. time 2^d , Longitude, $+$	$^{15^{h}}_{-5}$	$\frac{12^{m}}{00}$	$\begin{array}{c} 05 \\ 00 \end{array}$
Approx. Gr. time,	2 15	Gr. Ast. time 2ª,	15 12 05	Local Ast. time 2 ^d ,	20	12	05

THE NAUTICAL ALMANAC. a

282. The American Ephemeris and Nautical Almanac is divided into four parts, as follows: Part I, Ephemeris for the meridian of Greenwich, gives the ephemerides of the sun and moon, the geocentric and heliocentric positions of the major planets, the sun's coordinates, and other fundamental astronomical data for equidistant intervals of Greenwich mean time; Part II, Ephemeris for the meridian of Washington, gives the ephemerides of the fixed stars, sun, moon, and major planets for transit over the meridian of Washington; Part III, Phenomena, contains predictions of phenomena to be observed, with data for their computation; and Part IV, Star Numbers and other data, contains matter relating to certain fixed stars. Tables are also appended for the interconversion of mean and sidereal time and for finding the latitude by an altitude of Polaris.

The American Nautical Almanac is a smaller book made up of extracts from the "Ephemeris and Almanac" just described, and is designed especially for the use of navigators, being adapted to the meridian of Greenwich. It contains the positions of the sun and moon, the distances of the moon from the center of the sun, from the centers of the four most conspicuous planets, and from certain fixed stars, together with the ephemerides of the planets Mercury, Venus, Mars, Jupiter, and Saturn, and the mean places of 150 fixed stars; solar and lunar eclipses are described, and the tables for the interconversion of mean and sidereal time and for finding the latitude by Polaris are included.

The elements dependent upon the sun and moon are placed at the beginning of the book, arranged according to the months of the year; eighteen pages are devoted to each month, numbered in Roman notation from I to XVIII. Of these, page I contains the Apparent Right Ascension and Declination of the sun and the Equation of Time for the instant of Greenwich apparent noon; throughout the remaining seventeen pages Greenwich mean time forms the basis of reckoning. Page I is used in computations from observations that depend upon the time of the sun's meridian passage, at which instant the local apparent time is 0^h, and the Greenwich apparent time is equal to the longitude, if west, or to 24^h minus the longitude, if east; this page therefore affords a means for reducing the elements for such observations from a knowledge of the longitude alone. In all other observations the calculation is made for some definite instant of Greenwich mean time (usually as noted by the chronometer), in which case Pages II to XVIII are employed. **283.** REDUCTION OF ELEMENTS.—The reduction of elements in the Nautical Almanac is usually

283. REDUCTION OF ELEMENTS.—The reduction of elements in the Nautical Almanac is usually accomplished by *Interpolation*, but in certain cases where extreme precision is necessary the method of *Second Differences* must be used.

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The Ephemeris, being computed for the Greenwich meridian, contains the right ascensions, declinations, equations of time, and other elements for given equidistant intervals of Greenwich time. Hence, before the value of any of these quantities can be found for a given local time it is necessary to determine the corresponding Greenwich time. Should that time be one for which the Nautical Almanac gives the value of the required element, nothing more is necessary that to employ that value. But if the time falls between the Almanac times, the required quantity must be found by interpolation. The Almanac contains the rate of change or difference of each of the principal quantities for some

The Almanac contains the rate of change or difference of each of the principal quantities for some unit of time, and, unless great precision is required, the first differences only need be regarded. In order to use the difference columns to advantage, the Greenwich date should be expressed in the unit of time for which the difference is given. Thus, for using the hourly differences, the Greenwich time should be expressed in hours and decimal parts of an hour; when using the differences for one minute, the time should be in minutes and decimal parts of a minute. Instead of using decimal parts, some may prefer the use of aliguot parts.

Since the quantities in the Almanac are approximate numbers, given to a certain decimal, any interpolation of a lower order than that decimal is unnecessary work. Moreover, since, in computations at sea, the Greenwich time is more or less inexact, too great refinement need not be sought in reducing the Almanac elements.

Simple interpolation assumes that the differences of the quantities are proportional to the differences of the times; in other words, that the differences given in the Almanac are constant; this is seldom the case, but the error arising from the assumption will be smaller the less the interval between the times in the Almanac. Hence those quantities which vary most irregularly are given for the smallest units of time; as the variations are more regular, the units for which the differences are given increase.

In taking from the Almanac the elements relating to the fixed stars the data may be found either in the table which gives the "mean place" of each star for the year or in that which gives the "apparent place" occupied by each one on every tenth day throughout the year. As the annual variation of position of the fixed stars is small, the results will not vary greatly whichever table may be used. Yet, as it is proper to seek always the greatest attainable accuracy, the use of the table showing the exact positions is recommended. That table is, however, published in the "Ephemeris and Nautical Almanac" only, and is omitted from the abridged "Nautical Almanac;" hence, where the larger book is not at hand, the table of mean places must be employed.

284. To find from the Nautical Almanac a required element for any given time and place, it is first necessary to express the time astronomically and to convert it to Greenwich time and date. Then take from the Almanac, for the nearest given *preceding* instant, the required quantity, together with its corresponding "Diff. for 1^h" or "Diff. for 1^m," noting the name or sign in each case; for the sun use Page I of the proper month in the Almanac when *apparent* time is to be the basis for correction, but otherwise use Page II. Multiply the "Diff. for 1^h" by the number of minutes and fraction of an hour, or the "Diff. for 1^m" by the number of minutes and fraction of a minute, corresponding to the interval between the time for which the quantity is given in the Almanac and the time for which required; apply the correction thus obtained, having regard to its sign.

A modification of this rule may be adopted if the time for which the quantity is desired falls considerably nearer a *subsequent* time given in the Almanac than it does to one preceding; in this case the interpolation may be made backward, the sign of application of the correction being reversed.

interpolation may be made backward, the sign of application of the correction being reversed. EXAMPLE: At a place in longitude 81° 15′ W., April 17, 1879, find the sun's declination and the equation of time at apparent noon.

Long. =81° 15′ W. G. A. $T_{*} = 17^{d} 5^{h} 25^{m} = 17^{d} + 5^{h} .42$.

$\begin{array}{llllllllllllllllllllllllllllllllllll$	10° 26′ 42″.3 N. 4 46 .2	Eq. t., 17^{d} 0 ^h , $0^{m} 24^{s} . 46$ Corr., $+$ 3.18
Dec., 17 ^d 5 ^h 25 ^m ,	10 31 28 .5 N.	Eq. t., 17 ^d 5 ^h 25 ^m , 0 27.64
H. D., + G. A. T., +	52".80 5 ^h .42	$\begin{array}{ccccc} \text{H. D.,} & & + & 0^{\text{s}.587} \\ \text{G. A. T.,} & & + & 5^{\text{h}.42} \end{array}$
Corr., ' +	$\overline{\left\{\begin{array}{c} 286''.18\\ 4'46''.18\end{array}\right.}$	$\begin{array}{c} \text{Corr.,} & + & \overline{3^{*}.182} \\ (Subtract \text{ from } apparent \text{ time.}) \end{array}$

EXAMPLE: At a place in Long. 81° 15' E., April 17, 1879, find the sun's declination and the equation of time at apparent noon.

Long. =81° 15′ E. G. A. T. = $16^d 18^h 35^m = 17^d - 5^h.42$.

Dec., 17 ^d 0 ^h , Corr.,	(+)	10° 26′ 42″.3 N. 4 46 .2	Eq. t., 17 ^d 0 ^h , Corr.,	0 ^m	$24^{ m s}.46\ 3\ .18$
Dec., 16 ^d 18 ^h 35 ^m ,		10 21 56 .1 N.	Eq. t., 16 ^d 18 ^h 35 ^m ,	0	21.28
H. D., G. A. T.,	+	52″.80 5 ^h .42	H. D., G. A. T.,	+	0 ^s .587 5 ^h .42
Cor.,		{ 286".18 {4' 46".18	Corr.,		3*.182

EXAMPLE: April 16, 1879, at $11^{h} 55^{m} 30^{s}$ a. m., local mean time, in Long. $81^{\circ} 15'$ W., required the declination and semidiameter of the sun, the equation of time, and the right ascension, declination, horizontal parallax, and semidiameter of the moon and Jupiter.

and only many one

. . . .

	Loca	gitude,	$+ \frac{10^{\rm u}}{5^{\rm h}} \frac{23^{\rm u}}{25^{\rm m}} \frac{30^{\rm u}}{00}$)s)			
	Gree	enwich mean tim	e, $\begin{cases} 16^{d} & 5^{h} & 20^{m} & 30\\ 16^{d} & 5^{h} & 20^{m} & 5\\ 16^{d} & 5^{h} & 34 \end{cases}$,)я			
		For the	Sun.				
$\dot{\text{Dec., 0}}^{\text{h}}, (+) 10$ Corr., +	0° 05′ 30″. 1 N. 4 44 . 3	S. D., (Same as	15′ 58″. 0 at G. A. Noon.)	1	Eq. t., C Corr.,) ^h , 0 ^m +	${10^{ m s}}.15\ 3.22$
Dec., 10) 10 14 . 4 N.	-			Eq. t.,	0	13.37
H. D., + G. M. T., +	53''. 24 5^{h} . 34				Н. D., G. M. Т	+	
Corr., $+{$	284". 30 4' 44". 30				Corr., (Add)	+ to mean ti	3 ^s . 22 me.)
		For the 1	Moon.				
$\begin{array}{cccccccccccccccccccccccccccccccccccc$	8.29 Dec., 5 ^h , 8.31 Corr.,	(-) 7°59′ 36″.1 S. + 4 27 .1	Hor. Par., 0 ^h , Corr.,		' 13".6 7.2	S. D., 0 ^h , · Corr.,	- 1.8
R. A., 22 15 17	.60 Dec.,	7 55 09 .0 S.	Hor. Par.,	55	06.4	S. D.,	15 02 .9
1. D., $+$ 1 ^s to. min., $+$ 20	.869 M. D., 0 ^m .5 No. min.,	+ 13".03 + 20 ^m .5	Н. D., G. M. T.,	- +	1."34 5 ^h .34	н. D., G. М. Т.,	- 0".34 + 5 ^h .34
corr., + 38		+ $\left\{ \begin{array}{c} 267''.12 \\ 4' 27''.1 \end{array} \right.$	Corr.,		7".15	Corr.,	- 1".81
•		For Ju	piter.				
$\begin{array}{c} \text{R. A., 0^h,} \\ \text{Corr.,} \end{array} + 22^h \\ \end{array}$	$26^{ m m} \ 35^{ m s}. \ 54 \ 9 \ . \ 71$	$\begin{array}{llllllllllllllllllllllllllllllllllll$	10° 40′ 28″. 0 S. 53 . 6		Hor. Pa	ır., 16ª,	1". 6
R. A., 22	$26 45 \; . \; 25$	Dec.,	10 39 34 . 4 S.				
H. D., + G. M. T., +	$1^{\rm s}$. 819 $5^{\rm h}$. 34	H. D., + G. M. T., +	$10^{\prime\prime}.03$ $5^{h}.34$		S. D., 1	6 ^d ,	16″.9
Corr., +	9 ^s . 71	Corr., +	53". 6				

285. Should greater precision be required than that attainable by simple interpolation, resort must be had to the reduction for second differences.

The differences between successive values of the quantities given in the Nautical Almanac are called the *first differences*; the differences between successive first differences are called the *second differences*. Simple interpolation, which satisfies the necessities of sea computations, assumes the first differences to be constant; but if the variation of the first differences be regarded, a further interpolation is required for the second difference.

The difference for a unit of time in the American Nautical Almanac abreast any element expresses the rate at which the element is changing at that precise instant of Greenwich time. Now, regarding the second difference as constant, the first difference varies uniformly with the Greenwich time; therefore its value may be found for any intermediate time by simple interpolation.

Hence the following rule for second differences: Employ the interpolated value of the first difference which corresponds to the *middle* of the interval for which the correction is to be computed. EXAMPLE: For the Greenwich date 1879, April, 10^4 18^h 25^m 30^s, find the moon's declination.

 $\begin{array}{c} \text{Dec., } 18^{\text{h}}, (-) 26^{\circ} 19' 41''.1 \text{ S.} \\ \text{Corr., } + 2.1 \\ \text{Dec., } 26 19 39.0 \text{ S.} \\ \end{array} \begin{array}{c} \text{First diff., } + 0''.044 \\ \text{Corr., } + 0.039 \\ \text{No. min., } + 25^{\text{m}.5} \\ \text{Corr., } + 2''.12 \end{array} \begin{array}{c} \text{Second diff., } + 0''.181 \\ \text{Interval, } + 0^{\text{h}}.213 \\ \text{Corr., } + 0.083 \\ \text{Corr., } + 2''.12 \end{array}$

The difference for one minute being $+0^{\prime\prime}.044$ at 18^h, and $+0^{\prime\prime}.225$ at 19^h, the difference for one minute undergoes a change of $+0^{\prime\prime}.181$ during one hour. The time for which it is desired to obtain the difference is at the middle instant between 18^h 0^m and 18^h 25^m.5—that is, at 18^h 12^m.75, or its equivalent, 18^h 213. With a change of $+0^{\prime\prime}.181$ in one hour, the change in 0^h.213 is readily obtainable; correcting the minute's difference at 18^h.0 accordingly, the process of correcting the declination becomes the same as in simple interpolation.

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CONVERSION OF TIMES.

286. Conversion of Time is the process by which any instant of time that is defined according to one system of reckoning may be defined according to some other system; and also by which any interval of time expressed in units of one system may be converted into units of another.

287. SIDEREAL AND MEAN TIMES .- Mean time is the hour angle of the V Mean Sun; sidereal time is the hour angle of the First Point of Aries. Since the Right Ascension of the Mean Sun is the angular distance between the hour circles of the Mean Sun and of the First Point of Aries, mean time may be converted into sidereal time by adding to it the Right Ascension of the Mean Sun: and similarly, sidereal time may be converted into mean time by subtracting from it the Right Ascension of the Mean Sun.

This is explained in figure 36, which represents a projection of the celestial sphere upon the equator. If P be the pole; QPQ', the meridian; V, the First Point of Aries; M, the position of the mean sun (west of the meridian); then QPV, or the arc QV, is the sidereal time; QPM, or the arc QM, is the mean time; and VPM, or the arc VM, is the Right Ascension of the Mean Sun. From this it will appear that:

OV = OM + VM, or

Sidereal time=Mean time+Right Ascension of Mean Sun.

If the mean sun be on the opposite side of the meridian, at M', then the mean time equals 24^h-M'O. In this case:

QV = VM' - M'Q, or Sidereal time=Right Ascension of Mean Sun-(24h-Mean time), =Right Ascension of Mean Sun+Mean time-24^h.

Right ascension being measured to the east and hour angle to the west, the sidereal time will therefore always equal the sum of these two; but $24^{\rm h}$ must be subtracted when the sum exceeds that amount.

From the preceding equations, we also have:

$$QM = QV - VM;$$
 and
 $M'Q = VM' - QV,$ or
 $(24^{h} - M'Q) = (24^{h} + QV) - VM'.$

From this it may be seen that the mean time equals the sidereal time *minus* the Right Ascension of the Mean Sun, but the former must be increased by 24^h when necessary to make the subtraction possible.

288. APPARENT AND MEAN TIMES.—Apparent time is the angle between the meridian and the hour circle which contains the center of the sun; mean time is the angle between the meridian and the hour circle which contains the mean sun. Since the equation of time represents the angle between the hour circles of the mean and apparent suns, it is clear that the conversion of mean time to apparent time may be accomplished by the application of the equation of time, with its proper sign, to the mean time; and the reverse operation by the application of the same quantity, in an opposite direction, to the apparent time.

The resemblance of these operations to the interconversion of mean and sidereal times may be observed if, in figure 36, we assume that PV is the hour circle of the true sun, PM remaining that of the mean sun; then the arc QM will be the mean time; QV, the apparent time; and VM, the equation of time; whence we have as before:

$$QV = QM + VM$$
, or

Apparent time = Mean time + Equation of time;

the equation of time will be positive or negative according to the relative position of the two suns.

289. SIDEREAL AND MEAN TWE INTERVALS.—The sidereal year consists of 366,25636 sidereal days or of 365.25636 mean solar days. If, therefore, M be any interval of mean time, and S the corresponding interval of sidereal time, the relations between the two may be expressed as follows:

$$\frac{8}{M} = \frac{366.29636}{365.25636} = 1.0027379;$$

$$\frac{M}{8} = \frac{365.25636}{366.25636} = 0.9972696.$$

Therefore, $8 = 1.0027379$ M = M + .0027379 M;
M = 0.9972696 8 = 8 - .0027304 8.

If $M = 24^{h}$, $S = 24^{h} + 3^{m} 56^{s}.6$; or, in a mean solar day, sidereal time gains on mean time $3^{m} 56^{s}.6$, the gain each hour being 9'.8565. If $S = 24^{h}$, $M = 24^{h} - 3^{m} 55^{s}$.9; or, in a sidereal day, mean time losses on sidereal time $3^{m} 55^{s}$.9, the

loss each hour being 9^s.8296.

If M and S be expressed in hours and fractional parts thereof,

$$S = M + 9^{\circ}.8565 M;$$

$$M = S - 9^{s}.8296 S.$$

Tables for the conversion of the intervals of mean into those of sidereal time and the reverse are based upon these relations. Tables 8 and 9 of this work give the values for making these conversions, and similar tables are to b- found in the Nautical Almanac.



290. TO CONVERT MEAN SOLAR INTO SIDEREAL TIME.—Apply to the local mean time the longitude, adding if west and subtracting if east, and thus obtain the Green wich mean time. Take from the Nautical Almanac the Right Ascension of the Mean Sun at Greenwich mean noon, and correct it for the Greenwich mean time by Table 9 or by the hourly difference of 9^s.857. Add to the local mean time this corrected right ascension, rejecting 24^{h} if the sum is greater than that amount. The result will be the local sidereal time.

EXAMPLE: April 22, 1879, in Long. 81° 15' W., the local mean time is 2^h 00^m 00^s p. m. Required the corresponding local sidercal time:

L. M. T., Long., +	22^{d}	$\frac{2^{\mathrm{h}}}{5}$	$\frac{00^{m}}{25}$	00* 00	R. A. M. S., $22^4 0^{h}$, Red. for $7^{h} 25^{m}$ (Tab.	9), + 2	^h 00	m 41 $^{s}.24$ 13.10	L. M. T., R. A. M. S., +	$rac{2^{ m h}}{2}$	00 ^m 01	$\begin{array}{c} 00^{\rm s} \\ 54.34 \end{array}$
G. M. T.,	22	7	25	00	R. A. M. S., 7 ^h 25 ^m ,	2	2 01	54.34	L. S. T.,	+	01	54.34

EXAMPLE: April 22, 1879, in Long. 75° E., the local mean time is 4^h 00^m 00^s a. m. Required the local sidereal time.

L. M. T., 21^d 16^h 00^m 00^s	R. A M. S. 21 ^d 0 ^h ,	${1^{ m h}}{56^{ m m}}{44^{ m s}}.69 \\ 1 \ \ 48 \ .42$	L. M. T., 21^d 16^h 00^m 00^s
Long., $-$ 5 00 00	Red. for 11 ^h (Tab. 9), +		R. A. M. S., + 1 58 33.11
G. M. T., 21 11 00 00	R. A. M. S., 11 ^h ,	1 58 33.11	L. S. T., 21 17 58 33.11

In these examples the reduction of the R. A. M. S. has formed a separate operation in order to make clear the process. It would be as accurate to add together directly L. M. T., R. A. M. S., and Red., and the work would thus be rendered more brief.

291. TO CONVERT SIDEREAL INTO MEAN SOLAR TIME.-Take from the Nautical Almanac the Right Ascension of the Mean Sun for Greenwich mean noon of the given astronomical day, and apply to it the reduction for longitude, either by Table 9 or by the hourly difference of 9^s.857, and the result will be the Right Ascension of the Mean Sun at local mean noon, which is equivalent to the local sidereal time at that instant. Subtract this from the given local sidereal time (adding 24^h to the latter if necessary), and the result will be the interval from local mean noon, expressed in units of sidercal Convert this sidereal time interval into a mean time interval by subtracting the reduction as time. given by Table 8 or by the hourly difference of 9^{*} .830; the result will be the local mean time. EXAMPLE: April 22, 1879, a. m., in Long. 75° E., the local sidereal time is 17^{h} 58^m 33^s.11.

What is the local mean time?

Astronomical day, April 21.

L. S. T.,	$17^{ m h} 58^{ m m} 33^{ m s}.11$	R. A. M. S., Gr. 21 ^d 0 ^h ,	1 ^h 56 ⁿ	$44^{\circ}.69$
R. A. M. S., –	- 1 55 55 .41	Red. for -5 ^h long. (Tab. 9), -		49.28
Sid. interval from L. M. noon, Red. for sid. interval (Tab. 8),	$\begin{array}{cccccccccccccccccccccccccccccccccccc$	R. A. M. S., local 0 ^h ,	1 55	55.41

EXAMPLE: April 22, 1879, p. m., at a place in Long. 81° 15' W., the sidereal time is 4^h 01^m 54^s.34. What is the corresponding mean time?

Astronomical day, April 22.

L. S. T., $4^{h} 01$ R. A. M. S., $-2 01$	^m 54⁵.34 34 .63	R. A. M. S , Gr. $22^{d} 0^{h}$, Red. for $+5^{h} 25^{m}$ long. (Tab. 9), -	$^{2^{h}}$	00m 0	$41^{\circ}.24$ 53.39
Sid. interval from L. M. Noon, $2 00$ Red. for sid. interval (Tab. 8), $- 0$	$19.71 \\ 19.71$	R. A. M. S., local 0 ^h ,	2	01	34.63
L. M. T., 22^{4} , 200	00.00				

292. TO COVERT MEAN INTO APPARENT TIME AND THE REVERSE.-Find the Greenwich time corresponding to the given local time. If apparent time is given, find the Greenwich apparent time and take the equation of time from Page I of the Almanac. If mean time, find the Greenwich mean time and take the equation of time from Page II. Correct the equation of time for the required instant and apply it with its proper sign to the given time.

EXAMPLE: April 21, 1879, in Long. 81° 15' W., find the local apparent time corresponding to a local mean time of 3^{h} 05^m 00^s p. m.

L. M. T., $21^{d} 3^{h} 05^{m} 00^{s}$ Long., $+$ 5 25 00	L. M. T., $21^{d} 3^{h} 05^{m} 00^{s}$ Eq. t., $+$ 1 22.01	Eq. t., 0^{h} , Corr., +	1 ^m 17.61 4.40
G. M. T., 21 8 30 00	L. A. T., 21 3 06 22.01	Eq. t.,	1 22.01
		H. D., + G.M.T.,+	$0^{s}.518$ $8^{h}.5$
		Corr., +	4s.403

(Add to mean time.)

EXAMPLE: April 3, 1879, in Long, 81° 15′ E., the local apparent time is 8^h 45^m 00^s a. m. Required the mean time.

L. A. T., Long., –	$2^{ m d} \ 20^{ m h} \ 45^{ m m} \ 00^{ m s} \ 5 \ 25 \ 00$	L. A. T., Eq. t., +	$2^{ m d} \ 20^{ m h} \ 45^{ m m} \ 00^{s} \ 3 \ 30.90$	Eq. t., 0^{h} , $3^{m} 42^{s}.46$ Corr., -11.56
G. A. T.,	2 15 20 00	L. M. T.,	2 20 48 30.90	Eq. t., 3 30.90
				H. D., $-$ 0°.754 G. M. T., $-$ 15 ^h .33
				Corr., $-$ 11 ^s .56 (Add to apparent time.)

293. To FIND THE HOUR ANGLE OF A BODY FROM THE TIME, AND THE REVERSE.-In figure 36, if M and M' represent the positions of celestial bodies instead of those of the mean sun as before assumed, then the hour angles of the bodies will be Q M and $24^{h} - M'$ Q, respectively, and their right ascen-sions will be V M and V M'.

As before, we have:

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 $\begin{array}{rl} Q \ V &= Q \ M + V \ M, \\ &= V \ M' - M' \ Q; \\ Q \ M &= Q \ V - V \ M; \\ M' \ Q &= V \ M' - V \ Q, \ or \\ (24^h - M' \ Q) = (24^h + Q \ V) - V \ M'. \end{array}$

Substituting, therefore, hour angle of the body for mean time, and right ascension of the body for Right Ascension of the Mean Sun, the rules previously given for the conversion of mean and sidereal times will be applicable for the conversion of hour angle and sidereal time. Thus, the sidereal time is equal to the sum of the right ascension of the body and its hour angle, subtracting 24^h when the sum exceeds that amount; and the hour angle equals the sidereal time minus the right ascension of the body, 24^h being added to the former when necessary to render the subtraction possible. EXAMPLE: In Long. 81° 15′ W., on April 25, 1879, at 12^h 10^m 30^s (astronomical) mean time, find the

hour angle of Sirius.

L. M. T., Long., +	12 ^h 5	10 ^m 25	30* 00	L. M. T., R. A. M. S., 0^{h} , +	$\frac{12^{h}}{2}$	10^{n} 12 9	¹ 30 ^s 30.91 52 20
G. M. T.,	17	35	30	L. S. T., R. A. Sirius, –	$\overline{\begin{smallmatrix} 14\\6 \end{smallmatrix}}$	25 39	54.30 49.83
				H. A. Sirius,	7	46	04.47

EXAMPLE: May 9, 1879, Arcturus being 2^h 27^m 42^s.52 east of the meridian, find the local sidereal time

Н. А.,	$24^{h} 00^{n} \\ 2 27$	⁴ 00 [*] 42.52 E.	H. A., R. A., +	21 ^h 14	32 ^m 10	$17^{*}.48$ 11.71
Н. А.,	21 32	17.48 W.	L. S. T.,	11	42	29.19

Or thus:

H. R.	A., A.,	- +	$\frac{2^{h}}{14}$	27 ^m 10	$42^{s}.5$ 11.7	$\frac{2}{1}$
L. 8	S. Т.,		11	42	29.1	9

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CHAPTER X.

CORRECTION OF OBSERVED ALTITUDES.

294. The true altitude of a heavenly body at any place on the earth's surface is the altitude of its center, as it would be measured by an observer at the center of the earth, above the plane passed through the center of the earth at right angles to the direction of the zenith.

The observed altitude of a heavenly body, as measured at sea, may be converted to the true altitude by the application of the following-named corrections: *Index Correction, Dip, Refraction, Parallax*, and *Semidiameter*. The corrections for parallax and semidiameter are of inappreciable magnitude in observations of the fixed stars, and with planets are so small that they need only be regarded in refined calculations. In observations with the artificial horizon there is no correction for dip.

For theoretical accuracy, the corrections should be applied in the order in which they are named, but in ordinary nautical practice the order of application makes no material difference, except in the case of the parallax of the moon as explained in article 306.

INDEX CORRECTION.

295. This correction is fully explained in articles 249 and 250, Chapter VIII.

REFRACTION.

296. It is known by various experiments that the rays of light deviate from their rectilinear course in passing obliquely from one medium into another of a different density; if the latter be more dense, the ray will be bent toward the perpendicular to the line of junction of the media; if less dense, it will be bent away from that perpendicular.

Fig. 37.

The ray of light before entering the second medium is called the *incident* ray; after it enters the second medium it is called the *refracted* ray, and the difference of direction of the two is called the refraction.

The rays of light from a heavenly body must pass through the atmosphere before reaching the eye of an observer upon the surface of the earth. The earth's atmosphere is not of a uniform density, but is most atmosphere is not of a uniform density, but is most dense near the earth's surface, gradually decreasing in density toward its upper limit; hence the path of a ray of light, by passing from a rarer medium into one of continually increasing density becomes a curve, which is concave toward the earth. The last direction of the ray is that of a tangent to the curved path at the eye of the observer, and the difference of the direction of the ray before entering the atmosphere and this last direction constitutes the refraction.

297. To illustrate this, consider the earth's atmosphere as shown in figure 37; let SB be a ray from a star S, entering the atmosphere at B, and bent into the curve BA; then the apparent direction of the star is AS', the tangent to the curve at the point A, the refraction being the angle between the lines BS and AS'. If CAZ is the vertical line of the observer, by a law of Optics the vertical plane of the observer which contains the tangent AS' must also contain the whole curve BA and the incident ray BS. Hence refraction increases the apparent altitude of a star without affecting its azimuth.

At the zenith the refraction is nothing. The less the altitude the more obliquely the rays enter the atmosphere and the greater will be the refraction. At the horizon the refraction is the greatest.

298. The refraction for a mean state of the atmosphere (barometer 30ⁱⁿ, Fahr. thermometer 50°) is given in Table 20 A; the combined refraction and sun's parallax in Table 20 B; and the combined

refraction and moon's parallax in Table 24. Since the amount of the refraction depends upon the density of the atmosphere, and the density varies with the pressure and the temperature, which are indicated by the barometer and thermometer, the *true* refraction is found by applying to the mean refraction the corrections to be found in Tables 21 and 22; these are deduced from Bessel's formule, and are regarded as the most reliable tables constructed. It should be remembered, however, that under certain conditions of the atmosphere a very extraordinary deflection occurs in rays of light which reach the observer's eye from low altitudes (that is, from points near the visible horizon), the amount of which is not covered by the ordinary corrections for pressure and temperature; the error thus created is discussed under *Dip* (art. 301); on account of it, altitudes less than 10° should be avoided.

EXAMPLE: Required the refraction for the apparent altitude 5°, when the thermometer is at 20° and the barometer at 30^{in} .67.

The mean refraction by Table 20 A is, 9' 52''The correction for height of barometer is, +13The correction for the temperature, +42

True refraction,

299. The correction for refraction should always be subtracted, as also that for combined refraction and parallax of the sun; the correction for combined refraction and parallax of the moon is invariably additive.

DIP.

300. Dip of the Horizon is the angle of depression of the visible sea horizon below the true horizon, due to the elevation of the eye of the observer above the level of the sea.

In figure 38 suppose A to be the position of an observer whose height above the level of the sea is AB. CAZ is the true vertical at the position of the observer, and AH is the direction of the true horizon, S being an observed heavenly body. ATH' tangent to the earth's surface at T. Draw Disregarding refraction, T will be the most distant point visible from A. Owing to refraction, however, the most distant visible point of the earth's surface is H more remote from the observer than the point T, and is to be found at a point T', in figure 39. But to an observer at A the point T' will appear to lic in the direction of AH'', the tangent at A to the curve ATY. If the vertical plane were revolved about CZ as an axis, the line AH would generate the plane of the true horizon, while the point T' would generate the plate of a small circle of the terrestrial sphere called the Visible or Sea Horizon. The Dip of the Horizon is HAH", being the angle between the true horizon and the apparent direction of the sea horizon. Values of the dip are given in Table 14 for various heights of the observer's eye, and in the calculation of the table allowance has been made for the effect of atmospheric refraction as it exists under normal conditions.





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301. The fact must be emphasized, however, that under certain conditions the deflection of the ray in its path from the horizon to the eye is so irregular as to give a value of the dip widely different from that which is tabulated for the mean state of atmosphere. These irregularities usually occur when there exists a material difference between the temperature of the sea water and that of the air, and they attain a maximum value in calm or nearly calm weather, when the lack of circulation permits the air to arrange itself in a series of horizontal strata of different densities, the denser strata being below when the air is warmer, and the reverse condition obtaining when the air is cooler. The effect of such an arrangement is that a ray of light from the horizon, in passing through media of different densities, undergoes a refraction quite unlike that which occurs in the atmosphere of much more nearly homogeneous density that exists under normal conditions.

Various methods have been suggested for computing the amount of dip for different relative values of temperature of air and water, but none of these afford a satisfactory

solution, there being so many elements involved which are not susceptible of determination by an observer on shipboard that it will always be difficult to arrive at results that may be depended upon. ^a

As the amount of difference between the actual and tabulated values of the dip due to this cause may sometimes be very considerable—reliable observations having frequently placed it above 10', and values as high as 32' having been recorded—it is necessary for the navigator to be on his guard against the errors thus produced, and to recognize the possible inaccuracy of all results derived from observations taken under unfavorable conditions. Without attempting to give any method for the determination of the amount of the extraordinary variation in dip, the following rules may indicate to the navigator the conditions under which caution must be observed, and the direction of probable error:

(a) A displacement of the horizon should always be suspected when there is a marked difference between the temperatures of air and sea water; this fact should be especially kept in mind in regions such as those of the Red Sea and the Gulf Stream, where the difference frequently exists.

^aA sextant attachment devised by Lieutenant-Commander J. B. Blish, U. S. Navy, enables an observer to measure the actual dip at any time.

(b) The error in the tabulated value of the dip will increase with an increase in the difference of temperature, and will diminish with an increase in the force of the wind.

(c) The error will decrease with the height of the observer's eye: hence it is expedient, especially when error is suspected, to make the observation from the most elevated position available.

(d) When the sea water is colder than the air the visible horizon is raised and the dip is decreased; therefore the true altitude is greater than that given by the use of the ordinary dip table. When the water is warmer than the air, the horizon is depressed and the dip is increased. At such times the altitude is really less than that found from the use of the table.

The same cause, it may be mentioned here, affects the kindred matter of the visibility of objects. When the air is warmer, terrestrial objects are sighted from a greater distance and appear higher above the horizon than under ordinary conditions. When the water is warmer than the air, the distance of visibility is reduced, and terrestrial objects appear at a less altitude.

302. What has been said heretofore about the dip supposes the horizon ω be free from all intervening land or other objects; but it often happens that an observation is required to be taken from a ship sailing along shore or at anchor in harbor, when the sun is over the land and the shore is nearer the ship than the visible sea-horizon would be if it were unconfined; in this case the dip will be different from that of Table 14, and will be greater the nearer the ship is to that point of the shore to which the sun's image is brought down. In such case Table 15 gives the dip at different heights of the eye and at different distances of the ship from the land.

303. The dip is always to be subtracted from the observed altitude.



PARALLAX.

364. The *parallax* of a heavenly body is, in general terms, the angle between two straight lines drawn to the body from different points. But in Nautical Astronomy *geocentric parallax* is alone considered, this being the difference between the positions of a heavenly body as seen at the same instant from the center of the earth and from a point on its surface.

The zenith distance of a body, S (fig. 40), seen from A, on the surface of the earth, is ZAS; seen from C it is ZCS; the p trallax is the difference of these angles, ZAS-ZCS=ASC.

Parallax in altitude is, then, the angle at the heavenly Lody subtended by the radius of the earth.

If the heavenly body is in the horizon as at H', the radius, being at right angles to AH', subtends the greatest possible angle at the star for the same distance, and this angle is called the *horizontal parallax*. The parallax is less as the bodies are farther from the earth, as will be evident from the figure.

Let par. = parallax in altitude, ASC;

Z = SAZ, the apparent zenith distance (corrected for refraction); R = AC, the radius of the earth; and

D = CS, the distance of the object from the center of the earth.

Then, since $SAC = 180^{\circ} - SAZ$, the triangle ASC gives:

$$\sin \text{ par.} = \frac{R \sin Z}{D}.$$

If the object is in the horizon at H', the angle AH'C is the horizontal parallax, and denoting it by H. P. the right triangle AH'C gives:

$$\sin H. P. = \frac{R}{D}$$

Substituting this value of $\frac{R}{D}$ in the above, .

$$\sin par. = \sin H. P. \sin Z.$$

If h = SAH', the apparent altitude of the heavenly body, then $Z = 90^{\circ} - h$; hence,

 $\sin par. = \sin H. P. \cos h.$

Since par. and H. P. are always small, the sines are nearly proportional to the angles; hence,

par. = H. P. $\cos h$.

305. The Nautical Almanac gives the horizontal parallax of the moon, as well as of the planets Mercury, Venus, Mars, Jupiter, Saturn, Uranus, and Neptune.

In Table 16 will be found the values of the sun's parallax for altitude intervals of 5° or 10° , while Table 20 B contains the combined values of the sun's parallax and the refraction. In Table 24 is given the parallax of the moon, combined with the refraction, at various altitudes and for various values of the horizontal parallax.

306. Parallax is always additive; combined parallax and refraction additive in the case of the moon, but subtractive for the sun.

As the correction for parallax of the moon is so large, it is essential that it be taken from the table with considerable accuracy; the corrections for index correction, semidiameter, and dip should therefore be applied first, and the "approximate altitude" thus obtained should be used as an argument in entering Table 24 for parallax and refraction.

SEMIDIAMETER.

307. The semidiameter of a heavenly body is half the angle subtended by the diameter of the visible disk at the eye of the observer. For the same body the semidiameter varies with the distance; thus, the difference of the sun's semidiameter at different times of the year is due to the change of the earth's distance from the sun; and similarly for the moon and the planets. In the case of the moon, the earth's radius bears an appreciable and considerable ratio to the moon's

In the case of the moon, the earth's radius bears an appreciable and considerable ratio to the moon's distance from the center of the earth; hence the moon is materially nearer to an observer when in or near his zenith than when in or near his horizon, and therefore the semidiameter, besides having a menstrual change, has a semidiurnal one also.

The increase of the moon's semidiameter due to increase of altitude is called its *augmentation*. This reduction may be taken from Table 18.

• The semidiameters of the sun, moon, and planets are given in their appropriate places in the Nautical Almanac.

308. The semidiameter is to be added to the observed altitude in case the lower limb of the body is brought into contact with the horizon, and to be subtracted in the case of the upper limb. When the artificial horizon is used, the limb of the *reflected* image is that which determines the sign of this correction, it being additive for the lower and subtractive for the upper.

EXAMPLE: May 6, 1879, the observed altitude of the sun's upper limb was 62° 10' 40"; I. C., +3' 10"; height of the eye, 25 feet. Required the true altitude.

Obs. alt. ⊙, Corr.,	$-\frac{62^{\circ}\ 10'\ 40''}{18\ 04}$	I. C.,	+ 3' 10"
True alt.,	61 52 36	S. D. (Naut. Alm.), dip (Tab. 14), p. & r. (Tab. 20 B),	$\begin{array}{r} -15'53'' \\ -4 54 \\ - 27 \end{array}$
			-21 14
		Corr	

EXAMPLE: The altitude of Sirius as observed with an artificial horizon was 50° 59′ 30″; I. C., -1' 30″. Required the true altitude.

Obs. 2 alt. * , I. C., —		50°	$\frac{59'}{1}$	30″ 30
	2)	50	58	00
Obs. alt., ref. (Tab. 20 A),-	_	25	$\frac{29}{2}$	$\begin{array}{c} 00\\02 \end{array}$
True alt.		25	26	58

EXAMPLE: April 16, 1879, observed altitude of Venus 53° 26' 10"; I. C., + 2' 30"; height of eye, 20 feet. Required the true altitude.

Obs. alt.
$$*$$
, 53° 26′ 10″
 par. (Tab. 17), + 0′ 04″
 Hor. Par. (Naut. Alm.), 7″

 Corr., -
 2 32
 I. C., + 2 30
 Hor. Par. (Naut. Alm.), 7″

 53 23 38
 + 2 34
 I. C., + 2 30
 I. C., + 2 30

 dip (Tab. 14), -
 - 4′ 23″
 I. C., + 3
 I. C., - 4/3

 or for the constraint of th

CORRECTION OF OBSERVED ALTITUDES.

Obs. alt. $\underline{\mathbb{C}}$, 1st corr.,	$+^{25}$	30 [,] 30	' 30″ 57	S. D. (Na Aug. (Ta	ut. Ala 16. 18),	(1, 1), +1	6' 42" 08	Hor. Par. (N	Yaut. Alm.) , 61′ 10″
Approx. alt., p. & r. (Tab. 24), True alt.,	$+\frac{25}{26}$	41 53 34	27 07 34	dip (Tab I. C.,	. 14),	+ 1	$ \begin{array}{cccc} 6 & 50 \\ 4' & 23'' \\ 1 & 30 \\ 5 & 53 \\ \end{array} $		
				1st corr.		+1	0' 57″		
Or, the follow	ving m	odi	fication	may be ado	pted:				
Obs. alt. <u>⊄,</u> 1st corr.,	$^{25^{\circ}}$	$\frac{30'}{8}$	$56' \frac{30''}{56}$	S. D., Aug.,	$^{+16'}_{+}$	42″ 08	H. P., App. al	3670″ t., 25° 39′	$\begin{array}{c} \log \ 3.\ 56467 \\ \cos \ 9.\ 95494 \end{array}$
Approx. alt., par.,	$+\frac{25}{25}$	$\frac{39}{55}$	$\frac{26}{08}$	din	16	50	par.,	$\begin{cases} 3308'' \\ 55' \ 08'' \end{cases}$	$\log \ \overline{3.51961}$
True alt.,	26	34	34	ref., I. C.,	$- \frac{4}{-} \frac{2}{-} \frac{1}{-}$	23 01 30			
					- 7	54			
				1 at com	1 0/	56//			

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CHAPTER XL

THE CHRONOMETER ERROR.

309. It has already been explained (art. 261, Chap. VIII) that the error of a chronometer is the difference between the time indicated by it and the correct standard time to which it is referred; and that the *daily rate* is the amount that it gains or loses each day. In practice, chronometer errors are usually stated with reference to Greenwich mean time. It is not required that either the error or the rate shall be zero, but in order to be enabled to determine the correct time it is essential that both rate and error be known, and that the rate shall have been uniform since its last determination.

310. DETERMINING THE RATE.—Since all chronometers are subject to some variation in rate under the changeable conditions existing on shipboard, it is desirable to ascertain a new rate as often as possible. The process of obtaining a rate involves the determination of the error on two different occasions separated by an interval of time of such length as may be convenient; the change of error during this interval, divided by the number of days, gives the daily rate.

EXAMPLE: On March 10, at noon, found chronometer No. 576 to be 0^m 32^s.5 fast of G. M. T.; on March 20, at noon, the same chronometer was 0^m 48^s.0 fast of G. M. T. What was the rate?

Error, March 10 ^d 0 ^h , Error, March 20 ^d 0 ^h ,	$^{+0^{n}}_{+0}$	$132^{s}.548.0$
Change in 10 days,	+	15.5
Daily rate,	+	1°.55

The chronometer is therefore gaining 1^s.55 per day. **311.** DETERMINING ERROR FROM RATE.—The error on any given day being known, together with the daily rate, to find the error on any other day it is only necessary to multiply the rate by the number of days that may have elapsed, and to apply the product, with proper sign, to the given error. EXAMPLE: On December 17 a chronometer is 3^m 27^s.5 slow of G. M. T. and losing 0^s.47 daily.

What is the error on December 26?

Error Dec. 17, $-3^m 27^s.5$	Daily rate, $-0^{\circ}.47$
Correction, -4.2	No. days, 9
Error Dec. 26, $-3 31.7$	Corr., 4.23

The chronometer is therefore slow of G. M. T. on December 26, 3^m 31^s.7.

312. It is necessary to distinguish between the signs of the chronometer *correction* and of the chronometer *error*. A chronometer fast of the standard time is considered as having a *positive error*, since its readings are positive to (greater than) those of an instrument showing correct time; but the same chronometer has a negative correction, as the amount must be subtracted to reduce chronometer readings to correct readings.

313. Numerous methods are available for determining the error of a chronometer in port. The principal of these will be given.

BY TIME SIGNALS.

314. In nearly all of the important ports of the world a time signal is made each day at some defined instant. In many cases this consists in the dropping of a time-ball-the correct instant being given telegraphically from an observatory. In a number of places where there is no time-ball a signal may be received on the instruments at the telegraph offices, whereby mariners may ascertain the errors of their chronometers. Such signals are to be had in almost every port of the United States. The time signal may be given by a gun-fire or other sound, in which case allowance must be made

by the observer for the length of time necessary for the sound to travel from the point of origin to his position. Sound travels 1,090 feet per second at 32° F., and its velocity increases at the rate of 1.15 feet per second with each degree increase of temperature. If V be the velocity of sound in feet per second

at the existing temperature, and D the distance in feet to be traversed, $\frac{D}{V}$ is the number of seconds to be subtracted from the chronometer reading at the instant of hearing the signal, to ascertain the reading at the instant the signal was made.

This method of obtaining the chronometer error consists in taking the difference between the standard time and chronometer time at the time of observation and marking the result with appropriate sign.

EXAMPLE: A time-ball drops at $5^{h} 0^{m} 0^{s}$, G. M. T., and the reading of a chronometer at the same moment is $4^{h} 57^{m} 52^{s} .5$. What is the chronometer error?

G. M. T., Chro. t.,	$\frac{5^{h}}{4}$	$\frac{00^{u}}{57}$	$^{\circ}\frac{00^{s}}{52}.5$	5
Chro. error. –	-	2	07.5	- j

That is, chronometer slow 2^m 07^s.5; chronometer correction additive.

BY TRANSITS.

315. The most accurate method of finding the chronometer correction is by means of a transit instrument well adjusted in the meridian, noting the times of transit of a star or the limbs of the sun across the threads of the instrument.

At the instant of the body's passage over the meridian wire, mark the time by the chronometer. The hour angle at the instant is 0^{h} ; therefore the local sidereal time is equal to the right ascension of the body in the case of a star, or the local apparent time is 0^{h} in the case of the sun's center. By converting this sidereal or apparent time into the corresponding mean time and applying the longitude, the Greenwich mean time of transit is given. By comparing with this the time shown by chronometer the error is found.

EXAMPLE: 1879, May 9 (Ast. day), in Long. 44° 39′ E., observed the transit of Arcturus over the middle wire of the telescope, the time noted by a chronometer regulated to Greenwich mean time being 8^{h} 05^m 33°.5. Required the error.

L. S. T. (R. A. *), Long.,	 $rac{14^{ m h}}{2}$	$\frac{10^{\mathrm{m}}}{58}$	11ª. 71 36
G. S. T., R. A. M. S., 9 ^d 0 ^h ,	 $\frac{11}{3}$	11 07	35.71 42.69
Sid. int. from 0 ^h , Reduction (Tab. 8),	 8	$\begin{array}{c} 03\\1 \end{array}$	$53.02 \\ 19.27$
G. M. T., Chro. t.,	8 8	$\begin{array}{c} 02\\ 05 \end{array}$	$33.75 \\ 33.50$
Chro. fast,		2	59.75

EXAMPLE: June 25, 1879, in Long. 60° E., observed the transit of both limbs of the sun over the meridian wire of the telescope, noting the times by a chronometer. Find the error of the chronometer on G. M. T.

Transit of western limb, Transit of eastern limb,	$\begin{array}{cccccccccccccccccccccccccccccccccccc$	Eq. t., 2^{m} 16 ^s . 72
Chro. time, loc. app. noon,	8 05 11.25	H. D., $+ 0^{\circ}.332$ Long., $- 4^{h}$
L. A. T., loc. app. noon, Eq. t., +	${0^{ m h}} {00^{ m m}} {00^{ m s}} {00^{ m s}} {2 } {14.59}$	Corr., $-2^{s}.128$
L. M. T., loc. app. noon, Long., –	$\begin{array}{cccccccccccccccccccccccccccccccccccc$	Add to apparent time.
G. M. T., loc. app. noon, Chro. time, loc. app. noon,	$\begin{array}{cccccccccccccccccccccccccccccccccccc$	
Chro. fast,	256.66	

BY A SINGLE ALTITUDE (TIME SIGHT).

316. The problem involved in this solution, by reason of its frequent application in determining the longitude at sea, is one of the most important ones in Nautical Astronomy. It consists in finding the hour angle from given values of the altitude, latitude, and polar distance. The hour angle thus obtained is converted by means of the longitude and equation of time in the case of the sun, or longitude and right ascension in the case of other celestial bodies, into Greenwich mean time; and this, compared with the chronometer time, gives the error.

317. It should be borne in mind that the most favorable position of the heavenly body for time observations is when near the prime vertical. When exactly in the prime vertical a small error in the latitude produces no appreciable effect. Therefore, if the latitude is uncertain, good results may be obtained by observing the sun or other body when bearing east or west. If observations are made at the same or nearly the same altitude on each side of the meridian and the mean of the results is taken, various errors are eliminated of which it is otherwise impossible to take account, and a very accurate determination is thus afforded.

315. With a sextant and artificial horizon or good sea horizon, several altitudes of a body should be observed in quick succession, noting in each case the time as shown by a hack chronometer or comparing watch whose error upon the standard chronometer is known. Condensing the observation into

a brief interval justifies the assumption that the altitude varies uniformly with the time. A very satisfactory method is to set the sextant in advance at definite intervals of altitude and note the time as contact is observed.

319. Correct the observed altitude for instrumental and other errors, reducing the apparent to the true altitude.

If the sun, the moon, or a planet is observed, the declination is to be taken from the Nautical Almanac for the time of the observation. If the chronometer correction is not approximately known



and it is therefore impossible to determine the Greenwich mean time of observation with a fair degree of accuracy, the first hour angle found will be an approximate one; the declination corrected by this new value of the time will produce a more exact value of the hour angle, and the operation may be repeated until a sufficiently precise value is determined. **320.** In figure 41 there

are given: AO = h, the altitude of

the body O; DO = d, the declination; and

QZ = L, the latitude of the place.

In the astronomical triangle POZ there may be found from the foregoing:

ZO = z, the zenith distance of the body, $= 90^{\circ} - h$;

PO = p, the polar distance, $= 90^{\circ} \pm d$; and

PZ = co-L, the co-latitude of the place, $=90^{\circ} - L$. From this data it is required to find the angle POZ, the hour angle of the body, = t. This is given by the formula:

$$\sin^2 \frac{1}{2} t = \frac{\cos \frac{1}{2} (h + L + p) \sin \frac{1}{2} (L + p - h)}{\cos L \sin p}.$$

If we let $s = \frac{1}{2} (h + L + p)$, this becomes:

$$\sin \frac{1}{2} t = \sqrt{\sec L \csc p \cos s \sin (s - h)}.$$

The polar distance is obtained by adding the declination to 90° when of different name from the , latitude and subtracting it from 90° when of the same name. Like latitude and altitude it is always positive.

If the sun is the body observed, the resulting hour angle is the local apparent time and is to be taken from the a. m. or p. m. column of Table 44 according as the altitude is observed in the forenoon or afternoon. If the moon, a star, or a planet be taken, the hour angle is always found in the p. m. column.

Local apparent time as deduced from an observation of the sun is converted to local mean time by the application of the equation of time; then, by adding the longitude if west, and subtracting it if east, the Greenwich mean time is obtained.

The hour angle of any other body, added to its right ascension when it is west of the meridian at observation or subtracted therefrom when east, gives the local sidereal time, which may be reduced to Greenwich sidereal time by the application of the longitude, and thence to Greenwich mean time by methods previously explained.

A comparison of the Greenwich mean time with the chronometer time of sight gives the error of the chronometer.

EXAMPLE: January 20, 1879, p. m., in Lat. 48° 41′ 00″ S., Long. 69° 03′ 00″ E., observed a series of altitudes of the sun with a sextant and artificial horizon; mean double altitude, 59° 03′ 10″, images approaching; mean of times by comparing watch, $4^{h} 40^{m} 56^{s}$; C—W, $7^{h} 23^{m} 25^{s}$; index correction, -1' 30''; approximate chronometer correction, $-0^{m} 10^{s}$. What was the exact chronometer error?

W. T.,	$4^{h} 40^{m} 56^{h}$	Obs. 2 al	t. <u>O</u> , 59	° 03′ 10″	Dec.,	20° 08′ 26″. 6 S.	Eq. t.,	11 ^m 14 ^s .60
Chro. t.,	$ \begin{array}{ccccccccccccccccccccccccccccccccccc$	1. C.,	$-{2)59}$	1 30 01 40	Н. D., G. M. T.,	$+ \frac{32''.5}{0^{h}.07}$	H. D., G. M. T.,	+ 0 ^s .74 0 ^h .07
App. C. U.,	- 0 10	Θ	29	$ \begin{array}{ccccccccccccccccccccccccccccccccccc$	Corr.,	+ 2". 275	Corr.,	$+ 0^{s}.052$
Арр. G. м. 1., 0	, 0 04 11	Corr.,		45 33	Dec.,	20° 08′ 24″. 3 S.	. Eq. t.,	11 ^m 14 ^s .7
		S. D.,	÷	16' 17"	<i>P</i> ,	69° 51′ 36″	(Add to tim	apparent ne.)
		p. & r.,	_	1′ 34″				
		Corr.,	-+-	14' 43"				

$\begin{array}{cccc} h & 29^{\circ} & 45' & 33'' \\ \mathbf{L} & 48 & 41 & 00 \\ m & 69 & 51 & 36 \end{array}$	sec	.18031	L. A. T., Eq. t.,	-4 ^h +	29 ⁿ 11	46 ^s . 7 14. 7
$\frac{p}{2)148} \frac{18}{18} \frac{09}{09}$	tuset	.02740	L. M. T., Long.,	4	$\begin{array}{c} 41\\ 36\end{array}$	01. 4 12. 0
s 74 09 05 s—h 44 23 32	cos sin	9.43631 9.84483	G. M. T., Chro. t.,	$\overline{\begin{smallmatrix} 0\\0\\0\end{smallmatrix}}$	04 04	49.4 21.0
		2)19.48885	Chro. slow,	0	00	28.4
L A T 4h 29m 46s 7	$\sin k t$	9 74442				

EXAMPLE: May 18, 1879, p. m., in Lat. 8° 03' 22" S., Long. 34° 51' 57" W., observed a series of altitudes of the star Arcturus, east of the meridian, using artificial horizon; mean double altitude, 60° 10'; mean watch time, 6^h 50^m 32^s; C—W, 2^h 20^m 59^s.5; I. C., +2' 00". Find the true error of the chronometer.

W. Т., С—W,	${}^{6^{ m h}}_{ m 2} {}^{ m 50^{ m n}}_{ m 20}$	1 32 59).5	Obs. 2 a I. C.,	alt. * , +	60°	$\frac{10'}{2}$	00″ 00	R. A	. *:	14	^h 10	^m 11 ^s .7	•
Chro. t.,	9 11	31	1.5			2)60	12	00	Dee.	*,	19	° 48	' 33″.5	N.
				ref.,	_	30	$\begin{array}{c} 06 \\ 1 \end{array}$	00 41	р,		109	• 48	' 34″	
				h,		30	04	19						
h L	30° 8	04′ 03	19″ 22 34	sec	.0043	81	R H	. A, * , [. A.,		_	14 ^h 3	10 ^m 35	11 ^s .7 41	
p	2)147		15	0.0000	.0200	0	${}^{ m L}_{ m L}$. S. T., ong.,		+	$\frac{10}{2}$	$\frac{34}{19}$	$\begin{array}{c} 30.7\\ 27.8\end{array}$	
s - h	$\begin{array}{c} 73 \\ 43 \end{array}$	58 53	08 49	cos sin	9.4411 9.8409	.6 96	G R	. S. T., . A. M.	S., 0 ^h ,		$\frac{12}{3}$	53 43	$\frac{58.5}{11.7}$	
, H A	3h 35n	a 41	* E.	$\sin \frac{1}{2}t$	2)19.3129 	03 	Si R	id. int. f led. (Ta	from 0 ^h , b. 8),	-	9	10 1	$\begin{array}{c} 46.8\\ 30.2 \end{array}$	
	0.00				5.0001		G C	. M. T. hro. t.,	,		9 9	$\begin{array}{c} 09\\11 \end{array}$	$\begin{array}{c} 16\ .6\\ 31\ .5\end{array}$	
							С	hro. fas	t,			2	14.9	

BY EQUAL ALTITUDES.

321. The method of observing *equal altitudes* of the same body on opposite sides of the meridian is usually employed for accurate determinations of the chronometer error when the method of transits is not available.

In the case of a star, the mean of the two chronometer times corresponding to the equal altitudes is the chronometer time of transit; but in the case of the sun the mean of these times differs somewhat from the time of transit, since, in consequence of the change of the sun's declination between the observations, the equal altitudes do not occur at equal intervals before and after the transit.

The small correction necessary, when the sun is observed, to reduce the mean of the times to the time of transit is called the *equation of equal altitudes*.

322. EQUAL ALTITUDES OF THE SUN.^{*a*}—On shore, at a place whose longitude is *accurately* known, and whose latitude is *approximately* known, observe, with an artificial horizon, the same altitude both before and after meridian passage, as near the prime vertical as convenient when the altitude is more than 10°, noting the times. In low latitudes the method of equal altitudes will often give very accurate results, even when the observations are quite near the meridian.

It is most convenient, as well as conducive to accuracy, to take the observations in series, setting the sextant in advance of the altitude and marking the time at the instant that the contact is observed; about five or seven sights may compose a series, and several series may be observed, with the images of the sun alternately approaching and separating; thus the mean of the results (working each series of sights separately) will eliminate various possible errors. Ten minutes of double altitude will usually be found a convenient interval for observing.

The sights may be taken on opposite sides of the meridian for either upper or lower transit. If at upper transit, the first altitudes are taken in the forenoon and the times recorded; then in the afternoon the times corresponding to the same altitudes are observed, the last altitude taken in the morning being the first to come on in the afternoon; series taken with separating images in the forenoon should be observed with approaching images in the afternoon, and the reverse. If the time of lower transit is to be determined, the first set of sights is taken in the afternoon of one day and the second set in the forenoon of the next, care being taken as before to observe with images moving in opposite directions on opposite sides of the meridian.

323. The mean of the a. m. times call the A. M. Chronometer Time, the mean of the p. m. times, the P. M. Chronometer Time. If, instead of noting the times by the chronometer, a watch is used (compared with the chronometer both before and after each observation), it will generally be difference between the watch and chronometer at the instant of observation. The difference applied to the mean of the watch times gives the mean chronometer time the same as would have been found by employing the chronometer directly. The half sum of the A. M. and P. M. Chronometer Times is the *Middle Chronometer Time;* the P. M. minus the A. M. time in the case of observations for upper transit, or the A. M. minus the P. M. time

for lower transit, gives the *Elapsed Time*. Twelve hours should be added to the chronometer time at second observation in any case where the chronometer has passed XII^h during the interval between sights.

Take from the Nautical Almanac, page I, the sun's declination, the hourly difference of declination. and the equation of time, reducing each to the instant of local apparent noon by applying the differences due to the longitude.

Mark north latitude and declination +, south latitude and declination -. Mark hourly difference of declination when toward north +, when toward south -. Enter Table 37 with the elapsed time, and take out log A and log B, prefixing to each its proper sign as given in the table at the head of the page.

To log A add the logarithm of the hourly diff. (Table 42) and the log tangent of the latitude (Table 44). Prefix to each logarithm the sign of the quantity it represents, and to their sum the sign which results from the algebraic multiplication of the quantities. This sum is the logarithm (Table 42) of the number of seconds of time in the *first part* of equation of equal altitudes, to be marked + or -, like its logarithm.

To log B add the logarithm of the hourly diff. and the log tangent of the declination, marking the s as before. The sum is the logarithm of the second part of the equation of equal altitudes, to be signs as before. The sum is the log marked + or - like its logarithm.

Combine the two parts, having regard to signs, to obtain the equation of equal altitudes; apply this, with proper sign, to the Middle Chronometer Time and the result is the Chronometer Time of Local Apparent Noon or Chronometer Time of Local Apparent Midnight, according as observations were taken on opposite sides of the meridian at upper or at lower transit.

Apply the equation of time (adding when it is additive to mean time, otherwise subtracting); the result is the *Chronometer Time of Local Mean Noon*, or *Midnight*, which, if the chronometer is regulated to local time, will be $12^{h} 0^{m} 0^{s}$ when the chronometer is right, more than 12^{h} when fast, less than 12^{h} when slow.

If the chronometer is regulated to Greenwich time, apply the longitude (in time) to the chronometer time of mean noon (subtracting in west, adding in east longitude); the result will be more or less than 12^h, according as the chronometer is fast or slow.

EXAMPLE: April 13, 1879, at a place in Lat. 30° 25' N., Long. 5^h 25^m 42^s W., observed the following equal altitudes of the sun with a sextant and artificial horizon, noting the times by a watch compared with a chronometer regulated to Greenwich mean time. What is the error of the chronometer?

A. M. COMPAR	1802	NS.			P. M. COMPAR	RISO	NS.								
Chro., Watab		$\frac{2^{h}}{2}$	22°	n 30a 09	Chro., Watab		81	04n	1 30 ⁴	Dec.,	9° 0	0′ 54″.1 N.	H. D	. (13t	h), $+54''.40$
waten,		-			waten,			94	01	H. D. at no	on,-	+ 54".32	п. р	. (140	
CW,		5	30	28	С - W,		5	30	29	Long.,	-	⊢ 5 ^h .43	Diff.,	24 h	rs.,— 0 .37
Chro.,		2^{h}	561	n 30°	Chro.,		8h	33¤	30*	Corr.,		+ {294".96	Diff.,	1 hr	., -0".015
Watch,		9	26	02	Watch,		3	03	01			(4/55/.0	Diff.,	5h.48	3,0.08
C-W,		5	30	28	C-W,		5	30	29	Dec.,	90	05' 49" N.	H.D.	atno	on,+54″.32
	WA	TCI	н, а	. м.	ALTS.	WA	TCI	н, р.	. м.						
		9h	12^{n}	a 30s	91° 00′		2^{h}	45^{m}	45*						
			12	55	10			45	20						
			13	20	20			44	55	Tab. 37	\log	$\mathrm{A}(-)9.4445$		log I	B(+)9.3193
			13	45	30			44	30	H. D. +54".32	\log	(+)1.7350		\log	(+)1.7350
		_	14	10	40		_	44	05	Lat. +30° 25'	' tan	(+)9.7687	$d + 9^{\circ}6'$	tan	(+)9.2045
Mean, W. T., A. M.,		9h	13¤	a 20s	Mean, W. T., P. M.		2^{h}	44m	55^{s}	1st Part-8*.88	log	(-)0.9482			
C-W,	+	5	30	28	C - W,	+	5	30	29	2d Part+1.81		. ,		\log	(+) 0.2588
A. M. Chro. T.,		2	43	48	P. M. Chro. T.,		8	15	24	Eq. eq.] _7 07					
P. M. Chro. T.,	+	8	15	24	A. M. Chro, T.,	-	2	43	48	alt.					
	2)	10	59	12	Elapsed Time,		5	31	36						
Mid. Chro. T.,		5	29	36	Eq. t.,		0	ա 35	s.02						
Eq. eq. alt.,	-			7.1	ИБ		. •								
Chro t T A Noon		Б.	00	00 0	H. D., Long		+	U 5	P.00						
Ea t		9	29	20.0	Long.,		+	9	4,40						
	-		U	51.0	Corr		- 	9	s 52						
Chro. t. L. M. Noon.		5	28	57.4	CONTR		٢.		.00						
Long.	_	5	25	42.0	Eq. t., .			0m 3	11.5						
5.,					(Minus to me	an t	tim	e.)							
Chro. fast.		0	03	15.4				.,							

324. A quicker method of solving the same problem^a is available when results are not required to be accurate to the fraction of a second.

If h' is the change of altitude in minutes of arc, due to the total change in declination in the time elapsed between sights (the latitude and hour angle remaining the same), and t' the number of seconds it requires for the sun to change its altitude one minute of arc, then:

Equation of equal altitudes $=\frac{1}{2}h' \times t'$.

Table 25 gives the change of altitude of an object arising from a change of 100 seconds in declination at various altitudes, declinations, and latitudes. By multiplying the appropriate quantity taken from this table by the total change of declination between sights, dividing by 100, and converting the result from seconds to minutes of arc, h' is found. It is marked with the sign indicated in the table. By dividing the number of seconds of time between the first and last sights of one of the series by

By dividing the number of seconds of time between the first and last sights of one of the series by the number of minutes difference of altitude, we find t'. When the sights are taken on opposite sides of the upper meridian t' is minus; for the lower meridian it is plus. When the artificial horizon is used, if t' is computed on a basis of the change of the double altitude,

When the artificial horizon is used, if t' is computed on a basis of the change of the *double* altitude, its value is only half of the true one and the second term of the equation becomes $h' \times t'$ instead of as given above.

The example given in illustration of the preceding method when worked by this method is as follows:

Change in declination between sights = H. D. × elapsed time = $54".32 \times 5^{b}.53 = 300"$. Change in altitude due to 100" declination (Tab. 25) = +56".

 $\begin{aligned} h' &= + \frac{56 \times 300}{100 \times 60} = + 2'.80, \\ t' &= - \frac{2^{h}45^{m}45^{s} - 2^{h}44^{m}05^{s}}{91^{\circ}40' - 91^{\circ}00'} = - \frac{100^{s}}{40'} = - 2^{s}.5. \\ \text{Eq. equal alt.} &= + 2.80 \times - 2^{s}.5 = -7^{s}.00. \end{aligned}$

325. If equal altitudes of a planet were observed, the correction due to change of declination could be computed as in the case of the sun. It is not ordinarily expedient to use a planet, however, for if night sights are to be taken facility of working would make it preferable to employ a fixed star.

On account of its rapid and excessive change of declination the moon would never be observed for equal altitudes.

326. EQUAL ALTITUDES OF A FIXED STAR.—In selecting stars for this observation, it is to be remarked that the nearer to the zenith the star passes the less may the elapsed time be; and when a star passes exactly through the zenith the two altitudes may be taken within a few minutes of each other. But, with the ordinary sextants, altitudes near 90° can not be taken with the artificial horizon, as the double altitude is then nearly 180°. A limit is thus placed upon the extreme altitude that it is practicable to observe.

The sextant should be set and the coincidences of the two images of the star awaited, as in the case of the sun's limb, and the times by chronometer or watch noted as usual.

327. Take the mean of the times before the meridian passage as the A. M. Chronometer Time, and the mean of those after the meridian passage as the P. M. Chronometer Time. The mean of these two (adding $12^{\rm h}$ to the later one in case the chronometer has passed XII^h in the interval between sights) is the Chronometer Time of Star's Transit. At the instant of transit the local sidereal time will equal the right ascension of the star in case of the upper transit, or it will equal the right ascension plus $12^{\rm h}$ in case of the upper transit. Greenwich sidereal and thence into Greenwich site sidereal and thence into Greenwich sidere

wich mean time in the usual way, the chronometer error is found. EXAMPLE:—June 8, 1879, at Cape Town, Lat. 33° 56′ S., Long. 18° 28′ 40″ E., using sextant and artificial horizon, observed equal altitudes of star Antares before and after upper transit, as stated below. Required the chronometer error on Greenwich mean time.

	CE 7 ^h 7 7	HRO. 32 ^m 32 32	A. M. 10 ^s .5 35 .0 59 .3	Altitudes. 125° 30′ 40 50			Сн 11 ^ь 11 11	RO. I 34 ^m 33 33	² . M. 20 ⁸ .3 56.0 32.0
A. M. Chro. t., P. M. Chro. t.,	7 11	32 33	$\begin{array}{c} 34.9\\ 56.1 \end{array}$		P. M. Chro. t.,		11	33	56.1
Chrot Transit	(2)19	06	31.0	à	L. S. T.(R. A. *), Long.,	_	16^{h} 1	22 ^m 14	$03^{ m s}.5\ 54.7$
G. M. T. Transit, Chro. slow	9	59 26	30.9		G. S. T., R. A. M. S., 0 ^h ,	_	$^{15}_{5}$	$\begin{array}{c} 07\\05\end{array}$	$\begin{array}{c} 08.8\\ 59.4 \end{array}$
Child, Slow,			10.1		Sid. int. from 0 ^h , Red. (Tab. 8),	_	10	01 1	$\begin{array}{c} 09\ .4\\ 38\ .5\end{array}$
					G. M. T.,		9	59	30.9

a Suggested by Commander W. E. Sewell, U. S. Navy.

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328. DEGREE OF DEPENDENCE.—An error of 5' in the latitude would not affect the corresponding part of the equation of equal altitudes by more than one-hundredth of its amount in the most unfavorable case, and in general would have no sensible effect. It is one of the advantages of the equal altitude method, therefore, that it does not require an accurate knowledge of the latitude. It is also plain that errors in the longitude affecting the declination and its hourly difference produce but small proportionate effects upon the computed equation. The absolute error of the chronometer on Greenwich will be affected by the whole error in the longitude, but the *rate* will still be correct. Hence, we conclude that by this method the chronometer may be accurately *rated* at a place whose latitude and longitude are both imperfectly known. The chief source of error is in the observation itself. The best observers with the sextant can not

The chief source of error is in the observation itself. The best observers with the sextant can not depend on the noted time of a *single* contact within $0^8.5$, and hence the intervals between the successive chronometer times (which, if observations could be perfectly taken, would be sensibly equal) may differ 2^8 . But the greatest probable error of the chronometer time of sun's or star's transit, from the mean of six such observations on each side of the meridian, is found to be not more than $0^8.2$, provided the rate of the chronometer between the observations is uniform.

CHAPTER XII. LATITUDE

BY MERIDIAN ALTITUDE.

329. The latitude of a place on the surface of the earth, being its angular distance from the equator, is measured by an arc of the meridian between the zenith and the equator; hence, if the zenith distance



of any heavenly body when on the meridian be known, together with the declination of the body, the latitude can thence be found. Let figure 42 represent a projection of the celestial sphere on the plane of the meridian NZS; C, the center of the sphere; NS, the horizon; P and P', the poles of the sphere; QCQ', the equator; Z, the zenith of the observer. Then, by the above definition, ZQ will be the latitude of the observer; and NP, the altitude of the clevated pole, will also equal the latitude.

Let A be the position of a heavenly body north of the equator, but south of the zenith; QA = d, its declination; AS = h, its altitude; and $ZA = z = 90^{\circ} - h$, its zenith distance.

From the figure we have:

$$QZ = QA + AZ$$
, or $L = d + z$.

By attending to the names of z and d, marking the zenith distance north or south according as the zenith is north or south of the

body, the above equation may be considered general for any position of the body at upper transit, as A, A', A''.

In case the body is below the pole, as at A''—that is, at its lower culmination—the same formula may be used by substituting $180^\circ - d$ for d. Another solution is given in this case by observing that:

$$NP = PA''' + NA'''$$
, or
 $L = p + h$.

330. A common practice at sea is to commence observing the altitude of the sun's lower limb above the sea horizon about 10 minutes before noon, and then, by moving the tangent-screw, to follow the sun as long as it rises; as soon as the highest altitude is reached, the sun begins to fall and the lower limb will appear to *dip*. When the sun dips the reading of the limb is taken, and this is regarded as the meridian observation.

It will, however, be found more convenient, and frequently more accurate, for the observer to have his watch set for the local apparent time of the prospective noon longitude, or to know the error of the watch thereon, and to regard as the *meridian* altitude that one which is observed when the watch indicates noon. This will save time and try the patience less, for when the sun transits at a low altitude it may remain "on a stand" without appreciable decrease of altitude for several minutes after noon; moreover, this method contributes to accuracy, for when the conditions are such that the motion in altitude due to change of hour angle is a slow one, the motion therein due to change of the observer's latitude may be very material, and thus have considerable influence on the time of the sun's dipping. This error is large enough to take account of in a fast-moving vessel making a course in which there is a good deal of northing or southing.

In observing the altitude of any other heavenly body than the sun, the watch time of transit should previously be computed and the meridian altitude taken by time rather than by the dip. This is especially important with the moon, whose rapid motion in declination may introduce still another element of inaccuracy.

331. The watch time of transit for the sun, or other heavenly body, may be found by the forms given below, knowing the prospective longitude, the chronometer error, and the amount that the watch is slow of the chronometer.

For the Sun.

For other Bodies.

				11 211 8
L. A. T. noon,	0 ^h 00 ^m 00 ^s	L. S. T. transit,		(Right ascension.)
Long. $(+ \text{ if west}),$	<u></u>	Long. $(+ \text{ if west}),$	+	
G. A. T.,		G. S. T.,		
Eq. t.,	±	R. A. M. S., 0 ^h ,		
G. M. T.,		Sid int. from 0^{h} ,		
C. C. (sign reversed),	+	Red. (Tab. 8),		
Chro. time,		G. M. T.,		
C-W,		C. C. (sign reversed),		
Watch time noon.		Chro. time.		
		C-W.		
		Watch time transit,		

332. From the observed altitude deduce the true altitude, and thence the true zenith distance. Mark the zenith distance North if the zenith is north of the body when on the meridian, South if the zenith is south of the body.

Take out the declination of the body from the Nautical Almanac for the time of meridian passage, having regard for its proper sign or name.

The algebraic sum of the declination and zenith distance will be the latitude. Therefore, add together the zenith distance and the declination if they are of the same name, but take their difference if of opposite names; this sum or difference will be the latitude, which will be of the same name as the greater. EXAMPLE: At sea, June 21, 1879, in Long. 60° W., the observed meridian altitude of the sun's lower limb was 40° 4'; sun bearing south; I. C., +3' 0"; height of the eye, 20 feet; required the latitude.

TO T, oun	. bearing i	outin, 1. 0.,	100,	neight of the c	ye, 20 reet, require	su the fath
Obs. alt.,	40° 04′	00″	S. D.,	+ 15' 46''	Dec., 23° 27′	20″.5 N.
Corr.,	+ 13	21	I. C.,	+ 3 00		
					H. D., +	0''.32
h,	40 17	21		+1846	Long.,	4 ^h .
z.	49° 42′	39″ N.	dir.	-4'23''	Corr., +	1″.28
d.	23 27	22 N.	p. & r	-102	, i	
			1,		Dec., 23° 27′	22//
L,	73 - 10	01 N.		- 5 25		
		· .				
			0	1 10/ 01//		

Corr., + 13' 21''

EXAMPLE: At sea, April 14, 1879, in Long. 140° E., the observed meridian altitude of the sun's lower limb was 81° 15′ 30″; sun bearing north; I. C., -2′ 30″; height of the eye, 20 feet.

Obs. alt.,	81° 15′	30″ 50	S. D., + 15' 59"	Dec., 9° 22′ 35″.4 N.
h,	$+$ $\frac{-}{81}$ $\frac{-}{24}$	29	dip, $-$ 4 .23 p. & r., $-$ 0 07	H. D., $+$ 54".03 Long., $-$ 9 ^h .33
z, d,	$\begin{array}{ccc} 8^\circ & 35' \\ 9 & 14 \end{array}$	31″ S. 11 N.	I. C., $-\frac{2}{7} \frac{30}{00}$	Corr., $-\begin{cases} 504''.1\\ 8' 24''.1 \end{cases}$
L,	0 38	40 N.	Corr., + 8' 59"	Dec., 9° 14′ 11″ N.

EXAMPLE: At sea, May 15, 1879, Long. 0°, the observed meridian altitude of the sun's lower limb was 30° 13' 10"; sun bearing north; I. C., +1' 30"; height of the eye, 15 feet.

Dec., Gr. 0^h, 18° 50′ 48′′.5 N.

Obs. alt., Corr.,	$^{30^{\circ}}_{+}$	$\frac{13'}{12}$	$\frac{10'}{02}$,	S. D., I. C.,	++	15' 1	51 * 30
h,	30	25	12			+	17	21
$\overset{z,}{d}$,	59° 18	$\begin{array}{c} 34'\\ 50\end{array}$	48″ 49	' S. N.	dip, p. & r.,		$\frac{3'}{1}$	$\frac{48''}{31}$
L,	40	43	59	s.		-	5	19
					Corr.,	+	12'	02″

EXAMPLE: January 1, 1879, the observed meridian altitude of Sirius was $52^{\circ} 23' 40''$, bearing south; I. C., +5' 0''; height of the eye, 17 feet.

Obs. alt., 53° 23′ 40″ Corr., + 15	I. C., + 5' 00"	Dec. * , 16° 33′ 04′′ S.
$h, \overline{53 23 55}$	dip, $-4' 02''$ ref., -43	
z,	-445	
L, $\frac{10}{20} \frac{00}{03} \frac{01}{01}$ N.	Corr., + 0' 15"	

EXAMPLE: June 13, 1879, in Long. 65° W., and in a high northern latitude, the meridian altitude of the sun's lower limb was 8° 16' 10", below the pole; height of the eye, 20 feet; I. C., 0' 00". Greenwich apparent time of lower culmination, June 13, 16^h 20^m (=Long. + 12^h).

Obs. alt., $8^{\circ} 16' 10''$ Corr + 5 12	S. D., $+15' 47''$	Dec.,	23° 13′ 03′′.8 N.
h, 8 21 22	$\begin{array}{rrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrr$	Н. D., + G. M. T.,	$\frac{8^{\prime\prime}.58}{16^{\rm h}.33}$
$\begin{array}{c}z, & \overline{81^\circ \ 38' \ 38'' \ 8.}\\180^\circ - d, & 156 \ 44 \ 36 \ N.\end{array}$	10 35	Corr., +	$\left\{\begin{array}{c} 140^{\prime\prime}.5\\ 2^{\prime} 20^{\prime\prime}.5\end{array}\right.$
75 05 58 N.	Corr., $+$ 3 12	Dec.,	23° 15′ 24″ N.
h, 8° 21′ 22′′		р,	66° 44′ 36″
$\begin{array}{cccccccccccccccccccccccccccccccccccc$		180°—d,	156° 44′ 36″

EXAMPLE: June 26, 1879, in Long. 80° W., the observed meridian altitude of the moon's upper limb was 59° 6′ 40″, bearing south; I. C., +2' 0″; height of the eve, 19 feet.

h, 59° 18' 00''	Obs. alt.,	59° 06′ 40″	G. M. T., Gr. trans., 5h 27m Corr. for Long (Tab. 11). + 11	$\begin{array}{ccc} \text{Dec. (11h),} & 4^{\circ} \ 51' \ 36''.5 \ \text{S.} \\ 0 & & & & \\ \end{array}$
z, 30° 42′ 00″ N. d, 4 51 06 S.	1. C.,	+ 2' 00"	L. M. T., local trans., 5 38	$\begin{array}{c} & \text{M. D.,} & - & 15''.07\\ .0 & \text{No. min.,} & - & 2^{\text{m.}}.0\\ \end{array}$
L, 25 50 54 N.	Aug., dip,	- 10 00 - 14 - 4 16	G. M. T., local trans., +10 58	$-\frac{.0}{.0}$ Corr., + $30^{\prime\prime}.1$
	* /	- 20 33		Dec., 4º 51' 06'' S.
	1st Corr.,	- 18' 33''		
	Approx. alt., p. & r. (Tab. 24),	$58^{\circ} 48' 07''$ + 29 53		Hor. Par., 58' 46".3
	h,	59 18 00		

EXAMPLE: At sea, September 16, 1879, in Long. 75° E., the observed meridian altitude of Jupiter was 51° 25′ 24″, bearing north; I. C., +3' 0″; height of the eye, 16 feet.

Obs. alt.	., 51° 25′ 24″	par., + 0' 01"	G. M. T., Gr. trans., 10h 49m.8	Dec.,	10° 44′ 20″.5 S.
Corr.,	- 1 41	I. C., + 3 00	Corr. for Loug., $+$ 0.9		
				H. D., 🌯 -	- 6''.58
h,	$51 \ 23 \ 43$	+3 01	L. M. T., local trans., 10 50 .7	G. M. T.,	5h.84
		_	Long., - 5 00 .0		1
z,	38° 36' 17'' S.	dip, - 3' 55"		Corr., -	- 38".43
d,	10 44 59 S.	ref., - 47	G. M. T. local trans., 5.50.7		
'				Dec.,	10° 44' 59" S.
L.	49 21 16 S.	-4 42			
,				н. р.,	27.2
		Corr., - 1' 41"		par. (Tab. 17) ,	1''

333. CONSTANT.—In working a meridian altitude, especially the daily noon observation of the sun, it is frequently a convenience to so arrange the terms of the problem that all computation, excepting the application of the observed altitude, is completed beforehand; then the ship's latitude will be known immediately after the sight has been taken, it being necessary only to add or subtract the altitude.

It is assumed that the noon longitude will be sufficiently accurately known in advance to enable the navigator to correct the declination; also the approximate meridian altitude to correct the parallax and refraction: if the latter is not known, it may readily be found from the declination and approximate latitude.

Generally speaking,

Lat. = Zenith distance + Dec.,

 $= 90^{\circ} - \text{True alt} + \text{Dec},$ = 90° - (Obs. alt. + Corr.) + Dec., = (90° + Dec. - Corr.) - Obs. alt.,

in which the quantity $(90^\circ + \text{Dec.} - \text{Corr.})$ may be termed a *Constant* for the meridian altitude of the day, as it remains the same regardless of what the observed altitude may prove to be. The constant having been worked up before the observation is made, the latitude will be known as soon as the observed altitude is applied.

To avoid the confusion that might arise from the necessity of combining the terms algebraically according to their different names, it may be convenient to divide the problem into four cases and lay down rules for the *arithmetical* combination of the terms, disregarding their respective names as follows:

13 11/1	the diminitied combination of		the cher can be cher in	respective mannes as
Case	I. Lat. and Dec. same name,	Lat. greater	$+90^{\circ} + \text{Dec.}$ -	- Corr. $-$ Obs. alt.

- Case II. Lat. and Dec. same name, Dec. greater, -90° + Dec. Corr. + Obs. alt. Case III. Lat. and Dec. same name, Dec. greater, -90° + Dec. + Corr. + Obs. alt. Case III. Lat. and Dec. opposite names, $+90^{\circ}$ Dec. Corr. Obs. alt. Case IV. Lat. and Dec. same name, lower transit, $+90^{\circ}$ Dec. + Corr. + Obs. alt.

The correctness of such an arrangement will become readily apparent from an inspection of figure 42. The assumption has been made that the correction to the observed altitude is positive; when this is not true the sign of the correction must be reversed.

As examples of this method, the first, second, third, and fifth of the examples previously given illustrating the meridian altitude will be worked, using the constant; the details by which Corr. and Dec. are obtained are omitted, being the same as in the originals.

1st	r Exa	MPL	E.	2D	EXA	MPL	Е.	3D	EXA	MPLE.	5ті	i Exa	MP	LE.
	Case + 90	<i>I</i> . ° 00	00″		Case	11. 200/	'00″		Case $1 + 90^\circ$	UI. 200/00″		$Case 1 + 90^{\circ}$	/ V. 900/	′ 00″
Dec., Corr.,	+ 23	27 13	22 21	Dec., Corr.,	+9 + 9	14 8	11 59	Dec., Corr.,	_18 _	$\begin{array}{ccc} 50 & 49 \\ 12 & 02 \end{array}$	Dec., Corr.,	$\overset{-23}{+}$	$15 \\ 5$	24 12
Constant Obs. alt.,	$,+113 \\ -40$	3 14 0 04	01 00	Constant Obs. alt.,	-80 + 81	$\frac{36}{15}$	$50\\30$	Constant Obs. alt.,	$+70 \\ -30$	57 09 13 10	Constant Obs. alt.,	$+66 \\ + 8$	49 16	48 10
Lat.,	73	10	01 (N.	Lat.,	0	38	40 (N.)	Lat.,	40	43 59 (S.)	Lat.,	75	05	58 (N.)

BY REDUCTION TO THE MERIDIAN.

334. Should the meridian observation be lost, owing to clouds or for other reason, altitudes may be taken near the meridian and the times noted by a watch compared with the chronometer, from which, knowing the longitude, the hour angle may be deduced.

If the observations are within $26^{\rm m}$ from the meridian, before or after, the correction to be applied to the observed altitude to reduce it to the meridian altitude may be found by inspection of Tables 26 and 27. Table 26 contains the variation of the altitude for one minute from the meridian, expressed in seconds and tenths of a second. Table 27 contains the product obtained by multiplying the square of the minutes and seconds by the change of altitude in one minute.

Let a = change of altitude (in seconds of arc) in one minute from the meridian:

H = meridian altitude:

h =corrected altitude at observation; and

t = interval from meridian passage.

The value of the reduction to the meridian altitude of each altitude is found by the formula:

 $\mathbf{H} = h + at^2$.

a being found in table 26, and at² in Table 27; hence the following rule:
Find the hour angle of the body in minutes and seconds of time. Take from Table 26 the value of a corresponding to the declination and the latitude. Take from Table 27 the value of at² corresponding to the a thus found and to the interval, in minutes and seconds, from meridian passage. This quantity will represent the amount necessary to reduce the corrected altitude at the time of observation to the corrected altitude at the meridian passage; it is always additive when the body is near upper transit, and always to be subtracted when near lower transit.

If the mean of a number of sights is to be taken, determine each reduction separately, take the mean of all the reductions, and apply it to the mean of the altitudes; it is incorrect, in such a case, to take the mean of the times and work the sight with this single value of t. The differences of altitude being small, the parallax and refraction will be sensibly the same for all, and one computation of the correction to the observed altitude will suffice.

Knowing the meridian altitude, the latitude is to be found as previously explained.

335. When several sights are taken, the most expeditious method of calculating will be to find first the watch time of transit, and thence obtain the hour angle of each observation by comparing the watch time of observation. The watch time of transit may be found as already explained (art. 331) for computing that quantity as a guide in taking the meridian altitude, but the hour angle thus obtained is subject to a correction. The difference between watch time of transit and watch time of observation gives the watch time—that is, the mean time—elapsing between transit and observation. A fixed star covers in that time an angle corresponding to the sidercal and not to the mean time interval, and a reduction should be made accordingly to give its true hour angle at the instant of observation. A planet's hour angle should be corrected in the same way (for we may disregard its very small change in right ascension). The correction may be entirely neglected in the case of the sun, as the difference between mean and apparent time intervals is immaterial. The reduction of the hour angle in the case of the moon becomes rather cumbersome, so much so that it is better to find the hour angle of this body by the more usual method of converting watch time to G. M. T., and thence to L. S. T., and finding the difference between the latter and the R. A.; an additional reason for this is that the G. M. T. of observation must be known exactly, with the moon, for the correction of the declination (art. 338).

336. Table 26 includes values of the latitude up to 60°, and those of the declination up to 63°, thus taking in all frequented waters of the globe and all heavenly bodies that the navigator is likely to employ. No values of a are given when the altitudes are above 86° or below 6°, as the method of reduction to the meridian is not accurate when the body transits very near the zenith, and the altitudes themselves are questionable when very low. In case it is desired to find the change of altitude in one minute from noon for conditions not given in the tables, it may be computed by the formula:

$$a = \frac{1^{\prime\prime}.9635 \cos L \cos d}{\sin (L-d)}.$$

In working sights by this method where great accuracy is required, as in determining latitudes on shore for surveying purposes, it is well to compute the a rather than to take it from the table, as one is thus enabled to employ the value as found to the second decimal place.

Due regard must be paid to the names of the declination and latitude in working this formula; if they are of opposite names, the declination is negative, and L and d should be added together to obtain -d. L-

337. Table 27 contains values of at^2 up to the limits within which the method is considered to apply with a fair degree of accuracy. It must not be understood that the plan of reduction to the meridian is not available for wider limits, but it would seem preferable to employ the $\varphi' \varphi''$ formula, described hereafter, when the hour angle falls beyond that for which the table is computed. On the other hand, the reduction is not exact in all cases covered by the table; while sufficiently so for sea navigation, the limits given are far too wide for the precise determinations required in surveying, where the aim should be to observe bodies under such conditions that the total reduction d^2 shall not exceed 1'.

338. It should be kept clearly in mind when employing the method of reduction to the meridian that the resulting latitude is that of the ship at the instant of observation, and to bring it up to noon the run must be applied. The declination should properly be corrected for the instant of observation; with the sun or a planet, it is sufficiently accurate to use the declination at meridian passage, unless the interval from the meridian be quite large; but the moon's declination changes so rapidly that the exact time of observation must be used in its correction when working with this body.

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LATITUDE.

EXAMPLE: In latitude 47° S., having previously worked up the constant for meridian altitude; 78° 42′ 10″, observed altitude of sun near meridian, 31° 11′ 50″; Dec. 11° N.; watch time, 11^h 40^m 21^s, watch fast of L. A. T., 7^s. Find the latitude.

Watch time Watch fast	e, $11^{h} 40^{m} 21^{s}$, 07	Obs. alt., at^2 , $-$	$31^{\circ} 11' 50''$ - 10 24	a (Tab. 26),	1.″6
L. A. T.,	11 40 14	Mer. alt., Constant,	31 22 14 78 42 10	at ² (Tab. 27),	$\begin{cases} 1.''0 = 6' 30'' \\ . 6 = 3 54 \end{cases}$
t,	$19^{m}46^{s}$	Lat	47 19 56 S		1.6 = 1024

EXAMPLE: At sea, July 12, 1879, in Lat. 50° N., Long. 40° W., observed circum-meridian altitude of the sun's lower limb, 61° 48′ 30″, the time by a chronometer regulated to Greenwich mean time being $2^{h} 41^{m} 39^{*}$; chro. corr., $-2^{m} 30^{*}$; I. C., -3' 0''; height of the eye, 15 feet. Find the latitude.

Chro. t., $2^{h} 41^{m} 39^{s}$ C. C., $- 2 30$		Dec., $22^{\circ} 00' 23''.2$ N. Eq. t., $5^{m} 17^{s}.99$
G.M.T., 2 39 09 Eq. t - 5 19	h, 61 57 01	$\begin{array}{cccccccccccccccccccccccccccccccccccc$
G. A. T., 2 33 50	S. D., + <u>15' 46"</u>	Corr., - 55".9 Corr., +
Long., $-2 \ 40 \ 00$	$\begin{array}{cccccccccccccccccccccccccccccccccccc$	Dec., $21^{\circ} 59' 27''$ N. Eq. t., $5^{\text{\tiny III}} 18^{\circ}.9$ (Subtract from mean time.)
t, 6 10	-715	
	Corr., + 8 31	<i>a</i> (Tab. 26), 2.75
	$h, 61^{\circ} 57' 01'' \\ at^{2}, + 1 35$	at ² (Tab. 27), $\begin{cases} 2.''0 = 1' \ 16''\\ 0. \ 5 = 0 \ 19 \end{cases}$
	H, $61 58 36$	$\begin{bmatrix} 2. & 5 = 1 & 35 \end{bmatrix}$
	$\begin{array}{cccccccccccccccccccccccccccccccccccc$	
	L. $\overline{50 \ 00 \ 51}$ N.	

EXAMPLE: May 31, 1879, in Lat. 30° 25' N., Long. 5^h 25^m 42^s W., about 9 p. m., observed with a sextant and artificial horizon a series of altitudes of Spica; mean observed double altitude 98° 06' 34"; noted times as enumerated below by a watch compared with a chronometer which was $2^{m} 33^{*}$ fast of G. M. T.; C–W, $5^{h} 29^{m} 40^{*}$; I. C., -3' 00''. Find the latitude.

R. A. \star (L. S. T. trans	sit), $13^{h} 18^{m} 52^{s} .2$	Mean 2	alt.*, 98° 06' 34"	R. A. * ,	$13^{\rm h} \ 18^{\rm m} \ 52^{\rm s}.2$
Long.,	+ 3 23 42	1. U.,	- 3 00	Dec.,	10° 32′ 04″ S.
G. S. T., R. A. M. S. Gr. 0 ^h ,	$\begin{array}{rrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrr$		2) 98 03 34	a (Tab. 26),	2".5
Sid. int. from 0 ^h , Red. (Tab. 8),	$-\frac{14\ 10\ 07\ .3}{2\ 19\ .4}$	ref.,	$-\frac{49}{50}$		
G. M. T., C. C. (sign reversed),	$+ \begin{array}{ccc} \hline 14 & 07 & 47 & .9 \\ + & 2 & 33 \end{array}$	h,	49 00 57		
Chro. time transit, C—W,	$ \begin{array}{rrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrr$				
Watch time transit,	8 40 41		•		
	Intervals from trans	sit.	ett ² (Tab. 27).		
Watch times. $8^{h} 31^{m} 18^{s}.0$ 33 19.5 36 07.0 38 50.0	$\begin{array}{rllllllllllllllllllllllllllllllllllll$	$time. \\ {}^{n} 24^{s} \\ {}^{23} \\ {}^{35} \\ {}^{51}$	$\begin{array}{cccccccccccccccccccccccccccccccccccc$	$\begin{array}{c} h, & 49\\ at^2, +\\ H, & 49\end{array}$	$\frac{9^{\circ} \ 00' \ 57''}{1 \ 40}$ $\frac{7}{9 \ 02 \ 37}$

 $0 \ 01$

0 52

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-42

19004

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3

0 00 0 01

0 131 05

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0 55

231 58

0

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6 53

1033

27

 $\tilde{05}$

41 07.5

51 12.5

46.0

43 45.5

4533.0

47

026.5

3

6

10

04.5

05.0 $\overline{\mathbf{5}}$

52.0

31.5

L, 30 25 19 N.

z,

40 57 23 N.

10

32

04 8.

$$(4 \ 37)$$

9)15 00

37

0 $\overline{23}$

EXAMPLE: August 6, 1879, Lat. 59° S., Long. 175° 27′ E., during evening twilight, observed an altitude of Achernar, near lower transit, 26° 52′; watch time, 4^h 31^m 12°; C – W, 0^h 18^m 07^s; chro. fast of G. M. T., 12^m 42^s; I. C., +1' 20′′; height of eye, 24 ft. - Find hour angle by both methods; thence the latitude

R. A. $\star + 12^{h}$ L. S. T. lower trans. Long.,	$\left. \left. \left. \begin{array}{c} 13^{ m h}33^{ m m}15^{ m s}.4 \\ - 11 41 48 \end{array} \right. \right.$	Watch tim C-W,	e, +
G. S. T., R. A. M. S. Gr. 5 ⁴ 0 ^h ,	$\begin{array}{rrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrr$	Спго. t., С. С., G. М. Т. 5	
Sid. int., Red. (Tab. 8),	$- \begin{array}{r} 16 \ 56 \ 47.6 \\ - \ 2 \ 46.6 \end{array}$	R. A. M. S. Red. (Tab.	Gr. $5^{d} 0^{h}$, + 9), +
G. M. T., C. C. (sign reversed),	$+ {\textstyle \frac{16\ 54\ 01.0}{12\ 42}}$	G. S. T., Long.,	-+-]
Chro. time, C-W,	$\begin{array}{rrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrr$	L. S. T., R. A. * +	- 12 ^h ,
Watch time transit, Watch time obs.,	$\begin{array}{rrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrr$	t,	-
$t \begin{cases} \text{Mean time,} \\ \text{Sid. time,} \end{cases}$	$\begin{array}{c cccc} 17 & 24 \\ 17 & 27 \end{array}$		
Obs. alt. *,	26° 52′ 00″	R. A. * ,	1 ^h 33 ^m 15 ^s .4
I. C., +	1' 20"	Dec.,	57° 50′ 28″
dip, – ref., –	$-\frac{4'}{1}\frac{48''}{55}$	p,	32° 09′ 32″
-	6 43	$a (Tab. 26), at^2 (Tab. 27)$), $3' 03''$
Corr., –	- 5' 23"		
$h, at^2, -$	26° 46′ 37″ 3 03		
\mathbf{H}_{p} ,	$\begin{array}{rrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrr$		

58

53 06 S.

L.

Watch time, C—W,	+	$\frac{4^{ m h}}{0}$	$\frac{31^{n}}{18}$	$^{+}12^{s}$ 07
Chro. t., C. C.,		4	$\begin{array}{c} 49\\12\end{array}$	19 42
G. M. T. 5 ^d , R. A. M. S. Gr. 5 ^d 0 ^h , Red. (Tab. 9),	++	$\frac{16}{8}$	$\begin{array}{c} 36\\54\\2\end{array}$	$37 \\ 39.8 \\ 43.7$
G. S. T., Long.,	+-	1 11	34 41	$\begin{array}{c} 00.5\\ 48 \end{array}$
L. S. T., R. A. ¥ +12 ^h ,		$\frac{13}{13}$	$\frac{15}{33}$	$\begin{array}{r} 48.5\\15.4\end{array}$
t,			17	27

R. A. * ,	14 3	3. 3	.5 ^s .4
Dec.,	57°	50'	28″ S.
<i>p</i> ,	32°	09'	32″
a (Tab. 26), at ² (Tab. 27),		3⁄	0″.6 03″

BY A SINGLE ALTITUDE AT A GIVEN TIME.

339. This observation should be limited to conditions where the body is within three hours of meridian passage and where it is not more than 45° from the meridian in azimuth. On the prime vertical the solution by this method is inexact, and when the hour angle is 6^{h} it is impracticable.

The problem is: Given the hour angle, declination, and altitude, to find the latitude. The solution is accomplished by letting fall, in the usual astronomical triangle, a perpendicular from the body to the meridian, and considering separately the distances on the meridian, from the pole and zenith, respectively, to the point of intersection of the perpendicular; the sum or difference of these distances is the co-latitude.

Following the usual designation of terms and introducing the auxiliaries φ' and φ'' , the formulæ are as follows:

$$\tan \varphi'' = \tan d \sec t;$$

$$\cos \varphi' = \sin h \sin \varphi'' \operatorname{cosec} d;$$

$$L = \varphi' + \varphi''.$$

The terms φ' and φ'' will have different directions of application according to the position of the body relatively to the observer. From a knowledge of the approximate latitude, the method of combining them will usually be apparent; it is better, however, to have a definite plan for so doing, and this may be based upon the following rule:

Mark φ'' north or south, according to the name of the declination; mark φ' north or south, according to the name of the zenith distance, it being north if the body bears south and east or south and west, and south if the body bears north and east or north and west. Then combine φ'' and φ' according to their names; the result will be the latitude, except in the case of bodies near lower transit, when 180° – φ'' must be substituted for φ'' to obtain the latitude. It may readily be noted that if we substitute φ'' for declination and φ' for zenith distance, the

problem takes the form of a meridian altitude; indeed, the method resolves itself into the finding of the zenith distance and declination of that point on the meridian at which the latter is intersected by a perpendicular let fall from the observed body.

The time should be noted at the instant of observation, from which is found the local time, and thence the hour angle of the celestial object.

LATITUDE.

If the sun is observed, the hour angle is the L. A. T. in the case of a p. m. sight, or $12^{h} - L$. A. T. for an a. m. sight. If any other body, the hour angle may be found as hitherto explained. EXAMPLE: June 7, 1879, in Lat. 30° 25′ N., Long. 81° 25′ 30″ W., by account; chro. time, 6^h 22^m 52^s; obs. \bigcirc 75° 13′, bearing south and east; 1. C. -3' 00″; height of the eye, 25 feet; chro. corr. -2^{m} 36^s. Find the latitude.

Chro. t., C. C.,		$6^{\rm h}$	$\frac{22^{m}}{2}$	$\frac{52^{s}}{36}$	Obs. a Corr.	lt.⊙,	75°	$7 \frac{13'}{7} \frac{0}{4}$	0″ De 0	ес.,	22	2° 45′	09″.9) N.	Eq. t.,	1^{m}	$28^{s}.85$
G. M. T., Eq. t.,	+	6	$\frac{20}{1}$	$\frac{16}{26}$	h,		75	20 4	– H. 0 G.	. D., М. Т	`., + 		14″.6 6 ^h .3	3 3 —	H. D., G. M. T.	,+	0*.46 6 ^h .3
G. A. T., Long.,	_	$\frac{6}{5}$	21 25	42 42	S. D., dip,		+	15' 4 4' 5	8″ Co 4″	orr.,	$\{^+_+$	1′	91″.9 32″	.	Corr., Eq. t.,	 1 ^m	$2^{s}.85$ $26^{s}.0$
L. A. T. =	, {	0 ^h 14°	56 ^m 00′	[•] 00 [*] E. 00″	р. « 1 І.С.,	*, -		$\frac{1}{3 \ 0}$	$\frac{4}{0}$	ес.,	21	2° 46′	42″	N.	(Add to	mean	time.)
					Corr.	, .	+	7' 4	0″								
				t d	$ \begin{array}{r} 14^{\circ} \ 00' \\ 22 \ 46 \end{array} $	00'' 42		sec tan	$.01 \\ 9.62$	$\frac{310}{317}$		cosec	.4	1210			
				h φ″	$\begin{array}{ccc} 75 & 20 \\ 23 & 24 \end{array}$	40 07 N		tan	9.63	627		$\sin \sin$	$9.9 \\ 9.5$	$8563 \\ 9898$			
				φ'	7 02	30 N	•					\cos	9.9	9671			
				Lat.	30 26	37 N											

EXAMPLE: May 28, 1879, p. m., in Lat. 6° 20' S. by account, Long. 30° 21' 30" W.; chro. time, 7^h 35^m 10°; observed altitude of moon's upper limb, 75° 33' 00", bearing north and east; I. C., -3' 00"; height of eye, 26 feet; chro. fast of G. M. T., 1^m 37^s.5. Required the latitude.

Chro. t.,	7h (5 ^m 10,		Obs	s. alt. C.	75°	33'	00″	R. A. ((),	10 ^h	$21^{m} 0$	7*.78	Dec.,	6° 49′ 52	2".4 N.
C. C., G. M. T.,	7	1 37.5 33 32.5		S. I Au	D., g.,	_	$15'_{0}$	51″ 16	M. D., No. min.	,+	33	2*.06 5.54	M. D., No. min.,	- 14 33	".46 ^m .54
R. A. M. S., Red. (Tab. 9),	+ 4 :	1 14.5		dip I. (),), .	-	5 3	00 00	Corr.,	$+\overline{\left\{ \right. \right.}$	6 1 ^m 0	98.09 99	Corr.,	$-\overline{\left\{\begin{array}{c} 485\\ 8'\ 05\end{array}\right.}$,, ,,
G. S. T.,	11	57 24.3 19 17		1st	Corr.,	-	24	07	R A	104	99m 1	78	Dec.,	6° 41′ 47	" N.
H. A. from Gr. Long., t,	$ \begin{array}{c} 1 \\ 1 \\ 2 \\ 6^{\circ} \end{array} $	35 07 01 26 26m 19* 34' 45"	W. W. E.	Ар р. с h,	prox. alt., & <i>r</i> .(Tab.24),	$+\frac{75^{\circ}}{75}$	08' 14 23	53″ 37 30		.10			Hor. Par.,	58' 03	311
		t	6°	34'	45''	se	ec	.002	86						
		d	6	41	47	ta	n	9.069	73	co	sec	.9332	24		
		$\stackrel{h}{arphi^{\prime\prime}}$	$75 \\ 6$	$23 \\ 44$	30 26 N.	ta	n	9.072	59	siı siı	1	9.9857 9.0695	3 9		
		φ'	13	05	40 S.					co	s	9.9885	6		
		Lat.	6	21	14 S.		(

EXAMPLE: August 6, 1879, p. m., in Lat. 52° 47′ S. by D. R., Long. 146° 32′ E., observed altitude of Achernar, near lower transit, 24° 01′ 20″ bearing south and west; watch time, 6^h 48^m 22^s; C–W, 9^h 46^m 27^s; chro. corr. on G. M. T., $+ 1^m 57^s$; height of eye, 18 feet; I. C. + 1' 00″. Find the latitude.

Watch time, C–W, +	$\begin{array}{cccc} 6^{\rm h} \ 48^{\rm m} \ 22^{\rm s} \\ 9 \ 46 \ 27 \end{array}$	Obs. alt. Corr.,	* , 24° 01′ 20″ - 5 19	R. A. * , 1 ^h 33 ^m 15 ^s .3
Chro. t., C. C., +	$\begin{array}{rrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrr$	h, L C	$\frac{23}{4}$ 56 01 $\frac{1'}{100''}$	Dec., 01 00 20 p.
G. M. T., 5 ^a , R. A. M. S., + Red. (Tab. 9), +	$\begin{array}{cccccccccccccccccccccccccccccccccccc$	dip, ref.,	$\frac{4'09''}{210}$	
G. S. T., R. A. * ,	$\begin{array}{cccccccccccccccccccccccccccccccccccc$	Corr	- 6 19 - 5' 19"	
H. A. from Gr., Long.,	0 00 54 W. 9 46 08 E.	0011.,	0 10	
Н. А.,	9 47 02 W.			
<i>t</i> , {	2 ^h 12 ^m 58 ^s 33° 14′ 30″			

100

${d \atop d}$	33° 57	$\frac{14'}{50}$	$\frac{30''}{28}$	sec . 07760 tan . 20153	cosec	. 07233
h 180°- φ''	$\begin{array}{c} 23 \\ 117 \end{array}$	$\begin{array}{c} 56 \\ 44 \end{array}$	01 18 S.	tan . 27913	$\sin \sin \sin \theta$	$\begin{array}{c} 9.\ 60818\\ 9.\ 94699 \end{array}$
φ'	64	54	15 N.		\cos	9.62750
Lat.	$\overline{52}$	50	03 S.			

BY THE POLE STAR.

340. This method, confined to northern latitudes, is available when the star Polaris and the horizon are distinctly visible, the time of the observation being noted at the moment the altitude is measured. Two methods will be given. The first is sufficiently precise for nautical purposes, involving the computation of the formula:

$$L = h - p \cos t$$

in which.

h = true altitude, deduced from the observed altitude:

 $p = polar distance = 90^{\circ} - d$, the apparent declination being taken from the Nautical Almanac for the date:

t = star's hour angle.

Find the right ascension and declination of Polaris from the Nautical Almanac; then find the hour angle in the usual way.

To the log cosine of the hour angle add the logarithm of the polar distance in minutes; the number corresponding to the resulting logarithm will be a correction in minutes to be subtracted from the star's true altitude to find the latitude.

Attention must be paid to the sign of the correction $p \cos t$. If t is more than 6^h and less than 18^h . the sign of $\cos t$ is -; hence the formula becomes arithmetically:

$$L = h + p \cos t$$
.

EXAMPLE: June 11, 1879, from an observed altitude of Polaris the true altitude was found to be 29° 5′ 55″. The time noted by a Greenwich chronometer was 13^h 41^m 26^s; chro. corr. — 2^m 22^s; Long. 5^h 25^m 42^s W.

Chro. time, C. C.,	$-\frac{13^{h} 41^{n}}{2}$	$^{\mathrm{n}}$ $rac{26^{\mathrm{s}}}{22}$	$h, p \cos t,$	$29^{\circ}\ 05'\ 55''$ + 1 19 54	R. A. * ,	1 ^h 14 ^m 04 ^s
G. M. T., 11 ^d , R. A. M. S., Red. (Tab. 9),	$\begin{array}{rrrr} 13 & 39 \\ + & 5 & 17 \\ + & & 2 \end{array}$	$04 \\ 49 \\ 15$	Lat.,	30 25 49 N.	p,	$ \begin{array}{c} 88^{\circ} 39' 47'' \text{ N.} \\ \left\{ 1^{\circ} 20' 13'' \\ 80'.2 \\ 1 00117 \\ \end{array} \right. $
G. S. T., R. A. ★,	$ \begin{array}{r} 18 59 \\ - 1 14 \end{array} $	08 04			<i>p</i> , 30.2 <i>t</i> , 175° 09′ 30	$m_{\rm cos}^{100} (-) \frac{1.90417}{9.99845}$
H. A. from Gr. Long.,	, $17 45 \\ 5 25$	04 W. 42 W.			$p\cos t, -\begin{cases} 79\\1^\circ \end{cases}$	'.9 log (—) 1.90262 19′ 54″
н. А.,	12 19	22 W.				
t,	$\left\{ \begin{array}{c} 11^{h} 40^{h} \\ 175^{\circ} 09^{h} \end{array} \right\}$	^m 38 ^s E. ' 30″				

341. The second method is more rigorous, and should be employed when greater accuracy is sought. It is embodied in Table 28.

Reduce the observed altitude of the star to the true altitude. Find from the Nautical Almanac the apparent right ascension and declination of the star at the time of observation. Find the hour angle in the usual manner.

With the hour angle take out the *first correction*, A, from Table 28, giving to it the sign — when the hour angle is numerically less than 6^h; the sign + when the hour angle is greater than 6^h. With the hour angle and altitude take out the *second correction*, B, from Table 28. The sign of this correction is always +. (If the altitude is greater than 60°, this correction may be found by taking that for 45° and multiplying it by the tangent of the altitude; adding, if desirable, the second term in the expression for B, viz: $+0^{\prime\prime}.0076 \sin^4 t \tan^3 h.$)

With B and the declination take out the third correction, C, from Table 28, giving it the sign +

when the declination is less than 88° 48'; — when the declination is greater than 88° 48'. With A and the declination take out the *fourth correction*, D, from Table 28, giving it the same sign as that of A when the declination is less than 88° 48'; the opposite sign when the declination is greater than 88° 48'.

Combine these corrections with the true altitude according to their signs; the result is the latitude of the place of observation.

If, when several sights are taken, great precision is required, or the intervals are great, it will be necessary to take out the *first* and *second* corrections for each observation separately; in other cases the mean of the times may be used. The means of these two corrections may always be used for finding the *third* and *fourth* corrections; and these four quantities may be combined with the mean of the altitudes.

If the nearest 10" suffices for each, the corrections may be taken out for the nearest arguments If the hearest 10" suffices for each, the corrections may be taken out for the hearest arguments without interpolation, and all but the *first* may thus be taken out when a precision of 3" is required. If a precision of 1' is sufficient for each correction, as is ordinarily the case at sea, an hour angle within 3^m will suffice for A; C and D may be neglected, and B used only when the altitude exceeds 47°. EXAMPLE: January 1, 1903, about 9 p. m., Longitude 79° 54' 07" W., observed double altitude of Polaris with artificial horizon, 81° 57' 20"; chro. time 1^h 55^m 12^s; chro. corr. on G. M. T. + 1^m 07^s; I. C. -0' 50". (The necessary quantities, taken from the Nautical Almanac for 1903, are given

below.) Required the latitude.

Chro. time, C. C.,	1 ^h +	55 ^m 1	$ 12^{s} \\ 07 $	Obs. 2 alt. ★, I. C.,		81°	$57' \\ 0$	$\frac{20''}{50}$
G. M. T.,	13	56	19		$\overline{2}$)81	56	30
R. A. M. S., Red. (Tab. 9),	+18 $+$	2	50.9 17.4	rof	-	40	58	15
G. S. T., B. A. * .	8	$\frac{38}{24}$	27.3 33.3	h.		40	57	$\frac{07}{08}$ -
H. A. from Gr.,	7	13	54 W.	Â, B,	- +	1	03	13. 9 08. 9
Long.,	5	19	37 W.	С, D,				$\begin{array}{c} 00.\ 0\\ 15.\ 7 \end{array}$
Н. А.,	1	54	17 W.	Lat.,	-	39	53	47 N.

R. A. *, 1^h 24^m 33^s.3

Dec., 88° 47′ 42″ N.

LONGITUDE.

CHAPTER XIII. LONGITUDE.

342. The *longitude* of a position on the earth's surface is measured by the arc of the equator intercepted between the *prime meridian* and the meridian passing through the place, or by the angle at the pole between those two meridians.

Meridians are great circles of the terrestrial sphere passing through the poles.

The prime meridian is that one assumed as the origin, passing through the location of some principal observatory, such as Greenwich, Paris, or Washington. That of Greenwich is the prime meridian not only for English but also for American navigators, and those of many other nations.

Secondary meridians are those connected with the primary meridian, directly or indirectly, by exchange of telegraphic time signals.

Tertiary meridians are those connected with secondaries by carrying time in the most careful manner with all possible corrections.

Longitude is found by taking the difference between the hour angle of a celestial body from the prime meridian and its hour angle, at the same instant, from the local meridian. In determinations ashore the hour angle from the prime meridian may be found either from chronometers or from telegraphic signals; the local hour angle may be found by transit instruments or by sextant. In determinations at sea the chronometer and sextant give the only means available.

DETERMINATION ASHORE.

343. TELEGRAPHIC DETERMINATION OF SECONDARY MERIDIANS.—In order to locate with accuracy the positions of prominent points on the coasts, it is necessary to refer them, by chronometric measurements, to secondary meridians of longitude which have been determined with the utmost degree of care.

Before the establishment of telegraphic cables, this was attempted principally through the observation of moon culminations, which seemed always to carry with them unavoidable errors, or by transporting to and fro a large number of chronometers between the principal observatory and the position to be located; and in this method it can be conceived that errors would be involved, no matter how thorough the theoretical compensation for error of the instruments.

By the aid of the electric telegraph, differences of longitude are determined with great accuracy, and an ever-increasing number of secondary meridional positions are thus established over the world; these afford the necessary bases in carrying on the surveys to map correctly the various coast lines, and render possible the publication of reliable and accurate navigators' charts.

344. To determine telegraphically the difference of longitude between two points, a small observatory containing a transit instrument, chronograph, break-circuit sidereal chronometer, and a set of telegraph instruments is established at each of the two points, and, being connected by a temporary wire with the cable or land line at each place, the two observatories are placed in telegraphic communication with each other.

By means of transit observations of stars, the error of the chronometer at each place on its own local sidereal time is well determined, and the chronometers are then accurately compared by signals sent first one way and then the other, the times of sending and receiving being very exactly noted at the respective stations. The error of each chronometer on local sidereal time being applied to its reading, the difference between the local times of the two places may be found, and consequently the difference of longitude. The time of transmission over the telegraph line is eliminated by sending signals both ways. By the employment of chronometers keeping sidereal time, the computation is simplified, though mean-time chronometers may be used.

345. ESTABLISHMENT OF TERTIARY MERIDIANS.—Let it be supposed that the meridional distance between A and B is to be measured, of which A is a *secondary* meridional position accurately determined, and B a *tertiary* meridional position to be determined.

If possible, two sets of observations should be taken at A to ascertain the events and rates of the chronometers. The run is then made to B, and observations made to determine difference of longitude; and on the same spot altitudes of the sun, or of a nuboth, should be taken to determine the latitude.

Now, if chronometer rates could be relied on to be uniform, this measurement would suffice, but since variations may always arise, the run back to A should be made, or to another secondary meridional position, C, and new rates there obtained. Finally, the errors of the chronometers on the day when the observations were made at the tertiary position should be corrected for the loss or gain in rate, and for the difference of the errors as thus determined.

When opportunity does not permit obtaining a *rate* at the secondary meridional station or stations, both before and after the observations at B, the navigator may obtain the *errors* only, and assume that the rate has been uniform between those errors.

A modification of the foregoing method that may sometimes prove convenient is to make the first and third sets of observations at the position of the tertiary meridian, and the intermediate one at the secondary meridian; in this case the error will be obtained at the secondary station, and the rate at the tertiary. EXAMPLE: A vessel at a station A, of known longitude, obtained chronometer errors as follows:

May 27, noon, chro. slow, 7^m 18^s.9, June 3, noon, chro. slow, 7 12.7;

then proceeding to a station B a series of observations for longitude was taken on June 17; after which, returning to A, the following errors were obtained:

July 3, noon, chro. slow, 7^m 00°.7, July 10, noon, chro. slow, 6 59 .8.

Required the correct error on June 17.

May 27, June 3,	-7^{m} -7	${18^{ m s}.9}\ {12}\ .7$	July 3, July 10,	-7^{n} -6	" 00".7 59 .8
Change,	+	6.2	Change,	+	0.9
Daily rate,	+	0 ^s .89	Daily rate,	+	$0^{\rm s}.13$

Therefore, assuming that these rates were correct at the middle of the periods for which they were determined, we have.

May 30,	Midnight,	Rate,	$^{+0^{ m s}.89}_{+0.13}$
July 6,	Midnight,	Rate,	

Change of rate, 37 days. -0.76

Daily change of rate, $-0^{\circ}.021$

Change of rate for $3\frac{1}{2}$ days, $-0^{*}.07$; rate June 3, noon, $+0^{*}.89-0^{*}.07=+0^{*}.82$ Change of rate for $17\frac{1}{2}$ days, $-0^{*}.37$; rate June 17, noon, +0.89-0.37=+0.52

Mean daily rate, June 3 to 17,	+0.6
Total ehange of error, June 3 to 17, Error, June 3,	$+0^{m} 09^{s}.38$ -7 12.7
Error, June 17,	-7 03 3

346. SINGLE ALTITUDES.-The determination of longitudes ashore by single altitudes of a celestial body is identical in principle with the determination at sea by that method, which will be explained hereafter (art. 349). It may be remarked, however, that by taking observations on opposite sides of the meridian, at altitudes as nearly equal as possible, a means is afforded, which is not available at sea,

of eliminating certain constant errors of observation. **347.** EQUAL ALTITUDES.—The method of equal altitudes, explained in article 321, Chapter XI, is available for the determination of longitudes as well as for chronometer error. In the case of the sun, available for the determination of longitudes as well as for chronometer error. In the case of the sun, the sight gives the chronometer time of L. A. noon or midnight; applying the chronometer correction and equation of time (the latter with its sign for mean time), we obtain the G. A. T., which equals the longitude, if west, or 24^{h} minus the longitude, if east. For any other body, the sight gives the chro-nometer time of transit; apply the chronometer correction and there results G. M. T., which may be reduced to G. S. T.; the difference between the latter and the R. A. of the body (this being L. S. T.), is the longitude.

EXAMPLE: April 20 p. m. and April 21 a. m., 1879, in Lat. 30° 25′ N., Long. (approx.) 81° 26′ W., chro. corr. -3^m 11^s.4, observed times and equal altitudes of the sun as stated below; C–W for p. m. sights, 5^h 31^m 58^s.5, and for a. m. sights, 5^h 32^m 01^s. Required the longitude.

	WAT	сн,	Р. М.	ALTS.	W2	ATCH	н, А. М.					
	2 ^h	51 ^m	40 *	90° 0'	s	h 591	n 00 s	Dec.	110	29' 17".1 N	H D (20th)	+ 51// 15
		52	05	89 50		58	34 .5	,			H D (21st)	1 50 .07
		52	30	40		58	09.5	H. D. at Mid.	+	51// 10	··· ·· (215t),	,700.91
		52	55	30		57	46.0	Long. +1%		17h 43	Diff 9th	0 10
		53	20	20		57	20.0				Diii. 21°,	- 0 .48
Mean, W. T., P. M.	, 2 ^h	52m	30 .0	Mean, W. T., A. M.	, 8	h 581	n 10s	Corr.,	+ {	890″.7 14′ 51″	Diff. 1h,	- 0".02
C – W,• •	+5	31	58.5	C - W,	+ 5	32	01			-	Diff 17h 43	- 0// 35
					_		•	Dec.,	11° 4	14' 08" N.		- 0 .00
P. M. Chro. T.,	8	24	2	A. M. Chro. T. +12h	, 26	30	11.0				H. D. at Mid	+51// 10
A. M. Chro., T. +12	^h , 26	30	3	P. M. Chro. T.,	8	24	28.5					
	2)10	54	39.5	Elapsed Time,	18	05	42 ,5					
Mid. Chro. T.,	5	27	19.75									
Eq. eq. alt.,	+		19.35	Eq. t.,		10	° 04∎.9	Tab. 37]	log A	(+)9.9364	log B(-)9.7912
Chrot L A Mid	5	97	20 1	нр	. –		0. 54	Lat 30º 25/ 1	lan	$(\pm)9.7687$	10g (+)1.7084
Fa t	, 0	1	14 2	Long ± 125	+-		175 49	1.1111 00 10 1		(+)5.1001	atin (+)5.0170
134		*	14.0	nong, $\pm 12^{\circ}$,			17",40	1st Part +25*	.91 log	(+)1.4135		
Chro. t., L. M. Mid.	, 5	28	53.4	Corr.,	+		9=.4	2d I'art - 6	.56	(1)======	log (-)0.8171
C. C.,		3	11.4		·							
				Eq. t.,		1"	14 .3	Eq. eq. +19	.35			
Long., W.,	${5^{h}}{81^{\circ}}$	25m 25'	42*.0 30″	(Plus to mea	n tir	ne.)		,)				
34S. In the same example the equation of equal altitudes may be found by the less exact method heretofore given (art. 324), as follows:

Change in declination between sights = H. D. \times Elapsed time = 51".10 \times 18^h.1 = 925". Change in altitude due to 100" declination (Tab. 25) = +53".

$$h' = + \frac{53 \times 925}{100 \times 60} = + 8'.19.$$

$$t' = + \frac{2^{h} 53^{m} 20^{s} - 2^{h} 51^{m} 40^{s}}{90^{\circ} 00' - 89^{\circ} 20'} = + \frac{100^{s}}{40'} = + 2^{s}.5.$$

Eq. eq. alt. = + 8.19 × 2^{s}.5 = + 20^{s}.5.

DETERMINATION AT SEA.

349. THE TIME SIGHT.—The method of determining longitude at sea which is employed almost to the exclusion of all others is that of the *time sight*, sometimes called the *chronometer method*. The altitude of the body above the sea horizon is measured with a sextant and the chronometer time noted; the hour angle of the body is then found by the process described in article 316, Chapter XI.

If the sun is observed, the hour angle is equal to the local apparent time; the Greenwich apparent time may be determined by applying the equation of time to the Greenwich mean time as shown by the chronometer; the longitude is then equal to the difference between the local and the Greenwich apparent times, being east when the local time is the later, and west when it is the earlier of the two.

If any other celestial body is employed, the hour angle from the local meridian, found from the sight, is compared with the hour angle from the Greenwich meridian to obtain the longitude; the Greenwich hour angle is found by converting the Greenwich mean time into Greenwich sidereal time in the usual manner, and then taking the difference between the latter and the right ascension of the body, the remainder being marked east or west, according as the Greenwich sidereal time is the lesser or greater of the two quantities; and as the local hour angle may be marked east or west according to the side of the meridian upon which it was observed, the name of the longitude will be indicated in combining the quantities.

350. As has been stated, the most favorable position of the celestial body for finding the hour angle from its altitude is when nearest the prime vertical, provided the altitude is not so small as to be seriously affected by refraction.

351. In determining the longitude at sea by this method, it is necessary to employ the latitude by account. This is seldom exactly correct, and a chance of error is therefore introduced in the resulting hour angle; the magnitude of such an error depends upon the position of the body relatively to the observer. The employment of the Summer line, which is to be explained in a later chapter, insures the navigator against being misled from this cause, and its importance is to be estimated accordingly.

biserver. The employment of the sum of the sum of the stander the constant of the estimated accordingly. EXAMPLE: At sea, May 18, 1879, a. m.; Lat. 41° 33′ N.; Long. 33° 30′ W., by D. R., the following altitudes of the sun's lower limb were observed, and times noted by a watch compared with the Greenwich chronometer. Chro. corr., + 4^m 59^s.2; I. C., - 30″; height of the eye, 23 feet; C-W, 2^h 17^m 06^s.

W. T.,	71	20 ⁿ 20 20 21	47) 47) 14	Obs. alt.	, 2	9° 35′ 41 46	30" 20 10	Dec., H. D.,	19° 32' +	01".8 N.	Eq. t., $3^{m} 47^{*}.68$ H. D., $-0^{*}.09$ C. W. T. 2b. 2
Mean, C – W, +	7 2	20 17	45.3 06	Mean, Co rr. ,	2	9 41 9	00 05	Corr.,		76".1	Corr., $+$ 0°.21
Chro. t., C. C., +	9	37 4	51.3 59.2	h,	2	9 50	05	Dec.,	19° 30'	46″ N.	Eq. t., $3^m 47^s .9$
G. M. T., 17 ^d , Eq. t., +	21	42 3	50.5 47.9	S. D.,	+	15'	51"	р,	70° 29'	14″	(1 tas to mean time.)
G. A. T.,	21	46	38.4	ар, р. & r., І. С.,	-	1 0	34 30				
				Corr.,	+	6 	46 05″				
			$egin{array}{c} h \ {f L} \ p \end{array}$	2 4 7	$9^{\circ} 50 \\ 1 33 \\ 0 29$	$' 05' \\ 00 \\ 14$	_	8	ec cosec	$.12588 \\ .02569$	
			8	$\frac{2)14}{7}$	$ \frac{1 52}{0 56} $	19 09	-	C	208	9.51406	
			s-h	4	1 06	04	-	8	in	$\frac{9.81782}{2)19.48345}$	
			G. A. L. A.	\mathbf{T} . $\frac{2}{1}$ \mathbf{T} . $\frac{1}{f}$	$\frac{1^{h}}{9}$ $\frac{46}{32}$ $\frac{2^{h}}{2^{h}}$ $\frac{14}{14}$	07 11 31*	- - -	s	in ½ t	9.74172	
			noug.	<u></u>]3	3° 37	45	·/ ···				

EXAMPLE: At sea, April 16, 1879, p. m., in Lat. 11° 47′ S., Long. 0° 20′ E., by D. R., observed an altitude of the star Aldebaran, west of the meridian, 23° 13′ 20″; chronometer time, 6^h 56^m 32^s; chronometer fast of G. M. T., 2^m 27^s; I. C. -2' 00″; height of eye, 26 feet. What was the longitude?

Chro. t., 6^{h}	$56^{m} 32^{s}$	Obs.alt. *, 28	3° 13′ 20″ R. A	$\star, \star, 4^{h} 28^{m} 59^{s}.6$
0.0.,	2 21	Corr., —	Dec.	, 16° 15′ 59″ N.
G. M. T., 6	54 05	h, 23	6 04 04	1009 15/ 50//
R. A. M. S., $+1$ Red. (Tab. 9).+	1 08.0	I. C.,	$\frac{p}{2' \ 00''}$ p,	106° 15′ 59″
		dip, —	$\frac{1}{5}$ 00	
G. S. T., 8	32 14.9	ref., —	2 16	
R. A. ¥, 4	28 59.6	Corr —	9.16	
H.A. from Gr., 4	03 15 W.	cont,	0 10	
	h	23° 04′ 04″		
	L	$11 \ 47 \ 00$	sec . 00925	
	p	100 15 59	cosec .01//4	
	2)141 07 03		
	8	70 33 32	cos 9 52223	
	s - h	47 29 28	sin 9.86757	
			9)10 41670	
	Gr. H. A	. 4 ^h 03 ^m 15 ^s W.	2)15.41075	
	H. A.	4 05 50 W.	$\sin \frac{1}{2}t$ 9.70839	
	Long.	$\begin{cases} \overline{\begin{smallmatrix} 0^{h} & 02^{m} & 35^{s} \\ 0^{\circ} & 38' & 45'' \end{cases}} E.$		

EXAMPLE: At sea, April 17, 1879, a. m., in Lat. 25° 12' S., Long. 31° 32' W., by D. R., observed an altitude of the planet Jupiter, east of the meridian, 45° 40'; watch time, 5^{h} 48^m 02^s; C -W, 2^{h} 05^m 42^s; C. C., $+2^{m}$ 18^s; I. C., +1' 30"; height of eye, 18 feet. Required the longitude.

W. T., 5h 48m 02s	Obs. alt. *,	45° 40' 00"	R.A. (17d 0h),	22 ^h 27 ^m 19 ^s .0	Dec. (17d 0h), 10° 36′ 28″.1 S.
C-W, $2 \ 05 \ 42$ Chro. t., $7 \ 58 \ 44$ C. C., $+ \ 2 \ 18$	Corr., h, I. C.,	- 3 36 45 36 24 + 1' 30''	H. D., G. M. T., Corr.,	+ 1s.8 - 4 ^b .1 - 7 ^s .4	H. D., G. M. T., Corr	$ \begin{array}{c} + & 10''.0 \\ - & 4^{h}.1 \\ - & 41''. \end{array} $
G. M. T., 16^{a} , 19 56 02 R. A. M. S., 0^{b} , $+1$ 37 01.9 Red. (Tab. 9), $+$ 3 16.5 G. S. T. 21, 36, 20.4	dip, ref.,	$ \begin{array}{r} - & 4' \ 09'' \\ - & 0 \ 57 \\ - & 5 \ 06 \end{array} $	R. A.,	22h 27m 11s.6	Dec., p,	10° 37' 09" S. 79° 22' 51"
R. A. $*$, 22 27 11.6 H. A. from Gr., 0 50 51 E.	Corr.,	- 3' 36"				
	$egin{array}{c} h \ {f L} \ p \end{array}$	$\begin{array}{c} 45^{\circ} \ 36' \ 24'' \\ 25 \ 12 \ 00 \\ 79 \ 22 \ 51 \end{array}$	sec cosec	.04343 .00750		
	s s - h	$\begin{array}{cccccccccccccccccccccccccccccccccccc$	$\cos \sin i n$	$\begin{array}{c} 9.\ 41032\\ 9.\ 69217\end{array}$		
	Gr. H. H. A.	A. 0^{h} 50 ^m 51 ^s] 2 57 21	E. E. sin 1	$2)\overline{19.15342} \\ t 9.57671$		
	Long.	$\begin{cases} 2^{\rm h} \ 06^{\rm m} 30^{\rm s} \\ 31^{\circ} \ 37' \ 30'' \end{cases}$	}w.			

LONGITUDE.

EXAMPLE: At sea, June 26, 1879, p. m., in Lat. 49° 50′ N., Long. 6° 16′ W., by account, observed an altitude of the moon's lower limb 21° 18′ 10″, the body bearing east; chronometer time, $2^h 26^m 58^s$; chronometer slow of G. M. T., 42^s ; I. C., -1' 45''; height of eye, 22 feet. Find the longitude.

Chro. t.,	$2^{h} 26$	58 s	Obs. alt. <u>(</u> ,	2	1° 18′ 10″	R. A.,	11h 37m 41s.96	Dec.,	2° 35′ 36″.4 S.
С. С., н G. M. T.,	+ 2 27	42	S. D., Aug.,	++++	15' 59" 6	M. D., + No. min.,	2*.07 27 ^m .7	M. D., - No.min.,	- 15".1 27m.7
R. A. M. S., + Red. (Tab. 9), + G. S. T.,	+ 6 16 + 0 + 8 45	5 57.5 24.3 5 01.8	dip, L.C.,	+	16 05 4' 36" 1 45	Corr.:, + R. A.,	57*.34 11h 38m 39*.3	Corr., - Dec.,	$-\left\{\begin{array}{c} 419''.3\\ 6' 59''.3\\ \hline 2^{\circ} 42' 36'' & S. \end{array}\right.$
R. A. ((, H. A. from Gr.,	$\frac{11}{2}$ $\frac{38}{53}$	3 39.3 37- E.	1st corr	 +	6 21 9' 44"			p,	92° 42′ 36″
			Approx. alt., p. & r. (Tab. 2-	(1), $+\frac{1}{2}$	$ \begin{array}{r} 1^{\circ} 27' 54'' \\ 52 06 \\ 2 20 00 \end{array} $	Hor. par.,	58' 35"		
			$\begin{array}{c} h & 2\\ \mathbf{L} & 4\\ p & 9 \end{array}$	$2^{\circ} 20 \\ 9 50 \\ 2 42$	/ 00// 00 36	sec cosec	.19043 .00049		
			$2)\overline{16}$ $s = b$ 8 8 8		36 18 18	cos sin	9.11923 9.93799		
			Gr. H. A. H. A.	2 ^h 53 ⁱ 3 19	^m 37 ^s E. 04 E.	$\sin \frac{1}{2}t$	2)19.24814 9.62407		
			Long.	0 ^h 25 ^r 3° 21/	$\left[\frac{1}{45''}\right]^{W}$				

352. EQUAL ALTITUDES.—The method of finding the longitude at sea by observation of *equal altitudes* of a heavenly body is one that may be conveniently employed when applicable, though the limits of applicability are narrow.

If, on board a vessel which is either stationary in position or moving at a uniform rate of speed in a true east or west direction, equal altitudes of the sun, a planet, or a star be observed before and after transit, and the times noted by chronometer or watch, the interval from meridian being not greater than ten minutes of time and the altitude not less than 75° , the mean of the times will be the time (by the chronometer or watch used) of the meridian passage of the body; from this may be found the Greenwich mean time of transit and thence the longitude.

If (the limits of time and altitude remaining as stated) observations be taken when the body bears not less than 80° from the meridian, the time of meridian passage may with accurracy be regarded as equal to the mean of the times of observation, no matter what course may have been steered by the vessel in the interval.

But if the azimuth of the body is less than 80° from the north or south point of the horizon the method is not available for vessels making a material amount of northing or southing; and if the hour angle is greater than $10^{\rm m}$ or the altitude less than 75° , it can not be accurately employed by any vessel, no matter what course is steered. The navigator should not yield to the temptation offered by the simplicity of this method to follow it beyond the limits within which it may properly be considered to apply.

353. To deduce the longitude by this method take the mean of the watch times before and after transit, which will give the watch time of transit; correct this watch time in the usual manner for C-W and chronometer correction, from which is derived the Greenwich mean time of transit.

In the case of the sun, apply to the Greenwich mean time the equation of time, giving it its sign of application to mean time; the result is the Greenwich apparent time of transit, which is equal to the longitude if the latter is west, or to 24^h minus the longitude if east.

For other bodies, convert Greenwich mean time into Greenwich sidereal time by the usual method; the body being on the meridian, the local sidereal time is equal to the body's right ascension; the difference between Greenwich and local sidereal times is the longitude—east if the local time is greater, and west if it is less. EXAMPLE: April 2, 1879, in Lat. 3° 30' N., Long. 86° 00' E., by D. R., observed equal altitudes of \bigcirc before and after noon, using same sextant and same height of eye. Watch: a. m., 11^h 52^m 37^s; p.m., 12^h 07^m 22^s; C - W, 6^h 17^m 48^s; C. C., + 2^m 32^s. Vessel steering west between sights. Required the longitude at noon.

W. T., A. M., W. T., P. M.,	$\frac{11!}{12}$	$^{h} 52^{n} 07$	n 37 ^s 22	Eq. t., $3^{m} 42^{s} . 5$
	2)23	59	59	H. D., $-$ 0°.75 G. M. T., $-$ 5 ^h .7
W. T., L. A., noon, C-W,	$+ \frac{11}{6}$	$\frac{59}{17}$	$\begin{array}{c} 59.5 \\ 48 \end{array}$	Corr., $+ \frac{4^{*}.3}{4^{*}.3}$
Chro. t., L. A., noon, C. C.,	6 +	$\frac{17}{2}$	$\frac{47.5}{32}$	(Subtract from mean time)
G. M. T., L. A., noon, 1 ^d , Eq. t.,	18	$\frac{20}{3}$	$\begin{array}{c} 19.5 \\ 46.8 \end{array}$	
G. A. T., L. A., noon,	18	16	33	
Longitude,	$\left\{ \begin{array}{c} 5\\ 85 \end{array} \right.$	h 43 ° 51/	$\left(\frac{n}{45''}\right)^{\frac{27^{*}}{45''}}$ E.	

)

EXAMPLE: August 6, 1879, p. m., in Lat. 25° 55′ S., by obs., and Long. 36° 58′ W., by account, observed equal altitudes of the star Antares, the chronometer times before and after passage being $9^{h} 42^{m} 38^{s}$ and $10^{h} 00^{m} 26^{s}$, and the true azimuths S. 81° E. and S. 81° W., respectively; chro. fast of G. M. T., $1^{m} 27^{s}$. The ship was steaming on a course SSW. What was the longitude?

Chro. time before, Chro. time after,	ہ 10	$^{h} 42^{r}$	" 38 ^s 26
	$2)\overline{19}$) 43	04
Chro. time passage, C. C.,	- 6	$51 \\ 1$	$\frac{32}{27}$
G. M. T. passage, R. A. M. S., Red. (Tab. 9),		$50 \\ 50 \\ 58 \\ 1$	$\begin{array}{c} 05 \\ 36.3 \\ 36.9 \end{array}$
G. S. T. passage, L. S. T. passage (R. A.	*), 10	$\begin{array}{ccc} 3 & 50 \\ 3 & 22 \end{array}$	$18.2 \\ 03.4$
Longitude,	{3	2 ^h 28 ⁱ 7° 03	$[\frac{1}{45''}]^{n}$

CHAPTER XIV.

AZIMUTH.

AZIMUTH.

354. The azimuth of a body has been defined (art. 223, Chap. VII) as the arc of the horizon intercepted between the meridian and the vertical circle passing through the body; and the *amplitude* (art. 224) as the arc measured between the position of the body when its true altitude is zero and the east or west point of the horizon. The amplitude is measured from the east point at rising and the west point at setting, and, if added to or subtracted from 90°, will agree with the azimuth of the body when in the true horizon. The azimuth is usually measured from the north point of the horizon in north latitude, and from the south point in south latitude, through 180° to the east or west; thus, if a body bore N. by E., its azimuth would be named N. 11 $\frac{1}{4}$ ° E. in north, or S. 168 $\frac{3}{4}$ ° E. in south latitude. The determination of the azimuth of a celestial body is an operation of frequent necessity. At

The determination of the azimuth of a celestial body is an operation of frequent necessity. At sea, the comparison of the true bearing with a bearing by compass affords the only means of ascertaining the error of the compass due to variation and deviation; on shore, the azimuth is required in order to furnish a knowledge of the variation, and is further essential in all surveying operations, the true direction of the base line being thus obtained.

355. There are various methods of obtaining the true azimuth of a celestial body, which will be described as follows: (a) Amplitudes, (b) Time Azimuths, (c) Attitude Azimuths, (d) Time and Attitude Azimuths. A further method, by means of the Summer line, will be explained later (Chap. XV). Still another operation pertains to this subject, namely: (e) The determination of the True Bearing of a Terrestrial Object.

AMPLITUDES.

356. The method of obtaining the compass error by amplitudes consists in observing the compass bearing of the sun or other celestial body when its center is in the true horizon, the true bearing, under such conditions, being obtained by a short calculation. Since the true horizon is not marked by any visible line (differing as it does from the visible horizon by reason of the effects of refraction, parallax, and dip), allowance may be made for the difference by an estimate of the eye, or else the observation may be made in the visible horizon and a correction applied.

357. When the center of the sun is at a distance above the horizon equal to its own diameter it is almost exactly in the true horizon; at such a time, note its bearing by compass, and also note (as in all observations for determining compass error) the ship's head by compass, and the angle and direction of the ship's heel.

Or, note the bearing at the instant at which the center of the body is in the visible horizon; in the case of the sun and moon, the correct bearing at that time may be most accurately ascertained by taking the mean of the bearings when the upper and the lower limbs of the disk are just appearing or disappearing.

358. To find the true amplitude by computation there are given the latitude, L, and declination, d. The quantities are connected by the formula,

$\sin \operatorname{Amp.}=\operatorname{sec} \operatorname{L} \sin d$,

from a solution of which the amplitude is obtained.

D

To find the true amplitude by inspection enter Table 39 with the declination at the top and the latitude in the side column; under the former and opposite the latter will be given the true amplitude. To obtain accurate results, interpolate for minutes of latitude and declination.

To reduce the observed amplitude when taken in the visible horizon to what it would have been if taken in the true horizon, enter Table 40 with the latitude and declination to the nearest degree and apply the correction there found to the observed amplitude; the result will be the corrected amplitude by compass, which, by comparison with the true amplitude, gives the compass error. When the body observed is the sun, a star, or a planet, apply the correction, at rising in north latitude or at setting in south latitude, to the *right*, and at setting in north latitude or at rising in south latitude, to the *left*. For the moon, apply half the correction in a contrary direction.

EXAMPLE: At sea, in Lat. 11° 29' N., the observed bearing of the sun, at the time of rising when its center was estimated to be one diameter above the visible horizon, was E. 31° N.; corrected declination 22° 32' N. Required the compass error.

1	sy compation.		Dy inspection (1400e 59).
$\begin{array}{ccc} \mathrm{L} & 11^{\circ} \\ d & 22 \end{array}$	297 sec 32 sin	.00878 9.58345	L, 11°. 5 N. d, 22 .5 N. True Obsd. amp.	amp. E. 23°. 0 N. E. 31 . 0 N.
Obsd. amp.	E. 23° 017 N. sm E. 31 00 N.	9, 59223	Error,	8°.0 E.
Error,	7° 59′ E.			

EXAMPLE: At sea, in Lat. 25° 03′ S., the observed bearing of Venus when in the visible horizon at rising was E. 18° 30′ N., its declination being 21° 44′ N. Required the compass error.

By computation. By inspection (Table 39). 25° 03′ L, Τ. sec .0429021 44 \sin 9.56854 dE. 18°. 5 N. Obsd. amp. Comp. amp. E. 18.8 N. True amp. E. 24° 08' N. sin 9.61144 Corr. (Tab. 40) 0.3 left. Comp. amp. E. 18 48 N. 5°. 3 W. Error. Error. 5° 20′ W.

EXAMPLE: At sea, in Lat. 40° 27' N., the mean of the observed bearings of the upper and lower limbs of the moon when in contact with the visible horizon at setting was W. 17° S.; declination, 21° 12' S. What was the error of the compass?

By inspection (Table 39).
L, $40^{\circ}.5$ N. d, $21 \cdot 2 \cdot 5.$ Obsd. amp. W. 17^{\circ}.0 S. Corr. (Tab. 40) W. 17^{\circ}.0 S. Error, $11^{\circ}.7$ W. Comp. amp. W. 16 .7 S. $11^{\circ}.7$ W.

TIME AZIMUTHS.

359. In this method are given the hour angle at time of observation, t, the polar distance, p, and the latitude, L; to find the azimuth, Z.

Any celestial body bright enough to be observed with the azimuth circle may be employed for observation; the conditions are, however, most favorable for solution when the altitude is low.

360. Take a bearing of the object, bisecting it if it has an appreciable disk, and note the time with a watch of known error. Record, as usual, the ship's head by compass and the amount of heel. If preferred, a series of bearings may be taken with their corresponding times, and the means taken.

361. First prepare the data as follows:

 (a) Find the Greenwich time corresponding to the local time of observation.
 (b) Take out the declination of the body from the Nautical Almanac; if the method of computation is employed the polar distance and the co-latitude should be noted.

(c) Find the hour angle of the body by rules heretofore given.

This having been done, the true azimuth may be determined either by Time Azimuth Tables, by the graphic method of an Azimuth Diagram, or by Solution of the Astronomical Triangle. Owing to the possibility of more expeditions working, either of the first-named two is to be considered preferable to the last, and the navigator is recommended to supply himself with a copy of a book of Azimuth Tables, or with an Azimuth Diagram; an explanation of the method of use accompanies each of these.

362. To solve the triangle:

Let $S = \frac{1}{2}$ sum of polar distance and co-Lat. $D = \frac{1}{2}$ difference of polar distance and co-Lat. $\frac{1}{2}t = \frac{1}{2}$ hour angle. Z =true azimuth.

Then, $\tan X = \sin D \operatorname{cosec} S \operatorname{cot} \frac{1}{2} t;$ $\tan Y = \cos D \operatorname{sec} S \operatorname{cot} \frac{1}{2} t;$ $Z = X + Y, \text{ or } X \sim Y.$

First Case.—If the half-sum of the polar distance and co-Lat. is less than 90° : take the sum of the angles X and Y if the polar distance is greater than the co-Lat.; take the difference if the polar distance is *less* than the co-Lat.

Second Case.—If the half-sum of the polar distance and co-Lat. is greater than 90°: always take the difference of X and Y, which subtract from 180°, and the result will be the true azimuth. In either case, mark the true azimuth N. or S. according to the latitude, and E. or W. according

to the hour angle. It may sometimes be convenient to use the supplement of the true azimuth, by subtracting it from 180° and reversing the prefix N. or S., in order to make it correspond to the compass azimuth when the latter is less than 90°.

The cotangent of half the hour angle may be found from Table 44 abreast the *whole* hour angle in the column headed "Hour P. M."

EXAMPLE: December 3, 1879, a. m., in Lat. 30° 25′ N., Long. 5^b 25^m 42^s W., the observed bearing of sun's center was N. 135° 30′ E., and the Greenwich mean time, December 3, 2^b 36^m 11^s. The corrected declination of the sun was 22° 07′ S.; the equation of time (additive to mean time), 10^m 03^s. Required the error of the compass.

G. M. T. (Dec. 3), $2^{h} 36^{m} 11^{s}$ Long., $-5 25 42$	co-Lat., $59^{\circ} 35'$ p, 112 07	$\begin{array}{cccc}t & 2^{\rm h} \ 39^{\rm m} \ 28^{\rm s}\\ {\rm S} & 85^{\circ} \ 51'\\ {\rm D} & 26 & 16\end{array}$	$\cot \frac{1}{2}t$.44051 $\csc .00114$ $\sin 9.64596$	$\cot \frac{1}{2}t$.44051 $\sec 1.14045$ $\cos 9.95267$
L. M. T. (Dec. 2), 21 10 29 Eq. t., + 10 03	p+co-L, 171 42 S. 85 51	X 50 44 Y 88 19	$\frac{5.04550}{1000}$	tan 1.53363
L. A. T., $21 \ 20 \ 32$ $t, 2^h \ 39^m \ 28^s$	$p-\text{co-L}, \frac{52^\circ 32'}{26 - 16}$	X+Y 139 03		
	True azimuth, Comp. azimuth,	N. 139° 03′ E. N. 135 30 E.		

Compass error, 3 33 E.

EXAMPLE: April 9, 1879, in Lat. 2° 16' N., the observed bearing of the sun's center was N. 85° 15' E; sun's hour angle, $3^{h} 44^{m} 16^{s}$, and its declination, 7° 38' N. Required the compass error.

co-Lat., p,	87° 82	44' 22	${}^t_{ m S}$ D	$\frac{3^{h}}{85^{\circ}}$	44^{m} 03' 41	16^{s}	$\cot \frac{1}{2}$ $\cos e \cos \cos 2 \sin \sin$	t . 27372 . 00162 8. 67039	$\cot rac{1}{2}$ sec \cos	t . 27372 1. 06406 9. 99952
р+со-L, S,	.85	06 03	X Y	5 87	$ \begin{array}{c} 03 \\ 22 \end{array} $		tan	8.94573	tan	1. 33730
$\operatorname{co-L}-p$,	5°	22′	Y —	X 82	19					
D,	2	41	True Comp Comp	azimu 5. azin 5. asin	ith, nuth ror.	N. 8 , N. 8		E. E. V.		

EXAMPLE: April 26, 1879, Lat. 16° 32' S., observed bearing of Venus 56° 00' W., its hour angle being 4^h 27^m 31^s, and its declination 23° 12' N. What was the error of the compass?

co-Lat.,	73° 28′	t	$4^{h} 27^{m} 31^{s}$	$\cot \frac{1}{2}$	t - 18022	eot ½	t = .18022
p,	$113 \ 12$	s	93° 20′	cosec	.00074	sec	1.23549
		D	$19 \ 52$	\sin	9.53126	COS	-9.97335
p + co-L,	186 - 40						
		X	$27 \ 16$	tan	9.71222		
s,	$93 \ 20$	Y	87 40			tan	1.38906
_							
p - co-L,	. 39° 44′	Y - X	60 24				
D	10 50		1100.004				
D,	19 52	Z	119° 36′		•		
		True	azimuth, S.	119° 36⁄	W.		
		Comp	. azimuth, S.	124 00	W.		
			,				

ALTITUDE AZIMUTHS.

4 24 W.

363. This method is employed when the altitude of the body is observed at the same time as the azimuth; in such a case the hour angle need not be known, though the time of observation should be recorded with sufficient accuracy for the correction of the declination of the sun, moon, or a planet.

There are given the altitude, h, the polar distance, p, and the latitude, L; to find the azimuth, Z. **364.** Take a bearing of the body by compass, bisecting it if the disk is of appreciable diameter, and simultaneously measure the altitude; note the time approximately. Observe also the ship's heading (by compass) and the heel.

Or a series of azimuths, with corresponding altitudes, may be observed, and the mean employed. **365.** Calculate the true altitude and declination from the observed altitude and the time. Then compute the true azimuth from the following formula:

$$\cos \frac{1}{2} \mathbf{Z} = \sqrt{\cos s \cos (s - p) \sec \mathbf{L} \sec h},$$

in which $s = \frac{1}{2}(h + L + p)$. The resulting azimuth is to be reckoned from the north in north latitude and from the south in south latitude.

It may occur that the term (s-i) will have a negative value, but since the cosine of a negative angle less than 90° is positive, the result will not be affected thereby.

EXAMPLE: December 3, 1879, in Lat. 30° 25' N., the observed bearing of the sun's center was N. 135° 30' E., and its corrected altitude 24° 59'; the approximate G. M. T. was 2^h.6, the declination at that time being 22° 07' S. Required the compass error.

$egin{array}{c} h \ {f L} \ p \end{array}$	$\diamond 24^{\circ} 59 \\ 30 \ 25 \\ 112 \ 07$	sec sec	. 04267 . 06431	
8 8—1)	$ \begin{array}{r} 2)167 & 31 \\ \hline 83 & 45 \\ -28 & 22 \end{array} $	COS COS	9. 03690 9. 94445	
		2) 19.08833	
$\frac{1}{2}$ Z	69 30 139 00	cos	9, 54416	

TIME AND ALTITUDE AZIMUTHS.

366. When, at the time of observing the compass bearing of a celestial body, the altitude is measured and the exact time noted, the true azimuth may be very expeditiously determined, a knowledge of the latitude being unnecessary

In view of the simplicity of the computation this method strongly commends itself to observers not provided with an azimuth table or diagram.

367. The observation is identical with that of the altitude azimuth (art. 364), with the exception that the times of observation must be exactly instead of approximately noted.

368. Ascertain the declination of the body at time of sight, and correct the observed altitude; compute the hour angle. We then have:

$\sin Z = \sin t \cos d \sec h$.

from which the azimuth may be found.

This method has a defect in that there is nothing to indicate whether the resulting azimuth is

measured from the north or the south point of the horizon; but as the approximate azimuth is always known, cases are rare when the solution will be in question. EXAMPLE: December 3, 1879, in Lat. 30° 25′ N., Long. 5^h 25^m 42^s W., the observed bearing of the sun's center was N. 135° 30′ E.; its altitude at the time was 24° 59′; hour angle, 2^h 39^m 28^s (39° 52′), and declination 22° 07′ S. Find the compass error. (See example under Altitude Azimuths and first example under Time Azimuths.)

t	39° 52′	$\sin 9.80686$	True azimuth,	N.	139°	04'	Е.
d	22 07	$\cos 9.96681$	Comp. azimuth,	N.	135	30	\mathbf{E} .
h_{-}	24 59	sec . 04267					
•					3	34	E.
ZS	. 40° 56′ E.	$\sin 9.81634$					

TRUE BEARING OF A TERRESTRIAL OBJECT.

369. Thus far, sea observations for combined variation and deviation have been discussed, but if it becomes necessary, as in surveying, to ascertain the True Bearing of a Terrestrial Object, or to find the variation at a shore station, more accurate methods than the foregoing must be resorted to.

The most reliable method is that by an Astronomical Bearing. This consists in finding the true bearing of some well-defined object by taking the angle between it and the sun or other celestial body with a sextant or a theodolite, and simultaneously noting the time by chronometer, or measuring the altitude, or observing both time and altitude. It should always be noted whether the object is right or left of the sun.

370. By Sextant.-Measure the angular distance between the object and the sun's limb; and if there is a second observer, measure the altitude of the sun at the same moment and note the time. In the absence of an assistant, first measure the altitude of the sun; next, the angular distance between the sun and the object; then, a second altitude of the sun, noting the time of each observation. Also measure the altitude of the defined point above the sea or shore horizon.

By Theodolite.—This instrument is far more convenient than the sextant, for, being leveled, the horizontal angle between the sun and the object is at once given, no matter what may be the altitudes of the objects. In case the altitude of the sun is needed, it may be read accurately enough from the vertical circle, although not as finely graduated as the limb of the sextant. The error in altitude must, however, be found by the level attached to the telescope, since it will usually be found to differ from the levels of the horizontal circle. If, in directing the telescope to the sun, there is no colored eye-piece, an image of the sun may be cast on a piece of white paper held at a little distance from the eye-piece, and by adjusting the focus the shadow of the cross-wires will be seen.

It should be understood that any celestial body may be used as well as the sun, and there are, in fact, certain advantages in the use of the stars; the sun is chosen for illustration, because it will usually be found most convenient to employ that body.

AZIMUTH.

371. Find the true azimuth of the celestial body by any one of the methods previously explained in this chapter and apply to it the azimuth difference, or horizontal angle between the celestial and the

in this chapter and apply to it the azimuth difference, or norizontal angle between the celestial and the terrestrial body, having regard to the direction of one from the other. To find the azimuth difference from sextant observations, change the observed altitudes of the bodies into *apparent* altitudes by correcting them for index error of the sextant, dip, and semidiameter; change the observed angular distance into *apparent* angular distance, by correcting for index error and semidiameter. Then if $S = \frac{1}{2}$ (App. Dist. + App. Alt. \bigcirc + App. Alt. Object), we have:

 $\cos \frac{1}{2}$ Az. Diff. = $\sqrt{\text{sec App. Alt. } \odot \text{sec App. Alt. } Object \cos S \cos (S - App. Dist.)},$

whence the azimuth difference is deduced.

When the theodolite is used, the horizontal angle is given directly. If only one limb of the sun is observed, it will be necessary to apply the semidiameter, but it is usual to eliminate this correction by taking the mean of observations of both limbs.

EXAMPLE: December 10, 1879, a. m., in Lat. $30^{\circ} 25' 24''$ N., Long. $81^{\circ} 25' 24''$ W., made observations with a sextant and obtained the following data for finding the true bearing of a station:

Watch time, 11 ^h	¹ 22 ^m 36 ^s	Obs. Ang. Dist. [], 1	117° 07′ Left.	Dec. S., 22°	56' 27"
C - W, 5	$21 \ 18$	Obs. $2 \bigcirc$,	71° 37′ 20″	Eq. t., +	7 ^m 00 ^s
Chro. corr., $+$	2 16	Obs. alt. Station,	20'	S. D.,	16' 17"
•		I. C.,	zero.		

Required the true bearing of the object.

W. T., C – W,	11 ^h 5	22 ^m 21	36° 18	$2 \bigcirc,$	7	$1^{\circ} 37'$ 5 48	20″ 40	t d h	$\frac{8^{\circ}}{22}_{36}$	$\begin{array}{c} 08' \ 056 \ 203 \ 3 \end{array}$	00″ 27 37	sin 9.15069 cos 9.96422 sec .09239
Chro. t., C. C., +	+	43 2	16 10	8. D., Арр. А	+ .lt., 3	6 04	57	$Z \begin{cases} S. \\ N. \end{cases}$	9° 170	177 43	E. E.	sin 9.20730
G. M. T., Dec. 10, Eq. t., +	4	46 7	10 00	р. « r. h,	$, -\frac{1}{3}$	1 6 03	13 44					
G. A. T., Long., –	$\frac{1}{5}$	$\frac{53}{25}$	$ \begin{array}{c} 10 \\ 42 \end{array} $					·			•	
L. A. T.,	23	27	28									
t,	${0^{n} \\ 8^{\circ}}$	32 ^m '08'	$\frac{32^{s}}{00''}$									
Obs. Ang. Dist., 117	° 07'	00″	App.	Dist.	117°	23'			True	bearii	ng (),	N. 170° 43′ E.
⊙'s S. D., +	16	17	App.	Alt. ⊙	36	05	sec	0.09250	Az. D	iff.,		125 00 Left.
App. Ang. Dist., 117	23	17	App.	Alt. Object	2)153	20 48	sec	0.00001	True	beariı	ig object,	N. 45° 43' E.
			s		76	54	cos	9.35536				
			s — .	App. Dist.	40	29	cos 2)1	9.88115 19.32902				
			⅓ Az.	Diff.	620	30'	cos	9.66451				•
			Az.	Diff.	125	00						

EXAMPLE: Same date and place and same objects as in the preceding example; measurement made with a theodolite, angular distance \oplus , 123° 17′; object left of sun. Watch time, 11^h 16^m 34°.5; watch slow of L. A. T., 4^m 53°.5. Dec. \bigcirc , 22° 56′ S. Required the true bearing.

W. T., W. slow, -	11≞1 ⊢	6 ^m	34°.5 53 .5	eo-Lat.,	-59° -112	° 35′ 56	t S	0 ^h 86°	38 ^m 32 ^s 15′	$\cot \frac{1}{2}t$ cosec	$1.07435 \\ .00093$	$\cot \frac{1}{2} t$ sec	1.07435 1.18440
L. A. T.,	23 2	21	28.0	$v \pm \text{co-L}$. 172	31	D	26	41	\sin	9.65230	cos	9.95110
<i>t</i> ,	0 3	8	32	s,	86	15	X Y	79° 89	24⁄ 39	tan	.72758	tan	2.20985
				$p - \operatorname{co-L}$, 53	21	\mathbf{X} +	Y 169	03				
				D,	26	41							
					ue be z. Dif	earing f.,	⊙,	N. 169 123	° 03′ E. 17 Left	•			
				Tı	ue be	aring	object,	N. 45	46 E.				

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CHAPTER XV. THE SUMNER LINE.

DESCRIPTION OF THE LINE.

372. The method of navigation involving the use of the Sumner line takes its name from Capt. Thomas H. Sumner, an American shipmaster, who discovered it and published it to the world. As a proof of its value, the incident which led to its discovery may be related:

"Housing the bound of the second seco

The longitude by chronometer was determined, using this uncertain latitude, and it was found to be 15' E. of the position by dead reckoning; a second latitude was then assumed 10' north of that by dead reckoning, and toward the danger, giving a position 27 miles ENE. of the former position; a third latitude was assumed 10' farther north, and still toward the danger, giving a third position ENE. of the second 27 miles. Upon plotting these three positions on the chart, they were seen to be in a straight line, and this line passed through Smalls light.

"It then at once appeared that the observed altitude must have happened at all the three points and at Smalls light and at the ship at the same instant."

Then followed the conclusion that, although the absolute position of the ship was uncertain, she must be somewhere on that line. The ship was kept on the course ENE., and in less than an hour Smalls light was made, bearing ENE. $\frac{1}{2}$ E. and close aboard.

Smalls light was made, bearing 11×1^{-2} in an close observed. The latitude by dead reckoning was found to be 8' in error, and if the position given by that latitude had been assumed correct the error would have been 8 miles too far S. and 31' 30'' of longitude too far W., and the result to the ship might have been disastrous had this wrong position been adopted. This represents one of the practical applications of the Summer line.

The properties of the line thus found will now be explained.

373. CIRCLES OF EQUAL ALTITUDE.—In figure 43, if EE'E" represent the earth projected upon the horizon of a point A, and if it be assumed that, at some particular instant of time, a celestial body is in



The zenith of that point, then the true altitude of the body as observed at A will be 90° . In such a case the great circle EE/E", which forms the horizon of A, will divide the earth into two hemispheres, and from any point on the surface of one of those hemispheres the body will be visible, while over the whole of the other hemisphere it will be invisible. The great circle EE/E", from the fact of its marking the limit of illumination, and from any point on its circumference the true altitude of the center of the body will be zero. If, now, we consider any shall circle of the sphere, BB'B", CC'C", DD'D", whose plane is parallel to the plane of the circle of illumination and which lies within the hemisphere throughout which the body is visible, it will be apparent that the true altitude of the body at any point of one of these circles is equal to its true altitude at any other point of the same circle; thus, the altitude of the body at B is equal to its altitude at B' or B", and its altitude at D is the same as at D' or D".

It therefore follows that at any instant of time there is a series of positions on the earth at which a celestial body appears at the same given altitude, and these positions lie in the circumference of a circle described upon the earth's surface whose

center is at that position which has the body in the zenith, and whose radius depends upon the zenith distance, or—what is the same thing—upon the altitude. Such circles are termed *circles of equal altitude*.

374. The data for an astronomical sight comprise merely the time, declination, and altitude. The first two fix the position of the body and may be regarded as giving the latitude and longitude of that point on the earth in whose zenith the body is found; the zenith distance (the complement of the altitude) indicates the distance of the observer's zenith from that point; but there is nothing to show at which of the numerous positions fulfilling the required conditions the observation may have been taken. A or the number of navigators may measure the same altitude of a body at the same instant of time, at places thousands of miles apart; and each proceeds to work out his position with identical data, so far as this sight is concerned. It is therefore clear that a single observation is not enough, in itself, to locate the point occupied by the observer, and it becomes necessary, in order to fix the position, to employ a second circle, which may be either that of another celestial body or that of the same body given by an observation when it is in the zenith of some other point than when first taken; knowing that the point of observation lies upon each of two circles, it is only possible that it can be at one of their two points

of intersection; and since the position of the ship is always known within fairly close limits, it is easy to choose the proper one of the two. Figure 44 shows the plotting of observations of two bodies vertically over the points A and A' upon the earth, the zenith distances corresponding respectively to the radii AO and A'0.

375. THE SUMNER LINE.-In practice, under the conditions existing at sea, it is never necessary to determine the whole of a circle of equal altitude. as a very small portion of it will suffice for the purposes of navigation; the position is always known within a distance which will seldom exceed thirty miles under the most unfavorable conditions, and which is usually very much less; in the narrow limits thus required, the arc of the circle will practically coincide with the tangent at its middle point, and may be regarded as a straight line. Such a line, comprising so much of the circle of equal altitude as



covers the probable limits of position of the observer, is called a Sumner line or Line of position. **376.** Since the direction of a circle at any point—that is, the direction of the tangent—must be perpendicular to the radius at that point, it follows that the Summer line always lies in a direction at

right angles to that in which the body bears from the observer. Thus, in figure 44, it may be seen that In m' and n n', the extended Summer lines corresponding to the bodies at A and A', are respectively perpendiculur to the bearings of the bodies OA and OA'. This fact has a most important application in the employment of the Summer line. 377. USES OF THE SUMMER LINE.—The Summer line is valuable because it gives to the navigator

a knowledge of all of the probable positions of his vessel, while a sight worked with a single assumed latitude or lorgitude gives but one of the probable positions; it must be recognized that, in the nature of things, an error in the assumed coordinate will almost invariably exist, and its possible effect should be taken into consideration; the line of position reveals the difference of longitude due to an error in the latitude, or the reverse.

Since the Sumner line is at right angles to the bearing, it may be seen that when the body bears east or west—that is, when it is on the prime vertical—the resulting line runs north and south, coincid-ing with a meridian; if, in this case, two latitudes are assumed, the deduced longitudes will be the same. When the body bears north or south, or is on the meridian, the line runs east and west and becomes identical with a parallel of latitude; in such a case, two assumed longitudes will give the same latitude. Any intermediate bearing gives a Summer line inclined to both meridians and parallels; if the line agrees in direction more nearly with the meridian, latitude should generally be assumed and the longitude worked; if it is nearcr a parallel, the reverse course is usually preferable. The values of the assumed coordinates may vary from 10' to 1°, according to circumstances. 378. The greatest benefit to be derived from the Sumner method is when two lines are worked

and their intersections found. The two lines may be given by different bodies, which is generally preferable, or two different lines may be obtained from the same body from observations taken at different times. The position given by the intersection of two lines is more accurate the more nearly the lines are at right angles to each other, as an error in one line thus produces less effect upon the result. When two observations of the same body are taken, the position of the ship at the time of first sight must be brought forward to that at the second in considering the intersection; if, for example, a certain line is determined, and the ship then runs NW. 27 miles, it is evident that her new position is on a line parallel with the first and 27 miles to the NW. of it; a second line being obtained, the intersection of this with the first line, as corrected for the run, gives the ship's position.

Besides the employment of two lines for intersections with each other, a single line may be made to serve various useful purposes for the navigator. These are described in article 400, Chapter XVI.

METHODS OF DETERMINATION.

379. Any line may be defined in either of two ways—by two of its points, or by one point and the direction. There are thus two methods by which a Sumner line may be determined:

(a) Assume two values of one coordinate and find the corresponding values of the other. values of the latitude may be assumed and the longitudes determined, as was done by Captain Summer on the occasion that led to the discovery of the method; or else two values of the longitude may be assumed and the latitudes determined. Two points are fixed in this way, and the line joining them is the line of position.

(b) Assume either one latitude or one longitude and determine the corresponding coordinate. This gives one point of the line. The azimuth of the body is then ascertained, and a line is drawn through

the determined point at right angles to the direction in which the body bore at the time of sight. This will be the line of position.

380. It follows that if the Sumner line be located by the first method and its direction thus defined, the azimuth of the observed body may be determined by finding the angle made by the line

defined, the azimuth of the observed body may be determined by finding the angle made by the line with the meridian and adding or substracting 90°.
EXAMPLE: At sea April 17, 1879, A. M., in Lat. 25° 12′ S., Long. 31° 32′ W., by D. R., observed an altitude of the planet Jupiter, east of the meridian, 45° 40′; watch time, 5^h 48^m 02^s; C - W, 2^h 05^m 42^s; C. C., +2^m 18^s; I. C., +1′ 30″; height of eye, 18 feet. Required the Summer line. From a solution of this same problem for a single longitude (art. 351, Chap. XIII), the following were found: H. A. from Gr., 0^h 50^m 51^s E.; h, 45° 36′ 24″; p, 79° 22′ 51″. Assume values of Lat. 25° 02′

and 25° 22' S.

$egin{array}{c} h \ \mathbf{L_1} \ p \end{array}$	45° 25 79	36′ 02 22	$24'' \\ 00 \\ 51$	sec cosec	$.04278 \\ .00750$	L_2	25°	22	00″	sec cosec	.04403 .00750
	2)150	01	15								
$\frac{s_1}{s_1}$ -	75 - h 29	$\begin{array}{c} 00\\ 24 \end{array}$	$\frac{38}{14}$	$\cos \sin \theta$	$9.41282 \\ 9.69105$	$s_{2}^{s_{2}} - h$	$\frac{75}{29}$	$\begin{array}{c} 10\\ 34 \end{array}$	$\frac{38}{14}$	$\cos \sin $	$9.40794 \\ 9.69328$
Gr. H. A	. O ^h	50'	ⁿ 51 ^s E.	2	2)19.15415	Gr. H. A.	0^{h}	50^{n}	⁵ 1 ^s	2	2)19.15275
H. A. ₁	2	57	30 E.	$\sin \frac{1}{2}$	$t_1 9.57708$	H. A. ₂	2	57	12	$\sin \frac{1}{2} t$	9.57638
Long	$1 = \begin{cases} 2^{h} \\ 31^{0} \end{cases}$	06	$\left[\frac{m}{45''}^{39s}\right]W$	ν.		$Long_{\cdot_2}$	(2 ^h (31°	06¤ 35′	$\left[\frac{21^{s}}{15''} \right]$	w.	

It should be observed that s_2 and $s_2 - h$ can be obtained, respectively, from s_1 and $s_1 - h$ by adding half the difference between L_1 and L_2 ; also that log cosec p is the same for both hour angles. The determination of the second hour angle is thus considerably simplified.

A comparison of these results with those obtained by the solution with a single latitude shows that the hour angle, and consequently the longitude, corresponding to the latitude 25° 12' S. are the means of those corresponding to the latitudes here used; and therefore that the assumption that the Sumner line is a straight line is accurate.

The line of the same sight might also have been found as follows: Working with the single latitude 25° 12′ S., it was found that the corresponding longitude was 31° 37' 30' W. Now by referring to an azimuth table or azimuth diagram, the azimuth corresponding to Lat., 25°.2 S., Dec., 10°.6 S., H. A., 2^{h} 57^m. 3 E. is S. 101° 24' E.; therefore the Sumner line extends S. 11° 24' E.

The line may therefore be defined in either of two ways, thus:

	$A_1 \begin{cases} 25^\circ \ 02' \ 00'' \ S. \\ 31 \ 39 \ 45 \ W. \end{cases}$	$A_2 \begin{cases} 25^\circ 22' & 00'' & S. \\ 31 & 35 & 15 & W. \end{cases}$
Or,	$A \begin{cases} 25^{\circ} \ 12' \ 00'' \ S. \\ 31 \ 37 \ 30 \ W. \end{cases}$	Line runs S. 11° 24′ E.

By inspection of the coordinates of A1 and A2 it may be seen that-

+ 20' diff. lat. makes-4'.5 diff. long.; or,

+20 miles diff. lat. makes -4.1 miles departure.

Therefore by reference to Table 2 it appears that the line runs about S. 112° E., and the azimuth

Therefore by reference to Table 2 it appears that the line runs about S. $11\frac{5}{2}^{\circ}$ E., and the azimuth of the body is S. $101\frac{1}{2}^{\circ}$ E.; thus the results obtained by the two methods agree. EXAMPLE: At sea, May 18, 1879, A. M., Lat. 41° 33' N., Long. 33° 30' W., by D. R., the mean of a series of observed altitudes of the sun's lower limb was 29° 35' 30''; the mean watch time, 7^{h} 20^m 45^s.3; C. C., $+4^{m}$ 59^s.2; I. C., -30''; height of the eye, 23 feet; C – W, 2^{h} 17^m 06^s. Required the Summer line. From a solution of this same problem for a single longitude (art. 351, Chap. XIII) the following were found: G. A. T., 21^{h} 46^m 38^s; h, 29° 50' 05''; p, 70° 29' 14''. Assume values of the latitude 41° 03'

and 42° 03' N.

	h L_1 p	29° 41 70	' 50' 03 29	05″ 00 14	sec cosec	$.\ 12255$ $.\ 02569$	L_2	42° 03	34 00%	see cosec	.12927 .02569	
	2	2)141	22	19								
	$s_1 = h$	70 40	$\frac{41}{51}$	09 04	eos sin	$\begin{array}{c} 9.51950 \\ 9.81564 \end{array}$	$s_{2} - h$	$\begin{array}{ccc} 71 & 11 \\ 41 & 2 \end{array}$	$\begin{array}{ccc}1&09\\1&04\end{array}$	$\cos \sin $	9. 50852 9. 81999	
G.	А. Т.	21 ^h	146 ^m	38*		2)19.48338	G. A. T.	21 ^h 4	6 ^m 38 ^s ,		2)19.48347	
L	A. T.1	19	32	08	$\sin \frac{1}{2}t$	9.74169	L. A. T.,	19 3	2 06	$\sin \frac{1}{2} t_2$	9.74174	
]	Long.1	$\begin{pmatrix} 2^t \\ 33^t \end{pmatrix}$	14 ⁿ 37'	$\left[\frac{30^{8}}{30''}\right]$ W.			Long.2	$\left\{ \begin{array}{ccc} 2^{h} & 1 \\ 33^{\circ} & 3 \end{array} \right\}$	${}^{4^{\mathrm{m}}}_{8' 00''} {}^{32^{\mathrm{s}}}_{00''} {}^{\mathrm{W}}.$			
	Λ_1	$\binom{41}{33}$	° 03′ 37	00″ N. 30 W.	$\mathbf{A_2} \left\{ \begin{array}{c} \mathbf{a} \\ \mathbf{a} \\ \mathbf{a} \end{array} \right\}$	42° 03′ 00″ N. 33 38 00 W.	+60′ di +60 mi	iff. lat. les diff	makes + . lat. mak	$0'.5 \log + 0.4 n$; nile departur	e.

Line runs, N. ¹/₂° W. Azimuth, N. 89¹/₂° E.

The same sight worked with a single latitude, 41° 33′ N., as was done in the original example, with azimuth taken from tables or diagram, gives:

	(41°	33⁄	00%	/ N.	Azimuth,	N.	89°	38/	E.
A	133 -	37	45	W.	Line runs.	Ν.	0°	22'	W.

This example illustrates the case in which an observation is taken practically on the prime vertical; the azimuth shows the bearing to be within 0° 22′ of true East, and the Sumner line is therefore within the azimuth shows the bearing to be within $0^{\circ} 22'$ of true East, and the Summer line is therefore within $0^{\circ} 22'$ of the meridian; a variation of 30' in either direction from the dead reckoning latitude makes a difference of only 15'' in the longitude. EXAMPLE: May 28, 1879, in Lat. 6° 20' S. by account, Long. 30° 21' 30'' W.; chro. time, 7^h 35^m 10^s; observed altitude of moon's upper limb, 75° 33' 00'', bearing north and east; I. C., -3' 00''; height of eye, 26 feet; chro. fast of G. M. T., 1^m 37^s.5. Required the Summer line. From a solution of the same problem with a single longitude (art. 339, Chap. XII), the following values were obtained: H. A. from Greenwich, 1^h 35^m 07^s W.; h, 75° 23' 30''; d, 6° 41' 47'' N. Assume the longitudes 30° 10' and 30° 30' W.

				Gr. H. Long. ₁	A. 1^{t} 2	$\begin{array}{c} 35^{\mathrm{m}} \ 07^{\mathrm{s}} \\ 00 \ 40 \end{array}$	W. G W. L	r. H. A. 1 ong. $_2$ 2	${}^{ m h} {} {} {35^{ m u}} {} {07^{ m s}} {02} {} {00}$
					$t_1 \begin{cases} 0^{10} \\ 6^{10} \end{cases}$	25 ^m 33 ^s 23' 15"		$t_2 \begin{cases} 0\\6 \end{cases}$	$^{h} 26^{m} 53^{s}$ ° 43′ 15″
$\overset{t_1}{d}$	6° 6	23' - 41	' 15' 47	"	sec tan	.00270 9.06973	cosec	.93324	١
h	75	23	30				\sin	9.98573	$A_1 \begin{cases} 6^\circ 27' 03'' S. \\ 30 & 10 & 00 W. \end{cases}$
$\varphi^{\prime\prime}{}_1$	6	44	17	N.	tan	9.07243	\sin	9.06942	(** ** ** ***
φ'_1	13	11	20	s.			\cos	9.98839	
Lat.	6	27	03	8.					
$\overset{t_2}{d}$	6° 6	43′ 41	$\frac{15'}{47}$	/	sec tan	.00299 9.06973	cosec	.93324	
h	75	23	30				\sin	9.98573	$A_{2} \begin{cases} 6^{\circ} 16' 27'' S. \\ 20 & 20 & 00 \end{bmatrix} W$
${\varphi^{\prime\prime}}_2$	6	44	33		tan	9.07272	\sin	9.06972	- (50 50 00 14.
φ'_{2}	13	01	00				cos	9.98869	
Lat	6	ie	97	s					

Working by the other method, and finding the azimuth, we have:

 $A \begin{cases} 6^{\circ} \ 21' \ 14'' \ S. \\ 30 \ 21 \ 30 \ W. \end{cases}$ Line runs N. 62° W.

It might be shown that the results check with each other, as in previous cases. EXAMPLE: At sea, July 12, 1879, in Lat. 50° N., Long. 40° W., observed circum-meridian altitude of the sun's lower limb, the time by a chronometer regulated to Greenwich mean time being 2^h 41^m 39°; chro. corr., $-2^m 30^\circ$; I. C., -3' 0''; height of the eye, 15 feet. Find the Summer line. From the solution of the same problem for a single latitude (art. 338, Chap. XII) the following values were obtained: G. A. T., 2^h 33^m 50°; h, 61° 57′ 01′′; d, 21° 59′ 27′′ N.; a (Tab. 26), 2′′ .5. Assume longitudes 39° 45′ and 40° 15′ W.

Gr. H. A. $2^{h} 33^{m} 50^{s}$ Long. $_{1} -2 39 00$	Gr. H. A. $2^{h} 33^{m} 50^{s}$ Long. $_{2} -2 41 00$
t ₁ 5 10	t ₂ 7 10
$\begin{array}{cccc} h & 61^{\circ} 57' 01'' \\ at_{1^{2}} & + 1 06 \end{array}$	$ \begin{array}{ccc} h & 61^{\circ} 57' 01'' \\ at_2^2 & + 2 08 \end{array} $
H ₁ 61 58 07	H ₂ 61 59 09
$ \begin{array}{cccccccccccccccccccccccccccccccccccc$	$ \begin{matrix} z_2 & 28 & 00 & 51 \ d & 21 & 59 & 27 \end{matrix} $
$L_1 = 50 \ 01 \ 20 \ N.$	$L_2 = 50 \ 00 \ 18 \ N.$

The line given by these coordinates is then:

$$A_{1}\begin{cases} 50^{\circ} \ 01' \ 20'' \ N. \\ 39 \ 45 \ 00 \ W. \end{cases} \qquad A_{2}\begin{cases} 50^{\circ} \ 00' \ 18'' \ N. \\ 40 \ 15 \ 00 \ W. \end{cases}$$

This shows that the Summer line lies so nearly in a due east-and-west direction that a difference of longitude of 30' makes a difference of latitude of only 1'.

From an azimuth table or diagram, it is found that the azimuth of the sun corresponding to Lat. 50° N. Dec. 22° N. and H. A. 6^{m} 10° E., is N. 177° E. Therefore, using the values given by the earlier solution, the line is defined as follows:

 $A \begin{cases} 50^{\circ} \ 00' \ 51'' \ N. \\ 40 \ 00 \ 00 \ N. \end{cases}$

Line runs N. 87° E.

The direction of the line thus given and the one found from the double coordinates may be shown to agree as in examples before given.

FINDING THE INTERSECTION OF SUMNER LINES.

381. The intersection of Summer lines may be found either graphically or by computation.

382. GRAPHIC METHODS.—Each line may be plotted upon the chart of the locality in which the ship is being navigated and the intersection thus found. The details of the plotting will be obvious, whether the line is defined by two of its points, or by one point and its direction. This plan will commend itself especially when the vessel is near shore, as the chart in use will then probably be one of conveniently large scale, and it will be an advantage to see where the position falls with reference to soundings and landmarks.

383. When clear of the land it is often inconvenient to follow this plan; a large scale chart may not be at hand, it may not be desired to deface the chart with numerous lines, or the necessary space for chart work may not be available. In such a case, the following method a is recommended, as it obviates the disadvantages of the other.

To understand the principle of this method, suppose that the lines are defined by the latitude and longitude of two points of each, and consider that they are plotted on a chart which is constructed upon a sheet of elastic rubber. It is evident that if, while holding it fast in the direction of the meridians, we stretch this rubber along the lines of the parallels in a uniform manner until the length of each minute of longitude is made to equal a minute of latitude, the chart, while losing its accuracy as portraying actual conditions on the earth's surface, still correctly represents the positions of the various points in terms of the new coordinates which have been created, namely, those in which a minute of numte of longitude. Thus, if on the true chart a point is m minutes such and n minutes east, the only difference being that the minutes of longitude will now be of a different length; and if on the original chart the two Summer lines intersect at a point m minutes north and n minutes east (on the original scale) of some definite point of one of the lines, the intersection on the stretched chart will lie m minutes north and n minutes (of the new scale) to the east of the same point.

A stricter mathematical conception of the stretched chart and its properties may perhaps be obtained by considering the chart of the locality to be projected (with the eye at the zenith) upon a plane which passes through one of the meridians and makes an angle with the plane of the horizon which is equal to the latitude; each minute of longitude will then be increased by multiplying it by the secant of the latitude, and thus becomes equal to a minute of latitude.

From a consideration of the properties of this hypothetical chart it may be seen that the following rule may be laid down: If two or more Sumner lines be plotted by their latitude and longitude upon any sheet of paper, using a scale whereon latitude and longitude are equal regardless of the latitude of the locality, the intersection of those lines, measured by coordinates on the scale employed, correctly represents the intersection of the lines as it would be measured upon a true chart.

It follows from this that we may plot Summer lines upon any piece of paper, measuring the coordinates with an ordinary scale ruler, and assigning any convenient length for the mile; the larger the scale the more accurate will be the determination. Or, what is even more convenient, we may employ "profile paper," whereon lines are ruled at right angles to each other and at equal distances apart, in which case no scale ruler is needed.

One caution must be observed in using this method; all longitudes employed on the paper for any purpose must be those of the scale, namely, one minute of longitude equals one minute of latitude. For instance, if the two Summer lines be taken at different times, in bringing the first up to the position of the second by the intermediate run, that run must be laid down to scale; that is, the easting or westing must appear as so many minutes of longitude, not so many miles. To do this enter the traverse table with course and distance run, and pick out latitude and departure; then, by means of the middle latitude, convert departure into minutes of longitude and bring the first line to the second by laying off so many minutes of latitude north or south, and so many of longitude east or west.

so many minutes of latitude north or south, and so many of longitude east or west. In the case where the Summer is defined by one position and its line of direction, it is not correct to lay down the angle to the meridian on the hypothetical chart, for all angles are distorted thereon. The best way is to find another position on the line by assuming a second latitude ten or twenty miles removed from that of the point given, entering the traverse table with the angle that the line makes with the meridian as a course, and abreast the latitude taking out the departure; convert departure into difference of longitude, and plot the second point by its coordinates from the first.

EXAMPLE: Let it be required to find the intersection, by each of the methods, of the following lines:

$A_1 \begin{cases} 40^{\circ} \ 00' \ N. \\ 63 \ 15 \ W. \end{cases}$	$A_2 \begin{cases} 40^\circ 20' \text{ N.} \\ 63 & 07 \text{ W.} \end{cases}$
$B_{I} \begin{cases} 40 & 05 & N. \\ 63 & 03 & W. \end{cases}$	$B_{2} \begin{cases} 40 & 15 & N. \\ 63 & 12 & W. \end{cases}$

" Suggested by Lieut, G. W. Logan, U. S. Navy.

Figure 45 shows the intersection, (1) by Mercator chart, (2) by scale, and (3) on profile paper. as follows:



Intersection: $\begin{cases} 40^{\circ} & 12'.8 \text{ N}, \\ 63 & 09 & .9 \text{ W}. \end{cases}$

Suppose, in the example just given, the first line had been defined as follows: -

 $A \begin{cases} 40^{\circ} \ 00' \ N. \\ 63 \ 15 \ W. \end{cases}$ Line runs N. 17° E.

To find a second coordinate by which to plot it, proceed as follows: In Table 2, for 17°: Lat. 20' N., Dep. 6.1 m. E. For Mid. Lat.: 40°, Dep. 6.1 m., diff. long. 8'.0 E. Hence, as previously given:

$$A_1 \begin{cases} 40^{\circ} \ 00' \ N. \\ 63 \ 15 \ W. \end{cases} \qquad A_2 \begin{cases} 40^{\circ} \ 20' \ N. \\ 63 \ 07 \ W. \end{cases}$$

384. METHODS BY COMPUTATION.⁴—The finding of the intersection of two Summer lines by computation may be divided into two cases:

Case I. When one line lies in a NE.-SW. direction, and the other in a NW.-SE. direction. *Case II.* When both lie in a NE.-SW., or both in a NW.-SE. direction.

Suppose, first, that the lines are defined by the latitude and longitude of two points of each, and for the simplification of the problem consider the lines projected on a plane passing through one of the meridians and making an angle with the plane of the horizon equal to the latitude, the properties of which were explained under the graphic method, (art. 383); this saves the necessity of converting minutes of longitude into miles of departure before the solution and converting them back again afterwards; as all points are thus projected in corresponding relative

positions, the results are as exact as if the longer method be followed of dealing with minutes of latitude and longitude of unequal length.

385. Case I. One line NE.-SW., and the other NW.-SE.-Suppose the two lines, projected as described, are as shown in figure 46, $A_1 A_2$ and $B_1 B_2$; for the present assume that the two points, A_1 and B_1 , have a common latitude. Drop the perpendicular PO from the intersection; then the latitude of the intersection will be a distance OP above the common latitude of A, and B_1 , and its longitude will be a distance A_1O to the right of

A₁ and B₁O to the left of B₁. Find the angles α and β from the traverse table (Table 2), they being taken out with the difference of latitude between the two points of the same line in the column Lat. and the differ- A. ence of longitude in the column Dep. (Do not overlook the fact that we are dealing now with the plane of projection and that α and β are not the angles made by the Summer line with



meridians on the earth's surface.) The solution may now be accomplished by either of two methods: (a) Observe that the case is the same as if a ship were steaming along the line $A_1 B_1$ and took the first bearing of the point P when at A_{i} , at an angle from the course equal to $90^{\circ} - \alpha$, and the second bearing when at B_{i} , at an angle from the course equal to $90^{\circ} + \beta$, with an intervening run equal to the beam when a B_1 , at an angle from the considered as steaming from B_1 to A_1 , in which case the first angle is $90^\circ - \beta$ and the second $90^\circ + \alpha$. Picking out of Table 5 B, corresponding to the angles is the first of the second column, we shall have the ratio of the distance of passing abeam, OP, to the distance $A_1 B_1$; multiply the difference of longitude by this ratio, and we shall have the actual length of OP. Then entering the traverse table with this as a latitude and α as a course, we find in the departure column the distance A₁O by which the longitude of OP is defined; it is recommended also to pick out B₁O, using the angle β , which affords a proof of the correctness of all work done after the finding of α and β .

(b) The second method is to find by trial and error some latitude such that its departure corresponding to α , plus is departure corresponding to β , equals the difference of longitude $A_1 B_1$; then the point will be defined by the latitude, and by its longitude from A_1 and B_1 , the agreement of the longitude as established from the different points furnishing a check upon the operation.

EXAMPLE: Find the intersection of the following Sumner lines:

$A_1 \begin{cases} 49^{\circ} 40' & N. \\ 6 & 55.3 & W. \end{cases}$	${\rm A_2} \begin{cases} 50^\circ \ 00' & {\rm N}, \\ 7 & 20.0 & {\rm W}. \end{cases}$	$^{+20'}_{+24.7 long.}$ lat.	Line runs NWSE. $\alpha = 51^{\circ}$.
$B_1 \begin{cases} 49 & 40 & N. \\ 6 & 32.5 & W. \end{cases}$	$B_2 \begin{cases} 50 & 00 & N. \\ 6 & 11.3 & W. \end{cases}$	+20 lat. -21.2 long.	Line runs NESW. $\beta = 47^{\circ}$.

Longitude A₁ $B_1 = 22'.8$.



First draw a rough sketch (fig. 47) to illustrate the direction of coordinates.

of coordinates. Notice that A_1 is west of B_1 . The line through A_1 runs NW.-SE. That through B_1 , NE.-SW. The intersection is therefore south of both, east of A_1 , and west of B_1 . (a) To solve by Table 5 B: First bearing $(90^\circ - \alpha) = 39^\circ$; second bearing $(90^\circ + \beta) = 137^\circ$. Corresponding ratio, 0.43, multiplied by 22'.8 = 9'.8 lat. (The angles $90^\circ - \beta$ and $90^\circ + \alpha$ would have given the same ratio, 0.43.) Then (Table 2) with $\alpha = 51^\circ$, lat. = 9'.8, dep. = 12'.1; and with $\beta = 47^\circ$, lat. = 9'.8, dep. = 10'.510'.5.

Hence, intersection:

9'.8 S. of lat. 49° 40' N. = 49° 30'.2 N. 12 .1 E. of long. 6 55.3 W. = 6° 43 .2 W. 10 .5 W. of long. 6 32.5 W. = 6° 43.0 W. eheck.

(b) To solve by Table 2:

Assuming lat 5'	8'	10′	9'.9
Dep. for 51° 6.2 Dep. for 47° 5.3	9.7 8.5	$\frac{12.3}{10.7}$	$\frac{12.2}{10.6}$
Sum	$\overline{18.2}$	23.0	22.8

Hence, intersection:

 α

9'.9 S. of 49° 40' = 49° 30'.1. 12.2 E. of 6 55.3 = 6 43.1 10.6 W. of 6 32.5 = 6 43.1 check.

It may be seen that the results by the two methods substantially agree.

386. Case II. Both lines NE.-SW., or both NW.-SE.-Consider the lines as drawn in figure 48, and continue the assumption that A_1 and B_1 have a common latitude. The differences from the first case by both P methods simply involve a change of signs.



(b) It may be seen that $OA_1 - OB_1 = A_1 B_1$; in other words, to solve by the second method, the values must be so found that the difference of the corresponding departures equals the difference of longitude, instead of their sums, as before.

EXAMPLE: Find the intersection of the Summer lines defined below:

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Β.



Fig. 48.

+20' -3.3	lat. long.	Line runs NESW. $\alpha = 9^{\circ}$.
$^{+20}_{-33.7}$	lat. long.	Line runs NESW. $\beta = 59^{\circ}$.

In this case (fig. 49) B_1 is west of A_1 , the lines both run NE.-SW., and β is the greater angle; there-

for eintersection lies to the north and east of both points. (a) By Table 5 B: First course $(90^\circ + \alpha) = 99^\circ$; second course $(90^\circ + \beta) = 149^\circ$; ratio $0.67 \times 1'.0 =$ 0'.7; or, first course $(90^\circ - \beta) = 31^\circ$; second course $(90^\circ - \alpha) = 81^\circ$; ratio = 0.67, as before.



Hence, intersection:

(b) By Table 2:

0'.7 N. of 49° 30' N. 0.1 E. of 5 24.8 W. 1.2 E. of 5 25.8 W.	$= 49^{\circ}$ = 5 = 5	30′.7 N. 24 .7 W. 24 .6 W.	$\Big\}$ check
Assuming lat	2'.0	0'.5	0′.6
Dep. for 9° Dep. for 59°	$\begin{array}{c} 0.3\\ 3.3 \end{array}$	$\begin{smallmatrix} 0 & .1 \\ 0 & .9 \end{smallmatrix}$	$\begin{array}{c} 0 \ .1 \\ 1 \ .1 \end{array}$

Hence, intersection:

0'.6 N. of $49^{\circ} 30' = 49^{\circ} 30'.6$ 0.1 E. of 5 24.8 = 5 24.71.1 E. of 5 25.8 = 5 24.7 check.

Difference 3.0

387. In discussing these cases, we have assumed that there was a point of one line which had a common latitude with a point of the other line; this would be the case if two lines were worked from time sights taken at the same time. It may occur, however, either that they have not a common lati-tude, but do have a common longitude, as in the case of two lines worked from $\varphi' \varphi''$ (latitude) sights taken at the same time; or that

they have neither a common latitude nor a common longitude, as with one time sight and one

ß

latitude sight, or with two sights taken at different times.

In case there is a common longitude (fig. 50). which will be rather a rare one, the problem is worked with OP as a *longitude* co-ordinate; the modification of the other method will B suggest itself, the principal



change rendered necessary being due to the fact that the angles from the course in Table 5 B will be complementary to what they were before, as we are now dealing with angles to the meridian instead of angles to the parallel.

1.0

0.8

When there is no common coordinate of either latitude or longitude, the simplest way of solving is first to find some point on one line which corresponds in latitude with one of the points on the other line, then solve as before.

Thus, in figure 51, given $A_1 A_2$ and $B_1 B_2$, find α and β , and thence the longitude of a point A_3 corresponding to the difference of latitude between A_1 and B_1 on the course α ; then find intersection of A_3 A_2 and B_1 B_2 in the usual way.

EXAMPLE: Let it be required to find the intersection of Summer lines as follows:

$A_{1} \begin{cases} 25^{\circ} 30' \text{ S.} \\ 115 22 \text{ E.} \end{cases}$	$A_2 \begin{cases} 25^\circ 50' \text{ S.} \\ 115 & 40 \text{ E.} \end{cases}$	+20' lat. +18 long.	Line runs SENW. $\alpha = 42^{\circ}$.
$B_1 \begin{cases} 25 & 15 & S. \\ 115 & 37 & E. \end{cases}$	$B_2 \begin{cases} 25 & 35 & S. \\ 115 & 30 & E. \end{cases}$	+20 lat. -7 long.	Line runs NESW. $\beta = 19^{\circ}$

Find where $B_1 B_2$ crosses parallel 25° 30′ S.

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Fig. 51.

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 $\beta = 19^{\circ}$, lat. = +15', dep. = -5'.1. Hence, the line B₃ B₂ becomes:

 $B_3 \begin{cases} 25^{\circ} 30' \text{ S.} \\ 115 & 31.9 \text{ E.} \end{cases}$ Line runs NE.-SW. $A_1 B_3 = 9'.9$ $\beta = 19^{\circ}$.

The directions of the lines (fig. 52) require us to follow Case I. A_1 is west of B_3 . The line through A_1 runs SE.-NW., and that through B_3 , SW.-NE. Therefore, the intersection is south of A_1 and B_3 , east of A_1 , and west B 3 of B₃.

8' S. of 25° 30' S. = 25° 38' S. 7.2 E. of 115 22 E. =115 29.2 E. 2.7 W. of 115 31.9 E. =115 29.2 E. check.

(a) By Table 5 B. $(90^{\circ} - \alpha) = 48^{\circ}, (90^{\circ} + \beta) = 109^{\circ}$. Ratio $0.81 \times 9'.9 = 8'.0$ lat.; $\alpha = 42^{\circ}, \text{ lat.} = 8'.0, \text{ dep.} = 7'.2$. $\beta = 19^{\circ};$ lat. =8'.0, dep. =2'.7.

Hence, intersection:



(b) By Table 2:





Intersection:

8' S. of 25° 30' = 25° 38'7.2 E. of 115 22 =115 29.2 2.7 W. of 115 31.9 =115 29.2 check.

388. The following is a summary of the method when lines are given by coordinates of two points of each:

(a) By Table 5 B.

1. Write down lines; find α and β . 2. If there are no points which have a common atitude, reduce one point of one line to latitude of some given point of the other.
Write down difference of longitude.

4. Draw rough sketch to illustrate direction of point of intersection.

5. Enter Table 5 B:

Case I, angles $(90^\circ - \alpha)$ and $(90^\circ + \beta)$ or $(90^\circ - \beta)$ and $(90^\circ + \alpha)$.

 $Case II, angles (90^\circ + \alpha) and (90^\circ + \beta) or (90^\circ - \beta) and (90^\circ - \alpha).$ Take out ratio from second column, and multiply

by difference of longitude; this gives difference of latitude of intersection from the common latitude.

6. Find departure corresponding respectively to α and β with latitude; this gives differences, of longitude to the point of intersection from the respective points of common latitude.

389. If the lines, instead of being defined by coordinates of two points, are defined by the coordinates of one point of each with its direction as deduced from the azimuth of the body, it will be better not to consider the projection on the fictitious plane through the meridian, as there will then be no advantage in so doing. In this case, consider the angles of the lines with the meridian, as given, α and β ; reduce the difference of longitude A_1 B_1 to departure, and use this in miles instead of the A_1 B_1 in minutes; and when A_1 O and B_1 O are found, being in miles of departure, they must be reduced to minutes of longitude before being applied to the longitude of A_1 and B_1 . EXAMPLE: The Summer lines of the last example being expressed by a single point and the direction, as given, below below.

as given below, find the intersection.

 ${\rm A} \Big\{ \begin{matrix} 25^{\circ} \ 40' \\ 115 \ 31 \end{matrix} \Big.$ S. E. Line runs ($\alpha =$) N. 39° W. $B \begin{cases} 25 & 25 & S. \\ 115 & 33.5 & E. \end{cases}$ Line runs ($\beta =$) N. 18° E.

First bring second line up to Lat. 25° 40' S. $\beta = 18^{\circ}$; lat. = +15'; dep. = -4.9 m.; diff. long. = -5'.4; hence we have:

$$B'_{\{115\ 28.1\ E.\}$$

Line runs ($\beta =$) N. 18° E.



AB' = 2'.9 = 2.6 miles.

AB' = 2', 9 = 2.6 miles. B' being west of A (fig. 53), and the lines through the two points running respectively NE. and NW., the intersection is north of both, east of B', and west of A. (a) By Table 5 B. $(90^{\circ} - \alpha) = 51^{\circ}$; $(90^{\circ} + \beta) = 108^{\circ}$. Ratio $0.88 \times 2.6 = 2'.3$ lat. $\alpha = 39^{\circ}$, lat. = 2'.3, dep. = 1.8 m., diff. long. =2.0. $\beta = 18^{\circ}$, lat. = 2'.3, dep. = 0.7 m., diff. long. = 0.8.

Intersection:

2'.3 N. of 25° 40' S. = 25° 37'.7 S. 2.0 W. of 115 31 E. = 115 29 E. 0.8 E. of 115 28.1 E. = 115 28 .9 E. check.

(b) By Table 2:

* Assuming lat	4'	2'	2'.3	
•				
Dep. for 39°	3.2	1.6	1.9 = 2'.1	ł
Dep. for 18°	1.3	0.7	0.7 = 0.8	3
•		·		_
* Sum	4.5	2.3	2.6 = 2.9	9

Intersection:

2'.3 N. of $25^{\circ} 40' = 25^{\circ} 37'.7$ 2.1 W. of 115 31 = 115 28.9 0.8 E. of 115 28.1 = 115 28.9 check.

(b) By Table 2.

1. Write down lines; find α and β .

2. If there are no points which have a common at the area one point of one line to latitude of some given point of the other.
Write down difference of longitude.

4. Draw rough sketch to illustrate direction of point of intersection.

5. Enter Table 2, at pages α and β ; find by trial some latitude at which— Case I, the sum of the corresponding departures

equals the total difference of longitude;

Case II, the difference of the corresponding departures equals the total difference of longitude.

These give differences of latitude and longitude to the point of intersection from the respective points of common latitude.

The following summary gives the various steps when the lines are each given by the coordinates of one point with the direction:

(a) By Table 5 B.

1. Write down lines as given.

2. If the points have not a common latitude, reduce one point to latitude of the other.

3. Write down difference of longitude and convert it to departure.

4. Draw rough sketch to illustrate direction of point of intersection.

5. Enter Table 5 B:

Case I, angles $(90^\circ - \alpha)$ and $(90^\circ + \beta)$ or $(90^\circ - \beta)$ and $(90^\circ + \alpha)$. Case II, angles $(90^\circ + \alpha)$ and $(90^\circ + \beta)$ or $(90^\circ - \beta)$ and $(90^\circ - \alpha)$.

Take out ratio from second column, and multiply by departure between the two points; this gives difference of latitude of intersection from common latitude.

6. Find departure corresponding respectively to α and β with this difference of latitude, and convert to difference of longitude; this gives differences of longitude to the point of intersection from the respective points of common latitude.

(b) By Table 2.

1. Write down lines as given.

2. If the points have not a common latitude. reduce one point to latitude of the other.

3. Write down difference of longitude and convert it to departure.

4. Draw rough sketch to illustrate direction of point of intersection.

5. Enter Table 2 at pages α and β ; find by trial some latitude at which

Case I, the sum of the corresponding departures equals the departure between the two points:

Case II, the difference of the corresponding departures equals the departure between the two points.

This difference of latitude, and these departures (converted into difference of longitude) give distance of point of intersection in latitude and longitude from the respective points of common latitude.

390. The modification of the methods for finding the intersection of two Sumner lines, where there is a run between the observations from which they are deduced, will be readily apparent. It is known that at the time of taking a sight the vessel is at one of the points of the Sumner line, but which of the various points represents her precise position must remain in doubt until further data are acquired. Suppose, now, that after an observation the vessel sails a given distance in a given direction; it is clear that while her exact position is still undetermined it must be at one of the series of points comprised in a line parallel to the Sumner line and at a distance and direction therefrom corresponding to the course and distance made good; hence, if a second sight is then taken, the position of the vessel may be found from the intersection of two lines—one, the Sumner line given by the second observation, and the other

a line parallel to the first Sumner but removed from it by the amount of the intervening run. Positions may be brought forward graphically on a chart by taking the course from the compass rose with parallel rulers, and the distance by scale with dividers. If the method given in article 383 be employed, runs in latitude and longitude must each be applied on their own scales, as explained in the description of the method. If one of the methods by computation be adopted, the point or points of the first line are brought forward by the traverse tables, using middle latitude sailing. The direction of a Sumner line as determined from the azimuth of the body always remains the same, whatever shift may be made in the position of the point by which the line is further defined.

CHAPTER XVI.

THE PRACTICE OF NAVIGATION AT SEA.

391. Having set forth in previous chapters the methods of working dead reckoning and of solving problems to find the latitude, longitude, chronometer correction, and azimuth from astronomical observations, it will be the aim of the present chapter to describe the conditions which govern the choice and employment of the various problems, together with certain considerations by which the navigator may be guided in his practical work at sea.

392. DEPARTURE AND DEAD RECKONING.—On beginning a voyage, a good departure must be taken while landmarks are still in view and favorably located for the purpose; this becomes the origin of the dead reckoning, which, with frequent new departures from positions by observation, is kept up to the completion of the voyage, thus enabling the mariner to know, with a fair degree of accuracy, the position of his vessel at any instant.

At the moment of taking the departure, the reading of the patent log (which should have been put over at least long enough previously to be regularly running) must be recorded, and thereafter at the time of taking each sight and at every other time when a position is required for any purpose, the log reading must also be noted. It is likewise well to read the log each hour, for general information as to the speed of the vessel as well as to observe that it is in proper running order and that the rotator has not been fouled by seaweed or by refuse thrown overboard from the ship. It is a good plan to record the time by ship's clock on each occasion that the log is read, as a supplementary means of arriving at the distance will thus be available in case of doubt. If a vessel does not use the patent log but estimates her speed by the number of revolutions of the engines or the indications of the chip log, the noting of the time becomes essential. A good sight is of no value unless one knows the point in the ship's run at which it was taken, so that the position it gave may be brought forward with accuracy to any later time.

393. ROUTINE DAY'S WORK.—The routine of a day's work at sea, no part of which should ever be neglected unless cloudy weather renders it impossible to follow, consists in working the dead reckoning, an a. m. time sight and azimuth taken when the sun is in its most favorable position for the purpose, a meridian altitude of the sun (or, when clouds interfere at noon, a sight for latitude as near the meridian as possible), and a p. m. time sight and azimuth. This represents the minimum of work, and it may be amplified as circumstances render expedient.

394. MORNING SIGHTS.—The morning time sight and azimuth should be observed, if possible, when the sun is on the prime vertical. As the body bears east at that time, the resulting Sumner line is due north and south, and the longitude will thus be obtained without an accurate knowledge of the latitude. Another reason for so choosing the time is that near this point of the sun's apparent path the body is changing most slowly in azimuth, and an error in noting the time will have the minimum effect in its computed bearing. The time when the sun will be on the prime vertical—that is, when its azimuth is 90°—may be found from the azimuth tables or the azimuth diagram. Speaking generally, during half the year the sun does not rise until after having crossed the prime vertical, and is therefore never visible on a bearing of east. In this case it is best to take the observation as soon as it has risen above the altitude of uncertain atmospheric effects—between 10° and 15°.

A series of several altitudes should be taken, partly because the mean is more accurate than a single sight, and partly because an error in the reading of the watch or sextant may easily occur when there is no repetition. If the sextant is set in advance of the altitude on even five or ten minute divisions of the arc, and the time marked at contacts, the method will be found to possess various advantages. As the sight is being taken the patent log should be read and ship's time recorded. It is well, too, to make a practice of noting the index correction of the sextant each time that the sextant is used. The bearing of the sun by compass should immediately afterward be observed, and the heading by compass noted, as also the time (by the same watch as was used for the sight).

Before working out the sight, the dead reckoning is brought up to the time of observation, and the latitude thus found used as the approximate latitude at sight. It is strongly recommended that every sight be worked for a Sumner line, either by assuming two latitudes, or by using one latitude and the azimuth, the advantages derived therefrom being always well worth the small additional labor expended.

The compass error is next obtained. From the time sight the navigator learns that his watch is a certain amount fast or slow of L. A. T., and he need only apply this correction to the watch time of azimuth to obtain the L. A. T. at which it was observed; thence he ascertains the sun's true bearing from the azimuth tables or azimuth diagram, compares it with the compass bearing, and obtains the compass error; he should subtract the variation by chart and note if the remainder, the deviation, agrees with that given in his deviation table; but in working the next dead reckoning, if the ship's course does not change, the total compass error thus found may be used without separating it into its component parts. It should be increased or decreased, however, as the ship proceeds, by the amount of any *change* of the variation that the chart may show.

395. If there is any fear of the weather being cloudy at noon, the navigator should take the precaution, when the sun has changed about 30° in azimuth, to observe a second altitude and to record the appropriate data for another sight, though this need not actually be worked unless the meridian

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observation is lost. If it is required, it may be worked for either a time sight or $\varphi' \varphi''$ sight, according to circumstances, a second Sumner line obtained, and the intersection of the earlier Sumner with it will give the ship's position.

396. Noos Starrs.—Between 11 and 11.30 o'elock (allowing for gain or loss of time due to the day's run) the ship's clocks should be set for the L. A. T. of the prospective noon position. The noon longitude may be closely estimated from the morning sight and the probable run. The navigator should also set his own watch for that time, to the nearest minute, and note exactly the number of seconds that it is in error. He may now compute the constant (art. 333, Chap. XII) for the meridian The daily winding of the chronometer is a most important feature of the day's routine, and altitude. may well be performed at this hour. At a convenient time before noon, the observations for meridian altitude are commenced and continued until the watch shows L. A. noon, at which time the meridian altitude is measured and the latitude deduced.

If the weather is cloudy and there is doubt of the sun being visible on the meridian, an altitude may be taken at any time within a few minutes of noon, the time noted, and the interval from L. A. noon found from the known error of the watch. It is then the work of less than a minute to take out how norm Table 26, the at^2 from Table 27, and apply the reduction to the observed altitude to obtain the meridian altitude. Indeed, the method is so simple that it may be practiced every day and several values of the meridian altitude thus obtained, instead of only one.

This may be done graphically by **397.** It now becomes necessary to find the longitude at noon. There are a number of variations in a chart, or by computation. The former plan needs no explanation.

the methods of computation. The former plan needs of splannary sectors in the methods of computation, one of which will be given as a type. By the ship's run, work back the noon latitude to the latitude at a. m. time sight. If the Sumner line was found from two assumed latitudes which differed + m minutes, while the corresponding longi-

line was found from two assumed factures which indexes $\pm \frac{n}{m}$ minutes difference of longitude. If tudes differed $\pm n$ minutes, then 1' difference of latitude causes $\pm \frac{n}{m}$ minutes difference of longitude. If the true latitude at sight is $\pm x$ minutes from one of the assumed latitudes, then $\pm x \times \frac{n}{m}$ is the corre-

sponding difference of longitude. If the Summer line was found from one assumed latitude and an azimuth, Z, it makes an angle with the meridian equal to 90° -Z. Enter the traverse table with this as a course and with the difference between the true and assumed latitudes as a latitude, and the departure will be found; convert this into difference of longitude at the latitude of observation, and apply the result with its proper sign to the longitude corresponding to the assumed latitude. Having thus the longitude at sight, the longitude at noon is worked forward for the run. If the sights show a considerable current it should be allowed for, both in working back the latitude and in bringing up the longitude for the run between the sight and ncon.

398. CURRENT AND RUN.—The current may be found by comparing the noon positions as obtained by observation and by dead reckning; and the day's run is calculated from the difference between the day's noon position by observation and that of the preceding day. To "current" is usually attributed all discrepancies between the dead reckoning and observations; but it is evident that this is not entirely due to motion of the waters, as it includes errors due to faulty steering, improper allowance for the compass error, and inaccurate estimate of the vessel's speed through the water.

The noon position by observation becomes the departure for the dead reckoning that follows. **399.** AFTERNOON SIGHTS.—The p. m. time sight and azimuth is similar to the morning observation. **400.** SUMNER LINES.—By performing the work that has just been described a good position is obtained at noon each day, which, in a slow-moving vessel with plenty of sea room, may be considered with the provide the relation of the destination of the destination of the destination. sufficient; but conditions are such at times as to render it almost imperatively necessary that a more frequent determination of the latitude and longitude be made. If the vessel is near the land or in the vicinity of off-lying dangers, if she is running a great circle course requiring frequent changes, if she is making deep-sea soundings, if she has just come through a period of foggy or cloudy weather, or if the indications are that she is about to enter upon such a period, it is obviously inexpedient to await the coming of the next noon for a fix. The responsibilities resting upon the navigator require that he shall earlier find his ship's position; and, generally speaking, the greater the speed made by the vessel the more absolute is this requirement.

The key to all such determinations will lie in the Summer line, and a clear understanding of the properties of such a line will greatly facilitate the solutions. The mariner must keep in mind two facts: First, that a single observation of a heavenly body can never, by itself, give the *point* occupied by an observer on the earth's surface; and second, that whenever any celestial body is visible, together with enough of the horizon to permit the measuring of its altitude, an observer may thereby determine a line which passes through his own position on the earth's surface in a direction at right angles to the bearing of the body.

It may readily be seen that if two Summer lines are determined the observer's position must be at their intersection, and that that intersection will be most clearly marked when the angle between the lines equals 90°; hence, if two heavenly bodies are in sight at the same time the position may be found from the intersection of their Sumner lines, the angle of intersection being equal to the horizontal angle between the bodies. If only one body is in sight, as is generally the case when the sun is shining, one line of position may be gotten from an altitude taken at one time, and a second line from another altitude taken when it has changed some 30° in azimuth—usually, a couple of hours later. Bringing forward the first line for the intervening run, the intersection may be found.

With the general principles of the Sumner line clearly before him, the navigator will find no difficulty in making the choice of available bodies. If about to take a star sight, and sky and horizon are equally good in all quarters, two bodies should be taken whose azimuths differ as nearly as possible by 90°. If one body can be taken on or near the meridian, its bearing being practically north or south, the resulting Summer line will be east and west—that is, it may be said that whatever the longitude (within its known limits) the latitude will be the same; the other sight may then be worked as a time sight with this single latitude and time will thus be saved. The same is true if Polaris is observed, and it is a very convenient practice to take an altitude of that star at dawn and obtain a latitude for working

the a.m. time sight of the sun. A similar case arises when a body is observed on the prime vertical; its Summer line then runs north and south and coincides with a meridian; if the other body is favorably located for a $\varphi' \varphi''$ sight, it may be worked with a single longitude and the latitude thus found directly.

If it is not possible to obtain two lines and thus exactly locate the ship, the indications of a single line may be of great value to the navigator. A Sumner line and a terrestrial bearing will give the ship's position by their intersection in the same manner as two lines of position or two bearings; or the position of the ship on a line may be shown with more or less accuracy by a sounding or a series of soundings. If the body be observed when it bears in a direction at right angles to the trend of a neighboring shore line, the resulting line will be parallel with the coast and thus show the mariner his distance from the land, which may be of great importance even if his exact position on the line remains in doubt. If the bearing be parallel to the coast line, then the Sumner line will point toward shore; the value of a line that leads to the point that the vessel is trying to pick up is amply demonstrated by the experience of Captain Summer that led to the discovery of the method (art. 372, Chap. XV).

For especially accurate work three Sumner lines may be taken, varying in azimuth about 120°; if they do not intersect in a point, the most probable position of the ship is at the center of the triangle that they form.

If two pairs of lines be determined, each pair based upon observation of two bodies bearing in nearly opposite directions and at about the same altitude, the mean position that results from the intersection of the four lines will be as nearly as possible free from those errors of the instrument, of refraction, and of the observer, which can not otherwise be eliminated. This is fully explained in article 451, Chapter XVII.

401. Use of STARS, PLANETS, AND MOON.—It may be judged that the employment in navigation of other heavenly bodies than the sun is considered of the utmost importance, and mariners are urged to familiarize themselves with the methods by which observations of stars, planets, and the moon may be utilized to reveal to them the position of their vessels at frequent intervals throughout the twenty-four hours.

It should be remembered, however, that in order to be of value these observations must be accurate; and to measure an accurate altitude of the body above the horizon it is required not only that the body be visible but also that the horizon be distinctly in view. Care should therefore be taken to make the observations, if possible, at the time when the horizon is plainest—that is, during morning and evening twilight. It may be urgently required to get a position during hours of darkness, and a dim horizon line may sometimes be seen and an observation taken, using the star telescope of the sextant; if the moon is shining, its light will be a material aid; but results obtained from such sights should be regarded as questionable and used with caution. Altitudes measured, however, just before sunrise and just after sunset are open to no such criticism; a fairly well-practiced observer who takes a series of sights at such a time, setting the sextant for equal intervals of altitude, will find the regularity of the corresponding time intervals such as to assure him of accuracy.

402. IDENTIFICATION OF UNKNOWN BODIES.—On account of the very great value to be derived from the use of stars and planets in navigation, it is strongly recommended that all navigators familiarize themselves with the names and positions of those fixed stars whose magnitude renders possible their employment for observations, and also with the general characteristics—magnitude and color—of the three planets (Venus, Jupiter, and Mars) which are most frequently used. A study of the different portions of the heavens, with the aid of any of the numerous charts and books which bear upon the subject, will enable the navigator to recognize the more important constellations and single stars by their situation with relation to each other, and to the pole and the conator.

their situation with relation to each other, and to the pole and the equator. It may occur, however, that occasion will arise for observing a body whose name is not known, either because it has not been learned, or because the surrounding stars by which it is usually identified are obscured by clouds or rendered invisible by moonlight or daylight. In such a case the observer may estimate the hour angle and declination (the hour angle applied to local sidereal time giving the right ascension), and the star or planet may thus be recognized from a chart or from an inspection of the Nantical Almanac. This rough method will generally suffice when the body is the only one of its magnitude within an extensive region of the heavens; but cases often arise where a much closer approximation is necessary, and more exact data is required for identification.

403. If in doubt as to the name of the body at the time of taking the sight, it should be made an invariable rule to observe its bearing by compass, whence the true azimuth may be approximately deduced by applying the compass error. The method α to be described then affords a convenient means of identification. The quantities given are the corrected altitude of observation, h, the (approximate) true azimuth of the body, Z, and the latitude by dead reckoning, L; those to be determined are the declination, d, and the hour angle, t. From the astronomical triangle we have:

$$\frac{\sin Z}{\sin p} = \frac{\sin t}{\cos h}; \text{ or, } \sin Z \cos h = \sin t \cos d.$$

The value of sin $Z \cos h$ (calculated from the given azimuth and altitude) must therefore equal sin $t \cos d$, whatever the values of t and d may prove to be.

From a given latitude, azimuth and declination, the hour angle may be found either by azimuth tables or an azimuth diagram; or from a given latitude, azimuth and hour angle, the declination may be found by the same means. If, therefore, some probable value of the declination be assumed, using the known latitude and azimuth, we may ascertain the corresponding hour angle; or, if the hour angle be assumed, the corresponding declination is obtained; then the product of sin $t \cos d$ may be calculated, and if it agrees substantially with sin $Z \cos h$, the trial values of the hour angle and declination are the correct ones; if not, other trials may be made until the correct ones are found. It may be remembered that absolutely exact results are not sought, and in practice the operation may be made very short; the

values of the quantities may be taken in even degrees and the logarithms need not be carried beyond the third place: the sum of the logarithms will suffice and the corresponding numbers do not have to be taken out. The possibility that the observed body may have been a planet must always be kept in

mind in looking it up in the star table or chart. EXAMPLE: May 16, 1879, in Lat. 5° N., Long. 2^{h} 53^{m} W. by D. R., a star is observed whose corrected altitude is 38°, and true azimuth N. 107° E. The Greenwich sidereal time (as computed for use in the regular working of the sight) is 12^{h} 53^{m} . Let it be required to identify the body.

First find the logarithm of $\sin Z \cos h$.

$$\begin{array}{ccc} Z & 107^{\circ} & \sin 9.981 \\ h & 38^{\circ} & \cos 9.897 \\ \sin Z \cos h \log 9.878 \end{array}$$

Now suppose the observer estimates from the position of the body that its declination is 3° S. Look in the azimuth table on the page of latitude 5° (declination contrary name to latitude), and find the hour angle (p. m.) corresponding to Dec. 3° and Az. 107° ; this is about $1^{h} 40^{m}$; then with $d=3^{\circ}$, $t=1^{h} 40^{m}$, find sin t cos d. (Sin t may be obtained either by converting time into arc and taking from the table in the usual way, or by multiplying by 2 and finding it from the column headed "Hour P. M." Thus in the present case find the sine of $25^{\circ} 00'$ or of $3^{h} 20^{m}$. In using the time column be careful to take the name from the foot of the page when the double angle exceeds 6^{h} .)

> $t = 1^{h} + 40^{m}$ $\sin 9.626$ d 3° cos 9, 999 $\sin t \cos d \log 9.625$

As this logarithm should equal 9.878, it is seen that the assumption is incorrect. Try a value of the declination 5° farther south—that is, 8° S. The corresponding hour angle is 2^{h} 50^{m} .

 $t \ 2^{h} \ 50^{m} \ \sin 9.830 \ d \ 8^{\circ} \ \cos 9.996$ $\sin t \cos d \log 9.826$

The logarithm is not vet quite large enough; assume declination 10° S.; the hour angle is $3^{h} 20^{m}$.

t 1	3h	$rac{20^{ m u}}{10^{ m o}}$	sin 9.884 cos 9.993
si	n t	cos	$d \log 9.877$

This is practically identical with the logarithm of $\sin Z \cos h$, and the correct values are, therefore, $t=3^{h} 20^{m}, d=10^{\circ} S.$

We now have:

G. S. T.	12^{h}	53^{m}	
Long.	2	-53 W.	
L. S. T.	10	00	
H. A.	3	20 E.	
R. A.	13	$\overline{20}$	

From the Nautical Almanac it is found that the right ascension of Spica is 13^h 19^m and the decli-nation 10° 32' S. This is therefore the body observed. EXAMPLE: March 18, 1879, in Lat. 26° S., Long. 5^h 42^m E., by D. R., the altitude of a body is 41° and its azimuth S. 84° E., the Greenwich sidereal time being 10^h 52^m. Required the name of the body.

Z	84°	$\sin 9.998$
h	41°	$\cos 9.878$
\sin	Z cos	$h \log 9.876$

Assume first an hour angle of 3^h 00^m. The corresponding declination is 23° (same name as latitude).

t 3h	00^{m}	\sin	9.849
d	23°	cos	9.964
$\sin t$	cos	$d \log$	9.813

Next assume an hour angle of 3^h 30^m. The declination is then 21° S.

t 3^h 30^m sin 9.899 $d = 21^{\circ}$ cos 9.970 $\sin t \cos d \log 9.869$ Assume hour angle 3^h 35^m. Declination is still nearest to 21° S

t 3 ^h 35 ^m	\sin	9.907
d 21°	\cos	9.970
$\sin t \cos d$	log	9.877

The last assumption is therefore correct. We then have:

G. S. T.	$10^{\rm h}$	52^{m}
Long.	5	42 E.
L. S. T.	16	34
H. A.	3	35 E.
R. A.	$\overline{20}$	09

As there is no fixed star corresponding to these coordinates the tables for the planets should be consulted. On March 18, 1879, the right ascension of Mars is $20^{h} 09^{m}$, and the declination $21^{\circ} 06'$ S. This is therefore the body that was observed.

404. The following is a summary of the method employed:

1. Reduce time of observation to Greenwich sidereal time and find the true altitude to the nearest degree. (These operations must be performed before any sight can be worked; they are, therefore, not strictly a part of the process of identification.)

2. Correct the observed azimuth for deviation and variation.

3. Find the logarithm of $\sin Z \cos h$ to the third place.

4. Assume a declination and find the corresponding hour angle that will produce the given azimuth at the given latitude; or assume an hour angle and find the corresponding declination. (Use an azimuth table or diagram for the purpose.)

5. Find the logarithm of $\sin t \cos d$ to the third place.

6. Observe whether this agrees with the logarithm of sin $Z \cos h$, and if it does not, repeat trials until an agreement is found.

7. Having found the hour angle and declination, convert the Greenwich sidereal time into local sidereal time and subtract the hour angle if west, or add it if east; the result is the right ascension of the observed body, by which, with the declination and magnitude, the identification is accomplished.

405. The exactness with which the comparison of logarithms is carried out will depend upon the possibility of errors of identification in the region of the heavens involved. It will not usually be necessary to find the correspondence as closely as has been done in the examples given, and the cases will be rare when, with a fair estimate of hour angle or declination at beginning, a sufficiently accurate knowledge of the values can not be arrived at after the second approximation; and frequently the first will suffice for identification.

406. VALUE OF THE MOON IN OBSERVATIONS.—Next to the sun, the most conspicuous body in the heavens is the moon, and it may therefore frequently be employed by the mariner with advantage. Owing to its nearness to the earth and the rapidity/with which it changes right ascension and declination, the various corrections entailed render observations of this body somewhat longer to work out, with consequent increased chances of error; and errors in certain parts of the work will have more serious results than with other bodies; the navigator will therefore usually pass the moon by if a choice of celestial bodies is offered for a determination of position; but so many occasions present themselves when there is no available substitute for the moon that the extra time and care necessary to devote to it are well repaid. During hours of daylight it is often clearly visible, and its line of position may cut with that of the sun at a favorable angle, giving a good fix from two observations taken at the same time, when the only other method of finding the position would be to take two sights of the sun separated by a time interval in which an imperfect allowance for the true run intervening would affect the accuracy of the result, or a clouding-over of the heavens would prevent any definit result whatever being reached; and during the night, the gleam upon the water directly below the moon may define the horizon and give opportunity for an altitude of that body when it is impossible to take an observation of any other. Navigators are therefore recommended to make use of the moon with complete confidence whenever it will serve their purposes. It has been the purpose of this work to point out the features of the various sights wherein the practice with the moon differs from that of the sun, stars, or planets; care and intelligent consideration will render these quite clear.

Besides its availability for determining Sumner lines of position, which it shares with other bodies, the moon affords a means for ascertaining the Greenwich mean time independently of the chronometer, thus rendering it possible to deduce the longitude and chronometer error. This is accomplished by the method of lunar distances, which is fully explained in Appendix V. If the Greenwich time given by an observation of lunar distance could be relied upon for accuracy, the method would be a great boon to the navigator; but this is not the case. The most practiced observer can not be sure of obtaining results as close as modern navigation demands, and the errors to which the method is subject are larger than the errors that may be expected in the chronometer, even when the instrument is only a moderately good one and its rate is carried forward from a long voyage. The method is not, therefore, recommended for use except where the chronometer is disabled or where it is known to have acquired some extraordinary error; and when lunar distances are resorted to care must be taken to navigate with due allowance for possible inaccuracy of the results. In this connection it is appropriate to say that the best safeguard against the dire consequences that may result from a disabled or unreliable chronometer is for every vessel to carry two—or, far better, three—of those instruments, the advantages of which plan are stated in article 265, Chapter VIII.

407. EMPLOYMENT OF BODIES DEPENDENT UPON THEIR POSITION.—The practical navigator will soon observe that there are certain conditions in which bodies are especially well adapted for the finding of latitude, and others where the longitude is obtained most readily.

Taking the sun for an example, when a vessel is on the equator and the declination is zero, that body will rise due east of the observer and continue on the same bearing until noon, when for an instant it will be directly overhead, with a true altitude of 90°, and will then change to a bearing of west, which it will maintain until its setting. In such a case any observation taken throughout the day will give a true north-and-south Summer line, defining longitude perfectly, but giving no determination of the latitude, excepting for a moment only when the body is on the meridian. With the exception noted, all efforts

to determine the latitude will fail. The reduction to the meridian takes the form $\frac{0}{0}$, becoming inde-

terminate, and in the $\varphi' \varphi''$ sight the cosine of φ' will assume a value that corresponds alike to any angle within certain wide limits—the limits within which the circle of equal altitude has practically a north-and-south direction. In conditions approximating to this we may obtain a longitude position more easily than one for latitude, even within a few minutes of noon.

As the latitude and declination separate, conditions become more favorable for finding latitude and less so for longitude; the intermediate cases cover a wide range, wherein longitude may be well determined by observations three to five hours from the meridian, and latitude by those within two hours of meridian passage. As extreme conditions are approached the accuracy of longitude determinations continues to decrease; at a point in 60° north latitude, when the sun is near the southern solstice, its bearing differs only 39° from the meridian at rising; or, in other words, even if observed at the most favorable position, the resulting Sumner line is such that 1' in latitude makes a difference of 1.3 miles of departure, or 2'.6 of longitude, and is far better for a latitude determination than for longitude. And in higher latitudes still this condition is even more marked. Having grasped these general facts, the navigator must adapt his time for taking sights to the cir-

Having grasped these general facts, the navigator must adapt his time for taking sights to the circumstances that prevail, and when the sun does not serve for an accurate determination of either latitude or longitude the ability to utilize the stars, planets, and moon as a substitute will be of the greatest advantage.

408. Use of VARIOUS SIGHTS.—Having taken a sight, the navigator may sometimes be in doubt as to the best method of working it. No rigorous rules can be laid down, and experience alone must be his guide. In a general way it may be well, when the body is nearer to the prime vertical than to the meridian, to work it for longitude, assuming latitude, and using the time sight; and when nearer the meridian to work it for latitude, assuming longitude, by the $\varphi' \varphi''$ method. The time sight is more generally used than the other, it has wider limits of accurate application and is probably a little quicker; but as the meridian is approached and the hour angle decreases small errors in the terms make large ones in the results. The $\varphi' \varphi''$ or latitude method should not ordinarily be employed beyond three hours from the meridian, and only then when the body is within 45° of azimuth from the meridian; when the hour angle is six hours (90°) its secant becomes infinity and the method is not available; nor, as has been noted (art. 339, Chap. XII), does it give definite results when the azimuth is 90° or there-abouts.

When the body is close enough to the meridian for the method of reduction to the meridian to be applicable, that method is to be preferred because of its quickness and facility. It should be noted, however, that, though close enough to employ the reduction, it may not be sufficiently correct to assume that the body bears due north or south, and the sight should be worked with two longitudes, or the Summer line determined by the azimuth, unless the bearing nearly coincides with the direction of the meridian.

In cases where a body transits near the zenith, a good fix both in latitude and longitude may be obtained by sights, a few minutes apart, near its meridian passage. Various special methods have been devised for doing this, but it seems simpler to treat the problem as an ordinary one for Sunner lines, except where it falls within the narrow limits of application of the equal altitude method (art. 352, Chap. XIII). The solution is possible, because in the condition where it is available (that of a high transit) the body makes a very rapid change of azimuth (from nearly east to nearly west) in a short space of time, and two observations separated by a short interval give Sunner lines that cut at a favorable angle. The time sight or latitude sight may be used according as the body's bearing is greater or less than 45° from the meridian. If one observation be taken when the bearing is about SE, and the other when it is about SW., the intersection, allowing for intervening run, will not only give the longitude, but will also afford a good check upon the meridian observation for latitude, which, in the case of high transits, it is difficult to make with perfect accuracy. **409.** WORKING TO SECONDS AND ACCURACY OF DETERMINATIONS.—The beginner who seeks counsel

409. WORKING TO SECONDS AND ACCURACY OF DETERMINATIONS.—The beginner who seeks counsel from the more experienced in matters pertaining to navigation will find that he receives conflicting advice as to whether it is more expedient to carry out the terms to seconds of arc, or to disregard seconds and work with the nearest whole minute.

It is a well-recognized fact that exact results are not attainable in navigation at sea; the chronometer error, sextant error, error of refraction, and error of observation are all uncertain; it is impossible to make absolutely correct allowance for them, and the uncertainty increases if the position is obtained by two observations taken at different times, in which case an exactly correct allowance for the intervening run of the ship is an essential to the correctness of the determination. No navigator should ever assume that his position is not liable to be in error to some extent, the precise amount depending upon various factors, such as the age of the chronometer rate, the quality of the various instruments, the reliability of the observer, and the conditions at the time the sight was taken; perhaps a fair allowance for this possible error, under favorable circumstances, will be 2 miles; therefore, instead of plotting a position upon the chart, and proceeding with absolute confidence in the belief that the ship's position is on the exact point, one may describe, around the point as a center, a circle whose radius is 2 miles—if we accept that as the value of the possible error—and shape the future courses with the knowledge that the ship's position may be anywhere within the circle.

It is on account of this recognized inexactness of the determination of position that some navigators assume that the odd seconds may be neglected in dealing with the different terms of a sight; the average possible error due to this course is probably about one minute, though under certain conditions it may

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be considerably more. It is possible that, in a particular case, the error thus introduced through one term would be offset by that from others, and the result would be the same as if the seconds had been taken into account; but that does not affect the general fact that the neglect of seconds as a regular thing renders any determination liable to be in error about one minute. Those that omit the seconds argue, however, that since, in the nature of things, any sight may be in error two minutes, it is immaterial if we introduce an additional possibility of error of one minute, because the new error is as liable to decrease the old one as to increase it; but the fallacy of the argument will be apparent when we return to the circle drawn around our plotted point. The eccentricity of the sextant may exactly offset the improper allowance for refraction, and the mistake in the chronometer error may offset the observer's personal error, but unless we know that such is the case—which we never can—we have no justification for doing otherwise than assume that the ship may be any place within the 2-mile circle. If, now, we increase the possible error by 1 mile, our radius of uncertainty must be increased to 3 miles, and the diameter of the circle, representing the range of uncertainty in any given direction, is thereby increased from 4 to 6 miles.

It is deemed to be the duty of the navigator to put forth every effort to obtain the most probable position of the ship, which requires that he shall eliminate possible errors as completely as it lies within his power to do. By neglecting seconds he introduces a source of error that might with small, trouble be avoided. This becomes of still more importance since modern instruments and modern methods constantly tend to decrease the probability of error in the observation, and to place it within the power of the navigator to determine his ship's position with greater accuracy. **410.** There is a more exact way of defining the area of the ship's possible position than that of

410. There is a more exact way of defining the area of the ship's possible position than that of describing a circle around the most probable point, as mentioned in the preceding article, and that is to draw a line on each side of each of the Sumner lines by which the position is defined, and at a uniform distance therefrom equal to the possible error that the navigator believes it most reasonable to assume under existing conditions; the parallelogram formed by these four auxiliary lines marks the limit to be assigned for the ship's position; this method takes account of the errors due to poor intersections, and warns the navigator of the direction in which his position is least clearly fixed and in which he must therefore make extra allowance for the uncertainty of his determination.

It must be remembered in this connection that no position can ever be obtained except from the intersection of two Sumner lines, whether or not the lines are actually plotted; thus, a meridian altitude gives a Sumner line that extends due east and west, and a sight on the prime vertical a line that extends north and south, though it may not have been considered necessary to work the former with two longitudes or the latter with two latitudes. **411.** THE WORK BOOK AND. FORMS FOR SIGHTS.—The navigation work book, or sight book, being

411. THE WORK BOOK AND. FORMS FOR SIGHTS.—The navigation work book, or sight book, being the official record of all that pertains to the navigation of the ship when not running by bearings of the land, should be neatly and legibly kept, so that it will be intelligible not only to the person who performed the work, but also to any other who may have reason to refer to it.

Each day's work should be begun on a new page, the date set forth clearly at the top, and preferably, also, a brief statement of the voyage upon which the ship is engaged. It is a good plan to have the dead reckoning begin the space allotted for the day, and then have the sights follow in the order in which taken. The page should be large enough to permit the whole of any one sight to be contained thereon without the necessity of carrying it forward to a second page. No work should be commenced at the bottom of a page if there is not room to complete it. Every operation pertaining to the working of the sights should appear in the book, and all irrelevant matter should be excluded.

of the sights should appear in the book, and all irrelevant matter should be excluded. It is well to observe a systematic form of work for each sight, always writing the different terms in the same position on the page; this practice will conduce to rapidity and lessen the chances of error. In order to facilitate the adoption of such a method, there are appended to this work (Appendix II) a series of forms that are recommended for dead reckoning, and for time sights, meridian altitudes, and latitude sights (both by $\varphi' \varphi''$ formula and method of reduction to the meridian), for the sun, stars, planets, and moon, respectively. For beginners, these are deemed of especial importance, and it is recommended that, until perfect familiarity with the different sights is acquired, the first step in working out an observation be to write down a copy of the appropriate blank form, indicating the proper sign of application of each quantity (for which the notes will be a guide), and not to put in any figures until the scheme has been completely outlined; then the remainder of the work will consist m writing down the various quantities in their proper places and performing the operations indicated.

CHAPTER XVII. MARINE SURVEYING.

412. DEFINITIONS.—Surveying is the art of representing upon paper the surface of the earth, giving its characteristic features, such as, on land, the position of prominent objects, heights, and depressions, and on water, the depth, character of bottom, and position of shoals.

Topographical Surveying delineates the land, and Hydrographic Surveying, the water.

Geodesy is a higher kind of surveying, which takes into account the curvature of the earth. To points determined by a geodetic survey other surveys are referred.

It is not deemed appropriate to include in this work a complete treatise on Marine Surveying. The scope of this chapter will be to set forth such general information regarding the principles of surveying and the instruments therein employed as will give the navigator an intelligent understanding of the subject sufficient to enable him to comprehend the methods by which marine charts are made, and, if occasion should arise, to conduct a survey with such accuracy as the instruments ordinarily at hand on shipboard may permit. For a more detailed discussion of Marine Surveying, the student is referred to the various publications which treat the subject exhaustively.

INSTRUMENTS EMPLOYED IN MARINE SURVEYING.

413. THE THEODOLITE AND TRANSIT.—The Theodolite (fig. 54) is an instrument for the accurate measurement of horizontal and vertical angles. While these instruments vary in detail as to methods of construction, the essential principles are always identical.

A telescope carrying crosshairs in the common focus of the object-glass and eyepiece is so mounted as to have motion about two axes at right angles to one another; graduated circles and verniers are provided by which angular motion in azimuth and (usually) in altitude may be measured; and the instrument is capable of such adjustment by levels that the planes of motion about the respective axes will correspond exactly with the horizontal and the vertical.

The telescope is carried in appropriate supports upon a horizontal plate which has, immovably at-tached to it, one or more verniers, and which revolves just over a graduated circle that is marked upon the periphery of a second horizontal plate, a means of measuring the motion of the upper plate relatively to the lower one being thus provided. Thumb-screws are fitted by which the upper plate may be clamped to the lower, and (excepting in some simpler forms of the instrument) others by which the lower plate may be made immovable in azimuth, or allowed free motion, at will; all clamping



arrangements include slow-motion tangent-screws for finer control.

A vertical graduated circle, or arc, with a vernier, clamps, and tangent-screws, is fitted to most theodolites, for the measurement of the angular motion of the telescope in altitude. The theodolite usually carries a magnetic needle, with a graduated circle and vernier for compass

The instrument is mounted upon a tripod, and levels and leveling-screws afford a means of hearings. bringing the instrument to a truly horizontal position. The *Transit* used in surveying is a modified form of the theodolite, and is generally employed where

about its horizontal axis, or *transited*, without removal from its supports. **414.** The *line of collimation* of a telescope is an imaginary line passing through the optical center of

the object glass in a direction at right angles to that of its axis of rotation. This is also called the axis of collimation. The line of sight is an imaginary line passing through the optical center of the object-glass and the point of intersection of the cross-hairs.

A theodolite or transit, before it can be used for the accurate measurement of angles, must be in A theodone or transit, before it can be used for the accurate measurement of angles, must be in adjustment in the following respects: (a) The vertical axes of revolution of the upper and lower hori-zontal plates must be coincident; (b) the axis must be vertical and the plates horizontal when the bubbles of the levels are in their central positions; (c) the vertical cross hair must be perpendicular to the horizontal axis of the telescope; (d) the line of collimation must coincide with the line of sight; (c) the horizontal exist of the telescope intervent here perpendicular to the more different end of the telescope intervent here perpendicular to the more different end of the telescope intervent here perpendicular to the more different end of the telescope intervent end of telescope intervent end of telescope intervent end of telescope intervent end of te (e) the horizontal axis of the telescope must be perpendicular to the vertical axis of the instrument: (f) the bubble of the telescope level must stand at the middle of its scale, and the vertical circle must read zero, when the line of collimation is horizontal.

The last-named condition may be disregarded if vertical angles are not to be measured.

415. The instrument being in adjustment, to observe angles it should be set up, leveled, and focused. This involves placing the tripod so that a plumb bob from the center of the instrument shall hang directly over the spot at which the measurement is to be made. The legs of the tripod should be firmly placed in such manner that the height shall be convenient for the observer and the instrument shall be nearly level. Then the horizontal plates are brought to a true level by means of the leveling screws and bubbles. The telescope should next be focused by moving the object glass and eyepiece in such manner that the object sighted and the cross hairs may be plainly seen and that the object will not appear to have motion relatively to the cross hairs as the eye is moved to the right or left in front of the eyepiece. This last condition insures the cross hairs being at the common focus of the eyepiece and objective.

To observe a horizontal angle with a theodolite or transit, clamp the upper plate to the lower at zero, leaving the lower plate unclamped; swing the telescope so that its vertical cross hair bisects one of the objects, and clamp the lower plate; unclamp the upper plate and bring the telescope to bisect the other object, and the reading of the vernier on the scale will give the required angle. (The final nice motion by which the cross-hair is brought exactly upon a point is always given by the tangent screw.) In taking a *round of angles*, this operation is repeated successively upon each object to be observed

about the horizon, the upper plate being always swung, while the lower is kept where set upon the first object, or *origin*. The result will give the angular distance of each object from the origin, and, if the observations have been accurately made, upon finally sighting back to the origin, the reading should be zero.

To repeat an angle, having made the first measurement of it in the usual way, unclamp the lower circle and swing back the telescope until it again points to the first object, and clamp it; then unclamp the upper circle, swing to the second object, and clamp. The scale-reading should now be double that of the first angle. Repeat as often as the importance of the angle requires, and the accepted value will be the final reading divided by the number of measurements. All angles of the main triangulation, and others of importance in the survey, are repeated.

Defects in adjustment of the instrument may be eliminated by taking one series of angles with the *telescope direct* and another with the *telescope reversed*. To reverse the telescope, revolve it about its horizontal axis through 180°, then swing it about its vertical axis through 180°—in other words, invert it.

Vertical angles are measured on the same principle as that described for horizontal ones.

The process of setting up the instrument at a station and observing the angles between the various

objects that are visible is called *occupying* the station. **416.** THE PLANE TABLE.—This is an instrument by which positions are plotted in the field directly upon a working sheet. It consists (fig. 55) of a drawing board mounted upon a tripod in such manner as to be capable of motion in azimuth, and with facilities for being brought to a perfect level; in connection with it is employed an alidade, consisting of a straightedge ruler, upon which is mounted a telescope with cross-hairs whose line of sight is exactly parallel to the vertical plane through the edge of the rule. It is evident that if a sheet representing a chart be placed upon such a board and turned so that the true meridians, as portrayed thereon, lie in the direction of the earth's meridian at that place, then all lines of bearings on the chart will coincide with the corresponding lines on the earth's

place, then all lines of bearings on the enart will coincide with the corresponding lines on the earth's surface; from which it follows that if the alidade be so placed that its rule passes through the spot on the chart representing the position of the observer, while the telescope is directed to some visible object, the position of that object on the chart lies somewhere upon the line drawn along the edge of the rule. Upon this general principle depend the various applications of the plane table. The drawing board is usually made of several pieces of well-seasoned wood, tongued and grooved together, with the grain running in different directions to prevent warping; about its edge are several metal clips for securing the paper in place. It is supported upon three strong brass arms, to which it is attached by screws, thus permitting its removal at will. The arms are attached to a horizontal plate which revolves upon a second horizontal plate lying immediately below it; a clamp and tangent screw are fitted, by which the upper plate, and with it the drawing board, may be secured to the lower plate. are fitted, by which the upper plate, and with it the drawing board, may be secured to the lower plate, or may be given a fine motion in azimuth. Three equidistant lugs of brass, grooved on the under side, project down from the lower plate, resting on screws in the top of the tripod, by which the instrument is leveled; when adjusted in this respect it is firmly clamped in position, and, as the tripod is made unusually large, the adjustment is not easily deranged.

The alidade is a metal straightedge with a vertical column at its center, at the top of which are the supports which carry the telescope; a vertical arc and vernier are provided for measuring the motion of the telescope in altitude. The telescope is usually so fitted that it may be revolved in azimuth through an arc of exactly 180°, for the purpose of adjusting the line of collimation. On top of the rule near its center is the level—sometimes replaced by two levels at right angles—by means of which it may be seen when the table is in a true horizontal position.

A magnetic needle mounted in a rectangular metal box, whose outer straightedge is parallel to the zero line of a graduated scale over which the needle swings, is provided for drawing the north-and-south line on the chart: this is called a *declinatoire*.



Fig. 55.

417. To be in correct adjustment, a plane table must comply with the following conditions: (a) The fiducial edge of the rule must be perfectly straight. (b) The level must have the bubble in its central position when the table is truly horizontal. (c) The vertical cross hair must be perpendic-ular to the horizontal axis of the telescope. (d) The line of collimation must coincide with the line of sight. (e) The horizontal axis of the telescope must be parallel to the plane of the table. (f)The vertical circle should read zero when the line of collimation is horizontal.

418. The results derived from the use of the plane table, like all others dependent upon graphic methods, must be regarded as less accurate than those deduced by computation, and even less accurate than those derived from the careful plotting of theodolite angles. Hence it is that, in a careful marine survey, this instrument would be employed only for the topography and shore line.

For whatever purpose used, the plane table would not ordinarily be called into requisition until the survey had so far progressed that a chart could be furnished the observer showing certain stations whose positions were already established; with this chart, the first step would be to occupy one of the determined points. The table must be set up with the point on the chart directly over the center of the station; it must then be leveled and the telescope focused as described for the theodolite or transit; and finally it must be *oriented*, that is, so turned in azimuth that all lines of the chart are parallel to similar lines of the earth's surface. To orient, unclamp the table and swing it until the north-and-south line of the chart is approximately parallel to that of the earth, one means of doing which is afforded by the decli-natoire; place the alidade so that the edge of the rule passes through the points on the chart representing the station occupied and some second station which is clearly in view; then, sighting through the telescope, perfect the adjustment of the table by swinging it until the second station is exactly bisected by the vertical cross hair, the final slow motion being obtained by clamping the table and working the tangent screw. If the adjustment has been correctly made, the rule may be laid along the line joining the station occupied and any other on the chart, and the telescope will point exactly to that other station.

Being properly oriented, if the alidade be so placed that the edge of the rule pass through the station occupied, and the telescope point directly to some unknown object whose position is to be determined,

then a line drawn along the rule will contain the point which represents the position of that object. If, now, the plane table be set up at a second station, oriented for its new position, and a line be similarly drawn from that station toward the one to be established, it will intersect the first line in the required point. This is the method of determining positions by *prosection*. Actually, the surveyor does not regard the point as well established until the intersection is checked by a line from a third station.

In practical work, of course, each station is not occupied separately for the determination of each point; the instrument is set up at a station, lines are drawn to all required points in view, and each line is appropriately marked; then a second station is occupied, and the operation repeated, and so on, the various intersections being marked as the work proceeds. A second method of establishing positions is that of *resection;* in this the first line is drawn from

A second method of establishing positions is that of *resection;* in this the first line is drawn from some known station, as in the preceding method, and the observer next proceeds to the place whose position is required and occupies it; the plane table is there oriented by means of the line already drawn, placing the edge of the rule along the line, sighting back toward the first station, and swinging the table until that station is in the line of sight of the telescope; then choose some other established station as nearly as possible at right angles to the direction of the first; place the edge of the rule upon, the plotted position of this station and swing the alidade (the rule always being kept on the plotted point) until the object is bisected by the telescope cross-hairs; draw this line, and its intersection with the first will give the required point, the accuracy of which can be checked from some other plotted station.

A third method of locating a point is by means of a single bearing from a known station, with the distance from the occupied station to the required one, the process of plotting being self-evident.

A fourth method is given by occupying an undetermined position from which three established stations are in view; the point occupied by the observer is then plotted by an application of the "three-point problem."

419. It may be seen that where the greatest accuracy is not essential the plane table may be employed for plotting all the points of a survey. In such a case it would only be necessary to begin with the two base stations, plotted on the sheet on any relative bearing whatsoever and at a distance apart equal to the length of the base line (reduced to scale), as measured by the most accurate means available. The work of plotting might even proceed before the base line had been measured, the two stations being laid off at any convenient distance apart; when, later, the base line was measured, the scale of the chart would be determined, being equal to the distance on the chart between base stations divided by the length of the base line.

420. A plane table could be improvised on shipboard which would greatly facilitate the operation of any surveying work that a vessel not equipped with instruments might be called upon to perform. A drawing board could be mounted upon a tripod (as, for example, the tripod supplied for compass work on shore) in such manner as to be capable of motion in azimuth; it could be brought nearly to the horizontal, if no better means offered, by moving the tripod legs, and this adjustment could be proved by any small spirit level; sight vanes could be crected upon an ordinary ruler to take the place of the alidade; in case there was difficulty in observing any object with such an alidade, because of its altitude or for other reasons, a horizontal angle might be observed with a sextant and plotted with a protractor. By this means work could be done which, even if it should lack complete accuracy, might be of great value.

421. THE TELEMETER AND STADIA.—Any telescope fitted with a pair of horizontal cross-hairs at the focus may be used as a *telemeter*, and when accompanied by a graduated staff, called a *stadia*, affords a means of measuring distance (up to certain limits) with a close degree of accuracy; the method consists in observing the number of divisions of the scale subtended by the hairs when the stadia is held up vertically and perpendicular to the line of sight of the telescope, it being evident that the closer the distance the fewer divisions will appear between them. The facility with which distances can be measured by this method makes it most important that all telescopes of theodolites, transits, and plane tables be fitted as telemeters, and that stadia rods be provided for all surveying work.

tables be fitted as teleneters, and that stadia rods be provided for all surveying work. Speaking approximately, it may be said that the number of divisions intercepted between the crosshairs will vary directly as the distance of the stadia rod. This would be exactly true if we looked at the object through an empty tube, directly between the hairs. Since, however, the rays from the stadia are refracted by the object glass before they are intercepted by the wires, the statement, to be absolutely exact, must be slightly modified; but for practical surveying work it may be accepted as given.

422. There are two methods of installing the telemeter cross-hairs—the first, in which they are immovably secured in the telescope and always remain at the same distance apart, and the second, in which the distance of the cross hairs is made variable, being under the control of the observer. The former is generally regarded as the preferable method, and when it is employed it is evident that the subtended height of the stadia bears a constant ratio to the distance of the staff from the telescope. It proves most convenient in practice to space the hairs so that this constant ratio is some even multiple of 10, for facility in converting scale readings into distance; it is also advantageous to mark the stadia in the unit of the chart scale and decimals thereof; for example, if the ratio of stadia height to distance were 100, and the stadia were marked in meters and decimals, a reading of 2.07 would at once be converted into a distance of 207 meters. Any units and any ratio may, however, be employed, and for any given setting of cross-hairs it is very easy to graduate a stadia, by experiment, for any desired units; for example, if it is required to mark the stadia in fect, set up and level the telescope, measure off a distance of exactly 100 feet from it, hold up an unmarked staff and mark upon it the points intersected by the cross hairs; the interval between these marks will represent 100 feet of the scale; divide this length into 100 parts, each of which will represent a distance of one foot, and mark the whole staff on the same scale; then if the stadia be held up at any distance.

When the cross-hairs are movable the ratio becomes variable, but the principle of measuring remains the same—namely, the distance of the staff from the telescope is equal to the existing ratio multiplied by the distance intercepted on the scale.

423. The stadia is made of a light, narrow piece of wood and is usually hinged for convenience in transporting. Ordinarily the background of the scale is painted white, while the main divisions are marked in red, with minor divisions in black, and geometrical figures are employed to facilitate the reading of fractional parts of the scale. Devices are furnished by which the man holding the stadia may know when it is at right angles to the line of sight of the telescope—an essential condition for accuracy of measurements.

424. The use of the telemeter and stadia for measuring distances is limited to the distance at which the scale divisions can be accurately read through the telescope. For fairly close work and with the class of telescope usually supplied with surveying instruments, 400 meters represents about the greatest distance at which it can be employed. With this limitation, the character of the survey determines the nature of its employment. In a careful survey its greatest use would be in connection with the theodolite or plane table in putting in shore lines, contour lines, and topography generally. In a survey where only approximate results are sought it might afford the best means for the measurement of the base.

425. If the telemeter be applied to a theodolite, transit, or plane table which is fitted with a graduated vertical arc or circle, it is possible to measure the distance to the stadia not only in a horizontal but also in a vertical direction. In this case the vertical angle must be observed as well as the stadia reading. Tables are computed giving the solution of the triangles involved.

426. In making a survey with the ordinary resources of a ship, the principle of the telemeter and stadia may be profitably employed, using a sextant and improvised staff. In this case it is usual to have the stadia of some convenient fixed length, as, for example, 10 feet, and of slight width and thickness; this is held at right angles to the line of sight from the observer, who notes the angle subtended by the total length; tables are prepared by which the distance corresponding to each angle is given.

427. THE SEXTANT.—This instrument is of the greatest value in hydrographic surveying. It is fully described elsewhere in this work and its adjustment explained (Chap. VIII).

Sextants are manufactured of a form especially adapted to surveying work; they are smaller and lighter than those usually employed in astronomical observations, but have a longer limb, by which angles may be measured up to 135°; the vernier is marked for quick reading and has no finer graduation than half minutes; the telescope has a large field.

This instrument is principally employed in measuring the horizontal angles by means of which soundings are plotted. It may, however, be put to various uses when making an approximate survey, as has already been explained. It should be remembered, in measuring terrestrial angles with a sextant, that rigorous methods require a reduction to the horizontal if either of the objects has material altitude above the horizon.

428. THE LEVEL.—This is an instrument for the accurate measure of differences of elevation. It consists of a telescope, carried in a Y-shaped rest, which is mounted upon a tripod and leveled in a manner similar to a theodolite; but it differs from that instrument in that the telescope is not capable of motion about a horizontal axis, and in having no graduated circle for' measurements of altitude and azimuth. The principle of its use contemplates placing the line of collimation of the telescope in a truly horizontal plane and keeping it so fixed. **429.** It is principally employed in marine surveying to determine heights and contour lines—the

429. It is principally employed in marine surveying to determine heights and contour lines—the latter being lines of equal elevation above the sea level—and for locating bench marks for tidal observations (Chap. XX). In connection with it is used a graduated staff called a *leveling rod*, carrying a conspicuous mark, adjustable in height, called a *larget*. To ascertain the difference of level between any two points, set up the level with the telescope horizontal at some place between them; let an assistant take the leveling rod to one of the points, and, while holding it on the ground in a truly vertical position, move the target, under the direction of the observer at the telescope, to a point where it is exactly bisected by the horizontal cross-hair; the height of the target on the staff—that is, the height of the cross-hair above the level of the first point—is then accurately read with a vernier; now, without moving the level, shift the rod to the second point and again adjust the target and read it. It is evident that a comparison of the reading at the first position with that at the second will give the difference of height at the two points. The difference that can be read from one location of the instrument is limited by the level by making a sufficient number of shifts any difference may be measured.

The work of the level may be performed equally well by a theodolite whose telescope is adjusted to the true horizontal.

430. HELIOTROPE AND HELIOGRAPH.—These are instruments sometimes employed in surveying, by means of which the sun's rays may be reflected in any given direction; the object of their use is to render conspicuous a station which is to be observed at a distance and which would not otherwise be distinguishable. The instruments vary widely in form of construction and, in the absence of those made for the purpose, substitutes may easily be devised.

431. ASTRONOMICAL TRANSIT INSTRUMENTS.—Various instruments are employed for the astronomical determinations necessary in a marine survey. Among these are the *zenith telescope* and *portable transit*. While differing in detail they consist essentially of a telescope mounted upon a horizontal axis that is placed truly in the prime vertical, thus insuring the revolution of the line of collimation in the meridian; a vertical graduated circle and vernier are supplied, affording a measure of altitude; in the focus are a number of equidistant vertical cross-hairs or lines; a small lamp is so placed that its rays illuminate the cross-hairs and render possible observations at night. Latitude is obtained by observing the meridian altitude of stars; hour angle (and thence longitude) by observing the times of their meridian transit, which is taken from the mean of the times of passing all of the vertical cross-hairs.

Excepting in surveys of a most accurate nature, the astronomical determination of position by the sextant and artificial horizon is regarded as satisfactory.

432. THE THREE-ARMED PROTRACTOR, OR STATION POINTER.—This is an instrument whereby positions are plotted on the principle of the "three-point problem," of which an explanation is given in

article 152, Chapter IV. It consists (fig. 56) of a graduated circle with three arms pivoted at the center; each arm has one edge that is a true rule, the direction of which always passes through the center of the circle. The middle arm is immovably fixed at the zero of the scale: the right and left arms each revolve about the center on their own sides, and are provided with verniers giving the angular distance from the middle arm. The protractor being set for the right and left angles, it is so moved that the three arms pass through the respective stations, when the center marks the position of the observer. Center pieces of various forms are provided, being cylindrical plugs made to fit into a socket at the pivot, and by employing one or the other of them the true center may be pricked with a needle, dotted with a pencil, or its position indicated by cross-hairs. Adjustable arms are provided which can be fitted to the ends of the ordinary arms when working with distant signals.

The most valuable use of the threearmed protractor is in plotting the positions of soundings taken in boats, where sextant angles between signals are ob-served. It may occur, however, that certain shore stations will be located by its use.

433. In default of a three-armed protractor, a piece of tracing paper may be made to answer its purpose. To use the tracing paper, draw a line, making a dot on it to represent the center station, and with the center of an ordinary protractor on the dot, lay off the two observed angles right and left of the line; then, laying this on the plan, move it about till the three lines pass exactly through the three stations observed. The dot from which they were laid off will be on the



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position of the observer, and must be pricked lightly through or marked underneath in pencil.



FIG. 57.

434. THE BEAM COMPASS .- This instrument (fig. 57) is employed in chart drafting and performs the functions of compasses and dividers when the distance that must be spanned is beyond the limits of those instruments in their ordinary form. It consists of an angular bar of wood or metal upon which two instruments termed beam heads are fitted in such a manner that the bar may slide easily through them. A clamping screw attached to one side of the beam head will fix it in any part of its course along the beam. Upon each head a socket is constructed to carry a plain point, exchangeable for an ink or a pencil point. For exact purposes the beam head placed at the end of the beam has a fine adjustment, which moves the point a short distance to correct any error in the first rough setting of the instrument. This adjustment generally consists of a milled-head screw, which passes through a nut fixed upon the end of the beam head, which it carries with its motion.

435. PROPORTIONAL DIVIDERS .- These are principally employed for reducing or enlarging drawings in any given proportion. They consist (fig. 58) of two narrow flat pieces of metal called *legs*, which turn upon a pivot whose position is movable in the

direction of their length. The ends of both legs are shaped into points like those of ordinary dividers. When the pivot is fixed at the middle of the legs, any distance measured by the points at one end is just equal to that measured by those at the other; for any other location of the pivot, however, the distances thus measured will not be equal, but with a given setting of the pivot any distance measured by one end bears a fixed ratio to that measured by the other. The path of travel of the pivot is graduated so that the ratio may be given any desired value. Being adjusted in this respect, if a distance is taken off a chart with the legs at one end of the instrument, then those at the other end will show the same distance on the scale of a chart enlarged or reduced in the proportion represented by the ratio for which the pivot was set.

METHODS EMPLOYED IN A HYDROGRAPHIC SURVEY.

436. A geodetic survey has for its object the determination, with the greatest attainable accuracy, of points on the surface of the earth, by the employment of a process of triangulation, all positions being located either trigonometrically or astronomically, and the curvature of the earth being taken into account.

Before commencing a survey a general inspection of the field is made; a *base line* is located and its extremities marked by *signals*; certain other positions, known as *main* triangulation points, are selected and also marked with signals, being so chosen that, starting with the base and proceeding thence from one to another of these points, a series of well-conditioned triangles or quadrilaterals may cover the field of survey. The base line is measured with the greatest degree of accuracy which the resources of the survey render possible. Each extremity of the base line and each other main triangulation point is occupied by an observer with a theodolite, who measures the angles at each station between all the other stations which are in sight. An *astronomical* determination is made of the latitude and longitude of some point of the survey (frequently one of the extremities of the base) and of the true azimuth of some known line (frequently the base line). Data is now at hand for the location upon the chart of the base line and main triangulation points.

If the survey is one of considerable extent it is expedient to measure a *check base* near the end of the triangulation, a comparison between the measured and the computed distance between any two stations showing the accuracy of the work and affording a means of reconciling discrepancies. The position of a second observation spot may be determined for a similar purpose.

The primary triangulation gives a skeleton of the field, but the points thus determined are not usually close enough together to afford a basis for all the detail work that must be done. A second system of points is therefore selected and signals erected thereon, and the position of these points is determined by a series of angles from the main triangulation points and from each other. This is known as the secondary triangulation. The points thus located are used in the plotting of the topography and hydrography. It is not essential that their determination be as accurate as that of main triangulation points.

The topography is put in, and includes the delineation of the features of the land shore line, light-houses, beacons, contour lines, peaks, buildings, and, in short, everything that may be recognized by the navigator and utilized by him in locating the ship's position.

The hydrographic work is taken up and the depth of water and character of bottom determined as accurately as possible for the complete water area, especial care being taken to develop all shoals and dangers to navigation and to locate all aids to navigation, such as buoys, light-ships, and beacons.

One or more *tidal stations* are established where observations are taken, continually and at frequent intervals, of the height of the tide and direction and velocity of the tidal and other currents, whence data is derived for the reduction of all soundings to the plane of reference and for the information about tides and currents which is to appear upon the chart.

Observations are made to determine the *magnetic* variation and dip, and the intensity of the earth's magnetic force.

437. The foregoing represent, in outline, the various steps that must be taken in the accumulation of the data necessary for the construction of a complete hydrographic chart. In the following paragraphs the details of the various operations will be more fully set forth.

The navigator who is called upon to conduct a marine survey without having available the time, instruments, and general facilities necessary for the most thorough performance of the work must exercise his discretion as to the modifications of method that he will make, and call upon his ingenuity to adapt his means to the particular work in hand.

438. THE BASE LINE.—As the base line is the foundation for all distances on the chart, the correctness of the results of the survey will depend largely upon the degree of accuracy with which it is measured. The triangulation merely affords a measure of the various distances as compared with the distances between the two initial points from which it began; if that initial distance is 1,000 feet, we have certain values for the sides of the various triangles; if the same base line is 2,000 feet, the value of each side becomes twice as great as it was before; with the same triangulation, therefore, distances vary directly with the length of the base line; it may thus be seen that if an error exists in measurement which is only a small fraction of the total length, the error will become nuch more material as the more distant points of the survey are reached. In a base line 1,000 feet long, if a mistake of 10 feet be made, all distances measured upon the chart will be in error 1 per cent, and a point plotted by triangulation 10 miles from the observation spot (the point at which plotting begins), would be out of its correct position one-tenth of a mile.

It is important that the base line should be as long as possible, as an error in measurement will thus constitute a smaller percentage of the total length and will not accumulate so rapidly as the work proceeds. The position of the line must be such as to afford favorably conditioned triangles and quadri-

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laterals with adjoining main triangulation points, and its extremities must be visible from those points and from each other. The character of the ground and the facility for measuring will of course form an important consideration in the choice.

439. In measuring a base by tape, chain, or similar means, a number of successive fleets are made with the measure, whatever its nature, the distance traversed being appropriately marked after each fleet, while an observer, with a theodolite or transit, insures the measurement being made accurately along the line.

440. The most careful measurements are made by a steel tape 100 feet long, stretched along a series of battens which are supported by metal crutches and made exactly horizontal by a level. The tape is stretched to a uniform tension by a spring balance; its exact length at that tension is known from comparison with some standard; a correction for temperature is applied. The ends of the fleets are marked by driving into the ground a peg carrying in its top a tack; the exact end of the tape is marked by a score filed on the head of the tack at a point marked by a plumb bob from the tape, and this score becomes the origin for the next fleet. An assistant precedes the measuring party before each shift of the battens, and is accurately aligned by the theodolite to mark the true direction of the base line. The result of this method of measurement gives the *horizontal* distance between the points. It can be depended upon for the greatest degree of accuracy of any method, excepting that with a special *base-measuring apparatus*, which is seldom employed in marine surveys.

441. A second method of base measurement is with the surveyor's chain. This depends for accuracy upon the surface traversed being plane and level, a condition that is well fulfilled on a sandy beach, where the chain is nearly as accurate as the tape and much more rapid. A surveyor's chain is usually 100 feet long; the exact value of its length must be obtained by comparison with a standard, and correction applied for expansion or contraction due to temperature. The ends of the fleets are marked by steel pins driven into the ground; the alignment is kept by the theodolite.

442. Where neither chain nor tape is available substitutes may be improvised from sounding wire taken from the deep-sea sounding machine, or, failing this, from well-stretched cod line.

43. Measurements made by the telemeter and stadia afford a close approximation to the true result, and if these instruments are not at hand the sextant angle of a rod of fixed length can be employed. The masthead height of the vessel may be used in determining the length of base line on this principle, either by making the ship itself mark one of the extremities and observing the masthead angle from the other extremity, or by simultaneously observing the masthead angle from both ends of a shore. base, and also the three horizontal angles of the triangle formed by the ship and the two base stations. The latter plan is far preferable where accuracy is sought, as, if the angles are all taken by different observers at the same instant (which can be marked by the hauling down of a flag), the error arising from the notion of the ship about her anchor is eliminated, and, moreover, the data furnished offers a double solution of the triangle and the mean may be taken as giving a closer result.

444. A crude method of measuring a base is by means of the velocity of sound, though this would never be used where close results are expected. Fire a gun at one end of the base and at the other note by the most accurate means available the time between seeing the flash and hearing the report. Repeat several times in each direction. The mean number of seconds and tenths of a second multiplied by the velocity of sound per second at the temperature of observation (art. 314, Chap. XI) gives the approximate length of base line.

445. When for any reason the existing conditions do not permit of a direct measurement being made along the line between the two base stations, recourse must be had to a *broken base*, that is, one in which the length of the base is obtained by reduction from the measured length of two or more auxiliary lines. Necessity for resorting to a broken base arises frequently when the two stations are situated on a curving shore line and the straight line between them passes across water, or where wooded or unfavorable country intervenes, or where a stream must be crossed. The most common form of broken base is that in which the auxiliary lines run from each extremity of the base at an acute angle and intersect; in addition to measuring each of these lines, the angles of the triangle formed by them with the base line must be observed and the true length of the base deduced by solution of the triangle. The form that is most frequently used where only a short section of the base is incapable of measurement (as is the case where a deep stream flows across) is that of an auxiliary right triangle whose base is the required distance along the base line and altitude a distance measured along a line perpendicular thereto to some convenient point; by this measured distance and the angles which are observed, the triangle is solved and the length of the unmeasured section determined.

446. In a survey of considerable extent, where good means are at hand for the correct determination of latitude and longitude, a base line actually measured upon the earth may be dispensed with, and, instead of that, the positions of the two stations which are most widely separated may be determined astronomically and plotted; the triangulation is then plotted upon any assumed scale, and when it has been brought up to connect the two stations the true value of the scale is ascertained. This is called the method of an *astronomical base*.

447. SIGNALS.—All points in the survey whose positions are to be located from other stations, or from which other positions are to be located, must be marked by signals of such character as will render them distinguishable at the distance from which they are observed. The methods of constructing signals are of a wide variety.

A vessel regularly fitted out for surveying would carry scantlings, lumber, bolts, nuts, nails, whitewash, and sheeting for the crection of signals; however meager the equipment, the whitewash and sheeting (or some substitute for sheeting, preferably half of it white and half dark in color,) should be provided, it possible, before beginning any surveying work. Regular tripod signals, which are quickly erected and are visible, under favorable circumstances, for many miles, are almost invariably employed to mark the main triangulation stations; among other advantages the tripod form permits the occupation with the theodolite of the exact center of the station, and avoids the necessity for the reduction which must otherwise be applied. Signals on secondary stations take an innumerable variety of forms, the requirement being only that they shall be seen throughout the area over which they are to be made use of: a whitewashed spot on a rock, a whitewashed trunk of a tree, a whitewashed cairn of stones, a sheeting flag, a piece of sheeting wrapped about a bush or hung, with stones attached, over a cliff, or a white-washed barrel or box filled with rocks or earth and surmounted by a flag, suggest some of the secondary signals that may be employed; sometimes objects are found that are sufficiently distinct in themselves to be used as signals without further marking, as a cupola or tower, a hut, a lone tree, or a bowlder: but it is seldom that an object is not rendered more conspicuous by the flutter of a flag above it, or by the dead-white ray reflected from a daub of whitewash.

For convenience, each signal is given some short name by which it is designated in the records. 448. THE MAIN TRIANGULATION.—The points selected as stations for the main triangulation mark in outline the whole area to be surveyed; they are close enough together to afford an accurate means of plotting all intermediate stations of the secondary triangulation; and they are so placed with relation to one another that the triangles or quadrilaterals derived from them are well conditioned. The points are generally so chosen that small angles will be avoided. In order to fulfill the other conditions, it frequently becomes necessary to carry forward the triangulation by means of stations located on points a considerable distance inland, such as mountain peaks, which would not otherwise be regarded as properly within the limits of the survey.

Great care should be taken in observing all angles upon which the main triangulation is based: the best available instrument should be employed; angles taken with a theodolite or transit should be repeated, and observed with telescope direct and reversed, and the mean result taken; if the sextant is used, a number of separate observations of each angle should be taken and averaged for the most probable value. It must be remembered that while, in any other part of the work, an error in an angle affects only the results in its immediate vicinity, a mistake in the main triangulation goes forward through all the plotting that comes after it.

It frequently occurs that the purposes of the survey are sufficiently well fulfilled by a graphic plotting of the main triangulation, but where more rigorous methods prevail, the results are obtained by calculation. The sum of the angles of each triangle is taken, and if it does not exactly equal 180° the values are adjusted to make them comply with this condition. The lengths of the various sides are then computed, regarding the stations, usually, as forming a series of quadrilaterals, and allowing for the curvature of the earth where the sides are sufficiently long to render it expedient to do so.

449. THE SECONDARY TRIANGULATION.—The points of the secondary triangulation are located, as far as possible, by angles from the main triangulation stations; these angles, having less dependent upon them, need not be repeated. A graphic plotting of these stations, without calculation, will suffice. **450.** Astronomical Work.—This comprises the determination of the correct latitude and longitude

of some point of the survey, which is the first position plotted, and of the true direction of some other point from the observation spot, which is the first line to be laid down on the chart; it is evident that these determinations form the origin of all positions and of all directions, without which the chart could not be constructed.

The methods of finding latitude, longitude, and the true bearing of a terrestrial object are fully set forth in previous chapters. The feature that distinguishes such work in surveying from that of deter-mining the position of a ship at sea lies in the greater care that is taken to eliminate possible errors. At sea, results of absolute exactness are recognized as unattainable and are not required; but in a careful survey no step which will contribute to accuracy should be neglected.

The results should therefore be based upon a very large number of observations, employing the best instruments that are available, and the various sights being so taken that probable errors are offset in reckoning the mean.

451. By taking a number of sights the observer arrives at the most probable result of which his instruments and his own faculties render him capable; but this result is liable to an error whose amount is indeterminate and which is equal to the algebraic sum of a number of small errors due, respectively. to his instruments (which must always lack perfection in some details), to an improper allowance for refraction under existing atmospheric conditions, and to his own personal error. Assuming, as we may, that the personal error is approximately constant, these three causes give rise to an error by which all altitudes appear too great or too small by a uniform but unknown amount. Let us assume, for an illustration, that this error has the effect of making all altitudes appear 30" too great; if an observer attempted to work his latitude from the meridian altitude of a star bearing south, the result of this unknown error would give a latitude 30'' south of the true latitude; if another star to the southward were observed, this mistake would be repeated; but if a star to the north were taken, the resulting latitude would be 30'' to the north. It is evident, therefore, that the true latitude will be the mean of the results of observation of the northern and the southern star, or the mean of the average of several northern stars and the average of several southern stars. A similar process of reasoning will show that errors in the determination of hour angle are offset by taking the mean of altitudes of objects respectively east and west of the meridian.

452. It must be remembered that the uniformity of the unknown error only exists where the altitude remains approximately the same, as instrumental and refraction errors may vary with the altitude; another condition of uniformity requires that the instrument and the observer remain the same, and that all observations be taken about the same time, in order that atmospheric conditions remain unchanged; to preserve uniformity, if the artificial horizon is used, the same end of the roof should always be the near one to the observer; in taking the sun, however, as the personal error may not be the same for approaching as for separating limbs, every series of observations should be made up of an equal number of sights taken under each condition.

453. With all of this in mind, we arrive at the general rule that astronomical determinations shall be based upon the mean of observations, under similar conditions, of bodies whose respective distances from the zenith are nearly equal, and which bear in opposite directions therefrom.

454. This condition eliminates the sun from availability for observations for latitude, though it properly admits the use of that body for longitude where equal altitudes or single a. m. and p. m. sights Opposite stars of approximately equal zenith distance should always be used for latitude. are taken. circum-meridian altitudes being observed during a few minutes before and after transit; excellent results are also obtained from stellar observations for longitude; but very low stars should be avoided, on account of the uncertainty of refraction, and likewise very high ones, as the reflection from the index mirror of the sextant may not be perfectly distinct when the ray strikes at an acute angle.

455. If there is telegraphic communication, an endeavor should be made to obtain a time signal

 456. TOPOGRAPHY.—The plane-table, with telemeter and stadia, affords the most expeditious means of plotting the topography, and should be employed when available. Points on shore may also be 457. Hydrography.—The correct delineation of the hydrographic features being one of the most

important objects of the survey, great care should be devoted to this part of the work. Soundings are run in one or more series of parallel lines, the direction and spacing of which depend upon the scope of the survey. It is usual for one series of lines to extend in a direction normal to the general trend of the shore line. In most cases a second series runs perpendicular to the first, and in surveys of important bodies of water still other series of lines cross the system diagonally. In developing rocks, shoals, or dangers the direction of the lines is so chosen as will best illustrate the features of the bottom. When lines cross, the agreement of the reduced soundings at their intersection affords a test of the accuracy of the work.

As the depth of water increases, if there is no reason to suspect dangers, the interval between lines may be increased.

Lines are run by the ship or boat in such manner as to follow as closely as possible the scheme of sounding that has been laid out. The position is located by angles at the beginning of each line, at each change of course, at frequent intervals along the line, and at the point where each line is finished. Soundings taken between *positions* are plotted by the time interval or patent-log distances. **458.** There are a number of methods for determining positions while sounding, which may be

described briefly as follows:

By two sectant angles.—Two observers with sextants measure simultaneously the angles between three objects of known position, and the position is located by the three-point problem. This is the method most commonly employed in boat work, and has the great advantage that the results may be plotted at once on the working sheet in the boat and the lines as run thus kept nearly in coincidence with those laid out in the scheme. A study of the three-point problem (art. 153, Chap. IV) will give

the considerations that must govern in the selection of objects. By two theodolite angles.—Two stations on shore are occupied by observers with theodolites, and at certain instants, indicated by a signal from the ship or boat, they observe the angular distance thereof from some known point. The intersection of the direction lines thus given is at the required position. This method is expeditious where the signals are small or not numerous. Its disadvantage is that the plotting can not be kept up as the work proceeds.

By one sextant and one theodolite angle.—An observer ashore occupies a station with a theodolite and cuts in the ship or boat, while one on board takes a sextant angle between two objects, of which one should preferably be the occupied station. It is plotted by laying off the direction line from the theodolite and finding with a three-armed protractor or piece of tracing paper what point of that line subtends the observed angle between the objects. Its advantages and disadvantages are the same as those of the preceding method.

In running lines of soundings offshore, where signals are lost sight of, the best method is to get an accurate departure, before dropping the land, by the best means that offers, keeping careful note of the the dead reckoning, and on running in again, to get a position as soon as possible, note the drift and reconcile the plotting of intermediate soundings accordingly. Where circumstances require, the position may be located by astronomical observations as usually taken at sea.

459. A careful record of soundings must be kept, showing the time of each (so that proper tidal correction may be applied), the depth, the character of bottom, and such data as may be required to

locate the position. **460.** TIDAL OBSERVATIONS.—These should begin as early as practicable and continue throughout In the position of a lupar month. In the survey, it being most important that they shall, if possible, cover the period of a lunar month. In the chapter on Tides (Chap. XX) the nature of the data to be obtained is explained.

461. MAGNETIC OBSERVATIONS.-The feature of the earth's magnetism with which the navigator is most concerned is the variation, which is set forth on the chart, and upon the determination of which will depend the correctness of all courses and bearings on shipboard. It is usually obtained by noting the compass direction from the observation spot of the object whose true bearing is known by calcula-tion, and comparing the true and compass bearings; or it may be observed by mounting the ship's compass in a place on shore free from foreign magnetic influence, and finding the compass error as it is found

on board. Observations for dip and intensity are also made when the proper instruments are at hand. **462.** RUNNING SURVEY.—Where time and opportunity permit only a superficial examination of a coast line or water area, or where the interests of navigation require no more, recourse is had to a *Run*ning Survey, in which shore positions are determined and soundings are made while the ship steams along the coast stopping only occasionally to fix her position, and in which the assistance of boat or shore parties may or may not be employed.

In this method the ship starts at one end of the field from a known position, fixed either by astronomical observations or by angles or bearings of terrestrial objects having a determined location. Careful compass bearings or sextant angles are taken from this position to all objects ashore which can be recognized, and a series of direction lines is thus obtained. The ship then steams along the coast, at a convenient distance therefrom, keeping accurate account of her run by compass courses and patent log.
From time to time other series of bearings or angles are taken upon those objects ashore which are to be located, the direction lines plotted from the estimated position of the ship, and the various objects located by the intersections with their other direction lines. During all the time that the ship is under way, soundings are taken at regular intervals and plotted from the dead reckoning. As frequently as circumstances permit, the ship is stopped and her position located by the best available means, and the intervening dead reckoning reconciled for any current that may be found.

If a steam launch can be employed in connection with a running survey, it is usually sent to run a second line inshore of the ship. The boat's position is obtained by bearings of objects ashore which are located by the ship, or by bearings and mast-head angles of the ship, or by such other means as offer. The duty of the boat is to take a series of soundings, and to collect data for shore line and topography.

If circumstances allow the landing of a shore party, its most important duty is to mark the various objects on shore by some sort of signals which will render them unmistakable. Beyond this, it can perform such of the duties assigned to shore parties in a regular survey as opportunity permits.

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CHAPTER XVIII.

WINDS.

463. Wind is air in approximately horizontal motion. Observations of the wind should include its true direction, and its force or velocity. The direction of the wind is designated by the point of the compass from which it proceeds. The force of the wind is at sea ordinarily expressed in terms of the Beaufort Scale, each degree of this scale corresponding to a certain velocity in miles per hour, as explained in article 67. Chapter II.

explained in article 67, Chapter II. **464.** The CAYSE OF THE WIND.—Winds are produced by differences of atmospheric pressure, which are themselves ultimately, and in the main, attributable to differences of temperature.

To understand how the air can be set in motion by these differences of pressure it is necessary to have a clear conception of the nature of the air itself.

The atmosphere which completely envelops the earth may be considered as a fluid sea at the bottom of which we live, and which extends upward to a considerable height, probably 200 miles, constantly diminishing in density as the altitude increases.

The air, or material of which this atmosphere is composed, is a transparent gas, which, like all other gases, is perfectly elastic and highly compressible. Although extremely light, it has a perfectly definite weight, a cubic foot of air at ordinary pressure and temperature weighing 1.22 ounces, or about one seven hundred and seventieth part of the weight of an equal volume of water. In consequence of this weight it exerts a certain pressure upon the surface of the earth, amounting on the average to 15 pounds for each square inch. To accurately measure this pressure, which is constantly undergoing slight changes, we ordinarily employ a mercurial barometer (art. 48, Chap. II), an instrument in which the weight of a column of air of given cross section is balanced against that of a column of mercury having an equal cross section; and instead of saying that the pressure of the atmosphere is a certain number of pounds on each square inch, we say that it is a certain number of inches of mercury, meaning thereby that it is equivalent to the pressure of a column of mercury that many inches in height, and one square inch in cross section.

All gases, air included, are highly sensitive to the action of heat, expanding or increasing in volume as the temperature rises, contracting or diminishing in volume as the temperature falls. Suppose now that the atmosphere over any considerable region of the earth's surface is maintained at a higher temperature than that of its surroundings. The warmed air will expand, and its upper layers will flow off to the surrounding regions, cooling as they go. The atmospheric pressure at sea level throughout the heated areas will thus be diminished, while that over the circunjacent cooler areas will be correspondingly increased. As the result of this difference of pressure, there will be movement of the surface air away from the region of high pressure and towards the region of low, somewhat similar to the flow of water which takes place through the connecting bottom sluice as soon as we attempt to fill one compartment of a divided vessel to a slightly higher level than that found in the other.

A difference of atmospheric pressure at sea level is thus immediately followed by a movement of the surface air, or by winds; and these differences of pressure have their origin in differences of temperature. If the atmosphere were everywhere of uniform temperature it would lie at rest on the earth's surface—sluggish, torpid and oppressive—and there would be no winds. This, however, is fortunately not the case. The temperature of the atmosphere is continually or periodically higher in one region than in another, and the chief variations in the distribution of temperature are systematically repeated year after year, giving rise to like systematic variations in the distribution of pressure. **465.** THE NORMAL DISTRIBUTION OF PRESSURE.—The winds, while thus due primarily to differences

465. THE NORMAL DISTRIBUTION OF PRESSURE.—The winds, while thus due primarily to differences of temperature, stand in more direct relation to differences of pressure, and it is from this point of view that they are ordinarily studied.

In order to furnish a comprehensive view of the distribution of atmospheric pressure over the earth's surface, charts have been prepared showing the average reading of the barometer for any given period, whether a month, a season, or a year, and covering as far as possible the entire globe. These are known as isobaric charts, from the fact that all points at which the barometer has the same reading are joined by a continuous line or isobar.

The isobaric chart for the year (fig. 59) shows in each hemisphere a well-defined belt of high pressure (30.20 inches) completely encircling the globe, that in the northern hemisphere having its middle line about in latitude 35° North, that in the southern hemisphere about in latitude 30° South, these constituting the so-called meteorological tropics. From the summit or ridge of each of these belts the pressure fails off alike toward the equator and toward the pole, although much less rapidly in the former direction than in the latter. The equator itself is encircled by a belt of somewhat diminished pressure (29.90 inches), the middle line of which is ordinarily found in northern latitudes. In the northern hemisphere the diminution of pressure on the poleward slope is marked and much less regular than in the southern hemisphere, minima (29.70 inches) occurring in the North Atlantic Ocean near Iceland, and in the North Pacific Ocean near the Aleutian Islands, beyond which the pressure increases. In the southern hemisphere no such minima are apparent, the pressure continuing to diminish uninterruptedly as higher and higher latitudes are attained. Along the sixtieth parallel of south latitude the average barometric reading is 29.30 inches.

WINDS.



FIG. 59.

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466. SEASONAL VARIATIONS OF PRESSURE.—As might be expected from its close relation to the temperature, the whole system of pressure distribution exhibits a tendency to follow the sun's motion in declination, the baronetric equator occupying in July a position slightly to the northward of its position in January. In either hemisphere, moreover, the pressure over the land during the winter season is decidedly above the annual average, during the summer season decidedly below it; the season is decidedly above the annual average, during the summer season decidedly below it, the extreme variations occurring in the case of continental Asia, where the mean monthly pressure ranges from 30.50 inches during January to 29.50 inches during July. Over the northern ocean, on the other hand, conditions are reversed, the summer pressures being here somewhat the higher. Thus, in January the Icelandic and the Aleutian minima increase in depth to 29.50 inches, while in July these minima fill up and are well-nigh obliterated, a fact which has much to do with the strength and frequency of the winter gales in high northern latitudes and the absence of these gales during the summer. Over the southern ocean, in keeping with its slight contrast between winter and summer temperatures, similar variations of pressure do not exist.

467. The Prevailing Winds.—As a result of the distribution of pressure just described, there is in either hemisphere a continual motion of the surface air away from the meteorological tropic-on one side towards the equator, on the other side towards the pole, the first constituting in each case the trade winds, the second the prevailing winds of higher latitudes. Upon a stationary earth the direction of this motion would be immediately from the region of high towards the region of low barometer, the moving air steadily following the barometric slope or gradient, increasing in force to a gale where these are absent. The earth, however, is in rapid rotation, and this rotation gives rise to a force which exercises a material influence over all horizontal motions upon its surface, whatever their direction, serving constantly to divert them to the *right* in the northern hemisphere, to the *left* in the southern. The air set in motion by the difference of pressure is thus constantly turned aside from its natural course down the barometric gradient or slope, and the direction of the wind at any point, instead of being identical with that of the gradient at that point, is deflected by a certain amount, crossing the latter at an angle which in practice varies between 45° and 90° (4 to 8 compass points), the wind in the latter at an angle which in practice varies between 45 and 50° (4 to 5 compass points), the which in the latter case blowing parallel to the isobars. As a consequence of this deflection the northerly winds which one would naturally expect to find on the equatorial slope of the belt of high pressure in the northern hemisphere become northeasterly,—the NE. trade; the southerly winds of the polar slope become southwesterly,—the prevailing westerly winds of northern latitudes. So, too, for the southern hemisphere, the southerly winds of the equatorial slope here becoming southeasterly,—the SE. trades; the northerly winds of the polar slope northwesterly, -the prevailing westerly winds of southern latitudes.

468. The relation here described as existing between the distribution of atmospheric pressure and

the direction of the wind is of the greatest importance. It may be briefly stated as follows: In the northern hemisphere stand with the back to the wind; in this position the region of high barometer lies on your right hand and somewhat behind you; the region of low barometer on your left hand and somewhat in front of you.

In the southern hemisphere stand with the back to the wind; in this position the region of high barometer lies on your left hand and somewhat behind you; the region of low barometer on your right hand and somewhat in front of you.

This relation holds absolutely, not only in the case of the general distribution of pressure and circulation of the atmosphere, but also in the case of the special conditions of high and low pressure which usually accompany severe gales.

469. THE TRADE WINDS.—The Trade Winds blow from the tropical belts of high pressure towards the equatorial belt of low pressure—in the northern hemisphere from the northeast, in the southern hemisphere from the southeast. Over the eastern half of each of the great oceans they extend cousiderably farther from the line and their original direction inclines more towards the pole than in mid-ocean, where the latter is almost easterly. They are ordinarily looked upon as the most constant of winds, but while they may blow for days or even for weeks with slight variation in direction or strength, their uniformity should not be exaggerated. There are times when the trade winds weaken or shift. There are regions where their steady course is deformed, notably among the island groups of the South Pacific, where the trades during January and February are practically nonexistent. They attain their highest development in the South Atlantic and in the South Indian Ocean, and are every-where fresher during the winter than during the summer season. They are rarely disturbed by cyclonic storms, the occurrence of the latter within the limits of the trade wind region being furthermore confined in point of time to the late summer and autumn months of the respective hemispheres, and in scene of action to the western portion of the several oceans. The South Atlantic Ocean alone, however, enjoys complete immunity from tropical cyclonic storms. 470. The DOLDRUMS.—The equatorial girdle of low pressure occupies a position between the high-

pressure belt of the northern and the similar belt of the southern hemisphere. Throughout the extent of this barometric trough the pressure, save for the slight diurnal oscillation, is practically uniform, and decided barometric gradients do not exist. Here, accordingly, the winds sink to stagnation, or rise at most only to the strength of fitful breezes, coming first from one point of the compass, then from another, with cloudy, rainy sky and frequent thunderstorms. The region throughout which these conditions prevail consists of a wedge-shaped area, the base of the wedge resting in the case of the Atlantic Ocean on the coast of Atrica, and in the case of the Pacific Ocean on the coast of America, the axis extending westward. The position and extent of the belt vary somewhat with the season. Throughout February and March it is found immediately north of the equator and is of inappreciable width, vessels following the usual sailing routes frequently passing from trade to trade without interruption in both the Atlantic and the Pacific Oceans. In July and August it has migrated to the northward, the axis extending east and west along the parallel of 7° north, and the belt itself covering several degrees of latitude, even at its narrowest point. At this season of the year, also, the southeast trades blow with diminished fresh-ness across the equator and well into the northern hemisphere, being here diverted, however, by the effect of the earth's rotation, into southerly and southwesterly winds, the so-called southwest monsoon of the African and Central American coasts.

471. THE HORSE LATITUDES.—On the outer margin of the trades, corresponding vaguely with the summit of the tropical ridge of high pressure in either hemisphere, is a second region throughout which the barometric gradients are faint and undecided, and the prevailing winds correspondingly light and variable, the so-called *horse latitudes*, or calms of Cancer and of Capricorn. Unlike the doldrums, however, the weather is here clear and fresh, and the periods of stagnation are intermittent rather than continuous, showing none of the persistency which is so characteristic of the equatorial region. The explanation of this difference will become obvious as soon as we come to study the nature of the daily barometric changes of pressure in the respective regions, these in the one case being marked by the uniformity of the torrid zone, in the other sharing to a limited extent in the wide and rapid variations of the temperate.

472. THE PREVAILING WESTERLY WINDS.—On the exterior or polar side of the tropical maxima the pressure again diminishes, the barometric gradients being now directed towards the pole; and the currents of air set in motion along these gradients, diverted to the right and left of their natural course by the earth's rotation, appear in the northern hemisphere as southwesterly winds, in the southern hemisphere as northwesterly—the prevailing westerly winds of the temperate zone.

hemisphere as northwesterly—the prevaiing westerly whilds of the temperate zone. Only in the southern hemisphere do these winds exhibit anything approaching the persistency of the trades, their course in the northern hemisphere being subject to frequent local interruption by periods of winds from the eastern semicircle. Thus the tabulated results show that throughout the portion of the North Atlantic included between the parallels 40° -50° North, and the meridians 10° -50° West, the winds from the vestern semicircle (South—NNW.) comprise about 74 per cent of the whole number of observations, the relative frequency being somewhat higher in winter, somewhat lower in summer. The average force, on the other hand, decreases from force 6 to force 4 Beaufort scale, with the change of season. Over the sea in the southern hemisphere such variations are not apparent; here the westerlies blow through the entire year with a steadiness little less than that of the trades themselves, and with a force which, though fiftul, is very much greater, their boisterous nature giving the name of the "Roaring Forties" to the latitudes in which they are most frequently observed.

The explanation of this striking difference in the extra-tropical winds of the two halves of the globe is found in the distribution of atmospheric pressure, and in the variations which this latter undergoes in different parts of the world. In the landless southern hemisphere the atmospheric pressure after crossing the parallel of 30° South diminishes almost uniformly towards the pole, and is rarely disturbed by those large and irregular fluctuations which form so important a factor in the daily weather of the northern hemisphere. Here, accordingly, a system of polar gradients exists quite comparable in stability with the equatorial gradients which give rise to the trades; and the poleward movement of the air in obedience to these gradients, constantly diverted to the left by the effect of the earth's rotation, constitutes the steady westerly winds of the south temperate zone.

473. THE MONSOON WINDS.—The air over the land is warmer in summer and colder in winter than that over the adjacent oceans. During the former season the continents thus become the seat of areas of relatively low pressure; during the latter of relatively high. Pressure gradients, directed outward during the winter, inward during the summer, are thus established between the land and the sea, which exercise the greatest influence over the winds prevailing in the region adjacent to the coast. Thus, off the Atlantic seaboard of the United States southwesterly winds are most frequent in summer, northwesterly winds in winter; while on the Pacific coast the reverse is true, the wind here changing from northwest to southwest with the advance of the colder season.

The most striking illustration of winds of this class is presented by the monsoons (Mausum, season) of the China Sea and of the Indian Ocean. In January abnormally low temperatures and high pressure obtain over the Asiatic plateau, high temperatures and low pressure over Australia and the nearby portion of the Indian Ocean. As a result of the baric gradients thus established, the southern and eastern coast of the vast Asiatic continent and the seas adjacent thereto are swept by an outflowing current of air, which, diverted to the right of the gradient by the earth's rotation, appears as a north-east wind, covering the China Sea and the northern Indian Ocean. Upon entering the southern hemisphere, however, the same force which hitherto deflected the moving air to the right of the gradient now serves to deflect it to the left; and here, accordingly, we have the monsoon appearing as a northwest wind, covering the Indian Ocean as far south as 10°, the Arafura Sea, and the northern

In July these conditions are precisely reversed. Asia is now the seat of high temperature and correspondingly low pressure, Australia of low temperature and high pressure, although the departure from the annual average is by no means so pronounced in the case of the latter as in that of the former. The baric gradients thus lead across the equator and are addressed toward the interior of the greater continent, giving rise to a system of winds whose direction is southeast in the southern hemisphere, southwest in the northern.

The northeast (winter) monsoon blows in the China Sea from October to April, the southwest (summer) monsoon from May to September. The former is marked by all the steadiness of the trades, often attaining the force of a moderate gale; the latter appears as a light breeze, unsteady in direction, and often sinking to a calm. Its prevalence is frequently interrupted by tropical cyclonic storms, locally known as *typhoons*, although the occurrence of these latter may extend well into the season of the winter monsoon.

474. LAND AND SEA BREEZES.—Corresponding with the seasonal contrast of temperature and pressure over land and water, there is likewise a diurnal contrast which exercises a similar though more local effect. In summer particularly, the land over its whole area is warmer than the sea by day, colder than the sea by night, the variations of pressure thus established, although insignificant, sufficing to evoke a system of littoral breezes directed landward during the daytime, seaward during the night, which, in general, do not penetrate to a distance greater than 30 miles on and off shore, and extend but a few hundred feet into the depths of the atmosphere.

The sea breeze begins in the morning hours—from 9 to 11 o'clock—as the land warms. In the late afternoon it dies away. In the evening the land breeze springs up, and blows gently out to sea until

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morning. In the tropics this process is repeated day after day with great regularity. In our own latitudes, the land and sea breezes are often masked by winds of cyclonic origin.

475. A single important effect of the seasonal variation of temperature and pressure over the land remains to be described. If there were no land areas to break the even water surface of the globe, the trades and westerlies of the terrestrial circulation would be developed in the fullest simplicity, with linear divisions along latitude circles between the several members—a condition nearly approached in the land-barren southern hemisphere during the entire year, and in the northern hemisphere during the winter season. In the summer season, however, the tropical belt of high pressure is broken where it crosses the warm land, and the air shouldered off from the continents accumulates over the adjacent oceans, particularly in the northern or land hemisphere. This tends to create over each of the oceans a circular or elliptical area of high pressure, from the center of which the baric gradients radiate in all directions, giving rise to an outflowing system of winds, which by the effect of the earth's rotation is converted into an outflowing spiral eddy or *anticyclonic whirl*. The sharp lines of demarcation which would otherwise exist between the several members of the general circulation are thus obliterated, and northeasterly winds of the middle northern latitudes becoming successively northwesterly, northerly, and northeasterly as we approach the equator and round the area of high pressure by the east; the northeast trade becoming successively southeasterly, southerly, and southwesterly, as we recede from the equator and round this area by the west; similarly for the other hemisphere.

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476. VARIATIONS OF THE ATMOSPHERIC PRESSURE.—The distribution of the atmospheric pressure previously described (Chap. XVIII) and the attendant circulation of the winds are those which become evident after the effects of many disturbing causes have been eliminated by the process of averaging, or embracing in the summation observations covering an extended period of time. The distribution of pressure and the system of winds which actually exist at a given instant will in general agree with these in its main features, but may differ from them materially in detail.

Confining our attention for the time being to the subject of atmospheric pressure, it may be said that this, at any given point on the earth's surface, is in a constant state of change, the mercury rarely becoming stationary, and then only for a few hours in succession. The variations which the pressure undergoes may be divided into two classes; viz, periodic, or those which are continuously in operation, repeating themselves within fixed intervals of time, long or short; and non-periodic or accidental, which occur irregularly, and are of varying duration and extent.

477. PERIODIC VARIATIONS.—Of the former class of changes the most important are the seasonal, which have been already to some extent described, and the diurnal. The latter consists of the daily occurrence of two barometric maxima, or points of highest pressure, with two intervening minima. Under ordinary circumstances, with the atmosphere free from disturbances, the barometer each day attains its first minimum about 4 a. m. As the day advances the pressure increases, and a maximum, or point of greatest pressure, is reached about 10 a. m. From this time the pressure diminishes, and a second minimum is reached about 4 p. m., after which the mercury again rises, reaching its second maximum about 10 p. m. The range of this diurnal oscillation is greatest at the equator, where it amounts to ten hundredths (0.10) of an inch. It diminishes with increased latitude, and near the poles it seems to vanish entirely. In middle latitudes it is much more apparent in summer than in winter.

478. NON-PERIODIC VARIATIONS.—The equatorial slope of the tropical belt of high pressure which encircles the globe in either hemisphere is characterized by the marked uniformity of its meteorological conditions, the temperature, wind, and weather changes proper to any given season repeating themselves as day succeeds day with almost monotonous regularity. Here the diurnal oscillation of the barometer constitutes the main variation to which the atmospheric pressure is subjected. On the polar slope of these belts conditions the reverse of these obtain, the elements which go to make up the daily weather here passing from phase to phase without regularity, with the result that no two days are precisely alike; and as regards atmospheric pressure, it may be said that in marked contrast with the uniformity of the torrid zone, the barometer in the temperate zone is constantly subjected to non-periodic or accidental fluctuations of such extent that the periodic diurnal variation is scarcely apparent, the mercury at a given station frequently rising or falling several tenths of an inch in twenty-four hours.

479. PROGRESSIVE AREAS OF HIGH AND LOW PRESSURE.—The explanation of this rapid change of conditions is found in the approach and passage of extensive areas of alternately high and low pressure, which affect alike, although to a different degree, all the barometers coming within their scope. The general direction of motion of these areas is that of the prevailing winds; eastward, therefore, in the latitudes which are under consideration.

Taken in conjunction, these areas of high and low pressure exercise a controlling influence over the weather changes of the temperate zones. As the low area draws near, the sky becomes overclouded, the prevailing westerly wind falls away, and is succeeded by a wind from some easterly direction, faint at first, but increasing as the pressure continues to diminish; the lowest pressure having been reached, the wind again goes to the westward, the glass starts to rise, and the weather clears; all marking the eastward recession of the low area and the approach of the subsequent high. The first stage in the development of the low is a slight diminution of the atmospheric pressure,

The first stage in the development of the low is a slight diminution of the atmospheric pressure, amounting in general to not more than one or two hundredths of an inch, throughout an area covering a more or less extensive portion of the earth's surface, either land or water, but far more frequently over the former than over the latter. Shortly after the advent of this initiatory fall the decrease of pressure throughout some small region within the larger area assumes a more decided character, the mercury here standing at a lower level than elsewhere and reading successively higher as we go outward, the region thus becoming, as it were, the center of the whole barometric depression. A system of barometric gradients is by this means established, all directed radially inward, and in obedience to these gradients there is a movement of the surface air towards the center or point of lowest barometer. The air once in motion, however, the effect of the earth's rotation is brought into play precisely as in the case of the larger movements of the atmosphere, with the result that the several currents, instead of following the natural course along these gradients, are deflected from them, in the northern hemisphere to the right hand, in the southern hemisphere to the left, the extent of the deflection being from 4 to 8 compass points.

480. CYCLONES AND CYCLONIC CIRCULATIONS.—A central area of low barometer will thus be surrounded by a system of winds which constantly draw in towards the center but at the same time circulate about it, the whole forming an inflowing spiral; the direction of this circulation being in the southern hemisphere with the motion of the hands of a watch, in the northern hemisphere opposed to this

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motion. Where the barometric gradients are steep, these winds are apt to be strong; where they are gentle, the winds are apt to be weak; where they are absent, as is the case at the center or bottom of the depression, calms are apt to prevail.

Around the center of the area of high pressure a similar system of wind will be found, but blowing in a contrary direction. Here the barometric gradients are directed radially outward, with the result that in place of the inflowing, we have an outflowing spiral, the circulatory motion being right handed or with the hands of a watch in the northern hemisphere, left handed or against the hands of a watch in the southern.

All of these features are shown in the accompanying diagrams (fig. 60), which exhibit the general character of cyclonic (around the low) and anticyclonic (around the high) circulations in the northern *Anticyclonic*, NORTHERN HEMISPHERE. *Cyclonic*.



FIG. 60.

The light arrows show the direction of the gradients; the heavy arrows the direction of the winds,

and the southern hemisphere, respectively. The closed curves represent the isobars, or lines along which the barometric pressure is the same; the short arrows show the direction of the gradients, which are everywhere at right angles to the isobars; the long arrows give the direction of the winds, deflected by the earth's rotation to the right of the gradients in the northern hemisphere, to the left in the southern.

481. FEATURES OF CYCLONIC AND ANTICYCLONIC REGIONS.—Certain features of the two areas may here be contrasted. In the anticyclonic, the successive isobars are as a rule far apart, showing weak gradients and consequently light winds; the areas themselves are of relatively great extent, and their rate of progression is slow. During the summer they originate as extensions into higher latitudes of the margins of the tropical belts of high pressure; during the winter, as offshoots of the strong anticyclone which covers the land throughout that season. Their approach and presence is accompanied by polar or westerly winds, temperature below the seasonal average, fair weather, and clear skies. In the cyclonic area the successive isobars are crowded together, showing steep gradients and strong winds; they may appear either as trough-like extensions into the temperate zone of the polar belt of low pressure, in which case the easterly winds proper to their polar side are nonexistent, or (in lower latitudes) as independent areas, sometimes, indeed, as detached portions of the equatorial low-pressure belt, which move eastward and poleward across the temperate zone, and are ultimately merged into the great cyclonic area surrounding the pole. The progress of these independent areas is invariably attended by the strong and steadily shifting winds, foul weather, and other features which make up the ordinary storm at sea. In the trough-like depressions of higher latitudes these features may or may not be observed, their presence depending upon the depths of the barometric trough and the steepness of its slopes. In these, moreover, the cyclonic circulation is never completely developed, the storm winds having rather the character of right line gales, blowing from an equatorial or easterly direction until the axis of the trough is at hand, and as this passes shifting by the west at one bound to a polar direction.

axis of the trough is at hand, and as this passes shifting by the west at one bound to a polar direction. **482.** CYCLONIC STORMS.—Strong winds are the result of steep barometric gradients. These may occur with cyclonic or with anticyclonic areas, the latter being exemplified in the case of the northers in the Gulf of Mexico and the northwesterly winter gales along the Atlantic coast of the United States, which are almost invariably accompanied by barometers above the average. They are, however, so much more frequent in the case of areas of low pressure and consequent cyclonic circulations, with their attendant foul weather characteristics, that the latter are generally known as cyclonic storms, i. e., storms in which the wind circulation is cyclonic.

Cyclonic storms may with convenience be divided into two classes; viz, tropical, or those which originate near but not on the equator; and extra-tropical, or those which first appear in higher latitudes.

483. TROPICAL CYCLONIC STORMS.—The occurrence of tropical cyclonic storms is confined to the summer and autumn months of the respective hemispheres, and to the western part of the several oceans, the North Atlantic, the North Pacific, the South Pacific, and the Indian Ocean. They are unknown in the South Atlantic Ocean.

The Arabian Sea and the Bay of Bengal are also visited by cyclonic storms, the season of their occurrence extending from May to October.

484. MOTION OF THE STORM CENTER.—In the case of tropical cyclonic storms there is alway's a tendency for the barometric depression, impelled by the general motion of the atmosphere in the

trade wind region, to follow a path which tends at once westward and away from the equator. This motion continues until the limits of the trades are reached, where the path ordinarily recurves, and the subsequent motion of the depression is eastward and towards the pole, the disturbance at the same time assuming the features of the extra-tropical cyclonic storm. **485.** RATE OF PROGRESS OF THE STORM CENTER.—Within the tropics (in the northern hemisphere)

the average velocity of the storm center along the track is about 17 miles per hour; in the latitudes of recursive this drops to 8 miles per hour, the center at the time frequently becoming stationary; in higher latitudes it again increases, rising to 20 or even to 30 miles per hour.

In the southern hemisphere the average velocity of progress as far as determined is somewhat less than in the northern, but shows about the same relation in different parts of the track.

The general path of the tropical cyclonic storm in either hemisphere and the cyclonic circulation of the wind about the storm center are given in figures 61 and 62; that for the northern hemisphere applying to the West India hurricane; that for

the southern hemisphere to the hurricanes of the South Pacific Ocean.

486. CHARACTER OF TROPICAL CYCLONIC STORMS.—Within the tropics the storm area is small, the region covered by violent winds extending in general not more than 150 miles from The barometrie gradients are, howthe center ever, exceedingly steep, instances having been recorded in which the difference of pressure for this distance amounted to 2 inches. In the typhoons of the North Pacific Ocean gradients of one inch in 60 miles are not infrequent. The successive isobars are almost circular. As a consequence of this distribution of pressure the winds on the slopes of the depression are frequently of great violence, and in the matter of direction they are more symmetrically disposed about the center than is the case with the larger and less regularly shaped depressions of higher latitudes. In these low latitudes the average values of the deflection of the wind from the barometric gradient is in the neighborhood of six compass points,-to the right in the northern 487. To Fix the Bearing of the Storm

CENTER FROM THE VESSEL. - On this assumption, the following rules will enable an observer to fix the bearing of the storm center from his vessel:-

In the northern hemisphere, stand with the back to the wind: the storm center will bear six points to the observer's left.

In the southern hemisphere, stand with the back to the wind; the storm center will bear six points to the observer's right.

On the basis of these rules the tables hereafter given (art. 492) show the bearing of the center corresponding to a wind of any direction.

488. To FIX THE DISTANCE OF THE STORM CENTER FROM THE VESSEL.--The following table, taken from Piddington's "Sailor's Horn Book," may prove of some assistance in estimating the distance of the storm center from the vessel:

> Average fall of the barometer Distance from the storm center. per hour. From 0.02 to 0.06 in. From 250 to 150 miles.

From 0.06 to 0.08 in. From 0.08 to 0.12 in. From 0.12 to 0.15 in.

From 150 to 100 miles.

From 100 to 80 miles. From 80 to 50 miles.

The table assumes that the vessel is hove-to in front of the storm, and that the latter is advancing directly toward it.

489. To Avoid the Center of the Storm.-In the immediate neighborhood of the center itself the winds attain full hurricane force, the sea is exceedingly turbulent, and there is danger of being struck aback. Every effort should therefore be made to avoid this region, either by running or by heaving-to; and if recourse is had to the latter maneuver, much depends upon the selection of the proper tack; this being in every case the tack which will cause the wind to draw aft with each successive shift.

A vessel hove-to in advance of a tropical cyclonic storm will experience a long heavy swell, a falling barometer with torrents of rain, and winds of steadily increasing force. The shifts of wind will depend upon the position of the vessel with respect to the path followed by the storm center. Immediately upon the path, the wind will hold steady in direction until the passage of the central calm, the "eye of the storm," after which the gale will renew itself, but from a direction opposite to that which it previ-



FIG. 61.

ously had. To the right of the path, or in the right-hand semicircle of the storm (the observer being supposed to face along the track), the wind, as the center advances and passes the vessel, will constantly shift to the right, the rate at which the successive shifts follow each other increasing with the proximity to the center; in this semicircle, then, in order that the wind shall draw aft with each shift, the vessel must be hove-to on the starboard tack; similarly, in the left-hand semicircle, the wind will constantly shift to the left, and here the vessel must be hove-to on the port tack.

These rules hold alike for both hemispheres and for cyclonic storms in all latitudes.

The above shifts of the wind are based upon the supposition that the vessel is lying-to. A vessel in rapid westerly motion may, in low latitudes, readily overtake the storm center, in which case the observed shifts will be just the reverse of those here described.

490. DANGEROUS AND NAVIGABLE SEMICIRCLES.—Prior to recurving, the winds in that semicircle of the storm which is more remote from the equator (the right-hand semicircle in the northern heni-



FIG. 62.

ary, the position should be maintained until indications of a rise are apparent, upon which the course may be resumed with safety and held as long as the rise continues. If, however, the barometer falls, a steamer should make a run to the NNE. or NE. (southern hemisphere, SSE. or SE.), keeping the wind and sea a little on the port (southern hemisphere, starboard) bow, and using such speed as will at least keep the mercury stationary. Such a step will in general be attended with the assurance that the present weather conditions will in any case grow no worse. For a sailing vessel, unable to stand closer to the wind than six points, the last maneuver will be impossible, and driven to leeward by wind, sea, and current, she may be compelled to cross the track immediately in advance of the center, or may even become involved in the center itself. In this extremity the path of the storm center during the past twenty-four hours should be laid down on a diagram as accurately as the observations permit, and the line prolonged for some distance beyond the present position of the center. Having assumed an average rate of progress for the center, its probable position on the line should be frequently and carefully plotted, and the handling of the vessel should be in accordance with the diagram. **492.** SUMMARY OF RULES.—The following summary comprises the rules for maneuvering in the

Northern Hemisphere, so far as they may be made general:-

sphere, the left-hand semicircle in the southern) are liable to be more severe than those of the opposite semicircle. A vessel hove-to in the semicircle adjacent to the equator has also the advantage of immunity from becoming involved in the actual center itself, inasmuch as there is a distinct tendency on the part of the latter to move away from the equator. For these reasons the more remote semicircle has been called the dangerous; the less remote, the navigable.

491. MANEUVERING .- A vessel suspecting the dangerous proximity of a tropical cyclonic storm should lie-to for a time on the starboard tack to locate the center by observing shifts of the wind and the behavior of the barometer. If the former holds steady and increases in force, while the latter falls rapidly, say at a greater rate than 0.03 of an inch per hour, the vessel is probably on the track of the storm and in advance of the center. In this position the proper step (providing, of course, that sea room permits) is to run, keeping the wind, in the northern hemisphere, at all times well on the starboard quarter; in the southern hemisphere, well on the port; and thus constantly increasing the distance to the storm center. The same rule holds good if the observation places the vessel at but a scant distance within the forward quadrant of the dangerous semicircle. Here, too, the natural course will be to seek the navigable semicircle of the storm, even though such a course involves crossing the track in advance of the center, always exercising due caution to keep the wind from drawing too far aft.

The critical case is that of a vessel which finds herself in the forward quadrant of the dangerous semicircle and at a considerable distance from the track, for here the shifts of the wind are sluggish and the indications of the barometer are undecided, both causes conspiring to render the bearing of the center doubtful. If, upon heaving-to, the barometer becomes station-

CYCLONIC STORMS.

In the Right Semicircle: Haul by the wind on the starboard tack and carry sail as long as possible: if obliged to heave-to, do so on starboard tack.

In the Left Semicircle: Bring the wind on the starboard quarter, note course and keep it; if obliged

to heave-to, do so on port tack. In Front of Center: Bring wind two points on starboard quarter, note course and keep it; if obliged to heave-to, do so on port tack.

In Rear of Center: Run out with wind on starboard quarter; if obliged to heave-to, do so on starboard tack.

The application of these rules for the various directions of the wind is shown in the following table:-Storm Table, Northern Hemisphere.

Direction of wind.	Direction of center.	If wind shifts to- wards the right.	If wind shifts towards the left.		If wind steady barome	with falling ter.	If wind steady with rising barometer.		
North. NNE. NE. EAST. EAST. SSE. SSE. SOUTH. SSW. WSW. WSW. WSW. WSW. WSW. WSW. WS	ESE. SE. SSE. South. SSW. SSW. WSW. West. WNW. NNW. NOR. NNE. NNE. ENE. East.	Haul by wind on starboard tack and carry sail as long as possi- ble; if obliged to heave-to, do so on starboard tack.	Run SSW. Run SW. Run WSW. Run WSW. Run NW. Run NNW. Run NOrth. Run NNE. Run NE. Run ENE. Run ESE. Run SE. Run SSE. Run SSE. Run South.	Hold course a as long as possible; if obliged to heave-to, do so on port tack.	Run SSW. Run SW. Run WSW. Run WSW. Run NNW. Run NNW. Run NNE. Run NNE. Run ENE. Run ESE. Run ESE. Run SSE. Run SSE. Run South.	Hold course as long as possible; if obliged to heave-to, do so on port tack.	Run SSW. Run SW. Run WSW. Run WSW. Run NW. Run NW. Run NW. Run NNK. Run NE. Run ENE. Run ESE. Run ESE. Run SSE. Run SSE. Run South.	Hold course a as long as possible; if obliged to heave-to, do so on starboard tack.	

a Courses given are for wind two points on starboard quarter, but it is preferable to take wind broad on quarter if possible.

Similarly, the following rules and table apply for the Southern Hemisphere:-

In the Right Semicircle: Bring the wind on the port quarter, note course and keep it; if obliged to In the Left Semicircle: Haul by the wind on the port tack and carry sail as long as possible; if

obliged to heave-to, do so on port tack.

In Front of Center: Bring wind two points on port quarter, note course and keep it; if obliged to heave-to, do so on starboard tack.

In Rear of Center: Run out with wind on port quarter; if obliged to heave-to, do so on port tack.

Direction of wind.	Direction of center.	If wind shifts towards the right.		If wind shifts to- wards the left.	If wind steady y barome	with falling ter.	If wind steady with rising barometer.		
North. NNE. ENE. East. ESE. SSE. South. SSW. SSW. WSW. West. WNW. NW. NNW.	WSW. West. WNW. NNW. North. NNE. ENE. EAST. ESE. SSE. SSE. South. SSW. SW.	Run SSE, Run South. Run SSW. Run SW. Run WSW. Run West. Run WNW. Run NNW. Run NNW. Run NNE. Run NE. Run ENE. Run ENE. Run ESE. Run SE.	Hold course " as long as possible; if obliged to heave-to, do so on starboard tack.	Haul by wind on port tack and carry sail as long as possible; if obliged to heave-to, do so on port tack.	Run SSE Run South. Run SSW. Run WSW. Run WSW. Run WNW. Run NNW. Run NNW. Run NNE. Run NNE. Run ENE. Run ESE. Run ESE. Run SE.	Hold course as long as possible; if obliged to heave-to, do so on starboard tack.	Run SSE. Run South. Run SSW. Run WSW. Run WSW. Run WNW. Run NW. Run NNW. Run NNE. Run NE. Run ENE. Run ESE. Run ESE. Run SE.	Hold course " as long as possible; if obliged to heave-to, do so on port tack.	

Storm Table, Southern Hemisphere.

a Courses given are for wind two points on port quarter, but it is preferable to take wind broad on quarter, if possible.

493. EXTRA-TROPICAL CYCLONIC STORMS.—On turning to the cyclones of temperate latitudes, we find many features in which they resemble those of the torrid zone, but certain other features in which they differ. Their fundamental resemblance to tropical cyclones is seen in their incurving winds, forming an inflowing left-handed spiral about the center of low pressure in the northern hemisphere, an inflowing right-handed spiral in the southern. The intensity of these winds varies with the depth of the barometric depression. The depression itself, however, in place of covering a few miles, as is the case in the tropics, will frequently have a diameter of several hundred or even a thousand miles, and for some distance around the center the gradients will have a tolerably strong value. For this reason there is less concentration of violence close to the center, and the calm and clear central space, or "eye," is seldom sharply developed, although it is not uncommon to discover a gradual weakening or failing of the observer. The form of tropical cyclones as defined by their isobaric lines is nearly circular. Extra-tropical cyclones are as a rule less symmetrical, and their isobars are often elongated into an oval form, the longer axis of the oval trending (in the northern hemisphere) between north and east—about, therefore, in the direction of progression. The steepest gradients, and consequently the strongest winds, are apt to be found on the equatorial and westerly sides of the depression.

Extra-tropical cyclones generally follow an easterly course, inclining somewhat towards the pole; but they occasionally turn to one side or the other, become stationary, or even move backward. The velocity of progression varies from 15 to 40 miles an hour. If they exist as independent barometric depressions, with strong upward gradients on all sides of the center, the cyclonic circulation will be complete, the wind shifting with the sun for an observer situated in the equatorial semicircle of the storm, against the sun for an observer situated in the polar semicircle.

404. STORMS ALONG THE TRANSATLANTIC STEAMSHIP ROUTES.—The storms which are so frequently met during the winter season along the steamship routes between America and Europe are not, as a



rule, due to central barometric depressions, but to depressions having a trough or V shape, which extend southerly from the extensive permanent area of low pressure having its center in the vicinity of Iceland. They are not attended by complete cyclonic circulations, inasmuch as the polar gradients which would otherwise give rise to easterly winds on this polar side are lacking. Their approach is heralded by a gradual hauling of the wind to southward, which is later followed (at the time of passage of the central line of the trough) by a change to NW., accompanied by heavy rain squalls and a rapid increase in force. The general distribution of pressure and the surrounding winds are shown in figure 63.

The changes in wind and pressure ensue much more rapidly in the case of a westward-bound vessel than in that of one eastward bound, the rate at which the observer and the depression approach each other being in the former case the sum of his own westward velocity and the eastward velocity of the trough, in the latter case, the difference of these velocities.

CHAPTER XX.

TIDES.

495. DEFINITIONS.—Tidal phenomena present themselves to the observer under two aspects—as alternate elevations and depressions of the sea, and as recurrent inflows and outflows of streams. The word *tide*, in common and general usage, is made to refer without distinction to both the vertical and horizontal motions of the sea, and confusion has sometimes arisen from this double application of the term; in its strict sense, this word may be used only with reference to the changes of elevation, while the recurrent streams are properly distinguished as *tidal currents*.

The tide rises until it reaches a maximum height called *high water* or *high tide*, and then falls to a minimum level called *low water* or *low tide*; that period at high or low water marking the transition between the tides, during which no vertical change can be detected, is called *stand*.

Of the tidal currents, that which arises from a movement of the water in a direction, generally speaking, from the sea toward the land, is called *flood*, and that arising from an opposite movement, *ebb*; the intermediate period between the currents, during which there is no horizontal motion, is distinguished as *slack*. Set and *drift* are terms applicable to the tidal currents, the first referring to the direction and the second to the velocity.

Care should be taken to avoid confusing the terms relating to tides with those which relate to tidal currents.

496. CAUSE.—The cause of the tides is the unequal attraction of the sun and moon upon different parts of the earth. These bodies attract the parts of the earth's surface which are nearer to them with greater force than they do its center, and attract its center more than they do its opposite surface; to restore equilibrium the waters take a spheroidal figure, whose longer axis lies in the direction of the surface body. The mean force of the moon in raising the tides is two and a half times as great as that of the sun, for though the mass of the sun is vastly greater than the mass of the moon, the sun's distance is so great that it attracts the different parts of the earth with nearly equal force. Theory is not sufficiently advanced to render possible a prediction of tides or tidal changes from a mere knowledge of the positions of the sun and moon, but by theory, supplemented by observation of actual tidal conditions during a certain period of time, very accurate predictions may be arrived at.

497. ESTABLISHMENT.—High and low water occur, on the average of the twenty-eight days comprising a lunar month, at about the same intervals after the transit of the moon over the meridian. These nearly constant intervals, expressed in hours and minutes, are known respectively as the *high* water lunitidal interval and low water lunitidal interval.

The interval between the moon's meridian passage at any place and the time of the next succeeding high water, as observed on the days when the moon is at full or change, is called the *rulgar* (or *common*) *establishment* of that place, or, sometimes, simply the *establishment*. This interval is frequently spoken of as the *time of high water on full and change days* (abbreviated "H. W. F. & C."); for since, on such days, the moon's two transits (upper and lower) over the meridian occur about noon and midnight, the vulgar establishment then corresponds closely with the local times of high water. When more extended observations have been made, the average of all the high water lunitidal intervals for at least a lunar month is taken to obtain what is termed, in distinction to the vulgar establishment, the *corrected establishment* of the port, or *mean high water lunitidal interval*. In defining the tidal characteristics of a place some authorities give the corrected establishment, and others the vulgar establishment, or "high water, full and change;" calculations based upon the former will more accurately represent average conditions, though the two intervals seldom differ by a large amount.

Having determined the time of high water by applying the establishment to the time of moon's transit, the navigator may obtain the time of low water with a fair degree of approximation by adding or subtracting 6^{h} 13^{m} (one-fourth of a mean lunar day); but a closer result will be given by applying to the time of transit the *mean low water lumitidal interval*, which occupies the same relation to the time of low water as the mean high water lumitidal interval, or corrected establishment, does to the time of high water.

⁶ **498.** RANGE.—The range of the tide is the difference in height between low water and high water. This term is often applied to the difference existing under average conditions, and may in such a case be designated as the *mean range* or *mean rise and fall* to distinguish it from the *spring range* or *neap range*, which are the ranges at spring and neap tides, respectively. **499.** SPRING AND NEAP TIDES.—At the times of new and full moon the relative positions of sun

499. SPRING AND NEAP TIDES.—At the times of new and full moon the relative positions of sun and moon are such that the high water produced by one of those bodies occurs at the same time as that produced by the other, and so also with the low waters; the tides then occurring, called *spring tides*, have a greater range than any others of the lunar month, and at such times the highest high tides as well as the lowest low tides are experienced, the tidal range being then at its maximum. At the first and third quarters of the moon the positions are such that the high tide due to one body occurs at the time of the low tide due to the other, so that the two actions are opposed; this causes the *neap tides*, which are those of minimum range, the high waters being lower and the low waters higher than at other periods of the month.

Since the horizontal motion of the water depends directly upon the rise and fall of the tides, it follows that the currents will be greatest at springs and least at neaps.

The effect of the moon's being at full or change is not felt at once in all parts of the world, and the greatest range of tides does not generally occur until one or two days thereafter; thus, on the Atlantic coast of North America, the highest tides are experienced one day, and on the Atlantic coast of Europe, two days afterward, though on the Pacific coast of North America they occur nearly at full and change.

500. The nearer the moon is to the earth the stronger is its attraction, and as it is nearest in perigee, the tides will be larger then on that account, and consequently less in apogee. For a like reason, the tides will be increased by the sun's action when the earth is near its perihelion, about the 1st of January, and decreased when near its aphelion, about the 1st of July.

501. The height of the tides at any place may undergo modification on account of strong prevailing winds or abnormal barometric conditions, a wind blowing off the shore or a high barometer tending to reduce the tides, and the reverse. The effect of atmospheric pressure is to create a difference of about 2 inches in the height of tide for every tenth of an inch of difference in the barometer.

reduce the fides, and the reverse. The effect of atmospheric pressure is to create a difference of about 2 inches in the height of tide for every tenth of an inch of difference in the barometer. **502.** PRIMING AND LAGENG.—The *tidal day* is the variable interval, averaging 24^{h} 50^m, between two alternate high or low waters. The amount by which corresponding tides grow later day by day—that is, the amount by which the tidal day exceeds 24^{h} —is called the *daily retardation*. When the sun's tidal effect is such as to shorten the lumitidal intervals, thus reducing the length of the tidal day and causing the tides to occur earlier than usual, there is said to be a *priming* of the tide; when, from similar causes, the interval is lengthened, there is said to be a *lagging*. **503.** Types of Tides.—The observed tide is not a simple wave; it is a compound of several elemen-

503. TYPES OF TIDES.—The observed tide is not a simple wave; it is a compound of several elementary undulations, rising and falling from the same common plane, of which two can be distinguished and separated by a simple grouping of the data. These two waves are known as the *semi-diurnal* and the *diurnal* tides, because the first, if alone, would give two high and two low waters in a day, while the second would give but one high and one low water in an equivalent period of time. In nearly all ports these two tides coexist, but the proportion between them varies remarkably for different seas. The effect of the combination of these two types of tide is to produce a *diurnal inequality*, both in the height of two consecutive high or low waters, and in the intervals of time between their occurrence. The height of the diurnal wave may be regarded as reaching a maximum fortnightly, soon after the moon attains its extreme declination and is therefore near one of the tropics. The tides that then occur are denominated *tropic tides*.

In undertaking to investigate the tides of a port it is important to ascertain as early as possible the form of the tide; that is, whether it resembles the semi-diurnal, the diurnal, or the mixed type; because not only may this information be of scientific value, but the knowledge thus gained at the outset will enable the observer to fix upon the best method of keeping his record.



504. The type forms referred to are illustrated in the diagram in figure 64, where the waves are plotted in curves, using the times as abscisse and the heights as ordinates. In this diagram, the curve traced in the full line is a tide-wave of the semi-diurnal type; that traced by the dotted line one of the diurnal; while the broken line is one of the mixed type, in this case the compound of the two others. -

In order to determine the type to which the tide of any port belongs, it is usually only necessary to make hourly observations for a day or two at the date of the moon's maximum declination, and to repeat the series about a week later, when the moon crosses the equator. The reported irregularities of the rise and fall at any place should not deter persons from careful investigation. When analyzed, even the most complicated of tides are found to follow some general law.

505. TIDAL CURRENTS.—It should be clearly borne in mind by the naviga-

tor that the periods of flood and ebb currents do not necessarily coincide with those of rising and falling tides, and that, paradoxical though it may seem at first thought, the inward set of the surface eurrent does not always cease when the water has attained its maximum height, nor the outward set when a minimum height has been reached. Under some circumstances it may occur that stand and slack will be simultaneous, while other conditions may produce a maximum current at stand, with a maximum rate of rise or fall at slack water.

The varying effects which will be produced according to local conditions may be considered by the comparison of two tidal basins, to one of which the tide-wave has access from the sea by a channel of ample capacity, while the other has an entrance that is narrow and constricted. In the first case, the process of filling or emptying the basin keeps pace with the change of level in the sea and is practically completed as soon as the height without becomes stationary; in this case slack and stand occur nearly at the same time, as do flood and rise and ebb and fall. In the second case, the limited capacity of the entrance will not permit the basin to fill or empty as rapidly as the tide changes its level without;

hence there is still a difference of level to produce a current when the vertical motion in either direction has ceased on the outside, and for a considerable time after motion in the reverse direction has been in progress; under extreme conditions it may even occur that a common level will not be established until mid-tide, and therefore the surface current at some places will ebb until three hours after low water and flow until there hours after high water. Localities that partake of the nature of the first case are those upon open coasts and wide-mouthed

bights. Examples of the latter class will be found in narrow bays and long channels.

TIMES OF HIGH AND LOW WATER.

506. TIDE TABLES.—The most expeditious, as well as most exact, method of ascertaining the times of high and low water and other features of the tides will be by reference to a *Tide Table*, and every navigator is recommended to provide himself with such a publication. The United States Coast and Geodetic Survey publishes annually, in advance, tables giving, for every day in the year, the predicted time and height of the tides at certain principal ports of the world, and from these, by a simple reduc-tion, the times and heights at a multitude of other ports may readily be obtained; data for ascertaining the tidal currents in certain important regions are also provided. General tide tables are also published by the governments of other maritime nations, and special tables are to be had for many particular localities.

507. Where no tide tables are available, the method of calculation by applying the lunitidal interval to the time of the moon's meridian passage must be resorted to.

To do this, find first the time of the moon's meridian passage, upper or lower, as may be required. The Greenwich mean time of upper transit at Greenwich is given in the Nautical Almanac (page IV of The Greenwich mean time of upper transit at Greenwich is given in the Natural Almanac (page IV of the month); the corresponding time of lower transit is most easily found by taking the mean of the two adjacent upper transits; to the Greenwich time of Greenwich transit apply the correction for longitude given in Table 11 (using the daily variation of the moon's meridian passage shown in the Almanac), adding in west and subtracting in east longitude; the result is the local mean time of local transit. Add to this the high-water or low-water lunitidal interval of the port from Appendix IV, according as the time of high or low water may be required. The result is the time sought.

The astronomical date must be strictly adhered to, and in so doing it may be found necessary to employ the time of a lower transit, or the transit of a preceding day, to find the time of the tide in question.

Appendix IV contains, besides the geographical positions of all the more important positions in the world, a series of tidal data relating to many of those places. In such data are comprised the mean lunitidal intervals for high and low water; also, for places. In such at a recomplised the mean lunitidal intervals for high and low water; also, for places where the semi-diurnal type of tide prevails, the tidal range at spring and at neap tides, and for those where the tide is of the diurnal type, the tropic range. An alphabetical index is appended to this table.

The corrected establishment taken from the charts may be substituted for the high-water lunitidal interval of the table; or, with only slight variation in the results, the vulgar establishment (H. W. F. & C.) may be employed.

EXAMPLE: Find the times of the high and low waters at the New York navy yard, occurring next after noon on April 22, 1879.

G. M. T. of Gr. transit,
$$22^{d} 0^{h} 32^{m}.2$$

Corr. for $+74^{\circ}$ Long. (Tab. 11), $+ 10$

22 0 42

Transit, H. W. Lun. Int. (App. IV)	$22^{d} 0^{h} 42^{m}$	Transit, L. W. Lun. Int. (App. IV),	${22^{ m d}\over 2} {0^{ m h}\over 49} {49}$
L. M. T., H. W.,	{	L. M. T., L. W., · {	22 3 31 April 22, 3.31 p. m.

EXAMPLE: Find the time of high water at the Presidio, San Francisco, Cal., on the afternoon of May 7, 1879.

G. M. T. of Gr. transit,
Corr. for
$$+122^{\circ}$$
 Long. (Tab. 11), $+$
 6° 12^h 36^m.6

 L. M. T. of local transit,
H. W. Lun. Int. (App. IV), $+$
 6 12 59

 L. M. T., H. W.,
 $\{ \frac{7 \ 0 \ 42}{May \ 7, 12.42 \ p. m.} \}$

EXAMPLE: Find the time of low water at Singapore on the night of May 28, 1879.

G. M. T. of Gr. transit, Corr. for -104° Long. (Tab. 11),	$-\frac{28^{d}}{13}$ 5 ^h 55 ^m . 3
G. M. T. of local transit, L. W. Lun. Int. (App. IV),	$ \begin{array}{r} 28 5 42 \\ + 4 02 \end{array} $
L. M. T., L. W.,	{28 9 44 May 28, 9.44 p. m.

TIDES.

G. M. T. of Gr. upper transit, G. M. T. of Gr. upper transit, 25d 4h 40m.1 26 5 27 .0 2)51 10 07 .1 G. M. T. of Gr. lower transit. 25 17 04 Corr. for $+5^{\circ}$ Long. (Tab. 11), +01 L. M. T. of local lower trans. 25 17 05 25^d 17^h 05^m Transit. 25^d 17^h 05^m Transit. H. W. Lun. Int. (App. IV), $1 \ 35$ L. W. Lun. Int. (App. IV), 7 55 25 18 40 26 1 00 L. M. T., H. W., L. M. T., L. W., June 26, 6.40 a.m. June 26, 1 p. m.

TIDAL OBSERVATIONS.

508. Since navigators will frequently have opportunity to observe tidal conditions, either in connection with a hydrographic survey or otherwise, at places where existing knowledge of the tides is incomplete, an understanding of the methods employed in tidal observations may be important. 509. Tipes.—For the proper study of tides, frequent and continuous observations are necessary;

509. Thes.—For the proper study of tides, frequent and continuous observations are necessary; it will not suffice to observe the heights of the high and low waters only, even if they present themselves as distinct phases, but the whole tidal curve for each day should be developed by recording the height of water at intervals, which, preferably, should not exceed thirty minutes. Observations, to be complete, must cover a whole lunar month; or, if it be impracticable to observe the tides at night, the day tides of two lunar months may be substituted.

510. When made for the purposes of a hydrographic survey the tidal observations are used to correct the soundings, and care must be taken to make sure that the gauge is placed in a situation visited by the same form of tide as that which occurs at the place where soundings are being made. It will not answer, for instance, to correct the soundings upon an inlet-bar by tidal observations made within the lagoon with which this inlet communicates, because the range of the tide within the lagoon is less than upon the outside coast. A partial obstruction, like a bridge, or a natural contraction of the channel section, while it may not reduce the total range of the tide or materially affect the time of high or low tides, will alter the relative heights above and below at intermediate stages, so that the hydrographer must be careful to see that no such obstruction intervenes between his field of work and the gauge.

511. TIDAL CURRENTS.—Observations for tidal currents should be made with the same regularity as for tides; the intervals need not ordinarily be more frequent than once in every half hour. They should always be nade at the same point or points, which should be far enough from shore to be representative of the conditions prevailing in the navigable waters. The ordinary log may be employed for measuring the current, but it is better to replace the chip by a pole weighted to float upright at a depth of about fifteen feet; the line should be a very light one, and buoyed at intervals by cork floats to keep it from sinking; the set of the current should be noted by a compass bearing of the direction of the pole at the end of the observation.

512. RECORD.—The record of observations should be kept clearly and in complete form. It should include a description of the locality of observation, the nature of gauge and of instruments used for measuring currents, and the exact position of both tidal and current stations, together with situation and height of bench mark. The time of making each observation should be shown, and data given for reduction to some standard time. In extended tidal observations the meteorological conditions should be carefully recorded, the instruments used for the observations being properly compared with standards.

513. There are frequently remarkable facts in reference to tides and currents to be obtained from persons having local knowledge; these should be examined and recorded. The date and circumstances of the highest and lowest tides ever known form important items of information.

of the bighest and lowest tides ever known form important items of information. **514.** PLANES OF REFERENCE.—The *plane of reference* is the plane to which soundings and tidal data are referred. One of the principal objects of observing tides when making a survey is to furnish the means for reducing the soundings to this plane. Four planes of reference are used; namely, mean low water, mean low water springs, mean lower low waters, and the harmonic or Indian tide plane.

Mean low water is a plane whose depression below mean sea level corresponds with half the mean semi-diurnal range, while the depression of mean low-water springs corresponds with half the mean range of spring tide; mean lower low water depends upon the diurnal inequality in high and low water; the harmonic or Indian tide plane was adopted as a convenient means of expressing something of an approximation to the level of low water of ordinary spring tides, but where there is a large diurnal inequality in low waters it falls considerably below the true mean of such tides.

As these planes may differ considerably, it is important to ascertain which plane of reference is adopted before making use of any chart or considering data concerning the tides. **515.** The tides are subject to so many variations dependent upon the movements of the sun and

515. The tides are subject to so many variations dependent upon the movements of the sun and moon, and to so many irregularities due to the action of winds and river outflows, that a very long series of observations would be necessary to fix any natural plane. In consideration of this, and keeping in view the possibilities of repetitions of the surveys or subsequent discoveries within the field of work, it is necessary to define the position of the plane of reference which has resulted from any series of observations. This is done by leveling from the tide gauge to a permanent *bench*, precisely as if the adopted plane were arbitrary.

516. BENCH MARK.—The plinth of a light-house, the water table of a substantial building, the base of a monument, and the like, are proper benches; and when these are not within reach, a mark

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EXAMPLE: Find the time of morning high water and afternoon low water at Gibraltar on June 26, 1879.

may be made on a rock not likely to be moved or started by the frost, or, if no rock naturally exists in the neighborhood, a block of stone buried below the reach of frost and plowshare should be the resort. When a bench is made on shore, it should be marked by a circle of 2 or 3 inches diameter with a cross in the center, indicating the reference point. The levelings between this point and the gauge should be tructure is of little value, but in the absence of permanent objects it is better than nothing. The marks should be cut in, if on stone, and if on wood, copper nails should be used. The bench must be sketched and carefully described, and its location marked on the hydrographic sheet, with a statement of the relative position of the plane of reference.

517. The leveling from the bench mark to the tide gauge may be done, when a leveling instrument is not available, by measuring the difference of height of a number of intermediate points by means of a long straight-edged board, held horizontal by the aid of a carpenter's spirit level, or even a plummet square, taking care to repeat each step with the level inverted end for end. A line of sight to the sea horizon, when it can be seen from the bench across the tide staff, will afford a level line of sufficient accuracy, especially when observed with the telescope. It may often be convenient to combine these methods.

518. TIDE GAUGES.—The *Staff Gauge* is the simplest device for measuring the heights of tides, and in perfectly sheltered localities it is the best. It consists of a vertical staff graduated upward in feet and tenths, and so placed that its zero shall lie below the lowest tides. The same gauge may also be used where the surface is rough, if a glass tube with a float inside is secured alongside of the staff, care being taken to practically close the lower end of the tube so as to exclude undulations; readings may also be made by noting the point midway between the crest and trough of the waves.

A staff gauge should always be erected for careful tidal observations, even where other classes of gauge are to be employed, as it furnishes a standard for comparison of absolute heights, and also serves to detect any defects in the mechanical details upon which all other gauges are to a greater or less extent dependent.

519. Where there is considerable swell, and where, from the situation of the gauge or the great range of the tide (making it inconvenient for the observer to see the figures in certain positions) the staff gauge can not be used, recourse must be had to the *Box Gauge*. This gauge consists of a vertical box, closed at the bottom, with a few small holes in the lower part which admit sufficient water to keep the level within equal to the mean level without, but which do not permit the admission of water with sufficient rapidity to be affected by the waves. Within the box is a copper float; in some cases this float carries a graduated vertical rod whose position with reference to a fixed point of the box affords a measure for the height of the water; in other gauges of this class the float is attached to a wire or cord which passes over pulleys and terminates in a counterpoise whose position on a vertical graduated scale shows the height of tide.

520. An Automatic Gauge requires a box and float such as has just been described. The motion of the float in rising and falling with the tide is communicated to a pencil which rests upon a moving sheet of paper; uniform motion is imparted to the paper by the revolution of a cylinder driven by clockwork; the motion of the pencil due to the tide is in a direction perpendicular to the direction of motion of the paper, and a curve is thus traced, of which one coordinate is time, and the other height. The paper, which is usually of sufficient length to contain a month's record, is paid out from one cylinder, passes over a second whereon it receives the record, and is rolled upon a third cylinder, which thus contains the completed tidal sheet.

This gauge, besides giving a perfectly continuous record, has the further merit of requiring but little of the observer's time. But its indications, both of time and heights, should be checked by occasional comparisons with the standard clock and the staff gauge, the readings of which should be noted by hand at appropriate points of the graphic record.

CHAPTER XXI.

OCEAN CURRENTS.

521. An ocean current is a progressive horizontal motion of the water occurring throughout a region of the ocean, as a result of which all bodies floating therein are carried with the stream. The set of a current is the direction toward which it flows, and its *drift*, the velocity of the flow.

522. CAUSE.—The principal cause of ocean currents is the wind. Every breeze sets in motion, by its friction, the surface particles of the water over which it blows; this motion of the upper stratum is imparted to the stratum next beneath, and thus the general movement is communicated, each layer of particles acting upon the one below it, until a current is established. The direction, depth, strength, and permanence of such a current will depend upon the direction, steadiness, and force of the wind; all, however, subject to modification on account of extraneous causes, such as the intervention of land or shoals and the meeting of conflicting currents.

A minor cause in the generation of ocean currents is the difference in density of the sea water in different regions, as a result of which a set is produced from the more dense toward the less dense, in the effort to establish equilibrium of pressure; the difference of density may be due to temperature, the warmer water near the equator being less dense than the colder water of higher latitudes; or it may be created by a difference in the amount of contained saline matter, resulting from evaporation, freezing, or other causes. Another minor factor that may have influence upon ocean currents is the difference of pressure exerted by the atmosphere upon the water in different regions. But neither of the lastmentioned causes may be regarded as of great importance when compared with the influence, direct and indirect, of the wind.

523. DRIFT AND STREAM CURRENTS.—Ocean currents may be divided into two classes: Drift and Stream Currents.

A Drift Current is one which arises from the effect of wind upon the surface water, impelling the particles to leeward. Such currents reach only to shallow depths, except in regions where caused by winds whose prevalence is almost unbroken, and where, in consequence, motion is communicated stratum by stratum, during a long series of years, until the influence is felt at great depths.

A Stream Current is one which arises when the water carried forward by a drift current encounters an obstacle which prevents a further flow in the direction which it has been following, and the particles are forced to acquire a new motion which takes such direction as may be imposed by the conditions existing in the locality.

Some currents are compounded of both drift and stream; for a stream already formed may pass through the region of a prevalent wind in such direction that it will receive an accelerating effect due to the wind.

524. SUBMARINE CURRENTS.—In any scientific investigation of the circulation of ocean waters it is necessary to take account of the submarine currents as well as those encountered upon the surface; but for the practical purposes of the navigator the surface currents alone are of interest.

525. METHODS OF DETERMINATION.—The methods of determining the existence of a current, with its set and drift, may be divided into three classes; namely, (a) by observations from a vessel occupying a stationary position not affected by the current; (b) by comparison of the position of a vessel under way as given by observation with that given by dead reckoning; and (c) by the drift of objects abandoned to the current in one locality and reappearing in another.

526. Of these methods, the first named, by observations from a vessel at anchor, is by far the most accurate and reliable, but being possible only under special circumstances is not often available. The most valuable information about ocean currents being that which pertains to conditions in the open sea, the great depths there existing usually preclude the possibility of anchoring a vessel; ships especially fitted for the purpose have at times, however, carried out current observations with excellent results; the most notable achievements in this direction are those of the survey of the Gulf Stream, made by United States naval officers acting under the Coast and Geodetic Survey, during which the vessel was anchored and observations were made in positions where the depth reached to upward of 2,000 fathoms.

527. The method of determining current from a comparison of positions obtained, respectively, by observation and by dead reckoning is the one upon which our knowledge must largely depend. This method is, however, always subject to some inaccuracy, and the results are frequently quite erroneous, for the so-called current is thus made to embrace not only the real set and drift, but also the errors of observation and dead reckoning. In the case of a modern steamer accurately steered and equipped with good instruments for determining the speed through the water as well as the position by astronomical observations, the current may be arrived at by this method with a fairly close degree of accuracy. It is not always possible, however, to keep an exact reckoning, and this is especially true in sailing vessels, where the conditions render it difficult to determine correctly the position by account; this source of error may be combined with faulty instrumental determinations, giving apparent currents differing widely from those that really exist.

528. Much useful knowledge regarding ocean currents has been derived from the observed drift of objects from one to another locality. This is true not only of the bottles thrown overboard from vessels with the particular object of determining the currents, but also of derelicts, drifting buoys, and pieces

of wreckage, which fulfill a similar mission. The deductions to be drawn from such drift are of a general nature only. The point of departure, point of arrival, and elapsed time are all that are positively known. The route followed and the set and drift of current at different points are not indicated, and in the case of objects floating otherwise than in a completely submerged condition account must be taken of the fact that the drift is influenced by the wind. But even this general information is of great value in researches as to ocean currents, and navigators who desire to aid in the work of investigation may do so by throwing overboard, from time to time, sealed bottles containing a statement of date and position at which they are launched.

529. CURRENTS OF THE ATLANTIC OCEAN.—A consideration of the currents of the Atlantic most conveniently begins with a description of the *Equatorial Currents*. The effect of the northeast and southeast trade winds is to form two great drift currents, setting in a westerly direction across the Atlantic from Africa toward the American continent, whose combined width covers at times upward of fifty degrees of latitude. These are distinguished as the *Northern or Southern Equatorial Currents*, according as they arise from the trade winds of the northern or southern hemisphere.

Of the two, the Southern Equatorial Current is the more extensive. It has its origin off the continent of Africa south of the Guinea coast, and begins its flow with a daily velocity that averages about 15 miles; it maintains a general set of west, the portion near the equator acquiring later, however, a northerly component, while the drift steadily increases until, on arriving off the South American coast, a rate of 60 miles is not uncommon. At-Cape San Roque the current bifurcates, the main or equatorial branch flowing along the Guiana coast, while the other branch is deflected to the southward.

The Northern Equatorial Current originates to the northward of the Cape Verde Islands and sets across the ocean in a direction that averages due west; though parallel to the corresponding southern drift, its velocity is not so high.

530. Between the Northern and Southern Equatorial Currents is found the *Equatorial Counter Current*, which sets to the eastward, being apparently a flowing back, in the region of equatorial calms, of water carried westward by the trade drifts. The extent and strength of this current varies with the season, a maximum being attained in July or August, when its effect is apparent to the westward of the fiftieth meridian of west longitude, while at its minimum, in November or December. its influence is but slight and prevails over a limited area only.

531. To the westward of the region of the Equatorial Counter Current the North and the South Equatorial Currents unite. A large part of the combined stream flows into the Caribbean Sea through the various passages between the Windward Islands, takes up a course first to the westward and then to the northward and westward, finally arriving off the extremity of the peninsula of Yucatan; from here some of the water follows the shore line of the Gulf of Mexico, while another portion passes directly toward the north Cuban coast; by the reuniting of these two branches in the Straits of Florida there is formed the most remarkable of all ocean currents—the Gulf Stream.

From that portion of the combined equatorial currents which fails to find entrance to the Caribbean Sea a current of moderate strength and volume takes its course along the north coasts of Porto Rico, Haiti, and Cuba, flows between the last-named island and the Bahamas, and enters the Gulf Stream off the Florida coast, thus adding its waters to those of the main branch of the equatorial current which have arrived at the same point by way of the Caribbean, the Yucatan Passage, and the Gulf. **532.** The *Gulf Stream*, which has its origin, as has been described, in the Straits of Florida, and

532. The *Gulf Stream*, which has its origin, as has been described, in the Straits of Florida, and receives an accession from a branch of the Equatorial Current off the Bahamas, flows in a direction that averages true north as far as the parallel of 31°, then curves sharply to ENE. until reaching the latitude of 32°, when a direction a little to the north of NE. is assumed and maintained as far as Cape Hatteras; at this point its axis is about 40 miles, while its inner edge is in the neighborhood of 20 miles off the shore. Thus far in its flow the average position of the maximum current is from 11 to 20 miles outside the 100-fathom curve, disregarding the irregularities of the latter, and the width of the stream—about 40 miles—is nearly uniform. From off Hatteras the stream broadens rapidly and curves more to the eastward, seeking deeper water; its northern limit may be stated to be 60 to 80 miles off Nantucket Shoals and 120 to 150 miles. Further on, its identity as the Gulf Stream is lost, but its general direction is preserved in a current to be described later.

The water of the Gulf Stream is of a deep indigo-blue color, and its junction with ordinary sea water may be plainly recognized; in moderate weather the edges of the stream are marked by ripples; in cool regions the evaporation from its surface, due to difference of temperature between air and water, is apparent to the eye; the stream carries with it a quantity of weed known as "gulf weed," which is familiar to all who have navigated its waters.

In its progress from the tropics to higher latitudes the transit is so rapid that time is not given for more than a partial cooling of the water, and it is therefore found that the Gulf Stream is very much warmer than the neighboring waters of the seas through which it flows. This warm water is, however, divided by bands of markedly cooler water which extend in a direction parallel to the axis and are usually found near the edges of the stream of warm water. The most abrupt change from warm to cold water occurs on the inshore side, where the name of the *Cold Wall* has been given to that band which has appeared to some oceanographers to form the northern and western boundary of the stream.

The investigations of Pillsbury tend to prove that the thermometer is only an approximate guide to the direction and velocity of the current. Though it indicates the limits of the stream in a general way, it must not be assumed that the greatest velocity of flow coincides with the highest temperature, nor that the northeasterly set will be lost when the thermometer shows a region of cold sea water.

The same authority has also demonstrated that in the vicinity of the land there is a marked variation in the velocity of current at different hours of the day, which may amount to upward of 2 knots, and which is due to the elevation and depression of the sea as a result of tidal influences, the maximum current being encountered at a period which averages about three hours after the moon's transit. Another effect noted is that at those times when the moon is near the equator the current presents a narrow front with very high velocity in the axis of maximum strength, while at periods of great northerly or southerly declination the front broadens, the eurrent decreasing at the axis and increasing at the edges. These tidal effects are not, however, observed in the open sea.

The velocity of the Gulf Stream varies with the seasons, following the variation in the intensity of the trade winds, to which it largely owes its origin. The drift of the current under average conditions may be stated as follows:

Between Key West and Habana: Mean surface velocity in axis of maximum current, 24 knots; allowance to be made by a vessel crossing the entire width of the stream, 1.1 knots per hour.

Off Fowey Rocks: Mean surface velocity in axis, 3.5 knots; allowance in crossing, 2¹/₄ knots per hour. Off Cape Hatteras: Mean surface velocity in axis, upward of 2 knots; allowance in crossing the stream, 1¹/₄ knots per hour between the 100-fathom curve and a point 40 miles outside that curve.

533. After passing beyond the longitude of the easternmost portions of North America, it is generally regarded that the Gulf Stream, as such, ceases to exist; but by reason of the prevalence of westerly winds the direction of the set toward Europe is continued until the continental shores are approached, when the current divides, one branch going to the northeastward and entering the Arctic regions and the other running off toward the south and east in the direction of the African coast. These currents have received, respectively, the designations of the *Easterly, Northeast*, and *Southeast Drift Currents*.

534. The effect of the currents thus far described is to create a general circulation of the surface waters of the North Atlantic, in a direction coinciding with that of the hands of a watch, about the periphery of a huge ellipse, whose limits of latitude may be considered as 10° N. and 45° N., and which is bounded in longitude by the Eastern and Western continents. The central space thus inclosed, in which no well-marked currents are observed, and in the waters of which great quantities of the Sargasso or gulf weed are encountered, is known as the Sargasso Sea.

535. The Southeast Drift Current carries its waters to the northwest coast of Africa, whence they follow the general trend of the land from Cape Spartel to Cape Verde. From this point a large part of the current is deflected to the eastward close along the upper Guinea coast. The steam thus formed, greatly augmented at certain seasons by the prevailing monsoon and by the waters carried eastward with the Equatorial Counter Current, is called the *Guinea Current*. A remarkable characteristic of this current is the fact that its southern limit is only slightly removed from the northern edge of the west-moving Equatorial Current, the effect being that the two currents flow side by side in close proximity, but in diametrically opposite directions.

536. The Arctic or Labrador Current sets out of Davis Strait, flows southward down the coasts of Labrador and Newfoundland, and thence southwestward past Nova Scotia and the coast of the United' States, being found inshore of the Gulf Stream. It brings with it the ice so frequently met at certain seasons off Newfoundland.

537. Remell's Current is a temporary but extensive stream, which sets at times from the Bay of Biscay toward the west and northwest, across the entrance to the English Channel and to the westward of Cape Clear.

538. Of the two branches of the Southern Equatorial Current which are formed by its bifurcation off Cape San Roque, the northern one, setting along the coasts of northeastern Brazil and of Guiana and contributing to the formation of the Gulf Stream, has already been described; the other, known as the *Brazil Current*, flows to south and west, along the southeastern coast of Brazil, as far as the neighborhood of the island of Trinidad; here it divides, one part continuing down the coast and having some slight influence as far as the latitude of 45° S., and the other curving around toward east.

539. The last-mentioned branch of the Brazil Current is called the *Southern Connecting Current* and flows toward the African coast in about the latitude of Tristan d'Acunha. It then joins its waters with those of the general northerly current that sets out of the Antarctic region, forming a current which flows to the northward along the southwest African coast and eventually connects with the Southern Equatorial Current, thus completing the surface circulation of the South Atlantic.

540. There are two other currents whose effects are felt in the Atlantic, one originating in the Indian Ocean and flowing around the Cape of Good Hope, the other originating in the Pacific and flowing around Cape Horn. They will be described under the currents of the oceans in which they first appear.

541. CURRENTS OF THE PACIFIC OCEAN.—As in the Atlantic, the waters of the Pacific Ocean, in the region between the tropics, have a general drift toward the westward, due to the effect of the trade winds, the currents produced in the two hemispheres being denominated, respectively, the Northern and the Southern Equatorial Currents. These are separated, as also in the case of the Atlantic, by an east-setting stream, about 300 nulles wide, whose mean position is a few degrees north of the equator, and which receives the name of the Equatorial Counter Current.

542. The major portion of the Northern Equatorial Current, after having passed the Mariana Islands, flows toward the eastern coast of Formosa in a WNW. direction, whence it is deflected northward, forming a current which is sometimes called the *Japan Stream*, but which more frequently receives its Japanese name of *Kuro Sivo*, or "black stream." This current, the waters of which are dark in color and contain a variety of seaweed similar to "gulf weed," carries the warm tropical water at a rapid rate to the northward and eastward along the coasts of Asia and its offlying islands, presenting many analogies to the Gulf Stream of the Atlantic.

The limits and volume of the Kuro Siwo vary according to the monsoon, being augmented during the season of southwesterly winds and diminished during the prevalence of those from northeast. The current sets to the north along the east coast of Formosa, and in about latitude 26° N. changes its course to northeast, arriving at the extreme southwestern point of Japan by a route to westward of the Meiacosima and Loo-choo islands. A branch makes off from the main stream to follow northward along the west coast of Japan, entering the Sea of Japan by the Korea Channel; but the principal current bends toward the east, flows through Van Diemen Strait and the passages between the Linschoten Isles, and runs parallel to the general trend of the south shores of the Japanese islands of Kiushu, Sikok, and Nipon, attaining its greatest velocity between Bungo and Kii channels, where its average drift is between 2 and 3 knots per hour. Continuing beyond the southeastern extremity of Nipon, the direction of the stream becomes somewhat more northerly, and its width increases, with consequent loss of velocity. In the Kuro Siwo, as in the Gulf Stream, the temperature of the sea water is an approximate,

though not an exact, guide as to the existence of the current. **543.** Near 146° or 147° E. and north of the fortieth parallel the Kuro Siwo divides into two parts. One of these, called the *Kamchatka Current*, flows to the northeast in the direction of the Aleutian Islands, and its influence is felt to a high latitude. The second branch continues as the main stream, and maintains a general easterly direction to the 180th meridian, where it is merged into the north and northeast drift currents which are generally encountered in this region.

544. A cold counter current to the Kamchaka Current sets out of Bering Sea and flows to the south and west close to the shores of the Kuril Islands, Yezo and Nipon, sometimes, like the Labrador Current in the Atlantic, bringing with it quantities of Arctic ice. This is often called by its Japanese name of Oya Siwo.

545. On the Pacific coast of North America, from about 50° N. to the mouth of the Gulf of California, 23° N., a cold current, 200 or 300 miles wide, flows with a mean speed of three-quarters of a knot, being generally stronger near the land than at sea. It follows the trend of the land (nearly SSE.)

knot, being generally stronger near the land than at sea. It follows the trend of the land (nearly SSE.) as far as Point Concepcion (south of Monterey), when it begins to bend toward SSW., and then to WSW., off Capes San Blas and San Lucas, ultimately joining the great northern equatorial drift. On the coast of Mexico, from Cape Corrientes (20° N.) to Cape Blanco (Gulf of Nicoya), there are alternate currents extending over a space of more than 300 miles in width, which appear to be produced by the prevailing winds. During the dry season—January, February, and March—the currents generally set toward southeast; during the rainy season—from May to October—especially in July, August, and September, the currents set to northwest, particularly from Cosas Island and the Gulf of Nicoya to the parallel of 15°.

546. The Southern Equatorial Current prevails between limits of latitude that may be approximately given as 4° N. and 10° S., in a broad region extending from the American continent almost to the one hundred and eightieth meridian, setting always to the west and with slowly increasing velocity. In the neighborhood of the Fiji Islands this current divides; one part, known as the Rossel Current, con-The heighborhood of the right stands this current divides; one part, known as the *Kosset Current*, con-tinues to the westward, following a route marked by the various passages between the islands, and later acquiring a northerly component and setting through Torres Strait and along the north coast of New Guinea; the other part, called the *Australia Current*, sets toward south and west, arriving off the east coast of Australia, along which it flows southward to about latitude 35° S., whence it bends toward southeast and east and is soon after lost in the currents due to the prevailing wind.

547. The general drift current that sets to the north out of the Antarctic regions is deflected until, upon gaining the regions to the southwest of Patagonia, it has acquired a nearly easterly set; in striking the shores of the South American continent it is divided into two branches.

The first, known as the *Cape Horn Current*, maintains the general easterly direction, and its influence is felt, where not modified by winds and tidal currents, throughout the vicinity of Cape Horn, and, in the Atlantic Ocean, off the Falkland Islands and eastern Patagonia. The second branch flows northeast in the direction of Valdivia and Valparaiso, follows generally

the direction of the coast lines of Chile and Peru (though at times setting directly toward the shore in such manner as to constitute a great danger to the navigator), and forms the important current which has been called variously the *Peruvian*, *Chilean*, or *Humboldt Current*, the last name having been given for the distinguished scientist who first noted its existence. The principal characteristic of the Peru-yian Current is its relatively low temperature. The direction of the waters between Pisco and Payta is between north and northwest; near Cape Blanco the current leaves the coast of America and bears toward the Galapagos Islands, passing them on both the northern and southern sides; here it sets toward WNW. and west; beyond the meridian of the Galapagos it widens rapidly, and the current is lost in the equatorial current, near 108° W. As often happens in similar cases, the existence of a counter-current has been proved on different occasions; this sets toward the south, is very irregular, and extends only a little distance from shore.

548. CURRENTS OF THE INDIAN OCEAN.-In this ocean the currents to the north of the equator are very irregular; the periodical winds, the alternating breezes, and the changes of monsoon produce currents of a variable nature, their direction depending upon that of the wind which produces then, upon the form of neighboring coasts, or, at times, upon causes which can not be satisfactorily explained.

549. There is, in the Indian Ocean south of the equator, a regular Equatorial Current which, by reason of owing its source to the southeast trade winds, corresponds with the Southern Equatorial Currents of the Atlantic and Pacific. The limits of this west-moving current vary with the longitude as well as with the season. Upon reaching about the meridian of Rodriguez Island, a branch makes off toward the south and west, flowing past Mauritius, then to the south of Madagascar (on the meridian of which it is 480 miles broad), and thereafter, rapidly diminishing its breadth, forming part of the Agulhas Current a little to the south of Port Natal.

The main equatorial current continues westward until passing the north end of Madagascar, where, encountering the obstruction presented by the African continent, it divides, one branch following the coast in a northerly, the other in a southerly, direction. The former, in the season of the southwest monsoon, is merged into the general easterly and northeasterly drift that prevails throughout the ocean from the northern limit of the Equatorial Current on the south, as far as India and the adjacent Asiatic shores on the north; but during the northeast monsoon, when there exists in the northern regions of the Indian Ocean a westerly drift current analogous to the Northern Equatorial Currents produced in the Atlantic and Pacific by the northeast trades, there is formed an east-setting EquatorialCounter Current, which occupies a narrow area near the equator and is made up of the waters accumu-

ated at the western continental boundary of the ocean by the drift currents of both hemispheres. 550. The southern branch of the Equatorial Current flows to the south and west down the Mozambique channel, and, being joined in the neighborhood of Port Natal by the stream which arrives from the open ocean, there is formed the warm *Agullus Current*, which possesses many of the characteristics of the Gulf and Japan streams. This current skirts the east coast of South Africa and

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attains considerable velocity over that part between Port Natal and Algoa Bay. During the summer months its effects are felt farther to the westward; during the winter it diminishes in force and extent. The meeting of the Agulhas Current with the cold water of higher latitudes is frequently denoted by a broken and confused sea.

Upon arriving at the southern side of the Agulhas Bank, the major part of the current is deflected to the sonth, and then curves toward east, flowing back into the Indian Ocean with diminished strength and temperature, on about the fortieth parallel of south latitude, where its influence is felt as far as the eightieth meridian. A small part of the stream which reaches Agulhas Bank continues across the southern edge of that bank, then turns to the northwest along the west coast of the continent until it is united with the waters of the Southern Connecting Current of the Atlantic. **551.** Along the fortieth parallel of south latitude, between Africa and Australia, there is a general

551. Along the fortieth parallel of south latitude, between Africa and Australia, there is a general easterly set, due to the branch of the Agulhas current already described, to the continuation of the drift current from the Atlantic which passes to southward of the Cape of Good Hope, and to the westerly winds which largely prevail in this region. At Cape Leeuwin, the southwestern extremity of Australia, this east-setting current is divided into two branches; one, going north along the west coast of Australia, blends with the Equatorial current nearly in the latitude of the Tropic of Capricorn; the other preserves the direction of the original current and has the effect of producing an easterly set along the south coast of Australia.

552. As in the other oceans, a general northerly current is observed to set into the Indian Ocean from the Antarctic regions.

8

APPENDIX I.

EXTRACTS FROM THE AMERICAN EPHEMERIS AND NAUTICAL ALMA-NAC, FOR THE YEAR 1879, WHICH HAVE REFERENCE TO THE EXAMPLES FOR THAT YEAR GIVEN IN THIS WORK.

[Extracts: Page I.]

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AT GREENWICH APPARENT NOON.

Veek.	onth.			THE SUN'S			Sidereal Time of	Equation of Time, to be				
Day of the V	Day of the M	Apparent Right Ascension.	Diff. for 1 hour.	Apparent Declination.	Diff. for 1 hour.	Semi- diameter.	the Semi- diameter passing the Meridian.	added to subtracted from Appar- ent Time.	Diff. for 1 hour.			
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	APRIL.											
Tues. Wed. <i>Sun.</i> Mon. Tues. Wed. Thur. Frid. Sat. <i>Sun.</i> Mon.	$ \begin{array}{c} 1\\2\\3\\13\\14\\15\\16\\17\\18\\19\\20\\21\end{array} $	$\begin{array}{c} 0 \ \ 41 \ \ 54. \ 87 \\ 0 \ \ 45 \ \ 33. \ 24 \\ 0 \ \ 49 \ \ 11. \ 70 \\ 1 \ \ 25 \ \ 47. \ 34 \\ 1 \ \ 29 \ \ 28. \ 45 \\ 1 \ \ 33 \ \ 9. \ 91 \\ 1 \ \ 36 \ \ 51. \ \ 74 \\ 1 \ \ 40 \ \ 33. \ 95 \\ 1 \ \ 44 \ \ 16. \ 56 \\ 1 \ \ 47 \ \ 59. \ 58 \\ 1 \ \ 51 \ \ 43. \ 01 \\ 1 \ \ 55 \ \ 26. \ 87 \end{array}$	$\begin{array}{c} 9,096\\ 9,100\\ 9,106\\ 9,205\\ 9,219\\ 9,234\\ 9,256\\ 9,268\\ 9,268\\ 9,285\\ 9,302\\ 9,337\\ \end{array}$	$ \begin{array}{cccccccccccccccccccccccccccccccccccc$	+57.85 57.64 57.41 54.40 53.64 53.23 52.80 52.37 51.92 51.45 +50.97	$\begin{array}{cccccccccccccccccccccccccccccccccccc$	$\begin{array}{c} 64.\ 51\\ 64.\ 53\\ 64.\ 55\\ 64.\ 89\\ 64.\ 94\\ 64.\ 99\\ 65.\ 04\\ 65.\ 09\\ 65.\ 15\\ 65.\ 21\\ 65.\ 27\\ 65.\ 33\\ \end{array}$	$\begin{array}{cccccccccccccccccccccccccccccccccccc$	$\begin{array}{c} 0,758\\ 0,754\\ 0,748\\ 0,649\\ 0,635\\ 0,620\\ 0,604\\ 0,587\\ 0,570\\ 0,553\\ 0,536\\ 0,518\\ \end{array}$			
	1			MAY								
Mon. Tues. Sat. Sun. Thur. Frid. Sat. Sun.	5 6 10 11 15 16 17 18	2 48 30.72 2 52 22.03 3 7 53.03 3 11 47.27 3 27 30.07 3 31 27.26 3 35 25.03 3 39 23.37	9. 626 9. 650 9. 747 9. 771 9. 871 9. 895 9. 919 9. 942 midiamete	N. 16 13 40.4 16 30 40.4 17 35 53.8 17 51 29.1 18 50 48.5 19 4 51.6 19 18 35.5 N. 19 31 59.8	+42.86 42.17 39.33 38.59 35.52 34.72 33.91 +33.06	15 53. 36 15 53. 14 15 52. 25 15 52. 03 15 51. 20 15 51. 00 15 50. 80 15 50. 61	66. 37 66. 45 66. 78 66. 86 67. 19 67. 27 67. 35 67. 43	3 25. 18 3 30. 40 3 45. 58 3 47. 90 3 51. 32 3 50. 68 3 49. 47 3 47. 69 Sidereal Time	$\begin{array}{c} 0.\ 229\\ 0.\ 206\\ 0.\ 109\\ 0.\ 084\\ 0.\ 014\\ 0.\ 039\\ 0.\ 062\\ 0.\ 086\\ \end{array}$			
	Note.—Mean Time of the Semidiameter passing may be found by substracting 0.18 from the Sidereal Time. + prefixed to the hourly change of declination indicates that north declinations are increasing and south declinations are decreasing; - indicates that north declinations are decreasing and south declinations increasing.											

[Extracts: Page I.]

AT GREENWICH APPARENT NOON—Continued.

Week.	fonth.			THE SUN'S			Sidereal Time of	Equation of Time, to be						
Day of the V	Day of the N	Apparent Right Ascension.	Diff. for 1 hour.	Apparent Declination.	Diff. for 1 hour.	Diff. for 1 hour. diameter.		added to Apparent Time.	Diff. for 1 hour.					
		h. m. 8.	8.	0 / 11	"	, ,,	• 8.	m. s.	ĕ.					
	JUNE.													
Sat. Tues. Wed. Frid. Sat. Frid. Sat. Wed. Thur. Frid.	$\begin{array}{c} 7 \\ 10 \\ 11 \\ 13 \\ 14 \\ 20 \\ 21 \\ 25 \\ 26 \\ 27 \end{array}$	$\begin{array}{cccccccccccccccccccccccccccccccccccc$	$\begin{array}{c} 10.\ 312\\ 10.\ 348\\ 10.\ 358\\ 10.\ 376\\ 10.\ 383\\ 10.\ 402\\ 10.\ 402\\ 10.\ 389\\ 10.\ 389\\ 10.\ 376\\ \end{array}$	$\begin{array}{cccccccccccccccccccccccccccccccccccc$	$\begin{array}{c} +14.64\\ 11.63\\ 10.62\\ 8.58\\ 7.55\\ 1.36\\ \div \ 0.32\\ -3.78\\ 4.81\\ -5.84\end{array}$	$\begin{array}{c} 15 \ 47.\ 63\\ 15 \ 47.\ 20\\ 15 \ 47.\ 20\\ 15 \ 47.\ 20\\ 15 \ 46.\ 91\\ 15 \ 46.\ 48\\ 15 \ 46.\ 43\\ 15 \ 46.\ 27\\ 15 \ 46.\ 24\\ 15 \ 46.\ 22\\ \end{array}$	68, 70 68, 81 68, 84 68, 90 68, 92 68, 98 68, 98 68, 98 68, 94 68, 93 68, 91	$\begin{array}{c}1 \ 28.\ 86\\0\ 54.\ 76\\0\ 42.\ 87\\0\ 18.\ 42\\0\ 5.\ 89\\1\ 11.\ 75\\1\ 24.\ 86\\2\ 16.\ 72\\2\ 29.\ 42\\2\ 41.\ 97\end{array}$	$\begin{array}{c} 0.\ 455\\ 0.\ 490\\ 0.\ 500\\ 0.\ 518\\ 0.\ 525\\ 0.\ 546\\ 0.\ 546\\ 0.\ 532\\ 0.\ 526\\ 0.\ 519 \end{array}$					
	JULY.													
Frid. Sat. Tues. Wed. Thur.	$11 \\ 12 \\ 22 \\ 23 \\ 24$	$\begin{array}{cccccccccccccccccccccccccccccccccccc$	$10, 197 \\ 10, 179 \\ 9, 964 \\ 9, 939 \\ 9, 914$	N. 22 8 29.2 22 0 23.2 20 19 8.9 20 7 5.2 N. 19 54 41.3	-19.7620.7129.7230.57-31.41	$\begin{array}{cccccccccccccccccccccccccccccccccccc$	$\begin{array}{c} 68.\ 30\\ 68.\ 24\\ 67.\ 51\\ 67.\ 43\\ 67.\ 35\end{array}$	$\begin{array}{c} 5 & 10. \ 04 \\ 5 & 17. \ 99 \\ 6 & 10. \ 85 \\ 6 & 13. \ 15 \\ . \ 6 & 14. \ 84 \end{array}$	0, 339 0, 321 0, 108 0, 083 0, 059					
				SEPTEM	BER.	1	•	Tobesubtract- ed from Ap- parent Time.						
Wed. Thur.	10 11	$\begin{array}{cccccccccccccccccccccccccccccccccccc$	8, 993 8, 988	N. 4 59 24.2 N. 4 36 36.2	-56.90 -57.10	$\begin{array}{cccccccccccccccccccccccccccccccccccc$	$\begin{array}{c} 64.12 \\ 64.10 \end{array}$	$\begin{array}{cccc} 3 & 1.29 \\ 3 & 22.03 \end{array}$	0. 862 0. 867					
		·		DECEM	BER.		•		8					
Mon. Tues.	$\frac{22}{23}$	$\begin{array}{cccccccccccccccccccccccccccccccccccc$	11. 108 11. 107	S. 23 27 17.3 S. 23 26 54.3	+ 0.37 + 1.55	16 18.13 16 18.18	71. 30 71. 30	$\begin{array}{c}1 \ 16. \ 61\\0 \ 46. \ 64\end{array}$	1, 248 1, 246					
Note	а.—М +	ean Time of the Se prefixed to the ho declinations are d increasing.	midiamete urly chang lecreasing;	 NOTE.—Mean Time of the Semidiameter passing may be found by subtracting 0.18 from the Sidereal Time. + prefixed to the hourly change of declination indicates that north declinations are increasing and south declinations are decreasing; - indicates that north declinations are decreasing and south declinations increasing. 										

[Extracts: Page II.]

AT GREENWICH MEAN NOON.

Day of	Day of the		THE	sun's		Equation of Time, to be subtracted from Diff. for		Sidereal Time			
the Week.	the Month.	Apparent Right Ascension.	Diff. for 1 hour.	Apparent Declination.	Diff. for 1 hour.	added to Mean Time.	1 hour.	cension of Mean Sun.			
		h. m. s.	8.	0 ' "	"	<i>m. s</i> .	я.	h. m. s.			
				JANUARY	ζ.						
Frid. Sat. Mon. Tues.	$ \begin{array}{c} 10 \\ 11 \\ 20 \\ 21 \end{array} $	$\begin{array}{cccccccccccccccccccccccccccccccccccc$	10, 866 10, 842 10, 593 10, 562	$\begin{array}{cccccccccccccccccccccccccccccccccccc$	+ 22, 35 23, 41 32, 48 + 33, 42	7 43.42 8 7.37 11 14.60 11 31.91	1.010 0.986 0.738 0.706	$\begin{array}{cccccccccccccccccccccccccccccccccccc$			
APRIL.											
Tues. Wed. Tues. Wed. Thur. Sun. Mon. Tues. Wed. Thur. Frid. Tues. Wed.	$ \begin{array}{c} 1\\2\\8\\9\\15\\16\\17\\20\\21\\22\\23\\24\\25\\29\\30\end{array} $	$\begin{array}{cccccccccccccccccccccccccccccccccccc$	$\begin{array}{c} 9.098\\ 9.102\\ 9.146\\ 9.157\\ 9.236\\ 9.252\\ 9.269\\ 9.321\\ 9.338\\ 9.356\\ 9.375\\ 9.394\\ 9.414\\ 9.494\\ 9.515\end{array}$	N. 4 30 39. 4 4 53 45. 6 7 10 20.3 7 32 42.8 9 44 7. 4 10 5 30.1 10 26 42.8 11 29 18.1 11 49 47.6 12 10 5.4 12 30 11.2 12 50 4.7 13 9 45. 4 14 26 14.5 N. 14 44 46.7	$\begin{array}{r} + 57.86\\ 57.65\\ 56.08\\ 55.77\\ 53.65\\ 53.24\\ 52.81\\ 51.46\\ 50.98\\ 50.48\\ 49.97\\ 49.46\\ 48.92\\ 46.65\\ + 46.04\end{array}$	$\begin{array}{cccccccccccccccccccccccccccccccccccc$	$\begin{array}{c} 0.\ 758\\ 0.\ 754\\ 0.\ 709\\ 0.\ 698\\ 0.\ 620\\ 0.\ 604\\ 0.\ 587\\ 0.\ 536\\ 0.\ 518\\ 0.\ 500\\ 0.\ 481\\ 0.\ 462\\ 0.\ 442\\ 0.\ 361\\ 0.\ 340\\ \end{array}$	$\begin{array}{cccccccccccccccccccccccccccccccccccc$			
				MAY.				-			
Frid. Sat. Sun. Frid. Sat. Sun. Wed. Thur. Frid. Sat.	$9 \\ 10 \\ 11 \\ 12 \\ 16 \\ 17 \\ 18 \\ 28 \\ 29 \\ 30 \\ 31$	$\begin{array}{cccccccccccccccccccccccccccccccccccc$	$\begin{array}{c} 9.\ 723\\ 9.\ 747\\ 9.\ 771\\ 9.\ 796\\ 9.\ 895\\ 9.\ 919\\ 9.\ 942\\ 10.\ 155\\ 10.\ 173\\ 10.\ 190\\ 10.\ 207\\ \end{array}$	$\begin{array}{cccccccccccccccccccccccccccccccccccc$	$\begin{array}{r} + \ 40, 06 \\ 39, 33 \\ 38, 59 \\ 37, 84 \\ 34, 72 \\ 33, 91 \\ 33, 09 \\ 24, 28 \\ 23, 34 \\ 22, 40 \\ + \ 21, 45 \end{array}$	$\begin{array}{c} 3 \ 42.\ 68\\ 3 \ 45.\ 59\\ 3 \ 47.\ 91\\ 3 \ 49.\ 64\\ 3 \ 50.\ 68\\ 3 \ 49.\ 47\\ 3 \ 47.\ 68\\ 3 \ 0.\ 46\\ 2 \ 53.\ 08\\ 2 \ 45.\ 26\\ 2 \ 37.\ 03\\ \end{array}$	$\begin{array}{c} 0.\ 134\\ 0.\ 109\\ 0.\ 084\\ 0.\ 060\\ 0.\ 039\\ 0.\ 062\\ 0.\ 086\\ 0.\ 297\\ 0.\ 315\\ 0.\ 334\\ 0.\ 351 \end{array}$	$\begin{array}{cccccccccccccccccccccccccccccccccccc$			
				JUNE.		To be added to subtracted from Mean Time.					
Sat. Sun. Wed. Sat. Sun. Wed. Thur. Frid.	$ \begin{array}{c} 7 \\ 8 \\ 11 \\ 14 \\ 15 \\ 25 \\ 26 \\ 27 \\ \end{array} $	$\begin{array}{cccccccccccccccccccccccccccccccccccc$	$\begin{array}{c} 10.\ 311\\ 10.\ 324\\ 10.\ 357\\ 10.\ 382\\ 10.\ 388\\ 10.\ 588\\ 10.\ 382\\ 10.\ 382\\ 10.\ 375\\ \end{array}$	N. 22 45 9.9 22 50 49.3 23 5 23.0 23 16 17.4 23 19 6.4 23 24 33.2 23 22 49.7 N. 23 20 41.6	$\begin{array}{r} +14.64\\ 13.64\\ 10.62\\ 7.55\\ +6.52\\ -3.78\\ 4.81\\ -5.84\end{array}$	$\begin{array}{c} 1 \ 28, 85 \\ 1 \ 17, 77 \\ 0 \ 42, 86 \\ \hline 0 \ 5, 89 \\ \hline 0 \ 6, 80 \\ 2 \ 16, 70 \\ 2 \ 29, 40 \\ 2 \ 41, 95 \end{array}$	$\begin{array}{c} 0.\ 455\\ 0.\ 467\\ 0.\ 500\\ 0.\ 525\\ 0.\ 532\\ 0.\ 532\\ 0.\ 526\\ 0.\ 519 \end{array}$	$\begin{array}{cccccccccccccccccccccccccccccccccccc$			
Note	 Note.—The Semidiameter for Mean Noon may be assumed the same as that for Apparent Noon. + prefixed to the hourly change of declination indicates that north declinations are increasing and south declinations are decreasing; — indicates that north declinations are decreasing and south declinations increasing. 										

[Extracts: Page II.]

AT GREENWICH MEAN NOON—Continued.

Day of	Day of		THE	sun's		Equation of		Sidereal Time					
the Week.	the Month.	Apparent Right Ascension.	Diff. for 1 hour.	Apparent Declination,	Diff. for 1 hour,	Time, to be subtracted from Mean Time.	Diff, for 1 hour.	or Right As- cension of <i>Mean</i> Sun.					
		h. m. s.	8.	0 / //	"	m. s.	8.	h. m. s.					
	AUGUST.												
Tues. Wed.		$\begin{array}{rrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrr$	9.610 9.586	N. 17 1 29. 2 N. 16 45 8. 6	-40.52 -41.20	5 47.69 5 41.51	0, 246 0, 270	8 54 39.76 8 58 36.31					
^b SEPTEMBER. To be added to Mean Time.													
Wed. Thur.	10 11	$\begin{array}{cccccccccccccccccccccccccccccccccccc$	8, 995 8, 990	N. 4 59 21.3 N. 4 36 32.9	- 56.91 - 57.12	$\begin{array}{cccccccccccccccccccccccccccccccccccc$	0. 862 0. 867	11 16 35.72 11 20 32.26					
				OCTOBER									
Wed. Thur. Frid. Tues. Wed.	$15 \\ 16 \\ 17 \\ 28 \\ 29$	$\begin{array}{cccccccccccccccccccccccccccccccccccc$	9, 309 9, 333 9, 357 9, 662 9, 693	$\begin{array}{cccccccccccccccccccccccccccccccccccc$	-55.6555.3455.0250.34-49.82	$\begin{array}{cccccccccccccccccccccccccccccccccccc$	0, 548 0, 524 0, 500 0, 195 - 0, 164	$\begin{array}{cccccccccccccccccccccccccccccccccccc$					
				NOVEMBE	R.		· · · ·						
Wed. Thur.	$\begin{array}{c} 12\\ 13\end{array}$	$\begin{array}{rrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrr$	10.180 10.216	S. 17 41 18.4 S. 17 57 27.6	-40.77 -39.99	$\begin{array}{cccccccccccccccccccccccccccccccccccc$	0, 323 0, 359	$\begin{array}{cccccccccccccccccccccccccccccccccccc$					
				DECEMBE	R.								
Wed. Thur. Mon. Tues. Wed. Thur. Mon. Tues. Wed.	3 4 8 9 10 11 22 23 24	$\begin{array}{cccccccccccccccccccccccccccccccccccc$	10.844 10.869 10.960 10.979 10.998 11.015 11.104 11.103 11.101	$\begin{array}{cccccccccccccccccccccccccccccccccccc$	$\begin{array}{r} - 21.30 \\ 20.23 \\ 15.83 \\ 14.71 \\ 13.58 \\ - 12.45 \\ + 0.37 \\ 1.55 \\ + 2.73 \end{array}$	$\begin{array}{cccccccccccccccccccccccccccccccccccc$	$\begin{array}{c} 0.\ 987\\ 1.\ 013\\ 1.\ 104\\ 1.\ 123\\ 1.\ 142\\ 1.\ 159\\ 1.\ 248\\ 1.\ 246\\ 1.\ 244\\ \end{array}$	$\begin{array}{cccccccccccccccccccccccccccccccccccc$					
Note	Note.—The Semidiameter for Mean Noon may be assumed the same as that for Apparent Noon. + prefixed to the hourly change of declination indicates that north declinations are increasing and south declinations are decreasing; – indicates that north declinations are decreasing and south declinations increasing.												

[Extracts: Page III.]

AT GREENWICH MEAN NOON.

			THE SUN'S	~									
Day of the Month.	Day of the Year.	True LONG	ITUDE.	Diff. for		Logarithm of the Radius Vector of the Farth	Diff. for 1 hour.	Mean time of Sidereal 0 ^h .					
		λ	λ'	1 hour.	LATITUDE.	Lattii.	•						
	0 / 11 /		, ,,	"				h. m. s.					
	APŘIL.												
$\begin{array}{c} 21 \\ 22 \end{array}$	$\begin{array}{c} 111\\ 112 \end{array}$	$\begin{array}{cccccccccccccccccccccccccccccccccccc$	$\begin{array}{c} 59 \ 47.4 \\ 58 \ 16.9 \end{array}$	$146.27\\146.19$	$^{+0.52}_{+0.52}$	$\begin{array}{c} 0.\ 0023923\\ 0.\ 0025087 \end{array}$	+48.8 +48.3	$\begin{array}{cccccccccccccccccccccccccccccccccccc$					

[Extracts: Page IV.]

GREENWICH MEAN TIME.

onth.				т	HE MOON'S							
the M	SEMIDI	AMETER.		HORIZONTA	L PARALLAX.		MÉRIDIAN P	ASSAGE.	AGE.			
Day of	Noon.	Midnight.	Noon,	Diff, for 1 hour,	Midnight.	Diff. for 1 hour.		Diff. for 1 hour.	Noon.			
	, ,,	, ,,	, 11	"	, 11	"	h. m.	m.	d.			
	APRIL.											
$ \begin{array}{c ccccccccccccccccccccccccccccccccccc$												
				M	AY.							
	$\begin{array}{c} 16 & 44. \ 6 \\ 16 & 38. \ 5 \\ 15 & 47. \ 0 \\ 15 & 59. \ 4 \end{array}$	$\begin{array}{cccccccccccccccccccccccccccccccccccc$	$\begin{array}{c} 61 & 20. \ 1 \\ 60 & 57. \ 8 \\ 57 & 48. \ 8 \\ 58 & 34. \ 3 \end{array}$	-0.53 -1.29 +1.86 +1.90	$\begin{array}{c} 61 \ 11.\ 3\\ 60 \ 40.\ 2\\ 58 \ 11.\ 4\\ 58 \ 57.\ 1\end{array}$	$-0,93 \\ -1,62 \\ +1,90 \\ +1,88$	$\begin{array}{cccccccccccccccccccccccccccccccccccc$	2.66 2.69 1.95 1.98	$14.9 \\ 15.9 \\ 7.3 \\ 8.3$			
				JU	NE.							
$25 \\ 26 \\ 27$	$\begin{array}{cccccccccccccccccccccccccccccccccccc$	$\begin{array}{cccc} 15 & 54. 3 \\ 16 & 3. 0 \\ 16 & 11. 1 \end{array}$	$\begin{array}{cccc} 57 & 59. \ 1 \\ 58 & 31. \ 7 \\ 59 & 3. \ 0 \end{array}$	1,37 1,34 1,25	$\begin{array}{c} 58 & 15.5 \\ 58 & 47.6 \\ 59 & 17.5 \end{array}$	$1.36 \\ 1.30 \\ 1.17$	$\begin{array}{r} 4 \\ 4 \\ 5 \\ 27. \\ 0 \\ 6 \\ 15. \\ 6 \end{array}$	1, 94 1, 98 . 2, 08	5.76.77.7			

[Extracts: Pages V-XI1.]

GREENWICH MEAN TIME.

			THE MO	ox's rig	HT ASCE	NSION	AND	DE	CLINATI	on.				
Hour.	Right Ascension.	Diff. for 1 m.	Deelir	nation.	Diff. for 1 m.	Hour.	Righ	nt As	cension.	Diff. for 1 m.	Dec	linati	ion.	Diff. for 1 m.
	h. m. s.	۰.	0	, ,,	"		h.	т.	8.	8.	0	,	"	"
	THURS	DAY,	APRIL	10.		WEDNESDAY, MAY 28.								
$ \begin{array}{r} 17 \\ 18 \\ 19 \end{array} $	$\begin{array}{cccccccccccccccccccccccccccccccccccc$	2. 6448 2. 6414 2. 6379	$\begin{array}{c} \text{S. 26 1} \\ 26 1 \\ \text{S. 26 1} \\ \text{S. 26 1} \end{array}$.9 38.3 9 41.1 .9 33.0	- 0.138 + 0.044 + 0.225	6 7 8	$ \begin{array}{c} 10 \\ 10 \\ 10 \end{array} $	$19 \\ 21 \\ 23$	$\begin{array}{r} 4.23 \\ 7.78 \\ 11.34 \end{array}$	2,0591 2,0592 2,0593	N. 7 6 N. 6	49 35	$18.5 \\ 52.4 \\ 23.4$	-14.411 14.459 -14.507
	WEDNESDAY, APRIL 16.							THURSDAY, JUNE 26.						
$\frac{4}{5}$	$\begin{array}{cccccccccccccccccccccccccccccccccccc$	1, 8718 1, 8685 1, 8653	S. 8 1 7 5 S. 7 4	$\begin{array}{cccccccccccccccccccccccccccccccccccc$	+13.010 13.032 +13.054	$2 \\ 3 \\ 11$	11 11 11	$37 \\ 39 \\ 56$	$\begin{array}{c} 41.96\\ 46.49\\ 28.42\end{array}$	2. 0743 2. 0767 2. 0989	S. 2 S. 4	2 35 2 50 51	$36.4 \\ 44.4 \\ 36.5$	-15.135 15.133 -15.069
	FRID	AY, A	PRIL 2	5.				М	ONDA	Y, DEC	EMB	ER	8.	
16 17 18.	$\begin{array}{cccccccccccccccccccccccccccccccccccc$	2, 2558 2, 2562 2, 2566	N. 26 26 N. 26	$5 \ 43.8 \\ 4 \ 23.5 \\ 2 \ 55.2 $	-1.272 1.405 -1.537	$2 \\ 3 \\ 4$	$ \begin{array}{ } 12 \\ 12 \\ 12 \\ 12 \end{array} $	$23 \\ 25 \\ 27$	$ 13.52 \\ 23.37 \\ 33.54 $	2, 1615 2, 1668 2, 1722	S. 8 8 8, 8	9 23 38	24. 444. 9 $3. 8$	$14.354 \\ 14.328 \\ 14.302$
	TUESI	DAY, A	PRIL 2	29.								1.0		
$11\\12\\13$	$\begin{array}{cccccccccccccccccccccccccccccccccccc$	2, 1384 2, 1369 2, 1356	N. 15 2 15 1 N. 15	$\begin{array}{cccccccccccccccccccccccccccccccccccc$	-12, 185 12, 227 -12, 318									

[Extracts: Pages relating to Planets.]

GREENWICH MEAN TIME.

Γ		JU	PITEI	₹.			VENUS.							
			April.				April.							
of Month.	Apparent Right Ascension.	Var. of R. A. for 1 Hour.	Appar Declinat	ent tion.	Var. of Dec. for 1 Hour.	Meridian Passage.	of Month.	Apparent Right Ascension.	Var. of R. A. for 1 Hour.	App Decli	parent nation.	Var. of Dec. for 1 Hour.	Meridian Passage,	
Day (Noon.	Noon.	Noon	ı.	Noon.		Day e	Noon.	Noon.	Noon.		Noon.		
15 16 17 18	$\begin{array}{cccccccccccccccccccccccccccccccccccc$	+1.834 1.819 1.804 +1.789			'' +10.10 10.03 9.96 +9.89	$\begin{array}{c} h. & m. \\ 20 & 50.0 \\ 20 & 46.8 \\ 20 & 43.6 \\ 20 & 40.3 \end{array}$	$24 \\ 25 \\ 26$	$ \begin{array}{cccccccccccccccccccccccccccccccccccc$		$^\circ + \frac{22}{22} \frac{40}{55} \frac{33.2}{4.9} \\ + \frac{23}{8} \frac{8}{59.5}$		'' +37.08 35.55 +34.00	$\begin{array}{c} \hbar. & m. \\ 2 & 10.7 \\ 2 & 11.9 \\ 2 & 13.0 \end{array}$	
Day of the Month. 1st. 11th. 21st. 31st								y of the montl	n. 1st.	6th.	11th, 1	6th. 21	st. 26th.	
Po Ho	"" "" "" Polar Semidiameter 16.4 16.7 17.1 17.5 Horizontal Parallax 1.5 1.6 1.6 1.6						Se H	midiameter or. Parallax	$\begin{array}{c} "\\ 6.0\\ 6.2 \end{array}$	" 6.1 6.3	$\begin{matrix} "\\6.2\\6.4\end{matrix}$	$\begin{matrix} '' \\ 6.3 \\ 6.5 \end{matrix}$	$\begin{array}{c} '' & '' \\ 6.4 & 6.6 \\ 6.7 & 6.8 \end{array}$	
		Se	ptember.				MARS.							
fonth.	Apparent Right	Var. of R. A. for 1	Appare	nt ion.	Var. of Dec. for 1					March.				
Day of M	Noon.	Hour.	Noon		Honr. Noon.	Meridian Passage,	of Month.	Apparent Right Ascension,	Var. of R. A. for 1 Hour.	App Decli	parent nation,	Var. of Dec. for 1 Hour.	Meridian Passage:	
16	$\begin{array}{c ccccccccccccccccccccccccccccccccccc$						Day o	Noon.	Noon.	N	00n.	Noon.		
$\begin{array}{c ccccccccccccccccccccccccccccccccccc$						10 45.5	17 18	h. m. s. 20 5 56.83 20 9 1.27	$^{8.}_{+7.690}$ 7.680	$\stackrel{\circ}{\overset{-21}{21}}$		+20.48 20.98	${}^{h.}_{20} {}^{m.}_{26.4}_{20}$	
	Day of Mont.	n			. 2181	. 31st.	19	$20\ 12\ 5.45$	+7.669	-20	57 10.7	+21.48	20 24.7	
Po Ho	lar Semidian orizontal Para	neter allax	$\overset{''}{\overset{23.6}{2.2}}$	23	$\begin{array}{c c} 23\\ 2.5\\ 2.2\\ 2\end{array}$	$\begin{array}{c ccccc} " & " \\ 3.2 & 22.8 \\ 2.2 & 2.2 \end{array}$	-							
	NOTE -North d	eclinatio	ons are mi	arked	+, south) 1 declinati	ons -							

-Norm declinations are marked +, south declinations -. + prefixed to the hourly change of declination, indicates that north declinations are increasing and south declinations are decreasing; - indicates that north declinations are decreasing and south declinations increasing.

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[Extracts: Pages relating to Fixed Stars.]

FIXED STARS.

MEAN PLACES FOR 1879.0. (JAN. 0+d.016, WASHINGTON.)

Star's Name.	Magni- tude.	Right Ascension.	An, Variation,	Declination.	An. Varia- tion.
$\begin{array}{c} \alpha \text{ Ursee Min. } (Polaris)^* \\ \alpha \text{ Eridani } (Achernar) \\ \alpha \text{ Tauri } (Aldebaran) \\ \mu \text{ Geminorum} \\ \alpha \text{ Canis Maj. } (Sirius) \\ \alpha \text{ Virginis } (Spica) \\ \alpha \text{ Bootis } (Arcturus) \\ \alpha \text{ Scorpii } (Antares) \\ \end{array}$	$2 \\ 1 \\ 3 \\ 1 \\ 1 \\ 1 \\ 1.2$	$ \begin{array}{cccccccccccccccccccccccccccccccccccc$	$\begin{array}{c} \overset{s.}{+21.485} \\ + 2.233 \\ + 3.437 \\ + 3.633 \\ + 2.645 \\ + 3.154 \\ + 2.735 \\ + 3.670 \end{array}$	$\begin{array}{c} \circ & i & i \\ +88 & 39 & 49.92 \\ -57 & 51 & 5.79 \\ +16 & 15 & 53.35 \\ +22 & 34 & 26.94 \\ -16 & 33 & 4.30 \\ -10 & 31 & 44.21 \\ +19 & 48 & 48.59 \\ -26 & 9 & 41.94 \end{array}$	${\begin{subarray}{c} {\begin{subarray}{c} {\begin$

*Circumpolar Star.

APPARENT PLACES FOR THE UPPER TRANSIT AT WASHINGTON.

a Ursæ	Minoris. (Po	laris.)	a Erl	dani. (Achern	nar.)	a T	auri. (<i>Aldeba</i>	ran.)
Mean Solar Date.	Right Ascension.	Declination North.	Mean Solar Date.	Right Ascension.	Declination South.	Mean Solar Date.	Right Ascension.	Declination North.
June 10.8 11.8 12.8	h. m. 1 13 s. 63.54 64.35 65.21	$^{\circ}_{\begin{array}{c}+88&39\\&\\47.1\\&\\47.0\\&\\46.9\end{array}}$	July27.7 Aug. 6.7	$\begin{array}{c} \hbar. & m. \\ 1 & 33 \\ \\ *. \\ 14.91 & +.47 \\ 15.37 & +.45 \end{array}$	$\begin{array}{c} & \circ & ' \\ -57 & 50 \\ \\ & \\ 28.6 & +0.5 \\ 28.3 & 0.0 \end{array}$	Apr. 9.1 19.1 29.1	$\begin{array}{r} h. \ m. \\ 4 \ 28 \\ 59.66 \10 \\ 59.57 \ .07 \\ 59.52 \02 \end{array}$	$ \begin{array}{r} & \circ & ' \\ +16 & 15 \\ \\ & 58.7 & -0.2 \\ 58.6 & -0.1 \\ 58.5 & 0.0 \end{array} $
a Canis Majoris. (Sirius.)			a V	'irginis. (Spic	a.)	a F	sootis. (Arctur	us.)
Mean Solar Right Declination South.			Mean Solar Date.	Right Ascension.	Declination South.	Mean Solar Date,	Right Ascension.	Declination North.
(Dec. 30.5) Jan. 9.5 Apr. 9.2 19.2 29.2 May 9.2	$\begin{array}{c} h. m. \\ 6.39 \\ 51.06 + .10 \\ 51.14 + .05 \\ 50.0918 \\ 49.92 & .16 \\ 49.77 & .13 \\ 49.6510 \end{array}$	$\begin{array}{c} & & & & \\ & -16 & 32 \\ & & & \\ $	Apr. 29.5 May 9.4 19.4 29.4 June 8.3	$ \begin{array}{c} h. m. \\ 13 18 \\ 52.28 + .02 \\ 52.29 & .00 \\ 52.2803 \\ 52.24 & .04 \\ 52.1960 \end{array} $	$\begin{array}{c} \circ & , \\ -10 & 31 \\ \\ 64.6 & -0.1 \\ 64.7 & 0.0 \\ 64.6 & +0.1 \\ 64.4 & 0.3 \\ 64.1 & +0.4 \end{array}$	May 9.4 19.4	* h. m. 14 10 *. " 11.71 +.02 11.7101	$^{\circ}$ '+19 48 $^{''}$ 32.1 +1.6 33.7 +1.6
a see	Di-ht	De alimentian						
Date.	Ascension.	South.						
May 9.5 19.5 29.5 June 8.5 18.4 July 28.3 Aug. 7.3 17.3	$ \begin{array}{c} h. \ m. \\ 16 \ 21 \\ \\ 63.11 \ +.19 \\ 63.28 \ .16 \\ 63.43 \ .12 \\ 63.53 \ .09 \\ 63.60 \ +.05 \\ 63.49 \10 \\ 63.38 \ .13 \\ 63.24 \15 \end{array} $	$\begin{array}{c} \circ & \prime \\ -26 & 9 \\ \\ \\ 53.8 & -0.5 \\ 54.3 & 0.4 \\ 54.7 & 0.4 \\ 55.0 & 0.3 \\ 55.3 & -0.3 \\ 55.3 & -0.3 \\ 55.9 & +0.1 \\ 55.8 & +0.2 \end{array}$						

APPENDIX II.

A COLLECTION OF FORMS FOR WORKING DEAD RECKONING AND VARI-OUS ASTRONOMICAL SIGHTS, WITH NOTES EXPLAINING THEIR APPLICATION UNDER ALL CIRCUMSTANCES.

(The figures in parenthesis refer to the Notes following these forms.)

FORM FOR DAY'S WORK, DEAD RECKONING.

Time.	Compass Course.	Var.	Dev.	Lee- way.	Total error.	True Course.	Patent log.	Dist.	N.	s.	Е.	W.	Diff.(1) Long.
												-	

	Latitude.		Longitude	
Left at departure (or noon)	((2) N. or S.	(⁽²⁾ E. or W.
Run to		N. or S.		E. or W.
By D. R. at		N. or S.		E. or W.
Run to		N. or S.		E. or W.
By D. R. at		N. or S.		E. or W.

FORM FOR TIME SIGHT OF SUN'S LOWER LIMB (SUMNER LINE).

h. m. s.		0 / //		0 / //		111. 8.
W. T	Obs. alt	• 🛈 • • • • • • • • • •	(⁵) Dec.		(⁵) Eq. t.	
C-W +	Corr.	±				
Chro. t.	h		H.D. ±		H . D.	*. ±
C.C. \pm			C N B	h.		ħ.
(¹¹) G. M. T.	(3) S. D.	+	G. M. 1.		G. M. T.	
(7) Eq. t. \pm	(⁴) I. C.	+		/ //		8.
() A 7'			Corr. ±		Corr.	±
(t, A, 1,		T		0 / //		m. s.
		' "	Dec.	N. or S.	Eq. t.	
	dip n d r			0 / //		
,	<i>p</i> . c. <i>i</i> .		(⁶) p			
		/ //				
	Corr.	±				
o / //				o / //		
h						
L ₁	sec	•••••	(9) L_2	********	sec	*******
<i>p</i>	Cosec	******			cosec	•••••
2)						
81	cos		(10) 80		005	
s ₁ -/ <i>i</i>	sin		s3-h		sin	•••••
h m e				h an a		
G. A. T		-)	G. A. 7	r		2)
L.A.T1	$\sin \frac{1}{4} t_1$		L.A. 1	r. ₂	$\sin \frac{1}{2} t_2$	•••••
(h m n)				(1		
(8) Long. $(a, m, s) = E \cdot or W$			Long	$\begin{bmatrix} n, m, s, \\ \dots, m, s, \\ E, or W \end{bmatrix}$		
			nong.			

FORMS FOR WORK.

FORM FOR TIME SIGHT OF A STAR (SUMNER LINE).



FORM FOR TIME SIGHT OF A PLANET (SUMNER LINE).

	h. m. s.		0 / //		h. m. s.		0 / //
W. T.		Obs. al	t. *	R. A.		Dec.	N. or S.
C-W	+	Corr.	±				
					8.		"
Chro. t.		h		H, D.	±	H. D.	±
C. C.	±				h.		h.
			/ //	G. M. T.		G. M. T.	
(11) G. M. T.	· • • • • • • • • •	(15) pa r .	+				
R. A. M. S.	+	(4) I. C.	+		8.		/ //
Red. (Tab.9)) +			Corr.	±	Corr.	±
			$+ \dots$				
G. S. T.					h. m. s.		0 / //
R. A. 🛪			/ //	R. A.		Dec.	N.orS.
	·	dip					
(12) H.A. from G	rE. <i>or</i> W.	ref.					0 / //
						(6) p	
			/ //				
		Corr.	±				

For the remainder of the work, by which the hour angles and thence the longitudes are found, employ the method given under "Form for Time Sight of a Star (Sumner Line)."

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FORM FOR TIME SIGHT OF MOON'S LOWER LIMB (SUMNER LINE).

	h. m. s.		0 / 11		h. m. s.		0 / //
W. T.		Obs. alt. 🐧		(17) R. A.		(17) Dec.	N. or S.
C-W	+	_					
			, ,,		8.		"
Chro. t.	·····	(16) S. D.	+	M. D.	+	M. D.	±
C. C.	±	Aug.	+		т.		<i>m</i> .
		(4) I. C.	+	No. min	ı. ±	No. min.	±
(11) G. M. T.							
R. A. M. S.	+		+		8.		/ //
Red. (Tab.	9) +			Corr.	±	Corr.	±
G. S. T.		dip			h. m. s.		0 / //
R. A. ((R. A.		Dec.	N. or S.
(12) H.A. from (Gr	1st corr.	±			(⁶) p	
			0 / 11				
		Approx. alt. p.&r.(Tab.2-	4) +				
	\ \	h					

For the remainder of the work, by which the hour angles and thence the longitudes are found, employ the method given under "Form for Time Sight of a Star (Summer Line)."

FORM FOR MERIDIAN ALTITUDE OF SUN'S LOWER LIMB.

		0 / //		/ //		0 / //
	Obs. alt. 💽		(³) S. D.	+	(¹⁹) Dec.	N. or S.
	Corr. \pm		(4) I. C.	+		
				·		"
	h			+	Н. D.	±
						h.
		0 / //		1 11	Long.	±
(18)	2	N. or S.	dip			
	d	N. or S.	p. & r.			/ //
					Corr.	±
	Lat.	N. or S.				·
						0 / //
				/ //	Dec.	N. or S.
			Corr.	+		

FORM FOR MERIDIAN ALTITUDE OF A STAR.

		o / //				1 11			o 1	"
	Obs. alt. *			(4) I. C.	+			Dec.		N. or S.
	Corr. \pm									
						/ //				
	h			dip	-					
				ref.	-	·····				
(18)) 2	• • • • • • • • • • •	N. or S.							
	d		N. or S.			· · · · · ·				
		·								
	Lat.		N. or S.			1 11				
				Corr	. ±					

FORM FOR MERIDIAN ALTITUDE OF A PLANET.

	o / //	/ //	h. m.	0 / //
Obs. alt	· *	(15) par. +	G. M. T., Gr. trans.	Dee N. or S.
Corr.	±	(4) 1. C. +	Corr. for Long. \pm	
h		+	L. M. T., local trans.	H.D. ±
			Long. \pm	h.
	0 / //	/ //		G. M. T.
(18) z	N. or S.	dip	G. M. T., local trans	
d	N. or S.	ref. —		/ //
				$Cor. \pm \dots$
Lat.	N. or S.			
				o / //
		/ //		Dec N. or S.
		Corr. ±		

FORMS FOR WORK.

		FORM FOR MER	IDIAN ALTI	TUDE OF MOG	DN'S LOWER	R LIMB.		
	0 / //		0 / 1/			h. m.		0 / //
h		Obs. alt. <u>(</u>		G. M. T., Gr.	trans.		(17) Dec.	N. or S.
				Corr. for Long	$(Tab, 11) \pm$	•••••		
	0 / //	(14 - 1 - T)	. , ,,	1 M / 1.	1 4		N D	"
(18) 2	N. or S.	(¹⁶) S. D.	+ • • • • • • • • • • • • • • • • • • •	L. M. T., loca	I trans.		M. D.	±
et	N. or 8.	Aug.	+	Long.	±.		No min	<i>m</i> .
Lot	N or S	(*) 1. C.	+	G M T loss	trane		No. mn	1. ±
Lat.	· · · · · · · · · · · · · · · · · · ·	- C		G. M. 1., 10ca.	i trans.			/ //
		7					Corr.	+
			, ,,					
		dip						. • / //
							Dec.	N. or S.
			1 11					
		1st corr.	±					
							`	
			0 / //					
		Approx. Alt.						
		p. & r. (Tab.2	4) +					
		h						
	1	ALTERNATIVE FO	RM FOR ME	RIDIAN ALTIT	TUDE OF A	BODY.	(20)	
	+ 90° 00' 00''				Rules for 8	ians.		
(21) Dec.	+							
Corr.	+	Case	I. Lat. & De	c. same name,	Lat. greate	r	···· + 90° +	- Dec Corr Alt-
		Case	II. Lat. & De	e. same name.	Dec. greate	r	··· - 90° +	Dec. + Corr. + Alt.
Const	ant ±	Case I	II. Lat. and	Dec. opposite i	names		+ 90° -	Dec Corr Alt.
Obs. a	ult. ±	Case I	V. Lower tra	nsit			+ 90° -	- Dec. + Corr. + Alt.
Lat.		N. or S.						
	FOR	M FOR LATITUDE	SIGHTS OF	SUNS LOWE	R LIMB (S	UMNER	LINE).	
	h in a		0 / //	501 5 2011	0 / //			
W /	<i>п. н. </i> т	Obe alt	0	(5) Dec		X or	3 (5) 1	<i>m. s.</i>
0.1	ι	Corr	<u>_</u>	(*) Dec.			· (°) I	sq. i.
0-1			±		"			\$.
Chr	o. t	. h		H. D.	±	••	I	I.D. ±
С. С	λ.±		, ,,		h	•		h.
(11) G. 1	И.Т.	(3) S.D.	+	G. M. T		••	(ł. M. T
(7) Eq.	t. ±	(4) I.C.	+		/ //			8.
		-		Corr.	±			Corr. ±
G. 2	ч. т	•	+		0 / //	-		
Lor	$\log_{1} \pm \dots$	•	/ //	Dee		N or S	2 7	m. a.
L. A	А.Т.,	- aip		<i>D</i> .c.,				
	(h m e	$ p. \propto r.$						
	16. 116. 0.							
$(22) t_1$	0 / //	•	/ //					
		Corr.	+					
		-						
(00) X	h. m. s.							
(23) LOI	ng. 2 ±							
L. /	A. T. 2							
	(h m e	-						
	<i>n</i> , <i>n</i> , <i>o</i> ,							
t_2	0 / //	•						
	41 41	1 Mathed			D. J.			
	0 / // 0 / //	Methore.			Kean	uction to .	meriaian.	
t1		sec		(25) a				
d		tan	cosec	() 4				
					0 / //			0 / //
(24) II		4	sin	h	•••••		h	
(**) \$P1"	N. or S.	tan	sin	$(20) a t_1^2 \pm$	•••••		at_{2}^{2} =	E
\$1'	N. or S.		cos	\mathbf{H}_1			H_2	
Tat	V or 9				0 / 11			0 / "
Tat'l	n. or 8.			(18).~		N on H	~	
	0 / "			1	••••••	S or C	~2	
4	0 / //			u .		a, or a,		
t 2	•••••	sec	00/02 *	Lat.1		N. or S.	Lat. 2	N. or S.
a	*****	Lan	cosec					
h			sin				•	
φ : "		tan	sin	1				
m . /			09			•		
92				-				
Lat.2	N. or S.							

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FORM FOR LATITUDE SIGHTS OF A STAR (SUMNER LINE).

		h. m. s.		0 / //		h. m. s.	
	W. T.		Obs.alt	t.*	R. A.		
	C-W	+	Corr.	±		0 / //	
	Chro. t.		h		Dec.		N. or S.
	C. C.	±		/ //			
(11)	G. M. T.		(4) I. C.	+			
	R. A. M. S Red.(Tab.9) -	+ +		, ,,			
			dip				
	G. S. T.		ref.				
	R. A.*	·····					
(12)	H.A.from Gr.	E. or W.					
(27)	Long.1	E. or W.					
				/ //			
		$\begin{pmatrix} h. m. s. \end{pmatrix}$	Corr.	± •••••			
	t_1						
		[]					
		h. m. s.					
(23)	Long.2						
		(h. m. s.		,			
	t_2	0 / "					

For the remainder of the work, by which the latitudes are found from either the $\varphi' \varphi''$ formula or the reduction to the meridian, employ the methods given under "Form for Latitude Sights of Sun's Lower Limb (Summer Line)."

FORM FOR LATITUDE SIGHTS OF A PLANET (SUMNER LINE).

W. T. Obs. alt. * R. A. Dec. N C-W + Corr. \pm k . m Chro. t. h h k . m h . h . Chro. t. h h h . h . h . h . h . Chro. t. h . C. C. \pm h . h . h . h . h . h . (1) G. M. T. (15) par. $+$ G . M. T. h . h . h . h . R. A. M. S. $+$	
C-W + Corr. \pm k . $''$ Chro. t. h h h h h h C. C. \pm h h h h h (1) G. M. T. h h h h h h (1) G. M. T. h h h h h h R. A. M. S. $+$ (4) I. C. $+$ s c r Red. (Tab.9) $+$ $+$ c c r r r G. S. T. r r r r r r r r r R. A. $*$ r	. or S.
$\begin{array}{cccccccccccccccccccccccccccccccccccc$	
C. C. \pm h h h (11) G: M. T. (15) par. $+$ G . M. T. G . M. T. h R, A. M. S. $+$ (4) I. C. $+$ G . M. T. G . M. T. G . M. T. Red. (Tab. 9) $+$ (4) I. C. $+$ G . M. T. G . M. T. f G. S. T. f f f f f f f R. A. * f f f f f f f (12) H. A. from Gr. f f f f f f f (21) H. A. from Gr. f f f f f f f (21) H. A. from Gr. f	
$ \begin{array}{cccccccccccccccccccccccccccccccccccc$	
R. A. M. S. +	
Red. (Tab. 9) $+$ Corr. \pm \cdots G. S. T. \cdot \cdot \cdot \cdot \cdot \cdot R. A.* \cdot \cdot \cdot \cdot \cdot \cdot \cdot (12)H. A. from Gr.E. or W.ref. $ \cdot$ \cdot \cdot \cdot (27)Long. 1 \cdot E. or W. \cdot \cdot \cdot \cdot \cdot \cdot	
G. S. T.	
R. A.* dip R. A. Dec. N (12) H. A. from Gr. E. or W. ref. N (27) Long.1 E. or W. ref.	
$\begin{array}{cccccccccccccccccccccccccccccccccccc$. or S_{\bullet}
(27) Long. 1 E. or W.	
(h. m. s.)	
t_1 Corr. \pm	
(<u></u>)	
h. m. s.	
(²³) Long. ₂	
(h. m. s.	
· · · · · · · · · · · · · · · · · · ·	
**) • / //	
l	

For the remainder of the work, by which the latitudes are found from either the $\varphi' \varphi''$ formula or the reduction to the meridian, employ the methods given under "Forms for Latitude Sights of Sun's Lower Limb (Summer Line)."

	W. Т. С-W	h. m. s.	Obs. alt. ((o / //	(¹⁷) R. A.	h. m. s.	(17) Dec.	• / // N.or S.
	Chro. t. C. C	±	(¹⁶) S. D. Aug. (⁴) I. C.	/ " + +	M. D. No. min.	8. +m. ±	М. D. No, ші	" ± m. n. ±
(11)	G. M. T. R. A. M. S. Red. (Tab. 9)	+?		+	Corr.	<i>8</i> , ±	Corr.	· ///
	G. S. T. R. A. ⊄	·····	dip		R. A.	h. m. s.	Dec.	• / " N.orS.
(12) (27)	H. A. from Gr. Long. ₁	E.or W. E.or W.	1st Corr.	±				
	t_1	$\begin{cases} h. m. s. \\ \cdots \\ \circ & , & n \end{cases} E.or W.$	Approx. alt. p. & r. (Tab. 24)	+				
	Long.2	h. m. s. E.or W	Ь					
	<i>t</i> ₂	$\begin{cases} h. m. s. \\ \cdots & \cdots \\ \circ & \cdot & " \end{cases}$						

FORM FOR LATITUDE SIGHTS OF MOON'S LOWER LIMB (SUMNER LINE).

For the remainder of the work, by which the latitudes are found from either the $\varphi' \varphi''$ formula or the reduction to the meridian, employ the methods given under "Forms for Latitude Sights of Sun's Lower Limb (Sumner Line)."

FORM FOR CHRONOMETER CORRECTION BY EQUAL ALTITUDES OF SUN.

W. T., A. M. C-W	h. m. s. +	W. T., P. M. C-W	h. m. s.	(28) Dec.	• •	//////////////////////////////////////	N. or S.	H. D. (pre noon)	ev. }	" ±	
A. M. Chro. t. P. M. Chro. t.	+	P. M. Chro. t A. M. Chro. t		H. D. a merid.	$^{t}\}\pm \dots$	······		H. D. (fo noon)	$^{11.}$	±	
	2)	Elap. time		Long.	±	<i>n</i> .		Diff. 24 ^h		±	
Mid. Chro. t. Eq. eq. alt.	±			Corr.	±			Diff. 1 ^h		±	-
Chro. t. L. A. noon	}	-		Dec.		1	N. or S.	Diff. for lor	ng.	±	
(7) Eq. t.	±		me					H. D. at m	erid.	±	• •
Chro. t. L. M.	}	(28) Eq. t.		(³¹) Tab. 37	"	$\log A$	(±)		log	B (+)	• •
(29) Long.	, ±	Н. D.	*	H. D.	±,	\log	(±)	o /	\log	(\pm)	•
(30) Chro. error on	}±	Long.	±	L	± 8.	tan	(±)	d ±	tan	(±)	
	,	Corr,	8. ±	1st pt. 2d pt.	± ±	log	(±)	,	\log	(±)	•
		Eq.t.	m. e.	Eq. eq.) alt	•±						

FORM FOR FINDING THE TIME OF HIGH (OR LOW) WATER.

G. M. T. of Greenwich transit	d. h. m.
(³²) Corr. for Long. (Tab. 11)	±
L. M. T. of local transit Lunitidal int. (App. IV)	+
L. M. T. of high (or low) water	
NOTES RELATING TO THE FORMS.

1. It is not necessary to convert departure into difference of longitude for each course; it will suffice to make one conversion for the sum of all the departures used in bringing forward the position to any particular time.

2. In D. R. it will be found convenient to work Lat. and Long. in minutes and tenths, rather than in minutes and seconds.

3. If upper limb is observed, the correction for S. D. should be negative, instead of positive.

4. A positive I. C. has been assumed for illustration throughout the forms; if negative, it should be included with the minus terms of the correction.

5. For time sights and $\varphi' \varphi''$ sights, take Dec. and Eq. t. from Naut. Alm., p. II (G. M. noon).

6. To obtain p, subtract Dec. from 90° if of sume name as Lat.; add to 90° if of opposite name.

7. Sign of Eq. t. that of application to mean time.

8. If G. A. T. is later than L. A. T., Long. is west; otherwise it is east.

9. If Lat, is exactly known, a second latitude need not be employed.

10. s_2 and s_2-h may be obtained by applying half the difference between L_1 and L_2 , with proper sign, to s_1 and s_1-h , respectively.

11. The G. M. T. must represent the proper number of hours from noon, the beginning of the astronomical day; to obtain this it may be necessary to add 12^b to the Chro. t.

12. H. A. from Greeuwich is the difference between G. S. T. and R. A., and should be marked W. if the former is greater; otherwise, E.

13. Local H. A. is marked E. or W., according as the body is east or west of the meridian at time of observation,

14. Subtract local hour angle from Greenwich hour angle to obtain longitude; that is, change name of local hour angle and combine algebraically,

15. The forms include a correction for the parallax of a planet, but in most cases this is small, and may be omitted. When used, take hor, par. from Naut. Alm. and reduce to observed altitude by Table 17. The semidiameter of a planet may be disregarded in sextant work if the *center* of the body is brought to the horizon line.

16. If upper limb is observed, the corrections for S. D. and Aug. should be negative, instead of positive.

17. R. A. and Dec. are to be picked out of Naut. Alm. for nearest hour of G. M. T., and to be corrected for the number of minutes and tenths.

Mark zenith distance N. or S. according as zenith is north or south of the body observed; mark Dec. according to its name, subtracting it from 180° for cases of lower transit; then, in combining the two for Lat., have regard to their names.
 For meridian altitudes, take Dec. from Naut. Alm., p. I (G. A. noon).

20. This form enables "Constant" to be worked up before sight is taken, and gives latitude directly on completion of meridian observation. Longitude and altitude at transit must be known in advance with sufficient accuracy for correcting terms

21. The details of obtaining Dec. at transit and correction for altitude are shown in the meridian altitude forms for each of the various bodies.

22. In an a. m. sight subtract L. A. T. from 24^h to obtain t; in a p. m. sight L. A. T. is equal to t.

23. If Long. is exactly known, a second longitude need not be employed.

24. Mark φ'' N. or S. according to name of Dec., and subtract it from 180° when body is nearer to lower than to upper transit; mark φ' N. or S. according as zenith is north or south of the body; then combine for Lat. having regard to the names 25. Take *a* from Table 26 and *at*² from Table 27.

26. Add for upper, subtract for lower transits.

20. Add for upper, subtract for lower transits.

27. Subtract longitude from Greenwich hour angle to obtain local hour angle; that is, change name of longitude and combine algebraically.

28. For equal altitude sights, take Dec. and Eq. t. from Naut. Alm., p. I (G. A. noon).

29. Add longitude if east; subtract if west.

30. If error is +, the chronometer is fast, and the correction is subtractive; and the reverse.

31. Mark log A and log B as indicated in Table 37; mark N. Lat., N. Dec., and H. D. toward the north +, and the reverse. If, in combining the three logarithms for the respective parts of the equations, one or three of them should be minus, the sign of that part is minus; otherwise, plus.

32 Add for west, subtract for east longitude.

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APPENDIX III.

EXPLANATION OF CERTAIN RULES AND PRINCIPLES OF MATHEMATICS OF USE IN THE SOLUTION OF PROBLEMS IN NAVIGATION.

DECIMAL FRACTIONS.

Fractions, or Vulgar Fractions, are expressions for any assignable part of a unit; they are usaually denoted by two numbers, placed one above the other, with a line between them; thus $\frac{1}{4}$ denotes the fraction one-fourth, or one part out of four of some whole quantity, considered as divisible into four equal parts. The lower number, 4, is called the *denominator* of the fraction, showing into how many parts the whole is divided; and the upper number, 1, is called the *numerator*, and shows how many of those equal parts are contained in the fraction. It is evident that if the numerator and denominator be varied in the same ratio the value of the fraction will remain unaltered; thus, if both the numerator and denominator of the fraction, $\frac{1}{4}$, be multiplied by 2, 3, 4, etc., the fractions arising will be $\frac{2}{8}$, $\frac{3}{12}$, $\frac{1}{15}$, etc., $\frac{1}{4}$ of which are evidently equal to $\frac{1}{4}$.

and denominator of the fraction, $\frac{1}{4}$, be multiplied by 2, 3, 4, etc., the fractions arising will be $\frac{2}{8}$, $\frac{1}{12}$, $\frac{1}{76}$, etc., all of which are evidently equal to $\frac{1}{4}$. A Decimal Fraction is a fraction whose denominator is always a unit with some number of ciphers annexed and the numerator any number whatever; as, $\frac{2}{10}$, $\frac{1}{1000}$, etc. And as the denominator of a decimal is always one of the numbers 10, 100, 1000, etc., the necessity for writing the denominator may be avoided by employing a point; thus, $\frac{1}{30}$ is written .3, and $\frac{1}{1000}$ is written .14; the mixed number $3\frac{1}{100}$, consisting of a whole number and a fractional one, is written 3.14. In setting down a decimal fraction the numerator must consist of as many places as there are ciphers in the denominator; and if it has not so many figures the defect must be supplied by placing ciphers before it: thus $\frac{1}{100} = 16$, $\frac{1}{1000} = 0.016$, $\frac{1}{10000} = 0.0000$, etc. And as ciphers on the right-hand side

In setting down a decimal fraction the numerator must consist of as many places as there are ciphers in the denominator; and if it has not so many figures the defect must be supplied by placing ciphers before it; thus, $\frac{1}{160} = .16$, $\frac{1}{1000} = .016$, $\frac{1}{10000} = .0016$, etc. And as ciphers on the right-hand side of integers increase their value in a tenfold proportion. as 2, 20, 200, etc., so when set on the left hand of decimal fractions they decrease their value in a tenfold proportion, as .2, .02, .002, etc.; but ciphers set on the right hand of these fractions make no alteration in their value; thus, .2 is the same as .20 or .200.

The common arithmetical operations are performed the same way in decimals as they are in integers, regard being had only to the particular notation, to distinguish the integral from the fractional part of a sum.

ADDITION OF DECIMALS.—Addition of decimals is performed exactly like that of whole numbers, placing the numbers of the same denomination under each other, in which case the separating decimal points will range straight in one column.

	Miles.	Feet.	Inches.
Add:	26.7	1.26	272.3267
	32.15	2.31	.0134
	143,206	1.785	2.1576
	.003	2.0	31.4
Sum:	202.059	7.355	305.8977

SUBTRACTION OF DECIMALS.—Subtraction of decimals is performed in the same manner as in whole numbers, observing to set the figures of the same denomination and the separating points directly under each other.

		EXAMPLES.		
From: Take:	$\begin{array}{c} 31.267 \\ 2.63 \end{array}$	$\begin{array}{c} 36.75\\.026\end{array}$	$\substack{1.254\\.316}$	$\begin{array}{c}1364.2\\25.163\end{array}$
Differences	98 697	26 721	028	1339 037
Difference.	20.001	00.144	.000	1000.001

MULTIPLICATION OF DECIMALS.—Multiply the numbers together as if they were whole numbers, and point off as many decimals from the right hand as there are decimals in both factors together; and when it happens that there are not so many figures in the product as there must be decimals, then prefix such number of ciphers to the left hand as will supply the defect.

EXAMPLE I.	Example II.
Multiply 3.25 by 4.5.	Multiply .17 by .06.
$3.25 \\ 4.5$. 17 . 06
1.625 13.00	Answer: .0102

Answer: 14.625

In one of the factors is one decimal, and in the other two; their sum, 3, is the number of decimals of the product. In each of the factors are two decimals; the product ought therefore to contain 4; and, there being only three figures in the product, a cipher must be prefixed.

RULES AND PRINCIPLES OF MATHEMATICS.

EXAMPLE III. Multiply 0.5 by 0.7.		EXAMPLE IV. Multiply .18 by 24.	
Answer:	0.35	$\frac{72}{36}$	
		Answer: 4.32	

DIVISION OF DECIMALS.—Division of decimals is performed in the same manner as in whole num-bers. The number of decimals in the quotient must be equal to the excess of the number of decimals of the dividend above those of the divisor; when the divisor contains more decimals than the dividend, ciphers must be affixed to the right hand of the latter to make the number equal or exceed that of the divisor

EXAMPLE I.	EXAMPLE III.	
Divide 14.625 by 3.25.	Divide 17.256 by 1.16.	
3.25) 14.625 (4.5 1300	1.16) 17.25600 (14.875 116	
1625 1625 In this example there are two decimals in the divisor and three in the dividend; hence, there is an docimal in the anti-institute of the sector of the sect	$\overline{\begin{array}{c} 565\\ 464\\ 1016\\ 928\end{array}}$	
Example II.	880 812	
Previous to the division affix three ciphers to the right hand of 3.1, to make the number of deci- mals in the dividend equal the number in the divisor.		
$.0062) 3.1000 (500 \\ 310 \\ 000$		

MULTIPLICATION OF DECIMALS BY CONTRACTION.—The operation of multiplication of decimal fractions may be very much abbreviated when it is not required to retain any figures beyond a certain order or place; this will constantly occur in reducing the elements taken from the Nautical Almanac from Greenwich noon to later or earlier instants of time.

In multiplying by this method, omit writing down that part of the operation which involves decimal places below the required order, but mental note should be made of the product of the first discarded figure by the multiplying figure, and the proper number of tens should be carried over to insure accuracy in the lowest decimal place sought.

EXAMPLE: Required the reduction for the sun's declination for 7^h.43, the hourly difference being 58".18, where the product is required to the second decimal.

By ordinary method.	By contraction.
58".18	58".18
7 ^h .43	7 ^h .43
17454 ·	1.74
23272	-23.27
40726	407.26
432".2774	432."27

In the contracted method, for the multiplier .03 it is not necessary to record the product of any figures in the multiplicand below units; for the multiplier .4, none below tenths; but in each case observe the product of the left-hand one of the rejected figures and carry forward the number of tens. REDUCTION OF DECIMALS.—To reduce a vulgar fraction to a decimal, add any number of ciphers to the numerator and divide it by the denominator; the quotient will be the decimal fraction. The decimal point must be so placed that there may be as many figures to the right hand of it as there were added ciphers to the numerator. If there are not so many figures in the quotient place ciphers to the left hand to make up the number.

EXAMPLE I.

Reduce $\frac{1}{50}$ to a decimal. 50)1.00

02 Answer

EXAMPLE II.

Reduce § to a decimal. 8)3.000

.375 Answer.

EXAMPLE III.

Reduce 3 inches to the decimal of a foot. Since 12 inches = 1 foot this fraction is $\frac{3}{12}$. 12)3.00

.25 Answer.

EXAMPLE IV

Reduce 15 minutes to the decimal of an hour. Since $60^{m} = 1^{h}$, this fraction is $\frac{15}{60}$.

60)15.00

.25 Answer.

EXAMPLE V

Reduce 17^m 22^s to the decimal of an hour.

$$22^{s} = \frac{22^{m}}{60} = 0^{m}.37.$$

 $17^{\text{m}}.37 = --- = 0^{\text{h}}.289$ Answer.

Any decimal may be reduced to lower denominations of the same quantity by multiplying it by the number representing the relation between the respective denominations.

EXAMPLE VI: Reduce 7.231 days to days, hours, minutes, and seconds.

$ \begin{array}{r} 0^{4}.231 \\ 24 \end{array} $	$0^{h}.544_{60}$	0 ^m .640 60		
924 462	32 ^m .640	38 ^s .400	Answer: 2	7 ⁴ 5 ^h 32 ^m 38 ^s .4.
5 ^h .544				

GEOMETRY.

Geometry is the science which treats of the description, properties, and relations of magnitudes, of which there are three kinds; viz, a *line*, which has only length without either breadth or thickness; a *surface*, comprehended by length and breadth; and a *solid*, which has length, breadth, and thickness. A *point*, considered mathematically, has neither length, breadth, nor thickness; it denotes position

simply. A line has length without breadth or thickness.

A surface has length and breadth without thickness.

A solid has length, breadth, and thickness. A straight or right line is the shortest distance between two points on a plane surface.

A plane surface is one in which, any two points being taken, the straight line between them lies wholly within that surface.

Parallel lines are such as are in the same plane and if extended indefinitely never meet.

A circle is a plane figure bounded by a curve line of which every point is equally distant from a point within called the center. The bounding curve of the circle is called the circumference. The radius of a circle, or semi-diameter, is a right line drawn from the center to the circumference, as AC (fig. 65); its length is that distance which is taken between the points of the compasses to describe the circle.

A diameter of a circle is a right line drawn through the center and terminated at both ends by the circumference, as ACB, its length being twice that of the radius. A diameter divides the circle and its circumference into two equal parts.

An arc of a circle is any portion of the circumference, as DFE. The *chord* of an arc is a straight line joining the ends of the arc. It divides FIG. 65. The circle into two unequal parts, called *segments*, and is a chord to them both; thus, DE is the chord of the arcs DFE and DGE. A *semicircle*, or half circle, is a figure contained between a diameter and the arc terminated by that

diameter, as AGB or AFB.



180

Any part of a circle contained between two radii and an arc is called a sector, as GCH.

A quadrant is half a semicircle, or one-fourth part of a whole circle, as CAG.

All circles are supposed to have their circumferences divided into 360 equal parts, called degrees; each degree is divided into 60 equal parts, called minutes; and each minute into 60 equal parts, called seconds; an arc is measured by the number of degrees, minutes, and seconds that it contains.

A sphere is a solid bounded by a surface of which every point is equally distant from a point within which, as in the circle, is called the *center*. Substituting *surface* for *circumference*, the definitions of the *radius* and *diameter*, as given for the circle, apply for the sphere.

An angle is the inclination of two intersecting lines, and is measured by the arc of a circle inter-cepted between the two lines that form the angle, the center of the circle being the point of intersection. A right angle is one that is measured by a quadrant, or 90°. An acute angle is one which is less than a right angle. An obtase angle is one which is greater than a right angle.

a right angle. An obluse angle is one which is greater than a right angle.
A plane triangle is a figure contained by three straight lines in the same plane.
When the three sides are equal, the triangle is called *equilateral*; when two of them are equal, it is called *isosceles*. When one of the angles is 90°, the triangle is said to be *right-angled*. When each angle is less than 90°, it is said to be *acute-angled*. When one is greater than 90°, it is said to be *obtuse-angled*.
Triangles that are not right-angled are generally called *oblique-angled*.
A quadrilateral figure is one bounded by four sides. If the opposite sides are parallel, it is called a

A quadrulateral figure is one bounded by four sides. If the opposite sides are parallel, it is called a *parallelogram*. A parallelogram having all its sides equal and its angles right angles is called a *square*. When the angles are right angles and only the opposite sides equal, it is called a *rectangle*. In a right-angled triangle the side opposite the right angle is called the *hypotenuse*, one of the other sides is called the *base*, and the third side is called the *perpendicular*. In any oblique-angled triangle, one side having been assumed as a base, the distance from the intersection of the other two sides to the base or the base extended, measured at right angles to the latter, is the perpendicular. In a paralleloat right angles to its direction, is the perpendicular. The term *altitude* is sometimes substituted for perpendicular in this sense.

Every section of a sphere made by a plane is a circle. A *great circle* of a sphere is a section of the ace made by a plane which passes through its center. A *small circle* is a section by a plane which surface made by a plane which passes through its center. intersects the sphere without passing through the center.

A great circle may be drawn through any two points on the surface of a sphere, and the arc of that circle lying between those points is shorter than any other distance between them that can be measured

upon the surface. All great circles of a sphere have equal radii, and all bisect each other. The extremities of that diameter of the sphere which is perpendicular to the plane of a circle are called the *poles* of that circle. In the case of a small circle the poles are named the *adjacent pole* and the *remote pole*. All circles of a sphere that are parallel have the same poles. All points in the circumference of a circle are equidistant from the poles. In the case of a great circle, the poles are 90° distant from every point of the circle.

Assuming any great circle as a primary, all great circles which pass through its poles are called its All secondaries cut the primary at right angles. secondaries.

USEFUL FORMULE DERIVED FROM GEOMETRY.-In these formulæ the following abbreviations are adopted:

r, radius of sphere or circle.

A, major axis of ellipse.

a, minor axis of ellipse.

s, side of a cube.

d, diameter of sphere or circle.

b, base of triangle or parallelogram.

h, perpendicular of triangle or parallelogram.

7, height of cylinder or cone.

 π , ratio of diameter to circumference

(=3.141593).

Area of parallelogram $= b \times h$. Area of triangle $= \frac{1}{2} b \times h$. Area of any right-lined figure = sum of the areas of the triangles into which it is divided. Sum of three angles of any triangle = 180° . Circumference of circle = $2\pi r$, or πd .

Area of circle = πr^2 , or $\frac{\pi d^2}{4}$.

Angle subtended by arc equal to radius $= 57^{\circ}.29578.$

Volume of sphere	$=\frac{\pi d^3}{6}$.
Surface of sphere	$=\pi d^2$, or $4\pi r^2$.
Area of ellipse	$=\frac{\pi Aa}{4}$.
Volume of cube Volume of cylinder	$= s^{3}.$ = Area of base $\times l$.
Volume of pyramid	or cone = Area of base $\times \frac{l}{3}$.

TRIGONOMETRIC FUNCTIONS.

The trigonometric functions of the angle formed by any two lines are the ratios existing between the sides of a right triangle formed by are the ratios existing between the sides of a right triangle formed by letting fall a perpendicular from any point in one line upon the other line; no matter what point is chosen for the perpendicular nor which line, the ratios, and therefore the respective functions, will be the same for any given angle. Let ABC (fig. 66) be a plane right triangle in which C is the right angle; A and B, the other angles; c, the hypotenuse; a and b the sides opposite the angles A and B, respectively. In considering the functions of the guade A its opposite side a_i is recarded as the

the functions of the angle A, its opposite side, a, is regarded as the perpendicular and adjacent side, b, as the base; for the angle B, b is the perpendicular and a the base. Then the various ratios are designated as follows:

or perpendicular, is called the *sine* of angle A, abbreviated sin A; hypotenuse a c

hase

 $\frac{b}{c}$ hypotenuse, is called the *cosine* of angle A, abbreviated cos A: or

perpendicular, is called the *tangent* of the angle A, abbreviated tan A; $\frac{a}{b}$ or

perpendicular, is called the *cotangent* of the angle A, abbreviated cot A; base b \mathbf{or} a

or hypotenuse, is called the *secant* of the angle A, abbreviated sec A; с \overline{b}

hypotenuse c

perpendicular, is called the *cosecant* of the angle A, abbreviated cosec A; or a

1 - cosine A, is called the versed sine of A, abbreviated vers A.

1 - sine A, is called the *co-versed sine* of A, abbreviated covers A.

The following relations may be seen to exist between the various functions:

$$\frac{1}{\sin A} = 1 \div \frac{a}{c} = \frac{c}{a} = \operatorname{cosec} A;$$
$$\frac{1}{\cos A} = 1 \div \frac{b}{c} = \frac{c}{b} = \sec A;$$
$$\frac{1}{\tan A} = 1 \div \frac{a}{b} = \frac{b}{a} = \cot A;$$
$$\frac{\sin A}{\cos A} = \frac{a}{c} \div \frac{b}{c} = \frac{a}{b} = \tan A.$$

Hence the cosecant is the reciprocal of the sine, the secant is the reciprocal of the cosine, the cotangent is the reciprocal of the tangent, and the tangent equals the sine divided by the cosine.

The complement of an angle is equal to 90° minus that angle, and thus in the triangle ABC the angle B is the complement of A. The supplement is equal to 180° minus the angle.

From the triangle ABC, regarding the angle B, we have:

$$\sin B = \frac{b}{c} = \cos A;$$

$$\tan B = \frac{b}{a} = \cot A;$$

$$\sec B = \frac{c}{a} = \operatorname{cosec} A.$$



Hence it may be seen that the sine of an angle is the cosine of the complement of that angle; the tangent of an angle is the cosecant of its complement, and the secant of an angle is the cosecant of its complement.

The functions of angles vary in sign according to the quadrant in which the angles are located. Let AA' and BB' (fig. 67) be two lines at right

Let AA' and BB' (fig. 67) be two lines at right angles intersecting at the point O, and let that point be the center about which a radius revolves from an initial position OB, successively passing the points A, B', A'. In considering the angle made by this radius at any position, P', P'', P''', P'''', with the line OB, its position of origin, the functions will depend B' upon the ratios existing between the sides of a right triangle whose base, b, will always lie within BB,' and whose perpendicular, a, will always be parallel to AA', while its hypotenuse, c (of a constant length equal to that of the radius), will depend upon the position occupied by the radius. Now, if OB and OA be regarded as the positive directions of the base and perpendicular, respectively, and OB' and OA' as their negative directions, the sign of the hypotenuse being always positive, the sign of any function may be determined by the signs of the sides of the triangle upon which it depends.



For example, the sine of the angle P"OB is $\frac{a}{c}$, and since a is positive the quantity has a positive

value; its cosine is $\frac{b}{c}$, and as b is measured in a negative direction from O the cosine must therefore be negative.

In the first quadrant, between 0° and 90°, all quantities being positive, all functions will also be positive.

In the second quadrant, between 90° and 180°, sin A $\left(=\frac{a}{c}\right)$ is positive; cos A $\left(=\frac{b}{c}\right)$ has a negaative value because b is negative; tan A $\left(=\frac{a}{b}\right)$ is also negative because of b. The cosecant, secant, and cotangent have, as in all cases, the same signs as the sine, cosine, and tangent, respectively, being the reciprocals of those quantities.

In the third quadrant, between 180° and 270°, $\sin A\left(=\frac{a}{c}\right)$ and $\cos A\left(=\frac{b}{c}\right)$ are both negative,

because both a and b have negative values; tan A $\left(=\frac{a}{b}\right)$ is positive for the same reason.

In the fourth quadrant, between 270° and 360°, sin A $\left(=\frac{a}{c}\right)$ is negative, cos A $\left(=\frac{b}{c}\right)$ is positive,

and $\tan A\left(=\frac{a}{b}\right)$ is also negative.

From a consideration of the signs in the manner that has been indicated the following relations will appear:

 $\begin{array}{l} \sin A = \sin \left(180^\circ - A \right) = -\sin \left(180^\circ + A \right) = -\sin \left(360^\circ - A \right) . \\ \cos A = -\cos \left(180^\circ - A \right) = -\cos \left(180^\circ + A \right) = \cos \left(360^\circ - A \right) . \\ \tan A = -\tan \left(180^\circ - A \right) = \tan \left(180^\circ + A \right) = -\tan \left(360^\circ - A \right) . \\ \sin A = \cos \left(90^\circ - A \right) = -\cos \left(90^\circ + A \right) = -\cos \left(270^\circ - A \right) = \cos \left(270^\circ + A \right) . \end{array}$

Any similar relation may be deduced from the figure.

It is of great importance to have careful regard for the signs of the functions in all trigonometrical solutions.

LOGARITHMS.

In order to abbreviate the tedious operations of multiplication and division with large numbers, a series of numbers, called *Logarithms*, was invented by Lord Napier, by means of which the operation of multiplication may be performed by addition, and that of division by subtraction. Numbers may be involved to any power by simple multiplication and the root of any power extracted by simple division.

In Table 42 are given the logarithms of all numbers, from 1 to 9999; to each one must be prefixed an index, with a period or dot to separate it from the other part, as in decimal fractions; the numbers from 1 to 100 are given in that table with their indices; but from 100 to 9999 the index is left out for the sake of brevity; it may be supplied, however, by the general rule that the index of the logarithm of any integer or mixed number is always one less than the number of integral places in the natural number. Thus, the index of the logarithm of any number (integral or mixed) between 10 and 100 is 1; from 100 to 1000 it is 2; from 1000 to 10000 it is 3, etc.; the method of finding the logarithms from this table will be evident from the rules that follow:

To find the logarithm of any number less than 100, enter the first page of the table, and opposite the given number will be found the logarithm with its index prefixed. Thus, opposite 71 is 1.85126, which is its logarithm.

To find the logarithm of any number between 100 and 1000, find the given number in the left-hand column of the table of logarithms, and immediately under 0 in the next column is a number, to which must be prefixed the number 2 as an index (because the number consists of three places of figures), and the required logarithm will be found. Thus, if the logarithm of 149 was required, this number being found in the left-hand column, against it, in the column marked 0 at the top (or bottom) is found 17319, prefixing to which the index 2, we have the logarithm of 149, 2.17319.

To find the logarithm of any number between 1000 and 10000, find the three left-hand figures of the given number in the left-hand column of the table of logarithms, opposite to which, in the column that is marked at the top (or bottom) with the fourth figure, is to be found the required logarithm, to which must be prefixed the index 3, because the number contains four places of figures. Thus, if the logarithm of 1495 was required, opposite to 149, and in the column marked 5 at the top (or bottom) is 17464, to which prefix the index 3, and we have the logarithm, 3.17464.

To find the logarithm of any number above 10000, find the first three figures of the given number in the left-hand column of the table, and the fourth figure at the top or bottom, and take out the corresponding logarithm as in the preceding rule; take also the difference between this logarithm and the next greater, and multiply it by the remaining figure or figures of the number whose logarithm is sought, pointing off as many decimal places in the product as there are figures in the multiplier. To facilitate the calculation of the proportional parts several small tables are placed in the margin, which give the correction corresponding to the difference, and to the *fifth* figure of the proposed number. Thus, if the logarithm of 14957 was required, opposite to 149, and under 5, is 17464; the difference between this and the next greater number, 17493, is 29; this multiplied by 7 (the last figure of the given number) gives 203; pointing off the right-hand figure gives 20.3 (or 20) to be added to 17464, which makes 17484; to this, prefixing the index 4, we have the logarithm sought, 4, 17484. This correction, 20, may also be found by inspection in the small table in the margin, marked at the top 29; opposite to the *fifth* figure of the number, 7, in the left-hand column, is the corresponding correction, 20, in the right-hand column. Again, if the logarithm of 1495738 was required, the logarithm corresponding to 149 at the left, and

Again, if the logarithm of 1495738 was required, the logarithm corresponding to 149 at the left, and 5 at the top, is, as in the last example, 17464; the difference between this and the next greater is 29; multiplying this by 738 (the given number excluding the first four figures) gives 21402; crossing off the three right-hand figures of this product (because the number 738 consists of three figures), we have the correction 21 to be added to 17464; and the index to be prefixed is 6, because the given number consists of 7 places of figures; therefore the required logarithm is 6.17485. This correction, 21, may be found as above, by means of the marginal table marked at the top 29, taking at the side 7.38 (or $7\frac{1}{3}$ nearly), to which corresponds 21, as before.

To find the logarithm of any mixed decimal number, find the logarithm of the number, as if it were an integer, by the preceding rules, to which prefix the index of the integral part of the given number. Thus, if the logarithm of the mixed decimal 149.5738 was required, find the logarithm of 1495738, without noticing the decimal point; this, in the last example, was found to be 17485; to this prefix the index 2, corresponding to the integral part 149; the logarithm sought will therefore be 2.17485.

To find the logarithm of any decimal fraction less than unity, it must be observed that the index of the logarithm of any number less than unity is negative; but, to avoid the nixture of positive and negative quantities, it is common to borrow 10 in the index, which, in most cases, may afterwards be neglected in summing them with other indices; thus, instead of writing the index -1 it is written +9; instead of -2 we may write +8; and so on. In this way we may find the logarithm of any decimal fraction by the following rule: Find the logarithm of a fraction as if it were a whole number; see how many ciphers precede the first figure of the decimal fraction, subtract that number from 9, and the remainder will be the index of the given fraction. Thus the logarithm of 0.0391 is 8.59218 - 10; the logarithm of 0.25 is 9.39794 - 10; the logarithm of 0.0000025 is 4.39794 - 10, etc. In most cases the writing of -10 after the logarithm may be dispensed with, as it will be quite apparent whether the logarithm has a positive or a negative index.

To find the number corresponding to any logarithm, seek in the column marked 0 at top and bottom the next smallest logarithm, neglecting the index; write down the number in the side column abreast which this is found and this will give the first three figures of the required number; carry the eye along the line until the next smallest logarithm to the given one is found, and the fourth figure of the required number will be at the top and bottom of the column in which this stands; take the difference between this next smallest logarithm and the next larger one in the table, and also the difference between the next smallest logarithm and the given one; entering the small marginal table which has for its heading the first-named difference and finding in the right-hand column of that table the last-named difference, there will appear abreast the latter, in the left-hand column, the fifth figure of the required number. Where it is desired to determine figures beyond the fifth for the corresponding number, the difference between the next lower logarithm and the given one may be divided by the difference between the next lower and next higher ones, and the quotient (disregarding the decimal point, but retaining any ciphers that may come between the decimal point and the significant figures) will be the fifth and succeeding figures of the number sought. Having found the figures of the corresponding number, point off from the left a number of figures which shall be one greater than the index number, and there place a decimal point. In this operation of placing the decimal point, proper account must be taken of the negative value of any index.

Thus, if the number corresponding to the logarithm 1.52634 were required, find 52634 in the column marked 0 at the top or bottom, and opposite to it is 336; now, the index being 1, the required number must consist of two integral places; therefore it is 33.6.

If the number corresponding to the logarithm 2.57345 were required, look in the column 0 and find in it, against the number 374, the logarithm 57287, and, guiding the eye along that line, find the given logarithm, 57345, in the column marked 5; therefore the mixed number sought is 3745, and since the index is 2, the integral part must consist of 3 places; therefore the number sought is 374.5. If the index be 1 the number will be 37.45, and if the index be 0 the number will be 3.745. If the index be 8, corresponding to a number less than unity, the number will be 0.03745.

Again, if the number corresponding to the logarithm 3.57811 were required, find, against 378 and under 5, the logarithm 57807, the difference between this and the next greater logarithm, 57818, being 11, and the difference between 57807 and the given number, 57811, being 4; in the marginal table headed 11, find in the right hand column the number 4, and abreast the latter appears the figure 4, which is the fifth figure of the required number; hence the figures are 37854; pointing off from the left 3+1=4places, the number is 3785.4.

If the given logarithm were 5.57811, since the index 5 requires that there shall be six places in the whole number, it is desirable to seek accuracy to the sixth figure. The logarithmic part being the same as in the example immediately preceding, it is found as before that the first four figures are 3785, the difference between the next lower and next greater logarithms is 11, and between the next lower logarithm and the given one is 4; divide 4 by 11 and the quotient is .36; drop the decimal point, annex and point off, and the number required is found to be 378536.

It may be remarked that in using five-place logarithm tables it is not generally to be expected that results will be exact beyond the fifth figure.

To show, at one view, the indices corresponding to mixed and decimal numbers, the following examples are given:

Mixed number.	Logarithms.	Decimal number.	Logarithms.
40943.0	.Log. 4. 61218	0. 40943	Log. 9, 61218-10
4094.3	Log. 3. 61218	0.040943	Log. 8. 61218-10
409.43	Log. 2. 61218	0.0040943	Log. 7.61218-10
40.943	Log. 1. 61218	0.00040943	Log. 6. 61218 - 10
4.0943	.Log. 0.61218	0.000040943	Log. 5. 61218-10

To perform multiplication by logarithms, add the logarithms of the two numbers to be multiplied and the sum will be the logarithm of their product.

Example I.	EXAMPLE III.
Multiply 25 by 35.	Multiply 3.26 by 0.0025.
25Log. 1. 39794 35Log. 1. 54407	3. 26Log. 0. 51322 0. 0025Log. 7. 39794
Product, 875Log. 2.94201	Product, 0. 00815Log. 7. 91116
EXAMPLE II.	Example IV.
Multiply 22.4 by 1.8.	Multiply 0.25 by 0.003.
22. 4Log. 1. 35025 1. 8Log. 0. 25527	0. 25Log. 9. 39794 0. 003Log. 7. 47712
Product, 40.32Log. 1.60552	Product, 0. 00075Log. 6. 87506

In the last example, the sum of the two logarithms is really 16.87506-20; this is the same as 6.87506 -- 10, or, remembering that the quantity is less than unity, simply 6.87506.

To perform division by logarithms, from the logarithm of the dividend subtract the logarithm of the divisor; the remainder will be the logarithm of the quotient. 1

EXAMPLE III

EXAMPLE I

	Divide 875 by 25.		Divide 0.00815	5 by 0.0025.
	875 25	Log. 2.94201 Log. 1.39794	0.00815 0.0025	Log. 7. 91116 Log. 7. 39794
Quotient,	35	Log. 1.54407	Quotient, 3.26	Log. 0.51322
	EXAMPLE II.	•	Example	E IV.
	Divide 40.32 by 22.4.		Divide 0.0007	5 by 0.025.
	40. 32 22. 4	Log. 1.60552 Log. 1.35025	0.00075 0.025	Log. 6, 87506 Log. 8, 39794
Quotient,	. 1.8	Log. 0. 25527	Quotient, 0.03	Log. 8.47712

In Example III both the divisor and dividend are fractions less than unity, and the divisor is the lesser; consequently the quotient is greater than unity. In Example IV both fractions are less than unity; and, since the divisor is the greater, its logarithm is greater than that of the dividend; for this reason it is necessary to borrow 10 in the index before making the subtraction, that is, to regard the logarithm of .00075 as 16.87506 - 20; hence the quotient is less than unity.

The arithmetical complement of a logarithm is the difference between that logarithm and the loga-The arithmetical complement of a logarithm is the dimension between that logarithm and the logarithm of unity (10.00000-10, or 0.00000). It is therefore the logarithm of unity divided by that number which is the reciprocal of the number; and, since the effect of dividing by any number is the same as that of multiplying by its reciprocal, it follows that, in performing division by logarithms, we may either subtract the logarithm of the divisor or add the arithmetical complement of that logarithm. As the addition of a number of quantities can be performed in a single operation, while in subtraction The difference between only two quantities can be taken at a time, it is frequently a convenience to dear with the arithmetical complements rather than with the logarithms themselves.

Example I.	EXAMPLE III.
Divide 875 by 25. 875Log. 2, 94201 25Log. 1.39794Colog. 8, 60206 Quotient, 35Log. 1, 54407 EXAMPLE IL	$\begin{array}{c} \text{Simplify the expression,} & \frac{40.32 \times .00815}{22.4 \times .0025} \\ 40.32 & & \text{Log. 1, 60552} \\ .00815 & & \text{Log. 7, 91116} \\ 22.4 & & \text{Log. 1, 35025} \\ .0025 & & \text{Log. 7, 39794} \\ \end{array}$
Divide 0.00075 by 0.025. 0.00075Log. 6. 87506 0.025Log. 8.39794Colog. 1. 60206	Result, 5.868Log. 0.76849

To perform involution by logarithms, multiply the logarithm of the given number by the index of the power to which the quantity is to be raised; the product will be the logarithm of the power sought.

Example I.	Example III.
Required the square of 18.	Required the cube of 13.
18Log. 1. 25527 2	13Log. 1. 11394 3
Answer, 324Log. 2.51054	Answer, 2197Log. 3.34182
EXAMPLE II.	Example IV.
Required the square of 6.4. 6.4 Log. 0. 80618 2	Required the cube of 0.25. 0.25 Log. 9. 39794 3

Answer, 40.96 Log. 1. 61236 Answer, 0.015625 Log. 8. 19382

In the last example, the full product of the multiplication of 9.39794-10 by 3 is 28.19382-30, which

is equivalent to 8.19382-10. *To perform evolution by logarithms* divide the logarithm of the number by the index of the power; the quotient will be the logarithm of the root sought. If the number whose root is to be extracted is a decimal fraction less than unity, increase the index of its logarithm by adding a number of tens which shall be less by one than the index of the power before making the division.

EXAMPLE I.

Quotient, 0.03 Log. 8. 47712

EXAMPLE III.

		4					
Required the s 324	equare root of 324. Log. 2) 2. 51055	Required the square root of 4 40.96L	0.96. og. 2) 1. 61236				
Answer, 18	Log. 1.25527	Answer, 6.4 L	og. 0.80618				
Exa	MPLE II.	EXAMPLE IV.					
Required the	cube root of 2197.	Required the cube root of 0.015625.					
2197	Log. 3) 3. 34183	0.015625 Lo Add 20 to the index	g. 8. 19382 3)28. 19382				
Answer, 13	Log. 1.11394	Answer, 0.25.	og. 9.39794				

In the last example the logarithm 8.19382-10 was converted into its equivalent form of 28.19382-30, which, divided by 3, gives 9.39794-10. To find the logarithm of any function of an angle, Table 44 must be employed. This table is so

arranged that on every page there appear the logarithms of all the functions of a certain angle A, together with those of the angles 90° —A, 90° —A, and 180° —A; thus on each page may be found the logarithms of the functions of four different angles. The number of degrees in the respective angles are printed in **bold-faced** type, one in each corner of the page; the number of minutes corresponding appear in one column at the left of the page and another at the right; the names of the functions

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to which the various logarithms correspond are printed at the top and bottom of the columns. The invariable rule must be to take the name of the function from the top or the bottom of the page, according as the number of degrees of the given angle is found at the top or bottom; and to take the minutes from the right or left hand column, according as the number of degrees is found at the right or left hand side of the page; or, more briefly, take names of functions and number of minutes, respectively, from the line and column nearest in position to the number of degrees. Taking, as an example, the thirty-first page of the table, it will be found that 30° appears at the upper left-hand corner. Suppose that it is desired to find the log, sine of 30° 10′; following the rule given, we

Taking, as an example, the thirty-first page of the table, it will be found that 30° appears at the upper left-hand corner, 149° at the upper right-hand, 59° at the lower right-hand, and 120° at the lower left-hand corner. Suppose that it is desired to find the log. sine of 30° 10′; following the rule given, we find 10′ in the left-hand column and Sine at the top of the page, and abreast one and below the other is the required logarithm, 9.70115. But if the log. sine of 59° 10′ were sought, as 59° appears below and at the right of the page, the logarithm 9.93382 would be taken from the column marked Sine at the bottom and abreast 10′ on the right. It may also be seen that log. sin 30° 10′=log. cos 59° 50′=log. cos 120° 10′=log. sin 149° 50′=9.70115, the equality of the functions agreeing with trigonometrical deductions; (in this statement numerical values only are regarded, and not signs; the latter must, of course, be taken into account in all operations).

Example I.	Example 11.
Required the log. sine, cosecant, tangent, cotan-	Required the log. sine, cosecant, tangent, cotan-
gent, secant, and cosine of 28° 37'.	gent, secant, and cosine of 75° 42'.
Log. sin 9. 68029 Log. cot 10. 26313	Log. sin 9.98633 Log. cot 9.40636
Log. cosec 10. 31971 Log. sec 10. 05658	Log. cosec 10. 01367 Log. sec 10. 60730
Log. tan 9. 73687 Log. cos 9. 94342	Log. tan 10. 59364 Log. cos 9. 39270

When the angle of which the logarithmic function is required is given to seconds, it becomes necessary to interpolate between the logarithms given for the even minutes next below and next above; this may be done either by computation or (except in a few cases) by inspection of the table.

To interpolate by computation, let n represent the number of seconds. D the difference between the logarithms of the next less and next greater even minute, and d the difference between the logarithm of the next less even minute and that of the required angle. Then,

$$d = \frac{n}{60} \times D.$$

It should be noted when the number of seconds is 30, 20, 15, or some similar number, permitting the reduction of the fraction $\frac{n}{60}$ to a simple value, such as $\frac{1}{2}$, $\frac{1}{3}$, $\frac{1}{4}$, as the interpolation by this method may thus be made with greater facility.

Having obtained the difference of the logarithm from that of the next lower even minute, it must be applied in the proper direction—that is, if the function is such that its logarithm increases as the angle increases, the logarithmic difference must be added; but if it decreases, then that difference must be subtracted.

For example, let it be required to find the log. sin and log. cosec of $30^{\circ} 10' 19''$. The log. sin of $30^{\circ} 10'$ is 9.70115; the difference between this logarithm and that of the sine of $30^{\circ} 11' (9.70137)$ is +22, which is D. Hence,

$$d = \frac{19}{60} \times (+22) = +7;$$

and the required logarithm is 9.70122. The log. cosec of 30° 10' is 10.29885; the difference, D, between that and log. sin 30° 11' (10.29863) is -22. In this case

$$d = \frac{19}{60} \times (-22) = -7;$$

therefore, log. cosec $30^{\circ} 11' 19'' = 10.29878$.

The method of interpolating by inspection consists in entering that column marked "Diff." which is adjacent to the one from which the logarithmic function for the next lower minute is taken, and finding, abreast the number in the left-hand minute column which corresponds to the seconds, the required logarithmic difference; and the latter is to be added or subtracted according as the logarithms increase or decrease with an increased angle. Thus, if it be required to find log, sin 30° 10′ 19″, find as before log. sin 30° 10′ = 9.70115; then, in the adjacent column headed "Diff." and abreast the number of seconds, 19, in the left-hand minute column will be found 7, the logarithmic difference; add this, as the function is increasing, and we have the required logarithm 9.70122. If log, cosec 30° 10′ 19″ be sought, find log, cosec 30° 10′ = 10.29885; then in the adjacent difference, 7; and since this function decreases as the angle increases, this must be subtracted; therefore, log, cosec 30° 10′ 19″ = 10.29878. This method of interpolation by inspection is not available in that portion of the table where the logarithmic differences vary so rapidly that no values will annly alike to all the angles on the same

This method of interpolation by inspection is not available in that portion of the table where the logarithmic differences vary so rapidly that no values will apply alike to all the angles on the same page; on such pages the difference for one minute is given in a column headed "Diff. 1/," instead of the usual difference for each second; in this case, the interpolation must be made by computation, the given difference for one minute being D. In other parts of the table the interpolation by inspection may be liable to slight error because of the variation in logarithmic difference for different angles on the same page; but the tabulated values are sufficiently accurate for the usual calculations in navigation.

It will be evident that while the methods explained have contemplated entering the tables with a smaller angle and interpolating *ahead*, it would be equally correct to enter with a greater angle and interpolate *back* for the proper number of minutes, making the requisite change in the sign of the correction.

EXAMPLE I.

EXAMPLE II

Required the log. secant, cosecant, and cotangent

Required the log. sine, cosine, and tangent of 42° 57' 06".

	For 42° 57'	$\mid d$	For 42° 57′ 06″.		For 175° 32'	d	For 175° 32' 3
Log. sin	9,83338	+1	9.83339	Log. sec	10,00132	- 1	10.00131
Log. cos	9.86448	- 1	9.86447	Log. cosec	11.10858	+97	11.10955
Log. tan	9.96890	+3	9,96893	Log. cot	11.10726	-98	11.10824

of 175° 32' 36".

It should be observed that, for uniformity and convenience, all logarithms given in Table 44 have been increased by 10 in the index, and it is understood that -10 ought properly to be written after each; thus all logarithms under 10.00000 represent functions whose value is less than unity, and all over 10.0000 those greater than unity; for example, 11.10726 is the logarithm of a number in which the decimal point should be placed after the second figure from the left.

the decimal point should be placed after the second ngure from the left. To find the angle corresponding to any logarithmic function, the process is the reverse of the one just described. Find, in the column marked with the name of the function, either at top or bottom, the two logarithms between which the given one falls; write down the degrees and minutes of the lesser of the two corresponding angles, which will be the degrees and minutes of the angle required. Call the difference between the two tabulated logarithms D, and the difference between the given logarithm and that which corresponds to the lesser angle, d; then if n represent the number of seconds, we have:

$$n = \frac{d}{\mathrm{D}} \times 60.$$

Or, the same may be obtained by inspection (except where, as before explained, the differences for seconds are not tabulated) by finding, in the "Diff." column adjacent to that from which the logarithm was taken, the logarithmic difference, d, and noting the number of seconds abreast which it stands in the left-hand minute column.

Interpolation may be also made in the reverse direction from the next greater even minute. Thus, if it be required to find the angle corresponding to log. sin 9.61400, we find log. sin 24° 16', 9.61382, and log. sin 24° 17', 9.61411; hence D = 29, and d = 18;

$$n = \frac{18}{29} \times 60 = 37;$$

and the angle is 24° 16' 37". Or, in adjacent column headed "Diff.," 18 would be found abreast 38. 39, or 40 (seconds) in the left-hand minute column-a correspondence sufficiently close for navigation work.

If the angle were known to be in the second quadrant, we find log, sin 155° 43′, 9.61411, and log. sin 155° 44′, 9.61382; here, D = 29, and d = 11;

$$n = \frac{11}{29} \times 60 = 23;$$

therefore, the angle is 155° 43' 23". Or, in adjacent "Diff." column find, abreast 11, 23 or 24 seconds.

EXAMPLE I.

EXAMPLE II. Find angles in second quadrant corresponding to

Find angles less than 90° corresponding to log. cot 10.33621, log. sec 10.11579, and log. cos 8.70542.

0.33621, log. sec 10.11579, and log. cos 8.70542.				log. tan 10.1 10.04944.	15593, log. s	in 8.8	37926	, and	log. cos	ec		
		0	1	d	"			0	1	d	"	
Log. cot	10.33621	24	45	8	$15 \\ 22$	Log. tan	10.15593	124	55 30	19	42	
Log. cos	8. 70542	87	05	$11\overline{6}$	$\frac{22}{28}$	Log. cos	ec 10. 04944	116	49	3	$\frac{23}{27}$	

The Hour Columns in Table 44 give the measure in time corresponding to twice the angular distance given in arc. Thus, abreast the angle 13° 00' stands in the P. M. column 1^h 44^m 00^s, corresponding in time to $2 \times 13^{\circ}$ 00', and in the A. M. column 10^h 16^m 00^s, which is the same subtracted from 12^h. These columns are of use in working the various formulæ which involve functions of half the hour angle. Interpolation for values intermediate to those given in the tables is made on the same principle as for the angular measure; this operation may be performed by inspection by the use of the small tables at the bottom of each page, where n, the number of seconds of time, is given in bold-faced type, and d, the logarithmic difference for the respective columns, appears below.

EXAMPLE I.

Given log. sin $\frac{1}{2}$ t 9.91394, find the Hour A. M. Given $t=1^{h} 48^{m} 44^{s}$, find log. $\cot \frac{1}{2} t$. corresponding. For 1^h 48^m 40^s. log. cot. $\frac{1}{2}t$ 10. 61687 For 9.91389, 1h 39m12s Diff. for 4^s, Col. B, 28 Diff. for 5, Col. C, $\mathbf{5}$ For 1^h 48^m 44^s, log. cot $\frac{1}{2}t$ 10. 61659 For 9,91394. 4 39 07

EXAMPLE II.

MISCELLANEOUS USEFUL DATA.

Earth's Polar radius=6.356.583.8 meters. Earth's Equatorial radius=6,378,206.4 meters. 1 Earth's Compression $=\frac{1}{293.465}$ Earth's Eccentricity=0.0824846 log 8. 9163666. log 3. 7226339. log 3. 7839232. Number of feet in one statute mile=5280 Number of feet in one nautical mile=6080.27 Sine of 1''=0.00000485log 4. 6855749. $\log 4.0333743.$ $\log 6.4637261.$ $\log 0.4342945.$ Sine of 1'=0.00029089 The Napierian base $\varepsilon = 2.7182818$ The modulus of common logarithms=0.4342945 log 9.6377843. $\begin{array}{c} \log \ 9.\ 0377343.\\ \log \ 0.\ 5159890.\\ \log \ 6.\ 7933560.\\ \log \ 6.\ 7320620. \end{array}$ French meter in English feet, 3.28087 French meter in English statute miles. 0.00062138 French meter in nautical miles, 0.00053959 1 pound Avoirdupois=7,000 grains Troy. French gramme=0.00220606 Imperial pound Troy. French kilogramme=0.0196969 English cwts. Cubic inch of distilled water, in grains=252.458. Cubic foot of water, in ounces Troy=908.8488. Cubic foot of water, in pounds Troy=75.7374. Bar. 30.00 in.; ther. 62° F. Cubic foot of water, in ounces Avoirdupois=997.1366691. Cubic foot of water, in pounds Avoirdupois=62.3210606. Length of pendulum which vibrates second at Greenwich, 39.1393 inches.

MARITIME POSITIONS AND TIDAL DATA.

The following table contains the latitude and longitude of a large number of places, together with lunitidal intervals and tidal ranges at the more important ones. It is arranged geographically and followed by an alphabetical index.

The geographical position generally relates to some specified exact location, and is based upon the best available authority. The tidal data relate to the waters adjacent to the point whose latitude and longitude are given, being abstracted from the Tide Tables published by the United States Coast and Geodetic Survey for the year 1903.

The high water and low water lunitidal intervals represent the mean intervals between the moon's transit and the time of next succeeding high and low waters throughout a lunar month. The spring and neap ranges are the differences in height between high water and low water at spring and at neap tides. For those places where the tide is chiefly of a diurnal type, and where there is usually but one high and one low water during a lunar day, the tidal values are bracketed; in such cases the lunitidal intervals are for the semi-diurnal part of the tide (which, however, is only appreciable for a few days when the moon is near the equator), and the range given in the column headed "Spg." does not, as in other cases, apply to the spring tide, but to the greatest periodic daily range, which usually occurs a day or two after the moon attains its extreme of declination, and is therefore near one of the tropics. As those places where the diurnal type predominates seldom experience large tidal effects, the general data furnished regarding such tides will suffice for the ordinary purpose of the navigator. The method of finding the time of high or low water from this table is illustrated in article 507, Chapter XX.

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MARITIME POSITIONS AND TIDAL DATA.

EAST COAST OF NORTH AMERICA.

st.	Place	Lot N	Long W	Lun.	Int.	Rŧ	unge.
Coa	I save.	Lat. N.	Long. W.	H. W.	L. W.	Spg.	Neap.
		0 / //	0 / //	h. m.	h. m.	ft.	ſt.
	Salisbury Island: E. pt Nottingham Island: S. pt	$\begin{array}{cccccccccccccccccccccccccccccccccccc$	$\begin{array}{c} 76 & 30 & 00 \\ 77 & 50 & 00 \end{array}$	8 58	2 46	13.5	6.1
Labrador.	Digges Island: W. extreme	$\begin{array}{cccccccccccccccccccccccccccccccccccc$	$ \begin{array}{ccccccccccccccccccccccccccccccccccc$		•••••		
	Charles Island: E. pt	$62 \ 55 \ 00$ $62 \ 48 \ 00$	74 00 00				
	W. pt	62 50 00	75 20 00				
	Cape Weggs Prince of Wales Sound: Center of ent	$\begin{array}{cccccccccccccccccccccccccccccccccccc$	$74 \ 03 \ 00$ $72 \ 25 \ 00$			• • • • • •	
	Cape of Hopes Advance	61 18 00	70 02 00				
	Akpatok Island: E. pt	$\begin{array}{cccccccccccccccccccccccccccccccccccc$	$\begin{array}{cccccccccccccccccccccccccccccccccccc$			• • • • • •	
	Button Islands: N. pt	$60 \ 52 \ 00$	64 40 00				
	Cape Chilleigh	$\begin{array}{cccccccccccccccccccccccccccccccccccc$	$\begin{array}{cccccccccccccccccccccccccccccccccccc$				
	E. pt., C. Resolution	$61 21 00 \\ 61 40 00$	63 00 00 64 30 00				
und. Labrador. Co	Black Head	60 00 00	64 28 00				
rae	Eclipse Harbor: E. side Nachyack Bay: Islands off entrance	$59 \ 48 \ 00$ $59 \ 07 \ 00$	$64 07 15 \\ 63 20 00$		$1 48 \\ 0 48$	$\frac{0.0}{5.2}$	2.0 2.1
qu	Saddle Island	$57 \ 35 \ 00$	61 20 00				
Ħ	Port Manvers: Entrance	$57 \ 00 \ 00$ $56 \ 32 \ 45$	$\begin{array}{cccccccccccccccccccccccccccccccccccc$	7.00	81.0	6.5	3.0
	Hopedale Harbor: Hill to E'd	$50 \ 52 \ 40$ $55 \ 27 \ 04$	$60 \ 12 \ 34$	5 30	11 43	6.9	3.2
	Aillick Harbor: Cape Mokkivik	55 13 33	$59 \ 08 \ 01$ 57 56 40				
	Indian Harbor: Obs	54 55 50 54 26 55	$57 \ 57 \ 40$ $57 \ 12 \ 40$	6 10	12 23	7.0	3.2
	Outer Gannet Island: Summit	54 00 05	56 31 31				
	Gready Harbor Cartwright Harbor: Caribou Castle	$53 \ 50 \ 00$ $53 \ 42 \ 37$	$56 23 00 \\ 56 59 50$				
	Indian Tickle: Summit	$53 \ 34 \ 25$	55 58 39	6 27	$0 \ 15$	6.0	2.8
	Roundhill Island: Summit	$53 \ 26 \ 00 \ 52 \ 40 \ 07$	$55 \ 35 \ 48 \\ 55 \ 44 \ 29$	6.38	0.26	5.0	9.3
	Cape St. Lewis: SE. pt.	$52 \ 21 \ 16$	55 38 08	6 30	$0 \ 18$	3.5	1.6
	Battle Islands: NE. extreme, SE. I	52 15 36 52 06 00	55 32 20 55 41 00				
		51 50 00	55 41 00				
	Belle Isle: Light-house	əl ə3 00	55 22 10				
	Cape Bauld: Light-house	$51 \ 38 \ 48$ 50 42 10	$55 \ 25 \ 12$ 55 35 30			• • • • • • •	
	Cape St. John: Gull Island light	49 59 54	55 21 33				
ewfoundland. Labrac	Tilt Cove, Union Copper	10 59 00	55 97 17				
	Funk Island: Summit	$49 \ 55 \ 00 \ 49 \ 45 \ 29$	$53 \ 10 \ 56$				
	Offer Wadham: Light-house	49 35 40	$53 \ 45 \ 00$				
	Seldom-come-by Harbor: Shiphill	$49 \ 41 \ 20 \ 49 \ 36 \ 50$	54 47 35 54 12 00				
	Cape Freels: Gull I	49 15 20	$53 \ 25 \ 12$				
÷	Greenspond Island	$\begin{array}{r} 49 & 04 & 20 \\ 48 & 42 & 01 \end{array}$	$53 \ 37 \ 45 \\ 53 \ 04 \ 42$			• • • • • •	
hud	Catalina Harbor: Green I. light-house	48 30 15	53 0 2 40				
ql	Bonaventure Head	$48 16 55 \\ 47 53 10$	$53 23 35 \\ 53 23 20$	7 93	1 11		1.9
8	Baccalieu Island: Light-house	48 08 58	$53 \ 23 \ 20$ $52 \ 47 \ 42$	04.1		ч. 1 	1. 0
wfo	Harbor Grace: Light-house on beach	$47 \ 42 \ 45$ $17 \ 18 \ 20$	53 08 11 59 47 90	7 15	1 03	3.3	1.5
Ne	St. Johns Harbor: Chain Rock Battery.	47 34 02	52 47 20 52 40 54	7 12	1 01	3.3	1.5
	Cape Race: Light-house	46 39 24	53 04 30	6 50	0 38	6.5	3.0
	Trepassey Harbor: Shingle Neck	46 43 20	$53 \ 51 \ 50 \ 53 \ 22 \ 10$	6 50	0 38	6.6	3.1
	Cape St. Mary: Light-house	46 49 34	$54 \ 11 \ 42$	8 20	2 08	7.2	3.3
	Cove	47 17 55	53 58 43				
	Burin Island: Light-house	47 00 26	55 08 49				
	Laun: Gr. Laun R. C. Church St. Pierre: U. S. Coast Survey Station	$\begin{array}{c} 46 & 56 & 30 \\ 46 & 46 & 51 \end{array}$	$55 32 00 \\ 56 10 36$	8 05 8 23	$\begin{array}{c}1 53\\2 11\end{array}$	-7.0 6.6	$\frac{3.2}{3.1}$
	Brunet Island: Mercers Hd. light-house.	47 15 30	55 51 40	8 53	$\frac{2}{2}$ $\frac{11}{41}$	6.5	3.0
	Boar Islands: Burgeo I. light-house	47 35 13	57 36 52	8 22	2 10	6.2	2.9

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APPENDIX IV.

MARITIME POSITIONS AND TIDAL DATA.

EAST COAST OF NORTH AMERICA-Continued.

ust.		7 X.	*	Lun.	Int.	Re	inge.
Coa	Place.	Lat. N.	Long. W.	H. W.	L. W.	Spg.	Neap.
Newfoundland.	La Poile Bay: Gr. Espic Church Cape Ray: Light-house Codroy Island: S. side Boat Harbor Cape St. George: Red I., SE. pt Cow Head: NW. extreme Port Saunders: NE. point of entry Rich Point: Light-house Férolle Point: Cove Point, NE. extreme. Flower Cove: Capstan Pt Green Island: 150 fms. from NE. end Cape Norman: Light-house	$\begin{smallmatrix} & & & & & \\ 47 & 39 & 50 \\ 47 & 37 & 00 \\ 47 & 52 & 30 \\ 48 & 33 & 48 \\ 49 & 55 & 20 \\ 50 & 38 & 30 \\ 50 & 41 & 39 \\ 51 & 02 & 10 \\ 51 & 17 & 25 \\ 51 & 24 & 10 \\ 51 & 38 & 00 \\ \end{smallmatrix}$	$\begin{smallmatrix} \circ & \prime & \prime & \prime \\ 58 & 24 & 10 \\ 59 & 18 & 00 \\ 59 & 23 & 40 \\ 59 & 13 & 10 \\ 57 & 50 & 00 \\ 57 & 57 & 02 & 0 \\ 57 & 02 & 40 \\ 56 & 41 & 45 \\ 56 & 33 & 40 \\ 55 & 53 & 52 \end{smallmatrix}$	h. m. 8 50 8 50 9 40	h. m. 2 38 2 32 3 13	ft. 6.0 4.3 4.9	<i>ft.</i> 2.8 2.1 2.5
Labrador.	Chateau Bay: S. pt. Castle I Amour Point: Light-house Wood Island: S. pt. Greenly Island: Light-house Bradore Bay: Obs. Spot, Jones Pt Old Fort Island: Center. Great Mecatina Island: SE pt. Mecatina Harbor: S. point of Dead Cove. Little Mecatina I.: S. pt. C. McKinnon. St. Mary Reefs South Makers Ledge.	$\begin{array}{cccccccccccccccccccccccccccccccccccc$	$\begin{array}{cccccccccccccccccccccccccccccccccccc$				· · · · · · · · · · · · · · · · · · · ·
R. and G. of St. Lawrence.	Cape Whittle. Natashquan Point: S. edge Clearwater Point: SW. extreme Carousel Island: Light-house. Point de Monts: Light-house. Quebec: Mann's Bastion, Citadel. Montreal: Cathedral. Father Point: Light-house. Cape Chatte: Extreme. Cape Magdalen: Light-house. Cape Rosier: Light-house. Cape Gaspé: Light-house.	$\begin{array}{cccccccccccccccccccccccccccccccccccc$	$\begin{array}{cccccccccccccccccccccccccccccccccccc$	$ \begin{array}{r} 1 & 25 \\ 1 & 43 \\ 1 & 48 \\ 6 & 07 \\ \hline 1 & 52 \\ 1 & 46 \\ 1 & 33 \\ 1 & 25 \\ \end{array} $	$\begin{array}{r} 6 & 45 \\ 7 & 05 \\ 7 & 18 \\ 0 & 54 \\ \hline 7 & 33 \\ 7 & 13 \\ 6 & 50 \\ 6 & 40 \\ \hline \end{array}$	$\begin{array}{c} 4.0\\ \hline 8.1\\ 10.8\\ 14.6\\ \hline 12.0\\ 10.5\\ 6.4\\ 5.5\\ \hline \end{array}$	2.0 6.0 8.0 10.8 7.8 4.7 4.1
	Anticosti Island: Heath Pt. light-house SW. pt. light-house	$\begin{array}{cccccccccccccccccccccccccccccccccccc$	$\begin{array}{cccccccccccccccccccccccccccccccccccc$	$\begin{array}{ccc}1&20\\1&25\end{array}$	$\begin{array}{c} 6 & 35 \\ 6 & 40 \end{array}$	$3.6 \\ 4.9$	$1.8 \\ 2.5$
New Brunswick.	Bonaventure Island: E. pt Leander Shoal Macquereau Point Chaleur Bay: Carlisle Dalhousie I Miscou Island: NE. pt., Point Birch Miramichi Bay: Portage I., N. pt Point Escumenac: Light-house	$\begin{array}{rrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrr$	$\begin{array}{ccccccc} 64 & 08 & 00 \\ 64 & 18 & 00 \\ 64 & 46 & 30 \\ 65 & 19 & 00 \\ 66 & 22 & 10 \\ 64 & 29 & 00 \\ 65 & 02 & 00 \\ 64 & 47 & 33 \end{array}$	$ \begin{array}{r} 1 55 \\ 2 20 \\ 3 10 \\ 2 00 \\ 4 16 \end{array} $	$\begin{array}{c} 7 & 33 \\ 8 & 07 \\ 9 & 10 \\ 8 & 25 \\ 10 & 59 \end{array}$	$ \begin{array}{c} 4.7 \\ 4.8 \\ 8.1 \\ 4.0 \\ 2.3 \\ \end{array} $	2.3 2.4 4.1 2.0 1.2
P. Ed- ward I.	North Point: Light-house Richmond Harbor: Royalty Pt East Point: Light-house Charlottetown: Flag-staff on fort	$\begin{array}{cccccccccccccccccccccccccccccccccccc$	$\begin{array}{cccccccccccccccccccccccccccccccccccc$	$\begin{array}{r} 4 & 20 \\ 5 & 15 \\ 8 & 17 \\ 11 & 07 \end{array}$	$\begin{array}{cccc} 11 & 00 \\ 11 & 55 \\ 2 & 20 \\ 4 & 23 \end{array}$	$2.4 \\ 1.8 \\ 1.4 \\ 6.4$	$ \begin{array}{r} 1.2 \\ 0.9 \\ 0.7 \\ 3.2 \end{array} $
Magdalen Is.	Gt. Bird Rock: Light-house East Island: E. extreme Entry Island: Light-house Amherst Hbr.: N. side of entrance Deadman Rock: W. pt.	$\begin{array}{cccccccccccccccccccccccccccccccccccc$	$\begin{array}{cccccccccccccccccccccccccccccccccccc$				
	St. Paul Island: Light-house, NE. end Light-house, SW. end	$\begin{array}{cccc} 47 & 13 & 50 \\ 47 & 11 & 20 \end{array}$	$\begin{array}{cccccccccccccccccccccccccccccccccccc$	8 30	2 12	2.7	1.4
C. Bre- ton I.	Cape North: Light-house St. Anns Harbor: E. pt. entrance Sydney Harbor: Light-house	$\begin{array}{cccccccccccccccccccccccccccccccccccc$	$\begin{array}{cccccccccccccccccccccccccccccccccccc$	$egin{array}{cccc} 8 & 35 \\ 8 & 25 \\ 8 & 10 \end{array}$	$egin{array}{cccc} 2 & 17 \\ 2 & 13 \\ 2 & 05 \end{array}$	$3.1 \\ 6.0 \\ 5.0$	$ 1.6 \\ 3.7 \\ 3.1 $

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MARITIME POSITIONS AND TIDAL DATA.

EAST COAST OF NORTH AMERICA-Continued.

st.		Lat N	Long W	Lun.	Int.	Ra	nge.
Coa	Place.	Lat. N.	Long, W.	H. W.	L. W.	Spg.	Neap.
C. Bre- ton I.	Scatary Island: Light-house, NE. pt Louisburg: Light-house, NE. pt Madame Island: S. pt Port Hood: Just-au-corps I	$\begin{array}{c}\circ&&&\\46&02&15\\45&54&34\\45&28&00\\46&00&00\end{array}$	$ \begin{smallmatrix} \circ & i & j \\ 59 & 40 & 25 \\ 59 & 59 & 26 \\ 61 & 03 & 00 \\ 61 & 36 & 00 \\ \end{smallmatrix} $	$ \begin{array}{c} h. & m. \\ \hline 7 & 45 \\ 7 & 55 \\ 9 & 05 \end{array} $	$ \begin{array}{c} \hbar. & m. \\ 1 & 35 \\ 1 & 47 \\ 2 & 47 \end{array} $	<i>ft.</i> 5. 0 5. 0 3. 5	$ft. \\ 3.1 \\ 3.1 \\ 1.8$
	Sable Island: Light house, E. end	43 58 14	59 46 08				
Nova Scotla.	Picton: Custom-house	$\begin{array}{rrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrr$	$\begin{array}{cccccccccccccccccccccccccccccccccccc$	$\begin{array}{c} 9 & 34 \\ 9 & 20 \\ 9 & 26 \\ 7 & 55 \\ 7 & 43 \\ 7 & 45 \\ \hline \\ 7 & 34 \\ \hline \\ 7 & 32 \\ \hline \\ 7 & 39 \\ \hline \\ 8 & 17 \\ 9 & 35 \\ 10 & 00 \\ \hline \\ 8 & 17 \\ 9 & 35 \\ 10 & 00 \\ \hline \\ 10 & 29 \\ 10 & 49 \\ 11 & 07 \\ \hline \\ 0 & 27 \\ \end{array}$	$\begin{array}{c} 3 & 13 \\ 3 & 00 \\ 3 & 10 \\ 1 & 47 \\ 1 & 33 \\ 1 & 38 \\ \hline \\ 1 & 38 \\ \hline \\ 1 & 30 \\ \hline \\ 1 & 30 \\ \hline \\ 1 & 30 \\ \hline \\ 2 & 05 \\ 3 & 23 \\ 3 & 41 \\ \hline \\ 2 & 05 \\ 3 & 23 \\ 3 & 41 \\ \hline \\ 4 & 36 \\ 4 & 41 \\ 5 & 27 \\ \hline \\ 7 & 27 \\ \hline \end{array}$	$\begin{array}{c} 3.9\\ 2.8\\ 3.1\\ 5.0\\ 6.6\\ \end{array}\\ \hline\\ 5.2\\ \hline\\ \hline\\ 7.1\\ \hline\\ 7.0\\ \hline\\ \hline\\ 8.5\\ 12.8\\ 16.0\\ \hline\\ 20.8\\ 27.5\\ 33.0\\ \hline\\ 50.5\\ \end{array}$	$\begin{array}{c} 2.0\\ 1.4\\ 1.6\\ 3.1\\ 4.0\\ 4.1\\ \\ \\ \hline \\ 3.2\\ \\ \\ 4.4\\ \\ \\ 4.3\\ \\ \\ \\ \\ 5.2\\ 9.5\\ 11.8\\ \\ \\ 15.4\\ 20.4\\ 24.4\\ \\ \\ 37.4\\ \end{array}$
New Brunswick.	Cape Enragé: Light-house Cape Quaco: Light-house St. Johns: Partridge I. light Cape Lepreau: Light-house L'Etang Harbor: S. pt. tower St. Andrew: S. pt. light. Campo Bello Island: Light-house, N. pt. Grand Manan Island: Light-house, NE. pt. Gannet Rock: Light-house, NE. pt Machias Island: Light-house	$\begin{array}{cccccccccccccccccccccccccccccccccccc$	$\begin{array}{cccccccccccccccccccccccccccccccccccc$	11 21 11 07 11 07 11 04 11 09 11 00 11 02 10 51	556 458 526 508 500 521 456	30.0 23.9 24.5 23.3 24.9 22.5 18.0	$\begin{array}{c} 22.2\\ 17.7\\ 18.2\\ 17.1\\ 18.2\\ \\ 16.7\\ \\ 13.2 \end{array}$
Maine.	Calais: Astronomical station Eastport: Cong. Church Quoddy Head: Light-house Machias: Town Hall. Petit Manan Island: Light-house Bakers Island: Light-house Mount Desert Rock: Light-house Bangor: Thomas Hill Belfast: Methodist Church Rockland: Episcopal Church Monhegan Island: Light-house Monhegan Island: Light-house Bath: Winter St. Church Buth: Winter St. Church Brunswick: College spire Augusta: Baptist Church Portland : Custom-house Portland Head light-house Cape Elizabeth: Light-house (west) Wood Island: Light-house Boon Island: Light-house	$\begin{array}{cccccccccccccccccccccccccccccccccccc$	$\begin{array}{cccccccccccccccccccccccccccccccccccc$	$\begin{array}{c} 11 & 36 \\ 11 & 09 \\ \hline \\ 0 & 23 \\ 11 & 35 \\ 11 & 09 \\ 10 & 45 \\ \hline \\ 12 & 13 \\ \hline \\ 2 & 54 \\ 11 & 06 \\ \hline \\ 11 & 12 \\ \hline \\ 11 & 12 \\ \hline \end{array}$	$ \begin{array}{c} 5 & 40 \\ 5 & 05 \\ 4 & 59 \\ \hline 6 & 47 \\ 5 & 22 \\ 4 & 52 \\ 4 & 31 \\ \hline 6 & 16 \\ \hline 10 & 18 \\ 4 & 51 \\ \hline 4 & 51 \\ \hline \end{array} $	$\begin{array}{c} 23.3\\ 20.9\\ 15.5\\ 15.1\\ 11.7\\ 11.0\\ 10.2\\ \hline \\ \hline \\ \hline \\ 4.9\\ 10.1\\ \hline \\ 10.2\\ \hline \\ \hline \\ \end{array}$	$ \begin{array}{c} 17.1\\ 15.2\\ 11.3\\ 11.0\\ 8.6\\ 8.1\\ 7.5\\\\ 3.6\\ 7.3\\\\ 7.5\\\\$

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APPENDIX IV.

MARITIME POSITIONS AND TIDAL DATA.

ust.	Disco	Lot N	Long U	Lun.	Int.	Ra	nge.
Coa	Flace.	Latt. N,	Long. W.	H. W.	L. W.	Spg.	Neap.
N. H.	Whale Back: Light-house Portsmouth: Navy-yard flagstaff Fort Constitution Hampton: Baptist Church Isles of Shoals: White I. light-house	$\begin{array}{c}\circ & , & , \\ 43 & 03 & 32 \\ 43 & 04 & 56 \\ 43 & 04 & 16 \\ 42 & 56 & 15 \\ 42 & 58 & 02 \end{array}$	$ \begin{smallmatrix} \circ & & & \\ 70 & 41 & 49 \\ 70 & 44 & 22 \\ 70 & 42 & 34 \\ 70 & 50 & 12 \\ 70 & 37 & 25 \\ \end{smallmatrix} $	h. m. 11 23 11 19	h. m. 5 09 4 58	<i>ft</i> . 10. 5 10. 0	<i>ft.</i> 7.7 7.3
Massachusstts.	Newburyport: Academy	$\begin{array}{cccccccccccccccccccccccccccccccccccc$	$\begin{array}{cccccccccccccccccccccccccccccccccccc$	$\begin{array}{c} 11 \ 23 \\ 11 \ 17 \\ 11 \ 13 \\ 11 \ 02 \\ 11 \ 02 \\ 11 \ 02 \\ 11 \ 09 \\ 11 \ 27 \\ 11 \ 09 \\ 11 \ 27 \\ 11 \ 09 \\ 11 \ 23 \\ 11 \ 36 \\ 12 \ 11 \\ 12 \ 00 \\ 0 \ 04 \\ 11 \ 23 \\ 11 \ 36 \\ 12 \ 11 \\ 12 \ 00 \\ 0 \ 04 \\ 11 \ 34 \\ 7 \ 31 \\ 7 \ 36 \\ 7 \ 57 \\ 15 \\ 11 \ 34 \\ 7 \ 57 \\ 15 \\ 15 \\ 15 \\ 15 \\ 15 \\ 15 \\ 15 \\$	5 10 $5 04$ $5 00$ $4 49$ $5 03$ $4 57$ $5 17$ $4 56$ $5 11$ $5 25$ $5 57$ $5 48$ $6 00$ $1 51$ $4 33$ $1 20$ $0 59$ $1 18$	$\begin{array}{c} 9.1\\ \hline \\10.1\\ 10.1\\ \hline \\10.2\\ \hline \\10.6\\ 10.6\\ \hline \\11.0\\ 9\\ \hline \\10.8\\ 11.6\\ \hline \\10.8\\ 11.6\\ \hline \\10.8\\ 11.6\\ \hline \\2.8\\ 2.0\\ 3.7\\ 4.3\\ 5.2\end{array}$	$ \begin{array}{r} 6.6\\ \hline 7.4\\ 7.4\\ \hline 7.5\\ \hline 7.7\\ \hline 8.1\\ \hline 8.0\\ \hline \hline 7.9\\ 8.5\\ \hline \hline 3.4\\ 3.1\\ 2.3\\ \hline \hline 1.7\\ 1.2\\ 2.2\\ 6\\ 3.1\\ \hline \end{array} $
Rhode Island.	Sakonnet Point: Light-house Beaver Tail: Light-house Newport: Flagstaff, torpedo station Bristol Ferry: Light-house Providence: Unitarian Church Point Judith: Light-house Block Island: Light-house (SE) Watch Hill Point: Light-house	$\begin{array}{cccccccccccccccccccccccccccccccccccc$	$\begin{array}{cccccccccccccccccccccccccccccccccccc$	$\begin{array}{cccc} 7 & 40 \\ 7 & 40 \\ 7 & 48 \\ 7 & 53 \\ 8 & 12 \\ 7 & 32 \\ 7 & 33 \\ 8 & 49 \end{array}$	$\begin{array}{cccccccccccccccccccccccccccccccccccc$	$\begin{array}{c} 4.5 \\ 4.7 \\ 4.4 \\ 5.2 \\ 5.4 \\ 3.8 \\ 3.7 \\ 3.2 \end{array}$	$\begin{array}{c} 2.\ 6\\ 2.\ 8\\ 2.\ 6\\ 3.\ 6\\ 3.\ 4\\ 2.\ 3\\ 2.\ 2\\ 2.\ 1\end{array}$
Connecticut and New York.	Montauk Point: Light-house Stonington: Light-house New London: Groton Monument Little Gull Island: Light-house, N. pt Gardners Island: Light-house, N. pt Saybrook: Light-house, Lynde Pt New Haven: Yale College spire (middle). Bridgeport Harbor: Light-house Norwalk Island: Light-house Shinnecock Bay: Light-house Fire Island: Light-house Fire Island: Light-house Shinnecock Bay: Light-house Fire Island: Light-house Fire Island: Light-house Fort Wadsworth: Light-house	$\begin{array}{cccccccccccccccccccccccccccccccccccc$	$\begin{array}{cccccccccccccccccccccccccccccccccccc$	$\begin{array}{c} 8 & 20 \\ 9 & 09 \\ 9 & 26 \\ 9 & 26 \\ 9 & 40 \\ \hline \\ 10 & 29 \\ 11 & 08 \\ 11 & 09 \\ 11 & 03 \\ 7 & 48 \\ 7 & 19 \\ 5 & 13 \\ 8 & 44 \\ \hline \\ 7 & 41 \\ \end{array}$	$\begin{array}{c} 2 & 03 \\ 3 & 03 \\ 3 & 32 \\ 3 & 04 \\ 3 & 35 \\ \hline \\ 4 & 11 \\ 4 & 54 \\ 5 & 04 \\ 4 & 56 \\ 1 & 38 \\ 1 & 20 \\ 0 & 46 \\ 2 & 49 \\ \hline \\ 1 & 38 \\ \end{array}$	$\begin{array}{c} 2.3\\ 3.2\\ 2.9\\ 3.0\\ 2.5\\ \hline \\ 4.3\\ 7.0\\ 8.4\\ 8.2\\ 3.0\\ 2.2\\ 2.8\\ 5.3\\ \hline \\ 5.4\\ \end{array}$	$1.5 \\ 2.1 \\ 1.9 \\ 2.0 \\ 1.7 \\ 2.8 \\ 4.9 \\ 5.9 \\ 5.7 \\ 2.0 \\ 1.4 \\ 1.8 \\ 3.4 \\ 3.5 \\ 3.5 \\ 1.5 $

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MARITIME POSITIONS AND TIDAL DATA.

		1					
ast.	Place	Let N	Long W	Lun.	Int.	R	ange.
Co	1 Idee.	Latt. IV.	Long. II.	н. w.	L. W.	Spg.	Neap.
.pu	Sandy Hook: Light-house (rear) Light-ship	$^{\circ}$ / // 40 27 42 40 28 15	$^{\circ}$ / $^{\prime\prime}$ 74 00 09 73 50 09	h. m. 7 30	h. m. 1 23	ft. 5. 6	<i>,ft.</i> 3. 6
ind Maryla	Navesink Highlands: N. light-house Barnegat Inlet: Light-house Tuckers Beach: Light-house Absecon Inlet: Light-house Five Fathom Bank: Light-ship Cape May, Light house	$\begin{array}{cccccccccccccccccccccccccccccccccccc$	$\begin{array}{cccccccccccccccccccccccccccccccccccc$	7 50 7 48 9 59	$ \begin{array}{r} 1 & 43 \\ 1 & 42 \\ 3 & 57 \\ 1 & 47 \end{array} $	2.7 4.2 4.7 5.6	1.7 2.7 3.0
ıla, a	Philadelphia, Pa.: Statehouse	39 56 53	74 57 59 75 09 03	1 28	$ \begin{array}{c} 1 & 47 \\ 8 & 58 \end{array} $	5.6 6.2	3. 6 4. 4
re, Virgi	League I Wilmington, Del.: Town hall Cape Henlopen: Light-house Assateague Island: Light-house	$\begin{array}{cccccccccccccccccccccccccccccccccccc$	$\begin{array}{cccccccccccccccccccccccccccccccccccc$	$\begin{array}{r} 0 & 53 \\ 12 & 00 \\ 8 & 17 \end{array}$		$7.0 \\ 6.7 \\ 5.4 \\ \cdots$	5.2 4.9 3.5
sey, Delawa	Cape Charles: Light-house Baltimore: Washington Monument Annapolis: Naval Academy observatory. Point Lookout: Light-house. Washington, D. C.: Navy-yard flagstaff.	$\begin{array}{cccccccccccccccccccccccccccccccccccc$	$\begin{array}{cccccccccccccccccccccccccccccccccccc$	$\begin{array}{c} 8 & 03 \\ 6 & 34 \\ 4 & 39 \\ 0 & 31 \\ 7 & 42 \end{array}$	$\begin{array}{c}2 & 19 \\ 0 & 44 \\ 10 & 53 \\ 6 & 52 \\ 1 & 56\end{array}$	$\begin{array}{c} 3.\ 0\\ 1.\ 4\\ 1.\ 0\\ 1.\ 7\\ 3.\ 5\end{array}$	$2.0 \\ 1.0 \\ 0.8 \\ 1.1 \\ 2.5$
New Jer	Capitol dome Old Point Comfort: Light-house Norfolk: Navy-yard flagstaff Richmond, Va.: Capitol Cape Henry: Light-house	$\begin{array}{cccccccccccccccccccccccccccccccccccc$	$\begin{array}{cccccccccccccccccccccccccccccccccccc$	$\begin{array}{r} 8 & 44 \\ 9 & 05 \\ 4 & 30 \\ 7 & 53 \end{array}$	$\begin{array}{r} 2 & 17 \\ 2 & 47 \\ 11 & 55 \\ 1 & 43 \end{array}$	3.03.24.33.23.2	$2.0 \\ 2.1 \\ 2.8 \\ 2.1$
North Carolina.	Elizabeth City: Court-house Edenton: Court-house Currituck Beach: Light-house Bodie Island: Light-house Cape Hatteras: Light-house Ocracoke: Light-house Newbern, Episcopal spire Cape Lookout: Light-house Beaufort, N. C.: Court-house	$\begin{array}{cccccccccccccccccccccccccccccccccccc$	$\begin{array}{cccccccccccccccccccccccccccccccccccc$	7 37 7 00 6 29 7 21	1 26 0 45 0 20 1 08	$ \begin{array}{c} 3.4 \\ \hline 2.2 \\ \hline 4.4 \\ 3.3 \end{array} $	2. 2 1. 5 3. 0 2. 3
-	Frying-Pan Shoals: Light-ship Georgetown: Episcopal Church	$\begin{array}{cccccccccccccccccccccccccccccccccccc$	$\begin{array}{cccc} 77 & 49 & 12 \\ 79 & 16 & 49 \end{array}$	8 39	3 38	 4.3-	 2. 9
rolina	Light-house, North I Cape Romain: Light-house Charleston: Light-house. Morris I	$\begin{array}{cccccccccccccccccccccccccccccccccccc$	$\begin{array}{cccccccccccccccccccccccccccccccccccc$	6 59	0 50	5.9	4.1
S. Cal	St. Michael's Church Beaufort, S. C.: Episcopal Church Port Royal: Martins Industry light-ship.	$\begin{array}{cccccccccccccccccccccccccccccccccccc$	$\begin{array}{c} 79 & 55 & 49 \\ 80 & 40 & 27 \\ 80 & 33 & 15 \end{array}$	$\begin{array}{c} 7 & 20 \\ 8 & 10 \end{array}$	$\begin{array}{c}1&10\\2&06\end{array}$	6.0 8.5	4.2 5.9
Georgia.	Tybee Island: Light-house Savannah: Exchange spire Sapelo Island: Light-house Darien: Winnowing House St. Simon: Light-house Brunswick: Academy	$\begin{array}{cccccccccccccccccccccccccccccccccccc$	$\begin{array}{cccccccccccccccccccccccccccccccccccc$	$\begin{array}{cccc} 7 & 10 \\ 8 & 13 \\ 7 & 30 \\ 7 & 40 \\ 7 & 30 \\ 8 & 00 \end{array}$	$1 \ 04 \\ 3 \ 07 \\ 1 \ 24 \\ 1 \ 44 \\ 1 \ 27 \\ 1 \ 57 \\$	7.97.68.47.57.57.8	5.5 5.3 5.8 5.2 5.3 5.4
la.	Amelia Island: Light-house Fernandina: Astronomical station St. Johns River: Light-house Jacksonville: Methodist Church	$\begin{array}{cccccccccccccccccccccccccccccccccccc$	$\begin{array}{cccccccccccccccccccccccccccccccccccc$	$\begin{array}{c}7&39\\7&36\end{array}$	$\begin{array}{c}1&31\\1&33\end{array}$	$\begin{array}{c} 6.9\\ 5.4\\ \end{array}$	$\begin{array}{c} 4.8\\ 3.7\\ \end{array}$
Florid	St. Augustine: Fresbyterian Church Light-house. Cape Canaveral: Light-house. Jupiter Inlet: Light-house. Fowey Rocks: Light-house. Carysfort Reef: Light-house.	$\begin{array}{cccccccccccccccccccccccccccccccccccc$	$\begin{array}{cccccccccccccccccccccccccccccccccccc$	$\begin{array}{c} 8 & 12 \\ 8 & 00 \\ 8 & 00 \\ 8 & 20 \\ 8 & 21 \end{array}$	$\begin{array}{cccc} 2 & 00 \\ 1 & 52 \\ 2 & 00 \\ 2 & 16 \\ 2 & 08 \end{array}$	$5.3 \\ 5.9 \\ 1.8 \\ 2.6 \\ 2.7$	3.64.01.21.31.4

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APPENDIX IV.

MARITIME POSITIONS AND TIDAL DATA.

ıst.	Place	Tet N	Lene W	Lun. Int.	R	ange.
Cot		Latt. N.	Long. w.	H. W. L. W.	Spg.	Neap.
Florida.	Alligator Reef: Light-house Sombrero Key: Light-house. Sand Key: Light-house. Loggerhead Key: Light-house. Sanibel Island: Light-house. Gasparilla Island: Light-house. Tampa Bay: Egmont Key light. Cedar Keys: Ast. station, Depot Key. Seahorse Key light. St. Marks: Fort St. Marks. Apalachicola: Flag-staff. Cape St. George: Light-house Cape San Blas: Light-house Pensacola: Light-house Navy-yard chimney.	$ \begin{smallmatrix} \circ & \cdot & \prime & \prime \\ 24 & 51 & 02 \\ 24 & 37 & 36 \\ 24 & 27 & 10 \\ 24 & 32 & 58 \\ 24 & 38 & 04 \\ 26 & 27 & 11 \\ 26 & 43 & 06 \\ 27 & 36 & 04 \\ 29 & 07 & 29 \\ 29 & 05 & 49 \\ 30 & 09 & 03 \\ 29 & 43 & 32 \\ 29 & 35 & 18 \\ 29 & 40 & 00 \\ 30 & 20 & 47 \\ 30 & 20 & 49 \\ \end{smallmatrix} $	$ \begin{smallmatrix} \circ & \prime & \prime & \prime \\ 80 & 37 & 08 \\ 81 & 06 & 40 \\ 81 & 52 & 40 \\ 81 & 52 & 40 \\ 82 & 55 & 42 \\ 82 & 00 & 43 \\ 82 & 15 & 34 \\ 82 & 45 & 40 \\ 83 & 01 & 57 \\ 83 & 03 & 58 \\ 84 & 12 & 42 \\ 84 & 59 & 12 \\ 85 & 02 & 54 \\ 85 & 21 & 30 \\ 87 & 18 & 32 \\ 87 & 16 & 06 \\ \end{smallmatrix} $	$ \begin{array}{c ccccc} h. & m. & h. & m\\ 8 & 22 & 2 & 00\\ 8 & 24 & 2 & 02\\ 8 & 40 & 2 & 20\\ 9 & 20 & 2 & 31\\ 9 & 44 & 3 & 22\\ 12 & 17 & 6 & 14\\ 0 & 42 & 6 & 19\\ 11 & 32 & 5 & 07\\ 0 & 42 & 7 & 13\\ \hline & & & & & & \\ 2 & 00 & & & & & \\ 2 & 00 & & & & & \\ 2 & 00 & & & & & \\ 12 & 10 & & & & & \\ 5 & 33\\ \hline & & & & & \\ 111 & 10 & & & & \\ 11 & 28 & & & & \\ 111 & 28 & & & & \\ 112 & 8 & & & & \\ \end{array} $	$ \begin{array}{c} fl. \\ 2.6 \\ 5.1.9 \\ 0.1.5 \\ 6.1.4 \\ 0.2.3 \\ 1.4 \\ 1.4 \\ 0.2.3 \\ 1.4 \\ $	<i>ft.</i> 1.3 1.0 0.8 0.9 0.8 1.2 0.7 0.9 1.5
Alabama, Mississippi, and Louisiana.	Sand Island: Light-house (front) Mobile Point: Light-house Mobile: Episcopal Church Horn Island: Light-house East Pascagoula: Coast-Survey station Ship Island: Light-house Cat Island: Light-house Chandeleur: Light-house Mouth Mississippi River: Pass a l'Outre light S. Pass light (East Jetty) SW. Pass light New Orleans: United States Mint Barataria Bay: Light-house Ship Shoal: Light-house Southwest Reef: Light-house Southwest Reef: Light-house Sabine Pass: Light-house Sabine Pass: Light-house	$\begin{array}{c} 30 \ 11 \ 19 \\ 30 \ 13 \ 44 \\ 30 \ 41 \ 26 \\ 30 \ 13 \ 23 \\ 30 \ 20 \ 42 \\ 30 \ 22 \ 54 \\ 30 \ 12 \ 53 \\ 30 \ 12 \ 53 \\ 30 \ 12 \ 53 \\ 30 \ 12 \ 53 \\ 30 \ 12 \ 53 \\ 29 \ 11 \ 30 \\ 28 \ 59 \ 28 \\ 29 \ 57 \ 46 \\ 29 \ 16 \ 30 \\ 29 \ 02 \ 49 \\ 28 \ 54 \ 56 \\ 29 \ 43 \ 55 \\ 29 \ 43 \ 04 \\ \end{array}$	$\begin{array}{cccccccccccccccccccccccccccccccccccc$	$ \begin{array}{c ccccccccccccccccccccccccccccccccccc$	[1.5] [2.1] [2.0] [2.3] [2.1] [2.3] [2.1] [2.1] [2.1] [1.6] [1.7] [2.1] [2.1] [1.6] [2.1] [2.2] [2.2] [2.2] [2.2] [2.2] [2.0]	 1.3 0.6
Texas.	Galveston: Cathedral, N. spire Light-house, Bolivar Pt Matagorda: Coast-Survey station Light-house Indianola: Coast-Survey station Lavaca: Coast-Survey station Aransas Pass: Light-house Brazos Santiago: Light, S. end Padre I Point Isabel: Light-house Rio Grande del Norte: Obs. N. side of entrance	$\begin{array}{cccccccccccccccccccccccccccccccccccc$	94 47 26 94 46 00 95 57 26 96 25 28 96 31 01 96 37 21 97 03 23 97 10 00 97 12 28 97 08 57	$ \begin{bmatrix} 4 & 18 \\ [4 & 07] \\ [10 & 22 \\ [4 & 35] \\ [10 & 42 \\ [4 & 25] \\ [10 & 34 \\ [1 & 55] \\ [8 & 05 \\ [8 & 05 \\ [8 & 05 \\ [1 & 55] \\ [8 & 05 \\ [8 & 05 \\ [1 & 55] \\ [1 & 55] \\ [1 & 55$	$\begin{bmatrix} 1. 4 \\ 1. 6 \end{bmatrix}$ $\begin{bmatrix} 1. 6 \\ \\ \\ \\ . \\ . \\ . $	
Mexico.	San Fernando River: Entrance. Santander River: Entrance. Mount Mecate: Summit. Tampico: Light-house Cape Roxo Lobos Cay: Light-house Tuspan Reefs: Middle islet. Mexico: National Observatory. Bernal Chico: Middle of islet. Zempoala Point: Extreme Vera Cruz: San Juan d'Ulloa light. Sacrificios Island Orizaba Mountain: 17,400 feet. Cofre de Perote Mount: 14,000 feet Alvarado: E. side of entrance. Roca Partida: Summit. Tuxtla, volcano: Summit. Montepio: Landing place	$\begin{array}{cccccccccccccccccccccccccccccccccccc$	$\begin{array}{cccccccccccccccccccccccccccccccccccc$	[1 06] [7 14 [2 49] [8 38] [1.3]] [2.4]	

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MARITIME POSITIONS AND TIDAL DATA.

st.		T . A NY	I amon MV	Lun.	Int.	Rŧ	ange.
Coa	Place.	Lat. N.	Long. W.	н. w.	L. W.	spg.	Neap.
Mexico.	Zapotitlan Point: Light-house San Juan Point: Light-house Coatzacoalcos: Light-house Santa Ana Lagoon: Entrance Tupilco River: Entrance Tabasco River: Light-house Carmen Island: NE. pt Laguna de Terminos: Vigia tower, W. end Carmen I	$ \begin{smallmatrix} \circ & \prime & \prime & \prime \\ 18 & 34 & 00 \\ 18 & 19 & 45 \\ 18 & 08 & 56 \\ 18 & 18 & 49 \\ 18 & 26 & 44 \\ 18 & 39 & 30 \\ 18 & 47 & 08 \\ 18 & 38 & 44 \\ 18 & 38 & 48 \\ 18 & 38 & 48 \\ 18 & 38 & 44 \\ 18 & 38 & 38 \\ 18 & 38 & 48 \\ 18 & 38 & 44 \\ 18 & 38 & 48 \\ 18 & 38 & 38 \\ 18 & 38 & 48 \\ 18 & 38 & 48 \\ 18 & 38 & 38 \\ $	$ \begin{smallmatrix} \circ & \prime & \prime & \prime \\ 94 & 50 & 00 \\ 94 & 38 & 57 \\ 94 & 24 & 46 \\ 93 & 51 & 53 \\ 93 & 25 & 25 \\ 92 & 42 & 00 \\ 91 & 30 & 50 \\ 91 & 50 & 17 \\ \end{smallmatrix} $	h. m.	h. m.	ft.	ft.
Yucatan.	Paypoton Mount: Summit Lerma: Church	$\begin{array}{cccccccccccccccccccccccccccccccccccc$	$\begin{array}{c} 90 \ 43 \ 27 \\ 90 \ 36 \ 11 \\ 90 \ 32 \ 20 \\ 90 \ 30 \ 51 \\ 90 \ 22 \ 00 \\ 90 \ 02 \ 37 \\ 90 \ 18 \ 27 \\ 89 \ 39 \ 30 \\ 88 \ 54 \ 27 \\ 87 \ 04 \ 10 \\ 91 \ 57 \ 45 \\ 92 \ 13 \ 27 \\ 92 \ 13 \ 27 \\ 92 \ 12 \ 47 \\ 92 \ 18 \ 57 \\ 92 \ 12 \ 47 \\ 92 \ 18 \ 57 \\ 92 \ 14 \ 57 \\ 92 \ 14 \ 57 \\ 92 \ 14 \ 57 \\ 92 \ 14 \ 57 \\ 92 \ 14 \ 57 \\ 86 \ 48 \ 00 \\ 86 \ 43 \ 39 \\ 86 \ 46 \ 45 \\ 86 \ 43 \ 55 \\ 86 \ 59 \ 04 \\ 87 \ 28 \ 27 \\ 87 \ 23 \ 40 \end{array}$	2 59 10 20 9 30 [12 06] [12 00] 9 20 8 20	9 28 4 10 3 19 [5 50] [5 45] 3 08 2 08	2. 1 1. 8 1. 5 [1. 6] 1. 6 	1.3 0.9 0.8 0.9 0.9
Belize.	Half-Moon Cay: Light-house Mauger Cay, NW. end: Light-house Glover Reef: SW. Cay English Cay: Light-house St. Georges Cay: Center Sand-Fly Cays: Hut, S. end South Water Cay: Center Belize: Fort George light North Standing Creek: Entrance Sittee Point: Cay. Cockscomb Mount: Summit, 4,000 feet Placentia Point: Huts on point Icacos Point: S. extreme Sarstoon River: Entrance	$\begin{array}{cccccccccccccccccccccccccccccccccccc$	$\begin{array}{cccccccccccccccccccccccccccccccccccc$	8 00	1 50	1.5	0.8
Guat.	Dulce River: Entrance, W. side Dulce Gulf: Fort St. Philip Isabel	$\begin{array}{cccccccccccccccccccccccccccccccccccc$	$\begin{array}{cccccccccccccccccccccccccccccccccccc$	9 00	2 50	2.0	1.1
Honduras.	Hospital Bight: Hut, N. pt. of entrance. Cape Three Points: NW. extreme Seal Cays: S. Cay. Omoa: Entrance. Cape Triunfo: Bluff pt. Congrehoy Peak: Summit, 8,040 feet. Truxillo: Fort. Utilla Island: S. Cay. Hog Islands: Highest hill on W. islet Roatan: Center of Coxen Cay PortRoyal, NW.pt. of GeorgeCay Bonacca Island: Summit, 1,200 feet Misteriosa Bank: S. Point. Swan Islands: NW. pt. of W. I.	$\begin{array}{cccccccccccccccccccccccccccccccccccc$	$\begin{array}{cccccccccccccccccccccccccccccccccccc$		1 23 2 38	 3.5 	 1.8

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APPENDIX IV.

MARITIME POSITIONS AND TIDAL DATA.

st.		T . 4 . 37		Lun	Int.	Ra	nge.
Coa	Place.	Let. N.	Long. W.	н. w.	L. W.	Spg.	Neap.
Hondu- ras.	Great Rock Head: Bluff extreme Cape Camaron Brewers Lagoon: E. side of entrance Patook River: E. side of entrance Carataska Lagoon: E. side of entrance	$ \begin{smallmatrix} \circ & & & ' & '' \\ 15 & 53 & 00 \\ 16 & 00 & 00 \\ 15 & 51 & 50 \\ 15 & 48 & 50 \\ 15 & 23 & 40 \\ \end{smallmatrix} $	$ \begin{smallmatrix} \circ & \cdot & \prime & \prime \\ 85 & 27 & 10 \\ 85 & 03 & 00 \\ 84 & 38 & 33 \\ 84 & 17 & 10 \\ 83 & 42 & 36 \\ \end{smallmatrix} $	ħ. m.	h. m.	ft.	ft.
Nicaragua.	Cape Gracias-á-Dios: Light-house Caxones Reef: Great Hobby Islet Gorda Bank: Gorda Cay Farrall Rock: Center Half-Moon Cay: Center Alargate Reef: E. pt	$\begin{array}{cccccccccccccccccccccccccccccccccccc$	$\begin{array}{cccccccccccccccccccccccccccccccccccc$	10 20	4 07	2.0	1.1
Coast.	Mosquito Cays: S. end. Rosalind Bank: NW. extreme. Serranilla Bank: Beacon Cay. Serrana Bank: Little Cay. Quita Sueño Bank: S. extreme of reef. Spit at NW. end Roneador Cay: S. pt. Old Providence: Isabel House.	$\begin{array}{cccccccccccccccccccccccccccccccccccc$	$\begin{array}{cccccccccccccccccccccccccccccccccccc$	4 00 4 00 	$ \begin{array}{r} 10 & 13 \\ 10 & 13 \\ \\ 10 & 13 \\ 10 & 13 \end{array} $	2.0 2.0 1.0	1. 1 1. 1 0. 5
Mosquito Co	St. Andrews Island; SW.cove, Entrance I. Courtown Cays: Middle Cay Albuquerque Bank: Smith Cay. Brangmans Bluff: Extreme Pearl Cays: Colombilla Cay Pearl Cays: Colombilla Cay Pearl Cays Lagoon: Mosquito Pt Cookra Hill: Summit Bluefields: Schooner Pt. Little Corn Island: Gun Pt. Great Corn Island: Wells N. of Quin Bluff. Greytown: Light-house.	$\begin{array}{cccccccccccccccccccccccccccccccccccc$	$\begin{array}{c} 81 \ 43 \ 06 \\ 81 \ 27 \ 53 \\ 81 \ 49 \ 54 \\ 83 \ 21 \ 27 \\ 83 \ 23 \ 10 \\ 83 \ 37 \ 12 \\ 83 \ 45 \ 57 \\ 83 \ 41 \ 57 \\ 82 \ 58 \ 35 \\ 83 \ 03 \ 35 \\ 83 \ 42 \ 15 \end{array}$	1 50 1 40 1 35 1 00	8 03 7 52 7 47 7 13	2.0 2.0 2.0 2.0 1.5	1.1 1.1 1.1 1.1 0.8
C.R.	Mount Cartago: Peak, 11,100 feet Port Limon: Grape Cay light	$\begin{array}{cccccccccccccccccccccccccccccccccccc$	$\begin{array}{cccccccccccccccccccccccccccccccccccc$	1 00	7 13	1.6	0.9
Colombia.	Carreta Point: Extreme. Tirby Point: Extreme. Columbus Island: Lime Pt. Blanco Peak: Summit, 11,740 feet Shepherd Island: Hut on summit Cobbler Rock: Center Valiente Peak: Summit, 722 feet. Escudo de Veragua: W. pt. of island	$\begin{array}{cccccccccccccccccccccccccccccccccccc$	$\begin{array}{cccccccccccccccccccccccccccccccccccc$				
	WEST COAST C	OF NORTI	H AMERI	C A .			
	Point Barrow: Highest lat. of U. S Icy Cape: Extreme Cape Lisburne: 849 feet Cape Krusenstern: Extreme Chamisso Island: Summit Cape Espenberg: Extreme Diomede Island: Fairway Rock Cape Prince of Wales: W. pt Port Clarence: Point Spencer	$\begin{array}{cccccccccccccccccccccccccccccccccccc$	$\begin{array}{cccccccccccccccccccccccccccccccccccc$	11 41 7 45	5 33 1 50	0.6	0.2

Point Barrow: Highest lat. of U. S Icy Cape: Extreme	$\begin{array}{cccccccc} 71 & 23 & 30 \\ 70 & 16 & 00 \\ 68 & 52 & 00 \\ 66 & 14 & 30 \\ 66 & 14 & 30 \\ 66 & 32 & 00 \\ 65 & 35 & 30 \\ 65 & 16 & 40 \\ 65 & 00 & 00 \\ 64 & 26 & 00 \\ 63 & 26 & 00 \\ 63 & 26 & 00 \\ 63 & 40 & 00 \\ 63 & 16 & 00 \\ 63 & 16 & 00 \\ 60 & 13 & 00 \\ 60 & 25 & 22 \\ 58 & 48 & 31 \\ \end{array}$	$\begin{array}{cccccccccccccccccccccccccccccccccccc$	11 41 7 45 6 10 [2 05] [8 05] 4 40	5 33 1 50 1 10 [8 25] [1 20] 11 0 11 0	0.6 2.0 1.1 [2.1] [4.5] 3.1	0.2
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MARITIME POSITIONS AND TIDAL DATA.

st.				Lun. Int.	Rai	nge.
Coa	Place.	Lat. N.	Long. W.	H. W. L. W.	Spg.	Neap.
Alaska.	Cape Menchikof: Extreme Port Moller St. George Island: S. side	$ \begin{smallmatrix} \circ & , & , & , \\ 57 & 30 & 24 \\ 55 & 54 & 59 \\ 56 & 34 & 23 \\ \end{smallmatrix} $	$\begin{array}{c}\circ & , & , \\157 & 58 & 30 \\160 & 34 & 54 \\169 & 39 & 50\end{array}$	h. m. h. m.	ft.	ft.
Alcutian Islands.	Attu Island: Chichagof Harbor Kiska Island: Kiska Harbor, Ast. sta Amchitka Island: Constantine Harbor Adakh Island: Bay of Islands? Pribilof Island: St. Paul I., village Unalaska Island: C. S. station, Iliuliuk . Sannakh Reefs: S. edge Sannakh Reefs: S. edge Sannakh Island: NE. end Unga Island. Popof Island: Humboldt I Nagai Island: Sanborn Harbor Koniushi Island: NW. harbor NE. harbor Simeonof Island: Simeonof Harbor	$\begin{array}{cccccccccccccccccccccccccccccccccccc$	Long, E, 173 12 24 177 30 00 179 12 06 Long, W, 176 52 00 174 15 18 170 17 52 166 31 44 162 38 00 162 18 00 160 38 39 160 31 14 159 56 06 159 23 05 159 22 18 159 15 03	$\begin{array}{c ccccccccccccccccccccccccccccccccccc$	5.7 5.2 5.0 2.7 2.9 5.7 8.2 7.5	2.9 2.7 2.6 1.4 1.5 2.8 4.1 3.8
Alaska.	Cape Strogonof: Extreme Chignik Bay: Anchorage. Anowik Island: S. end. Chiachi Islands. Light-House Rocks Chirikof Island. Kodiak Island, St. Paul Harbor: Cove NW. of village Port Etches Middleton Island Mount St. Elias: Summit. Yakutat Bay: Port Mulgrave. Lituya Bay Sitka: Middle of parade ground Juneau Wrangell: Ast. station	$\begin{array}{cccccccccccccccccccccccccccccccccccc$	$\begin{array}{cccccccccccccccccccccccccccccccccccc$	$\begin{array}{c ccccccccccccccccccccccccccccccccccc$	8.1 9.0 10.1 9.5 9.9 18.6 17.7	4.0 4.5 5.1 5.0 5.2 9.7 9.2
Queen Charlotte Is.	North Island: N. pt Cape Knox: Extreme Port Kuper: Sansum I Forsyth Point: Extreme St. James Cape: S. extreme Cumshewa Harbor: N. side of entrance . Skidegate Bay: Rock on bar Rose Spit Point: Extreme Massett Harbor: Uttewas village Cape Edenshaw: Extreme	$\begin{array}{cccccccccccccccccccccccccccccccccccc$	$\begin{array}{cccccccccccccccccccccccccccccccccccc$	0 00 6 12	11.5 12.8	6. 1 6. 7
Vancouver Island.	Hecate Bay: Observatory Islet Stamp Harbor: Observatory Islet Island Harbor: Observatory Islet Cape Beale: Light-house Refuge Cove: Village on W. side Hesquiat Harbor: Boat Cove Estevan Point: S. extreme Nootka Sound: Friendly Cove. Port Langford: Colwood Islet Esperanza Inlet: Observatory Rock Nasparti Inlet: Head Beach Cook Cape: Solander I. North Harbor: Observatory Rock	$\begin{array}{cccccccccccccccccccccccccccccccccccc$	$\begin{array}{cccccccccccccccccccccccccccccccccccc$	$\begin{array}{c ccccccccccccccccccccccccccccccccccc$	10. 0 12. 4 9. 9 10. 3 9. 8 9. 7 9. 3 9. 3 	$5.8 \\ 7.1 \\ 5.7 \\ 5.9 \\ 5.6 \\ 5.5 \\ 5.3 $

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APPENDIX IV.

MARITIME POSITIONS AND TIDAL DATA.

st.	Diam	Lot N	Long W	Lun. 1	int. '	Ra	nge.
Coa	Place.	Latt. N.	Long. W.	H.W.	L. W.	Spg.	Neap.
Vancouver I.	Koprino Harbor: Observatory Rock Hecate Cove: Kitten Islet Triangle Island: W. side Cape Scott: Summit Bull Harbor, Hope Island: N. pt. Indian I. Port Alexander: Islet in center Beaver Harbor: Shell Islet Cormorant I.: Yellow Bluff in Alert Bay. Baynes Sound: Beak Pt Nanoose Harbor: Entrance Rock Nanaimo: Light-house Victoria: Light-house Esquimalt: Fisgard I. light Race Island: Light-house Sooke Inlet: Secretary I Port San Juan: Pinnacle Rock	$ \begin{smallmatrix} \circ & \prime & \prime & \prime \\ 50 & 30 & 00 \\ 50 & 32 & 26 \\ 50 & 51 & 53 \\ 50 & 46 & 41 \\ 50 & 54 & 47 \\ 50 & 50 & 49 \\ 50 & 42 & 36 \\ 50 & 35 & 02 \\ 49 & 36 & 29 \\ 49 & 15 & 43 \\ 49 & 12 & 50 \\ 49 & 10 & 18 \\ 48 & 25 & 50 \\ 48 & 25 & 50 \\ 48 & 17 & 53 \\ 48 & 19 & 35 \\ 48 & 33 & 30 \\ \end{smallmatrix} $	$ \begin{smallmatrix} \circ & \prime & \prime & \prime \\ 127 & 51 & 42 \\ 127 & 35 & 44 \\ 129 & 05 & 58 \\ 128 & 26 & 11 \\ 127 & 55 & 29 \\ 127 & 39 & 23 \\ 127 & 24 & 33 \\ 126 & 56 & 56 \\ 124 & 50 & 44 \\ 124 & 07 & 32 \\ 123 & 48 & 11 \\ 123 & 56 & 02 \\ 123 & 23 & 28 \\ 123 & 26 & 46 \\ 123 & 31 & 47 \\ 123 & 42 & 40 \\ 124 & 27 & 37 \\ \end{smallmatrix} $	h. m. 0 10 0 32 0 30 0 55 4 45 4 52 4 40 [2 17] [2 00]	h. m. 6 22 6 44 6 42 7 08 11 00 11 18 11 05 [8 31] [8 14]	ft. 10. 7 11. 6 11. 5 12. 8 10. 2 9. 8 [5. 7] [5. 8]	<i>ft.</i> 5.6 6.1 6.0 6.7 6.6 6.4
British Columbia.	Port Harvey: Tide Pole Islet Port Neville: Robber's Nob Knox Bay, Thurlow Island: Stream at head of bay Valdes Island: S. pt. Howe Sound: Plumper Cove Atkinson Point: Light-house Vancouver, Burrard Inlet: Govt. Re- serve, English Bay Fraser River: Garry Pt New Westminster: Military barracks Point Roberts: Parallel station Semiamoo Bay: Parallel station	$\begin{array}{cccccccccccccccccccccccccccccccccccc$	$\begin{array}{cccccccccccccccccccccccccccccccccccc$	$ \begin{array}{c} 1 55 \\ 2 30 \\ 3 40 \\ 4 45 \\ 5 38 \\ 5 20 \\ 5 28 \\ 5 11 \\ \hline 4 59 \\ \end{array} $	8 10 8 47 10 00 10 15 11 58 11 35 12 01 11 23 11 10	14. 1 16. 0 15. 7 7. 2 9. 0 7. 8 8. 2 7. 0 7. 1	7.4 8.3 7.7 4.8 5.6 4.9 5.0 4.4 4.6
Washington.	Admiralty Head: Light-house Steilacoom: Methodist Church Seattle: C. S. ast. station Port Townsend: C. S. ast. station Smith Island: Light-house New Dungeness: Light-house Port Angeles: Ediz Hook light-house Cape Flattery: Light-house Cape Shoalwater: Light-house Cape Disappointment: Light-house Kalama: Methodist Church Bremerton: Navy-yard flagstaff Tacoma: St. Luke Church	$\begin{array}{cccccccccccccccccccccccccccccccccccc$	$\begin{array}{cccccccccccccccccccccccccccccccccccc$	$\begin{array}{c} & & 4 & 46 \\ 4 & 22 \\ 3 & 47 \\ 3 & 40 \\ 2 & 42 \\ 2 & 10 \\ 0 & 08 \\ \hline \\ 12 & 22 \\ 3 & 39 \\ 4 & 27 \\ 4 & 32 \\ \end{array}$	$\begin{array}{c} 11 & 04 \\ 10 & 33 \\ 9 & 32 \\ 9 & 28 \\ 8 & 34 \\ 8 & 23 \\ 6 & 16 \\ 6 & 19 \\ 11 & 25 \\ 10 & 35 \\ 10 & 45 \\ \end{array}$	$11.0 \\ 9.2 \\ 6.2 \\ 5.6 \\ 5.0 \\ 5.3 \\ 7.1 \\ 7.7 \\ 3.2 \\ 9.4 \\ 9.8$	$\begin{array}{c} 7.2 \\ 6.0 \\ 4.0 \\ 3.7 \\ 3.3 \\ 3.4 \\ 4.1 \\ \hline \\ 4.5 \\ 1.9 \\ 6.1 \\ 6.4 \end{array}$
Oregon.	Astoria: Flagstaff Yaquina Head: Light-house Cape Arago, or Gregory: Light-house Cape Blanco: Light-house	$\begin{array}{cccccccccccccccccccccccccccccccccccc$	$\begin{array}{cccccccccccccccccccccccccccccccccccc$	$\begin{array}{c} 0 \ 15 \\ 11 \ 50 \\ 11 \ 55 \end{array}$	$egin{array}{ccc} 6 & 42 \ 5 & 37 \ 5 & 49 \end{array}$	$7.8 \\ 7.3 \\ 6.0 \\ \cdots$	$\begin{array}{c} 4.7 \\ 4.3 \\ 3.5 \\ \end{array}$
California.	Crescent City: Light-house Trinidad Head: Light-house Eureka: Methodist Church Humboldt: Light-house Cape Mendocino: Light-house Point Arena: Light-house Point Reyes: Light-house San Francisco: Coast Survey ast. station Presidio station Mare Island: Stone block, obs. station Benicia: Church Farallon Islet: Light-house Santa Clara: Catholic Church Mount Hamilton: Obs. peak San José: Spire Pigeon Point: Light-house	$\begin{array}{cccccccccccccccccccccccccccccccccccc$	$\begin{array}{cccccccccccccccccccccccccccccccccccc$	$\begin{array}{c} 11 & 33 \\ 11 & 27 \\ 11 & 57 \\ 11 & 33 \\ 11 & 00 \\ 10 & 36 \\ 11 & 23 \\ 12 & 07 \\ 11 & 43 \\ 1 & 05 \\ 1 & 35 \\ 10 & 40 \\ \hline \\ $	$\begin{array}{c} 5 \ 15 \\ 5 \ 11 \\ 5 \ 45 \\ 5 \ 19 \\ 4 \ 50 \\ 4 \ 21 \\ 5 \ 08 \\ 5 \ 34 \\ 5 \ 07 \\ 7 \ 15 \\ 7 \ 48 \\ 4 \ 25 \\ \end{array}$	$5.8 \\ 5.7 \\ 5.7 \\ 5.3 \\ 4.7 \\ 4.1 \\ 5.1 \\ 4.6 \\ 5.6 \\ 4.5 \\ \cdots \\ $	$\begin{array}{c} 3.4\\ 3.3\\ 3.3\\ 3.1\\ 3.0\\ 2.6\\ 3.2\\ 3.2\\ 2.9\\ 3.7\\ 3.7\\ 2.9\\ \dots\\ \dots\\$

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MARITIME POSITIONS AND TIDAL DATA.

ا ي				Lun, Int.	Range.	
Coas	Place.	Lat. N.	Long. W.	H. W. L. W.	Spg. Neap.	
California.	Santa Cruz: Warehouse flagstaff Monterey: C. S. azimuth station Point Pinos: Light-house Piedras Blancas: Light-house Santa Barbara: N. tower, Mission Church San Buenaventura: C. S. ast. station Pt. Fermin, San Pedro Bay: Light-house. Los Angeles: Court-house Point Loma: Light-house Point Loma: Light-house Mexican Boundary: Obelisk San Diego: C. S. ast. station Mexican Boundary: Obelisk Santa Rosa Island: E. pt Santa Cruz Island: NE, pt Santa Barbara Island: Summit San Nicolas Island: Summit Santa Catalina Island: Catalina Peak	$\begin{smallmatrix} \circ & \cdot & \cdot & \cdot \\ 36 & 57 & 31 \\ 36 & 35 & 21 \\ 35 & 39 & 50 \\ 34 & 26 & 49 \\ 34 & 26 & 10 \\ 34 & 15 & 46 \\ 33 & 42 & 14 \\ 34 & 03 & 05 \\ 32 & 39 & 48 \\ 32 & 43 & 06 \\ 32 & 31 & 58 \\ 34 & 04 & 19 \\ 33 & 56 & 30 \\ 34 & 03 & 12 \\ 34 & 00 & 25 \\ 33 & 28 & 16 \\ 33 & 14 & 55 \\ 33 & 23 & 09 \\ \end{smallmatrix}$	$\begin{smallmatrix} \circ & \prime & \prime & \prime \\ 122 & 01 & 29 \\ 121 & 52 & 59 \\ 121 & 56 & 02 \\ 121 & 17 & 06 \\ 120 & 28 & 18 \\ 119 & 42 & 42 \\ 119 & 15 & 56 \\ 118 & 17 & 41 \\ 118 & 14 & 32 \\ 117 & 14 & 37 \\ 117 & 09 & 41 \\ 117 & 07 & 32 \\ 120 & 21 & 55 \\ 119 & 58 & 29 \\ 119 & 33 & 51 \\ 119 & 23 & 04 \\ 119 & 02 & 29 \\ 119 & 31 & 19 \\ 118 & 24 & 05 \\ \end{smallmatrix}$	$\begin{array}{c ccccccccccccccccccccccccccccccccccc$	$\begin{array}{c ccccccccccccccccccccccccccccccccccc$	
Lower California.	Ensenada Harbor: Head of bay, close to beach	$\begin{array}{cccccccccccccccccccccccccccccccccccc$	$\begin{array}{c} 116 \ 38 \ 05 \\ 116 \ 40 \ 51 \\ 116 \ 17 \ 28 \\ 116 \ 06 \ 46 \\ 115 \ 59 \ 07 \\ 115 \ 48 \ 12 \\ 115 \ 12 \ 14 \\ 118 \ 18 \ 30 \\ 114 \ 115 \ 12 \ 14 \\ 118 \ 18 \ 30 \\ 114 \ 15 \ 114 \ 06 \ 21 \\ 115 \ 113 \ 06 \ 114 \ 15 \\ 114 \ 06 \ 21 \\ 115 \ 113 \ 35 \ 04 \\ 112 \ 115 \ 36 \ 10 \\ 114 \ 54 \ 27 \\ 113 \ 16 \ 25 \\ 113 \ 35 \ 04 \\ 112 \ 41 \ 44 \\ 112 \ 17 \ 52 \\ 113 \ 35 \ 04 \\ 112 \ 18 \ 25 \\ 112 \ 08 \ 54 \\ 111 \ 42 \ 54 \\ 111 \ 30 \ 21 \\ 110 \ 14 \ 07 \\ 109 \ 54 \ 50 \\ 109 \ 40 \ 43 \\ 109 \ 28 \ 57 \\ 109 \ 50 \ 29 \\ 110 \ 20 \ 34 \\ 110 \ 20 \ 35 \\ 110 \ 41 \ 47 \\ 110 \ 20 \ 35 \\ 110 \ 41 \ 47 \\ 111 \ 01 \ 43 \\ 111 \ 06 \ 53 \\ 111 \ 21 \ 03 \\ 111 \ 27 \ 14 \\ 112 \ 05 \ 39 \\ 112 \ 19 \ 56 \\ 112 \ 47 \ 36 \\ 112 \ 55 \ 59 \\ 112 \ 55 \ 59 \\ 112 \ 55 \ 59 \\ 112 \ 55 \ 59 \\ 112 \ 55 \ 59 \\ 112 \ 19 \ 56 \\ 112 \ 57 \ 59 \ 59 \\ 112 \ 57 \ 59 \ 59 \ 50 \ 112 \ 57 \ 59 \ 50 \ 112 \ 57 \ 59 \ 50 \ 112 \ 57 \ 59 \ 50 \ 112 \ 57 \ 50 \ 50 \ 112 \ 57 \ 50 \ 50 \ 112 \ 57 \ 50 \ 50 \ 112 \ 57 \ 50 \ 50 \ 50 \ 50 \ 50 \ 50 \ 50$	9 28 3 06 9 27 3 05 9 23 3 00 9 15 2 53 9 05 2 42 9 00 2 37 9 00 2 37 9 00 2 37 9 00 2 48 8 29 2 17 8 25 2 12 9 40 3 34 9 40 3 34 9 40 3 34 11 50 5 47	$ \begin{array}{c ccccccccccccccccccccccccccccccccccc$	

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APPENDIX IV.

MARITIME POSITIONS AND TIDAL DATA.

st.				Lun. Int.		Range.	
Coat	Place.	Lat. N.	Long. W.	H.W. L.	w.	Spg.	Neap.
Lower California.	Las Animas: Low pt Raza Island: Landing place, S. side Angeles Bay: Bight on NW. shore Remedios Bay: Beach on W. shore Mejia Island: S. side San Luis Island: SE. side San Firmin: Beach, N. of bight San Felipe Point: Peak, 1,000 feet Philips Point: Beacon	$ \begin{smallmatrix} \circ & \cdot & \cdot & \cdot \\ 28 & 47 & 40 \\ 28 & 49 & 11 \\ 28 & 56 & 39 \\ 29 & 13 & 52 \\ 29 & 33 & 08 \\ 29 & 57 & 27 \\ 30 & 25 & 16 \\ 31 & 02 & 57 \\ 31 & 46 & 10 \\ \end{smallmatrix} $	$ \begin{smallmatrix} \circ & & & ' & '' \\ 113 & 12 & 48 \\ 113 & 00 & 05 \\ 113 & 34 & 35 \\ 113 & 40 & 00 \\ 113 & 35 & 19 \\ 114 & 25 & 49 \\ 114 & 39 & 47 \\ 114 & 52 & 10 \\ 114 & 43 & 31 \\ \end{smallmatrix} $	h. m. h.	m.	ft.	ft.
Mexico.	Georges Island: NE. shore	$\begin{array}{cccccccccccccccccccccccccccccccccccc$	$\begin{array}{c} 113 \ 16 \ 30 \\ 112 \ 53 \ 26 \\ 112 \ 53 \ 26 \\ 112 \ 53 \ 26 \\ 112 \ 25 \ 51 \\ 112 \ 21 \ 46 \\ 111 \ 58 \ 57 \\ 111 \ 16 \ 00 \\ 110 \ 54 \ 28 \\ 109 \ 57 \ 17 \\ 109 \ 40 \ 48 \\ -109 \ 17 \ 30 \\ 109 \ 10 \ 23 \\ 109 \ 10 \ 23 \\ 107 \ 59 \ 37 \\ 106 \ 26 \ 37 \\ 107 \ 59 \ 37 \\ 106 \ 26 \ 47 \\ 105 \ 18 \ 40 \\ 106 \ 33 \ 14 \\ 105 \ 38 \ 37 \\ 105 \ 16 \ 00 \\ 106 \ 33 \ 14 \\ 105 \ 38 \ 37 \\ 105 \ 16 \ 00 \\ 105 \ 39 \ 21 \\ 105 \ 08 \ 54 \\ 110 \ 49 \ 22 \\ 110 \ 56 \ 53 \ 21 \\ 110 \ 56 \ 53 \\ 112 \ 04 \ 07 \\ 114 \ 44 \ 17 \\ 109 \ 13 \ 00 \\ 104 \ 43 \ 26 \\ 104 \ 19 \ 50 \\ 102 \ 07 \ 06 \\ 101 \ 40 \ 25 \\ 101 \ 33 \ 23 \\ 101 \ 27 \ 14 \\ 101 \ 04 \ 32 \\ 99 \ 55 \ 50 \\ 98 \ 35 \ 05 \\ 96 \ 30 \ 43 \\ 96 \ 15 \ 04 \\ 96 \ 08 \ 10 \\ 95 \ 46 \ 43 \\ 95 \ 12 \ 31 \\ \end{array}$	11 30 5 11 30 5 10 07 5 9 08 2 9 08 2 9 07 2 9 1	26 59 51 52 53 253 253 254 254	5. 0 5. 0 5. 8 3. 8 3. 2 2. 5 1. 9 2. 0	1. 2 1. 2 1. 4 0. 9 1. 0 1. 1 1. 1 1. 3 0. 9
Central America.	Champerico: Inshore end of iron wharf. San José de Guatemala: Light-house Acajutla: Light-house Libertad: Light-house La Union: Light-house Chicarene Point: Extreme Corinto: Light-house San Juan del Sur: Signal station Salinas Bay: Salinas Islet Port Culebra: Extremity of Mala Pt Ballena Bay: N. Estero Toussa Parida Anchorage: S. pt. of Deer Id Port Nuevo: Entrada Pt Bahia Honda: W. end of Centinela I Coiba (Quibo) Island: Observation pt	$\begin{array}{cccccccccccccccccccccccccccccccccccc$	$\begin{array}{c} 91 \ 55 \ 36\\ 90 \ 49 \ 45\\ 89 \ 50 \ 26\\ 89 \ 19 \ 25\\ 87 \ 51 \ 00\\ 87 \ 47 \ 06\\ 87 \ 12 \ 31\\ 85 \ 52 \ 59\\ 85 \ 43 \ 38\\ 85 \ 42 \ 46\\ 85 \ 00 \ 46\\ 82 \ 14 \ 32\\ 81 \ 43 \ 30\\ 81 \ 41 \ 51\\ \end{array}$	$\begin{array}{c} 2 50 \\ 2 50 \\ 2 55 \\ 3 05 \\ 3 15 \\ 2 55 \\ 3 15 \\ 2 55 \\ 2 55 \\ 2 45 \\ 3 10 \\ 3 10 \\ 4 5 \\ 3 10 \\ 4 5 \\ 5 \\ 3 10 \\ 4 5 \\ 5 \\ 5 \\ 5 \\ 5 \\ 5 \\ 5 \\ 5 \\ 5 \\$	02 02 08 18 28 08 12 02 58 28 28 28 28 28 28 28	$\begin{array}{c} 8.5\\ 9.0\\ 9.5\\ 10.0\\ 10.5\\ \hline \\ 10.5\\ 9.0\\ \hline \\ 10.5\\ \hline \\ 10.5\\ \hline \\ 11.0\\ \hline \end{array}$	$\begin{array}{c} 4.6 \\ 4.9 \\ 5.1 \\ 5.4 \\ 5.7 \\ \hline 5.7 \\ 5.4 \\ 5.1 \\ 4.9 \\ \hline 5.7 \\ \hline 5.9 \\ \hline \end{array}$

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MARITIME POSITIONS AND TIDAL DATA.

WEST COAST OF NORTH AMERICA-Continued.

ıst.	Place	Lat. N. Lor	Y	Lun.	Int.	Range.	
COS	Frace.		Lat. N. Long. W.		L. W.	Spg.	Neap.
C. America.	Cocos Island: Head of Chatham Bay Panama: NE. bastion, ast. station Taboga Island: Church Cape Mala: Extreme Malpelo Island: Summit	$ \begin{smallmatrix} \circ & & & \\ 5 & 32 & 57 \\ 8 & 57 & 12 \\ 8 & 47 & 45 \\ 7 & 27 & 40 \\ 4 & 03 & 00 \\ \end{smallmatrix} $	$ \begin{smallmatrix} \circ & & & & \\ 86 & 59 & 17 \\ 79 & 32 & 05 \\ 79 & 33 & 16 \\ 79 & 59 & 25 \\ 81 & 36 & 00 \\ \end{smallmatrix} $	$ \begin{array}{cccccccccccccccccccccccccccccccccccc$	h. m. 9 14 9 13 9 22	<i>ft.</i> 16.0 15.4 13.0	<i>ft.</i> 8.7 8.3 7.0

WEST INDIA ISLANDS.

	Momony Books Conton	96 56 59	70 06 51	7 10	1 90	9.0	1.7
	Memory Rock: Center	20 00 00	79 00 04	7 40	1 28	3.2	1.7
	Banama Island: W. pt	20 41 18	79 00 38				
	Abaco Island: Light-house	20 01 00	77 10 40				
	Little Guana Cay: Light-house	20 31 10	10 07 30			•••••	• • • • • •
	Walker Cay: Highest part	27 15 42	78 23 48				
	Great Isaac Cay: Light-house	26 02 00	79 06 00				
	Gun Cay: Light-house	25 34 30	79 18 26	8 20	2.08	3.0	1.5
	Ginger Cay: Center	22 45 10	78 06 02				
	Cay Lobos: Light-house	$22 \ 22 \ 30$	77 34 26				
	St. Domingo Cay: Center	$21 \ 42 \ 00$	75 44 39				
	Cay Verde: Hill at S. end	$22 \ 01 \ 15$	75 10 34				
	Ragged Island: Gun Pt	22 14 02	75 45 17				
	Nairn Cay: E. pt	22 20 44	75 28 20				
	Nurse Channel Cay: Beacon	$22 \ 31 \ 15$	75 51 41				
	Long Island: S. pt.	22 51 00	74 51 54				
	Great Emma Island: Beacon	23 32 15	75 46 24				
	Clarence Harbor: Light-house	23 06 00	74 59 00	8 20	2 08	4.1	2.1
18	Eleuthera Island: Light-house	25 00 00	76 13 00	7 00	0 48	4.0	2.1
ā.	Royal Island: Eastern Pass	25 31 20	76 51 48				
Ia.	Nassau: Light-house	25 05 37	77 21 58	7 20	1.08	4.0	2.1
*	Andros Island, Light-house	24 43 45	77 46 45	7 40	1 28	3.0	15
	Great Stirrun Cay: Light-house	25 49 40	77 53 55	. 10	1 -0	0.0	1.0
8	Little Stirrup Cay: W and	25 49 12	77 57 06				
E I	San Salvador (Cat I): Light-house	24 06 15	75 26 00	7.00	81.0	4.0	9 1
3	Concepcion Island. W hay	23 50 50	75 07 27	7 00	0 10	7.0	<i>4</i> •1
H	Watlings Island: Hunshinbroko Rook	23 56 10	74 98 20				
	Rum Cay: Harbor Pt	23 00 40	71 50 08				
	Castle Island, Light house	20 07 40	74 00 08				
	Fortune Island, C and	22 00 40	74 20 37				
	Created Island: Maga flagstoff	22 32 40	74 22 04			• • • • • •	
	Dind Island: Light house	22 47 50	74 20 21				
	Samana Care W at	22 01 00	74 22 40	• • • • • • • • •			
	Samana Cay: W. pt.	23 03 30	75 49 15				
	Plana Cay: NW. pt.	22 34 38	73 38 03		1 00		
	Mariguana Island: SE. pt	22 16 30	72 47 03	7 20	1 08	3.0	1.5
	Hogsty Keel: NW. Cay	21 40 30	73 50 29			· · · · · · ·	
	Inagua Island: Light-house	20 56 00	73 40 17	7 50	1 38	3, 5	1.8
	Little Inagua Island: NW. pt	21 30 40	73 42 33			• • • • • •	
	W. Calcos Cay: Hill, SE. end	21 37 30	72 28 18				
	French Cay: W. pt.	$21 \ 30 \ 00$	72 12 51			,	
	Fort George Cay: Old magazine	21 54 00	72 07 14				
	Calcos Island: Parsons Pt., S. 1slet	21 29 33	71 31 12				
	Turk Island: Light-house	21 30 55	71 07 29	7 30	1 18	3, 0	1.5
	Square Handkerchief Bank: NE. breaker	21 06 30	70 29 54				
	Silver Bank: E. extreme	20 35 00	69 21 24	- *			
	Navidad Bank: Center of E. side	20 02 00	68 47 24				
	Cano Mavei: Light-bougo	20 15 10	74 00 41	5 10	11 52		1.6
	Port Bargeog: Light-house	20 10 10	71 90 91	040	11 99	4.0	1.0
	Port Cavo Moa: Caroporo Pt	20 21 40	71 52 11				
	Port Nino: Rome Pt	20 41 41	75 99 19				
	Lucrosia Point: Light-house	21 0.1 21	75 26 50		••••		
pa pa	Port Sama: E side of optrance	21 04 24	75 17 10	•••••	• • • • • • • • •		
<u>a</u> 1	Pool of Same Sumplit 225 feet	21 09 00	75 17 10	•••••			
<u>ہ</u>	Port Narania: F side of entrance	21 07 00	70 47 40				
	Libera, Fort San Formando	21 07 30	10 02 18 70 07 19	e 90	0.00		T f
	Port Padro: Cuinabez Dt	21 07 00	76 95 91	0 20	0.08	2.4	1.4
	Port Nuovites: Light house	21 10 30	77 01 94	7.00	0.10		1.9
	1 of thuevitas. Light-house	21 01 00	11 04 04	1 00	0 48	4.4	نہ .1

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APPENDIX IV.

MARITIME POSITIONS AND TIDAL DATA.

WEST INDIA ISLANDS-Continued.

st.	Direc	Lat N	Long W	Lun. Int.		Ra	inge.
Coa	race.	Lat. N.	Long. W.	H. W.	L. W.	Spg.	Neap.
Cuba.	Maternillos Point: Light-house Cay Verde: NW. end Cay Confites: S. pt. Paredon Grande Cay: Light-house Bahia de Cadiz Cay: Light-house Piedras Cay: Light-house Matanzas: Summit of peak Habana: Morro light-house Transit pier, arsenal yard Cape San Antonio: Light-house San Felipe Cays: SW. pt. Isle of Pines: Port Frances Piedras Cay: Light-house Cape Cay: Light-house San Felipe Cays: SW. pt. Isle of Pines: Port Frances Piedras Cay: Light-house Cape Cruz: Light-house Santiago de Cuba: Light-house Port Guantanamo: Fisherman Pt	$ \begin{smallmatrix} \circ & \cdot & \prime & \prime \\ 21 & 40 & 02 \\ 22 & 08 & 45 \\ 22 & 11 & 14 \\ 22 & 29 & 10 \\ 23 & 56 & 30 \\ 23 & 12 & 34 \\ 23 & 14 & 10 \\ 23 & 01 & 54 \\ 23 & 09 & 21 \\ 23 & 08 & 03 \\ 21 & 51 & 44 \\ 21 & 55 & 30 \\ 21 & 57 & 30 \\ 21 & 57 & 35 \\ 22 & 01 & 58 \\ 19 & 50 & 13 \\ 19 & 57 & 31 \\ 19 & 54 & 39 \\ \end{smallmatrix} $	$ \begin{smallmatrix} \circ & , & , & , & , & , & , & \\ 77 & 37 & 33 & 73 & 39 & 23 \\ 78 & 09 & 11 & \\ 80 & 27 & 51 & \\ 80 & 27 & 51 & \\ 80 & 29 & 26 & \\ 81 & 07 & 20 & \\ 81 & 07 & 20 & \\ 82 & 21 & 17 & \\ 84 & 57 & 28 & \\ 83 & 31 & 18 & \\ 83 & 09 & 13 & \\ 81 & 07 & 18 & \\ 80 & 26 & 32 & \\ 77 & 43 & 30 & \\ 75 & 52 & 12 & \\ 75 & 09 & 27 & \\ \end{smallmatrix} $	h. m. 7 20 8 30 8 18 8 30 4 47 7 50	$ \begin{array}{c} \hbar. m. \\ 1 08 \\ 2 18 \\ 1 56 \\ 2 18 \\ 11 00 \\ 2 30 \\ 2 00 \end{array} $	<i>ft.</i> 2. 8 2. 2 1. 3 1. 5 2. 0 2. 2 2. 6	<i>ft.</i> 1.6 1.2 0.7 0.9 1.1 1.1 1.3
	Cayman Brac: E. pt Little Cayman: W. pt Grand Cayman: Fort George, W. end	$\begin{array}{cccccccccccccccccccccccccccccccccccc$	$\begin{array}{cccccccccccccccccccccccccccccccccccc$			[1.3]	
Jamaica.	Morant Point: Light-house Port António: Folly Pt. Light Port Maria: NW. wharf St. Ann Bay: Long wharf Falmouth: Fort Montego Bay: Fort St. Lucia: Fort Savanna-la-Mar: Fort Kingston: Plum Pt. light Port Royal: Fort Charles, flagstaff Morant Cays: NE. Cay Pedro Bank: Portland Rock, E. end Baxo Nuevo: Sandy Cay	$\begin{array}{cccccccccccccccccccccccccccccccccccc$	$\begin{array}{cccccccccccccccccccccccccccccccccccc$			[1. 1] [1. 2] [1. 1]	
Haiti.	Samana Town: Fort Cape Cabron: Extreme Port Plata: Light-house. Grange Point: W. end. Manzanilla Point: Presidente Pt. Cape Haitien: Town fountain. Port Paix: Wharf Nicolas Mole: Fort George, flagstaff Gonave Island: W. pt. Arcadius Islands: Light-house. Port au Prince: Fort Islet light. Petite Rivière Village: Sand beach in front of huts Jeremie: Fort Navassa Island: N. extreme. Formigas Bank: Shoal spot. Vache Island: Sand beach, near NW, pt. Jacmel: Wharf Beata Island: NW, pt. Frayle Rock: Center. Alta Vela: Summit Avarena Point: Extreme. Salinas Point (Caldera): Extreme. Point Espada: Extreme.	$\begin{array}{c} 19 \ 12 \ 29 \\ 19 \ 21 \ 17 \\ 19 \ 49 \ 15 \\ 19 \ 54 \ 45 \\ 19 \ 45 \ 34 \\ 19 \ 46 \ 20 \\ 19 \ 57 \ 40 \\ 19 \ 57 \ 40 \\ 19 \ 57 \ 40 \\ 19 \ 57 \ 40 \\ 19 \ 57 \ 40 \\ 19 \ 57 \ 40 \\ 19 \ 57 \ 40 \\ 18 \ 48 \ 13 \\ 18 \ 33 \ 54 \\ 18 \ 33 \ 54 \\ 18 \ 33 \ 54 \\ 18 \ 33 \ 54 \\ 18 \ 33 \ 54 \\ 18 \ 33 \ 54 \\ 18 \ 33 \ 54 \\ 18 \ 33 \ 54 \\ 18 \ 33 \ 54 \\ 18 \ 33 \ 54 \\ 18 \ 33 \ 54 \\ 18 \ 33 \ 54 \\ 18 \ 33 \ 54 \\ 18 \ 33 \ 54 \\ 18 \ 33 \ 54 \\ 18 \ 33 \ 60 \ 18 \ 13 \ 30 \\ 17 \ 36 \ 45 \\ 17 \ 37 \ 00 \\ 17 \ 28 \ 50 \\ 18 \ 12 \ 00 \\ 18 \ 12 \ 00 \\ 18 \ 12 \ 00 \\ 18 \ 12 \ 00 \\ 18 \ 27 \ 54 \\ 18 \ 19 \ 43 \end{array}$	$\begin{array}{cccccccccccccccccccccccccccccccccccc$	9 00	2 48	3.0 	1.5 2.9

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MARITIME POSITIONS AND TIDAL DATA.

WEST INDIA ISLANDS-Continued.

st.		Lot N	Long W	Lun. Int.	Range.
Coa	Place.	Lat. N.	Long. W.	H. W. L. W.	Spg. Neap.
ico.	Mona Island: Light-house Mayaguez: Mouth of Mayaguez R Aguadilla Bay: Village San Juan de Porto Rico: Morro light-	$ \begin{smallmatrix} \circ & \prime & '' \\ 18 & 02 & 43 \\ 18 & 11 & 56 \\ 18 & 25 & 09 \\ \end{smallmatrix} $	$\begin{array}{c}\circ&'&''\\67&50&30\\67&09&04\\67&16&08\end{array}$	h. m. h. m. 7 04 2 00	ft. ft. 2.0 1.0
Porto R	Cape San Juan: Light-house Guanica: Meseta Pt. Culebrita Island: Light-house Vieques (Crab) Island: Port Ferro light.	$\begin{array}{cccccccccccccccccccccccccccccccccccc$	$\begin{array}{cccccccccccccccccccccccccccccccccccc$	$ \begin{array}{c ccccccccccccccccccccccccccccccccccc$	$ \begin{array}{c c} 1.3 & 0.9 \\ [1.0] \\ [1.0] \\ [1.1] \\ \end{array} $
	St. Thomas: Fort Christian, SW. bastion. St. John Island: Ram Head Tortola: Fort Burt Virgin Gorda: Vixen Pt Anegada: W. pt E. extreme of reefs Christiansted, Santa Cruz: SW. bastion	$\begin{array}{cccccccccccccccccccccccccccccccccccc$	$\begin{array}{cccccccccccccccccccccccccccccccccccc$		
	of fort Sombrero: Light-house Dog Island: Center Anguilla: Custom-house St. Martin: Fort Marigot light St. Bartholomew: Fort Oscar. Saba: Diamond Rock St. Eustatius: Fort flagstaff. St. Christopher: Basseterre Church	$\begin{array}{cccccccccccccccccccccccccccccccccccc$	$\begin{array}{cccccccccccccccccccccccccccccccccccc$		[1.5]
	Booby Island: Center Nevis: Fort Charles Barbuda: Flagstaff, Martello Tower Antigua, English Harbor: Flagstaff, dockyard	17 13 38 17 07 52 17 35 50 17 00 00	$\begin{array}{cccccccccccccccccccccccccccccccccccc$		[2.0]
	Sandy Island: Light-house Redonda Islet: Center Montserrat: Plymouth Wharf Guadeloupe, Basseterre: Light on mast Port Louis: Light on mast Gožier Islet: Light-house Manroux Id.: Light-house	$\begin{array}{cccccccccccccccccccccccccccccccccccc$	$\begin{array}{cccccccccccccccccccccccccccccccccccc$		[1.3]
	Desirade: E. pt. Petite Terre: Light-house Marie Galante: Light-house Saintes Islands: Tower on Chameau hill. Dominica, Prince Ruperts Bay: Sand beach W. of church	$\begin{array}{c} 16 & 13 & 56 \\ 16 & 19 & 56 \\ 16 & 10 & 17 \\ 15 & 52 & 59 \\ 15 & 51 & 32 \\ 15 & 34 & 34 \end{array}$	$\begin{array}{c} 61 & 33 & 13 \\ 61 & 00 & 44 \\ 61 & 06 & 45 \\ 61 & 19 & 15 \\ 61 & 35 & 55 \\ 61 & 28 & 14 \end{array}$	4 00 10 12	1.5 0.8
	Roseau: Flagstaff, Fort Young. Aves Island: Center Martinique, Fort de France: Fort St. Louis light St. Pierre: Ste. Marthe Bat-	$ \begin{array}{cccccccccccccccccccccccccccccccccccc$	$\begin{array}{cccccccccccccccccccccccccccccccccccc$		
	tery Caravelle Pen.: Light-house. Cabrit Islet: Summit St. Lucia, Port Castries: Light-house Barbades, Bridgetown: Flagstaff, Rick-	$\begin{array}{cccccccccccccccccccccccccccccccccccc$	$\begin{array}{cccccccccccccccccccccccccccccccccccc$	3 50 10 02	
	ett's Battery S. Point: Light-house Ragged Point: Light-house St. Vincent, Kingstown: Light-house Bequia Island, Admiralty Bay: Church Grenada: St. George light-house Tobago, Rocky Bay: Light-house	$\begin{array}{cccccccccccccccccccccccccccccccccccc$	$\begin{array}{cccccccccccccccccccccccccccccccccccc$	$\begin{array}{ c c c c c c c c c c c c c c c c c c c$	$ \begin{array}{c ccccccccccccccccccccccccccccccccccc$

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APPENDIX IV.

MARITIME POSITIONS AND TIDAL DATA.

WEST INDIA ISLANDS-Continued.

st.	Place	Lot N	Long W	Lun. Int.	Rang	ge.
CO8	Flace.	Lat. N.	Long. W.	H. W. L. W.	Spg.	Neap.
<u> </u>	Testigos Islets: Center of Testigo Grande. Sola Island: Center Pampatar, Margarita I. : San Carlos Castle. Tortugas Island: S. end of W. Tortugillo Islet. Orchila Island: S. side. Roques Islands: Pirate Cay Bonaive Island: Light-house. Little Curacao Island: Light-house.	$ \begin{array}{c} \circ & , & '' \\ 11 & 25 & 02 \\ 11 & 19 & 00 \\ 10 & 59 & 43 \\ 10 & 57 & 45 \\ 11 & 57 & 45 \\ 11 & 56 & 16 \\ 12 & 02 & 06 \\ 11 & 59 & 30 \\ \end{array} $	$\begin{array}{c} \circ & \prime & \prime \\ 63 & 05 & 48 \\ 63 & 36 & 00 \\ 63 & 48 & 00 \\ 65 & 26 & 38 \\ 66 & 12 & 31 \\ 66 & 39 & 10 \\ 68 & 14 & 10 \\ 68 & 39 & 19 \\ \end{array}$	h. m. h. m.	<i>ft.</i>	ft.
	Curaçao Island: Time-ball station Light-house Oruba Island: Light-house	$\begin{array}{cccccccccccccccccccccccccccccccccccc$	$\begin{array}{cccccccccccccccccccccccccccccccccccc$			

NORTH AND EAST COASTS OF SOUTH AMERICA.

Colombia.	Chagres: San Lorenzo Castle Toro Point: Light-house Colon: Light-house Porto Bello: Ft. St. Geronimo Caledonia Harbor: Scorpion Cay Caribana Point: Extreme Fuerte Island: N. extreme Cispata Port: Zapote Pt Cartagena: Light-house Savanilla: Light-house Magdalena River: NW. pt. of Gomez I Santa Marta: Light-house Rio de la Hacha: Light on church Cape La Vela: Sand beach inside cape Bahia Honda: E. pt., S. side	$\begin{array}{c} 9 \ 19 \ 27 \\ 9 \ 22 \ 39 \\ 9 \ 22 \ 09 \\ 9 \ 32 \ 30 \\ 8 \ 54 \ 52 \\ 8 \ 47 \ 00 \\ 9 \ 24 \ 00 \\ 9 \ 24 \ 00 \\ 10 \ 25 \ 50 \\ 11 \ 00 \ 15 \\ 10 \ 07 \ 00 \\ 11 \ 15 \ 28 \\ 11 \ 33 \ 30 \\ 12 \ 12 \ 34 \\ 12 \ 23 \ 09 \end{array}$	$\begin{array}{cccccccccccccccccccccccccccccccccccc$		6 18 5 17	1.1	0.6
Venezuela.	Espada Point: Extreme Maracaibo: Zapara I. light Estangues Point: 500 ft. from extreme Cape San Roman: Extreme Marjes Islets: N. islet Vela de Coro: Light-house Tucacas Island: Ore house St. Juan Bay: Cay Puerto Cabello: Light-house La Guaira: Light-house Cape Codera: Morro Corsarios Bay: W. pt Centinela Islet: Center Barcelona: Morro Cumana: Light-house Escarseo Point: Extreme Chacopata: Morro Esmeralda Islet: Center Carupano: Light-house Estarseo Point: Extreme Chacopata: Morro Curanan: Santo Bay: Sand spit S. of Morro. Tres Puntas Cape: Extreme Unare Bay: Obs. spot, 200 yds. S. of Morro Pena Point: Extreme Pato Island: E. pt Mocomoco Pt : Extreme	$\begin{array}{cccccccccccccccccccccccccccccccccccc$	$\begin{array}{cccccccccccccccccccccccccccccccccccc$	6 00		2.5	1.5
Trinidad.	Port of Spain: King's Wharf light Chacachacare Island: Rocks off SW. pt Galera Point: NE. extreme, light-house. Icacos Point: Light-house San Fernando: Pierhead	$\begin{array}{cccccccccccccccccccccccccccccccccccc$	$\begin{array}{cccccccccccccccccccccccccccccccccccc$	4 20	10 30	3.2	1.9

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MARITIME POSITIONS AND TIDAL DATA.

NORTH AND EAST COASTS OF SOUTH AMERICA-Continued.

st.		1	T	Lun. Int.		Rí	inge.
Coa	Place.	Lat. N.	Long, W.	H. W.	L. W.	Spg.	Neap.
Guiana.	Demerara: Georgetown light-house Nickerie River: Light-house Paramaribo: Stone steps Maroni River: W. light-house Salut Islands: Light-house Enfant Perdu Islet: Light-house Cayenne: Light-house Connétable Islet: Center Carimare Mount: Summit	$ \begin{smallmatrix} \circ & \prime & \prime & \prime \\ 6 & 49 & 20 \\ 5 & 58 & 30 \\ 5 & 49 & 30 \\ 5 & 44 & 50 \\ 5 & 16 & 50 \\ 5 & 02 & 40 \\ 4 & 56 & 20 \\ 4 & 49 & 30 \\ 4 & 23 & 20 \\ \end{smallmatrix} $	$ \begin{smallmatrix} \circ & i & m \\ 58 & 11 & 30 \\ 57 & 00 & 30 \\ 55 & 08 & 48 \\ 54 & 00 & 30 \\ 52 & 34 & 53 \\ 52 & 21 & 11 \\ 52 & 20 & 26 \\ 51 & 55 & 36 \\ 51 & 50 & 36 \\ \end{smallmatrix} $	h. m. - 4 18 - 5 50 	h. m. 9 50 12 00 10 30	<i>ft.</i> 8.6 9.5 6.0	<i>ft.</i> 3.9 4.3 2.7
Brazil.	Orange Cape: Extreme	$\begin{array}{c} 4 \ 20 \ 45 \\ 2 \ 46 \ 30 \\ 1 \ 40 \ 17 \\ 1 \ 40 \ 17 \\ 1 \ 40 \ 17 \\ 1 \ 26 \ 59 \\ 0 \ 35 \ 03 \\ 10 \ 11 \\ 2 \ 31 \ 48 \\ 2 \ 16 \ 22 \\ 2 \ 41 \ 55 \\ 2 \ 53 \ 52 \\ 2 \ 53 \ 52 \\ 2 \ 53 \\ 5 \ 20 \ 15 \\ 5 \ 29 \ 15 \\ 5 \ 29 \ 15 \\ 5 \ 29 \ 15 \\ 5 \ 20 \ 15 \\ 5 \ 29 \ 15 \\ 5 \ 20 \ 15 \\ 5 \ 20 \ 15 \\ 5 \ 20 \ 15 \\ 5 \ 20 \ 15 \\ 5 \ 20 \ 15 \\ 5 \ 20 \ 15 \\ 5 \ 20 \ 15 \\ 5 \ 20 \ 15 \\ 5 \ 20 \ 15 \\ 5 \ 20 \ 15 \\ 5 \ 20 \ 15 \\ 5 \ 20 \ 15 \\ 5 \ 20 \ 15 \\ 5 \ 20 \ 15 \\ 5 \ 20 \ 15 \\ 5 \ 20 \ 15 \\ 5 \ 20 \ 15 \\ 20 \ 30 \ 30 \\ 10 \ 58 \ 20 \\ 11 \ 09 \ 45 \\ 11 \ 27 \ 40 \\ 12 \ 12 \ 20 \ 30 \ 30 \\ 10 \ 58 \ 20 \\ 11 \ 09 \ 45 \\ 11 \ 27 \ 40 \\ 12 \ 12 \ 34 \ 40 \\ 12 \ 12 \ 20 \ 34 \\ 10 \ 30 \ 37 \\ 12 \ 52 \ 48 \\ 13 \ 22 \ 37 \\ 13 \ 56 \ 41 \\ 15 \ 21 \ 10 \\ 14 \ 47 \ 40 \\ 15 \ 12 \ 21 \ 10 \\ 16 \ 17 \ 20 \ 19 \ 23 \\ 20 \ 38 \ 25 \\ 20 \ 49 \ 00 \\ 20 \ 57 \ 35 \\ 20 \ 49 \ 00 \\ 20 \ 57 \ 35 \ 45 \\ 45 \ 45 \ 45 \ 45 \\ 45 \ 45 \ 4$	$\begin{array}{c} 51 & 27 & 46 \\ 50 & 54 & 46 \\ 49 & 56 & 46 \\ 48 & 23 & 30 & 11 \\ 47 & 20 & 54 \\ 44 & 25 & 56 \\ 44 & 18 & 45 \\ 43 & 37 & 30 \\ 42 & 18 & 02 \\ 538 & 28 & 25 \\ 37 & 44 & 55 \\ 38 & 28 & 25 \\ 37 & 44 & 55 \\ 38 & 28 & 25 \\ 37 & 44 & 55 \\ 38 & 28 & 25 \\ 37 & 44 & 55 \\ 38 & 28 & 25 \\ 37 & 44 & 55 \\ 38 & 28 & 25 \\ 37 & 44 & 55 \\ 38 & 28 & 25 \\ 37 & 44 & 55 \\ 38 & 28 & 25 \\ 37 & 44 & 55 \\ 35 & 51 & 52 \\ 35 & 15 & 52 \\ 35 & 15 & 52 \\ 35 & 15 & 52 \\ 35 & 15 & 52 \\ 35 & 15 & 52 \\ 35 & 15 & 52 \\ 35 & 15 & 52 \\ 35 & 15 & 52 \\ 35 & 15 & 52 \\ 35 & 15 & 52 \\ 36 & 21 & 51 \\ 37 & 04 & 00 \\ 37 & 12 & 36 \\ 38 & 41 & 45 \\ 38 & 21 & 6 \\ 38 & 31 & 16 \\ 40 & 16 & 36 \\ 39 & 11 & 16 \\ 39 & 31 & 16 \\ 40 & 40 & 45 \\ 40 & 40 $	$\begin{array}{c} 11 50 \\ \hline \\ 6 50 \\ 5 35 \\ 5 05 \\ \hline \\ 5 25 \\ 5 50 \\ \hline \\ 4 05 \\ \hline \\ 3 35 \\ \hline \\ 3 50 \\ \hline \\ \hline \\ 3 50 \\ \hline \\ 3 50 \\ \hline \\ \hline \\ 3 2 5 \\ \hline \\ \hline \\ \hline \\ 2 2 0 \\ \hline \end{array}$	$\begin{array}{c} 5 & 37 \\ 0 & 38 \\ 11 & 47 \\ 11 & 17 \\ 11 & 37 \\ 12 & 00 \\ \hline 10 & 17 \\ 0 & 10 & 17 \\ \hline 10 & 50 \\ \hline 10 & 29 \\ \hline 10 & 00 \\ \hline 0 & 32 \\ \hline 10 & 29 \\ \hline 10 & 00 \\ \hline 0 & 9 & 47 \\ \hline 0 & 00 \\ \hline 0 & 9 & 47 \\ \hline 0 & 9 & 37 \\ \hline 0 $	$ \begin{array}{c} 11.0\\ 16.5\\ 13.1\\ 11.7\\ 8.2\\ 8.0\\ 8.8\\ 7.0\\ 8.5\\ 7.0\\ 7.6\\ 6.0\\ 6.3\\ 6.4\\ 7.5\\ 4.0\\ 5.0\\ 9.2\\ \end{array} $	5.2 7.9 6.2 5.6 3.9 3.8 4.2 3.3 4.1 3.7 3.6 2.9 3.0 3.1 3.6 1.9 2.9 3.1 3.6 1.9 2.4 4.4

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APPENDIX IV.

MARITIME POSITIONS AND TIDAL DATA.

NORTH AND EAST COASTS OF SOUTH AMERICA-Continued.

st.				Lun. Int.		Range.	
Coa	Place.	Lat. S.	Long. W.	н. w.	L. W.	Spg.	Neap.
		o / //	0 / //	h. m.	h. m.	ft.	ft.
	Santa Anna Island: Summit Barra São João: Village	$22 \ 26 \ 00$ $22 \ 37 \ 00$	$41 \ 43 \ 15$ $41 \ 59 \ 45$		•••••		• • • • • • •
	Busios: Church	22 46 00	41 54 05				
	Cape Frio: Light-house	23 00 42	42 00 00				
	Maricas Islands: S. islet	$\begin{array}{cccccccccccccccccccccccccccccccccccc$	$42 01 15 \\ 42 54 05$	2 30	8 42	4.9	2.3
	Rio de Janeiro: Fort Villegagnon Light.	22 54 46	43 09 24	2 50	9 00	4.2	2.0
	Imperial Observatory	22 54 15 22 02 40	43 10 16				
	Petropolis: Center of town	23 03 40 22 32 00	43 11 01				
	Cape Guaratiba: Summit	$23 \ 03 \ 40$	$43 \ 33 \ 24$				
	Marambaya Island: Summit of SW. end.	$\begin{array}{cccccccccccccccccccccccccccccccccccc$	43 59 26 41 02 20				
	Palmas Bay: Beach at head of bay	23 09 20	44 02 25				
	Angra dos Reis: Landing-place	23 00 30	44 19 04				
	Ilha Grande: Light-house	23 09 50 23 12 20	44 05 45	1 25	7 47	5.9	
	Ubatuba: Cathedral	-23 25 55	45 04 04	1 00		0.0	2.0
	Porcos Grande Islet: Summit	$23 \ 32 \ 57$	45 03 50				
<u> </u>	Busios Islets: Summit	$23 \ 45 \ 15 \ 23 \ 58 \ 30$	45 00 39				
zi	Villa Nova da Princessa: Center	$23 \ 47 \ 20$	45 15 20				
3ra	Santos: Moela I. light-house	24 03 06	46 15 57				
-	Alcatrasses Island: Summit, 880 ft	23 56 00	46 19 09	2 50	9 00	5.0	2.8
	Conceição: Church	24 10 32	46 47 44				
	.Quemada Grande Island: Summit, 623ft	24 28 45	46 41 04				
	Iguape: Quay	24 42 35 25 06 40	47 32 54 47 51 50				
6.1	Ilha do Mel: Light-house	25 30 55	48 19 53				
	Paranagua: Quay	25 31 20	48 31 03	2 55	9 05	6:4	3.1
	Coral Islet: Center	25 20 30 25 44 10	48 43 14				
	Itacolomi Islet: Center	25 50 15	$48 \ 25 \ 51$				
	São Francisco: Center of town	26 14 17	48 39 29				
	Cambria: Church	27 01 35	48 36 44				
•	Arvoredo Island: Light-house	27 18 00	48 22 20				
	Anhatomirim: Light-house St. Catharing Island: Rana Pt	27 25 30 27 22 55	48 34 25	2 35	8 47	5.9	2.8
	Naufragados light.	27 50 27	48 35 16				
	Nostra Senhora do Deserto: Quay	27 36 00	48 34 14				
	Cape St. Martha: Light-house	27 36 40 28 38 00	48 55 44				
	Torres Point: Extreme	29 20 20	49 43 39				
	Rio Grande do Sul: Light-house	$32 \ 06 \ 40$	52 07 44	4 00	10 12	1.8	0.9
	Castillos: Beuna Vista Hill, 184 feet	34 21 19	53 47 16	8 20	2 08	2.0	0.9
y.	Cape Santa Maria: Light-house	34 40 01	54 09 14				
ua	Maldonado: Light-house	34 58 15	54 55 16 54 57 10				
- III	Flores Island: Light-house	34 56 55	$55 \ 55 \ 04$				
5	Montevideo: Cathedral, SE. tower	34 54 33	56 12 15	2 00	8 12	3.5	$2.3 \\ 2.7$
	Coloma: Light-house	04 20 20	01 02 21	0.50	0.00	4.0	2.1
	Martin Garcia Island: Light-house	34 10 50	58 15 40		10.15		
	Buenos Ayres: Cupola of custom-nouse	34 36 30 34 54 30	58 22 14 57 54 15	6 43	12 15	2.1	1.4
Bu	Indio Point: Light-house	35 15 45	$57 \ 10 \ 45$				
- HE	Piedras Point: Extreme.	35 26 50	57 05 28	0.50	9.95	5.9	9 5
di la	Madanas Point: Light-house	$36 \ 18 \ 24$ $36 \ 53 \ 00$	$56 \ 38 \ 54$	9.90	5 50	0.3	3. 9
4	Cape Corrientes: E. summit	38 05 30	57 30 01				
	Port Belgrano: Anchor-Stock Hill	38 57 00 38 13 50	$61 59 15 \\ 62 15 97$	6 00	0 00	15.8	8.2
	mgonuna. roit	00 40 00	02 10 21				

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MARITIME POSITIONS AND TIDAL DATA.

NORTH AND EAST COASTS OF SOUTH AMERICA-Continued.

st.				Lun.	Int.	Rŧ	inge.
Coar	Place.	Lat. S.	Long. W.	H. W.	L.W.	Spg.	Neap.
. Argentina.	Labyrinth Head: Summit Union Bay: Indian Head San Blas Harbor: SW. end of Hog Islet San Blas Bay: Summit of Rubia Pt Bermeja Head: E. summit Port San Antonio: Point Villarino San Antonio Sierra: Summit Port San José: San Quiroga Pt Delgado Point: SE. cliff Cracker Bay: Anchorage Port Madryn: Anchorage off cave bluff Chupat River: Entrance Port St. Elena: St. Elena pen Leones Island: SE. summit Port Malaspina: S. pt Cape Three Points: NE. pitch Port San Julian: Sholl Pt Port San Julian: Sholl Pt Port San Julian: Sholl Pt Gallegos River: Observation mound Cape San Diego: Extreme Staten Island, Cape St. John: Lighthouse, W. pt Port Cork: Observation mark, summit Middle pt Good Success Bay: Seide of beach	$\begin{array}{c} \circ & \ \ \ \ \ \ \ \ \ \ \ \ \ \ \ \ \ \$	$\begin{array}{c} \circ & , & "\\ 62 & 03 & 22\\ 62 & 07 & 46\\ 62 & 09 & 30\\ 62 & 10 & 12\\ 62 & 45 & 11\\ 63 & 08 & 16\\ 64 & 54 & 41\\ 65 & 12 & 29\\ 64 & 27 & 56\\ 63 & 37 & 16\\ 64 & 28 & 20\\ 65 & 03 & 36\\ 65 & 22 & 10\\ 65 & 53 & 01\\ 65 & 52 & 30\\ 66 & 32 & 36\\ 65 & 51 & 46\\ 65 & 53 & 46\\ 65 & 54 & 45\\ 65 & 45 & 40\\ 67 & 42 & 30\\ 68 & 23 & 00\\ 69 & 09 & 47\\ 69 & 00 & 31\\ 68 & 22 & 12\\ 65 & 05 & 53\\ 63 & 47 & 00\\ 64 & 03 & 00\\ 64 & 45 & 45\\ 65 & 13 & 48\\ \end{array}$	h. m. h. m. 10 50 10 35 7 05 3 50 0 00 10 35 9 20 9 00 8 40 8 18 4 20 4 19	$\begin{array}{c} 2.4.4.2\\ h. m.\\ \hline \\ 1.4.38\\ \hline \\ 4.23\\ \hline \\ 1.4.23\\ \hline \\ 0.52\\ \hline \\ 10.03\\ \hline \\ 10.03\\ \hline \\ 6.12\\ \hline \\ 4.23\\ \hline \\ 3.08\\ 2.47\\ 2.28\\ 2.06\\ 10.33\\ \hline \\ 10.32\\ \hline \\ 10.32\\ \hline \end{array}$	<i>ft.</i> <i>ft.</i> <i>14. 7</i> <i>23. 5</i> <i>13. 2</i> <i>16. 8</i> <i>18. 3</i> <i>29. 5</i> <i>39. 6</i> <i>40. 0</i> <i>45. 6</i> <i>40. 0</i> <i>45. 6</i> <i>38. 7</i> <i>9. 9</i> <i>7. 8</i> <i></i>	<i>ft.</i> <i>ft.</i> <i>7.7</i> <i>12.3</i> <i></i> <i>6.9</i> <i></i> <i>9.6</i> <i></i> <i>9.6</i> <i></i> <i>9.6</i> <i></i> <i>9.2.9</i> <i>20.2</i> <i>5.2</i> <i>6.0</i>
Chile.	Lennox Cove: Bluff, N. end of beach Goree Road: Guanaco Pt Wollaston Island: Middle Cove Barneveldt Islands: Center Cape Horn: South sunmit, 500 ft Hermite Island: St. Martin Cove	$\begin{array}{cccccccccccccccccccccccccccccccccccc$	$\begin{array}{cccccccccccccccccccccccccccccccccccc$	3 50 4 07	10 03 10 02	6.7 	5.2

WEST COAST OF SOUTH AMERICA.

							1
	False Cape Horn: S. extreme	$55 \ 43 \ 15$	68 04 40				
	Ildefonso Island: Highest summit	$55 \ 52 \ 30$	69 17 30				
	Diego Ramirez Island: Highest summit.	$56 \ 28 \ 50$	$68 \ 41 \ 30$	-3 50	10 03	5.0	3.9
	York Minster Rock: Summit, 800 ft	$55 \ 24 \ 50$	$70 \ 01 \ 30$				
	Cape Desolation: S. summit	54 45 40	$71 \ 36 \ 10$				
	Mount Skyring: Summit, 3,000 ft	54 24 48	$72 \ 10 \ 20$				
	Noir Island: SE. extreme	$54 \ 30' \ 00$	73 00 00	2 20	8 33	4.8	3.7
	Landfall Island: Summit of Cape Inman.	$53 \ 18 \ 30$	74 18 15	1 50	8 03	4.7	3.7
ile.	Cape Deseado: Peaked summit	52 55 30	74 36 30				
	Apostle Rocks: W. rocks	$52 \ 46 \ 15$	$74 \ 46 \ 50$				
5	Cape Pillar: N. cliff	$52 \ 42 \ 50$	74 42 20	0 32	6 45	4.0	3.1
•	Dungeness Point: Light-house	$52 \ 23 \ 55$	$68 \ 25 \ 45$	8 19	2 07	39.4	20.6
	Cape Espiritu Santo: NE. cliff	$52 \ 39 \ 00$	68 34 00	8 20	$2 \ 08$	39.0	20.4
	Catharine Point: NE. extreme	$52 \ 32 \ 00$	$68 \ 45 \ 20$	8 24	$2 \ 12$	30.0	15.7
	Cape Possession: Light-house	$52 \ 17 \ 54$	68 57 10	8 35	2 25	39.0	20.4
	Cape Orange: N. extreme	$52 \ 28 \ 40$	$69 \ 24 \ 00$				
	Delgada Point: Light-house	$52 \ 28 \ 00$	69 33 00	8 47	2 40	39.0	20.4
	Cape Gregory: Light-house	$52 \ 38 \ 18$	70 14 16	9 23	3 20	21.0	11.0
	Cape San Vicente: W. extreme	$52 \ 46 \ 20$	$70 \ 25 \ 25$				

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APPENDIX IV.

MARITIME POSITIONS AND TIDAL DATA.

st.	711	T 0	T	Lun.	Int.	Re	inge.
Pog	Place.	Lat. S.	Long. w.	HW	TW	Spa	Noon
				11. 11.	1. 11.	opg.	Meap.
		0 / 11	0 1 11	,	T		
	Elizabeth Island, NE bluff	59 40 10	70 97 51	n. m.	n. m.	Jt.	jt.
	Elizabeth Island: NE. bluit	02 49 18 50 10 10	70 57 51	10 24	4 24	8.0	4.2
	Sandy Point: Light-house	53 10 10	70 54 24	11 03	5 03	5.0	2.6
	Cape St. Valentine: Summit, at extreme.	53 33 30	70 34 27				
	Port Famine: Observatory	$53 \ 38 \ 12$	$70 \ 58 \ 31$	11 58	5 58	6.0	3.1
	Cape San Isidro: Extreme	$53 \ 47 \ 00$	70 55 03	$12 \ 21$	621	8.0	4.2
	Cape Froward: Summit of bluff	53 53 43	71 17 15	0.28	6 53	7.0	3 7
	Mount Pond Summit	53 51 45	71 55 30	0 -0	0 00		0.1
	Port Gallant: Wigwam Pt	53 41 45	71 59 41	1 90	7 40	8.0	1.9
	Charles Island, White real year NW and	59 19 57	71 00 41	1 40	1 40	0.0	4.4
	Durantes Island: White rock hear NW. end	00 40 07	72 04 40			•••••	
	Rupert Island: Summit	53 42 00	72 10 42				
	Mussel Bay: Entrance	$53 \ 37 \ 10$	72 19 30				
	Tilly Bay: Sarah I	53 34 20	$72 \ 27 \ 10$				
	Borja Bay: Bluff on W. shore	$53 \ 31 \ 45$	$72 \ 34 \ 15$	154	8 11	5.5	2.9
	Cape Quad: Extreme	$53 \ 32 \ 10$	72 32 25				
	Barcelo Bay: Entrance	53 30 50	72 38 00				
-	Swallow Bay. Shag I	53 30 05	$72 \ 47 \ 30$	1 53	8 08	5.0	3.0
	Cano Noteh: Extreme	53 25 00	79 47 55	1 00	0.00	0.0	0.0
	Plana Parda Coros Summit of Shalton I	59 10 45	72 00 20	1 91	7 14	4 5	0.5
	Tiaya Farda Cove: Summit of Shefter 1	03 18 40		1 31	1 44	4.5	3.5
	Pollard Cove: Entrance	53 15 30	73 12 05				
	Port Angosto: Hay Pt	53 13 40	73 21 30	1 09	7 21	4.0	3.1
	St. Anne Island: Central summit	53 06 30	$73 \ 15 \ 30$				
	Half Port Bay: Point	$53 \ 11 \ 40$	$73 \ 17 \ 45$				
	Upright Port: Entrance	$53 \ 06 \ 35$	$73 \ 16 \ 15$				
	Port Tamar: Mouat Islet	52 55 46	73 44 28	0.55	7 07	6.0	4.6
	Port Churruea: Summit of Blanca Pep	53 01 00	73 59 33	0.00		0.0	
	Valentine Harbor: Observation mount	52 55 00	74 17 15				
	Cano Dankon, W summit	52 55 00	71 19 90				
	Cape Farker: w. summit	52 42 00	74 13 30		••••		
	Mercy Harbor: Summit of Battle 1	52 44 58	74 38 14				
	Mayne Harbor: Observation spot	$51 \ 18 \ 29$	74 04 00				
••	Port Grappler: Observation spot	49 25 19	74 17 39				
3	Port Riofrio: Vitalia I	49 12 40	74 23 27				
5	Eden Harbor: Observation spot	49 07 30	74 25 10				
•	Halt Bay: Observation islet	48 54 20	74 20 55				
	Westminster Hall Islet: E summit	59 37 18	74 23 10				
	Evengelistes Islandt) ight house	59 91 00	75 00 00	0.55	7 00		9.4
	Cons With my Technology	52 24 00	75 00 00	0.99	108	4.4	5.4
	Cape Victory: Extreme	52 16 10	74 55 00	• • • • • • • • •			
	Cape Isabel: W. extreme	51 51 50	75 13 20				
	Cape Santiago: Summit	$50 \ 42 \ 00$	75 27 45				
	Molyneux Sound: Romalo I	$50 \ 17 \ 20$	74 51 30				
	Cape Tres Puntas: Summit, 2,000 ft	50 02 00	$75 \ 22 \ 00$				
'	Port Henry: Observation spot	$50 \ 00 \ 18$	75 13 20	0 30	6 45	4.5	3.5
	Mount Corso: SW. summit	49 48 00	75 34 00				
	Rock of Dundee Summit	48 06 15	75 40 30				
	Santa Barbara Port: N extreme obs. nt	48 02 20	75 28 20	0.15	6.20	5.2	JI
	Guginago Islande: Snoodwall Bay bill	10 02 20	10 20 20	0.10	0.00	0.0	7.1
	NE of	17 20 20	75 10 00			1	
	Dent Otres Observe t	47 59 30	75 10 00				
	Fort Otway: Observation spot	46 49 31	75 18 20	0.10	6 25	5.3	4.1
	Cape Tres Montes: Extreme	46 58 57	$75 \ 25 \ 30$				
	Cape Raper: Rock close to cape	$46 \ 49 \ 10$	$75 \ 37 \ 55$				
	Christmas Cove: SE. extreme	$46 \ 35 \ 00$	$75 \ 31 \ 30$				
	Hellver Rocks: Middle	46 04 00	$75 \ 12 \ 00$				
	Cape Taytao: W. extreme	45 53 20	75 06 00	0.00	6 13	4.4	3.4
	Socorro Island: S extreme	14 55 50	75 08 15	0.00	0.10		0.1
	Mayne Mountain: Summit 9 000 ft	4.1 00 00	74 07 45				
	Port Low: Observation islot	12 10 20	79 50 95	19 90	6 10	6.9	10
	Huefe Island, S. antoni Islet	40 40 00	73 09 30	12 20	0 10	0.2	4.0
	Dent Cap Deduce Ca	43 41 80	74 42 00	12 10	0.00	0.1	5.1
	Fort San Fedro: Cove on S. shore	43 19 35	73 41 50				
	Cape Quilan: SW. extreme	43 17 10	74 22 00				
	Corcovado Volcano: Summit, 7,510 ft	$43 \ 11 \ 20$	72 44 40				
	Minchinmadiva Volcano: S. summit.						
	8,000 feet	42 48 00	72 30 30				
	Castro: E. end of town	42 27 45	73 45 20	0 01	6 21	18.0	9.1

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MARITIME POSITIONS AND TIDAL DATA.

št.				Lun	Int.	Ra	ange.
Coas	Place.	Lat. S.	Long. W.	H. W.	L. W.	Spg.	Neap.
Coast.	Place. Dalcahue: Chapel Oscuro head: Observation pt Coman Inlet: Olvidada I Port Calbuco: La Picuta San Carlos de Ancud: Light-house Condor Cove: Landing. Ranu Cove: Anchorage Muilcalpue Cove: Landing place Milagro Cove: Landing place Laruehuapi Cove: Landing place Lebu River: Tucapel Head Yañez Port: Anchorage Lebu River: Tucapel Head Santa Maria Island: Light-house Light on Quinquina I Lico: Village Port San Antonio: Village Aconcagua Mountain: Summit Santiago: Observatory Valparaiso: Playa Ancha Pt. light	Lat. 8. $ \begin{array}{ccccccccccccccccccccccccccccccccccc$	Long. W. 73 36 00 73 25 00 72 45 00 73 07 15 73 52 54 73 51 00 73 49 50 73 49 50 73 45 20 73 45 20 73 45 20 73 41 50 73 26 25 73 14 00 73 58 06 73 39 55 73 40 00 73 11 13 73 22 30 73 02 49 72 06 12 71 38 00 70 41 32 71 38 52	Lun. H. W. h. m. 1 10 0 04 0 00 10 25 10 18 10 20 10 15 10 10 10 05 9 57 9 44 9 37	$\begin{array}{c c} \text{Int.} \\ \hline L. W. \\ \hline h. m. \\ \hline \\ \hline \\ 7 & 35 \\ 6 & 20 \\ \hline \\ \hline \\ 6 & 13 \\ 4 & 13 \\ 4 & 05 \\ 5 & 07 \\ 4 & 02 \\ 3 & 55 \\ 3 & 50 \\ 3 & 55 \\ 3 & 50 \\ 3 & 55 \\ 3 & 51 \\ 3 & 53 \\ 3 & 48 \\ 3 & 34 \\ \hline \\ \hline \\ 3 & 26 \\ \end{array}$	Ra Spg. <i>ft.</i> 14. 8 5. 9 7. 2 5. 6 4. 9 3. 3 4. 9 5. 3 4. 9 5. 3 4. 9 5. 3 4. 1 4. 0	Inge. Neap. ft. 7.5 3.0
Chile.	Site of Fort San Antonio Quintero Point: Summit	$\begin{array}{cccccccccccccccccccccccccccccccccccc$	$\begin{array}{cccccccccccccccccccccccccccccccccccc$	9 35 9 30 9 26 9 15 8 58 8 23 8 50 8 21 8 50 9 00 9 05 9 10	$\begin{array}{c} 3 & 25 \\ 3 & 20 \\ 3 & 16 \\ \\ \\ \\ \\ \\ \\ \\ \\ \\ \\ \\ \\ \\ \\ \\ \\ \\ $	$\begin{array}{c} 4.1\\ 3.9\\ 4.2\\ \\ \\ \\ \\ \\ \\ \\ \\ \\ \\ \\ \\ \\ \\ \\ \\ \\ \\ $	$\begin{array}{c} 2.1\\ 2.0\\ 2.1\\ \\ \\ \\ \\ 2.1\\ \\ \\ \\ \\ \\ \\ \\ \\ \\ \\ \\ \\ \\ \\ \\ \\ \\ \\ $
-	Port Taltal: Light-house Grande Point: Outer summit Paposo Road: Huanillo Pt Reyes Head: Extreme pitch Cobre Bay: Pt. W. of village.	$\begin{array}{cccccccccccccccccccccccccccccccccccc$	$\begin{array}{cccccccccccccccccccccccccccccccccccc$	9 20 9 35 9 30	$\begin{array}{ccc} 3 & 07 \\ 3 & 22 \\ 3 & 17 \end{array}$	$4.9 \\ 5.0 \\ 4.9$	$2.5 \\ 2.5 \\ 2.5 \\ 2.5 \\ $
_	Jara Head: Summit Antofagasta: Light-house Chimba Bay: E. pt. of large island	$\begin{array}{cccccccccccccccccccccccccccccccccccc$	$\begin{array}{c} 70 & 32 & 28 \\ 70 & 25 & 18 \\ 70 & 26 & 55 \end{array}$	9 05	2 52	4.7	2.4

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APPENDIX IV.

MARITIME POSITIONS AND TIDAL DATA.

tst.	Place.	Lot S	Long W	Lun. Int.		R	Range.	
Cog		Lat. S.	Long. w.	H. W.	L. W.	Spg.	Neap.	
е.	Moreno Mountain: Summit Constitution Cove: Shingle pt. of island. Mexillones Mount: Summit Port Cobija: Landing place Tocopilla: Extremity Point San Francisco Head: W. pitch Loa River: Mouth Lobos Point: Outward pitch	o / " 23 28 30 23 26 42 23 06 30 22 34 00 22 06 00 21 55 50 21 28 00 21 05 30	$\begin{array}{c} \circ & \prime & '' \\ 70 & 34 & 56 \\ 70 & 37 & 11 \\ 70 & 31 & 39 \\ 70 & 17 & 42 \\ 70 & 13 & 40 \\ 70 & 11 & 17 \\ 70 & 02 & 45 \\ 70 & 12 & 12 \\ 7$	h. m. 9 35 9 44 8 55 9 00	h. m. 3 22 3 31 2 42 	<i>ft.</i> 3.9 4.0 4.8 	<i>ft.</i> 2.0 2.0 2.4 2.5	
Chi	Pabellon de Pica: Summit Patache Point: Extreme Iquique: Light-house Mexillon Bay: Landing place Pisagua: Pichalo Pt., extreme Gorda Point: W. low extreme Lobos Point: Summit Arica: Iron church	$\begin{array}{cccccccccccccccccccccccccccccccccccc$	$\begin{array}{cccccccccccccccccccccccccccccccccccc$	8 35 8 32 7 49	$ \begin{array}{c} 2 & 22 \\ 2 & 20 \\ \hline 1 & 37 \end{array} $	5. 0 5. 0 5. 6	2.5 2.5 2.8	
Peru.	Schama Mount: Highest summit Coles Point: Extreme. Ilo: Mouth of rivulet Port Mollendo: Light-house Islay: Custom-house. Quilca: W. head of cove Pescadores Point: SW. extreme Atico: E. cove Chala Point: Extreme Lomas: Flagstaff on pt San Juan Port: Needle Hummock Nasca Point: Summit Mesa de Doña Maria: Central summit. Carreta Mount: Summit Carreta Mount: Summit Paraca Bay: N. extreme of W. pt Pisco: Light-house Chincha Islands: Boat slip, E. side N. id. Frayles Point: Extreme. Asia Rock: Summit. San Lorenzo Island: Light-house Callao: Palominos Rock Light. Pescadores Islands: Summit of largest. Pelado Island: Summit Supé: W. end of village Huarmey: W. end of sandy beach Colina Redonda: Summit Samanco Bay: Cross Pt Chino Islet: Center. Guanape Islands: Summit of highest Huarney: W. end of sandy beach Colina Redonda: Summit of highest. Huarney: W. end of sandy beach Colina Redond	$\begin{array}{cccccccccccccccccccccccccccccccccccc$	$\begin{array}{cccccccccccccccccccccccccccccccccccc$	7 55 7 39 6 47 6 16 5 47 5 08 4 50 4 19 4 04 3 20	1 43 1 27 0 35 0 35 0 04 12 00 12 00 11 21 11 03 10 32 10 17 9 33	5.3 6.2 3.9 3.9 3.8 3.8 3.5 2.1 2.0 2.0 2.1 2.5 3.5	2.7 3.1 2.0 1.9 1.8 1.1 1.0 1.1 1.3 1.8	
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MARITIME POSITIONS AND TIDAL DATA.

WEST COAST OF SOUTH AMERICA-Continued.

st.	Place	Tat 9	Long W	Lun.	Int.	Ra	ange.
Coa	FIACe.	Lat. 5.	Long. w.	н. w.	L. W.	Spg.	Neap.
	Guayaquil River: Light on Santa Clara I. Guayaquil, Concejo: S. pt. of city Puna: Mandinga Pt. light Point Santa Elenge: Veintemilla light	$ \begin{smallmatrix} \circ & i & i' \\ 3 & 10 & 40 \\ 2 & 12 & 24 \\ 2 & 44 & 30 \\ 2 & 12 & 00 \\ \end{split} $	80 25 29 79 52 19 79 53 45 80 59 00	$^{h.}$ $^{m}_{4}$ $^{00}_{7}$ $^{7}_{00}$	h, m. 10 13 1 00 9 13	$\begin{array}{c} ft.\\ 10.0\\ 11.0\\ \hline 7.9\end{array}$	$\begin{array}{c} ft. \\ 5.1 \\ 5.6 \\ \hline 4.0 \end{array}$
Ecuador	Plata Isle: E. pt. Cape San Lorenzo: Marlingspike Rock. Manta Bay: Light-house Caraques Bay: Punta Playa Cape Pasado: Extreme.	$\begin{array}{c}1&16&55\\1&03&30\\0&56&50\\0&35&25\\0&21&30\end{array}$	$\begin{array}{c} 81 & 03 & 55 \\ 80 & 55 & 55 \\ 80 & 42 & 50 \\ 80 & 25 & 24 \\ 80 & 30 & 37 \end{array}$	3 10 3 15	9 23 9 28	7.5	3.8
	Point Galera: N. extreme Cape San Francisco: SW. extreme	Lat. N. 0 50 10 0 40 00	$\begin{array}{cccccccccccccccccccccccccccccccccccc$				
Colombia.	Esmeralda River: Light-house Mangles Point: S. pt. of creek entrance Tumaco: S. pt. of El Morro I Guascama Point: Extreme Gorgona Island: Watering Bay Buenaventura: Basan Pt Chirambiri Point: N. extreme Cape Corrientes: SW. extreme Cupica Bay: Entrance to Cupica River Cape Marzo: SE. extreme Isla del Rey: Extreme of Cocos Pt Darien Harbor: Graham Pt Flamenco Island: N. Pt Chepillo Island: Center Point Chamé: Extreme	$\begin{array}{cccccccccccccccccccccccccccccccccccc$	$\begin{array}{cccccccccccccccccccccccccccccccccccc$	3 35 6 00 3 40 3 30 3 00 3 05 3 30	9 48 12 13 9 53 9 43 9 13 9 18 9 42	13. 2 13. 2 13. 1 13. 3 15. 7 16. 0 15. 0	7.1 7.1 7.0 7.2 8.5 8.5 8.7 8.1

ISLANDS IN THE ATLANTIC OCEAN.

	and the second								
	Færoe Islands, Strom Islet: Thorshaven Fort flagstaff Halderoig Islet: Halde- roig Church Numken Rock Rockall Islet: Summit, 70 feet	$\begin{array}{cccccccccccccccccccccccccccccccccccc$	2 26 8 20 3 00 5 52	$\begin{array}{c} 6 & 43 \\ 7 & 00 \\ 6 & 45 \\ 13 & 42 \end{array}$	08 36 30 21				
Azores Islands.	Corvo Island: S. pt Flores Island: Santa Cruz Fort Fayal Channel: N. Magdalen Rock Fayal Island, Horta: Castle of Santa Cruz. Caldera: summit 3,351 ft Pico Island: Summit St. George Island: Light-house Graciosa Island: Santo Fort light Terceira Island: Monte del Brazil, near Angra St. Michael Island: Custom-house, Ponta Delgada. Pt. Arnel light Santa Maria Island: Villa do Porto light.	39 40 39 2 38 3 38 3 38 3 38 40 38 0 38 3 37 4 36 50 37 10	$\begin{array}{c} 0 & 07 \\ 7 & 00 \\ 2 & 09 \\ 1 & 45 \\ 4 & 30 \\ 5 & 00 \\ 0 & 30 \\ 5 & 24 \\ 8 & 20 \\ 4 & 16 \\ 9 & 20 \\ 3 & 00 \\ 3 & 44 \end{array}$	$\begin{array}{cccccccccccccccccccccccccccccccccccc$	$\begin{array}{c} 00\\ 49\\ 00\\ 39\\ 00\\ 12\\ 00\\ 45\\ 45\\ 45\\ 40\\ 21\\ 00\\ 06\\ \end{array}$	11 30 0 20 0 15	5 18 6 32 6 27	3.9 4.4 	1. 8 2. 0
Madelra Is.	Porto Santo Island: Light-house Desertas: Chao I., Sail Rock Madeira Island: Funchal light Fora I. light-house Pico Ruivo, summit 6,056 ft Pargo (W.) Pt	$\begin{array}{cccccccccccccccccccccccccccccccccccc$	$\begin{array}{c} 3 & 15 \\ 5 & 45 \\ 7 & 42 \\ 3 & 14 \\ 5 & 00 \\ 8 & 07 \end{array}$	$\begin{array}{c} 16 & 16 \\ 16 & 33 \\ 16 & 55 \\ 16 & 39 \\ 16 & 57 \\ 17 & 16 \end{array}$	$20 \\ 30 \\ 16 \\ 31 \\ 30 \\ 05$	0 40	6 52 6 47	6. 6 6. 6	3. 0 3. 0

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APPENDIX IV.

MARITIME POSITIONS AND TIDAL DATA.

ISLANDS IN THE ATLANTIC OCEAN-Continued.

st.				Lun. Int.		Range.	
COB	Place.	Lat. N.	Long. W.	H. W.	L. W.	Spg.	Neap.
	Gebrer Lie de dicht heure Gren Sal	0 / //	0 / //	h. m.	h. m.	ft.	ft.
	vage I	30 08 00	15 54 00				
Canary Islands.	Alegranza Island: Delgada Pt. light Lanzarote Island: Port Naos light Pechinguera Pt. light Fuerta Ventura Island: Jandia Pt. light Gran Canaria: Isleta Pt. light Palmas light Teneriffe Island: Anga Pt. light Santa Cruz, Br. con- sulate Summit of peak, 12, 180 ft Gomera Island: Port Gomera	$\begin{array}{cccccccccccccccccccccccccccccccccccc$	$\begin{array}{cccccccccccccccccccccccccccccccccccc$	0 50	7 00 6 50 7 27	8.5 9.3 7.8	3.9 4.3 3.6
	Ferro Island: Port Hierro Palma Island: Light NE nt	$\begin{array}{cccccccccccccccccccccccccccccccccccc$	$17 54 22 \\ 17 47 01$	0.20	6.30	8.6	4 0
Bernu- da Is. Cape Verde Islands.	San Antonio Island: Eugli, NED pt Summit, 7,400 ft St. Vincent Island: Porto Grande light St. Lucia Island: N. pt Raza Island: E. pt St. Nicholas Island: Light-house Sal Island: N. pt. light S. pt Boavista Island: NW. pt Light-house Mayo Island: English Road St. Jago Island: Reta Pt. light Fogo Island: N. S. da Luz, village Brava Island: Light-house Ireland Island: Dock yard clock tower Bastion C Hamilton Island: Light-house	$\begin{array}{cccccccccccccccccccccccccccccccccccc$	$\begin{array}{cccccccccccccccccccccccccccccccccccc$	5 50 7 30 5 50 5 50 7 04	12 00 1 20 1 20 1 20 1 20 1 20 0 52	3.3 4.4 4.8 4.0	1. 5 1. 5 2. 0 2. 2 2. 6
· · · ·	St. Paul Rocks: Summit, 64 ft Rocas Reef: NW. sandy islet Fernando Noronha: The Pyramid Ascension Island: Fort Thornton St. Helena Island: Obs. Ladder Hill Martin Vaz Rocks: Largest islet Trinidad Island: SE. pt Inaccessible Island: Center Tristan d'Acunha Islands: NW. pt Gough Island: Penguin Islet	0 55 30 Lat. S. 3 51 30 7 55 20 20 27 42 20 30 32 37 19 00 37 02 48 40 19 11	$\begin{array}{cccccccccccccccccccccccccccccccccccc$	5 05 5 00 5 20 3 00 3 35 3 40 12 50	$ \begin{array}{c} 11 & 18 \\ 11 & 13 \\ 11 & 30 \\ 9 & 10 \\ 9 & 48 \\ 9 & 53 \\ \hline 5 & 40 \\ \end{array} $	$10.0 \\ 6.0 \\ 2.0 \\ 2.8 \\ 3.5 \\ 4.0 \\ 5.2$	$ \begin{array}{c} 4.6\\2.7\\0.9\\1.3\\1.6\\1.8\\\\\hline\\2.4\end{array} $
Falkland Islands.	Port Egmont: Observation spot Mare Harbor: Observation spot Port Louis: Flagstaff, govt. house Port Stanley: Governor's house Cape Pembroke: Light-house South Georgia Island: N. cape Shag Rocks: Center Sandwich Islands: S. Thulé Traverse I. volcano	$\begin{array}{cccccccccccccccccccccccccccccccccccc$	$\begin{array}{cccccccccccccccccccccccccccccccccccc$	7 20	1 08	10.7	5.6

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MARITIME POSITIONS AND TIDAL DATA.

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ISLANDS IN THE ATLANTIC OCEAN-Continued.

st.	Place.		Tot C Long W		Lun. Int.			Range.					
Coa	Frace.	1	Lat. S. Long W.		н.	w.	L. \	v.	Spg.	Neap.			
		0	1	"	0	,	"	h.	m.	h.	<i>m</i> .	ft.	ft.
•	New S. Orkney Is.: E. pt. Laurie I	60	54	00	44	25	00		• • • •		• • •		
	tion I., 5,397 ft	60	46	00	45	53	00						
	New S. Shetland Islands, Deception	69	55	26	80	25	00						
	Island. 1 off Postel	02	00	00		ากฐ	E						
*	Bouvets Island (Circumcision): Center	54	16	00	$\tilde{6}$	14	00						

ATLANTIC COAST OF EUROPE.

			-					1
	Greenwich: Observatory	Lat. N. 51 28 38	Long. W. 0 00 00	1 10	7 46	18.8	12.6	1
	Oxford: University Observatory	$51 \ 45 \ 34$	$1 \ 15 \ 04$					
	Cambridge: Observatory	$52 \ 12 \ 52$	0 05 40					
			Long. E.					
	North Foreland: Light-house	$51 \ 22 \ 28$	$1 \ 26 \ 48$	11 24	5 53	16.8	8.4	
.	South Foreland: Light-house	$51 \ 08 \ 23$	$1 \ 22 \ 22$	11 09	5 43	19.8	10.0	2
	Dungeness: Light-house	50 54 47	0 58 18	10 35	4 23	21.5	11.0	
	Beachy Head: Light-house	50 44 15	0 13 00	11 10	4 58	19.8	10.1	Ļ
			Long, W.					
	Southsea Castle: Light-house	50 46 35	$1 \ 05 \ 15$					
	Portsmouth: Observatory	$50 \ 48 \ 03$	1 05 58	11 31	4 19	13.2	6.7	
	Southampton: Royal Pier light	50 53 45	$1 \ 24 \ 00$	0 35	6 48	12.8	6.5	
	Hurst Castle: W. light.	50 42 07	1 33 04	11 05	4 53	12.2	6.2	
	Needles Rocks: Old light-house	50 39 42	1 35 25					
[St. Catharine: New light-house	50 34 30 50 91 10	11747	e 90			1.0	
	Start Point: Light house	50 51 10 50 12 18	2 21 30	5 25	11 22	0.7	1.0	
	Plymouth: Brookwater light	50 13 18 50 20 02	4 09 27	5 20	11 30	15.9	0.8	
	Eddystone: Light-house	$50 \ 10 \ 49$	4 15 53	0 20	11 00	10.0	1.0	
	Falmouth: St. Anthony Pt. light	50 08 30	5 01 00					
2 -	Lizard Point: W. light-house	49 57 40	$5 \ 12 \ 06$	4 45	10 58	14.2	6.5	
	Porthcurnow: SE. cor. telegraph co.'s sta.	$50 \ 02 \ 44$	$5 \ 39 \ 18$					
	Lands End: Longships light-house	$50 \ 04 \ 10$	$5 \ 44 \ 45$					e.
	Scilly Ilands: St. Agnes light-house	49 53 33	$6\ 20\ 38$	4 15	10 28	15.9	7.3	
-	Trevose Head: Light-house	50 33 00	$5 \ 01 \ 55$					6
5	Bideford: High light-house	51 04 00	4 12 30	5 45	11 58	22.7	11.4	1
5	Lundy Island: Light-house, N. pt	51 12 05	4 40 35	5 00	11 13	26.9	13.5	
	Cardiff: Light house W pier	$\begin{array}{c} 01 & 27 & 24 \\ 51 & 97 & 48 \end{array}$	2 30 00 3 00 49	6 45	0 48	31.3	10.7	
	Swanses: Light-house, W. pier	51 27 40 51 26 50	3 09 42	5 45	11 59	00.2 97 1	10.1	
	Caldy Island. Light-house	$51 \ 37 \ 52$	4 40 59	5 40	11 53	27.1	19.0	
	St. Anns: Upper light-house	$51 \ 41 \ 00$	5 10 30	5 41	11 54	24.0	12.0	
	Smalls Rocks: Light-house	51 43 15	5 40 15	5 40	11 53	20.9	10.5	
	Aberystwith: Light-house	$52 \ 24 \ 20$	$4 \ 05 \ 40$	7 25	1 13	14.2	7.1	
	Bardsey Island: Light-house	$52 \ 45 \ 00$	4 47 50	7 24	1 12	14.9	7.5	
	South Stack: Light-house on rocks	$53 \ 18 \ 30$	$4 \ 42 \ 00$					
	Holyhead: Light-house on old pier	53 18 54	4 37 01	10 00	3 48	15.8	7.9	
	Skerries Rocks: Light-house, nighest 1	53 25 15	4 36 20		••••	· · · • • •		
- 1	Liverpool: Rock light	$\begin{array}{cccccccccccccccccccccccccccccccccccc$	$\begin{array}{c} 5 & 10 & 42 \\ 2 & 02 & 97 \end{array}$					
	Observatory	53 20 50 53 24 04	3 04 16	11 08	5 97	27 6	14 0	
	Morecambe Bay: Fleetwood high light	53 55 03	3 00 20	11 00	4 48	27 4	13.9	
	Calf of Man: Upper light-house	$54 \ 03 \ 14$	4 49 37		1 10		10.0	
	Isle of Man: Ayre Pt. light-house	$54 \ 24 \ 56$	4 22 01	10 55	4 43	19.7	10.0	
	St. Bees: Light-house	$54 \ 30 \ 50$	3 37 50					
	White Haven: W. pier-head light	$54 \ 33 \ 00$	$3 \ 36 \ 00$	11 00	4 48	25.9	13.1	
	Mull of Galloway: Light-house	$54 \ 38 \ 10$	4 51 20	11 05	4 53	14.8	8,9	
	Ayr, Firth of Clyde: Light-house, N. side	FF 00 70	1 00 10	11.40		0.77	٢٥	
	Theory Light house inner nice	00 28 10 55 99 55	4 38 10	11 40	ə 28	8.7	5.2	
	rioon: Light-house, inner pier	00 02 00	4 41 00					

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APPENDIX IV.

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MARITIME POSITIONS AND TIDAL DATA.

d Place, Lat. N. Long. W.		inge.
8 H. W. L. V	L. W. Spg.	Neap.
8 1	L. w. Spg. $h.$ $m.$ $fl.$ 5 23 8.8 7 08 11.2 4 08 4.0 11 22 12.8 11 408 4.0 11 22 12.8 11 408 4.0 11 22 13.4 0 22 13.4 0 22 13.4 0 22 13.4 0 22 13.4 0 322 5.2 4 17 6.0 3 47 9.8 6 36 11.2 7 02 11.7 8 88 15.5 33 14.8 9 9 31 14.8 9 33 14.2 10 03 8.8	Neap. ft. 5.3 6.7 2.4 7.7 4.8 5.7 4.2 2.2 2.2 2.2 2.2 2.6 2.7 4.2 6.1 6.4 8.9 7.5 7.4 7.3 7.0 8.8 10.2 3.65 6.6 4.4 5.3 4.6 5.3 6.1 4.6

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MARITIME POSITIONS AND TIDAL DATA. ATLANTIC COAST OF EUROPE—Continued.

1				Lun.	Int.	Re	inge.
1SI	Place	Lat N	Long W				
õ	1 4000		1101101 111	H.W.	L. W	Sng	Nean
9						~18.	reap.
		0 / //	0 / //	h. m.	h. m.	ft.	ft.
	Feragh Island Light-house	53 08 55	9 51 30				
i	Amen Jaland, Light house	52 07 29	0 12 06	4 15	10 99	19 4	
	Afran Island: Light-house	00 07 00	9 42 00	4 10	10 20	15.4	0.4
	Galway: Mutton I. light	$53 \ 15 \ 13$	9 03 10	4 19	10 19	15.1	6.4
	Golam Head: Tower	53 13 46	9 46 03				
	Clane Heads N light house	59 99 50	10 14 01	4 10	10.90	19 0	E 17
	Siyne riead: N. light-house	05 45 08	10 14 01	4 10	10 29	15.2	ə. 7
	Clifden Bay: Gortrumnagh Hill	53 29 47	10 03 54				
	Tully Monutain: Ordnance survey station	53 35 00	10 00 15				
	Inishhoffing I won Head light	59 96 40	10 00 10	4 90	10 99	19 1	5.0
	Inishbolini: Lyon nead light	00 00 40	10 03 40	4 20	10 55	12.1	0.2
	Inishturk Island: Tower	53 42 27	$10 \ 06 \ 41$				
Í	Clew Bay: Inishgort light	$53 \ 49 \ 34$	9 40 12				
	Nownowt: Church	53 53 06	0 39 56				
		50 00 00	0 50 00				
	Clare Island: Light-house	53 49 30	9 59 00				
	Blacksod Point: Light-house	$54 \ 05 \ 45$	10 03 34				
	Fagle Island: W light house	54 17 00	10 05 31				
	Dagle Island. W. light-house	54 10 00	0 50 00		11 00	10 4	
	Broadhaven: Guba Cashel light	$54 \ 16 \ 00$	9 53 00	4 50	11 03	10.4	4.5
	Dounpatrick Head: Ordnance survey						
	station	54 19 36	9 20 41				
	Anglaria Hagel. Onderson and the	54 10 00	0 40 00				
	Anguris Head: Ordnance survey station.	04 10 33	8 46 02				
	Knocknarea: Tumulus	$54 \ 15 \ 30$	8 34 25				
	Sligo Bay: Black Rock light	54 18 00	8 37 00	5 10	11 22	11 4	5 3
	Knooldonos Andrones and stati-	51 00 50	9 40 14	0.10	11 20	11. 1	0.0
	Knocklane: Ordnance survey station	04 20 00	0 40 14				
	Killybegs (Donegal Bay): St. Johns Pt.						
	light	51 31 08	8 27 33	5 03	11 16	11 9	48
	$\mathbf{D}_{\mathbf{r}} \mathbf{A} \mathbf{I}_{\mathbf{r}}^{\mathbf{r}} \mathbf{O} \mathbf{D}_{\mathbf{r}}^{\mathbf{r}} \mathbf{P}_{\mathbf{r}} \mathbf{I}_{\mathbf{r}} \mathbf{A} \mathbf{I}_{\mathbf{r}}^{\mathbf{r}} \mathbf{h} \mathbf{A} \mathbf{h}$	F1 00 47	0 10 50	0.00	11 10	11.0	7.0
	Rathlin O birne Islet: Light-house	04 59 47	8 49 52				
	Aran Island: Rinrawros light	55 00 52	8 33 48				
	Bloody Foreland: Ordnance survey sta-						
	tion	55 00 19	0 15 90				
	tion	55 08 15	0 10 00				
	Tory Island: Light-house	55 16 26	8 15 00				
1	Horn Head: Ordnance survey station	55 12 31	7 57 15				
•	Molmono Head, Tower	55 15 11	7 47 19	5 90	11 /1	11 0	E 9
A	Melmore riead: Tower	00 10 14	1 47 12	0 20	11 41	11.0	0.0
E I	Fanad Point: Light-house	$55 \ 16 \ 33$	7 37 53				
3	Glashedy Island: Ordnance survey station	55 19 07	7 23 51				
EI	Malin Hoad: Tower	55 99 50	7 99 99				
	Mann flead. Tower		7 10 07				
-	Inishtranull: Light-nouse	55 25 55	7 13 37				
8	Inishowen Head: E. light-house	55 13 38	65538				
ž I	Moville: New Pier	55 10 20	7 02 20	6 55	0.43	75	34
ت <u>ت</u>	Landandaman (lathadaa)	54 50 40	7 10 05	7 40	1 05	1.0	0.1
	Londonderry: Cathedrai	64 69 40	7 19 25	1 48	1 30	8.0	3.0
	Scalp Mountain: Ordnance survey station	$55 \ 05 \ 23$	7 21 51				
	Benhaue Head · Summit	55 15 03	6 28 45				
	Pathlin Island: Altacomy light house	55 19 05	6 10 45				
	Ratinin Island. Anacarry light-house	00 10 00	0 10 40				• • • • • • •
	Maiden Rocks: W. light-house	54 55 47	5 44 18	$10 \ 30$	4 18	6.7	4.5
	Lough Larne: Farres Pt. light-house	54 51 07	5 47 21				
	Belfast Bay Light east side	54 40 20	5 49 20	10.49	4 06	9.2	6.3
	Man Islanda Islahahama	54 41 50	F 01 00	10 42	1 00	0.0	0.0
	mew Islands: Light-house	04 41 00	0 31 30				
	Donaghadee: Light-house	$54 \ 38 \ 45$	$5\ 32\ 01$	11 00	4 48	11.1	7.4
	South Rock: Light vessel	54 24 04	5 22 20				
	Dundrum Bay: St. John Pt. light	54 13 30	5 39 30				
	Confinational Lough, Haulbourling D1 14	51 01 10	6 04 47	10 45	4 00	15 0	
i	Caringiora Lough: Haubowime Rk. It	04 01 10	0 04 40	10 45	4 33	19.8	9.2
	Drogheda: Light-house	$53 \ 43 \ 00$	$6\ 15\ 00$	$10 \ 45$	4 33	11.6	6.8
	Rockabill: Light-house	53 35 47	6 00 20				
	Howth Doningula, Bailow light	59 91 10	6 09 00	10 55	4 40	10 7	
	D 11 Ol aney nght	00 21 40	0 05 00	10 55	4 40	12.1	1.0
	Dubin: Observatory	53 23 13	6 20 30				
	N. wall light	53 20 47	6 13 33				
	Poolbeg: Light-house	53 20 30	6 09 00	11 00	4.49	13.0	7.6
- 1	Toolbeg. Light-house	50 20 00	0 05 00	11 00	4 40	10.0	7.0
	Kingstown: E. pier light	03 18 10	6 07 30	10 52	4 27	10.9	0.4
	Killiney Hill: Mapas obelisk	$53 \ 15 \ 52$	6 06 37				
	Bray Head: Ordnance survey station	53 10 39	6 04 55	10.30	4 18	11.8	6.9
	Wieklow Honor light	59 57 24	6 00 00	10 10	9 50	0.7	5 1
	wicklow: Opper light	02 01 04	0 00 08	10 10	5 58	0.7	9.1
	Tara Hill: Summit	$52 \ 41 \ 55$	6 13 01				
	Black Stairs Mountain: Ordnance survey						
	station	59 39 55	6 48 17				
	Tom Hill, Ordnange and the	50 00 00	7 07 01				
	Tory rim: Ordnance survey station	52 20 53	1 07 31				
	Wexford: College	$52 \ 20 \ 04$	$6\ 28\ 15$	7 05	0 53	4.9	2.9
	Forth Mount: Ordnance survey station	52 18 57	$6\ 33\ 41$				
	Tuskar Rock: Light-house	52 12 09	6 12 35	5 30	11 43	8.8	5 1
	Great Saltee: S end	52 06 41	6 37 15	0.00			J. 1
	Waterford, Hoop Dt 1:-L4	52 00 41	0 01 10	E 05	11 10	10 0	
	waterioru: moop rt. light	02 07 20	0 00 03	0 00	11 18	12.0	0.2

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APPENDIX IV.

MARITIME POSITIONS AND TIDAL DATA.

				Lun	mt.	R	ange.
Coa	Place.	Lat. N.	Long. W.	H. W.	L. W.	Spg.	Neap.
	Waterford: Cathedral Great Newton Head: Metal Man Tower. Dungarvan: Ballinacourty light Knockmealdown Wount: Ordnance sur.	$ \begin{smallmatrix} \circ & i & '' \\ 52 & 15 & 33 \\ 52 & 08 & 13 \\ 52 & 04 & 27 \\ \end{smallmatrix} $	$ \begin{smallmatrix} \circ & \prime & '' \\ 7 & 06 & 24 \\ 7 & 10 & 15 \\ 7 & 33 & 05 \\ \end{smallmatrix} $	h. m. 5 00	h. m. 11 13	ft. 12.4	<i>ft.</i> 6. 2
Great Britain.	Knockmealdown Mount: Ordnance sur- vey station Helvick Head: Ordnance survey station. Mine Head: Light-house Capel Island: Tower Ballycottin: Light-house Cork Harbor: Haulbowline Coal Wharf. Queenstown: Roches Pt. light Kinsale: Light-house, S. pt Seven Heads: Tower Galley Head: Light on summit Stag Rocks: Largest Alderney Harbor: Old pier light St. Heliers: Light on Victoria Pier Vardo: Fortress	$\begin{array}{cccccccccccccccccccccccccccccccccccc$	$\begin{array}{cccccccccccccccccccccccccccccccccccc$	$ \begin{array}{c} & 5 & 02 \\ & 4 & 40 \\ & 4 & 33 \\ & 4 & 30 \\ & 4 & 20 \\ & & & \\ & & & & \\ & & & & & \\ & & & &$	11 15 10 53 10 59 10 43 10 33 0 16 0 00 11 57	12.6 11.8 11.6 11.4 10.7 17.2 31.2 9.0	6.3 5.9 5.8 5.7 5.3 7.6 13.6 5.1
Norway.	 Vadso: Light-house North Cape: Extreme Frubolm: Light-house Hammerlest: Light-house Tromso: Observatory Hekkingen: Light-house Andenes: Light-house Andenes: Light-house Lodingen (Hjertholm): Light-house Lodingen (Hjertholm): Light-house Lofoten Island: Skraaven I. light Gryto: Light-house Stot: Light-house Stot: Light-house Stot: Light-house Trænen: Soe Islet light Bronnosund: Light-house Villa: Light-house Villa: Light-house Trondheim: Munkholmen flagstaff Grip: Church Christiansund: Storvaden Freikallen Hestskjaer: Light-house Svinoen Islet Hjærringa Mountain: Summit Halden Island: Store Kinnsund: Light-house Svinoen Islet Hjærringa Mountain: Summit Marstenen Islet: Light-house Furen Islet Ulsire: Light-house Furen Islet Ulsire: Light-house Synose Ken Mountain: Summit Marstenen Islet: Light-house Furen Islet Ulsire: Light-house Synose Mountain: Summit Marstenen Islet: Light-house Synose Mountain: Summit Marstenen Islet: Light-house Synose Mountain: Summit Kompas Mountain: Summit Kompas Mountain: Summit Lister: Light-house Synosevarde Mountain: Summit Lister: Light-house Synosevarde Mountain: Summit Lister: Light-house Synose Islat Kompas Mountain: Summit Kompas Mountain: Summit Lister: Light-house Ryvingen Island: Light-house Ryvingen Island: Light-house 	$\begin{array}{cccccccccccccccccccccccccccccccccccc$	$\begin{array}{c} 31 \ 51 \ 50 \$	2 20 1 35 0 42 11 35 11 18 11 18 10 15 9 43 	11 57 8 40 7 48 6 55 5 23 5 04 4 48 3 55 3 55 3 40	8.3 7.0 7.0 6.9 8.4 5.0 4.1	3.1 4.7 4.4 4.0 3.3

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MARITIME POSITIONS AND TIDAL DATA. ATLANTIC COAST OF EUROPE—Continued.

t.				Lun.	Int.	Rŧ	inge.
Coas	Place.	Lat. N.	Long. E.	H. W.	L, W.	Spg.	Neap.
		0 / //	0 / 11	h. m.	h. m.	ft.	ft.
	Okso: Light-house	58 04 15 58 15 02	8 03 30 8 31 36				
	Arendal Inlet: Inner Torungerne light.	$58 \ 10 \ 02$ $58 \ 24 \ 40$	8 47 55	4 17	10 10	1.0	0.7
	Jomfruland: Light-house	58 51 50 58 59 25	9 36 15 9 45 50				
	Langesund: Church	58 59 25 59 00 01	9 45 50				
	Frederiksværn: Lookout tower	58 59 34	$10 \ 03 \ 28$	4 34	10 00	1.3	1.0
	Svenor: Light-house Forder Islet: Light-house	$58 58 05 \\ 59 01 35$	$10 \ 09 \ 26$ $10 \ 31 \ 55$				
	Fulehuk: Light-house	59 10 30	$10 \ 36 \ 25$				
Wa	Basto: Light-house	$59 \ 23 \ 10 \\ 59 \ 25 \ 34$	$10 \ 32 \ 45 \\ 10 \ 29 \ 52$			•••••	•••••
010	Holmestrand: Church	59 29 23	10 19 15				
Z	Drobak: Church	$59 \ 39 \ 52 \\ 59 \ 40 \ 21$	$10 \ 38 \ 08 \ 10 \ 36 \ 55$				•••••
	Christiania: Observatory	59 54 44	$10 \ 40 \ 35$ $10 \ 43 \ 35$	5 22	10 37	1.2	0.9
	Stromtangen (Torgauten): Light-house.	59 09 00 50 07 08	10 50 15 11 21 00		••••		• • • • • •
	Torbjornskjær: Light-house	$59 \ 07 \ 08$ $58 \ 59 \ 45$	$11 24 09 \\ 10 47 20$				
	Koster: Light-house	$58\ 54\ 05$	$11 \ 00 \ 45$		• • • • • • • • •		•••••
	Stromstad: Steeple	58 56 24	11 10 28				
	Nord Koster Islands: Light-house	58 54 12	$11 \ 00 \ 36$				
	Hollo Island: Light-house	$ 58 \ 32 \ 45 \\ 58 \ 20 \ 12 $	$11 02 16 \\ 11 13 24$				
	Paternoster Rocks: Light-house	57 53 49	11 28 04				
	Nidingen Islet: Light-house	57 40 58 57 18 15	$11 \ 53 \ 54 \ 11 \ 54 \ 16$				
	Warberg: Castle tower	57 06 26	$12 \ 14 \ 32$				
	Falkenberg: Church Halmstad: Palace	$56 54 08 \\ 56 40 21$	$12 29 48 \\ 12 51 38$				• • • • • • •
	Engelholm: Church	56 14 40	12 51 47				
	Kullen Point: Light-house Helsinghorg: Light-house	$56 \ 18 \ 06 \\ 56 \ 02 \ 37$	12 27 11 12 41 30		•••••		• • • • • •
	Landskrona: Light-house	55 52 00	$12 \ 49 \ 48$				
	Malmo: Light-house	$55 \ 36 \ 47 \ 55 \ 23 \ 00$	$12 59 49 \\ 12 49 02$				
	Trelleborg: Light-house	55 22 00	13 09 20				
	Ystad: Light-house	$55\ 25\ 42$ 55\ 22\ 58	$13 \ 49 \ 38$ 14 11 10				
	Hano Island: Light-house	$56 \ 00 \ 54$	14 50 57				
en	Karlshamn: Light-house	56 10 04 56 00 45	14 52 02 15 26 05				
ved	Oland Island: Light on S. pt	$56 \ 05 \ 45$ $56 \ 11 \ 50$	16 24 04				
5	Gottland Island: Hoburg light, S. pt	56 55 18 57 26 20	18 11 06 18 50 27				
	Faro Island: Holmadden light	$57 \ 20 \ 25 \ 57 \ 57 \ 24$	$18 \ 59 \ 27 \ 19 \ 22 \ 36$				
	Sparo Vestervik: Granso light	57 45 38	$16 \ 40 \ 36$				
	Norrkopings Inlopp: Light-house	$58 \ 06 \ 52$ $58 \ 17 \ 55$	$16 \ 59 \ 22$ $16 \ 11 \ 28$				
	Landsort: Light-house	$58 \ 44 \ 26$	17 52 09				
	Upsala: Observatory	$59 \ 20 \ 35$ $59 \ 51 \ 31$	$18 \ 03 \ 30 \ 17 \ 37 \ 39$				
	Norrtelge: Inn	59 45 24	$18 \ 41 \ 34$				
	Soderarm: Light-house	$ \begin{array}{cccccccccccccccccccccccccccccccccccc$	$19 24 34 \\18 49 49$				
	Osthammar: Church	60 15 19	$18 \ 22 \ 36$				
	Diursten: Light-house	$\begin{array}{cccccccccccccccccccccccccccccccccccc$	$18 \ 26 \ 33 \ 18 \ 24 \ 21$				
	Forsmark: Church	$60 \ 22 \ 26$	18 09 49				
	Orskar Rock: Light-house Gefle: Church	$\begin{array}{cccccccccccccccccccccccccccccccccccc$	$18 \ 22 \ 38 \ 17 \ 08 \ 29$				
	Eggegrund Islet: Light-house	60 43 48	$17 \ 33 \ 50$				
	Hamrange: Church Soderhamm: Court-bouse	$\begin{array}{cccccccccccccccccccccccccccccccccccc$	$17 \ 02 \ 57 \\ 17 \ 04 \ 18$	•••••		'	
	Enanger: Church	61 32 54	17 01 51				

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APPENDIX IV.

MARITIME POSITIONS AND TIDAL DATA.

ŗ.				Lun	Int.	Ra	inge.
COAS	Place.	Lat. N.	Long. E.	H. W.	L. W.	Spg.	Neap.
			0 / //				
	Hudiksvalls: Court-house	61 43 57	17 07 37	<i>n. m.</i>	<i>n. m.</i>	<i>μ</i> .	Ji.
	Gnarp: Church	$62 \ 02 \ 51$	$17 \ 16 \ 22$				
	Sundsvall: Church	62 23 30	17 19 05	••••			
en	Lungo: Light-house	$\begin{array}{c} 62 & 38 & 35 \\ 62 & 11 & 55 \end{array}$	18 05 05				
pa	Holmogadd: Light-house	$63 \ 11 \ 00 \ 63 \ 35 \ 34$	19 02 00 20 45 35	••••			
an	Umea: Bredekar Light	$63 \ 39 \ 33$	$20 \ 10 \ 35$				
8	Bjuroklubb: Light-house	$64 \ 28 \ 50$	$21 \ 34 \ 45$				
	Pitea	$65 \ 19 \ 10$	$21 \ 30 \ 00$				
	Rodkallen: Light-house	$65 \ 18 \ 53$	$22 \ 21 \ 55$				
	Maloren: Light-house	65 31 30	23 34 00				
-	Tornea: Light-house	$65 \ 48 \ 30$	24 12 00				
	Uleaborg: Karlo I. light	65 02 20	$24 \ 34 \ 00$				
	Ulko Kalla Rock: Light-house	$64 \ 20 \ 05$	$23 \ 27 \ 00$				
	Norrsher Islet: Kvarken light	63 14 08	$20 \ 37 \ 40$				
	Kaske: Shelgrund I. light	62 20 06 c1 22 20	21 11 24				
	Nuistad: Enghor light	60 43 10	21 22 34				
	Abo Observatory	60 26 57	21 01 00 22 17 03				
	Aland Island: Shelsher light	60 24 45	19 34 00				
	Ekkere light	60 13 20	$19 \ 31 \ 20$				
	Logsher light	59 50 50	19 54 05				
	Bogsher: Beacon	$59 \ 31 \ 11$	20 25 50				
	Ute 1slet: Light-house	59 46 30	21 22 00				
	Rensher: Light-house	59 40 00	22 00 00				
	Helsingfors: Observatory	60 09 43	24 57 17				
	Soder Skars: Light-house	60 06 40	$25 \ 25 \ 51$				
	Kalboden Island: Light vessel	$59 \ 58 \ 45$	$25 \ 37 \ 30$				
	Rodsher Island: Light-house	59 58 08	$26 \ 41 \ 05$				
	Hogland Island: Lower light	60 00 40	27 01 40				
	Upper light	60 06 22	20 58 44				
	Vieborg Bay: Nelva I light	60 12 51 60 14 43	27 58 36				
	Stirsudden: Light-house	60 11 05	29 03 01				
	Kronstadt: Light on Frederikstadt bas-						
а.	tion	59 58 14	$29 \ 47 \ 12$				
	Cathedral.	59 59 44	29 46 07				
12	St. Petersburg: Observatory	50 46 10	30 19 22				
—	Peterhof: Pier-head light	59 53 26	29 54 54			·····	
	Oranienbaum: Light-house	59 55 40	29 46 38				
	Seskar Islet: Light-house	60 02 08	$28 \ 23 \ 01$				
	Narva: Light S. pt. of entrance	$59 \ 28 \ 04$	$28 \ 03 \ 31$				
	Stensher Rock: Light-house	59 49 10	26 23 00				
	Koksher: Light-house	59 41 00	20 48 08				
	Revel: Light N. end of W. mole	59 27 05	24 46 10				
	Cathedral	59 26 28	24 44 45				
	Nargen Island: Light-house	59 36 22	$24 \ 31 \ 57$				
	Surop: W. light	59 27 55	24 24 05				
	Baltic Port: Light-house	59 21 30	24 04 30				
	Takhkona Point: Light-house	59 18 00	23 23 10				
	Dago Island: Dagerort light.	58 55 02	$22 \ 11 \ 36$				
	Filzand Island: Light-house.	58 23 02	21 49 56				
	Svalferort Tzerel: Light-house	57 54 37	22 04 15				
	Kuino: Light-house	58 05 50	23 59 34				
	Pernau: Light at S. entrance	58 23 10	24 49 25				
	Cathedral	56 56 36	24 00 09				
	Runo Island: Light-house	57 48 02	23 15 00				
	Domesnes: Light-house	57 48 10	22 39 15				
	Windau: Light on S. jetty	57 24 00	21 34 00				
	Libau: Light at entrance of port	56 31 01	20 59 40				

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MARITIME POSITIONS AND TIDAL DATA.

st.				Lun.	Int.	R	ange.
Coa	Place.	Lat. N.	Long. E.	H. W.	L. W.	Spg.	Neap.
	· · · · · ·	0 / //	0 / //	h. m.	h. m.	ft.	ft.
	Memel: Light-house	$55 \ 43 \ 45$	21 06 06				
	Heiligen Creutz: Church tower Brusterort: Light-house	$54 53 47 \\54 57 40$	20 01 25				
	Pillan: Light-house	54 38 25	19 53 55 19 53 55				
	Fischausen: City-hall tower	54 43 49	20 00 39				
	Konigsberg: Observatory	$54 \ 42 \ 51$	20 29 44		• • • • • • • • • •		
	Tolkemit: Church tower	54 19 19 51 00 44	19 31 58				
	Tiegenort: Church tower	$54 \ 09 \ 44$ 54 16 30	19 23 38 19 08 37				
	Danzig: Observatory	$54 \ 21 \ 18$	$18 \ 39 \ 46$				
	Neufahrwasser light	54 24 28	$18 \ 39 \ 59$				
	Weichselmunde: Fortress tower	54 23 51 54 19 16	$18 \ 41 \ 03$ $18 \ 40 \ 25$				
	Oxhoft: Light-house	54 12 10 54 33 09	$18 \ 40 \ 35$ $18 \ 33 \ 46$				
	Hela: Light-house	54 36 06	18 49 04				
	Rixhoft: Light-house	$54 \ 49 \ 55$	$18 \ 20 \ 29$				
	Leba: Church tower	$54 \ 45 \ 29$	$17 \ 33 \ 38$ 16 51 25		• • • • • • • • •		
	Stopelmunde: Unuren	54 50 10 54 32 29	$16 \ 32 \ 50$			• • • • • •	
	Rugenwalde: St. Mary's Church	54 25 27	16 24 52				
	Coslin: St. Mary's Church	$54 \ 11 \ 28$	$16 \ 11 \ 05$				
	Funkenhagen: Light-house	54 14 40	15 52 39				
	Colberg: St. Mary's Church	51 10 40 51 05 47	$15 34 44 \\ 15 04 06$				
	Cammin: Cathedral tower	53 58 29	$14 \ 46 \ 36$				
	Wollin: Church tower	53 50 41	$14 \ 37 \ 12$				
	Stettin: N. Castle tower	$53 \ 25 \ 41$	$14 \ 33 \ 52$				
	Swinemunde: Light-house	53 55 03	$14 17 19 \\ 14 01 17$		•••••	••••	
	Usedom: Church tower	53 52 17	13 55 26				
	Lassau: Church tower	53 56 59	13 51 13				
'n	Wolgast: Church tower	54 03 18	$13 \ 46 \ 51$				
ma	Griefswald: St. Nicholas Unurch	54 05 49 54 15 09	$13 22 53 \\ 13 55 49$			• • • • • •	
en	Granitz: Castle tower	54 22 56	$13 \ 37 \ 54$				
3	Bergen: Church tower	$54 \ 25 \ 08$	$13 \ 26 \ 11$				
	Arkona: Light-house	54 40 53	$13 \ 26 \ 12$				
	Derssonart: Light-house	54 18 42 51 98 98	13 05 30	•••••			
	Wustrow: Church	54 20 47	$12 \ 24 \ 02$				
	Ribnitz: Church tower	54 14 42	$12 \ 26 \ 04$				
	Warnemunde: Church	54 10 42	$12 \ 05 \ 19$				
	Rostock: St. Jacob's Church	54 05 27	12 08 10 11 46 04				
	Basdorf: Survey station	54 08 00	$11 \ 40 \ 04$ $11 \ 41 \ 54$				
1	Wismar: St. Nicholas Church	53 53 50	$11 \ 28 \ 09$				
	Hohenschonberg: Survey station	53 58 54	$11 \ 05 \ 54$				
	Travemunde: Light-house	53 57 44	$10 52 59 \\ 11 11 50$				
	Marienleuchte: Light-house	54 29 43	$11 11 09 \\ 11 14 29$				
	Petersdorf: Church tower	54 28 54	11 04 18				
	Hessenstein: Flagstaff of lookout tower	54 19 47	$10 \ 32 \ 59$				
	Schonberg: Church	54 23 52	10 22 24 10 19 04				•••••
	Kiel: Observatory	54 27 25 54 20 30	$10 \ 12 \ 04 \ 10 \ 08 \ 56$				
	Eckemforde: Church	54 28 25	9 50 23				
	Schleswig: Cathedral	54 80 55	9 34 23				
	Kappeln: Church	54 39 48	9 56 13	•••••		•••••	
	Duppel: Survey station	54 54 28	9 20 20 9 45 35			• • • • • •	
	Schleimunde: Light-house	54 40 23	10 02 23				
	Augustenburg: Church	54 56 48	9 52 20				
	Hugeberg: Survey station	54 58 05	9 58 41			•••••	
	Skoorgaarde: Survey station	55 02 46 55 03 59	9 20 18			•••••	
	Ballum: Church	55 05 31	8 39 41				
	List: E. light-house	55 03 04	8 26 50	0 20	6 33	5.2	3.0

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APPENDIX IV. MARITIME POSITIONS AND TIDAL DATA.

st.	Disco	Lat N		Lun.	. Int.	R	ange.
Coa	Place.	Lat. N.	Long. E.	H. W.	L. W.	Spg.	Neap.
		0 / //.	0. 1 11	h. m.	h. m.	jt.	ſt.
	Keitum: Church	$54 54 13 \\54 41 51$	$\begin{array}{c ccccccccccccccccccccccccccccccccccc$	1 35	7 47	7.8	4.5
	Galgenberg: Survey station	54 41 21	8 33 58				
	Husum: Church	$54 28 43 \\54 19 08$	9 03 21 8 56 38	$ \begin{array}{c} 2 & 10 \\ 1 & 45 \end{array} $		10.8	6.2
	Busum: Church	$54 \ 07 \ 52$	$^{\circ}85153$	1 11	7 24	11.7	6.8
	Helgoland: Light-house	$54 \ 10 \ 57$	7 53 11	11 29	5 17	8.1	4.7
	Scharhorn: Beacon	53 57 15 53 55 01	8 24 35		•••••		
	Cuxhaven: Light-house	53 52 01 53 52 25	8 42 43	0 39	6 51	10.1	5.8
-	Stade: Church steeple	$53 \ 36 \ 12$	9 28 48				
y.	Steinkirchen: Church	53 33 43	9 36 40	4 00	10 13	8.5	4.9
uu	Hamburg: Observatory	$53 \ 32 \ 45$ $53 \ 33 \ 07$	9 56 35 - 9 58 25	5 00	11 12	6.1	3.5
E.	Berlin: Öbservatory	$52 \ 30 \ 17$	$13 \ 23 \ 44$				
Ge	Harburg: Light-house	53 28 30	9 59 37	0.95		10.1	
	Langwarden: Church	53 + 2 = 50 53 - 36 = 20	8 18 30	0 20	0 00	10.1	0.7
-	Bremerhaven: New harbor light	$53 \ 32 \ 52$	$8 \ 34 \ 25$	0 54	7 07	10.4	5.8
	Minsener Sand: Light vessel	$53 \ 46 \ 57$	8 04 47	0 10	$6\ 23$	9.5	5.3
	Wilhelmshaven: Observatory	$53 \ 42 \ 21$ $53 \ 31 \ 52$	8 01 43	0.04	6 17	13.2	7.4
	Wangeroog: Light-house	$53 \ 47 \ 25$	7 54 09	11 27	5 15	8.0	4.5
	Spikeroog: Church	$53 \ 46 \ 19$	7 41 45		• • • • • • • • •		
	Balstrum: Church	53 43 00 53 43 46	$7 50 41 \\ 7 22 03$		•••••		
	Norderney: Light-house	$53 \ 42 \ 39$	7 13 58	11 05	4 53	7.3	4.1
	Juist: Church	53 40 45	65953	0.04			
	Emden: City Han tower	05 42 00	1 12 20	0 24	0 30	0.9	5.0
	Falster: Gjedser light.	54 33 50	11 58 03				
	Moen Island: Stege Church spire	54 59 03 54 56 46	$12 \ 17 \ 16 \ 12 \ 32 \ 40$				•••••
	Præste: Church spire	55 07 24	12 03 07				
	Kjorge: Church tower	55 29 44	$12 \ 07 \ 36$				
	Amager Island: Holloenderby Ch. spire Nordse Rase light	$55 \ 30 \ 40 \ 55 \ 38 \ 10$	$12 \ 38 \ 24 \ 12 \ 41 \ 26$		•••••	• • • • • • •	
-	Copenhagen: New observatory	$55 \ 41 \ 14$	$12 \ 34 \ 47$	9 33	$3 \ 21$	0.6	0.3
-	Bornholm: Ronne light	55 05 40	14 42 00	• • • • • • • • •			
-	Christianso Island: Great tower	55 19 19 56 02 20	$15 11 39 \\ 19 32 02$		•••••		• • • • • •
-	Nakkehooed: Upper light.	$56 \ 07 \ 10$	$12 \ 02 \ 02$ $12 \ 20 \ 50$				
	Hesselo Island: Light-house	56 11 50	$11 \ 42 \ 50$		·····		• • • • • • •
	Anholt Island: Light-house	$ \begin{array}{cccccccccccccccccccccccccccccccccccc$	$11 \ 39 \ 15 \ 11 \ 51 \ 36$		•••••		
	Roeskilde: Cathedral	$55 \ 38 \ 34$	$11 01 00 \\ 12 05 02$				
url	Nykjobing: Church tower	55 55 30	11 40 29				
m	Oddensby: Church tower	$55 57 52 \\ 55 55 09$	11 24 06 11 05 07		• • • • • • • • •	•••••	
en	Kallundborg: Church	$55 \ 40 \ 50$	11 05 04				
	Omo Island: Church	55 09 48	$11 \ 09 \ 32$		· · · · · · · · ·		
-	Vordingborg: Waldemar's tower	$55 \ 00 \ 26$ $55 \ 02 \ 19$	11 54 59 11 99 93	• • • • • • • • •	•••••		
	Langeland Island: Fakkebjerg light	$54 \ 44 \ 23$	$11 \ 42 \ 13$				
^	Æro Island: Church spire	54 51 14	$10 \ 24 \ 11$				
	Lyo Island: Church tower	$55 02 34 \\ 55 16 09$	$10 \ 09 \ 16 \\ 9 \ 53 \ 50$				
	Baago Island: Light-house	55 17 44	9 48 09				
-	Kolding: Castle tower	55 29 31	9 28 40		• • • • • • • •		
	Bogense: Church spire.	$55 \ 34 \ 03 \ 55 \ 18 \ 41$	$10 \ 05 \ 29$ $10 \ 47 \ 47$			• • • • • •	
-	Turo Island: Church spire	55 03 00	10 40 02				
	Svendborg: Frue Church	55 03 37	10 36 48				
	Endelaye Island: Church tower	55 45 32 55 48 02	$10 \ 16 \ 20$ $10 \ 33 \ 37$		•••••	• • • • • • •	
	Horsens: Frélser Church spire	55 51 44	9 51 19				
				5			

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MARITIME POSITIONS AND TIDAL DATA.

st.		Tet X	Tong F	Lun. Int.		Range.	
Coa	Place.	Lat. N.	Long. D.	H. W.	L. W.	Spg.	Neap.
Dennark.	Tuno Island: Light-house Samsoe Island: Nordby Church tower Aarhus: Cathedral spire Hjelm Islet: Light-house Fornæs: Light-house Hals: Church tower Aalborg: St. Rudolph's Church Cape Skaw, or Skagen: Old light-house . Hirtshals: Light-house. Haustholm: Light-house. Boobjerg: Light-house. Ringkjobing: Church spire. Loune: Church tower Blaabjerg: Summit, 100 ft. Guldager: Church Fano Island: Nordby Church. Mano Island: Church spire.	$ \begin{smallmatrix} \circ & , & '' \\ 55 & 56 & 58 \\ 55 & 57 & 06 \\ 56 & 09 & 26 \\ 56 & 08 & 00 \\ 56 & 26 & 36 \\ 56 & 59 & 54 \\ 57 & 02 & 54 \\ 57 & 03 & 46 \\ 57 & 35 & 06 \\ 57 & 06 & 50 \\ 56 & 30 & 48 \\ 56 & 05 & 27 \\ 55 & 47 & 17 \\ 55 & 44 & 50 \\ 55 & 31 & 52 \\ 55 & 26 & 26 \\ 55 & 16 & 11 \\ \end{smallmatrix} $	$ \begin{smallmatrix} & & & & \\$	$\begin{array}{c} h. m. \\ \hline \\ 5 46 \\ 4 18 \\ \hline \\ 2 35 \\ \hline \\ 2 35 \\ 2 34 \\ \hline \end{array}$	h. m. 	<i>ft.</i> 1.0 1.2 2.1 4.5 4.7	<i>ft.</i> 0.5 0.7 1.2 2.6 2.7
Holland.	Niewe Diep: Time-ball station. Amsterdam: W. church tower. Utrecht: Observatory. Leyden: Observatory. The Hague: Church tower Scheveningen: Light-house Brielle: Light-house. Rotterdam: Time-ball station Hellevoetsluis: Time-ball station Willemstadt: Light-house. Goedereede: Light on church tower Flushing: Time-ball station	$\begin{array}{cccccccccccccccccccccccccccccccccccc$	$\begin{array}{c} 4 & 46 & 36 \\ 4 & 53 & 04 \\ 5 & 07 & 50 \\ 4 & 29 & 03 \\ 4 & 18 & 30 \\ 4 & 15 & 10 \\ 4 & 10 & 45 \\ 4 & 28 & 50 \\ 4 & 07 & 40 \\ 4 & 26 & 26 \\ 3 & 58 & 35 \\ 3 & 35 & 48 \\ 3 & 34 & 32 \end{array}$	7 17 2 50 3 35 2 20 3 20 	$ \begin{array}{c} 1 & 05 \\ \hline \\ 9 & 02 \\ 9 & 47 \\ 8 & 32 \\ 9 & 32 \\ \hline \\ 6 & 56 \\ \end{array} $	3.9 4.8 6.7 5.2 9.8 14.7	2.0 2.5 3.5 2.8 5.2 7.8
Belgium.	Brussels: Observatory Antwerp: Observatory Notre Dame Cathedral Blankenberghe: Fort light-house Ostend: Light-house Church tower Nieuport: Templars tower	$\begin{array}{cccccccccccccccccccccccccccccccccccc$	$\begin{array}{rrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrr$	$ \begin{array}{r} 4 & 15 \\ 0 & 05 \\ 0 & 02 \\ 0 & 10 \\ \end{array} $	$ \begin{array}{r} 10 \ 27 \\ 6 \ 17 \\ 6 \ 32 \\ \hline 6 \ 22 \\ \end{array} $	14. 8 12. 5 16. 1 15. 7	7.8 6.7 8.4 8.4
France.	Paris: Observatory Dunkerque: Tower Gravelines: Light on N. breakwater Calais: Light on old fort Cape Gris Nez: Light-house Boulogne, C. Alprech: Light-house Boulogne, C. Alprech: Light-house Boulogne, C. Alprech: Light-house Cayeux: Light-house Dieppe: W. jetty light. Ailly Point: Light-house St. Valery en Caux: Light on W. break- water Fécamp: N. jetty light. Cape La Heve: S. light Havre: S. jetty light. Havre: S. jetty light. Caen: Church tower Port Corseulles: W. jetty light Point De Ver: Light-house. Cape Barfleur: Light-house Cape Barfleur: Light-house Cherbourg: Light, W. head of break- water Naval Observatory Cape La Hague: Light-house	$\begin{array}{cccccccccccccccccccccccccccccccccccc$	$\begin{array}{cccccccccccccccccccccccccccccccccccc$	11 58 11 59 11 39 11 17 11 18 10 54 10 29 10 06 9 03 	558 616 613 551 552 548533502414	16. 8 19. 0 21. 0 21. 5 25. 2 27. 3 26. 8 23. 3 22. 5 18. 5 17. 0 17. 6	8.5 9.6 10.7 11.0 12.8 13.3 13.1 11.4 8.2 7.5 7.8
	Casquets Rocks: Light on NW. rock	49 43 22 49 43 17	$ \begin{array}{ccccccccccccccccccccccccccccccccccc$	6 20	0 15	15.5	6.9

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APPENDIX IV.

MARITIME POSITIONS AND TIDAL DATA.

st.				Lun.	Int.	R	ange.
Coa	Place.	Lat. N.	Loug. W.	н. w.	L. W.	Spg.	Neap.
		0 / //	0 / //	h. m.	h m	ft	ft
	Port St. Peter, Guernsey: Light on Cas-	10. 97. 19	0 91 91	6 10	0.07	00.0	11 -
	Douvres Rocks: Light-house	49 27 13	2 31 31 2 48 49	0 12	0.07	20.0	11. 5
	Cape Carteret: Light-house	49 22 27	$1 \ 48 \ 25$	6 07	$0 \ 15$	30.8	13.5
	Coutances: Cathedral tower	49 02 54	$\begin{array}{cccccccccccccccccccccccccccccccccccc$	5 50		96 7	10.0
	Chausev Is.: Light on SE. end of large id.	48 50 07 48 52 13	$1 30 40 \\ 1 49 20$	5 50 55	0 09 04	34.7	10.0
	St. Malo: Rochebourne light	48 40 18	1 58 41	$5 \ 43$	0 04	36.0	15.7
	Cape Frehel: Light-house	48 41 05	$\begin{array}{cccccccccccccccccccccccccccccccccccc$	5 95	12 00	30.4	19.9
	Morlaix, Ile Noire: Light-house	48 40 23	3 52 33	5 00	$12 00 \\ 11 25$	23.1	10.6
	De Bas Íslet: Light-house	48 44 45	4 01 38	4 35	11 00	22.0	10.1
	Abervrach: Light on Vrach Islet Ushant: Stiff Point light	$48 \ 36 \ 57 \ 48 \ 28 \ 31$	$\begin{array}{c} 4 & 34 & 34 \\ 5 & 03 & 26 \end{array}$	$\frac{4}{3}$ $\frac{00}{35}$	$10 25 \\ 10 00$	20.6	9.5
	Brest: Observatory		4 29 36	3 23	9 45	19.5	9.0
	Brest (approach): Quelern light	48 19 10	4 34 28		0.59	17 0	
	Bec du Raz: Light-house	$48 02 40 \\ 48 02 28$	4 52 03 4 45 25	3 20	9 9 3	17.2	1.9
	Audierne: Pier-head light	48 00 47	$4 \ 32 \ 50$	3 04	9 31	11.1	5.1
	Penmarch Rocks: Light-house	$47 \ 47 \ 52$	$\begin{array}{c} 4 & 22 & 30 \\ 2 & 57 & 15 \end{array}$	$ \begin{array}{c} 3 & 05 \\ 2 & 00 \end{array} $	934	13.3	6.1
	De Groix Island: Light-house	47 38 51	3 37 13 33 35	3 00	9 21	13.0	0.0
	Lorient: Church-tower light	47 44 53	3 21 31	3 09	9 36	13.8	6.3
	Belle Isle: Light-house Port Haliguen: Light on N jetty	$47 \ 18 \ 42 \\ 47 \ 29 \ 10$	$\begin{array}{cccccccccccccccccccccccccccccccccccc$	$^{\cdot 3}_{3 35}$	9 50	16.6 16.9	
ce.	Haedic Island: Light-house	47 19 18	$\begin{array}{cccccccccccccccccccccccccccccccccccc$	3 20	9 46	16.7	7.7
an	Port Navalo: Light-house	47 32 53	25508	3 45	10 08	16.6	7.7
F	Le Four Rock: Light-house	$47 \ 39 \ 30 \ 47 \ 17 \ 53$	2 45 28 2 38 05	5 47	12 11	15.8	7.4
	Croisic: End of breakwater	47 18 30	$, \frac{2}{2} \ \frac{31}{31} \ \frac{25}{25}$	3 25	9 47	16.7	7.7
	Guerande: Steeple	47 19 44	$\begin{array}{cccccccccccccccccccccccccccccccccccc$	9.95	0.54	16 6	
	Paimbœuf: Steeple	47 10 18	$\begin{array}{c} 2 & 11 & 50 \\ 2 & 02 & 09 \end{array}$	3 33 4 18	10 39	10.0 17.0	7.9
	Nantes: Cathedral	$47 \ 13 \ 08$	$1 \ 32 \ 59$	5 50	12 28	16.5	7.7
	Noir Moutier Island: Light-house	$47 \ 00 \ 41$ $47 \ 02 \ 35$	$\begin{array}{cccccccccccccccccccccccccccccccccccc$	3 05	9 26	16.7	7.7
	D'Yeu Island: Light-house	46 43 04	$\frac{2}{2}$ $\frac{21}{22}$ $\frac{51}{56}$	3 18	9 40	14.7	6.8
	La Chaume: Light-house.	46 29 38	$1 \ 47 \ 45$	3 20	9 44	12.7	5.9
	Ré Island: Light, NW, pt	$46 20 41 \\ 46 14 40$	$1 27 49 \\ 1 33 40$		••••		
•	Rochelle: E. Quay light	46 09 25	1 08 57	3 27	9 22	16.6	7.7
	Aix Island: Light-house	46 00 36	1 10 40 0 57 50	$\frac{3}{2} \frac{27}{45}$	9 22	$ 16.6 \\ 16.7 $	7.7
	Oleron Island: Light NW. pt	46 02 49	12437	540	9 00	10. /	1.1
	Point de la Coubre: Light-house	45 41 39	$1 \ 15 \ 16$				
	Point Cordouan: Light-house	$\begin{array}{cccccccccccccccccccccccccccccccccccc$	$\begin{array}{cccccccccccccccccccccccccccccccccccc$	3 35	9 53	16.8	7.8
	Bordeaux: St. André	44 50 19	0 34 42	6 30	$0 \ 12$	15.3	7.1
	Bayonne: Cathedral	43 29 29	1 28 43 1 22 16		· · · · · · · · · ·		
	St. Jean de Luz: St. Barbe Point light	43 29 58 43 23 58	$1 55 10 \\ 1 39 53$	3 07	9 14	12.3	5.8
	E strengt in It'llt an Grant II' man	40.00.00	1 (= 00				
	Port Pasages: Light at entrance.	$\begin{array}{cccccccccccccccccccccccccccccccccccc$	$\begin{array}{cccccccccccccccccccccccccccccccccccc$	•••••			
	San Sebastian: Monte Igueldo light	43 19 22	2 01 40	255	9 05	11.7	5.5
ga]	Bilbao: Light on Galea Castle	$\begin{array}{cccccccccccccccccccccccccccccccccccc$	$\begin{array}{c} 3 & 04 & 06 \\ 3 & 16 & 10 \end{array}$	$\frac{2}{2}$ 50	9 03	12.7	$5.9 \\ 5.5$
in.	Santoña: Pescador Point light	43 28 36	3 10 10 3 28 06	$\stackrel{2}{2} \stackrel{50}{55}$	9 03 9 07	11.8 12.3	5.7
201	Santander: Cape Mayor light	43 29 30	3 47 40	3 05	9 18	14.8	6.9
L D	San Martin de la Arena: Light-house San Vincent de la Barquera: End of new	43 26 50	4 01 00	3 00	·9 14	11.7	5.5
an	mole	43 23 35	4 24 55	3 00	9 14	10.4	4.9
ii	Rivadesella: Mount Somos light	43 31 00	5 07 10 5 40 11	2 50	0.02	13 5	6.9
ba	Aviles: Light-house	43 38 05	$5 \ 56 \ 00$	$\frac{2}{2}$ $\frac{50}{45}$	8 58	13.0 12.0	4.9
9 2	Rivadeo: Light-house.	43 34 40	7 03 00	2 45	8 58	14.4	3.9
	Estaca Point: Light-house	43 47 20	7 42 00				

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MARITIME POSITIONS AND TIDAL DATA. ATLANTIC COAST OF EUROPE—Continued.

		1		Lun.	Int.	R	inge.
OBSI	Place.	Lat. N.	Long. W.	нш	L.W	Sng	Nean
0					12. 11.		neap.
	Dust Calainer Linkthouse	0 / //	° / // 8 05 20	h. m.	h. m.	ft.	ft.
	Ferrol: Old naval observatory	43 29 30	8 13 29	243 244	$\frac{8-50}{8.57}$	14.8	6.1
	Priorino Chico light	43 27 30	$8\ 20\ 20$				
	Coruña: Hercules Tower light	43 23 10	8 24 26	2 43	8 56	14.8	6.1
	Cape Finisterre: Light-house	$\begin{array}{cccccccccccccccccccccccccccccccccccc$	$9 15 28 \\ 8 54 00$	2 42	8 55	10.0	4.6
	Oporto: Light, N. S. de Luz	41 09 10	8 40 35	2 25	8 38	10.0	4.3
	Cape Mondego: Light-house	40 10 47	85415	2 20	8 35	7.0	3.0
Za]	Berlanga Island: Light-house	39 24 49 30 21 00	9 30 29	2.05	e 15		
tu;	Cape Roca: Light-house	38 46 49	9 29 46	2 00	0 10	1.0	0. 1
or	Lisbon: Royal Observatory	$38 \ 42 \ 31$	$9 \ 11 \ 10$	2 20	8 05	11.1	4.8
	Setubal: Light-house	$\begin{array}{cccccccccccccccccccccccccccccccccccc$	8 56 00	2 10	8 20	11.6	5.0
Ĩ	Lagos: Church	37 01 20 37 07 48	8 39 53	1 55	8 08	13.0	5.6
=	Cape Sta. Maria: Light-house	36 58 23	7 51 48				
ai	Ayamonte: Light-house	37 11 00	7 24 00				
5	Huelva: Plaza at head of mole	36 43 58	6 26 30	1 15	7 28	12 3	5.6
	Cadiz: Observatory of San Fernando	36 27 40	6 12 20				
	San Sebastian light	36 31 30	6 19 00	1 45	7 58	11.8	5.4
	Cape Tratalgar: Light-house	36 10 50		1 39	7 59	5.6	2.6
	Algeciras: Verde I. light	36 07 19	$5\ 26\ 12$	1 02	1 02	0.0	2.0
	Gibraltar: Dockyard flagstaff	36 07 10	5 21 17				
	Europa Pt. light	36 06 25	5 20 42	1 35	7 55	3.7	1.7
	COASTS OF THE MEDITERRAN	NEAN, A	DRIATIC	, AND :	BLACK	SEAS	.
		00 10 00	1.01.00	0.15	0.05		1 5
	Malaga: Light-house	$36 42 39 \\ 36 50 12$	$ \begin{array}{r} 4 24 38 \\ 2 27 50 \end{array} $	2 15	8 35	2.9	1.5
	Cape de Gata: Light-house	$36 \ 42 \ 57$	$ \frac{2}{2} \frac{11}{11} \frac{10}{12} $				
	Mazarron: Light-house	37 33 28	1 15 12				
	Cartagena: Arsenal gate Escombrera light	$\begin{array}{cccccccccccccccccccccccccccccccccccc$	$05909 \\ 05758$				
	Porman: Light-house	37 34 38	0 50 20				
	Santa Pola Bay: Light-house	38 12 30	0 30 12				
	Alicante: N. mole light	38 20 12 38 30 00	$0\ 28\ 48$ $0\ 11\ 42$				
	Benidonne: Tower	$38 \ 30 \ 57$	$0 11 42 \\ 0 10 06$				
	Altea: Light-house	$38 \ 33 \ 30$	$0 \ 04 \ 02$				
			Long. E.				
	Calpe: Church tower	38 38 36	$0 \ 02 \ 52$				
i	Morayva: Tower	38 40 51	0 09 17 0 12 02				
jai	Denia: Mole-head light	38 51 00	0 07 30				
5			Long W				
	Cape Cullera: Light-house	$39\ 12\ 15$	0 13 37				
	Valencia: Light-house	39 28 05	0 19 48	5 00	11 90		
	Mole-end light	39 27 30	0 18 50	5.00	11 30	1.0	0.8
	Columbratas Islands: Light-house	20 52 57	Long, E.				
	Oropesa Cape: Light-house	40 04 53	0 08 56				
	Vinaroz: Mole-head light	40 27 48	$0\ 28\ 48$				
	Port Alfaques: Baña light	40 33 30	$0\ 39\ 45$ $0\ 52\ 55$				
	Tarragona: E. mole light	41 06 00	1 14 42				
	Barcelona: E. mole-head light	41 22 10	$2 \ 10 \ 52$				
	Palamos Bay: Molino Pt. light	41 50 04	$\begin{array}{c} 3 & 08 & 28 \\ 2 & 17 & 10 \end{array}$	• • • • • • • • •			
	Cape Creux: Light-house	42 10 15 42 19 10	$3 17 10 \\ 3 18 55$				
	The order angle would		0 10 00				
÷	Cape Bear: Light-house	42 30 59	$\begin{array}{c} 3 & 07 & 30 \\ 2 & 06 & 50 \end{array}$				
)	Fort vendres: Fort Fanal fight	42 31 18	3 06 90				

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APPENDIX IV.

MARITIME POSITIONS AND TIDAL DATA.

st.				Lun.	Int.	· Ra	inge.
Coa	Place.	Lat. N.	Long E.	H. W.	L. W.	Spg.	Neap.
	Port Nouvelle: S. jetty light Cette: Light, St. Louis mole Aigues Mortes: Espignette Pt. light	$ \begin{smallmatrix} \circ & \prime & '' \\ 43 & 00 & 47 \\ 43 & 23 & 50 \\ 43 & 29 & 17 \\ \end{smallmatrix} $	$ \circ $	h. m.	h. m.	ft.	ft.
France.	Planier Rock: Light-house Marseille: Janet Cliff light New observatory Ciotat: Berouard mole light Toulon: St. Mandrien light Grand Riband Island: Light-house Cannes: Light-house Antibes: Garoupe light Nice: Light-house	$\begin{array}{cccccccccccccccccccccccccccccccccccc$	$\begin{array}{cccccccccccccccccccccccccccccccccccc$	7 31	2 00	0.6	0.3
	Ville Franche: Mole-head light Cape Ferret light Port Ibiza: Light-house	$\begin{array}{r} 43 \ 41 \ 58 \\ 43 \ 40 \ 30 \\ 38 \ 54 \ 10 \end{array}$	$\begin{array}{c} 7 & 18 & 42 \\ 7 & 19 & 41 \\ 1 & 27 & 25 \end{array}$				•••••
Bal. I	Cabrera Island: Light-house Pi (Majorca): Light-house Port Mahon (Minorca): Light-house	$\begin{array}{c} 39 & 06 & 34 \\ 39 & 33 & 00 \\ 39 & 51 & 53 \end{array}$	$\begin{array}{cccccccccccccccccccccccccccccccccccc$				
Sardinia.	Cape Spartivento: Light-house Cape Sandalo: Light on San Pietro I Porte Conte: Cape Caccia light Port Torres: Light-house Cape Testa: Light-house Razzoli Island: Light-house Capera Island: Galera Pt Cape Figari: Signal station Cape Figari: Light-house Cape Bellavista: Light-house Cape Carbonera: Cavoli I. light Cagliari: Light on mole	$\begin{array}{rrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrr$	$\begin{array}{c} 8 \ 51 \ 08 \\ 8 \ 13 \ 29 \\ 8 \ 10 \ 00 \\ 8 \ 23 \ 56 \\ 9 \ 08 \ 35 \\ 9 \ 20 \ 21 \\ 9 \ 29 \ 40 \\ 9 \ 39 \ 07 \\ 9 \ 44 \ 22 \\ 9 \ 43 \ 25 \\ 9 \ 32 \ 35 \\ 9 \ 07 \ 20 \end{array}$				
Corsica.	Bonifacio: Mount Pertusato light Ajaccio: Light-house Corti: Church tower Calvi: Light-house Cape Corso: Giraglia I. light Bastia: Light-house Porto Vecchio: Chiape Pt. light	$\begin{array}{cccccccccccccccccccccccccccccccccccc$	$\begin{array}{c} 9 \ 11 \ 15 \\ 8 \ 35 \ 45 \\ 9 \ 09 \ 04 \\ 8 \ 43 \ 25 \\ 9 \ 24 \ 10 \\ 9 \ 27 \ 00 \\ 9 \ 22 \ 05 \end{array}$				
	Cape Melle: Light-house. Genoa: San Benigno light Spezzia: Fort Santa Maria light Florence: Observatory. Leghorn (Livorno): Light on S. end of curved breakwater. Capraia Island: Cape Ferrajone light Elba Island, Porto Longone: Fort For-	$\begin{array}{rrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrr$	$\begin{array}{c} 8 & 10 & 22 \\ 8 & 54 & 19 \\ 9 & 50 & 48 \\ 11 & 15 & 22 \\ 10 & 17 & 25 \\ 9 & 51 & 07 \end{array}$				
aly.	cado light. Pianosa Island: Light on battery, W. side of fort Africa Roek: Light-house Monte Christo Islet: Summit. Giglio Island, Cape Rosso: Light-house. Civita Veechia: Light N. end of break-	$\begin{array}{cccccccccccccccccccccccccccccccccccc$	$\begin{array}{cccccccccccccccccccccccccccccccccccc$				
Ita	water Rome: Observatory. Gaeta: Orlando tower. Ponza Islet: Punto della Guardia light Naples: Observatory Light on elbow of mole. Capri Island: Carena Pt. light. Lipari Island: Casa Bianca light. Ustiea Island: NE. point light. Faro of Messina: Capo di Faro light Milazzo: Light-house Palermo: Observatory Light on mole head Trapani: Palumbo Rock light.	$\begin{array}{r} 42 \ 05 \ 38 \\ 41 \ 53 \ 54 \\ 41 \ 12 \ 27 \\ 40 \ 52 \ 38 \\ 40 \ 51 \ 46 \\ 40 \ 50 \ 15 \\ 40 \ 32 \ 07 \\ 38 \ 28 \ 43 \\ 38 \ 42 \ 40 \\ 38 \ 16 \ 02 \\ 38 \ 16 \ 02 \\ 38 \ 16 \ 10 \\ 38 \ 06 \ 44 \\ 38 \ 07 \ 56 \\ 38 \ 00 \ 39 \end{array}$	$\begin{array}{cccccccccccccccccccccccccccccccccccc$	4 00	10 13	0.7	0.2

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MARITIME POSITIONS AND TIDAL DATA.

	-	1		Lun	. Int.	R	ange.
ast	Place.	Lat. N.	Long. E.				
õ				H. W.	L. W.	Spg.	Neap.
		0 / //	0 / 11	h m	h m	tt.	14
	Maritimo Island: Light on SW. pt	37 57 13	12 02 55	16. 110.	<i>n. m.</i>	<i>Ji</i> .	Jt.
	Marsala: W. mole light	37 47 10	$12 \ 25 \ 59$				
	Girgenti: Port Empedoche light	37 16 55	$13 \ 32 \ 27$				
	Gozo Island: Light on NW. pt	36 04 10	$14 \ 12 \ 55$				
	Malta Island, Valetta Harbor: Light-	25 51 00	14 91 90	9 19	0.95	0.7	0.9
	house.	35 54 00	14 31 30	3 12	9 25	0.7	0.2
	Lampedusa Island: Carallo Bianco light.	35 29 37	12 36 12				
	Cape Passaro: Light-house	36 41 03	15 07 45				
	Syracuse: Maniace Castle light	37 03 04	15 17 37				
	Augusta Port: Torre d'Avola light	37 12 39	15 13 20	3 00	9 13	0.9	0.3
	Catania: Sciari Biscari light	37 29 35 27 50 25	15 05 19				
	Cape Taorinina: Semaphore	37 30 23	15 34 36				
	Cape Peloro: Light-house	38 16 02	15 39 11				
U)	Cape Spartivento: Light-house	37 55 29	16 03 31				
Its	Cape Colonna: Light-house	39 01 29	17 12 09				
	Cotrone: Mole-head light	39 04 38	17 08 07				
	Taranto: Cape St. Vito light	40 24 41	17 12 23				
	Gallipoli: St. Andrea light	40 02 48	17 50 55				
	Cape Sta. Maria ul Leuca. Light-house.	40 06 23	18 31 25				
	Port Otranto: Castle	40 09 06	18 28 45				
	Brindisi: Light-house	40 39 36	17 59 37	3 30	9 43	1.8	0.5
	Bari: St. Catalolo light	41 08 19	16 50 52				
	Viesti: Light on St. Croce Rock	41 53 17	16 11 13				•••••
	Manfredonia: Light-nouse	41 37 39	15 55 34				
	Ancona: Monte Cappucini light	43 37 14	13 31 18				
	Malamocco: Rocchetta Mole light	45 20 30	12 19 09	10 15	4 45	3.3	0.9
	Venice: Site of tower of St. Mark	45 25 58	$12 \ 20 \ 29$				
					1		
	Grado: Church tower	45 41 06	13 22 54			• • • • • • •	
	Trigeta: Observatory Nautical Academy	45 38 51	13 32 10		• • • • • • • • • •		
	Theresa Mole light	45 38 54	13 45 14	9 20	3 50	2.0	0.6
	Capo d'Istria: Light-house	45 33 00	13 43 18				
	Isola: Light-house	45 32 34	$13 \ 39 \ 32$				
	Pirano: Light-house	45 31 54	13 33 48				
	Salvore Point: Light-house	45 29 24	13 29 30				
	Citta Nuova: Light-house	40 19 10	13 33 42 12 12 25 39				
	Rovigno. St. Enfemia light	45 05 00	13 38 00				
	Pola: N. cupola of observatory	44 51 49	13 50 46	9 00	3 25	3.4	0.9
	Promontore Point: Porer Rock light	44 45 30	13 53 36				
	Nera Point: Light-house	44 57 24	14 08 42				
	Fiume: Cathedral tower	45 19 36	14 26 41	8 15	$2 \ 35$	1.2	0.3
	Porto Ré: Light-house	45 16 18	14 33 42	••••			
8	Prostonizza Point: Light-house	45 01 50	14 34 30				
5	Cherso: Kimen Point light	44 57 36	14 23 30	•••••			
ns	Galiola Rock: Light-house	44 43 36	14 10 36				
•	Unie Island: Netak Point light	44 37 20	14 14 06				
	Lussin Piccolo: Sta. Maria Church	44 31 49	$14 \ 28 \ 06$	8 10	2 25	1.1	0.3
1	St. Pietro di Nembo Island: Health office.	44 27 42	14 33 28				
	Gruizza Kock: Light-house	44 24 42	14 34 00		•,•••••		
	Terstenik Rock: Light-house	44 00 24	14 34 42				
	Carlobago: Light-house	44 31 30	15 04 24				
	Zara: Church tower	44 07 05	$15 \ 14 \ 05$				
	Bianche Point: Light-house	44 09 06	14 49 24				
	Zara Vecchia: Church tower	43 56 16	$15 \ 26 \ 21$				
	Port Tajer: Lestrice I. light	43 51 15	15 12 06				
	Sebenico Mount Tartaro	43 45 08	15 58 07	6 10	0.20	1.0	0.3
	Rogosnizza Port: Mulo Rock light	43 31 00	15 55 00	0 10			
	Zirona Grande Island: St. George						
	Church tower	43 27 00	$16 \ 08 \ 51$				
	Trani: Cathedral tower	$43 \ 31 \ 02$	$16 \ 15 \ 09$				

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APPENDIX IV.

MARITIME POSITIONS AND TIDAL DATA.

st.		Tet N	X	Lun.	Int.	Ra	ange.
Coa	Place.	Lat. N.	Long. E.	H. W.	L. W.	Spg.	Neap.
Austria.	Port Spalato: Cathedral tower	$\begin{array}{c}\circ & \ \ \ \ \ \ \ \ \ \ \ \ \ \ \ \ \ \ $	$\begin{array}{c} \circ \ \ \ \ \ \ \ \ \ \ \ \ \ \ \ \ \ \ $	h. m. 4 00	h. m. 10 30	<i>fl. 2.4</i>	<i>ft.</i>
	Antivari: Pt. Valovica light Dulcigno: W. windmill	$\begin{array}{cccccccccccccccccccccccccccccccccccc$	$\begin{array}{cccccccccccccccccccccccccccccccccccc$				
Turkey.	Cape Rodoni: Guard-house Cape Pali: Guard-house Durazzo: Light-house. Cape Laghi: Ruin. Skumbi River: Pyramid at mouth Semeny River: Samana Pt. light Vojazza River: Pyramid at mouth Saseno Island: Light-house. Avlona: Light-house. Cape Linguelta: Extreme. Mount Cica: Pyramid. Port Palermo: Pyramid. Cape Kiefali: Pyramid. Fano Island: Pt. Kastri light Port Pagonia: Ruin Port Gomenitza: Well Dogana Port Parga: Madonna I	$\begin{array}{cccccccccccccccccccccccccccccccccccc$	$\begin{array}{cccccccccccccccccccccccccccccccccccc$				
Greece.	Port St. Spiridione: Convent Corfu: Light-house Paxo Island: Madonna I. light Prevesa; Fort Nuovo minaret Port Drepano: Observation island Port Viko: Custom-house Port Vathi: Lazaretto light Port Argostoli: St. Theodoro light Patras: Light-house Katakolo: Light-house Xante: Mole light Strovathi, or Strivali Island: Stamphani I. light Proti Passage: Marathon Pt Navarin: Light-house Mothoni: Round tower Koroni Anchorage: Mole light Petalidi Bay: Petalidi Pt Candia Island, Port Suda: Light-house Megalo Kastron: Mole light	$\begin{array}{cccccccccccccccccccccccccccccccccccc$	$\begin{array}{cccccccccccccccccccccccccccccccccccc$	3 40	9 53	1.0	0.3

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MARITIME POSITIONS AND TIDAL DATA.

				1			
÷				Lun	Int.	R	ange.
BS	Place.	Lat. N.	Long, E.	17 377	T) Y
30				H. W.	L. W.	Spg.	Neap.
		0 / //	0 / //	h. m.	h. m.	ft.	ft.
	Kandeliusa Island: Light-house	36 29 40	$26\ 59\ 25$				
	Stampali Island, Maltezana Port: Agios						
	Ioanes	$36 \ 34 \ 25$	$26 \ 24 \ 28$				
	Christiana Islands: N. pt.	$36 \ 15 \ 20$	$25 \ 13 \ 00$				
	Milo Island: Summit, Mt. St. Elias	36 40 27	$24 \ 23 \ 15$				
	Sinhano Island. Light-house	36 59 12	24 40 30				
	Navos Island Navia: Gataon Bacchus I	37 06 32	25 23 00				
	Paros Island, Port Trio: Trio Pt	37 00 01	25 14 21				
	Port Naussa: St Vauni	07 00 01	20 11 21				
	Church	27 08 28	95 11 09				
	Course Male light	97 96 19	20 14 00				
	Syra: Mole light	- 57 20 12 - 97 07 92	24 00 14				
	Sermo Island: Amyno Pt	37 07 30	24 32 23				
	Thermia Island: Ruins of Cythnus	37 25 55	24 23 35				
	Jura Island: North pt	37 38 00	24 44 32				
	Port St. Nikolo: Light-house	$37 \ 39 \ 28$	24 19 44				
	St. Nikalao Island: Port Mandri	$37 \ 44 \ 00$	$24 \ 04 \ 12$				
	Andros Island, Cape Fasse: Light-house.	37 57 30	$24 \ 42 \ 30$				
	Ieraka: Acropolis	$36 \ 47 \ 05$	$23 \ 05 \ 40$				
	Port Kheli: Light-house	37 18 42	$23 \ 08 \ 53$				
	Poros Island: Light-house	37 31 45	$23 \ 25 \ 45$				
	Ægina: Light-house	37 44 30	23 25 30				
	Piræus: Light-house	37 56 14	23 38 10				1
ee	Athens: Observatory	37 58 20	23 43 55				
ee	Cape Colonna: Extreme	37 38 45	24 02 15				
뭁	Port Banhti: Statue I	37 52 48	24 03 00				
	Petali Island, Trago I neak	38 01 28	24 16 42				
	Euripo Strait: Light-house	38 28 15	23 36 45				
	Skiathoe Island: Mount Stavros	39 10 48	23 27 07				
	Selonika: S bestion	40 37 28	22 58 00				
	Port Bablar: Cano Yorog	40 32 40	26 45 00				
	Lompog Island, Kastro Castlo	20 52 10	20 40 00				
	Dent Mondros, Congrede Dt	20 50 52	25 03 20				
	Ctusti Island, St Stasti Church	00 00 02 20 01 50	20 14 14				
	Mit de la Lloud Dout Ciude Liebt l	00 10 05	24 09 10				
	Mityleni Island, Port Sigri: Light-house.	39 12 35	25 50 00				
	Mityleni: Lighton Mity-	40 00 10	00.04.54				
	leni Pt.	39 06 10	20 34 04				
	Port lero: Sidero Islet.	39 03 20	26 31 39				
	Psara Island: Fort.	$38 \ 32 \ 00$	25 35 00				
	Tchesme: C. Kezil light	38 19 55	26 17 45				
	Samos Island: Fonia Pt. light	$37 \ 41 \ 24$	$26 \ 58 \ 42$				
	Port Isene: Tower	$37 \ 16 \ 33$	$27 \ 36 \ 55$				
	Kos: Light-house	36 55 00	27 18 25				
	Marmorice Harbor: Adassi Pt. light	$36 \ 48 \ 00$	28 18 00				
	Makry Harbor: Kasil I	36 39 33	$29 \ 06 \ 13$				
	Rhodes Port: Arab's Tower light	$36 \ 26 \ 00$	$28 \ 16 \ 24$				
	Port Lindo: Tower	$36 \ 05 \ 53$	$28 \ 08 \ 10$				
	Dardanelles: Hellas Pt. light	40 02 30	26 10 54				
	Gallipoli: Light-house	40 24 27	26 41 24				
ey	Bosphorus: Tofana Pt. light	41 01 20	29 01 00				
H	Scutari: Leander Tower light	41 01 02	29 00 29				
3	Constantinople: Seraglio Pt. light	41 00 35	29 01 14				
E.	St. Sophia Mosque	41 00 16	28 58 59				
	Cape Kara Burnu: Light-house	41 21 15	28 42 14				
	Yuiada Road: Fort Tersana	41 52 04	27 58 45				
	Burghaz: Light-house	42 27 52	27 35 54				
	Varna Bay: Light-house	43 10 00	27 58 35				
	Kusterieh: Cape Kusterieh light	44 10 20	$28 \ 39 \ 14$				
	Danube River: Salina light	45 09 47	$29 \ 41 \ 14$				
÷.	Fidonisi Island: Light-house	45 16 00	30 14 14				
si	Odessa: Observatory	46 28 36	30 45 34				
2	Dnieper Bay: Fort Nikolaeo light	46 34 27	31 33 36				
1 H	Sebastopol: E. light-house	44 36 55	33 36 26				
	Balaklava Bay: Hospital	44 29 50	33 36 25				
	Kertch: Light-house	45 21 03	36 28 30				
	Berdiansk: Breakwater light	46 45 00	36 46 40				
	Saukhoum: Light-house	42 58 00	40 55 10				
	Batoum: Light-house.	41 39 30	41 38 15				
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APPENDIX IV.

MARITIME POSITIONS AND TIDAL DATA.

ust.		Lot X	Long D	Lun. Int.		Re	inge.
Coa	Place.	Lat. N.	Long. E.	H. W.	L. W.	Spg.	Neap.
Turkey.	Trebizond: Light-house Sinope: Light-house Bender Erekli: Light-house Marmora Island: Light off E. pt Artaki Bay: Zeitijn Adasi Islet Tenedos Island: Ponente Pt. light Port Ajano: Nikolo Rock Port Ali-Agha: W. pt. of entrance Smyrna: English consulate flag-staff Vourlah: Custom-house Sighajik Harbor: Beacon on islet Budrum: Light-house Adalia: Light-house Latakiyah: Light-house Tripoli Roadstead: Bluff Islet light Ruad Island: Light-house Saida (ancient Sidon): Light-house Sûr (ancient Tyre): Light-house Haifa: Light-house	$\begin{array}{c} \circ & \prime & \prime & \prime \\ +1 & 01 & 00 \\ +2 & 01 & 20 \\ +1 & 18 & 03 \\ +0 & 23 & 30 \\ +0 & 23 & 30 \\ 39 & 50 & 00 \\ 39 & 50 & 00 \\ 39 & 01 & 21 \\ 38 & 50 & 10 \\ 38 & 21 & 48 \\ 38 & 12 & 21 \\ 37 & 02 & 00 \\ 36 & 35 & 30 \\ 36 & 35 & 30 \\ 36 & 35 & 30 \\ 36 & 35 & 30 \\ 36 & 35 & 30 \\ 36 & 35 & 30 \\ 36 & 35 & 30 \\ 36 & 35 & 30 \\ 36 & 35 & 30 \\ 37 & 40 \\ \end{array}$	$\begin{smallmatrix} \circ & \prime & \prime & \prime \\ 39 & 46 & 25 \\ 35 & 13 & 20 \\ 31 & 25 & 49 \\ 27 & 47 & 30 \\ 25 & 58 & 34 \\ 26 & 47 & 57 \\ 26 & 57 & 20 \\ 27 & 09 & 10 \\ 26 & 47 & 32 \\ 27 & 27 & 05 \\ 30 & 45 & 34 \\ 36 & 10 & 20 \\ 35 & 46 & 30 \\ 35 & 44 & 24 \\ 35 & 51 & 00 \\ 35 & 28 & 25 \\ 35 & 21 & 30 \\ 35 & 14 & 40 \\ 35 & 08 & 00 \\ 35 & 05 & 00 \\ \end{smallmatrix}$	h. m. 9 15 9 45	h. m. 3 15 3 3 35	<i>ft.</i> 2.5 1.2	<i>ft.</i>
Cyprus.	Famagusta: Light-house C. Gata: Light Lamaka: Light-house	$\begin{array}{cccccccccccccccccccccccccccccccccccc$	$\begin{array}{cccccccccccccccccccccccccccccccccccc$	· 9 40	3 30	1.4	0:4
Egypt.	Port Said: High light-house River Nile: Damietta Mouth Rosetta Mouth light Aboukir Bay: Nelson I. peak Alexandria: Eunostos Pt. light	$\begin{array}{cccccccccccccccccccccccccccccccccccc$	$\begin{array}{cccccccccccccccccccccccccccccccccccc$	9 40 9 45	3 30 	1.0. 1.1	0.3
	Ben Ghazi: Castle Tripoli Harbor: Light-house	$\begin{array}{cccccccccccccccccccccccccccccccccccc$	$\begin{array}{cccccccccccccccccccccccccccccccccccc$	$\begin{array}{c}9&55\\10&00\end{array}$	$\begin{array}{c}3&45\\3&50\end{array}$	$\begin{array}{c} 1.2\\ 1.9\end{array}$	$ \begin{array}{c} 0.3 \\ 0.5 \end{array} $
Tunis.	Sfax: Ras Tina light Mehediah: Sidi Jubber Monastir: Burj el Kelb battery Hammamet Bay: Castle flag-staff Kalibia Road: Light-house Cape Bon: Light-house Tunis: Goletta light	$\begin{array}{cccccccccccccccccccccccccccccccccccc$	$\begin{array}{cccccccccccccccccccccccccccccccccccc$	3 35 	9 57	4.2	1.1 0.8
Algeria.	Cape Farina: Extreme Benzert: N. Jetty light Galita Island: Monte Guardia Bona: Fort Genois light Stora: Singe I. light Cape Bougaroni: Light-house Cape Carbon: Light-house Algier: Light-house near Admiralty Cape Tenez: Light-house	$\begin{array}{cccccccccccccccccccccccccccccccccccc$	$\begin{array}{c} 10 \ 17 \ 30 \\ 9 \ 53 \ 21 \\ 8 \ 56 \ 12 \\ 7 \ 46 \ 40 \\ 6 \ 53 \ 11 \\ 6 \ 28 \ 37 \\ 5 \ 06 \ 22 \\ 3 \ 04 \ 13 \\ 1 \ 20 \ 36 \end{array}$	2 46	8 58	2.6	 1. 3
	Oran: Mers el Kebir light Habibas Island: Light-house	$\begin{array}{cccccccccccccccccccccccccccccccccccc$	Long. W. 0 41 38 1 07 57				
Morocco.	Zafarin Islands: Light Isabel Segunda I. Alboran Island: Light-house Ceuta: Light-house Tangier: Casbah tower Cape Spartel: Light-house	$\begin{array}{cccccccccccccccccccccccccccccccccccc$	$\begin{array}{cccccccccccccccccccccccccccccccccccc$	$\begin{array}{c}1&55\\1&30\end{array}$	$\begin{array}{c} 8 & 07 \\ 7 & 40 \end{array}$	3. 3 8. 0	1.5 3.7
	WEST CO.	AST OF A	FRICA.				
	El Araish: S. pt. of entrance Sali: Fort Cape Dar el Beida: Light-house	$\begin{array}{cccccccccccccccccccccccccccccccccccc$	$\begin{array}{c} 6 & 09 & 13 \\ 6 & 48 & 00 \\ 7 & 33 & 00 \end{array}$	1 35	7 45	10.4	4.8

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MARITIME POSITIONS AND TIDAL DATA. WEST COAST OF AFRICA-Continued.

st.			-	Lun.	Int.	Ra	inge.
Coa	Place.	Lat. N.	Long. w.	H.W.	L. W.	Spg.	Neap.
		0 / //	0 / 11	h. m.	h. m.	ft.	ft.
	Cape Blanco, North: Extreme	$\begin{array}{cccccccccccccccccccccccccccccccccccc$	$8 35 05 \\ 9 43 30$	1 05	7 17	10.9	5.0
	Cape Ghir: Extreme	30 38 00	9 50 00				
	Cape Noun: Extreme	$\begin{array}{cccccccccccccccccccccccccccccccccccc$	11 02 00 12 56 00	11 55	5 49		
	Cape Bojador: Extreme	$27 \ 50 \ 00$ $26 \ 07 \ 57$	$12 \ 50 \ 00$ $14 \ 29 \ 00$	11 50 11 50	5 38	7.3	3. 5
	Penha Grande.	$25 \ 07 \ 06$	14 50 44				
	Ouro River entrance: Dumford Pt Pedra de Galba	$\begin{array}{cccccccccccccccccccccccccccccccccccc$	$15 58 00 \\ 16 48 11$				
	Cape Blanco, South: Extreme	20 46 27	$17 \ 05 \ 40$	$11 \ 35$	$5\ 23$	5.5	2.5
	Portendik: Village	$18 \ 18 \ 45$ $16 \ 01 \ 31$	$16 02 00 \\ 16 30 22$				•••••
	Almadie Point: Light-house	10 01 31 14 44 45	$10 \ 30 \ 22 \ 17 \ 32 \ 25$				
	Cape Verde: Light-house	14 43 20	$17 \ 30 \ 55$ $17 \ 95 \ 99$		· · · · · · · · ·		
	Cape Manoel: Light-house	$14 \ 40 \ 30 \ 14 \ 38 \ 55$	$17 25 28 \\ 17 26 47$				
	Goree Island: Fort	$14 \ 39 \ 55$	$17 \ 24 \ 30$				
	Bird Island: Flagstaff	$13 \ 39 \ 45 \\ 13 \ 28 \ 00$	$16 \ 40 \ 30$ $16 \ 35 \ 00$	9.00	2 50	5.9	9 7
	Carabane: Light-house	$12 \ 35 \ 00$	$16 \ 44 \ 00$		2 00		2.1
	Nunez River: Sand I	10 36 37	14 42 00	7 90	1 00		
	Isles de Los: Light-house	9 30 30	14 04 50 13 44 00	7 30	1 20	11.4	<i>ð. 2</i>
	Matacong Island: House	9 16 10	$13 \ 26 \ 20$				
	Scarcies River: W. end of Yellaboi 1	8 57 05 8 30 00	$13 18 25 \\ 13 18 30$	7 40	1 30	11 6	5.3
	N. battery	8 29 57	13 14 30				
	Sherbro Island: N. island	7 40 36	13 04 30	5 50	10.00	10.4	4 0
	Gallinas River: W. elbow of Kamasoun I.	7 22 40 7 00 08	$12 \ 31 \ 35 \ 11 \ 38 \ 45$	5 50	12 00	10.4	4.8
	Cape Mount: W. peak	6 44 30	$11 \ 22 \ 51$				
	Cape Mesurado: Light-house	$6 19 10 \\ 6 19 00$	10 49 25 10 50 00	5 40	11 54	6.0	2 5
	Marshall: Agent's house	6 08 06	10 22 45				2.0
	Grand Bassa: Agent's house	5 54 08 5 26 25	10 04 05 0 21 15				
	Sangwin River: Sangwin Pt	$5 \ 26 \ 25 \ 5 \ 12 \ 42$	9 20 16				
	Sinon: Bloobarra Pt	4 59 15	9 02 05	4 50	11 05	4.8	2.0
	Cape Palmas: Light-house Tabou River: Tabou Pt	$\begin{array}{r} 4 & 22 & 10 \\ 4 & 24 & 47 \end{array}$	7 44 15 7 21 30	4 30	10 43	4.3	1.8
	Axim Bay: Ft. St. Anthony	4 52 18	2 14 45				
	Cape Three Points: Light-house	4 45 00 4 17 45	$\begin{array}{c} 2 & 05 & 45 \\ 1 & 56 & 10 \end{array}$	4 00	10 13	4.7	1.9
	Tacorady Bay: Tacorady Pt	4 53 00	$1 \ 45 \ 00$				
	Chama Bay: Dutch Fort	5 01 00	1 38 00 1 91 05				
	Cape Coast Castle: Light-house	$50448 \\ 50620$	$1 21 05 \\ 1 13 50$	4 20	10 32	6.0	2.5
	Accra: Light-house	$5 \ 31 \ 50$	$0 \ 11 \ 30$				
	Volta River entrance: Dolbens Pt	5 46 00	Long. E. 0 41 00	4 20	10.33	12	1.8
	Lagos River: Light-house	$6\ 25\ 15$	3 25 15	4 50	10 05 11 05	3.3	1.3
	Benin River entrance: N. pt	5 46 01	5 03 05 6 15 00				
	Calebar River (New): Rough Corner	4 10 40 4 23 07	7 07 00				
	Opobo River: W. pt. beacon (approx.)	4 27 00	7 40 00				
	Quaebo River: Bluff Pt Calebar River (Old): Townsend flagstaff	4 30 40	1 59 00				
	(Dunketown)	4 56 24	8 20 46				
	Fernando Po Island: Light-house San Bento River: Joho Pt (approx)	$\begin{array}{cccccccccccccccccccccccccccccccccccc$	8 47 05				
	Princes Island: Diamond Rocks, center	1 00 00	0 00 00				
	of largest	$1 \ 40 \ 42$	7 27 56				
	light	0 20 30	6 42 45				
		Lat. S.	F 00 10				
	Cape Lopez: Light-house	$ \begin{array}{cccccccccccccccccccccccccccccccccccc$	$ \begin{array}{r} 5 38 12 \\ 8 43 10 \end{array} $				
	Mayumba Bay: Light-house	3 23 00	10 38 00	4 25	10 38	7.0	2.9

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APPENDIX IV.

MARITIME POSITIONS AND TIDAL DATA.

WEST COAST OF AFRICA-Continued.

st.				Lun.	Int.	Ra	inge.
Con	Place.	Lat. S.	Long. E.	H. W.	L. W.	Spg.	Neap.
	Loango Bay: Indian Pt. light	° ′ ″ 4 40 00	° ′ ″ 11 46 30	k. m. 4 13	h. m. 10, 26	ft. 6. 5	ft. 2.7
	Black Point Bay: Sandy Pt	4 49 00	11 45 00 12 08 00				
	Kabenda Bay: Kabenda Pt. light	$5 18 30 \\ 5 32 30$	$12 08 00 \\ 12 11 00$				
	Congo River entrance: Shark Pt Margate Head: Summit	$\begin{array}{c} 6 & 04 & 36 \\ 6 & 31 & 50 \end{array}$	$12 \ 15 \ 00 \\ 12 \ 25 \ 25$	4 10	$10 \ 25$	6.0	2.5
	St. Paul de Loando: Flag staff, Ft. San	0 10 01	10 10 00	9 10	0.59	1.0	
	Lobito Point: Extreme	$\begin{array}{c} 8 \ 48 \ 24 \\ 12 \ 20 \ 00 \end{array}$	$13 \ 13 \ 20$ $13 \ 32 \ 00$	3 40	9 53	4.8	2.0
	Benguela: Telegraph office	$12 \ 34 \ 43 \ 13 \ 12 \ 30$	$13 \ 23 \ 45 \\ 12 \ 48 \ 55$	3 30	9 43	5.5	2.3
	St. Mary Bay: Bay I	$13 \ 26 \ 05$	$12 \ 36 \ 00$				
	Port Alexander: Bateman Pt	$15 \ 09 \ 00 \\ 15 \ 47 \ 30$	$12 12 00 \\ 11 52 40$				
	Great Fish Bay: Tiger Pt	$16 \ 30 \ 00$ $18 \ 22 \ 00$	$11 \ 42 \ 00$ $11 \ 57 \ 12$	3 00	9 12	5.7	2.4
	Walfisch Bay: Light-house.	$ \begin{array}{ccccccccccccccccccccccccccccccccccc$	$11 \ 37 \ 12 \ 14 \ 30 \ 00$				
	Ichabo Island Angra Pequena: Diaz Pt	$\begin{array}{cccccccccccccccccccccccccccccccccccc$	$\begin{array}{cccccccccccccccccccccccccccccccccccc$				
	Elizabeth Bay: S. pt. of Possession I	$\begin{array}{cccccccccccccccccccccccccccccccccccc$	$15 12 22 \\ 16 52 02$	$ \begin{array}{c} 2 & 35 \\ 9 & 95 \end{array} $	8 47	5.5	2.3
	Hondeklip Bay	$\begin{array}{cccccccccccccccccccccccccccccccccccc$	$\begin{array}{cccccccccccccccccccccccccccccccccccc$	2 20	0 00	0.0 	2.2
	Roodewal Bay Saldanha Bay: Constable Hill	$\begin{array}{cccccccccccccccccccccccccccccccccccc$	$\begin{array}{cccccccccccccccccccccccccccccccccccc$	$\frac{2}{2}20$	8 33	5.1	2.1
	Table Bay: Robben I. light	33 48 52	18 22 33 18 28 40	1 90	7 47	1.0	
	Cape of Good Hope: Light-house	$33 \ 50 \ 04 \ 34 \ 21 \ 12$	$18 \ 28 \ 40 \ 18 \ 29 \ 26$	1 30		4.0	2.0
	EAST COAST OF AF	RICA AN	ID THE 1	RED SE	А.		
	Simons Bay: Light-house	34 10 45	18 27 30	2 35	8 48	5.2	99
	Cape Hangklip: Extreme	$34 \ 23 \ 48$	$18 \ 50 \ 20$				
	Quoin Point: Extreme. Cape Agulhas: Light-house	$\begin{array}{cccccccccccccccccccccccccccccccccccc$	$\begin{array}{cccccccccccccccccccccccccccccccccccc$	2 40	8 53	5.2	2.2
	Port Beaufort: Flag-staff	$\begin{array}{cccccccccccccccccccccccccccccccccccc$	20 48 40	3 18	0.31	5.6	2 0
	Knysna Harbor: Fountain beacon	34 04 35	23 03 38				2.0
	Plettenberg Bay: Summit of Seal Pt St. Francis: Light-house	$\begin{array}{cccccccccccccccccccccccccccccccccccc$	$\begin{array}{cccccccccccccccccccccccccccccccccccc$				
	Cape Recife: Light-house	34 01 41	$25 \ 42 \ 12$ $25 \ 27 \ 21$	9 01	0.99	5.1	1.0
	Bird Islands: Light-house	$ \begin{array}{ccccccccccccccccccccccccccccccccccc$	$25 \ 57 \ 21$ $26 \ 17 \ 13$	0 21	9 00	0.4	1. 9
	Port Alfred: Signal staff	$\begin{array}{cccccccccccccccccccccccccccccccccccc$	$\begin{array}{cccccccccccccccccccccccccccccccccccc$				
	Madagascar Reef: Center	33 23 10	27 20 48				
	East London: Light-house	33 05 10 33 01 45	$27 \ 49 \ 12$ $27 \ 55 \ 02$	3 37	9 50	5.0	1.8
	Cape Morgan: Extreme	$\begin{array}{cccccccccccccccccccccccccccccccccccc$	$\begin{array}{cccccccccccccccccccccccccccccccccccc$				
	Rame Head: Extreme	31 48 15	29 21 15 29 21 15				
	Waterfall Bluff	$\begin{array}{c} 31 & 38 & 06 \\ 31 & 26 & 15 \end{array}$	$29 \ 33 \ 16 \ 29 \ 48 \ 40$				
	Port Natal (Durban): Light-house	$\begin{array}{cccccccccccccccccccccccccccccccccccc$	$\begin{array}{cccccccccccccccccccccccccccccccccccc$	3 58	10 11	5.6	1.6
	Cape St. Lucia: Extreme	$ \begin{array}{c} 23 & 00 & 12 \\ 28 & 32 & 30 \\ 20 & 00 \\ 30$	$32 \ 27 \ 39$				
	Cape Vidal: Extreme Delagoa Bay: Reuben Pt. light	$\begin{array}{cccccccccccccccccccccccccccccccccccc$	$\begin{array}{cccccccccccccccccccccccccccccccccccc$	5 10	11 22	11.9	3.4
	Cape Corrientes: Small rock	$\begin{array}{cccccccccccccccccccccccccccccccccccc$	$\begin{array}{cccccccccccccccccccccccccccccccccccc$	4 30	10 49	11 0	3 2
	Cape St. Sebastian: Extreme.	22 05 00	35 29 00				
	Bazaruto Island: N. pt. light Chuluwan Island: Light-house	$ \begin{array}{ccccccccccccccccccccccccccccccccc$	$\begin{array}{cccccccccccccccccccccccccccccccccccc$				
	Sofala: Fort on N. side of entrance	$\begin{array}{cccccccccccccccccccccccccccccccccccc$	$ \begin{array}{c} 34 & 46 & 00 \\ 36 & 11 & 47 \end{array} $	4 15	10.97	13 5	3.0
	Quillimane River: Light-house	18 02 30 18 01 24	36 58 30	- 10	10 21		
	Quillimane: Town Mazemba River: Entrance	$\begin{array}{cccccccccccccccccccccccccccccccccccc$	$\begin{array}{cccccccccccccccccccccccccccccccccccc$				
				1		1	

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MARITIME POSITIONS AND TIDAL DATA.

EAST COAST OF AFRICA AND THE RED SEA-Continued.

št.	•			Lun.	Int.	Rŧ	inge.
COBS	Place.	Lat. S.	Long, E,	H. W.	L. W.	Spg.	Neap.
<u> </u>							
	Promaire Islands: Conter of Casuaring I	° / //	° / // 39.06.27	h. m.	h. m.	ſt.	ft.
	Angoxa Islands: Center of Hurd I	$16 \ 33 \ 24$	$39 \ 49 \ 57$				
	Mafamale Island: Center	$16 \ 20 \ 30$	40 03 57				
	Port Mokamba: Mokambo Pt	$15 08 00 \\ 15 09 19$	40 36 12				
	San Sebastian light	$15 \ 02 \ 12 \ 15 \ 00 \ 45$	40 45 45	4 00	10 12	11.8	3.4
	Cape Cabeceira: Light-house	$14\ 58\ 20$	$40 \ 45 \ 10$				
	Port Conducia: Bar Pt	14 53 00 12 22 10	40 40 00				
	Pemba Bay: N. pt light	$13 \ 25 \ 40 \ 12 \ 55 \ 45$	40 40 00		· · · · · · · ·		
	Querimba Islands: Ibo I. light	12 19 30	40 40 09				
	Numba Island: E. pt	11 09 18	$40 \ 43 \ 21$	2.50	10.11	11 9	
	Cape Delgado: Light-nouse Msimbati: Ras Matunda	$10 \ 41 \ 20$ $10 \ 19 \ 22$	40 38 35 40 26 34	3 99	10 11	11.3	3.3
	Mikindini Harbor: Kinizi	$10 \ 16 \ 31$	40 10 33				
	Mgan Mwania: Madjori Rock	$10 \ 06 \ 43$	40 02 14	0.55	10.00		;-;
	Mchinga Bay: Observation spot	9 59 30	$39 \ 46 \ 41$ $39 \ 47 \ 07$	3 99	10 08	10.9	4.5
	Kiswere Harbor: Rustmigi	$9\ 25\ 36$	$39 \ 39 \ 31$				
	Kilwa Kisiwani: Fort.	8 57 15	$39 \ 30 \ 42$				
	Mafia Island: Moresby Pt Dar Fe-Salaam: Flagstaff	7 38 10 6 49 41	$39 \ 54 \ 42$ $39 \ 17 \ 05$				• • • • • •
	Bagamoyo: French Mission	6 26 10	38 54 27				
	Zanzibar: English consulate	6 09 43	39 11 08	4 05	$10 \ 17$	14.5	6.0
	Tanga Bay: Light-house	5 00 35	$\begin{array}{cccccccccccccccccccccccccccccccccccc$		• • • • • • • • •		
	Port Melinda: Vasco de Gama's Pillar	3 12 48	40 11 21	4 00	10 13	12.1	5.0
	Lamo Bay: Lamo Castle	2 15 42	40 56 21				
	Manda Roads: E. side of Manda Toto I.	$\begin{array}{cccccccccccccccccccccccccccccccccccc$	40 59 40 41 51 15	1 20	10 12	11 7	
	Kisimavu Bay: S. pt. of Kisimavu I	$ \begin{array}{c} 1 & 13 & 00 \\ 0 & 22 & 35 \end{array} $	42 33 57	4 30	10 42	11.7	4.9
		Lat N					
	Brava: Well	1 06 48	$44 \ 03 \ 27$	4 15	$10 \ 27$	7.5	3.1
	Meurka Anchorage: S. pt. of town	1 42 06	44 53 49				
	Magadoxa: Tower Murat Hill: Peak	2 01 48 2 30 00	45 24 39				
	Ras Hafun: E. extreme of Africa	$10 \ 26 \ 30$	$51 \ 22 \ 55$				
	Cape Guardafui: E. pt.	11 50 30	51 16 45	6 00	12 12	6.1	2.5
	Abd-al-Kuri Island NE. nt	$12 \ 26 \ 00 \ 12 \ 11 \ 15$	$\begin{array}{cccccccccccccccccccccccccccccccccccc$			• • • • • •	•••••
	Socotra Island: Tamarida, mosque	12 39 00	53 59 31	7 05	1 17	7.5	3.1
	Ras Antareh: Extreme of rocky pt	$11 \ 27 \ 30$	49 35 40				
	Port Berbera: Light-house	$11 13 00 \\ 10 25 00$	47 17 00				
	Zeyla: Mosque	10 20 00 11 22 00	-43 29 35	7 30	1 18	8.5	3.5
	Perim Island: Light-house	$12 \ 39 \ 00$	43 25 35	7 50	1 38	7.2	3.0
	Hanfelah Bay: Hanfelah Pt	14 44 00	40 52 00				
	Disei Island: Village Bay	$15 \ 28 \ 10$	$39 \ 45 \ 30$				
	Massaua Harbor: N. pt. of entrance	$15 \ 37 \ 12$	$39 \ 27 \ 23$	0 45	657	4.0	1.7
	Snakin: Light-house	$18 15 12 \\ 19 07 00$	$38 19 30 \\ 37 19 09$	2 10	8 99	1 7	0.7
	Makaua Island: S. pt	$20 \ 44 \ 00$	37 15 30				
	St. Johns Island: Peak	$23 \ 36 \ 20$	36 10 15				
	Dædalus Snoal: Light-house Kosair Anchorage: SW, augle of fort	$24 \ 56 \ 30$ $26 \ 06 \ 24$	$\begin{array}{cccccccccccccccccccccccccccccccccccc$				
a.	Brothers Island: Light-house	$\frac{26}{26}$ 18 $\frac{50}{50}$	34 50 45	6 40	0 28	2.0	0.8
ø	Safajah Island: N. summit	26 45 48	33 59 43				
ted	Ashrafi Island: Light-house	27 47 21 28 20 52	$33 \ 42 \ 28$ $33 \ 06 \ 31$	10.35	4 23	1.5	0.6
H	Zafarana: Light-house	29 06 29	$32 \ 39 \ 43$	10 40	$\frac{1}{4}$ $\frac{29}{28}$	5.5	2.3
	Suez: Newport Rock	29 53 05	$\begin{array}{cccccccccccccccccccccccccccccccccccc$	10 45	4 32	6.8	2.8
	Sherm Yahar: Entrance	$\begin{array}{cccccccccccccccccccccccccccccccccccc$	33 36 96 35 30 30				
	Sherm Joobbah: Entrance	$27 \ 33 \ 00$	35 32 30				
	Sherm Wej: Light-house	$\begin{array}{cccccccccccccccccccccccccccccccccccc$	$\begin{array}{cccccccccccccccccccccccccccccccccccc$				
	Yembó: Anchorage	$\begin{array}{cccccccccccccccccccccccccccccccccccc$	$\frac{37}{38} \frac{17}{02} \frac{45}{45}$				

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APPENDIX IV.

MARITIME POSITIONS AND TIDAL DATA.

EAST COAST OF AFRICA AND THE RED SEA-Continued.

				Lun. Int,		Range.	
Coas	Place.	Lat. N.	Long, E.	н. w.	L. W.	Spg.	Neap.
Red Sea.	Sherm Rabigh: Anchorage Jiddah: Jezirah el Mifsaka I Lith: Agha Islet Jelalil: Anchorage Kunfidah: Islet Khôr Nohud: Entrance Farisan I. Anchorage: Jebel Mandhakh Gizau: Fort Loheiya: Hill Fort Kamarán Bay: Harbor Hodeïda Road Jebel Zukur Island: N. pt. Mokha: N. Fort	$\begin{array}{c} \circ & \cdot & \prime & \prime \\ 22 & 43 & 50 \\ 21 & 28 & 00 \\ 20 & 09 & 00 \\ 19 & 55 & 30 \\ 19 & 07 & 40 \\ 18 & 15 & 50 \\ 16 & 50 & 15 \\ 16 & 53 & 00 \\ 15 & 42 & 00 \\ 15 & 42 & 00 \\ 15 & 42 & 00 \\ 15 & 20 & 30 \\ 14 & 47 & 00 \\ 14 & 03 & 53 \\ 13 & 19 & 43 \end{array}$	$ \begin{smallmatrix} \circ & \prime & \prime & \prime \\ 39 & 00 & 30 \\ 39 & 10 & 38 \\ 40 & 12 & 00 \\ 40 & 30 & 00 \\ 41 & 03 & 20 \\ 41 & 27 & 30 \\ 41 & 27 & 30 \\ 41 & 27 & 30 \\ 41 & 27 & 30 \\ 41 & 27 & 30 \\ 42 & 29 & 00 \\ 42 & 38 & 45 \\ 42 & 34 & 00 \\ 42 & 45 & 28 \\ 43 & 13 & 3 \\ 6 & 7 \\ 12$	h. m. 3 30 1 15 11 45	h. m. 9 42 7 27 5 33	<i>ft.</i> 2.0 2.9 4.5	<i>ft.</i> 0.8 1.2 1.9
	ISLANDS OF T	HE IND	IAN OCE.	AN.			
Laceadive Islands.	Chitlac Islet: S. end Betrapar Islet: N. Island Kittan Islet: S. end Cardamum Islet: Center Ameni Islet: N. end Underut Islet: Center Cabrut Islet: E. end Seuheli Par: N. islet Kalpeni Islet: S. end Minikoi Island: Light-house	$\begin{array}{cccccccccccccccccccccccccccccccccccc$	$\begin{array}{cccccccccccccccccccccccccccccccccccc$	10 20 	4 00 	6. 3 2. 5	3. 0 1. 2
Maldive Islands.	Heawandu Island: S. endKee-lah Island: N. endMah Kundu Island: NE. extremeNar Foree IslandHee-tah-doo IslandTo-du Island: CenterGafor Island: CenterMalé, or Kings Island: FlagstaffPha-li-du Island: Northern endMoluk Island: CenterHimmittee IslandKimbeedso Island: S. endEsdu Island: NE. ptWahdu Island: E. end	$\begin{array}{cccccccccccccccccccccccccccccccccccc$	$\begin{array}{cccccccccccccccccccccccccccccccccccc$	0 20	6 25	2.9	 1.4
	Amirante Islands: Ile des Roches, N. beach African Islands Seychelle Is., Platte I.: S. end Port Victoria: End of Ho- doul Jetty Bird Island: Tree Chagos Archipelago, Peros Banhos: Dia- mond Islet Diego Garcia: N. end of Middle I Cargados Carajos: Establishment I., flag- staff Rodriguez Island: Mathurina Bay, Point Venus	5 40 56 4 52 26 5 53 00 4 37 15 3 43 06 5 15 00 7 13 37 16 25 12 19 40 22 10 52 22 10 52 22 10 52 22 10 52 22 10 55 22 10 55 55 10 5	$\begin{array}{cccccccccccccccccccccccccccccccccccc$	4 22 1 30 1 50 0 20	10 35 7 43 8 03 6 32	4.3 5.8 4.0 5.5	1.2 1.7 1.2 1.6
Mauri- tius I.	Flat Island: Light-house Cannonier Point: Light-house Port Louis: Martello tower, Ft. George. Grand Port: Fouquet I. light	$\begin{array}{cccccccccccccccccccccccccccccccccccc$	$\begin{array}{cccccccccccccccccccccccccccccccccccc$	0 48	7 00	1.6	0.3

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MARITIME POSITIONS AND TIDAL DATA.

ISLANDS OF THE INDIAN OCEAN-Continued.

st.				Lun.	Int.	Ra	ange.
Соа	Place.	Lat. S.	Long. E.	H. W.	L. W.	Spg.	Neap.
	Réunion Island: St. Denis light Bel-Air light St. Paul light Tromelin Island: N. end Agalegas Island: NW. pt Farquhar Islands: Hall's house Alphonse Island: SE. part (Trees) Coetivy Island: N. end Cape St. Mary: S. extreme Leven Island: Center Port Machilows: Parmocoute I	$\begin{array}{c} \circ & \prime & \prime & \prime \\ 20 & 51 & 38 \\ 20 & 53 & 11 \\ 20 & 59 & 45 \\ 21 & 19 & 47 \\ 15 & 51 & 37 \\ 10 & 21 & 30 \\ 10 & 06 & 45 \\ 7 & 00 & 30 \\ 7 & 06 & 00 \\ 7 & 06 & 00 \\ 25 & 39 & 10 \\ 25 & 39 & 10 \\ 25 & 30 & 00 \end{array}$	$\begin{array}{c}\circ & , & , & , \\55 & 26 & 59 \\55 & 36 & 18 \\55 & 16 & 18 \\55 & 28 & 58 \\54 & 28 & 46 \\56 & 32 & 00 \\51 & 10 & 21 \\52 & 44 & 57 \\56 & 22 & 00 \\45 & 06 & 50 \\44 & 17 & 57 \\44 & 07 & 20 \end{array}$	h. m. 11 50	h. m. 5 38	ft. 3.5	<i>ft.</i> 0.6
Madagascar.	Port Machikora: Barracouta I St. Augustine Bay: Nosi Vei I Murderers Bay: Center of Murder I Mourondava: Village Mourondava: Village Kovra Rythi Point: Extreme Coffin Island: Nosi Vao Cape St. Andrew: Extreme Boyanna Bay: Barabata Pt Cape Tauzon: Extreme Majunga (Mojanga): Light-house Majamba Bay: W. pt Narendri Bay: Moormora Pt Port Radama: Pt. Blair Radama Islands: N. pt. Nossuvee I Baratoube Bay: Ambubuka Pt Nosi Bé: Hellville jetty Minow Islands: N. pt. Great I Cape San Sebastian: Extreme Port Liverpool: N. pt. of entrance Cape Amber: NE. extreme Port Looké: Pt. Bathurst Port Leven: S. pt. Nosi Hau I Andrava Bay: Berry Head Vohemar: Flagstaff. Cape East: Ugoncy I Venangue Bé Bay: Entrance Port Choiseul: Maran Seelzy Village Cape Bellone: Extreme St. Marys Island: Light on Madame I Port Tantang: Flagstaff. Tamatave: Pt. Hastie Mahanuru: Town Matatane: Village Santa Lucia: N. end of town, Obs. Rock. Point Ytapere: Extreme Yapere Bay: N. pt Fort Dauphin: Flagstaff.	$\begin{array}{cccccccccccccccccccccccccccccccccccc$	$\begin{array}{c} 44 \ 07 \ 20 \\ 43 \ 38 \ 20 \\ 43 \ 15 \ 20 \\ 43 \ 15 \ 20 \\ 43 \ 12 \ 20 \\ 41 \ 20 \ 21 \\ 44 \ 19 \ 21 \\ 44 \ 19 \ 21 \\ 44 \ 19 \ 21 \\ 44 \ 19 \ 21 \\ 44 \ 19 \ 21 \\ 45 \ 18 \\ 45 \ 18 \\ 45 \ 18 \\ 45 \ 18 \\ 45 \ 18 \\ 45 \ 18 \\ 45 \ 18 \\ 45 \ 18 \\ 45 \ 18 \\ 45 \ 18 \\ 45 \ 18 \\ 47 \ 58 \ 21 \\ 47 \ 58 \ 21 \\ 47 \ 58 \ 21 \\ 47 \ 58 \ 21 \\ 47 \ 58 \ 21 \\ 47 \ 58 \ 21 \\ 47 \ 58 \ 21 \\ 47 \ 58 \ 21 \\ 47 \ 58 \ 21 \\ 47 \ 58 \ 21 \\ 47 \ 58 \ 21 \\ 47 \ 58 \ 21 \\ 47 \ 58 \ 21 \\ 47 \ 58 \ 21 \\ 47 \ 48 \ 45 \ 45 \\ 49 \ 11 \ 21 \\ 49 \ 35 \ 56 \\ 49 \ 45 \ 40 \\ 49 \ 56 \ 25 \\ 50 \ 01 \ 59 \\ 50 \ 16 \ 05 \\ 50 \ 16 \ 05 \\ 50 \ 16 \ 05 \\ 50 \ 16 \ 05 \\ 49 \ 49 \ 11 \\ 49 \ 50 \ 59 \\ 49 \ 50 \ 59 \\ 49 \ 50 \ 59 \\ 49 \ 50 \ 59 \\ 49 \ 50 \ 59 \\ 49 \ 50 \ 59 \\ 49 \ 50 \ 59 \\ 49 \ 50 \ 59 \\ 49 \ 25 \ 31 \\ 48 \ 52 \ 10 \\ 48 \ 14 \ 50 \ 47 \ 10 \ 34 \\ 47 \ 07 \ 20 \\ 47 \ 10 \ 34 \\ 47 \ 07 \ 20 \\ 47 \ 04 \ 24 \\ 46 \ 59 \ 11 \end{array}$	5 40 	11 52 11 28 11 28 9 57 10 12	9.8 10.9 10.9 5.1 7.3 4.7	2.9
	Europa Island: Center Bassas da India: E. pt Geyser Reef: SE. extreme Mayotta Island: Zaoudzi Lohanna Island: Landiagalaga Bornari	$\begin{array}{cccccccccccccccccccccccccccccccccccc$	$\begin{array}{cccccccccccccccccccccccccccccccccccc$	4 00	10 13	 11.9	2.0
	Mohilla Island: Numa Choa Harbor Glorioso Island: Numa Choa Harbor Glorioso Island: W. islet Comoro Island: Islet in Mauroni Bay Assumption Island: Hummock Aldabra Island: West I., E. side entrance. Cosmoledo Islands: Observation islet	$\begin{array}{cccccccccccccccccccccccccccccccccccc$	$\begin{array}{cccccccccccccccccccccccccccccccccccc$	4 45	10 58	10.0	1.7

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APPENDIX IV.

· MARITIME POSITIONS AND TIDAL DATA.

ISLANDS OF THE INDIAN OCEAN-Continued.

ıst.	Place	Lat S	Long F	Lun.	Int.	Re	ıngé.
Coe	r ace,	Dat. P.	Long, E,	H. W.	L. W. '	Spg.	Neap.
	Drings Edwards Islands, Marian I. Obs.	0 / //	0 / //	h. m.	h. m.	ft.	ft.
	spot, NE. side	46 49 30	37 49 İ5				
	Penguin Islands: Center of SW. islet	46 36 00	50 41 30	· · · · · · · · · ·			
t Is	Twelve Islands: Summit NE, I	46 22 00 46 01 00	$51 \ 30 \ 15$ $50 \ 40 \ 00$			•••••	
OZC	Navire Bay	46 28 18	51 50 00				
Ğ	East Island: Center	46 10 40 46 46 26 00	$50 \ 35 \ 00$ $52 \ 13 \ 00$				
;	Christmas Harbor	48 40 00	69 04 00	-			
I	Blighs Cape	48 26 45	68 48 20				
ele	Cape Bourbon Molloy, Port Royal Sound: U. S. Tr. of	49 42 00	68 54 00				
n Su	Venus Obs., 1874	49 21 22	70 04 31	0 14	6 36	4.6	1.3
Ke	Balfour Rock	$\begin{array}{cccccccccccccccccccccccccccccccccccc$	$70 15 00 \\70 29 50$	· · · · · · · · · · ·			
	Heard Island: Cane Laurens NW and	53 02 45	73 15 30				
	Sealing station	53 13 00	73 52 00				
	McDonald Island, Summit St. Pauls Island: Ninepin Rock	53 02 50 38 42 51	$72 \ 31 \ 45 \ 77 \ 31 \ 53$	10 40	4 28	3.0	0.9
	Amsterdam Island: Summit, 2,750 feet.	37 50 00	77 29 15	10 50	4 38	3.3	1.0
	Keeling or Cocos Islands: Direction I Christmas Island: Flying Fish Cove	$12 \ 06 \ 22 \ 10 \ 25 \ 19$	$96 53 02 \\105 45 57$	$^{\circ}$ 5 20 7 10	$11 32 \\ 1 00$	$5.1 \\ 4.5$	$1.5 \\ 1.3$
-							
	SOUTH C	OAST OF	ASIA.				
		Lat. N.	Long. E.	7 40	1 41		
	Sughra: Sheik's house	$12 47 16 \\ 13 22 00$	44 59 07 45 40 50	7 49	1 41	4.9	2.0
	Mokatein: Black ruin	13 24 50 12 22 15	46 26 35				
	Banderburum: SE. house of town	$13 28 45 \\14 20 10$	48 56 45				
	Makalleh Bay: Flagstaff	14 31 15	49 07 35	8 20	2 07	6.8	2.8
	Sharmoh: Single house	14 43 50 14 49 00	49 57 05				
	Kosair: High house	14 54 40 15 12 00	$50 \ 16 \ 35$ 51 10 30				
	Ras Fartak: Extreme pt	$15 12 00 \\ 15 38 00$	$51 10 50 \\ 52 14 20$				
	Damghot: Town	$16 \ 30 \ 00$ $16 \ 59 \ 00$	$52 \ 48 \ 00$ 54 43 20	8 50		7.0	9 9
	Kuria Maria Is., Hullaniyeh I.: NE. bluff	$10 \ 00 \ 00 \ 17 \ 17 \ 32 \ 45$	56 03 05				
da.	Ras Sherbedat: Point Cane Isolette: Islet	$17 53 15 \\ 19 00 25$	$56 \ 20 \ 35 \ 57 \ 51 \ 35$	•••••	••••		
ral	Masirah Island: Point Abu-Rasas	20 10 00	$58 \ 38 \ 35$				
•	Point Ras Ye Ras-al-Hed: Extreme nt	$\begin{array}{cccccccccccccccccccccccccccccccccccc$	58 58 35 59 48 35	$945 \\ 915$	$ 3 32 \\ 3 03 $	9.6	4.4
	Maskat (Muscat): Maskat Pt	23 38 00	58 30 50	9 30	3 20	6.0	2.8
	Sueik: Fort	23 52 00 23 51 30	$58 \ 08 \ 00$ $57 \ 26 \ 00$				
	Sohar: SE. tower of town hall	24 21 50	56 46 12				
	Ras Musendom: N. end of island	25 21 00 26 24 13	56 22 50 56 32 22				
	Great Quoin Islet: Center	$26 \ 30 \ 00$	56 31 29 55 94 19				
	Abu-Thabi: Fort flagstaff	23 21 34 24 29 02	53 24 12 54 22 14				
	Al Beda'a Harbor: Nessah Pt., N. extreme	25 17 24	$51 \ 33 \ 32$ 51 13 46				
	Bahrain Harbor: Portuguese fort	26 10 55 26 13 56	50 32 17	5 15	11 30	6.4	3.7
	Basrah: Custom-house flagstaff	$\begin{array}{cccccccccccccccccccccccccccccccccccc$	$\begin{array}{c} 47 51 23 \\ 48 00 55 \end{array}$	0.05	6 17	8.3	4.8
		00 15 05	FO 01 13	0.00		0.0	1.0
sia.	Abu Shahr: Residency flagstaff	$ \begin{array}{c} 29 & 15 & 25 \\ 28 & 59 & 07 \end{array} $	$50 21 11 \\ 50 50 35$	7 12	1 13	2.6	1.5
Per	Shaikh Shu'aib Islet: E. end	$26_47 40$ $26_33 37$	53 23 36 54 02 21	0.30	6 40	6.6	3.8
	True reacts True horsessessessessesses		01 04 41	0.00	0 10		1 0.0

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MARITIME POSITIONS AND TIDAL DATA.

st.	DI	Place Lat X Long E		Lun. Int.		Range.	
Coa	Place.	Lat. N.	Long. E.	H. W.	L. W.	Spg.	Neap.
	Pisidih, Chanal	0 / // 96 20 19	0 / //	h. m.	h. m.	ft.	ft.
;	Haujam Islet: Ruined mosque	$26 \ 59 \ 12$ $26 \ 40 \ 49$	$55 \ 10 \ 47 \ 55 \ 54 \ 25$		•••••		
rsia	Kasm: Fort	$\begin{array}{cccccccccccccccccccccccccccccccccccc$	56 17 37 57 46 14	10 50	$4\ 35$	11.6	5.3
Pel	Kub Kalat: High peak, 1,680 feet	$25 \ 38 \ 19 \ 25 \ 29 \ 45$	$57 \ 46 \ 14$ $59 \ 40 \ 32$	9 20	3 03	1.8	3.0
	Chahbar Bay: Telegraph office	25 16 43	60 37 40				
:	Gwatar Bay: Islet	25 03 17	61 26 24				
tar	Gwadar Bay: Telegraph office	$25 \ 07 \ 19$	62 19 42	9 20	$3 \ 05$	8.1	3.7
his	Pasni: Telegraph office	$\begin{array}{cccccccccccccccccccccccccccccccccccc$	$\begin{array}{cccccccccccccccccccccccccccccccccccc$				
Iuc	Sunmiyani: Jam's house	$25 \ 25 \ 19$	$66 \ 35 \ 39$	8 50	$2 \ 35$	8.1	3.8
Ba	Cape Monze: Peak	24 50 03	66 39 58		• • • • • • • • • •		
	Karachi: Manora light	24 47 37	66 58 06	$10 \ 15$	4 00	7.3	3.4
	Observatory Mandavi: Light-house	$\begin{array}{cccccccccccccccccccccccccccccccccccc$	$\begin{array}{cccccccccccccccccccccccccccccccccccc$				
	Beyt (Bet): Light-house	$ \frac{22}{22} $ $ \frac{20}{29} $ $ \frac{20}{20} $	$69 \ 04 \ 40$	$12 \ 05$	$5 \ 39$	10.8	5.2
	Dwarka: Light-house	$\begin{array}{cccccccccccccccccccccccccccccccccccc$	68 57 06 68 58 54		• • • • • • • • •		
•	Porebander: Light-house	$ \begin{array}{c} 22 \\ 21 \\ 38 \\ 00 \end{array} $	$69 \ 36 \ 00$				
	Mangarol: Light-house	21 06 00	$70 \ 06 \ 32$				
	Kutpur: Light-house	$20 \ 41 \ 20 \ 21 \ 02 \ 21$	$70 \ 50 \ 45$ $71 \ 49 \ 35$				
	Bhaunagar: Light-house	$21 \ 47 \ 00$	72 14 00	4 27	11 18	29.8	15.1
	Perim Island: Light-house Cambay: Flagstaff	$21 \ 35 \ 54$ $22 \ 17 \ 00$	$\begin{array}{cccccccccccccccccccccccccccccccccccc$				
	Surat River: Tapti light		$72 \ 38 \ 40$				
	Surat: Minaret Adrusah Bassein: Center of town	$ \begin{array}{cccccccccccccccccccccccccccccccccccc$	$\begin{array}{cccccccccccccccccccccccccccccccccccc$		• • • • • • • • •		
	Bombay: Observatory	18 53 45	72 48 56	11 26	5 08	12.0	4.9
	Kenery Island light	$18 \ 42 \ 08$ 17 58 00	72 48 49				
	Ratnagherry: Fort	17 58 00 16 59 30	73 02 40 73 15 56				
la.	Viziadrug: Fort flagstaff	16 33 26	73 19 39				
pu	Goa: St. Denis Church	$15 05 12 \\ 15 21 24$	73 54 50 73 54 00				
-	Agaada light	15 29 25	73 46 10	$10 \ 34$	4 10	5.2	2.5
	Vingoria: Signal-station light	$15 51 10 \\ 15 53 20$	$73 \ 37 \ 00 \ 73 \ 27 \ 15$				
	Sedashigar Bay: Oyster Rock light	$14 \ 49 \ 00$	74 03 40	$10 \ 34$	4 11	5.0	2.4
	Kumpta: Light-house Hináwar: Monument	$14 \ 25 \ 00 \\ 14 \ 17 \ 28$	$74 22 30 \\ 74 26 40$				
	Kundapur: Light-house.	$13 \ 38 \ 15$	74 39 50				
	Mangalore: Light-house	12 52 17 11 51 10	74 50 40 75 21 51	10 50	4 28	6.5.	3.4
	Tellicherri: Flagstaff	$11 \ 45 \ 00$	75 29 40				
	Mahé: Light-house	11 42 00 11 15 10	75 31 10 75 46 40	11 91	1 50		1 1
	Cochin: Light-house	9 58 00	76 14 40	$11 \ 21 \ 11 \ 33$	$\frac{4}{5}06$	$\frac{2.7}{2.1}$	1.4
	Alipee: Light-house	9 30 00	76 20 40	0.10			
	Trevandrum: Observatory	8 35 20 8 30 47	76 54 00 76 56 45	0 18	0 10	2.0	1.0
	Cape Comorin: Light-house	8 04 00	77 32 35				
	Tuticorin: Light-house	$8 29 55 \\ 8 47 10$	$78 \ 07 \ 47 \ 78 \ 11 \ 26$	1 52	7 51	3.0	0.8
	Paumben Pass: Light-house	9 17 20	$79 \ 12 \ 50$	1 37	7 36	2.0	0.5
	Manaar: Center of town	8 59 00	$79 \ 53 \ 52$				
	Colombo: Light-house	$\begin{array}{c} 6 55 40 \\ 5 55 20 \end{array}$	79 50 40 80 34 12	1 55	7 49	2.0	0.4
lon	Point de Galle: Light-house	6 01 25	80 13 04	2 02	8 07	1.9	0.4
Jey.	Great Bassas Rocks: Light-house	$\begin{array}{c} 6 \ 10 \ 10 \\ 6 \ 25 \ 00 \end{array}$	81 28 15				
•	Batticaloa: Light-house	$\begin{array}{c} 6 & 25 & 00 \\ 7 & 45 & 00 \end{array}$	81 41 00				
	Trincomali: Dock-yard flagstaff	8 33 30	81 13 42	8 10	1 44	2.0	0.5
а.	Calimere Point: Light-house	10 18 00	79 51 30				
ipı	Negapatam: Light-house	10 45 28	79 50 47	8 37	2 37	2.1	0.9
I	Pondicherri: Light-house	11 55 40	79 50 10				

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APPENDIX IV.

MARITIME POSITIONS AND TIDAL DATA.

st.		Lat N		Lun.	Int.	Ra	inge.
Coa	Place.	Lat. N.	Long. E.	H. W.	L. W.	Spg.	Neap.
		0 / //	0 / //	h. m.	h. m.	ſt.	ft.
	Madras: Observatory Light-house	$\frac{13}{13} \ \frac{04}{05} \ \frac{06}{15}$	$\begin{array}{cccccccccccccccccccccccccccccccccccc$	8 41	$\frac{1}{2}26$	3.1	1.2
	Pulicat: Light-house.	$13 \ 25 \ 15$ $10 \ 52 \ 00$	80 19 12				
	Armeghon: Light-house	$13 53 08 \\ 15 47 00$	$80 12 30 \\ 80 59 00$				
	Masulipatam: Flagstaff	16 09 45	81 11 00				
	Vizagapatam: Fort flagstaff	$16 56 21 \\ 17 41 34$	$82 15 05 \\ 83 17 42$	$842 \\ 848$	$ \begin{array}{c} 2 & 35 \\ 2 & 34 \end{array} $	4.5	$1.9 \\ 1.8$
Ip	Kalingapatam: Light-house	18 19 00	84 07 30				
Ē.	Gopalpur: Light-house	$19 13 00 \\ 19 22 30$	$84 52 06 \\ 85 03 29$				
	Juggernath: Great temple	19 48 17	85 49 09	0.91			
	Balasor River: Chandipur light	$ \begin{array}{ccccccccccccccccccccccccccccccccccc$	87 02 20	<i>5</i> 21		0.0	2.0
	Saugor Island: Light-house	$\begin{array}{cccccccccccccccccccccccccccccccccccc$	88 02 00				
	Calcutta: Ft. William semaphore	$ \begin{array}{ccccccccccccccccccccccccccccccccc$	88 20 12	1 25	9 06	11.2	4.4
	Chittagong River: Light-house	22 11 00	91 49 00	1.02	7 56	13.1	5.6
	Akyab: Oyster Reef light	20 05 00	92 39 00				
	Ramree Island: S. pt	$ \begin{array}{cccccccccccccccccccccccccccccccccccc$	$92 52 40 \\93 56 30$	9 40	3 28	7.6	3.0
	Chedubah Island: NW. peak	18 50 30 16 01 20	93 31 00				
	Bassein River: Alguada Reef light	$15 \ 01 \ 50 \ 15 \ 42 \ 14$	94 13 10 94 12 00				
	Bassein: Port Dalhousie	16 01 30 14 12 30	94 23 00 93 22 30	3 05	9 55	18.7	7.8
	Port Cornwallis, Rock in	14 12 50	00 22 00				
a.	entrance Port Blair, Light-house	$13 18 40 \\11 40 40$	$92 57 10 \\92 45 15$	9 50	$\begin{vmatrix} 3 & 37 \\ 3 & 27 \end{vmatrix}$	8.6	$ \begin{array}{c} 2.9 \\ 2.1 \end{array} $
rm	Little Andaman Island,	10.07.00	00 01 10				
Bu	Krishna Shoal: Light vessel	$10 \ 27 \ 00 \ 15 \ 37 \ 26$	$92 \ 31 \ 10$ $95 \ 37 \ 32$				
	Rangoon River: Grove Pt. light	16 30 01	96 23 00	1 90	11 15	16 0	7.0
	Moulmein: Docks	$16 \ 46 \ 00$ $16 \ 26 \ 00$	97 38 00	3 07	10 49	10. 5	5.0
	Moulmein River: Amherst Pt. light	$16 04 45 \\ 15 52 00$	$97 \ 33 \ 05 \\ 97 \ 35 \ 00$	2 12	8 49	19.2	7.4
	Tavoy River: Light-house	$13 \ 36 \ 40$	98 13 00	10 50	4 20	15.6	5.9
	Mergui: Court-house	$12 \ 26 \ 15 \ 12 \ 06 \ 00$	98 35 59 99 03 00	10 40	4 10	18.0	6.9
	St. Matthew Island: Hastings Harbor	10 05 05	98 10 15				
	Pak Chan River: Light-house	9 58 00	97 35 00				
	Tongka Harbor, Junkseylon Island:	7 50 00	08 25 20				
	Pulo Penang: Fort Cornwallis	52445	$100 \ 21 \ 44$	11 50	5 40	8.8	3.8
	Dinding Channel: Hospital Rock	$\begin{array}{c ccccccccccccccccccccccccccccccccccc$	$100 \ 34 \ 15$ $100 \ 59 \ 12$	5 50	12 00	14 4	6.2
	Cape Rachado: Light-house	$ \frac{2}{2} 24 08 $	$101 \ 51 \ 02$				
	Malacca; Stat. St. Pauls Hill Singapore Strait: Copey Island light	$\begin{array}{c ccccccccccccccccccccccccccccccccccc$	$102 15 00 \\ 103 44 47$	7 20	1 08	10.5	4.5
	Singapore: Fullerton Battery	1 17 11	103 51 15	10 18	4 02	7.6	3.2
а.	Singapore Strait: Pedra Branca light Summit Biutang great	1 19 57	104 24 08				
a y s	hill, 1,253 feet	1 04 20	104 27 21				
ala	Terkolei: Light-house	$1 03 13 \\0 57 10$	104 10 30 104 19 52				
R	LittleGarras: Light-house	0 44 30	104 21 19	9 40	3 14	7.1	3.1
	staff	0 55 50	$104 \ 25 \ 43$				
	Pitong Island: Peak Abang Besar Island: N. pt	$\begin{array}{cccc} 0 & 36 & 52 \\ 0 & 36 & 30 \end{array}$	$104 \ 04 \ 42 \\ 104 \ 11 \ 31$				
	T the state of the	Lat. S.	101 00 11	0.00	10.10	11	4.0
	Singkep Island: Mountain summit	$\begin{array}{c} 0 & 12 & 34 \\ 0 & 26 & 13 \end{array}$	$104 \ 36 \ 14$ $104 \ 30 \ 15$	6 00	12 13	11.0	4.9
	Menali Island: N. pt	0 57 51	105 38 20				
	Nicobar Islands, Car Nicobar: N. pt	9 15 40	92 48 00				

APPENDIX IV. MARITIME POSITIONS AND TIDAL DATA. SOUTH COAST OF ASIA—Continued.

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st.	Place	Lat. N	Long, E	Lun	. Int.	Ra	inge.
Coa	1 1000.			H. W.	L. W.	Spg.	Neap.
Malaysia.	Nicobar Islands, Nancowry Harbor: Naval Pt Great Nicobar: W. pt. Galathea Bay	 , " 8 02 10 6 46 20 	• / "93 29 4293 49 20	h. m. 9 05	h. m. 2 52	ft. 8.3	ft. 2.8
	Acheen (Acheh) Head: Pulo Bras light N. extreme Diamond Point: Light-house	5 45 00 5 34 40 5 15 58 Lat. S.	$\begin{array}{cccccccccccccccccccccccccccccccccccc$	$\begin{array}{c}10&00\\11&50\end{array}$	$\begin{array}{c}3&44\\5&34\end{array}$	5.2 8.7	2.3 3.7
Sumatra.	Point Baru or Datu: Extreme Point Bon or Djabon: Extreme Moeara-Kompehi: Fort Djambi: Flagstaff of fort Palembang: Residency flagstaff Lampong Bay: Telok Betong light Blimbing Bay Kroë: Village Engano Island: Barioe anchorage Binteean: River mouth Mega Island: N. pt Benkulen: Light-house Bantal: Village Indrapura Point: Extreme Pisang: Light-house Siberaet Island: Sigeb Pt Katiagam: Village Batoe Islands: N. point of Simoe Islet Summit of Tello	$\begin{array}{c} 0 \ 00 \ 32 \\ 1 \ 00 \ 55 \\ 1 \ 23 \ 13 \\ 1 \ 35 \ 33 \\ 2 \ 59 \ 26 \\ 5 \ 27 \ 00 \\ 5 \ 57 \ 02 \\ 5 \ 11 \ 24 \\ 5 \ 18 \ 35 \\ 3 \ 59 \ 25 \\ 3 \ 47 \ 22 \\ 2 \ 44 \ 54 \\ 3 \ 59 \ 25 \\ 3 \ 47 \ 22 \\ 2 \ 44 \ 54 \\ 2 \ 10 \ 35 \\ 0 \ 59 \ 56 \\ 0 \ 57 \ 53 \\ 0 \ 53 \ 58 \\ 0 \ 07 \ 41 \\ 0 \ 03 \ 13 \\ 0 \ 02 \ 56 \end{array}$	$\begin{array}{cccccccccccccccccccccccccccccccccccc$	5 40 5 5 50 5 35	11 52 12 03 11 48	2.6 	0.7
-	Ayer Bangis: Fort flagstaff Natal: Fort flagstaff Nias Island: Lagoendi Bay Lapan Siboga: Flagstaff Singkel: Post-office Bangkaru Islands: Bay Simaloe Island: NW. pt Tampat Toewon; Flagstaff Analaboe Batve Toetong: Landing place	$ \begin{array}{c} {}^{\rm LatN.}\\ 01141\\ 03311\\ 03447\\ 11736\\ 12416\\ 14424\\ 21647\\ 20232\\ 25130\\ 31459\\ 40814\\ 43821\\ \end{array} $	$\begin{array}{c} 99 \ 22 \ 09 \\ 99 \ 06 \ 33 \\ 97 \ 43 \ 43 \\ 97 \ 36 \ 46 \\ 97 \ 12 \ 28 \\ 98 \ 46 \ 08 \\ 97 \ 45 \ 06 \\ 97 \ 06 \ 53 \\ 95 \ 56 \ 02 \\ 97 \ 10 \ 13 \\ 96 \ 07 \ 23 \\ 95 \ 34 \ 29 \end{array}$	5 29	11 42	2.8	0.7

	0 =
Java Head: First Pt. light	0.7
. Sunda Strait: Krakatoa I. peak	1.1
a North Watcher Island: Light-house	
Lucipara I.: Beacon	
🗖 Banka Island: Tobol Ali Fort	
Berikat, summit	
a Nanka I.: Light-house	
Banka Island: Mintok light	
Blinyu	
Crassok Pt 1 29 00 106 57 30	
G Shoalwater Island: Light-house 3 19 10 107 12 42 [2 08] [8 21] [5.6]	
E Pulo Lepar: Light-house 2 56 52 106 54 38	
Pulo Jelaka: Light-house	
🖫 Billiton Island: Tandjong Pandan flag-	
$\frac{1}{2}$ staff	
$\begin{array}{c c c c c c c c c c c c c c c c c c c $	
\ddot{c} 'aspar Island: Peak	

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APPENDIX IV. MARITIME POSITIONS AND TIDAL DATA.

st.		The		Lun.	Int.	Ra	ange.
Coa	Place.	Lat. S.	Long. E.	н. พ.	L. W.	Spg.	Neap.
	Carimata Island: Sharp peak Pulo Eu: Center Pulo Aor: S. peak, 1,805 feet	$ \begin{smallmatrix} \circ & i & i' \\ 1 & 33 & 24 \\ 2 & 07 & 00 \\ 2 & 26 & 30 \\ \end{smallmatrix} $	$ \begin{smallmatrix} \circ & , & , & , \\ 108 & 55 & 13 \\ 104 & 17 & 00 \\ 104 & 34 & 06 \\ \end{smallmatrix} $	h. m.	h. m.	ft.	ft.
Entrance China Sea	St. Barbe Island: Center of W. side Direction Island: S. pt Dato Island: Summit St. Julian Island: Summit Tambelan Island: S. pt Tamban I. obs. station Victory Island: S. pt Anamba Islands: White rock Pulo Repon Pulo Domar St. Pierre Rock: S. pt Natuna Islands: Pyramidal rocks Semione I	Lat. N. 0 07 26 0 14 19 0 06 37 0 55 00 0 56 52 1 00 27 1 34 41 2 18 10 2 25 00 2 44 31 1 51 42 4 03 00 4 31 00	$\begin{array}{cccccccccccccccccccccccccccccccccccc$				
Gulf of Slam.	Pulo Varella: Center Pulo Brala: Center Tringano River: N. pt Great Redang Harbor: Bukit Maria I. Kalantan: Entrance small river Cape Patani: NE. pt Singora: SW. pt. of Ticos I. Koh Krah Islet: SE. pt. Bangkok: Old British factory Cape Liant: NW. rock of Koh Mesan.	$\begin{array}{c} 3 \ 17 \ 00 \\ 4 \ 53 \ 00 \\ 5 \ 21 \ 40 \\ 6 \ 11 \ 53 \\ 6 \ 58 \ 01 \\ 7 \ 13 \ 54 \\ 8 \ 24 \ 47 \\ 13 \ 44 \ 20 \\ 12 \ 35 \ 08 \end{array}$	$\begin{array}{cccccccccccccccccccccccccccccccccccc$	8 00 8 20 8 00	1 48 2 08 2 00	5.8 2.8 7.3	2.5 1.2 3.1
Cochin China.	Chentabun River: Entrance, Bar I Koh Chang: Small island on W. side Koh Kong: S. pt. of river entrance Kusrovie Rock: Center Koh Tang Rocks: SW. rock of group Panjang Island: NW. corner of SW. bay. Obi Islands: Light-house Saigon: Observatory Mitho: S. gate of citadel Cape St. James: Light-house Cape Padaran: Extreme Cape Varella: Extreme Quin Hon: Battery flagstaff	$\begin{array}{cccccccccccccccccccccccccccccccccccc$	$\begin{array}{cccccccccccccccccccccccccccccccccccc$	10 00 	3 50 11 20	4.5	2.1 4.2
China Sea.	Condore Islands: Light-house Safatu Island: Summit Ceicer de Mer Island: SW. hill Natuna Islands: Murundum I., SE. pt Low I	$\begin{array}{rrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrr$	$\begin{array}{cccccccccccccccccccccccccccccccccccc$				· · · · · · · · ·
Cochin China.	Canton Pulo: Light-house Cham-Callao Islet: Watering place Tourane Bay: Light-house Hon-Mé: Summit Nam-Dinh: Citadel tower Hon Dau Island: Light-house	$\begin{array}{cccccccccccccccccccccccccccccccccccc$	$\begin{array}{cccccccccccccccccccccccccccccccccccc$	9 00	2 48	4.3	2.1
China.	Hai-Fong: Observation pagoda Hai-Duong: Citadel tower Ha-Noi: Citadel tower Pak-Hoi: Custom-house flagstaff. Hainan Island: Cape Bastion, extreme . Gaalong Bay, E. Brother	$\begin{array}{cccccccccccccccccccccccccccccccccccc$	$\begin{array}{cccccccccccccccccccccccccccccccccccc$	5 00	11 12	14.0	6.6

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MARITIME POSITIONS AND TIDAL DATA.

st.	Place	Lat. N.	Long F	Lun.	Int.	Range.	
Coa	riace.	Lat. N.	Long. E.	H. W.	L. W.	Spg.	Neap.
		0 / //	0 / //	h. m.	h. m.	ft.	ſt.
	Hainan Island: Light-house	$\begin{array}{cccccccccccccccccccccccccccccccccccc$	$110 \ 16 \ 10$				
	Paracel Islands: Iriton I	15 + 6 - 30 16 - 36 - 00	111 14 30 111 40 30				
	Lincoln I	$16 \ 40 \ 07$	$112 \ 43 \ 32$				
	Woody I Pratas Island: NE part	$16 \ 49 \ 55 \ 20 \ 42 \ 03$	$\begin{array}{cccccccccccccccccccccccccccccccccccc$	• • • • • • • • •		•••••	
	Ty-fung-kyoh Island: Center	$ \begin{array}{cccccccccccccccccccccccccccccccccccc$	110 10 00 111 10 30				
	Tien-pak Harbor: Pauk Pyah Islet	21 24 15	111 15 25	11 50	5 37	8.2	3.8
	Hui-lang-san Harbor: Mamechow Islet.	21 31 00 21 34 00	$111 \ 38 \ 30$ $111 \ 46 \ 43$	· · · · · · · · ·			
	Mandarins Cap: Summit, 200 ft	21 28 00	$112 \ 21 \ 30$				
	Macao: Fort Guia light Fort San Francisco	$\begin{array}{cccccccccccccccccccccccccccccccccccc$	$113 \ 34 \ 00$ $113 \ 33 \ 25$	9 50	3 38	6.3	3.0
	Canton: Dutch Folly light	$23 \ 06 \ 35$	113 16 30	2 00	8 00	5.1	2.4
	Raleigh Rock: Center	$\begin{array}{cccccccccccccccccccccccccccccccccccc$	$113 \ 47 \ 00$ $113 \ 56 \ 20$				
	Hongkong: Cathedral	21 + 40 + 50 = 22 + 16 + 52	$113 \ 00 \ 20$ $114 \ 09 \ 31$				
	Wellington Battery	$\begin{array}{cccccccccccccccccccccccccccccccccccc$	114 10 02	9 20	252	4.4	2.0
	Nine-pin Rock: Center	$\begin{array}{cccccccccccccccccccccccccccccccccccc$	114 19 20 114 22 07				
	Tuni-ang Island: Summit	22 27 06	$114 \ 36 \ 45$				
	Single Island: E. summit	22 24 06 22 30 42	$114 \ 39 \ 12$ $114 \ 50 \ 00$			• • • • • •	
	Pank Piah Rock: Summit	$ \begin{array}{ccccccccccccccccccccccccccccccccc$	115 01 00				
	Pedra Blanca Rock: Summit, 130 ft	$\begin{array}{cccccccccccccccccccccccccccccccccccc$	$115 \ 06 \ 54$ $115 \ 17 \ 56$	• • • • • • • • •			•••••
	Cupchi Point: Hill	22 + 48 + 14 22 + 48 + 07	$116 \ 47 \ 56$ $116 \ 04 \ 26$				
	Breaker Point: Light-house	22 56 24	116 29 44				
	Swatau: British consulate	$\begin{array}{cccccccccccccccccccccccccccccccccccc$	116 47 00 116 40 22	250	9.00	7.5	3.5
	Lamock Island: Light-house	$23 \ 15 \ 43$	117 17 04				
	Brothers Islets: SE. Islet	$\begin{array}{cccccccccccccccccccccccccccccccccccc$	$117 \ 42 \ 00$ $117 \ 36 \ 48$	11 20	5.08	12.0	7.6
na	Chapel Island: Light-house	24 09 49	118 13 30			12.0	
Chi	Amoy: Taitan I. light	$\begin{array}{cccccccccccccccccccccccccccccccccccc$	118 10 00 118 20 11	0 05	6 13	15.5	9.9
•	Chinchin Harbor: Pisai Islet	24 49 13	118 41 00				
	Pyramid Point: Extreme	24 52 12	118 58 00				
	Sorrel Rock: Summit	$24 \ 59 \ 36 \ 25 \ 02 \ 18$	$119 27 07 \\119 10 36$			•••••	
	Lamyit Island: High Cone Peak	$25 \ 12 \ 00$	$119 \ 35 \ 00$				
	Hungwha Channel: Sentry I	25 16 30 25 26 10	$119 \ 45 \ 00$ $119 \ 56 \ 07$			••••	
	East Dog Island: Light-house	$ \frac{26}{25} \frac{20}{58} \frac{10}{10} $	119 50 01 119 59 02				
	Min River: Pagoda, Losing I	25 59 00	$119 \ 27 \ 16$ $110 \ 27 \ 25$	0 30	$\begin{array}{c} 7 & 00 \\ 2 & 22 \end{array}$	19.3	12.2
	Alligator Island: Summit	$ \begin{array}{ccccccccccccccccccccccccccccccccc$	$119 \ 57 \ 55 \ 120 \ 24 \ 06$	940		19.0	12.0
	Tung-yung Islands: Peak, N. end	26 22 37	120 29 40				
	Double Peak Island: Highest peak	$26 \ 30 \ 00$ $26 \ 36 \ 06$	$120 \ 10 \ 00$ $120 \ 11 \ 12$			• • • • • •	
	Pih-seang Island: Town I	$ 26 \ 42 \ 30 $	$120 \ 22 \ 42$				
	Dangerous Rock: Summit	$\begin{array}{cccccccccccccccccccccccccccccccccccc$	$120 \ 32 \ 33$ $120 \ 49 \ 24$				
	Nam-quan Harbor: Bate I	$ \begin{array}{ccccccccccccccccccccccccccccccccc$	$120 \ 42 \ 54 \ 120 \ 25 \ 50$	9 50	3 38	17.2	10.9
	Ping-fong Island: Summit	27 09 42	$120 \ 32 \ 42$				
	Port Namki: E, horn	$27 \ 19 \ 18 \ 27 \ 26 \ 18$	$120 \ 27 \ 14$ $121 \ 06 \ 36$				
	Pih-ki-shan Island: Summit	$27 \ 37 \ 36$	$121 \ 12 \ 09$				
	Pe-shan Islands: Summit, SW. end Tung-chub Island: Summit	$ \begin{array}{ccccccccccccccccccccccccccccccccccc$	$121 \ 30 \ 04$ $121 \ 55 \ 21$		•••••		
	Kweshan Islands: Patahecock	29 22 45	$121 \ 50 \ 21$ $122 \ 13 \ 16$				
	Nimrod Sound: Middle islet	29 34 20	$121 \ 43 \ 15$ $122 \ 25 \ 24$				
	Chin-hai: Citadel	$29 51 53 \\ 29 57 08$	$122 \ 35 \ 24 \\ 121 \ 43 \ 06$				
	Ning-po: Square I. light	29 59 21	$121 \ 45 \ 22$	1 00	7 12	8.8	4.6
	Unusan Islands: Ting-hai Harbor	30 04 30	$122 \ 03 \ 47$				

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APPENDIX IV.

MARITIME POSITIONS AND TIDAL DATA.

st.				Lun. Int.		Range.	
COR	Place.	Lat. N.	Long. E.	H. W.	L. W.	Spg.	Neap.
China.	Video Island: Summit West Volcano Island: Light-house Chapu: Battery Gutzlaff Island: Light-house Saddle Islands: N. Saddle light West Barren Island: Summit Shanghai: Eng. consulate flagstaff Wusung: Light-house Shaweishan Island: Light-house	$ \begin{smallmatrix} \circ & , & '' \\ 30 & 08 & 04 \\ 30 & 20 & 50 \\ 30 & 36 & 00 \\ 30 & 48 & 37 \\ 30 & 51 & 41 \\ 30 & 44 & 07 \\ 31 & 14 & 42 \\ 31 & 23 & 18 \\ 31 & 25 & 27 \\ \end{smallmatrix} $	$ \begin{smallmatrix} \circ & , & '' \\ 122 & 45 & 48 \\ 121 & 51 & 25 \\ 121 & 03 & 00 \\ 122 & 10 & 12 \\ 122 & 40 & 17 \\ 123 & 08 & 27 \\ 121 & 28 & 55 \\ 121 & 29 & 36 \\ 122 & 14 & 12 \\ \end{smallmatrix} $	h. m.	h.m.	<i>ft.</i>	<i>ft.</i> 4. 8
	Pescadores Islands: Fisher I. light Second pt.on N.side Makung Harbor	$\begin{array}{cccccccccccccccccccccccccccccccccccc$	119 28 05 119 30 12				•••••
Formosa I.	South Cape: Light-house Takan: Saracen Head Port Heongsan Tam-sui Harbor: White Fort Kelung Harbor: Light-house Soo (Sauo) Bay: Beach near village Botel Tobago Sima: S. extreme	$\begin{array}{cccccccccccccccccccccccccccccccccccc$	$\begin{array}{cccccccccccccccccccccccccccccccccccc$	$9 45 \\ 10 00 \\ 10 15 \\ 6 00 \\ \dots$	$ \begin{array}{r} 3 & 32 \\ 3 & 47 \\ 4 & 03 \\ 12 & 13 \\ \end{array} $	4.0 8.0 3.0 5.8	$ \begin{array}{r} 1.7 \\ 3.4 \\ 1.3 \\ 2.5 \\ \end{array} $
Borneo.	Tanjong Datu Saráwak River: Po Pt. light Saráwak: Fort Cape Sirik: Light-house. Tanjong Barram Bruni River: Light-house Labuan I., Victoria Hbr.: Light-house Sandakhan Harbor: Light-house Unsang: Anchorage Cape Kaniongan: E. pt. of Borneo	$\begin{array}{c} 2 \ 05 \ 15 \\ 1 \ 43 \ 50 \\ 1 \ 33 \ 55 \\ 2 \ 45 \ 20 \\ 2 \ 36 \ 15 \\ 5 \ 02 \ 00 \\ 5 \ 15 \ 25 \\ 5 \ 50 \ 10 \\ 5 \ 16 \ 30 \\ 1 \ 04 \ 00 \\ \ Lat. \ S. \end{array}$	$\begin{array}{cccccccccccccccccccccccccccccccccccc$	· 4 00 5 20 · · · · · · · · · · · · · · · · · · ·	$ \begin{array}{c} 10 & 12 \\ 11 & 35 \\ \hline \\ 3 & 23 \\ 5 & 50 \\ \hline \\ \end{array} $	$9.0 \\ 14.1 \\ 5.5 \\ 5.2 \\$	3.9 6.1
	Pamaroong I.: E. pt. delta River Koetei Pulo Laut: S. pt. Koengit Islet Selatan Point: Extreme of Sita Pt Bandjermasin: Residency flagstaff Sampit Bay: Bandaran Pt Kottaringin Bay: Samadra I Succadana: Town Padang Tikar: Point	$\begin{array}{c} 0 \ 45 \ 00 \\ 4 \ 05 \ 42 \\ 4 \ 10 \ 40 \\ 3 \ 18 \ 55 \\ 3 \ 16 \ 00 \\ 2 \ 54 \ 00 \\ 1 \ 14 \ 00 \\ 0 \ 40 \ 00 \end{array}$	$\begin{array}{cccccccccccccccccccccccccccccccccccc$	[7 45]	[1 33] 	[7. 0] 7. 2	3.1
	Port Laykan: SW. pt. of Celebes Macassar: Fort light Palos Bay: Village at head	$\begin{array}{cccccccccccccccccccccccccccccccccccc$	$\begin{array}{cccccccccccccccccccccccccccccccccccc$	4 40	10 55	3.9	2.9
Celebes Island.	Cape Rivers: NE. Cape, Slime Islet Gorontalo: Light-house Manado Bay: Light-house Bajuren Island: Summit Tagulanda Island: Peak. Seao Island: Conical peak. Sauguir Island: S. pt. Cape Palumbatu Taluat Island: Kabruang I., SE. pt Cape Flesko: Extreme	Lat. N. 1 20 00 0 29 41 1 31 00 2 07 00 2 22 00 2 44 00 3 21 00 3 49 00 0 27 00	$\begin{array}{cccccccccccccccccccccccccccccccccccc$	6 00	12 15	4.3	3.1
	Cape Talabo: E. end. Wowoni Island: N. pt Bouton Island: N. pt E. pt Fort Cape Lassa: Extreme Salayar Island: N. pt S. pt	Lat, S. 0 46 00 3 58 00 4 23 30 5 15 00 5 29 15 5 35 00 5 47 00 6 26 00	$\begin{array}{cccccccccccccccccccccccccccccccccccc$				

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MARITIME POSITIONS AND TIDAL DATA.

st.	Blood	Test (1	Long, E.	Lun.	Int.	Rŧ	unge.
Coa	Place.	Lat. S.	Long, E.	H. W.	L. W.	Spg.	Neap.
	Anjer: Fourth pt. light Bantam: Flagstaff Batavia: Observatory Buitenzorg: Palace tower Boompjeo Island: Racket I. light	$ \begin{smallmatrix} \circ & - & - & - \\ 6 & 04 & 15 \\ 6 & 01 & 20 \\ 6 & 07 & 40 \\ 6 & 35 & 45 \\ 5 & 56 & 15 \\ 5 & 56 & 15 \\ \end{smallmatrix} $		h. m. 7 11 [11 58]	h. m. 0 58 [5 46]	$\begin{array}{c} {}^{ft.}\\ 2.4\\ \hline [3.0]\\ \end{array}$	^{<i>ft.</i>} 0. 7
Java	Cheribon: Light-house. Tegal: Flagstaff Pekalongan: Light W. of entrance Samarang: Light-house Rembang: Residency flagstaff Surabaya: Time-ball station Pasuruan: Light-house. Madura Island: Light-house Soemenep flagstaff Besuki: Light-house Cape Sedano: NE. pt. of Java Bantenan: S. pt. of Java Bartenan: S. pt. of Java Barung Island: S. pt. Kambangan Island: Light-house	$\begin{array}{c} 6 \ 43 \ 00 \\ 6 \ 51 \ 09 \\ 6 \ 57 \ 09 \\ 6 \ 57 \ 09 \\ 6 \ 42 \ 18 \\ 7 \ 12 \ 10 \\ 7 \ 7 \ 20 \ 00 \\ 7 \ 02 \ 30 \\ 7 \ 43 \ 25 \\ 7 \ 49 \ 00 \\ 8 \ 12 \ 30 \\ 8 \ 47 \ 00 \\ 8 \ 32 \ 00 \\ 7 \ 46 \ 30 \\ 7 \ 46 \ 30 \\ 7 \ 46 \ 30 \\ \end{array}$	$\begin{array}{cccccccccccccccccccccccccccccccccccc$	[6 00] 12 07 11 44 10 00 8 33	$ \begin{array}{c} [12 \ 13] \\ 5 \ 54 \\ 5 \ 31 \\ \hline 3 \ 45 \\ \hline 2 \ 21 \end{array} $	[4. 0] 4. 9 6. 2 7. 8 5. 2	1.7 2.3 2.6
Islands.	Karimon Djawa Island: Flagstaff Rawean Island: Sangkapura flagstaff Great Solombo Island: NW. pt Arentes Island: S. pt Bali Island: Bliling light-house Peak, 11,326 ft Badong Bay, Kotta village Lombok Island: Peak 12,379 ft Ampenam light Sumbawa I.: Sumbawa village Tambora Volcano, sum- mit E. side of crater Bima, flagstaff Postilion Islands: N. island Maria Reigersbergen I Ardassier Islands: S. id Brill Reef: Light-house Hegadis Island Token Bessi I.: Wangi-Wingi, NW. pt. Binongko, S. pt Gunong Api: Volcano Lucipari Islands: N. islet Flores Island: Reo village Ende village Flores Head, extreme Komba Island: Peak, S. part	$\begin{array}{cccccccccccccccccccccccccccccccccccc$	$\begin{array}{cccccccccccccccccccccccccccccccccccc$		4 38 1 37 6 12	8.7 5.8 5.7	
	Adenara Island: Sunmit, Mount Woka. Lombata Island: Sunmit, Mount Woka. Lombata Island: Supeak of saddle on S. pt Ornbay Island: Dololo anchorage Timor Island: Deli, custom-house Atapopa Koupang, Fort Concor- dia Rotti Island: W. pt Saru Island: Seba Bay, on NW. side Sandalwood Island: Nangamessie Wetta Island: Ilwaki road Roma Island: W. pt	$\begin{array}{c} 8 & 20 & 30 \\ 8 & 33 & 00 \\ 8 & 34 & 00 \\ 8 & 12 & 00 \\ 9 & 00 & 00 \\ 10 & 09 & 54 \\ 10 & 46 & 00 \\ 10 & 29 & 00 \\ 9 & 35 & 03 \\ 7 & 53 & 00 \\ 7 & 38 & 00 \end{array}$	$\begin{array}{cccccccccccccccccccccccccccccccccccc$	0 45	6 58 4 37 5 07	5.7 8.5 16.5	2.0

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APPENDIX IV.

MARITIME POSITIONS AND TIDAL DATA.

st.	Place			Lun.	Int.	R	ange.
Coa	Place.	Lat. S.	Long. E.	H. W.	L. W.	Spg.	Neap.
		0 / //	0 / //	h. m.	h. m.	ft.	ít.
	Moa Island: Buffalo Peak, 4,100 ft	8 12 00	$128 \ 01 \ 00$				
	Sermalta Island: NE. pt	$ 8 14 00 \\ 7 02 00 $	129 00 00				
	Nila Island: Center	6 44 00	128 28 00		•••••		
	Mano or Bird Island: NW. extremity.	5 32 50	130 17 44				
	Timor Laut Island: Olilet, on E. coast	7 55 00	$131 \ 23 \ 30$				
	Vordate Island: S. pt	7 04 00	131 55 00				
	Mulu Island: N. pt	$\begin{array}{c} 6 & 35 & 00 \\ 7 & 10 & 00 \end{array}$	131 40 00 121 21 00		• • • • • • • • •		
	N. pt	5 20 00	134 40 00				
	Great Ki Island: S. pt	5 56 00	132 54 00				
	Tello Islands: S. island, summit	$5\ 20\ 00$	131 58 00				
	Tehor Island: NE. pt	4 44 00 4 22 00	$131 \ 47 \ 00$ $121 \ 50 \ 00$				
	Goram Islands: Goram Mosque	4 03 05	$131 \ 50 \ 00$ $131 \ 25 \ 23$				
	Banda Island: Mole	4 31 53	129 53 18	1 45	7 57	9.0	6.6
	Bouro Island, Kajeli: Fort Defense	3 22 48	$127 \ 06 \ 18$	1 20	7 32	4.2	· 3.1
	Ceram Island: Kawa	$\begin{array}{cccccccccccccccccccccccccccccccccccc$	$128 \ 07 \ 04$		0 99		
	Nulla Islands, Taliabo Island, NW pt	1 44 00	128 10 00	2 20	0 02	1.0	0.0
	Mangola Island: E. pt	1 48 12	126 21 19				
	Besi Island: E. pt	$2\ 28\ 00$	$126 \ 01 \ 00$				
	Oby Major Island: W. pt	$1 \ 30 \ 00$	127 18 00			• • • • • • •	
	Mysole Island: Effect Harbor	$\frac{1}{2} \frac{11}{04} \frac{21}{00}$	129 55 48	• • • • • • • • •			
	Mysole Island. Dibe Harbor	2 01 00	100 12 00				
	Geber Islands: NW nt	Lat. N.	129 17 30				
ds	Gillolo Island: Cape Tabo: E. extreme.	0 11 00	128 52 00				
a a	Cape Salawag: NE. pt	$1 \ 26 \ 00$	$128 \ 37 \ 00$				
2	Derrick Point: N. ex-	9 19 00	190 09 90				
	Molucca Is. Makkian I.: Fort Reeburgh.	$ \begin{array}{c} 2 & 12 & 00 \\ 0 & 24 & 00 \end{array} $	$128 \ 03 \ 30 \ 127 \ 21 \ 00$				
	Ternate Island: Residency						
	flagstaff	0 47 13	127 22 39	5 00	11 10	3.9	2.9
	Batian Island: Church	Lat. S. 0 38 03	$127 \ 28 \ 21$				
		Lat. N.					
	Meiaco-Sima Is., Kumi I: N. Beach Broughton Bay: Land	24 26 00	122 56 00				
	ing place	$24 \ 21 \ 30$	124 17 40				
	Port Haddington:	01 07 00	101 00 10				
	Hamilton pt	24 25 00	124 06 40			• • • • • •	
	Karimata Anch	24 48 18	$125 \ 17 \ 57$	7 27	1 14	4.9	2.1
	Raleigh Rock: Summit, 270 ft	25 55 00	$124 \ 35 \ 00$				
	Ti-ao-usu Island: Summit, 600 ft	25 58 30	123 40 00				
	Hoa-pin-su Island: N. face	25 47 07	123 30 31				
	Nafa-Kiang	$26 \ 12 \ 25$	127 40 10	6 30	0 15	5.8	2.5
	Yori-sima, 413 ft	$27 \ 02 \ 00$	$128 \ 25 \ 24$				
	Yerabu-sima peak,	97 91 00	198 99 10				
	Kakirouma: Sum-	21 21 00	120 00 10				
		$27 \ 44 \ 00$	128 59 00				
	Iwo-sima: Volca-	97 59 00	198:14:20				
	Oho-sima: N. ex-	21 03 00	120 14 30	•••••			
	treme	28 31 40	$129 \ 42 \ 30$				
	mit, 867 ft	28 18 00	129 59 00				

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MARITIME POSITIONS AND TIDAL DATA.

Lst.	Place	Lat. N.	Long. E.	Lun. Int.		Range.	
COR	Place.	Lat. N.	Long. E.	H.W. L.	W.	Spg.	Neap.
		0 / 1/	0 / 11	h. m. h.	<i>m</i> .	ſt.	ſt.
	Balábac Island, Cape Melville: Light- honse	7 49 25	117 00 00				
	Paláwan Island, Cape Bovliluyan: S.	0 00 05	117 00 05				
	Victoria Peak, 5,680 ft.	$8 20 23 \\ 9 22 30$	117 09 35 118 17 30				
	Port Royalist: Tide	0 12 12	110 49 09	F11 903' F	: 907	re 51	
	Taytay Fort	10 50 00	$118 \ 43 \ 03$ $119 \ 31 \ 10$) 20]	[0.9]	
	PortBarton: Bubon Pt.	10 29 19	$119 \ 05 \ 36$				
	extreme	$11 \ 26 \ 25$	119 29 55				
	Cuyo Island: Obs. spot	10 51 26	$121 \ 00 \ 25$				
	Quiniluban Islet: Summit	$11 \ 05 \ 05 \ 11 \ 25 \ 47$	$120 \ 36 \ 26$ $120 \ 45 \ 38$				
	Culion Island: Fort	11 53 53 12 02 00	$120 \ 00 \ 48$ 190 19 56			·····	
	Apo Islet: Summit	$12 \ 02 \ 09 \ 12 \ 39 \ 46$	$120 \ 12 \ 50 \ 120 \ 12 \ 18$				
	Câluya Island: Summit	11 54 28 12 06 45	$121 \ 30 \ 24$				
	Mindoro Island: Mangarin Pt., SE. ex-	12 00 45	121 20 10				
	tremity	$12 \ 20 \ 03$ 12 50 15	$121 \ 03 \ 33$ 120 41 42			• • • • • • •	
	Monte Calavite	$12 \ 30 \ 13 \ 13 \ 28 \ 40$	120 44 42 120 22 33				
	Escarceo Pt	$13 \ 31 \ 35 \ 12 \ 06 \ 05$	120 59 17 121 20 20				
	Ylin Island	$12 \ 17 \ 15$	$121 \ 25 \ 20 \ 121 \ 01 \ 53$				
:	Lubang Island, Port	13 49 30	120 09 58				
nd,	Luzon Island, Batangas: Ast. station	$13 \ 45 \ 50 \ 13 \ 45 \ 22$	$120 \ 03 \ 56$ $121 \ 02 \ 56$				
sla	Balayan: Plaza Rizal Loro Peak: Summit 3 985	13 56 17	120 43 37	[11 07] [4	£ 50]	[4.9]	
6	feet	$14 \ 12 \ 20$	120 38 10				
i d	Caballo 1.: Light-house - Corregidor Island: Light-	14 21 48	120 36 40				
dil	house	$14 \ 22 \ 27$	$120 \ 33 \ 48$	[10 22] [3	3 56]	[4.4]	
H.	Manila: Pasig light-house	$14 \ 29 \ 50 \\ 14 \ 35 \ 49$	$120 54 40 \\ 120 57 19$	10 44 F4	101	[4, 6]	
	Manila: Cathedral	$14 \ 35 \ 31$	120 58 06			[]	
	CaponesIslet:Light-house	$14 \ 52 \ 36 \ 14 \ 55 \ 33$	$120 \ 13 \ 52 \ 120 \ 00 \ 15$	[9 42] [4	: 33]	[3, 8]	
	Iba: Ast. station	15 19 30	119 57 11			•••••	
	Santa Cruz: Plaza	$15 \ 34 \ 48 \ 15 \ 45 \ 43$	119 54 16 119 54 00				
	Sual: Army Hospital	16 04 06 16 07 15	$120 \ 06 \ 01$	$\begin{bmatrix} 10 & 20 \end{bmatrix} \begin{bmatrix} 3 \\ 10 & 21 \end{bmatrix}$	33]	[2.4]	
	Port San Fernando:	10 27 10	119 90 10		, 44]	[2.3]	
	Main street	$16 \ 37 \ 15$ 17 11 12	$120 \ 18 \ 25$ $120 \ 26 \ 11$	[9 40] [3	: 29]	[2.6]	
	Port Santiago: Remark-	17 11 49	120 20 14		• • • • •		
	able tree S. of port	$17 \ 16 \ 55 \ 17 \ 22 \ 56$	$120 \ 25 \ 07$ $120 \ 29 \ 51$				
	Salomague Island: Port	17 00 00	120 22 01		• • • • •		
	Salomague flagstaff	17 47 17	$120 \ 25 \ 04$		• • • •		
	Capa Bojeador: Light-	10 01 09	120 20 44		• • • • •		
	house	18 31 08 18 39 02	$120 \ 35 \ 35 \ 120 \ 50 \ 53$				
	Aparri: Plaza	$18 \ 35 \ 02$ $18 \ 21 \ 43$	$120 \ 30 \ 33$ $121 \ 37 \ 27$	5 43 -0	02	3.2	1.9
	, Port San Vicente: San Vicente Islet	18 98 29	199 04 14				
	Cape Engaño: Roña Islet	$18 \ 20 \ 32 \ 18 \ 32 \ 02$	$122 04 14 \\ 122 05 49$				
	Camiguin I.: Summit Fuga Island: W summit	$18 50 26 \\ 18 52 54$	$\begin{array}{cccccccccccccccccccccccccccccccccccc$	6 00 - 0	12	5.0	2.7
	Dalupiri Island: Peak	19 03 03	121 11 28				
	Calayan Island: NE. pt Babayan Claro Island: W. pt	$ 19 22 00 \\ 19 30 00 $	$\begin{array}{cccccccccccccccccccccccccccccccccccc$				
	I	_0 00 00					

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APPENDIX IV.

MARITIME POSITIONS AND TIDAL DATA.

Coast.	Place.	T		Lun, Int,		Range.		
		Lat. N.	Long, E,	H. W.	L. W.	Spg.	Neap.	B-+
		0 / //	0 / //	h. m.	h. m.	ít.	ít.	-
	Balingtang Islands	19 58 30	122 14 00					
	Batan Island: Mount Irada	20 28 30	122 01 20 121 52 20		• • • • • • • •	• • • • • •	•••••	
	Yani Island: Islot off SW part	20 48 00	$121 \ 02 \ 00 \ 121 \ 58 \ 94$					
	Luzon Island. Port Dimasalasan: En-	21 01 00	121 00 21			••••		
	trance	17 20 17	122 19 20					
	Polillo I.: Port Polillo	$14 \ 51 \ 00$	121 54 48					
	Tabaco: Church belfry .	$13 \ 21 \ 33$	$123 \ 43 \ 53$	6 08	0 00	5.2	2.8	
	N islot	1.1 00 00	124 06 48					
	Cautanduanco Islands:	14 05 00	124 00 40					
	S. extreme	$13 \ 28 \ 30$	124 04 48					
	Point Calaan: S. extreme	$12 \ 31 \ 20$	124 04 18					
	Port Sorsogon, Tinacos	10 50 00	100 40 00					
	Islet	$12 \ 52 \ 20$ $19 \ 99 \ 10$	123 49 22 192 25 59				•••••	
	Rugui Pt light-house	$12 \ 22 \ 10$ $12 \ 36 \ 00$	123 14 36				•••••	
	Camasusu I.: Summit.	12 10 03	123 12 47					
	Tintolo Point: Extreme	11 56 09	123 07 34					
	Burias Island: Busainga	$13 \ 07 \ 40$	$123 \ 02 \ 45$	[4 30]	[10 20]	[5, 5]		
	Marinduque I.: Summit of Mount Catala.	$13 \ 18 \ 10$	121 54 33	• • • • • • • • • ·				
	maestro de Campo Island, Port Con-	19 54 03	121 43 08					
	Banton Island: Banton Mountain	12 56 56	122 04 48					
	Tablas Island: Tablas Head	$12 \ 38 \ 42$	122 08 38					
	Sanguilan Pt	$12 \ 33 \ 44$	121 58 32					
	Carabao Island: W. pt	$12 \ 03 \ 15$	121 53 53					
	Romblon Island: Sabang Pt. light	$12 \ 36 \ 00$ 19 25 22	122 17 08 122 16 26			• • • • • •	• • • • • • •	
ż	Summit over port	$12 \ 30 \ 30 \ 12 \ 12 \ 24 \ 55$	122 10 20 122 33 23					
pu	Samar Island, Guiuan: Pier	11 01 30	$122 \ 03 \ 20 \ 125 \ 43 \ 14$					
+la	Catbalogan: Fort	$11 \ 46 \ 44$	124 51 37					
-	Maripipi Island: Summit	$11 \ 47 \ 30$	124 18 15		1.05			
ne	Leyte, Tacloban	11 15 08 11 00 17	124 59 56	6 53	1 25	1.5	1.1	
ida	Palompon: Church	11 00 17 11 02 37	124 30 20	-				
E	Maasin	10 07 39	124 50 15	11 47	4 50	2.8	2.0	
E	Bohol I., Lapiniu I.: Mount Basiao	$10 \ 03 \ 22$	$124 \ 32 \ 35$					
P	Cebu Island, Cebu: Plaza	$10 \ 17 \ 30$	123 54 18					
	Siquiquor Island, Port Canoan: S. pt. of	0 15 17	199 94 96					
	Negros Island Port Bunbonou: E pt	9 10 17	120 04 20			• • • • • •		
	of entrance	9 03 37	123 06 09	.				
	Dumaguete: Town	$9\ 18\ 25$	123 18 43					
	Volcano of Malaspina,	10.01.05						
	8,192 ft	10 24 35 10 10 91	123 07 05 199 55 49				• • • • • •	
	Guimaras I Inampulugan I SW pt	$10 \ 40 \ 21$ $10 \ 26 \ 38$	$122 \ 00 \ 42$ $122 \ 40 \ 20$		• • • • • • • • •			
	Panay Island. Hoilo: Fort.	$10 \ 41 \ 27$	122 34 26	11 06	5 22	4.2	1.9	
	San José	$10 \ 44 \ 08$	121 54 27					
	Pan de Azucar	$11 \ 16 \ 47$	122 09 09		• • • • • • •			
	Bathatan Island: Summit	11 28 20 11 15 20	121 52 36 191 59 50				•••••	
	Pucio Point: Extreme Port Batan: Villaga	11 40 50 11 35 40	$121 \ 58 \ 59$ $192 \ 28 \ 50$			• • • • • • •		
	Capiz: Town	$11 \ 35 \ 06$	122 45 03					
	Siargao Island, Port Sapao: Semaphore.	$10 \ 11 \ 26$	$126 \ 02 \ 53$					
	Gibdo Island: Semaphore	9 53 00	125 31 17					
	Bucas Island: E. pt. of Port Sibanga	9 41 34	125 58 22	F11 401	F6 151	T6 51	• • • • • • •	
	Cane St Angustin	9 4/ 03	120 28 00		[0 19]	[0.0]		
	Mindanao Island, Davao: Mole.	7 01 22	125 34 35	6 00	-0 13	6.9	5.1	
	Saranguni Islets: W.							
	islet	$5\ 22\ 30$	$125 \ 13 \ 48$					
	Basianang Bay: N.	0 00 20	109 57 97					
	Pollog: Small bill	0 28 90	120 01 31	•••••				
-	back of town	7 21 15	124 11 42					

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MARITIME POSITIONS AND TIDAL DATA.

st.	Place.	T-4 N	Long P	Lun. Int.		Range.	
Coa		Lat. N.	Long. E.	H. W.	L. W.	Spg.	Neap.
	Mindanao Island, Santa Cruz Islands: SE. islet	\circ \prime $''$ 6 52 15	° ′ ″ 122 04 00	h. m.	h, m,	ft.	<i>ft</i> .
	Zamboanga: Fort Sibuco Bay: Hill S.	6 54 03	122 04 52	6 50	0 42	3, 8	2.8
	Port Sta. Maria: Fort	7 45 41	$122 \ 03 \ 18$ $122 \ 04 \ 58$				
Philippine Islands.	Dapitan: Village Misamis: Fort	8 40 15 8 08 29	$123 23 13 \\123 50 44$	[10 48]	[4 50]	[5, 1]	
	Camiguin Island: Mount Camiguin	9 10 19	124 42 50				
	Sombrero Rock: Center Piedra Blanca: Center	$\begin{array}{cccccccccccccccccccccccccccccccccccc$	$121 \ 33 \ 00 \ 121 \ 03 \ 00$				
	Cagayanes Islands: Rocky islet be- tween two larger islands	9 35 30	121 23 30				•••••
	nukan Cagayan Jolo Island: Middle of W.	$7 \ 43 \ 00$	118 27 00				
	coast	$\begin{array}{c} 7 & 00 & 38 \\ 4 & 54 & 10 \end{array}$	118 26 06 119 22 45			• • • • • •	
	Sibutu Island: Hill on E. coast	4 49 30	$119 \ 48 \ 00$			· · · · · · ·	
	Simonor Island: NW. pt Bahaltolis Island: Sandakan Harbor	$\begin{array}{cccccccccccccccccccccccccccccccccccc$	$\begin{array}{cccccccccccccccccccccccccccccccccccc$				
	Bongao Island: S. pt	5 00 30	$119 \ 44 \ 15$				
	Keenapoussan Island: Center Bubuan Island: Lagoon eutrance	$5 13 00 \\ 5 25 15$	$120 \ 40 \ 45 \ 120 \ 35 \ 00$				
	Cuad Basang Island: SW. pt	$5\ 27\ 10$	120 11 30				
	Siassi: Town Bulipongpong Island: Center hill	$5 32 40 \\ 5 41 30$	$120 \ 48 \ 25 \ 120 \ 49 \ 45$	9 94	-0 18	8.0	6.4
	Tapul Island: Center hill, 1,676 ft.	5 44 30	120 55 00				
	bank	5 54 45	121 00 40			• • • • • • •	
	yan Islet	$\begin{array}{cccccccccccccccccccccccccccccccccccc$	$121 \ 18 \ 20$ $120 \ 58 \ 40$	F9 381	F3 101	[5 0]	
	Doc Can Islet: W. extreme	5 52 30	119 55 55	[0 00]		[0.0]	
	Pangituran Island: SW. pt Basilan Island: La Isabela	$\begin{array}{cccccccccccccccccccccccccccccccccccc$	$\begin{array}{cccccccccccccccccccccccccccccccccccc$	•••••	 	•••••	
	Wang-kia-tia Bay: Langwang temple Kyauchau Bay: Yunuisan light	$\begin{array}{cccccccccccccccccccccccccccccccccccc$	$\begin{array}{cccccccccccccccccccccccccccccccccccc$	4 50	11 03	 11.4	6.0
	Staunton Island: Landing place, N. side.	36 45 29	$122 \ 16 \ 48$	4.00	10.19		
	Weihaiwei: Light, S. side harbor	37 24 00 37 27 41	$122 \ 42 \ 00 \ 122 \ 15 \ 05$	$ \begin{array}{c} 4 & 00 \\ 9 & 20 \end{array} $	$ \begin{array}{c} 10 & 12 \\ 3 & 08 \end{array} $	6.8 9.0	5.0 6.6
	Chifu: Light-house	$\begin{array}{cccccccccccccccccccccccccccccccccccc$	$121 \ 31 \ 09$ 191 96 91	$10 \ 25$	4 13	8.1	6.0
China.	Miautao Island: Peak of N. Island	$37 \ 30 \ 00$ $38 \ 23 \ 37$	121 20 21 120 55 00				
	Pei-ho: S. Taku Fort, S. Cavalier Tientsin: Shore opp NE angle of wall	38 58 16 39 09 00	117 42 48 117 11 44	6.50	1.00	4 5	3.3
	Shaluitien Island: Light-house	38 56 00	118 31 00				
	Nuchwang: Lightship Hulu-shan Bay: N. side	$ 40 35 00 \\ 39 30 46 $	$122 \ 00 \ 00$ $121 \ 18 \ 03$	4 30	10 50	11.7	8.7
	Port Adams: Entry	39 16 00	$121 \ 35 \ 59$				
	Port Arthur: Obs. spot.	$38 43 17 \\ 38 47 50$	$121 \ 08 \ 26$ $121 \ 15 \ 54$	10 05	3 53	7.5	5.5
	Ta-lien-wan Bay: Isthmus on S. San-	28 59 28	191 51 59				
	Round Island: Summit	$38 \ 40 \ 00$	$121 \ 01 \ 00 \ 122 \ 11 \ 30$				
	Beach opposite Temple Point	39 04 00	$123 \ 10 \ 34$				
Korea.	Choda Island: S. pt.	38 27 00 37 58 00	$124 \ 34 \ 40$ $121 \ 21 \ 20$				
	Chemulpo: So Wolmi	$37 \ 37 \ 00 \ 37 \ 27 \ 40$	$124 \ 34 \ 50 \ 126 \ 36 \ 27$	4 19	10 31	28.8	11.6
	Marjoribanks Harbor: Manzoc Islet Tas de foin Islet: Center	$\begin{array}{cccccccccccccccccccccccccccccccccccc$	$126 \ 28 \ 00 \\ 126 \ 24 \ 00$				
	Guerin Island: Summit, 969 ft	36 07 00	126 01 09				

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APPENDIX IV. MARITIME POSITIONS AND TIDAL DATA.

EAST COAST OF ASIA-Continued.

st.	Place.	Lat. N.	Long. E.	Lun. Int.		Range.	
COR				H, W.	L. W.	Spg.	Neap.
Korea.	Kokoun-tan Islands: Camp Islet Barren Island: Center, 600 ft Sea Rock: Center, 160 ft Modeste Island: N. peak, 1,228 ft Ross Island: Peak, 1,920 ft Kuper Harbor: NE, extreme of Josling I. Port Hamilton: W. pt. of Obs. Island Bate Islands: Summit Thornton Islet Montravel Island: Center, 1,041 feet Quelpart Island: Beaufort I., middle of W. side Observation Island: Point of W. arm Sentinel Island: Summit, 400 feet Broughton Head: Extreme Tsau-liang-hai Harbor: Light-house	$\begin{smallmatrix} \circ & 7 & 8 \\ 35 & 48 & 08 \\ 35 & 21 & 00 \\ 34 & 42 & 00 \\ 34 & 42 & 30 \\ 34 & 06 & 00 \\ 34 & 17 & 20 \\ 34 & 01 & 23 \\ 33 & 57 & 00 \\ 33 & 59 & 00 \\ 33 & 29 & 40 \\ 34 & 39 & 00 \\ 34 & 33 & 00 \\ 34 & 48 & 00 \\ 35 & 07 & 15 \\ \end{smallmatrix}$	$ \begin{smallmatrix} \circ & , & '' \\ 126 & 31 & 00 \\ 125 & 58 & 00 \\ 126 & 19 & 45 \\ 125 & 16 & 00 \\ 125 & 07 & 00 \\ 126 & 35 & 28 \\ 127 & 18 & 34 \\ 126 & 18 & 00 \\ 126 & 55 & 00 \\ 126 & 55 & 00 \\ 126 & 58 & 25 \\ 128 & 14 & 00 \\ 128 & 40 & 00 \\ 128 & 44 & 00 \\ 129 & 02 & 10 \\ 10 \\ 10 \\ 10 \\ 10 \\ 10 \\ 10 \\ 10$	h. m. 	h. m. 2 52 1 23	<i>ft.</i> 10.5 7.0	<i>ft.</i> 4.2 3.0
Japan.	Tsu Sima: Observation rock Iki Sima: Summit, S. end of island Oro No Sima: Summit, 277 ft. Kosime No Osima: Summit Wilson I Yeboshi Sima: Light-house Yobuko Harbor: Bluff opposite Nicoya. Hirado No Seto: Taske light Goto Island: Ose Saki light Pallas Rocks: S. rock Mejaco Sima: Ears Peak Nagasaki: Transit Venus Station Kuchinotsu: Light-house Kagoshima: Breakwater light Tsukarase Rocks: Summit, 96 ft Uji Shima: High peak, 1,097 ft Yamagawa Harbor: Spit N. of town Satano Misaki: Light-house	$\begin{array}{cccccccccccccccccccccccccccccccccccc$	$\begin{array}{cccccccccccccccccccccccccccccccccccc$	8 56 	2 44 3 10 1 41 1 00 1 08	6.7 6.4 8.4 10.5 9.5	2.4 2.5 3.5 4.4 3.9
Linschoten Is.	Kusakaki Jima: Ingersoll Rocks, 530 ft. Kuro Sima: 2,160 ft. Iwo Shima: Peak, 2,469 ft. Yakuno Shima: Mount Matomi, 6,252 ft. Firase Rocks: Highest, 92 ft. Kuchino Shima: Summit, 2,230 ft. Guaja Shima: Summit, 1,687 ft. Naka no Shima: Peak, 3,400 ft. Suwanose Jima: Volcano, 2,706 ft. Tokara Jima: Summit, 860 ft. Yoko Shima: Summit, 1,700 ft.	$\begin{array}{cccccccccccccccccccccccccccccccccccc$	$\begin{array}{cccccccccccccccccccccccccccccccccccc$	• •			
Japan.	Shimonoseki Strait: Meji Zaki, extreme. Rokuren Island: Light-house Shirasu Reef: Light-house Susaki: SW. battery Tomo Roads: Tamatsu Sima Port Okayama: Take Siua temple Wusimado Pt.: Wusimado Peak, 548 ft. Akashi-no-seto: Maico Fort Hiogo: Wada Misaki light Kobe: Light-house Osaka: Fort Temposan light Sakai: Pier-head light Osaki Bay: Tree Islet, S. pt Yura No Uchi: Pier Tanabe Bay: Fossil pt Oö-sima Hbr.: Kashinosaki light, E. pt. Uragami Harbor: Village pt Owashi Bay: Hikimoto Mura Harbor: Osima Islet	$\begin{array}{cccccccccccccccccccccccccccccccccccc$	$\begin{array}{cccccccccccccccccccccccccccccccccccc$	8 30 5 55 11 16 7 30 7 30 6 23	2 20 12 08 5 04 1 25 1 25 0 10	6.7 5.0 10.2 4.7 4.7	2.4 2.0 4.5 2.0 2.0

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MARITIME POSITIONS AND TIDAL DATA.

EAST COAST OF ASIA-Continued.

st.				Lun.	Int.	Ra	ange.
Coa	Place.	Lat. N.	Long. E.	H. W.	L. W.	Spg.	Neap.
Japan. Coast.	Place. Matoya Harbor: Anori-saki light Shimizu Bay: Mound on pt Shimizu Bay: Mound on pt Mikomoto Island: Light-house Simoda Harbor: Center I Yokosuka Harbor: Eyi Yama pt Yokohama: English Hatoba light Tokio: Naval Observatory No Sima Saki: Light-house No Sima Saki: Light-house Vries Island (O Sima) Volcano: Summit, 2,512 ft	Lat. N. 34 21 57 34 35 52 35 00 51 34 34 25 35 00 51 35 051 34 34 25 35 918 34 34 25 35 26 52 35 39 18 34 54 17 34 43 30 35 26 52 35 39 18 34 54 17 34 43 30 33 56 50 33 56 50 33 56 50 33 56 50 33 52 00 33 04 24 32 29 00 32 00 42 32 00 32 00 32 02 700 30 28 26 29 46 28 35 42 13 38 16 57 39 16 30 39 27 17 41 25 58 41 33 34 40 50 00 41 16 17 40 31 00 39 12 02 38 29 23 38 19 55 36 47 47 37 28 00 37 55 14 37 35 00 37 02 37 35 40 24 48 00 34 40 00 34 42 00 34 41 7 36	Long. E. $^{\circ}$ / " 136 54 09 138 13 49 138 31 19 138 56 30 138 57 30 139 39 43 139 39 43 139 38 41 139 44 30 139 53 24 139 23 00 139 08 00 139 31 00 139 31 00 139 31 00 139 43 31 140 00 00 140 12 20 140 19 40 140 52 23 141 55 30 141 52 50 141 52 50 141 52 50 141 52 33 141 52 50 141 52 50 141 52 33 141 52 50 141 52 33 141 52 50 141 52 33 141 52 50 141 59 00 131 32 58 139 32 58 139 15 31 138 27 09 137 03 15 137 22 00 131 36 00 131 18 00 131 18 00 131 18 00 131 18 00 131 18 00 131 09 00 130 50 29 140 41 49	Lun. H. W. h. m. 5 52 5 52 5 04 	Int. L. W. h. m. 12 04 12 04 11 30 11 17 	Ra Spg. fl. 4.3 3.9 4.9 3.7 3.4 3.4 0.6 1.1 3.0	Image. Neap. ft. 1.7 1.6
	Hakodate: Light-ship. Endermo Harbor: Bluff on E. side Okishi Bay: Light-house. Noshiaf Saki: Light-house. Nemuro: Benten Sima light Notsuke Anchorage: Village Noshiaf Misaki: Light-house Risiri Islet: Peak, 5,713 ft	$\begin{array}{cccccccccccccccccccccccccccccccccccc$	$\begin{array}{cccccccccccccccccccccccccccccccccccc$	$ \begin{array}{r} 3 & 40 \\ 3 & 32 \\ 3 & 41 \\ 3 & 48 \\ 3 & 33 \\ 4 & 50 \\ $	$ \begin{array}{c} 10 & 00 \\ 9 & 45 \\ 9 & 53 \\ 10 & 00 \\ 9 & 46 \\ 11 & 05 \\ \end{array} $	$\begin{array}{c} 3.0 \\ 3.5 \\ 3.0 \\ 3.1 \\ 2.1 \\ 3.7 \\ \end{array}$	$ \begin{array}{r} 1.2 \\ 1.5 \\ 1.4 \\ 1.4 \\ 0.5 \\ 1.8 \\ \end{array} $
Kurll Islands.	Kunashir Island: St. Anthonys Peak Iturup Island: NE. pt Urup Island: Cape Vanderlind Broughton Island: Summit Simusir Island: Prevost Peak Ketoy Island: S. pt Matana Island: Peak Shiash-Kotan Island: Center Kharim-Kotan Island: Center Oune-Kotan Island: SW. pt Moukon rushi Island: Center Poro musir Island: Center Soumshu Island: Center	$\begin{array}{ccccccc} 44 & 20 & 00 \\ 45 & 38 & 30 \\ 45 & 37 & 00 \\ 46 & 42 & 30 \\ 47 & 02 & 50 \\ 47 & 17 & 30 \\ 48 & 06 & 00 \\ 48 & 52 & 00 \\ 49 & 08 & 00 \\ 49 & 19 & 00 \\ 49 & 19 & 00 \\ 49 & 51 & 00 \\ 50 & 15 & 36 \\ 50 & 46 & 00 \end{array}$	$\begin{array}{cccccccccccccccccccccccccccccccccccc$				



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APPENDIX IV.

MARITIME POSITIONS AND TIDAL DATA.

EAST COAST OF ASIA-Continued.

st.				Lun.	Int.	Re	inge.
Coa	Place.	Lat, N.	Long. E.	H. W.	L. W.	Spg.	Neap.
Korea.	Cape Clonard: Extreme. Ping-hai Harbor. Liancourt Rocks: Summit, 410 ft Matu Sima: Peak, 4,000 ft. Port Lazaref: S. 1½ miles from the S. end of Bontenef I.		$\begin{array}{c} \circ & 7 & 7 \\ 129 & 33 & 30 \\ 129 & 20 & 00 \\ 131 & 55 & 00 \\ 130 & 53 & 00 \\ 127 & 32 & 48 \end{array}$	h. m.	h. m.	<i>ft</i> .	ft.
Siberia.	Wawoda Rock: Summit, 12 ft Expedition Bay: Light-house	$\begin{array}{c} 42 \ 14 \ 30 \\ 42 \ 38 \ 05 \\ 42 \ 38 \ 05 \\ 42 \ 33 \ 40 \\ 43 \ 05 \ 13 \\ 42 \ 41 \ 00 \\ 43 \ 22 \ 00 \\ 43 \ 51 \\ 33 \ 42 \ 41 \ 00 \\ 44 \ 32 \ 20 \\ 00 \\ 44 \ 33 \ 53 \ 40 \\ 44 \ 36 \\ 55 \ 10 \ 30 \\ 45 \ 41 \ 30 \\ 45 \ 41 \ 30 \\ 45 \ 41 \ 30 \\ 45 \ 41 \ 30 \\ 45 \ 45 \ 30 \\ 55 \ 11 \ 00 \\ 56 \ 25 \ 28 \\ 56 \ 22 \ 30 \\ 55 \ 11 \ 00 \\ 56 \ 25 \ 28 \\ 56 \ 22 \ 30 \\ 55 \ 11 \ 00 \\ 56 \ 25 \ 28 \\ 56 \ 22 \ 30 \\ 55 \ 11 \ 00 \\ 56 \ 25 \ 28 \\ 56 \ 22 \ 30 \\ 55 \ 11 \ 00 \\ 56 \ 25 \ 28 \\ 56 \ 22 \ 30 \\ 55 \ 51 \ 10 \\ 46 \ 01 \ 20 \\ 55 \ 51 \ 10 \\ 56 \ 25 \ 28 \\ 56 \ 22 \ 30 \\ 55 \ 51 \ 02 \ 00 \\ 54 \ 32 \ 24 \\ 56 \ 10 \ 00 \\ 58 \ 26 \ 00 \\ 59 \ 55 \ 00 \\ 63 \ 12 \ 00 \\ 64 \ 16 \ 00 \\ 64 \ 16 \ 00 \\ 64 \ 46 \ 00 \\ 64 \ 50 \ 00 \\ 64 \ 46 \ 00 \\ 64 \ 50 \ 00 \\ 66 \ 02 \ 00 \ 00 \\ 66 \ 02 \ 00 \ 00 \ 00 \ 00 \ 00 \ 00 \$	$\begin{array}{cccccccccccccccccccccccccccccccccccc$	2 45 2 45 	9 00 9 00 3 40 4 40 5 08 7 30 10 08 9 45 12 15 12 15	1.9 1.9 2.7 6.3 4.2 8.4 4.6 5.1 4.5 	0.8 0.8 1.1 1.1 2.6 1.7 1.7 1.7 1.9 2.1 1.8 1.8
	ISLANDS	OF THE	PACIFIC.				
apagos.	Malpelo Island: Summit, 1,200 ft Cocos Island: Head of Chatham Bay Redondo Rock: Summit, 85 ft Towers Island: W. cliff Bindloe Island: S. summit Diadon Island: S. summit	$\begin{array}{c} 4 & 03 & 00 \\ 5 & 32 & 57 \\ 0 & 13 & 30 \\ 0 & 20 & 00 \\ 0 & 18 & 50 \\ 0 & 24 & 25 \end{array}$	81 36 00 86 59 17 91 03 00 89 58 43 90 30 08				
Gala	Wenman Island: Summit, 1,950 ft	$ \begin{array}{cccccccccccccccccccccccccccccccccccc$	90 44 23 91 49 43				

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MARITIME POSITIONS AND TIDAL DATA.

ISLANDS OF THE PACIFIC-Continued.

ıst.		Tet 0	Y	Lun.	Int.	R	inge.
Coe	Place.	Lat. S.	Long. W.	H. W.	L. W.	Spg.	Neap.
ż	Albemarle Island: Iguana Cove	$^{\circ}$ / // 0 59 00 0 31 00	$^{\circ}$ / $^{\prime\prime}$ 91 29 12 91 36 00	${}^{h.\ m.}_{2\ 00}$	h. m. 8 13	$\overset{\textit{ft.}}{6.2}$	<i>.ft</i> . 3. 1
sland	James Island: Sugarloaf, 1,200 ft Jervis Island: Summit	$\begin{array}{c} 0 & 51 & 00 \\ 0 & 15 & 20 \\ 0 & 25 & 00 \\ \end{array}$	$\begin{array}{c} 90 & 52 & 53 \\ 90 & 43 & 30 \\ 90 & 41 & 30 \\ \end{array}$	2 45	8 58	5.2	2.6
1 802	Duncan Island: Center hill Indefatigable Island: NW. bay	$\begin{array}{cccc} 0 & 36 & 30 \\ 0 & 33 & 25 \\ 0 & 50 & 20 \end{array}$	$\begin{array}{c} 90 \ 41 \ 00 \\ 90 \ 33 \ 58 \\ 90 \ 06 \ 13 \end{array}$	2 00	8 13	6.2	3.1
lapa	Charles Island: Summit, 1,780 ft Fatu Huku or Hood Island: E. summit,	1 19 00	90 28 13	2 10	8 23	6.0	3.0
Ça	640 ft Chatham Island: Mount Pitt, 800 ft	1 25 00 0 44 15	$\begin{array}{c} 89 & 40 & 08 \\ 89 & 16 & 58 \end{array}$	2 20	8 33	6.5	3.3
	Christmas Island: N. pt. of Cook Islet Fanning Island: Flagstaff, entrance to	1 57 17	$157 \ 27 \ 45$	4 25	10 38	2.4	1.4
	English Hbr Washington Island	$\begin{array}{cccccccccccccccccccccccccccccccccccc$	$\begin{array}{cccccccccccccccccccccccccccccccccccc$	6 00	12 15	2.4	1.4
	Palmyra Island Baker Islet: Center Howland Islands: Contor island	5 52 15 0 13 30 0 49 00	$\begin{array}{cccccccccccccccccccccccccccccccccccc$	5 25 7 10	11 40	1.5	0.9
-	Arorai or Hurds Island: S. pt	Lat. S. 2 40 54	Long. E. 177 01 13	1 10	1 00	0.2	5,0
	Tamana Island: Center Onoatoa Island: Center	$\begin{array}{cccccccccccccccccccccccccccccccccccc$	$\begin{array}{cccccccccccccccccccccccccccccccccccc$				
	Taputeuea or Drummond Island: SE. pt. Nukupau or Byron Island: SE. pt	$1 29 14 \\ 1 23 42$	$175 12 20 \\ 176 31 33$				
spu	Peru or Francis Island: NW. pt	1 17 14 0 26 00	175 57 09 171 21 00				
(slan	Aranuka or Henderville Island: W . pt	Lat. N.	174 24 00				
bert	of W. island. Apanama or Hoppers Island: Entrance	0 11 10	$173 \ 32 \ 40$				
GIII	islet . Maiana Island: S. pt	$\begin{array}{cccc} 0 & 20 & 54 \\ 0 & 51 & 30 \end{array}$	$\begin{array}{cccccccccccccccccccccccccccccccccccc$	4 30	10 45	4.7	2.7
	Tarawa Island: NE. pt Apaiang Island: S. pt	$\begin{array}{cccccccccccccccccccccccccccccccccccc$	$\begin{array}{cccccccccccccccccccccccccccccccccccc$	4 45	11 00	4.7	2.7
	Maraki Island: N. pt Taritari Island: S. pt	$\begin{array}{cccc} 2 & 03 & 00 \\ 3 & 01 & 30 \end{array}$	$\begin{array}{cccccccccccccccccccccccccccccccccccc$				
	Ebon Atoll: Rube Pt Jaluit or Bonham Islands: Jarbor Pier	$\begin{array}{cccccccccccccccccccccccccccccccccccc$	$168 \ 41 \ 31 \ 169 \ 39 \ 31$	4 45	11 00	4.7	2.7
	Burrh Island: Port Rhin, N. pt. of en- trance	6 14 00	171 46 00	5 00	11 15	5.0	2.8
	Majuro or Arrowsmith Islands: An- chorage Djarrit I	7 05 30	171 24 30				
	Arno Atoll: NE. pt Odia Islands: S. islet	$\begin{array}{cccccccccccccccccccccccccccccccccccc$	$171 55 51 \\ 168 46 00$				
	Namu Island: S. pt	8 14 00· 8 27 00	168 03 00 168 26 00				
.spi	Aurh or Ibbetson Island: NE. end, an-	8 10 00	108 20 00				
Islar	Maloclab Islands: NW. end Karen Islet. Wotje or Romanzov Islands: Christmas	8 54 21	170 49 00		•••••		
all.	Harbor Litkieh Island: NW. pt	$\begin{array}{c} 9 & 28 & 09 \\ 10 & 03 & 40 \end{array}$	$\begin{array}{c ccccccccccccccccccccccccccccccccccc$				
Isu	Ailuk Islands: Capeniur Islet Bigar Islet: Center	$10 \ 17 \ 25$ 11 48 00	169 59 20 170 07 00	4 50	11 00	6.2	3.6
M.	Kongelab or Pescadores Islands: Center	11 10 00	167 91 57				
	Rongerik or Radakala Islands: Obser-	11 19 21	107 24 07				
	Ailinginae Island: Easternmost Islet Bikini or Eschholtz Islands: W. ex-	$11 \ 24 \ 00$ $11 \ 07 \ 00$	167 55 00 166 35 00	•••••			
	treme	$\begin{array}{cccc} 11 & 40 & 00 \\ 10 & 05 & 00 \end{array}$	$166 \ 24 \ 25 \ 166 \ 04 \ 00$				
	Eniwetok Islands: North or Engibi I. Uielang or Providence Island: Center	11 40 00	$162 \ 15 \ 00$				
	of atoll	9 39 00	161 08 30				

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APPENDIX IV.

MARITIME POSITIONS AND TIDAL DATA. ISLANDS OF THE PACIFIC—Continued.

št.		,		Lun.	Int.	R	ange.
Coa	Place,	Lat. N.	Long. E.	H. W.	L. W.	Spg.	Neap.
	Greenwich Island, Northam islat	° ' " 1 0.1 00	o / //	h. m.	h. m.	ft.	ft.
Caroline Islands.	Matelotas group: Easternmost of the S. islands. Yap Island: Light in Tomil Bay Eau Island: Center Uluthi or Mackenzie Islands: Mogmog Islet. Feys or Tromelin Island: E. extreme Sorol or Philip Island: Center Eauripik or Kama Islands: E. islet Oleai group: Raur Islet, N. pt Ifalik or Wilson Islets: N. end Faraulen Island: S. end	$\begin{array}{c} 8 & 18 & 30 \\ 9 & 29 & 00 \\ 9 & 52 & 30 \\ \hline 10 & 06 & 00 \\ 9 & 46 & 00 \\ 8 & 06 & 00 \\ 6 & 40 & 00 \\ 7 & 21 & 45 \\ 7 & 15 & 00 \\ 8 & 35 & 00 \\ \end{array}$	$\begin{array}{cccccccccccccccccccccccccccccccccccc$	7 15	1 00	3.4	1.9
	W. Faiu Islet: Center Olimarao Islet: Center Toass Island: Center. Satawal Island: Center. Coquille or Pikelot Island: Center Suk or Polusuk Island: S. end Los Martires: Ollap Islet, N. pt Namonuito Islands: Magur Islet Hall Island: Namuine Islet Hogolu (Hogulu) Group: N. end of	$\begin{array}{c} 8 & 03 & 00 \\ 7 & 43 & 30 \\ 7 & 29 & 30 \\ 7 & 22 & 00 \\ 8 & 09 & 00 \\ 6 & 40 & 00 \\ 7 & 38 & 00 \\ 8 & 59 & 45 \\ 8 & 25 & 30 \end{array}$	$\begin{array}{cccccccccccccccccccccccccccccccccccc$				
	Tsis Islet. Namoluk Islands: NW. islet Mortlock Islands: Lukanor, Port Cha- misso Nukuor or Monteverde Islands: E. pt. Oraluk or Bordelaise Island: Center Ngatik or Valientes Islands: E. extreme. Ponapi Island: Jamestown Harbor. Mokilor Duperrey Islands: Aoura, NE.pt Pingelasp or MacAskill Islands: E. end of island Ualan or Strong Island: Chabrol Harbor.	$\begin{array}{c} 7 \ 18 \ 30 \\ 5 \ 55 \ 00 \\ \end{array}$ $\begin{array}{c} 5 \ 29 \ 18 \\ 3 \ 51 \ 00 \\ 7 \ 39 \ 00 \\ 5 \ 48 \ 00 \\ 7 \ 00 \ 35 \\ 6 \ 41 \ 45 \\ \end{array}$ $\begin{array}{c} 6 \ 14 \ 00 \\ 5 \ 20 \ 06 \end{array}$	$\begin{array}{cccccccccccccccccccccccccccccccccccc$	4 00 6 00	10 15 12 15	4.3	2. 4
Pelew Islands.	Angaur Island: SW. pt Pililu Island: S. pt Earakong or Akamokan Island: Center. Korror Islands: Korror Harbor, Mal- akal pier Baubeltaub Island: Cape Artingal Kyangle Islets: Center of largest	$\begin{array}{ccccccc} 6 & 53 & 55 \\ 7 & 02 & 00 \\ 7 & 08 & 00 \\ 7 & 19 & 00 \\ 7 & 40 & 30 \\ 8 & 08 & 00 \end{array}$	$\begin{array}{cccccccccccccccccccccccccccccccccccc$				
	Warren Hastings Island: Center Nevil or Lord North Island: Center Sonserol Island: Approx	$\begin{array}{ccccccc} 4 & 20 & 00 \\ 3 & 02 & 00 \\ 5 & 20 & 00 \end{array}$	$\begin{array}{cccccccccccccccccccccccccccccccccccc$				
adrone (or Mariana) Islands.	Guam Island: Fort Sta. Cruz, San Luis d'Apra Rota Island: Summit Tinian Island: Sunharon village Saipan Island: Magicienne Bay, land- ing Tanapag Hbr., Garapag Anataxan Island: Center Sariguan Island: Center Guguan Island: Center Alamaguan Island: Center Pagan Island: SW. pt. Agrigan Island: SE. pt. Asuncion Island: Crater, 2,600 ft Urracas Island: Largest islet.	$\begin{array}{cccccccccccccccccccccccccccccccccccc$	$\begin{array}{cccccccccccccccccccccccccccccccccccc$	7 20	1 20	2.6	1.5 1.1

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MARITIME POSITIONS AND TIDAL DATA.

ISLANDS OF THE PACIFIC-Continued.

st.		T. t. Y	Lour E	Lun, I	nt.	Ra	nge.
COR	Place.	Lat. N.	Long, E.	H. W.	L. W.	Spg.	Neap.
	Wake Island: Center		$\begin{smallmatrix}\circ&&&&\\166&31&30\\168&54&28\end{smallmatrix}$	h. m.	h. m.	ft.	jt.
	Johnston or Cornwallis Islands: Flag- staff on W. island Clipperton Island: Center	$\begin{array}{cccccccccccccccccccccccccccccccccccc$	Long. W. 169 32 24 109 13 00				
Hawafian Islands.	Hawaii Island: Hilo, Kanaha Pt. light. Kawaihae light Kealakeakua Bay light. Kailua, stone church Kahoolawe Island: Summit Maui Island: Kanahena Pt. light Lahaina light Molokai Island: Light-house Oahu Island: E. pt. Makapun station Diamond Head Honolulu, Tr. of V. Obs Honolulu, Reef light Kauai Island: Hanalei, Black Head	$\begin{array}{cccccccccccccccccccccccccccccccccccc$	$\begin{array}{cccccccccccccccccccccccccccccccccccc$	3 09 2 20 3 32 2 38 3 46	9 06 8 10 9 58 8 56 9 59 10 20	2.3 1.6 2.2 2.1 1.5	1.3 0.9 1.2 1.1 0.8
	Bird Island: Center Necker Island: Center French Frigate Shoal: Islet (120 ft.) Gardiner Island: Center Maro Reef: NW. pt Laysan Island: Light-house Lisiansky Island: Light-house Pearl and Hermes Reef: NE. extreme Midway Islands: N. end Sand Islet Ocean Island: Sand Islet	$\begin{array}{cccccccccccccccccccccccccccccccccccc$	$\begin{array}{cccccccccccccccccccccccccccccccccccc$	3 30	9 45	1.1	0.6
	Marcus Island: Center Bonin Is., Parrys Group: N. rock Kater Island: N. rock Peel Island: Port Lloyd, ob- servatory Volcano Is., San Alessandro or North	$\begin{array}{cccccccccccccccccccccccccccccccccccc$	Long. E. 153 58 00 142 06 53 142 11 53 142 11 23	6 10	0 00	2.4	1.4
	Sulphur Island : Center Sulphur Island San Augustine Island: Center Rosario Island: Center, 148 ft Douglass Rocks: Center Borodino Islands: Center of N. island Center of S. island Rasa Island: Center	$\begin{array}{cccccccccccccccccccccccccccccccccccc$	$\begin{array}{c} 141 & 11 & 00 \\ 141 & 13 & 00 \\ 141 & 20 & 00 \\ 140 & 50 & 28 \\ 136 & 10 & 00 \\ 131 & 19 & 30 \\ 131 & 12 & 17 \\ 131 & 01 & 50 \end{array}$				· · · · · · · · · · · · · · · · · · ·
Marquesas Islands.	Fatu Hiya Island: S. pt Motane Island: SSE. pt Tahuata Island: Port Resolution, wa- tering place Hiya-Oa Island: C. Balguerie Fatu Huku Island: Center Roa Poua Island: Obelisk Islet Nuka-Hiya Island: Port Tai-o-hae light. Hiaou Island: S. pt Motu-ili Island: Summit, 130 ft. Ua-Huka or Ua-Una Island: N. pt Fetouhouhou Island: NE. pt	Lat. S. $10 \ 32 \ 00$ $10 \ 01 \ 40$ $9 \ 56 \ 00$ $9 \ 45 \ 00$ $9 \ 27 \ 30$ $9 \ 29 \ 30$ $8 \ 55 \ 13$ $8 \ 03 \ 30$ $8 \ 44 \ 00$ $8 \ 54 \ 00$ $7 \ 55 \ 00$	$\begin{array}{c} \text{Long. W.} \\ 138 \ 39 \ 20 \\ 138 \ 48 \ 30 \\ \hline \\ 139 \ 09 \ 00 \\ 138 \ 47 \ 40 \\ 138 \ 55 \ 10 \\ 140 \ 04 \ 45 \\ 140 \ 04 \ 40 \\ 140 \ 38 \ 30 \\ 140 \ 38 \ 30 \\ 139 \ 33 \ 30 \\ 140 \ 34 \ 40 \\ \end{array}$		8 45 10 05	3. 1 	1. 9
	Caroline Islands: Solar Eclipse Transit Pier Vostok Island: Center Flint Island: S. extremity	$\begin{array}{cccccccccccccccccccccccccccccccccccc$	$\begin{array}{cccccccccccccccccccccccccccccccccccc$	4 00	10 14	1.1	0.7

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APPENDIX IV.

MARITIME POSITIONS AND TIDAL DATA.

ISLANDS OF THE PACIFIC-Continued.

				Lun.	Int.	Re	inge.
Cons	Place.	Lat. S.	Long. W.	H. W.	L. W.	Spg.	Neap.
	Malden Island: Flagstaff, W. side Starbuck Island: Flagstaff, W. side	$^{\circ}$ / " 4 03 00 5 37 00	$^{\circ}$ / " 155 01 00 155 56 00	h. m.	h. m.	ft.	ft.
	Penrhyn or Tongarewa Island: NNW.pt. Jarvis Island: Center	$\begin{array}{cccccccccccccccccccccccccccccccccccc$	$\begin{array}{cccccccccccccccccccccccccccccccccccc$	6 00	12 15	1.5	0.9
	Reirson Island: Church. Humphrey Island: N. pt.	$\begin{array}{cccccccccccccccccccccccccccccccccccc$	$\begin{array}{cccccccccccccccccccccccccccccccccccc$			• • • • • • • •	•••••
	Union or Tokelau Islands: Spot N. of Fakaofu or Bowditch Islet	9 23 02	171 14 46	6 00	12 13	2.4	1.4
	or SE. island, Duke of Clarence I Union or Tokelau Islands: Clump on	9 13 06	171 44 40		•••••		
	S. island, Oatafu or Duke of York I	8 39 40	172 28 10	•••••			
Phenix Is.	Canton or Mary Island: N. pt. Enderbury Island: W. pt. Phœnix Island, N. pt. Birneys Island: S. pt. Gardners Island: Center McKean Island: Center. Hulls Island: W. pt.	$\begin{array}{cccccccccccccccccccccccccccccccccccc$	$\begin{array}{cccccccccccccccccccccccccccccccccccc$	5 00	11 15	4.6	2.7
Ellice Islands.	Mukulaelae or Mitchells Island: S. pt Funafuti or Ellice Island: E. pt Nukufetau or De Peysters Island: S. pt. Vaitupu Island: S. end Nui or Netherland Island: S. pt. Nauomaga Island: Center Niutao Island: Church Nanomea Island: Center	$\begin{array}{cccccccccccccccccccccccccccccccccccc$	$\begin{array}{c} \text{Long. E.} \\ 179 50 00 \\ 179 07 25 \\ 178 28 51 \\ 178 41 01 \\ 177 16 50 \\ 176 16 30 \\ 177 20 01 \\ 176 06 15 \end{array}$				
	Ocean or Paanopa Island: Center (appx). Pleasant Island: Center Indispensable Reefs: S. pt. of S. reef Rennel Island: SE. extreme W. end	$\begin{array}{cccccc} 0 & 52 & 00 \\ 0 & 25 & 00 \\ 12 & 50 & 15 \\ 11 & 52 & 15 \\ 11 & 33 & 45 \end{array}$	$\begin{array}{cccccccccccccccccccccccccccccccccccc$				
	San Christoval Island: Point Wanga-	10 17 32	161 33 30	6 45	0.33	3.3	2.0
	Guadalcanar Island: Wanderer Bay, mouth of Boyd Creek Florida Island: Mboli Harbor, Tree Islet. Malaita Island: Village, Mary I., Port	$ \begin{array}{c} 9 & 41 & 47 \\ 9 & 01 & 30 \end{array} $	$\begin{array}{c} 151 & 35 & 36 \\ 159 & 39 & 30 \\ 160 & 27 & 20 \end{array}$				
slands.	Adam Stewart Islands: Largest islet. Isabel Island: N. side of Cockatoo Islet. Gizo or Shark Island: N. point village Choiseul Island: Choiseul Bay en-	$\begin{array}{c} 9 & 30 & 00 \\ 8 & 23 & 00 \\ 8 & 30 & 50 \\ 8 & 05 & 40 \end{array}$	$\begin{array}{cccccccccccccccccccccccccccccccccccc$	5 00	11 15	3.5	2.1
omon]	trance Treasury Islands: Observation Islet Bougainville Island: Hiisker Pt., Ga-		$\begin{array}{cccccccccccccccccccccccccccccccccccc$	12.00	5 47		
Sol	Buka Island: Cape North Lord Howe Group: Center, small SW.	5 38 00	155 05 00 154 35 00 159 21 00	12 00		2.1	1.0
	Center, small NE. islet	5 18 00	159 34 00				
	mond I	5 18 00	159 17 00		• • • • • • • • •		
	New Britain, Blanche Bay: Matupi I. N. pt	4 14 12	$152 \ 11 \ 35$	9 00	2 45	2.1	1.3
	bor, Spit Pt	4 06 25	$152 \ 06 \ 15$				

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MARITIME POSITIONS AND TIDAL DATA. ISLANDS OF THE PACIFIC—Continued.

st.	a This is	Tot C	Long P	Lun. Int.		Ra	nge.
Coa	Fince.	Lat. S.	Long. E.	H. W. L.	W.	Spg.	Neap.
	New Ireland: Carteret Harbor, Cocoa- nut I	° ′ ″ 4 41 26	\circ / " 152 42 25	h. m. h.	m.	ft.	jt.
	Katharine Haven Holz Haven, E. side New Hanover Island: Water Haven, creek month	$ \begin{array}{c} 3 & 11 & 00 \\ 2 & 47 & 30 \\ 2 & 33 & 43 \end{array} $	$151 \ 35 \ 30 \ 150 \ 57 \ 35 \ 150 \ 04 \ 33$	2 50 9	03	2.4	1.4
	North Haven anchorage St. Matthias Island: SW. extreme	$\begin{array}{c} 2 & 26 & 30 \\ 1 & 35 & 00 \end{array}$	$\begin{array}{c} 149 \\ 55 \\ 149 \\ 37 \\ 00 \end{array}$	2 30 8	43	2.4	1.4
Admiralty Is.	Admiralty Island: Nares Harbor, obs. islet	$\begin{array}{cccccccccccccccccccccccccccccccccccc$	$\begin{array}{c} 146 \ 40 \ 56 \\ 147 \ 28 \ 35 \\ 147 \ 55 \ 00 \\ 145 \ 13 \ 04 \\ 145 \ 33 \ 04 \\ 145 \ 08 \ 00 \\ 146 \ 15 \ 00 \end{array}$				
New Guinea Island.	Point d'Urville: extreme Drei Cap Peninsula: Wass Islet Triton Bay: Fort Dubus, Dubus Haven. Cape Walsche: Extreme Fly River: Free Islet, S. pt Port Moresby: N. end of Jane I Cape Rodney: Extreme South Cape: S. pt. Su An I Hayter Island: W. end Cape Cretin: Cretin Islets	$\begin{array}{cccccccccccccccccccccccccccccccccccc$	$\begin{array}{cccccccccccccccccccccccccccccccccccc$	$ \begin{array}{c} 0 55 \\ 8 50 \\ 9 15 \\ 8 25 \\ 2 \end{array} $	08 38 00 12	7.3 8.0 8.1 5.8	4.3 4.8 4.8 3.4
Louisiade Arch.	Trobriand Islands: NE. pt. Cape Denis. Woodlark Islands: N. pt D'Entrecasteaux Is.: Ferguson I., SW. extreme Well Island, E. pt. Normanby I., obs. islet St. Aignan Island: Summit Renard Islands: W. pt Rossel Island: E. pt Adèle Island: S. extreme	$\begin{array}{c} 8 & 24 & 00 \\ 9 & 03 & 30 \\ 9 & 38 & 00 \\ 9 & 41 & 00 \\ 9 & 43 & 53 \\ 10 & 42 & 00 \\ 10 & 52 & 40 \\ 11 & 23 & 25 \\ 11 & 29 & 10 \\ \end{array}$	$\begin{array}{cccccccccccccccccccccccccccccccccccc$	4 45 10 7 05 0	58 53	3.0 4.2	1.8 2.5
Coral Sea Arch.	Coringa Islands: Chilcott Islet Herald Cays: NE. Cay Tregosse Islands; S. islet Lhou Reef: Observation Cay Mellish Reef: Cay beacon Bampton Island Renard Island: Center Wreck Reef: Bird Islet Cato Island: Center	$\begin{array}{cccccccccccccccccccccccccccccccccccc$	$\begin{array}{cccccccccccccccccccccccccccccccccccc$				
Santa Cruz Is.	Duff or Wilson Group: N. island Matema or Swallow Group: Nimanu Islet Tinakula Island: Summit, 2,200 ft Nitendi Island: NE. pt., Cape Byron Tapua Island: Basilisk Harbor, S. pt. of entrance Vanikoro: Ocili village	9 48 00 10 21 00 10 23 30 10 40 00 11 17 30 11 40 24	$\begin{array}{cccccccccccccccccccccccccccccccccccc$	4 50 11	05	3.8	2.3

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APPENDIX IV.

MARITIME POSITIONS AND TIDAL DATA.

ISLANDS OF THE PACIFIC-Continued.

st.		Tet O	1	Lun.	Int.	Ra	nge.
Coa	riace.	Lat. S.	Long. E.	н. w.	L. W.	Spg.	Neap.
		0 / 11	0 / 11	h. m.	h. m.	ft.	ft.
	Torres or Ababa Island: Hayter Bay, Middle I	13 15 00	166 33 00				
	Vanua Lava Island: Port Patterson,	19 10 00	167 90 91	6 10	0.90	9.0	
ds.	Santa Maria Island: Lasolara Anchor-	13 48 00	• 107 30 31	0 40	0.30	3.8	2.3
un	age	14 11 00	$167 \ 30 \ 00$ $168 \ 02 \ 00$	•••••			
-	Mallicollo Island: Port Sandwich, pt.	14 58 00	100 02 00				
des	on E. side	$16 \ 26 \ 00$	167 47 15	4 38	10 50	3.8	1.9
bri	Harbor, Matapou Bay flagstaff	$17 \ 44 \ 58$	$168 \ 18 \ 50$	5 15	$11 \ 27$	3.0	1.8
He	Williams	18 47 30	168 58 00				
Me	Tanna Island: Port Resolution, Mission.	19 31 17 19 31 20	$169 \ 27 \ 30$ $170 \ 11 \ 15$		•••••		•••••
Ż	Aneityum Island: Port Anatom, Sand	10 01 20	110 11 10				
	Islet	$\begin{array}{cccccccccccccccccccccccccccccccccccc$	$169 44 45 \\171 20 30$	5 10	$11 \ 23$	3.1	1.9
	Hunter Island: Peak, 974 feet	22 24 02	$172 \ 05 \ 15$				
	waipole Island: S. pt	22 38 07	168 56 45				•••••
	Mitre Island: Center Rotumah Island: Eminiqi Peak	$11 55 00 \\ 12 30 10$	$170 \ 10 \ 00 \ 177 \ 07 \ 15$	6 15	0.00	4 9	2.5
	The last last state last state last	12 00 10	111 01 10	0 10	0 00	1	2.0
	light	18 38 15	178 32 15				
	Mt. Washington, N.	19 07 09	177 57 09				
	N'galoa Harbor, outer	10 01 00	111 01 03		•••••		
	beacon Vatu Lele Island: S. pt	$\begin{array}{c} 19 & 05 & 30 \\ 18 & 36 & 00 \end{array}$	$\begin{array}{cccccccccccccccccccccccccccccccccccc$	6 40	0 25	4.0	2.4
	Ovalau Island: Levuka light-house	17 40 45	178 49 00		••••		
	Islet	17 44 45	177 09 00				
	Suya Harbor, low	18 06 50	178 24 40	6.30	0.15	3.6	2.2
	Mbega or Mbengha Island: Swan Har-	10 00 00	170 00 70	0.00	0 10	0.0	2.2
	bor, Leaven Pt Matuku Island: N. side of Matuku en-	18 22 00	178 06 53				
ż	trance. Moole Jalandi, Booka off N. nt	19 09 38 18 29 10	179 44 27				
pur	Ngau Island: Herald Bay, E. side	$18 52 49 \\ 17 59 32$	$179 \ 50 \ 25$ $179 \ 14 \ 08$				
Isla	Wakaya Island: Rocky Peak	$17 \ 37 \ 11 \ 17 \ 97 \ 14$	178 59 29				
10	Goro Island: NW. pt	17 15 21	179 20 44				
3	Vanua Levu Island: Mount Dana Nandi observation	16 42 01	178 54 15				
	islet	16 57 53	178 48 32				
	treme	16 49 19	179 16 08	6 00	12 13	4.3	2.6
	NE Pt	16 08 00	Long. W.				
	Taoiuni Island: Somu-Somu town	$16 \ 46 \ 00$	179 51 00				
	Thikombia Island: E. hummock	15 44 45	179 54 26			•••••	
	Vatu Vara Island: N. end, summit	17 05 00 17 25 33	179 17 00 179 32 17				
	Kanathea Island: S. pt.	17 17 20 17 10 20	179 10 00				
	Mango Island: Pier end	$17 10 00 \\ 17 25 26$	179 00 45 179 10 33	6 10	0 00	3.1	1.9
	Thithia Island: Highest peak	17 44 12	179 19 49				
	Najan Island: Peak.	$17 39 33 \\17 59 00$	178 50 27				•••••
	Lakemba Island: Kendi Pt	18 14 10	178 52 00				
	Oneata Island: Summit of Loa I	$18 25 46 \\18 38 56$	$178 27 04 \\ 178 30 54$			• • • • • •	
	Mamuka Island: Center, 260 feet	18 46 00	178 44 00	·····			

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MARITIME POSITIONS AND TIDAL DATA.

ISLANDS OF THE PACIFIC-Continued.

st.	Direc	Lot S	Long W	Lun.	Int.	Rŧ	inge.
Соа	171866.	Lat. S.	Long. W.	H. W.	L. W.	Spg.	Neap.
ds.	Kambara Island: Highest peak Totoya Island: Black Rock Bay, W. side	$^{\circ}$ / " 18 56 15 18 58 57 19 92 99	$^{\circ}$, " 178 59 05 179 52 58 179 47 95	h. m. 6 35	h. m. 0 20	<i>ft.</i> 3.5	<i>ft.</i> 2, 1
Fijl Islan	Fulanga Island: W. Dluff. Ongea Levu Island: Center. Vatoa or Turtle Island: Hummock. Ono Islands: Peak. Michaeloff Island: Center. Simonoff Island: Center.	$\begin{array}{cccccccccccccccccccccccccccccccccccc$	$\begin{array}{cccccccccccccccccccccccccccccccccccc$	6 10	0 00	3.1	1.9
	Fatuna or Horne Island: Mt. Schouten. Uea or Wallis Island: Fenua-fu Islet Niua-fu or Good Hope Island: NW. extreme Keppel Island: Center Boscawen Island: Center	$\begin{array}{cccccccccccccccccccccccccccccccccccc$	$\begin{array}{cccccccccccccccccccccccccccccccccccc$	6 40	0 28	4.4	2.7
Samoan Is.	Savaii Island: Paluale village Upulo Is.: Apia Harbor, obs. spot Tutuila Island: Pago-Pago, obs. pt Manua Island: Village, NW. side Rose Island: Center	$\begin{array}{cccccccccccccccccccccccccccccccccccc$	$\begin{array}{cccccccccccccccccccccccccccccccccccc$	$\begin{array}{c} 6 & 25 \\ 7 & 00 \\ 6 & 00 \end{array}$	$\begin{array}{c} 0 & 13 \\ 0 & 45 \\ 12 & 13 \end{array}$	$\begin{array}{c} 3.1\\ 2.7\\ 4.6\end{array}$	$1.9 \\ 1.6 \\ 2.7$
	Iniue or Sarage Island: S. pt Danger, or Bernardo, Is.: Middle rock . Suwarrow or Souwaroff Island: Cocoa- nut Islet Palmerston Islands: W. islet Scilly Islands: E. islet Bellingshausen Island: Center Mopelia (Lord Howe) Island: Center	$\begin{array}{cccccccccccccccccccccccccccccccccccc$	$\begin{array}{cccccccccccccccccccccccccccccccccccc$	3 10	9 23	2.4	1.4
Society Islands.	Maitea Island: Summit Tahiti Island: Light-house Tubuai-Manu or Maia-iti I.: NW. pass Eimeo Island: Talu Hbr., Vincennes Pt. Huaheine Island: Light-house Ulietea Island: Regent Pt Tahoa Island: Center Bola-Bola Island: Otea-Vanua village Tubai or Motu-iti Island: N. pt. of reef Marua or Maupili Island: Center	$\begin{array}{cccccccccccccccccccccccccccccccccccc$	$\begin{array}{cccccccccccccccccccccccccccccccccccc$	12 00 	5 48 	1.0	0.6
Thamotu Archipelago.	 Ducie Island: N.E. entrance	$\begin{array}{cccccccccccccccccccccccccccccccccccc$	$\begin{array}{cccccccccccccccccccccccccccccccccccc$		8 03	2.4	1.4

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APPENDIX IV. MARITIME POSITIONS AND TIDAL DATA. ISLANDS OF THE PACIFIC—Continued.

ust.				Lun. Int.	Range.
CO8	Place.	Lat. S.	Long. W.	H.W. L.W.	Spg. Neap.
Tuamotu Archipelago.	Hao or La Harpe Island: NW. pass Paraoa or Glocester Island: Center Ravahere Island: S. pt Reitoru or Bird Island: N. beach Hikueru or Melville Island, E. pt Puka-puka Island: W. pt Angatau or Araktcheff Island: W. pt Tukume or Wolkonsky Island: NW. pt Napuka Island: NW. pt Napuka Island: NW. pt Napuka Island: NW. pt Nihiru Island (Tuanake): SW. pt Anaa Island: Islet in N. pass Tepoto Island: N. pt Makemo or Phillips Island: W. pt s Fakarana or Wittgenstein Island: SE. pass Taiaro or Kings I.: Middle of W. shore. Aratika Island: E. pt Toau or Elizabeth Island: Amyot Bay. Takapoto Island: S. pt Aheu Island: E. pt Makatea Island: W. pt Matahiva Island: W. pt	$ \begin{smallmatrix} & & & & & & & \\ & & & & & & & \\ & & & & & & & \\ & & & & & & \\ & & & & & & \\ & & & & & & \\ & & & & & & \\ & & &$	$ \begin{smallmatrix} \circ & \cdot & \cdot & \cdot \\ 140 & 59 & 30 \\ 141 & 41 & 10 \\ 142 & 11 & 31 \\ 143 & 05 & 23 \\ 142 & 35 & 16 \\ 141 & 29 & 43 \\ 138 & 46 & 45 \\ 141 & 15 & 37 \\ 140 & 53 & 35 \\ 142 & 08 & 40 \\ 144 & 14 & 45 \\ 142 & 53 & 34 \\ 145 & 30 & 54 \\ 144 & 17 & 18 \\ 143 & 57 & 59 \\ 145 & 22 & 45 \\ 146 & 02 & 45 \\ 146 & 02 & 45 \\ 146 & 02 & 45 \\ 146 & 02 & 45 \\ 146 & 10 & 00 \\ 148 & 15 & 00 \\ 148 & 15 & 00 \\ 148 & 39 & 45 \\ \end{smallmatrix} $	h. m. 2 40 8 5 	fl. fl. fl. 5 2.4 1.4
	Juan Fernandez Island: Fort S. Juan Batista Mas-afuera Island: Summit, 4,000 ft St. Ambrose Island: N. part creek Sala y Gomez: NW. pt Easter Island: Cooks Bay, mission Rapa or Oparo Island: Tauna Islet Bass Islets (Morotiri): SE. islet, 344 ft . Tubuai or Austral Is., Vavitoa I.: Center. Tubuai I.: Flag staff, N. side Rurutu I.: N. pt Rimitara I.: Cen- ter	$\begin{array}{cccccccccccccccccccccccccccccccccccc$	$\begin{array}{cccccccccccccccccccccccccccccccccccc$	$ \begin{array}{c} $	$ \begin{array}{c} 5 \\ 5 \\ 5 \\ 5 \\ 5 \\ 2.4 \\ 1.4 \\ \hline \end{array} $ $ \begin{array}{c} 2.4 \\ 1.4 \\ \hline \end{array} $ $ \begin{array}{c} 3 \\ 2.4 \\ 1.4 \\ \hline \end{array} $
Cook Islands.	Hull Island: NW. pt Mangara Island: Center Rarotonga Island: NW. pt Mauki or Parry Island: Center Mitiero Island: Center Vatiu or Atiu Island: Center Hervey Islets: Center Aitutaki Island: Center	$\begin{array}{cccccccccccccccccccccccccccccccccccc$	$\begin{array}{cccccccccccccccccccccccccccccccccccc$	6 00 12 1	5 2.7 1.7
Tonga Is.	Vavau Island: Port Valdes, Sandy Pt Kao Island: Summit, 5,000 ft Tofua Island: Summit, 2,800 ft Tongatabu Island: Light-house	$\begin{array}{cccccccccccccccccccccccccccccccccccc$	$\begin{array}{cccccccccccccccccccccccccccccccccccc$	6 20 0 1 6 20 0 1	$\begin{array}{c c c c c c c c c c c c c c c c c c c $
	Minerva Reefs, N. Minerva: NE. side S. Minerva: S. side of entrance Kermadec Is., Raoulor Sunday I.: Den- ham B. flag staff Macauley I.: Center Curtis I.: Center	23 37 06 23 55 00 29 15 30 30 15 00 30 35 00 21 44 45	178 55 45 179 07 45 177 55 40 178 31 45 178 37 00 Long. E. 174 37 45	7 50 1 3 6 00 12 1	5 5.5 3.3 3 3.3 2.7

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MARITIME POSITIONS AND TIDAL DATA. ISLANDS OF THE PACIFIC—Continued.

st.	•				E.	Ra	nge,	
Joa :	Place.	Lat. S.		Long. E.	H. W.	L. W.	Spg.	Nean
							~ P5+	
		0 / //	,	0 / //	h. m.	h. m.	ſt.	ft.
	Loyalty Is., Uvea or Halgan I.: Uvea	00.05.0		100 05 05				
	Church	20 27 0	6	166 35 25		• • • • • •		
	choro	20 46 0	0	167 02 30	6 30	0.18	1.2	9.5
	Mare or Britannia I · S pt	20 40 0		168 00 00	0.50	0 10	4. 4	4.0
	mare of Diffamma i.e. o. pt.	<i>u</i> i <i>u</i> 0		100 00 00				
5	Port Kanala: Observatory	21 29 1	$2 \mid$	$165\ 58\ 50$				
al a	Port St. Vincent: Marceau I	$22 \ 00 \ 10$	0	$166 \ 05 \ 00$	5 40	11 52	3.3	2.0
SE	Noumea: Light-house	22 16 2	$\frac{2}{4}$	$166 \ 25 \ 52$	8 25	2 13	3.1	1.9
00	Balari Pass: Amedee 1. light	22 28 4	4	$100 28 01 \\ 167 97 55$	7 55	1 .15	2 6	
Z	Fort Alcinene: Alcinene 1	44 44 0	0	107 27 30	1 00	1 TO	0.0	4.4
	Norfolk Island: Inner end of jettv	29 03 4	5	167 58 06	7 30	1 17	4.7	3.9
	Elizabeth Reef: Center	29 56 0	0	$159 \ 04 \ 30$				
	Lord Howe Island: S. end of middle		_				·	
	beach	31 31 3	8	159 05 58	8 20	2 08	5.4	3.3
	Bans Fyramid: Summit, 1,816 It	54 10 0		109 10 10 158 58 00		• • • • • • • • •	• • • • • •	• • • • • • •
	Angeland Is · Port Ross Terror Cove	50 32 1	5	166 13 20	11.50	5 38	3.9	2.6
	Campbell Island: S. harbor. Shoal Pt.	52 33 2	6	169 08 41	11 45	5 33	3.5	2.9
	Antipodes Island: Summit, 600 ft	49 42 0	0	178 43 05	3 20	9 30	5.3	4.3
·	Bounty Islands: Anchorage N. I., West							
	Group	47 43 0	0	179 00 27				
	Chatham Island, Whare-Kauri Island:			Long W				
	Port Waitangi. Pt. Hanson	43 57 2	4	176 32 15				
	Chatham Island, Whare-Kauri Island:							
	Port Hutt, Gordon Pt	43 49 0	3	$176 \ 42 \ 00$	5 22	0 23	2.5	2.1
	A	USTRAI	LIA	A .				
					1			
				Long. E.				
	Groate Eylandt: SE. pt	14 16 0	0	136 58 00				
	Bickerton Island: Summit	13 + 30		136 15 00 127 00 00		• • • • • • • • •		
	Cape Wilberforce: E extreme	12 14 0 11 53 0	0	136 34 00	8.00	1 48	9.8	5.8
	Cape Wessel: Extreme.	10 59 0	0	136 46 00	0.00	1 10	0.0	0.0
la.	Dale Point: Extreme	11 36 0	0	136 07 00				
E.	Cape Stewart: Extreme	11 57 0	0	$134 \ 45 \ 00$				
5	Liverpool River: W. pt. entrance	11 54 0	0	$134 \ 12 \ 00$	6 17	$0 \ 05$	12.0	7.1
	Cape Croker: Extreme	10 57 0	0	$132 \ 36 \ 30$ $129 \ 00 \ 10$				
	Melville Island: Cape Van Diemen	11 08 0	$\frac{2}{0}$	132 09 18			• • • • • • •	• • • • • •
11	Bathurst Island: Cape Fourcrov.	11 51 0	0	129 58 00				
ŝ	Adelaide River: E. entrance pt	12 13 2	0	131 16 30	5 15	11 27	16.8	9.9
	Port Darwin: Charles Pt. light	12 23 2	0	$130 \ 37 \ 00$	4 57	11 18	17.0	10.0
	Port Patterson: Quail Islet	12 30 5	8	130 27 00	3 50	10 00	16.7	9.9
	Port Keats: Tree Pt.	13 59 0	0	129 37 00	5 45 6 45	11 58	21.9	12.9
	Victoria River: Water Valley	14 20 0	5	129 20 42	0 40	0 27	25.0	13. 6
	· iciona anver. · · aler · aney	10 10 4		120 10 11				
	Cape Dussejour: Rock off cape	14 42 0	0	$128 \ 10 \ 00$				
	Cape Londonderry: Extreme	13 44 0	0	126 57 00				
IIa	Cassini Island: S nt	13 52 0 13 57 0	7	126 12 00 125 29 15				
E	Cape Voltaire: Flat Hill	14 15 0	6	125 39 00				
1×1	Barker 1slets: Center	13 55 0	ŏ	124 55 00				
V	Montalivet Islands: W. islet	14 14 0	0	$125 \ 12 \ 00$				
F	Maret Islets: N. islet	14 23 0	0	125 00 00				
ter	Colbert Islet: Center.	14 51 0	0	$124 \ 42 \ 00$				
es	Prince Regent River: Mount Trafalgar.	15 16 3	6	$125 \ 07 \ 00$ $125 \ 01 \ 00$				
1	De Freveinet Islets: Beacon on summit	10 00 0	0	120 UI UU 191 39 11	• • • • • • • • •		•••••	
	Red Islet: Center.	15 13 1	5	124 14 00				
	Cockell Islet: W. pt.	15 46 0	0	124 04 00				
	-		1					

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APPENDIX IV.

MARITIME POSITIONS AND TIDAL DATA.

AUSTRALIA-Continued.

ast.	Place	Tat C	Long F	Lun.	Int.	Ŕ	ange.
CO8	Flace.	Lat. S.	Long, E.	H. W.	L. W.	Spg.	Neap.
		0 / //	0 / //	h. m.	h. m.	ft.	ft.
	MacLeay Islets: Rock off N. end Port Ushorne: S ^o nt	$15 52 00 \\ 15 39 25$	$123 \ 45 \ 00$ $123 \ 36 \ 27$			•••••	
	Fitz Roy River: Escape Pt	17 24 25	123 39 47				
	Cape L'Evêque: Extreme	$16 \ 23 \ 00$	122 55 45				
	Lacepede Island: NW. islet	16 50 00	$122 \ 05 \ 30$				
	Cape Baskerville: Extreme	17 09 00	122 15 00				
	Cape Latouche Treville: Extreme	18 29 00	121 54 00				
	Cape Lambert: Extreme	20 36 00	117 11 00	11 30	5 10	17.6	10.4
	Legendre Island: NW. extreme	20 19 00	116 45 00	11 00		11.0	10.1
	Rosemary Island: W. summit	20 27 00	116 30 00				
	Enderby Island: Rocky Head	20 35 00	116 23 00				
	Montebello Island: N. extreme of reef	20 16 45	115 22 00				
ч.	Barrow Island: N. pt.	20 40 40	115 27 40			• • • • • • •	
III	Cape Cuvier: Extreme	21 40 41	113 21 00		• • • • • • • • •		•••••
5	Cape Inscription: Extreme	25 29 19	112 57 09				•••••
IIS I	Houtman Rocks: N. islet	28 18 05	113 35 33				
4	Port Gregory	28 12 00	114 14 30				
L	Cape Leschenault: Extreme	31 18 00	$115 \ 30 \ 00$				
ste	Rottnest Island: Light-house	32 00 20	$115 \ 30 \ 12$				
lee	Perth (Fremantle): Arthur Head light.	32 03 12 29 97 00	115 44 23	[10 16]	[3 43]	[2, 1]	•••••
2	Cana Naturalista: Extreme	32 27 00	115 44 00		• • • • • • • • •		
	Cape Leeuwin: Light-house	34 21 55	115 08 00				
	D'Entrecasteaux Point: Extreme	34 52 00	116 01 00				
	Nuyts Point: Extreme	35 05 00	116 38 00				
	West Cape Howe: Extreme	35 09 00	117 40 00				
	Eclipse Islets: Summit of largest	35 11 54	117 53 45				•••••
	King George Sound: Commissariat	25 09 90	117 51 01	E10 521	F4 407	[0 6]	
	Bald Isle: Center	34 55 00	118 27 00	[10.00]	[4 40]	[2.0]	
	Hood Point: Doubtful Isles	34 24 00	119 34 00				
	Recherche Archipelago: Termination						
	Isle	34 30 00	121 58 00				
	Culver Point: Extreme	32 57 00	124 39 00				
	Dover Point: Extreme	32 34 00	125 30 00				
	Fowler Point: Extreme	32 01 30	132 33 00	11 50	9 35	5.1	0.3
	Streaker Bay: Port Blanche	32 48 00	134 13 40				
	Coffin Bay: Mount Dutton	$34 \ 29 \ 29$	$135 \ 24 \ 56$	0 35	6 55	5.5	0.3
	Cape Catastrophe: W. pt	35 00 15	135 56 09				
	Neptune Isles: SE. Islet.	35 20 15	136 06 24				
la.	Franklin Harbor: Observation spot	34 45 22	130 01 00 196 57 22				
In:	Port Augusta: Flagstaff	32 29 42	137 45 24	8 20	2 15	11.4	0.7
str	Port Victoria: Wardang Island hut	34 28 25	137 22 21				
Va	Cape Spencer: S. pt	$35 \ 18 \ 21$	136 53 30				
-	Investigator Strait: Troubridge light	35 07 31	137 49 39		10 45		
n t	Port Wakefield: Light-house	34 12 00 24 50 25	138 09 00	4 31	10 45	10.2	0.6
0	Cano Jervis, Light-house	34 80 48	138 05 29	4 04	10 22	0.0	0.9
	Cape Borda: Light-house	$35 \ 45 \ 30$	$136 \ 34 \ 39$				
	Cape Willoughby: Light-house	35 51 00	138 07 45	4 00	10 15	5.8	0.3
	Port Victor: Flagstaff	35 34 06	138 37 09				
	Cape Jaffa: Margaret Brock light-house.	36 57 00	139 39 39	11 50	5 10		
	Cape Northumberland: Light-house	38 04 18	140 39 40	11 52	5 4 0	4.2	0.2
	Cape Nelson: S. extreme	38 26 00	141 32 39				
:	Portland Bay: Lawrence Rock	38 24 39	141 40 02	0 20	6 35	2.7	2.1
ria	Port Fairy: Griffith Island summit	38 23 47	142 14 37				•••••
10	Cape Otway: Light-house	38 51 40	$143 \ 30 \ 39$ $149 \ 57 \ 02$				
Te	Port Phillin Point Lonsdale light	39 35 38	143 37 03	10.43	4 30	95	1.9
-	Geelong: Custom-house.	38 08 52	144 21 47	202	8 20	3.0	2.3
	Melbourne: Observatory	37 49 53	144 58 35	2 19	8 41	1.9	1.5

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MARITIME POSITIONS AND TIDAL DATA.

AUSTRALIA-Continued.

				Lun.	Int.	R	ange.
oast	Place.	Lat. S.	Long. E.	u w	T W		Nor
Ŭ				H. W.	L. W.	spg.	Neap,
		0 / //	0 / //	h. m.	h. m.	ft.	ft.
	Cape Schanck: Light-house	$38 \ 29 \ 42$	$144 \ 52 \ 51$				
	Port Western: Extreme of W. head	38 29 15	$145 \ 01 \ 34$				
а.	Wilson Promontory: Light, SE. pt	39 08 00	$146 \ 25 \ 16$ $147 \ 10 \ 20$				
ri	Kent Island: Deal Island light	39 29 45	147 18 39		• • • • • • • • •	• • • • • • •	
eto	Googo Island: Light on S and	40 11 45	148 04 00 147 47 30	10.38	4 25	8 1	6.2
N	Banks Strait: Swan Island light	40 43 40	148 07 24	10 00	1 20	0.1	0.2
	Port Albert: Light-house	38 45 06	146 37 43				
	Gabo Island: Light-house	$37 \ 34 \ 15$	149 55 10	8 40	2 27	4.5	3.4
	Cape Howe (east): Extreme	$37 \ 30 \ 10$	$149 \ 58 \ 39$				
		97 15 40	150 00 01				
	Cape Green: SE. pt	$\frac{37}{97}$ $\frac{15}{04}$ $\frac{40}{18}$	$150 \ 03 \ 04$ $140 \ 54 \ 45$	8.05	1 59	5.9	
	Dromedary Mountain Summit	36 18 30	150 01 34	0.00	1.02	0. 2	0.1
	Montagu Island: Light-house	36 14 30	150 13 34	8 20	$2 \ 07$	5.3	3.2
	Bateman Bay: Observation head	$35 \ 43 \ 58$	$150 \ 12 \ 34$				1
les	Ulladulla: Inner end of pier	$35\ 21\ 41$	$150 \ 29 \ 29$	8 20	2 07	5.4	3.3
a	Jervis Bay: Light-house	$35 \ 09 \ 15$	$150 \ 46 \ 26$				
2	Kiama Harbor: Outerextreme of S. head	34 40 25	150 52 19				
th th	Wollongong: Summit of head	34 23 30 22 51 41	$100 \ 50 \ 14$ $151 \ 19 \ 99$	9 10	0.97	1.9	
10	Port Jackson: Outer S. head light	33 51 41	$101 12 20 \\ 151 18 15$	840	2 21	4. 2	2.0
0	Broken Bay: Baranio Head light	$33 \ 35 \ 00$	$151 \ 10 \ 10 \ 10 \ 10$				
6 M	Newcastle: Nobby Head light	32 55 15	$151 \ 48 \ 19$	8 35	2 23	4.7	2.8
Z	Port Stephens: Light-house	$32 \ 45 \ 10$	$152 \ 13 \ 20$	8 15	2 00	5.8	3.6
	Sugar Loaf Point: Light-house	$32 \ 26 \ 20$	$152 \ 33 \ 40$				
	Port Macquarie: Entrance	31 25 30	152 55 19	9 00	2 46	4.1	2.4
	Clarence River: S. Head light	30 12 00 29 25 30	$103 17 00 \\ 153 93 10$	8 15	2.00	0 1	2 4
	Clarence River. 5. Head light	28 29 50	100 20 10	0 10	2 00	7.0	2.4
	Richmond River: N. Head light	28 51 30	$153 \ 35 \ 55$				
	Brisbane: Signal station	$27 \ 27 \ 32$	$153 \ 01 \ 48$	$10 \ 45$	4 30	6.4	3.9
	Lookout Point: Extreme	27 26 20 27 00 10	$153 \ 33 \ 50$				
	Double Island Point: Light house	27 02 10	153 28 04				
	Indian Head Extreme	25 00 00 25 00 15	153 15 00 153 23 00				
	Sandy Cape: Light-house	24 43 20	153 13 40				
	Burnett River: S. Head light	24 45 00	$152 \ 25 \ 00$				
	Lady Elliot Islet: Light-house	24 07 00	$152 \ 45 \ 15$				
	Bustard Head: Light-house	24 01 20	$151 \ 41 \ 04$				
	Rodd Bay: Spit end	24 01 20 22 52 00	$151 \ 37 \ 15$ $151 \ 92 \ 50$				• • • • • •
-	Cane Capricorn: Light-house	23 29 30	$101 \ 20 \ 00$ $151 \ 14 \ 04$				
	Port Bowen: Observation rock	$ \begin{array}{ccccccccccccccccccccccccccccccccc$	$150 \ 45 \ 44$				
	Percy Isles: Pine I. light	$21 \ 39 \ 00$	150 14 00.				
°p	Northumberland Isles: Summit of Prud-	•					
8	hoe I	$21 \ 19 \ 15$	149 43 30				
S	Cape Palmerston: N. extreme	21 32 00	149 31 04			• • • • • •	• • • • • • •
en	Port Molle: S side of entrance	$20 \ 32 \ 20$ $20 \ 18 \ 50$	148 53 15				
ne	Cumberland Island: Whitsunday I.	20 10 00	110 00 10				
9	summit on W. side	$20 \ 15 \ 30$	149 00 00				
	Port Denison: Obs. pt., W. side of Stone						
	Isle	20 00 50	$148 \ 16 \ 54$	$10 \ 05$	3 53	9.0	5.4
	Gloucester Island: Summit near N. end.	19 57 30 10 41 50	148 27 34				
	Cape Bowling Green: Light-house	19 41 50	148 23 00 147 97 10				• • • • • • •
	Cape Cleveland: Light-house	19 11 25	147 01 10				
	Palm Islands: SE, point of SE, island	18 45 30	$146 \ 42 \ 50$				
	Rockingham Bay: Peak of Goold Isle	18 09 30	$146 \ 11 \ 04$				
	Barnard Island: Light-house	17 40 40	146 11 00				
	Frankland Island: High islet	17 09 45	146 02 30				
	Uape Tribulation: Extreme	16 04 20 15 45 00	140 29 34				
	Cook Mountain: Summit	15 49 00	140 28 30	8 55	2 43	7.5	4.5
	Cape Bedford: SE. extreme	15 16 30	145 23 15	0.00			

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APPENDIX IV.

MARITIME POSITIONS AND TIDAL DATA.

AUSTRALIA-Continued.

				Taxa	Int		
ast.	Place.	Lat. S.	Long. E.			Range.	
Ŭ				H. W.	L. W.	Spg.	Neap.
Queensland. C	Murdock Point: Extreme	$ \begin{smallmatrix} \circ & \cdot & \prime & \prime \\ 14 & 37 & 15 \\ 14 & 10 & 00 \\ 14 & 07 & 45 \\ 14 & 00 & 30 \\ 13 & 24 & 45 \\ 12 & 51 & 00 \\ 11 & 58 & 15 \\ 11 & 55 & 00 \\ 11 & 46 & 30 \\ 11 & 36 & 30 \\ 10 & 41 & 30 \\ 10 & 37 & 45 \\ 10 & 22 & 00 \\ 10 & 46 & 00 \\ 10 & 36 & 05 \\ 17 & 36 & 40 \\ \end{smallmatrix} $	$ \begin{smallmatrix} \circ & & & ' & '' \\ 144 & 57 & 30 \\ 144 & 32 & 34 \\ 144 & 15 & 19 \\ 143 & 42 & 15 \\ 143 & 36 & 19 \\ 143 & 34 & 00 \\ 143 & 15 & 15 \\ 143 & 29 & 00 \\ 143 & 06 & 00 \\ 142 & 56 & 19 \\ 142 & 32 & 24 \\ 142 & 39 & 20 \\ 142 & 21 & 19 \\ 142 & 10 & 50 \\ 141 & 53 & 49 \\ 140 & 37 & 06 \\ \end{smallmatrix} $	h. m. 9 00 1 00 4 20	h. m. h. m. 2 47 7 10 10 30	<i>ft.</i> <i>ft.</i> <i>9.6</i> <i>8.0</i> <i>7.8</i>	<i>л.евр.</i> <i>Л.</i> 5.8 4.7 4.7
	Albert River: Kangaroo Pt.	17 35 10	$139 \ 45 \ 56$		•••••	•••••	
	sweers Island: Inscription Pt	17 06 50	139 38 36			•••••	
		I					
	T.	ASMANIA	l		,		
		1					
	Cape Portland: NW. pt Port Dalrymple: Low Head light Port Sorrell: NW. entrance head Port Frederick: Entrance Leven River: W. entrance head Hunter Island: N. pt Cape Grim: Outer Doughboy Islet Albatross Islet: N. pt Arthur River: Entrance. Pieman River: Rocks close to entrance. Macquarie Harbor: Entrance Islet Cape Sorrell: Light-house. Port Davey: Pollard Head Southwest Cape: Extreme pt Mewstone Rock: Center Cape Bruny: Light-house Bruny Island: Penguin Islet Hobart Town: Transit of Venus station. Cape Frederik Hendrik: Extreme Freycinet Peninsula: Summit St. Patrick Head: N. pt Eddystone Point: Extreme	$\begin{array}{cccccccccccccccccccccccccccccccccccc$	$\begin{array}{cccccccccccccccccccccccccccccccccccc$	11 10 7 20 8 05	5 00 	9.0	6.9 2.1 3.2
	NEV	V ZEALA	ND.				
North I.	Three Kings Islands: NE. extreme of NE. island	$\begin{array}{cccccccccccccccccccccccccccccccccccc$	$\begin{array}{cccccccccccccccccccccccccccccccccccc$	7 40 7 26	$1 30 \\ 1 55$	6.4 5.9	4.5 4.2

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MARITIME POSITIONS AND TIDAL DATA.

NEW ZEALAND—Continued.

st.				Lun.	Int.	Ra	nge.
Coa	Place.	Lat. S.	Long, E.	H. W.	L. W.	Spg.	Neap.
	Wangaruru Harbor: Grove Pt Wangari Harbor: Loot Pt Great Barrier Island: Needles Pt Auckland Harbor: Light-house Coromandel Harbor: Tuhnia I Cape Colville: N. pt	$ \begin{smallmatrix} \circ & \cdot & \cdot & \cdot \\ 35 & 23 & 48 \\ 35 & 51 & 09 \\ 36 & 01 & 15 \\ 36 & 50 & 06 \\ 36 & 48 & 35 \\ 36 & 28 & 20 \\ \end{smallmatrix} $	$\begin{array}{c} \circ & \prime & \prime \\ 174 & 21 & 24 \\ 174 & 31 & 14 \\ 175 & 25 & 34 \\ 174 & 51 & 00 \\ 175 & 24 & 34 \\ 175 & 21 & 04 \end{array}$	$ \begin{array}{cccccccccccccccccccccccccccccccccccc$	$ \begin{array}{c} h. m. \\ 1 05 \\ 0 55 \\ 1 10 \\ 0 55 \end{array} $	<i>ft.</i> 6.5 6.7 10.8 10.7	<i>ft.</i> 4.6 4.8 7.7 7.6
North Island.	Cuvier Island: Light-house Tauranga Harbor: Mount Maunganui, 860 ft White Island: Summit, 863 ft Cape Runaway: Extreme East Cape: Islet, 420 ft	36 26 20 37 36 25 37 30 00 37 30 45 37 40 00 38 30 50	$\begin{array}{cccccccccccccccccccccccccccccccccccc$	$7 \ 05 \\ 8 \ 10 \\ 8 \ 00$	$\begin{array}{c} 0 & 55 \\ 2 & 00 \\ 1 & 50 \end{array}$	6.1 6.6 6.8	4.4 4.7 5.8
	Mahia Peninsula: S. extreme of Port- land I. Ahuriri Harbor: Light-house	38 20 30 39 18 00 39 28 30 39 38 00 41 36 45 11 21 40	$\begin{array}{c} 178 \ 20 \ 14 \\ 177 \ 53 \ 15 \\ 176 \ 54 \ 14 \\ 177 \ 06 \ 44 \\ 175 \ 18 \ 45 \\ 174 \ 15 \ 104 \end{array}$	6 05 4 40	$\begin{array}{c} 12 & 15 \\ 10 & 50 \end{array}$	3.5 5.7	3.0 4.9
	Port Nicholson: Pencarrow light Wellington: Queen's Wharf light Mana-watu River: Light-house Wanganui River: N. head Egmont Mountain: Summit, 8,270 ft	$\begin{array}{c} 41 & 21 & 40 \\ 41 & 17 & 17 \\ 40 & 27 & 10 \\ 39 & 57 & 00 \\ 39 & 18 & 00 \end{array}$	$\begin{array}{cccccccccccccccccccccccccccccccccccc$	$\begin{array}{c c} 4 & 52 \\ 9 & 40 \end{array}$	$\begin{array}{c}10&54\\&3&30\end{array}$	3.6 6.3	3.1 5.4
	New Plymouth: Flag-staff Kawhia Harbor: S. head Aotea Harbor: S. head Whaingaroa Harbor: S. entrance pt Manukau Harbor: Paratutai flag-staff	$\begin{array}{ c c c c c c c c c c c c c c c c c c c$	$\begin{array}{cccccccccccccccccccccccccccccccccccc$	9 15 9 10 9 08 9 05 9 09 9 09 9 09 9 09 9 09 9 09 9 09 9 09 9 09 9 09 9 09 9 09 9 09 9 09 9 09 9 09 9 00 00 9 00 00 00 000 0	$ \begin{array}{r} 3 & 05 \\ 3 & 00 \\ 2 & 55 \\ 2 & 50 \\ 9 & 50 \\ \end{array} $	$ \begin{array}{c} 11. 6 \\ 11. 9 \\ \hline 12. 3 \\ 12. 6 \\ 10. 0 \end{array} $	$8.2 \\ 8.5 \\ 8.7 \\ 9.0 \\ 5.1 \\ 1$
	Kaipara Harbor: Light-house Hokianga River: Flag-staff at entrance. Cape Campbell: Light-house	$\begin{array}{cccccccccccccccccccccccccccccccccccc$	$174 08 00 \\173 21 59 \\174 17 14$	9 00 8 40 4 45	$ \begin{array}{r} 2 & 30 \\ 2 & 30 \\ 11 & 00 \end{array} $	10.0 9.2 7.5	6.5 6.5
	Port Cooper: Lyttleton custom-house Akaroa Island: Light-house Ashburton River: N. entrance pt Waitangi River: N. entrance head	$\begin{array}{cccccccccccccccccccccccccccccccccccc$	$\begin{array}{cccccccccccccccccccccccccccccccccccc$	3 45	10 00	7.4	5.8
-	Otago Harbor: Taivoa Head light Molyneux Bay: Landing place Nugget Point: Light-house Bluff Harbor: Light-house	$\begin{array}{cccccccccccccccccccccccccccccccccccc$	$\begin{array}{cccccccccccccccccccccccccccccccccccc$	$ \begin{array}{c} 3 & 31 \\ \hline 1 & 05 \end{array} $	9 39 7 15	5.6	4.4 6.2
h island	Tewaewae Bay: Pahia Pt Solander Islands: Summit, 1,100 ft Preservation Inlet: Light-house West Cape: Extreme	$\begin{array}{cccccccccccccccccccccccccccccccccccc$	$\begin{array}{c ccccccccccccccccccccccccccccccccccc$	11 10	5 00	7.5	5.9
Sout	Queenstown: U. S, Tr. of Venus station. Milford Sound: Freshwater Basin Cascade Point: N. extreme Grey River: Entrance Hokitika: Entrance light.	$\begin{array}{cccccccccccccccccccccccccccccccccccc$		$ \begin{array}{c} 10 & 10 \\ 10 & 20 \end{array} $	$ \begin{array}{r} 4 & 00 \\ 4 & 10 \end{array} $	9.8 9.5	7.7
	Cape Foulwind: Light-house Cape Farewell: Extreme. Nelson: Bowlder Bank light. D'Urville Island: Port Hardy Port Gore: Head of Melville Cove Port Underwood: Flag Pt	$\begin{array}{c} 41 & 45 & 40 \\ 40 & 29 & 50 \\ 41 & 16 & 05 \\ 40 & 46 & 35 \\ 41 & 01 & 55 \\ 41 & 20 & 28 \end{array}$	$\begin{array}{cccccccccccccccccccccccccccccccccccc$	$ \begin{array}{r} 9 55 \\ 9 45 \\ \hline 6 00 \end{array} $	$ \begin{array}{r} 3 & 45 \\ 3 & 35 \\ 12 & 15 \end{array} $	$ \begin{array}{c} 12.0 \\ 11.6 \\ \overline{} \\ 7.6 \end{array} $	9.4 9.2 6.6
wart I.	Port William: Howell's House Paterson Inlet: Glory Cove Port Adventure: White Beach, S. end Port Pegasus: Cove abreast Anchor-	$\begin{array}{cccccccccccccccccccccccccccccccccccc$	$\begin{array}{cccccccccccccccccccccccccccccccccccc$	1 00	9 15	7.8	6.2
Ste	age I. Codfish Island: NW. extreme	$\left \begin{array}{rrrrr} 47 & 11 & 40 \\ 46 & 45 & 45 \end{array}\right $	$\begin{array}{cccccccccccccccccccccccccccccccccccc$	11 45	5 40	7.9	6.2
	Snares Islands: SW. islet	48 06 43	$166 \ 27 \ 44$				

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APPENDIX IV.

MARITIME POSITIONS AND TIDAL DATA.

THE ARCTIC REGIONS.

st.				Lun. Int.		Range.	
Coa	Place.	Lat. N.	Long. W.	H.W.	L. W.	Spg.	Neap.
		0 / //	0 / //		h m		
	Cape Walsingham: Extreme	66 00 00	69 28 00	<i>n. m.</i>	<i>n. m.</i>	Jt.	<i>μ</i> .
	Mile Island: N. pt	64 04 00	77 50 00	1.00	10.15	10.0	
	Cape Kendall: Extreme.	$\begin{array}{cccccccccccccccccccccccccccccccccccc$	87 15 00	4 00	10 15	12.0	5.1
	Iglooik Island: E. pt	69 21 00	81 31 00	$6\ 50$	0 40	8.0	4.2
	Victoria Harbor: N. shore	70 09 17 70 28 14	$91 \ 30 \ 33$ $92 \ 10 \ 56$				
	Magnetic Pole, 1831	$70 \ 35 \ 14$ $70 \ 05 \ 00$	96 47 00				
	Port Neill: N. pt. of entrance	$73 \ 09 \ 13$	89 00 54				
	Port Bowen: N. cove	$\begin{array}{cccccccccccccccccccccccccccccccccccc$	88 54 48				
	Port Leopold: Whaler Pt	$73 \ 13 \ 00 \ 73 \ 50 \ 05$	90 12 00	11 38	5 29	5.5	2.9
	Careys Islands	76 49 00	73 10 00				
	Discovery Harbor	81 04 40	64 45 00	10.95	4 90		1.0
	Cape Joseph Henry: N. extreme	82 40 00	$63 \ 38 \ 00$	10 55	4 20	2.0	1.0
	Cape Hecla: N. extreme	82 54 00	$64 \ 45 \ 00$				
	Cape Columbia: Extreme	$83 \ 07 \ 00$	70 20 00	1 90			
	Melville Island: Winter Harbor	68 55 00	110 48 15 179 57 00	1 20	1 40	3.8	1.9
		00 00 00	Long. E.				
	Liakhov Islands: E. pt. of New Siberia.	75 10 00	$150 \ 30 \ 00$				
	Cape Tscheljuskin: E. pt	77 41 00 70 25 00	59 10 00	••••••			•••••
	Cape Costin (Kostina).	70 55 00	53 01 50	10 00	3 50	7.0	- 4.0
	NÉ. pt., Cape Desire	76 58 00	$65 \ 40 \ 00$				
	Franz Josef Land: Wilczek 1	79 55 00	$58 \ 45 \ 00$				
	Moriovetz Island: Light-house	$65 50 18 \\ 66 45 50$	42 30 00				
	Archangel: Trinity Church	64 32 06	40 33 30	7 18	2 00	2.2	1.3
	Jighinsk Island: Light-house	65 12 17	36 51 30	5 05	11.30	3.8	2.1
	Onega: St. Michael's Church	$\begin{array}{cccccccccccccccccccccccccccccccccccc$	38 08 30 35 37 00	9 02	3 10	9.1	5.2
	Cape Sviatoi Nos: Light-house	$68 \ 08 \ 51$	$39 \ 48 \ 54$	9 05	2 55	13.9	7.8
	Bear Island	$74 \ 30 \ 00$	$20 \ 00 \ 00$				
	Spitzbergen Island: S. cape	$76 \ 35 \ 00$	17 23 00 11 40 20				
	Danes L. Robbe	19 00 00	11 40 50				
	Bay	$79\ 42\ 00$	$11 \ 07 \ 00$	0 14	$6\ 25$	5.3	3.0
	Thank God Harbor	81 38 00	Long. W. 61 44 00	19 14	5 58	5.4	2.0
	Cape York: Extreme	75 55 00	65 30 00	12 11			2.0
	Upernivik: Flagstaff	$72 \ 47 \ 48$	55 53 42	10 50	4 38	8.0	3.0
	Proven: Village	72 20 42 70 40 00	55 20 00				
	Godhavn: Village	69 14 04	51 53 00 53 24 07				
	Jacobshavn: Village	$69 \ 13 \ 12$	50 56 30				
	Claushavn: Village	$\begin{array}{cccccccccccccccccccccccccccccccccccc$	50 55 30				
	Egedesmunde: Village	68 49 00 68 42 30	51 00 00 52 46 00				
	Whalefish Island: Boat Inlet	68 58 30	$53 \ 27 \ 00$	8 05	1 52	7.5	3.6
Pa	Holsteinberg: Village	66 55 54	53 40 18	6 20	0 07	10.0	4.8
Ia	Kangamint	$\begin{array}{c} 65 & 48 & 42 \\ 65 & 24 & 30 \end{array}$	53 23 00 52 54 00				
Gen	Godthaab: Flagstaff	64 10 36	51 45 48	6 40	0 27	12.5	6.0
L'	Sermelik Fjord: Kasuk Peak	$63 \ 29 \ 12$	$51 \ 10 \ 48$				
	Fiskernaes: Village	$\begin{array}{cccccccccccccccccccccccccccccccccccc$	$50 \ 43 \ 36$ $48 \ 57 \ 00$		• • • • • • • • •		
	Ravn Storo: Peak	$62 \ 50 \ 00 \ 62 \ 42 \ 36$	50 20 48				
	Frederikshaab: Church	61 59 36	49 44 00	6 12	0 00	9.0	3.6
	Kangarssuk Havn: Village	61 28 20	48 51 00	6 15	0.02	19.0	
	Arsuk: Fingo Beacon Kajartalik Island: Summit	61 10 24 61 09 49	48 26 00 48 30 42	6 19	0 03	12.0	4.8
	Ivigtuk: House	61 12 12	48 10 30				
	Bangs Havn: Anchorage	60 47 30	47 52 00				
	Aurora Harbor	60 48 36	47 46 48				

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MARITIME POSITIONS AND TIDAL DATA.

THE ARCTIC REGIONS-Continued.

ast.	Place	Lat N	Long W	Lun.	Int.	Ra	inge.
Cot	race.	Lat. N.	nong. w.	H. W.	L. W.	Spg.	Neap.
Greenland.	Julianshaab: Village Neunortalik: Village Frederiksthal: Village Cape Farewell: Staten Huk Aleuk Islands: Center Cape Tordenskjold: Extreme. Cape Juli: Extreme. Cape Juli: Extreme. Cape Lowenorn: Extreme. Dannesbrog Island: Beacon Ingolsfjeld Rigny Mount: Summit. Pendulum Islands Cape Philipp Broke. Cape Bismark: Extreme	$ \begin{smallmatrix} \circ & \cdot & \cdot & \cdot \\ 60 & 43 & 07 \\ 60 & 08 & 12 \\ 60 & 00 & 00 \\ 59 & 49 & 00 \\ 60 & 09 & 00 \\ 61 & 25 & 00 \\ 62 & 01 & 00 \\ 63 & 14 & 00 \\ 64 & 30 & 00 \\ 65 & 18 & 00 \\ 66 & 19 & 02 \\ 74 & 40 & 00 \\ 74 & 55 & 00 \\ 76 & 47 & 00 \\ \end{smallmatrix} $	$ \begin{smallmatrix} \circ & \prime & \prime & \prime \\ 46 & 01 & 00 \\ 45 & 16 & 00 \\ 44 & 40 & 00 \\ 44 & 01 & 42 \\ 42 & 55 & 00 \\ 42 & 15 & 00 \\ 42 & 00 & 00 \\ 42 & 00 & 00 \\ 40 & 50 & 00 \\ 39 & 30 & 00 \\ 38 & 30 & 00 \\ 38 & 30 & 00 \\ 35 & 11 & 00 \\ 26 & 10 & 24 \\ 18 & 17 & 00 \\ 17 & 33 & 00 \\ 18 & 40 & 00 \\ \end{smallmatrix} $	h. m. 4 56 5 33 2 55 4 00 	$\begin{array}{c} \hbar. m. \\ 11 \ 09 \\ 11 \ 46 \\ 9 \ 10 \\ 10 \ 13 \\ \end{array}$	<i>ft.</i> 7.0 8.6 9.4 7.5 	<i>ft.</i> 2.8 3.4 3.8 3.0 3.9 2.1
	Jan Mayen Island: Mt. Beerenberg, 6,870 ft Youngs Fore- land, or Cape Northeast Mary Muss Bay	71 04 00 71 08 00 71 00 00	$\begin{array}{cccc} 7 & 36 & 00 \\ 7 & 26 & 00 \\ 8 & 28 & 00 \end{array}$	 11 21	5 06	3.8	2.2
Iceland.	Langanaes Point. Rissnaes Point. Grimsey Norddranger: Tr. Station Skagataas Point North Cape: Kalfatindr. Straumness Point. Fugle or Staabierg Huk: Point Snaefells Yokul: Tr. Station. Reykiavik: Observatory Cape Skagi: Light-house. Ingolfshofde: Tr. Station. Papey Island: Tr. Station. Reythur Fjeld: Tr. Station. Balatangi: Light-house Dia Fjeld: Tr. Station.	$\begin{array}{cccccccccccccccccccccccccccccccccccc$	$\begin{array}{cccccccccccccccccccccccccccccccccccc$	5 10	11 25	14.5	8.4

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APPENDIX V.

LUNAR DISTANCES.

By reason of the comparative rapidity of motion of the moon relatively to the earth, it occurs that the angular distance, measured from the earth, between the moon and a body that occupies a fixed, or nearly fixed, position in the celestial sphere, is constantly changing. If, therefore, an observer accurately measures with a sextant the angle between the moon and one of the various celestial bodies for which the lunar distance is tabulated in the Nautical Almanac, this observed distance, reduced to true distance, affords a means for determining the absolute instant of time at which the observation was taken; and from this may be deduced the longitude and the chronometer error.

If it were practicable to obtain results with a close degree of accuracy by this method, it would be an invaluable aid to the navigator, eliminating all anxiety as to change of rate of the chronometer, and even rendering it possible to navigate a vessel without such an instrument. It is unfortunately the case, however, that the method does not afford results that may be regarded as reliable within small limits, since a very small error in the observed angle, which it may not be possible to avoid even though every care be taken, causes a large error in the deduced time. Navigators of the present day do not, therefore, employ the method of lunar distances except under extraordinary circumstances, such as when an accident to the chronometer occurs, or, on a very long voyage, when there is reason to suspect the correctness of the chronometer error as brought forward by the rate.

In order to facilitate the method of determining the longitude from lunar distances, there is published in the Nautical Almanac, for every third hour of Greenwich mean time, the angular distances of the center of the moon from the center of the sun, from the brightest planets and from certain bright fixed stars selected in the path of the moon. All the distances that can be observed on the same day are grouped together under that date, and the columns are read from left to right across both pages of the same opening. The letter W. or E. is affixed to the name of the sun, planet, or star to indicate that it is on the west or east side of the moon. An observer on the surface of the earth having measured a lunar distance, corrected it for instrumental errors and for the semidiameters of the objects, and cleared it from the effects of refraction and parallax, finds the *true* or geocentric distance. With this distance and the distances in the Nautical Almanac of the same bodies on the same day, the Greenwich mean time of the observation can be found, as will hereafter be described.

mean time of the observation can be found, as will hereafter be described. The unavoidable errors to which the observation of lunar distance is subject are diminished by making a number of measurements. Errors of the instrument may be diminished by measuring distances on opposite sides of the moon, when possible, and combining the results.

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Although all the instruments used in these observations ought to be well adjusted, yet particular care should be taken of the sextant used in measuring the angular distance of the moon from the sun or star, since an error of 1' in this distance will cause an error of nearly 30' in the longitude deduced therefron. When a great angular distance is to be measured it is absolutely necessary to use a telescope, and its parallelism with respect to the plane of the instrument must be carefully examined; but in measuring small distances the use of the telescope is not of such great importance, and a sight tube may then be used, taking care, however, that the eye and point of contact of the objects on the horizon glass be equally distant from the plane of the instrument. It is always conducive to accuracy to use a telescope, and, after a little practice, this is easily done.

While one person is observing the distance of the objects, two others should observe the altitudes. The chronometer should be under the eye of a fourth person appointed to note the time; the observer who takes the angular distance gives previous notice to the others to be ready with their altitudes by the time he has finished his observation, which, being done, the time, altitudes, and distance should be carefully noted; if other sets of observations are taken it must be done within the space of fifteen minutes, and the mean of all the observations should be worked as a single one.

When a ship is rolling considerably it is difficult to measure the distance of the objects, but when steady there is much less difficulty, especially in small distances, which are much more easily measured than large ones, and are not so liable to error from an ill adjustment of the telescope; an observer would therefore do well to choose those times for observation when the distance of the objects is less than 70° or 80°. But it must be observed that neither of the objects, if possible, ought to be at a less altitude than 10°, on account of the uncertainty of the refraction near the horizon, for the horizontal refraction varies from 33' to 36' 40'' by an alteration of 40° in the thermometer; this alteration might cause an error of 2° in the longitude with an observer who uses the mean refraction.

In measuring the distance of the moon from the sun we must bring the moon's round limb in contact with the nearer limb of the sun. In measuring the distance of the moon from a planet or fixed star the round limb must be brought in contact with the center of the star or planet, observing that, the semidiameter of the planet being only a few seconds, the center of it can be estimated sufficiently near for all the purposes of this observation.

In taking the altitude of the moon, the round limb, whether it be the upper or lower, must be brought to the horizon. In misty weather it is rather difficult to observe the altitude of the stars on account of their dimness. Sometimes they are so dim that they can not be seen through the telescope of a sextant, particularly if the mirrors are not well silvered. In this case the telescope must be laid aside and the altitude taken with a sight tube.

It has been assumed that there were observers enough to measure the altitudes when the distance was observed, but if that is not the case the altitudes may be estimated in a manner to be explained hereafter.

The method here given is that of Professor Chauvenet, and involves the use of the tables in this Appendix. The object of these tables is to give the true correction of a lunar distance in all cases when. with the apparent distance of the moon from the sun, a planet, or star, the apparent altitudes of the two objects have also been obtained by observation. They enable us readily to take into account: First, the parallax of the moon in the latitude of the observer, allowing for the spheroidal figure of the earth; second, the parallax of the sun or a planet; third, the true atmospheric refraction, allowing for the actual state of the air as shown by the barometer and thermometer; and, fourth, that effect of refraction which gives the apparent disks of the moon and sun an oval or elliptical figure.

The longitude deduced from a lunar observation, when no attention is paid to the spheroidal figure of the earth, to the barometer and thermometer, or to the elliptical figure of the disks, may in certain cases be in error a whole degree. It is true these extreme cases are rare in practice, but cases are common in which from such neglect the error in the longitude is 10', 15', or 20', and it is absolutely necessary to get rid of such errors and to leave no other inaccuracy in the result than that which unavoidably follows from the observations.

THE OBSERVATION.—The record of a complete observation embraces:

1. The latitude and approximate longitude of the place of observation.

 The approximate local time.
 The time of observation as shown by a chronometer, and the error of the chronometer, or its difference from mean Greenwich time.

4. The apparent distance of the moon's bright limb from a star or planet, or from the nearer limb of the sun.

5. The apparent altitude of the moon's upper or lower limb above the sea horizon.

6. The apparent altitude of the star, planet, or lower limb of the sun above the sea horizon. 7. The height of the barometer and thermometer.

8. The height of the eye above the level of the sea.

9. The index correction of the sextant.

The index correction of the sextant may be supposed to be previously determined; but, since even in the best instruments it is not constant, its determination should be considered a necessary part of the observation.

The error of the chronometer alluded to is that which is obtained by applying the daily rate (multiplied by the proper number of days) to the error found before leaving port. The agreement or disagreement of the error thus found with that found by the lunar observation will be the test of the accuracy of the chronometer, subject, of course, to the accepted limits of accuracy of the observation itself.

PREPARATION OF THE DATA.-Greenwich Date.-Correct the chronometer time for its error from Greenwich time and deduce the Greenwich date, i. e., the Greenwich day and hour (mean time), reckoning the hours in succession from 0 to 24, beginning at noon.

Nautical Almanac.—With the Greenwich date enter the Almanac and take out the moon's semidiameter and horizontal parallax; if the sun is observed, take its semidiameter; in the case of a planet, take its horizontal parallax only.

Apparent Altitude of the Moon.—To the altitude given by the sextant apply the index correction of the instrument and subtract the dip of the horizon (Table 14)." If the lower limb is observed, add the semidiameter and augmentation (Table 18); if the upper limb is observed, subtract the augmented semidiameter. The result is the apparent altitude of the moon's center, denoted "C's App. Au."

Apparent Altitude of the Sun, Planet, or Star.—To the observed altitude apply the index correction of the sextant, and subtract the dip (Table 14); and if the sun is used, add its semidiameter when the lower limb is observed, or subtract it when the upper limb is observed. The result is the apparent altitude results denoted by if Q_{12} and M_{12}^{12} required, denoted by " \bigcirc 's or \star 's App. Alt." Apparent Distance.—First, when the sun is used, to the observed distance (corrected for index error

when necessary) add the moon's augmented semidiameter and the sun's semidiameter; second, when a planet or star is used, add the moon's augmented semidiameter if its nearer limb is observed, but subtract it if its farther limb is observed. The result is "App. Dist." Moon's Reduced Parallax and Refraction.—Enter Table 19 with the latitude of the place of observa-

tion and the moon's horizontal parallax, and take out the correction, which add to the horizontal parallax. Call the result the moon's reduced parallax, or "C's Red. P." Enter Table I with the moon's apparent altitude, and take out the mean reduced refraction, and

apply to this mean refraction the corrections given in Tables 21 and 22, adding or subtracting these corrections according to the directions in the tables. The result is the moon's reduced refraction, or " \mathbb{C} 's Red. R."

^a The tables designated by their numbers in Arabie notation are to be found in Part II. The tables contained in this Appendix, which are for exclusive use with lunar-distance observations, are denoted by Roman numbers.

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Subtract the "ℂ's Red. R." from the "ℂ's Red. P." and mark the result as "ℂ's Red. P. and R." Reduced Parallax and Refraction of Sun, Planet, or Star. —With the apparent altitude of the sun, planet, or star, take from Table I the mean reduced refraction, which correct by Tables 21 and 22. If planet, or star, take from Table 1 the mean reduced refraction, which correct by Tables 21 and 22. If the sun is observed, subtract its horizontal parallax (which may always be taken at 8".5) from its reduced refraction, and mark the result as "O's Red. P. and R." If a planet is observed subtract its horizontal parallax, and mark the result as " \star 's Red. P. and R." If a star is observed, its reduced refraction is at once the required " \star 's Red. P. and R." If a star is observed, its reduced refraction is COMPUTATION OF THE TRUE DISTANCE.—Take from Tables II, III, IV, and V respectively the four

logarithms A. B. C. D.^b and place these logarithms each at the head of a column, marking the columns logarithms A, B, C, D, ^b and place these logarithms each at the head of a column, 'A, B, C, and D; then put the— log of C's Red. P. and R. (Table IX) in columns A and B. log of O's or *'s Red. P. and R. (Table IX) in columns C and D. log sin C's App. Alt. (Table 44) in columns A and D. log sin O's or *'s App. Alt. (Table 44) in columns B and C. log cot App. Dist. (Table 44) in columns A and C.

log cot App. Dist. (Table 44) in columns A and D. log cosec App. Dist. (Table 44) in columns B and D. The sum of the four logs in Col. A is the log (Table IX) of the *First Part of C's Correction*, which is to be marked + when the app. dist. is less than 90°, but — when the app. dist. is greater than 90°. The sum of the four logs in Col. B is the log (Table IX) of the *Second Part of C's Correction*, which

is always to be marked

The sum of the four logs in Col. C is the log (Table IX) of the First Part of the \bigcirc 's or \star 's Correction, which is to be marked — when the app. dist. is less than 90°, but + when the app. dist. is greater than 90°.

The sum of the four logs in Col. D is the log (Table IX) of the Second part of the \bigcirc 's or \star 's Correction, which is always to be marked -

Combine the first and second parts of the C's correction according to the signs prefixed; that is, sign of the greater to the result, which call " ('s whole correction." In the same manner form the "O's or *'s whole correction."

First Correction of Distance.—Combine the C's whole corr. and the \bigcirc 's or *'s whole corr., according to their signs; the result is the First Correction of Distance, which is to be added to or subtracted from

the apparent distance, according as its sign is + or -. Second Correction of Distance, —Enter Table VI with the Apparent Distance and the First Correction of Distance, and take out the Second Correction of Distance, which is to be applied to the distance according to the directions in the side columns of the Table.

Correction for the Elliptical Figure of the Moon's Disk, or Contraction of the Moon's Semi-diameter.—Enter Table VII A with the \mathbb{C} 's App. Alt. and \mathbb{C} 's Red. P. and R., and take out the number. With this number and the \mathbb{C} 's whole correction enter Table VII B and take out the required contraction, which is to be added to the app. dist. when the farther limb is observed, but subtracted when the nearer limb is

Correction for the Elliptical Figure of the Sun's Disk, or Contraction of the Sun's Semi-diameter.—Enter Table VIII A with the O's App. Alt. and O's Red. P. and R., and take out the number. With this number and the O's whole corr. enter Table VIII B and take out the required contraction, which is always to be subtracted from the distance (the nearer limb of the sun being always observed). Correction for Compression, or for the Spheroidal Figure of the Earth.—Take from the Nautical Alma-nac for the Greenwich date the declinations of the bodies to the nearest whole degree. With the moon's

Correction for Compression, or for the Spheroidal Figure of the Earth.—Take from the Nautical Alma-nac for the Greenwich date the declinations of the bodies to the nearest whole degree. With the moon's declination and apparent distance, take from Table XI A the first part of N, and mark it with the sign in the table if the declination is North; but if the declination is South, change the sign from + to - or from - to +. With the sun's or star's declination and the apparent distance, take from Table XI B the second part of N, giving it the same sign as the declination. Take the sum, or difference, of the two parts, according as their signs are the same or different, and to the resulting number prefix the sign of the greater. The logarithm of this number of seconds, taken from Table IX, with its sign prefixed, is the required log N. To log N add the log sine of the latitude of the place of observation; the sum is the log (Table IX) of the required correction for compression. In porth latitude add this correction if log N is +(Table IX) of the required correction for compression. In north latitude add this correction if log N is +, or subtract it if log N is -; in south latitude subtract the correction when log N is +, and add it when log N is

All these corrections being applied to the Apparent Distance, the result is the *True Distance*. TO FIND THE GREENWICH TIME.—Find in the Nautical Almanac the two distances between which the true distance falls. Take out the first of these, together with the Prop. Log following it, and the hours of Greenwich time over it. Find the difference between the distance taken from the Almanac and the true distance, and to the log of this difference (Table IX) add the Prop. Log from the Almanac; the sum is the log (Table IX) of an interval of time to be added to the hours of Greenwich time taken from the Almanac. The result is the approximate Greenwich time.

To correct this Greenwich time, take the difference between the two Prop. Logs in the Almanac ch stand against the two distances between which the true distance falls. With this difference and which stand against the two distances between which the true distance falls. the interval of time just found enter Table X and take out the seconds, which are to be added to the approximate Greenwich time when the Prop. Logs are decreasing, but subtracted when the Prop. Logs are increasing. The result is the true Greenwich time.

By comparing with this the local mean time the longitude will be found; or, if testing the time shown by chronometer, the difference between the true Greenwich time and the time shown by the chronometer is the error of the chronometer as determined by the lunar observation.

a The parallax of a star being zero, its "reduced parallax and refraction" become, of course, merely its "reduced refrac-tion" but as no mistake can arise from marking it as "* s Red. P. c ud R.," this designation has been retained in order to give simplicity and uniformity at once to the rules and the tables. ^b No interpolation is necessary in taking out these logarithms.

LUNAR DISTANCES.

DEGREE OF DEPENDENCE.—If the error thus determined agrees with that deduced by means of the rate and original error, it may be accepted as a confirmation of the rate of the chronometer; if otherwise, more or less doubt is thrown upon the chronometer, according to the degree of accuracy of the lunar observation itself. An error of 10" in the measurement of the distance produces about 20^s error in the Greenwich time; and since, even with the best observers, a single set of distances is subject to a possible error of 10", it may be well to consider the chronometer as still to be trusted so long as it does not differ from the lunar by more than 20^s. Since, however, so much depends upon skill in measuring the distance, the observer can only form a correct judgment of the degree of dependence to be placed upon his own observations by repeated trials and a careful comparison of his several results.

distance, the observer can only form a correct judgment of the degree of dependence to be placed upon his own observations by repeated trials and a careful comparison of his several results. EXAMPLE: In Lat. 35° 30' N., Long. 30° W., by account, at the local mean time, 1855, September 6, 18^h 8^m 0', the observed distance of O's and C's nearer limbs was 43° 52' 10''; observed alt. (, 49° 32' 50''; observed alt. (), 5° 27' 10''; barometer, 29^m. 1; thermometer, 75°; height of the eye above the sea, 20ⁿ; I. C., 0' 00''; required the longitude.

Preparation of the Data.

L. M. T., Sept. 6, Long., D. R.,	$^{18}_{+2}$	^h 08 ^m 00	€ 's S. D., Aug. Table 18,	+	14' 5 1	$0^{\prime\prime}.0$ 1 .2	€'s Par., N. A., Aug., Table 19,		541	$\frac{19''.4}{3}$.6
G. M. T., approx.,	20	08	€'s Aug. S. D,		15 0	01.2	€'s Red. P.,		54	23 .0
Obs. Alt. $\underline{\mathbb{C}}$,48Dip, Table 14,- \mathbb{C} 's Aug. S. D.,+	32' 4 15	50'' 23 01	Obs. Alt. $\underline{\bigcirc}$, Dip, \bigcirc 's S. D.,	-5	• 27′ 4 15	10'' 23 55	Obs. Dist. $\bigcirc \mathbb{C}, \mathbb{C}$'s Aug. S. D., \bigcirc 's S. D.,	43 + +		$ \begin{array}{c} 10^{\prime\prime} \\ 01 \\ 55 \end{array} $
€'s App. Alt., 4	9 43	28	⊙'s App. Alt.,	5	38	42	App. Dist.,	44	23	06
C's Red. R., Table I, Bar. 29 ⁱⁿ .1, Table 21, Ther. 75°, Table 22,	1'	$16'' \\ 3 \\ 4$	⊙'s Red R., Table J Bar., Table 21, Ther., Table 22,	[, 	8′	57'' 16 28	€'s Dec., N. A., ⊙'s Dec., N. A.,	-	2	5° N. 6° N.
€'s Red. R., €'s Red. P.,	$\frac{1}{54}$	$\begin{array}{c} 09\\ 23 \end{array}$	⊙'s Red. R., ⊙'s Par.,		8	$\frac{13}{8}$				
C's Red. P. and R.,	53	14	⊙'s Red. P. and R.	,	8	05				

Computation of the True Distance.

C.

log A, Table II, 0.0021 log C's Red. P. and R., 3.5043 log sin C's App. Alt., 9.8825 log cot App. Dist., 0.0093 C T 11. W	log C, Table IV, 9.9949 log O's Red. P. and R., 2.6857 log sin O's App. Alt., 8.9929 log cot App. Dist., 0.0093	
(1st Part C 's corr., $+41' 43''$	100, Table IX, 1.6828 (1st Part \bigcirc 's corr., $-0' 48''$	
В,	D.	
$\log B$, Table III, 9.9951 $\log \mathbb{C}$'s Red. P. and R., 3.5043 $\log \sin \odot$'s App. Alt., 8.9929 $\log \operatorname{cosec} App.$ Dist., 0.1552	$\log D$, Table V, 9.9992 $\log \bigcirc$'s Red. P. and R., 2.6857 $\log \sin \mathbb{C}$'s App. Alt., 9.8825 $\log \csc$ App. Dist., 0.1552	
$\begin{array}{ll} \begin{array}{c} \begin{array}{c} \begin{array}{c} \begin{array}{c} \begin{array}{c} \begin{array}{c} \end{array} \\ \end{array} \end{array} \\ \begin{array}{c} \begin{array}{c} \end{array} \\ \begin{array}{c} \end{array} \\ \begin{array}{c} \end{array} \\ \end{array} \\ \end{array} \\ \end{array} \\ \begin{array}{c} \end{array} \\ \end{array} $	$ \begin{array}{cccc} & & & & & \\ & & & & \\ & & &$	App. Dist., 1st Corr., 2d Corr., Table VI, Contraction of ('s) S D Table VI
log N, Tabs. XI and IX, $(-)0.845$ log sin Lat., $+35^{\circ} 30'$, $(+)9.764$		Contraction of ⊙'s) S.D.,Table VIII, J
$\{ \log, \text{Table IX}, (-) 0.609 \\ \text{Corr. for Compression}, - 4'' \}$		True Distance,

A.

 $\begin{array}{c} 23' \ 06'' \\ 42 \ 18 \\ 16 \\ 0 \\ 20 \\ 4 \end{array}$

45 04 44

LUNAR DISTANCES.

Extract from Nautical Almanac, September, 1855.

GREENWICH MEAN TIME: LUNAR DISTANCES.

Day of the month.	Star's nar positie	ne and on.	Midnight.	P. L. of Diff.	XV ^h .	P. L. of Diff.	XVIII ^h .	P. L. of Diff.	XXI ^h .	P. L. of Diff.
6	Sun	E.	48° 46′ 55″	3422	47° 25′ 3″	3427	46° 3′ 17″	3433	44° 41′ 38″	3438

Computation of Greenwich Mean Time.

True Distance, Distance, N. A., at XVIII ^h ,	$\begin{array}{cccccccccccccccccccccccccccccccccccc$	P. L., 0.3433	Diff. P. logs $+$ 5
Difference,	58 33	log, Table IX, 3.5457	
Approximate interval, Add—	$\frac{2^{h}}{18}$ $\frac{09^{m}}{04^{s}}$ $\frac{04^{s}}{18}$	log, Table IX, 3.8890	
Approx. G. M. T., Corr., Table X,	$-\frac{\overline{20 09 04}}{2}$		
True G. M. T., L. M. T.,	$\begin{array}{cccccccccccccccccccccccccccccccccccc$		
Longitude,	+ 2 01 02 =	= 30° 15′ 30″ W.	

EXAMPLE: In Lat. 55° 20' S., Long. 120° 25' W., by account, on August 29, 1855, at 9^h 40^m 00^s p. m., local mean time, the following distance and altitudes were found, being the mean of six observations corrected for index error. Observed distance of Fomalhaut and moon's farther limb, 46° 30' 23''; observed alt. $\underline{\mathbb{G}}$, 6° 26' 10''; observed alt. Fomalhaut, 52° 34' 40''; barometer, 31ⁱⁿ; thermometer, 20°; height of the eye above the sea, 18th.

Preparation of the Data.

L. M. T., August 29, $9^{h} 40^{m} 00^{s}$ Long. by D. R., $+ 8 01 40$	C'sS.D., Naut.Al., 16′ 26″.3 Aug., Table 18, + 2.0	C's Par., N. A., 60′ 11″.8 Aug., Table 19, + 8.3
Approx. G. M. T., 17 41 40	ℂ 's aug S. D., 16 28 .3	€ ' Red P., 60 20 .1
Obs. alt. $\underline{\mathbb{C}}$ $6^{\circ} 26' 10''$ Dip, $ \underline{\mathbb{C}}$'s aug. S. D., $+$ 16 28	Obs. alt. $*$, 52° $34'$ $40''$ Dip, - 4 09 $*$'s App. Alt., 52 30 31	Obs. Dist. $\star \mathbb{C}$, $46^{\circ} 30' 23''$ \mathbb{C} 's aug., S. D., $ 16$ 28 App. Dist., 46
C's App. Alt., 6 38 29 C's Red R., Table I, 7' 48'' Bar., Table 21, + 16 Ther., Table 22, + 32	★'s Red. R., Table I, 1′ 13″ Bar., Table 21, + 2 Ther., Table 22, + 5	€ 's Dec., N. A., 4° N. ★'s Dec., N. A., 30° S.
ℂ's Red R., 8 36 ℂ's Red. P., 60 20	*'s Red. R., 1 20 *'s Red P., 0	
C 's Red. P. and R., 51 44	\star 's Red. P. and R., 1 20	

LUNAR DISTANCES.

Computation of the True Distance.

А.		С.				
log A, Table II, log ℂ's Red. P. and R., log sin ℂ's App. Alt., log cot App. Dist.,	0.0274 3.4919 9.0632 9.9813	log C, Table IV, log ★'s Red. P. and R., log sin ★'s App. Alt., log cot App. Dist.,	9.9999 1.9031 9.8995 9.9813			
$\{\log, Table IX, \\ 1st Part C's corr., + 6$	2.5638	∫log, Table IX, lst Part ★'s corr., —	1.7838 1' 01''			
В.		D.				
log B, Table III, log \mathbb{C} 's Red. P. and R., log sin \star 's App. Alt., log cosec App. Dist.,	0.0001 3.4919 9.8995 0.1414	log D, Table V, log ★'s Red. P. and R., log sin €'s App. Alt., log cosec App. Dist.,	$\begin{array}{c} 0.0267 \\ 1.9031 \\ 9.0632 \\ 0.1414 \end{array}$			
	3.5329 751'' 45	{log, Table IX, {2d Part ★'s corr., + ★'s whole corr., -	$\begin{array}{c} 1.1344 \\ 0' \ 14'' \\ 0 \ 47 \end{array}$	App. Dist., 46 1st corr., – 2d corr., Table VI, –	° 13′ 51	55'' 32 22
log N, Tabs. XI and (-)	1.230			Contraction of C's +		17
$\log \sin \text{Lat.}, -55^{\circ}, (-)$	9.913			Corr. for Comp., +		14
{log Table IX, (+) Corr. for Comp., +	$\frac{1.143}{14''}$			True Distance, 45	22	32

Extract from Nautical Almanac, August, 1855.

GREENWICH MEAN TIME: LUNAR DISTANCES.

Day of the month.	Star's name and position.	Midnight.	P. L. of Diff.	XV ^h .	P. L. of Diff.	XVIII ^h .	P. L. of Diff,	XXI [‡] .	P. L. of Diff.
29	Fomalhaut W.	42° 11′ 34′′	2535	43° 51′ 59′′	, 2527	45° 32′ 35′′	2521	47° 13′ 19″	2516

Computation of Greenwich Mean Time.

True Distance, Dist., N. A., at XV ^h ,	$\begin{array}{cccccccccccccccccccccccccccccccccccc$	Р. L.,	0.2527	Diff. P. logs – 6
Difference,	1 30 33	log, Table IX,	3.7350	
Approx. interval, Add—	$2^{h} 42^{m}01^{s}$ 15	log, Table IX,	3.9877	
Approx. G. M. T., Corr., Table X,	$+ \begin{array}{ccc} 17 & 42 & 01 \\ + & 01 \end{array}$			
True G. M. T., L. M. T.,	$\begin{array}{cccccccccccccccccccccccccccccccccccc$			
Long.,	+80202 =	120° 30′ 30″ W.		

METHOD OF TAKING A LUNAR OBSERVATION BY ONE OBSERVER.—Three observers are required to make the necessary observations for determining the longitude—one to measure the distance of the bodies, and the others to take the altitudes. In case of not having a sufficient number of instruments or observers to take the altitudes, the latter may be calculated, there being given the latitude of the place, the time, the right ascensions, and the declinations of the objects. These calculations are long, however, especially in the case of the moon, and a considerable degree of accuracy is required in finding from the Nautical Almanac the moon's right ascension and declination, which must be liable to some error on account of the uncertainty of the ship's longitude. The following method of obtaining those altitudes is far more simple, and sufficiently accurate. This method depends on the supposition that the altitudes increase or decrease uniformly.

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Before measuring the distance of the bodies, take their altitudes, and note the times by a chro-nometer; then measure the distance and note the time (or measure a number of distances, and note the corresponding times, and take the means); after having measured the distances, again measure the altitudes, and note the times; then, from the two observed altitudes of either of the objects, the required altitude of that object may be found from the following formula, which is based upon simple proportion:

$$x = \frac{d \times e}{t},$$

where x = change of altitude, in minutes, between first altitude and time of measuring the lunar distance, being positive or negative according as body is rising or falling;

d = difference between first and second altitudes, in minutes;

 $e = \text{time, in seconds, between first altitude and lunar observations; and <math>t = \text{time in seconds, between first and second altitudes.}$

The change of altitude thus deduced, applied with proper sign to the first altitude, gives the

altitude at time of observing the lunar distance. EXAMPLE: Suppose the distances and altitudes of the sun and moon were observed, as in the following table; it is required to find the altitudes at the time of measuring the mean distance.

	Times by chro- nomcter.	Lunar dis- tance.	Times by nome	y chro-Obs. alt. tcr. ('s L. L.	Times by chro- nometer.	Obs. alt. ⊙'s L. L.
	$\begin{array}{cccccccccccccccccccccccccccccccccccc$	40° 00' 00'' 40 00 30 40 01 30	$2^{h} 02 \\ 2 06$		$\begin{array}{cccccccccccccccccccccccccccccccccccc$	$ \frac{40^{\circ} \ 20'}{39 \ 12} $
Mean,	2 04 30	40 00 40	$t, \begin{cases} 4 \end{cases}$	$ \begin{array}{cccccccccccccccccccccccccccccccccccc$	$t, \left\{ egin{array}{cc} 4 & 30 \ 270^{ m s} \end{array} ight.$	$d, \begin{cases} 1 & 08 \\ 68' \end{cases}$
		For \mathbb{C} .		For	⊙ .	
	Time of lunar	obs.,	2 ^h 04 ^m 30 ^s	Time of lunar obs.,	2 ^h 04 ^m	30ª
	Time of 1st al	lt.,	2 02 00	Time of 1st alt.,	\cdot 2 02	30
	е,		$\left\{ \begin{array}{cc} 2 & 30 \\ 150^{s} \end{array} \right.$	е,	$\left\{ \begin{array}{c} 2\\ 1 \end{array} \right\}$	00 20 ^s
	$x = + \frac{34 \times 1}{250}$	$\frac{150}{2} = +20'.4$	= +20' 24''	$x = -\frac{68 \times 120}{270} =$	= -30'.2 = -30'	12″
	First altitude	,	20° 46′ 00″	First altitude,	40° 20'	00″
	x,	-	+ 20 24	x,	- 30	12
	Required alti	tude,	21 06 24	Required altitude,	$\overline{39 \ 49}$	48

To obtain the altitudes by calculation the following formulæ may be employed:

 $\tan A = \tan d \sec t$:

$$\sin h = \frac{\cos \left(\mathbf{A} - \mathbf{L}\right) \sin d}{\sin \mathbf{A}};$$

in which d is the declination; t, the hour angle; L, the latitude; h, the *true* altitude of the center of the object; A, an arc which has the same name or sign as the declination and is numerically in the same quadrant as t. In the solution, strict regard must be had for the signs.

EXAMPLE: Required the apparent allitude of the sun's center on December 22, 1879, in Lat. 48° 23' N., Long. 60° W., at 10^h 01^m 14^s a. m., app. time.

L. A. T., Long.,	Decen	abei	r 21, +	22 ^h	01 ^m 00	14 ^s 00	t,)'s De	c.,	1 ^h 58 ^m 46 ^s 23° 27′ 16″ S.
G. A. T.,	Decen	abei	r 22,	2	01	14				
t d	$-\frac{29^{\circ}}{23}$	$\frac{41'}{27}$	$30'' \\ 16$		sec tan	(—)	0.06113 9.6373	3 5	sin	(-) 9.59991
$_{ m L}^{ m A}$	$^{-26}_{+48}$	$\frac{32}{23}$	$\begin{array}{c} 20\\00 \end{array}$		tan	(—)	9.6984	8	cose	c (-) 0.34989
$\mathbf{A} - \mathbf{L}$	- 74	55	20						\cos	(+) 9.41520
h ref.—par.	$+^{13}$	$\frac{23}{3}$	$\begin{array}{c} 58 \\ 50 \end{array}$						\sin	(+) 9.36500
App. alt.	13	27	48			,				

APPENDIX V: TABLE I.

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Mean Reduced Refraction for Lunars.

Barometer 30 inches. Fahrenheit's Thermometer 50°.

Apparent al- titude,	Reduced re- fraction.	Diff. to 1'.	Apparent al- titude.	Reduced re- fraction.	Apparent al- titude.	Reduced re- fraction.	Apparent al- titude.	Reduced re- fraction.
$ \begin{smallmatrix} \circ & \cdot \\ 5 & 0 \\ 5 \\ 10 \\ 15 \\ 20 \\ 25 \\ \end{smallmatrix} $	$\begin{array}{c} & & \\ 9 & 54. \ 2 \\ 9 & 46. \ 3 \\ 9 & 38. \ 6 \\ 9 & 31. \ 0 \\ 9 & 23. \ 7 \\ 9 & 16. \ 5 \end{array}$	$" \\ 1.6 \\ 1.5 \\ 1.5 \\ 1.5 \\ 1.4 \\ $	$ \begin{smallmatrix} \circ & \prime \\ 10 & 0 \\ 5 \\ 10 \\ 15 \\ 20 \\ 25 \end{smallmatrix} $	$\begin{array}{c} & "\\ 5 & 24. 1\\ 5 & 21. 6\\ 5 & 19. 2\\ 5 & 16. 8\\ 5 & 14. 4\\ 5 & 12. 1\end{array}$	$ \begin{smallmatrix} \circ & \prime \\ 15 & 0 \\ 10 \\ 20 \\ 30 \\ 40 \\ 50 \end{smallmatrix} $	$\begin{array}{c} & & "\\ 3 & 41.7\\ 3 & 39.4\\ 3 & 37.1\\ 3 & 34.9\\ 3 & 32.7\\ 3 & 30.6 \end{array}$	$ \begin{smallmatrix} \circ & \prime \\ 27 & 0 \\ 27 & 30 \\ 28 & 0 \\ 28 & 30 \\ 29 & 0 \\ 29 & 30 \\ \end{smallmatrix} $	$\begin{array}{cccccccccccccccccccccccccccccccccccc$
$egin{array}{cccc} 5 & 30 \\ & 35 \\ & 40 \\ & 45 \\ & 50 \\ & 55 \end{array}$	$\begin{array}{cccccccccccccccccccccccccccccccccccc$	$1.4 \\ 1.3 \\ 1.3 \\ 1.3 \\ 1.2 \\ 1.2 \\ 1.2$	$ \begin{array}{r} 10 & 30 \\ & 35 \\ & 40 \\ & 45 \\ & 50 \\ & 55 \\ \end{array} $	$\begin{array}{cccccccccccccccccccccccccccccccccccc$	$ \begin{array}{r} 16 & 0 \\ 10 \\ 20 \\ 30 \\ 40 \\ 50 \\ \end{array} $	$\begin{array}{c} 3 & 28.5 \\ 3 & 26.5 \\ 3 & 24.5 \\ 3 & 22.6 \\ 3 & 20.7 \\ 3 & 18.8 \end{array}$	$\begin{array}{cccc} 30 & 0 \\ 30 & 30 \\ 31 & 0 \\ 31 & 30 \\ 32 & 0 \\ 32 & 30 \end{array}$	$\begin{array}{c}1 & 56.2 \\1 & 54.5 \\1 & 52.8 \\1 & 51.2 \\1 & 49.7 \\1 & 48.2\end{array}$
$egin{array}{ccc} 6 & 0 & 5 \ 10 & 15 \ 20 & 25 \end{array}$	$\begin{array}{c} 8 \ 30, 9 \\ 8 \ 24, 9 \\ 8 \ 19, 1 \\ 8 \ 13, 4 \\ 8 \ 7, 8 \\ 8 \ 2, 4 \end{array}$	$1.2 \\ 1.2 \\ 1.1 $	$ \begin{array}{r} 11 & 0 \\ 5 \\ 10 \\ 15 \\ 20 \\ 25 \\ \end{array} $	$\begin{array}{r} 4 & 56.7 \\ 4 & 54.6 \\ 4 & 52.5 \\ 4 & 50.5 \\ 4 & 48.5 \\ 4 & 46.6 \end{array}$	$egin{array}{cccc} 17 & 0 & \ 10 & 20 & \ 30 & 40 & \ 50 & \ \end{array}$	$\begin{array}{c} 3 & 16. \\ 9 \\ 3 & 15. \\ 1 \\ 3 & 13. \\ 4 \\ 3 & 11. \\ 6 \\ 3 & 9. \\ 9 \\ 3 & 8. \\ 2 \end{array}$	$\begin{array}{cccccccccccccccccccccccccccccccccccc$	$1 \ 46.7 \\ 1 \ 45.3 \\ 1 \ 44.0 \\ 1 \ 42.7 \\ 1 \ 41.4 \\ 1 \ 40.2$
$egin{array}{ccc} 6 & 30 \\ & 35 \\ & 40 \\ & 45 \\ & 50 \\ & 55 \end{array}$	$\begin{array}{cccccccccccccccccccccccccccccccccccc$	$ \begin{array}{c} 1.0\\ 1.0\\ 1.0\\ 1.0\\ 1.0\\ 0.9 \end{array} $	$ \begin{array}{cccc} 11 & 30 \\ & 35 \\ & 40 \\ & 45 \\ & 50 \\ & 55 \\ \end{array} $	$\begin{array}{r} 4 & 44.\ 6\\ 4 & 42.\ 7\\ 4 & 40.\ 8\\ 4 & 38.\ 9\\ 4 & 37.\ 1\\ 4 & 35.\ 3\end{array}$	18 0 10 20 30 40 50	$\begin{array}{cccccccccccccccccccccccccccccccccccc$	$\begin{array}{cccccccccccccccccccccccccccccccccccc$	$\begin{array}{c}1&39.\\0\\1&37.8\\1&36.7\\1&35.6\\1&34.5\\1&33.5\end{array}$
$egin{array}{cccc} 7 & 0 & 5 \ 5 & 10 & 15 \ 20 & 25 & 25 \end{array}$	$\begin{array}{cccccccccccccccccccccccccccccccccccc$	0. 9 0. 9 0. 9 0. 9 0. 9 0. 9 0. 8	$ \begin{array}{rrrr} 12 & 0 \\ 5 \\ 10 \\ 15 \\ 20 \\ 25 \end{array} $	$\begin{array}{r} 4 & 33.5 \\ 4 & 31.7 \\ 4 & 30.0 \\ 4 & 28.3 \\ 4 & 26.6 \\ 4 & 24.9 \end{array}$	$\begin{array}{cccc} & 19 & 0 \\ & 10 \\ & 20 \\ & 30 \\ & 40 \\ & 50 \end{array}$	$\begin{array}{cccccccccccccccccccccccccccccccccccc$	$\begin{array}{rrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrr$	$\begin{array}{c}1&32.5\\1&31.5\\1&30.6\\1&29.6\\1&28.7\\1&27.8\end{array}$
$7 \ \begin{array}{c} 30 \\ 35 \\ 40 \\ 45 \\ 50 \\ 55 \end{array}$	$\begin{array}{cccccccccccccccccccccccccccccccccccc$	$\begin{array}{c} 0.8 \\ 0.8 \\ 0.8 \\ 0.8 \\ 0.8 \\ 0.8 \\ 0.7 \end{array}$	$\begin{array}{rrrr} 12 & 30 \\ & 35 \\ & 40 \\ & 45 \\ & 50 \\ & 55 \end{array}$	$\begin{array}{r} 4 \ 23.2 \\ 4 \ 21.6 \\ 4 \ 20.0 \\ 4 \ 18.4 \\ 4 \ 16.8 \\ 4 \ 15.2 \end{array}$	$\begin{array}{cccc} 20 & 0 \\ & 10 \\ & 20 \\ & 30 \\ & 40 \\ & 50 \end{array}$	$\begin{array}{c}2&49.0\\2&47.6\\2&46.4\\2&45.1\\2&43.8\\2&42.6\end{array}$	$\begin{array}{r} 42 & 0 \\ 42 & 30 \\ 43 & 0 \\ 43 & 30 \\ 44 & 0 \\ 44 & 30 \end{array}$	$\begin{array}{c}1&27.\\0\\1&26.\\2\\1&25.\\4\\1&24.\\6\\1&23.\\8\\1&23.\\1\end{array}$
	$\begin{array}{c} 6 & 37.2 \\ 6 & 33.5 \\ 6 & 29.9 \\ 6 & 26.3 \\ 6 & 22.8 \\ 6 & 19.4 \end{array}$	0.7 0.7 0.7 0.7 0.7 0.7 0.7	$ \begin{array}{r} 13 & 0 \\ 5 \\ 10 \\ 15 \\ 20 \\ 25 \end{array} $	$\begin{array}{r} & 13.7 \\ 4 & 12.2 \\ 4 & 10.7 \\ 4 & 9.2 \\ 4 & 7.7 \\ 4 & 6.3 \end{array}$	$ \begin{array}{cccccccccccccccccccccccccccccccccccc$	$\begin{array}{c} 2 & 41. \\ 2 & 40. \\ 2 & 39. \\ 0 \\ 2 & 37. \\ 9 \\ 2 & 36. \\ 7 \\ 2 & 35. \\ 6 \end{array}$	$\begin{array}{cccccccccccccccccccccccccccccccccccc$	$ \begin{array}{r} 1 & 22.4 \\ 1 & 21.0 \\ 1 & 19.6 \\ 1 & 18.4 \\ 1 & 17.2 \\ 1 & 16.0 \\ \end{array} $
$ \begin{array}{r} 8 30 \\ 35 \\ 40 \\ 45 \\ 50 \\ 55 \\ \end{array} $	$\begin{array}{cccccccccccccccccccccccccccccccccccc$	$\begin{array}{c} 0.7\\ 0.6\\ 0.6\\ 0.6\\ 0.6\\ 0.6\\ 0.6\\ \end{array}$	$ \begin{array}{r} 13 \ 30 \\ 35 \\ 40 \\ 45 \\ 50 \\ 55 \\ 55 \end{array} $	$\begin{array}{c} 4 & 4.8 \\ 4 & 3.4 \\ 4 & 2.0 \\ 4 & 0.6 \\ 3 & 59.3 \\ 3 & 57.9 \end{array}$	$\begin{array}{cccc} 22 & 0 \\ 10 \\ 20 \\ 30 \\ 40 \\ 50 \end{array}$	$\begin{array}{c} 2 & 34.5 \\ 2 & 33.4 \\ 2 & 32.4 \\ 2 & 31.3 \\ 2 & 30.3 \\ 2 & 29.2 \end{array}$	$\begin{array}{cccccccccccccccccccccccccccccccccccc$	$ \begin{array}{c} 1 & 15. \\ 0 & 1 & 13. \\ 1 & 13. \\ 0 \\ 1 & 13. \\ 0 \\ 1 & 12. \\ 0 \\ 1 & 11. \\ 1 & 10. \\ 3 \\ \end{array} $
$ \begin{array}{r} 9 & 0 \\ 5 \\ 10 \\ 15 \\ 20 \\ 25 \end{array} $	$\begin{array}{cccccccccccccccccccccccccccccccccccc$	$\begin{array}{c} 0.\ 6\\ 0.\ 6\\ 0.\ 6\\ 0.\ 6\\ 0.\ 6\\ 0.\ 5\end{array}$	$ \begin{array}{rrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrr$	$\begin{array}{c} 3 & 56. \ 6 \\ 3 & 55. \ 3 \\ 3 & 54. \ 0 \\ 3 & 52. \ 7 \\ 3 & 51. \ 4 \\ 3 & 50. \ 1 \end{array}$	$\begin{array}{rrrrr} 23 & 0 \\ & 20 \\ & 40 \\ 24 & 0 \\ & 20 \\ & 40 \end{array}$	$\begin{array}{cccccccccccccccccccccccccccccccccccc$	$\begin{array}{cccccccccccccccccccccccccccccccccccc$	$ \begin{array}{rrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrr$
$9 \ 30 \\ 35 \\ 40 \\ 45 \\ 50 \\ 55 \\ $	$5 \ 39. 8 \\ 5 \ 37. 0 \\ 5 \ 34. 4 \\ 5 \ 31. 7 \\ 5 \ 29. 2 \\ 5 \ 26. 6 $	$\begin{array}{c} 0.5 \\ 0.5 \\ 0.5 \\ 0.5 \\ 0.5 \\ 0.5 \\ 0.5 \\ 0.5 \end{array}$	$ \begin{array}{r} 14 & 30 \\ 35 \\ 40 \\ 45 \\ 50 \\ 55 \\ \hline 55 \end{array} $	$\begin{array}{c} 3 \ 48.9 \\ 3 \ 47.6 \\ 3 \ 46.4 \\ 3 \ 45.2 \\ 3 \ 44.0 \\ 3 \ 42.8 \end{array}$	$25 ext{ 0} ext{ 20} ext{ 40} ext{ 26} ext{ 0} ext{ 20} ext{ 40} ext{ 20} ext{ 40} ext{ 40} ext{ 20} ext{ 40} ext{ 40} ext{ 20} ext{ 40} ex$	$\begin{array}{c} 2 & 17.2 \\ 2 & 15.5 \\ 2 & 13.9 \\ 2 & 12.3 \\ 2 & 10.8 \\ 2 & 9.3 \end{array}$	$\begin{array}{ccccc} 66 & 0 \\ 68 & 0 \\ 70 & 0 \\ 73 & 0 \\ 76 & 0 \\ 80 & 0 \end{array}$	$\begin{array}{cccccccccccccccccccccccccccccccccccc$
10 0	$5\ 24.1$		15 0	3 41.7	$27 ext{ 0}$	$2 \ 7.8$	90 0	0 58.3

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APPENDIX V: TABLE II.

	Reduced parallex and refraction of moon														
App. alt.of	p. Reduced patriax and reflection of moon.														
moon.	41'	42'	43'	44'	45'	46'	47'	48'	497	50'	51'	52'	53/	54'	55/
5° 0'	.0288	0295	0301	0308	0315	0321	0328	0335	0341	0348	0355	0361	0368		
2	.0286	0293	0299	0306	0313	0319	0326	0333	0339	0346	0352	0359	0366		
4	.0284	0291	0297	0304	0311	0317	0324	0330	0337	0344	0350	0357	0363		
0	.0282	0289	0290	0302	0309	0310	0322	0328	0330	0341	0348	0304	0361		
5 10	.0281	0287	0204	0300	0307	0313	0320	0320	0333	0335	0211	0352	0355		
$ \frac{0}{12} $.0279	0280	0292	0298	0303	0309	0316	0324	0329	0335	0341	0348	0354		
14	.0275	0282	0288	0295	0301	0307	0314	0320	0327	0333	0339	0346	0352		
$\hat{16}$.0274	0280	0286	0293	0299	0306	0312	0318	0325	0331	0337	0344	0350		
18	.0272	0278	0285	0291	0297	0304	0310	0316	.0323	0329	0335	0341	0348		
$5\ 20$.0270	0277	0283	0289	0296	0302	0308	0314	0321	0327	0333	0339	0346		
22	.0269	0275	0281	0288	0294	0300	0306	0313	0319	0325	0331	0337	0344		
24	.0267	0273	0280	0286	0292	0298	0304	0311	0317	0323	0329	0335	0341	0040	
26	.0260	0272	0278	0284	0290	0296	0303	0309	0310	0321	0327	0333	0339	0340	
5 20	0204	0270	0275	0202	0200	0200	0200	0307	0313	0319	0320	0390	0301	0210	
39	0262	0208	0273	0279	0285	0293	0295	0303	0309	0317	0323	0329	0334	0340	
34	.0259	0265	0271	0277	0283	0290	0296	0302	0308	0314	0320	0326	0332	0338	
36	.0258	0264	0270	0276	0282	0288	0294	0300	0306	0312	0318	0324	0330	0336	
38		0262	0268	0274	0280	0286	0292	0298	0304	0310	0316	0322	0328	0334	
5 40		0261	0267	0273	0279	0285	0290	0296	0302	0308	0314	0320	0326	0332	
42		0259	0265	0271	0277	0283	0289	0295	0301	0306	0312	0318	0324	0330	
44		0258	0264	0270	0275	0281	0287	0293	0299	0305	0311	0316	0322	0328	
46		0255	0262	0268	0274	0280	0286	0291	0297	0303	0309	0310	0320	0326	
5 50		0200	0201	0207	$\frac{0272}{0971}$	0213	0204	0290	0290	0301	0307	0313	$\frac{0319}{0217}$	0999	
5 50		0255	0259	0265	0271	0277	0282	0288	0294	0298	0305	0311	0317 0315	0323	
54		0251	0256	0262	0268	0274	0279	0285	0291	0296	0302	0308	0313	0319	
$\tilde{56}$		0249	0255	0261	0266	0272	0278	0283	0289	0295	0300	0306	0312	0317	
58		0248	0254	0259	0265	0271	0276	0282	0287	0293	0299	0304	0310	0316	
6 0		0247	0252	0258	0263	0269	0275	0280	0286	0291	0297	0303	0308	0314	
2		0245	0251	0256	0262	0268	0273	0279	0284	0290	0295	0301	0307	0312	
4		0244	0249	0255	0261	0266	0272	0277	0283	0288	0294	0299	0305	0310	
6		0243	0248	0204	0259	0200	0270	0276	0281	0287	0292	0298	0303	0309	
6 10		0241	0247	0252	0256	0203	0205	0274	0280	0200	0291	0290	0302	0307	
12		0240	0240	0251	0255	0261	0266	0273	0278	0282	0289	0293	0299	0304	
14		0237	0243	0248	0254	0259	0265	0270	0275	0281	0286	0292	0297	0302	
16		0236	0242	0247	0252	0258	0263	0269	0274	0279	0285	0290	0295	0301	
18		0235	0240	0246	0251	0257	0262	0267	0273	0278	0283	0289	0294	0299	
6 20		0234	0239	0245	0250	0255	0261	0266	0271	0276	0282	0287	0292	0298	
22		0233	0238	0243	0249	0254	0259	0264	0270	0275	0280	0286	0291	0296	
24		0231	0237	0242	0247	0253	0258	0263	0268	0274	0279	0284	0289	0295	
26			0236	0241	0240	0251	0207	0262	0267	0272	0277	0283	0288	0293	0207
<u> </u>			0234	0240	0240	0200	0251	0200	0200	$\frac{0271}{0270}$	0270	0201	0280	0282	0201
0 30			0233	0238	0244	0248	0253	0258	0263	0268	0273	0278	0285	0289	0290
34			0231	0236	0241	0246	0251	0257	0262	0267	0272	0277	0282	0287	0292
36			0230	0235	0240	0245	0250	0255	0260	0266	0271	0276	0281	0286	0291
- 38			0229	0234	0239	0244	0249	0254	0259	0264	0269	0274	0279	0284	0290
6 40			0227	0232	0238	0243	0248	0253	0258	0263	0268	0273	0278	0283	0288
42			0226	0231	0236	0241	0246	0252	0257	0262	0267	0272	0277	0282	6287
44			0225	0230	0235	0240	0245	0250	0255	0260	0265	0270	0275	0280	0285
46			0224	0229	0234	0239	0244	0249	0204	0259	0264	0269	0274	0219	0284
6 50			0220	0220	0200	0208	0240	0248	0200	0208	0203	0208	0273	0278	0200
0 50			0222	0227	0232	0237	0242	0247	0252	0257	0262	0200	0271	0270	0281
54			0220	0225	0230	0235	0239	0244	0249	0254	0259	0264	0269	0274	0279
56			0219	0224	0229	0233	0238	0243	0248	0253	0258	0263	0267	0272	0277
58			0218	0223	0227	0232	0237	0242	0247	0252	0257	0261	0266	0271	0276
7 0			0217	0222	0226	0231	0236	0241	0246	0251	0255	0260	0265	0270	0275
		1								1					

APPENDIX V: TABLE II.

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Log. A, for computing the First Correction of the Lunar Distance.

App.	P. Reduced parallax and refraction of moon,														
alt. of moon,	44'	45'	46'	47'	48′	49'	50′	51'	52'	53'	54'	55'	567	57'	
7° 0'	.0222	0226	0231	0236	0241	0246	0251	0255	0260	0265	0270	0275			
3	.0220	0225	0230	0234	0239	0244	$0249 \\ 0247$	0254 0252	$0258 \\ 0257$	0263	0268	0273 0271			
9	.0218 .0217	0223	0228	0233	0236	0242	0247	0252	$0257 \\ 0255$	0261	0200	0271			
12	.0215	0220	0225	0230	0234	0239	0244	0248	0253	0258	0262	0267			
7 15	.0214	0219	0223	0228	0233	0237	0242	0247	0251	0256	0261	0265			
18	.0213	0217	0222	0226	0231	0236	0240	0245	0250	0254	0259	0263			
$\frac{21}{24}$.0211 .0210	$0210 \\ 0214$	0220	0223	0230	0234	0239	0243	0246	$0253 \\ 0251$	$0257 \\ 0255$	0262			
27	.0208	0213	0217	0222	0227	0231	0236	0240	0245	0249	0254	0258			
7 30	.0207	0211	0216	0220	0225	0230	0234	0239	0243	0248	0252	0257			
33	.0206	0210	0215	0219	0224	0228	0232	0237	0241	0246	0250	0255			
39	.0204 .0203	0205	$0213 \\ 0212$	0218	0222	0225	0231	0233	0238	0244	0249	0253			
42	.0202	0206	0210	0215	0219	0224	0228	0232	0237	0241	0246	0250			
7 45	.0200	0205	0209	0213	0218	0222	0227	0231	0235	0240	0244	0248			
$\frac{48}{51}$.0199	0203	0208	0212	0216	0221	0225	0229	0234	0238	0242	0247	09.10		
54	.0198	0202	0205	0209	0213	0215	0222	0228	0232	0237	0239	0245	0249		
57	.0195	0200	0204	0208	0212	0217	0221	0225	0229	0234	0238	0242	0246		
8 0	.0194	0198	0203	0207	0211	0215	0219	0224	0228	0232	0236	0241	8245		
3	.0193	0197	0201	0206	0210	0214	0218	0222	0227	0231	0235	0239	0243		
9	.0192	0196	0199	0204	0208	0213	$0217 \\ 0215$	0221	0225 0224	0229	0232	0238	0242		
12		0193	0198	0202	0206	0210	0214	0218	0222	0227	0231	0235	0239		
8 15		0192	0196	0201	0205	0209	0213	0217	0221	0225	0229	0233	0237		
18		0191	0195	0199	0203	0207	0212	0217	0220	0224	0228	0232	0236		
21 91		0190	0194	0198	0202	0206	0210	0214	0218	0222	0226	0231	0230		
$\bar{27}$		0188	0192	0196	0200	0200	0208	0213	0216	0220	0224	0228	0232		
8 30	-	0187	0191	0195	0199	0203	0207	0211	0215	0219	0223	0226	0230		
- 33		0186	0190	0193	0197	0201	0205	0209	0213	0217	0221	0225	0229		
36		0184	0188	0192	0196	0200	0204	0208	$0212 \\ 0211$	$0216 \\ 0215$	0220	0224 0223	0228		
42		0182	0186	0191	0194	0198	0203	0206	0210	0210	0217	0221	0225		
8 45		0181	0185	0189	0193	0197	0201	0205	0208	$\overline{0212}$	0216	0220	0224		
48		0180	0184	0188	0192	0196	0200	0203	0207	0211	0215	0219	0223		
$\frac{51}{54}$		0179	0183	0187	0191	0195 -	0198	0202	0206	0210	0214	0218 0216	0221		
57		0177	0181	0185	0189	0192	0196	0200	0204	0208	9211	0215	0219		
9 0		0176	0180	0184	0188	0191	0195	0199	0203	0206	0210	0214	0218		
3		0175	0179	0183	0186	0190	0194	0198	0201	0205	0209	0213	0216		•
9		$0174 \\ 0173$	0178	0182	0185	0189	0193	0197	0200	0204	0208	0211	0215		
12		0172	0176	0180	0183	0187	0191	0194	0198	0202	0206	0209	0213		
9 15		0171	0175	0179	0182	0186	0190	0193	0197	0201	0204	0208	0212		
18		0170	0174	0178	0181	0185	0189	0192	0196	0200	0203	0207	0211		
$\frac{21}{24}$		0170	$0173 \\ 0172$	0177	$0180 \\ 0179$	0184	0188	0191	0195	0199	0202	$0206 \\ 0205$	0209		
$\frac{21}{27}$			0171	0175	0179	0182	0186	0189	0193	0196	0200	0204	0207		
9 30			0170	0174	0178	0181	0185	0188	0192	0195	0199	0203	0206		
33			0170	0173	0177	0180	0184	0187	0191	0194	0198	0201	0205	1	
36			0169	$0172 \\ 0171$	$0176 \\ 0175$	0179	0183	0186	0190	$0193 \\ 0109$	0197	0200	0204	1	
$\frac{33}{42}$			0167	0170	0175	0178	0181	0184	0188	0192	0195	0195	$0203 \\ 0202$		
9 45			0166	0169	0173	0176	0180	0183	0187	0190	0194	0197	0201		
48			0165	0169	0172	0176	0179	0182	0186	0189	0193	0196	0200	0203	
51	100		0164	0168	0171	$0175 \\ 0171$	$0178 \\ 0177$	0182	0185	0188	0192	0195	0199	0202	
57			0163	0166	0169	0174	0176	0180	0183	0186	0190	0194	0198	0200	
10 0			0162	0165	0169	0172	0175	0179	0182	0186	0189	0192	0196	0199	

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APPENDIX V: TABLE II.

	Reduced parallax and refraction of moon,													
alt, of moon.	46'	47'	48'	497	50'	51'	521	53'	ō4'	55'	56'	57'	58/	
										1				
10° 0′	.0162	0165	0169	0172	0175	0179	0182	0186	0189	0192	0196	0199		
	.0100 .0159	0164	0166	0171	$0174 \\ 0172$	0177 0176	0179	0184	0187	0191	0194	0197		
15	.0158	0161	0164	_0168	0171	0174	0178	0181	0184	0187	0191	0194		
20	.0156	0160	0163	0166	0170	0173	0176	0179	0183	0186	0189	0192	ł	
25	.0155	0158	0162	0165	0168	0171	0175	0178	0181	0184	0188	0191		
$10 \ 30 \ 35$	$.0104 \\ 0153$	0157	0160	0164	0167	0170	0173	$0177 \\ 0175$	0180	0183	0186	0189		
40	.0155	0155	0155	0161	0164	0105	0171	0174	0177	0180	0183	0186		
45	.0150	0153	0157	0160	0163	0166	0169	0172	0175	0179	0182	0185		
· 50	.0149	0152	0155	0158	0162	0165	0168	0171	0174	0177	0180	0183		
$\frac{30}{11}$	0148	0150	0154	0156	0159	-0103 -0162	0165	0168	0173	0170	0175	0182		
5	.0146	0149	0152	0155	0158	0161	0164	0167	0170	0173	0176	0179		
10		0148	0151	0154	0157	0160	0163	0166	0169	0172	0175	0178		
15		0146	0149	0152	0155	0158	0161	0164	0167	0170	0173	0176		
20 25		$0145 \\ 0144$	0148	0151	0154	0157	0159	0163	$0100 \\ 0165$	0169	0172 0171	$0175 \\ 0174$		
$\frac{20}{11,30}$		0143	0146	0149	0152	0155	0158	0161	0164	0167	0170	$\frac{0171}{0172}$		
35		0142	0145	0148	0151	0154	0157	0160	0162	0165	0168	0171		
40		0141	0144	0147	0150	0153	0156	0158	0161	0164	0167	0170		
40 50		0140	0143	$0146 \\ 0145$	0149	0151	0154	0157	0150	0163	0165	0169		
55		0138	0141	0144	0146	0149	0152	0155	0158	0161	0163	0166		
12 0		0137	0140	0143	0145	0148	0151	0154	0157	0159	0162	0165		
5		0136	0139	0142	0144	0147	0150	0153	0156	0158	0161	0164		
10		0135	$0138 \\ 0127$	0141	0143	0146	0149	0152	0154	0157	0160	0163		
$\frac{10}{20}$		0134 0133	0136	0139	0142	0140	0143	0150	0155	0155	0158	0162		
25		0132	0135	0138	0140	0143	0146	0148	0151	0154	0157	0159		
12 30		0131	0134	0137	0139	0142	0145	0147	0150	0153	0155	0158		
35		$0130 \\ 0120$	0133	$0136 \\ 0135$	$0138 \\ 0137$	0141	0144	0146	0149	$0152 \\ 0151$	0154	0157		
40		0129 0129	0132	0133	0137	0139	0143	0143	0143	0150	$0153 \\ 0152$	0155	0158	
50		0128	0130	0133	0136	0138	0141	0143	0146	0149	0151	0154	0156	
55		0127	0129	0132	0135	0137	0140	0142	0145	0148	0150	0153	0155	
$13 \ 0 \\ 5$		$0126 \\ 0125$	0129	0131	0134	0136	0139	0141	0144	0147	0149	0152	$0154 \\ 0152$	
10		0123	0123	$0130 \\ 0129$	0133	0135	0133-	0140	0143	0145	0143	0150	$0153 \\ 0152$	
$\tilde{15}$		0123	0126	0129	0131	0134	0136	0139	0141	0144	0146	0149	0151	
= 20		0123	0125	0128	0130	0133	0135	0138	0140	0143	0145	0148	0150	
$\frac{20}{12,20}$		0122	0124	$\frac{0127}{0198}$	0129	0132	0134	0137	0139	$\frac{0142}{0111}$	$\frac{0144}{0149}$	0147	0149	
15 50		$0121 \\ 0120$	0124 0123	$0120 \\ 0125$	$0129 \\ 0128$	0131 0130	0133	$0130 \\ 0135$	0138	0140	0143 0142	0146	$0148 \\ 0147$	
40		0120	0122	0124	0127	0129	0132	0134	0137	0139	0142	0144	0146	
45			0121	0124	0126	0128	0131	0133	0136	0138	0141	0143	0145	
55 D			$0120 \\ 0120$	$0123 \\ 0122$	0125	$0128 \\ 0127$	0130	$0132 \\ 0132$	0135	0137	0140	0142	$0145 \\ 0111$	
14 0			0119	0121	0121	0126	0128	0131	0133	0136	0138	0140	$\frac{0111}{0143}$	
5	[0118	0121	0123	0125	0128	0130	0132	0135	0137	0139	0142	
10			0117	0120	0122	0124	0127	0129	0132	0134	0136	0139	0141	
15 20			0117	0119	$0121 \\ 0121$	0124	0126	0128	0131	0133	0135	$0138 \\ 0137$	0140	
$\frac{20}{25}$			0115	0118	0120	0122	0124	0127	0129	0131	0134	0136	0138	
14 30			0114	0117	0119	0121	0124	0126	0128	0131	0133	0135	0137	
35			0114	0116	0118	0121	0123	0125	0128	0130	0132	0134	0137	
40			0113	$0115 \\ 0115$	$0118 \\ 0117$	0120	0122	$0124 \\ 0124$	0127	0129	0131	0134	0136	
50			0112	0114	0116	0118	0121	0123	0125	0127	0130	$0133 \\ 0132$	0134	
55			0111	0113	0116	0118	0120	0122	0124	0127	0129	0131	0133	
15 0			0110	0113	0115	0117	0119	0121	0124	0126	0128	0130	01.33	

APPENDIX V: TABLE II.

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App.	Reduced parallax and refraction of moon.													
alt. of moon,	43'	49'	50'	51'	52'	58'	54'	55′	56'	57′	58'	59'	 	
15° 0′	.0110	0113	0115	0117	0119	0121	0124	0126	0128	0130	0133			
10 20	$.0109 \\ 0108$	$0111 \\ 0110$	$0113 \\ 0112$	$0110 \\ 0114$	0118	0120	$0122 \\ 0121$	$0124 \\ 0123$	$0127 \\ 0125$	$0129 \\ 0127$	$0131 \\ 0129$			
30	.0107	0109	0111	0113	0115	0117	0119	0121	0124	0126	0128			
40	.0105	0107	0110	0112	0114	0116	0118	0120	0122	0124	0126		 	
16 0	0.0104 0.0103	$0106 \\ 0105$	$0108 \\ 0107$	0110	$0112 \\ 0111$	$0115 \\ 0113$	$0117 \\ 0115$	$0119 \\ 0117$	$0121 \\ 0119$	$0123 \\ 0121$	0125			
10 0	.0103	0104	0106	0108	0110	0112	0114	0116	0118	0120	0122			
20	.0101	0103	0105	0107	0109	0111	0113	0115	0117	0119	0121		•	
	0100	0102	$\frac{0103}{0102}$	0105	0107 0106	-0109 -0108	0110	$\frac{0113}{0112}$	$\frac{0115}{0114}$	$\frac{0117}{0116}$	$\frac{0119}{0118}$		 	
50	.0097	0099	0101	0103	0105	0107	0109	0111	0113	0115	0117			
17 0	.0096	0098	0100	0102	0104	0106	0108	0110	0112	0114	0116			
$\frac{10}{20}$.0095 .0094	0097	0099	$0101 \\ 0100$	$0103 \\ 0102$	$0103 \\ 0104$	0107	0109	0109	$0112 \\ 0111$	$0114 \\ 0113$			
		0095	0097	0099	0101	0103	0104	0106	0108	0110	0112		 	
40		0094	0096	0098	0100	0101	0103	0105	0107	0109	0111			
18 0		0093	0095	0097	0099	0100	0102	0104 0103	$0106 \\ 0105$	0108	0109			
10		0091	0093	0095	0097	0098	0100	0102	0104	0105	0107	0109		
20		0090	0092	0094	0096	0097	0099	0101	0103	0104	0106	0108		
30 40		$0089 \\ 0088$	0091	0093 0092	0095	0096	0098	0100	0102	$0103 \\ 0102$	0105	$0107 \\ 0106$		
$\tilde{50}$		0088	0089	0091	0093	0094	0096	0098	0099	0101	0103	0105		
19 0		0087	,0088	0090	0092	0093	0095	0097	0098	0100	0102	0104	 	
$\frac{10}{20}$		0086	0087	0089	0091	$0092 \\ 0092$	0094	0096	0098	0099	0101	$0103 \\ 0102$		
30		0084	0086	0087	0089	0091	0092	0094	0096	0097	0099	0101		
40 50		0083	0085	0087	0088	0090	0091	0093	0095	0096	0098	0100		
$\frac{30}{20}$		-0082	0083	0085	0086	0089	0090	$\frac{0092}{0091}$	0094	0095	0097	0099	 	
10		0081	0082	0084	0086	0087	0089	0090	0092	0093	0095	0097		
$\frac{20}{20}$		0080	0082	0083	0085	0086	0088	0089	0091	0093	0094	0096	-	
• 40		0079	0081	$0082 \\ 0082$	0084	$0080 \\ 0085$	0087	0089	0090	$0092 \\ 0091$	0095	0095		
50		0078	0079	0081	0082	0084	0085	0087	0088	0090	0091	0093	 	
$21 0 \\ 10$		$0077 \\ 0076$	$0079 \\ 0078$	0080	0082	0083	0085	0086	0088	0089	0091	0092		
$\frac{10}{20}$		0076	0078	0079	0081	$0082 \\ 0082$	0083	0085	0086	0087	0090	0091		
		0075	0076	0078	0079	0081	0082	0084	0085	0087	0088	0090	 	
40		0074	0076	0077	0079	0080	0082	0083	0084	0086	0087	0089		
22 0		0073	0074	0076	0077	0079	0081	0081	0083	0084	0086	0087		
10		0072	0074	0075	0076	0078	0079	0081	0082	0083	0085	0086		
$\frac{20}{30}$		0072	$\frac{0073}{0072}$	0074	$\frac{0076}{0075}$	0077	0079	0080	$\frac{0081}{0081}$	0083	0084	0085	 	
40		0070	0072	0073	0074	0076	0077	0079	0080	0081	0083	0084		
50		0070	0071	0072	0074	0075	0076	0078	0079	0081	0082	0083		
$\frac{23}{10}$		0069	0070	0072	0073	0074	0076	0077	0078	0080	0081	$0082 \\ 0082$		
20		0068	0069	0070	0072	0073	0074	0076	0077	0078	0080	0081	 	
30		0067	0069	0070	0071	0072	0074	0075	0076	0078	0079	0080		
40 50		0067	0068	0069	0071	0072	0073	0074	0076	0077	0078	0080		
24 0		5000	0067	0068	0069	0071	0072	0073	0074	0076	0077	0078		
10			0066	0067	0069	0070	0071	0073	0074	0075	0076	0078		
20 30			0066	0067	0068	0069	0071	0072 0071	0073	0074	0076	0077		
40			0065	0066	0067	0068	0069	0071	0072	0073	0074	0076		
$\frac{50}{25}$			0064	0065	0066	0068	0069	0070	0071	0072	0074	0075	 	
20 0			0063	0065	0066	0067	0068	0069	0071	0072	0073	0074	ł	

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APPENDIX V: TABLE II.

App.	1				Red	uced par	allax an	id refrac	tion of r	moon,	-			
ant. or moon.	50'	51'	52'	53'	54'	55'	56'	57'	581	59'	60′			
25° 0/	.0063	0065	0066	0067	0068	0069	0071	0072	0073	0074				
20	.0062	0064	0065	0066	0067	0068	0069	0071	0072	0073				
40	.0061	0062	0064	0065	0066	0067	0068	0069	0071	0072				
26 0	.0060	0061	0063	0064	0065	0060	0067	0068	0069	0071				
20	.0000	0000	0004	0000	0001	0000	0000	0007	0005	0069				
97 0	.0055	0059	0060	0062	0005	0063	0065	0065	0067	0068				
20	.0056	0057	0059	0060	0061	0062	0063	0064	0065	0066				
40	.0055	0057	0058	0059	0060	0061	0062	0063	0064	0065				
28 0	.0055	0056	0057	0058	0059	0060	0061	0062	0063	0064				
20	.0054	0055	0056	0057	0058	0059	0060	0061	0062	0063			1	
40	.0053	0054	0055	0056	0057	0058	0059	0060	0061	0062				
29 0	.0052	0055	0054	0000	0055	0057	0058	0059	0060	0061				
20	.0051	0052	0055	0054	0055	0055	0057	0058	0059	0050				
20 0	-0050	0051	0051	0052	0053	0054	0055	0056	0000	0055				
20	0049	0050	0051	0052	0052	0053	0054	0055	0056	0057				
40	.0048	0049	0050	0051	0052	0053	0053	0054	0055	0056				
31 0	.0047	0048	0049	0050	0051	0052	0053	0053	0054	0055				
20	.0047	0047	0048	0049	0050	0051	0052	0053	0054	0054	0055			
40	.0046	0047	0048	0048	0049	0050	0051	0052	0053	0054	0054			
32 0 0	.0045	0046	0047	0048	0048	0049	0050	0051	0052	0053	0054			
40	.0044	0045	0040	0047	0048	0049	0049	0000	0051	0052	0053			
33 0	0043	0046	0045	0045	0046	0040	0048	0049	0030	0051	0052			
20	0042	0043	0044	0045	0046	0046	0047	0048	0049	0050	0050			
40	.0042	0043	0043	0044	0045	0045	0046	0047	0048	0049	0050		1	
34 0	.0041	0042	0043	0043	0044	0045	0046	0046	0047	0048	0049			
20	.0040	0041	0042	0043	0043	0044	0045	0046	0047	0047	0048			
40	.0040	0041	0041	0042	0043	0044	0044	0045	0046	0047	0047			
35_{-00}	.0039	0040	0041	0041	0042	0043	0044	0044	0045	0046	0047			
40	.0039	0039	0040	0041	0044	0042	0045	0044	0044	0040	0040			
36 0	0037	0038	0039	0040	0040	0041	0042	0042	0043	0044	0044			
20	.0037	0038	0038	0039	0040	0040	0041	0042	0042	0043	0044			
40	.0036	0037	0038	0038	0039	0040	0040	0041	0042	0042	0043			
37 0	.0036	0036	0037	0038	0038	0039	0040	0040	0041	0042	0042			
20	.0035	0036	0037	0037	0038	0039	0039	0040	0040	0041	0042			
ao 40	.0030	0030	0036	0037	0037	0038	0039	0039	0040	0040	0041			
38 0	0034	0030	0035	0030	0034	0037	0030	0038	0030	0020	0040			
40	.0034	0034	0034	0035	0030	0037	0037	0033	0039	0039	0040			
39 0	.000.	0033	0034	0034	0035	0036	0036	0037	0037	0038	0039			
20	1	0033	0033	0034	0035	0035	0036	0036	0037	0037	0038			
40	1	0032	0033	0033	0034	0035	0035	0036	0036	0037	0037			
40 0		0032	0032	0033	0033	0034	0035	0035	0036	0036	0037	1		
20	1	0031	0032	0032	0033	0034	0034	0035	0035	0036	0036			
40	1 1	0031	0031	0032	0032	0033	0034	0034	0035	0035	0036			ł
⁺¹ 0	1	0030	0031	0031	0032	0035	0033	0034	0034	0030	0035			
	I	0029	0030	0030	0031	0032	0032	0033	0033	0034	0034			
42 0	1	0029	0029	0030	0031	0031	0032	0032	0033	0033	0034			
20	1	0029	0029	0030	0030	0031	0031	0032	0032	0033	0033			
40	1	0028	0029	0029	0030	0030	0031	0031	0032	0032	0033			
43 0	I!	0028	0028	0029	0029	0030	0030	0031	0031	0032	0032			_
20	1	0027	0028	0028	0029	0029	0030	0030	0031	0031	0032			
40	1	0027	0027	0028	0028	0029	0029	0030	0030	0031	0031			
44 0		0020	0027	0027.	0028	0028	0029	0029	0030	0030	0031			
40		0026	0026	0026	0027	0023	0028	0028	0029	0029	0030			
45 0		0025	0026	0026	0027	0027	0027	0028	0028	0029	0029			
10 4	4	0040	0040	00-0 1	00-1	00-1	00-1	0020	00-01	0020	0020		1	

APPENDIX V: TABLE II.

[Page 301.

					Podu	and name	ller and	rofroati	ion of m	007	 			
App. alt. of					neuu	eeu para	nax and	Tenacu						
moon.	51'	52'	53'	54/	55'	56'	57'	58'	59'	607				
150 01	0005	0000	0000	0097	0097	0097	0090	0099	0090	0090				
49~ 0/	. 0025	0026	0020	0027	0027	0027	0028	0028	0029	0029				
46 0	0023	0024	0025	0025	0026	0026	0027	0027	0027	0028				
30	.0023	0024	0024	0025	0025	0026	0026	0026	0027	0027				
47 0	.0023	0023	0024	0024	0025	0025	0025	0026	0026	0026				
30	.0022	0023	0023	0024	0024	0024	0025	0025	0025	0026		_		
48 0	.0022	0022	0023	0023	0023	0024	0024	0024	0025	0025				
30	.0021	0022	0022	0022	0023	0023	0024	0024	0024	0025				
49 0	.0021	0021	0022	0022	0022	0023	0023	0023	0024	0024				
50 0	. 0020	0021	0021	0021	0022	0022	0022	0020	0023	0023	 1			_
30 0	.0020	0020	0020	0021	0021	0022	0022	0022	0023	0023				
51 0	.0019	0019	0020	0020	0021	0020	0021	0021	0021	0022				
30	. 0018	0019	0019	0019	0020	0020	0020	0021	0021	0021				
52 0	.0018	0018	0019	0019	0019	0019	0020	0020	0020	0021				
30	.0018	0018	0018	0018	0019	0019	0019	0020	0020	0020				
53 0	. 0017	0017	0018	0018	0018	0018	0019	0019	0019	0020	-			
30	. 0017	0017	0017	0017	0018	0018	0018	0019	0019	0019				
0 16	.0016	0016	0017	0017	0017	0018	0018	0018	0018	0019	1			
55 0	0015	0010	0010	0016	0017	0017	0017	0013	0010	0010	 			
30	. 0015	0016	0015	0016	0016	0017	0017	0017	0017	0017				
56 0	.0015	0015	0015	0015	0016	0016	0016	0016	0017	0017	1			
30	.0014	0014	0015	0015	0015	0015	0016	0016	0016	0016				
57 0	.0014	0014	0014	0015	0015	0015	0015	0015	0016	0016				
30	. 0014	0014	0014	0014	0014	0015	0015	0015	0015	0015				
58 0	.0013	0013	0014	0014	0014	0014	0014	0015	0015	0015				
30	. 0013	0013	0013	0013	0014	0014	0014	0014	0014	0015				
-09 U -20-	.0012	0013	0013	0013	0013	0013	0014	0014	0014	0014		1		
60	0012	0012	0012	0013	0013	0013	0013	0013	0014	0014	 			
61	0012	0012	0012	0012	0013	0013	0013	0013	0013	0013				
62	. 0011	0011	0011	0011	0011	0011	0011	0012	0012	0012			-	
63	.0010	0010	0010	0010	0011	0011	0011	0011	0011	0011				
64	. 0009	0010	0010	0010	0010	0010	0010	0010	0010	0011	 1			
65	. 0009	0009	0009	0009	0009	0009	0010	0010	0010	0010				
66 67	. 0008	0008	0009	0009	0009	0009	0009	0009	0009	0009		•		
07	. 0008	0008	0008	0008	0008	0008	0008	0009	0009	0009	1			
69	0007	0007	0008	0003	0003	0008	0008	0008	0008	0008				
70	0007	0007	0007	0007	0007	0007	0007	0007	0003	00007	 			
71	. 0006	0006	0006	0006	0006	0006	0007	0007	0007	0007				
72	.0006	0006	0006	0006	0006	0006	0006	0006	0006	0006	1.			
73	.0005	0005	0006	0006	0006	0006	0006	0006	0006	0006				
74	. 0005	0005	0005	0005	0005	0005	0005	0005	0005	0006	 			
$\frac{75}{70}$. 0005	0005	0005	0005	0005	0005	0005	0005	0005	0005				
10	. 0004	0005	0005	0005	0005	0005	0005	0005	0005	0005				
78	.0004	0004	10004	10004	0004	0004	0004	0004	0004	0004				
79	.0001	0004	0004	0004	0004	0004	0004	0004	0004	0004				
80	,0004	0004	0004	0004	0004	0004	0004	0004	0004	0004	 			
81	,0003	0003	0003	0003	0003	0003	0003	0003	0003	0003				
82	. 0003	0003	0003	0003	0003	0003	0003	0003	0003	0003				
83	. 0003	0003	0003	0003	0003	0003	0003	0003	0003	0003				
84	. 0003	0003	0003	0003	0003	_0003	0003	0003	0003	0003	 	-		
85 66	. 0003	0003	0003	0003	0003	0003	0003	0003	0003	0003				
80 87	. 0003	0003	0003	0003	0003	0003	0003	0003	0003	0003				
88	. 0003	0003	0003	0003	0003	0003	0003	0003	0003	0003		1		
89	. 0003	0003	0003	0003	0003	0003	0003	0003	0003	0003				
90	. 0003	0003	0003	0003^{-}	0003	0003	0003	0003	0003	0003	 			

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APPENDIX V: TABLE III.

Ann alt	1			Reć	luced refr	action an	d paralla	x of sun c	er star.			
of sun or star.	0' 0''	1 0' 30''	1' 0''	1' 30"	2' 0"	2' 30"	8' 0"	8' 30''	4' 0"	4' 30"	5' 0''	5' 30''
										T 90		0.00
$5^{\circ} 0'$							1					
20							Ĺ					
30 40		٠										
6 0												10000
20 40										1		9.9970
7 0											9,9976	9.9974
$\frac{20}{40}$		•								9 9981	9.9977	9.9975
8 0										9.9982	9.9979	9.9977
$\frac{20}{40}$										9.9982 9.9983	9.9980 9.9981	9.9978
9 0							1		9.9986	9.9984	9.9982	9.9980
$20 \\ 40$									9.9986	9.9985	9.9983	9.9981
10					1			9.9989	9.9988	9.9986	9.9984	9.9982
11						'	9.9992	9.9991	9.9989	9.9987	9.9986	9.9984
$12 \\ 13$						9, 9995	9,9995 9,9994	9.9992 9.9992	9.9990 9.9991	9.9989	9.9987	9.9986
14					0.0007	9.9995	9.9994	9.9993	9.9992	9.9991	9.9990	0.00
15 16					9.9997	9.9996	9.9995	9.9994	9.9993	9.9992 9.9993	9.9991	
18				9.9999	9.9998	9.9997	9.9996	9.9995	9.9995			
$\frac{20}{25}$			0.0000	9.9999	9.9998 9.9999	9,9998	9.9997	9.9996	9.9996			
30		0.0001	0.0001	0.0000	0.0000	0.0000	9.9999	0.0000				
50	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001						
90	0.0001	0.0002	0.0002	0.0002								
App. alt.	「 <u> </u>			Red	luced refr	action an	d paralla:	x of sun o	r star.			
or star.	6' 0''	6' 30''	7' 0''	7' 30''	8' 0''	8' 30''	9' 0''	9' 30''	10' 0''	10' 30''	11' 0''	11' 30''
5° 0′			9.9951	9.9947	9.9944	9, 9940	9.9937	9.9933	9.9929	9.9926	9.9922	9.9919
10			9.9953	9.9949	9.9946	9.9942	9.9939	9,9935	9.9932	9,9928	9.9925	9.9921
$\frac{20}{30}$		9.9959	9.9956	9.9951	9.9948	9.9944	9.9941	9.9937	9.9934	9.9931	9.9927 9.9929	9.9924
40		9.9960	9.9957	9.9954	9.9951	9.9948	9.9944	9.9941	9.9938	9.9935	9.9932	
50 6 0	9.9965	9.9962	9.9958	9.9955	9.9952	9.9949	9.9946	9.9943	9.9940	9.9937		
20	9.9968	9.9965	9.9962	9.9959	9.9956	9.9954	9.9951	9,9948	9.9945	9.0000		
$^{+}70^{-}0$	9.9969	9.9967	9.9964	9.9961	9.9959	9.9956	9.9953	9.9951	9.9948	1		
20	9.9972	9.9970	9.9968	$\frac{9.0005}{9.9965}$	9,9963	9.9960	9.9958	9, 9900		!		
40	9.9974	9.9971	9.9969	9.9967	9.9965	9.9962						
	9.9970	9.9973 9.9974	9.9971	9.9908	9,9968	9, 9904					1 /	
40	9.9977	9.9975	9.9973	9.9971	!			-			'	
$9 0 \\ 20$	9.9978 9.9979	9.9976	9.9974	9,9972								
40	9.9980	9.9978	9.9976				1			(· · ·)	1 1	
10 11	9.9981 9.9983	9.9979	9.9977								1	
$\frac{11}{12}$	9,9985	0.000.	!									
13			1								1	
14			/				1				1	
16						·						
$\frac{18}{20}$									-		1	
25											1	
30 50					· I						1	

			Log, C,	APP for comp	ENDL uting the	X V: 7	TABLI rection of	E IV. the Luna	r Distanc	e,	[Page	e 303
App. alt.	l			Redu	need refra	ction and	parallax	of sun or	star.			
of sun or star.	0' 0"	0' 30"	1' 0"	1' 30″	2' 0"	2' 30"	3' 0"	3' 30"	4' 0"	4' 30"	5' 0"	5' 30"
$5^{\circ} 0' 20 40 6 0 20$												9. 9969
								9, 9988	9. 9984 9. 9986	9. 9980 9. 9982 9. 9984	9, 9974 9, 9978 9, 9980 9, 9982	9.9970 9.9972 9.9975 9.9978 9.9981
$ \begin{array}{r} 11 \\ 12 \\ 13 \\ 14 \\ 15 \end{array} $					9. 9995	9. 9993 9. 9994 9. 9994	9.9990 9.9991 9.9992 9.9993 9.9993	9.9989 9.9990 9.9991 9.9991 9.9992	9, 9987 9, 9988 9, 9989 9, 9990 9, 9991	9, 9986 9, 9987 9, 9988 9, 9989 9, 9990	9.9984 9.9985 9.9987 9.9988 9.9988 9.9989	9, 9982 9, 9984 9, 9985
$ \begin{array}{r} 16 \\ 17 \\ 18 \\ 20 \\ 25 \end{array} $			9. 9998 9. 9999	9. 9997 9. 9998 9. 9998	9.9996 9.9996 9.9996 9.9997 9.9998	9.9995 9.9995 9.9995 9.9996 9.9997	9.9994 9.9994 9.9994 9.9995 9.9995	9.9993 9.9993 9.9994 9.9994 9.9996	9, 9992 9, 9992 9, 9993 9, 9993	9.9990 9.9991 •		
$ \begin{array}{r} 30 \\ 40 \\ 50 \\ 90 \end{array} $	0.0000 0.0000	0.0000 0.0000 0.0000 0.0000 0.0000	9.9999 9.9999 0.0000 0.0000	9,9999 9,9999 9,9999 0,0000	9, 9998 9, 9999 9, 9999	9, 9998 9, 9999	9, 9997					
App.alt.				Red	nced refra	etion and	l parallar	c of sun o	r star.			
or star.	6' 0"	6' 30"	7' 0"	7' 30"	8' 0"	8' 30"	9' 0"	9' 30"	10' 0"	10' 30"	11' 0"	11' 30"
$5^{\circ} 0'$ 20 40 6 0 20	9. 9962 9. 9964 9. 9966	9. 9956 9. 9959 9. 9961 9. 9963	9.9949 9.9953 9.9955 9.9958 9.9958 9.9960	9. 9946 9. 9949 9. 9952 9. 9955 9. 9957	9.9942 9.9946 9.9949 9.9952 9.9955	9.9938 9.9942 9.9946 9.9949 9.9952	9.9935 9.9939 9.9943 9.9946 9.9949	$\begin{array}{c} 9.\ 9931\\ 9.\ 9936\\ 9.\ 9939\\ 9.\ 9943\\ 9.\ 9946\\ \end{array}$	9. 9927 9. 9932 9. 9936 9. 9940 9. 9943	9, 9924 9, 9929 9, 9933 9, 9937	9. 9920 9. 9925 9. 9930	9.9916 9.9922
	9.9968 9.9969 9.9973 9.9976 9.9979	9.9965 9.9967 9.9971 9.9974 9.9977	$\begin{array}{c} 9.\ 9962\\ 9.\ 9964\\ 9.\ 9969\\ 9.\ 9972\\ 9.\ 9975\\ \end{array}$	9.9960 9.9962 9.9966 9.9970	9.9957 9.9959 9.9964 9.9968	9, 9954 9, 9956 9, 9962	9, 9951 9, 9954 9, 9960	9, 9949 9, 9951	9.9946			
$ \begin{array}{c} 11 \\ 12 \\ 13 \\ 14 \\ 15 \\ \end{array} $	9, 9981 9, 9983	9, 9979										
$ \begin{array}{r} 16 \\ 17 \\ 18 \\ 20 \\ 25 \end{array} $												
$ \begin{array}{r} 30 \\ 40 \\ 50 \\ 90 \end{array} $												

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APPENDIX V: TABLE V.

App.			\$		Red	luced pa	rallax s	and refr	action (of moor	1.				
moon.	41'	42'	43'	44'	45'	46'	47'	48'	49'	50'	51'	52'	53'	54'	55'
5° 0'	.0283	0290	0296	0303	0310	0316	0323	0329	0336	0343	0349	0356	0362	0369	
3	.0280	0287	0293	0300	0307	0313	0320	0326	0333	0339	0346	0352	0359	0365	
6	.0277	0284	0291	0297	0304	0310	0317	0323	0330	0330	0342	0349	0355	0362	
12	0272	0279	0285	0294	0298	0304	0310	0320	0323	0330	0336	0340	0349	0355	
5 15	0270	0276	0282	0289	0295	0301	0308	0314	0320	0326	0333	0339	0345	0351	
18	.0267	0273	0280	0286	0292	0298	0305	0311	0317	0323	0330	0336	0342	0348	
$\tilde{21}$.0264	0271	0277	0283	0289	0296	0302	0308	0314	0320	0327	0333	0339	0345	
24	.0262	0268	0274	0281	0287	0293	0299	0305	0311	0317	0324	0330	0336	0342	
27	.0260	0266	0272	0278	0284	0290	0296	0302	0308	0314	0321	0327	0333	0339	
5 30	.0257	0263	0269	0275	0282	0288	0294	0300	0306	0312	0318	0324	0330	0336	
33	.0255	0261	0267	0273	0279	0285	0291	0297	0303	0309	0315	0321	0327	0333	
36	.0253	0259	0265	0271	0276	0282	0288	0294	0300	0306	0312	0318	0324	0330	
- 39 - 49		0200	0202	0268	0274	0280	0280	0292	0298	0303	0309	0315	0321	0327	
5 15		0204	0200	0200	0212	0277	0200	0209	0290	0202	0300	0912	0310	0324	
5 45 48		0252	0255	0203	0209	0275	0281	0287	0292	0298	0304	0310	0310	0321	
51	1	0247	0253	0259	0267	0270	0276	0281	0287	0293	0299	0304	0310	0316	
54		0245	0251	0257	0262	0268	0274	0279	0285	0290	0296	0302	0307	0313	
57		0243	0249	0254	0260	0266	0271	0277	0282	0288	0294	0299	0305	0310	
6 0		0241	0247	0252	0258	0263	0269	0275	0280	0286	0291	0297	0302	0308	
3		0239	0245	0250	0256	0261	0267	0272	0278	0283	0289	0294	0300	0305	
6		0237	0243	0248	0254	0259	0265	0270	0275	0281	0286	0292	0297	0302	
9	i i	0235	0241	0246	0252	0257	0262	0268	0273	0279	0284	0289	0295	0300	
12		0233	0239	0244	0249	0255	0260	0266	0271	0276	0282	0287	0292	0298	
6 15		0231	0237	0242	0247	0253	0258	0263	0269	0274	0279	0285	0290	0295	
18		0230	0235	0240	0245	0251	0256	0261	0267	0272	0277	0282	0288	0293	
21		0228	0233	0238	0243	0249	0204	0259	0264	0270	0270	0280	0280	0290	
24 97		0220	0231	0230	0342	0247	0252	0257	0202	0207	0275	0278	0285	0288	0201
6.30			0220	0204	0240	0240	0200	0200	0200	0200	0268	0270	0201	0280	0201
33			0227	0235	0236	0245	0248	0255	0256	0203	0208	0274	0275	0204	0205
36			0224	0229	0234	0239	0244	0249	0254	0259	0264	0269	0274	0279	0284
39			0222	0227	0232	0237	0242	0247	0252	0257	0262	0267	0272	0277	0282
42			0220	0225	0230	0235	0240	0245	0250	0255	0260	0265	0270	0275	0280
6 45			0219	0224	0229	0234	0239	0244	0248	0253	0258	0263	0268	0273	0278
48			0217	0222	0227	0232	0237	0242	0247	0251	0256	0261	0266	0271	0276
51			0216	0220	0225	0230	0235	0240	0245	0250	0254	0259	0264	0269	0274
54			0214	0219	0224	0228	0233	0238	0243	0248	0253	0257	0262	0267	0272
51			0212	0217	0222	0227	0232	0236	0241	0246	0251	0255	0260	0265	0270
7 0			0211	0216	0220	0225	0230	0235	0239	0244	0249	0254	0258	0263	0268
3 6		-	0209	0214	0219	0223	0228	0233	0238	0242	0247	0202	0200	0201	0200
9			0208	0212	0217	0222	0227	0231	0230	0241	0240	0200	0255	0200	0204
12				0209	0214	0219	0223	0228	0232	0237	0242	0246	0251	0255	0260
7 15				0208	0212	0217	0222	0226	0231	0235	0240	0245	0249	0254	0258
18				0206	0211	0216	0220	0225	0229	0234	0238	0243	0247	0252	0256
21				0205	0209	0214	0219	0223	0228	0232	0237	0241	0246	0250	0255
24				0204	0208	0213	0217	0222	0226	0230	0235	0239	0244	0248	0253
27	1			0202	0207	0211	0216	0220	0224	0229	0233	0238	0242	0247	0251
7 30				0201	0205	0210	0214	0218	0223	0227	0232	0236	0241	0245	0249
33	1			0199	0204	0208	0213	0217	0221	0226	0230	0234	0239	0243	0248
36				0198	0202	0207	0211	0215	0220	0224	0229	0233	0237	0242	0246
- 39 - 49				0197	0201	0205	0210	0214	0218	0223	0227	0231	0236	0240	0244
44	'			0195	0200	0204	0208	0213	0217	0221	0220	0230	0234	0238	0243
7 40				0194	0198	0203	0207	0211	0215	0220	0224	0228	0232	0237	0241
40	l			0195	0197	0201	0203	0210	0214	0218	0222	0227	0251	0255	0259
51			1	0191	0190	0200	0204	0208	0213	0217	0221	0220	0220	0234	0236
57				0189	0193	0197	0205	0206	0210	0214	0218	0222	0226	0230	0235
8 0				0188	0192	0196	0200	0204	0208	0212	0217	0221	0225	0229	0233
	4	1		0100	0102	0100	0.00	0401	0.001	1 04141	1 Omili	1.0 mm 1	0440	00000	0.000

APPENDIX	V:	TABLE	V.
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Log. D, for computing the First Correction of the Lunar Distance.

App.					Reduc	ed para	allax ar	d refra	etion of	f moon.					
alt. of moon.	45'	46'	47'	48'	497	50'	51′	52'	53/	54'	55'	56′	57'	581	
8° 0′	.0192	0196	0200	0204	0208	0212	0217	0221	0225	0229	0233	0237			
5	.0190	0194	0198	0202	0206	0210	0214	0218	0222	0227	0231	0235			
10	.0188	0192	0196	0200	0204	0208	0212	0216	0220	0224	0228	0232			
- 10 - 20	.0180	0190	0194	0198	0202	0200	0210	0214	0218	0222	0220	0230			
25	0182	0186	0190	0194	0197	0201	0205	0209	0213	0217	0220	0225			
8 30	. 0180	0184	0188	0192	0195	0199	0203	0207	0211	0215	0219	0223			
35	.0178	0182	0186	0190	0193	0197	0201	0205	0209	0213	0216	0220			
40	. 0176	0180	0184	0188	0191	0195	0199	0203	0207	0210	0214	0218			
	-0174	$\frac{0178}{0176}$	0182	0180	0189	$\frac{0195}{0101}$	0197	0201	0200	0208	$\frac{0212}{0210}$	0210 0211			
50	.0173	$0170 \\ 0175$	0178	0184	0186	0191	0193	0195	0202	0200	0210	$0214 \\ 0212$		ĺ	
9 0	.0169	0173	0177	0180	0184	0188	0191	0195	0198	0202	0206	0209			
5	.0167	0171 -	0175	0178	0182	0186	0189	0193	0197	0200	0204	0207			
10	. 0166	0169	0173	0177	0180	0184	0187	0191	0195	0198	0202	0205			
10	.0164	0168	0171	0170	0179	0182	0186	0189	0193	0196	0200	0203			
25	. 0161	0165	0168	0173	0175	0179	0184	0186	0189	0193	0196	0199			
9 30		0163	0166	0170	0173	0177	0180	0184	0187	0191	0194	0198			
35		0161	0165	0168	0172	0175	0179	0182	0185	0189	0192	0196			
40		0160	0163	0167	0170	0174	0177	0180	0184	0187	0191	0194	0105		
40 50		$0158 \\ 0157$	0162	0100	0169	0172 0170	0175	0179	0182	0185	0189	0192	0195		
$55 \\ 55 \\ 55 \\ 55 \\ 55 \\ 55 \\ 55 \\ 55 $		0156	0159	0162	0165	0169	0172	0175	0179	0182	0185	0189	0192		
10 0		0154	0157	0161	0164	0167	0171	0174	0177	0180	0184	0187	0190		
5		0153	0156	0159	0162	0166	0169	0172	0175	0179	0182	0185	0188		
10		0151	0155	0158	0161	0164	0167	0171	0174	0177	0180	0183	0187		
20		0150	$0155 \\ 0152$	0155	0150	0163	0100	0169	0172	0175	0179	0182	0180		
25		0147	0150	0154	0157	0160	0163	0166	0169	0172	0175	0179	0182		
10 30		0146	0149	0152	0155	0158	0162	0165	0168	0171	0174	0177	0180		
35		0145	0148	0151	0154	0157	0160	0163	0166	0169	0172	0175	0179	ŀ	1
40 45		0143	0147	0150	0153	0154	0159	0162	0165	0168	0171	0174	0177 0175		
• 50		0142	0144	0143	0150	0154	0156	0159	0162	0165	0168	0171	0174		
55		0140	0143	0146	0149	0152	0155	0158	0161	0164	0167	0170	0172		
11 0		0139	0142	0145	0147	0150	0153	0156	0159	0162	0165	0168	0171		
5		0137	0140	0143	0146	0149	0152	0155	0158	0161	0164	0167	0170		
10			0139	0142	0145	0148	0151	0152	0157 0155	0159	0162	0165	0167		
20			0137	0140	0143	0145	0148	0151	0154	0157	0160	0163	0165		
25			0136	0139	0141	0144	0147	0150	0153	0156	0158	0161	0164		
11 30			0135	0137	0140	0143	0146	0149	0151	0154	0157	0160	0163		
			0133	$0136 \\ 0135$	0139	0142	0140	0147	0150	0153	0154	0159	0161		
			0131	0134	0137	0140	0142	0145	0148	0150	0153	0156	0159		
50			0130	0133	0136	0138	0141	0144	0147	0149	0152	0155	0157		
55			0129	0132	0135	0137	0140	0143	0145	0148	0151	0153	0156		
12 0			0128	0131	0134	0136	0139	0142	0144	0147	0150	0152	$0155 \\ 0151$		
			0127	0130	0132	0130	$\frac{0138}{0137}$	0130	0143	0140	0140	0151	0159		
15			0125	0123	0130	0133	0136	0133	0142	0143	0146	0149	0151		
20			0124	0127	0129	0132	0135	0137	0140	0142	0145	0147	0150		
25			0123	0126	0128	0131	0133	0136	0139	0141	0144	0146	0149		
12 30			0122	0125	0127	0130	0132	0135	0138	0140	0143	0145	0148		
30 40			$0121 \\ 0120$	0124	0126	0129	0131	0134	0136	0139	0141	0144	0147		
45			0119	0122	0124	0127	0129	0132	0134	0137	0139	0142	0144	0147	
50			0118	0121	0123	0126	0128	0131	0133	0136	0138	0141	0143	0146	
55			0118	0120	0123	0125	0127	0130	0132	0135	0137	0140	0142	0145	
13 0			0117	0119	0122	0124	0126	0129	0131	0134	0136	0139	0141	0143	

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APPENDIX V: TABLE V.

Ann					Redu	eed para	llax and	i refract	ion of r	noon.				
App. alt. of moon.	17/	19/	1 10/	50/	51/	2.0/	1 2.9/		55/	1 5.6/	\$71	= 0/	1 =0/	1 1
Aba	+1	+5	+9 	ə u	16	92	99	94	99	90.	91.	58.	59.	
13° 0'	. 0117	0119	0122	0124	0126	0129	0131	0134	0136	0139	0141	0143		
10	. 0115	0117	0120	0122	0125	0127	0129	0132	0134	0137	0139	0141		
20	.0113	0116	0118	0120	0123	0125	0127	0130	0132	0134	0137	0139		
30	.0112	0114	0110	0119	0121	0125	0125	0128	0130	0132	0135	0137		
		0114	0113	0115	0117	0121	0124	0120	0126	0101	0100	0100	-	
14 0	1	0109	0110	0113	0116	0118	0120	0124	0120	0120	0151	0155		
10	1	0107	0110	0112	0114	0116	0118	0121	0123	0125	0127	0129		
20		0106	0108	0110	0112	0114	0117	0119	0121	0123	0125	0127		
30	1	0104	0106	0109	0111	0113	0115	0117	0119	0121	0123	0126		
40		0103	0105	0107	0109	0111	0113	0115	0118	0120	0122	0124		
50	1	0101	0103	0106	0108	0110	0112	0114	0116	0118	0120	0122		
10 - 10	1 -	0100	0104	0104	0105	0105	0110	0112	0114	0110	0118	0120		
20	1	0095	00101	0105	0103	0105	0107	0109	0111	0113	0117	0115		
	I'	0096	0098	0100	0102	0104	0106	0108	0110	0112	0113	0115		
40	1	0094	0096	0098	0100	0102	0104	0106	0108	0110	0112	0114		
50		0093	0095	0097	0099	0101	0103	0105	0107	0108	0110	0112		
16 0	1 /	0092	0094	0096	0098	0099	0101	0103	0105	0107	0109	0111		
10	('	0091	0093	0094	0096	0098	0100	0102	0104	0106	0107	0109		
20	1	0089	0091	0093	0095	0097	0099	0100	0102	0104	0106	0108		
30 40	1	0088	0090	0092	0094	0090	0097	0099	0101	0103	0105	0100		
50	1	0087	0085	0091	0091	0094	0090	0095	0100	0101	0105	0105		
17 0	1	0085	0087	0088	0090	0092	0093	0095	0097	0099	0100	0102		
10	()	0084	0085	0087	0089	0091	0092	0094	0096	0097	0099	0101		
20	1	0083	0084	0086	0088	0089	0091	0093	0094	0096	0098	0099		
30	1		0083	0085	0086	0088	0090	0091	0093	0095	0096	0098		
40	1	1	0082	0084	0085	0087	0089	0090	0092	0094	0095	0097	1	
10 0	l!	ł!	0081	0085	0084	0080	0087	0089	0091	0092	0094	0090		
$18 \ 0 \ 20$	1	1	0080	0082	0085	0080	0080	0088	0090	0080	0095	0094	0093	
40	1	1	0076	0077	0079	0080	0082	0080	0085	0085	0080	0090	0091	
19 0	1		0074	0075	0077	0078	0080	0081	0083	0084	0086	0087	0089	
20			0072	0073	0075	0076	0078	0079	0081	0082	0084	0085	0086	
40			0070	0072	0073	0074	0076	0077	0079	0080	0081	0083	0084	
$20 \ 0$	1	1	0068	0070	0071	0073	0074	0075	0077	0078	0079	0081	0082	
20	1	1	0067	0068	0069	0071	0072	0073	0075	0076	0077	0079	0080	
91 0	1	1	0000	0000	0008	0009	0070	0072	0073	0074	0075	0077	0076	
20	II		0062	0063	0064	0065	0067	0010	0069	0072	0072	0073	0074	[]
40		1	0060	0061	0063	0064	0065	0066	0067	0069	0070	0071	0072	
22 0	1	1	0059	0060	0061	0062	0063	0065	0066	0067	0068	0069	0070	
20	1	()	0057	0058	0059	0061	0062	0063	0064	0065	0066	0068	0069	
40	I	.[]	0056	0057	0058	0059	0060	0061	0062	0064	0065	0066	0067	
23 0	1	1	0054	0055	0057	0058	0059	0060	0061	0062	0063	0064	0065	
40	1 1	[]	0055	0004	0055	0055	0057	0057	0055	0000	0001	0005	000+	1
24 0	1 1	1	0050	0051	0052	0053	0054	0055	0056	0057	0058	0059	0060	1
20	i	()		0050	0051	0052	0053	0054	0055	0056	0057	0058	0059	
40	1	()		0049	0050	0051	0052	0053	0053	0054	0055	0056	0057	
25 0	i	1	(0047	0048	0049	0050	0051	0052	0053	0054	0055	0056	1
20	i		1	0046	0047	0048	0049	0050	0051	0052	0053	0053	0054	
96 0	i)	1		0040	0040	0017	0048	0049	0049	0050	0001	0052	0000	
20 0		[]		0013	0010	0014	0040	0016	0017	0010	0000	0001	000-	
40)	1 1		0040	0040	0043	0040	0040	0046	0040	00+0	0040	0000	1
27 0	1	(1	0040	0041	0042	0043	0011	0014	0045	0046	0047	0047	1
20	1	()	1	0039	0040	0041	0042	0042	0043	0044	0045	0045	0046	1
40	· · · · · · · · · · · · · · · · · · ·			0038	0039	0040	0040	0041	0042	0043	0043	0044	0045	
28 0		1		0037	0038	0039	0039	0040	.0041	0042	0042	0043	0044	

APPENDIX V: TABLE V.

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				Dade	od to and	or ord	frontier	f meen			
App. alt. of				Reduc	ee paran	ax and re	erraction (or moon.	1		
moon.	50'	517	52'	531	54'	55'	56'	57/	58'	59'	60'
	0.0007	0.0000	0.0000	0.0000	0.0010	0.0011	0.0010	0.0010	0.0010	0.0011	
$28^{\circ} 0'$	0.0037	0.0038	0.0039	0.0039	0.0040	0.0041	0.0042	0.0042	0.0043	0.0044	
20 0	0.0030	0.0035	0.0037	0.0036	0.0037	0.0035	0.0040	0.0040	0.0041	0.0042	
20 0	0.0033	0.0033	0.0034	0,0035	0.0035	0.0036	0.0036	0.0837	0.0038	0.0038	
30 0	0.0031	0.0032	0.0032	0.0033	0.0034	0.0034	0.0035	0.0035	0.0036	0.0037	
- 30	0.0030	0.0030	0.0031	0.0031	0.0032	0.0033	0.0033	0.0034	0.0034	0.0035	
31 0	0.0028	0.0029	0.0029	0.0030	0.0031	0.0031	0.0032	0.0032	0.0033	0.0033	
30	0.0027	0.0028	0.0028	0.0029	0.0029	0.0030	0.0030	0.0031	0.0031	0.0032	0.0032
32 0	0.0026	0.0026	0.0027	0.0027	0.0028	0.0028	0.0029	0.0029	0.0030	0.0030	0.0031
30	0.0024	0.0025	0.0025	0.0020	0.0020	$\frac{0.0027}{0.0025}$	$\frac{0.0027}{0.0027}$	0.0028	0.0028	$\frac{0.0029}{0.0027}$	0.0029
33 0	0.0023 0.0022	0.0024 0.0022	0.0024	0.0020	0.0025 0.0021	0.0023 0.0024	0.0020 0.0025	0.0026	0.0027	0.0027	0.0028
34 0	0.0022 0.0021	0.0021	0.0023	0.0022	0.0024 0.0022	0.0023	0.0023	0.0023	0.0020	0.0020	0.0025
30	0.0020	0.0020	0.0020	0.0021	0.0021	0.0022	0.0022	0.0022	0.0023	0.0023	0.0023
35 0	0.0018	0.0019	0.0019	0.0020	0.0020	0.0020	0.0021	0.0021	0.0021	0.0022	0.0022
30	0.0017	0.0018	0.0018	0.0018	0.0019	0.0019	0.0019	0.0020	0.0020	0.0020	0.0021
36 0	0.0016	0.0017	0.0017	0.0017	0.0018	0.0018	0.0018	0.0019	0.0019	0.0019	0.0019
30	0.0015	0.0016	0.0016	0.0016	0.0016	0.0017	0.0017	0.0017	0.0018	0.0018	0.0018
37 0	0.0014	0.0014 0.0013	0.0015	0.0013	0.0013	0.0010	0.0010 0.0015	0.0015	0.0016	0.0017	0.0017
38 0	0.0013	0.0013	0.0013	0.0014	$\frac{0.0014}{0.0013}$	0.0013	0.0011	0.0013	0.0010	0.0013	0.0014
30	0.0012 0.0011	0.0012	0.0013	0.0013	0.0013	0.0012	0.0014 0.0012	0.0014 0.0013	0.0013	0.0014 0.0013	0.0013
39 0	0.0010	0.0010	0.0011	0.0011	0.0011	0.0011	0.0011	0.0012	0.0012	0.0012	0.0012
30		0.0009	0.0010	0.0010	0.0010	0.0010	0.0010	0.0010	0.0011	0.0011	0.0011
40		0.0008	0.0009	0.0009	0.0009	0.0009	0.0009	0.0009	0.0010	0.0010	0.0010
41		0.0007	0.0007	0.0007	0.0007	0.0007	0.0007	0.0007	0.0007	0.0008	0.0008
42		0.0005	0.0005	0.0005	0.0005	0.0005	0.0005	0.0005	0.0005	0.0005	0.0006
43		0.0003	0.0003	0.0003	0.0003	0.0003	0.0003	0.0003	0.0003	0,0003	0.0004
45		0.0001	0.0000	0.0001	0.0001	0.0001	0.0001	0.0002	0.0002	0.0002	0.0002
46		9.9998	9,9998	9.9998	9.9998	9,9998	9,9998	9.9998	9.9998	9.9998	9.9998
47		9.9997	9.9997	9.9997	9.9997	9.9996	9.9996	9.9996	9.9996	9,9996	9,9996
48		9.9995	9.9995	9.9995	9.9995	9.9995	9.9995	9.9995	9,9995	9.9994	9.9994
49.		9.9994	9.9994	9.9994	9.9993	9.9993	9.9993	9,9993	9.9993	9.9993	9.9993
50		9.9992	9.9992	9.9992	9.9992	9.9992	9.9992	9.9992	9.9991	9.9991	9.9991
51		9.9991	9.9991	9.9991	9.9991	9.9990	9.9990	9.9990	9.9990	9,9990	9.9990
52 53		9.9990	9.9990	9 9988	9.9988	9.9988	9.9988	9 9987	9 9987	9.9987	9.9987
54		9,9988	9.9987	9.9987	9,9987	9.9987	9.9986	9.9986	9.9986	9,9986	9,9985
55		9.9986	9.9986	9.9986	9.9986	9.9985	9.9985	9.9985	9.9984	9.9984	9.9984
56		9.9985	9.9985	9.9985	9.9984	9.9984	9.9984	9.9984	9.9983	9.9983	9.9983
57		9.9984	9.9984	9.9984	9.9983	9.9983	9.9983	9.9982	9.9982	9.9982	9.9981
58		9.9983	9.9983	9.9983	9.9982	9.9982	9.9982	9.9981	9,9981	9.9981	9.9980
60 60		9,9982	9,9982	9.9981	9,9980	9,9980	9.9980	9.9980	9,9980	9.9979	9 9978
61		9.9980	9.9980	9.9980	9.9979	9,9979	9.9978	9.9978	9 9978	9.9977	9.9977
62		9.9979	9,9979	9.9979	9.9978	9.9978	9.9977	9.9977	9.9977	9.9976	9.9976
63		9.9979	9.9978	9.9978	9.9977	9.9977	9.9976	9.9976	9.9976	9.9975	9.9975
64		9.9978	9.9977	9.9977	9.9976	9.9976	9.9976	9.9975	9.9975	9.9974	9.9974
65		9.9977	9.9977	9.9976	9.9976	9,9975	9.9975	9.9974	9.9974	9.9973	9.9972
66 07		9.9976	9.9976	9.9975	9.9975	9.9974	9.9974	9.9973	9.9973	9.9973	9.9972
68		9,9976	9.9975	9,9975	9.9974	9.9974	9.9973	9.9973	9.9972 0.0071	9.9972 0.0071	9.9971
69		9,9974	9,9974	9,9973	9,9973	9,9972	9,9972	9,9971	9.9971	9,9970	9, 9970
70		9.9974	9.9973	9.9973	9.9972	9.9972	9.9971	9.9970	9.9970	9.9969	9, 9969
72		9.9972	9.9972	9.9971	9.9971	9.9970	9.9970	9.9969	9.9969	9,9968	9.9968
74		9.9971	9.9971	9.9970	9.9970	9,9969	9.9969	9.9968	9.9968	9.9967	9.9966
76		9.9971	9.9970	9.9969	9.9969	9.9968	9.9968	9.9967	9,9966	9,9966	9.9965
78		9.9970	9.9969	9,9969	9.9968	9.9967	9.9967	9,9966	9,9966	9.9965	9,9964
80		9.9909	9.9969	9.9968	9.9967	9.9967	9,9966	9,9965	<u>8, 9969</u>	9.9964	9, 9904
90		9.9968	9,9967	9, 9966	a. aaee	9. 9969	9. 9964	9. 9964	9, 9963	a . a a63	9,9902

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APPENDIX V: TABLE VI.

Second Correction of the Lunar Distance.

Appar-	1						First	correc	tion of	distan	ee.						Lanar
ent dis- tance.	3'	171	10	121	14'	16'	18'	20'	21/	22/	23'	24'	25'	26'	277	28'	ent dis- tance,
15° 0'	0	0	3	5	6	8	11	13	14	16	17	19	20	99		26	Add,
30	ŏ	$\overline{2}$	3	5	6	8	10	13	14	15	17	18	20	21	23	25	
16 0	0	1	3	+	6	8	10	12	13	15	16	18	19	21	22	24	
30	0	1	3	4	6	8	10	12	13	14	16	17	18	20	21	23	
17 0		1	3	4	6	7	9_	11	13	14	15	16	18	19	21	22	
30	0	1	3	+	5	7	9	11	12	13	15	16	17	19	20	22	
18 0	0	1	3	+	5	7	9	11	12	13	14	15	17	18	20	21	i
10 0	0	1	0 2	± 1	5	ß	8	10	12	13	14	10	10	18	19	20	
30	ŏ	1	0	1	5	6	8	10	11	12	13	14	15	17	18	19	
20 0	-0					6		10	-11	12	13	11	15	-16		10	
21	ŏ	1	$\frac{1}{2}$	3	4	6	7	9	10	11	12	13	14	15	17	18	
22	Ŏ.	î	$\tilde{2}$	3	4	6	7	9	10	10	iī	12	14	15	16	17	
23	0	1	2	3	4	5	7	8	9	10	11	12	13	14	15	16	
24	0	1	2	3	4	5	6	8	9	9	10	11	12	13	14	15	
25	0	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	
26	0	1	2	3	. 4	5	6	7	8	9	9	10	11	12	13	14	
27	0	1	2	$\frac{2}{2}$		4	6	7	8	8	9	10	11	12	12	13	
28	0	1	2	2	3	+	- D - 5		1	8	9	9	10	11	12	13	
29	-0	<u></u>		2				0		8	8		10	11		12	
30				2	3	4	0 5	0	l B	4	8	9	9	10		12	
31 29		1	1	3	3	4	5	6	6	7	07	8	9	10	10	11	
33	ŏ	1	1	2	3	3	4	5	6	$\frac{1}{7}$	7	8	8	9	10	11	
34	ŏ	1	i	$\frac{1}{2}$	3	3	4	5	6	6	7	7-	8	9	10	10	
35	-0^{-}	1		$\overline{2}$	$\overline{2}$	3	+	5	5	6	7	7	8	8	9	10	
36	ŏ	î	î	$\overline{2}$	$\overline{2}$	3	4	5	5	6	6	7	8	8	9	9	
37	0	1	1	2	2	3	4	5	5	6	6	7	7	8	8	9	
38	0	1	1	2	2	3	4	4	5	5	6	6	7	8	8	9	
39	0	1	1	2	2	3	3	4	5	5	6	6	7	7	8	8	
40	0	1	1	2	$\begin{vmatrix} 2 \\ 2 \end{vmatrix}$	3	3	4	5	5	6	6	7	7	8	8	140°
42	0	0					3	4	4	Ð	9 5	6		7	7	8	138
44	0	0	1	1			3	4	-+	+	0	0 5	5	0	6	-	130
40	ŏ	0	1	1		$\frac{2}{2}$	3	3	3	1	4	5	5	5	6	6	132
50	-0-	$-\frac{1}{0}$	1	1			2									- 6	130
52	ŏ	ŏ	i	i	1	$\overline{2}$	$\tilde{2}$	3	3	3	4	4	4	5	5	5	128
54	0	Ő	1	ī	1	2	2	3	3	3	3	4	4	4	5	5	126
56	0	0	1	1	1	2	2	2	3	3	3	3	4	4	4	5	124
58	0	0	1	1	1	1	2	2	2	3	3	3_	3	4	4	4	122
60	0	0	0	1	1	1	2	2	2	2	3	3	3	3	4	4	120
62	0	0	0	1	1	1	2	2	2	2	2	3	3	3	3	4	118
64	0	0	0	1	1	1	1	2	. 2	2	2	2	3	3	3	3	116
66	0	0	0				1	2	2	2	2			3	3	3	114
00	-0	0			1		1	1									112
70	0	0	0				1	1	1	2	1	2	$\frac{2}{2}$	2	2	2	106
78	l o	0	0	01	0		1	1	1	1	1	1	1	ĩ	1	1	100
82	ŏ	0	0	0	0	ő	Ô	ō	1	î	î	i	i	1	1	ī	98
86	ŏ	ŏ	ŏ	0	0	ŏ	ŏ	0	ô	Õ	Õ	0	Ō	ô	Ô	Ō	94
90	0	0	$\overline{0}$	$\overline{0}$	0	0	0		0	0	<u>0'</u>	0	0	0	0	-0	- 90
Appar-	3'	71	10'	12/	14'	16'	18'	20'	21'	22'	23'	24'	25'	26'	27/	28'	Appar- ent dis-
tance.							First	correc	tion of	distan	cc.						tance.

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Second Correction of the Lunar Distance.

Appar-	-						Firs	t corre	etion o	f distar	nce.						Appar-
cnt dis- tance.	29'	30'	31'	32'	33'	347	85'	36′	87′	38′	39 ′	40′	41′	42'	43'	447	ent dis- tance.
Sub.	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	Add.
15° 0′	27	29	31	33	35	38	40	42	45	47	50	52	55	57	60	63	
30	26	28		32	34	36	39	41	$\frac{43}{42}$	45	48	50	53	56	58	$61 \\ 50$	
16 0	26	27	29	31	33	30	3/	39	42	44	46	49	01 50	- 54 59	- 56 54	59 57	
17 0	20	26	20	20	31	33	35	37	39	- 1 0 	13	46	48	50	59	55	
20	92	-20	27	20	30	- 32	- 3.1	- 36	- 38		-19	-44	47	-40	51	-51	
18 0	$\frac{23}{23}$	$\frac{20}{24}$	$\frac{21}{26}$	28	29	31	33	35	37	39	41	43	45	47	50	52	
30	22	$\overline{23}$	25	27	28	30	32	34	36	38	40	42	44	46	48	50	
19 0	21	23	24	26	$\cdot 28$	29	31	- 33	35	37	39	41	43	45	47	49	
30	21.	22	24	25	27	28	30	32	34	36	37	39	41	43	46	48	
20	20	22	23	25	26	28	-29	31	33	35	36	38	40	42	44	46	
21	19	20	22	23	25	26	28	29	31	33	35	36	38	40	42	-44	
22	18	19	21	$\frac{22}{21}$	24	25	26	28	30	$\frac{31}{20}$	33	35	36	38	40	42	
23	17	19	20	21	22	24	25	27	28	30	31	33	30	30	38	40	
- 44	$\frac{10}{10}$	10	19	20	- 21	- 40	- 44	20	- 21	20	- 00		- 00	- 00-	- 00 - 95	- 00	
20 26	10	16	18	19	19	22	23	24 23	$\frac{20}{25}$	26	20	- 30 - 29	30	30	30	30	
27	14	15	16	18	19	$\frac{21}{20}$	$\frac{22}{21}$	$\frac{20}{22}$	$\frac{20}{23}$	25	26	$\frac{23}{27}$	29	30	32	33	
28	14	15	16	17	18	19	$\overline{20}$	$\overline{21}$	$\frac{1}{22}$	24	$\overline{25}$	$\overline{26}$	28	29	30	32	
29	13	14	15	16	17	18	19	20	22	23	24	25	26	28	29	30	
30	13	14	14	15	$\overline{16}$	17	19	-20	21	22	23	24	25	27	28	29	
31	12	13	14	15	16	17	18	19	20	21	22	23	24	26	27	28	
32	12	13	13	14	15	16	17	18	19	20	21	22	23	25	$26 \\ 26 \\ 27 \\ 26 \\ 27 \\ 26 \\ 27 \\ 20 \\ 20 \\ 20 \\ 20 \\ 20 \\ 20 \\ 20$	27	
33		$12 \\ 10$	13	14	15	$\frac{16}{15}$	16	17	18 10	19	$\frac{20}{20}$	22	23	24	25	26	
34	11	12	$\frac{12}{12}$	$\frac{13}{19}$	14	10	$\frac{10}{15}$	$\frac{17}{10}$	$\frac{18}{17}$	$\frac{19}{10}$		$\frac{21}{100}$	22	23	24	20	
30 90	10		12	13	14	14	10	10	16	$\frac{18}{17}$	19	20	21	22	23	24	
30 37	10	10	11	$\frac{12}{12}$	10	14	14	15	· 16	$\frac{17}{17}$	18	$19 \\ 19$	19	$\frac{21}{20}$	$\frac{22}{21}$	20	
38	10	10	11	11	$\frac{10}{12}$	13	14	14	15	16	17	18	19	$\frac{1}{20}$	21	22	
39	9	10	10	11	$\overline{12}$	12	13	14	15	16	16	17	18	$\overline{19}$	20	$\overline{21}$	
40	-9	9	10	11	11	12	13	13	14	15	16	17	17	18	19	- 20	140°
42	8	9	9	10	11	11	12	13	13	14	15	16	16	17	18	19	138
44	8	8	9	9	10	10	11	12	12	13	14	14	15	16	17	17	136
46	- 7		8	9	9	10	$\frac{10}{10}$	11	12	12	$\frac{13}{10}$	13	14	15	16	16	134
48		1	8	8	9		0		11	11	12	13	$\frac{13}{10}$	14	10	10	132
50 52	0 R	6	4	8	8	8	9	9	10	10	10	12	12	15	14	14	130
54	5	6	6	6	4	07	8	8	9	9	10	10	11	11	10	19	128
56	ă	ā	6	6	6	7	7	8	8	9	9	9	10	10	11	11	124
58	5	5	5	6	6	6	7	7	7	8	8	9	9	10	10	11	122
60	4	5	5	5	5	6	6	7	7	7	8	8	8	9	9	10	120
62	4	4	4	5	5	5	6	6	6	7	7	7	8	8	9	9	118
64	4	4	4	4	5	5	5	6	6	6	6	7	7	8	8	8	116
66	3	4	4	+	4	4	ð	ð	ð	6	6	6	7	7	1	8 7	114
68	3	3	3		- 4												112
70	3	3	3	3	3	4	4	4	4	0	G	5	5	6	65	6	110
78	- Z 9		2	3. 9	- 3 - 9	3 9	5 9	0 9	0 2	4	4	4	4	4 2	0 2	6	100
82	1	1	Î	Í	1	ĺ	$\frac{2}{2}$	5	2	2	2	2	2	2	2	2	98
86	î	1	1	1	1	1	ĩ	1	ĩ	ĩ	1	ĩ	ĩ	ĩ	1	ĩ	94
90°	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	90°
Appar-	29'	30.	31'	321	33'	34'	35′	36'	87'	38/	39'	40'	41'	42'	48′	44'	Appar-
tance.							Firs	t corre	ction o	f distan	ice.						tance,

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APPENDIX V: TABLE VI.

Second Correction of the Lunar Distance.

Appar-							Firs	st corre	ction o	f distai	nce.						Appar-
ent dis- tance.	45'	46'	47/	48'	49'	50′	51'	52'	53'	54'	55'	56'	57/	58'	59'	60'	ent dis- tance.
Sub.		"	"	"		"	"	"	11	"	"		"	"		"	Add.
15° 0′	66	69	72	75	78	81	85	88	91	95	99	102	106	110	113	117	
16 0	64	67	70	72	70	79 78	82 70	80	88	92	95	99	102	106	110	113	
30	60	62	65	68	71	74	77	80	83	86 86	89	90 92	99	102	100	106	
17 0	58	60	63	66	69	71	74	77	80	83	86	90	93	96	99	103	
	56	59	61	64	66	69	72	75	78	81	84	87	90	93	- 96	100	
18 0	54	57	59	62	64	67	70	73	75	78	81	84	87	90	94	97	
10 0	53	- DD 5-1	58	60 59	63	65	68 66	- 71 - 60	73	76	79	82	85	88	91	94	
19 0	50	52	54	57	59	62	64	67	69	79	75	79	80	83	- 86 - 86	89	
20	49	51	53	55	-58	60	62	65	67	70	$-\frac{10}{73}$	75	78	81		86	
21	46	48	50	52	55	57	59	61	64	66	69	71	74	76	79	82	
22	44	46	48	50	52	54	56	58	61	63	65	68	70	73	75	$\overline{78}$	1
23	42	-14	40	47	$\frac{49}{17}$	51	53	56	58	60	62 50	64	67	69	72_{00}	74	
24	40	-10	40	40	-15	49	- 10	-00-51	-52	55	57	$-\frac{01}{50}$	<u>61</u>	62	65	-11	
26	36	38	40	41	43	45	47	48	50	$\frac{55}{52}$	54	56	58	60	62	64	
27	35	36	38	39	41	43	45	46	48	50	52	54	$\overline{56}$	58	60	62	
28	33	35	36	38	39	41	43	44	46	48	50	51	53	55	57	59	
29	$\frac{32}{32}$	33	35	36			41			-46	48	49			55	57	
30 21	31	32	33	35	36	$\frac{38}{26}$	39	41	42	44	$\frac{16}{11}$	47	49	51	53	54	1
32 32	29	30	31	- 39 - 39	34	30 35	36	38	39	$\frac{42}{41}$	44	40	47	49	- 19	- 50 - 50	
33	27	$\overline{28}$	30	31	32	34	35	36	38	39	41	42	44	45	47	48	
34	26	27	29	30	31	32	34	35	- 36	- 38	- 39	41	42	44	45	47	
35	25	26	28	29	30	31	32	34	35	36	38	39	40	42	43	45	
36	24	25	27	28	29	30	31	32	34	35	36	- 38	39	40	42	43	
38	20	20 94	20	$\frac{21}{26}$	$\frac{28}{27}$	$\frac{29}{28}$	20	30	- 20 - 31	- 3 1 - 33	- 50 - 34	- 30 - 35	- 38 - 36	- 39 - 38	39	42	
39	22	23	24	$\frac{10}{25}$	$\overline{26}$	27	$\tilde{28}$	29	30	31	- 33	34	35	36	38	39	
40	21	22	23	$\overline{24}$	25	26	27	-28	29	- 30	31	- 33	-34	35	36	37	140°
42	20	21	21	22	23	24	25	26	27	28	29	30	31	33	34	35	138
44	18	19	20	21	22	23	24	24	25	26	27	28	29	30	31	- 33	136
40	16	18	19	19	20	$\frac{21}{20}$	22	23	24 99	20	$\frac{20}{24}$	20 25	27	- 28	29	30	134
50 '	$\frac{10}{15}$	16	16	$\frac{10}{17}$	$\frac{10}{18}$	$\frac{20}{18}$	$\frac{20}{19}$	$-\frac{21}{20}$	$-\frac{22}{21}$	20		-23	$\frac{20}{24}$	20	-25		130
52	14	14	15	16	10	17	18	18	19	20	$\tilde{21}$	$\tilde{21}$	22	23	24	$\frac{20}{25}$	128
54	13	13	14	15	15	16	16	17	18	18	19	20	21	21	22	23	126
56	12	12	13	14	14	15	15	16	17	17	18	18	19	$\frac{20}{10}$	20	21	124
86	11	$\frac{12}{11}$	12	$\frac{10}{10}$	$\frac{13}{10}$	$\frac{14}{19}$	$\frac{14}{19}$	10	10	10	10	$\frac{17}{10}$	$\frac{18}{10}$	18	19	20	122
62	10	10	10	$12 \\ 11$	12	10	13	$\frac{14}{13}$	14	10	10 11	10	10	16	18	18	120
64	9	- 9	9	10	10	11	11	12^{10}	$10 \\ 12$	12	13	13^{10}	14	14	15	15	116
66	8	8	9	9	9	10	10	11	11	11	12	12	13	13	14	14	114
68	7	7	8	8	8	9_	9_	10	10	10	11	11	11	12	12	13	112
70	- 6	1	7	7	8	8	8	9	9	. 9	10	10	10	11	11	11	110
74 78	6 1	0 1	0	0	0 1	5	5	5	5	5	8	8	8	8	9	-7	106
82	2	3	3	3	3	3	3	3	3	4	4	4	4	4	4	4	98
86	1	1	1	1	1	2	2	$\frac{3}{2}$	2	$\hat{2}$	2	$\tilde{2}$	2	2	2	2	94
90°	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	90°
Appar- ent dis-	45'	46'	47'	48'	49'	50'	51'	52'	53′	54'	55'	56'	57'	58'	59'	60′	Appar- ent dis-
tance.							First	correc	etion of	distan	ce.						tance.

APPENDIX V: TABLE VII.

For finding the Correction of the Lunar Distance for the Contraction of the Moon's Semidiameter. TABLE VII A.—GIVING THE ARGUMENT FOR TABLE VII B.

Red. P. and B. of											App	parei	nt al	tituć	te of	mo	on.								
moon.	50	510	6°	610	70	710	80	810	9°	910	100	110	120	130	140	15	° 1	1Co	170	180	20°	250	300	40°	50°
$ \begin{array}{r} 41'\\ 42\\ 43\\ 44\\ 45\\ \hline 46\\ 47\\ 48\\ 49\\ 50\\ \hline 51\\ 52\\ \end{array} $	$\begin{array}{c} 65 \\ 63 \\ 62 \\ 60 \\ 58 \\ 57 \\ 56 \\ 54 \\ 53 \\ 52 \\ 50 \\ 49 \end{array}$	$56 \\ 54 \\ 53 \\ 51 \\ 50 \\ 49 \\ 48 \\ 46 \\ 45 \\ 44 \\ 43 \\ 42$	$\begin{array}{r} 47\\ 46\\ 45\\ 43\\ 42\\ 41\\ 40\\ 39\\ 38\\ 38\\ 37\\ \end{array}$	$ \begin{array}{r} 41\\ 40\\ 39\\ 38\\ 37\\ 36\\ 35\\ 35\\ 34\\ 33\\ 32\\ \end{array} $	$ \begin{array}{r} 35 \\ 34 \\ 33 \\ 32 \\ 31 \\ 30 \\ 30 \\ 29 \\ 28 \end{array} $	$ \begin{array}{r} 30 \\ 30 \\ 29 \\ 28 \\ 27 \\ 26 \\ 25 \end{array} $	$ \begin{array}{r} 27 \\ 26 \\ 25 \\ 25 \\ 24 \\ 24 \\ 23 \\ 23 \end{array} $	$ \begin{array}{r} & \frac{24}{23} \\ & 22 \\ & 22 \\ & 21 \\ & 21 \\ & 20 \end{array} $	$ \begin{array}{r} 21 \\ 21 \\ 20 \\ 20 \\ 19 \\ 19 \\ 19 \\ 18 \\ \end{array} $	$\begin{array}{c} 20 \\ 19 \\ 19 \\ 18 \\ 18 \\ 17 \\ 17 \\ 17 \\ 17 \end{array}$	$ \begin{array}{r} 17 \\ 17 \\ 17 \\ 16 \\ 16 \\ 15 \\ 15 \\ \end{array} $	$\frac{15}{14}$ 14 14 13 13 13	$ \begin{array}{r} 12 \\ 12 \\ 12 \\ 11 \\$	10 10 10 10 10 9	9 9 9 9 8 8 8		8 8 8 7 7	7777777777	$\begin{array}{c} 6\\ 6\\ 6\\ \hline 6\\ \hline 6\\ 6\\ \hline \end{array}$	6 5 5 5	5 5 5 4	3 3 3 3 3 3 3	$\frac{3}{2}$	$\frac{2}{2}$	22
$53 \\ 54$	$\frac{48}{47}$	41 41	$\frac{36}{35}$	$\frac{32}{31}$	$\frac{28}{27}$	$\frac{25}{24}$	$\frac{22}{22}$	$\frac{20}{19}$	18 18	$\begin{array}{c}16\\16\end{array}$	15 15	$\frac{12}{12}$	11 10	9 9	88		$\frac{7}{7}$	6	$\frac{6}{6}$	5 5	4	33	2	$\frac{2}{2}$	$\frac{2}{2}$
55	ч. —	·	35	30	27	24	21	19	17	16	14	12	$\frac{10}{10}$	9	8		7	6	<u>6</u> 5	5	4	3	2	$\frac{1}{2}$	2
$ 50 \\ 57 \\ 58 \\ 59 \\ 60 $					26	20	21	19	17	15 15	14 14 13	12 12 11	10 10 10	9 9 8 8	8 7 7 7		7 7 6	6 6 6	ə 5 5 5	ə 5 5 5	4 4 4 4 4	0 3 3 3 3 3 3			$\frac{2}{2}$
ion Dn.		_	Т	'AB	LE	VI	I B	.—(ON.	TR.	AC	ΓIO mt. 1	N ()F]	MO	ON ³	'S S	SEN TI A	11-D	IAM	ETF	ER.			
Whol correct of mod	2	4 6	8	10	12	14	16	18	20	22	24	26	28	30	32	34	36	38	40	44	48	52	56	60	64
,	"	" "	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"
$ \begin{array}{c} 0 \\ \cdot 5 \\ 10 \\ 15 \\ 20 \\ \hline 20 \end{array} $	0 0 0 0 0	$ \begin{array}{cccccccccccccccccccccccccccccccccccc$	$ \begin{array}{c} 0 \\ 0 \\ 0 \\ 1 \end{array} $	0 0 0 1	$ \begin{array}{c} 0 \\ 0 \\ 0 \\ 1 \\ 1 \end{array} $	$ \begin{array}{c} 0 \\ 0 \\ 0 \\ 1 \\ 1 \end{array} $	$ \begin{array}{c} 0 \\ 0 \\ 0 \\ 1 \\ 1 \end{array} $	$ \begin{array}{c} 0 \\ 0 \\ 1 \\ 1 \end{array} $	$ \begin{array}{c} 0 \\ 0 \\ 0 \\ 1 \\ 2 \end{array} $	$ \begin{array}{c} 0 \\ 0 \\ 0 \\ 1 \\ 2 \end{array} $	$ \begin{array}{c} 0 \\ 0 \\ 0 \\ 1 \\ 2 \end{array} $	$ \begin{array}{c} 0 \\ 0 \\ 1 \\ 1 \\ 2 \end{array} $	$ \begin{array}{c} 0 \\ 0 \\ 1 \\ 1 \\ 2 \\ $	$ \begin{array}{c} 0 \\ 0 \\ 1 \\ 1 \\ 2 \\ \hline 2 \end{array} $	$ \begin{array}{c} 0 \\ 0 \\ 1 \\ 1 \\ 3 \end{array} $	$ \begin{array}{c} 0 \\ 0 \\ 1 \\ 2 \\ 3 \\ 2 7 7 7 7 7 $	$ \begin{array}{c} 0 \\ 0 \\ 1 \\ 2 \\ 3 \\ 2 7 7 7 7 7 $	$ \begin{array}{c} 0 \\ 0 \\ 1 \\ 2 \\ 3 \end{array} $	$ \begin{array}{c} 0 \\ 0 \\ 1 \\ 2 \\ 3 \\ 1 \end{array} $	$0 \\ 0 \\ 1 \\ 2 \\ 4$	$ \begin{array}{c} 0 \\ 0 \\ 1 \\ 2 \\ 4 \\ \overline{5} \end{array} $	$\begin{array}{c} 0\\ 0\\ 1\\ 2\\ 4\\ -\overline{}\end{array}$	$ \begin{array}{c} 0 \\ 0 \\ 1 \\ 3 \\ 4 \\ \end{array} $	$ \begin{array}{c} 0 \\ 0 \\ 1 \\ 3 \\ 5 \\ -2 \end{array} $	$ \begin{array}{c} 0 \\ 0 \\ 1 \\ 3 \\ 5 \end{array} $
$22 \\ 24 \\ 26 \\ 28 \\ 30$	0 0 0 0 0	$ \begin{bmatrix} 0 & 1 \\ 0 & 1 \\ 1 & 1 \\ 1 & 1 \\ 1 & 1 \\ 1 & 1 $	1 1 1 1 1	$\begin{array}{c}1\\1\\1\\2\\2\end{array}$	$\begin{array}{c}1\\1\\2\\2\\2\end{array}$	$\frac{1}{2}$ $\frac{2}{2}$ $\frac{2}{3}$ $\frac{3}{3}$	22233	$\frac{2}{2}$	$22 \\ 33 \\ 4$	2 3 3 4	23344	3 4 4 5	$\frac{3}{3}$ $\frac{4}{4}$ $\frac{4}{5}$	33455			3 4 5 6 6		+ 5 5 6 7	4 5 6 7 8	5 6 8 9	5 6 7 8 9			
$ \begin{array}{r} 32 \\ 34 \\ 36 \\ 38 \\ 40 \\ \end{array} $	$ \begin{array}{c} 0 \\ 0 \\ 1 \\ 1 \\ 1 \end{array} $	$ \begin{array}{c} 1 & 1 \\ 1 & 1 \\ 1 & 2 \\ $		$\begin{array}{c} 2\\ 2\\ 3\\ 3\\ 3\\ 3\end{array}$	$ \begin{array}{c} 2 \\ 3 \\ 3 \\ 3 \\ 4 \end{array} $	$3 \\ 3 \\ 4 \\ 4 \\ 4 \\ 4$	3 4 4 5 5	$\begin{array}{c}4\\4\\5\\5\\6\end{array}$			5 6 7 8	5 6 7 8 8	6 6 7 8 9	6 7 8 9 9	$ \begin{array}{r} 7 \\ 7 \\ 8 \\ 9 \\ 10 \end{array} $	8 9 10 11				$9 \\ 10 \\ 11 \\ 13 \\ 14$	$ \begin{array}{r} 10 \\ 11 \\ 12 \\ 14 \\ 15 \end{array} $	$ \begin{array}{c} 11 \\ 12 \\ 13 \\ 15 \\ 17 \end{array} $	$ \begin{array}{c} 11 \\ 13 \\ 15 \\ 16 \\ 18 \\ 18 \end{array} $	$ \begin{array}{r} 12 \\ 14 \\ 16 \\ 17 \\ 19 \\ \end{array} $	$ \begin{array}{r} 13 \\ 15 \\ 17 \\ 18 \\ 20 \\ \end{array} $
$ \begin{array}{r} 42 \\ 44 \\ 45 \\ 46 \\ 47 \end{array} $	$ \begin{array}{c} 1 \\ 1 \\ 1 \\ 1 \\ 1 \\ 1 \end{array} $	$ \begin{array}{c ccccccccccccccccccccccccccccccccccc$	3 3 3 3 4	+ + + + + +	$\frac{4}{5}5555$	5 5 6 6 6	$\begin{array}{c} 6\\ 6\\ 6\\ 7\\ 7\\ 7\end{array}$	6 7 7 7 8	7 8 8 8 9		8 9 10 10 11	9 10 11 11 11	$ \begin{array}{r} 10 \\ 11 \\ 11 \\ 12 \\ 12 \\ 12 \end{array} $	$ \begin{array}{r} 11 \\ 12 \\ 12 \\ 13 \\ 13 \\ 13 \end{array} $	$ \begin{array}{c} 11 \\ 12 \\ 13 \\ 14 \\ 14 \\ 14 \end{array} $	$ \begin{array}{r} 12 \\ 13 \\ 14 \\ 14 \\ 15 \\ \end{array} $	$ \begin{array}{r} 13 \\ 14 \\ 15 \\ 15 \\ 16 \\ \end{array} $	$ \begin{array}{r} 13 \\ 15 \\ 16 \\ 17 \end{array} $	$ \begin{array}{r} 14 \\ 15 \\ 16 \\ 17 \\ 18 \end{array} $	$ \begin{array}{r} 16 \\ 17 \\ 18 \\ 19 \\ 19 \\ 19 \\ 19 \\ \end{array} $	$17 \\ 19 \\ 19 \\ 20 \\ 21$	$ \begin{array}{r} 18 \\ 20 \\ 21 \\ 22 \\ 23 \end{array} $	$20 \\ 22 \\ 23 \\ 24 \\ 25$	$\begin{array}{c} 21\\ 23\\ 24 \end{array}$	23
$ \begin{array}{r} 48 \\ 49 \\ 50 \\ 51 \\ 52 \end{array} $	1 1 1 1 1	$ \begin{array}{ccccccccccccccccccccccccccccccccc$		5 5 5 5 5 5	6 6 6 6 6	6 7 7 7 8	7 8 8 8 9	8 9 9 9 10	$9 \\ 10 \\ 10 \\ 10 \\ 11 \\ 11$	$ \begin{array}{c} 10 \\ 11 \\ 11 \\ 11 \\ 11 \\ 12 \end{array} $	$ \begin{array}{r} 11 \\ 12 \\ 12 \\ 12 \\ 13 \\ 13 \end{array} $	$12 \\ 12 \\ 13 \\ 14 \\ 14 \\ 14$	$ \begin{array}{r} 13 \\ 13 \\ 14 \\ 15 \\$	$ \begin{array}{r} 14 \\ 14 \\ 15 \\ 16 \\ 16 \\ 16 \\ 16 \\ \end{array} $	$ \begin{array}{r} 15 \\ 15 \\ 16 \\ 17 \\ 17 \\ 17 \end{array} $	$ \begin{array}{r} 16 \\ 16 \\ 17 \\ 18 \\ 18 \\ 18 \end{array} $	$ \begin{array}{r} 17 \\ 17 \\ 18 \\ 19 \\ 10 \\$	18 18 19 20 21	$ \begin{array}{r} 18 \\ 19 \\ 20 \\ 21 \\ 22 \end{array} $	$20 \\ 21 \\ 22 \\ 23 \\ 24$	$22 \\ 23 \\ 24 \\ 25 \\ 26$	$24 \\ 25 \\ 26 \\ 27$	26		
$53 \\ 54 \\ 55 \\ 56 \\ 57$	ī	$ \begin{array}{c cccccccccccccccccccccccccccccccc$	$ \frac{4}{5} 5 5 5 5 5 5 5 5 $		7 7 7 8	8 8 8 9	9 9 10 10	$ \begin{array}{c} 10 \\ 10 \\ 11 \\ 11 \\ 11 \end{array} $	$ \begin{array}{c} 11 \\ 12 \\ 12 \\ 13 \end{array} $	$ \begin{array}{c} 12 \\ 13 \\ 13 \\ 14 \end{array} $	$ \begin{array}{r} 13 \\ 14 \\ 15 \\ 15 \\ 15 \end{array} $	$ \begin{array}{c} 15 \\ 15 \\ 16 \\ 16 \\ 16 \end{array} $	16 16 17	$\frac{17}{17}$ $\frac{17}{18}$	18 19 19	$ \begin{array}{r} 19 \\ 20 \\ 21 \end{array} $	$ \begin{array}{c} 20 \\ 21 \\ 22 \end{array} $	$\frac{21}{22}$	$\overline{\begin{array}{c}22\\23\end{array}}$	25 26	27				

When the nearer limb is observed, substract this correction; when the farther, add.

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APPENDIX V: TABLE VIII.

For finding the Correction of the Lunar Distance for the Contraction of the Sun's Semidiameter. TABLE VIII A.—GIVING THE ARGUMENT FOR TABLE VIII B.

Red. P.	-										Ap	pare	nt al	ltitu	de of	í sun	•						•	
and R. of sun.	50	5 ¹⁰	60	6 <u>1</u> 0	70	7 <u>1</u> 0	8°	810	90	910	10°	110	120	130	140	15°	160	170	180	200	250	30°	40°	500
$\begin{array}{ccc} 1' & 0'' \\ & 30 \\ 2 & 0 \\ & 30 \\ 3 & 0 \end{array}$					٠								•	-	44	46	40 49	$\frac{42}{51}$	35 44 • 53	37 47 57	$30 \\ 42 \\ 53$	$ \begin{array}{r} 34 \\ 46 \\ 59 \end{array} $	$\begin{array}{c} 22\\ 24\\ 46 \end{array}$	18 29
$ \begin{array}{r} 30 \\ 4 & 0 \\ 30 \\ 5 & 0 \\ 30 \\ 30 \end{array} $					47	50	$\frac{47}{52}$	50 55	$ \begin{array}{r} 47 \\ 52 \\ 57 \\ \end{array} $	49 54 60	$ \begin{array}{r} 45 \\ 51 \\ 57 \\ 62 \end{array} $	49 55 61 67	$ \begin{array}{r} 45 \\ 52 \\ 59 \\ 66 \\ 72 \end{array} $	48 55 63 70	$51 \\ 59 \\ 66 \\ 74$	54 62 70	57 65	60 68	62	67		•		
$ \begin{array}{r} 6 & 0 \\ & 30 \\ 7 & 0 \\ & 30 \\ 8 & 0 \\ \hline \end{array} $	55	$51 \\ 55 \\ 59 \\ 69 \\ 69 \\ 69 \\ 69 \\ 69 \\ 69$	$50 \\ 54 \\ 58 \\ 62 \\ 62 \\ 62 \\ 62 \\ 62 \\ 62 \\ 62 \\ 6$	$ \begin{array}{r} 49 \\ 53 \\ 58 \\ 62 \\ 66 \\ \overline{0} \end{array} $	$52 \\ 56 \\ 61 \\ 65 \\ 70 \\ 71$	$55 \\ 59 \\ 64 \\ 69 \\ 73 \\$	$57 \\ 62 \\ 67 \\ 72 \\ 77 \\ 77 \\ 77 \\ 100 \\$	60 65 70 75	63 68 74	66 71	68 74	74										•		-
$ \begin{array}{r} 30 \\ 9 \\ 0 \\ 30 \\ 10 \\ 0 \\ 30 \\ \hline 11 \\ 0 \end{array} $	$ \begin{array}{c} 59 \\ 62 \\ 66 \\ 69 \\ 73 \\ \overline{} \end{array} $	$ \begin{array}{r} 63 \\ 66 \\ 70 \\ 74 \\ 77 \\ \overline{} \\ \overline{} \\ \overline{} \\ 71 \\ \overline{} \\ $	56 70 74 78	70 74 79	79																			
$11 0 \\ 30$	80	81	ļ												•	,		1						
Whole rrection of sun.	20	34	T.	ABI	LE	VII	IB	i.—(CON A	rgui	ment	TIC	mbe	OF r fro	SU:	N'S able	SEN	A.	AM	ETE	R.		= ()	
	20	24	28	32	36	40	++	46	+8	-00	-02	04		98	60	62	64						76	
$\begin{array}{c} & & \\ 0 & 0 \\ 1 & 0 \\ 2 & 0 \\ 1 & 30 \\ 3 & 0 \end{array}$	" 0 1	" 0 1							" 0 2 2 3	" 0 1 2 3													$ \begin{array}{c} 0 \\ 0 \\ 1 \\ 1 \\ 2 \end{array} $	
$\begin{array}{r} 30 \\ 4 & 0 \\ 20 \\ 40 \\ 5 & 0 \end{array}$							57	5 6 7 9 10	5 6 7 8 9							$ \frac{4}{5} 5 6 7 $		$ \begin{array}{c} 3 \\ 4 \\ 5 \\ 6 \\ 7 \end{array} $			3			3
$ \begin{array}{r} 20 \\ 40 \\ 6 \\ 20 \\ 40 \\ 40 \\ \hline 7 7 7 7 7 $	•								11	$ \begin{array}{r} 10 \\ 12 \\ 13 \\ 14 \\ 16 \\ \hline \end{array} $	$ \begin{array}{r} 10 \\ 11 \\ 12 \\ 14 \\ 15 \\ \hline \end{array} $	$ \begin{array}{r} 9 \\ 11 \\ 12 \\ 13 \\ 15 \\ \hline \end{array} $	$ \begin{array}{r} 9 \\ 10 \\ 12 \\ 13 \\ 14 \\ \hline 14 \\ \hline 12 \\ 13 \\ 14 \\ \hline 14 \\ \hline 15 \\ 14 \\ \hline 15 \\ $	$9 \\ 10 \\ 11 \\ 12 \\ 14 \\ 14 \\ 11 \\ 12 \\ 14 \\ 14$	$ \begin{array}{r} 9 \\ 10 \\ 11 \\ 12 \\ 13 \\ \end{array} $		8 9 10 11 13				7 8 9 10 11		7 8 9 10 11	
7 0 20 40 8 0 20 20 20 20 20 20								1		18	17 19	$ \begin{array}{r} 16 \\ 18 \\ 20 \\ 21 \end{array} $	$ \begin{array}{c} 16 \\ 17 \\ 19 \\ 21 \end{array} $	$ \begin{array}{r} 15 \\ 17 \\ 18 \\ 20 \\ 22 \end{array} $	$ \begin{array}{r} 15 \\ 16 \\ 18 \\ 19 \\ 21 \end{array} $	$ \begin{array}{r} 14 \\ 16 \\ 17 \\ 19 \\ 20 \\ \end{array} $	$ \begin{array}{r} 14 \\ 15 \\ 17 \\ 18 \\ 20 \\ \end{array} $	$ \begin{array}{r} 13 \\ 15 \\ 16 \\ 17 \\ 19 \\ \end{array} $	$ \begin{array}{r} 13 \\ 14 \\ 16 \\ 17 \\ 18 \\ \hline \end{array} $	$ \begin{array}{r} 13 \\ 14 \\ 15 \\ 16 \\ 18 \\ \hline \end{array} $	$ \begin{array}{r} 12 \\ 13 \\ 15 \\ 16 \\ 17 \\ \end{array} $	$ \begin{array}{c} 12 \\ 13 \\ 14 \\ 16 \\ 17 \\ \end{array} $	$ \begin{array}{r} 12 \\ 13 \\ 14 \\ 15 \\ 16 \\ \hline \end{array} $	$ \begin{array}{c} 11 \\ 12 \\ 14 \\ 15 \\ 16 \end{array} $
$ \begin{array}{r} 40 \\ 9 \\ 20 \\ 40 \\ 10 \\ 0 \end{array} $														23	23	22 24	$21 \\ 23 \\ 25$	$20 \\ 22 \\ 24 \\ 25$	$20 \\ 21 \\ 23 \\ 25 \\ 26$	$ \begin{array}{r} 19 \\ 21 \\ 22 \\ 24 \\ 26 \end{array} $	$ \begin{array}{r} 19 \\ 20 \\ 22 \\ 23 \\ 25 \end{array} $	$ \begin{array}{r} 18 \\ 20 \\ 21 \\ 23 \\ 24 \end{array} $	18 19 21 22 24	$ \begin{array}{r} 17 \\ 19 \\ 20 \\ 22 \\ 23 \end{array} $
$\begin{array}{r}20\\40\\11&0\\20\end{array}$						a di tari suna sundi di si filma di senter signa								-				_		28	27 28	26 28	25 27 29	$25 \\ 26 \\ 28 \\ 30$

Subtract this correction from the distance.

APPENDIX V: TABLE IX.

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'Arc.	0"	1″	2"	3"	4″	5″	6″	7″	8 ″	9″
0 1 "	*									
0 ^h 0 ^m 0 ^s	5	0.0000	0.3010	0.4771	0.6021	0.6990	0.7782	0.8451	0.9031	0.9542
0 10	1.0000	1.0414	1.0792	1.1139	1.1461	1.1761	1.2041	1.2304	1.2553	1.2788
$ \begin{array}{ccc} 0 & 20 \\ 0 & 30 \end{array} $	1.3010 1.1771	1.3222	1.3424 1.5051	1.3617 1.5185	1.3802 1.5315	1.3979 1.5441	1.4100 1.5563	1.4314 1.5689	1.4472 1.5708	1.4624 1.5011
0 40	1.6021	1.6128	1.6232	1.6335	1.6435	1.6532	1.6628	1.6721	1.6812	1.6902
0 50	1.6990	1.7076	1.7160	1.7243	1.7324	1.7404	1.7482	1.7559	1.7634	1.7709
0 1 0	1.7782	1.7853	1.7924	1.7993	1.8062	1.8129	1.8195	1.8261	1.8325	1.8388
1 10	1.8451	1.8513	1.8573	1.8633	1.8692	1.8751	1.8808	1.8865	1.8921	1.8976
1 20 1 30	1.9031 1.9542	1.9080	1.9138 1.9638	$1.9191 \\ 1.9685$	1.9243 1.9731	1.9294 1.9777	1.9340 1.9893	1.9395	1.9440	1.9494
1 40	2.0000	2.0043	2.0086	2.0128	2.0170	2.0212	2.0253	2.0294	2.0334	2.0374
1 50	2.0414	2.0453	2.0492	2.0531	2.0569	2.0607	2.0645	2.0682	2.0719	2.0755
0 2 0	2.0792	2.0828	2.0864	2.0899	2.0934	2.0969	2.1004	2.1038	2.1072	2.1106
$ \begin{array}{ccc} 2 & 10 \\ 9 & 20 \end{array} $	2.1139	2.1173	2.1206	2.1239 2.1552	2.1271	2.1303	2.1335	2.1367 2.1672	2.1399	2.1430
$\frac{2}{2}$ $\frac{20}{30}$	2.1401	2.1492	2. 1025	2.1000	2.1004	2,1014	2.1044	2.1075	2,1705	2.1752
$\frac{1}{2}$ 40	2. 2041	2. 2068	2. 2095	2. 2122	2.2148	2.2175	2. 2201	2. 2227	2. 2253	2.2279
2 50	2.2304	2.2330	2.2355	2.2380	2.2405	2.2430	2.2455	2.2480	2.2504	2.2529
0 3 0	2.2553	2.2577	2.2601	2,2625	2.2648	2.2672	2.2695	2.2718	2.2742	2.2765
3 10 2 20	2.2788	2.2810	2.2833	2.2856	2.2878	2.2900	2.2923	2.2945	2.2967	2.2989
3 20 3 30	2.3010 2.3222	2.3243	2.3004 2.3263	2.3075 2.3284	2.3030 2.3304	2.3110 2.3324	2.3139 2.3345	2.3365	2.3181 2.3385	2. 3404
3 40	2.3424	2.3444	2.3464	2.3483	2.3502	2.3522	2.3541	2,3560	2.3579	2.3598
3 50	2.3617	2.3636	2.3655	2.3674	2.3692	2.3711	2.3729	2.3747	2.3766	2.3784
$0 \ 4 \ 0$	2.3802	2.3820	2.3838	2.3856	2.3874	2.3892	2.3909	2.3927	2.3945	2.3962
4 10	2.3979 2.4150	2.3997	2.4014	2.4031	2.4048	2.4000 9.1939	2,4082	2.4099	2.4116 9 1991	2.4133
$\frac{4}{4}$ $\frac{20}{30}$	2.4150	2. 4330	2,4346	2,4362	2.4210 2.4378	2.4292 2.4393	2,4409	2. 4425	2. 4261	2. 4456
4 40	2.4472	2.4487	2.4502	2.4518	2,4533	2.4548	2.4564	2.4579	2.4594	2.4609
4 50	2.4624	2,4639	2.4654	2.4669	2,4683	2.4698	2.4713	2.4728	2.4742	2.4757
050	2.4771	2.4786	2.4800	2.4814	2.4829	2.4843	2.4857	2.4871	2.4886	2.4900
5 10 5 20	2.4914	2.4928	2.4942	2,4900	2.4909 2.5105	2,4985	2.4997	2.0011 2.5145	2.5024	2.0038 2.5172
$5 \frac{20}{5}$	2.5001 2.5185	2.5000 2.5198	2.5211	2.5052 2.5224	2.5105 2.5237	2. 5250	2, 5263	2.5276	2.5100 2.5289	2.5302
5 40	2.5315	2.5328	2.5340	2.5353	2.5366	2.5378	2.5391	2.5403	2.5416	2.5428
5 50	2.5441	2.5453	2.5465	2.5478	2.5490	2.5502	2.5514	2.5527	2.5539	2.5551
$ \begin{array}{ccc} 0 & 6 & 0 \\ c & 10 \end{array} $	2,5563	2.5575	2.5587	2.5599	2.5611	2.5623	2.5635	2.5647	2.5658	2.5670
6 20	2.0082 2.5798	2.0094	2.5705	2.5717 2.5832	2.5729	2.5740	2.5866	2.5705	2.0110	2.5780
	2.5911	2,5922	2.5933	2.5944	2.5955	2.5966	2.5977	2.5988	2.5999	2.6010
6 40	2.6021	2.6031	2.6042	2.6053	2,6064	2.6075	2.6085	2.6096	2.6107	2.6117
6 50	2.6128	2.6138	2.6149	2.6160	2.6170	2.6180	2.6191	2.6201	2.6212	2.6222
$ \begin{array}{cccccccccccccccccccccccccccccccccccc$	2.6232 2.6225	2.6243 2.6245	2.6253	2.6263 2.6265	2.6274 2.6275	2.6284	2.6294 2.6295	2.6304	2.6314	2.6325
$\frac{7}{7}$ 20	2.6435	2.6444	2,0355 2,6454	2.6464	2.6474	2.6484	2.6493	2.6503	2.6513	2.6522
7 - 30	2.6532	2.6542	2.6551	2.6561	2.6571	2.6580	2.6590	2.6599	2.6609	2.6618
$\frac{7}{10}$	2.6628	2.6637	2.6646	2.6656	2.6665	2.6675	2.6684	2.6693	2.6702	2.6712
7 50	2.6721	2.6730	2.6739	2.6749	2.6758	2.6767	2.6776	2.6785	2.6794	2.6803
0 8 0	2.6812	2.6821 2.6011	2,6830	2.6839	2.6848	2.6804	2.6866	2.6875	2.6881 2.6972	2.6893
8 20	2.6990	2.6998	2.0007	2.0528 2.7016	2.7024	2.0040 2.7033	2.7042	2.0004 2.7050	2.0312 2.7059	2.0001 2.7067
8 30	2.7076	2.7084	2.7093	2.7101	2.7110	2.7118	2.7126	2.7135	2.7143	2.7152
8 40	2.7160	2.7168	2.7177	2.7185	2.7193	2.7202	2.7210	2.7218	2.7226	2.7235
8 00	2.7243	2. 7201	2.7209	2.7267	2. 1210	2.7284	2,7292	2.7300	2.7308	2.7316
9 10	2.7324	2.7352 2.7412	2.7340 2.7419	2.7348	2.7300 2.7435	2.7504 2.7443	2.7451	2.7380 2.7459	2.7388 2.7466	2.7390 2.7474
9 20	2.7482	2.7490	2.7497	2.7505	2.7513	2.7520	2.7528	2.7536	2.7543	2.7551
9 30	2.7559	2.7566	2.7574	2.7582	2.7589	2.7597	2.7604	2.7612	2.7619	2.7627
9 40	2.7634	2.7642	2.7649	2.7657	2.7664	2.7672	2.7679	2.7686	2.7694	2.7701
9 90	2.7709	2.7710	2.1123	2.1131	2.1138	2.1740	2. 1102	2.1100	2.1101	2.1114

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APPENDIX V: TABLE IX.

	Arc.		0"	1″	2"	3"	4″	5″	6″	7"	8"	9″
							-					
0 ^h	10 ⁿ 10 10 10 10		$\begin{array}{c} 2.\ 7782\\ 2.\ 7853\\ 2.\ 7924\\ 2.\ 7993\\ 2.\ 8062\\ 2.\ 9062\\ \end{array}$	$\begin{array}{c} 2.\ 7789\\ 2.\ 7860\\ 2.\ 7931\\ 2.\ 8000\\ 2.\ 8069\\ 2.\ 8069\end{array}$	$\begin{array}{c} 2.\ 7796\\ 2.\ 7868\\ 2.\ 7938\\ 2.\ 8007\\ 2.\ 8075\\ 2.\ 9142\\ \end{array}$	$\begin{array}{c} 2.\ 7803\\ 2.\ 7875\\ 2.\ 7945\\ 2.\ 8014\\ 2.\ 8082\\ 0.140\end{array}$	$\begin{array}{c} 2.\ 7810\\ 2.\ 7882\\ 2.\ 7952\\ 2.\ 8021\\ 2.\ 8089\\ 2.\ 8089\\ \end{array}$	$\begin{array}{c} 2.\ 7818\\ 2.\ 7889\\ 2.\ 7959\\ 2.\ 8028\\ 2.\ 8096\\ 2.\ 8096\end{array}$	$\begin{array}{c} 2.\ 7825\\ 2.\ 7896\\ 2.\ 7966\\ 2.\ 8035\\ 2.\ 8102\\ 2.\ 8102\\ \end{array}$	$\begin{array}{c} 2.\ 7832\\ 2.\ 7903\\ 2.\ 7973\\ 2.\ 8041\\ 2.\ 8109\\ 2.\ 8109\\ \end{array}$	$\begin{array}{c} 2.\ 7839\\ 2.\ 7910\\ 2.\ 7980\\ 2.\ 8048\\ 2.\ 8116\\ 2.\ 8116\\ \end{array}$	$\begin{array}{c} 2.\ 7846\\ 2.\ 7917\\ 2.\ 7987\\ 2.\ 8055\\ 2.\ 8122\\ \end{array}$
0	$ \begin{array}{r} 10 \\ 11 \\ 11 \\ 11 \\ 11 \\ 11 \\ 11 \\ 11 \\ 11 \\ 12 \\ \end{array} $	$ \begin{array}{r} 50 \\ 0 \\ 10 \\ 20 \\ 30 \\ 40 \\ 50 \\ 0 \end{array} $	$\begin{array}{c} 2.8129 \\ 2.8195 \\ 2.8261 \\ 2.8325 \\ 2.8388 \\ 2.8451 \\ 2.8513 \\ \hline 2.8573 \end{array}$	$\begin{array}{c} 2.8136 \\ \hline 2.8202 \\ 2.8267 \\ \hline 2.8331 \\ \hline 2.8395 \\ 2.8457 \\ \hline 2.8519 \\ \hline 2.8579 \end{array}$	$\begin{array}{r} 2.8142 \\ \hline 2.8209 \\ 2.8274 \\ 2.8338 \\ 2.8401 \\ 2.8463 \\ 2.8525 \\ \hline 2.8585 \end{array}$	$\begin{array}{r} 2.8149 \\ \hline 2.8215 \\ 2.8280 \\ 2.8344 \\ 2.8407 \\ 2.8470 \\ 2.8531 \\ \hline 2.8591 \end{array}$	$\begin{array}{r} 2.8136 \\ \hline 2.8222 \\ 2.8287 \\ \hline 2.8351 \\ \hline 2.8414 \\ 2.8476 \\ \hline 2.8537 \\ \hline 2.8597 \end{array}$	$\begin{array}{r} 2.8162 \\ \hline 2.8228 \\ 2.8293 \\ 2.8357 \\ 2.8420 \\ 2.8482 \\ 2.8543 \\ \hline 2.8603 \end{array}$	$\begin{array}{r} 2.8169 \\ \hline 2.8235 \\ 2.8299 \\ 2.8363 \\ 2.8426 \\ 2.8488 \\ 2.8549 \\ \hline 2.8609 \end{array}$	$\begin{array}{r} 2.8176 \\ \hline 2.8241 \\ 2.8306 \\ 2.8370 \\ 2.8432 \\ 2.8494 \\ 2.8555 \\ \hline 2.8615 \end{array}$	$\begin{array}{r} 2.8182 \\ \hline 2.8248 \\ 2.8312 \\ 2.8376 \\ 2.8439 \\ 2.8500 \\ \hline 2.8561 \\ \hline 2.8621 \end{array}$	$\begin{array}{r} 2.8189 \\ \hline 2.8254 \\ 2.8319 \\ 2.8382 \\ 2.8445 \\ 2.8506 \\ 2.8567 \\ \hline 2.8627 \end{array}$
0	$ \begin{array}{r} 12 \\ 12 \\ 12 \\ 12 \\ 12 \\ 13 \\$	$ \begin{array}{r} 10 \\ 20 \\ 30 \\ 40 \\ 50 \\ \hline 0 \\ 10 \\ 20 \\ 30 \\ 30 \\ \end{array} $	$\begin{array}{c} 2,8633\\ 2,8692\\ 2,8751\\ 2,8808\\ 2,8865\\ \hline 2,8921\\ 2,8976\\ 2,9031\\ 2,9085\\ \end{array}$	$\begin{array}{c} 2.8639 \\ 2.8698 \\ 2.8756 \\ 2.8814 \\ 2.8871 \\ \hline 2.8927 \\ 2.8982 \\ 2.9036 \\ 2.9090 \\ \end{array}$	$\begin{array}{c} 2,8645\\ 2,8704\\ 2,8762\\ 2,8820\\ 2,8876\\ 2,8932\\ 2,8932\\ 2,9042\\ 2,9096\\ \end{array}$	$\begin{array}{c} 2,8651\\ 2,8710\\ 2,8768\\ 2,8825\\ 2,8882\\ \hline 2,8938\\ 2,8993\\ 2,9047\\ 2,9101\\ \end{array}$	$\begin{array}{c} 2.8657\\ 2.8716\\ 2.8774\\ 2.8831\\ 2.8887\\ \hline 2.8943\\ 2.8998\\ 2.9053\\ 2.9106\\ \end{array}$	$\begin{array}{c} 2.\ 8663\\ 2.\ 8722\\ 2.\ 8779\\ 2.\ 8837\\ 2.\ 8893\\ \hline 2.\ 8949\\ 2.\ 9004\\ 2.\ 9058\\ 2.\ 9112\\ \end{array}$	$\begin{array}{c} 2,8669\\ 2,8727\\ 2,8785\\ 2,8842\\ 2,8899\\ \hline 2,8954\\ 2,9009\\ 2,9063\\ 2,9117\\ \end{array}$	$\begin{array}{c} 2,8675\\ 2,8733\\ 2,8791\\ 2,8848\\ 2,8904\\ \hline 2,8960\\ 2,9015\\ 2,9069\\ 2,9122\\ \end{array}$	$\begin{bmatrix} 2,8681\\ 2,8739\\ 2,8739\\ 2,8797\\ 2,8854\\ 2,8910\\ \hline 2,8965\\ 2,9020\\ 2,9074\\ 2,9128\\ \end{bmatrix}$	$\begin{array}{c} 2.8686\\ 2.8745\\ 2.8802\\ 2.8859\\ 2.8915\\ \hline \\ 2.9025\\ 2.9079\\ 2.9133\\ \end{array}$
0	$ \begin{array}{r} 13 \\ 13 \\ 14 \\ $	$ \begin{array}{r} 40 \\ 50 \\ 0 \\ 10 \\ 20 \\ 30 \\ 40 \\ 50 \\ \end{array} $	$\begin{array}{c} 2.\ 9138\\ 2.\ 9191\\ \hline 2.\ 9243\\ 2.\ 9294\\ 2.\ 9345\\ 2.\ 9395\\ 2.\ 9445\\ 2.\ 9494\\ \end{array}$	$\begin{array}{c} 2, 9143 \\ 2, 9196 \\ \hline 2, 9248 \\ 2, 9299 \\ 2, 9350 \\ 2, 9400 \\ 2, 9450 \\ 2, 9499 \\ \end{array}$	$\begin{array}{r} 2.9149\\ 2.9201\\ \hline 2.9253\\ 2.9304\\ 2.9355\\ 2.9405\\ 2.9455\\ 2.9504\\ \end{array}$	$\begin{array}{c} 2,9154\\ 2,9206\\ \hline 2,9258\\ 2,9309\\ 2,9360\\ 2,9410\\ 2,9460\\ 2,9509\\ \end{array}$	$\begin{array}{c} 2,9159\\ 2,9212\\ \hline 2,9263\\ 2,9315\\ 2,9365\\ 2,9415\\ 2,9465\\ 2,9513\\ \end{array}$	$\begin{array}{c} 2,9165\\ 2,9217\\ \hline 2,9269\\ 2,9320\\ 2,9370\\ 2,9420\\ 2,9469\\ 2,9518\\ \end{array}$	$\begin{array}{c} 2.\ 9170\\ 2.\ 9222\\ \hline 2.\ 9274\\ 2.\ 9325\\ 2.\ 9375\\ 2.\ 9425\\ 2.\ 9474\\ 2.\ 9523\\ \end{array}$	$\begin{array}{c} 2.\ 9175\\ 2.\ 9227\\ \hline 2.\ 9279\\ 2.\ 9330\\ 2.\ 9380\\ 2.\ 9430\\ 2.\ 9479\\ 2.\ 9528\\ \end{array}$	$\begin{array}{c} 2.\ 9180\\ 2.\ 9232\\ \hline 2.\ 9284\\ 2.\ 9335\\ 2.\ 9385\\ 2.\ 9435\\ 2.\ 9435\\ 2.\ 9484\\ 2.\ 9533\\ \end{array}$	$\begin{array}{c} 2.9186\\ 2.9238\\ \hline 2.9289\\ 2.9340\\ 2.9390\\ 2.9440\\ 2.9489\\ 2.9538\\ \end{array}$
0	$ \begin{array}{r} 15 \\ 15 \\ 15 \\ 15 \\ 15 \\ 15 \\ 15 \\ 16 \\ \end{array} $	$ \begin{array}{c} 0 \\ 10 \\ 20 \\ 30 \\ 40 \\ 50 \\ 0 \end{array} $	$\begin{array}{c} 2.9542 \\ 2.9590 \\ 2.9638 \\ 2.9685 \\ 2.9731 \\ 2.9777 \\ 2.9823 \end{array}$	$\begin{array}{r} 2.9547 \\ 2.9595 \\ 2.9643 \\ 2.9689 \\ 2.9736 \\ 2.9782 \\ \hline 2.9827 \end{array}$	$\begin{array}{r} 2.9552 \\ 2.9600 \\ 2.9647 \\ 2.9694 \\ 2.9741 \\ 2.9786 \\ \hline 2.9832 \end{array}$	$\begin{array}{r} 2.9557 \\ 2.9605 \\ 2.9652 \\ 2.9699 \\ 2.9745 \\ 2.9791 \\ \hline 2.9836 \end{array}$	$\begin{array}{r} 2.9562 \\ 2.9609 \\ 2.9657 \\ 2.9703 \\ 2.9703 \\ 2.9750 \\ 2.9795 \\ \hline 2.9841 \end{array}$	$\begin{array}{r} 2.9566\\ 2.9614\\ 2.9661\\ 2.9708\\ 2.9754\\ 2.9800\\ \hline 2.9845 \end{array}$	$\begin{array}{r} 2.9571 \\ 2.9619 \\ 2.9666 \\ 2.9713 \\ 2.9759 \\ 2.9805 \\ \hline 2.9850 \end{array}$	$\begin{array}{r} 2.9576 \\ 2.9624 \\ 2.9671 \\ 2.9717 \\ 2.9763 \\ 2.9809 \\ \hline 2.9854 \end{array}$	$\begin{array}{r} 2.9581 \\ 2.9628 \\ 2.9675 \\ 2.9722 \\ 2.9768 \\ 2.9814 \\ \hline 2.9859 \end{array}$	$\begin{array}{r} 2.9586\\ 2.9633\\ 2.9680\\ 2.9727\\ 2.9773\\ 2.9818\\ \hline 2.9863\\ \hline \end{array}$
-0	$ \begin{array}{r} 16 \\ 16 \\ 16 \\ 16 \\ 16 \\ 16 \\ 17 \\ \end{array} $	$ \begin{array}{c} 0 \\ 20 \\ 30 \\ 40 \\ 50 \\ 0 \end{array} $	2. 9868 2. 9912 2. 9956 3. 0000 3. 0043	$\begin{array}{c} 2.9872 \\ 2.9917 \\ 2.9961 \\ 3.0004 \\ 3.0048 \\ \hline 3.0090 \end{array}$	$\begin{array}{c} 2.9877 \\ 2.9877 \\ 2.9921 \\ 2.9965 \\ 3.0009 \\ 3.0052 \\ \hline \begin{array}{c} 3.0005 \\ \hline \end{array}$	$\begin{array}{c} 2.9881 \\ 2.9881 \\ 2.9926 \\ 2.9969 \\ 3.0013 \\ 3.0056 \\ \hline \begin{array}{c} 3.0099 \\ \hline \end{array}$	$\begin{array}{c} 2.9886 \\ 2.9930 \\ 2.9974 \\ 3.0017 \\ 3.0060 \\ \hline 3.0102 \end{array}$	$\begin{array}{c} 2.9890 \\ 2.9890 \\ 2.9934 \\ 2.9978 \\ 3.0022 \\ 3.0065 \\ \hline 3.0107 \end{array}$	$\begin{array}{c} 2.9894 \\ 2.9939 \\ 2.9939 \\ 2.9983 \\ 3.0026 \\ 3.0069 \\ \hline \end{array}$	$\begin{array}{r} 2.9899 \\ 2.9843 \\ 2.9943 \\ 2.9987 \\ 3.0030 \\ 3.0073 \\ \hline 3.0116 \end{array}$	$\begin{array}{c} 2.9903 \\ 2.9948 \\ 2.9991 \\ 3.0035 \\ 3.0077 \\ \hline 3.0120 \end{array}$	$\begin{array}{c} 2.9908\\ 2.9952\\ 2.9996\\ 3.0039\\ 3.0082\\ \hline 3.0124 \end{array}$
	$17 \\ 17 \\ 17 \\ 17 \\ 17 \\ 17 \\ 17 \\ 17 \\$	$ \begin{array}{r} 10 \\ 20 \\ 30 \\ 40 \\ 50 \\ \end{array} $	$\begin{array}{c} 3.\ 0080\\ 3.\ 0128\\ 3.\ 0170\\ 3.\ 0212\\ 3.\ 0253\\ 3.\ 0294 \end{array}$	$\begin{array}{c} 3.\ 0050\\ 3.\ 0133\\ 3.\ 0175\\ 3.\ 0216\\ 3.\ 0257\\ 3.\ 0298\end{array}$	$\begin{array}{c} 3.\ 0033\\ 3.\ 0137\\ 3.\ 0179\\ 3.\ 0220\\ 3.\ 0261\\ 3.\ 0302 \end{array}$	$\begin{array}{c} 3.\ 0099\\ 3.\ 0141\\ 3.\ 0183\\ 3.\ 0224\\ 3.\ 0265\\ 3.\ 0306\end{array}$	$\begin{array}{c} 3.0103 \\ 3.0145 \\ 3.0187 \\ 3.0228 \\ 3.0269 \\ 3.0310 \end{array}$	$\begin{array}{c} 3.0107 \\ 3.0149 \\ 3.0191 \\ 3.0233 \\ 3.0273 \\ 3.0314 \end{array}$	$\begin{array}{c} 3.0111\\ 3.0154\\ 3.0195\\ 3.0237\\ 3.0278\\ 3.0318\\ \hline \end{array}$	$\begin{array}{c} 3.\ 0110\\ 3.\ 0158\\ 3.\ 0199\\ 3.\ 0241\\ 3.\ 0282\\ 3.\ 0322\\ \end{array}$	$\begin{array}{c} 3.0120\\ 3.0162\\ 3.0204\\ 3.0245\\ 3.0286\\ 3.0326\\ \end{array}$	$\begin{array}{c} 3.0124\\ 3.0166\\ 3.0208\\ 3.0249\\ 3.0290\\ 3.0330\end{array}$
0	18 18 18 18 18 18 18	$\begin{array}{c} 0\\ 10\\ 20\\ 30\\ 40\\ 50 \end{array}$	$\begin{array}{c} 3.\ 0334\\ 3.\ 0374\\ 3.\ 0414\\ 3.\ 0453\\ 3.\ 0492\\ 3.\ 0531 \end{array}$	$\begin{array}{c} 3.\ 0338\\ 3.\ 0378\\ 3.\ 0418\\ 3.\ 0457\\ 3.\ 0496\\ 3.\ 0535 \end{array}$	$\begin{array}{c} 3.\ 0342\\ 3.\ 0382\\ 3.\ 0422\\ 3.\ 0461\\ 3.\ 0500\\ 3.\ 0538 \end{array}$	$\begin{array}{c} 3.\ 0346\\ 3.\ 0386\\ 3.\ 0426\\ 3.\ 0465\\ 3.\ 0504\\ 3.\ 0542 \end{array}$	$\begin{array}{c} 3.\ 0350\\ 3.\ 0390\\ 3.\ 0430\\ 3.\ 0469\\ 3.\ 0508\\ 3.\ 0546 \end{array}$	$\begin{array}{c} 3.\ 0354\\ 3.\ 0394\\ 3.\ 0434\\ 3.\ 0473\\ 3.\ 0512\\ 3.\ 0550\end{array}$	$\begin{array}{c} 3.\ 0358\\ 3.\ 0398\\ 3.\ 0438\\ 3.\ 0477\\ 3.\ 0515\\ 3.\ 0554 \end{array}$	$\begin{array}{c} 3.\ 0362\\ 3.\ 0402\\ 3.\ 0441\\ 3.\ 0481\\ 3.\ 0519\\ 3.\ 0558\end{array}$	$\begin{array}{c} 3.\ 0366\\ 3.\ 0406\\ 3.\ 0445\\ 3.\ 0484\\ 3.\ 0523\\ 3.\ 0561 \end{array}$	$\begin{array}{c} 3.\ 0370\\ 3.\ 0410\\ 3.\ 0449\\ 3.\ 0488\\ 3.\ 0527\\ 3.\ 0565 \end{array}$
0	19 19 19 19 19 19	$\begin{array}{c} 0\\ 10\\ 20\\ 30\\ 40\\ 50 \end{array}$	$\begin{array}{c} 3.\ 0569\\ 3.\ 0607\\ 3.\ 0645\\ 3.\ 0682\\ 3.\ 0719\\ 3.\ 0755 \end{array}$	$\begin{array}{c} 3.\ 0573\\ 3.\ 0611\\ 3.\ 0648\\ 3.\ 0686\\ 3.\ 0722\\ 3.\ 0759 \end{array}$	$\begin{array}{c} 3.\ 0577\\ 3.\ 0615\\ 3.\ 0652\\ 3.\ 0689\\ 3.\ 0726\\ 3.\ 0763\\ \end{array}$	$\begin{array}{c} 3.\ 0580\\ 3.\ 0618\\ 3.\ 0656\\ 3.\ 0693\\ 3.\ 0730\\ 3.\ 0766\end{array}$	$\begin{array}{c} 3.\ 0584\\ 3.\ 0622\\ 3.\ 0660\\ 3.\ 0697\\ 3.\ 0734\\ 3.\ 0770 \end{array}$	$\begin{array}{c} 3.\ 0588\\ 3.\ 0626\\ 3.\ 0663\\ 3.\ 0700\\ 3.\ 0737\\ 3.\ 0774 \end{array}$	$\begin{array}{c} 3.\ 0592\\ 3.\ 0630\\ 3.\ 0667\\ 3.\ 0704\\ 3.\ 0741\\ 3.\ 0777\end{array}$	$\begin{array}{c} 3.\ 0596\\ 3.\ 0633\\ 3.\ 0671\\ 3.\ 0708\\ 3.\ 0745\\ 3.\ 0781 \end{array}$	$\begin{array}{c} 3.\ 0599\\ 3.\ 0637\\ 3.\ 0674\\ 3.\ 0711\\ 3.\ 0748\\ 3.\ 0785 \end{array}$	$\begin{array}{c} 3.\ 0603\\ 3.\ 0641\\ 3.\ 0678\\ 3.\ 0715\\ 3.\ 0752\\ 3.\ 0788 \end{array}$

APPENDIX V: TABLE IX.

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			1			1					
	Are.	0''	1"	2''	3''	4"	5″	6''		S''	9''
° O ^h	$\begin{array}{cccc} & & & & \\ & 20^{m} & 0^{s} \\ 20 & 10 \\ 20 & 20 \\ 20 & 30 \\ 20 & 40 \\ 20 & 50 \end{array}$	$\begin{array}{c} 3.\ 0792\\ 3.\ 0828\\ 3.\ 0864\\ 3.\ 0899\\ 3.\ 0934\\ 3.\ 0969 \end{array}$	$\begin{array}{c} 3.\ 0795\\ 3.\ 0831\\ 3.\ 0867\\ 3.\ 0903\\ 3.\ 0938\\ 3.\ 0973 \end{array}$	$\begin{array}{c} 3.\ 0799\\ 3.\ 0835\\ 3.\ 0871\\ 3.\ 0906\\ 3.\ 0941\\ 3.\ 0976 \end{array}$	$\begin{array}{c} 3.\ 0803\\ 3.\ 0839\\ 3.\ 0874\\ 3.\ 0910\\ 3.\ 0945\\ 3.\ 0980 \end{array}$	$\begin{array}{c} 3.\ 0806\\ 3.\ 0842\\ 3.\ 0878\\ 3.\ 0913\\ 3.\ 0948\\ 3.\ 0983 \end{array}$	$\begin{array}{c} 3.\ 0810\\ 3.\ 0846\\ 3.\ 0881\\ 3.\ 0917\\ 3.\ 0952\\ 3.\ 0986 \end{array}$	$\begin{array}{c} 3.\ 0813\\ 3.\ 0849\\ 3.\ 0885\\ 3.\ 0920\\ 3.\ 0955\\ 3.\ 0990 \end{array}$	$\begin{array}{c} 3.\ 0817\\ 3.\ 0853\\ 3.\ 0888\\ 3.\ 0924\\ 3.\ 0959\\ 3.\ 0993 \end{array}$	$\begin{array}{c} 3.\ 0821\\ 3.\ 0856\\ 3.\ 0892\\ 3.\ 0927\\ 3.\ 0962\\ 3.\ 0997 \end{array}$	$\begin{array}{c} 3.\ 0824\\ 3.\ 0860\\ 3.\ 0896\\ 3.\ 0931\\ 3.\ 0966\\ 3.\ 1000 \end{array}$
0	$\begin{array}{cccc} 21 & 0 \\ 21 & 10 \\ 21 & 20 \\ 21 & 30 \\ 21 & 40 \\ 21 & 50 \end{array}$	$\begin{array}{c} 3.\ 1004\\ 3.\ 1038\\ 3.\ 1072\\ 3.\ 1106\\ 3.\ 1139\\ 3.\ 1173\\ \end{array}$	$\begin{array}{c} 3.\ 1007\\ 3.\ 1041\\ 3.\ 1075\\ 3.\ 1109\\ 3.\ 1143\\ 3.\ 1176 \end{array}$	$\begin{array}{c} 3.\ 1011\\ 3.\ 1045\\ 3.\ 1079\\ 3.\ 1113\\ 3.\ 1146\\ 3.\ 1179 \end{array}$	$\begin{array}{c} 3.\ 1014\\ 3.\ 1048\\ 3.\ 1082\\ 3.\ 1116\\ 3.\ 1149\\ 3.\ 1183 \end{array}$	$\begin{array}{c} 3.\ 1017\\ 3.\ 1052\\ 3.\ 1086\\ 3.\ 1119\\ 3.\ 1153\\ 3.\ 1186 \end{array}$	$\begin{array}{c} 3.\ 1021\\ 3.\ 1055\\ 3.\ 1089\\ 3.\ 1123\\ 3.\ 1156\\ 3.\ 1189 \end{array}$	$\begin{array}{c} 3.\ 1024\\ 3.\ 1059\\ 3.\ 1092\\ 3.\ 1126\\ 3.\ 1159\\ 3.\ 1193\\ \end{array}$	$\begin{array}{c} 3.\ 1028\\ 3.\ 1062\\ 3.\ 1096\\ 3.\ 1129\\ 3.\ 1163\\ 3.\ 1196 \end{array}$	$\begin{array}{c} 3.\ 1031\\ 3.\ 1065\\ 3.\ 1099\\ 3.\ 1133\\ 3.\ 1166\\ 3.\ 1199 \end{array}$	$\begin{array}{c} 3.\ 1035\\ 3.\ 1069\\ 3.\ 1103\\ 3.\ 1136\\ 3.\ 1169\\ 3.\ 1202 \end{array}$
0	$\begin{array}{cccccccccccccccccccccccccccccccccccc$	$\begin{array}{c} 3.\ 1206\\ 3.\ 1239\\ 3.\ 1271\\ 3.\ 1303\\ 3.\ 1335\\ 3.\ 1367 \end{array}$	$\begin{array}{c} 3.\ 1209\\ 3.\ 1242\\ 3.\ 1274\\ 3.\ 1307\\ 3.\ 1339\\ 3.\ 1370 \end{array}$	$\begin{array}{c} 3.\ 1212\\ 3.\ 1245\\ 3.\ 1278\\ 3.\ 1310\\ 3.\ 1342\\ 3.\ 1374 \end{array}$	$\begin{array}{c} 3.\ 1216\\ 3.\ 1248\\ 3.\ 1281\\ 3.\ 1313\\ 3.\ 1345\\ 3.\ 1377 \end{array}$	$\begin{array}{c} 3.\ 1219\\ 3.\ 1252\\ 3.\ 1284\\ 3.\ 1316\\ 3.\ 1348\\ 3.\ 1380 \end{array}$	$\begin{array}{c} 3.\ 1222\\ 3.\ 1255\\ 3.\ 1287\\ 3.\ 1319\\ 3.\ 1351\\ 3.\ 1383 \end{array}$	$\begin{array}{c} 3.\ 1225\\ 3.\ 1258\\ 3.\ 1290\\ 3.\ 1323\\ 3.\ 1355\\ 3.\ 1386 \end{array}$	$\begin{array}{c} 3.\ 1229\\ 3.\ 1261\\ 3.\ 1294\\ 3.\ 1326\\ 3.\ 1358\\ 3.\ 1389 \end{array}$	$\begin{array}{c} 3.\ 1232\\ 3.\ 1265\\ 3.\ 1297\\ 3.\ 1329\\ 3.\ 1361\\ 3.\ 1392 \end{array}$	$\begin{array}{c} 3.\ 1235\\ 3.\ 1268\\ 3.\ 1300\\ 3.\ 1332\\ 3.\ 1364\\ 3.\ 1396 \end{array}$
0	$\begin{array}{cccc} 23 & 0 \\ 23 & 10 \\ 23 & 20 \\ 23 & 30 \\ 23 & 40 \\ 23 & 50 \end{array}$	$\begin{array}{c} 3.\ 1399\\ 3.\ 1430\\ 3.\ 1461\\ 3.\ 1492\\ 3.\ 1523\\ 3.\ 1553\end{array}$	$\begin{array}{c} 3.\ 1402\\ 3.\ 1433\\ 3.\ 1464\\ 3.\ 1495\\ 3.\ 1526\\ 3.\ 1556\end{array}$	$\begin{array}{r} 3.1405 \\ 3.1436 \\ 3.1467 \\ 3.1498 \\ 3.1529 \\ 3.1559 \end{array}$	$\begin{array}{c} 3.1408\\ 3.1440\\ 3.1471\\ 3.1501\\ 3.1532\\ 3.1562 \end{array}$	$\begin{array}{c} 3.\ 1411\\ 3.\ 1443\\ 3.\ 1474\\ 3.\ 1504\\ 3.\ 1535\\ 3.\ 1565 \end{array}$	$\begin{array}{c} 3.\ 1414\\ 3.\ 1446\\ 3.\ 1477\\ 3.\ 1508\\ 3.\ 1538\\ 3.\ 1569 \end{array}$	$\begin{array}{r} 3.1418\\ 3.1449\\ 3.1480\\ 3.1511\\ 3.1541\\ 3.1572 \end{array}$	$\begin{array}{c} 3.\ 1421\\ 3.\ 1452\\ 3.\ 1483\\ 3.\ 1514\\ 3.\ 1544\\ 3.\ 1575\end{array}$	$\begin{array}{c} 3.1424\\ 3.1455\\ 3.1486\\ 3.1517\\ 3.1547\\ 3.1578\end{array}$	$\begin{array}{c} 3.\ 1427\\ 3.\ 1458\\ 3.\ 1489\\ 3.\ 1520\\ 3.\ 1550\\ 3.\ 1581 \end{array}$
0	$\begin{array}{cccc} 24 & 0 \\ 24 & 10 \\ 24 & 20 \\ 24 & 20 \\ 24 & 30 \\ 24 & 40 \\ 24 & 50 \end{array}$	$\begin{array}{c} 3.\ 1584\\ 3.\ 1614\\ 3.\ 1644\\ 3.\ 1673\\ 3.\ 1703\\ 3.\ 1732 \end{array}$	$\begin{array}{c} 3.\ 1587\\ 3.\ 1617\\ 3.\ 1647\\ 3.\ 1676\\ 3.\ 1706\\ 3.\ 1735 \end{array}$	$\begin{array}{r} 3.\ 1590\\ 3.\ 1620\\ 3.\ 1649\\ 3.\ 1679\\ 3.\ 1708\\ 3.\ 1738 \end{array}$	$\begin{array}{c} 3.\ 1593\\ 3.\ 1623\\ 3.\ 1652\\ 3.\ 1682\\ 3.\ 1711\\ 3.\ 1741 \end{array}$	$\begin{array}{c} 3.\ 1596\\ 3.\ 1626\\ 3.\ 1655\\ 3.\ 1685\\ 3.\ 1714\\ 3.\ 1744 \end{array}$	$\begin{array}{r} 3.\ 1599\\ 3.\ 1629\\ 3.\ 1658\\ 3.\ 1688\\ 3.\ 1717\\ 3.\ 1746 \end{array}$	$\begin{array}{c} 3.\ 1602\\ 3.\ 1632\\ 3.\ 1661\\ 3.\ 1691\\ 3.\ 1720\\ 3.\ 1749 \end{array}$	$\begin{array}{c} 3.\ 1605\\ 3.\ 1635\\ 3.\ 1664\\ 3.\ 1694\\ 3.\ 1723\\ 3.\ 1752 \end{array}$	$\begin{array}{c} 3.\ 1608\\ 3.\ 1638\\ 3.\ 1667\\ 3.\ 1697\\ 3.\ 1726\\ 3.\ 1755 \end{array}$	$\begin{array}{c} 3.\ 1611\\ 3.\ 1641\\ 3.\ 1670\\ 3.\ 1700\\ 3.\ 1729\\ 3.\ 1758\end{array}$
0	$\begin{array}{cccccccccccccccccccccccccccccccccccc$	$\begin{array}{r} 3.1761 \\ 3.1790 \\ 3.1818 \\ 3.1847 \\ 3.1875 \\ 3.1903 \end{array}$	$\begin{array}{c} 3.\ 1764\\ 3.\ 1793\\ 3.\ 1821\\ 3.\ 1850\\ 3.\ 1878\\ 3.\ 1906 \end{array}$	$\begin{array}{c} 3.\ 1767\\ 3.\ 1796\\ 3.\ 1824\\ 3.\ 1853\\ 3.\ 1881\\ 3.\ 1909 \end{array}$	$\begin{array}{c} 3.\ 1770\\ 3.\ 1798\\ 3.\ 1827\\ 3.\ 1855\\ 3.\ 1884\\ 3.\ 1912 \end{array}$	$\begin{array}{c} 3.\ 1772\\ 3.\ 1801\\ 3.\ 1830\\ 3.\ 1858\\ 3.\ 1886\\ 3.\ 1915 \end{array}$	$\begin{array}{c} 3.\ 1775\\ 3.\ 1804\\ 3.\ 1833\\ 3.\ 1861\\ 3.\ 1889\\ 3.\ 1917 \end{array}$	$\begin{array}{r} 3.1778 \\ 3.1807 \\ 3.1836 \\ 3.1864 \\ 3.1892 \\ 3.1920 \end{array}$	$\begin{array}{r} 3.1781 \\ 3.1810 \\ 3.1838 \\ 3.1867 \\ 3.1895 \\ 3.1923 \end{array}$	$\begin{array}{c} 3.1784\\ 3.1813\\ 3.1841\\ 3.1841\\ 3.1870\\ 3.1898\\ 3.1926 \end{array}$	$\begin{array}{c} 3.\ 1787\\ 3.\ 1816\\ 3.\ 1844\\ 3.\ 1872\\ 3.\ 1901\\ 3.\ 1928 \end{array}$
0	$\begin{array}{cccc} 26 & 0 \\ 26 & 10 \\ 26 & 20 \\ 26 & 30 \\ 26 & 40 \\ 26 & 50 \end{array}$	$\begin{array}{c} 3.1931 \\ 3.1959 \\ 3.1987 \\ 3.2014 \\ 3.2041 \\ 3.2068 \end{array}$	$\begin{array}{c} 3.\ 1934\\ 3.\ 1962\\ 3.\ 1989\\ 3.\ 2017\\ 3.\ 2044\\ 3.\ 2071 \end{array}$	$\begin{array}{r} 3.1937\\ 3.1965\\ 3.1965\\ 3.2019\\ 3.2019\\ 3.2047\\ 3.2074 \end{array}$	$\begin{array}{c} 3.1940 \\ 3.1967 \\ 3.1995 \\ 3.2022 \\ 3.2049 \\ 3.2076 \end{array}$	$\begin{array}{c} 3.\ 1942 \\ 3.\ 1970 \\ 3.\ 1998 \\ 3.\ 2025 \\ 3.\ 2052 \\ 3.\ 2079 \end{array}$	$\begin{array}{r} 3, 1945 \\ 3, 1973 \\ 3, 2000 \\ 3, 2028 \\ 3, 2055 \\ 3, 2082 \end{array}$	$\begin{array}{c} 3. \ 1948 \\ 3. \ 1976 \\ 3. \ 2003 \\ 3. \ 2030 \\ 3. \ 2057 \\ 3. \ 2084 \end{array}$	$\begin{array}{r} 3.1951 \\ 3.1978 \\ 3.2006 \\ 3.2033 \\ 3.2060 \\ 3.2087 \end{array}$	$\begin{array}{r} 3.1953\\ 3.1981\\ 3.2009\\ 3.2036\\ 3.2063\\ 3.2090 \end{array}$	$\begin{array}{c} 3.\ 1956\\ 3.\ 1984\\ 3.\ 2011\\ 3.\ 2038\\ 3.\ 2066\\ 3.\ 2092 \end{array}$
0	$\begin{array}{cccc} 27 & 0 \\ 27 & 10 \\ 27 & 20 \\ 27 & 30 \\ 27 & 40 \\ 27 & 50 \end{array}$	$\begin{array}{c} 3.\ 2095\\ 3.\ 2122\\ 3.\ 2148\\ 3.\ 2175\\ 3.\ 2201\\ 3.\ 2227 \end{array}$	$\begin{array}{c} 3.\ 2098\\ 3.\ 2125\\ 3.\ 2151\\ 3.\ 2177\\ 3.\ 2204\\ 3.\ 2230 \end{array}$	$\begin{array}{c} 3.\ 2101\\ 3.\ 2127\\ 3.\ 2154\\ 3.\ 2180\\ 3.\ 2206\\ 3.\ 2232 \end{array}$	$\begin{array}{c} 3.\ 2103\\ 3.\ 2130\\ 3.\ 2156\\ 3.\ 2183\\ 3.\ 2209\\ 3.\ 2235 \end{array}$	$\begin{array}{c} 3.\ 2106\\ 3.\ 2133\\ 3.\ 2159\\ 3.\ 2185\\ 3.\ 2212\\ 3.\ 2238 \end{array}$	$\begin{array}{r} 3.\ 2109\\ 3.\ 2135\\ 3.\ 2162\\ 3.\ 2188\\ 3.\ 2214\\ 3.\ 2240 \end{array}$	$\begin{array}{c} 3.\ 2111\\ 3.\ 2138\\ 3.\ 2164\\ 3.\ 2191\\ 3.\ 2217\\ 3.\ 2243 \end{array}$	$\begin{array}{c} 3.\ 2114\\ 3.\ 2140\\ 3.\ 2167\\ 3.\ 2193\\ 3.\ 2219\\ 3.\ 2245 \end{array}$	$\begin{array}{c} 3.\ 2117\\ 3.\ 2143\\ 3.\ 2170\\ 3.\ 2196\\ 3.\ 2222\\ 3.\ 2248 \end{array}$	$\begin{array}{r} 3.\ 2119\\ 3.\ 2146\\ 3.\ 2172\\ 3.\ 2198\\ 3.\ 2225\\ 3.\ 2250\\ \end{array}$
0	$\begin{array}{cccc} 28 & 0 \\ 28 & 10 \\ 28 & 20 \\ 28 & 30 \\ 28 & 40 \\ 28 & 50 \end{array}$	$\begin{array}{c} 3.\ 2253\\ 3.\ 2279\\ 3.\ 2304\\ 3.\ 2330\\ 3.\ 2355\\ 3.\ 2380 \end{array}$	$\begin{array}{c} 3.\ 2256\\ 3.\ 2281\\ 3.\ 2307\\ 3.\ 2333\\ 3.\ 2358\\ 3.\ 2383 \end{array}$	$\begin{array}{c} 3.\ 2258\\ 3.\ 2284\\ 3.\ 2310\\ 3.\ 2335\\ 3.\ 2360\\ 3.\ 2385 \end{array}$	$\begin{array}{c} 3.\ 2261\\ 3.\ 2287\\ 3.\ 2312\\ 3.\ 2338\\ 3.\ 2363\\ 3.\ 2388 \end{array}$	$\begin{array}{c} 3.\ 2263\\ 3.\ 2289\\ 3.\ 2315\\ 3.\ 2340\\ 3.\ 2365\\ 3.\ 2390 \end{array}$	$\begin{array}{c} 3.\ 2266\\ 3.\ 2292\\ 3.\ 2317\\ 3.\ 2343\\ 3.\ 2368\\ 3.\ 2393 \end{array}$	$\begin{array}{c} 3.\ 2269\\ 3.\ 2294\\ 3.\ 2320\\ 3.\ 2345\\ 3.\ 2370\\ 3.\ 2395 \end{array}$	$\begin{array}{c} 3.\ 2271\\ 3.\ 2297\\ 3.\ 2322\\ 3.\ 2348\\ 3.\ 2373\\ 3.\ 2398 \end{array}$	$\begin{array}{c} 3.\ 2274\\ 3.\ 2299\\ 3.\ 2325\\ 3.\ 2350\\ 3.\ 2375\\ 3.\ 2400 \end{array}$	$\begin{array}{c} 3.\ 2276\\ 3.\ 2302\\ 3.\ 2327\\ 3.\ 2353\\ 3.\ 2378\\ 3.\ 2403 \end{array}$
0	$\begin{array}{cccc} 29 & 0 \\ 29 & 10 \\ 29 & 20 \\ 29 & 30 \\ 29 & 40 \\ 29 & 50 \end{array}$	$\begin{array}{c} 3.\ 2405\\ 3.\ 2430\\ 3.\ 2455\\ 3.\ 2455\\ 3.\ 2480\\ 3.\ 2504\\ 3.\ 2529\end{array}$	$\begin{array}{c} 3.\ 2408\\ 3.\ 2433\\ 3.\ 2458\\ 3.\ 2458\\ 3.\ 2482\\ 3.\ 2507\\ 3.\ 2531 \end{array}$	$\begin{array}{c} 3.\ 2410\\ 3.\ 2435\\ 3.\ 2460\\ 3.\ 2485\\ 3.\ 2509\\ 3.\ 2533 \end{array}$	$\begin{array}{c} 3.\ 2413\\ 3.\ 2438\\ 3.\ 2463\\ 3.\ 2487\\ 3.\ 2512\\ 3.\ 2536\end{array}$	$\begin{array}{c} 3.\ 2415\\ 3.\ 2440\\ 3.\ 2465\\ 3.\ 2490\\ 3.\ 2514\\ 3.\ 2538 \end{array}$	$\begin{array}{c} 3.\ 2418\\ 3.\ 2443\\ 3.\ 2467\\ 3.\ 2492\\ 3.\ 2516\\ 3.\ 2541 \end{array}$	$\begin{array}{c} 3.\ 2420\\ 3.\ 2445\\ 3.\ 2470\\ 3.\ 2494\\ 3.\ 2519\\ 3.\ 2543 \end{array}$	$\begin{array}{c} 3.\ 2423\\ 3.\ 2448\\ 3.\ 2472\\ 3.\ 2497\\ 3.\ 2521\\ 3.\ 2545 \end{array}$	$\begin{array}{c} 3.\ 2425\\ 3.\ 2450\\ 3.\ 2475\\ 3.\ 2499\\ 3.\ 2524\\ 3.\ 2548 \end{array}$	$\begin{array}{c} 3.\ 2428\\ 3.\ 2453\\ 3.\ 2477\\ 3.\ 2502\\ 3.\ 2526\\ 3.\ 2550 \end{array}$

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APPENDIX V: TABLE IX.

		e									
Arc		0"	1″	2"	3″	4 ″	5″	6″	•"	5"	9″
o /	"		0.000	0.0	0.0	0.07	0.000	0.0			
0 ^h 30	m 0 ^s	3. 2553	3.2555	3.2558	3.2560	3.2562	3. 2565	3.2567	3.2570	3.2572	3.2574
30	10	3.2017	5.2019 3.9609	5.2582 3.960±	5.2084 3.9000	5. 2986 3. 9010	5. 2089 3. 9619	5. 2091 3. 9e1=	5. 2594 3. 5017	ə. 2996 3-9290	5. 2098 3. 9400
30 20	20	3 2625	3 2697	3 2690	3. 2622	3.2610 3.2631	0. 2015 3. 2636	3.2630	3. 2611	3 98.12	3. 2618
30	40	3. 2648	3. 2651	3, 2653	3.2655	3. 2658	3. 2660	3.2662	3, 2665	3, 2667	3. 2669
30	50	3.2672	3.2674	3.2676	3.2679	3.2681	3.2683	3.2686	3.2688	3.2690	3.2693
0 31	0	3.2695	3. 2697	3.2700	3.2702	3.2704	3.2707	3.2709	3.2711	3.2714	3.2716
31	10	3.2718	3.2721	3.2723	3.2725	3.2728	3.2730	3.2732	3.2735	3. 2737	3.2739
31	20	3.2742	3.2744	3.2746	3.2749	3.2751	3.2753	3.2755	3.2758	3.2760	3.2762
31	30	5.2765 3.9700	5. 2767 3. 2700	5.2769 3.9709	5. 2112 3. 9704	5.2114 3.9707	0.2776 3 9700	3 9901	3 9904	5. 2183 3 9000	3 9000
31	50	3, 2810	3,2813	3. 2815	3. 2817	3. 2819	3, 2822	3, 2824	3.2826	3, 2828	3,2800 3,2831
0 32	0	3.2833	3.2835	3.2838	3.2840	3.2842	3.2844	3. 2847	3. 2849	3.2851	3, 2853
32	10	3.2856	3.2858	3.2860	3.2862	3.2865	3.2867	3.2869	3.2871	3.2874	3.2876
32	20	3.2878	3.2880	3.2882	3.2885	3.2887	3.2889	3.2891	3.2894	3.2896	3.2898
32	30	3.2900	3.2903	3. 2905	3.2907	3.2909	3.2911	3.2914	3.2916	3.2918	3.2920
32	40 50	3. 2923	3, 2925 3, 90.17	3.2927	3.2929	3.2931	3.2934	5. 2936 2. 9050	3.2938	3. 2940	3.2942
	- 00	3 2027	3 2040	3 2071	3 9079	3 9075	3 9070	3 9000	3 9000	3 9004	3 9000
0 33	10	3, 2980	3.2909 3.2991	3, 2993	3. 2995	3. 2913	3. 2999	3.2980 3.3002	3. 3001	5. 2084 3. 3006	0. 2980 3. 3008
33	20	3.3010	3.3012	3.3015	3.3017	3. 3019	3. 3021	3. 3023	3. 3025	3.3028	3.3030
- 33	30	3.3032	3.3034	3.3036	3.3038	3.3041	3.3043	3.3045	3.3047	3.3049	3.3051
33	40	3.3054	3.3056	3.3058	3.3060	3.3062	3.3064	3.3066	3.3069	3.3071	3.3073
33	06	3. 3075	3.3077	3.3079	3. 3081	3. 3084	3.3086	3.3088	3.3090	3.3092	3,3094
0 34	10	5. 3096 3. 2110	5. 5098 3. 2190	5. 5101 3 2199	5. 5103 3. 2194	5.5105 3.2196	3. 3107 3. 2190	5.5109 3.9190	3.5111 3.2190	3.3113	5. 5115 3. 3127
34	20	3,3139	3.3120 3.3141	3,3143	3, 3145	3.3120 3.3147	3,3149	3, 3150	3, 3153	3.3156	3, 3158
34	30	3.3160	3. 3162	3. 3164	3.3166	3.3168	3. 3170	3.3172	3.3174	3. 3176	3.3179
34	40	3.3181	3.3183	3.3185	3.3187	3.3189	3.3191	3.3193	3.3195	3. 3197	3.3199
34	50	3.3201	3.3204	3.3206	3.3208	3.3210	3.3212	3.3214	3.3216	3.3218	3.3220
0 35	0	3.3222	3. 3224	3.3226	3.3228	3.3230	3.3233	3. 3235	3. 3237	3. 3239	3. 3241
35	10	5. 5243 3. 2969	5. 3245 3. 296=	5. 5247 3. 2967	5. 5249 3. 2960	0. 0201 3 2070	0. 5203 3-2974	0. 0200 3 2070	0. 0207 3 2070	3. 3299	5. 5261 3. 2920
	30	3.3281	3. 3286 ·	3. 3288	3. 3290	3. 3299	3.3291	3. 3296	3. 3298	3,3300	3. 3302
35	40	3. 3304	3, 3306	3, 3308	3.3310	3. 3312	3. 3314	3.3316	3. 3318	3.3320	3. 3322
35	50	3.3324	3.3326	3.3328	3.3330	3.3332	3.3334	3. 3336	3.3339	3, 3341	3, 3343
0 36	0	3. 3345	3.3347	3.3349	3.3351	3. 3353	3. 3355	3. 3357	3, 3359	3. 3361	3. 3363
36	10	3. 3365	3. 3367	3.3369	3.3371	3.3373	3. 3375	3.3377	3.3379	3.3381	3.3383
36	$\frac{20}{20}$	3. 3385	3.3387	3.3389	3.3391	5. 3393 2. 2410	5. 3395 2. 2 11 1	3. 3397	5. 3398 2. 2410	3.3400	5. 3402 9 2400
30 96	- 50 - 40	3. 3494	3.3496	3. 3498	3, 3430	3. 3439	3. 3434	3. 3436	3.3438	3.3440	3, 3449
36	50	3. 3444	3. 3446	3. 3448	3. 3450	3. 3452	3. 3454	3. 3456	3. 3458	3. 3460	3.3462
0 37	0	3. 3464	3.3465	3. 3467	3.3469	3.3471	3. 3473	3.3475	3. 3477	3. 3479	3. 3481
37	10	3.3483	3.3485	3.3487	3.3489	3. 3491	3, 3493	3.3495	3. 3497	3.3499	3.3501
37	20	3.3502	3.3504	3.3506	3.3508	3.3510	3.3512	3.3514	3.3516	3.3518	3.3520
37	30	3.3522	3.3524	3.3526	3.3528	3.3530	3.3531	3.3533	3.3535	5.3537 3.3557	3. 3539
37	40 50	0.0041 3.3560	0. 0043 3 3569	3 3564	3. 3566	3. 3568	3, 3570	0. 0000 3. 3579	3, 3574	0, 5000 3, 3576	3.3577
0 29	0	3 3579	3. 3591	3 3582	3 3585	3 3587	3 3589	3, 3591	3 3593	3, 3595	3. 3596
38	10	3.3598	3, 3600	3, 3602	3.3604	3.3606	3.3608	3.3610	3.3612	3.3614	3,3615
38	20	3.3617	3.3619	3.3621	3.3623	3.3625	3.3627	3,3629	3.3630	3.3632	3.3634
38	30	3.3636	3.3638	3, 3640	3.3642	3.3644	3.3646	3.3647	3.3649	3.3651	3.3653
38	40	3.3655	3.3657	3.3659	3.3660	3.3662	3.3664	3.3666	3.3668	3.3670	3.3672
		2 2602	3 9204	2 9600	3 2000	3 2700	3 2701	3 2709	3 2705	3 2707	3 2700
0 38	, 0	3.3092 3.3711	3. 3712	3 3711	3 3716	3.3710	3.3701 3.3790	3. 3799	3.3705 3.3791	3.3707 3.3795	3. 3797
30	20	3.3729	3.3731	3, 3733	3. 3735	3.3736	3.3738	3, 3740	3.3742	3.3744	3.3746
39) 30	3.3747	3.3749	3.3751	3.3753	3.3755	3.3757	3.3758	3.3760	3.3762	3.3764
39	40	3.3766	3.3768	3.3769	3.3771	3.3773	3.3775	3.3777	3.3779	3.3780	3.3782
39	• 50	3.3784	3.3786	3.3788	3.3789	3.3791	3.3793	3.3795	3.3797	3.3798	3.3800

APPENDIX V: TABLE IX.

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	_	_										_
	Arc.		0″	1″	2"	3″	4″	5″	6″	7″	8″	S″
0	,	"							*			
0^{h}	40 ⁿ	n Os	3.3802	3.3804	3.3806	3.3808	3.3809	3.3811	3.3813	3.3815	3.3817	3.3818
	40	10	3.3820	3.3822	3.3824	3.3826	3.3827	3.3829	3.3831	3. 3833	3, 3835	3.3836
	40	20	3.3838	3.3840	3.3842	3.3844	3.3845	3.3847	3.3849	3.3851	3.3852	3.3854
	40	30	3.3856	3.3858	3.3860	3.3861	3.3863	3.3865	3.3867	3.3869	3.3870	3.3872
	-40	40	3.3874	3.3876	3.3877	3.3879	3.3881	3.3883	3.3885	3.3886	3.3888	3.3890
	40	_50_	3.3892	3.3893	3.3895	3.3897	3, 3899	3.3901	3.3902	3.3904	3.3906	3.3908
0	41	0	3.3909	3.3911	3. 3913	3.3915	3.3916	3.3918	3.3920	3.3922	3.3923	3.3925
	41	10	3.3927	3.3929	3.3930	3.3932	3.3934	3.3936	3.3938	3.3939	3.3941	3.3943
	+1	20	3.3940	3.3946	3. 3948	3.3930	3.3952	3.3953	3.3900	3.3957	3.3959	3.3960
	41	30	3, 3902	5. 590 4 9. 9091	3, 3900	3, 3907	3, 3909	0.3971	2 2000	2 2002	3. 3970	3. 3978
	11	50	3, 3919	3, 3901	3. 1000	3, 3960	3. 3980	3 1005	3, 1007	3. 3992	3. 1011	3, 1019
	19	- 00	3 1011	2 1016	2 1017	2 4010	3,1091	2 1092	3 1091	2 1026	2 1098	2 1020
U	12	10	3 4031	3 4033	3 4035	3 4019	3.4021 3.4038	3 4040	3 4041	3 4043	3 4045	3 4047
	49	-20	3 4048	3 4050	3 4059	3 4053	3 4055	3 4057	3 4059	3,4060	3 4062	3 4064
	$\tilde{42}$	30	3,4065	3.4067	3, 4069	3, 4071	3,4072	3, 4074	3, 4076	3, 4077	3, 4079	3,4081
	42	40	3,4082	3,4084	3,4086	3.4087	3,4089	3.4091	3,4093	3.4094	3,4096	3.4098
	42	50	3.4099	3.4101	3.4103	3.4104	3.4106	3. 4108	3.4109	3. 4111	3. 4113	3.4115
0	43	0	3,4116	3. 4118	3.4120	3.4121	3.4123	3, 4125	3.4126	3.4128	3.4130	3.4131
	43	10	3, 4133	3.4135	3.4136	3.4138	3.4140	3.4141	3.4143	3.4145	3.4146	3.4148
	43	20	3.4150	3.4151	3.4153	3.4155	3.4156	3.4158	3.4160	3.4161	3.4163	3.4165
	43	30	3.4166	3.4168	3.4170	3.4171	3. 4173	3.4175	3. 4176	3.4178	3.4180	3.4181
	43	40	3.4183	3. 4185	3.4186	3.4188	3,4190	3.4191	3. 4193	3.4195	3,4196	3.4198
	40	00	0.4200	9, 4201	9, 1910	0. 4200	0.4200	0. 4208	0.4209	3, 4411	0.4210	0.4214
0	++	10	3, 4210 9, 1999	3,4218	3.4219	3. 4221	3. 4223	3.4224 9 1911	3, 4220	3. 4228	3. 4229	3. 4231
	11	20	3 1219	3 1250	3 1259	3 1951	3 1955	3 1957	3 1250	3 1260	3. 4240	3 4263
	44	30	3,4265	3 4267	3 4268	3 4270	3 4272	3,4271	3,4275	3,4276	3 4278	3 4280
	44	40	3,4281	3, 4283	3.4285	3. 4286	3.4288	3, 4289	3,4291	3, 4293	3, 4294	3, 4296
	44	50	3,4298	3.4299	3.4301	3.4302	3.4304	3.4306	3, 4307	3.4309	3.4310	3.4312
0	45	0	3.4314	3,4315	3,4317	3.4318	3.4320	3,4322	3.4323	3.4325	3.4326	3, 4328
	45	10	3.4330	3, 4331	3.4333	3.4334	3.4336	3.4338	3.4339	3,4341	3.4342	3.4344
	45	20	3.4346	3.4347	3.4349	3.4350	3.4352	3.4354	3.4355	3. 4357	3.4358	3.4360
	45	30	3.4362	3.4363	3.4365	3, 4366	3.4368	3,4370	3.4371	3.4373	3.4374	3.4376
	45	•40	3.4378	3.4379	3,4381	3,4382	3.4384	3. 4385	3, 4387	3.4389	3.4390	.3.4392
	40	-00	3. 4393	3, 4395	3, 4390	3. 4398	3. 4400	3.4401	3, 4403	3. 4404	3.4400	3.4408
0	40	10	3, 4409	$3, \frac{11}{1100}$	3. 4412	3, 1111	3. 4410	3. 1111	3. 4419	3.4420	3. 4422	3. 4423
	40	20	3.4420	5. 11 20 9. 1.1.19	3.4428	3. 1115	3. 1117	3.1118	3.4454	3.4400	3.1152	3.4459
	46	30	3 4456	3 1158	3 4459	3 1161	3 1162	3, 1161	3 4465	3 4467	3 1168	3 4170
	46	40	3.4472	3, 4473	3.4475	3 4476	3 4478	3, 4479	3 4481	3. 4482	3 4484	3. 4486
	46	50	3.4487	3.4489	3.4490	3.4492	3.4493	3.4495	3.4496	3.4498	3.4499	3.4501
0	47	0	3.4502	3.4504	3.4506	3.4507	3.4509	3.4510	3.4512	3.4513	3.4515	3,4516
	47	10	3.4518	3.4519	3.4521	3.4522	3.4524	3.4526	3.4527	3.4529	3.4530	3.4532
	47	20	3.4533	3.4535	3.4536	3.4538	3.4539	3.4541	3.4542	3.4544	3.4545	3.4547
	47	30	3.4548	3.4550	3.4551	3.4553	3.4555	3.4556	3.4558	3.4559	3.4561	3.4562
	47	40	3.4564	3.4565	3.4567	3.4568	3.4570	3. 4571	3.4573	3.4574	3.4576	3.4577
	47	-00	3. 4579	3. 4580	3.4582	3. 4583	3.4585	3.4586	3.4588	3. 4589	3.4591	3.4592
0	48	10	3. 4094	3. 4595	3.4597	3.4598	3.4600	3.4601	3.4603	3. 4604	3.4606	3. 4607
	10	- 10	0. 4009 3 1694	9.4010	3.4012	3 1696	3 1620	0.4010 3 1891	3 1639	3 4621	3 4021	3 4622
	48	30	3 4639	3 4640	3 4649	3 4643	3 4645	3 4646	3 4648	3 4649	3 4651	3 4652
	48	40	3, 4654	3, 4655	3, 4657	3:4658	3. 4660	3. 4661	3, 4663	3, 4664	3. 4666	3, 4667
	48	50	3.4669	3.4670	3.4672	3.4673	3.4675	3.4676	3.4678	3.4679	3.4681	3.4682
0	49	0	3.4683	3, 4685	3,4686	3,4688	3.4689	3, 4691	3.4692	3. 4694	3.4695	3.4697
	49	10	3. 4698	3.4700	3.4701	3.4703	3.4704	3.4706	3.4707	3.4709	3.4710	3.4711
	49	20	3.4713	3.4714	3.4716	3.4717	3.4719	3.4720	3.4722	3.4723	3.4725	3.4726
	49	30	3.4728	3.4729	3.4730	3.4732	3.4733	3.4735	3.4736	3.4738	3.4739	3.4741
	49	40	3.4742	3.4744	3.4745	3.4747	3.4748	3.4749	3.4751	3.4752	3.4754	3.4755
	49	50	3.4757	3.4758	3.4760	3. 4761	3.4763	3. 4764	3.4765	3.4767	3.4768	3.4770

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APPENDIX V: TABLE IX.

110	0"	1//	3//	27	1"	5/	67	7//	s#	9//
										0
0 / // 0h 50m 0s	3 4771	3 4773	3 1771	3 4776	3 1777	3 4778	3 1780	3 4781	3 1783	3 4784
50 10	3. 4786	3.4787	3. 4789	3. 4790	3.4791	3.4793	3.4794	3. 4796	3. 4797	3. 4799
50 20	3.4800	3.4802	3.4803	3.4804	3.4806	3.4807	3.4809	3.4810	3.4812	3.4813
50 30	3.4814	3,4816	3.4817	3.4819	3.4820	3.4822	3.4823	3. 4824	3.4826	3.4827
50 40	3.4829	3.4830	3.4832	3, 4833	3.4834	3.4836	3.4837	3.4839	3.4840	3.4842
$\frac{50}{0}$ $\frac{50}{0}$	3.4843	3. 4844	3. 4840	3. 4847	3.4849	0. 4800	0.4802	0. 4800	3. 4804	3. 4800
$ \begin{array}{cccccccccccccccccccccccccccccccccccc$	3.4897	3.4809	3.4800 3.4871	3.4801	3.4803 3.4877	3.4804 3.4878	3.4800 3.4880	3. 4007	3. 1883	3.4870
$51 \ 20$	3. 4886	3.4887	3, 4888	3.4890	3. 4891	3. 4893	3, 4894	3.4895	3. 4897	3. 4898
$51 \ 30$	3.4900	3.4901	3.4902	3.4904	3.4905	3.4907	3,4908	3.4909	3.4911	3.4912
51 40	3.4914	3.4915	3, 4916	3.4918	3.4919	3.4921	3,4922	3, 4923	3.4925	3.4926
51 50	3.4928	3.4929	3.4930	3.4932	3.4933	3.4935	3.4936	3.4937	3.4939	3.4940
0 52 0	3.4942	3.4943	3. 4944	3. 4946	3.4947	3.4949	3.4950	3. 4951	3.4953	3. 4954
52 10 52 20	3.4900	3.4937	3.4938	3.4900	3.4901	3.4962	3.4904	3.4900	3.4907	3.4908
$52 - 20 \\ 52 - 30$	3,4983	3, 4984	3, 4986	3, 4987	3, 4989	3, 4990	3. 4991	3, 4993	3, 4994	3, 4995
52 40	3.4997	3.4998	3.5000	3.5001	3.5002	3.5004	3.5005	3.5006	3.5008	3, 5009
52 50	3.5011	3.5012	3.5013	3.5015	3.5016	3.5017	3.5019	3.5020	3.5022	3, 5023
0 53 0	3,5024	3.5026	3.5027	3.5028	3.5030	3.5031	3.5032	3.5034	3.5035	3. 5037
53 10	3.5038	3.5039	3. 5041	3,5042	3.5043	3.5045	3.5046	3. 5047	3.5049	3.5050
53 20	3.5001	3.5053	3. 5069	3,5056	3.5057	$\begin{vmatrix} 3.5058 \\ 2.5072 \end{vmatrix}$	3.5060	3. 0061	3.5062	3.5064 2.5077
53 40	3.5009	3.5000	3 5081	3.5083	3.5070	3.5072	3.5075	3.5075	3.5070	3 5091
53 50	3.5092	3. 5093	3. 5095	3. 5096	3.5097	3.5099	3, 5100	3. 5101	3.5103	3. 5104
0 54 0	3.5105	3.5107	3.5108	3.5109	3.5111	3.5112	3.5113	3.5115	5.5116	3.5117
54 10	3.5119	3.5120	3.5122	3.5123	3.5124	3.5126	3,5127	3.5128	3.5130	3.5131
54 20	3.5132	3.5134	3.5135	3.5136	3.5138	3.5139	3.5140	3.5141	3, 5143	3.5144
54 30	3.5145	3.5147	3.5148	3.5149	3.5151	3.5152	3.5153	3.5155	3.5156	3.5157
$ \begin{array}{r} 0 \\ 54 \\ 50 \end{array} $	3.0109 3.5179	3.0100	3.0101 3.5175	3.5103 3.5176	3. 5104	3.0100 3.5170	3. 5107	3.0108	3.5109	3. 5171
0 55 0	3 5185	3 5186	3 5188	3 5189	3 5190	3 5192	$\frac{0.0100}{3.5193}$	3 5194	3 5196	3 5197
55 10	3.5198	3.5200	3.5201	3.5202	3.5204	3.5205	3. 5206	3. 5207	3.5209	3. 5210
55 20	3.5211	3.5213	3.5214	3.5215	3.5217	3.5218	3.5219	3.5221	3.5222	3.5223
55 30	3.5224	3.5226	3.5227	3.5228	3.5230	3. 5231	3.5232	3.5234	3.5235	3.5236
55 40	3,5237	3.5239	3.5240	3.5241	3.5243	3.5244	3,5245	3, 5247	3.5248	3.5249
$\frac{33}{0}$ $\frac{30}{56}$ 0	0.0200	9 5965	0.0200 9 5066	9 5967	3. 3230	0.0207	9 5971	0.0200	9 5971	0.0202
56 10	3.5203 3.5276	3.5200 3.5278	3,5200 3,5279	3.5280	3. 5205	3.5283	3.5271 3.5284	3 5285	3 5287	3 5288
$56 \ 20$	3.5289	3. 5290	3.5292	3.5293	3.5294	3.5296	3.5297	3.5298	3, 5299	3. 5301
56 30	3.5302	3.5303	3.5305	3.5306	3.5307	3.5308	3.5310	3.5311	3.5312	3.5314
56 40	3.5315	3.5316	3.5317	3.5319	3.5320	3.5321	3.5322	3.5324	3.5325	3.5326
56 50	3.5328	3.5329	3.5330	3.5331	3.5333	3.5334	3. 5335	3.5336	3.5338	3.5339
0 57 0 5-10	3.5340	3.5342	3.5343	3.5344	3. 5345	3.5347	3. 5348	3.5349	3. 5350	3. 5352
$57 \ 20$	3,5366	3 5367	3.5368	3.5369	3.5556 3.5371	3 5372	3.5301 3.5373	3,5302 3,5374	3 5376	3,5304 3,5377
57 30	3.5378	3. 5379	3, 5381	3.5382	3. 5383	3.5384	3.5386	3,5387	3. 5388	3.5390
57 40	3.5391	3.5392	3.5393	3.5395	3.5396	3.5397	3.5398	3.5400	3.5401	3.5402
57 50	3.5403	3.5405	3,5406	3.5407	3.5408	3.5410	3.5411	3.5412	3, 5413	3.5415
0 58 0	3.5416	3. 5417	3.5418	3.5420	3.5421	3.5422	3.5423	3.5425	3.5426	3. 5427
$ \begin{array}{r} 58 & 10 \\ 59 & 20 \end{array} $	3. 5428	3. 5429	3. 5431	3.5432	3.5433	3.5434 2.5.117	3.0436 2.5440	3. 5437	3. 5438	3. 5439
58 20 58 30	3 5453	3 5454	3 5456	3 5457	3 5458	3 5459	3 5460	3 5469	3 5463	3 5464
58 40	3. 5465	3. 5467	3. 5468	3. 5469	3.5470	3. 5472	3.5473	3.5474	3. 5475	3. 5477
58 50	3.5478	3.5479	3.5480	3.5481	3.5483	3.5484	3.5485	3.5486	3.5488	3.5489
0 59 0	3.5490	3.5491	3.5492	3.5494	3.5495	3.5496	3.5497	3.5499	3.5500	3.5501
59 10	3.5502	3.5504	3.5505	3.5506	3.5507	3.5508	3.5510	3.5511	3.5512	3.5513
59 20 50 20	3.5514	3. 5516	3.5517	3.5518	3. 5519	3.5521	3. 5522	3. 5523	3. 5524 2. 5520	3. 5520
59 40	3. 5539	3. 5540	3.5541	3, 5542	3. 5544	3. 5545	3, 5546	3, 5547	3, 5549	3. 5550
59 50	3.5551	3. 5552	3. 5553	3. 5555	3, 5556	3, 5557	3. 5558	3. 5559	3. 5561	3,5562
	R.					1				

APPENDIX V: TABLE IX.

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						-				
Are.	0″	1″	2″	3″	4″	5″	6″	7″	8″	9″
0 / //										
¹ 1 ^h 0 ^m 0 ^s	3.5563	3.5564	3.5565	3.5567	3.5568	3.5569	3.5570	3.5571	3.5573	3.5574
0 10	3.5575	3.5576	3.5577	3.5579	3.5580	3.5581	3.5582	3.5583	3.5585	3.5586
0 20	3.5587	3.5588	3.5589	3.5591	3.5592	3.5593	3.5594	3.5595	3.5597	3.5598
0 30	3.5599	3.5600	3.5601	3.5603	3.5604	3.5605	3.5606	3.5607	3.5609	3.5610
0 40	3.5611	3.5612	3.5613	3.5615	3,5616	3.5617	3.5618	3.5619	3.5621	3.5622
	3. 3023	3. 3024	3. 3023	3. 3020	3. 3028	3. 3029	3. 3030	3. 3031	3. 3032	3. 0034
	3.0030	3. 0030	3. 0037	3. 0038	3. 0040	3.0041	3. 0042	3. 0043	3.0044	3. 0040
1 10 1 20	3.5658	3.5660	3.5661	3.5662	3.5663	3.5664	3.5666	3.5667	3.5668	3.5669
$1 \frac{1}{30}$	3.5670	3.5671	3.5673	3.5674	3.5675	3.5676	3.5677	3.5678	3.5680	3.5681
1 40	3.5682	3.5683	3.5684	3.5686	3.5687	3.5688	3.5689	3.5690	3.5691	3.5693
1 50	3.5694	3.5695	3.5696	3.5697	3.5698	3.5700	3.5701	3.5702	3.5703	3.5704
$1 \ 2 \ 0$	3.5705	3.5707	3.5708	3.5709	3.5710	3.5711	3.5712	3.5714	3.5715	3.5716
2 10	3.5717	3.5718	3.5719	3.5721	3.5722	3.5723	3.5724	3.5725	3.5726	3.5728
2 20	3.5729	3.5730	3.5731	3.5732	3.5733	3.5735	3.5736	3.5737	3.5738	3.5739
2 30	3.5740	3.5741	3.5742	3.5744	3.5745	3.5746	3.5747	3.5748	$\begin{bmatrix} 3.5750 \\ 9.5761 \end{bmatrix}$	3.5751
2 + 0 2 50	3.0702 2.5762	3.0705	3.0704	3. 3733	3.3730	3.0708	3. 5770	3. 5700	$\begin{vmatrix} 3.0701 \\ 9.5772 \end{vmatrix}$	3. 3702
$\frac{2}{1}$ $\frac{30}{2}$	9 5775	2 5776	9 5777	3 5778	3.5780	3 5781	2 5789	2 5792	2 5791	2 5795
1 3 0 3 10	3.5770 3.5786	3.5788	3.5789	3 5790	3.5780	3.5781 3.5792	3.5782 3.5793	3 5794	3 5796	3.5797
3 20	3.5798	3.5799	3, 5800	3, 5801	3.5802	3, 5804	3. 5805	3. 5806	3.5807	3, 5808
3 30	3.5809	3.5810	3.5812	3.5813	3.5814	3.5815	3,5816	3.5817	3.5818	3.5819
3 40	3.5821	3.5822	3. 5823	3.5824	3.5825	3.5826	3.5827	3.5829	3.5830	3.5831
3 50	3.5832	3.5833	3.5834	3.5835	3.5837	3.5838	3.5839	3.5840	3.5841	3.5842
1 4 0	3.5843	3.5844	3.5846	3.5847	3.5848	3.5849	3.5850	3.5851	3.5852	3, 5853
4 10	3.5855	3.5856	3.5857	3.5858	3.5859	3.5860	3.5861	3.5862	3.5864	3.5865
4 20	3.5866	3.5867	3,5868	3.5869	3.5870	3.5871	3.5873	3.5874	3.5875	3.5876
+ 30	3.08/1	3,08/8	3, 3879	3.0880	3. 3882	3. 0883	3. 3884	3. 3883	3. 3880	3. 3887
4 40	3,0000 3,5899	3.5901	3,5902	3. 5903	3 5904	3 5905	3.5906	3.5907	3.5908	3,5910
1 5 0	3 5911	3 5912	3 5913	3 5914	3 5915	3 5916	3 5917	3 5918	3 5920	3 5921
1 5 0 5 10	3. 5922	3.5923	3.5924	3.5925	3.5926	3.5927	3.5928	3.5930	3.5920 3.5931	3.59321 3.5932
5 20	3.5933	3, 5934	3, 5935	3.5936	3.5937	3.5938	3.5940	3.5941	3.5942	3.5943
5 30	3.5944	3.5945	3.5946	3.5947	3.5948	3.5949	3.5951	3.5952	3.5953	3.5954
5 .40	3.5955	3.5956	3.5957	3.5958	3, 5959	3.5960	3.5962	3.5963	3.5964	3. 5965
5 50	3.5966	3.5967	3. 5968	3. 5969	3.5970	3.5971	3.5973	3.5974	3.5975	3. 5976
$1 \begin{array}{c} 6 \\ 0 \\ 1 \end{array}$	3.5977	3.5978	3.5979	3.5980	3.5981	3.5982	3.5984	3. 5985	3.5986	3.5987
6 10 e 20	3.5988	3.5989	3.5990	3. 5991	3. 5992	3.5993	3. 0994	3. 3996	3.5997	3. 5998
6 30	3.0999	3.6000	3.6001	3.6002	3.6011	3.6015	3,6016	3.6017	3.6018	3.6020
6 40	3.6021	3.6022	3.6023	3.6024	3.6025	3.6026	3.6027	3.6028	3.6029	3,6030
6 50	3.6031	3.6033	3,6034	3.6035	3.6036	3.6037	3.6038	3.6039	3.6040	3.6041
1 7 0	3.6042	3.6043	3.6044	3.6046	3.6047	3.6048	3.6049	3.6050	3.6051	3,6052
7 10	3.6053	3.6054	3.6055	3.6056	3.6057	3,6058	3,6060	3.6061	3.6062	3.6063
7 - 20	3.6064	3.6065	3.6066	3.6067	3.6068	3.6069	3.6070	3.6071	3.6072	3.6073
$\frac{7}{10}$	3.6075	3.6076	3.6077	3.6078	3.6079	3.6080	3.6081	3.6082	3.6083	3.6084
$\frac{1}{7}$ $\frac{40}{50}$	3.6085	3.6086	3.6087	3.6088	3,6090	3,6091	3.0092	3.6093	3.6094	3.6095
$\frac{700}{100}$	9 6107	3.0097	2 6100	2 8110	9 6111	9 6119	9 6119	9 6111	9 6115	9.6116
	3.6107	3.6118	3.6110	3.6120	3.6111 3.6191	3.0114 3.6193	3 6191	3 6195	3,0110	3.0110 3.6197
8 20	3.6128	3.6129	3, 6130	3.6131	3. 6132	3, 6133	3. 6134	3, 6135	3,6136	3. 6137
8 30	3.6138	3.6139	3.6141	3.6142	3.6143	3.6144	3.6145	3.6146	3.6147	3.6148
8 40	3.6149	3.6150	3.6151	3.6152	3.6153	3.6154	3.6155	3.6156	3.6157	3.6158
8 50	3.6160	3.6161	3.6162	3.6163	3.6164	3.6165	3.6166	3.6167	3.6168	3.6169
$1 \ 9 \ 0$	3.6170	3.6171	3.6172	3.6173	3.6174	3.6175	3.6176	3.6177	3.6178	3.6179
9 10	3.6180	3.6182	3.6183	3.6184	3.6185	3.6186	3.6187	3.6188	3.6189	3.6190
9 20	3.6191	3.6192	3.6193	3.6194	3.0193	3.6196	3.0197	3.6198	3.6199	5.0200 2.6911
06 6 01 0	3.6201 3.6919	3.6202 3.6913	3.6203	3.0204 3.6915	3 6216	3 6217	3.6208	3 6219	3.0210 3.6990	3. 62211
9 50	3.6222	3.6223	3, 6224	3.6225	3. 6226	3.6227	3. 6228	3. 6229	3.6230	3. 6231
0 50	1									

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APPENDIX V: TABLE IX.

								1				
	Are.		0''	1''	£''	3''	4''	5''	6''	. 7″	8″	9''
	-											
11	10"	1 05	3 6939	3 6934	3 6235	3 6236	3 6237	3 6238	3 6239	3 6910	3 6941	3 6212
1	10	10	3 6943	3 6244	3 6245	3 6246	3. 6247	3.6248	3 6249	3 6250	3 6251	3 6252
	10	20	3 6953	3 6254	3 6255	3 6256	3 6257	3 6258	3.6259	3 6260	3 6261	3 6262
	10	30	3. 6263	3. 6264	3.6265	3. 6266	3.6268	3, 6269	3.6270	3.6271	3.6272	3.6273
	10	40	3. 6274	1.3.6275	3. 6276	3. 6277	3.6278	3.6279	3.6280	3.6281	3.6282	3. 6283
	10	50	3.6284	3.6285	3.6286	3.6287	3.6288	3.6289	3.6290	3,6291	3,6292	3.6293
1	11	-0	3.6294	3.6295	3,6296	3.6297	3,6298	3,6299	3,6300	3.6301	3.6302	3,6303
1	11	10	3,6304	3.6305	3.6306	3.6307	3.6308	3.6309	3.6310	3.6311	3.6312	3.6313
	11	20	3.6314	3.6315	3.6316	3.6317	3.6318	3.6320	3.6321	3.6322	3.6323	3.6324
	11	30	3.6325	3.6326	3.6327	3.6328	3.6329	3.6330	3.6331	3.6332	3,6333	3.6334
	11	40	3.6335	3.6336	3.6337	3.6338	3.6339	3.6340	3.6341	3.6342	3.6343	3.6344
	11	50	3.6345	3.6346	3.6347	3.6348	3.6349	3,6350	3.6351	3.6352	3.6353	3.6354
1	12	0	3.6355	3.6356	3.6357	3.6358	3.6359	3.6360	3.6361	3.6362	3.6363	3.6364
	12	10	3,6365	3.6366	3.6367	3.6368	3.6369	3.6370	3.6371	3.6372	3.6373	3.6374
	12	20	3.6375	3.6376	-3.6377	3.6378	3.6379	3.6380	3.6381	3.6382	3.6383	3.6384
	12	30	3.6385	3.6386	3.6387	3.6388	3.6389	3.6390	3.6391	3.6392	3.6393	3.6394
	12	40	3.6395	3.6396	3.6397	3.6398	3.6399	3.6400	3.6401	3.6402	3.6403	3.6404
	12	50	3.6405	3.6406	3.6407	3.6408	3.6409	3.6410	3.6411	3.6412	3.6413	3.6414
1	13	0	3.6415	3.6416	3.6417	3.6418	3.6419	3.6420	3.6421	3.6422	3.6423	3.6424
	13	10	3.6425	3.6426	3.6427	3.6428	3.6429	3.6430	3.6431	3.6432	3.6433	3.6434
	13	20	3.6435	3.6436	3. 6437	3.6437	3.6438	3.6439	3.6440	3. 6441	3.6442	3. 64-3
	13	30	3.0444	3.0440	3.0440	3.0447	3.0448	3.0449	3.0400	0.0401	3.0402	3.0493
	15	40	3.0434	0,0 1 00 9,6165	5.0400 9.6166	5.0407	3. 0408 9. 6 169	5.0409 2.6160	3,0400	0.0401 9.6471	3.0402	3,0403
	10	- 00	0.0404	9.0400	0.0400	3.0407	9.6170	9.6170	9.0470	3.0471	0.0472	0.01/0
1	14	• 0	3.04/4	3.04/3	5.0470	3.04//	3.0+/8	3.0479	3.0480	3.0481	3.0482	3. 0483
	14	20	0.0404 9.6109	3.0430	5.0480 2.6105	3 6.106	3.0400	2 6400	3.0469	3.0490	3.0491	3.0492
	1.1	30	3 6563	3 6504	3, 6505	3 6506	3.6507	3 6508	3 6509	3.6510	3.6511	3.6512
	11	40	3 6513	3 6514	3 6515	3.6516	3.6517	3 6518	3 6519	3.6510	3 6521	3.6521
	14	50	3.6522	3.6523	3. 6524	3.6525	3.6526	3.6527	3. 6528	3.6529	3. 6530	3. 6531
	15	0	3 6532	3 6533	3 6534	3 6535	3 6536	3.6537	3.6538	3 6539	3 6540	3 6541
-	15	10	3.6542	3, 6543	3.6544	3.6545	3.6546	3.6547	3.6548	3,6549	3, 6549	3.6550
	15	$\tilde{20}$	3,6551	3.6552	3.6553	3.6554	3.6555	3.6556	3,6557	3,6558	3.6559	3.6560
	15	30	3.6561	3.6562	3.6563	3.6564	3.6565	3.6566	3.6567	3,6568	3.6569	3.6570
	15	40	3.6571	3.6572	3.6572	3.6573	3.6574	3.6575	3.6576	3.6577	3.6578	3.6579
	15	50	3.6580	3.6581	3.6582	3.6583	3.6584	3.6585	3.6586	3.6587	3.6588	3.6589
1	16	0	3.6590	3.6591	3.6592	3.6593	3.6593	3.6594	3.6595	3.6596	3.6597	3.6598
	16	10	3.6599	3.6600	3.6601	3.6602	3, 6603	3.6604	3.6605	3.6606	3.6607	3.6608
	16	20	3.6609	3.6610	3.6611	3.6611	3.6612	3.6613	3.6614	3.6615	3.6616	3.6617
	16	- 30	3.6618	3.6619	3.6620	3.6621	3.6622	3.6623	3.6624	3.6625	3,6626	3.6627
	16	40	3.6628	3,6629	3.6629	3.6630	3.6631	3.6632	3.6633	3.6634	3.6635	3.6636
	10	- 00	3.0037	3.0038	3.0039	3.0040	3.0041	3.6642	3.0043	3.0044	3.6645	3.0045
1	17	10	3.6646	3.6647	3.6648	3.6649	3.6650	3.6651	3.6652	3.6653	3.6654	3.6655
	17	10	3.6656	3.6657	3.6658	3.6659	3.6660	3.6660	3.6661	3.6662	3.6663	3.6664
	17	20	5.0000 9.6675	3.0000	3.0007	3.0008	5.0009 2.6679	3.0070	3.00/1	3.00/2	3.00/3	5,0074
	17	- 10	9.0019	3.6695	3 6686	3.6687	3.6689	3 6680	3 6680	3 6600	3.0082	2 6609
	17	50	3.6603	3 6691	3.6695	3.6696	3.6697	3.6698	3.6699	3.6700	3.6701	3.6702
- 1	10		9 6709	2 6702	2 6701	2 6705	2 8708	2 6707	2 6709	9.6700	2 6710	9 6711
1	18	10	3 6719	3 6713	3 6714	3 6715	3 6715	3 6716	3 6717	3 6718	3 6710	3 6790
	18	20	3.6721	3.6722	3, 6723	3.6724	3. 6725	3.6726	3.6727	3.6727	3.6728	3. 6729
	18	30	3,6730	3,6731	3,6732	3.6733	3.6734	3.6735	3.6736	3.6737	3,6738	3.6738
	18	40	3.6739	3.6740	3.6741	3.6742	3.6743	3.6744	3.6745	3.6746	3.6747	3.6748
	18	50	3.6749	3.6750	3.6750	3.6751	3.6752	3.6753	3.6754	3.6755	3.6756	3.6757
1	19	0	3.6758	3.6759	3.6760	3.6761	3.6761	3.6762	3.6763	3.6764	3.6765	3.6766
	19	10	3.6767	3.6768	3.6769	3.6770	3.6771	3.6772	3.6772	3.6773	3.6774	3.6775
	19	20	3.6776	3.6777	3.6778	3.6779	3.6780	3.6781	3.6782	3.6782	3.6783	3.6784
	19	30	3.6785	3.6786	3.6787	3.6788	3.6789	3.6790	3.6791	3.6792	3.6792	3.6793
	19	40	3.6794	3.6795	3.6796	3.6797	3.6798	3.6799	3.6800	3.6801	3.6802	3.6802
	19	50	3.6803	3.6804	3.6805	3,6806	3.6807	3.6808	3, 6809	3.6810	3.6811	3.6812
APPENDIX V: TABLE IX.

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Logarithms of Small Arcs in Space or Time.

Are.	0″	1″	2″	3″	4″	5″	6″	7″	8″	9″
0 / //										
1 ^h 20 ^m 0 ^s	3.6812	3.6813	3.6814	3.6815	3.6816	3.6817	3.6818	3.6819	3.6820	3.6821
$ \begin{array}{ccc} 20 & 10 \\ 20 & 20 \end{array} $	3.6821	3.6822	3.6823	3.6824	3.6825	3.6826	3.6827	3.6828	3.6829	3.6830
20 20	3.6830	3.6831	3,6832	3.6833	3.6834	3.6835	3.6836	3.6837	3.6838	3.6839
20 30 20 40	3. 6848	3. 6849	3.6850	3.6851	3. 6852	3. 6853	3. 6854	3. 6855	3. 6856	3.6857
$ \frac{1}{20} 50 $	3. 6857	3. 6858	3.6859	3.6860	3.6861	3.6862	3, 6863	3.6864	3.6865	3.6865
$1 \ 21 \ 0$	3.6866	3.6867	3.6868	3.6869-	3.6870	3.6871	3.6872	3.6873	3.6874	3.6874
21 10	3.6875	3.6876	3.6877	3.6878	3.6879	3.6880	3.6881	3.6882	3.6882	3.6883
21 20	3.6884	3.6885	3.6886	3.6887	3.6888	3.6889	3.6890	3.6890	3.6891	3.6892
$21 \ 30 \ 21 \ 40$	3, 6902	3. 6903	3,6904	3 6905	3. 6906	3. 6906	3.6907	3. 6908	3,6909	3.6901
21 50	3. 6911	3.6912	3. 6913	3.6913	3. 6914	3. 6915	3. 6916	3, 6917	3.6918	3.6919
1 22 0	3.6920	3.6921	3.6921	3.6922	3.6923	3.6924	3.6925	3.6926	3.6927	3.6928
22 10	3.6928	3.6929	3.6930	3.6931	3.6932	3.6933	3.6934	3.6935	3.6936	3.6936
22 20	3.6937	3.6938	3.6939	3.6940	3.6941	3.6942	3.6943	3.6943	3.6944	3.6945
$\frac{22}{22}$ $\frac{50}{40}$	3, 6940	3 6956	3. 6957	3 6957	3 6958	3 6959	3,6960	3.6961	3 6962	3. 6963
22 50	3.6964	3.6964	3.6965	3.6966	3.6967	3.6968	3. 6969	3. 6970	3. 6971	3.6971
1 23 0	3.6972	3.6973	3.6974	3.6975	3.6976	3.6977	3.6978	3.6978	3.6979	3.6980
23 10	3.6981	3.6982	3.6983	3.6984	3.6984	3.6985	3.6986	3.6987	3.6988	3.6989
23 20	3.6990	3.6991	3,6991	3.6992	3.6993	3. 6994	3.6995	3.0990	3.0997	3.6998
$\frac{23}{23}$ $\frac{30}{40}$	3. 7007	3.7008	3, 7009	3, 7010	3.7010	3.7011	3.7012	3. 7013	3. 7014	3. 7015
23 50	3.7016	3.7017	3.7017	3.7018	3.7019	3.7020	3.7021	3.7022	3.7023	3.7023
1 24 0	3.7024	3.7025	3.7026	3.7027	3.7028	3.7029	3.7029	3.7030	3.7031	3.7032
24 10	3.7033	3.7034	3.7035	3.7035	3.7036	3.7037	3.7038	3.7039	3.7040	3.7041
24 20 24 30	3.7042 3.7050	3,7042	3.7043	3.7044	3.7045	3.7040	3.7047	3.7048	3.7048	3.7049
24 30 24 40	3. 7059	3.7001 3.7060	3. 7060	3. 7055	3. 7062	3. 7063	3. 7055	3.7050 3.7065	3. 7065	3. 7066
24 50	3.7067	3.7068	3.7069	3.7070	3.7071	3.7071	3.7072	3.7073	3.7074	3. 7075
$1 \ 25 \ 0$	3.7076	3.7077	3.7077	3.7078	3.7079	3.7080	3.7081	3.7082	3.7083	3.7083
25 10	3.7084	3.7085	3.7086	3.7087	3.7088	3.7088	3.7089	3.7090	3.7091	3. 7092
25 20 25 30	3.7093	3.7094	3.7094	3.7090	3.7090	3.7097	3.7098	3.7099	3.7099	3.7100
$25 \cdot 40$	3.7110	3. 7110	3.7111	3.7112	3. 7113	3.7114	3. 7115	3.7116	3.7116	3. 7117
25 50	3.7118	3.7119	3.7120	3.7121	3.7121	3.7122	3.7123	3.7124	3.7125	3.7126
$1 \ 26 \ 0$	3.7126	3.7127	3.7128	3.7129	3.7130	3.7131	3.7132	3.7132	3.7133	3.7134
26 10	3.7135	3.7136	3.7137	3.7137	3.7138	3.7139	3.7140	3.7141	3.7142	3.7142
20 20 26 30	3 7159	3.7144	3.7140	3.7140 3.7154	3. 7147	3.7156	3.7148	3.7149 3.7158	3.7150	3 7151
$\frac{26}{26}$ 40	3.7160	3. 7161	3.7162	3, 7163	3.7163	3.7164	3.7165	3, 7166	3. 7167	3. 7168
26 50	3.7168	3.7169	3.7170	3.7171	3.7172	3.7173	3.7173	3.7174	3.7175	3.7176
$1 \ 27 \ 0 \ 27 \ 10$	3.7177	3.7178	3.7178	3.7179	3.7180	3.7181	3.7182	3.7183	3.7183	3. 7184
$27 10 \\ 27 20$	3.7180 2.7102	3.7186	3.7187	3.7188	3.7188 2.7107	3.7189 2 7107	3.7190	3.7191	3.7192	3.7192
$27 \ 20 \ 30$	3.7202	3. 7202	3.7203	3. 7204	3. 7205	3. 7206	3 7207	3.7199 3.7207	3.7200 3.7208	3.7201 3.7209
27 40	3.7210	3.7211	3.7212	3. 7212	3.7213	3.7214	3. 7215	3.7216	3.7216	3. 7217
27 50	3.7218	3.7219	3.7220	3.7221	3.7221	3.7222	3.7223	3.7224	3.7225	3.7226
$1 \ 28 \ 0$	3.7226	3.7227	3.7228	3.7229	3.7230	3.7230	3.7231	3.7232	3.7233	3.7234
28 10 28 20	3.7230	3. 7230	3.7236	3.7237	3.7238	3.7239	3.7239	3.7240	3.7241	3.7242
$\frac{23}{28}$ $\frac{20}{30}$	3, 7251	3.7244 3.7252	3, 7253	3. 7253	3. 7254	3, 7255	3.7248 3.7256	3, 7257	3. 7257	3, 7258
28 40	3.7259	3.7260	3.7261	3.7262	3.7262	3.7263	3.7264	3.7265	3.7266	3.7266
28 50	3.7267	3.7268	3.7269	3.7270	3.7271	3.7271	3.7272	3.7273	3.7274	3.7275
1 29 0 20 10	3.7275	3.7276	3.7277	3.7278	3.7279	3.7279	3.7280	3.7281	3.7282	3.7283
29 10 29 20	3.7284	5.7284 3.7999	3.7280 3.7202	3. 7286	3. 7287	3. 7288	3.7288	5. 7289 3. 7907	3.7290	3.7291
	3. 7300	3.7301	3.7301	3,7302	3, 7303	3.7304	3,7305	3,7305	3, 7306	3.7307
29 40	3.7308	3.7309	3.7309	3.7310	3.7311	3.7312	3.7313	3.7313	3.7314	3.7315
29 50	3.7316	3.7317	3.7317	3.7318	3.7319	3.7320	3.7321	3.7322	3.7322	3.7323

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APPENDIX V: TABLE IX.

		1	1	1		1			1	
Are.	0″	1″	2"	3″	4″	5″	6″	7″	8″	9″
0 / // 1h 20m 0s	3 7224	8 7995	2 7326	3 7396	9 7997	2 7298	2 7220	9 7990	2 7220	9 7991
	3. 7332	3. 7333	3 7334	3. 7334	3. 7335	3 7336	3 7337	3 7338	3 7338	3 7339
30 20	3.7340	3.7341	3. 7342	3.7342	3. 7343	3.7344	3. 7345	3.7346	3 7346	3 7347
30 30	3.7348	3, 7349	3, 7350	3, 7350	3.7351	3.7352	3, 7353	3, 7354	3, 7354	3, 7355
30 40	3.7356	3. 7357	3.7358	3.7358	3.7359	3.7360	3.7361	3,7362	3,7362	3, 7363
30 50	3.7364	3.7365	3.7366	3.7366	3.7367	3.7368	3.7369	3.7370	3.7370	3.7371
$1 \ 31 \ 0$	3.7372	3.7373	3.7374	3.7374	3.7375	3.7376	3.7377	3.7377	3.7378	3.7379
31 10	3.7380	3.7381	3.7381	3.7382	3.7383	3,7384	3.7385	3.7385	3.7386	3.7387
31 20	3.7388	3.7389	3.7389	3.7390	3.7391	3.7392	3.7393	3.7393	3.7394	3.7395
31 30	3.7396		3.7397	3.7398	3.7399	3.7400	3.7400	3.7401	3.7402	3.7403
31 40	3.7404	3.7404	3.7405	3.7406	3.7407	3.7408	3.7408	3.7409	3.7410	3.7411
$\frac{31}{100}$	3. 7412	3. 1412	0.7410	3. 7414	3. 7413	3.7410	3. 7410	3. /41/	3. 7418	3.7419
1 32 0 20 10	3. 7419	3. 7420	3.7421	3. 7422	3.7423	3.7423	3.7424	3. 7425	3. 7426	3. 7426
$ \frac{32}{32} \frac{10}{20} $	3.7427	3.7420	3.7429	3. 7430	3.7430	3.7431	3.7432	3. 7400	3.7434	0. 1404
32 20 32 30	3. 7443	3 7444	3.7444	3 7445	3 7446	3 7447	3 7448	3 7448	3 7449	3 7450
32 40	3.7451	3, 7452	3.7452	3, 7453	3. 7454	3, 7455	3, 7455	3. 7456	3. 7457	3. 7458
32 50	3.7459	3.7459	3.7460	3.7461	3.7462	3.7462	3.7463	3.7464	3.7465	3.7466
1 33 0	3.7466	3.7467	3.7468	3.7469	3.7469	3.7470	3.7471	3.7472	3.7473	3.7473
33 10	3.7474	3.7475	3.7476	3.7476	3.7477	3.7478	3.7479	3.7480	3.7480	3.7481
33 20	3.7482	3.7483	3.7483	3.7484	3.7485	3.7486	3.7487	3.7487	3.7488	3.7489
33 30	3.7490	3.7490	3.7491	3.7492	3.7493	3.7493	3.7494	3.7495	3.7496	3.7497
33 40 22 50	3. 7497	3.7498	3.7499	3.7000	3.7500	3.7501	3.7502	3.7503	3.7504	3.7504
$\frac{33.00}{1.21.0}$	9 7519	2 7514	9 7514	9.7515	9 7510	9 7517	9 7517	9 7510	9 7510	9.7590
34 10	3 7520	3 7521	3 7522	3 7523	3 7524	3 7524	3 7525	3 7526	3 7527	3 7527
34 20	3.7528	3, 7529	3, 7530	3, 7530	3, 7531	3. 7532	3, 7533	3, 7534	3, 7534	3, 7535
34 30	3.7536	3.7537	3.7537	3.7538	3.7539	3.7540	3.7540	3.7541	3.7542	3.7543
34 40	3.7543	3.7544	3.7545	3.7546	3.7547	3.7547	3.7548	3.7549	3.7550	3.7550
34 50	3.7551	3.7552	3.7553	3.7553	3.7554	3.7555	3.7556	3.7556	3.7557	3.7558
1 35 0 25 10	3.7559	3.7560	3.7560	$\begin{bmatrix} 3.7561 \\ 2.7560 \end{bmatrix}$	3.7562	3.7563	3.7563	3.7564	3.7565	3.7566
35 10 35 20	3. 7574	3. 7007	3.7508	3.7009	3.7009	3.7578	3.7570	3.7072	3.7580	3.7073
35 30	3.7582	3.7582	3. 7583	3. 7584	3. 7585	3.7585	3.7586	3. 7587	3. 7588	3.7588
35 40	3.7589	3.7590	3.7591	3.7591	3,7592	3.7593	3.7594	3,7594	3.7595	3,7596
35 50	3.7597	3.7597	3.7598	3, 7599	3.7600	3.7600	3.7601	3.7602	3.7603	3.7603
$1 \ 36 \ 0$	3.7604	3.7605	3.7606	3.7606	3.7607	3.7608	3.7609	3.7609	3.7610	3.7611
36 10	3.7612	3. 7613	3. 7613	3.7614	3.7615	3.7616	3.7616	3.7617	3.7618	3.7619
36 20	3.7619	3.7620	3.7621	$\begin{bmatrix} 3.7622\\ 9.7690 \end{bmatrix}$	3. 7622	3.7623	3.7624	3.7625	3.7625	3.7626
30 30 26 40	3, 7627	3.7028	3.7628	3.7629	3.7630	3.7031	3.7031	3.7632	3. 7033	3.7034
$36 \ 50$	3.7649	3 7613	3 7643	3 7644	3.7645	3 7645	3 7616	3.7040	3.70,40	3 7641
$\frac{33}{1}$ $\frac{37}{37}$ 0	3 7649	3 7650	3 7651	3 7651	3 7652	3 7653	3 7654	3 7654	3 7655	3 7656
37 10	3.7657	3. 7657	3.7658	3. 7659	3, 7660	3, 7660	3.7661	3.7662	3.7663	3.7663
37 20	3.7664	3.7665	3.7666	3.7666	3.7667	3.7668	3.7669	3.7669	3.7670	3.7671
$37 \ 30$	3.7672	3.7672	3.7673	3.7674	3.7675	3.7675	3.7676	3.7677	3.7677	3.7678
37 40	3.7679	3.7680	3.7681	3.7681	3.7682	3.7683	3.7683	3.7684	3.7685	3.7686
37 50	3.7686	3.7687	3.7688	3.7689	3.7689	3.7690	3.7691	3.7692	3.7692	3.7693
$1 \ 38 \ 0 \ 38 \ 10$	3.7694	3.7695	3.7695	3.7696	3.7697	3.7697	3.7698	3.7699	3.7700	3.7700
38 20	3.7709	3. 7709	3.7710	3.7711	3 7711	3.7712	3.7713	3.7714	3.7714	3. 7715
38 30	3.7716	3.7717	3.7717	3.7718	3.7719	3.7720	3.7720	3.7721	3.7722	3.7722
38 40	3.7723	3.7724	3.7725	3.7725	3.7726	3.7727	3.7728	3.7728	3.7729	3.7730
38 50	3.7731	3.7731	3.7732	3.7733	3.7733	3.7734	3.7735	3.7736	3.7736	3.7737
1 39 0	3.7738	3.7739	3.7739	3.7740	3.7741	3.7742	3.7742	3.7743	3.7744	3.7744
39 10	3. 1145	3.7746	3.7747	3. 1747	3.1748	3. 7749	3.7750	3.7750	3.7750	3. 1152
39-20 39-30	3.7760	3.7760	3 7761	0.1100 3 7769	0.1100 3.7769	3.7769	3.7761	3.7765	3.7766	3.7766
39 40	3.7767	3.7768	3,7768	3,7769	3,7770	3,7771	3.7771	3.7772	3.7773	3.7774
39 50	3.7774	3.7775	3.7776	3.7776	3.7777	3.7778	3.7779	3.7779	3.7780	3.7781
		1		1			1			í .

APPENDIX V: TABLE IX.

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								- Parco o				
	Are.		0″	1″	2"	3″	4″	5″	6″	7″	8"	9″
0	,	,,										
1 ^h	40 ^m	0^{s}	3.7782	3.7782	3.7783	3.7784	3.7784	3.7785	3.7786	3.7787	3.7787	3.7788
	40	10	3.7789	3.7789	3.7790	3.7791	3.7792	3.7792	3.7793	3.7794	3.7795	3.7795
	40	$\frac{20}{20}$	3.7796	3.7797	3.7197	3.7798	3.7799	3.7800	3.7800	3.7801	3.7802	3.7802
	40	30 40	3.7810	3.7811	3. 7812	3, 7813	3.7800 3.7813	3. 7814	3. 7815	3. 7815	3.7816	3. 7810
	40	50	3.7818	3. 7818	3. 7819	3.7820	3.7820	3.7821	3.7822	3. 7823	3. 7823	3.7824
1	41	0	3.7825	3.7825	3.7826	3.7827	3.7828	3.7828	3.7829	3.7830	3.7830	3. 7831
-	41	10	3.7832	3.7833	3.7833	3.7834	3.7835	3.7835	3.7836	3.7837	3.7838	3.7838
	41	20	3.7839	3.7840	3.7840	3.7841	3.7842	3.7843	3,7843	3.7844	3.7845	3.7845
	41	30 40	5. 7846 3. 7959	3.7847	3. 7848	5. 7848 3. 7855	5. 7849 3. 7856	0. 7850 3 7857	3.7850 3.7850	5. 7851 3 7850	3.7852 3.7850	3. 7880 3. 7880
	41	50	3.7860	3.7861	3.7862	3.7863	3.7863	3.7864	3.7865	3.7865	3.7866	3, 7867
1	42	0	3.7868	3.7868	3.7869	3.7870	3.7870	3.7871	3.7872	3.7872	3. 7873	3.7874
-	42	10	3.7875	3.7875	3.7876	3.7877	3.7877	3.7878	3.7879	3.7880	3.7880	3.7881
	42	20	3.7882	3.7882	3.7883	3.7884	3.7885	3.7885	3.7886	3.7887	3.7887	3.7888
	42	30	3.7889	3.7889	3.7890	3.7891	3.7892	3.7892	3.7893	3.7894	3.7894	3.7895
	42 49	40 50	5.7890 3.7903	3. 7904	3,7904	3, 7905	3, 7906	3, 7906	3, 7900	3, 7901	3, 7901	3. 7902
1	43	0	3, 7910	3, 7911	3,7911	3, 7912	3.7913	3,7913	3.7914	3, 7915	3,7916	3, 7916
1	43	10	3.7917	3.7918	3.7918	3.7919	3. 7920	3.7920	3. 7921	3.7922	3.7923	3. 7923
	43	20	3.7924	3.7925	3.7925	3.7926	3.7927	3.7927	3.7928	3.7929	3.7930	3.7930
	43	30	3.7931	3.7932	3.7932	3.7933	3.7934	3.7934	3. 7935	3.7936	3.7937	3.7937
	43 42	40 50	3. 7938 3. 7045	3. 7939 3. 70.16	3. 7939 3. 7046	5. 7940 3. 70.17	3. 7941	3.7941 3.7049	3. 7942 3. 7040	5.7943 3.7050	3. 7943 3. 7050	5.7944 3.7051
- 1	40		3 7059	3 7052	3 7052	3 7054	3 7055	3 7055	3 7056	3 7057	3 7057	3 7059
T	44	10	3.7952 3.7959	3.7959	3, 7960	3,7961	3, 7962	3, 7962	3, 7963	3. 7964	3, 7964	3.7965
	44	$\hat{20}$	3.7966	3.7966	3.7967	3. 7968	3.7969	3.7969	3. 7970	3.7971	3.7971	3.7972
	44	30	3.7973	3.7973	3.7974	3.7975	3.7975	3.7976	3.7977	3.7978	3.7978	3.7979
	44	40	3.7980	3.7980	3.7981	3.7982	3.7982	3.7983	3.7984	3.7984	3.7985	3.7986
	44	00	3. 1987	3. 7987	3. 7988	3.7989	3.7989	3.7990	3.7991	3.7991	3. 7992	3. 7993
1	40 45	10	3, 8000	5.7994 3.8001	5.7995 3,8002	3, 8002	3, 8003	3, 8004	3, 8004	3, 8005	3. 8006	3, 8000
	45	20	3.8007	3.8008	3.8009	3.8009	3.8010	3.8011	3.8011	3.8012	3.8013	3, 8013
	45	30	3.8014	3.8015	3.8015	3.8016	3.8017	3.8017	3.8018	3.8019	3.8020	3.8020
	45	• 40	3.8021	3.8022	3.8022	3.8023	3.8024	3.8024	3.8025	3.8026	3.8026	3.8027
	40	06	3.8028	3.8028	3.8029	3.8030	3.8030	3.8031	3.8032	3.8033	3.8033	3.8034
T	46	10	3.8041	5. 8035 3. 8049	3, 8043	3, 8043	3, 8044	5. 8038 3. 8045	3, 8045	3, 8046	3.8040 3.8047	3, 8041
	46	20	3.8048	3.8049	3.8050	3.8050	3.8051	3.8052	3.8052	3.8053	3. 8054	3, 8054
	46	30	3.8055	3.8056	3.8056	3.8057	3.8058	3.8058	3.8059	3.8060	3.8060	3.8061
	46	40	3.8062	3.8062	3.8063	3.8064	3.8065	3.8065	3.8066	3.8067	3.8067	3.8068
	46	- 00	3.8069	3.8069	3.8070	3.8071	3.8071	3.8072	3.8073	3.8073	3.8074	3.8075
1	47	10	3.8075	3.8076	3.8077	3.8077	3.8078	3.8079	3.8079	3.8080	3.8081 3.8000	3.8081
	47	20	3.8089	3, 8090	3.8090	3.8091	3.8092	3. 8092	3.8093	3.8094	3. 8094	3. 8095
	47	30	3.8096	3.8096	3. 8097	3.8098	3.8098	3.8099	3.8099	3.8100	3.8101	3.8102
	47	40	3.8102	3.8103	3.8104	3.8104	3.8105	3.8106	3.8106	3.8107	3.8108	3.8108
	47	50	3.8109	3.8110	3.8110	3.8111	3.8112	3.8112	3.8113	3.8114	3.8114	3.8115
1	48	10	3.8116 3.0100	3.8116	3.8117	3.8118	3.8118	3.8119	3.8120	3.8120	3.8121	3.8122
	48 48	20	3.8122 3.8120	3, 8123	3.8124	3.8124	3. 8125	3.8120	3, 8120	3.8127	3.8128	3. 8125
	48	30	3.8136	3, 8136	3. 8137	3.8138	3.8138	3.8139	3, 8140	3, 8140	3.8141	3, 8142
	48	40	3.8142	3.8143	3.8144	3.8144	3.8145	3.8146	3.8146	3.8147	3.8148	3.8148
	48	50	3.8149	3.8150	3.8150	3.8151	3.8152	3.8152	3.8153	3.8154	3.8154	3.8155
1	49	0	3.8156	3.8156	3.8157	3.8158	3.8158	3.8159	3.8160	3.8160	3.8161	3.8162
	49	10	3.8162	3.8163	3.8164	3.8164	3.8165	3.8166 3.8170	3.8166	3.8167 3.9174	3.8168 3.9174	3.8168
	49	30	3.8109 3.8176	3.8176	3, 8177	3.8171 3.8178	3.8172 3.8178	3.8172 3.8179	3.8180	3.8180	3.8174 3.8181	3, 8182
	49	40	3.8182	3.8183	3.8184	3.8184	3.8185	3. 8185	3.8186	3.8187	3. 8188	3.8188
	49	50	3.8189	3.8190	3.8190	3.8191	3.8191	3, 8192	3.8193	3.8193	3.8194	3.8195

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APPENDIX V: TABLE IX.

		1			1			1		
Are.	0″	1″	2"	3″	+"	ō″	6″	7″	8″	9″
0 / //										
1 ^h 50 ^m 0 ^s	3.8195	3.8196	3.8197	3.8197	3.8198	3.8199	3.8199	3.8200	3.8201	3.8201
50 10	3.8202	3.8203	3.8203	3.8204	3.8205	3.8205	3.8206	3.8207	3.8207	3.8208
50 20	3.8209	3.8209	3.8210	3.8211	3.8211	3.8212	3.8213	3.8213	3.8214	3.8214
50 30	3.8210	3. 8210	3.8210	3.8217	3.8210	3.8225	3.8219	3.8220	3.8220	3.8221
50 50	3.8222 3.8228	3. 8229	3.8230	3.8230	3. 8231	3.8231	3.8220 3.8232	3.8233	3. 8233	3. 8234
1 51 0	3.8235	3, 8235	3.8236	3.8237	3.8237	3,8238	3,8239	3.8239	3.8240	3.8241
51 10	3.8241	3.8242	3.8243	3.8243	3.8244	3.8245	3.8245	3.8246	3.8246	3.8247
$51 \ 20$	3.8248	3.8248	3.8249	3.8250	3.8250	3.8251	3.8252	3.8252	3.8253	3.8254
51 30	3.8254	3.8255	3.8256	3.8256	3.8257	3.8258	3.8258	3.8259	3.8259	3.8260
51 40	3.8261	3.8261	3.8262	3.8263	3.8263	3.8264	3.8265	3.8265	3.8266	3,8267
$\frac{51}{1}$ $\frac{50}{10}$	3.8267	3.8268	3.8269	3.8209	3.8210	3.8270	$\frac{3.8271}{2.0070}$	3.8272	3.8272	3.8213
$1 \ 52 \ 0 \ 52 \ 10$	3.8274	3.8274	3.8270	3.8270	3.8270	3 8283	3.8218	3.8285	3.8279	3.8280
52 10 52 20	3.8280 3.8287	3. 8287	3.8288	3.8289	3. 8289	3.8290	3.8290	3.8291	3.8292	3.8292
52 30	3.8293	3, 8294	3,8294	3.8295	3.8296	3. 8296	3.8297	3, 8298	3.8298	3,8299
52 - 40	3.8299	3.8300	3.8301	3.8301	3.8302	3.8303	3.8303	3.8304	3.8305	3.8305
52 50	3.8306	3.8307	3.8307	3.8308	3.8308	3.8309	3.8310	3.8310	3.8311	3.8312
1 53 0	3.8312	3.8313	3.8314	3.8314	3.8315	3.8315	3.8316	3.8317	3.8317	3.8318
53 10	3.8319	3.8319	3.8320	3.8321	3.8321	3.8322	3.8323	3.8323	3.8324	3.8324
$ \begin{array}{r} 33 & 20 \\ 53 & 30 \end{array} $	3,8320	3.8320	3.8320	3.8321	3.8328	3.8328	3.8329	3.8330	3.8330	3.8331
$53 \ 50 \ 53 \ 40$	3 8338	3 8338	3 8339	3 8340	3 8340	3 8341	3 8342	3.8342	3 8343	3 8344
53 50	3.8344	3. 8345	3.8345	3.8346	3.8347	3. 8347	3.8348	3.8349	3. 8349	3. 8350
1 54 0	3.8351	3.8351	3.8352	3.8352	3.8353	3.8354	3.8354	3.8355	3.8356	3.8356
54 10	3.8357	3.8358	3.8358	3.8359	3.8359	3.8360	3.8361	3.8361	3.8362	3.8363
54 20	3.8363	3.8364	3.8365	3.8365	3.8366	3.8366	3.8367	3.8368	3.8368	3.8369
54 30	3.8370	3.8370	3.8371	3.8371	3.8372		3.8373	3.8374	3.8375	3.8375
04 40 54 50	3.8310	3.8311	3.8311	3.83/8	3.8378	3.8379	3.8380	3.8380	3.8381	3.8382
1 55 0	3 8388	3 8389	3 8390	3 8390	3 8391	3 8392	3 8392	3 8393	3 8394	3 8391
55 10	3,8395	3, 8395	3.8396	3.8397	3.8397	3.8398	3.8399	3, 8399	3.8400	3.8400
55 20	3.8401	3.8402	3.8402	3.8403	3.8404	3.8404	3.8405	3.8405	3.8406	3.8407
55 30	3.8407	3.8408	3.8409	3.8409	3.8410	3.8410	3.8411	3.8412	3.8412	3,8413
55 40	3.8414	3.8414	3.8415	3.8415	3.8416	3.8417	3.8417	3.8418	3.8419	3.8419
$\frac{55}{100}$	3.8420	3.8420	3.8421	3.8422	3.8422	3.8423	3.8424	3.8424	3.8425	3.8425
$1 56 0 \\ 56 10$	3,8426	3.8427	3.8427	3.8428	3.8429	3.8429	3.8430	3.8430	3.8431	3.8432
56 20	3 8130	2 8130	3 8140	3 8110	3 8441	3 8149	3 8449	3 8113	3 8144	3.0400
56 - 30	3. 8445	3. 8445	3.8446	3.8447	3.8447	3.8448	3.8448	3, 8449	3.8450	3, 8450
56 40	3.8451	3.8452	3.8452	3.8453	3.8453	3.8454	3.8455	3.8455	3.8456	3.8457
56 50	3.8457	3.8458	3.8458	3.8459	3.8460	3.8460	3.8461	3.8462	3.8462	3.8463
1 57 0	3.8463	3.8464	3.8465	3.8465	3.8466	3.8466	3.8467	3.8468	3.8468	3.8469
57 10	3.8470	3.8470	3.8471	3.8471	3.8472	3.8473	3.8473	3.8474	3.8474	3.8475
$ \begin{array}{r} 57 & 20 \\ 57 & 20 \end{array} $	3.8470	3.84/0	3.84//	3.84/8	3.8478	3.8479	3.8419	3.8480	3.8481	3.8481
57 50 57 10	3 8488	3 8189	3 8480	3 8100	3 8191	3 8191	3 8192	3 8102	3 8103	3 8191
57 50	3.8494	3. 8495	3. 8495	3. 8496	3. 8497	3.8497	3.8498	3.8499	3.8499	3.8500
1 58 0	3,8500	3,8501	3.8502	3.8502	3.8503	3.8503	3.8504	3,8505	3.8505	3.8506
58 10	3.8506	3.8507	3:8508	3.8508	3.8509	3.8510	3.8510	3.8511	3.8511	3.8512
58 20	3.8513	3.8513	3.8514	3.8514	3.8515	3.8516	3.8516	3.8517	3.8517	3.8518
58 30	3.8519	3.8519	3.8520	3.8521	3.8521	3.8522	3.8522	3.8523	3.8524	3.8524
$ 58 \pm 0 $	3.8020 9.8591	3.8520	3.8526	3.8527	3.8027	3,8028	3.8528	3.8529	3.8530	3.8530
	3 8527	3.0002	3 9590	3 8520	3 8520	3 8510	3 85.11	3 85.11	3 85 19	3 8519
59 10	3.8543	3.8544	3.8544	3.8545	3.8545	3.8540 3.8546	3.8547	3.8541 3.8547	3. 8548	3.8549
59 20	3.8549	3.8550	3.8550	3,8551	3.8552	3.8552	3.8553	3.8553	3.8554	3.8555
59 30	3.8555	3.8556	3.8556	3.8557	3.8558	3.8558	3.8559	3.8559	3.8560	3.8561
59 40	3.8561	3.8562	3.8562	3.8563	3.8564	3.8564	3.8565	3.8565	3.8566	3.8567
59 50	3.8567	3.8568	3.8568	3.8569	3.8570	3.8570	3.8571	3.8572	3.8572	3.8573

APPENDIX V: TABLE IX.

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			0			-				
Arc.	0″	1″	2"	3″	4″	5″	6″	7″	8″	977
$ \begin{array}{c} \circ & \prime & {}'' \\ 2^{\rm h} & 0^{\rm m} & 0^{\rm s} \\ & 0 & 10 \\ & 0 & 20 \\ & 0 & 30 \\ & 0 & 40 \end{array} $	3. 8573 3. 8579 3. 8585 3. 8591 3. 8597	$\begin{array}{c} 3.\ 8574\\ 3.\ 8580\\ 3.\ 8586\\ 3.\ 8592\\ 3.\ 8598 \end{array}$	3. 8575 3. 8581 3. 8587 3. 8593 3. 8599	$\begin{array}{c} 3.\ 8575\\ 3.\ 8581\\ 3.\ 8587\\ 3.\ 8593\\ 3.\ 8599 \end{array}$	$\begin{array}{c} 3.8576\\ 3.8582\\ 3.8588\\ 3.8594\\ 3.8600 \end{array}$	$\begin{array}{c} 3.8576 \\ 3.8582 \\ 3.8588 \\ 3.8594 \\ 3.8600 \end{array}$	3. 8577 3. 8583 3. 8589 3. 8595 3. 8601	$\begin{array}{c} 3.8578 \\ 3.8584 \\ 3.8590 \\ 3.8596 \\ 3.8602 \end{array}$	3. 8578 3. 8584 3. 8590 3. 8596 3. 8602	3. 8579 3. 8585 3. 8591 3. 8597 3. 8603
	3.8603 3.8609	$\frac{3.8604}{3.8610}$	3.8605 3.8611	$\frac{3.8605}{3.8611}$	3.8606 3.8612	3.8606 3.8612	3.8607	3.8608 3.8614	3.8608 3.8614	$\frac{3.8609}{3.8615}$
$ \begin{array}{rrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrr$	$\begin{array}{c} 3.\ 8615\\ 3.\ 8621\\ 3.\ 8627\\ 3.\ 8633\\ 3.\ 8639\end{array}$	$\begin{array}{c} 3.8616\\ 3.8622\\ 3.8628\\ 3.8634\\ 3.8640\end{array}$	$\begin{array}{c} 3.\ 8617\\ 3.\ 8623\\ 3.\ 8628\\ 3.\ 8634\\ 3.\ 8640 \end{array}$	$\begin{array}{c} 3.8617\\ 3.8623\\ 3.8629\\ 3.8635\\ 3.8641 \end{array}$	$\begin{array}{c} 3.8618\\ 3.8624\\ 3.8630\\ 3.8636\\ 3.8642 \end{array}$	$\begin{array}{c} 3.8618\\ 3.8624\\ 3.8630\\ 3.8636\\ 3.8642 \end{array}$	$\begin{array}{c} 3.\ 8619\\ 3.\ 8625\\ 3.\ 8631\\ 3.\ 8637\\ 3.\ 8643 \end{array}$	$\begin{array}{c} 3.8620 \\ 3.8625 \\ 3.8631 \\ 3.8637 \\ 3.8643 \end{array}$	$\begin{array}{c} 3.8620 \\ 3.8626 \\ 3.8632 \\ 3.8638 \\ 3.8644 \end{array}$	$\begin{array}{c} 3.8621 \\ 3.8627 \\ 3.8633 \\ 3.8639 \\ 3.8645 \end{array}$
$ \begin{array}{ccccccccccccccccccccccccccccccccc$	$\begin{array}{c} 3.8645\\ 3.8651\\ 3.8657\\ 3.8663\\ 3.8669\\ 3.8669\\ 3.8675\end{array}$	$\begin{array}{c} 3.8646\\ 3.8652\\ 3.8658\\ 3.8663\\ 3.8663\\ 3.8669\\ 3.8675\end{array}$	$\begin{array}{r} 3.8646\\ 3.8652\\ 3.8658\\ 3.8664\\ 3.8670\\ 3.8670\\ 3.8676\end{array}$	$\begin{array}{c} 3.8647\\ 3.8653\\ 3.8659\\ 3.8665\\ 3.8665\\ 3.8671\\ 3.8676\end{array}$	$\begin{array}{c} 3.8647 \\ 3.8653 \\ 3.8659 \\ 3.8665 \\ 3.8671 \\ 3.8671 \end{array}$	$\begin{array}{c} 3.8648 \\ 3.8654 \\ 3.8660 \\ 3.8666 \\ 3.8672 \\ 3.8678 \end{array}$	$\begin{array}{c} 3.8649\\ 3.8655\\ 3.8661\\ 3.8666\\ 3.8672\\ 3.8678\end{array}$	$\begin{array}{c} 3.8649\\ 3.8655\\ 3.8661\\ 3.8667\\ 3.8673\\ 3.8673\\ 3.8679\end{array}$	$\begin{array}{c} 3.8650 \\ 3.8656 \\ 3.8662 \\ 3.8668 \\ 3.8673 \\ 3.8679 \end{array}$	$\begin{array}{c} 3.8650 \\ 3.8656 \\ 3.8662 \\ 3.8668 \\ 3.8674 \\ 3.8680 \end{array}$
$ \begin{array}{cccccccccccccccccccccccccccccccccccc$	$\begin{array}{c} 3.8681 \\ 3.8686 \\ 3.8692 \\ 3.8698 \\ 3.8704 \\ 3.8710 \end{array}$	$\begin{array}{c} 3.8681\\ 3.8681\\ 3.8693\\ 3.8693\\ 3.8699\\ 3.8705\\ 3.8710\end{array}$	$\begin{array}{c} 3.8682 \\ 3.8682 \\ 3.8693 \\ 3.8699 \\ 3.8699 \\ 3.8705 \\ 3.8711 \end{array}$	$\begin{array}{c} 3.8682 \\ 3.8682 \\ 3.8694 \\ 3.8700 \\ 3.8700 \\ 3.8706 \\ 3.8712 \end{array}$	$\begin{array}{c} 3.8683\\ 3.8689\\ 3.8695\\ 3.8701\\ 3.8706\\ 3.8712\end{array}$	$\begin{array}{c} 3.8684 \\ 3.8689 \\ 3.8695 \\ 3.8701 \\ 3.8707 \\ 3.8713 \end{array}$	$\begin{array}{c} 3.8684 \\ 3.8690 \\ 3.8696 \\ 3.8702 \\ 3.8702 \\ 3.8708 \\ 3.8713 \end{array}$	$\begin{array}{c} 3.8685\\ 3.8691\\ 3.8696\\ 3.8702\\ 3.8702\\ 3.8708\\ 3.8714 \end{array}$	$\begin{array}{c} 3.8685\\ 3.8691\\ 3.8697\\ 3.8703\\ 3.8703\\ 3.8709\\ 3.8715\end{array}$	$\begin{array}{r} 3.8686\\ 3.8692\\ 3.8698\\ 3.8703\\ 3.8709\\ 3.8715\end{array}$
$ \begin{array}{r} 3 30 \\ 2 4 0 \\ 4 10 \\ 4 20 \\ 4 30 \\ 4 40 \\ 4 50 \\ \end{array} $	$\begin{array}{c} 3.8716 \\ 3.8716 \\ 3.8722 \\ 3.8727 \\ 3.8733 \\ 3.8739 \\ 2.8715 \end{array}$	$\begin{array}{r} 3.8710\\ \hline 3.8716\\ 3.8722\\ \hline 3.8728\\ \hline 3.8734\\ \hline 3.8740\\ \hline 9.9745\end{array}$	$\begin{array}{r} 3.8711\\ \hline 3.8717\\ 3.8723\\ \hline 3.8729\\ \hline 3.8734\\ \hline 3.8740\\ \hline 2.9716\end{array}$	$\begin{array}{c} 3.8712 \\ \hline 3.8717 \\ 3.8723 \\ \hline 3.8729 \\ \hline 3.8735 \\ \hline 3.8741 \\ \hline 9.8747 \end{array}$	$\begin{array}{r} 3.8712 \\ \hline 3.8718 \\ 3.8724 \\ \hline 3.8730 \\ \hline 3.8736 \\ \hline 3.8741 \\ \hline 2.8741 \\ \hline 2.8741 \\ \hline 2.8741 \\ \hline \end{array}$	$\begin{array}{r} 3.8713 \\ \hline 3.8719 \\ 3.8724 \\ \hline 3.8730 \\ \hline 3.8736 \\ \hline 3.8742 \\ \hline 9.9749 \end{array}$	$\begin{array}{r} 3.8719\\ 3.8725\\ 3.8731\\ 3.8737\\ 3.8742\\ 2.9719\end{array}$	$\begin{array}{c} 3.8714\\ \hline 3.8720\\ 3.8726\\ \hline 3.8731\\ \hline 3.8737\\ \hline 3.8743\\ \hline 2.8740\end{array}$	$\begin{array}{c} 3.8710\\ 3.8720\\ 3.8726\\ 3.8732\\ 3.8732\\ 3.8738\\ 3.8744\\ 2.8740\end{array}$	$\begin{array}{r} 3.8713 \\ \hline 3.8721 \\ 3.8727 \\ \hline 3.8733 \\ \hline 3.8738 \\ \hline 3.8744 \\ 2.8750 \end{array}$
$ \begin{array}{r} 4 & 30 \\ 2 & 5 & 0 \\ 5 & 10 \\ 5 & 20 \\ 5 & 30 \\ 5 & 40 \\ 5 & 50 \\ \end{array} $	$\begin{array}{r} 3.8749 \\ \hline 3.8751 \\ 3.8756 \\ \hline 3.8762 \\ \hline 3.8768 \\ \hline 3.8768 \\ \hline 3.8774 \\ \hline 3.8779 \end{array}$	$\begin{array}{r} 3.8749 \\ \hline 3.8751 \\ 3.8757 \\ \hline 3.8763 \\ 3.8769 \\ \hline 3.8769 \\ \hline 3.8774 \\ \hline 3.8780 \end{array}$	$\begin{array}{r} 3.8740 \\ \hline 3.8752 \\ 3.8758 \\ 3.8763 \\ 3.8769 \\ 3.8775 \\ 3.8781 \end{array}$	$\begin{array}{r} 3.8747 \\ \hline 3.8752 \\ 3.8758 \\ \hline 3.8764 \\ \hline 3.8770 \\ \hline 3.8775 \\ \hline 3.8781 \end{array}$	$\begin{array}{r} 3.8747 \\ \hline 3.8753 \\ 3.8759 \\ \hline 3.8764 \\ \hline 3.8770 \\ \hline 3.8776 \\ \hline 3.8782 \end{array}$	$\begin{array}{r} 3.8748 \\ \hline 3.8754 \\ 3.8759 \\ \hline 3.8765 \\ \hline 3.8765 \\ \hline 3.8771 \\ \hline 3.8777 \\ \hline 3.8782 \end{array}$	$\begin{array}{r} 3.8748 \\ \hline 3.8754 \\ 3.8760 \\ 3.8766 \\ 3.8771 \\ 3.8777 \\ 3.8783 \end{array}$	$\begin{array}{r} 3.8749\\ \hline 3.8755\\ 3.8760\\ \hline 3.8766\\ \hline 3.8772\\ \hline 3.8778\\ \hline 3.8788\\ \hline 3.8783\end{array}$	3.8749 3.8755 3.8761 3.8767 3.8773 3.8778 3.8778 3.8784	$\begin{array}{c} 3.8750 \\ \hline 3.8756 \\ 3.8762 \\ \hline 3.8767 \\ \hline 3.8773 \\ \hline 3.8779 \\ \hline 3.8785 \end{array}$
$\begin{array}{cccccccccccccccccccccccccccccccccccc$	$\begin{array}{c} 3.8785\\ 3.8791\\ 3.8791\\ 3.8797\\ 3.8802\\ 3.8808\\ 3.8814 \end{array}$	$\begin{array}{r} 3.8786\\ 3.8792\\ 3.8797\\ 3.8803\\ 3.8809\\ 3.8814 \end{array}$	$\begin{array}{r} 3.8786\\ 3.8792\\ 3.8798\\ 3.8804\\ 3.8809\\ 3.8815 \end{array}$	3. 8787 3. 8793 3. 8798 3. 8804 3. 8810 3. 8816	$\begin{array}{r} 3.8788 \\ 3.8793 \\ 3.8799 \\ 3.8805 \\ 3.8810 \\ 3.8816 \end{array}$	3. 8788 3. 8794 3. 8800 3. 8805 3. 8811 3. 8817	3.8789 3.8794 3.8800 3.8806 3.8812 3.8812	3. 8789 3. 8795 3. 8801 3. 8806 3. 8812 3. 8818	3. 8790 3. 8796 3. 8801 3. 8807 3. 8813 3. 8813 3. 8818	$\begin{array}{r} 3.8790 \\ 3.8796 \\ 3.8802 \\ 3.8808 \\ 3.8813 \\ 3.8813 \\ 3.8819 \end{array}$
$ \begin{array}{cccccccccccccccccccccccccccccccccccc$	$\begin{array}{c} 3.8820\\ 3.8825\\ 3.8831\\ 3.8837\\ 3.8842\\ 3.8848 \end{array}$	$\begin{array}{c} 3.\ 8820\\ 3.\ 8826\\ 3.\ 8832\\ 3.\ 8837\\ 3.\ 8843\\ 3.\ 8849 \end{array}$	$\begin{array}{c} 3.8821\\ 3.8826\\ 3.8832\\ 3.8838\\ 3.8843\\ 3.8849 \end{array}$	$\begin{array}{c} 3.\ 8821\\ 3.\ 8827\\ 3.\ 8833\\ 3.\ 8838\\ 3.\ 8844\\ 3.\ 8850 \end{array}$	$\begin{array}{c} 3.8822\\ 3.8828\\ 3.8833\\ 3.8839\\ 3.8845\\ 3.8850 \end{array}$	$\begin{array}{c} 3.8822\\ 3.8828\\ 3.8834\\ 3.8839\\ 3.8845\\ 3.8851 \end{array}$	$\begin{array}{c} 3.\ 8823\\ 3.\ 8829\\ 3.\ 8834\\ 3.\ 8840\\ 3.\ 8846\\ 3.\ 8851 \end{array}$	$\begin{array}{c} 3.8824\\ 3.8829\\ 3.8835\\ 3.8841\\ 3.8846\\ 3.8852 \end{array}$	$\begin{array}{c} 3.\ 8824\\ 3.\ 8830\\ 3.\ 8835\\ 3.\ 8841\\ 3.\ 8847\\ 3.\ 8852 \end{array}$	$\begin{array}{c} 3.8825 \\ 3.8830 \\ 3.8836 \\ 3.8842 \\ 3.8847 \\ 3.8853 \end{array}$
$\begin{array}{cccccccccccccccccccccccccccccccccccc$	$\begin{array}{c} 3.\ 8854\\ 3.\ 8859\\ 3.\ 8865\\ 3.\ 8871\\ 3.\ 8876\\ 3.\ 8882 \end{array}$	$\begin{array}{c} 3.8854\\ 3.8860\\ 3.8865\\ 3.8871\\ 3.8877\\ 3.8882 \end{array}$	3, 8855 3, 8860 3, 8866 3, 8872 3, 8877 3, 8883	$\begin{array}{c} 3.\ 8855\\ 3.\ 8861\\ 3.\ 8867\\ 3.\ 8872\\ 3.\ 8878\\ 3.\ 8883 \end{array}$	3.8856 3.8862 3.8867 3.8873 3.8878 3.8878 3.8884	3. 8856 3. 8862 3. 8868 3. 8873 3. 8879 3. 8885	3. 8857 3. 8863 3. 8868 3. 8874 3. 8880 3. 8885	3. 8858 3. 8863 3. 8869 3. 8874 3. 8880 3. 8880 3. 8886	$\begin{array}{c} 3.\ 8858\\ 3.\ 8864\\ 3.\ 8869\\ 3.\ 8875\\ 3.\ 8881\\ 3.\ 8886 \end{array}$	$\begin{array}{c} 3.\ 8859\\ 3.\ 8864\\ 3.\ 8870\\ 3.\ 8876\\ 3.\ 8881\\ 3.\ 8887 \end{array}$
$\begin{array}{cccccccccccccccccccccccccccccccccccc$	$\begin{array}{c} 3.8887\\ 3.8893\\ 3.8899\\ 3.8904\\ 3.8910\\ 3.8915 \end{array}$	$\begin{array}{c} 3.8888\\ 3.8894\\ 3.8899\\ 3.8905\\ 3.8905\\ 3.8910\\ 3.8916 \end{array}$	$\begin{array}{c} 3.8889\\ 3.8894\\ 3.8900\\ 3.8900\\ 3.8905\\ 3.8911\\ 3.8916 \end{array}$	$\begin{array}{c} 3.8889\\ 3.8895\\ 3.8900\\ 3.8900\\ 3.8906\\ 3.8911\\ 3.8917 \end{array}$	3.8890 3.8895 3.8901 3.8906 3.8912 3.8918	$\begin{array}{c} 3.8890\\ 3.8896\\ 3.8901\\ 3.8901\\ 3.8907\\ 3.8912\\ 3.8918 \end{array}$	$\begin{array}{c} 3.\ 8891\\ 3.\ 8896\\ 3.\ 8902\\ 3.\ 8908\\ 3.\ 8913\\ 3.\ 8919 \end{array}$	$\begin{array}{c} 3.\ 8891\\ 3.\ 8897\\ 3.\ 8903\\ 3.\ 8908\\ 3.\ 8914\\ 3.\ 8919 \end{array}$	$\begin{array}{c} 3.\ 8892\\ 3.\ 8897\\ 3.\ 8903\\ 3.\ 8909\\ 3.\ 8914\\ 3.\ 8920 \end{array}$	3. 8892 3. 8898 3. 8904 3. 8909 3. 8915 3. 8920

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APPENDIX V: TABLE IX.

			1			1		1		1	1	
	Arc		0"	1″	2"	3″	4″	5″	6″	7″	<u> </u>	9"
0	1	"	0.0001	0.0000	0.0000	0.0000	0.0000	9.0004	0.0004	0.0007	0.0007	0.0000
2^n	10 ^m	0 ^s	3.8921	3.8922	3.8922	3.8923	3.8923	3.8924	3.8924	3.8925	3.8925	3.8926
	10	10	3.8927	3.8927	3.8928	3, 8928	3.8929	3. 8929	3.8930	3.8930	3.8931	3.8932
	10	20	3. 8934	3 8038	3 8030	3, 0904	3, 8040	3, 8930	3. 8930	3 80.11	3.8957	3 80.12
	10	10	3 8913	3 8911	3 8944	3 8945	3 8945	3 8946	3 8946	3 8947	3 8942	3 8018
	10	50	3.8949	3.8949	3, 8950	3. 8950	3. 8951	3.8951	3.8952	3, 8953	3. 8953	3. 8954
9	11	0	3 8954	3 8955	3 8955	3 8956	3 8956	3 8957	3 8958	3 8958	3 8959	3 8959
-	11	10	3. 8960	3, 8960	3, 8961	3, 8961	3, 8962	3. 8963	3, 8963	3, 8964	3. 8964	3. 8965
	11	$\hat{20}$	3. 8965	3.8966	3,8966	3.8967	3. 8967	3.8968	3.8969	3, 8969	3.8970	3.8970
	11	30	3.8971	3.8971	3.8972	3.8972	3.8973	3.8974	3.8974	3.8975	3.8975	3.8976
	11	40	3.8976	3.8977	3.8977	3.8978	3.8978	3.8979	3.8980	3.8980	3.8981	3.8981
	11	50	3.8982	3.8982	3.8983	3, 8983	3.8984	3.8985	3.8985	3.8986	3.8986	3.8987
2	12	0	3.8987	3.8988	3, 8988	3.8989	3, 8989	3.8990	3.8991	3.8991	3.8992	3.8992
	12	10	3.8993	3.8993	3.8994	3.8994	3.8995	3.8995	3.8996	3.8997	3.8997	3.8998
	12	20	3.8998	3.8999	3.8999	3.9000	3.9000	3.9001	3.9001	3.9002	3.9003	3.9003
	12	30	3.9004	3.9004	3.9005	3.9005	3.9006	3.9006	3.9007	3.9007	3.9008	3.9009
	12	40	3.9009	3.9010	3.9010	3.9011	3,9011	3.9012	3.9012	3.9013	3.9013	3.9014
	12	00	3.9010	0. 9010	3.9010	0.9010	3.9017	3. 9017	0.9018	3. 9018	3, 9019	3.9019
Z	13	10	3.9020	3.9021	3.9021	3.9022	3.9022	3.9023	3.9023	3,9024	3.9024	3.9020
	10	10	3.9020	3.9020	3. 9027	3. 9027	3.0028	3.9028	3. 9029	3. 9029	3.9030	3.9030
	10	20	3 9036	3 9037	3. 9032	3, 9038	3 9033	3, 9034	3 9040	3 9010	3 9011	3. 9030
	13	40	3 9042	3 9042	3.9043	3.9043	3.9044	3.9044	3.9045	3.9046	3. 9046	3 9047
	13	50	3, 9047	3.9048	3, 9048	3. 9049	3, 9049	3,9050	3.9050	3,9051	3.9051	3,9052
2	14	0	3.9053	3,9053	3,9054	3.9054	3,9055	3.9055	3.9056	3.9056	3.9057	3,9057
~	14	10	3,9058	3.9058	3.9059	3,9060	3,9060	3.9061	3, 9061	3,9062	3.9062	3.9063
	14	20	3.9063	3.9064	3.9064	3.9065	3.9066	3.9066	3, 9067	3.9067	3.9068	3,9068
	14	30	3.9069	3.9069	3.9070	3.9070	3.9071	3.9071	3.9072	3.9073	3.9073	3.9074
	14	40	3.9074	3.9075	3.9075	3.9076	3.9076	3.9077	3.9077	3.9078	3.9078	3.9079
	14	50	3.9079	3.9080	3.9081	3.9081	3.9082	3.9082	3.9083	3.9083	3.9084	3.9084
2	15	0	3.9085	3.9085	3.9086	3.9086	3.9087	3.9088	3.9088	3.9089	3.9089	3.9090
	15	10	3,9090	3.9091	3.9091	3.9092	3.9092	3.9093	3.9093	3.9094	3.9094	3.9095
	15	20	3.9096	3.9096	3.9097	3.9097	3.9098	3.9098	3.9099	3.9099	3.9100	3.9100
	10	30	3.9101 2.010g	3.9101	3.9102	3.9103	3.9103	3.9104	3.9104	3.9105	3.9103	3.9100
	10	40 50	3 0119	3.9107	3. 9107	3. 9108	3. 9108	3.9109	3.9109	3.9110	3 0116	3 0116
	16		3 0112	3 0117	3 0118	3 0118	3 0110	3 0120	3 0120	3 0191	3 0191	3 0199
2	16	10	3 9122	3 9123	3 9123	3 9191	3 9191	3 9125	3 9125	3 9121	3 9121	3.9122 3.9127
	16	20	3.9128	3, 9128	3,9129	3, 9129	3, 9130	3, 9130	3, 9131	3.9131	3. 9132	3.9132
	$\tilde{16}$	30	3.9133	3.9133	3.9134	3.9134	3, 9135	3.9135	3.9136	3.9137	3.9137	3.9138
	16	40	3.9138	3.9139	3.9139	3.9140	3.9140	3.9141	3.9141	3.9142	3.9142	3.9143
	16	50	3.9143	3.9144	3.9144	3.9145	3.9146	3.9146	3.9147	3.9147	3.9148	3.9148
2	17	0	3.9149	3.9149	3.9150	3.9150	3.9151	3.9151	3.9152	3.9152	3.9153	3.9153
	17	10	3.9154	3.9155	3.9155	3.9156	3.9156	3.9157	3.9157	3.9158	3.9158	3.9159
	17	20	3.9159	3.9160	3.9160	3.9161	3.9161	3.9162	3.9162	3.9163	3.9163	3.9164
	17	30	3.9165	3.9165	3.9166	3.9166	3.9167	[3.9167]	3.9168	3.9168	3.9169	3.9169
	17	40	3.9170	3.9170	3.9171	3.9171	3.9172	3.9172	3.9173	3.9173	3.9174	3.9175
0	17	- 00	3.9173	0.9170	0.9170	3.9177	0.9177	3.9178	3.9178	3.9179	3.9179	3.9180
2	18	10	3.9180	3.9181	3.9181	3.9182	3.9182	3.9183	3.9183	3.9184	3.9184	3.9185
	10	20	3.9180	2 0101	3.9187	3.9187	2 0102	2 0102	3.9109	3.9109	2 0105	2 0105
	18	30	3 9106	3 9197	3 9197	3 9192	3 9199	3 9190	3 9199	3 9200	3 9200	3 9201
	18	40	3,9201	3,9202	3, 9202	3,9203	3,9203	3,9204	3,9204	3. 9205	3. 9205	3.9206
	18	50	3, 9206	3,9207	3.9207	3,9208	3,9209	3,9209	3.9210	3,9210	3.9211	3.9211
2	19	0	3,9212	3,9212	3.9213	3,9213	3,9214	3,9214	3,9215	3,9215	3.9216	3.9216
	19	10	3.9217	3.9217	3.9218	3.9218	3.9219	3.9219	3,9220	3.9221	3.9221	3.9222
	19	20	3.9222	3.9223	3.9223	3.9224	3.9224	3.9225	3.9225	3.9226	3.9226	3.9227
	19	30	3.9227	3.9228	3.9228	3.9229	3.9229	3.9230	3.9230	3.9231	3.9231	3.9232
	19	40	3.9232	3.9233	3.9233	3.9234	3.9235	3.9235	3.9236	3.9236	3.9237	3.9237
	19	50	3.9238	3.9238	3.9239	3.9239	3.9240	3.9240	3.9241	3.9241	3.9242	3.9242

APPENDIX V: TABLE IX.

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					0							
	Are.		0″	1″	2″	3″	4″	5″	6″	7″	8″	9″
0	,	"					_					
2^{h}	20^{m}	0^{s}	3.9243	3.9243	3.9244	3.9244	3.9245	3.9245	3.9246	3.9246	3.9247	3.9247
	20	10	3.9248	3.9248	3.9249	3.9250	3.9250	3.9251	3.9251	3.9252	3.9252	3.9253
	20^{-20}	$\frac{20}{20}$	3.9253	3,9254	3.9254	3.9255	3.9255	3.9206	3.9206	3.9257	3.9257	3.9258
	20	30	3.9208	3.9209	3.9209	5.9200 3.9265	3.9200	5.9201 3.9266	3.9201	3,9202	3.9202	3.9203
	20	50	3 9269	3, 9269	3 9270	3.9200 3.9270	3.9200 3.9271	3.9200 3.9271	3.9272	3.9272	3.9203	3.9200 3.9273
	20	0	3 9971	3 9274	3 9275	3 9275	3 9276	3 9276	3 9277	3 9277	3 9278	3 9278
-	21	10	3.9279	3.9279	3.9280	3, 9280	3. 9281	3.9281	3,9282	3, 9282	3.9283	3, 9283
	$\tilde{21}$	$\frac{10}{20}$	3.9284	3.9284	3.9285	3.9285	3.9286	3.9287	3.9287	3.9288	3,9288	3.9289
	$\overline{21}$	30	3.9289	3.9290	3.9290	3.9291	3.9291	3.9292	3.9292	3.9293	3.9293	3.9294
	21	40	3.9294	3.9295	3.9295	3.9296	3.9296	3.9297	3.9297	3.9298	3.9298	3.9299
	21	50	3.9299	3.9300	3.9300	3.9301	3.9301	3.9302	3.9302	3.9303	3.9303	3.9304
2	22	0	3.9304	3.9305	3.9305	3.9306	3.9306	3.9307	3.9307	3.9308	3.9308	3.9309
	22	10	3.9309	3.9310	3,9311	3.9311	3.9312	3.9312	3.9313	3.9313	3.9314	3.9314
	22	20	3.9315	3.9315	3.9316	3.9316	3,9317	3,9317	3.9318	3.9318	3.9319	3.9319
	44 99	30	3,9320	3 9320	3 9326	3 9326	3 9322	3 9322	3 9328	3 9328	3 9329	3 9324
	22	50	3.9330	3.9330	3. 9331	3, 9331	3, 9332	3, 9332	3, 9333	3,9333	3, 9334	3.9334
- 2	23	0	3 9335	3,9335	3.9336	3.9336	3.9337	3.9337	3.9338	3.9338	3.9339	3,9339
-	23	10	3.9340	3,9340	3, 9341	3.9341	3.9342	3, 9342	3, 9343	3, 9343	3.9344	3.9344
	23	20	3.9345	3.9345	3.9346	3.9346	3.9347	3.9348	3.9348	3.9349	3.9349	3.9350
	23	30	3,9350	3.9351	3.9351	3.9352	3.9352	3.9353	3.9353	3.9354	3.9354	3, 9355
	23	40	3.9355	3.9356	3.9356	3.9357	3.9357	3.9358	3.9358	3.9359	3.9359	3.9360
	23	50	3,9360	3.9361	3.9361	3.9362	3.9362	3.9363	3.9363	3.9364	3.9364	3.9365
2	24	0	3.9365	3.9366	3.9366	3.9367	3.9367	3.9368	3.9368	3.9369	3.9369	3.9370
	24	10	3.9370	3.9371	3.9371	3.9372	3.9372	3.93/3	3.93/3	3.93/4	3.9374	3.9375
	24	20	3.9373	3.9370	3.9370	3 0389	3.9377	3 0383	3 9310	3,9379	3.9379	3.9380
	24	40	3 9385	3 9386	3 9386	3.9387	3 9387	3 9388	3. 9388	3.9389	3.9389	3.9390
	$\tilde{24}$	50	3.9390	3. 9391	3.9391	3.9392	3. 9392	3, 9393	3,9393	3.9394	3.9394	3,9395
$\overline{2}$	25	0	3,9395	3.9396	3.9396	3,9397	3.9397	3.9398	3.9398	3.9399	3.9399	3.9400
	25	10	3.9400	3.9401	3.9401	3.9402	3.9402	3.9403	3.9403	3.9404	3.9404	3.9405
	25	20	3.9405	3.9406	3.9406	3.9407	3.9407	3.9408	3.9408	3.9409	3.9409	3.9410
	25	30	3.9410	3.9411	3.9411	3.9412	3.9412	3.9413	3.9413	3.9414	3.9414	3,9415
	25	40	3.9415	3.9416	3.9416	3.9417	3.9417	3.9418	3.9418	3.9419	3.9419	3.9420
	20	00	3.9420	3.9421	3.9421	3.9422	3.9422	3. 9423	3.9423	3.9424	3.9424	3.9420
Z	20	10	3.9420	3.9420	3.9420	3.9427	3.9427	3. 9428	3.9428	3.9429	3.9429	3.9430
	26	$\frac{10}{20}$	3 9435	3.9435	3 9436	3 9436	3 9432	3. 9432	3.9438	3.9438	3.9439	3.9439
	$\bar{26}$	30	3.9440	3.9440	3.9441	3.9441	3.9442	3.9442	3.9443	3.9443	3.9444	3.9444
	26	40	3.9445	3.9445	3.9446	3.9446	3.9447	3.9447	3.9448	3.9448	3.9449	3.9449
	26	50	3,9450	3.9450	3.9451	3.9451	3.9452	3.9452	3.9453	3.9453	3,9454	3.9454
2	27	0	3.9455	3.9455	3.9456	3.9456	3.9457	3.9457	3.9458	3.9458	3.9459	3.9459
	27	10	3.9460	3.9460	3.9461	3.9461	3.9462	3.9462	3.9463	3.9463	3.9464	3.9464
	27	$\frac{20}{20}$	3.9465	3.9465	3.9466	3.9466	3.9466	3.9467	3.9467	3.9468	3.9468	3.9469
	2	30	3.9469	3.9470	3.9470	3.9471	3.9471	3.9472	3.9472	3.94/3	3.94/3	3.9474
	$\frac{41}{97}$	40 50	3 9474	3.9475	3 9475	3.9470	3 9470	3 9477	3 9477	3 94/8	3 9478	3 9479
	- 21	-00	3 0.18.1	3 0185	3 0.185	3 0.186	3 0.186	3 0.187	3 0.187	3 0.188	3 0.188	3 0.180
-	28	-10	3.9489	3.9490	3 9490	3 9490	3 9491	3.9491	3 9492	3.9492	3.9493	3.9493
	$\overline{28}$	$\tilde{20}$	3.9494	3,9494	3.9495	3.9495	3.9496	3.9496	3.9497	3.9497	3.9498	3,9498
	28	30	3.9499	3.9499	3.9500	3.9500	3.9501	3.9501	3.9502	3.9502	3.9503	3.9503
	28	40	3.9504	3.9504	3.9505	3.9505	3.9506	3.9506	3.9507	3.9507	3.9508	3.9508
	28	50	3.9509	3.9509	3.9509	3.9510	3.9510	3.9511	3.9511	3.9512	3.9512	3.9513
2	29	0	3.9513	3.9514	3.9514	3.9515	3.9515	3.9516	3.9516	3.9517	3.9517	3.9518
	29	10	3.9518	3.9519	3.9519	3,9520	3.9520	3.9521	3.9521	3.9522	3.9522	3.9523
	29	20	3.9923	3.9924	3.9024	3.9929	3.9520	3,9526	3.9526	3,9526	3.9927	3.9027
	29	40	3 9533	3 9533	3 9534	3 9529	3 9535	3 9135	3 9536	3 9536	3 9537	3 9537
	$\frac{1}{29}$	50	3.9538	3,9538	3, 9539	3, 9539	3,9540	3.9540	3,9540	3,9541	3.9541	3.9542
	-					1				1		

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APPENDIX V: TABLE IX.

					ogannin	is or onia	II AIG III	space of	Tune.			
	Arc.		0″	1″	211	3″	4″	5″	6″	7″	8″	9″
0	,	"								_		
2 ^h	30^{m}	- 0*	3.9542	3.9543	3.9543	3.9544	3.9544	3.9545	3.9545	3,9546	3.9546	3.9547
	30	10	3.9547	3.9548	3.9548	3.9549	3.9549	3.9550	3.9550	3.9551	3.9551	3.9552
	30	20	3.9552	3.9553	-3.9553	3.9554	3.9554	3.9554	3.9555	3.9555	3.9556	3.9556
	30	30	3.9557	3.9557	3.9558	3.9558	3.9559	3,9559	3.9560	3.9560	3.9561	3.9561
	30	40	3.9562	3.9562	3.9563	3.9563	3.9564	3.9564	3.9565	3.9565	3,9566	3.9566
	30	50	3.9566	3.9567	3.9567	3.9568	3.9568	3.9569	3.9569	3.9570	3.9570	3.9571
2	31	0	3.9571	3.9572	3,9572	3.9573	3.9573	3.9574	3.9574	3.9575	3.9575	3,9576
	31	10	3.9576	3.9577	3.9577	3.9578	3.9578	3.9578	3.9579	3.9579	3.9580	3.9580
	31	20	3.9581	3.9581	3.9582	3.9582	3.9583	3.9583	3.9584	3.9584	3.9585	3.9585
	31	30	3.9586	3.9586	3.9587	3.9587	3.9588	3.9588	3.9589	3.9589	3.9589	3.9590
	31	40	3.9590	3.9591	3.9591	3.9592	3.9592	3.9593	3.9593	3.9594	3.9594	3,9595
	31	50	3.9595	3.9596	3.9596	3.9597	3.9597	3.9598	3.9598	3.9599	3.9599	3.9599
2	32	0	3,9600	3.9600	3.9601	3.9601	3.9602	3.9602	3.9603	3.9603	3.9604	3,9604
	32	10	3.9605	3.9605	3.9606	3.9606	3.9607	3.9607	3.9608	3.9608	3,9609	3.9609
	32	20	3.9609	3.9610	3.9610	3.9611	3.9611	3.9612	3.9612	3.9613	3.9613	3.9614
	32	30	3.9614	3.9615	3.9615	3.9616	3.9616	3.9617	3.9617	3.9618	3.9618	3.9618
	32	40	3.9619	3.9619	3.9620	3.9620	3.9621	3,9621	3.9622	3.9622	3,9623	3.9623
	32	50	3.9624	3.9624	3.9625	3.9625	3.9626	3.9626	3.9627	3.9627	3.9627	3.9628
2	33	0	3.9628	3.9629	3.9629	3.9630	3.9630	3.9631	3.9631	3.9632	3,9632	3.9633
	33	10	3.9633	3.9634	3.9634	3.9634	3.9635	3.9635	3.9636	3.9636	3,9637	3.9637
	33	20	3.9638	3.9638	3.9639	3, 9639	3,9640	3.9640	3.9641	3.9641	3.9642	3.9642
	33	30	3.9642	3.9643	3.9643	3.9644	3.9644	3.9645	3.9645	3.9646	3.9646	3.9647
	33	40	3.9647	3,9648	3.9648	3.9649	3.9649	3.9650	3.9650	3.9651	3.9651	3.9652
	_33	50	3.9652	3.9653	3.9653	3.9653	3.9654	3.9654	3.9655	3.9655	3.9656	3.9656
2	34	0	3.9657	3.9657	3.9658	3.9658	3.9658	3.9659	3.9659	3.9660	3.9660	3.9661
	34	10	3.9661	3.9662	3.9662	3.9663	3.9663	3.9664	3.9664	3.9665	3.9665	3.9665
	34	20	3.9666	3.9666	3.9667	3.9667	3.9668	3.9668	3.9669	3.9669	3.9670	3.9670
	34	30	3.9671	3.9671	3.9672	3.9672	3.9672	3.9673	3.9673	3.9674	3.9674	3.9675
	34	40	3.9675	3.9676	3.9676	3.9677	3.9677	3.9678	3.9678	3.9679	3.9679	3.9680
	34	50	3.9680	3.9681	3.9681	3.9682	3.9682	3.9682	3.9683	3.9683	3.9684	3.9684
2	35	0	3.9685	3.9685	3.9686	3.9686	3,9687	3.9687	3.9688	3.9688	3.9689	3.9689
	35	10	3.9689	3.9690	3.9690	3.9691	3.9691	3.9692	3.9692	3.9693	3.9693	3.9694
	35	20	3,9694	3,9695	3.9695	3,9696	3.9696	3.9696	3.9697	3.9697	3.9698	3.9698
	30	30	3.9699	3.9699	3.9700	3.9700	3.9701	3.9701	3.9702	3.9702	3.9703	3.9703
	30	40	3.9703	3.9704	3.9704	3.9705	3.9705	3.9706	3.9706	3.9707	3.9707	3.9708
	30	00	3.9708	3.9709	3.9709	3.9710	3.9710	3.9710	3.9711	3.9711	3.9712	3.9712
2	36	0	3.9713	3.9713	3.9714	3.9714	3.9715	3.9715	3.9716	3.9716	3.9716	3.9717
	36	10	3.9717	3.9718	3.9718	3.9719	3.9719	3.9720	3.9720	3.9721	3.9721	3.9722
	36	20	3.9722	3,9722	3,9723	3,9723	3,9724	3.9724	3.9725	3.9725	3.9726	3.9726
	36	30	3.9727	3.9727	3.9728	3.9728	3.9729	3,9729	3.9729	3.9730	3.9730	3.9731
	30	40	3.9731	3.9732	3.9732	3.9733	3.9733	3.9734	3.9734	3.9735	3.9730	3.9730
	00	00	3.9730	3.9730	3.9737	3.9737	3.9738	0.9738	3. 9739	0.9709	0.9740	3. 9740
z	37	10	3.9741	3.9741	3.9741	3.9742	3.9742	3.9743	3.9743	3.9744	3.9744	3.9745
	31	10	3.9745	3.9746	3.9746	3.9746	3.9747	3.9747	3.9748	3.9748	3.9749	3.9749
	31	20	3.9750	3.9750	3.9731	3.9791	3.9752	3.9752	3.9792	3.9703	3.9753	3.9734
i	37	10	3.9734	3.9730	3.9700	3.9700	3.9730	3.9707	3.9707	0.9700	0.9708	3.9738
	37	50	3. 9769	3.9739	3.9760	2 0765	2 0765	2 0766	3.9702	3.9702	3.9703	3. 5703
- 0	00	00	0.9700	3. 9704	0.9704	3. 9700	3. 9700	3.9700	9.0771	0.0771	0.0770	3. 3703
Z	30	10	3.9708	3.9709	3.9709	3.9769	3.9770	3.9/10	3.9771	3.9771	3.9112	3.9772
	00 90	10	3.9713	3.9773	3.9774	3.9774	3.9774	3.9770	3.9770	3.9770	3.9770	0.9777
	30	20	3 0729	3 0720	3 0702	3 0702	3.9719	3 0721	3 0705	3 0725	3 0725	3 9798
	36	10	3 0790	3.9782	3 0707	3.0700	3.0700	3 0720	3 0720	3.0700	3 0700	3 9700
	38	50	3 9701	3.9701	3. 9709	3.0700	3.0703	3. 9709	3.9709	3.0700	3 9795	3 9795
. 0	30	00	2 0705	9 0700	9 0700	3.0792	9 0707	9 0700	9 0700	9 0700	2 0700	2 0000
4	30	10	3 0600	3.8790	3.9790	3.9/9/	3.9/9/	3.9198	3.9798	3 0603	3.9799	3.9800
	30	20	3 9805	3. 2000	3. 9801	3. 9801	3.9802	3.9802	3, 8803	3 0802	3 0804	3 0800
	30	30	3 0200	3.9809	3 0210	3.9800	3.9800	3 0211	3 0219	3 0219	3 0819	3 9819
	39	40	3 9811	3 9814	3 9815	3 9815	3 9815	3 9816	3 9816	3 9817	3 9817	3 9818
	39	50	3 9819	3 9810	3 9810	3 9810	3 0820	3 9820	3 9891	3 9821	3 9822	3 9822
	00	00	0.0010	0.0019	9. 9919	0. 9019	0. 9820	0. 0020	0. 0821	0.0041	0. 0042	0.0022

APPENDIX V: TABLE IX.

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				1			1					
	Arc.		0″	1″	2"	3″	4″	5″	6"	7″	8″	9″
c	,	"										
2^{i}	40 ⁿ	n Os	3.9823	3.9823	3.9824	3.9824	3.9825	3.9825	3.9825	3.9826	3.9826	3.9827
	40	10	3.9827	3.9828	3.9828	3.9829	3.9829	3.9829	3.9830	3.9830	3.9831	3.9831
	40	20	3.9832	3.9832	3.9833	3.9833	3,9834	3.9834	3.9834	3.9830	3.9835	3.9836
	40	40	3 9841	3 9841	3 9819	3 9842	3 9843	3 9843	3 9843	3 9844	3.9840	3.9840
	40	50	3.9845	3.9846	3. 9846	3, 9847	3. 9847	3. 9848	3.9848	3.9848	3, 9849	3. 9849
$\overline{2}$	41	0	3,9850	3.9850	3.9851	3,9851	3.9852	3.9852	3.9852	3, 9853	3.9853	3.9854
-	41	10	3.9854	3.9855	3.9855	3.9856	3.9856	3.9857	3.9857	3.9857	3.9858	3.9858
	41	20	3.9859	3.9859	3.9860	3.9860	3.9861	3.9861	3.9861	3.9862	3.9862	3.9863
	41	30	3.9863	3.9864	3.9864	3.9865	3.9865	3.9865	3.9866	3.9866	3.9867	3.9867
	41	40	3.9868	3.9868	3.9869	3.9869	3,9870	3.9870	3.9870	3.9871	3.9871	3.9872
	41	<u> </u>	3.9872	3.9873	3.9873	3.9874	3.98/4	3.98/4	3.9870	3.9875	3.9876	3.9876
2	42	10	3.98//	3.9877	3.98/8	3.98/8	3.9878	3.9879	3.9879	3.9880	3.9880	3.9881
	42	20	3 9886	3.9886	3 9886	3.9002 3.9887	3,9000	3 9888	3 9888	3 9889	3.9880	3.9800
	42	30	3.9890	3, 9890	3.9891	3. 9891	3, 9892	3, 9892	3, 9893	3, 9893	3.9894	3.9894
	$\overline{42}$	40	3.9894	3.9895	3.9895	3.9896	3.9896	3.9897	3.9897	3.9898	3.9898	3.9898
	42	50	3.9899	3.9899	3.9900	3.9900	3.9901	3.9901	3.9902	3.9902	3.9903	3.9903
2	43	0	3.9903	3.9904	3.9904	3.9905	3.9905	3.9906	3.9906	3.9906	3.9907	3.9907
	43	10	3.9908	3.9908	3.9909	3.9909	3.9910	3.9910	3.9910	3.9911	3.9911	3.9912
	43	20	3.9912	3.9913	3.9913	3.9914	3.9914	3.9914	3.9915	3.9915	3.9916	3.9916
	43	30	2 0091	3.9917	3.9918	3.9918	2 0022	3.9919	3.9919	3.9920	3.9920	3.9921
	43	50	3.9921	3 9926	3 9926	3.9922	3.9927	3. 9928	3. 9928	3 9929	3 9929	3.9920
2	44	0	3,9930	3 9930	3 9931	3 9931	3,9932	3,9932	3 9933	3 9933	3 9933	3 9934
-	44	10	3.9934	3.9935	3. 9935	3.9936	3,9936	3.9937	3.9937	3.9937	3.9938	3.9938
	44	20	3.9939	3.9939	3.9940	3.9940	3.9941	3.9941	3.9941	3.9942	3.9942	3.9943
	44	30	3.9943	3.9944	3.9944	3.9944	3.9945	3.9945	3.9946	3.9946	3.9947	3.9947
	-14	40	3.9948	3.9948	3.9948	3.9949	3.9949	3.9950	3.9950	3.9951	3.9951	3.9952
	44	- 50	3.9952	3.9952	3.9953	3.9953	3.9954	3.9954	3.9955	3.9955	3.9955	3.9956
2	40	10	3.9956	3.9957	3.9957	3.9958	3.9958	3.9959	3.9959	3.9959	3.9960	3.9960
	45	20	3.9965	3.9966	3.9966	3. 9966	3.9967	3.9967	3.9968	3.9968	3.9969	3.9969
	45	$\overline{30}$	3.9969	3,9970	3.9970	3,9971	3,9971	3.9972	3.9972	3.9973	3.9973	3.9973
	45.	40	3.9974	3.9974	3.9975	3.9975	3.9976	3.9976	3.9976	3.9977	3.9977	3.9978
	45	50	3.9978	3.9979	3.9979	3.9980	3.9980	3.9980	3.9981	3.9981	3.9982	3.9982
2	46	0	3.9983	3.9983	3.9983	3.9984	3.9984	3.9985	3.9985	3.9986	3.9986	3.9987
	46	10	3.9987	3.9987	3.9988	3.9988	3.9989	3.9989	3.9990	3.9990	3.9990	3.9991
	40	20	3.9991	3.9992	3.9992	3.9993	3,9993	3.9993	3.9994	3.9994	3.9995	3.9995
	46	40	4 0000	4 0000	4 0001	4 0001	4 0002	4 0002	4 0003	4 0003	4 0003	4 0004
	46	50	4.0004	4.0005	4.0005	4.0006	4.0006	4.0007	4.0007	4.0007	4.0008	4.0008
$\overline{2}$	47	0	4.0009	4.0009	4.0010	4.0010	4.0010	4.0011	4.0011	4.0012	4.0012	4.0013
	47	10	4.0013	4.0013	4.0014	4.0014	4.0015	4.0015	4.0016	4.0016	4.0016	4.0017
	47	20	4.0017	4.0018	4.0018	4.0019	4.0019	4.0019	4.0020	4.0020	4.0021	4.0021
	47	30	4.0022	4.0022	4.0023	4.0023	4.0023	4.0024	4.0024	4.0025	4.0025	4.0026
	47	40	4.0026	4.0020	4.0027	4.0027	4.0028	4,0028	4,0029	4.0029	4.0029	4,0030
- 9	48		4.0035	4.0031	4.0035	4.0036	4.0032	4.0032	4.0035	4.0038	1 0038	4.0034
4	48	10	4.0039	4.0039	4.0040	4.0040	4.0041	4.0041	4.0041	4.0042	4.0042	4.0043
	$\overline{48}$	$\tilde{20}$	4.0043	4.0044	4.0044	4.0045	4.0045	4.0045	4.0046	4.0046	4.0047	4.0047
	48	30	4.0048	4.0048	4.0048	4.0049	4.0049	4.0050	4.0050	4.0051	4.0051	4.0051
	48	40	4.0052	4.0052	4.0053	4.0053	4.0054	4.0054	4.0054	4.0055	4.0055	4.0056
	48	50	4.0056	4.0057	4.0057	4.0057	4.0058	4.0058	4.0059	4.0059	4.0060	4.0060
2	49	10	4.0060	4.0061	4.0061	4.0062	4.0062	4.0063	4.0063	4.0063	4.0064	4.0064
	49	20	4.0000	4.0000	4.0000	4.0000	4.0000	4.0007	4.0007	4.0008	4.0008	4.0009
	49	30	4,0073	4.0074	4.0074	4.0074	4.0075	4.0075	4.0072	4.0072	4.0072	4.0073
	49	40	4.0077	4.0078	4.0078	4.0079	4.0079	4.0080	4.0080	4.0080	4.0081	4.0081
	49	50	4.0082	4.0082	4.0083	4.0083	4.0083	4.0084	4.0084	4.0085	4.0085	4.0086

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APPENDIX V: TABLE IX.

l										
Are.	0″	1'' .	2''	3''	4''	5″	6''	7"	8″	9''
0 / //							1	-)		
2h 50m 0s	4.0086	4.0086	4.0087	4.0087	4.0088	4.0088	4.0089	4.0089	4.0089	4.0090
50 10	4.0090	4.0091	4.0091	4.0092	4.0092	4.0092	4.0093	4.0093	4.0094	4.0094
50 20 50 30	4.0095	4.0095	4.0095	4.0090	4.0090	4.0097	4.0097	4.0097	4.0098	4.0098
50 50 50 40	4.0055	4.0000	4.0100	4.0100	4.0100	4.0101	4.0101	4.0102	4.0102	4.0105
50 50	4.0107	4. 0108	4.0108	4.0109	4.0109	4.0109	4.0110	4.0110	4.0111	4.0111
2 51 0	4.0111	4.0112	4.0112	4.0113	4.0113	4.0114	4.0114	4.0114	4.0115	4.0115
51 10	4.0116	4.0116	4.0117	4.0117	4.0117	4.0118	4.0118	4.0119	4.0119	4.0120
51 20	4.0120	4.0120	4.0121	4.0121	4.0122	4.0122	4.0122	4.0123	4.0123	4.0124
51 30	4.0124	4.0120	4.0120	4.0125	4.0120	4.0120	4.0127	4.0127	4.0128	4.0128
51 ± 0 51 50	4.0120	4.0120	4.0125	4.0130	4.0130	4.0130	4.0131	4.0131	4.0132	4.0134
01 00	4.0100	4.0137	1 0138	4.0138	4.0138	4.0139	4.0139	4.0140	4.0140	4.0100
52 52 10	4.0141	4.0141	4.0142	4.0142	4.0143	4.0143	4.0144	4.0144	4.0144	4.0145
$5\bar{2}$ 20	4.0145	4.0146	4.0146	4.0146	4.0147	4.0147	4.0148	4.0148	4.0149	4.0149
52 30	4.0149	4.0150	4.0150	4.0151	4.0151	4.0152	4.0152	4.0153	4.0153	4.0153
52 + 0	4.0154	4.0154	4.0154	4.0155	4.0155	4.0156	4.0156	4.0157	4.0157	4.0157
<u>52 au</u>	4.0100	4.0100	4.0105	4.0100	4.0109	4.0100	4.0100	4.0101	4.0101	4.0162
$\begin{array}{cccccccccccccccccccccccccccccccccccc$	4.0162	4.0162	4,0105	4.0105	4.0104	4.0104	4.0104	4.0105	4.0105	4.0100
53 20	4.0170	4.0171	4.0171	4.0172	4.0172	4.0172	4.0173	4.0173	4.0174	4.0174
53 30	4.0175	4.0175	4.0175	4.0176	4.0176	4.0177	4.0177	4.0177	4.0178	4.0178
53 40	4.0179	4.0179	4.0180	4.0180	4.0180	4.0181	4.0181	4.0182	4.0182	4.0182
53 50	4.0183	4.0183	4.0184	4.0184	4.0185	4.0185	4.0185	4.0186	4.0186	4.0187
2540	4.0187	4.0187	4.0188	4.0188	4.0189	4.0189	4.0190	4.0190	4.0190	4.0191
54 10 54 20	4.0191	4.0192	4,0192	4.0192	4.0195	4.0195	4.0194	4.0194	1 0194	4.0195
54 30	4.0199	4.0200	4.0100	4.0201	4.0101	4.0101	4.0100	4.0100	4.0100	4.0100
54 40	4.0204	4.0204	4.0204	4.0205	4.0205	4.0206	4.0206	4.0207	4.0207	4.0207
54 50	4.0208	4.0208	4.0209	4.0209	4.0209	4.0210	4.0210	4.0211	4.0211	4.0211
2 55 0	4.0212	4.0212	4.0213	4.0213	4.0214	4.0214	4.0214	4.0215	4.0215	4.0216
55 10	4.0216	4.0216	4.0217	4.0217	4.0218	4.0218	4.0219	4.0219	4.0219	4.0220
55 30	4.0220	4.0221	4.0221	4.0221	4. 0222	4.0222	4. 0225	4.0225	4.0220	4.0224
55 40	4.0228	4. 0229	4. 0229	4. 0230	4. 0230	4. 0230	4. 0231	4. 0231	4. 0232	4. 0232
55 50	4. 0233	4. 0233	4.0233	4.0234	4.0234	4.0235	4.0235	4.0235	4.0236	4.0236
2 56 0	4.0237	4.0237	4.0237	4.0238	4.0238	4.0239	4.0239	4.0240	4.0240	4.0240
56 10	4.0241	4.0241	4.0242	4.0242	4.0242	4.0243	4.0243	4.0244	4.0244	4.0244
56 20 7	4.0245	4.0245	4.0246	4.0246	4.0246	4.0247	4.0247	4.0248	4.0248	4.0249
56 56 40	4.0249	4,0249	4.0250 4.0254	4.0250	4.0251 4.0255	4.0251	4.0201	4.0252	4.0252	4.0255
56 50	4. 0257	4. 0258	4. 0258	4. 0258	4. 0259	4. 0259	4. 0260	4. 0260	4. 0260	4. 0261
2 57 0	4.0261	4. 0262	4.0262	4.0262	4.0263	4.0263	4.0264	4.0264	4.0265	4.0265
57 10	4.0265	4.0266	4.0266	4.0267	4.0267	4.0267	4.0268	4.0268	4.0269	4.0269
57 20	4.0269	4.0270	4.0270	4.0271	4.0271	4.0271	4.0272	4.0272	4.0273	4.0273
57 30	4.0273	4.0274	4.0274	4.0275	4.0275	4.0276	4.0276	4.0276	4. 0277 1	4.0277
57 50	4.0270	4. 0210	4.0278	4.0275	4. 0218	4.0280	4.0280	4.0280	4.0281	4.0281
9 58 0	4.0202	4.0286	4.0202	4.0203	4.0287	4.0281	4.0281	4.0289	4.0289	4.0289
58 10	4. 0290	4. 0290	4. 0291	4. 0291	4. 0291	4. 0292	4. 0292	4. 0293	4. 0293	4. 0293
58 20	4.0294	4.0294	4.0295	4.0295	4.0295	4.0296	4.0296	4.0297	4.0297	4.0297
58 30 /	4.0298	4.0298	4.0299	4.0299	4.0300	4.0300	4.0300	4.0301	4.0301	4.0302
58 40 J	4.0302	4.0302	4.0303	4.0303	4.0304	4.0304	4.0304	4. 0305	4.0305	4.0306
58 50	4.0300	4.0300	4.0307	4.0307	4.0300	4.0300	4.0300	4.0309	4.0305	4.0310
2 59 0 10	4.0310	4.0310	4.0311	4.0311	4.0312	4.0312	4.0312	4.0315	4.0313	4.0314
59 20	4.0318	4.0319	4.0319	4.0319	4.0320	4.0320	4.0321	4.0321	4.0321	4. 0322
59 30	4.0322	4.0323	4.0323	4.0323	4.0324	4.0324	4.0325	4.0325	4.0325	4.0326
59 40	4.0326	4.0327	4.0327	4.0327	4.0328	4.0328	4.0329	4.0329	4.0329	4.0330
59 80 7	4.0330 +	4.0331	4.0331	4.0331	4.0332	4.0332	4.0333	4.0333	4.0333	4.0334

APPENDIX V: TABLE X.

Table showing the correction required, on account of Second Differences of the Moon's Motion, in Finding the Greenwich Time corresponding to a Corrected Lunar Distance.

Appro	vimate		Difference of the proportional logarithms in the Ephemeris.																
inte	rval.	2	4	6	8	10	. 12	14	16	18	20	22	24	26	28	30	32	34	36
$\begin{array}{c} h. \ m. \\ 0 \ 0 \\ 0 \ 10 \\ 0 \ 20 \\ \hline 0 \ 30 \end{array}$	$ \begin{array}{c ccccc} h. m. \\ 3 & 0 \\ 2 & 50 \\ 2 & 40 \\ \hline 2 & 30 \end{array} $	8. 0 0 0	$ \begin{array}{c} s.\\ 0\\ 0\\ 1\\ \hline 1 \end{array} $	8. 0 0 1 1		$\begin{array}{c} s.\\ 0\\ 1\\ 1\\ \hline 2 \end{array}$	$ \begin{array}{c} s.\\0\\1\\2\\\hline 2\end{array} \end{array} $	$ \begin{array}{c} $	$\begin{array}{c} \overset{s.}{0}\\ 1\\ \underline{2}\\ \overline{3} \end{array}$					$\begin{array}{c} s. \\ 0 \\ 2 \\ 3 \\ \hline 5 \end{array}$	^{8.} 0 2 3 5		$ \begin{array}{r} $	$ \begin{array}{r} $	$ \begin{array}{r} $
$\begin{array}{c} 0 & 40 \\ 0 & 50 \end{array}$	$\begin{array}{ccc} 2 & 20 \\ 2 & 10 \end{array}$	$\begin{array}{c} 0 \\ 1 \end{array}$	1 1	$rac{1}{2}$	$\frac{2}{2}$	$\frac{2}{3}$	$\frac{3}{3}$	$\frac{3}{4}$	$\frac{3}{4}$	$\frac{4}{5}$	$\frac{4}{5}$	5 5	$\begin{array}{c} 5\\ 6\end{array}$	$\begin{array}{c} 6\\ 6\end{array}$	$\frac{6}{7}$	$\begin{array}{c} 6 \\ 7 \end{array}$	7 8	7 8	$\frac{8}{9}$
$egin{array}{cccc} 1 & 0 \ 1 & 10 \ 1 & 20 \ 1 & 30 \end{array}$	$ \begin{array}{cccc} 2 & 0 \\ 1 & 50 \\ 1 & 40 \\ 1 & 30 \end{array} $	$ \begin{array}{c} 1 \\ 1 \\ 1 \\ 1 \\ 1 \end{array} $	1 1 1 1	$\begin{array}{c}2\\2\\2\\2\end{array}$	$ \begin{array}{c} 2 \\ 2 \\ 3 \\ 3^{\cdot} \end{array} $	3 3 3 3	3 4 4 4 4	$\begin{array}{c} 4\\ 4\\ 4\\ 4\\ 4\end{array}$	$ \begin{array}{c} 4 \\ 5 \\ 5 \\ 5 \\ 5 \end{array} $	$5 \\ 5 \\ 6 \\ 6$	$\begin{array}{c} 6\\ 6\\ 6\\ 6\\ 6\end{array}$		$\begin{array}{c} 7\\7\\7\\8\end{array}$	7 8 8 8	8 8 9 9	8 9 9 9	9 9 10 10	9 10 10 11	$ \begin{array}{c} 10 \\ 11 \\ 11 \\ 11 \\ 11 \end{array} $
·						Diffe	erence	of th	e prop	ortion	al log	arith	ıms ir	the I	Ephem	eris.			
		38	40	42	44	46	48	50	52	54	56	1	58	60	62	64	66	68	70
$\begin{array}{c} h. \ m. \\ 0 \ 0 \\ 0 \ 10 \\ 0 \ 20 \end{array}$	$h. m. \\ 3 0 \\ 2 50 \\ 2 40 \\ \hline 2 2 0 \\ \hline 2 2 0 \\ \hline 2 2 0 \\ \hline 2 0 \hline 2 0 \\ \hline 2 0 \hline \hline 2 0 \\ \hline 2 0 \hline 2 0 \\ \hline 2 0 \hline 2 0 \\ \hline 2 0 \hline 2 0 \hline 2 0 \\ \hline 2 0 $		8. 0 3 5	8. 0 3 5	8. 0 3 5	8. 0 3 6	8. 0 3 6	8, 0 3 6	8. 0 3 6	8. 0 4 7	8. 0 4 7		8. 0 4 7	8. 0 4 7	8. 0 4 8	8. 0 4 8	8. 0 4 8	8. 0 4 8	8. 0 5 9
$\begin{array}{c} 0 & 30 \\ 0 & 40 \\ 0 & 50 \end{array}$	$\begin{array}{ccc} 2 & 30 \\ 2 & 20 \\ 2 & 10 \end{array}$	8 9	9 10	9 10	$\begin{array}{c} 8\\10\\11\end{array}$		$\begin{array}{c} 8\\10\\12\end{array}$	$ \begin{array}{c} 9 \\ 11 \\ 13 \end{array} $	$ \begin{array}{c} 9 \\ 11 \\ 13 \end{array} $	$\frac{9}{12}$ 14	10 12 14		$\begin{array}{c c}10\\13\\15\end{array}$	$ \begin{array}{c} 10 \\ 13 \\ 15 \end{array} $	$\frac{11}{13}$ 16	$\frac{11}{14}$ 16	$\begin{array}{c} 12\\14\\16\end{array}$	$\begin{array}{c} 12\\15\\17\end{array}$	12 15 17
$ \begin{array}{rrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrr$	$ \begin{array}{ccc} 2 & 0 \\ 1 & 50 \\ 1 & 40 \\ 1 & 30 \end{array} $	$ \begin{array}{r} 10 \\ 11 \\ 12 \\ 12 \end{array} $	$ \begin{array}{c} 11 \\ 12 \\ 12 \\ 12 \\ 12 \end{array} $	$ \begin{array}{c} 12 \\ 12 \\ 13 \\ 13 \end{array} $	$ \begin{array}{r} 12 \\ 13 \\ 14 \\ 14 \\ 14 \end{array} $	$ \begin{array}{r} 13 \\ 14 \\ 14 \\ 14 \\ 14 \end{array} $	$ \begin{array}{r} 13 \\ 14 \\ 15 \\ 15 \end{array} $	$ \begin{array}{r} 14 \\ 15 \\ 15 \\ 16 \end{array} $	$ \begin{array}{r} 14 \\ 15 \\ 16 \\ 16 \\ 16 \end{array} $	$ \begin{array}{r} 15 \\ 16 \\ 17 \\ 17 \\ 17 \end{array} $	$ \begin{array}{r} 16 \\ 17 \\ 17 \\ 18 \\ 18 \end{array} $		16 17 18 18	$17 \\ 18 \\ 19 \\ 19 \\ 19 \\ 19 \\ 19 \\ 19 \\ 19$	$ \begin{array}{c} 17 \\ 18 \\ 19 \\ 19 \\ 19 \\ 19 \\ \end{array} $	18 19 20 20 20	18 19 20 21	$ \begin{array}{r} 19 \\ 20 \\ 21 \\ 21 \\ 21 \end{array} $	$ \begin{array}{r} 19 \\ 21 \\ 21 \\ 22 \end{array} $
			·}	۱ <u> </u>					1	_		-	_				_		
						Diffe	rence	of the	e prop	ortion	al log	arith	ms in	the E	pheme	eris.		•	
		72	74	76	78	Diffe 80	rence 82	of the	e prop 86	ortion: 88	al loga	arith	ms in 92	the E	2pheme 96	eris. 98	100	102	104
$\begin{array}{c} h. \ m. \\ 0 \ 0 \\ 0 \ 10 \\ 0 \ 20 \end{array}$	$h. m. \\ 3 0 \\ \cdot 2 50 \\ 2 40$	72 8. 0 5 .9	8. 0 5 9	76 8. 0 5 9	78 8. 0 5 10	Diffe 80 8. 0 5 10	se s	of the 84 8. 0 6 10	e prop 86 8. 0 6 11	ortion 88 8 0 6 11	al log: 90 8. 0 6 11	arith	ms in 92 8. 0 6 11	the E 94 8. 0 6 12	2pheme 96 8. 0 6 12	eris. 98 8. 0 6 12	100 8. 0 7 12	102 8. 0 7 13	104 8. 0 7 13
$\begin{array}{c} h. \ m. \\ 0 \ 0 \\ 0 \ 10 \\ 0 \ 20 \\ \hline 0 \ 30 \\ 0 \ 40 \\ 0 \ 50 \end{array}$	$ \begin{array}{c} \hbar. \ m. \\ 3 \ 0 \\ \cdot \ 2 \ 50 \\ 2 \ 40 \\ \hline 2 \ 30 \\ 2 \ 20 \\ 2 \ 10 \\ \end{array} $	72 8. 0 5 .9 13 16 18	74 8. 0 5 9 13 16 19	76 8. 0 5 9 13 16 19	$ \begin{bmatrix} 78 \\ 8. \\ 0 \\ 5. \\ 10 \\ 14 \\ 17 \\ 20 \end{bmatrix} $	Diffe 80 8. 0 5 10 14 17 20	rence 82 8. 0 5 10 14 18 21	of the 84 8. 0 6 10 14 18 21	e prop 86 8. 0 6 11 15 19 22		al log: 90 8. 0 6 11 16 19 22	arith	ms in 2 8. 0 6 11 16 20 23	s. 0 6 12 16 20 23	s. 0 6 12 17 21 24 24 17 16 16 17 16 <td>eris. 98 8. 0 6 12 17 21 24</td> <td>100 *. 0 7 12 17 22 25</td> <td>102 8. 0 7 13 18 22 26</td> <td>104 8. 0 7 13 18 22 26</td>	eris. 98 8. 0 6 12 17 21 24	100 *. 0 7 12 17 22 25	102 8. 0 7 13 18 22 26	104 8. 0 7 13 18 22 26
$\begin{array}{c} h. \ m. \\ 0 \ 0 \\ 0 \ 10 \\ 0 \ 20 \\ \hline 0 \ 30 \\ 0 \ 40 \\ 0 \ 50 \\ \hline 1 \ 0 \\ 1 \ 10 \\ 1 \ 20 \\ 1 \ 30 \\ \end{array}$	$\begin{array}{c} \hbar. \ m. \\ 3 \ 0 \\ 2 \ 500 \\ 2 \ 400 \\ 2 \ 200 \\ 2 \ 100 \\ 1 \ 500 \\ 1 \ 400 \\ 1 \ 300 \end{array}$	$\begin{array}{c} \hline & & \\ \hline & & \\ &$	$\begin{array}{c} 74\\ s.\\ 0\\ 5\\ 9\\ \hline 13\\ 16\\ 19\\ 21\\ 22\\ 23\\ 23\\ 23\\ \end{array}$	$\begin{array}{c} 76 \\ \hline s. \\ 0 \\ 5 \\ 9 \\ \hline 13 \\ 16 \\ 19 \\ 21 \\ 22 \\ 23 \\ 24 \\ \end{array}$	$ \begin{array}{r} $	Diffe 80 8. 0 5 10 14 17 20 22 24 25 25	sec 82 8. 0 5 10 14 18 21 23 24 25 25	$ \begin{array}{c} \text{of the} \\ \hline 84 \\ \hline 8, \\ 0 \\ 6 \\ 10 \\ \hline 14 \\ 18 \\ 21 \\ 23 \\ 25 \\ 26 \\ 26 \\ 26 \\ 26 \\ \end{array} $	$\begin{array}{c} e \text{ prop} \\ \hline 86 \\ \hline 8. \\ 0 \\ 6 \\ 11 \\ \hline 15 \\ 19 \\ 22 \\ 24 \\ 25 \\ 26 \\ 27 \\ \end{array}$	$ \begin{array}{r} \text{ortion} \\ \hline 88 \\ \hline 8. \\ 0 \\ 6 \\ 11 \\ \hline 15 \\ 19 \\ 22 \\ 24 \\ 26 \\ 27 \\ 27 \\ 27 \\ \end{array} $	$ \begin{array}{c c} $		$\begin{array}{c c} ms in \\ \hline p2 \\ \hline s. \\ 0 \\ 6 \\ 11 \\ \hline 16 \\ 20 \\ 23 \\ 25 \\ 27 \\ 28 \\ 29 \\ \hline \end{array}$	s. 0 6 12 16 20 23 26 28 29 29 29	Sector Sector<	erís. 98 8. 0 6 12 17 21 24 27 29 30 31	$ \begin{array}{c} 100 \\ $	102 8. 0 7 13 18 22 26 28 30 31 32	$ \begin{array}{r} 104 \\ $
$\begin{array}{c} h. \ m. \\ 0 \ 0 \\ 0 \ 10 \\ 0 \ 20 \\ 0 \ 30 \\ 0 \ 40 \\ 0 \ 50 \\ \hline 1 \ 0 \\ 1 \ 10 \\ 1 \ 20 \\ 1 \ 30 \\ \end{array}$	$ \begin{array}{c} \hbar. \ m. \\ 3 \ 0 \\ \cdot 2 \ 500 \\ 2 \ 400 \\ 2 \ 200 \\ 2 \ 100 \\ 1 \ 500 \\ 1 \ 400 \\ 1 \ 300 \\ \end{array} $	$\begin{array}{c} 72 \\ \hline s. \\ 0 \\ 5 \\ 9 \\ \hline 13 \\ 16 \\ 18 \\ 20 \\ 21 \\ 22 \\ 23 \\ \hline \end{array}$	$\begin{array}{ c c c c c c c c c c c c c c c c c c c$	$ \begin{array}{r} 76 \\ 8. \\ 0 \\ 5 \\ 9 \\ 13 \\ 16 \\ 19 \\ 21 \\ 22 \\ 23 \\ 24 \\ \end{array} $	$ \begin{bmatrix} 78 \\ 8. \\ 0 \\ 5 \\ 10 \\ 14 \\ 17 \\ 20 \\ 22 \\ 23 \\ 24 \\ 24 \end{bmatrix} $	Diffe 80 8. 0 5 10 14 17 20 22 24 25 25 Diffe	rence 82 8. 0 5 10 14 18 21 23 24 25 25 rence	$\begin{array}{c} \text{of th} \\ \hline 84 \\ \hline 8, \\ 0 \\ 6 \\ 10 \\ \hline 14 \\ 18 \\ 21 \\ \hline 23 \\ 25 \\ 26 \\ 26 \\ 26 \\ \hline 0 \\ \text{of the} \end{array}$	e prop 86 8. 0 6 11 15 19 22 24 25 26 27 , prop		al log: 90 8. 0 6 111 166 19 222 255 277 288 28 al log:	arith	ms in 92 8. 0 6 11 16 20 23 25 27 28 29 ms in	step 94 8. 0 6 12 16 20 23 26 28 29 29 the E	Second	eris. 98 8. 0 6 12 17 21 24 27 29 30 31 eris.	$ \begin{array}{c} 100 \\ \hline $	102 8. 0 7 13 18 22 26 28 30 31 32	104 <i>s.</i> 0 7 13 18 22 26 29 31 32 32
$\begin{array}{c} h. \ m. \\ 0 \ 0 \ 0 \\ 0 \ 20 \\ 0 \ 30 \\ 0 \ 40 \\ 0 \ 50 \\ \hline 1 \ 0 \\ 1 \ 10 \\ 1 \ 30 \\ \end{array}$	$\begin{array}{c} h. \ m. \\ 3 \ 0 \\ \cdot \ 2 \ 50 \\ 2 \ 40 \\ 2 \ 30 \\ 2 \ 10 \\ 2 \ 10 \\ 1 \ 50 \\ 1 \ 40 \\ 1 \ 30 \end{array}$	72 8. 0 5 9 13 16 18 20 21 22 23 106	74 s. 0 5 9 13 16 19 21 22 23 23	76 s. 0 5 9 13 16 19 21 22 23 24	$ \begin{array}{r} 78 \\ 8. \\ 0 \\ 5 \\ $	Diffe 80 8. 0 5 10 14 17 20 22 24 25 25 Diffe 114	se 0 5 10 14 18 21 23 24 25 25 rence 116 116 116	of the 84 8, 0 6 10 14 18 21 23 25 26 26 26 0f the 118	e prop 86 8. 0 6 11 15 19 22 24 25 26 27 26 27 120	ortion 88 8. 0 6 11 15 19 22 24 26 27 27 ortion 122	al log: 90 8. 0 6 111 166 199 222 255 277 288 28 al log: 124	arith	ms in 92 8. 0 6 111 16 20 23 25 27 28 29 ms in 26 -	s. 0 6 12 16 20 23 26 28 29 29 10 the E 128 10	Second state Second state<	eris. 98 8. 0 6 12 17 21 24 27 29 30 31 eris. 132	8. 0 7 12 17 22 25 38 30 31 31 134	102 8. 0 7 13 18 22 26 28 30 31 32 136	104 <i>s.</i> 0 7 13 18 22 26 29 31 32 32 138 - 138
$\begin{array}{c} h. \ m. \\ 0 \ 0 \\ 0 \ 10 \\ 0 \ 50 \\ \hline 1 \ 0 \\ 1 \ 0 \\ 1 \ 0 \\ 1 \ 30 \\ \hline h. \ m. \\ 0 \ 0 \\ 0 \ 10 \\ 0 \ 20 \\ \hline 0 \ 30 \\ 0 \ 40 \\ \hline \end{array}$	$\begin{array}{c} h. m. \\ 3 & 0 \\ \cdot 2 & 500 \\ 2 & 200 \\ 2 & 200 \\ 2 & 200 \\ 2 & 200 \\ 2 & 100 \\ 1 & 500 \\ 1 & 400 \\ 1 & 300 \\ 1 & 300 \\ 1 & 300 \\ 2 & 500 \\ 2 & 400 \\ 2 & 200 \\ 2 & 200 \\ 2 & 210 \end{array}$	72 8. 0 5 9 13 16 8. 0 21 22 23 0 106 8. 0 7 13 18 22 23	74 s. 0 5 9 13 16 19 21 22 23 108 s. 0 7 13 19 23 23 20 23 23 23	$\begin{array}{c} \textbf{76} \\ \textbf{8.} \\ 0 \\ 5 \\ 9 \\ \textbf{9} \\ \textbf{110} \\ \textbf{21} \\ \textbf{22} \\ \textbf{23} \\ \textbf{24} \\ \textbf{110} \\ \textbf{8.} \\ 0 \\ \textbf{7} \\ \textbf{14} \\ \textbf{19} \\ \textbf{24} \\ \textbf{27} \\ \textbf{27} \end{array}$	$\begin{array}{c} \hline 78 \\ \hline 8. \\ 0 \\ 5 \\ \hline 10 \\ 14 \\ 17 \\ 20 \\ 22 \\ 23 \\ 24 \\ 24 \\ \hline \\ 112 \\ \hline \\ 8. \\ 0 \\ 7 \\ 14 \\ 19 \\ 24 \\ 28 \\ \hline \\ 28 \\ \end{array}$	$\begin{array}{c c} \text{Diffe} \\ \hline \textbf{80} \\ \hline \textbf{8}, \\ 0 \\ 5 \\ 10 \\ 14 \\ 20 \\ 22 \\ 24 \\ 25 \\ 25 \\ 25 \\ 114 \\ \hline \textbf{8}, \\ 0 \\ 7 \\ 14 \\ 20 \\ 25 \\ 29 \\ 29 \\ \end{array}$	$\begin{array}{c} \text{rence} \\ 82 \\ \hline s. \\ 0 \\ 5 \\ 10 \\ 14 \\ 18 \\ 21 \\ 23 \\ 24 \\ 25 \\ 25 \\ \hline \text{rence} \\ \hline 116 \\ \hline s. \\ 0 \\ 8 \\ 14 \\ 20 \\ 25 \\ 29 \\ \end{array}$	$\begin{array}{c} \text{of th}_{0} \\ \hline 84 \\ \hline 8, \\ 0 \\ 6 \\ 10 \\ 14 \\ 18 \\ 21 \\ 23 \\ 25 \\ 26 \\ 26 \\ 26 \\ 118 \\ \hline 8, \\ 0 \\ 8 \\ 15 \\ 20 \\ 25 \\ 29 \\ 29 \\ \end{array}$	$\begin{array}{c} e \text{ prop} \\ \hline 86 \\ \hline 8. \\ 0 \\ 6 \\ 11 \\ 15 \\ 19 \\ 22 \\ 24 \\ 25 \\ 26 \\ 27 \\ 120 \\ \hline 8. \\ 0 \\ 8 \\ 15 \\ 21 \\ 26 \\ 30 \\ \end{array}$	$\begin{array}{c} \text{ortion} \\ \hline \\ 88 \\ \hline \\ 88 \\ \hline \\ 88 \\ \hline \\ 0 \\ 66 \\ 11 \\ 15 \\ 9 \\ 22 \\ 24 \\ 266 \\ 27 \\ 27 \\ 27 \\ 0 \\ 122 \\ \hline \\ 88 \\ 15 \\ 21 \\ 266 \\ 30 \\ \end{array}$	al log: 90 8. 0 6 11 16 19 22 25 27 28 28 28 al log: 8. 0 8 8 15 21 27 31	arith	ms in 12 8. 0 6 11 16 20 23 25 27 28 29 ms in 26 8 15 22 27 31	$\begin{array}{c} \text{the E} \\ \textbf{94} \\ \hline \textbf{96} \\ \hline \textbf{12} \\ \hline \textbf{12} \\ \hline \textbf{12} \\ \hline \textbf{22} \\ \textbf{29} \\ \hline \textbf{29} \\ \hline \textbf{29} \\ \hline \textbf{128} \\ \hline \textbf{8} \\ \hline \textbf{16} \\ \hline \textbf{22} \\ \textbf{28} \\ \textbf{32} \\ \hline \end{array}$	Spheme 96 8. 0 6 12 17 21 24 27 28 29 30 130 s. 0 8 16 22 28 32	eris. 98 8. 0 6 12 17 21 24 27 29 30 31 eris. 132 8. 0 9 16 23 28 33	100 8. 0 7 12 25 38 30 31 31 134 8. 0 9 16 23 29 33	$ \begin{array}{c} 102 \\ \hline $	104 s. 0 7 13 22 26 29 31 32 . 138 s. 0 9 17 24 30 34

The correction is to be added to the approximate Greenwich time when the proportional logarithms in the Ephemeris are decreasing, and subtracted when they are increasing.

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APPENDIX V: TABLE XI.

For finding the value of N for Correcting Lunar Distances for the Compression of the Earth.

												-											
		Т	abl	e XI	A, §	giving	1st p	art of	N					Т	'abl	e XI	В, g	iving	2d pa	art of :	N		
App.					Mo	on's d	eclin	ation.				ADD.				Ot	her	body'	s deel	inatio	n.		
dist.	00	30	60	90	120	150	180	210	240	270	300	dist.	00	30	60	90	120	150	180	210	240	270	300
		-	-											-	-								
20	-0	3	6	10	13	16	19	22	25	28	31	-20	$+0^{''}$	3	7	10	14	17	20	24	27	30	33
22	0	3	6	9	12	- 14	17	20	23	25	28	22	0	3	6	9	13	16	19	22	25	27	30
24	0	3	5	87	11	13	16	18	$21 \\ 10$	23	25	24	0	3	6	9	$\frac{12}{11}$	14	17	$\begin{vmatrix} 20 \\ 10 \end{vmatrix}$	23	$\frac{25}{22}$	28
28	0	$\frac{2}{2}$	4	7	10	11	13	$17 \\ 15$	19	$121 \\ 19$	$\frac{23}{21}$	$\frac{20}{28}$	0	$\frac{3}{3}$	5	8	10^{11}	13	$10 \\ 15$	17	$\frac{21}{20}$	$\frac{23}{22}$	20
	-0	2	4	6	8	10	$\overline{12}$	14	$\overline{16}$	18	$\overline{20}$	30	+0	$\overline{2}$	$\overline{5}$	7	9	$\overline{12}$	14	16	18	$\overline{21}$	$\frac{-}{23}$
32	0	$\left \begin{array}{c} 2 \\ 9 \end{array} \right $	4	6	87	9	11	13	15	16	$\frac{18}{17}$	32	0	2	4	7	9	11	13	15	17	19	21
36	0	$\frac{2}{2}$	43	- 5 - 5	7	8	10	$12 \\ 11$	$14 \\ 13$	10	16^{17}	36 36	0	$\frac{2}{2}$	4	6	8	10	$13 \\ 12$	10	16	$18 \\ 17$	20
38	Ŏ	2	3	5	6	8	9	10	12	13	14	38	Ő	2	4	6	8	10	11	13	15	17	$\tilde{18}$
40	-0	1	3	4	6	7	8	10	11	12	13	40	+0	2	4	6	7	9	11	13	14	$\frac{16}{15}$	18
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48	0	1	$\frac{2}{3}$	3	4				8		$\frac{10}{10}$	48	0	$\frac{2}{2}$	$\frac{3}{2}$	5	6	8			12	14	15
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54	ŏ	î	$\left \tilde{2} \right $	3	3	4	5	6	7	7	8	54	ŏ	ĩ	3	4	$\ddot{6}$	7	9	10	11	13	14
56	0	$ \frac{1}{1} $	$ \frac{2}{1} $	2	3	4	5	5	6	7	8	56	0	1	3	4	6	7	8	10	11	$12 \\ 19$	14
$\frac{-38}{-60}$	$\frac{0}{-0}$	$\frac{1}{1}$	$\frac{1}{1}$	$\frac{4}{2}$	$\frac{3}{3}$			$\frac{-3}{5}$	$\frac{0}{5}$	$\frac{-6}{6}$	-7	$-\frac{38}{60}$	$\frac{0}{+0}$	$\frac{1}{1}$	$\frac{\partial}{\partial}$	$\frac{4}{4}$	$\frac{0}{5}$	$-\frac{i}{7}$	$\frac{\circ}{8}$	$\frac{10}{9}$	$-\frac{11}{11}$	$\frac{12}{12}$	$\frac{10}{13}$
62	ŏ	î	î	$\tilde{2}$	3	3	4	4	5	5	6	62	0	î	3	4	5	7	8	9	10	12^{12}	13
64	0	$\frac{1}{1}$	1	2	$\begin{vmatrix} 2 \\ 0 \end{vmatrix}$	3	3	4	4	5	6	64	0	1	3	4	5	7	8	9	10	11	13
- 00 - 68	0	$\begin{bmatrix} 1\\0 \end{bmatrix}$	$\frac{1}{1}$	$\frac{2}{1}$	$\frac{2}{2}$	$\frac{3}{2}$	3	$\frac{4}{3}$	4		9 5	68		1	$\begin{vmatrix} \mathbf{o} \\ 3 \end{vmatrix}$	4	5	0 6	8	9	$10 \\ 10$	11	$\frac{12}{12}$
70	-0	$\overline{0}$	$\overline{1}$	1	$\overline{2}$	$\overline{2}$	3	3	3		4	70	+0	$\overline{1}$	3	4	5	6	7		10	11	$\overline{12}$
72	0	$\left \begin{array}{c} 0 \\ 0 \end{array} \right $	1	1	2	2	2	3	3	3	4	72	0	1	$\begin{vmatrix} 2 \\ 0 \end{vmatrix}$	4	5	6	7	9	10	11	12
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80	0	0	0	1	1	1	1	1	2	2	2	80	$+0^{-}$	1	2	4	5	6	7	8	9	10	11
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86	ŏ	Õ	0	ŏ	ŏ	Ô	Õ	ĩ	ĩ	î	î	86	ŏ	ī	$\overline{2}$	4	5	$\ddot{6}$	7	8	9	$\tilde{10}$	11
88	0	$\frac{0}{0}$	$\frac{0}{0}$	0	$\frac{0}{0}$	$\frac{0}{0}$	$\frac{0}{0}$	$\frac{0}{0}$	$\frac{0}{0}$	$\frac{0}{0}$	$\frac{0}{0}$	88	$\frac{0}{100}$	1	$\frac{2}{2}$	4	5	$\frac{-6}{2}$	$\frac{7}{7}$	8		$\frac{10}{10}$	$\frac{11}{11}$
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100	0	0	0	1	1	1	1	$\frac{1}{2}$	$\tilde{2}$	$\tilde{2}$	$\tilde{2}$	102	10	1	$\left \frac{2}{2} \right $	4	5	6	7	8	9	11	12
104	0	$\begin{bmatrix} 0 \\ 0 \end{bmatrix}$	1	1	1	1	$\frac{2}{2}$	$\frac{2}{2}$	$\frac{2}{2}$	3	3	104	0	1	$\left \begin{array}{c} 2 \\ 0 \end{array} \right $	4	5	6	7	8	9	11	12
106	0	0	$\frac{1}{1}$	1	$\frac{1}{2}$	$\frac{2}{2}$	$\frac{2}{2}$	$\frac{z}{3}$	3	3 3	3 4	100	0	1	$\begin{vmatrix} z \\ 2 \end{vmatrix}$	4	$\frac{9}{5}$	6	$-\frac{1}{7}$	$\frac{8}{9}$	10	11	$\frac{12}{12}$
110	+0	$\overline{0}$	$\overline{1}$	1	$\frac{-}{2}$	${2}$	$\overline{3}$	3	3	4	4	110	+0	$\overline{1}$	$\frac{1}{3}$	4	$\overline{5}$		7	9	10	11	$\overline{12}$
112	0	0	1	1	2	2	3	3	4	4	5	112	0	1	3	4	5	6	8	9	10	11	12
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118	ŏ	î	ĩ	$\tilde{2}$	$\tilde{3}$	3	4	4	$\hat{5}$	$\overline{5}$	6	118	Ő	1	3	4	$\tilde{5}$	7	8	9	10	12	13
120	+0	1	1	2	3	3	4	5	5	6	7	120	+0	1	3	4	5	7	8	9	11	12	13
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128	0	1	$\frac{2}{c}$	3	4	5		6		8	-9	128	0	$\frac{2}{2}$	$\frac{3}{2}$	_4	$\frac{6}{2}$			10	$\frac{12}{12}$	_13	14
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The signs in the 0° column apply to all the numbers in the same line, and are to be used when the declination is North. When the declination is South change the sign + to - and - to +.

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PART II.

TABLES.

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EXPLANATION OF THE TABLES.

TABLES 1, 2: TRAVERSE TABLES.

Tables 1 and 2 were originally calculated by the natural sines taken from the fourth edition of Sherwin's Logarithms, which were previously examined, by differences; when the proof sheets of the first edition were examined the numbers were again calculated by the natural sines in the second edition of Hutton's Logarithms; and if any difference was found, the numbers were calculated a third time by Taylor's Logarithms.

The first table contains the difference of latitude and departure corresponding to distances not exceeding 300 miles, and for courses to every quarter point of the compass. Table 2 is of the same nature, but for courses consisting of whole degrees; it was originally of the same extent as Table 1, but has been extended to include distances up to 600 miles. The manner of using these tables is particularly explained under the different problems of Plane, Middle Latitude, and Mercator Sailing in Chapter V.

The tables may be employed in the solution of any right-triangle.

TABLE 3: MERIDIONAL PARTS.

This table contains the meridional parts, or increased latitudes, for every degree and minute to 80°, calculated by the following formula:

$$m = \frac{a}{M} \log \tan \left(45^{\circ} + \frac{L}{2} \right) - a \left(e^{2} \sin L + \frac{1}{3} e^{4} \sin^{3} L + \frac{1}{5} e^{6} \sin^{5} L + \dots \right),$$

in which

the Equatorial radius $a = \frac{10800'}{\pi} = 3437'.74677 \ (\log 3.5362739);$

M, the modulus of common logarithms = 0.4342945;

 $\frac{1}{M} = 2.3025851 \ (\log 0.3622157);$

C, the compression or meridional eccentricity of the earth

according to Clarke (1880)
$$=\frac{1}{293.465} = 0.003407562 \ (\log 7.5324437);$$

 $e = \sqrt{2c - c^2} = 0.0824846 \ (\log 8.9163666);$

from which

 $\begin{array}{l} \frac{a}{\mathbf{M}} &= 7915'.7044558 \ (\log 3.8984895);\\ ae^2 &= 23'.38871 \ (\log 1.3690072);\\ \frac{1}{3}ae^4 &= 0'.053042 \ (\log 8.7246192);\\ 4ae^6 &= 0'.000216523 \ (\log 6.3355038). \end{array}$

The results are tabulated to one decimal place, which is sufficient for the ordinary problems of navigation.

The practical application of this table is illustrated in Chapters II and V, in articles treating of the Mercator Chart and Mercator Sailing.

TABLE 4: LENGTH OF DEGREES OF LATITUDE AND LONGITUDE.

This table gives the length of a degree in both latitude and longitude at each parallel of latitude on the earth's surface, in nautical and statute miles and in meters, based upon Clarke's value (1866) of the earth's compression, $\frac{1}{299.15}$. In the case of latitude, the length relates to an arc of which the given degree is the center.

TABLES 5A, 5B: DISTANCE BY TWO BEARINGS.

These tables have been calculated to facilitate the operation of finding the distance from an object by two bearings from a given distance run and course. In Table 5A the arguments are given in points, in Table 5B in degrees; the first column contains the multiplier of the distance run to give the distance of observed object at second bearing; the second, at time of passing abean.

The method is explained in article 143, Chapter IV.

TABLE 6: DISTANCE OF VISIBILITY OF OBJECTS.

This table contains the distances, in nautical and statute miles, at which any object is visible at sea, It is calculated by the formulæ:

$$d = 1.15 \sqrt{x}$$
, and $d' = 1.32 \sqrt{x}$,

in which d is the distance in nautical miles, d' the distance in statute miles, and x the height of the eye or the object in feet.

To find the distance of visibility of an object, the distance given by the table corresponding to its height should be added to that corresponding to the height of the observer's eye. EXAMPLE: Required the distance of visibility of an object 420 feet high, the observer being at an

elevation of 15 feet.

Dist. corresponding to 420 feet, 23.5 naut. miles. Dist. corresponding to 15 feet, 4.4 naut. miles.

Dist. of visibility, 27.9 naut. miles.

TABLE 7: CONVERSION OF ARC AND TIME.

In the first column of each pair in this table are contained angular measures expressed in arc (degrees, minutes, or seconds), and in the second column the corresponding angles expressed in time (hours, minutes, or seconds). As will be seen from the headings of columns, the time corresponding to degrees (°) is given in hours and minutes; to minutes of arc (\prime), in minutes and seconds of time; and to seconds of arc ("), in seconds and sixtieths of a second of time. The table will be especially convenient in dealing with longitude and hour angle. The method of

its employment is best illustrated by examples.

T.3				
- H-11	C 4 3	TOP	13	
- I'z.	A /A 2	1 1 1		

EXAMPLE IL.

Required the time corresponding to 50° 31′ 21″. Required the arc corresponding to 6^h 33^m 26^s.5.

50°	$rac{00'}{31}$	$00''_{00}_{21}$	' = 3 ^h = =	20 ^m 2	$00^{\rm s} \\ 04 \\ 1\frac{24}{50}$		6 ^h	32 ^m 1	${ \begin{array}{c} 00^{\rm s} \\ 24 \\ 2\frac{3}{6}\frac{0}{6} \end{array} } }$	= 98° = =	00' 21	$00'' \\ 00 \\ 37.5$
50	31	21	= 3	22	05.4		6	33	26.5	= 98	21	37.5

TABLES 8 AND 9: SIDEREAL AND MEAN SOLAR TIMES.

These tables give, respectively, the reductions necessary to convert intervals of sidereal time into those of mean solar time, and intervals of mean solar into those of sidereal time. The reduction for any interval is found by entering with the number of hours at the top and the number of minutes at the side, adding the reduction for seconds as given in the margin.

The relations between mean solar and sidereal time intervals, and the methods of conversion of these times, are given in articles 289-291, Chapter IX.

TABLE 10: SUN'S RISING AND SETTING.

This table gives the local mean time of the sun's visible rising and setting—that is, of the appearance and disappearance of the sun's upper limb in the unobstructed horizon of a person whose eye is 15 feet above the level of the earth's surface, the atmospheric conditions being normal.

The local apparent times of rising and setting were determined from the formula for a time sight, the altitude employed being -0° 56' 08", made up of the following terms: Refraction, -36' 29"; semi-diameter, -16' 00"; dip, -3' 48"; and parallax, +9". To ascertain the time of rising or setting for any given date and place, enter the table with the

latitude and declination, interpolating if the degrees are not even. In the line R will be found the time of rising; in the line S, the time of setting. Be careful to choose the page in which the latitude is of the correct name, and in which the "approximate date" corresponds, nearly or exactly, with the given date.

This table is computed with the intention that, if accuracy is desired, it will be entered with the declination as an argument—not the date—as it is impossible to construct any table based upon dates whose application shall be general to all years. But as a given degree of declination will, in the majority of years, fall upon the date given in the table as the "approximate date," and as, when it does not do so, it can never be more than one day removed therefrom, it will answer, where a slight inaccuracy may be admitted, to enter the table with the date as an argument, thus avoiding the necessity of ascertaining the declination.

EXAMPLE: Find the local mean time of sunset at Rio de Janeiro, Brazil (lat. 22° 54' S., long. 43° 10' W.), on January 1, 1903 (dec. 23° 04' S.).

Exact method.

Lat. 22°	6^{h} 48^{m}
Corr. for $+ 54'$ lat	+ 02
Corr. for $+ 04'$ dec	00

L. M. T. sunset 6 50

Approximate method.

Lat. 22°	$6^{\rm h}$	48^{m}
Corr. for $+$ 54' lat Corr. for 1 day	+	$\begin{array}{c} 02\\01 \end{array}$
L. M. T. sunset	6	49

TABLE 11: REDUCTION FOR MOON'S TRANSIT.

This table was calculated by proportioning the daily variation of the time of the moon's passing the meridian.

The numbers taken from the table are to be added to the Greenwich time of moon's transit in west longitude, but subtracted in east longitude.

TABLE 12: REDUCTIONS FOR NAUTICAL ALMANAC.

This is a table of proportional parts for finding the variation of the sun's right ascension or declination, or of the equation of time, in any number of minutes of time, the horary motion being given at the top of the page in seconds, and the number of minutes of time in the side column; also for finding the variation of the moon's declination or right ascension in any number of seconds of time, the motion in one minute being given at the top, and the numbers in the side column being taken for seconds.

TABLE 13: CHANGE OF SUN'S RIGHT ASCENSION.

This is a table that may be employed for finding the change of the sun's right ascension for any given number of hours, the hourly change, as taken from the Nautical Almanac, being given in the marginal columns.

TABLE 14: DIP OF SEA HORIZON.

This table contains the dip of the sea horizon, calculated by the formula:

$$D = 58''.8 \sqrt{F}$$
,

in which F = height of the eye above the level of the sea in feet. It is explained in article 300, Chapter X.

TABLE 15: DIP SHORT OF HORIZON.

This table contains the dip for various distances and heights, calculated by the formula:

$$\mathrm{D}=rac{3}{7}\,d+0.56514 imesrac{h}{d},$$

in which D represents the dip in miles or minutes, d, the distance of the land in sea miles, and h, the height of the eye of the observer in feet.

TABLE 16: PARALLAX OF SUN.

This table contains the sun's parallax in altitude calculated by the formula:

par. =
$$\sin z \times 8''.75$$
,

in which z = apparent zenith distance, the sun's horizontal parallax being 8%.75. It is explained in article 304, Chapter X.

TABLE 17: PARALLAX OF PLANET.

Parallax in altitude of a planet is found by entering at the top with the planet's horizontal parallax, and at the side with the altitude.

TABLE 18: AUGMENTATION OF MOON'S SEMIDIAMETER.

This table gives the augmentation of the moon's semidiameter calculated by the formula:

 $x = c \ s^2 \sin h + \frac{1}{2} \ c^2 \ s^3 \sin^2 h + \frac{1}{2} \ c^2 \ s^3$, where h = moon's apparent altitude; s = moon's horizontal semidiameter; x = augmentation of semidiameter for altitude h; and $\log c = 5.25021$.

TABLE 19: AUGMENTATION OF MOON'S HORIZONTAL PARALLAX.

This table contains the augmentation of the moon's horizontal parallax, or the correction to reduce the moon's equatorial horizontal parallax to that point of the earth's axis which lies in the vertical of the observer in any given latitude; it is computed by the formulæ:

$$\Delta \pi = \pi (b-1), \qquad \qquad b = \frac{1}{\sqrt{(1-e^2 \sin^2 L)}},$$

where $\pi =$ equatorial horizontal parallax;

L = latitude;

e = eccentricity of the meridian; log $e^2 = 7.81602$; and

 $\Delta \pi$ = augmentation of the horizontal parallax for the latitude L.

TABLE 20A: MEAN REFRACTION.

This table gives the refraction, reduced from Bessel's tables, for a mean atmospheric condition in which the barometer is 30.00 inches, and thermometer 50° Fahr.

TABLE 20B: MEAN REFRACTION AND PARALLAX OF SUN.

This table contains the correction to be applied to the sun's apparent altitude for mean refraction and parallax, being a combination of the quantities for the altitudes given in Tables 16 and 20A.

TABLES 21, 22: CORRECTIONS OF REFRACTION FOR BAROMETER AND THERMOMETER.

These are deduced from Bessel's tables. The method of their employment will be evident.

TABLE 23: MEAN REFRACTION AND MEAN PARALLAX OF MOON.

This table contains the correction of the moon's altitude for refraction and parallax corresponding to the mean refraction (Table 20A), and a horizontal parallax of the mean value of 57' 30".

TABLE 24: MEAN REFRACTION AND PARALLAX OF MOON.

This table contains the correction to be applied to the moon's apparent altitude for each minute of horizontal parallax, and for every 10' of altitude from 5°, with height of barometer 30.00 inches, and thermometer 50° Fahr.

For seconds of parallax, enter the table abreast the approximate correction and find the seconds of horizontal parallax, the tens of seconds at the side and the units at the top. Under the latter and opposite the former will be the seconds to add to the correction.

For minutes of altitude, take the seconds from the extreme right of the page, and apply them as there directed.

TABLE 25: CHANGE OF ALTITUDE DUE TO CHANGE OF DECLINATION.

This table gives the variation of the altitude of any heavenly body arising from a change of 100" in the declination. It is useful for finding the equation of equal altitudes by the approximate method explained in article 324, Chapter XI, and for other purposes.

If the change move the body toward the elevated pole, apply the correction to the altitude with the signs in the table; otherwise change the signs.

TABLE 26: CHANGE OF ALTITUDE IN ONE MINUTE FROM MERIDIAN.

This table gives the variation of the altitude of any heavenly body, for one minute of time from meridian passage, for latitudes up to 60°, declinations to 63°, and altitudes between 6° and 86°. It is based upon the method set forth in article 334, Chapter XII, and the values may be computed by the formula:

$$a = \frac{1^{\prime\prime}.9635 \cos L \cos d}{\sin (L-d)},$$

where a = variation of altitude in one minute from meridian,

L = latitude, and

d = declination—positive for same name and negative for opposite name to latitude at upper transit, and negative for same name at lower transit. The limits of the table take in all values of latitude, declination, and altitude which are likely to

The limits of the table take in all values of latitude, declination, and altitude which are likely to be required. In its employment, care must be taken to enter the table at a place where the declination is appropriately named (of the same or opposite name to the latitude); it should also be noted that at the bottom of the last three pages values are given for the variation of a body at *lower* transit, which can only be observed when the declination and latitude are of the same name, and in which case the reduction to the meridian is subtractive; the limitations in this case are stated at the *foot* of the page, and apply to all values below the heavy rules.

TABLE 27: CHANGE OF ALTITUDE IN GIVEN TIME FROM MERIDIAN.

This table gives the product of the variation in altitude in one minute of a heavenly body near the meridian, by the square of the number of minutes. Values are given for every half minute between $0^{m} 30^{s}$ and $26^{m} 0^{s}$, and for all variations likely to be employed in the method of "reduction to the meridian."

The formula for computing is:

Red. = $a \times t^2$,

where a = variation in one minute (Table 26), and

t = number of minutes (in units and tenths) from time of meridian passage.

The table is entered in the column of the nearest interval of time from meridian, and the value taken out corrresponding to the value of a found from Table 26. The units and tenths are picked out separately and combined, each being corrected by interpolation for intermediate intervals of time.

The result is the amount to be applied to the observed altitude to reduce it to the meridian altitude, which is always to be added for upper transits and subtracted for lower.

TABLE 28, A, B, C, D: LATITUDE BY POLARIS.

The formula on which these tables are based is:

 $L = h - p \cos t + \frac{1}{2} p^2 \sin 1'' \sin^2 t \tan h$ $-\frac{1}{2}p^{3}\sin^{2}1^{\prime\prime}\cos t\sin^{2}t + \frac{1}{2}p^{4}\sin^{3}1^{\prime\prime}\sin^{4}t\tan^{3}h;$

in which

L = the latitude of the place: h = the true altitude; p = the polar distance; and t = the hour angle of the star.

Table A contains for the declination 88° 48', or $p_0 = 1^{\circ} 12' = 4320''$, the first correction,

 $A = -p_{0} \cos t - \frac{1}{3} p_{0}^{3} \sin^{2} 1^{\prime \prime} \cos t \sin^{2} t;$

Argument, the hour angle of the star, or 24^h - the hour angle. Table B contains the second correction.

 $B = \frac{1}{2} p_0^2 \sin \frac{1''}{2} \sin^2 t \tan h + \frac{1}{2} p_0^4 \sin^3 \frac{1''}{2} \sin^4 t \tan^3 h;$

Arguments, the true altitude of the star and the hour angle, or 24^h - the hour angle. This correction is always additive.

Table C contains the third correction.

 $C = \frac{1}{2} (p^2 - p_{c}^2) \sin 1^{\prime\prime} \sin^2 t \tan h$

Arguments, B and the declination of the star from 88° 47' 20" to 88° 49' 20". Table D contains the fourth correction.

 $-(p-p_{o})\cos t - \frac{1}{2}(p^{3}-p^{3}_{o})\sin^{2} 1''\cos t\sin^{2}t;$

Arguments, A and the declination of the star from 88° 47' 20'' to 88° 49' 20''. The method of employing this table is illustrated in article 341, Chapter XII.

TABLES 29, 30, 31: CONVERSION TABLES.

These are self-explanatory.

TABLE 32: TRUE FORCE AND DIRECTION OF WIND.

This table enables an observer on board of a moving vessel to determine the true force and direction of the wind from its apparent force and direction. Enter the table with the apparent direction of the wind (number of points on the bow) and force (Beaufort scale) as arguments, and pick out the direc-tion relatively to the ship's head and the force corresponding to the known speed of the ship. EXAMPLE: A vessel steaming SE. at a speed of 15 knots appears to have a wind blowing from three points on the starboard bow with a force of 6, Beaufort scale. What is the true direction and force? In the column headed 3 (meaning three points on bow, apparent direction) and in the line 6 (apparent force, Beaufort scale), we find abreast 15 (knots, speed of vessel) that the true direction is 5 points on starboard bow, *i. e.*, S. by W., and true force 4.

TABLE 33: VERTICAL ANGLES.

This table gives the distance of an object of known height by the vertical angle that it subtends at the position of the observer. It was computed by the formula:

 $\tan \alpha = \frac{h}{d},$ where α = the vertical angle; h = the height of the observed object in feet; and d = the distance of the object, also converted into feet.

The employment of this method of finding distance is explained in article 139, chapter IV.

TABLE 34: HORIZON ANGLES.

This shows the distance in yards corresponding to any observed angle between an object and the sea horizon beyond, the observer being at a known height. The method of use is explained in article 139, chapter IV.

TABLE 35: SPEED TABLE.

This table shows the rate of speed, in nautical miles per hour, of a vessel which traverses a measured mile in any given number of minutes and seconds. It is entered with the number of minutes at the top and the number of seconds at the side; under one and abreast the other is the number of knots of speed.

TABLE 36: LOCAL AND STANDARD TIMES

This table contains the reduction to be applied to the local time to obtain the corresponding time at any other meridian whose time is adopted as a standard. The results are given to the nearest minute of time only, being intended for the reduction of such approximate quantities as the time of high water or time of sunset. More exact reductions, when required, may be made by Table 7.

TABLE 37: LOGARITHMS FOR EQUAL ALTITUDE SIGHTS.

Logarithms of A and B, for computing the Equation of Equal Altitudes, are calculated by the formulae:

 $\Lambda = \frac{E}{1800 \sin \frac{1}{2} E'}$ $B = \frac{E}{1800 \tan \frac{1}{2}E},$

where E in the numerator is the elapsed time in minutes, and E in the denominator the elapsed time expressed in arc.

If we put

L = latitude of the place of observation, + north, - south, d = declination of the sun, + north, - south, n = hourly change of declination, + north, - south, C = correction to reduce the middle chronometer time to chronometer time of apparent noon, algebraically additive,

C' = the same for midnight,

we have

$$C = -A n \tan L + B n \tan d;$$

$$C' = A n \tan L + B n \tan d.$$

This is Chauvenet's table to aid the solution of the problem of Equal Altitudes, and is explained in article 322 and following articles, Chapter XI.

TABLE 38: EFFECT UPON LONGITUDE OF ERROR IN LATITUDE.

Table 38 shows, approximately, the error in longitude in miles and tenths of a mile, occasioned by an error of one mile in the latitude.

Thus, when the sun's altitude is 30°, the latitude 30°, and the polar distance 100°, the error is eight-tenths of a mile.

The effect of an *increase* of latitude is as follows:

In West longitude, { East } of meridian, the { decreased } except where marked { increased } the body being { West } longitude is { increased } by *, when it is { decreased } decreased ?

In *East* longitude, { East } of meridian, the { increased } except where marked { decreased } the body being { West } longitude is { decreased } by *, when it is { increased }.

A decrease of latitude has the contrary effect.

The direction of error may readily be seen by drawing the Sumner line in a direction at right angles to the approximate bearing of the body.

TABLE 39: AMPLITUDES.

This table contains amplitudes of heavenly bodies, at rising and setting, for various latitudes and declinations, computed by the formula:

 $\sin \operatorname{amp.} = \operatorname{sec} \operatorname{Lat.} \times \sin \operatorname{dec.}$

It is entered with the declination at the top and the latitude at the side. Its use is explained in article 358, Chapter XIV.

TABLE 40: CORRECTION FOR AMPLITUDES.

This table gives a correction to be applied to the observed amplitude to counteract the vertical displacement due to refraction, parallax, and dip, when the body is observed with its center in the visible horizon.

The correction is to be applied for the sun, a planet, or a star, as follows:

At Rising in N. Lat. Setting in S. Lat. } apply the correction to the right. At Rising in S. Lat. Setting in N. Lat. } apply the correction to the left.

For the moon, apply half the correction in the contrary manner.

TABLE 41: NATURAL SINES AND COSINES.

This table contains the natural sine and cosine for every minute of the quadrant, and is to be entered at the top or bottom with the degrees, and at the side marked M., with the minutes; the corresponding numbers will be the natural sine and cosine, respectively, observing that if the degrees are found at the top, the name sine, cosine, and M. must also be found at the top, and the contrary if the degrees are found at the bottom. It should be understood that all numbers given in the table should be divided by 100,000—that is, pointed off to contain five decimal places. Thus, .43366 is the natural sine of $25^{\circ} 42'$, or the cosine of $64^{\circ} 18'$.

In the outer columns of the margin are given tables of proportional parts, for the purpose of finding, approximately, by inspection, the proportional part corresponding to any number of seconds in the proposed angle, the seconds being found in the marginal column marked M., and the correction in the adjoining column. Thus, if we suppose that it were required to find the natural sine corresponding to $25^{\circ} 42' 19''$, the difference of the sines of $25^{\circ} 42'$ and $25^{\circ} 43'$ is 26, being the same as at the top of the left-hand column of the table; and in this column, and opposite 19 in the column M., is the correction 8. Adding this to the above number. 43366, because the numbers are *increasing*, we get .4£374 for the sine of $25^{\circ} 42' 19''$. In like manner, we find the cosine of the same angle to be .90108 – 4 = .90104, using the right-hand columns, and subtracting because the numbers are *decreasing*; observing, however, that the number 14 at the top of this column varies 1 from the difference between the cosines of $25^{\circ} 42'$ and $25^{\circ} 43'$, which is only 13; so that the table may give in some cases a unit too much between the angles $25^{\circ} 42'$ and $25^{\circ} 43'$, but this is, in general, of but little importance, and when accuracy is required, the usual method of proportional parts is to be resorted to, using the actual tabular difference.

TABLE 42: LOGARITHMS OF NUMBERS.

This table, containing the common logarithms of numbers, was compared with Sherwin's, Hutton's, and Taylor's logarithms; its use is explained in an article on Logarithms in Appendix III.

TABLE 43: LOGARITHMS OF TRIGONOMETRIC FUNCTIONS, QUARTER POINTS.

This table contains the logarithms of the sines, tangents, etc., corresponding to points and quarter points of the compass. This was compared with Sherwin's, Hutton's, and Taylor's logarithms.

TABLE 44: LOGARITHMS OF TRIGONOMETRIC FUNCTIONS, DEGREES.

This table contains the common logarithms of the sines, tangents, secants, etc. It was compared with Sherwin's, Hutton's, and Taylor's tables. Two additional columns are given in this table, which are very convenient in finding the time from an altitude of the sun; also, three columns of proportional parts for seconds of space, and a small table at the bottom of each page for finding the proportional parts for seconds of time. The degrees are marked to 180°, which saves the trouble of subtracting the given angle from 180° when it exceeds 90°.

The use of this table is fully explained in Appendix III in an article on Logarithms.

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TABLE 1.

Difference of Latitude and Departure for 1 Point.

	Difference of Latitude and Departure for $\frac{1}{4}$ Point.N. $\frac{1}{4}$ E.N. $\frac{1}{4}$ W.S. $\frac{1}{4}$ E.S. $\frac{1}{4}$ W.													
Dist.	Lat.	Dep.	Dist.	Lat.	Dep.	Dist.	Lat.	Dep.	Dist.	Lat.	Dep.	Dist.	Lat	Dep
1	1.0	0.0	61	60.9	$\frac{3.0}{2.0}$	121	120.9	5.9	181	180.8	8.9	241	240.7	11.8
2 3	2.0	0.1	62	62 9	3.1	22	121.9 129.9	6.0	82	182.8	8.9	42	241.7 942.7	11.9
4	4.0	$0.1 \\ 0.2$	64	63.9	3.1	24	123.9	6.1	84	183.8	9.0	44	242.7	12.0
5	5.0	0.2	65	64.9	3.2	25	124.8	6.1	85	184.8	9.1	45	244.7	12.0
6	6.0	0.3	66	65.9	3.2	26	125.8	6.2	86	185.8	9.1	46	245.7	12.1
7	7.0	0.3	67	66.9	3.3	27	126.8	6.2	87	186.8	9.2	47	246.7	12.1
8	8.0	0.4	68	61.9	3.3	28	127.8	6.3	88	187.8	9.2	48	247.7	12.2
10	9.0 10.0	0.4	70	69.9	3.4	$\frac{29}{30}$	128.8 129.8	6.4	90	189.8	9.3	50	248.7	12.2 12.3
11	11.0	0.5	71	70.9	3.5	131	130.8	6.4	191	190.8	9.4	251	250.7	12.3
12	12.0	0.6	72	71.9	3.0	32	131.8	6.0	92	191.8	9.4	52	251.7	12.4
10	13.0 14.0	0.0	74	73.9	3.6	31	132.0	6.6	93	192.8	9.5	- 00 - 54	202.7 253.7	12.4
15	15.0	0.7	75	74.9	3.7	35	134.8	6.6	95	194.8	9.6	55	254.7	12.5 12.5
16	16.0	0.8	76	75.9	3.7	36	135.8	6.7	96	195.8	9.6	56	255.7	12.6
17	17.0	0.8	77	76.9	3.8	37	136.8	6.7	97	196.8	9.7	57	256.7	12.6
18	18.0	0.9	78	77.9	3.8	38	137.8	$\begin{bmatrix} 6.8 \\ 2.9 \end{bmatrix}$	98	197.8	9.7	58	257.7	12.7
19	19.0	0.9	19 80	79.9	3.9	39	138.8	6.8	200	198.8	9.8	- 59 - 60	258.7 250.7	12.7
$\frac{20}{21}$	$\frac{20.0}{21.0}$	1.0	81	80.9	4.0	141	$\frac{100.0}{140.8}$	6.9	200	200.8	<u> </u>	261	260.7	$\frac{12.0}{19.8}$
$\frac{21}{22}$	21.0 22.0	1.1	82	81.9	4.0	42	141.8	7.0	02	201.8	9.9	62	261.7	12.0
23	23.0	1.1	83	82.9	4.1	43	142.8	7.0	03	202.8	10.0	63	262.7	12.9
24	24.0	1.2	84	83.9	4.1	44	143.8	7.1	04	203.8	10.0	64	263.7	13.0
25	25.0	1.2	85	84.9	4.2	45	144.8	[7.1]	05	204.8	10.1	65	264.7	13.0
$\frac{20}{97}$	20.0	1.0	80	80.9 86 0	4.2	40	145.8	$\frac{1.2}{7.9}$	05	205.8	10.1	60	265.7	13.1
$\frac{1}{28}$	$\frac{27.0}{28.0}$	1.4	88	87.9	4.3	48	140.8	7.3	08	200.8 207.7	10.2 10.2	68	260.7 267.7	13.1 13.2
$\overline{29}$	29.0	1.4	89	88.9	4.4	49	148.8	7.3	09	208.7	10.3	69	268.7	13.2
30	30.0	1.5	- 90	89.9	4.4	50	149.8	7.4	10	209.7	10.3	70	269.7	13.2
31	31.0	1.5	91	90.9	4.5	151	150.8	7.4	211	210.7	10.4	271	270.7	13.3
32	32.0	1.6	92	91.9	4.5	52	151.8	7.5	12	211.7	10.4	72	271.7	13.3
31	33.0 34.0	$1.0 \\ 1.7$	95	92.9	4.0	- 05 - 54	152.8	7.8	13	212.7 213.7	10.5	13	272.7	13.4
35	35.0	1.7	95	94.9	4.7	55	154.8	7.6	15	214.7	10.5	75	274.7	13.5
36	36.0	1.8	96	95.9	4.7	56	155.8	7.7	16	215.7	10.6	76	275.7	13.5
37	37.0	1.8	97	96.9	4.8	57	156.8	7.7	17	216.7	10.6	77	276.7	13.6
38	38.0	1.9	98	97.9	4.8	58	157.8	7.8	18	217.7	10.7	78	277.7	13.6
40	$\frac{39.0}{40.0}$	1.9	100	98.9	4.9	- 59 - 60	159.8	$\frac{1.8}{7.9}$	19	218.7 219.7	10.7	80	278.7	13.7
41	41.0	$\frac{2.0}{2.0}$	$\frac{100}{101}$	100.9	$\frac{1.0}{5.0}$	$\frac{00}{161}$	100.8	7.9	$\frac{20}{221}$	$\frac{210.7}{220.7}$	10.8	281	280.7	$\frac{10.1}{13.8}$
42	41.9	2.1	02	101.9	5.0	62	161.8	7.9	22	221.7	10.9	82	281.7	13.8
43	42.9	2.1	03	102.9	5.1	63	162.8	8.0	23	222.7	10.9	83	282.7	13.9
11	43.9	2.2	04	103.9	5.1	64	163.8	8.0	24	223.7	11.0	81	283.7	13.9
40	44.9	2.2	06	104.9	$\frac{0.2}{5.2}$	- 60 - 66	165 8	8.1 8.1	20	224.7	11.0 11 1	80 86	284.7	14.0
47	46.9	2.3	07	106.9	5.3	67	166.8	$\frac{8.1}{8.2}$	$\frac{20}{27}$	$\frac{226.7}{226.7}$	11.1	87	286.7	14.1
48	47.9	2.4	08	107.9	5.3	68	167.8	8.2	28	227.7	11.2	88	287.7	14.1
49	48.9	2.4	09	108.9	5.3	69	168.8	8.3	29	228.7	11.2	89	288.7	14.2
_50	49.9	2.5	10	109.9	5.4	70	169.8	8.3		229.7	11.3	90	289.7	14.2
01 59	50.9	2.5	111	110.9	5.4 5.5	171	170.8 171.8	8.4	231	230.7 921.7	11.3	291	290.6	14.3
53	51.9 52.9	$\frac{2.0}{2.6}$	$12 \\ 13$	111.9	5.5	$\frac{72}{73}$	171.8 172.8	8.5	33	231.7 232.7	11.4 11.4	93	291.0 292.6	14.0
54	53.9	$\frac{1}{2.6}$	14	113.9	5.6	74	173.8	8.5	34	233.7	11.5	94	293.6	14.4
55	54.9	2.7	15	114.9	5.6	75	174.8	8.6	35	234.7	11.5	95	294.6	14.5
56 - 57	55.9	2.7	16	115.9	5.7	76	175.8	8.6	. 36	235.7	11.6	96	295.6	14.5
07 58	56.9 57.0	$\frac{2.8}{2.8}$	17	116.9 117.0	5.7	70	176.8 177.9	8.7	37	236.7 937.7	$11.6 \\ 11.7$	97	296.6 207 c	14.6
59	58.9	$\frac{2.0}{2.9}$	19	118.9	5.8	79	178.8	8.8	39	238.7	11.7	- 99	298.6	14.7
60	59.9	$\bar{2}.9$	20	119.9	5.9	80	179.8	8.8	40	239.7	11.8	300	299.6	14.7
Dist.	Dep	Lat	Dist.	Den	Lat	Dist	Den	Let	Dist.	Den	Lat	Dist.	Den.	Lat.
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		NT 1	. 17	Differe	nce of .	Latitu	de and	Depart	ure fo	or ∲ Poin	it.	1 117		
		N. <u>1</u>	E.		N. <u>1</u>	5 W.			F.			2 W.		
Dist.	Lat.	Dep.	Dist.	Lat.	Dep.	Dist.	Lat.	Dep.	Dist.	Lat.	Dep.	Dist.	Lat.	Dep.
1	1.0	0.1	61	60.7	6.0	121	120.4	11.9	181	180.1	17.7	241	239.8	23.6
$\frac{2}{2}$	2.0	0.2	62	61.7 62.7	6.1	$\frac{22}{93}$	121.4 122.4	12.0 12 1	82 83	181.1 182 1	17.8 17.9	$\frac{42}{43}$	240.8 241.8	23.7 23.8
4	4.0	0.3	64	63.7	6.3	24	123.4	12.2	84	183.1	18.0	44	242.8	23.9
5	5.0	0.5	65	64.7	6.4	25	124.4	12.3	85	184.1	18.1	45	243.8	24.0
$\frac{6}{7}$	6.0 7.0	0.6	60	66.7	0.0 6.6	$\frac{26}{27}$	120.4 126.4	12.4 12.4	80	185.1	18.2 18.3	40	244.8	24.1 24.2
8	8.0	0.8	68	67.7	6.7	28	127.4	12.5	88	187.1	18.4	48	246.8	24.3
9	9.0	$0.9 \\ 1.0$	$\frac{69}{70}$	68.7 69.7	6.8 6.9	$\frac{29}{30}$	128.4 129.4	12.6 12.7	89 90	188.1 189.1	18.5 18.6	$\frac{49}{50}$	247.8 248.8	24.4 24.5
$-\frac{10}{11}$	10.0 10.9	$\frac{1.0}{1.1}$	$-\frac{70}{71}$	70.7	7.0	131	130.4	12.8	191	$\frac{100.1}{190.1}$	18.7	251	249.8	24.6
12	11.9	1.2	72	71.7	7.1	32	131.4	12.9	.92	191.1	18.8	52	250.8	24.7
13	12.9 13.9	1.3	$\frac{73}{74}$	72.6	$7.2 \\ 7.3$	- 33 - 34	132.4 133.4	13.0 13.1	93 94	192.1 193.1	18.9	- 53 - 54	251.8 252.8	24.8 24.9
15	14.9	1.5	75	74.6	7.4	$3\hat{5}$	134.3	13.2	95	194.1	19.1	55	253.8	25.0
$16 \\ 17$	15.9	1.6	$\frac{76}{77}$	75.6	7.4	36 37	135.3 136.3	13.3	96	195.1	19.2	$\frac{56}{57}$	254.8	$\begin{array}{ c c c c c c c c c c c c c c c c c c c$
18	10.9 17.9	1.8	78	77.6	7.6	38	130.3 137.3	13.5	98	197.0	19.4	58	256.8	25.3
` <u>19</u>	18.9	1.9	79	78.6	7.7	39	138.3	13.6	99	198.0	19.5	59 60	257.8	25.4
$\frac{20}{21}$	$-\frac{19.9}{20.9}$	$\frac{2.0}{2.1}$	80	80.6	$\frac{1.8}{7.9}$	$\frac{40}{141}$	$\frac{139.3}{140.3}$	$\frac{13.7}{13.8}$	$\frac{200}{201}$	$\frac{199.0}{200.0}$	19.0 19.7	$\frac{00}{261}$	$\frac{258.7}{259.7}$	$\frac{23.3}{25.6}$
$\frac{21}{22}$	$\frac{20.9}{21.9}$	2.2	82	81.6	8.0	42	141.3	13.9	02	201.0	19.8	62	260.7	25.7
23	22.9	2.3	83	82.6	8.1	43	142.3	14.0	03	202.0	19.9	63	261.7	25.8
$\frac{24}{25}$	23.9 24.9	$\frac{2.4}{2.5}$	85	84.6	8.3	$\frac{44}{45}$	145.5	14.1 14.2	04	203.0	20.0 20.1	65	262.7 263.7	25.9 26.0
26	25.9	2.5	86	85.6	8.4	46.	145.3	14.3	06	205.0	20.2	66	264.7	26.1
$\frac{27}{28}$	$\begin{array}{c} 26.9\\ 27.9\end{array}$	$\frac{2.6}{2.7}$	87 88	86.6	8.5	$\frac{47}{48}$	146.3 147.3	14.4 14.5	07	206.0	20.3 20.4	67	265.7 266.7	26.2 26.3
$\frac{20}{29}$	28.9	2.8	89	88.6	8.7	49	148.3	14.6	09	208.0	20.5	69	267.7	26.4
$\frac{30}{31}$	$\frac{29.9}{29.9}$	$\frac{2.9}{2.9}$	90	89.6	8.8	$\frac{50}{151}$	149.3	14.7	$\frac{10}{011}$	209.0	$\frac{20.6}{20.7}$	70	268.7	$\frac{26.5}{26.6}$
$\frac{31}{32}$	30.9 31.8	$\frac{3.0}{3.1}$	91 92	90.6 91.6	8.9	$151 \\ 52$	150.3 151.3	14.8	$\frac{211}{12}$	210.0 211.0	20.7 20.8	$\frac{271}{72}$	269.7 270.7	26.6 26.7
33	32.8	$3.\hat{2}$	93	92.6	9.1	53	152.3	15.0	13	212.0	20.9	73	271.7	26.8
$\frac{34}{35}$	33.8 34 8	$\frac{3.3}{3.4}$	94 95	93.5 91.5	9.2	54	153.3 154.3	15.1 15.2	14	213.0 214 0	21.0 21.1	$\frac{74}{75}$	272.7	$\begin{array}{ c c c c c c c c c c c c c c c c c c c$
36	*35.8	3.5	96	95.5	9.4	56	155.2	15.3	16	215.0	21.2	76	274.7	27.1
$\frac{37}{20}$	36.8	$\frac{3.6}{2.7}$	97	96.5	9.5	57	156.2	15.4	17	216.0	21.3	77	275.7	27.2
$\frac{38}{39}$	37.8 38.8	3. 1 3. 8	98 99	97.5	9.6	$\frac{58}{59}$	157.2 158.2	$10.0 \\ 15.6$	$18 \\ 19$	217.0 217.9	21.4 21.5	$\frac{78}{79}$	276.7	27.3
40	39.8	3.9	100	99.5	9.8	60	159.2	15.7	20	218.9	21.6	80	278.7	27.4
41	40.8	$\frac{4.0}{1}$	101	100.5	9.9	161	160.2	15.8	221	219.9	21.7	281	279.6	27.5
42 43	41.8 42.8	4.1	02	101.5 102.5	10.0 10.1	63	161.2 162.2	10.9 16.0	$\frac{22}{23}$	220.9 221.9	21.8 21.9	82 83	280.0 281.6	27.7
44	43.8	4.3	04	103.5	10.2	64	163.2	16.1	24	222.9	22.0	84	282.6	27.8
45 46	$44.8 \\ 45.8$	4.4	00 06	104.5 105.5	10.3 10.4	65 66	164.2 165.2	16.2 16.3	25 26	223.9	22.1 22.2	85 86	283.6	27.9 28.0
47	46.8	4.6	07	106.5	10.5	67	166.2	16.4	27	225.9	22.2	87	285.6	28.1
48	47.8	4.7	08	107.5 108.5	$ 10.6 \\ 10.7 $	68 60	167.2	16.5	28	226.9	22.3	88	286.6	28.2
50	49.8	4.9	10	103.5 109.5	10.8	70	169.2	16.0 16.7	$\frac{29}{30}$	221.9	22.4 22.5	90	288.6	28.4
51	50.8	5.0	111	110.5	10.9	171	170.2	16.8	231	229.9	22.6	291	289.6	28.5
$\frac{52}{53}$	51.7 52.7	$\frac{5.1}{5.2}$	$\frac{12}{13}$	111.5 112.5	$ 11.0 \\ 11 1$	$72 \\ 73$	$171.2 \\ 172.2$	$16.9 \\ 17.0$	32	230.9 231.9	22.7 22.8	92	290.6 291_6	28.6 28.7
54	53.7	5.3	14	113.5	11.2	74	173.2	17.1	34	232.9	22.9	94	292.6	28.8
55 56	54.7 55.7	5.4	15	114.4	11.3	$75 \\ 76$	174.2 175.9	17.2	35 26	233.9	23.0	95 04	293.6	28.9
57	56.7	5.6	17	110.4 116.4	11.4	77	176.1	$17.3 \\ $	30 37	234.9	$\begin{array}{c} 25.1\\ 23.2 \end{array}$	90 97	294.0 295.6	29.0
58	57.7	5.7	18	117.4	11.6	78	177.1	17.4	38	236.9	23.3	98	296.6	29.2
59 60	58.7 59.7	$5.8 \\ 5.9$	$\frac{19}{20}$	118.4 119.4	11.7 11.8	79 80	178.1 179.1	$17.5 \\ 17.6$	-10 -10	237.8 238,8	$23.4 \\ 23.5$	99 300	297.6 298,6	$29.3 \\ 29.4$
Dist.	Dep.	Lat.	Dist.	Dep.	Lat.	Dist.	Dep.	Lat.	Dist.	Dep.	Lat.	Dist.	Dep.	Lat.
	E. $\frac{1}{2}$ N.			E. $\frac{1}{2}$ S.			W. $\frac{1}{2}$ N.			$W \frac{1}{2} S.$		[Fo	or $7\frac{1}{2}$ Poi	ints.

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Pa	ge 354					ľ	ABL	E 1.						
	01			Differe	ence of	Latitu	ide and	Depart	ure fo	r 3 Poin	.t.			
	:	N. 3 E.			N. 34 W			S. ³ / ₄ E.			S. 3 W			
Dist.	Lat.	Dep.	Dist.	Lat.	Dep.	Dist.	Lat.	Dep.	Dist.	Lat.	Dep.	Dist.	Lat.	Dep.
1	1.0	0.1	61	60.3	9.0	121	119.7	17.8	181	179.0	26.6	241	238.4	35.4
$\frac{2}{3}$	2.0	0.3	$62 \\ 63$	61.3	, 9.1	22	120.7 121.7	17.9	82	180.0	26.7	42	239.4	35.5
4	4.0	0.4	64	63.3	9.4	24	121.7 122.7	18.0	84	181.0	20.9 27.0	44	240.4	35.8
5	4.9	0.7	65 66	64.3	9.5	25	123.6	18.3	85	183.0	27.1	45	242.3	35.9
	6.9	1.0	67	66.3	9.8	27	124.0	18.6	87	185.0	27.3	40	243.3 244.3	36.2
8	7.9	1.2	68 60	67.3	10.0	28	126.6	18.8	88	186.0	27.6	48	245.3	36.4
10	8.9 9.9	$1.5 \\ 1.5$	70	69.2	10.1	$\frac{29}{30}$	127.0 128.6	10.9	90	187.9	27.9	.50	240.3 247.3	36.7
11	10.9	1.6	71	70.2	10.4	131	129.6	19.2	191	188.9	28.0	251	248.3	36.8
$12 \\ 13$	11.9 12.9	1.8	$72 \\ 73$	$71.2 \\ 72.2$	10.0 10.7	$\frac{32}{33}$	130.6	19.4	92 93	189.9	$28.2 \\ 28.3$	52 53	249.3 250.3	37.0 37.1
14	13.8	2.1	74	73.2	10:9	34	132.5	19.7	94	191.9	28.5	54	251.3	37.3
10 16	$14.8 \\ 15.8$	$\frac{2.2}{2.3}$	$\frac{79}{76}$	$74.2 \\ 75.2$	$11.0 \\ 11.2$	30 36	133.5 134.5	19.8 20.0	95	192.9 193.9	28.6 28.8	56 56	252.2 253.2	37.4 37.6
17	16.8	2.5	77	76.2	11.3	37	135.5	20.1	97	194.9	28.9	57	254.2	37.7
$18 \\ 19$	$\begin{array}{c} 17.8\\ 18.8 \end{array}$	$\frac{2.6}{2.8}$	$\frac{78}{79}$	77.2 78.1	11.4 11.6	- <u>38</u> - <u>39</u>	136.5 137.5	20.2 20.4	98 99	195.9	29.1 29.2	$58 \\ 59$	255.2 256.2	37.9 38.0
20	19.8	2.9	80	79.1	11.7	40	138.5	20.5	200	197.8	29.3	60	257.2	38.1
$\frac{21}{22}$	20.8	$\frac{3.1}{3.9}$	81 82	80.1	11.9	'141 42	139.5	20.7	201	198.8	29.5	$261'_{62}$	258.2 259.2	38.3
$\frac{22}{23}$	21.8 22.8	3.4	83	82.1	12.0 12.2	42	140.5	20.8 21.0	02	200.8	29.0	63	260.2	38.6
24	23.7	3.5	84	83.1	12.3	44	142.4	21.1	04	201.8	29.9	64 65	261.1	38.7
$\frac{20}{26}$	24.7 25.7	3. 7 3. 8	86	85.1	12.5 12.6	40	145.4	21.5 21.4	06	202.8	30.1 30.2	66	262.1 263.1	39.0
27	26.7	4.0	87	86.1	12.8	47	145.4	21.6	07	204.8	30.4	67	264.1	39.2
$\frac{28}{29}$	27.7 28.7	4.3	89	87.0	12.9	49	140.4	21.7 21.9	08	205.7	30.5 30.7	69	265.1 266.1	39.5
30	29.7	4.4	90	89.0	13.2	50	148.4	22.0	10	207.7	30.8	70	267.1	39.6
$\frac{31}{32}$	30.7 31.7	4.5	$\frac{91}{92}$	90.0	13.4 13.5	$\frac{151}{52}$	149.4 150.4	22.2 22.3	$\frac{211}{12}$	208.7 209.7	31.0 31.1	$\begin{array}{c} 271 \\ 72 \end{array}$	268.1 269.1	39.8 39.9
33	32.6	4.8	93	92.0	13.6	53	151.3	22.4	13	210.7	31.3	73	270.0	40.1
$\frac{34}{35}$	33.6 34.6	$5.0 \\ 5.1$	94 95	93.0 94.0	$13.8 \\ 13.9$	54 55	152.3 153.3	22.6 22.7	14 15	211.7 212.7	31.4 31.5	$74 \\ 75$	271.0 272.0	40.2
36	35.6	5.3	96	95.0	14.1	56	154.3	22.9	16	213.7	31.7	76	273.0	40.5
$\frac{37}{38}$	36.6 37.6	5.4	97 98	96.0	14.2 14.4	57 58	155.3 156.3	$\begin{vmatrix} 23.0\\23.2 \end{vmatrix}$	17	214.7 215.6	31.8 32.0	77	274.0 275.0	40.6 40.8
39	38.6	5.7	99	97.9	14.5	59	157.3	23.3	19	216.6	32.1	79	276.0	40.9
40	39.6	$\frac{5.9}{6.0}$	100	98.9	14.7	$\frac{60}{101}$	158.3	$\frac{23.5}{22.6}$	$\frac{20}{-991}$	$\frac{217.6}{218.6}$	$\frac{32.3}{29.4}$	80	$\frac{277.0}{278.0}$	$\frac{41.1}{11.9}$
41 42	40.6	6.0	$101 \\ 02$	99.9	14.8 15.0	62^{101}	169.3 160.2	23.0 23.8	$\frac{221}{22}$	218.0	32.4 32.6	82	278.9	41.4
43	42.5	6.3	03	101.9	15.1	63	161.2	23.9	23	220.6	32.7	83	279.9	41.5
44	43.5	6.6	04	102.9 103.9	15.5 15.4	65	162.2 163.2	24.1 24.2	$\frac{24}{25}$	221.0 222.6	33.0	85	280.9	41.8
46	45.5	6.7	06	104.9	15.6	66	164.2	24.4	26	223.6	33.2	86	282.9	42.0
$\frac{47}{48}$	46.5	6.9	07	105.8 106.8	15. 7	68	165.2 166.2	24.5 24.7	$\frac{27}{28}$	$\begin{array}{c c} 224.0\\ 225.5 \end{array}$	33.5	88	285.9	42.1
49	48.5	7.2	09	107.8	16.0	69	167.2	24.8	29	226.5	33.6	89	285.9	42.4
$\frac{50}{51}$	49.5 50.4	$\frac{7.3}{7.5}$	$\frac{10}{111}$	108.8 109.8	$\frac{16.1}{16.3}$	$\frac{70}{171}$	168.2 169.1	$\frac{24.9}{25.1}$	$\frac{30}{231}$	$\frac{221.5}{228.5}$	$\frac{33.7}{33.9}$	$\frac{90}{291}$	286.9	42.0
52	51.4	7.6	111	110.8	16.4	72	170.1	25.2	32	229.5	34.0	92	288.8	42.8
53 54	52.4	7.8	$13 \\ 14$	111.8	16.6	73	171.1	25.4	33	230.5	34.2	93	289.8	43.0
55	54.4	8.1	$14 \\ 15$	112.8	16.9	75	173.1	25.0 25.7	35	232.5	34.5	95	291.8	43.3
56	55.4	8.2	16	114.7	17.0	$\frac{76}{77}$	174.1	25.8	36	233.4	34.6	96 97	292.8	43.4
58	57.4	8.5	18	116.7	17.3	78	176.1	26.0 26.1	38	235.4	34.9	98	294.8	43.7
59 60	58.4	8.7	19	117.7	17.5	79	177.1	26.3	39 40	236.4	35.1	99 300	295.8	43.9 44.0
- 00	ə9.4	8.8	20	118.7	17.0	- 80	178.1	20.4	40	201.4	50.2		200.0	11. 0
Dist.	Dep.	Lat.	Dist.	Dep.	Lat.	Dist.	Dep.	Lat.	Dist.	Dep.	Lat.	Dist.	Dep.	Lat.
	E. $\frac{3}{4}$ N.			E. $\frac{3}{4}$ S.			W. $\frac{3}{4}$ N	•		W. $\frac{3}{4}$ S		[]	For 74 P	oints.

						ŋ	[ABL]	E 1.					[Pag	e 355
Difference of Latitude and Departure for 1 Point. N. by E. N. by W. S. by E. S. by W.														
	N	i. by E			N. by	W.		S. by	Е.			S. by	W.	
Dist.	Lat.	Dep.	Dist.	Lat.	Dep.	Dist.	Lat.	Dep.	Dist.	Lat.	Dep.	Dist.	Lat.	Dep.
1	1.0	0.2	61	59.8	11.9	121	118.7	23.6	181	177.5	35.3	241	236.4	47.0
$\frac{2}{3}$	2.0	0.4	$\frac{62}{63}$	60.8 e1 8	12.1	$\frac{22}{23}$	119.7	23.8	82 83	178.5	35.5 25.7	42	237.4	47.2
3 4	$\frac{2.9}{3.9}$	0.0	64 64	61. 8 62. 8	$12.5 \\ 12.5$	$\frac{20}{24}$	120.0 121.6	24.0	84	179.0	35.7 35.9	40	230.5 239.3	47.6
5	4.9	1.0	65	63.8	12.7	25	122.6	24.4	85	181.4	36.1	45	240.3	47.8
$\begin{array}{c} 6\\7\end{array}$	5.9	1.2 1 4	$\begin{array}{c} 66 \\ 67 \end{array}$	64.7 65.7	12.9 13 1	$\frac{26}{27}$	123.6	24.0	86 87	182.4	36.3	46 47	241.3 242.3	48.0
8	7.8	1.6	68	66.7	13.3 13.3	28	125.5	25.0	88	184.4	36.7	48	242.0	40. 2
9	8.8	1.8	69 70	67.7	13.5	29	126.5	25.2	89	185.4	36.9	49	244.2	48.6
10	9.8	$\frac{2.0}{9.1}$	$\frac{70}{71}$	68.7	13.1	30	127.5	25.4	90	186. 3	$\frac{37.1}{97.3}$	051	245.2	48.8
12	11.8	$2.3^{2.1}$	72	70.6	14.0	$\frac{131}{32}$	120.0 129.5	25.0 25.8	191 92	187.5	37.5	$\frac{251}{52}$	240.2 247.2	49.0
13	12.8	2.5	73	71.6	14.2	33	130.4	25.9	93	189.3	37.7	53	248.1	49.4
14	13.7	2.7	74	72.6	14.4	34	131.4	26.1	94	190.3	37.8	54 55	249.1	49.6
10 16	14.7 15.7	$\frac{2.5}{3.1}$	76	73.0	14.0	36	132.4 133.4	20.5 26.5	90 96	191.5	$\frac{38.0}{38.2}$	- 5 6	250.1 251.1	49.7
17	16.7	3.3	77	75.5	15.0	37	134.4	26.7	97	193.2	38.4	57	252.1	50.1
18	17.7	3.5	78	76.5	15.2	38	135.3	26.9	98	194.2	38.6	58	253.0	50.3
$\frac{19}{20}$	18.0	3.1	80	77.5	15.4 15.6	39 40	130.5 137.3	$\begin{bmatrix} 27.1\\ 27.3 \end{bmatrix}$	99 200	195.2 196.2	38.0 39.0	55 60	254.0	50. ə 50. 7
-21	20.6	4.1	81	79.4	15.8	141	138.3	27.5	201	197.1	39.2	261	256.0	50.9
22	21.6	4.3	82	80.4	16.0	42	139.3	27.7	02	198.1	39.4	62	257.0	51.1
23	22.6	4.5	83	81.4	16.2	43	140.3	27.9	03	199.1	39.6	63 64	257.9	51.3 51.5
25	23.5 24.5	4.9	85	83.4	16.6	45	141.2	28.1 28.3	05	200.1 201.1	40.0	65	258.5 259.9	51.7
26	25.5	5.1	86	84.3	16.8	46	143.2	28.5	06	202.0	40.2	66	260.9	51.9
$27 \\ 99$	26.5	5.3	87	85.3	17.0	47	144.2	28.7	07	203.0	40.4	67	261.9	52.1
$\frac{20}{29}$	27.0 28.4	$5.0 \\ 5.7$	89	80.0	17.4	40 49	140.2 146.1	28.5 29.1	08	204.0	40.0	69 69	262. 0	52.5 52.5
30	29.4	5.9	90	88.3	17.6	50	147.1	29.3	10	206.0	41.0	70	264.8	52.7
31	30.4	6.0	91	89.3	17.8	151	148.1	29.5	211	206.9	41.2	271	265.8	52.9
$\frac{32}{33}$	$\frac{31.4}{32.4}$	$\begin{array}{c} 6.2 \\ 6.4 \end{array}$	92 93	90.2	17.9	$\frac{52}{53}$	149.1 150.1	29.7	$\frac{12}{13}$	207.9	41.4 41.6	$\frac{72}{73}$	266.8	53.1
34	33.3	6.6	94	92.2	18.3	54	151.0	30.0	14	200.0	41.7	74	268.7	53.5
35	34.3	6.8	95	93.2	18.5	55	152.0	30.2	15	210.9	41.9	75	269.7	53.6
$\begin{vmatrix} 36\\ 37 \end{vmatrix}$	35.5	$\frac{7.0}{7.2}$	90 97	94. 2 95. 1	18.1 18.9	57	153.0	30.4	10 17	211.8 212.8	$\frac{42.1}{42.3}$	70 77	270.7	53.8
38	37.3	7.4	98	96.1	19.1	58	155.0	30.8	18	213.8	42.5	78	272.7	54.2
39	38.3	7.6	99	97.1	19.3	59	155.9	31.0	19	214.8	42.7	79	273.6	54.4
$\frac{40}{41}$	39.2	7.8	100	98.1	19.0	<u>60</u> 161	156.9	31.2 91.4	20	215.8	42.9	80	274.0	54.0
41 42	40. 2	8.2		100.0	19.1 19.9	$\frac{101}{62}$	157.0 158.9	31.4 31.6	$\frac{241}{22}$	$\begin{bmatrix} 210.0\\217.7 \end{bmatrix}$	43, 3	201 82	275.6	04.0 55.0
43	42.2	8.4	03	101.0	20.1	63	159.9	31.8	23	218.7	43.5	83	277.6	55.2
44	43.2	8.6	04	102.0	20.3	$64 \\ 65$	160.8	$\frac{32.0}{29.2}$	24	219.7	43.7	84	278.5	55.4
40 46	44.1	9.0	05	105.0	$\begin{bmatrix} 20.5\\ 20.7 \end{bmatrix}$	66	161.0	$\frac{32.2}{32.4}$	$\frac{20}{26}$	220.7 221.7	40. 0 44. 1	86 86	279.0 280.5	55.8
47	46.1	9.2	07	104.9	20.9	67	163.8	32.6	27	222.6	44.3	87	281.5	56.0
48	47.1	9.4 0.6		105.9	21.1	68	164.8	32.8	28	223.6	44.5	88	282.5	56.2
$\frac{49}{50}$	48.1	9.0	10	106.9 107.9	$\begin{bmatrix} 21.5\\ 91.5 \end{bmatrix}$	09 70	165.0 166.7	33.0 33.2	$\frac{29}{30}$	224.0 225.6	44.9	89 90	285. +	56.6
51	50.0	9.9	111	108.9	21.7	171	167.7	33.4	231	226.6	45.1	291	285.4	56.8
52	51.0	10.1	12	109.8	21.9	72	168.7	33.6	32	227.5	45.3	92	286.4	57.0
53 54	52.0	10.3 10.5	$\begin{vmatrix} 13\\ 14 \end{vmatrix}$	110.8	$\left[\begin{array}{c} 22.0\\ 92.2 \end{array} \right]$	$73 \\ 74$	169.7 170.7	33.8	33 34	228.5	45.5	93 04	287.4	57.2
55	53.9	10.7	15	112.8	$ \frac{22.2}{22.4} $	75	171.6	34.1	35	229.5 230.5	45.8	95	289.3	57.6
56	54.9	10.9	16	113.8	22.6	76	172.6	34.3	36	231.5	46.0	96	290.3	57.7
57	55.9	11.1	17	114.8	22.8	77	173.6	34.5	37	232.4	46.2	97	291.3	57.9
59	57.9	$11.5 \\ 11.5$	10 19	(110.7) (116.7)	23.0 23.2	79	174.0 175.6	34.9	$\frac{35}{39}$	233. 4	46.6	99	292.5 293.3	58.3
60	58.8	11.7	20	117.7	23.4	80	176.5	35.1	40	235.4	46.8	300	294.2	58.5
			(l				
Dist.	pep.	Latt.	Dist.	Dep.	Lan.	Dist.	Dep.	Lat.	Dist.	Dep.	Lat.	Dist.	Dep.	Lat.
4	E.,	by N.		E. v)у S.		W. by	N.		W. by r	5.	J	For (p	oints.

Pa	ge 356]				1	ſABLI	E 1.						
				Differer	nce of I	Latitu	de and J	Departu	ire foi	11 Poir	nts.			
	N.	by E.	‡Ε.	N	i. by W	V. ‡ W		S. by	$E.\frac{1}{4}$	Е.	s.	by W	. ‡ W.	
Dist.	Lat.	Dep.	Dist.	Lat.	Dep.	Dist.	Lat.	Dep.	Dist.	Lat.	Dep.	Dist.	Lat.	Dep.
1	1.0	0.2	61	59.2	14.8	121	117.4	29.4	181	175.6	44.0	241	233.8	58.6
2	1.9	0.5	62	60.1	15.1	22	118.3	29.6	82	176.5	44.2	42	234.7	58.8
3	2.9	0.7	63	61.1 62.1	15.3	23	119.3	29.9	83	177.5	44.5	43	235.7	59.0
45	5.9 4.9	1.0 1.2	65	63.1	15.0	24	120.5 121.3	30.1	85	178.0 179.5	45.0	44	230.7 237.7	59.3 59.5
6	5.8	1.5	66	64.0	16.0	26	122.2	30.6	86	180.4	45.2	46	238.6	59.8
7	6.8	1.7	67	65.0	16.3	27	123.2	30.9	87	181.4	45.4	47	239.6	60.0
8	7.8	1.9	68 60	66.0	16.5	28	124.2	31.1	88	182.4	45.7	48	240.6	60.3
10	8.7	2.2	70	67.9	10.8 17.0	29 30	125.1 126.1	31.3 31.6	90	185.5	45.9	49 50	241.5 242.5	60.5
11	10.7	2.7	71	68.9	17.3	131	127.1	31.8	191	185.3	46.4	251	243.5	61.0
12	11.6	2.9	$\overline{72}$	69.8	17.5	32	128.0	32.1	92	186.2	46.7	52	244.4	61.2
13	12.6	3.2	73	70.8	17.7	33	129.0	32.3	93	187.2	46.9	53	245.4	61.5
14	13.6	3.4	74	71.8	18.0	34	130.0	32.6	94	188.2	47.1	54	246.4	61.7
$10 \\ 16$	14.0	ə. 0 3. 9	$\frac{73}{76}$	72.8 73.7	18.2	- 55 - 36	131.0 131.9	33 0	90	189.2	47.4	- 56 - 56	247.4	62.0 62.2
17	16.5	4.1	77	74.7	18.7	37	132.9	33.3	97	191.1	47.9	57	249.3	62.4
18	17.5	4.4	78	75.7	19.0	38	133.9	33, 5	- 98	192.1	48.1	58	250.3	62.7
19	18.4	4.6	79	76.6	19.2	39	134.8	33.8	99	193.0	48.4	59	251.2	62.9
-20	$\frac{19.4}{20.4}$	4.9	- 80	$\frac{11.0}{79.0}$	19.4	40	$\frac{130.8}{196.9}$	34.0	$\frac{200}{901}$	194.0	48.0	$\frac{00}{-901}$	202.2	03.2
$\frac{21}{22}$	20.4	$\frac{0.1}{5.3}$	81	78.0	19.7	42	130.8 137.7	34.5	$\frac{201}{02}$	195.0	48.8	$\frac{201}{62}$	253.2 254.1	63.4 63.7
$\frac{22}{23}$	21.0 22.3	5.6	83	80.5	20.2	$\frac{12}{43}$	138.7	34.7	03	196.9	49.3	63	251.1 255.1	63.9
24	23.3	5.8	84	81.5	20.4	44	139.7	35.0	04	197.9	49.6	64	256.1	64.1
25	24.3	6.1	85	82.5	20.7	45	140.7	35.2	05	198.9	49.8	65	257.1	64.4
$\frac{26}{97}$	25.2	6.3	86	83.4	20.9	46	141.6	35.5	06	199.8	50.1	66	258.0	64.6
$\frac{27}{28}$	$\frac{20.2}{27.2}$	6.8	88	85 4	21.1 21.4	47	142.0	36.0	08	200.8	50.5	68	259.0 260.0	65 1
$\frac{1}{29}$	28.1	7.0	89	86.3	21.6	49	144.5	36.2	09	202.7	50.8	69	260.9	65.4
- 30	29.1	7.3	90	87.3	21.9	50	145.5	36.4	10	203.7	51.0	70	261.9	65.6
31	30.1	7.5	91	88.3	22.1	151	146.5	36.7	211	204.7	51.3	271	262.9	65.8
$\frac{32}{99}$	$\frac{31.0}{22.0}$	7.8	92	89.2	22.4	52	147.4	36.9	12	205.6	51.5	72	263.8	66.1
34	32.0 33.0	8.3	95 94	91 2	22.0	54	148.4	37.4	10	200.0	51.8 52.0	74	265.8	66 6
35	34.0	8.5	95	92.2	23.1	55	150.4	37.7	15	208.6	52.2	75	266.8	66.8
36	34.9	8.7	96	93.1	23.3	56	151.3	37.9	16	209.5	52.5	76	267.7	67. 1
37	35.9	9.0	97	94.1	23.6	57	152.3	38.1	17	210.5	52.7	77	268.7	$\begin{bmatrix} 67.3\\$
38	30.9	9.2	98	95.1	23.8	- 58 - 59	103.3	38.4	18	211.5 219.4	03.0 53.9	$\frac{78}{79}$	269.7	67.8
40	38.8	9.7	100	97.0	24.3	60	154.2 155.2	38.9	$\frac{10}{20}$	212.4	53.5	80	270.0 271.6	68.0
41	39.8	10.0	101	98.0	24.5	161	156.2	39.1	221	214.4	53.7	281	272.6	68.3
42	40.7	10.2	02	98.9	24.8	62	157.1	39.4	22	215.3	53.9	82	273.5	68.5
43	41.7	10.4	03	99.9	25.0	63	158,1	39.6	23	216.3	54.2	83	274.5	68.8
44	42.7	10.7	04	100.9	25.3	64	159.1	39.8	24 95	217.3	54.4	84	275.5	69.0
46	44.6	10.9 11.2	06	101.9 102.8	25.8	66	161.0	40.1	20	218.3	54.9	86	277.4	69.2 69.5
47	45.6	11.4	07	103.8	26.0	67	162.0	40.6	-27	220.2	55.2	87	278.4	69.7
-48	46.6	11.7	08	104.8	26.2	68	163.0	40.8	28	221.2	55.4	88	279.4	70.0
49	47.5	11.9	09	105.7	26.5	<u>69</u>	163.9	41.1	29	222.1	55.6	89	280.3	70.2
51	48.5	$\frac{12.1}{19.4}$	$\frac{10}{111}$	105.7	26.7	$\frac{70}{171}$	$\frac{164.9}{165.0}$	41.3	$\frac{30}{0.01}$	$\frac{223.1}{994.1}$	$\frac{55.9}{59.1}$	90	$\frac{281.3}{200.9}$	$\frac{70.5}{70.7}$
52	49.0	12.4	$111 \\ 12$	107.7	27.0	$\frac{171}{72}$	105.9 166.8	41.0	231	224.1	56.1	291 92	282.5 283.2	71.0
53	51.4	12.9	13	109.6	27.5	73	167.8	42.0	33	226.0	56.6	93	284.2	71.2
54	52.4	13.1	14	110.6	27.7	74	168.8	42.3	-34	227.0	56.9	94	285.2	71.4
55	53.4	13.4	15	111.6	27.9	75	169.8	42.5	35	228.0	57.1	95	286.2	71.7
- 56 57	04.3 55.2	13.6	$\frac{16}{17}$	112.5 112.5	28.2 28.1	76	170.7	42.8	36 27	228.9	57.8	96	287.1	72.9
58	56.3	13.8 14.1	18	113.5	$\frac{20.4}{28.7}$	78	172.7	43.3	38	230.9	57.8	98	289.1	72.4
59	57.2	14.3	19	115.4	28.9	79	173.6	43.5	39	231.8	58.1	99	290.9	72.7
60	58.2	14.6	20	116.4	29.2	80	174.6	43.7	40	232.8	58.3	300	291.0	72.9
Dist	Den	Let	Dist	Dep	Lat	Dist	Den	Lat	Dist	Den	Lat	Dist	Den	Lat
F	VF 3 F	and th	F	SE 3 F	1	W	VW 3 V	V	T	VSW 3	W	Г. Г.	for 63 P	ointe
E.	L. 4 L	•	Ľ	or. 4 r.		11 1		••	,	1011.4		L I	01 04 F	onns.
						T	ABLE	1.					[Page	357
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	V	by F	I F	Differen	ce of L	atitud W 1	e and D W	epartu:	re for by E	$1\frac{1}{2}$ Point	ts.	by U	* 1 W	
Dist]	N Let	Den	Dist.	Lat.	Den.	Dist.	Lat.	Dep.	Dist.	Lat.	Dep.	Dist.	• 2 • • •	Dep.
Dist.						1.01			101	170.0		0.11		=0.0
1	$\frac{1.0}{1.0}$	0.3	$\begin{array}{c} 61 \\ 62 \end{array}$	58.4 59.3	17.7	$\frac{121}{22}$	115.8 116.7	35.1 35.4	181 82	173.2 174.2	52.5 52.8	$\frac{241}{42}$	230.6 231.6	70.0 70.2
$\tilde{3}$	2.9	0.9	63	60.3	18.3	23	117.7	35.7	83	175.1	53.1	43	232.5	70.5
4	3.8	1.2	64	61.2	18.6	24	118.7	36.0	84	176.1	53.4	44	233.5	70.8
5	4.8	$\frac{1.5}{1.7}$	$\begin{array}{c} 65\\ cc\end{array}$	62.2	18.9	25	119.6	$\frac{36.3}{26.6}$	85	177.0 178.0	53.7	45	234.5	71.1
0 7	0.7 6.7	$\frac{1.7}{2.0}$	67	63.2 64.1	19.2	20	120.6 121.5	36.9	87	178.0	54.3	40	236.4 236.4	71.7
8	7.7	2.3	68	65.1	19.7	28	122.5	37.2	88	179.9	54.6	48	237.3	72.0
9	8.6	2.6	69	66.0	20.0	29	123.4	37.4	89	180.9	54.9	49	238.3	72.3
10	9.6	2.9		67.0	20.3	$\frac{30}{101}$	124.4	37.7	90	181.8	55.2	50	239.2	72.6
11	10.5 11.5	$\frac{3.2}{3.5}$	$\begin{bmatrix} 71 \\ 72 \end{bmatrix}$	67.9 68.9	20.6	$\frac{131}{39}$	125.4 126.3	$\frac{38.0}{38.2}$	191	182.8 183.7	55.4 55.7	251 52	240.2 941.1	$\frac{72.9}{73.2}$
$12 \\ 13$	12.4	$\frac{3.9}{3.8}$	$\frac{72}{73}$	69.9	20.3 21.2	33	120.3 127.3	38.6	93	183.7	56.0	53	241.1 242.1	73.4
14	13.4	4.1	74	70.8	21.5	- 34	128.2	38.9	94	185.6	56.3	54	243.1	73.7
15	14.4	4.4	75	71.8	21.8	35	129.2	39.2	95	186.6	56.6	55	244.0	74.0
$\frac{16}{17}$	15.3 16.3	4.6	$\frac{76}{77}$	72.7	22.1 22.1	36	130.1 131 1	39.5	96 97	187.6	57.9		245.0	74.3
18	$10.3 \\ 17.2$	5.2	78	74.6	22.4 22.6	38	131.1 132.1	40.1	98	189.5	57.5	58	246.9	74.9
19	18.2	5.5	79	75.6	22.9	39	133.0	40.3	- 99	190.4	57.8	59	247.8	75.2
20	19.1	5.8	80	76.6	23.2	40	134.0	40.6	200	191.4	58.1	60	248.8	75.5
21	20.1	$\frac{6.1}{6.1}$	81	77.5	23.5	141	134.9 125.0	40.9	$201 \\ 02$	192.3	58.3	$261 \\ 69$	249.8	75.8
$\frac{22}{23}$	$\frac{21.1}{22.0}$	6.4	82 83	78.5	23.8 24 1	42	135.9 136.8	41.2 41.5	02	195.5	58.0 58.9	62	250.7	$\frac{70.1}{76.3}$
24	23.0	7.0	84	80.4	24.4	44	137.8	41.8	04	195.2	59.2	64	252.6	76.6
25	23.9	7.3	85	81.3	24.7	45	138.8	42.1	05	196.2	59.5	65	253.6	76.9
26	24.9	7.5	86	82.3	25.0	46	139.7	42.4	06	197.1	59.8	66 67	254.5	77.2
28	20.8 26.8	81	88	84 9	20.5 25.5	47	140.7	43.0	08	198.1	60.1	68	256 5	77.8
29	27.8	8.4	89	85.2	25.8	49	142.6	43.3	09	200.0	60.7	69	257.4	78.1
30	28.7	8.7	90	86.1	26.1	50	143.5	43.5	10	201.0	61.0	_70	258.4	78.4
31	29.7	9.0	91	87.1	26.4	151	144.5	43.8	211	201.9	61.3	271	259.3	78.7
$\frac{32}{33}$	30.6	9.3	92	88.0	26.7	$\frac{52}{52}$	145.5	44.1	12	202.9 203.8	61.5 61.8	$\frac{72}{73}$	260.3	79.0
34	32.5	9.9	94	90.0	$\frac{27.0}{27.3}$	54	140.4	44.7	14	203.8	62.1	74	261.2 262.2	79.5
35	. 33. 5	10.2	95	90.9	27.6	55	148.3	45.0	15	205.7	62.4	75	263, 2	79.8
36 .	34.4	10.5	96	91.9	27.9	56	149.3	45.3	16	206.7	62.7	76	264.1	80.1
37	30.4	10.7	91	92.8	28.2 28.1	07 59	150.2 151.9	45.6	17	207.7	63.0	11	265.1	80.4
39	37.3	11.3	99	94.7	28.7	59	151.2 152.2	46.2	19	209.6	63.6	79	260.0 267.0	81.0
40	38.3	11.6	100	95.7	29.0	60	153.1	46.4	20	210.5	63.9	80	267.9	81.3
41	39.2	11.9	101	96.7	29.3	161	154.1	46.7	221	211.5	64.2	281	268.9	81.6
42	40.2	12.2 19.5	$\begin{bmatrix} 02\\ 02 \end{bmatrix}$	97.6	29.6		155.0 156.0	47.0	22	212.4	64.4	82	$ 269.9 \\ 270.9 $	81.9
43	42.1	12.9 12.8	03	98.0 99.5	$\frac{29.9}{30.2}$	03 64	156.0 156.9	47.6	$\frac{23}{24}$	213.4 214.4	65.0	83 84	270.8 271.8	82.4
45	43.1	13.1	05	100.5	30.5	65	157.9	47.9	$\tilde{25}$	215.3	65.3	85	272.7	82.7
46	44.0	13.4	06	101.4	30.8	66	158.9	48.2	26	216.3	65.6	86	273.7	83.0
47	45.0	13.6	07	102.4	31.1 31.4	67 69	159.8	48.5	27	217.2	66.9	87	274.6	83.3
49	46.9	14.2	08	105.3 104.3	31.4	08 69	160.8 161.7	49.1	28	218.2 219.1	$\begin{bmatrix} 00.2\\ 66.5 \end{bmatrix}$	89	275.0	83.9
50	47.8	14.5	10	105.3	31.9	70	162.7	49.3	30	220.1	66.8	90	277.5	84.2
51	48.8	14.8	111	106.2	32.2	171	163.6	49.6	231	221.1	67.1	291	278.5	84.5
52	49.8	15.1	12	107.2	32.5	72	164.6	49.9	32	222.0	67.3	92	279.4	84.8
- 03 54	00.7 51.7	15.4	$13 \\ 14$	108.1	32.8	$73 \\ 74$	165.6 166.5	50.2	33	223.0 222.0	67.6	93	280.4	85.1
55	52.6	16.0	15	110.0	33.4	75	167.5	50.8	35	224.9	68.2	95	282.3	85.6
56	53.6	16.3	16	111.0	33.7	76	168.4	51.1	36	225.8	68.5	96	283.3	85.9
57	54.5	16.5	17	112.0	34.0	77	169.4	51.4	37	226.8	68.8	97	284.2	86.2
- 58 59	00.0 56.5	16.8	18	112.9	34.3	78	170.3 171.2	52 0	38	227.8 228.7	69.1	98	285.2 286.1	86.5
60	57.4	17.4	20	114.8	34.8	80	172.2	52.3	40	229.7	69.7	300	287.1	87.1
				1										
Dist.	Dep.	Lat.	Dist.	Dep.	Lat.	Dist.	Dep.	Lat.	Dist.	Dep.	Lat.	Dist.	Dep.	Lat.
EN	$\mathbf{E} \cdot \frac{1}{2} \mathbf{E} \cdot$		ESI	E. ½ E.		WN	W. $\frac{1}{2}$ W		WS	SW. $\frac{1}{2}$ W	<i>v</i> .	[]	For $6\frac{1}{2}$ P	oints.

Pa	ge 358]				I	ABL	E 1.						
			73 0 1	Differen	ice of L	atitud	le and I)epartu	re for	1 ³ / ₄ Poin	ts.			
		N. by	E. 4 J	E.	N. by	W. 4	W.	S. by	E. 4	E.	S. by	W. 4	N.	
Dist.	Lat.	Dep.	Dist.	Lat.	Dep.	Dist.	Lat.	Dep.	Dist.	Lat.	Dep.	Dist.	Lat.	Dep.
1	0.9	0.3	61	57.4	20.6	121	113.9	40.8	181	170.4	61.0	241	226.9	81.2
2	1.9	0.7	62	58.4	20.9	.22	114.9	41.1	82	171.4	61.3	42	227.9	81.5
3	2.8	1.0	63	59.3	21.2	23	115.8	41.4	83	172.3	61.7	43	228.8	81.9
4	3.8	1.3	64	60.3	21.6	24	116.8	41.8	84	173.2	62.0	44	229.7	82.2
5	4.7	1.7	6 5 .	61.2	21.9	25	117.7	42.1	80	174.2	62.3	45	230.7	82.5
2	0.0	2.0	67	$\begin{array}{c} 02.1\\ 62.1\end{array}$	22.2	20	118.0	42.4	80	170.1 176.1	62.7	40	231.0	82.9
ŝ	7.5	2.4	68	64 0	22.0	28	120.5	43 1	88	177 0	63 3	48	232.0	83 5
9	8.5	3.0	69	65.0	23.2	29	121.5	43.5	89	178.0	63.7	49	234.4	83.9
10	9.4	3.4	70	65.9	23.6	30	122.4	43.8	- 90	178.9	64.0	50	235.4	84.2
11	10.4	3.7	71	66.8	23.9	131	123.3	44.1	191	179.8	64.3	251	236.3	84.6
12	11.3	4.0	72	67.8	24.3	32	124.3	44.5	92	180.8	64.7	52	237.3	84.9
13	12.2	4.4	73	68.7	24.6	33	125.2	44.8	93	181.7	65.0	53	238.2	85.2
14	13.2	4.7	74	69.7	24.9	34	126.2	45.1	94	182.7	65.4	54	239.2	85.6
10	14.1	0.1	$\frac{73}{76}$	70.0	20.0	- 00 - 26	127.1	40.0	95	183.0	66 0	- 00 - 56	240.1	80.9
17	16.1	57	77	72.5	25.0	37	120.0 129.0	46.2	97	185.5	66 4	57	241.0	86 6
18	16.9	6.1	78	73.4	26.3	- 38	129, 9	46.5	98	186.4	66.7	58	242.9	86.9
19	17.9	6.4	79	74.4	26.6	39	130.9	46.8	99	187.4	67.0	59	243.9	87.3
20	18.8	6.7	80	75.3	27.0	40	131.8	47.2	200	188.3	67.4	60	244.8	87.6
21	19.8	7.1	81	76.3	27.3	141	132.8	47.5	201	189.3	67.7	261	245.7	87.9
22	20.7	7.4	82	77.2	27.6	42	133.7	47.8	02	190.2	68.1	62	246.7	88.3
23	21.7	7.7	83	78.1	28.0	43	134.6	48.2	03	191.1	68.4	63	247.6	88.6
24	22.0	8.1	84	19.1 80.0	28.3	44	130.0	48.0	04	192.1	60 1	04	248.0	88.9
20	20.0	8.8	86	81 0	20.0	46	130.5 137.5	49.2	06	193.0	69.4	66	249.5	89.6
$\frac{10}{27}$	25.4	9.1	87	81.9	29.3	47	138.4	49.5	07	194.9	69.7	67	251.4	89.9
28	26.4	9.4	88	82.9	29.6	48	139.3	49.9	08	195.8	70.1	68	252.3	90.3
29	27.3	9.8	- 89	83.8	30.0	49	140.3	50.2	- 09	196.8	70.4	69	253.3	90.6
30	28.2	. 10. 1	90	84.7	30.3	50	141.2	50.5	10	197.7	70.7	70	254.2	91.0
$\frac{31}{22}$	29.2	10.4	91	85.7	30.7	151	142.2	50.9	211	198.7	71.1	271	255.2	91.3
32	30.1	10.8	92	86.6	31.0	52	143.1	51.2	12	199.6	71.4	72	256.1	91.6
- 00 - 24	32.0	11.1	95	88 5	31.3 $ 31.7$	54	144.1	51.9 51.9	10	200.5	72 1	7.1	258 0	92.0
35	33.0	11.8	95	89.4	32.0	55	145.9	52.2	$1\frac{17}{15}$	201.0	72.4	75	258.9	92.6
36	33.9	12.1	96	90.4	32.3	56	146.9	52.6	16	203.4	72.8	76	259.9	93.0
37	34.8	12.5	97	91.3	32.7	57	147.8	52.9	17	204.3	73.1	77	260.8	93.3
38	35.8	12.8	98	92.3	33.0	58	148.8	53.2	18	205.3	73.4	78	261.7	93.7
39	36.7	13.1	99	93.2	33.4	59	149.7	53.6	19	206.2	73.8	79	262.7	94.0
40	$\frac{31.1}{99.6}$	$\frac{13.0}{19.0}$	100	94.2	$\frac{33.1}{94.0}$	100	150.0	51.9	20	207.1	74.1	80	203.0	94.3
41 / 49	38.0	13.8	101	95.1	34.0	101	101.0	04.2 54.6	221	208.1	74.0	281	204.0	94.7
43	40.5	14.1	02	97.0	34 7	63	153.5	54 9	23	210 0	75 1	83	266.5	95.0
44	41.4	14.8	04	97.9	35.0	64	154.4	55.2	24	210.9	75.5	84	267.4	95.7
45	42.4	15.2	05	98.9	35.4	65	155.4	55.6	25	211.8	75.8	85	268.3	96.0
46	43.3	15.5	06	99.8	35.7	66	156.3	55.9	26	212.8	76.1	86	269.3	96.4
47	44.3	15.8	07	100.7	36.0	67	157.2	56.3	27	213.7	76.5	87	270.2	96.7
48	40.2	16.2	08	101.7	36.4	68	158.2	50.0	28	214.7	76.8	88	271.2	97.0
49 50	40.1	16.8	10	102.0	30.7	70	169.1 160.1	57 3	29	215.0	77 5	90	272.1 273.0	97.4
51	18 0	17.9	111	101.5	27 4	171	161.0	57 6	921	210.0	77.8	901	273.0	08.0
52	49.0	17.5	12	105.5	37 7	$\frac{171}{72}$	161.0	57.9	32	218 4	78.2	92	274 9	98.0
53	49.9	17.9	13	106.4	38.1	73	162.9	58.3	33	219.4	78.5	93	275.9	98.7
54	50.8	18.2	14	107.3	38.4	74	163.8	58.6	34	220.3	78.8	94	276.8	99.0
55	51.8	18.5	15	108.3	38.7	75	164.8	59.0	35	221.3	79.2	95	277.8	99.4
56	52.7	18.9	16	109.2	39.1	76	165.7	59.3	36	222.2	79.5	96	278.7	99.7
07 59	03.7 51.0	19.2	17	110.2	39.4	11	165.7	59.6	37	223.1 99.1 1	19.8	97	279.6	100.1
59	55 6	19.0	10	112.0	40 1	70	168.5	60.0	30	224.1	80.2	90	280.0	100.4
60	56.5	20.2	20	113.0	40.4	80	169.5	60.6	40	226.0	80.9	300	282.5	101.1
Dist	Don	Lot	Dist	Der	Let	Dist	Don	Let	Dist	Den	Let	Dist	Den	Lat
Trist.	ENE 1	E E	I Dist.	ESE 11	Lat.	Dist.	VNW 1	W.	Dist.	USW 1	W.	FF	or 61 Po	ints
	101112- 3	13.		1. T. T. T.	4.	,						. [1	01 04 10	11105.

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Difference of Latitude and Departure for 2 Points.

		NN	IE.		N	W.		S	SE.		SS	W.		
Dist.	Lat.	Dep.	Dist.	Lat.	Dep.	Dist.	Lat.	Dep.	Dist.	Lat.	Dep.	Dist.	Lat.	Dep.
1	0.9	0.4	61	56.4	23.3	121	111.8	46.3	181	167.2	69.3	241	222.7	92.2
2	1.8	0.8	62	57.3	23.7	22	112.7	46.7	82	168.1	69.6 70.0	42	223.6	92.6
3	2.8	1.1	63	58.2	24.1	23	113.6	47.1	83	169.1	70.0	43	224.5	93.0
4	3.7	1.5	64	59.1	24.5	24	114.6	47.5	84	170.0	70.4	44	220.4	93.4
. 9	4.6	1.9	65	60.1	24.9	25	110.0	41.8	80	170.9	70.8	40	226.4	93.8
ō	0.0	2.3	00	01.0 61.0	20.3	20	110.4	40.2	80	179.9	71.6	40	221.0	94.1
6	0.0	2.1	01 60	60.9	20.0	21	110.2	40.0	01	172.0 172.7	71.0	41	220.2	94.0
0	6.4	0.1 2.1	- 00 - 60	62.0	20.0 26.4	20	110.0	10 1	80	174 6	72.3	10	229.1	94.9
10	0.0	38		61 7	26.4	30	190 1	19.7	90	175.5	72.7	50	231 0	95.7
-11	10.2	1.9	-71	65.6	97.9	121	120.1	50.1	101	176.5	72 1	251	201.0	06.1
12	10.2 11 1	4.2	72	66.5	27 6	32	121.0 122.0	50.1 50.5	92	177 4	73.1	52	232.8	96.1
$\frac{12}{13}$	12.1	5.0	73	67.4	27.9	33	122.0	50.9	93	178.3	73.9	53	233.7	96.8
14	12.9	5.4	74	68.4	28.3	34	123.8	51.3	94	179.2	74.2	54	234.7	97.2
15	13.9	5.7	75	69.3	$\frac{1}{28.7}$	35	124.7	51.7	95	180.2	74.6	55	235.6	97.6
16	14.8	6.1	76	70.2	29.1	36	125.6	52.0	96	181.1	75.0	56	236.5	98.0
17	15.7	6.5	77	71.1	29.5	37	126.6	52.4	97	182.0	75.4	57	237.4	98.3
18	16.6	6.9	78	72.1	29.8	38	127.5	52.8	98	182.9	75.8	58	238.4	98.7
19	17.6	7.3	79	73.0	30.2	- 39	128.4	53.2	- 99	183.9	76.2	59	239.3	99.1
20	18.5	7.7	80	73.9	30.6	40	129.3	53.6	200	184.8	76.5	60	240.2	99.5
21	19.4	8.0	81	74.8	31.0	141	130.3	54.0	201	185.7	76.9	261	241.1	99.9
22	20.3	8.4	82	75.8	31.4	42	131.2	54.3	02	186.6	77.3	62	242.1	100.3
23	21.2	8.8	83	76.7	31.8	43	132.1	54.7	03	187.5	77.7	63	243.0	100.6
24	22.2	9.2	84	77.6	32.1	44	133.0	55.1	04	188.5	78.1	64	243.9	101.0
25	23.1	9.6	85	78.5	32.5	45	134.0	55.5	05	189.4	78.5	65	244.8	101.4
26	24.0	9.9	86	79.5	32.9	46	134.9	55.9	06	190.3	78.8	66	245.8	101.8
27	24.9	10.3	87	80.4	33.3	47	135.8	56.3	07	191.2	79.2	67	246.7	102.2
28	25.9	10.7	88	81.3	33.7	48	130.7	57.0	08	192. Z	19.6	68	247.6	102.6
29	20.8	11.1	89	82.2 99.1	34.1	49	131.1	57.0	10	195.1	80.0	09	248.0	102.9
- 00	21.1	$\frac{11.0}{11.0}$	- 90	00.1	04.4	151	100.5	57.4	- 10	101.0	00.4	- 10	249.4	100.0
31	28.0	11.9	91	84.1	34.8	101	139.0	01.8 50 0	$\frac{211}{10}$	194.9	80.7	$\frac{271}{79}$	200.4	103.7
- ∂⊿ - 99	29.0	12.2	92	85.0	00. 4 95. 6	- 04 - 52	140.4	50.4 50.6	12	106 9	01.1 91.5	$\frac{12}{79}$	201.0	104.1
21	30.0	12.0	0.1	86.8	36.0	51	141.4	58.0	14	190.8	81.0	74	252.2	104.0
35	32.3	13.0	95	87.8	36.0	55	142.0 143.2	59.3	15	198 6	82.3	75	254 1	105.2
36	33 3	13.8	96	88 7	36.7	56	144 1	59 7	16	199 6	82 7	76	255 0	105 6
37	34.2	14.2	97	89.6	37.1	57	145.0	60.1	17	200.5	83.0	77	255.9	106.0
38	35.1	14.5	98	90.5	37.5	58	146.0	60.5	18	201.4	83.4	78	256.8	106.4
39	36.0	14.9	99	91.5	37.9	59	146.9	60.8	19	202.3	83.8	79	257.8	106.8
40	37.0	15.3	100	92.4	38.3	60	147.8	61.2	20	203.3	84.2	80	258.7	107.2
41	37.9	15.7	101	93.3	38.7	161	148.7	61.6	221	204.2	84.6	281	259.6	107.5
42	38.8	16.1	02	94.2	39.0	62	149.7	62.0	22	205.1	85.0	82	260.5	107.9
43	39.7	16.5	03	95.2	39.4	63	150.6	62.4	-23	206.0	85.3	83	261.5	108.3
44	40.7	16.8	04	96.1	39.8	64	151.5	62.8	24	206.9	85.7	84	262.4	108.7
45	41.6	17.2	05	97.0	40.2	65	152.4	63.1	25	207.9	86.1	85	263.3	109.1
46	42.5	17.6	06	97.9	40.6	66	153.4	63.5	26	208.8	86.5	86	264.2	109.4
47	43.4	18.0	07	98.9	40.9	67	154.3	63.9	27	209.7	86.9	87	265.2	109.8
48	44.3	18.4	08	99.8	41.3	68	150.2	64.3	28	210.6	87.3	88	265.1	110.2
49	40.5	18.8 10.1	10	100.7	41.7	- 69 - 70	150.1	04.7	29	211.0	81.0	89	207.0	110.0
- 50	40.4	19.1	10	101.0	42.1	170	157.1	00.1	- 00	212.0	00.0	- 90	207.9	111.0
- 51 - 59 -	47.1	19.0	111	102.6	42.0	171	158.0	00.4	231	213.4	88.4	291	268.8	111.4
52	40.0	19.9	12	105.5	42.9	12	150.9	00.8	- 32 - 99	214.0	00.0	92	209.8	111.7
5.1	10 0	20. 5	1.0	104.4	40.2 12 R	7.1	160 9	66 B	- 00 - 2.1	210.0	80.5	0.1	270.7	110 5
55	50.8	21 0	15	109.0	11 0	75	161 7	67 0	35	210.2	89.0	95	272 5	112.0
56	51.7	21.0 21.4	16	107.2	44 4	76	162.6	67 4	36	218.0	90.3	96	273 5	112.9
57	52.7	21.8	17	108 1	44.8	77	163 5	67.7	37	219.0	90.7	97	274.4	113.7
58	53.6	22.2	18	109.0	45.2	78	164.5	68.1	- 38	219.9	91.1	- 98	275.3	114.0
59	54.5	22.6	19	109.9	45.5	79	165.4	68.5	- 39	220.8	91.5	99	276.2	114.4
60	55.4	23.0	20	110.9	45.9	80	166.3	68.9	40	221.7	91.8	300	277.2	114.8
Dist.	Dep.	Lat.	Dist.	Dep.	Lat,	Dist.	Dep.	Lat.	Dist.	Dep.	Lat.	Dist.	Dep.	Lat.
	ENE.			ESE.			WNW			WSW		[F	or 6 Poi	nts.

Dec	TA 960	1				T	ADIE	-1						
raį	5e 200	J		Difform	oo of T	1 atitud	ADLE	L.	ro for	91 Poin	ta			
		NNE	. 1 E.	Differen	NNW	. ‡ W	ie and L	SSE.	+ E.	24 F0III	SSW.	ŧw.		
Dist.	Lat.	Dep.	Dist.	Lat.	Dep.	Dist.	Lat.	Dep.	Dist.	Lat.	Dep.	Dist.	Lat.	Dep.
1	0.0	0.1		55 1	96.1	191	100 1	51 7	101	169 6	77.4	011	917 0	102.0
$\frac{1}{2}$	0.9	0.4	$61 \\ 62$	55.1 56.0	20.1 26.5	$\frac{121}{22}$	109.4 110.3	51.7 52.2	82	103.0 164.5	77.8	$\frac{241}{42}$	217.9 218.8	103.0 103.5
3	2.7	1.3	63	57.0	26.9	23	111.2	52.6	83	165.4	78.2	43	219.7	103.9
4 5	3.6	1.7	04 65	58 S	27.4	$\frac{24}{25}$	112.1	53.0 53.1	84	166.3 167.9	78.7	44	220.6 221.5	104.3
6	5.4	2.6	66	59.7	28.2	$\frac{26}{26}$	113.9	53.9	86	168.1	79.5	46	221.0 222.4	104.8 105.2
7	6.3	3.0	67	60.6	28.6	27	114.8	54.3	87	169.0	80.0	47	223.3	105.6
8	$\frac{7.2}{8.1}$	$3.4 \\ 3.8$	$\frac{68}{69}$	61.5 62.4	29.1 29.5	$\frac{28}{29}$	115.7 116.6	04.7 55.2	88 89	169.9 170.9	80.4	48 49	224.2 925.1	106.0 106.5
10	9.0	4.3	70	63.3	29.9	30	117.5	55.6	90	171.8	81.2	50	226.0	106.9
11	9.9	4.7	$\frac{71}{79}$	64.2	30.4	131	118.4	56.0	191	172.7	81.7	251	226.9	107.3
12 13	10.8	$5.1 \\ 5.6$	$\frac{72}{73}$	66.0	30.8 31.2	$\frac{52}{33}$	119.5 120.2	56.4 56.9	92 93	173.0 174.5	82.1 82.5	$\frac{52}{53}$	227.8 228.7	107.7 108.2
14	12.7	6.0	74	66.9	31.6	34	121.1	57.3	94	175.4	82.9	54	229.6	108.6
$15 \\ 16$	13.6 14.5	6.4	75 76	67.8	32.1	35	122.0 122.0	57.7	95 06	176.3	83.4	55 56	230.5	109.0
17	15.4	7.3	77	69. 6	32.9 32.9	37	122.9 123.8	58.6	97	178.1	84.2	57	231.4 232.3	109.9 109.9
18	16.3	7.7	78	70.5	33.3	38	124.8	59.0	98	179.0	84.7	58	233.2	110.3
$\frac{19}{20}$	17.2	8.1	79 80	71.4 72.3	33.8	39	125.7 126.6	59.4 50.0	99	179.9	85.1	59 60	234.1 235.0	$ 110.7 \\ 111.9 $
$\frac{20}{21}$	$\frac{10.1}{19.0}$	9.0	$\frac{00}{81}$	$\frac{72.0}{73.2}$	34.6	141	120.0 127.5	60.3	200	181.7	85.9	261	$\frac{235.0}{235.9}$	111.6
22	19.9	9.4	82	74.1	35.1	42	128.4	60.7	02	182.6	86.4	62	236.8	112.0
$23 \\ 21$	20.8 21.7	9.8	83 81	75.0	35.5	43	129.3 130.2	61.1 61.6	03	183.5	86.8 87.2	$63 \\ 64$	237.7 238.7	$ 112.4 \\ 112.9$
25	22.6	10.7	85	76.8	36.3	45	131.1	62.0	05	185.3	87.6	65	239.6	113.3
26	23.5	11.1	86	77.7	36.8	46	132.0	62.4	06	186.2	88.1	66	240.5	113.7
$\frac{27}{28}$	24.4 25.3	11.5 12.0	87 88	78.6	37.2 37.6	41	132.9 133.8	62.9 63.3	07	187.1 188.0	88.9	68	241.4 242.3	114.2 114.6
29	26.2	12.4	89	80.5	38.1	49	134.7	63.7	09	188.9	89.4	69	243.2	115.0
$\frac{30}{91}$	$\frac{27.1}{27.1}$	12.8	$\frac{90}{01}$	81.4	38.5	$\frac{50}{151}$	135.6	$\frac{64.1}{64.2}$	10	189.8	89.8	70	244.1	115.4
$\frac{31}{32}$	28.0 28.9	13.3 13.7	$\frac{91}{92}$	82.3 83.2	38.9	$\frac{151}{52}$	136.5	64.6 65.0	$\frac{211}{12}$	190.7	90.2	$\frac{271}{72}$	245.0 245.9	115.9 116.3
33	29.8	14.1	93	84.1	39.8	53	138.3	65.4	13	192.5	91.1	73^{-1}	246.8	116.7
$\frac{34}{35}$	30.7	14.5 15.0	$94 \\ 05$	85.0	40.2	54	139.2 140.1	65.8	14	193.5	91.5	$\frac{74}{75}$	247.7	$ 117.2 \\ 117.6 $
36 36	31.0 32.5	15.4	$\frac{35}{96}$	86.8	41.0	$56 \\ 56$	140.1	66.7	$10 \\ 16$	195.3	92.4	76	249.5	118.0
37	33.4	15.8	97	87.7	41.5	57	141.9	67.1	17	196.2	92.8	77	250.4	118.4
38	$\frac{34.4}{35.3}$	$16.2 \\ 16.7$	98 98	88.6	41.9 42.3	58 59	142.8 143.7	67.6	18	197.1	93.2	78	251.3 252.2	$ 118.9 \\ 119.3$
40	36.2	17.1	100	90.4	42.8	60	143.7	68.4	$\frac{13}{20}$	198.9	94.1	80	253.1	119.5
41	37.1	17.5	101	91.3	43.2	161	145.5	68.8	221	199.8	94.5	281	254.0	120.1
42	38.0 38.0	18.0	$02 \\ 03$	92.2	43.6	62 63	146.4	69.3 69.7	22	200.7	94.9	82 83	254.9 255.8	120.6 121.0
44	39.8	18.8	04	94.0	44.5	64	148.3	70.1	24	202.5	95.8	84	256.7	121.4
45	40.7	19.2	05	94.9	44.9	65	149.2	70.5	25	203.4	96.2	85	257.6	121.9
$\frac{46}{47}$	$41.6 \\ 42.5$	19.7 20.1	06	95.8	45.3	66 67	150.1 151.0	71.0	$\frac{26}{27}$	204.3 205.2	96.6	86 87	258.5 259.4	122.3 122.7
48	43.4	20.5	08	97.6	46.2	68	151.9	71.8	28	206.1	97.5	88	260.3	123.1
49	44.3	21.0	09	98.5	46.6	69	152.8	72.3	29	207.0	97.9	89	261.3	123.6
51	$\frac{45.2}{16.1}$	$\frac{21.4}{21.8}$	$\frac{10}{111}$	99.4	$\frac{47.0}{47.5}$	$\frac{70}{171}$	$\frac{153.7}{154.6}$	$\frac{12.1}{73.1}$	$\frac{30}{931}$	$\frac{207.9}{208.8}$	$\frac{98.3}{98.8}$	90	$\frac{262.2}{263.1}$	124.0
$51 \\ 52$	40.1	22.2	$111 \\ 12$	100.3	47.9	72	155.5	73.5	$\frac{231}{32}$	203.3 209.7	99.2	92	263.1 264.0	124.8
53	47.9	22.7	13	102.2	48.3	73	156.4	74.0	33	210.6	99.6	93	264.9	125.3
04 55	48.8 49.7	23.1 23.5	14	103.1 104 0	48.7	74	157.3 158.2	74.4	34 35	211.5 212.4	100.0 100.5	94 95	265.8 266.7	120.7 126.1
56	50.6	23.9	16	104.9	49.6	76	159.1	75.2	36	213.3	100.9	96	267.6	126.6
57	51.5	24.4	17	105.8	50.0	77	160.0	75.7	37	214.2	101.3	97	268.5	127.0
	52.4 53.3	24.8	18 19	106.7	50.9	$\frac{78}{79}$	160.9 161.8	70.1 76.5	- 38 - 39	215.1 216.1	101.8 102.2	98 99	209.4 270.3	127.4 127.8
60	54.2	25.7	20	108.5	51.3	80	162.7	77.0	40	217.0	102.6	300	271.2	128.3
Dist.	Dep.	Lat.	Dist.	Dep.	Lat.	Dist.	Dep.	Lat.	Dist.	Dep.	Lat.	Dist.	Dep.	Lat.
NE	L by E	3 E.	SF	by E	3 E.	NI	by W	3 W	SW	by W	3 W.	Г	For 53 P	oints.

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·						 Г	ABLE	C 1.					Page	361
				Differer	nce of T	atitud	le and I)epartu	re for	21 Poin	ts.		[001
		NNE	.] E.	21110101	NNW	7. 12 W		SSE.	$\frac{1}{2}$ E.	-2 - 01-	SSW.	$\frac{1}{2}$ W.		
Dist.	Lat.	Dep.	Dist.	Lat.	Dep.	Dist.	Lat.	Dep.	Dist.	Lat.	Dep.	Dist.	Lat.	Dep.
	· · ·	0.5		= 0 0	00 0	101	102 7	57.0	101	150 8	05 9	0.11	010 5	110.0
$\frac{1}{2}$	$0.9 \\ 1.8$	0.5	$61 \\ 62$	53.8	28.8 29.2	$\frac{121}{22}$	106.7 107.6	57.5	82	159.0 160.5	85.8	42	212.5 213.4	113.0
3	2.6	1.4	63	55.6	29.7	23	108.5	58.0	83	161.4	86.3	43	214.3	114.5
4 5	3.5	1.9	64 65	56.4	30.2 30.6	$\frac{24}{25}$	109.4	58.5	84	162.3 163.2	86.7	44	215.2 216.1	115.0 115.5
$\begin{bmatrix} 0\\6\end{bmatrix}$	$\frac{4.4}{5.3}$	$2.4 \\ 2.8$	66	58.2	31.1	$\frac{20}{26}$	111.1	59.4	86	164.0	87.7	46	210.1 217.0	115.5 116.0
7	6.2	3.3	67	59.1	31.6	27	112.0	59.9	87	164.9	88.2	47	217.8	116.4
8	7.1	3.8	68 69	60.0	32.1 32.5	28	112.9	60.3	88	160.8 166.7	88.6	48	218.7	116.9
10	8.8	4.7	70	61.7	33.0	30	114.6	61.3	90	167.6	89.6	50	220.5	117.8
11	9.7	5.2	71	62.6	33.5	131	115.5	61.8	191	168.4	90.0	251	221.4	118.3
$12 \\ 12$	10.6	5.7	$\frac{72}{79}$	63.5	33.9	$\frac{32}{22}$	116.4	62.2	92	169.3	90.5	52	222.2	118.8
10	11.5 12.3	6.1	73	65.3	34.9	$\frac{33}{34}$	117.3 118.2	63.2	93	170.2	91.5	54	223.1 224.0	119.3 119.7
15	13.2	7.1	75	66.1	35.4	35	119.1	63.6	95	172.0	91.9	55	224.9	120.2
$16 \\ 17$	14.1	7.5	$\frac{76}{77}$	67.0	35.8	36	119.9	64.1	96	172.9	92.4	56 57	225.8	120.7
$\frac{17}{18}$	15.0 15.9	8.0	78	68.8	30.3	37	120.8 121.7	65.1	97	173.7	92.9 93.3	- 57 - 58	220.7 227.5	121.1 121.6
19	16.8	9.0	79	69.7	37.2	39	122.6	65.5	99	175.5	93.8	59	228.4	122.1
20	17.6	9.4	80	70.6	37.7	40	123.5	66.0	200	176.4	94.3	60	229.3	122.6
$\frac{21}{22}$	18.5	9.9	81	71.4	38.2	141	124.4 195.9	66.5	$201 \\ 02$	177.3 178.1	94.8	261	330.2 231 1	123.0 123.5
$\frac{22}{23}$	19.4 20.3	10.4 10.8	83	72.3 73.2	39.1	43	125.2 126.1	67.4	03	179.0	95.7	63	231.1 231.9	123.0
24	21.2	11.3	84	74.1	39.6	44	127.0	67.9	04	179.9	96.2	64	232.8	124.4
$25 \\ 26$	22.0	11.8	85	75.0	40.1	45	127.9	68.4	05	180.8	96.6	65 66	233.7	124.9
$\frac{20}{27}$	$\frac{22.9}{23.8}$	$12.5 \\ 12.7$	80 87	$75.8 \\ 76.7$	40.5	40	128.8 129.6	69.3	07	181.7 182.6	97.6	$\frac{00}{67}$	235.5	125.4 125.9
$\overline{28}$	24.7	13.2	88	77.6	41.5	48	130.5	69.8	08	183.4	98.1	68	236.4	126.3
$\frac{29}{20}$	25.6	13.7	89	78.5	42.0	49	131.4	70.2	09	184.3	98.5	69 70	237.2	126.8
$\frac{-30}{-31}$	$\frac{20.0}{97.3}$	$\frac{14.1}{14.6}$	$-\frac{90}{91}$	$\frac{79.4}{80.3}$	$\frac{+2.4}{49.9}$	$\frac{50}{151}$	$\frac{152.5}{133.9}$	71.2	211	$\frac{180.2}{186.1}$	99.0	$\frac{70}{271}$	$\frac{238.1}{239.0}$	$\frac{127.5}{127.7}$
32	$\frac{21.0}{28.2}$	15.1	92	81.1	43.4	52	134.1	71.7	12	187.0	99.9	72	239.9	128.2
33	29.1	15.6	93	82.0	43.8	53	134.9	72.1	13	187.8	100.4	73	240.8	128.7
34 35	30.0	16.0 16.5	94	82.9	44.3	- 04 55	130.8 136.7	72.6 73.1	14	188.7	100.9 101 4	74	241.6 242.5	129.2
36	31.7	17.0	96	84.7	45.3	56	137.6	73.5	16	190.5	101.8	76	243.4	130.1
37	32.6	17.4	97	85.5	45.7	57	138.5	74.0	17	191.4	102.3	77	244.3	130.6
38	33.5	17.9	98	86.4	46.2 46.7	58 59	139.3	74.5	18	192.3	102.8 103.2	78	240.2 246.1	131.0 131.5
40	35.3	18.9	100	88.2	47.1	60	141.1	75.4	20	194.0	103.7	80	246.9	132.0
41	36.2	19.3	101	89.1	47.6	161	142.0	75.9	221	194.9	104.2	281	247.8	132.5
$\frac{42}{12}$	37.0	19.8	$\frac{02}{02}$	90.0	48.1	62	142.9	76.4	$\frac{22}{22}$	195.8	104.7	82	248.7	132.9
44	37.9 38.8	20.3 20.7	04	91.7	49.0	64	144.6	77.3	$\frac{23}{24}$	197.6	105.1 105.6	84	249.0 250.5	133.4 133.9
45	39.7	21.2	05	92.6	49.5	65	145.5	77.8	25	198.4	106.1	85	251.3	134.3
$\frac{46}{47}$	40.6	21.7	$06 \\ 07$	93.5	50.0	66	146.4	78.3	$\frac{26}{27}$	199.3	106.5	86	252.2 252.1	134.8 125.2
48	42.3	22.2 22.6	08	95.2	50.4 50.9	68	147.3 148.2	79.2	$\frac{27}{28}$	200.2 201.1	107.0 107.5	88	253.1 254.0	135.3 135.8
49	43.2	23.1	09	96.1	51.4	69	149.0	79.7	29	202.0	107.9	89	254.9	136.2
50	44.1	$\frac{23.6}{21.0}$	10	97.0	51.9		149.9	80.1	30	202.8	108.4	90	255.8	136.7
$\frac{51}{52}$	45.0 45.9	24.0 24.5	111 19	97.9 98.8	52.3 52.8	171 79	150.8 151.7	80.6 81 1	231	203.7 204 6	$\begin{bmatrix} 108.9\\ 109.4 \end{bmatrix}$	291 99	256.6 257.5	137.2 137 e
53	46.7	25.0	13	99.7	53.3	73	152.6	81.6	33	205.5	109.8	93	258.4	138.1
54	47.6	25.5	14	100.5	53.7	74	153.5	82.0	34	206.4	110.3	94	259.3	138.6
- 55 - 56	48.5 49.1	25.9 26.4	$\frac{15}{16}$	101.4	$\begin{bmatrix} 54.2\\54.7 \end{bmatrix}$	70 76	154.3 155.2	82.5	35 36	207.3	$\begin{bmatrix} 110.8\\ 111.9 \end{bmatrix}$	95 96	260.2 261.0	139.1
57	50.3	26.9	17	103.2	55.2	77	156.1	83.4	37	209.0	111.7	97	261.9	140.0
58	51.2	27.3	18	104.1	55.6	78	157.0	83.9	38	209.9	112.2	98	262.8	140.5
- 59 - 60	52.0 52.0	27.8	19 20	104.9 105.9	56.1 56.6	79 80	157.9 158.7	84.4 81 a	39	210.8 211 7	112.7	- 99 300	263.7 261 6	140.9 141.4
	02.0	20.0	20	100.0	00.0		100.7	01.0	40	/ ، المدين	110.1	000	201.0	171,4
Dist.	Dep.	Lat.	Dist.	Dep.	Lat.	Dist.	Dep.	Lat.	Dist.	Dep.	Lat.	Dist.	Dep.	Lat.
NE	by E.	$\frac{1}{2}$ E.	SE	by E.	$\frac{1}{2}$ E.	NW	. by W.	$\frac{1}{2}$ W.	SW	. by W.	$\frac{1}{2}$ W.	[]	For $5\frac{1}{2}$ P	oints.

2.4

Pa	ge 362]]				Т	ABLE	1.						
	1	NNE. 3	E.	Differer	nce of I NNW.	Latitud ∦ W.	le and I	Dep <mark>artu</mark> SSI	re for E. 3 E	$2\frac{3}{4}$ Poin	ts. Si	SW. 3	W.	
Dist.	Lat.	Dep.	Dist.	Lat.	Dep.	Dist.	Lat.	Dep.	Dist.	Lat.	Dep.	Dist.	Lat.	Dep.
$\begin{array}{c}1\\2\\3\\4\\5\\6\end{array}$	$\begin{array}{c} 0.9\\ 1.7\\ 2.6\\ 3.4\\ 4.3\\ 5.1\\ 6.0\\ \end{array}$	$\begin{array}{c} 0.5 \\ 1.0 \\ 1.5 \\ 2.1 \\ 2.6 \\ 3.1 \\ 2.6 \end{array}$	61 62 63 64 65 66 67	52. 353. 254. 054. 955. 856. 657. 5	$\begin{array}{c} 31.4\\ 31.9\\ 32.4\\ 32.9\\ 33.4\\ 33.9\\ 24.4 \end{array}$	$ \begin{array}{r} 121 \\ 22 \\ 23 \\ 24 \\ 25 \\ 26 \\ 97 \end{array} $	$103.8 \\ 104.6 \\ 105.5 \\ 106.4 \\ 107.2 \\ 108.1 \\ 108.0 \\ 0 \\ 108.0 \\ 0 \\ 0 \\ 0 \\ 0 \\ 0 \\ 0 \\ 0 \\ 0 \\ 0 \\$	$\begin{array}{c} 62.\ 2\\ 62.\ 7\\ 63.\ 2\\ 63.\ 7\\ 64.\ 3\\ 64.\ 8\\ 65.\ 9\end{array}$	$ 181 \\ 82 \\ 83 \\ 84 \\ 85 \\ 86 \\ 67 7 $	$\begin{array}{c} 155.\ 2\\ 156.\ 1\\ 157.\ 0\\ 157.\ 8\\ 158.\ 7\\ 159.\ 5\\ 169.\ 4\end{array}$	93.193.694.194.695.195.6	$241 \\ 42 \\ 43 \\ 44 \\ 45 \\ 46 \\ 47$	$\begin{array}{c} 206.\ 7\\ 207.\ 6\\ 208.\ 4\\ 209.\ 3\\ 210.\ 1\\ 211.\ 0\\ 011.\ 0 \end{array}$	$123.9 \\124.4 \\124.9 \\125.4 \\126.0 \\126.5 \\127.0 \\$
	$ \begin{array}{r} 6.0 \\ 6.9 \\ 7.7 \\ 8.6 \\ \hline 9.4 \\ 10.3 \end{array} $	$ \begin{array}{r} 3.0 \\ 4.1 \\ 4.6 \\ 5.1 \\ \overline{5.7} \\ 6.2 \\ \end{array} $	$ \begin{array}{r} 68 \\ 69 \\ \overline{70} \\ \overline{71} \\ 72 \end{array} $	$ \begin{array}{r} 57.5 \\ 58.3 \\ 59.2 \\ 60.0 \\ \hline 60.9 \\ 61.8 \end{array} $	$ \begin{array}{r} 34.4\\ 35.0\\ 35.5\\ 36.0\\ \hline 36.5\\ 37.0\\ \end{array} $	$ \begin{array}{r} 28 \\ 29 \\ 30 \\ \overline{131} \\ 32 \end{array} $	$ \begin{array}{r} 108.9\\ 109.8\\ 110.6\\ 111.5\\ \hline 112.4\\ 113.2 \end{array} $	$\begin{array}{r} 63.3 \\ 65.8 \\ 66.3 \\ 66.8 \\ \hline 67.3 \\ 67.9 \end{array}$	87 88 89 90 191 92	$160.4 \\ 161.3 \\ 162.1 \\ 163.0 \\ \hline 163.8 \\ 164.7 \\ \hline$	96.196.797.297.798.298.7		$\begin{array}{r} 211.9\\ 212.7\\ 213.6\\ 214.4\\ \hline 215.3\\ 216.1 \end{array}$	$127.0 \\ 127.5 \\ 128.0 \\ 128.5 \\ 129.0 \\ 129.6 \\ 129.$
$ \begin{array}{r} 13\\ 14\\ 15\\ 16\\ 17\\ 18\\ 19\\ 20 \end{array} $	$\begin{array}{c} 11.2\\ 12.0\\ 12.9\\ 13.7\\ 14.6\\ 15.4\\ 16.3\\ 17.2 \end{array}$	$\begin{array}{c} 6.7\\ 7.2\\ 7.7\\ 8.2\\ 8.7\\ 9.3\\ 9.8\\ 10.3\end{array}$	73 74 75 76 77 78 79 80	$\begin{array}{c} 62.\ 6\\ 63.\ 5\\ 64.\ 3\\ 65.\ 2\\ 66.\ 0\\ 66.\ 9\\ 67.\ 8\\ 68.\ 6\end{array}$	$\begin{array}{c} 37.5\\ 38.0\\ 38.6\\ 39.1\\ 39.6\\ 40.1\\ 40.6\\ 41.1 \end{array}$	$ \begin{array}{c} 33 \\ 34 \\ 35 \\ 36 \\ 37 \\ 38 \\ 39 \\ 40 \end{array} $	$\begin{array}{c} 114.1\\ 114.9\\ 115.8\\ 116.7\\ 117.5\\ 118.4\\ 119.2\\ 120.1 \end{array}$	68. 4 68. 9 69. 4 69. 9 70. 4 70. 9 71. 5 72. 0	93 94 95 96 97 98 99 200	$\begin{array}{c} 165.5\\ 166.4\\ 167.3\\ 168.1\\ 169.0\\ 169.8\\ 170.7\\ 171.5\end{array}$	99. 2 99. 7 100. 3 100. 8 101. 3 101. 8 102. 3 102. 8	$53 \\ 54 \\ 55 \\ 56 \\ 57 \\ 58 \\ 59 \\ 60$	$\begin{array}{c} 217. \ 0\\ 217. \ 9\\ 218. \ 7\\ 219. \ 6\\ 220. \ 4\\ 221. \ 3\\ 222. \ 2\\ 223. \ 0\end{array}$	$\begin{array}{c} 130.1\\ 130.6\\ 131.1\\ 131.6\\ 132.1\\ 132.6\\ 133.2\\ 133.7\end{array}$
$ \begin{array}{r} 21 \\ 22 \\ 23 \\ 24 \\ 25 \\ 26 \\ 27 \\ 28 \\ 29 \end{array} $	$\begin{array}{c} \hline 18.0\\ 18.9\\ 19.7\\ 20.6\\ 21.4\\ 22.3\\ 23.2\\ 24.0\\ 24.9\\ \end{array}$	$\begin{array}{c} 10.8\\ 11.3\\ 11.8\\ 12.3\\ 12.9\\ 13.4\\ 13.9\\ 14.4\\ 14.9 \end{array}$	81 82 83 84 85 86 87 88 89	$\begin{array}{c} 69.5\\ 70.3\\ 71.2\\ 72.0\\ 72.9\\ 73.8\\ 74.6\\ 75.5\\ 76.3\\ \end{array}$	$\begin{array}{r} 41.6\\ 42.2\\ 42.7\\ 43.2\\ 43.7\\ 44.2\\ 44.7\\ 45.2\\ 45.8\\ \end{array}$	$ \begin{array}{r} 141 \\ 42 \\ 43 \\ 44 \\ 45 \\ 46 \\ 47 \\ 48 \\ 49 \\ 49 \end{array} $	$\begin{array}{c} \hline 120.9\\ 121.8\\ 122.7\\ 123.5\\ 124.4\\ 125.2\\ 126.1\\ 126.9\\ 127.8\\ \end{array}$	$\begin{array}{r} 72.5\\73.0\\73.5\\74.0\\74.5\\75.1\\75.6\\76.1\\76.6\end{array}$	$\begin{array}{c} 201 \\ 02 \\ 03 \\ 04 \\ 05 \\ 06 \\ 07 \\ 08 \\ 09 \end{array}$	$\begin{array}{c} 172.4\\ 173.3\\ 174.1\\ 175.0\\ 175.8\\ 176.7\\ 177.5\\ 177.5\\ 178.4\\ 179.3 \end{array}$	$\begin{array}{r} \hline 103.3\\ 103.8\\ 104.4\\ 104.9\\ 105.4\\ 105.9\\ 106.4\\ 106.9\\ 107.4 \end{array}$	$\begin{array}{c} 261 \\ 62 \\ 63 \\ 64 \\ 65 \\ 66 \\ 67 \\ 68 \\ 69 \end{array}$	$\begin{array}{c} \hline 223.9\\ 224.7\\ 225.6\\ 226.4\\ 227.3\\ 228.2\\ 229.0\\ 229.9\\ 230.7\\ \end{array}$	$\begin{array}{c} 134.2\\ 134.7\\ 135.2\\ 135.7\\ 136.2\\ 136.8\\ 137.3\\ 137.8\\ 138.3 \end{array}$
$ \begin{array}{r} 30 \\ 31 \\ 32 \\ 33 \\ 34 \\ 35 \\ 36 \\ 37 \\ 38 \\ 39 \\ 10 \\ \end{array} $	$\begin{array}{r} \underline{25.7}\\ \hline \underline{26.6}\\ 27.4\\ 28.3\\ 29.2\\ 30.0\\ 30.9\\ 31.7\\ 32.6\\ 33.5\\ 24.2\end{array}$	$\begin{array}{c} 15.4\\ 15.9\\ 16.5\\ 17.0\\ 17.5\\ 18.0\\ 18.5\\ 19.0\\ 19.5\\ 20.6\end{array}$	$ \begin{array}{r} 90 \\ 91 \\ 92 \\ 93 \\ 94 \\ 95 \\ 96 \\ 97 \\ 98 \\ 99 \\ 100 \\ \end{array} $	$\begin{array}{r} 77.2\\ \hline 78.1\\ 78.9\\ 79.8\\ 80.6\\ 81.5\\ 82.3\\ 83.2\\ 84.1\\ 84.9\\ 95.9\end{array}$	$\begin{array}{r} 46.3 \\ 46.8 \\ 47.3 \\ 47.8 \\ 48.3 \\ 48.8 \\ 49.4 \\ 49.9 \\ 50.4 \\ 50.9 \\ 51.1 \end{array}$	$ \begin{array}{r} 50 \\ 151 \\ 52 \\ 53 \\ 54 \\ 55 \\ 56 \\ 57 \\ 58 \\ 59 \\ 60 \\ \end{array} $	$\begin{array}{r} 128.7\\ \hline 129.5\\ 130.4\\ 131.2\\ 132.1\\ 132.9\\ 133.8\\ 134.7\\ 135.5\\ 136.4\\ 127.9\end{array}$	$\begin{array}{r} 77.1 \\ 77.6 \\ 78.1 \\ 78.7 \\ 79.2 \\ 79.7 \\ 80.2 \\ 80.7 \\ 81.2 \\ 81.7 \\ 81.9 \end{array}$	$ \begin{array}{r} 10 \\ 211 \\ 12 \\ 13 \\ 14 \\ 15 \\ 16 \\ 17 \\ 18 \\ 19 \\ 20 \\ \end{array} $	$\begin{array}{c} 180.1\\ \hline 181.0\\ 181.8\\ 182.7\\ 183.6\\ 184.4\\ 185.3\\ 186.1\\ 187.0\\ 187.8\\ 188.7\end{array}$	$\begin{array}{c} 108.0\\ 108.5\\ 109.0\\ 109.5\\ 110.0\\ 110.5\\ 111.0\\ 111.6\\ 112.1\\ 112.6\\ 112.1\\ 11$	$\begin{array}{r} 70 \\ 271 \\ 72 \\ 73 \\ 74 \\ 75 \\ 76 \\ 77 \\ 78 \\ 79 \\ 90 \end{array}$	$\begin{array}{c} 231.6\\ \hline 232.4\\ 233.3\\ 234.2\\ 235.0\\ 235.9\\ 236.7\\ 237.6\\ 238.4\\ 239.3\\ 240.2\\ \end{array}$	$\begin{array}{c} 138.8\\ \hline 139.3\\ 139.8\\ 140.4\\ 140.9\\ 141.4\\ 141.9\\ 142.4\\ 142.9\\ 143.4\\ 143.4\end{array}$
$ \begin{array}{r} 40 \\ 41 \\ 42 \\ 43 \\ 44 \\ 45 \\ 46 \\ 47 \\ 48 \\ 49 \\ 50 \\ \end{array} $	$\begin{array}{r} 34.3 \\ \hline 35.2 \\ 36.0 \\ 36.9 \\ 37.7 \\ 38.6 \\ 39.5 \\ 40.3 \\ 41.2 \\ 42.0 \\ 42.9 \end{array}$	$\begin{array}{c} 20.6\\ \hline 21.1\\ 21.6\\ 22.1\\ 22.6\\ 23.1\\ 23.6\\ 24.2\\ 24.7\\ 25.2\\ 25.7\\ \end{array}$	$ \begin{array}{r} 100 \\ 101 \\ 02 \\ 03 \\ 04 \\ 05 \\ 06 \\ 07 \\ 08 \\ 09 \\ 10 \\ \end{array} $	$\begin{array}{c} 53.8 \\ 86.6 \\ 87.5 \\ 88.3 \\ 89.2 \\ 90.1 \\ 90.9 \\ 91.8 \\ 92.6 \\ 93.5 \\ 94.4 \end{array}$	51.4 51.9 52.4 53.0 53.5 54.0 54.5 55.0 55.5 56.0 56.6	$ \begin{array}{r} 80 \\ 161 \\ 62 \\ 63 \\ 64 \\ 65 \\ 66 \\ 67 \\ 68 \\ 69 \\ 70 \\ 70 \end{array} $	$\begin{array}{c} 137.2\\ \hline 138.1\\ 139.0\\ 139.8\\ 140.7\\ 141.5\\ 142.4\\ 143.2\\ 144.1\\ 145.0\\ 145.8 \end{array}$	$\begin{array}{c} 82.3 \\ 82.8 \\ 83.3 \\ 83.8 \\ 84.3 \\ 84.8 \\ 85.3 \\ 85.9 \\ 86.4 \\ 86.9 \\ 87.4 \end{array}$	$ \begin{array}{r} 20 \\ 221 \\ 22 \\ 23 \\ 24 \\ 25 \\ 26 \\ 27 \\ 28 \\ 29 \\ 30 \\ \end{array} $	$\begin{array}{c} 188.\ t\\ \hline 189.\ 6\\ 190.\ 4\\ 191.\ 3\\ 192.\ 1\\ 193.\ 0\\ 193.\ 8\\ 194.\ 7\\ 195.\ 6\\ 196.\ 4\\ 197.\ 3\end{array}$	$\begin{array}{c} 113.1\\ \hline 113.6\\ 114.1\\ 114.6\\ 115.2\\ 115.7\\ 116.2\\ 116.7\\ 117.2\\ 117.7\\ 118.2 \end{array}$	80 281 82 83 84 85 86 87 88 89 90	$\begin{array}{r} 240.2\\ \hline 241.0\\ 241.9\\ 242.7\\ 243.6\\ 244.5\\ 245.3\\ 246.2\\ 247.0\\ 247.9\\ 248.7 \end{array}$	$\begin{array}{r} 143.9\\ \hline 144.5\\ 145.0\\ 145.5\\ 146.0\\ 146.5\\ 147.0\\ 147.5\\ 148.1\\ 148.6\\ 149.1 \end{array}$
$51 \\ 52 \\ 53 \\ 54 \\ 55 \\ 56 \\ 57 \\ 58 \\ 59 \\ 60$	$\begin{array}{r} 43.\ 7\\ 44.\ 6\\ 45.\ 5\\ 46.\ 3\\ 47.\ 2\\ 48.\ 0\\ 48.\ 9\\ 49.\ 7\\ 50.\ 6\\ 51.\ 5\end{array}$	$\begin{array}{c} 26.\ 2\\ 26.\ 7\\ 27.\ 2\\ 27.\ 8\\ 28.\ 3\\ 28.\ 8\\ 29.\ 3\\ 29.\ 8\\ 30.\ 3\\ 30.\ 8\end{array}$	$ \begin{array}{c} 111\\ 12\\ 13\\ 14\\ 15\\ 16\\ 17\\ 18\\ 19\\ 20\\ \end{array} $	$\begin{array}{c} 95.2\\ 96.1\\ 96.9\\ 97.8\\ 98.6\\ 99.5\\ 100.4\\ 101.2\\ 102.1\\ 102.9 \end{array}$	$\begin{array}{c} 57.1\\ 57.6\\ 58.1\\ 58.6\\ 59.1\\ 59.6\\ 60.2\\ 60.7\\ 61.2\\ 61.7\end{array}$	$ \begin{array}{r} 171 \\ 72 \\ 73 \\ 74 \\ 75 \\ 76 \\ 77 \\ 78 \\ 79 \\ 80 \\ \end{array} $	$\begin{array}{c} 146.\ 7\\ 147.\ 5\\ 148.\ 4\\ 149.\ 2\\ 150.\ 1\\ 151.\ 0\\ 151.\ 8\\ 152.\ 7\\ 153.\ 5\\ 154.\ 4 \end{array}$	87.9 88.4 88.9 89.5 90.0 90.5 91.0 91.5 92.0 92.5	$231 \\ 32 \\ 33 \\ 34 \\ 35 \\ 36 \\ 37 \\ 38 \\ 39 \\ 40$	$\begin{array}{c} 198. 1 \\ 199. 0 \\ 199. 9 \\ 200. 7 \\ 201. 6 \\ 202. 4 \\ 203. 3 \\ 204. 1 \\ 205. 0 \\ 205. 9 \end{array}$	$\begin{array}{c} 118.8\\ 119.3\\ 119.8\\ 120.3\\ 120.8\\ 121.3\\ 121.8\\ 122.4\\ 122.9\\ 123.4 \end{array}$	$ \begin{array}{r} 291 \\ 92 \\ 93 \\ 94 \\ 95 \\ 96 \\ 97 \\ 98 \\ 99 \\ 300 \end{array} $	$\begin{array}{c} 249.\ 6\\ 250.\ 5\\ 251.\ 3\\ 252.\ 2\\ 253.\ 0\\ 253.\ 9\\ 254.\ 7\\ 255.\ 6\\ 256.\ 5\\ 257.\ 3\end{array}$	$\begin{array}{c} 149.\ 6\\ 150.\ 1\\ 150.\ 6\\ 151.\ 1\\ 151.\ 7\\ 152.\ 2\\ 152.\ 7\\ 153.\ 2\\ 153.\ 7\\ 154.\ 2\end{array}$
Dist.	Dep. E. by E	Lat.	Dist.	Dep. E. by E.	Lat.	Dist.	Dep.	Lat.	Dist.	Dep.	Lat.	Dist.	Dep. r 5‡ Poi	Lat.

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Difference of Latitude and Departure for 3 Points.

	N	E. by	N.	Dinore	NW.	by N.	10 0000	SI	E. by	s.		SW. 1	oy S.	
Dist.	Lat.	Dep.	Dist.	Lat.	Dep.	Dist	Lat.	Dep.	Dist.	Lat.	Dep.	Dist.	Lat.	Dep,
1	0.8	0.6	61	50.7	33.9	. 121	100.6	67.2	181	150.5	100.6	241	200.4	133.9
2	1.7	1.1	62	51.6	34.4	22	101.4	67.8	82	151.3	101.1	42	201.2	134.4
3	2.5	1.7	63	52.4	35.0	23	102.3	68.3	83	152.2	101.7	43	202.0	135.0
4	3.3	2.2	64	53.2	35.6	24	103.1	68.9	84	153.0	102.2	44	202.9	135.6
5	4.2	2.8	65	54.0	36.1	20	103.9	69.4	80	153.8	102.8	40	203.7	136.1
0	5.0	3.3	60 67	54.9	30.7	20	104.8	70.0	80	104.7	103.3	40	204.0	130.7
ó	5.8	3.9	01 69	00.1 56.5	31.2	21	105.0	71 1	80	100.0	105.5	41	200.4	157.2
- 8	0.7	4.4	60	00.0 57.1	31.0	20	100.4	$\frac{11.1}{71.7}$	80	157 1	104.4	40	200.2	134.8
10	1.0	0.0	$\frac{09}{70}$	01.4	30.0	29	107.5	79 9	00	158 0	105.0	49	207.0	138.0
10	0.0	0.0		50.4	00.0	191	100.1	70.0	101	100.0	100.0	051	201.0	100.0
11	10.0	0.1	$\frac{(1)}{79}$	59.0	39.4	131	108.9	72.8	191	100.0	100.1	201 .	208.7	139. +
12	10.0	0.1	$\frac{14}{72}$	09.9	40.0	04 22	109.0	72 0	92	180 5	107.9	52	209.0	140.0
10	10.0	4.4	73	00.7 81.5	40.0	31	110.0	71 1	9.0	161 3	107.8	54	911 9	1.11 1
15	19.5	8.3	75	62 1	41.1	35	112.9	75 0	95	162 1	107.0	55	211.2	141.1
16	12.0 13.3	8.9	76	63 2	42.2	36	113.1	75.6	96	163.0	108.9	56	912.9	142.2
17	14.1	9.4	77	64.0	42.8	37	113.9	76.1	97	163.8	109.4	57	213.7	142.8
18	15 0	10.0	78	64.9	43.3	38	114.7	76.7	98	164.6	110.0	58	214.5	143.3
19	15.8	10.6	79	65.7	43.9	39	115.6	77.2	- 99	165.5	110.6	59	215.4	143.9
20	16.6	11.1	80	66.5	44.4	40	116.4	77.8	200	166.3	111.1	60	216.2	144.4
	17.5	11 7	- 81	67.3	45.0	141	117.2	78.3	201	167.1	111.7	261	217.0	145.0
22	18.3	12.2	82	68.2	45.6	42	118.1	78.9	02	168.0	112.2	62	217.8	145.6
23	19.1	12.8	83	69.0	46.1	43	118.9	79.4	03	168.8	112.8	63	218.7	146.1
24	20. 0	13.3	84	69.8	46.7	44	119.7	80.0	04	169.6	113.3	64	219.5	146.7
25	20.8	13.9	85	70.7	47.2	45	120.6	80.6	05	170.5	113.9	65	220.3	147.2
26	21.6	14.4	86	71.5	47.8	46	121.4	81.1	06	171.3	114.4	66	221.2	147.8
27	22.4	15.0	87	72.3	48.3	47	122.2	81.7	07	172.1	115.0	67	222.0	148.3
28	23.3	15.6	88	73.2	48.9	48	123.1	82.2	08	172.9	115.6	68	222.8	148.9
29	24.1	16.1	89	74.0	49.4	49	123.9	82.8	-09	173.8	116.1	69	223.7	149.4
30	24.9	16.7	90	74.8	50.0	50	124.7	83.3	10	174.6	116.7	70	224.5	150.0
31	25.8	17.2	91	75.7	50.6	151	125.6	83.9	211	175.4	117.2	271	225.3	150.6
32	26.6	17.8	92	76.5	51.1	52	126.4	84.4	12	176.3	117.8	72	226.2	151.1
33	27.4	18.3	93	77.3	51.7	53	127.2	85.0	13	177.1	118.3	73	227.0	151.7
34	28.3	18.9	94	78.2	52.2	54	128.0.	85.6	14	177.9	118.9	74	227.8	152.2
35	29.1	19.4	95	79.0	52.8	55	128.9	86.1	15	178.8	119.4	75	228.7	152.8
36	29.9	20.0	96	79.8	53.3	56	129.7	86.7	16	179.6	120.0	76	229.5	153.3
37	30.8	20.6	97	80.7	53.9	57	130.5	87.2	17	180.4	120.6	77	230.3	153.9
38	31.6	21.1	98	81.5	54.4	58	131.4	87.8	18	181.3	121.1	78	231.1	154.4
39	32.4	21.7	99	82.3	55.0	59	132.2	88.3	19	182.1	121.7	79	232.0	155.0
40	33.3	22.2	100	83.1	55.6	60	133.0	88.9	20	182.9	122.2	80	232.8	155.6
41	34.1	22.8	101	84.0	56.1	161	133.9	89.4	221	183.8	122.8	281	233.6	156.1
42	34.9	23.3	02	84.8	56.7	62	134.7	90.0	22	184.6	123.3	82	234.5	156.7
43	35.8	23.9	03	85.6	57.2	63	135.5	90.6	23	185.4	123.9	83	235.3	157.2
44	36.6	24.4	04	86.5	57.8	64	136.4	91.1	24	186.2.	124.4	84	236.1	157.8
45	37.4	25.0	05	87.3	58.3	65	137.2	91.7	25	187.1	125.0	85	237.0	158.3
46	38.2	25.6	06	88.1	58.9	66	138.0	92. Z	26	187.9	125.6	80	237.8	158.9
11	39.1	26.1	07	89.0	59.4	67	138.9	92.8	27	188.7	126.1	87	238.6	159.4
48	39.9	26.7	08	89.8	60.0	68	139.7	93.3	28	189.0	126.7	88	239.0	160.0
49	40.7	21.2	10	90.0	60.0	70	140.0	93.9	29	190.4	127.2	89	240.5	160.0
	41.0	-21.0	-10	91.0	01.1		141.0	94.4	00	191.2	121.0	- 201	241.1	101.1
- 21	42, 4	28.3		92.5	61.7	171	142.2	90.0	231	192.1	128.0	291	242.0	161.7
52	43.2	28.9	12	95.1	62.2	$\frac{12}{72}$	145.0	95.0	32	192.9	128.9	92	242.8	16Z. Z
- 00 - 54	44.1	29.4	10	94.0	02.0	10	143.0	90.1	- 00 - 91	195.7	129. 4	90	243.0	102.0
04 55	15 7	30.0 20.6		94.0	03.0	14	145.5	90.7	34	194.0	130.0	94	244.0	103.0
56	18 6	00.0 91.1	10	90.0	05.9	$\frac{10}{76}$	140.0	91.2	- 30	190. ±	100.0 121 1	90	240.0	100.9 101.1
57	17 1	21 7	17	07.3	85 0	77	140.0 147.9	02 3	30	190.2	101.1 121.7	97	240.1	165 0
58	18 9	29 9	18	91.0	85 6	78	147.2	90.0	38	107 0	101.7	08	240. 9	100.0
59	10.2	29 8	10	08 0	88 1	70	148.0	90.0	30	197.9	192.2	90	241.0	186 1
60	10 9	22.3	20	00.0	66 7	80	140.0	100 0	40	100.7	192.0	300	910 1	100.1
00	10.0	00.0		00.0	00.7	00	170.1	100.0	10	100.0	100.0	000	570, T	100.1
Dist.	Dep.	Lat.	Dist.	Dep.	Lat.	Dist.	Dep.	Lat.	Dist.	Dep.	Lat.	Dist.	Dep.	Lat.
1	NE. by	E.	S	E. by F	ŝ. j	NV	V. by W	7.	SW	V. by W		[Fe	or 5 Poir	nts.

Pa	ge 364]				T	ABLE	1.						
				Differen	ce of I	atitud	le and I)epartu	re for	31 Poin	its.	0117	3.0	
Dist	Tat	E. 4 N	Di-t	Tet	NW.	τ Ν.	Let	Der	L. 4 L	. Let	Der	SW.	4 D.	Der
Dist.	Lat.	Dep.	Dist.	Lat.	Dep.	Dist.	Lat.	Dep.	Dist.	Lat.	Dep.	Dist.	Lat.	Dep.
1	0.8	0.6	61 62	49.0 40.8	$\frac{36.3}{36.9}$	$\frac{121}{22}$	97.2	72.1 72.7	181	145.4 146.2	107.8	241	193.6	143.6 144.2
$\frac{2}{3}$	1.0 2.4	1. 2	63^{-02}	50.6	37.5	$\frac{22}{23}$	98.8	73.3	83	147.0	100.4 109.0	42	194.4 195.2	144.2
. 4	3.2	$\frac{2.4}{3.0}$	64 - 65	51.4 52.2	38.1 38.7	24 25	99.6 100.4	73.9 74.5	84 85	147.8 148.6	109.6	44	196.0	145.4
6	4.8	3.6	66	53.0	39.3	$\frac{20}{26}$	100.4	75.1	86	149.4	110.2	46	197.6	146.5
7	5.6	$\frac{4.2}{4.8}$	67	53.8 54.6	39.9	$\frac{27}{28}$	102.0 102.8	75.7	87	150.2 151.0	111.4	47	198.4	147.1 147.7
9	7.2	5.4	69	55.4	41.1	29	102.8	76.8	89	151.8	112.0 112.6	49	200.0	148.3
10	8.0	6.0	$\frac{70}{-71}$	$\frac{56.2}{57.0}$	41.7	$\frac{30}{191}$	104.4	77.4	90	152.6	113.2	50	200.8	148.9
$11 \\ 12$	$\frac{8.8}{9.6}$	7.0	$\frac{71}{72}$	57.0 57.8	42.3 42.9	$\frac{131}{32}$	105.2 106.0	78.0	$191 \\ 92$	153.4 154.2	115.8	$\frac{251}{52}$	201.6 202.4	149.5 150.1
13	10.4	7.7	$73 \\ 71$	58.6	43.5	33	106.8	79.2	93	155.0	115.0	53	203.2	150.7
$114 \\ 15$	$11.2 \\ 12.0$	8.9	$\frac{74}{75}$	60.2	44.1	35	107.0	80.4	94 95	155.8 156.6	115.0 116.2	55 - 55	204.0 204.8	151.5 151.9
$\frac{16}{17}$	12.9	9.5	$\frac{76}{76}$	61.0	45.3	36	109.2	81.0	96	157.4	116.8	56	205.6	152.5
11^{11}_{18}	13.7 14.5	10.1 10.7	78	$61.8 \\ 62.7$	46.5	$\frac{37}{38}$	110.0	81.6	97	158.2 159.0	117.4	57 58	200.4 207.2	153.1 153.7
19	15.3	11.3	79	63.5	47.1	39	111.6	82.8	99	159.8	118.5	59	208.0	154.3
$\frac{20}{21}$	$\frac{10.1}{16.9}$	$\frac{11.9}{12.5}$	$\frac{-80}{-81}$	$\frac{04.3}{65.1}$	$\frac{47.7}{48.3}$	$\frac{40}{141}$	$\frac{112.4}{113.3}$	84.0	$\frac{200}{201}$	160.8 161.4	119.1 119.7	$\frac{60}{261}$	$\frac{208.8}{209.6}$	$\frac{134.9}{155.5}$
22	17.7	13.1	82	65.9	48.8	42	114.1	84.6	02	162.2	120.3	62	210.4	156.1
$\frac{23}{24}$	$18.5 \\ 19.3$	13.7 14.3	$\frac{83}{84}$	66.7	49.4 50.0	43	114.9 115.7	85.2 85.8	03	163.1 163.9	120.9 121.5	$\frac{63}{64}$	$211.2 \\ 212.0$	156.7 157.3
25	20.1	14.9	85	68.3	50.6	45	116.5	86.4	05	164.7	122.1	65	212.8	157.9
$\frac{26}{27}$	20.9 21.7	15.5 16.1	$\frac{86}{87}$	69.1 69.9	51.2 51.8	$\frac{46}{47}$	117.3 118.1	87.0	06	165.5 166.3	$ 122.7 \\ 123.3 $	$66 \\ 67$	213.7 214.5	158.5 159.1
28	22.5	16.7	88	70.7	52.4	48	118.9	88.2	08	167.1	123.9	68	215.3	159.6
$\frac{29}{30}$	$\begin{array}{c}23.3\\24.1\end{array}$	17.3 17.9	$\frac{89}{90}$	$71.5 \\ 72.3$	53.0 53.6	$\frac{49}{50}$	119.7 120.5	88.8	$09 \\ 10$	167.9 168.7	124.5 125.1	$\frac{69}{70}$	216.1 216.9	160.2 160.8
31	24,9	18.5	91	73.1	54.2	151	121.3	90.0	211	169.5	$1\overline{25.7}$	271	217.7	161.4
$\frac{32}{33}$	25.7 26.5	19.1 19.7	$\frac{92}{93}$	73.9 74.7	54.8	$52 \\ 53$	122.1 122.9	90.5	$12 \\ 13$	170.3 171 1	126.3 126.9	$72 \\ 73$	218.5 219.3	162.0 162.6
34	27.3	20.3	94	75.5	56.0	54	123.7	91.7	14	171.9	127.5	74	220.1	163.2
$\frac{35}{36}$	$\frac{28.1}{28.9}$	20.8 21.4	95 96	76.3 771	56.6 57.2	$55 \\ 56$	124.5 125.3	92.3 92.9	$15 \\ 16$	172.7 173.5	128.1 128.7	$75 \\ 76$	220.9 221.7	163.8 164.4
37	29.7	22.0	97	77.9	57.8	57	126.1	93.5	17	174.3	129.3	77	222.5	165.0
$-38 \\ -39$	30.5 31.3	22.6 23.2	$-98 \\ -99$	78.7	58.4 59.0	$58 \\ 59$	$ 126.9 \\ 127.7 $	94.1 94.7	18 19	175.1 175.9	129.9 130.5	78 79	223.3 224.1	165.6 166.2
40	32.1	23.8	100	80.3	59.6	60	128.5	95.3	20	176.7	131.1	80	224.9	166.8
41	$\frac{32.9}{33.7}$	24.4 25.0	$101 \\ 02$	81.1	$\begin{array}{c} 60.2 \\ 60.8 \end{array}$	$161 \\ 69$	129.3 130_1	95.9 96.5	$221 \\ 99$	177.5 178.2	131.6 132.9	$\frac{281}{82}$	225.7 226.5	167.4 168.0
43	34.5	25.6	03	82.7	61.4	63	130.9	97.1	$\frac{22}{23}$	179.1	132.8	83	220.0 227.3	168.6
44	35.3 36.1	26.2 26.8	04	83.5 84-3	62.0 62.5	$64 \\ 65$	131.7 132.5	97.7	24 25	179.9 180.7	133.4 134.0	84 85	228.1	169.2 169.2
46	36, 9	27.4	06	85.1	63.1	66	133.3	98.9	$\frac{20}{26}$	181.5	134.6	86	229.7	170.4
47	37.8 38.6	$\frac{28.0}{28.6}$	07	85.9 86.7	63.7	67 68	134.1 134.0	99.5 100.1	27	182.3 183 1	135.2 135.9	87 89	230.5	171.0 171.6
49	39.4	29.2	09	87.5	64.9	69	135.7	100.1	29	183.9	136.4	89	231.3 232.1	171.0 172.2
50	40.2	29.8	10	88.4	65.5	70	136.5	$\frac{101.3}{101.0}$	30	184.7	137.0	90	232.9	172.8
$ 51 \\ 52 $	41.0 41.8	30.4 31.0	$111 \\ 12$	89.2 90.0	66.7	$\frac{171}{72}$	$137.3 \\ 138.2$	101.9 102.5	$\frac{231}{32}$	180.0 186.3	137.6 138.2	291 92	233.7	173.3 173.9
53	42.6	31.6	13	90.8	67.3	73	139.0	103.1	33	187.1	138.8	93	235.3	174.5
55 b	43.4	$32.2 \\ 32.8$	14	91.6 92.4	68.5	$\frac{74}{75}$	139.8 140.6	103.7 104.2	34 35	188.0	139.4 140.0	94 95	236.1 236.9	170.1 175.7
56	45.0	33.4	16	93.2	69.1	76	141.4	104.8	36	189.6	140.6	96	237.7	176.3
58	45.8 46.6	34.0 34.6	18	94.0	$ \begin{array}{c} 69.7 \\ 70.3 \end{array} $	78	142.2 143.0	105.4 106.0	$\frac{37}{38}$	190.4 191.2	141.2 141.8	97 98	238.6 239.4	170.9 177.5
59	47.4	35.1	19	95.6	70.9	79	143.8	106.6	39	192.0	142.4	99	240.2	178.1
60	48.2	30.7	20	96.4	71.5	80	144.6	107.2	40	192.8	143.0	300	241.0	178.7
Dist.	Dep.	Lat.	Dist.	Dep.	Lat.	Dist.	Dep.	Lat.	Dist.	Dep.	Lat.	Dist.	Dep.	Lat.
	NE. $\frac{3}{4}$	E.		SE. $\frac{3}{4}$ E	•	N	W. $\frac{3}{4}$ W.		SW	$1 \frac{3}{4}$ W.		[F	or $4\frac{3}{4}$ Pc	oints.



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Difference of Latitude and Departure for 3½ Points.

		NE. ½	N.		NW	. <u>1</u> N.		SE	$\frac{1}{2}$ S.	-	sv	V. $\frac{1}{2}$ S		
Dist.	Lat.	Dep.	Dist.	Lat.	Dep.	Dist.	Lat.	Dep.	Dist,	Lat.	Dep.	Dist.	Lat.	Dep.
1	0.8	0.6	61	47.2	38.7	121	93.5	76.8	181	139.9	114.8	241	186.3	152.9
2	1.5	1.3	62	47.9	39.3	22	94.3	77.4	82	140.7	115.5	42	187.1	153.5
3	2.3	1.9	63	48.7	$\frac{10.0}{10.0}$	23	95.1	78.0	83	141.5	116.1	43	187.8	154.2
-1	3,1	2.0	04	49.0	40.0	24	90.9	$\frac{18.1}{70.2}$	84	142.2	110.1	44	188.0	104.8
0 C	3.9	3.2	00 66	51 0	41.4	20 96	90.0	79.0	86	143.0	118 0	46	109.4	156 1
07	5.1	0.0 1 4	67	51.0	41.9	20	08 9	80 6	87	143.8	118.6	40	190.2	150, 1 156, 7
ŝ	6.2	5 1	68	52.6	43 1	28	98.9	81.2	88	145.3	110.0 119.3	48	191 7	157 3
9	7.0	5.7	69	53.3	43.8	29	99.7	81.8	89	146.1	119.9	49	192.5	158.0
10	7.7	6.3	70	54.1	44.4	30	100.5	82.5	90	146.9	120.5	50	193.3	158.6
-11	8.5	-7.0	71	54.9	45.0	131	101.3	83.1	191	147.6	121.2	251	194.0	159.2
12	9.3	7.6	72	55.7	45.7	32	102.0	83.7	92	148.4	121.8	52	194.8	159.9
13	10.0	8.2	73	56.4	46.3	- 33	102.8	84.4	93	149.2	122.4	53	195.6	160.5
14	10.8	8.9	74	57.2	46.9	34	103.6	85.0	94	150.0	123.1	54	196.3	161.1
15	11.6	9.5	75	58.0	47.6	35	104.4	85.6	95	150.7	123.7	55	197.1	161.8
16	12.4	10.2	76	58.7	48.2	36	105.1	86.3	96	151.5	124.3	56	197.9	162.4
17	13.1	10.8	77	59.5 60.2	48.8	37	105.9	80.9	91	152.3	125.0	- 01 E0	198.7	163.0
18	13.9	11.4	70	00. 3 61 1	49.0	- 20 - 20	100.7	81.0	98	152.9	120.0 196.9	50	199.4	103.7
20	14.7	12.1 12.7	79 80	61.8	50.1	- 59 - 40	107.4	88 8	200	154 6	120.2	- 60	200.2	164.5
-20	10.0	$\frac{12.7}{19.9}$	00	$\frac{01.0}{0.0}$	51 1	141	100.2	80.1	200	155 1	120.5 197 5	961	201.0	104. 9
21	10.2 17.0	13.3	82	62.0	52 0	141	109.0	90 1	201	150.4 156.1	127.0 198 1	²⁰¹ 62	201.8	166 2
22	17.0	14.0	83	64 2	52.0 52.7	43	110.5	90.7	02	156.9	128.8	63	202.0	166 8
24	18.6	15.2	84	64.9	53.3	44	111.3	91.4	04	157.7	129.4	64	204.1	167.5
25	19.3	15.9	85	65.7	53.9	45	112.1	92.0	05	158.5	130.1	$\tilde{65}$	204.8	168.1
26	20.1	16.5	86	66.5	54.6	46	112.9	92.6	06	159.2	130.7	66	205.6	168.7
27	20.9	17.1	87	67.3	55.2	47	113.6	93.3	07	160.0	131.3	67	206.4	169.4
28	21.6	17.8	88	68.0	55.8	48	114.4	93.9	08	160.8	132.0	68	207.2	170.0
29	22.4	18.4	89	68.8	56.5	49	115.2	94.5	09	161.6	132.6	69	207.9	170.7
30	23.2	19.0	90	69.6	57.1	50	116.0	95.2	10	162.3	133.2	70	208.7	171.3
31	24.0	19.7	91	70.3	57.7	151	116.7	95.8	211	163.1	133.9	$\frac{271}{50}$	209.5	171.9
32	24.7	20.3	92	71.1 71.0	50.4	52 59	117.5	96.4	12	163.9	134.0	72	210.3	172.6
30	20.0	20.9	95	79.7	59.0 59.6	54	110.0	97.1	1.1	165 4	135.8	71	211.0	173.8
35	.20.0	$\frac{21.0}{22.2}$	95	73.4	60.3	55	119.8	98.3	15	166.2	136.0	75	211.8	174 5
36	27.8	22.8	96	74.2	60.9	56	120.6	99.0	16	167.0	137.0	76	213.4	175.1
37	28.6	23.5	97	75.0	61.5	57	121.4	99.6	17	167.7	137.7	77	214.1	175.7
38	29.4	24.1	- 98	75.8	62.2	58	122.1	100.2	18	168.5	138.3	78	214.9	176.4
- 39	30.1	24.7	- 99	76.5	62.8	59	122.9	100.9	19	169.3	138.9	- 79	215.7	177.0
40	30.9	25.4	100	77.3	63.4	60	123.7	101.5	20	170.1	139.6	80	216.4	177.6
41	31.7	26.0	101	78.1	64.1	161	124.5	102.1	221	170.8	140.2	281	217.2	178.3
42	32.5	26.6	02	78.8	64.7	62	125.2	102.8	22	171.6	140.8	82	218.0	178.9
43	33.2	27.3	03	79.6	65.3	63	126.0	103.4	23	172.4	141.5	- 83	218.8	179.5
44	34.0	27.9	04	80.4	00.0	04	126.8	104.0	24	173.2	142.1	84	219.5	180. 2
40	25 6	28.0	00	81.2	$\begin{array}{c} 00.0 \\ 67.9 \end{array}$	60	127.0	104.7	20	173.9	142.7	80	220.3	180.8
40	36.3	29.2	00	81.9	67.0	67	128.0	105.0	20	175.5	140.4	87	221.1	181.4
48	37.1	$\frac{20.0}{30.5}$	08	83.5	68 5	68	120.1	106.6	28	176.2	144.0 144.6	88	999 G	182.1
49	37.9	31.1	09	84.3	69.1	69	130.6	100.0 107.2	29	177.0	145.3	89	223.4	183.3
50	38.7	31.7	10	85.0	69.8	70	131.4	107.8	30	177.8	145.9	90	224.2	184.0
51	39.4	32.4	111	85.8	70.4	171	132.2	108.5	231	178.6	146.5	291	224.9	184.6
52	40.2	33.0	12	86.6	71.1	72	133.0	109.1	-32	179.3	147.2	92	225.7	185.2
53	41.0	33.6	13	87.4	71.7	73	133.7	109.8	33	180.1	147.8	93	226.5	185.9
54	41.7	34.3	14	88.1	72.3	74	134.5	110.4	34	180.9	148.4	94	227.3	186.5
00 50	42.5	34.9	15	88.9	73.0	75	135.3	111.0	35	181.7	149.1	95	228.0	187.1
- 00 57	43.3	30.0	10	89.7	73.6	75	136.0	111.7 119.9	30 97	182.4	149.7	96	228.8	181.8
58	44.1	36.8	18	91.4	71 0	78	130.8	112.3	20	181.0	150.4	97	229.0	180 0
59	45.6	37.4	19	92 0	75.5	79	138 4	112.9	30	184.0	151.0	90	230.4	189.7
60	46.4	38.1	20	92.8	76.1	80	139.1	114.2	40	185.5	152.3	300	231.9	190.3
													-01.0	
Dist.	Dep.	Lat.	Dist.	Dep.	Lat.	Dist.	Dep.	Lat.	Dist.	Dep.	Lat.	Dist.	Dep.	Lat.
	NE. $\frac{1}{2}$	E.		SE. $\frac{1}{2}$ E.	•	N	W. $\frac{1}{2}$ W			SW. 1 7	W.	[F	or $4\frac{1}{2}$ Pe	oints.

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Difference of Latitude and Departure for 33 Points.

	NI	E. ‡ N.		Differen	NW.	4 N.	ie and D	opartu	SE. ‡	54 I 0111 S.	10.	SW	7.] S.	
Dist.	Lat.	Dep.	Dist.	Lat.	Dep.	Dist.	Lat.	Dep.	Dist.	Lat.	Dep.	Dist.	Lat.	Dep.
1	0.7	0.7	61	45.2	41.0	121	89.7	81.3	181	134.1	121.6	241	178.6	161.8
2	1.5	1.3	62	45.9	41.6	22	90.4	81.9	82	134.9	122.2	42	179.3	162.5
3	2.2	2,0	63	46.7	42.3	23	91.1	82.6	83	135.6	122.9	43	180.1	$ 163.2 \\ 169.2 $
+ 5	3.0	2.7	65	47.4	43.0	24	91.9 92.6	83.0	85	130.3 137 1	123.0	44	180.8	163.9
6	4.4	4.0	66	48.9	44.3	26	93.4	84.6	86	137.8	124.2	40	182.3	164.0 165.2
7	5.2	4.7	67	49.6	45.0	27	94.1	85.3	87	138.6	124.0 125.6	47	183.0	165.9
8	5.9	5.4	68	50.4	45.7	28	94.8	86.0	88	139.3	126.3	48	183.8	166.5
9	6.7	6.0	69	51.1	46.3	- 29	95.6	86.6	89	140.0	126.9	49	184.5	167.2
10	7.4	6.7	_70_	51.9	47.0		96.3	87.3	90	140.8	127.6	_ 50	185.2	167.9
11	8.2	7.4	71	52.6	47.7	131	97.1	88.0	191	141.5	128.3	251	186.0	168.6
$\frac{12}{12}$	8.9	8.1	72	53.3	48.4	32	97.8	88.6	92	142.8	128.9	52	186.7	169.2
$10 \\ 14$	9.0	0.1	70	04.1 51.8	49.0	- 00 - 2.1	98.0	00 0	93	143.0	129.0		187.0	109.9
15	11 1	10 1	75	55 6	50 4	35	100 0	90.7	95	144 5	131 0	55	188 9	170.0 171.2
16	11.9	10.7	76	56.3	51.0	36	100.8	91.3	96	145.2	131.6	· 56	189.7	171.9
17	12.6	11.4	77	57.1	51.7	37	101.5	92.0	97	146.0	132.3	57	190.4	172.6
18	13.3	12.1	78	57.8	52.4	38	102.3	92.7	98	146.7	133.0	58	191.2	173.3
19	14.1	12.8	79	58.5	53.1	39	103.0	93.3	99	147.4	133.6	59	191.9	173.9
20	14.8	13.4	80	59.3	53.7	40	103.7	94.0	200	148.2	134.3	60	192.6	174.6
21	10.6	14.1	81	60.0	54.4	141	104.5	94.7	201	148.9	135.0	261	193.4	175.3
22	10.3 17.0	14.8	82 82	61 5	55.1	42	105.2	95.4	02	149.7	130.7	62	194.1	178.8
24	17.0 17.8	16.1	84	62.2	56.4	44	106.7	96.7	04	150.4 151.2	130.5 137.0	64	194.9	170.0 177.3
$\overline{25}$	18.5	16.8	85	63.0	57.1	45	107.4	97.4	05	151.9	137.7	65	196.4	178.0
26	19.3	17.5	86	63.7	57.8	46	108.2	98.0	06	152.6	138.3	66	197.1	178.6
27	20.0	18.1	87	64.5	58.4	47	108.9	98.7	07	153.4	139.0	67	197.8	179.3
28	20.7	18.8	88	65.2	59.1	48	109.7	99.4	08	154.1	139.7	68	198.6	180.0
29	21.5	19.5	89	65.9	59.8	49	110.4	100.1	09	154.9	140.4	69	199.3	180.6
- 30	22.2	20.1	90	00.7	00.4	151	111.1	100.7	- 10	100.0	141.0	- 10	200.1	181.3
31 29	$\frac{23.0}{23.7}$	20.8 21.5	91	68 9	61.1	101	111.9	101.4 102 1	12	130.3 157.1	141.7	$\frac{271}{72}$	200.8	182.0 182.7
33	24.5	$\frac{21.0}{22.2}$	93	68.9	62.5	53	112.0	102.7	13^{12}	157.8	143.0	73	201.0 202.3	183.3
34	25.2	22.8	94	69.6	63.1	54	114.1	103.4	14	158.6	143.7	74	203.0	184.0
35	25.9	23.5	95	70.4	63.8	55	114.8	104.1	15	159.3	144.4	75	203.8	184.7
36	26.7	24.2	96	71.1	64.5	56	115.6	104.8	16	160.0	145.1	76	204.5	185.4
37	27.4	24.8 25.5	97	71.9	65.1	57	116.3	105.4	17	160.8	145.7	77	205.2	186.0
30	28.2	$\frac{20.0}{26.2}$	98	72.0	66.5	- 50 - 59	117.1 117.8	106.1	10	101.0 162.3	140.4	79	206.0	180.7
40	29.6	26.9	100	74.1	67.2	60	118.6	107.4	$\frac{10}{20}$	163.0	147.7	80	207.5	188.0
-41	30.4	27.5	101	74.8	67.8	161	119.3	108.1	221	163.8	148.4	281	208.2	188.7
42	31.1	28.2	02	75.6	68.5	62	120.0	108.8	22	164.5	149.1	82	208.9	189,4
43	31.9	28.9	03	76.3	69.2	63	120.8	109.5	23	165.2	149.8	83	209.7	190.1
44	-32.6	29.5	04	77.1	69.8	64	121.5	110.1	24	166.0	150.4	84	210.4	190.7
40	35.5	30.2	00	78 5	70.5 71.9	- 60 - 66	122.5 123.0	110.8 111.5	20	100.7 167.5	101.1 151.8	80 86	211.2 211.0	191.4
47	34.8	31.6	07	79.3	71.9	67	123.0 123.7	1112.2	$\frac{20}{27}$	167.0 168.2	151.0	87	211.5 212.7	192.1 192.7
48	35.6	32.2	08	80.0	72.5	68	124.5	112.8	28	168.9	153, 1	88	213.4	193.4
49	36.3	32.9	- 09	80.8	73.2	69	125.2	113.5	29	169.7	153.8	89	214.1	194.1
50	37.0	33.6	10	81.5	73.9		126.0	114.2	30	170.4	154.5	_ 90_	214.9	194.8
$51 \\ 52$	37.8	34.2	111	82.2	74.5	$171 \\ -22$	126.7	114.8	231	171.2	155.1	291	215.6	195.4
52 52	38.0	34.9 25.6	12	83.0	75.2	$\frac{12}{72}$	127.4	110.0	32	171.9	156 5	92	216.4 917 1	196.1
54	40.0	36.3	14	84.5	76.6	74	128.9	116.9	34	172.0 173.4	157.1	-94	217.8	197.4
55	40.8	36.9	15	85.2	77.2	75	129.7	117.5	35	174.1	157.8	95	218.6	198.1
56	41.5	37.6	16	86.0	77.9	76	130.4	118.2	36	174.9	158.5	96	219.3	198.8
57	42.2	38.3	17	86.7	78.6	77	131.1	118.9	37	175.6	159.2	97	220.1	199.5
58	43.0	39.0	18	87.4	79.2	78	131.9	119.5	38	176.3	159.8	- 98	220.8	200.1
- 59 - 60	43.7	39.6	19	88.2	79.9 80.6	79	132.6	120.2 120.0	39	177 0	160.5 161.9	300	221.0	200.8
00	44.0	40.0	20	00, 9	00.0	00	100, 4	120.9	40	111.8	101.2	500	444.0	201.0
Dist.	Dep.	Lat.	Dist.	Dep.	Lat.	Dist.	Dep.	Lat.	Dist.	Dep.	Lat.	Dist.	Dep.	Lat.
]	NE. ‡ E		8	E. ‡ E.		N	W. ‡ W.		S	W. 4 W.		[F	or 41 Pc	oints.

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Difference of Latitude and Departure for 4 Points.

Big. Lat. Dep. Dist. Lat. Dep. Dist. Lat. Dep. Dist. Lat. Dep. 1 0.7 0.7 0.7 61 43.1 43.1 121 85.6 85.6 181 128.0 178.0			NF	C.	2	NV	v.		- opini	SE.		0.0	sw.		
$ \begin{array}{ c c c c c c c c c c c c c c c c c c c$	Dist.	Lat.	Dep.	Dist.	Lat.	Dep.	Dist.	Lat.	Dep.	Dist.	Lat.	Dep.	Dist.	Lat.	Dep.
$\begin{array}{c c c c c c c c c c c c c c c c c c c $	1	0.7	0.7	61	43.1	43.1	121	85.6	85.6	181	128.0	128.0	241	170.4	170.4
$ \begin{array}{c c c c c c c c c c c c c c c c c c c $	$\frac{2}{2}$	1.4	1.4	62	43.8	43.8	22	86.3	86.3	82	128.7	128.7	42	171.1	171.1
$ \begin{array}{c c c c c c c c c c c c c c c c c c c $	3	2.1		63	44.5	44.0	23	81.0	87.0	83	129.4	129.4	43	171.8	171.8
$ \begin{array}{c c c c c c c c c c c c c c c c c c c $	4	2.8	2.8	04 65	40.0	40.0	24	81.1	81.1	01	130.1	130.1	44	172.0 172.9	172.0
$ \begin{array}{c c c c c c c c c c c c c c c c c c c $	0 0	3.0	0.0	- 00 66	40.0	40.0	20	00.4 90.1	80.1	00	190.0	191.5	40	173.2	173.2
$ \begin{array}{c c c c c c c c c c c c c c c c c c c $		4.2	4.2	67	40.7	40.7	$\frac{20}{97}$	80.1	80.8	87	132.9	131.0	40	175.9	173.9
9 9 6.4 6.4 6.4 6.9 48.8 48.8 29 61.2 91.2 69 133.6 133.6 149 176.1 176	8	57	5.7	68	48 1	48 1	28	90.5	90.5	88	132.2 132.9	132.2	48	175 4	175.4
$ \begin{array}{ c c c c c c c c c c c c c c c c c c c$	9	6.4	6.4	69	48.8	48.8	29	91.2	91.2	89	133 6	133.6	49	176 1	176.1
$ \begin{array}{ c c c c c c c c c c c c c c c c c c c$	10	7.1	7.1	70	49.5	49.5	30	91.9	91.9	90	134.4	134.4	50	176.8	176.8
$\begin{array}{c c c c c c c c c c c c c c c c c c c $	11	7.8	7.8	71	50.2	50.2	131	92.6	92.6	191	135.1	135.1	251	177.5	177.5
13 9.2 9.2 73 51.6 51.6 53 94.0 94.0 93 136.5 136.5 136.7 137.9 177.7 177.7 177.9 177.9 177.9 177.9 177.9 177.9 177.9 177.9 177.9 177.9 177.9 <	$\hat{1}\hat{2}$	8.5	8.5	$\overline{72}$	50.9	50.9	32	93.3	93.3	92	135.8	135.8	52	178.2	178.2
14 9.9 9.9 74 52.3 52.3 54.9 94.8 94.8 94.1 137.2 137.2 54.4 150.3 160.3	13	9.2	9.2	73	51.6	51.6	- 33	94.0	94.0	93	136.5	136.5	53	178.9	178.9
15 10.6 10.6 75 53.0 53.7 36 95.5 95.5 95.1 137.9 137.9 155 180.3 180.0 17 12.0 12.0 77 54.4 54.4 37 96.9 96.9 97 130.3 133.4 57 181.7 181.7 18 12.7 77 55.4 55.9 55.9 39 98.3 99 140.0 140.0 58 182.4 182.4 13.4 13.4 79 55.9 57.3 141 99.7 201 142.1 142.1 261 184.6 188.6 188.8 188.8 21 14.8 14.8 81 57.3 57.3 141 199.7 201 142.1 142.1 261 184.6 188.8 188.8 188.8 188.8 188.8	14	9.9	9.9	74	52.3	52.3	34	94.8	94.8	94	137.2	137.2	54	179.6	179.6
16 11.3 11.3 76 53.7 53.7 36 96.2 96.1 88.6 18.6 158.6 56 58.1 18.7 18	15	10.6	10.6	75	53.0	53.0	35	95.5	95.5	95	137.9	137.9	55	180.3	180.3
$\begin{array}{c c c c c c c c c c c c c c c c c c c $	16	11.3	11.3	76	53.7	53.7	36	96.2	96.2	96	138.6	138.6	56	181.0	181.0
18 12, 7 18 12, 7 18 55, 2 38 97, 6 97, 6 98, 3 99 140, 0 58 182, 4 182, 4 182, 4 182, 4 182, 4 182, 4 182, 4 182, 4 182, 4 183, 1 184, 1 142, 1 142, 1 142, 1 142, 1 142, 1 142, 1 143, 1 143, 5 63 186, 0 186	17	12.0	12.0	77	54.4	54.4	37	96.9	96.9	97	139.3	139.3	57	181.7	181.7
19 13. 4 13. 4 179 55. 9 35 93 98.3 99.1 140.7 140.7 56 163.1 183.1 183.1 20 14.1 14.1 8 15.6 15.6 15.6 15.6 15.6 15.6 15.6 15.6 15.6 15.6 15.6 15.7 35.7 35.7 141 99.7 99.7 201 142.1 142.2 142.8 12.2 12.6 185.3 185.3 23 16.3 16.3 83 58.7 58.7 43 101.1 101.1 03 143.5 143	18	12.7	12.7	78	55.2	55.2	38	97.6	97.6	98	140.0	140.0	58	182.4	182.4
$\begin{array}{c c c c c c c c c c c c c c c c c c c $	19	13.4	13.4	79	55.9	55.9	39	98.3	98.3	- 99	140.7	140.7	59	183.1	183.1
$\begin{array}{c c c c c c c c c c c c c c c c c c c $	20	14.1	14.1	80	56.6	56.6		99.0	99.0	200	141.4	141.4	60	183.8	183.8
$\begin{array}{c c c c c c c c c c c c c c c c c c c $	21	14.8	14.8	81	57.3	57.3	141	99.7	99.7	201	142.1	142.1	261	184.6	184.6
	22	15.6	15.6	82	58.0	58.0	42	100.4	100.4	02	142.8	142.8	62	185.3	185.3
$\begin{array}{c c c c c c c c c c c c c c c c c c c $	23	16.3	16.3	83	58.7	58.7	43	101.1	101.1	03	143.5	143.5	63	186.0	186.0
$ \begin{array}{c c c c c c c c c c c c c c c c c c c $	24	17.0	17.0	84	59.4 co.1	59.4 co 1	44	101.8	101.8	04	144.2	144.2	64	186.7	186.7
$ \begin{array}{c c c c c c c c c c c c c c c c c c c $	20	10.1	10.1	80	60. I 60. 9	60.1	40	102.0	102.0	00	145.0	145.0	60	187.4	187.4
$ \begin{array}{c c c c c c c c c c c c c c c c c c c $	20	10.4	10.4	80 97	61 5	61 5	40	103.2	103.2	00	140.7	140.7	67	100.1	100.1
$ \begin{array}{c c c c c c c c c c c c c c c c c c c $	21	10.1	10.1	88	62.2	62 2	48	103.9 104.7	103.5	08	140.4	140.4	68	180.0	189.5
$ \begin{array}{c c c c c c c c c c c c c c c c c c c $	20	20.5	20.5	89	62.2 62.9	62.2 62.9	49	105.4	104.7 105.4	00	147.8	147.1	69	190.2	190.2
31 21.9 21.9 21.9 91 64.3 64.3 151 106.8 100.8 211 149.2 2149.2 271 191.6 192.3 33 23.3 23.3 93 65.8 65.8 53 108.2 108.2 131 150.6 73 192.3 192.3 34 24.0 24.0 94 66.5 66.5 54 108.9 14 151.3 151.3 74 193.7 193.7 35 24.7 24.7 95 67.2 67.2 55 109.6 100.6 15 152.0 75 194.5 194.5 194.5 194.5 194.5 195.9	30	$\frac{20.0}{21.2}$	21.2	90	63.6	63.6	50	106.1	106.1	10	148.5	148.5	70	190.9	190.9
$\begin{array}{c c c c c c c c c c c c c c c c c c c $	31	21.9	21.9	- 91	64.3	64.3	151	106.8	106.8	211	149 2	149.2	271	191 6	191.6
$\begin{array}{c c c c c c c c c c c c c c c c c c c $	32	$\frac{21.0}{22.6}$	22.6	92	65.1	65.1	52	100.0 107.5	107.5	12	149.9	149.9	72	192.3	192.3
$\begin{array}{c c c c c c c c c c c c c c c c c c c $	33	${23.3}$	$\frac{1}{23.3}$	93	65.8	65.8	53	108.2	108.2	13	150.6	150.6	73^{-}	193.0	193.0
$\begin{array}{c c c c c c c c c c c c c c c c c c c $	34	24.0	24.0	94	66.5.	66.5	54	108.9	108.9	14	151.3	151.3	74	193.7	193.7
3625.525.59667.967.956110.3110.316152.7152.776195.2195.23726.226.29768.668.657111.0111.0117153.4153.477195.9195.93826.926.99869.369.358111.7111.7118154.1178196.6196.63927.627.69970.070.059112.4112.419154.9154.979197.3197.34028.328.310070.770.760113.1113.120155.6155.680198.0198.04129.029.010171.471.4161113.8113.3221156.3156.3281198.7198.74229.729.70272.172.162114.6114.6221157.0157.082199.4199.44330.40372.873.564116.0116.024158.4158.484200.8200.84531.831.80574.274.265116.7116.725159.1159.185201.5201.54632.532.50675.075.775.767118.1118.127160.5160.587202.922.94833.933.9 <t< td=""><td>35</td><td>24.7</td><td>24.7</td><td>95</td><td>67.2</td><td>67.2</td><td>55</td><td>109.6</td><td>109.6</td><td>15</td><td>152.0</td><td>152.0</td><td>75</td><td>194.5</td><td>194.5</td></t<>	35	24.7	24.7	95	67.2	67.2	55	109.6	109.6	15	152.0	152.0	75	194.5	194.5
$\begin{array}{c c c c c c c c c c c c c c c c c c c $	36	25.5	25.5	96	67.9	67.9	56	110.3	110.3	16	152.7	152.7	76	195.2	195.2
$\begin{array}{c c c c c c c c c c c c c c c c c c c $	37	26.2	26.2	- 97	68.6	68.6	57	111.0	111.0	17	153.4	153.4	77	195.9	195.9
$\begin{array}{c ccccccccccccccccccccccccccccccccccc$	38	- 26.9	26.9	98	69.3	69.3	58	111.7	111.7	18	154.1	154.1	78	196.6	196.6
$\begin{array}{c c c c c c c c c c c c c c c c c c c $	39	27.6	27.6	99	70.0	70.0	59	112.4	112.4	19	154.9	154.9	79	197.3	197.3
$\begin{array}{c c c c c c c c c c c c c c c c c c c $	40	28.3	28.3	100	10.7	10.7	60	113.1	113.1	20	100.6	155.6	80	198.0	198.0
$\begin{array}{c ccccccccccccccccccccccccccccccccccc$	41	29.0	29.0	101	71.4	71.4	161	113.8	113.8	221	156.3	156.3	281	198.7	198.7
$\begin{array}{c ccccccccccccccccccccccccccccccccccc$	42	29.7	29.7	02	$\frac{12.1}{79.0}$	$\frac{72.1}{79.9}$	$\frac{62}{62}$	114.6	114.6	22	157.0	157.0	82	199.4	199.4
$\begin{array}{c ccccccccccccccccccccccccccccccccccc$	43	30.4	30.4	03	12.8 72 E	12.8	03	110.3	110.3	23	157.7	150.1	83	200.1	200.1
$\begin{array}{c ccccccccccccccccccccccccccccccccccc$	44	21 0	01.1 91.0	04	73.0	71.9	04 65	110.0 116.7	116.0	24	108.4	108.4	04	200.8	200.8
$\begin{array}{c ccccccccccccccccccccccccccccccccccc$	40	39.5	39.5	00	75.0	75.0	66	110.7	117.4	20	159.1	159.1	- 00 - 86	201.0	201.0
1833.9 03.2 06 76.4 76.4 68 118.8 118.8 108.12 161.2 161.2 88 203.6 203.6 49 34.6 34.6 09 77.1 77.1 69 119.5 119.5 29 161.9 161.2 88 203.6 203.6 50 35.4 35.4 10 77.8 77.8 70 120.2 202.2 30 162.6 162.6 90 205.1 205.1 51 36.1 36.1 111 78.5 78.5 171 120.9 120.9 231 163.3 163.3 291 205.8 205.8 52 36.8 36.8 12 79.2 79.2 72.2 121.6 322 164.0 164.0 92 206.5 206.5 53 37.5 37.5 13 79.9 73.2 122.3 122.3 332 164.8 164.8 93 207.2 207.2 54 38.2 38.2 14 80.6 80.6 74 123.0 123.0 34 165.5 165.5 94 207.9 207.9 55 38.9 38.9 15 81.3 81.3 75 123.7 123.7 35 166.2 166.9 96 209.3 209.3 57 40.3 40.3 17 82.7 82.7 77 125.2 125.2 37 167.6 97 210.0 210.0	47	33 2	33.2	07	75.7	75.7	67	118 1	118 1	$\frac{20}{27}$	160.0	160.0 160.5	87	202.2	202.2
49 34.6 63.4 600 77.1 77.1 69 119.5 119.5 29 161.9 161.9 89 204.4 204.4 50 35.4 35.4 10 77.8 77.8 70 120.2 120.2 30 161.9 89 204.4 204.4 50 35.4 35.4 10 77.8 77.8 70 120.2 120.2 30 162.6 162.6 90 205.1 205.1 51 36.1 36.1 111 78.5 78.5 171 120.9 120.9 231 163.3 163.3 291 205.8 205.8 52 36.8 36.8 12 79.2 79.2 72.2 72.2 122.3 322.3 164.8 164.8 93 207.2 207.2 54 38.2 38.2 13 81.3 81.3 75 123.7 123.0 $134.65.5$ 165.5 94 207.2 207.2 54 38.9 38.9 15 81.3 81.3 75 123.7 123.7 35 166.2 166.2 95 208.6 208.6 56 39.6 16 82.0 82.0 76 124.5 324.5 36 166.9 96 209.3 209.3 57 40.3 40.3 17 82.7 82.7 77 125.2 125.2 37 167.6 167.6 97 210.0 210.0 59 <td>48</td> <td>33.9</td> <td>33 9</td> <td>08</td> <td>76.4</td> <td>76.4</td> <td>68</td> <td>118.8</td> <td>118.8</td> <td>28</td> <td>161.2</td> <td>161.2</td> <td>88</td> <td>203 6</td> <td>203.6</td>	48	33.9	33 9	08	76.4	76.4	68	118.8	118.8	28	161.2	161.2	88	203 6	203.6
$ \begin{array}{c ccccccccccccccccccccccccccccccccccc$	49	34.6	34.6	09	77.1	77.1	69	119.5	119.5	-29	161.9	161.9	89	204.4	204.4
$ \begin{array}{c ccccccccccccccccccccccccccccccccccc$	50	35.4	35.4	10	77.8	77.8	70	120.2	120.2	30	162.6	162.6	90	205.1	205.1
$\begin{array}{c ccccccccccccccccccccccccccccccccccc$	51	36.1	36.1	111	78.5	78.5	171	120.9	120.9	231	163.3	163.3	291	205.8	205.8
$\begin{array}{c ccccccccccccccccccccccccccccccccccc$	52	36.8	36.8	12	79.2	79.2	72	121.6	121.6	32	164.0	164.0	92	206.5	206.5
$\begin{array}{c ccccccccccccccccccccccccccccccccccc$	53	37.5	37.5	13	79.9	79.9	73	122.3	122.3	- 33	164.8	164.8	93	207.2	207.2
$ \begin{array}{c ccccccccccccccccccccccccccccccccccc$	54	38.2	38.2	14	80.6	80.6	74	123.0	123.0	34	165.5	165.5	94	207.9	207.9
$ \begin{array}{c ccccccccccccccccccccccccccccccccccc$	55	38.9	38.9	15	81.3	81.3	75	123.7	123.7	35	166.2	166.2	95	208.6	208.6
$\begin{array}{c ccccccccccccccccccccccccccccccccccc$	56	39.6	39.6	$16 \\ 17$	82.0	82.0	76	124.5	124.5	36	166.9	166.9	96	209.3	209.3
35 41.0 41.0 18 83.4 83.4 78 125.9 125.9 38 168.3 198 210.7 210.7 210.7 59 41.7 41.7 19 84.1 84.1 79 126.6 126.6 39 169.0 169.0 99 211.4 211.4 60 42.4 42.4 20 84.9 80 127.3 127.3 40 169.7 169.7 300 212.1 212.1 Dist. Dep. Lat.	57	40.3	40.3	17	82.7	82.7	11	125.2	125.2	37	167.6	167.6	97	210.0	210.0
60 42.4 42.4 20 84.9 80 127.3 127.3 40 169.7 169.7 300 212.1 212.1 Dist. Dep. Lat.	50	41.0	41.0	18	83.4	83.4	18	120.9	120.9	38	160.0	108.3	98	210.7	210.7
Obst. Dep. Lat. Dist.	60	41.1	41.1	- 19	81 0	84 0	19	120.0 197.2	120.0 197.2	39	169.0	109.0 169.7	300	211.4	211.4
Dist. Dep. Lat. Dist. Dep. Lat. Dist. Dep. Lat. Dist. Dep. Lat. NE, NW, SE, SW. For 4 Points.	00	12. I	74.4	20	01.0	01.0	00	141.0	141.0	10	103.7	100.7	000	212.1	414.L
NE. NW. SE. SW. [For 4 Points.	Dist.	Dep.	Lat.	Dist.	Dep.	Lat.	Dist.	Dep.	Lat.	Dist.	Dep.	Lat.	Dist.	Dep.	Lat.
ALTER MARKE STREET		. NE			NW.			SE.		SW			<u></u> гі	For 4 Po	ints.

Pa	ge 368]					Т	ABLE	2 2.							
			Differ	ence of [Latitud	le and	Depart	ure for	1° (17	79°, 181°	°, 359°).			
Dist.	Lat.	Dep.	Dist.	Lat.	Dep.	Dist.	Lat.	Dep.	Dist.	Lat.	Dep.	Dist.	Lat.	Dep.	
$\frac{1}{2}$	$1.0 \\ 2.0$	0.0 0.0	$\begin{array}{c} 61 \\ 62 \\ \end{array}$	$61.0 \\ 62.0 \\ 0$	$\begin{array}{c} 1.1\\ 1.1 \end{array}$	$121 \\ 22 \\ 22 \\ 22 \\ 22 \\ 22 \\ 22 \\ 22 $	121.0 122.0	2.1 2.1	181 82	$181.0 \\ 182.$	$3.2 \\ 3.2 \\ 2.2 \\ 3.2 $	$241 \\ 42 \\ 12$	241.0 242.0	$\frac{4.2}{4.2}$	
$\frac{3}{4}$	$3.0 \\ 4.0 \\ 5.0$	$ \begin{array}{c} 0.1\\ 0.1\\ 0.1\\ 0.1 \end{array} $		$63.0 \\ 64.0 \\ 65.0$	1.1 1.1 1.1	$ \begin{array}{c} 23 \\ 24 \\ 25 \end{array} $	$123.0 \\ 124.0 \\ 125.0$	$2.1 \\ 2.2 \\ 2.2 \\ 2.2$	83 84 85	$183.0 \\ 184.0 \\ 185.0$	3.2 3.2 3.2	43 44 45	$243.0 \\ 244.0 \\ 245.0$	$\frac{4.2}{4.3}$	
6 7 8	6.0 7.0 8.0	$ \begin{array}{c} 0.1 \\ 0.1 \\ 0.1 \end{array} $	$^{\oplus}{}^{66}_{67}_{68}$	$66.0 \\ 67.0 \\ 68.0$	$1.2 \\ 1.2 \\ 1.2 \\ 1.2$	$ \begin{array}{c} 26 \\ 27 \\ 28 \end{array} $	126.0 127.0 128.0	2.2 2.2 2.2	86 87 88	$186.0 \\ 187.0 \\ 188.0$	$3.2 \\ 3.3 \\ 3.3 $	46 47 48	246.0 247.0 248.0	$\frac{4.3}{4.3}$	
9 10	9.0 10.0	$0.1 \\ 0.2 \\ 0.2$	69 70	69.0 70.0	$1.2 \\ 1.2 \\ 1.2$	$\begin{array}{c} 20\\ 29\\ 30\end{array}$	$120.0 \\ 129.0 \\ 130.0$	2.3 2.3	89 90	$ 189.0 \\ 190.0 $	3.3 3.3	$ \frac{49}{50} $	$249.0 \\ 250.0$	4.3 4.4	
$ \begin{array}{c} 11 \\ 12 \\ 13 \end{array} $	$\frac{11.0}{12.0}\\13.0$	$0.2 \\ 0.2 \\ 0.2$	$ \begin{array}{c} 71 \\ 72 \\ 73 \end{array} $	$\begin{array}{c} 71.0 \\ 72.0 \\ 73.0 \end{array}$	$\begin{array}{c}1.2\\1.3\\1.3\end{array}$	$\begin{array}{c}131\\32\\33\end{array}$	$131.0 \\ 132.0 \\ 133.0$	$= \frac{2.3}{2.3}$	$ \begin{array}{r} 191 \\ 92 \\ 93 \end{array} $	$191.0 \\ 192.0 \\ 193.0$	$3.3 \\ 3.4 \\ 3.4$	$251 \\ 52 \\ 53$	251.0 252.0 253.0	4.4 4.4 4.4 4.4 4.4	
$^{+}14 \\ 15 \\ 16$	$14.0 \\ 15.0 \\ 16.0 $	$\begin{array}{c} 0.2\\ 0.3\\ 0.3\end{array}$	$ \begin{array}{r} 74 \\ 75 \\ 76 \end{array} $	74.0 75.0 76.0	$1.3 \\ 1.3 \\ 1.3$	$ 34 \\ 35 \\ 36 $	$134.0 \\ 135.0 \\ 136.0$	2.3 2.4 2.1	94 95 96	194.0 195.0 196.0	$3.4 \\ 3.4 \\ 8.4$	54 55 56	254.0 255.0 256.0	4.4 4.5 4.5	
17 18	17.0 18.0	$0.3 \\ 0.3 $	77 78 78	77.0 78.0	$1.3 \\ 1.4 \\ 1.4$	37 38 20	137.0 138.0 120.0	2.4 2.4	97 98	197.0 198.0	3.4 3.5	57 58	257.0 258.0 250.0	4.5 4.5	
$\frac{19}{20}$	19.0 20.0	0.3 0.3	80	<u>- 79.0</u> - 80.0	1.4 1.4	$\frac{39}{40}$	139.0 140.0	2.4	$\frac{99}{200}$	200.0	$\frac{3.5}{3.5}$	$\frac{59}{60}$	259.0 260.0 261.0	4.5	
$\frac{21}{22}$ 23	$\begin{array}{c} 21.0 \\ 22.0 \\ 23.0 \end{array}$	0.4 0.4 0.4	$\begin{array}{c} 81\\ 82\\ 83\end{array}$	81.0 82.0 83.0	1.4 1.4 1.4	$ \begin{array}{r} 141 \\ 42 \\ 43 \end{array} $	$ \begin{array}{c} 141.0\\ 142.0\\ 143.0 \end{array} $	$2.5 \\ 2.5 \\ 2.5 \\ 2.5$	$\begin{array}{c} 201 \\ 02 \\ 03 \end{array}$	201.0 202.0 203.0	$3.5 \\ 3.5 \\ 3.5$		$\begin{array}{c} 261.0 \\ 262.0 \\ 263.0 \end{array}$	4. 6 4. 6 4. 6	
$\frac{24}{25} \cdot \frac{26}{26}$	$\begin{array}{cccccccccccccccccccccccccccccccccccc$														
27 28	27.0 28.0	0.5	87 88 80	87.0 88.0	1.5 1.5 1.5	47 48 40	$ \begin{array}{c c} 147.0 \\ 148.0 \\ 140.0 \end{array} $	$ \begin{array}{c} 2.6 \\ 2.6 \\ 2.6 \\ 2.6 \end{array} $	07	207.0 208.0	3.6 3.6 2.6		267.0 268.0	4.7	
$\begin{array}{cccccccccccccccccccccccccccccccccccc$															
$ 32 \\ 33 $	$\begin{array}{cccccccccccccccccccccccccccccccccccc$														
$\frac{34}{35}\\ 36$	$\begin{array}{c} 34.0 \\ 35.0 \\ 36.0 \end{array}$	$0.6 \\ 0.6 $	94 95 96	$ \begin{array}{r} 94.0\\ 95.0\\ 96.0 \end{array} $	$ \begin{array}{c} 1.6 \\ 1.7 \\ 1.7 \\ 1.7 \\ \end{array} $	$54 \\ 55 \\ 56$	$ \begin{array}{c} 154.0\\ 155.0\\ 156.0 \end{array} $	$ \begin{bmatrix} 2.7 \\ 2.7 \\ 2.7 \\ 2.7 \end{bmatrix} $	$ \begin{array}{r} 14 \\ 15 \\ 16 \end{array} $	$\begin{array}{c c} 214.0 \\ 215.0 \\ 216.0 \end{array}$	$ \begin{array}{c} 3.7 \\ 3.8 \\ 3.8 \end{array} $	$\begin{bmatrix} 74\\75\\76\end{bmatrix}$	$\begin{array}{c} 274.0 \\ 275.0 \\ 276.0 \end{array}$	$ \begin{array}{c c} 4.8 \\ 4.8 \\ 4.8 \end{array} $	
37 38 20	37.0 38.0 20.0	$ \begin{array}{c} 0.6 \\ 0.7 \\ 0.7 \end{array} $	97 98 00	97.0 98.0	$1.7 \\ 1.7 \\ 1.7 \\ 1.7$	57 58 59	157.0 158.0 159.0	2.7 2.8 2.8	$17 \\ 18 \\ 10$	217.0 218.0 219.0	3.8 3.8 2.9	77 78 79	277.0 278.0 279.0	4.8 4.9	
$\frac{39}{40}$	$\frac{40.0}{41.0}$		$\frac{100}{101}$	$\frac{100.0}{101.0}$	$\frac{1.7}{1.7}$	$\frac{60}{161}$	$\frac{160.0}{161.0}$	$\frac{2.8}{2.8}$	$\frac{15}{20}$	$\begin{array}{r} 213.0 \\ 220.0 \\ \hline 221.0 \end{array}$		$\frac{80}{281}$	$ \frac{275.0}{280.0} \\ \overline{281.0} $	$\frac{4.9}{4.9}$	
42 43	42.0 43.0 44.0	$0.7 \\ 0.8 \\ 0.8$	$ \begin{array}{c} 02 \\ 03 \\ 04 \end{array} $	$ \begin{array}{c c} 102.0 \\ 103.0 \\ 104.0 \end{array} $	$1.8 \\ 1.8 $	62 63 64	162.0 163.0 164.0	$ \begin{array}{c c} 2.8 \\ 2.8 \\ 2.9 \\ 2.9 \\ \end{array} $	$ \begin{array}{c} 22 \\ 23 \\ 24 \end{array} $	222.0 223.0 224.0	3.9 3.9 3.9	82 83 84	282.0 283.0 284.0	4.9 4.9 5.0	
45 46	45.0 46.0	0.8	05 06	101.0 105.0 106.0	1.8 1.8 1.8	65 66	$ \begin{array}{c} 165.0 \\ 166.0 \\ 167.0 \\ 166.0 \\ 167.0 \\ 177.0 $	2.9 2.9 2.9		225.0 226.0	3.9 3.9	85 86	285.0 286.0	5.0 5.0 5.0	
$\frac{47}{48}$ 49	47.0 48.0 49.0	$0.8 \\ 0.8 \\ 0.9$	07 08 09	107.0 108.0 109.0	$1.9 \\ 1.9 \\ 1.9 \\ 1.9$	$\begin{array}{c} 67\\ 68\\ 69\end{array}$	$ \begin{array}{r} 167.0 \\ 168.0 \\ 169.0 \end{array} $	$ \begin{array}{c} 2.9 \\ 2.9 \\ 2.9 \\ 2.9 \end{array} $	$ \begin{array}{r} 21 \\ 28 \\ 29 \end{array} $	$\begin{array}{c c} 227.0 \\ 228.0 \\ 229.0 \end{array}$	4.0 4.0 4.0	87 88 89	287.0 288.0 289.0	5.0 5.0 5.0	
$\frac{50}{51}$	50.0 51.0	0.9	$\frac{10}{111}$	$\frac{110.0}{111.0}$	$\frac{1.9}{1.9}$	$\frac{70}{171}$	$\frac{170.0}{171.0}$	$\frac{3.0}{3.0}$	$\frac{30}{231}$	$\frac{230.0}{231.0}$	$\frac{4.0}{4.0}$	$\frac{90}{291}$	$\begin{array}{c c} 290.0\\\hline 291.0\end{array}$	$\frac{5.1}{5.1}$	
$52 \\ 53 \\ 54$	52.0 53.0 54.0	0.9 0.9 0.9	$ 12 \\ 13 \\ 14 $	$112.0 \\ 113.0 \\ 114.0$	2.0 2.0 2.0	$72 \\ 73 \\ 74$	$ \begin{array}{c c} 172.0\\ 173.0\\ 174.0 \end{array} $	3.0 3.0 3.0	$ 32 \\ 33 \\ 34 $	$\begin{array}{c c} 232.0\\ 233.0\\ 234.0 \end{array}$	4.0 4.1 4.1	$92 \\ 93 \\ 94$	$\begin{array}{c c} 292.0\\ 293.0\\ 294.0 \end{array}$	$5.1 \\ 5.1 \\ 5.1 \\ 5.1$	
$55 \\ 56 \\ 57$	55.0 56.0	1.0 1.0 1.0	15 16 17	$ \begin{array}{c c} 115.0\\ 116.0\\ 117.0 \end{array} $	2.0 2.0 2.0	$75 \\ 76 \\ 77$	$ \begin{array}{c c} 175.0\\ 176.0\\ 177.0 \end{array} $	$\begin{array}{c c} 3.1\\ 3.1\\ 3.1\\ 2 \end{array}$	35 36	$\begin{array}{c c} 235.0\\ 236.0\\ 227.0\\ \end{array}$	4.1	95 96 97	295.0 296.0	5.1 5.2 5.2	
54 58 59	57.0 58.0 59.0	1.0 1.0 1.0	17 18 19	$ \begin{array}{c} 117.0 \\ 118.0 \\ 119.0 \end{array} $	$2.0 \\ 2.1 \\ 2.1 \\ 2.1$	78 79	$ \begin{array}{c} 177.0 \\ 178.0 \\ 179.0 \end{array} $	3.1 3.1 3.1	37 38 39	$\begin{array}{c c} 237.0 \\ 238.0 \\ 239.0 \\ \end{array}$	4.1 4.2 4.2	97 98 99	297.0 298.0 299.0	$ \begin{array}{c c} 5.2 \\ $	
60	60.0	1.0	20	120.0	2.1	80	180.0	3.1	40	240.0	4.2	300	300.0	$-\frac{5.2}{1.1}$	
Dist.	Dep.	Lat.	Dist.	Dep.	Lat.	89° (9	91°, 269	°, 271°).	Dep.	Lat.	Dist.	pep.	Lat.	

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Difference of Latitude and Dep	arture for 1° (179°, 181°, 359°).														
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59 358.9 6.3 19 418.9 7.3 79 478 60 359.9 6.3 20 419.9 7.3 80 478 Dia Dia Dia Dia Dia Dia Dia Dia	9 8.4 39 538.9 9.4 99 598.9 10.4 9 8.4 40 539.9 9.4 600 599.9 10.5														
Dist. Dep. Lat. Dist. Dep. Lat. Dist. De 89° (91°, 2	. Lat. Dist. Dep. Lat. Dist. Dep. Lat. 39°, 271°).														

Pa	ge 370	1				Т	ABLE	2						
	0,010		Differ	ence of	Latituc	le and	Depart	ure for	2° (1	78°, 182	°, 358°).		
Dist.	Lat.	Dep.	Dist.	Lat.	Dep.	Dist.	Lat.	Dep.	Dist.	Lat.	Dep.	Dist.	Lat.	Dep.
$\frac{1}{2}$	1.0	0.0	$\frac{61}{62}$	61.0 62.0	2.1	$\frac{121}{22}$	120.9 121.9	4.2	181 82	180.9	6.3	$241 \\ 42$	240.9 241.9	8.4
3	3.0	0.1	63	63.0	2.2	23	122.9	4.3	83	182.9	6.4	43	242.9	8.5
45	$\frac{4.0}{5.0}$	$0.1 \\ 0.2$	$64 \\ 65$	64.0 65.0	$\frac{2.2}{2.3}$	$\frac{24}{25}$	123.9 124.9	4.3	84 85	183.9 184 9	$6.4 \\ 6.5$	44	243.9	8.5
6	6.0	0.2	66	66.0	2.3	$\frac{26}{26}$	125.9	4.4	86	185.9	6,5	46	245.9	8.6
7	7.0	0.2	67	67.0	$\frac{2.3}{2.4}$	$\frac{27}{29}$	126.9 127.0	4.4	87	186.9	6.5	47	246.8	8.6
9	9.0	0.3	69	69.0	$2.4 \\ 2.4$	$\frac{28}{29}$	127.9 128.9	4.5 4.5	89	187.9	6.6	48	247.8	8.7
10	10.0	0.3	70	70.0	2.4	30	129.9	4.5	90	189.9	6.6	_ 50	249.8	8.7
11	11.0 12.0	0.4	$\frac{71}{72}$	71.0 72.0	2.5	$\frac{131}{32}$	130.9 131.0	4.6	$191 \\ 02$	190.9	$\begin{array}{c} 6.7 \\ 6.7 \end{array}$	$251 \\ 52$	250.8	8.8
$12 \\ 13$	12.0 13.0	$0.4 \\ 0.5$	$\frac{72}{73}$	72.0 73.0	2.5 2.5	$\frac{32}{33}$	131.9	4.6	93	191.9	6.7	$\frac{52}{53}$	251.8 252.8	8.8
14	14.0	0.5	74	74.0	2.6	34	133.9	4.7	94	193.9	6.8	54	253.8	8.9
15	15.0 16.0	0.5	$\frac{75}{76}$	75.0	$\frac{2.6}{2.7}$	35 36	134.9 135.9	4.7	95 96	194.9	6.8	50 56	254.8	8.9
17	17.0	0.6	77	77.0	$\bar{2}.7$	37	136.9	4.8	97	196.9	6.9	57	256.8	9.0
18	18.0	0.6	78	78.0	2.7	38	137.9	4.8	98	197.9	6.9	58 50	257.8	9.0
20	19.0 20.0	$0.7 \\ 0.7$	80	80.0	$\frac{2.8}{2.8}$	40	138.9	4.9	200	198.9	7.0	$\frac{59}{60}$	258.8 259.8	9.0
21	21.0	0.7	81	81.0	2.8	141	140.9	4.9	201	200.9	7.0	261	260.8.	9.1
$\frac{22}{92}$	22.0	0.8	82	82.0	$\frac{2.9}{2.0}$	$\frac{42}{42}$	141.9	$5.0 \\ 5.0$	$02 \\ 03$	201.9	7.0	62 62	261.8	9.1
$\frac{23}{24}$	23.0 24.0	0.8	84	82.9	$2.9 \\ 2.9$	40	142.9	5.0 5.0	03	202.9 203.9	7.1	64	262.8	9.2
25	25.0	0.9	85	84.9	3.0	45	144.9	5.1	05	204.9	7.2	65	264.8	9.2
$\begin{array}{c ccccccccccccccccccccccccccccccccccc$														9.3
$\frac{2}{28}$	28.0	1.0	88	87.9	3.1	48	147.9	5.2	08	200.9	7.3	68	267.8	9.4
29	29.0	1.0	89	88.9	3.1	49	148.9	5.2	09	208.9	7.3	69 70	268.8	9.4
$\frac{30}{21}$	$\frac{30.0}{31.0}$	$\frac{1.0}{1.1}$	90	89.9	3.1	$\frac{50}{151}$	$\frac{149.9}{150.9}$	$\frac{0.2}{5.3}$	$\frac{10}{211}$	$\frac{209.9}{210.9}$	7 4	$\frac{70}{271}$	$\frac{209.8}{270.8}$	9.4
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36	36.0	1.3	96	95.9	3.4	56	155.9	5.4	16	215.9	7.5	76	275.8	9.6
37	37.0	1.3	97	96.9	3.4	57	156.9	5.5	17	216.9	7.6	77	$ 276.8 \\ 277.8 $	9.7
$\frac{30}{39}$	38.0 39.0	1.3	99	98.9	3.5	59	157.9	5.5	19	218.9	7.6	79	278.8	9.7
40	40.0	1.4	100	99.9	3.5	60	159.9	5.6	20	219.9	7.7	80	279.8	9.8
41	41.0	1.4	$101 \\ 02$	100.9	3.5	$161 \\ 62$	160.9 161.9	$5.6 \\ 5.7$	$221 \\ 22$	$ 220.9 \\ 221.9 $	7.7	$\frac{281}{82}$	280.8	9.8
$\frac{42}{43}$	42.0 43.0	1.5	02	101.9	3.6	63	161.9	5.7	$\frac{22}{23}$	222.9	7.8	83	282.8	9.9
44	44.0	1.5	04	103.9	3.6	64	163.9	5.7	24	223.9	7.8	84	283.8	9.9
$ 45 \\ 46 $	$\begin{array}{c} 45.0\\ 46.0 \end{array}$	1.6 1.6	05	104.9 105.9	3.7 3.7	60 66	164.9 165.9	$5.8 \\ 5.8$	$\frac{25}{26}$	224.9 225.9	7.9	80 86	284.8 285.8	9.9
47	47.0	1.6	07	106.9	3.7	67	166.9	5.8	27	226.9	7.9	87	286.8	10.0
48	48.0	1.7	08	107.9	3.8	68 60	167.9	5.9	28	227.9	8.0	88	287.8	10.1
$\frac{49}{50}$	49.0 50.0	1.7	10	108.9	3.8	70	168.9 169.9	5.9	$\frac{23}{30}$	229.9	8.0	90	289.8	10.1
51	51.0	1.8	111	110.9	3.9	171	170.9	6.0	231	230.9	8.1	291	290.8	10.2
52	52.0	1.8	12	111.9	3.9	$\frac{72}{72}$	171.9	6.0	$\frac{32}{33}$	231.9	8.1	92	291.8	10.2
- 53 - 54	53.0 54.0	$1.8 \\ 1.9$	13	112.9	4.0	74	172.9	6.1	34	232.9 233.9	8.2	93 94	292.8	10. 2
55	55.0	1.9	15	114.9	4.0	75	174.9	6.1	35	234.9	8.2	95	294.8	10.3
$56 \\ 57$	56.0 57.0	2.0 2.0	$16 \\ 17$	115.9 116.9	4.0	$\begin{array}{c} 76 \\ 77 \end{array}$	175.9 176.9	6.1	$\frac{36}{37}$	235.9	8.2	96 97	295.8 296.8	10.3 10.4
58	58.0	2.0	18	117.9	4.1	78	177.9	6.2	38	237.9	8.3	98	297.8	10.4
59	59.0	2.1	. 19	118.9	4.2	79	178.9	6.2	39	238.9	8.3	99	298.8	10.4
	60.0	2.1	20	119.9	4.2		179.9	0.0	40	239.9		000	200.0	10.0
Dist.	Dep.	Lat.	Dist.	Dep.	Lat.	Dist.	Dep.	Lat.	Dist.	Dep.	Lat.	Dist.	Dep.	Lat.
						90. (8	, 208	, 212')	•					

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			Differ	ence of	Latituc	le and	Depart	ure for	2° (1'	78°, 182'	°, 358°).	Lrage	911
Dist.	Lat.	Dep.	Dist.	Lat.	Dep.	Dist.	Lat.	Dep.	Dist.	Lat.	, Dep.	Dist.	Lat.	Dep.
301	300.8	10.5	361	360.8	12.6	421	420.8	14.7	481	480.7	16.8	541	540.7	18.9
02	301.8	10.5	62	361.8	12.6	22	421.8	14.7	82	481.7	16.8	42	541.7	18.9
03	302.8	10.6	63 64	362.8	12.7 12.7	$\frac{23}{24}$	422.8	14.7	83 84	482.7	16.8	43	542.7 543.7	18.9
05	304.8	10.6	65	364.8	12.7	25	424.8	14.8	85	484.7	16.9	45	544.7	19.0
06	305.8	10.7	66	365.8	12.8	26	425.7	14.9	86	485.7	16.9	46	545.7	19.0
07	306.8	10.7	67 68	366.8	12.8	27	426.7	14.9	87	486.7	17.0	47	546.7	19.1
08	307.8	10.1	69	368.8	12.0	29	428.7	14. 5	89	488.7	17.0	49	548.7	19.1
10	309.8	10.8	70	369.8	12.9	30	429.7	15.0	90	489.7	17.1	50	549.7	19.2
311	310.8	10.8	371	370.8	12.9	431	430.7	15.0	491	490.7	17.1	551	550.7	19.2
$\frac{12}{13}$	311.8 312.8	10.9	$\frac{72}{73}$	371.8 372.8	13.0 13.0	$\frac{32}{33}$	431.7	15.1 15.1	92 93	491.7	17.1 17.2	$\frac{52}{53}$	551.7 552.7	19.2
14	313.8	10.9	74	373.8	13.0	34	433.7	15.1	94	493.7	17.2 17.2	54	553.7	19.3
15	314.8	11.0	75	374.8	13.1	35	434.7	15.2	95	494.7	17.2	55	554.7	19.3
16	315.8	11.0	$\frac{76}{77}$	375.8	13.1	$\frac{36}{27}$	435.7	15.2	96	495.7	17.3	$56 \\ 57$	555.7	19.4
$\frac{17}{18}$	316.8	11.0	78	370.8	13.1 13.2	37	430.7	15.2 15.3	97	490.7	17.3 17.3	58	000.7 557.7	19.4
19	318.8	11.1	79	378.8	13.2	39	438.7	15.3	99	498.7	17.4	59	558.7	19.5
20	319.8	11.2	80	379.8	13.2	40	439.7	15.3	500	499.7	17.4	60	559.7	19.5
321	320.8	11.2	381	380.8	13.3	441	440.7	15.4	501	500.7	17.5	561	560.7	19.5
22	321.8 322.8	11.2 11.3	82 83	381.0	13.3 13.3	42 43	441.7	15.4	02	502.7	17.5	62 63	561.7 562.7	19.6
24	323.8	11.3	84	383.8	13.4	44	443.7	15.5	04	503.7	17.6	64	563.7	19.6
25	324.8	11.3	85	384.8	13.4	45	444.7	15.5	05	504.7	17.6	65	564.7	19.7
$\frac{26}{97}$	325.8	11.4	86	385.8	13.5	46	445.7	15.6	06	505.7	17.6	66	565.7	19.7
21 28	320.6 327.8	11.4	88	380.0	13.0 13.5	41	440.7	15.0 15.6	07	507.7	17.7	68	567.7	19.1
29	328.8	11.5	89	388.8	13.6	49	448.7	15.7	09	508.7	17.7	69	568.7	19.8
30	329.8	11.5	90	389.8	13.6	50	449.7	15.7	10	509.7	17.8	70	569.7	19.9
$\frac{331}{22}$	330.8	11.5	$\frac{391}{09}$	390.8	13.6	451	450.7	15.7	511	510.7	17.8	571	570.7	19.9
32	331.0	11.0	92 93	391.8	13.7 13.7	53 52	401.7	10.0	12	512.7	17.9	$\frac{12}{73}$	572.7	19.9
34	333.8	11.6	94	393.8	13.7	54	453.7	15.8	14	513.7	17.9	74	573.6	20.0
35	334.8	11.7	95	394.8	13.8	55	454.7	15.9	15	514.7	17.9	75	574.6	20.0
30	.335. 8 226 8	11.7 11.7	96	395.8	13.8	$\frac{56}{57}$	455.7	15.9 15.9	$\frac{16}{17}$	515.7	18.0	70	575.6	20.1
38	337.8	11.8	98	397.8	13.9	58	450.7	16.0	18	517.7	18.1	78	577.6	20.1
39	338.8	11.8	99	398.8	13.9	59	458.7	16.0	19	518.7	18.1	79	578.6	20.2
40	339.8	11.9	400	399.8	13.9	60	459.7	16.0	20	519.7	18.1	80	579.6	20.2
$\frac{341}{49}$	340.8	11.9	401	400.8	14.0 14.0	461	460.7	16.1	$521 \\ 99$	520.7	18.2	581	580.6	20.2
43	342.8	$11.5 \\ 12.0$	02	401.8	14.0 14.0	63	462.7	10.1 16.1	22	521.7 522.7	18.2 18.2	82	581.0 582.6	20. 3
44	343.8	12.0	04	403.8	14.1	64	463.7	16.2	24	523.7	18.3	84	583.6	20.3
45	344.8	12.0	05	404.8	14.1	65	464.7	16.2	25	524.7	18.3	85	584.6	20.4
46	345.8	12.1 19 1	06	405.8	$\begin{array}{c} 14.2 \\ 14.2 \end{array}$	$\frac{66}{87}$	465.7	16.2	$.26 \\ -97$	525.7 596.7	18.4	86 87	585.6	20.4
48	347.8	12.1 12.1	08	407.8	14.2 14.2	68	467.7	16.3	$\frac{2}{28}$	520.7 527.7	18.4	88	587.6	20. 4
49	348.8	12.2	09	408.8	14.3	69	468.7	16.4	29	528.7	18.5	89	588.6	20.5
50	349.8	12.2	10	409.8	14.3	70	469.7	16.4	30	529.7	18.5	90	589.6	20.5
$\frac{351}{52}$	350.8	12.2	411	410.8	14.3	471	470.7	16.4	$531 \\ 29$	530.7	18.5	591	590.6	20.6
53	352.8	12.5 12.3	12	411.8	14.4 14.4	$\frac{72}{73}$	472.7	$16.0 \\ 16.5$	32 33	531.7 532.7	18.0	92 93	591.0 592.6	20.6
54	353.8	12.3	14	413.8	14.4	74	473.7	16.5	34	533.7	18.6	94	593.6	20.7
55	354.8	12.4	15	414.8	14.5	15	474.7	16.6	35	534.7	18.7	95	594.6	20.7
57 57	355.8	12.4	$\frac{16}{17}$	415.8	14.5 14.5	$\frac{76}{77}$	475.7	16.6	$\frac{36}{37}$	535.7	18.7	96 97	595.6	20.7
58	357.8	12.4 12.5	18	410.8	14.0 14.6	78	470.7	10.0 16.7	38	537.7	18.1	97	590.0 597.6	20.8 20.8
59	358.8	12.5	19	418.8	14.6	79	478.7	16.7	39	538.7	18.8	99	598.6	20.8
60	359.8	12.5	20	419.8	14.6	80	479.7	16.7	40	539.7	18.8	600	599.6	20.9
Dist.	Dep.	Lat.	Dist.	Dep.	Lat.	Dist.	Dep.	Lat.	Dist.	Dep.	Lat.	Dist.	Dep.	Lat.
						88° (§	92°, 268°	, 272°)).					

Pa	ge 372]				ľ	ABLE	2 2.		,	-			
			Differ	rence of	Latitu	de and	l Depart	ure for	· 3° (1	77°, 183	°, 357°	').		
Dist.	Lat.	Dep.	Dist.	Lat.	Dep.	Dist.	Lat.	Dep.	Dist.	Lat.	Dep.	Dist.	Lat.	Dep.
1	1.0	0.1	61	60.9	3.2	121	120.8	6.3	181	180.8	9.5	241	240.7	12.6
$\frac{2}{3}$	$\frac{2.0}{3.0}$	$0.1 \\ 0.2$	$62 \\ 63$	61.9 62.9	3.2 3.3	$\frac{22}{23}$	121.8 122.8	0.4 6.4	82	181.8 182.7	9.5	42	241.7 242.7	12.7 12.7
4	4.0	0.2	64	63.9	3.3	24	123.8	6.5	84	183.7	9.6	44	243.7	12.8
	5.0 6.0	0.3	66	65.9	3.5	$\frac{23}{26}$	124.8 125.8	0. 5 6. 6	80 86	184.7	9.7	40 46	244.7 245.7	12.8 12.9
7	7.0	0.4	67	66.9	3.5	27	126.8	6.6	87	186.7	9.8	47	246.7	12.9
8 9	8.0 9.0	0.4	68	68.9	3.6	$\frac{28}{29}$	127.8 128.8	6.7	88 89	187.7	9.8	48 49	247.7 248.7	13.0 13.0
10	10.0	0.5	70	69.9	3.7	_ 30	129.8	6.8	90	189.7	9.9	50	249.7	13.1
$11 \\ 12$	$11.0 \\ 12.0$	0.6	$71 \\ 72$	70.9 71.9	3.7 3.8	$\frac{131}{32}$	$ 130.8 \\ 131.8 $	6.9	$\frac{191}{92}$	190.7	10.0	$251 \\ 52$	250.7 251.7	13.1 13.2
$1\overline{3}$	13.0	0.7	73	72.9	3.8	33	132.8	7.0	93	192.7	10.1	53	252.7	13.2
$14 \\ 15$	$14.0 \\ 15.0$	0.7	$\frac{74}{75}$	73.9	3.9	34	133.8 134.8	$7.0 \\ 7.1$	94 95	193.7	10.2	54 55	253.7 254.7	13.3
16	16.0	0.8	76	75.9	4.0	36	135.8	7.1	96	195.7	10.3	56 - 56	255.6	13.4
$17 \\ 18$	17.0 18.0	0.9	$77 \\ 78$	76.9 77.9	4.0	37 38	136.8 137.8	$\frac{7.2}{7.2}$	97	196.7 197.7	10.3	57 58	256.6 257.6	13.5
19	19.0	1.0	79	78.9	4.1	39	138.8	7.3	99	198.7	10.4	59	258.6	13.6
$\frac{20}{21}$	$\frac{20.0}{21.0}$	$\frac{1.0}{1.1}$	80	$\frac{79.9}{80.0}$	$\frac{4.2}{1.2}$	40	139.8	$\frac{7.3}{7.4}$	$\frac{200}{201}$	199.7	10.5	60	259.6	13.6
$\frac{21}{22}$	21.0 22.0	$1.1 \\ 1.2$	82	81.9	4.3	42	140.8	$7.4 \\ 7.4$	02	200.7	10.5 10.6	62^{201}	260.6 261.6	13.7
23	23.0	1.2	83	82.9	4.3	43	142.8	7.5	03	202.7	10.6	63	262.6	13.8
$\frac{24}{25}$	$24.0 \\ 25.0$	1.3	85	84.9	4.4	44 45	143.8	7.6 7.6	04	203.7	10.7	65 65	263.6 264.6	13.8
26	26.0	1.4	86	85.9	4.5	46	145.8	7.6	06	205.7	10.8	66	265.6	13.9
$\frac{27}{28}$	$\frac{27.0}{28.0}$	1.4	87	80.9	4.6	47	140.8 147.8	7.7	07	206.7 207.7	10.8	67	266.6 267.6	14.0 14.0
29	29.0	1.5	89	88.9	4.7	49	148.8	7.8	09	208.7	10.9	69 70	268.6	14.1
$\frac{-30}{-31}$	$\frac{30.0}{31.0}$	$\frac{1.0}{1.6}$	$\frac{90}{91}$	$\frac{-89.9}{-90.9}$	$\frac{4.7}{4.8}$	$\frac{50}{151}$	149.8 150.8	$\frac{7.9}{7.9}$	$\frac{10}{211}$	$\frac{209.7}{210.7}$	$\frac{11.0}{11.0}$	$\frac{70}{271}$	$\frac{209.0}{270.6}$	$\frac{14.1}{14.2}$
32	32.0	1.7	92	91.9	4.8	52	151.8	8.0	12	211.7	11.1	72^{-72}_{-72}	271.6	14.2
$\frac{33}{34}$	33.0 34.0	1.7 1.8	93 94	92.9 93.9	4.9	53 54	152.8 153.8	8.0	13	212.7 213.7	11.1 11.2	73	272.6 273.6	14.3 14.3
35	35.0	1.8	95	94.9	5.0	55	154.8	8.1	15	214.7	11.3	75	274.6	14.4
$\frac{36}{37}$	36.0 36.9	$1.9 \\ 1.9$	96 97	95.9 96.9	$5.0 \\ 5.1$	$\frac{56}{57}$	155.8 156.8	$\frac{8.2}{8.2}$	16 17	215.7 216.7	$11.3 \\ 11.4$	$\frac{76}{77}$	275.6 276.6	14.4 14.5
38	37.9	2.0	98	97.9	5.1	58	157.8	8.3	18	217.7	11.4	78	277.6	14.5
39 40	38.9 39.9	$\frac{2.0}{2.1}$	99 100	98.9	$5.2 \\ 5.2$	59 60	158.8. 159.8	$8.3 \\ 8.4$	19 20	218.7 219.7	$11.5 \\ 11.5$	79 80	278.6 279.6	14.6 14.7
41	40.9	2.1	101	100.9	5.3	161	160.8	8.4	221	220.7	11.6	281	280.6	14.7
$\frac{42}{43}$	41.9	$\frac{2.2}{2.3}$	$ \begin{array}{c} 02 \\ 03 \end{array} $	101.9 102.9	$5.3 \\ 5.1$	$\frac{62}{63}$	$161.8 \\ 162.8$	$\frac{8.5}{8.5}$	$\frac{22}{23}$	221.7 222.7	11.6	82 83	$\frac{281.6}{282.6}$	14.8
44	43.9	2.3	04	103.9	5.4	64	163.8	8.6	24	223.7	11.7	84	283.6	14.9
45	44.9	2.4	05	104.9 105.9	5.5	65 66	164.8 165.8	$\frac{8.6}{8.7}$	25 26	224.7 225.7	11.8	$\frac{85}{86}$	284.6 285.6	14.9
47	46.9	2.5	07	106.9	5.6	.67	166.8	8.7	- 27	226.7 226.7	11.9	87	286.6	15.0
48	47.9	$\frac{2.5}{2.6}$	08	107.9	5.7	68, 60	167.8 168.8	8.8	28	227.7	11.9	88	287.6	15.1
50	49.9	2.6 2.6	10	109.8	5.8	70	169.8	8.9	$\frac{29}{30}$	229.7	12.0 12.0	90	289.6	15.1 15.2
51	50.9	2.7	111	110.8	5.8	171	170.8	8.9	231	230.7	12.1	291	290.6	15.2
$\frac{52}{53}$	51.9 52.9	$\frac{2.7}{2.8}$	$12 \\ 13$	$111.8 \\ 112.8$	$5.9 \\ 5.9$	$\frac{72}{73}$	$171.8 \\ 172.8$	9.0 9.1	$\frac{32}{33}$	231.7 232.7	12.1 12.2	$\frac{92}{93}$	291.6 292.6	15.3 15.3
54	53.9	2.8	14	113.8	6.0	74	173.8	9.1	34	233.7	12.2	94	293.6	15.4
56 56	55.9	$\frac{2.9}{2.9}$	15 16	114.8 115.8	$6.0 \\ 6.1$	$\frac{75}{76}$	$174.8 \\ 175.8$	$9.2 \\ 9.2$	35 36	234.7 235.7	12.3 12.4	90 96	294.6 295.6	15.4 15.5
57	56.9	3.0	17	116.8	6.1	77	176.8	9.3	37	236.7	12.4	97	296.6	15.5
58 59	57.9	3.0 3.1	18	117.8	$0.2 \\ 6.2$	78 79	177.8 178.8	9.3 9.4	- 38 - 39	237.7	12.5 12.5	98 99	297.6 298.6	15.6
60	59.9	3.1	20	119.8	6.3	80	179.8	9.4	40	239.7	12.6	300	299.6	15.7
Dist.	Dep.	Lat,	Dist.	Dep.	Lat.	Dist.	Dep.	Lat.	Dist.	Dep.	Lat.	Dist.	Dep.	Lat.
						87° (§	93°, 267°	, 273°).					

						I	ABLE	2 2.					[Page	373	
			Differ	ence of	Latitu	le and	l Depart	ure for	3° (1	77°, 183	°, 357°).			
Dist.	Lat.	Dep.	Dist.	Lat.	Dep.	Dist.	Lat.	Dep.	Dist.	Lat.	Dep.	Dist.	Lat.	Dep.	
301	300.6	15.7	361	360.5	18.9	421	420.4	22.0	481	480.3	25.2	541	540.2	28.3	
$ \begin{array}{c} 02 \\ 03 \end{array} $	301.6 302.6	15.8	$\frac{62}{63}$	361.5 362.5	19.0	$\frac{22}{23}$	421.4	22.1 22.2	82 83	481.3	25.2 25.3	42	541.2 542.2	28.4 28.4	
04	303.5	15.9	64	363.5	19.1	24	423.4	22.2	84	483.3	25.3	44	543.2	28.5	
05	304.5	16.0	65	364.5	19.1	$\frac{25}{26}$	424.4	22.3	85	484.3	25.4	45	544.2	28.5	
06	305.5	16.0	00 67	366.5	19.2 19.2	20	425.4 426.4	$\frac{22.3}{22.4}$	80	485.3	25.4 25.5	40	546.2	28.0 28.6	
08	307.5	16.1	68	367.5	19.3	28	427.4	22.4	88	487.3	25.5	48	547.2	28.7	
09	308.5	16.2	69	368.5	19.3	29	428.4	22.5	89	488.3	25.6	49	548.2	28.7	
$\frac{10}{911}$	309.5	$\frac{16.2}{16.2}$	$\frac{70}{971}$	369.5	19.4	$\frac{30}{491}$	429.4	22.5	90	489.3	$\frac{25.6}{25.7}$	551	549.2	$\frac{28.8}{3000}$	
$\frac{311}{12}$	310.5 311.5	10.3 16.3	$\frac{371}{72}$	370.5 371.5	19.4	431	431.4	22.6 22.6	491 92	491.3	$\frac{23.7}{25.7}$	$\frac{551}{52}$	550.2 551.2	28.8 28.9	
13^{12}	312.5	16.4	73	372.5	19.5	33	432.4	22.7	93	492.3	25.8	53	552.2	28.9	
14	313.5	16.4	74	373.5	19.6	34	433.4	22.7	94	493.3	25.9	54	553.2	29.0	
15	314.5 215.5	16.5	75	374.5 275.5	19.6	35	434.4	22.8	95	194.3 105.2	25.9 26.0	56 56	555 2	29.1	
17	310.5 316.5	10.0 16.6	77	376.5	19.7	37	436.4	22.8 22.9	97	496.3	26.0 26.0	57	556.2	29.1 29.2	
18	317.5	16.7	78	377.4	19.8	- 38	437.4	22.9	- 98	497.3	26.1	58	557.2	29.2	
19	318.5	$ 16.7 \\ 16.7$	79	378.4	19.9	39	438.4	23.0	99	498.3	26.1	59	558.2	29.3	
$\frac{20}{991}$	319.0	16.8	201	379.4	19.9	40	439.4	$\frac{23.0}{92.1}$	501	<u>499.3</u> 500.2	$\frac{20.2}{96.9}$	561	$\frac{339.2}{560.2}$	29.3 90.1	
$\frac{321}{22}$	320.5 321.5	16.9	82	381.4	$\begin{bmatrix} 20.0\\ 20.0 \end{bmatrix}$	42	441.4	$\frac{23.1}{23.1}$	$001 \\ 02$	500.3 501.3	20.2 26.3	62^{-001}	561.2	29.4 29.4	
23	322.5	16.9	83	382.4	20.1	43	442.4	23.2	03	502.3	26, 3	63	562.2	29.5	
24	323.5	17.0	84	383.4	20.1	44	443.4	23.3	04	503.3	$\frac{26.4}{26.4}$	64	563.2	29.5	
20 26	324.0 325.5	17.0 17.1	80 86	384.4 385.4	20.2 20.2	40	444.4	23.3 23.4	00	505.3	$\frac{20.4}{26.5}$	60 66	$\begin{array}{c} 304.2 \\ 565.2 \end{array}$	29.0	
$\tilde{27}$	$\begin{array}{cccccccccccccccccccccccccccccccccccc$														
28	327.5	17.2	88	387.4	20.3	48	447.4	23.5	- 08	507.3	26.6	68	567.2	29.7	
$\frac{29}{20}$	328.5	17.2	89	388.4	20.4	49	448.4	23.5	09	508.3	26.6	$\frac{69}{70}$	568.2 560.2	29.8	
331	330 5	$\frac{17.3}{17.3}$	391	$\frac{369.4}{390.4}$	$\frac{20.4}{20.5}$	451	450 3	$\frac{23.0}{23.6}$	$\frac{10}{511}$	510 3	$\frac{20.7}{26.7}$	571	$\frac{509.2}{570.2}$	29.0	
32	$\begin{array}{c ccccccccccccccccccccccccccccccccccc$														
- 33	$\begin{array}{c ccccccccccccccccccccccccccccccccccc$														
34	$\begin{array}{cccccccccccccccccccccccccccccccccccc$														
- 30 - 36 •	$\begin{array}{c ccccccccccccccccccccccccccccccccccc$														
37	336.5	17.7	97	396.4	20.8	57	456.3	23.9	17	516.3	27.1	77	576.2	30.2	
38	337.5	17.7	98	397.4	20.8	58	457.3	24.0	18	517.3	27.1	78	577.2	30.2	
$\frac{39}{40}$	338.9 339-5	17.8 17.8	400	398.4	20.9	- 6 0	459 3	24.0	19 20	518.3	27.2 27.2	- 79	579 2	30.3	
$\frac{10}{341}$	340.5	$\frac{11.0}{17.9}$	401	400.4	21.0	461	460.3	$\frac{24.1}{24.1}$	521	520.3	27.3	581	580.2	$\frac{30.9}{30.4}$	
42	341.5	17.9	02	401.4	21.1	62	461.3	24.2	22	521.3	27.3	82	581.2	30.4	
43	342.5	18.0	03	402.4	21.1	63	462.3	24.2	23	522.3	27.4	83	582.2	30.5	
44 45	344.5	18.0	04	404.4	$\begin{bmatrix} 21, 2\\ 21, 2 \end{bmatrix}$	04 65	405.3	24.3 24.4	24 25	523.3 524.3	27.5	85	584 2	30. ð 30. 6	
46	345.5	18.1	06	405.4	21.3	66	465.3	24.4	26	525.3	27.5	86	585.2	30.6	
47	346.5	18.2	07	406.4	21.3	67	466.3	24.5	27	526.3	27.6	87	586.2	30.7	
48	347.5 348 5	18.2	08	407.4	21.4	68 60	467.3	24.5 94 B	28	$\begin{vmatrix} 527.3\\528.2 \end{vmatrix}$	27.6 97.7	88 80	587.2 588.2	30.7	
50	349.5	18.3	10	409.4	21.4 21.5	70	469.3	24.6	$\frac{29}{30}$	520.3 529.3	27.7	90	589.2	30.9	
351	350.5	18.4	411	410.4	21.5	471	470.3	24.7	531	530.3	27.8	591	590.2	30.9	
52	351.5	18.4	12	411.4	21.6	72	471.3	24.7	32	531.3	27.8	92	591.2	31.0	
53 54	352.5 352.5	18.5	13	412.4	$ \begin{array}{c} 21.6 \\ 21.7 \end{array} $	73	472.3	24.8	33	532.3	27.9	93	592.2	31.0	
55	354.5	18.6	15	414.4	21.7 21.7	$\frac{74}{75}$	474.3	24.0	35	534.3	$\frac{27.9}{28.0}$	95	593.2 594.2	31.1 31.1	
56	355.5	18.6	16	415.4	21.8	76	475.3	24.9	36	535.3	28.1	96	595.2	31.2	
57	356.5	18.7	$17 \\ 10$	416.4	21.8	77	476.3	25.0	-37	536.3	$\frac{28.1}{28}$	97	596.2	31.2	
- 58 - 59	358 5 ·	18.8	18	417.4	$\begin{bmatrix} 21.9\\21.9 \end{bmatrix}$	78 79	478 3	$\frac{20.0}{95.1}$	- 38 39	037.3 538-3	$\begin{bmatrix} 28.2 \\ 28.2 \end{bmatrix}$	98	597.2 598-2	- 51.3 - 31.3	
60	359.5	18.9	$\frac{10}{20}$	419.4	22.0	80	479.3	25.1	40	539.3	$\frac{20.2}{28.3}$	600	599.2	31.4	
Dist.	Dep.	Lat,	Dist.	Dep.	Lat.	Dist.	Dep.	Lat.	Dist.	Dep.	Lat.	Dist.	Dep.	Lat.	
						87° (9	93°, 267°	, 273°)).						

Pa	ge 374			1		r	TABL	E 2.						
		,	Differ	ence _, of 1	Latitud	le and	Depart	ure for	4° (1	76°, 184	°, 356°).		
Dist.	Lat.	Dep.	Dist.	Lat.	Dep.	Dist.	Lat.	Dep.	Dist.	Lat.	Dep.	Dist.	Lat.	Dep.
$ \begin{array}{c} 1 \\ 2 \\ 3 \\ 4 \\ 5 \\ 6 \\ 7 \\ 8 \\ 9 \\ 10 \\ \end{array} $	1.0 2.0 3.0 4.0 5.0 6.0 7.0 8.0 9.0 10.0	$\begin{array}{c} 0. \ 1 \\ 0. \ 1 \\ 0. \ 2 \\ 0. \ 3 \\ 0. \ 3 \\ 0. \ 4 \\ 0. \ 5 \\ 0. \ 6 \\ 0. \ 6 \\ 0. \ 7 \end{array}$	$\begin{array}{c} 61 \\ 62 \\ 63 \\ 64 \\ 65 \\ 66 \\ 67 \\ 68 \\ 69 \\ 70 \end{array}$	$\begin{array}{c} 60.\ 9\\ 61.\ 8\\ 62.\ 8\\ 63.\ 8\\ 64.\ 8\\ 65.\ 8\\ 66.\ 8\\ 67.\ 8\\ 68.\ 8\\ 69.\ 8\end{array}$	$\begin{array}{r} 4.3\\ 4.3\\ 4.4\\ 4.5\\ 4.5\\ 4.6\\ 4.7\\ 4.7\\ 4.8\\ 4.9\end{array}$	$121 \\ 22 \\ 23 \\ 24 \\ 25 \\ 26 \\ 27 \\ 28 \\ 29 \\ 30$	$\begin{array}{c} 120.\ 7\\ 121.\ 7\\ 122.\ 7\\ 123.\ 7\\ 124.\ 7\\ 125.\ 7\\ 126.\ 7\\ 126.\ 7\\ 127.\ 7\\ 128.\ 7\\ 129.\ 7\\ \end{array}$	$\begin{array}{c} 8.4 \\ 8.5 \\ 8.6 \\ 8.6 \\ 8.7 \\ 8.8 \\ 8.9 \\ 8.9 \\ 9.0 \\ 9.1 \end{array}$	$181 \\ 82 \\ 83 \\ 84 \\ 85 \\ 86 \\ 87 \\ 88 \\ 89 \\ 90$	$180. 6 \\181. 6 \\182. 6 \\183. 6 \\184. 5 \\185. 5 \\186. 5 \\187. 5 \\188. 5 \\189. 5$	$\begin{array}{c} 12.\ 6\\ 12.\ 7\\ 12.\ 8\\ 12.\ 9\\ 13.\ 0\\ 13.\ 0\\ 13.\ 1\\ 13.\ 2\\ 13.\ 3\end{array}$	$241 \\ 42 \\ 43 \\ 44 \\ 45 \\ 46 \\ 47 \\ 48 \\ 49 \\ 50$	$\begin{array}{c} 240.\ 4\\ 241.\ 4\\ 242.\ 4\\ 243.\ 4\\ 244.\ 4\\ 245.\ 4\\ 245.\ 4\\ 246.\ 4\\ 247.\ 4\\ 248.\ 4\\ 249.\ 4\end{array}$	$ \begin{vmatrix} 16.8 \\ 16.9 \\ 17.0 \\ 17.0 \\ 17.1 \\ 17.2 \\ 17.2 \\ 17.3 \\ 17.4 \\ 17.4 \end{vmatrix} $
$ \begin{array}{c} 11\\ 12\\ 13\\ 14\\ 15\\ 16\\ 17\\ 18\\ 19\\ 20\\ \end{array} $	$\begin{array}{c} 11.0\\ 12.0\\ 13.0\\ 14.0\\ 15.0\\ 16.0\\ 17.0\\ 18.0\\ 19.0\\ 20.0 \end{array}$	$\begin{array}{c} 0.8\\ 0.9\\ 1.0\\ 1.0\\ 1.1\\ 1.2\\ 1.3\\ 1.3\\ 1.4 \end{array}$	$71 \\ 72 \\ 73 \\ 74 \\ 75 \\ 76 \\ 77 \\ 78 \\ 79 \\ 80$	$\begin{array}{c} 70.8 \\ 71.8 \\ 72.8 \\ 73.8 \\ 74.8 \\ 75.8 \\ 76.8 \\ 77.8 \\ 78.8 \\ 78.8 \\ 79.8 \end{array}$	$5.0 \\ 5.0 \\ 5.1 \\ 5.2 \\ 5.2 \\ 5.3 \\ 5.4 \\ 5.4 \\ 5.5 \\ 5.6 \\$	$ \begin{array}{r} 131 \\ 32 \\ 33 \\ 34 \\ 35 \\ 36 \\ 37 \\ 38 \\ 39 \\ 40 \\ 40 \end{array} $	$\begin{array}{c} 130.\ 7\\ 131.\ 7\\ 132.\ 7\\ 133.\ 7\\ 134.\ 7\\ 135.\ 7\\ 136.\ 7\\ 136.\ 7\\ 138.\ 7\\ 138.\ 7\\ 139.\ 7\end{array}$	9.1 9.2 9.3 9.3 9.4 9.5 9.6 9.6 9.7 9.8	$ \begin{array}{r} 191 \\ 92 \\ 93 \\ 94 \\ 95 \\ 96 \\ 97 \\ 98 \\ 99 \\ 200 \\ \end{array} $	$\begin{array}{c} 190.5\\ 191.5\\ 192.5\\ 193.5\\ 194.5\\ 195.5\\ 196.5\\ 196.5\\ 197.5\\ 198.5\\ 199.5\\ \end{array}$	$\begin{array}{c} 13.3\\ 13.4\\ 13.5\\ 13.5\\ 13.6\\ 13.7\\ 13.7\\ 13.7\\ 13.8\\ 13.9\\ 14.0 \end{array}$	$\begin{array}{r} 251 \\ 52 \\ 53 \\ 54 \\ 55 \\ 56 \\ 57 \\ 58 \\ 59 \\ 60 \end{array}$	$\begin{array}{c} 250.\ 4\\ 251.\ 4\\ 252.\ 4\\ 253.\ 4\\ 254.\ 4\\ 255.\ 4\\ 256.\ 4\\ 257.\ 4\\ 258.\ 4\\ 258.\ 4\\ 259.\ 4\end{array}$	$\begin{array}{c} 17.5\\ 17.6\\ 17.6\\ 17.7\\ 17.8\\ 17.9\\ 17.9\\ 17.9\\ 18.0\\ 18.1\\ 18.1 \end{array}$
$ \begin{array}{r} 21\\ 22\\ 23\\ 24\\ 25\\ 26\\ 27\\ 28\\ 29\\ 30\\ \end{array} $	20. 9 21. 9 22. 9 23. 9 24. 9 25. 9 26. 9 27. 9 28. 9 29. 9	$ \begin{array}{c} 1.5\\ 1.5\\ 1.6\\ 1.7\\ 1.7\\ 1.8\\ 1.9\\ 2.0\\ 2.0\\ 2.1\\ \end{array} $	81 82 83 84 85 86 87 88 89 90	80. 8 81. 8 82. 8 83. 8 84. 8 85. 8 86. 8 87. 8 88. 8 89. 8	5.7 5.7 5.8 5.9 5.9 6.0 6.1 6.1 6.2 6.3	$ \begin{array}{r} 141 \\ 42 \\ 43 \\ 44 \\ 45 \\ 46 \\ 47 \\ 48 \\ 49 \\ 50 \\ 50 \end{array} $	$\begin{array}{c} \hline 140.7\\ 141.7\\ 142.7\\ 143.6\\ 144.6\\ 145.6\\ 145.6\\ 146.6\\ 147.6\\ 148.6\\ 149.6\\ \end{array}$	9.8 9.9 10.0 10.0 10.1 10.2 10.3 10.3 10.4 10.5	$ \begin{array}{c} 201 \\ 02 \\ 03 \\ 04 \\ 05 \\ 06 \\ 07 \\ 08 \\ 09 \\ 10 \end{array} $	$\begin{array}{c} 200.\ 5\\ 201.\ 5\\ 202.\ 5\\ 203.\ 5\\ 203.\ 5\\ 204.\ 5\\ 205.\ 5\\ 206.\ 5\\ 207.\ 5\\ 208.\ 5\\ 209.\ 5\\ \end{array}$	$\begin{array}{c} 14.0\\ 14.1\\ 14.2\\ 14.2\\ 14.3\\ 14.4\\ 14.4\\ 14.5\\ 14.6\\ 14.6\\ 14.6\\ \end{array}$	$\begin{array}{r} 261 \\ 62 \\ 63 \\ 64 \\ 65 \\ 66 \\ 67 \\ 68 \\ 69 \\ 70 \end{array}$	$\begin{array}{c} 260.\ 4\\ 261.\ 4\\ 262.\ 4\\ 263.\ 4\\ 264.\ 4\\ 265.\ 4\\ 265.\ 4\\ 266.\ 3\\ 267.\ 3\\ 268.\ 3\\ 269.\ 3\end{array}$	$\begin{array}{c} 18.2\\ 18.3\\ 18.3\\ 18.4\\ 18.5\\ 18.6\\ 18.6\\ 18.6\\ 18.7\\ 18.8\\ 18.8\end{array}$
$31 \\ 32 \\ 33 \\ 34 \\ 35 \\ 36 \\ 37 \\ 38 \\ 39 \\ 40$	$\begin{array}{c} 30.9\\ 31.9\\ 32.9\\ 33.9\\ 34.9\\ 35.9\\ 36.9\\ 37.9\\ 38.9\\ 39.9\end{array}$	$\begin{array}{c} 2.2 \\ 2.2 \\ 2.3 \\ 2.4 \\ 2.4 \\ 2.5 \\ 2.6 \\ 2.7 \\ 2.7 \\ 2.8 \end{array}$	91 92 93 94 95 96 97 98 99 100	90. 8 91. 8 92. 8 93. 8 94. 8 95. 8 96. 8 97. 8 98. 8 99. 8	$\begin{array}{c} 6.3 \\ 6.4 \\ 6.5 \\ 6.6 \\ 6.6 \\ 6.7 \\ 6.8 \\ 6.8 \\ 6.9 \\ 7.0 \end{array}$	$ \begin{array}{r} 151 \\ 52 \\ 53 \\ 54 \\ 55 \\ 56 \\ 57 \\ 58 \\ 59 \\ 60 \\ \end{array} $	$\begin{array}{c} 150.\ 6\\ 151.\ 6\\ 152.\ 6\\ 153.\ 6\\ 154.\ 6\\ 155.\ 6\\ 156.\ 6\\ 157.\ 6\\ 158.\ 6\\ 159.\ 6\end{array}$	$\begin{array}{c} 10.5\\ 10.6\\ 10.7\\ 10.7\\ 10.8\\ 10.9\\ 11.0\\ 11.0\\ 11.1\\ 11.2 \end{array}$	$\begin{array}{c} 211 \\ 12 \\ 13 \\ 14 \\ 15 \\ 16 \\ 17 \\ 18 \\ 19 \\ 20 \end{array}$	$\begin{array}{c} 210.5\\ 211.5\\ 212.5\\ 213.5\\ 214.5\\ 215.5\\ 216.5\\ 216.5\\ 217.5\\ 218.5\\ 219.5\\ \end{array}$	$\begin{array}{r} 14.7\\ 14.8\\ 14.9\\ 14.9\\ 15.0\\ 15.1\\ 15.1\\ 15.2\\ 15.3\\ 15.3\end{array}$	$\begin{array}{r} 271 \\ 72 \\ 73 \\ 74 \\ 75 \\ 76 \\ 77 \\ 78 \\ 79 \\ 80 \end{array}$	$\begin{array}{c} 270.3\\ 271.3\\ 272.3\\ 273.3\\ 274.3\\ 275.3\\ 276.3\\ 276.3\\ 277.3\\ 278.3\\ 279.3\\ \end{array}$	$\begin{array}{c} 18.9\\ 19.0\\ 19.0\\ 19.1\\ 19.2\\ 19.3\\ 19.3\\ 19.3\\ 19.4\\ 19.5\\ 19.5\\ \end{array}$
$ \begin{array}{r} 41 \\ 42 \\ 43 \\ 44 \\ 45 \\ 46 \\ 47 \\ 48 \\ 49 \\ 50 \\ 50 \\ \end{array} $	$\begin{array}{r} 40.9\\ 41.9\\ 42.9\\ 43.9\\ 44.9\\ 45.9\\ 46.9\\ 47.9\\ 48.9\\ 49.9\end{array}$	$\begin{array}{c} 2.9\\ 2.9\\ 3.0\\ 3.1\\ 3.1\\ 3.2\\ 3.3\\ 3.3\\ 3.4\\ 3.5\end{array}$	$ \begin{array}{c} 101 \\ 02 \\ 03 \\ 04 \\ 05 \\ 06 \\ 07 \\ 08 \\ 09 \\ 10 \\ \end{array} $	100.8 101.8 102.7 103.7 104.7 105.7 106.7 106.7 107.7 108.7 109.7	$\begin{array}{c} 7.0\\ 7.1\\ 7.2\\ 7.3\\ 7.3\\ 7.4\\ 7.5\\ 7.5\\ 7.6\\ 7.7\end{array}$	$ \begin{array}{r} 161 \\ 62 \\ 63 \\ 64 \\ 65 \\ 66 \\ 67 \\ 68 \\ 69 \\ 70 \\ \end{array} $	$\begin{array}{c} 160.\ 6\\ 161.\ 6\\ 162.\ 6\\ 163.\ 6\\ 164.\ 6\\ 165.\ 6\\ 166.\ 6\\ 167.\ 6\\ 168.\ 6\\ 169.\ 6\\ \end{array}$	$\begin{array}{c} 11.2\\ 11.3\\ 11.4\\ 11.4\\ 11.5\\ 11.6\\ 11.6\\ 11.7\\ 11.8\\ 11.9\end{array}$	$221 \\ 222 \\ 232 \\ 241 \\ 252 \\ 262 \\ 272 \\ 282 \\ 292 \\ 300 $	$\begin{array}{c} 220.5\\ 221.5\\ 222.5\\ 223.5\\ 223.5\\ 224.5\\ 225.4\\ 226.4\\ 227.4\\ 228.4\\ 229.4\\ \end{array}$	$\begin{array}{c} 15.4\\ 15.5\\ 15.6\\ 15.6\\ 15.7\\ 15.8\\ 15.8\\ 15.9\\ 16.0\\ 16.0\\ 16.0 \end{array}$	281 82 83 84 85 86 87 88 89 90	$\begin{array}{c} 280.3\\ 281.3\\ 282.3\\ 283.3\\ 284.3\\ 285.3\\ 285.3\\ 286.3\\ 287.3\\ 288.3\\ 289.3\\ \end{array}$	19. 6 19. 7 19. 7 19. 8 19. 9 20. 0 20. 0 20. 1 20. 2 20. 2
$51 \\ 52 \\ 53 \\ 54 \\ 55 \\ 56 \\ 57 \\ 58 \\ 59 \\ 60$	$\begin{array}{c} 50.9\\ 51.9\\ 52.9\\ 53.9\\ 54.9\\ 55.9\\ 56.9\\ 57.9\\ 58.9\\ 59.9\\ 59.9\end{array}$	$\begin{array}{c} 3.6\\ 3.6\\ 3.7\\ 3.8\\ 3.8\\ 3.9\\ 4.0\\ 4.0\\ 4.1\\ 4.2 \end{array}$	$111 \\ 12 \\ 13 \\ 14 \\ 15 \\ 16 \\ 17 \\ 18 \\ 19 \\ 20$	$\begin{array}{c} 110.\ 7\\ 111.\ 7\\ 112.\ 7\\ 113.\ 7\\ 114.\ 7\\ 115.\ 7\\ 115.\ 7\\ 116.\ 7\\ 117.\ 7\\ 118.\ 7\\ 119.\ 7\\ \end{array}$	$\begin{array}{c} 7.7 \\ 7.8 \\ 7.9 \\ 8.0 \\ 8.0 \\ 8.1 \\ 8.2 \\ 8.2 \\ 8.3 \\ 8.4 \end{array}$	$ \begin{array}{r} 171 \\ 72 \\ 73 \\ 74 \\ 75 \\ 76 \\ 77 \\ 78 \\ 79 \\ 80 \\ \end{array} $	$\begin{array}{c} 170.\ 6\\ 171.\ 6\\ 172.\ 6\\ 173.\ 6\\ 174.\ 6\\ 175.\ 6\\ 176.\ 6\\ 176.\ 6\\ 177.\ 6\\ 178.\ 6\\ 179.\ 6\end{array}$	$\begin{array}{c} 11. \ 9\\ 12. \ 0\\ 12. \ 1\\ 12. \ 1\\ 12. \ 2\\ 12. \ 3\\ 12. \ 3\\ 12. \ 3\\ 12. \ 4\\ 12. \ 5\\ 12. \ 6\end{array}$	$\begin{array}{c} 231 \\ 32 \\ 33 \\ 34 \\ 35 \\ 36 \\ 37 \\ 38 \\ 39 \\ 40 \end{array}$	$\begin{array}{c} 230.4\\ 231.4\\ 232.4\\ 233.4\\ 233.4\\ 235.4\\ 235.4\\ 236.4\\ 237.4\\ 238.4\\ 239.4\\ \end{array}$	$\begin{array}{c} 16.1\\ 16.2\\ 16.3\\ 16.3\\ 16.4\\ 16.5\\ 16.5\\ 16.5\\ 16.6\\ 16.7\\ 16.7\\ 16.7\\ \end{array}$	$291 \\92 \\93 \\94 \\95 \\96 \\97 \\98 \\99 \\300$	$\begin{array}{c} 290.\ 3\\ 291.\ 3\\ 292.\ 3\\ 293.\ 3\\ 294.\ 3\\ 295.\ 3\\ 295.\ 3\\ 296.\ 3\\ 297.\ 3\\ 298.\ 3\\ 299.\ 3 \end{array}$	$\begin{array}{c} 20.3\\ 20.4\\ 20.4\\ 20.5\\ 20.6\\ 20.6\\ 20.7\\ 20.8\\ 20.9\\ 20.9\end{array}$
Dist.	Dep.	Lat.	Dist.	Dep.	Lat.	Dist. 36°; (1	Dep. 94°, 266	Lat. °, 274°	Dist.	Dep.	Lat.	Dist.	Dep.	Lat.

						Т	ABLE	2 2.					Page	375
			Differ	ence of	Latitud	le and	Depart	ure for	4° (1	76°, 184	°, 356°).		
Dist.	Lat.	Dep.	Dist.	Lat.	Dep.	Dist.	Lat.	Dep.	Dist.	Lat.	Dep,	Dist.	Lat.	Dep.
$\begin{array}{c} 301 \\ 02 \\ 03 \\ 04 \\ 05 \\ 06 \\ 07 \\ 08 \\ 09 \\ 10 \end{array}$	$\begin{array}{c} 300.\ 3\\ 301.\ 3\\ 302.\ 2\\ 303.\ 2\\ 304.\ 2\\ 305.\ 2\\ 306.\ 2\\ 307.\ 2\\ 308.\ 2\\ 309.\ 2\end{array}$	$\begin{array}{c} 21.0\\ 21.1\\ 21.1\\ 21.2\\ 21.3\\ 21.3\\ 21.4\\ 21.5\\ 21.6\\ 21.6\\ 21.6\end{array}$	$\begin{array}{c} 361 \\ 62 \\ 63 \\ 64 \\ 65 \\ 66 \\ 67 \\ 68 \\ 69 \\ 70 \end{array}$	$\begin{array}{c} 360.\ 1\\ 361.\ 1\\ 362.\ 1\\ 363.\ 1\\ 364.\ 1\\ 365.\ 1\\ 366.\ 1\\ 367.\ 1\\ 368.\ 1\\ 369.\ 1 \end{array}$	$\begin{array}{c} 25.2\\ 25.2\\ 25.3\\ 25.4\\ 25.5\\ 25.5\\ 25.6\\ 25.7\\ 25.7\\ 25.8\end{array}$	$\begin{array}{r} 421 \\ 22 \\ 23 \\ 24 \\ 25 \\ 26 \\ 27 \\ 28 \\ 29 \\ 30 \end{array}$	$\begin{array}{c} 420.\ 0\\ 421.\ 0\\ 422.\ 0\\ 423.\ 0\\ 424.\ 0\\ 424.\ 9\\ 425.\ 9\\ 425.\ 9\\ 426.\ 9\\ 427.\ 9\\ 428.\ 9\end{array}$	$\begin{array}{c} 29.4\\ 29.4\\ 29.5\\ 29.6\\ 29.6\\ 29.7\\ 29.8\\ 29.9\\ 29.9\\ 30.0 \end{array}$	$\begin{array}{r} 481 \\ 82 \\ 83 \\ 84 \\ 85 \\ 86 \\ 87 \\ 88 \\ 89 \\ 90 \end{array}$	$\begin{array}{r} 479.8\\ 480.8\\ 481.8\\ 482.8\\ 483.8\\ 483.8\\ 484.8\\ 485.8\\ 485.8\\ 486.8\\ 487.8\\ 487.8\\ 488.8\end{array}$	$\begin{array}{c} 33.5\\ 33.6\\ 33.7\\ 33.7\\ 33.8\\ 33.9\\ 33.9\\ 33.9\\ 34.0\\ 34.1\\ 34.2 \end{array}$	$541 \\ 42 \\ 43 \\ 44 \\ 45 \\ 46 \\ 47 \\ 48 \\ 49 \\ 50$	$\begin{array}{c} 539.\ 7\\ 540.\ 7\\ 541.\ 7\\ 542.\ 7\\ 543.\ 7\\ 544.\ 7\\ 545.\ 7\\ 546.\ 7\\ 547.\ 7\\ 548.\ 7\end{array}$	$\begin{array}{c} 37.\ 7\\ 37.\ 8\\ 37.\ 9\\ 37.\ 9\\ 38.\ 0\\ 38.\ 1\\ 38.\ 1\\ 38.\ 2\\ 38.\ 3\\ 38.\ 3\end{array}$
$\begin{array}{r} 311\\12\\13\\14\\15\\16\\17\\18\\19\\20\\\end{array}$	$\begin{array}{c} 310.\ 2\\ 311.\ 2\\ 312.\ 2\\ 313.\ 2\\ 314.\ 2\\ 315.\ 2\\ 316.\ 2\\ 317.\ 2\\ 318.\ 2\\ 319.\ 2\\ \end{array}$	$\begin{array}{c} 21.7\\ 21.8\\ 21.8\\ 21.9\\ 22.0\\ 22.1\\ 22.1\\ 22.2\\ 22.3\\ 22.3\end{array}$	$\begin{array}{r} 371 \\ 72 \\ 73 \\ 74 \\ 75 \\ 76 \\ 77 \\ 78 \\ 79 \\ 80 \end{array}$	$\begin{array}{c} 370.\ 1\\ 371.\ 1\\ 372.\ 1\\ 373.\ 1\\ 374.\ 1\\ 375.\ 1\\ 376.\ 1\\ 376.\ 1\\ 377.\ 1\\ 378.\ 1\\ 379.\ 1 \end{array}$	$\begin{array}{c} 25.9\\ 25.9\\ 25.9\\ 26.0\\ 26.1\\ 26.2\\ 26.2\\ 26.3\\ 26.4\\ 26.4\\ 26.5\\ \end{array}$	$\begin{array}{r} 431 \\ 32 \\ 33 \\ 34 \\ 35 \\ 36 \\ 37 \\ 38 \\ 39 \\ 40 \end{array}$	$\begin{array}{r} 429.9\\ 430.9\\ 431.9\\ 432.9\\ 433.9\\ 433.9\\ 434.9\\ 435.9\\ 435.9\\ 436.9\\ 437.9\\ 438.9\end{array}$	$\begin{array}{c} 30.1\\ 30.1\\ 30.2\\ 30.3\\ 30.3\\ 30.4\\ 30.5\\ 30.6\\ 30.6\\ 30.6\\ 30.7\\ \end{array}$	$\begin{array}{r} 491 \\ 92 \\ 93 \\ 94 \\ 95 \\ 96 \\ 97 \\ 98 \\ 99 \\ 500 \end{array}$	$\begin{array}{c} 489.8\\ 490.8\\ 491.8\\ 492.8\\ 493.8\\ 493.8\\ 494.8\\ 495.8\\ 495.8\\ 496.8\\ 497.8\\ 498.8 \end{array}$	$\begin{array}{c} 34.2\\ 34.3\\ 34.4\\ 34.4\\ 34.5\\ 34.6\\ 34.6\\ 34.6\\ 34.7\\ 34.8\\ 34.8\\ 34.8\end{array}$	$\begin{array}{c} 551 \\ 52 \\ 53 \\ 54 \\ 55 \\ 56 \\ 57 \\ 58 \\ 59 \\ 60 \end{array}$	$\begin{array}{c} 549.\ 7\\ 550.\ 7\\ 551.\ 7\\ 552.\ 7\\ 553.\ 6\\ 554.\ 6\\ 555.\ 6\\ 555.\ 6\\ 556.\ 6\\ 557.\ 6\\ 557.\ 6\\ 558.\ 6\end{array}$	$\begin{array}{c} 38.4\\ 38.5\\ 38.5\\ 38.6\\ 38.7\\ 38.7\\ 38.7\\ 38.8\\ 38.9\\ 38.9\\ 38.9\\ 39.0\\ \end{array}$
$\begin{array}{c} 321 \\ 22 \\ 23 \\ 24 \\ 25 \\ 26 \\ 27 \\ 28 \\ 29 \\ 30 \end{array}$	$\begin{array}{c} 320.\ 2\\ 321.\ 2\\ 322.\ 2\\ 323.\ 2\\ 324.\ 2\\ 325.\ 2\\ 326.\ 2\\ 327.\ 2\\ 328.\ 2\\ 329.\ 2\\ \end{array}$	$\begin{array}{c} 22.4\\ 22.5\\ 22.5\\ 22.6\\ 22.7\\ 22.7\\ 22.8\\ 22.9\\ 23.0\\ 23.0\end{array}$	$ \begin{array}{r} 381 \\ 82 \\ 83 \\ 84 \\ 85 \\ 86 \\ 87 \\ 88 \\ 89 \\ 90 \\ 90 \\ \end{array} $	$\begin{array}{c} 380.1\\ 381.1\\ 382.1\\ 383.1\\ 384.0\\ 385.0\\ 385.0\\ 386.0\\ 387.0\\ 388.0\\ 389.0 \end{array}$	$\begin{array}{c} 26.\ 6\\ 26.\ 7\\ 26.\ 8\\ 26.\ 9\\ 26.\ 9\\ 26.\ 9\\ 27.\ 0\\ 27.\ 1\\ 27.\ 1\\ 27.\ 2\end{array}$	$ \begin{array}{r} 441 \\ 42 \\ 43 \\ 44 \\ 45 \\ 46 \\ 47 \\ 48 \\ 49 \\ 50 \\ \end{array} $	$\begin{array}{r} 439.9\\ 440.9\\ 441.9\\ 442.9\\ 443.9\\ 444.9\\ 445.9\\ 445.9\\ 446.9\\ 447.9\\ 448.9\end{array}$	$\begin{array}{c} 30.8\\ 30.8\\ 30.9\\ 31.0\\ 31.0\\ 31.1\\ 31.2\\ 31.2\\ 31.3\\ 31.4 \end{array}$	$501 \\ 02 \\ 03 \\ 04 \\ 05 \\ 06 \\ 07 \\ 08 \\ 09 \\ 10$	$\begin{array}{r} 499.8\\ 500.8\\ 501.8\\ 502.8\\ 503.8\\ 504.8\\ 505.8\\ 506.8\\ 507.8\\ 508.8\end{array}$	$\begin{array}{c} 34.9\\ 35.0\\ 35.0\\ 35.1\\ 35.2\\ 35.2\\ 35.3\\ 35.4\\ 35.5\\ 35.6\\ 35.6\end{array}$	$561 \\ 62 \\ 63 \\ 64 \\ 65 \\ 66 \\ 67 \\ 68 \\ 69 \\ 70$	559.6 560.6 561.6 562.6 563.6 564.6 565.6 566.6 567.6 568.6	$\begin{array}{c} 39.1 \\ 39.2 \\ 39.2 \\ 39.3 \\ 39.4 \\ 39.4 \\ 39.5 \\ 39.6 \\ 39.7 \\ 39.8 \end{array}$
$\begin{array}{r} 331 \\ 32 \\ 33 \\ 34 \\ 35 \\ 36 \\ 37 \\ 38 \\ 39 \\ 40 \end{array}$	$\begin{array}{c} 330.\ 2\\ 331.\ 2\\ 332.\ 2\\ 333.\ 2\\ 334.\ 2\\ *\ 335.\ 2\\ 336.\ 2\\ 337.\ 2\\ 338.\ 2\\ 339.\ 2\\ \end{array}$	$\begin{array}{c} 23.1\\ 23.2\\ 23.2\\ 23.3\\ 23.4\\ 23.4\\ 23.5\\ 23.6\\ 23.6\\ 23.6\\ 23.7\end{array}$	$ \begin{array}{r} 391 \\ 92 \\ 93 \\ 94 \\ 95 \\ 96 \\ 97 \\ 98 \\ 99 \\ 400 \\ \end{array} $	$\begin{array}{c} 390.0\\ 391.0\\ 392.0\\ 393.0\\ 394.0\\ 395.0\\ 396.0\\ 396.0\\ 397.0\\ 398.0\\ 399.0\\ \end{array}$	$\begin{array}{c} 27.3\\ 27.3\\ 27.4\\ 27.5\\ 27.6\\ 27.6\\ 27.6\\ 27.7\\ 27.8\\ 27.8\\ 27.8\\ 27.9\end{array}$	$\begin{array}{r} 451 \\ 52 \\ 53 \\ 54 \\ 55 \\ 56 \\ 57 \\ 58 \\ 59 \\ 60 \end{array}$	$\begin{array}{r} 449.9\\ 450.9\\ 451.9\\ 452.9\\ 452.9\\ 453.9\\ 454.9\\ 455.9\\ 455.9\\ 456.9\\ 457.9\\ 458.9\end{array}$	$\begin{array}{c} 31.5\\ 31.5\\ 31.6\\ 31.7\\ 31.7\\ 31.7\\ 31.8\\ 31.9\\ 31.9\\ 32.0\\ 32.1 \end{array}$	$511 \\ 12 \\ 13 \\ 14 \\ 15 \\ 16 \\ 17 \\ 18 \\ 19 \\ 20$	$\begin{array}{c} 509.8\\ 510.8\\ 511.8\\ 512.7\\ 513.7\\ 514.7\\ 515.7\\ 516.7\\ 516.7\\ 517.7\\ 518.7\\ \end{array}$	$\begin{array}{c} 35.\ 6\\ 35.\ 7\\ 35.\ 8\\ 35.\ 8\\ 35.\ 9\\ 36.\ 0\\ 36.\ 0\\ 36.\ 1\\ 36.\ 2\\ 36.\ 2\end{array}$	$571 \\ 72 \\ 73 \\ 74 \\ 75 \\ 76 \\ 77 \\ 78 \\ 79 \\ 80$	$\begin{array}{c} 569.\ 6\\ 570.\ 6\\ 571.\ 6\\ 572.\ 6\\ 573.\ 6\\ 574.\ 6\\ 575.\ 6\\ 576.\ 6\\ 577.\ 6\\ 577.\ 6\\ 578.\ 6\end{array}$	$\begin{array}{r} 39.8\\ 39.9\\ 40.0\\ 40.0\\ 40.1\\ 40.2\\ 40.2\\ 40.3\\ 40.4\\ 40.5\end{array}$
$\begin{array}{r} 13\\ 341\\ 42\\ 43\\ 44\\ 45\\ 46\\ 47\\ 48\\ 49\\ 50\\ \end{array}$	$\begin{array}{r} 340.2\\ 341.2\\ 342.2\\ 343.1\\ 344.1\\ 345.1\\ 346.1\\ 347.1\\ 348.1\\ 349.1\\ \end{array}$	$\begin{array}{r} 23.8\\ 23.9\\ 23.9\\ 24.0\\ 24.1\\ 24.1\\ 24.2\\ 24.3\\ 24.3\\ 24.4\end{array}$	$ \begin{array}{r} 100 \\ 401 \\ 02 \\ 03 \\ 04 \\ 05 \\ 06 \\ 07 \\ 08 \\ 09 \\ 10 \\ \end{array} $	$\begin{array}{c} 400.\ 0\\ 401.\ 0\\ 402.\ 0\\ 403.\ 0\\ 404.\ 0\\ 405.\ 0\\ 406.\ 0\\ 407.\ 0\\ 408.\ 0\\ 409.\ 0\end{array}$	$\begin{array}{c} 28.0\\ 28.0\\ 28.1\\ 28.2\\ 28.2\\ 28.3\\ 28.4\\ 28.5\\ 28.5\\ 28.6\end{array}$	$\begin{array}{c} 461 \\ 62 \\ 63 \\ 64 \\ 65 \\ 66 \\ 67 \\ 68 \\ 69 \\ 70 \end{array}$	$\begin{array}{r} 459.9\\ 460.9\\ 461.9\\ 462.9\\ 463.9\\ 463.9\\ 464.9\\ 465.8\\ 466.8\\ 466.8\\ 467.8\\ 468.8 \end{array}$	$\begin{array}{c} 32.2\\ 32.2\\ 32.3\\ 32.4\\ 32.4\\ 32.4\\ 32.5\\ 32.6\\ 32.6\\ 32.6\\ 32.7\\ 32.8\end{array}$	$521 \\ 22 \\ 23 \\ 24 \\ 25 \\ 26 \\ 27 \\ 28 \\ 29 \\ 30$	$\begin{array}{c} 519.7\\ 520.7\\ 520.7\\ 521.7\\ 522.7\\ 523.7\\ 524.7\\ 525.7\\ 526.7\\ 526.7\\ 527.7\\ 528.7\\ \end{array}$	$\begin{array}{c} 36.3\\ 36.4\\ 36.4\\ 36.5\\ 36.6\\ 36.7\\ 36.8\\ 36.8\\ 36.8\\ 36.8\\ 36.9\\ 37.0\\ \end{array}$	581 82 83 84 85 86 87 88 89 90	$\begin{array}{c} 579.\ 6\\ 580.\ 6\\ 581.\ 6\\ 582.\ 6\\ 583.\ 6\\ 584.\ 6\\ 585.\ 6\\ 585.\ 6\\ 586.\ 6\\ 587.\ 6\\ 588.\ 6\end{array}$	$\begin{array}{c} 10.5\\ \hline 40.5\\ 40.6\\ 40.7\\ 40.7\\ 40.8\\ 40.9\\ 40.9\\ 40.9\\ 41.0\\ 41.1\\ 41.2 \end{array}$
$\begin{array}{r} 351 \\ 52 \\ 53 \\ 54 \\ 55 \\ 56 \\ 57 \\ 58 \\ 59 \\ 60 \end{array}$	$\begin{array}{c} 350. \ 1\\ 351. \ 1\\ 352. \ 1\\ 353. \ 1\\ 354. \ 1\\ 355. \ 1\\ 356. \ 1\\ 356. \ 1\\ 357. \ 1\\ 358. \ 1\\ 359. \ 1 \end{array}$	$\begin{array}{c} 24.5\\ 24.6\\ 24.6\\ 24.7\\ 24.8\\ 24.8\\ 24.9\\ 25.0\\ 25.0\\ 25.1\\ \end{array}$	$\begin{array}{c} 411 \\ 12 \\ 13 \\ 14 \\ 15 \\ 16 \\ 17 \\ 18 \\ 19 \\ 20 \end{array}$	$\begin{array}{c} 410.\ 0\\ 411.\ 0\\ 412.\ 0\\ 413.\ 0\\ 413.\ 0\\ 415.\ 0\\ 416.\ 0\\ 416.\ 0\\ 417.\ 0\\ 418.\ 0\\ 419.\ 0\\ \end{array}$	$\begin{array}{c} 28.7\\ 28.7\\ 28.8\\ 28.9\\ 28.9\\ 29.0\\ 29.1\\ 29.2\\ 29.2\\ 29.3\\ \end{array}$	$\begin{array}{r} 471 \\ 72 \\ 73 \\ 74 \\ 75 \\ 76 \\ 77 \\ 78 \\ 79 \\ 80 \end{array}$	$\begin{array}{r} 469.8\\ 470.8\\ 471.8\\ 472.8\\ 473.8\\ 473.8\\ 474.8\\ 475.8\\ 476.8\\ 476.8\\ 477.8\\ 478.8 \end{array}$	$\begin{array}{c} 32.9\\ 32.9\\ 33.0\\ 33.1\\ 33.1\\ 33.2\\ 33.3\\ 33.3\\ 33.3\\ 33.4\\ 35.5 \end{array}$	$531 \\ 32 \\ 33 \\ 34 \\ 35 \\ 36 \\ 37 \\ 38 \\ 39 \\ 40$	$\begin{array}{c} 529.\ 7\\ 530.\ 7\\ 531.\ 7\\ 532.\ 7\\ 533.\ 7\\ 534.\ 7\\ 535.\ 7\\ 535.\ 7\\ 536.\ 7\\ 537.\ 7\\ 538.\ 7\end{array}$	$\begin{array}{c} 37.\ 0\\ 37.\ 1\\ 37.\ 2\\ 37.\ 2\\ 37.\ 2\\ 37.\ 3\\ 37.\ 4\\ 37.\ 5\\ 37.\ 5\\ 37.\ 6\\ 37.\ 7\end{array}$	$591 \\ 92 \\ 93 \\ 94 \\ 95 \\ 96 \\ 97 \\ 98 \\ 99 \\ 600$	$\begin{array}{c} 589.\ 6\\ 590.\ 6\\ 591.\ 6\\ 592.\ 6\\ 593.\ 6\\ 594.\ 6\\ 595.\ 6\\ 596.\ 6\\ 597.\ 6\\ 598.\ 6\end{array}$	$\begin{array}{r} 41.3\\ 41.3\\ 41.4\\ 41.5\\ 41.5\\ 41.6\\ 41.7\\ 41.7\\ 41.8\\ 41.9\end{array}$
Dist.	Dep.	Lat,	Dist.	Dep.	Lat,	Dist.	Dep.	Lat.	Dist.	Dep.	Lat.	Dist.	Dep.	Lat
					ł	86°; (94°, 266	°, 274°).					

Difference of Latitude and Departure for 5° (173°, 183°, 355°). Dist. Lat. Dep. Dist. Lat. Lat. Lat	Pa	ge 376]				Г	ABLE	E 2.						
$ \begin{array}{ c c c c c c c c c c c c c c c c c c c$				Differ	ence of	Latitu	de and	l Depart	ure for	5° (1	75°, 185	°, 355°).		
$ \begin{array}{ c c c c c c c c c c c c c c c c c c c$	Dist.	Lat.	Dep.	Dist.	Lat.	Dep.	Dist.	Lat.	Dep.	Dist.	Lat.	Dep.	Dist.	Lat.	Dep.
$\begin{array}{c ccccccccccccccccccccccccccccccccccc$	$\begin{array}{ c c c c c c c c c c c c c c c c c c c$	$\begin{array}{c} \text{Lat.} \\ \hline 1.0 \\ 2.0 \\ 3.0 \\ 4.0 \\ 5.0 \\ 6.0 \\ 7.0 \\ 8.0 \\ 9.0 \\ 10.0 \\ 11.0 \\ 12.0 \\ 13.9 \\ 14.9 \\ 15.9 \\ 15.9 \\ 15.9 \\ 15.9 \\ 16.9 \\ 17.9 \\ 18.9 \\ 19.9 \\ 20.9 \\ 21.9 \\ 22.9 \\ 23.9 \\ 24.9 \\ 25.9 \\ 26.9 \\ 27.9 \\ 27.9 \end{array}$	$\begin{array}{c} \text{Dep.} \\ \hline \\ 0.1 \\ 0.2 \\ 0.3 \\ 0.4 \\ 0.5 \\ 0.67 \\ 0.8 \\ 0.9 \\ 1.0 \\ 1.0 \\ 1.0 \\ 1.1 \\ 1.2 \\ 1.3 \\ 1.4 \\ 1.5 \\ 1.6 \\ 1.7 \\ 1.7 \\ \hline 1.8 \\ 1.9 \\ 0 \\ 2.0 \\ 2.1 \\ 2.2 \\ 2.3 \\ 2.4 \\ 2.4 \end{array}$	$\begin{array}{ c c c c c c c c c c c c c c c c c c c$	Lat. 60. 8 61. 8 62. 8 63. 8 64. 8 65. 7 66. 7 66. 7 67. 7 70. 7 71. 7 76. 7 73. 7 74. 7 75. 7 76. 7 76. 7 77. 7 78. 7 79. 7 80. 7 81. 7 83. 7 84. 7 85. 7 86. 7 87. 7 87. 7 87. 7 86. 7 7 7 7 7 7 7 7 7 7 7 7 7 7	$\begin{array}{c} \text{Dep.} \\ \hline 5.3 \\ 5.4 \\ 5.56 \\ 5.7 \\ 5.8 \\ 5.9 \\ 6.0 \\ 6.1 \\ \hline 6.2 \\ 6.3 \\ 6.4 \\ 6.5 \\ 6.6 \\ 6.7 \\ 6.8 \\ 6.9 \\ 7.0 \\ \hline 7.1 \\ 7.2 \\ 7.3 \\ 7.4 \\ 7.5 \\ 7.6 \\ 7.7 \\ \end{array}$	$\begin{array}{c} \text{Dist.} \\ 121 \\ 22 \\ 23 \\ 24 \\ 25 \\ 26 \\ 27 \\ 28 \\ 29 \\ 30 \\ 131 \\ 32 \\ 33 \\ 34 \\ 35 \\ 36 \\ 37 \\ 38 \\ 39 \\ 40 \\ 141 \\ 422 \\ 43 \\ 44 \\ 45 \\ 46 \\ 47 \\ 48 \end{array}$	Latt. 120, 5 121, 5 122, 5 123, 5 124, 5 125, 5 126, 5 127, 5 127, 5 128, 5 129, 5 130, 5 131, 5 132, 5 132, 5 134, 5 134, 5 135, 5 136, 5 137, 5 138, 5 139, 5 140, 5 141, 5 142, 5 144, 4 145, 4 147, 4 147, 4	$\begin{array}{ c c c c c c c c c c c c c c c c c c c$	$\begin{array}{c} \text{Dist,}\\ \hline \\ 181\\ 82\\ 83\\ 84\\ 85\\ 86\\ 87\\ 88\\ 89\\ 90\\ \hline 191\\ 92\\ 93\\ 94\\ 95\\ 96\\ 97\\ 98\\ 99\\ 200\\ \hline 201\\ 02\\ 03\\ 04\\ 05\\ 06\\ 07\\ 08\\ \end{array}$	$\begin{array}{c} \text{Lat.} \\ \hline \\ 180, 3 \\ 181, 3 \\ 182, 3 \\ 184, 3 \\ 185, 3 \\ 184, 3 \\ 185, 3 \\ 186, 3 \\ 186, 3 \\ 187, 3 \\ 188, 3 \\ 190, 3 \\ 191, 3 \\ 192, 3 \\ 191, 3 \\ 192, 3 \\ 194, 3 \\ 195, 3 \\ 194, 3 \\ 195, 3 \\ 194, 3 \\ 195, 2 \\ 198, 2 \\ 199, 2 \\ 200, 2 \\ 201, 2 \\ 200, 2 \\ 202, 2 \\ 203, 2 \\ 204, 2 \\ 205, 2 \\ 206, 2 \\ 206, 2 \\ 207, 2 \\ $	$\begin{tabular}{ c c c c c c c c c c c c c c c c c c c$	$\begin{array}{c} \text{Dist.} \\ \hline 241 \\ 42 \\ 43 \\ 44 \\ 45 \\ 46 \\ 47 \\ 50 \\ \hline 251 \\ 52 \\ 53 \\ 54 \\ 55 \\ 56 \\ 57 \\ 58 \\ 59 \\ 60 \\ \hline 261 \\ 62 \\ 63 \\ 64 \\ 65 \\ 66 \\ 67 \\ 68 \end{array}$	Lat. 240.1 242.1 242.1 243.1 244.1 245.1 245.1 245.1 245.1 247.1 247.1 248.1 249.0 250.0 251.0 253.0 254.0 253.0 254.0 255.0 256.0 256.0 256.0 256.0 256.0 256.0 257.0 258.0 259.0 260.0 260.0 266.0 267.	$\begin{array}{c} \text{Dep.} \\ \hline \\ 21.0 \\ 21.1 \\ 21.2 \\ 21.3 \\ 21.4 \\ 21.4 \\ 21.5 \\ 21.6 \\ 21.7 \\ 21.8 \\ \hline \\ 22.0 \\ 22.1 \\ 22.0 \\ 22.1 \\ 22.2 \\ 22.3 \\ 22.4 \\ 22.5 \\ 22.6 \\ 22.7 \\ 22.8 \\ 22.6 \\ 22.7 \\ 22.8 \\ 22.9 \\ 23.0 \\ 23.1 \\ 23.2 \\ 23.3 \\ 23.4 \\ 4 \end{array}$
$ \begin{array}{cccccccccccccccccccccccccccccccccccc$	$\begin{array}{c} 29\\ 30\\ 31\\ 32\\ 33\\ 34\\ 35\\ 36\\ 37\\ 38\\ 39\\ 40\\ 41\\ 423\\ 44\\ 45\\ 46\\ 47\\ 48\\ 49\\ 50\\ 51\\ 52\\ 53\\ 54\\ \end{array}$	$\begin{array}{c} 28.9\\ 29.9\\ 30.9\\ 31.9\\ 32.9\\ 33.9\\ 34.9\\ 35.9\\ 35.9\\ 36.9\\ 37.9\\ 38.9\\ 37.9\\ 38.9\\ 39.8\\ 40.8\\ 41.8\\ 42.8\\ 44.8\\ 44.8\\ 45.8\\ 44.8\\ 45.8\\ 44.8\\ 45.8\\ 45.8\\ 45.8\\ 45.8\\ 45.8\\ 50.8\\ 51.8\\ 52.8\\ 52.8\\ 52.8\\ 53.8\end{array}$	$\begin{array}{c} 2 \\ 2 \\ 2 \\ 2 \\ 2 \\ 2 \\ 2 \\ 3 \\ 3 \\ 3 \\$	$\begin{array}{c} 89\\ 90\\ \hline 91\\ 92\\ 93\\ 94\\ 95\\ 96\\ 97\\ 98\\ 99\\ 100\\ \hline 101\\ 02\\ 03\\ 04\\ \cdot \ 05\\ 06\\ 07\\ 08\\ 09\\ 10\\ \hline 111\\ 12\\ 13\\ 14\\ \hline \end{array}$	$\begin{array}{c} 88.7\\ 89.7\\ 90.7\\ 91.6\\ 92.6\\ 93.6\\ 94.6\\ 95.6\\ 95.6\\ 95.6\\ 96.6\\ 97.6\\ 98.6\\ 99.6\\ 101.6\\ 102.6\\ 102.6\\ 102.6\\ 103.6\\ 104.6\\ 105.6\\ 106.6\\ 105.6\\ 106.6\\ 107.6\\ 108.6\\ 109.6\\ 110.6\\ 110.6\\ 111.6\\ 112.6\\ 113.6\\ \end{array}$	$\begin{array}{c} 7.8 \\ 7.8 \\ 7.9 \\ 8.01 \\ 8.2 \\ 8.3 \\ 8.4 \\ 8.55 \\ 8.6 \\ 8.7 \\ 8.8 \\ 9.9 \\ 9.1 \\ 9.2 \\ 9.3 \\ 4 \\ 9.5 \\ 9.6 \\ 9.7 \\ 9.8 \\ 9.9 \\$	$\begin{array}{c} 49\\ 50\\ \hline 151\\ 52\\ 53\\ 54\\ 55\\ 56\\ 57\\ 58\\ 59\\ 60\\ \hline 161\\ 62\\ 63\\ 64\\ 65\\ 66\\ 67\\ 68\\ 69\\ 70\\ \hline 171\\ 72\\ 73\\ 74\\ \hline \end{array}$	$\begin{array}{c} 148.4\\ 149.4\\ 150.4\\ 150.4\\ 151.4\\ 152.4\\ 153.4\\ 154.4\\ 155.4\\ 155.4\\ 155.4\\ 155.4\\ 157.4\\ 158.4\\ 159.4\\ 160.4\\ 161.4\\ 162.4\\ 163.4\\ 164.4\\ 164.4\\ 166.4\\ 166.4\\ 166.4\\ 166.4\\ 167.4\\ 168.4\\ 169.4\\ 170.3\\ 171.3\\ 172.3\\ 173.3\\ 17$	$\begin{array}{c} 13.0\\ 13.1\\ \hline 13.2\\ 13.2\\ 13.3\\ 13.4\\ 13.5\\ 13.6\\ 13.7\\ 13.8\\ 13.9\\ 14.0\\ 14.1\\ 14.2\\ 14.3\\ 14.4\\ 14.5\\ 14.6\\ 14.7\\ 14.8\\ 14.9\\ 15.0\\ 15.1\\ 15.2\\ \end{array}$	$\begin{array}{c} 09\\ 09\\ 10\\ 211\\ 12\\ 13\\ 14\\ 15\\ 16\\ 17\\ 18\\ 19\\ 20\\ 221\\ 23\\ 24\\ 25\\ 26\\ 27\\ 28\\ 29\\ 30\\ 231\\ 32\\ 33\\ 34\\ 33\\ 34\\ 34\\ 34\\ 34\\ 34\\ 34\\ 34$	$\begin{array}{c} 208,2\\ 209,2\\ 210,2\\ 211,2\\ 212,2\\ 213,2\\ 214,2\\ 215,2\\ 214,2\\ 215,2\\ 214,2\\ 215,2\\ 214,2\\ 215,2\\ 214,2\\ 214,2\\ 214,2\\ 214,2\\ 214,2\\ 220,2\\ 221,2\\ 220,2\\ 222,2\\ 223,1\\ 224,1\\ 222,1\\ 222,1\\ 222,1\\ 222,1\\ 223,1\\ 223,1\\ 23$	$\begin{array}{c} 18.2\\ 18.3\\ 18.4\\ 18.5\\ 18.6\\ 18.7\\ 18.7\\ 18.7\\ 18.7\\ 18.7\\ 18.7\\ 19.9\\ 19.0\\ 19.1\\ 19.2\\ 19.3\\ 19.4\\ 19.5\\ 19.6\\ 19.7\\ 19.8\\ 19.9\\ 20.0\\ 20.0\\ 20.0\\ 20.0\\ 20.0\\ 20.3\\ 20.4\\ 20.3\\ 20.4\\$	$\begin{array}{c} 69\\ 70\\ 271\\ 72\\ 73\\ 74\\ 75\\ 76\\ 77\\ 78\\ 79\\ 80\\ 281\\ 822\\ 83\\ 84\\ 85\\ 86\\ 87\\ 88\\ 89\\ 90\\ 291\\ 922\\ 93\\ 94\\ 93\\ 94\\ 74\\ 75\\ 76\\ 78\\ 79\\ 80\\ 291\\ 92\\ 93\\ 94\\ 74\\ 75\\ 76\\ 78\\ 78\\ 88\\ 89\\ 90\\ 291\\ 92\\ 93\\ 94\\ 74\\ 75\\ 76\\ 78\\ 78\\ 78\\ 78\\ 79\\ 80\\ 78\\ 78\\ 78\\ 88\\ 89\\ 90\\ 291\\ 92\\ 93\\ 94\\ 74\\ 75\\ 78\\ 78\\ 78\\ 78\\ 78\\ 78\\ 78\\ 78\\ 78\\ 78$	$\begin{array}{c} 268. \ 0\\ 269. \ 0\\ 270. \ 0\\ 270. \ 0\\ 271. \ 0\\ 273. \ 0\\ 273. \ 0\\ 274. \ 9\\ 275. \ 9\\ 275. \ 9\\ 275. \ 9\\ 277. \ 9\\ 276. \ 9\\ 277. \ 9\\ 286. \ 9\\ 285. \ 9\\ 285. \ 9\\ 285. \ 9\\ 286. \ 9\\$	$\begin{array}{c} 23.4\\ 23.5\\ 23.6\\ 23.7\\ 23.8\\ 23.9\\ 24.0\\ 24.1\\ 24.2\\ 24.3\\ 24.4\\ 24.5\\ 24.4\\ 24.5\\ 24.6\\ 24.7\\ 24.8\\ 24.8\\ 24.9\\ 25.2\\ 25.3\\ 25.4\\ 25.5\\ 25.6\\$
950 (050 9250 9750)	55 56 57 58 59 60 Dist.	54. 8 54. 8 55. 8 56. 8 57. 8 58. 8 59. 8 59. 8	4.8 4.9 5.0 5.1 5.1 5.2 Lat.	15 16 17 18 19 20 Dist.	114. 6 115. 6 115. 6 116. 6 117. 6 118. 5 119. 5 Dep.	10. 0 10. 1 10. 2 10. 3 10. 4 10. 5 Lat.	75 76 77 78 79 80 Dist.	174. 3 175. 3 175. 3 176. 3 177. 3 178. 3 179. 3 Dep.	15. 3 15. 3 15. 4 15. 5 15. 6 15. 7 Lat.	35 36 37 38 39 40 Dist.	234. 1 235. 1 236. 1 237. 1 238. 1 239. 1 Dep.	20. 5 20. 6 20. 7 20. 7 20. 7 20. 8 20. 9	95 96 97 98 99 300 Dist.	293. 9 294. 9 295. 9 296. 9 297. 9 298. 9 Dep.	25. 7 25. 8 25. 9 26. 0 26. 1 26. 1 Lat.

		·				r	ABL	E 2.					[Page	e 377
			Differ	rence of	Latitu	de and	l Depart	ure for	• 5° (1	75°, 185	°, 355°).		
Dist.	Lat.	Dep.	Dist.	Lat.	Dep.	Dist.	Lat.	Dep.	Dist.	Lat.	Dep.	Dist.	Lat.	Dep,
301	299.9	26.2	361	359.6	31.5	421	419.4	36.7	481	479.2	41.9	541	538.9	47.2
$02 \\ 02$	300.8	26.3	62	360.6	31.6	22	420.4	36.8	82	480.2	42.0	42	539.9	47.3
03	301.8	20.4	60 61	362.6	31.0 31.7	20	421.4	37 0	81	481.2	42.1	45	540.9	47.5
04	302.8	26.6 26.6	65	363.6	31.8	25	423.4	37.1	85	483.2	42.3	45	542.9	47.6
06	304.8	26.7	66	364.6	31.9	26	424.4	37.1	86	484.1	42.4	46	543.9	47.7
07	305.8	26.8	67	365.6	32.0	27	425.4	37.2	- 87	485.1	42.4	47	544.9	47.7
08	306.8	26.9	68	366.6	32.1	28	426.4	37.3	88	486.1	42.5	48	545.9	47.8
10	307.8	20.9	- 69 70	307.0	32.2	29	427.4	37.5	89	188 1	42.0	-49 -50	547.9	47.9
-10	300.0	27.1	371	369 6	32.0	431	120.1	37 6	191	489 1	12.1	551	548 9	48.1
12	310.8	27.2	72	370.6	32.4	32	430.4	37.7	92	490.1	42.9	52	549.9	48.2
13	311.8	27.3	73	371.6	32.5	- 33	431.3	37.7	93	491.1	43.0	53	550.9	48.3
14	312.8	27.4	74	372.6	32.6	- 34	432.3	37.8	94	492.1	43.1	54	551.9	48.4
15	313.8	27.5	75	373.6	32.7	35	433.3	37.9	95	493.1	43.1	55	552.9	48.4
16	314.8	21.0	76	374.6 975 e	32.8	36	434.3	38.0	96	494.1	43.2	- 2 6	553.9	18.0
18	316.8	27.0	78	376 6	32.9 33.0	- 38	436.3	38.9	98	496 1	43.3	58	555 9	48.0
$10 \\ 19$	317.8	$\tilde{27.8}$	79	377.6	33.0	- 39	437.3	38.3	99	497.1	43.5	59	556.9	48.8
20	318.8	27.9	80	378.6	33.1	-40	438.3	38.4	500	498.1	43.6	60	557.9	48.8
321	319.8	28.0	381	379.5	33.2	441	439.3	38.4	501	499.1	43.7	561	558.8	48.9
22	320.8	28.1	82	380.5	33.3	42	440.3	38.5	02	500.1	43.8	62	559.8	49.0
23	321.8	28.2	83	381.5	33.4	43	441.3	38.6	03	501.1	43.8	63	560.8	49.1
24	322.8	28.2	84	382.0	33.0	44	442.3	38.7	04	502.1 503 1	43.9	65	562.8	49.2
$\begin{array}{cccccccccccccccccccccccccccccccccccc$														49.4
$\begin{array}{c ccccccccccccccccccccccccccccccccccc$														49.5
$\begin{array}{ c c c c c c c c c c c c c c c c c c c$														49.6
$\begin{array}{c ccccccccccccccccccccccccccccccccccc$														49.7
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$ \begin{array}{ c c c c c c c c c c c c c c c c c c c$														
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35	333.7	29.2	95	393.5	34.4	55	453.3	39.7	15	513.0	44.9	75	572.8	50.2
36	.334.7	29.3	96	394.5	34.5	56	454.3	39.8	16	514.0	45.0	76	573.8	50.3
31	330.7	29.4.	97	395.5	34.0	- 37 - 59	456 2	39.8	10	515.0 516.0	40.1	11	575 8	50.4
39	337.7	29.0	99	397.5	34.8	59	457 3	40 0	10	517.0	45.2	$\frac{70}{79}$	576.8	50.4
40	338.7	29.6	400	398.5	34.9	60	458.2	40.1	20	518.0	45.3	80	577.8	50.6
341	339.7	29.7	401	399.5	35.0	461	459.2	40.2	521	519.0	45.4	581	578.8	50.7
42	340.7	29.8	02	400.5	35.0	62	460.2	40.3	22	520.0	45.5	82	579.8	50.8
43	341.7	29.9	03	401.5	35.1	63	461.2	40.4	23	521.0	45.6	83	580.8	50.9
44	342.7	$\frac{30.0}{20.1}$	04	402.5	39.2	64	462.2	40.4	24	522.0	45.7	84	581.8	51.0
46	344 7	30.1 30.2	06	404.5	35.3	66	464.2	40.6	26	524 0	45.9	- 86 - 86	583.8	51.0
47	345.7	30.3	07	405.4	35.5	67	465.2	40.7	$\tilde{27}$	525.0	45.9	87	584.8	51.2
48	346.7	30.3	08	406.4	35.6	68	466.2	40.8	28	526.0	46.0	88	585.8	51.3
49	347.7	30.4	09	407.4	35.7	69	467.2	40.9	29	527.0	46.1	89	586.8	51.4
50	348.7	30.5	10	408.4	35.7		468.2	41.0	30	528.0	46.2	90	587.8	51.5
301	349.7	$\frac{30.6}{20.7}$	411	409.4	35.8	471	469.2	41.1	031 90	529.0	46.3	- <u>591</u> - 03	588.7	$\begin{bmatrix} 51.6\\ 51.6 \end{bmatrix}$
52	351 7	30.7	12	410.4	36 0	72	471.2	41.1	- 52 - 33	550.0 531.0	40.4	92	590 7	51.0 51.7
54	352.6	30.9	14	412.4	36.1	74	472.2	41.3	34	532.0	46.6	94	591.7	51.8
55	353.6	30.9	15	413.4	36.2	75	473.2	41.4	35	533.0	46.6	95	592.7	51.9
56	354.6	31.0	16	414.4	36.3	76	474.2	41.5	- 36	533.9	46.7	- 96	593.7	52.0
57	355.6	31.1	17	415.4	$\frac{36.4}{26.4}$	77	475.2	41.6	37	534.9	46.8	97	594.7	52.1
- 38 50	396, 6 357 - 6	$\frac{31.2}{31.2}$	18	410.4	36.5	78	±10.2	41.7	38	050.9 536 Q	40.9	98	999.7 596-7	$\begin{bmatrix} 32.2\\52.2 \end{bmatrix}$
60	358.6	31.4	20	418.4	36.6	80	478.2	41.8	40	537.9	47.1	600	597.7	52.3
Dist.	Dep.	Lat.	Dist.	Dep.	Lat.	Dist.	Dep.	Lat.	Dist.	Dep.	Lat.	Dist.	Dep.	Lat.
						85° (9	95°, 265°	e, 275°)).					

Pa	ge 378]				Т	ABLE	2 2.						
			Differ	ence of	Latitu	de and	l Depart	ure for	· 6° (1	74°, 186	°, 354°).		
Dist.	Lat.	Dep.	Dist.	Lat.	Dep.	Dist.	Lat.	Dep.	Dist.	Lat.	Dep.	Dist.	Lat.	Dep.
1	1.0	0.1	61	60.7	6.4	121	120.3	12.6	181	180.0	18.9	241	239.7	25.2
$\frac{2}{3}$	$\frac{2.0}{3.0}$	0.2 0.3		61.7 62.7	6.5 6.6	$\frac{22}{23}$	121.3 122.3	12.8 12.9	82	181.0 182.0	19.0 19.1	$\frac{42}{43}$	240.7 241.7	25.3 25.4
4	4.0	0.4	64	63.6	6.7	24	123.3	13.0	84	183.0	19.2	44	242.7	25.5
$\frac{5}{6}$	5.0 6.0	0.5	65 66	$64.6 \\ 65.6$	$6.8 \\ 6.9$	$\frac{25}{26}$	124.3 125.3	13.1 13.2	85 86	184.0 185.0	19.3 19.4	$\frac{45}{46}$	243.7 244.7	$\begin{array}{c c} 25.6\\ 25.7 \end{array}$
7	7.0	0.7	67	66.6	7.0	27	126.3	13.3	87	186.0	19.5	47	245.6	25.8
8	$\frac{8.0}{9.0}$	$0.8 \\ 0.9$	$\frac{68}{69}$	$\begin{array}{c} 67.6\\ 68.6\end{array}$	$7.1 \\ 7.2$	$\frac{28}{29}$	127.3 128.3	13.4 13.5	88 89	187.0	19.7 19.8	$\frac{48}{49}$	246.6 247.6	$\begin{array}{c} 25.9 \\ 26.0 \end{array}$
10	9.9	1.0	70	69.6	7.3	30	129.3	13.6	90	189.0	19.9	50	248.6	26.1
$\begin{array}{c}11\\12\end{array}$	10.9 11.9	1.1	$71 \\ 72$	70.6 71.6	$7.4 \\ 7.5$	$\frac{131}{32}$	130.3	$ 13.7 \\ 13.8 $	$ \begin{array}{r} 191 \\ 92 \end{array} $	190.0 190.9	20.0 20.1	$251 \\ 52$	249.6 250.6	26.2 26.3
$12 \\ 13$	12.9	1.4	73	72.6	7.6	33	132.3	13.9	93	191.9	20.1 20.2	53	250.0 251.6	26.3
14	13.9	1.5	74	73.6	7.7	34	133.3 134.3	14.0	94 95	192.9	20.3	54 55	252.6	26.6
$10 \\ 16$	15.9	1.7	76	75.6	7.9	36	135.3	14.2	96	194.9	20.4 20.5	56	254.6	26.8
17	16.9 17.0	1.8	77	76.6	8.0	37	136.2	14.3	97	195.9	20.6	57	255.6	26.9
$18 \\ 19$	17.9 18.9	$1.9 \\ 2.0$	79	78.6	8.3	$\frac{38}{39}$	137.2 138.2	14.4	99	196.9	20.7 20.8	$\frac{58}{59}$	256.6 257.6	27.0 27.1
20	19.9	2.1	80	79.6	8.4	40	139.2	14.6	200	198.9	20.9	60	258.6	27.2
$\frac{21}{22}$	20.9 21.9	$\frac{2.2}{2.3}$	81 82	80.6	8.5	$ \begin{array}{c} 141 \\ 42 \end{array} $	$ 140.2 \\ 141.2 $	14.7	$ \begin{array}{c} 201 \\ 02 \end{array} $	199.9	21.0 21.1	$261 \\ 62$	259.6	27.3 27.4
23	$\tilde{2}2.9$	2.4	83	82.5	8.7	43	142.2	14.9	03	201.9	21.2	63	261.6	$\tilde{27.5}$
24 25	23.9	2.5	84 85	83.5	8.8	44	$ 143.2 \\ 144.2 $	15.1 15.2	04	202.9	21.3	64 65	262.6	27.6
26	25.9	2.7	86	85.5	9.0	46	145.2	15.3	06	203. 9	21.4 21.5	66	264.5	27.8
27	26.9	2.8	87	86.5	9.1	47	$ 146.2 \\ 147.2 $	15.4	07	205.9	21.6	67	265.5	27.9
$\frac{28}{29}$	28.8	2.9	89	88.5	9.3	49	148.2	15.6	09	200.9	21. 7	69	260.5 267.5	28.0
30	29.8	3.1	90	89.5	9.4	50	149.2	15.7	10	208.8	22.0	70	268.5	28.2
$\frac{31}{32}$	$\begin{array}{c} 30.8\\ 31.8\end{array}$	$3.2 \\ 3.3$	91 92	90.5	9.5	$151 \\ 52$	150.2 151.2	15.8	$\frac{211}{12}$	209.8 210.8	$\begin{array}{c} 22.1\\ 22.2 \end{array}$	$\frac{271}{72}$	269.5 270.5	28.3 28.4
$ \begin{array}{ c c c c c c c c c c c c c c c c c c c$														28.5
$ \begin{array}{c ccccccccccccccccccccccccccccccccccc$														28.6 28.7
36	35.8	3.8	96	95.5	10.0	56	155.1	16.3	16	214.8	22.6	76	274.5	28.8
$\frac{37}{38}$	$\frac{36.8}{37.8}$	$\frac{3.9}{4.0}$	97 98	96.5	10.1 10.2	57 58	156.1 157.1	16.4	17	215.8 216.8	22.7	•77 78	275.5 276.5	29.0
39	38.8	4.1	99	98.5	10.3	59	158.1	16.6	19	217.8	22.0	79	277.5	29.2
40	39.8	4.2	$\frac{100}{101}$	99.5	10.5	$\frac{60}{101}$	159.1	16.7	$\frac{20}{001}$	218.8	$\frac{23.0}{22.1}$	80	278.5	29.3
$\frac{41}{42}$	40.8 41.8	4.3	$101 \\ 02$	100.4 101.4	10.6 10.7	$101 \\ 62$	160.1 161.1	10.8 16.9	$\frac{221}{22}$	$\begin{vmatrix} 219.8\\220.8\end{vmatrix}$	$\begin{array}{c} 23.1\\ 23.2 \end{array}$	$\frac{281}{82}$	279.5	29.4 29.5
43	42.8	4.5	03	102.4	10.8	63	162.1	17.0	23	221.8	23.3	83	281.4	29.6
$\frac{44}{45}$	43.8 44.8	4.6	$04 \\ 05$	103.4	10.9	65 + 65	163.1 164.1	17.1 17.2	$\frac{24}{25}$	222.8	23.4 23.5	$\frac{84}{85}$	282.4 283.4	29.7
46	45.7	4.8	06	105.4	11.1	66	165.1	17.4	26	224.8	23.6	86	284.4	29.9
47	46.7 47.7	$4.9 \\ 5.0$	07	106.4 107.4	$11.2 \\ 11.3$	67 68	166.1 167.1	17.5 17.6	$\frac{27}{28}$	225.8 226.8	23.7 23.8	87 88	$285.4 \\ 286.4$	30.0 30.1
49	48.7	5.1	09	108.4	11.4	69	168.1	17.7	29	227.7	23.9	89	287.4	30.2
$\frac{50}{51}$	$\frac{49.7}{50.7}$	$\frac{5.2}{5.2}$	$\frac{10}{111}$	109.4	11.5	$\frac{70}{171}$	169.1	$\frac{17.8}{17.9}$	$\frac{30}{991}$	228.7	$\frac{24.0}{24.1}$	$\frac{90}{201}$	288.4	$\frac{30.3}{20.4}$
$51 \\ 52$	50.7 51.7	5.4	$111 \\ 12$	111.4	11.0	72	170.1	18.0	$\frac{231}{32}$	230.7	24.1	$\frac{291}{92}$	209.4 290.4	30.4
53	52.7	5.5	13	112.4	11.8	73	172.1	18.1	33	231.7	24.4	93	291.4	30.6
55	54.7	$5.0 \\ 5.7$	$14 \\ 15$	113.4	11.9 12.0	$\frac{74}{75}$	173.0	18.2	34	232.7 233.7	24. 5	94 95	292.4 293.4	30.7
56	55.7	5.9	16	115.4	12.1	76	175.0	18.4	36	234.7	24.7	96	294.4	30.9
57 58	56.7 57.7	$6.0 \\ 6.1$	17 18	116.4	12.2 12.3	77 78	176.0 177.0	18.5 18.6	37 38	235.7 236.7	24.8	- 97	295.4 296.4	31.0 31.1
59	58.7	6.2	19	118.3	12.4	79	178.0	18.7	39	237.7	25.0	99	297.4	31.3
60	59.7	6.3	20	119.3	12.5	80	179.0	18.8	40	238.7	25.1	300	298.4	31.4
Dist.	Dep.	Lat.	Dist,	Dep.	Lat.	Dist.	Dep.	Lat.	Dist.	Dep.	Lat.	Dist.	Dep.	Lat.
						84° (§	96°, 264°	', 276°)).					

						Т	'ABLE	2.					[Page	379
			Differ	ence of 1	Latitud	le and	Departu	ure for	6° (17	74°, 186°	°, 354°)).		
Dist.	Lat.	Dep.	Dist.	Lat.	Dep.	Dist.	Lat.	Dep.	Dist.	Lat.	Dep.	Dist.	Lat.	Dep.
301	299.3	31.5	361	359.0	37.7	421	418.7	44.0	481	478.4	50. 3	541	538.0	56. 5
$\begin{array}{c} 02 \\ 03 \end{array}$	300.3 301.2	$\frac{31.6}{31.7}$	$\begin{array}{c} 62 \\ 63 \end{array}$	360.0 361.0	37.8 37.9	$\begin{array}{c} 22\\ 23 \end{array}$	419.7 420.7	44.1 44.2	$\frac{82}{83}$	479.4 480.4	$\frac{50.4}{50.5}$	$\begin{array}{c} 42\\ 43\end{array}$	эз9. 0 540. 0	$ \begin{array}{c} 30.6 \\ 56.7 \end{array} $
03	302.3	31.8	64	362.0	38.0	24	421.7	44.3	84	481.3	50.6	44	541.0	56.8
05	303.3	31.9	65 ee	363.0	$\frac{38.1}{38.2}$	$\begin{array}{c} 25\\ 9e \end{array}$	422.7 422.7	44.4	85 80	482.3 482.9	50.7	45 40	542.0 542.0	56.9 57.0
$\begin{array}{c} 06\\ 07\end{array}$	304.3 305.3	32.0 32.1	67	365.0	38.4	$\frac{20}{27}$	$\frac{420.1}{424.7}$	44. 6	80 87	484.3	50.8 50.9	40 47	544.0	$57.0 \\ 57.1$
08	306.3	32.2	68	366.0	38.5	. 28	425.7	44.7	88	485.3	51.0	48	545.0	57.2
$\begin{array}{c} 09 \\ 10 \end{array}$	307.3 308.3	$32.3 \\ 32.4$	$\begin{array}{c} 69 \\ 70 \end{array}$	$367.0 \\ 368.0$	$38.6 \\ 38.7$	$\begin{array}{c} 29\\ 30 \end{array}$	426.6 427.6	44.8 44.9	$\frac{89}{90}$	$\frac{486.3}{487.3}$	$egin{array}{c} 51.1 \ 51.2 \end{array}$	$\begin{array}{c} 49 \\ 50 \end{array}$	546.0 547.0	$\frac{57.3}{57.4}$
311	309.3	32.5	371	369.0	38.8	431	428.6	45.0	491	488.3	51.3	551	548.0	57.5
12	310.3	32.6	72	370.0	$\frac{38.9}{20.0}$	$\frac{32}{22}$	429.6	45.2	92	489.3	51.4	52	549.0	57.6
$\begin{array}{c} 13\\14\end{array}$	$\begin{array}{c} 511.3\\ 312.3 \end{array}$	32.7 32.8	$\frac{13}{74}$	$\begin{array}{c} 3/1.0\\ 371.9\end{array}$	39.0 39.1	$\frac{53}{34}$	431.6	40.3 45.4	93 94	491.3	$\begin{array}{c} 51.5\\51.6\end{array}$	53 54	$\begin{array}{c} 550.0\\ 551.0\end{array}$	57.9
15	313.3	32.9	75	372.9	39.2	35	432.6	45.5	95	492.3	51.7	55	552.0	58.0
$\begin{array}{c} 16 \\ 17 \end{array}$	314.3 315.2	33.0	$\frac{76}{77}$	373.9	39.3 39.4	$\begin{array}{c} 36\\ 27\end{array}$	433.6 431 e	$45.6 \\ 45.7$	96 97	493.3 491 2	$51.8 \\ 51.0$	56 57	551 0	$\begin{array}{c} 58.1 \\ 58.2 \end{array}$
$\frac{17}{18}$	310.3 316.3	33.2	78	375.9	39.5	38	435.6	45.8	98	495.3	52.0	58	555.0	58.3
19	317.3	33.3	79	376.9	39.6	39	436.6	45.9	99 502	496.3	52.1	59	556.0	58.4
20	$\frac{318.2}{310}$	33.4	80	378 0	39.7	40	438 0	46.0	000 501	497.3	$\frac{32.3}{52.4}$	$\frac{60}{561}$	$\frac{336.9}{557.9}$	08.5 58 e
$\frac{521}{22}$	$319.2 \\ 320.2$	33.7	82	379.9	39.9	42	439.6	46.2	02	499.3	$52.4 \\ 52.5$	62	558.9	58.7
23	321.2	33.8	83	380.9	40.0	43	440.6	46.3	03	500.2	52.6	63	559.9	58.8
$\frac{24}{25}$	$\frac{322.2}{323.2}$	$33.9 \\ 34.0$	84 85	381.9 382.9	40.1 40.2	44 45	441.6	$46.4 \\ 46.5$	04	$\begin{smallmatrix} 501.2\\ 502.9 \end{smallmatrix}$	$\begin{bmatrix} 52.7\\52.8 \end{bmatrix}$	64 65	000.9 561.9	09.0 59.1
$\frac{26}{26}$	324.2	34.1	86	383.9	40.3	46	443.6	46.6	06	503.2	52.9	66	562.9	59.2
27	325.2	34.2	87	384.9	40.5	47	444.5	46.7	07	504.2	53.0	67 60	563.9	59.3
$\frac{28}{29}$	320.2 327.2	34. 3 34. 4	88 89	386.9	40.6	48 49	446.5	$\frac{40.8}{46.9}$	08	505.2 506.2	$53.1 \\ 53.2$	$68 \\ 69$	565.9	59.4 59.5
30	328.2	34.5	90	387.9	40.8	50	447.5	47.0	10	507.2	53.3	70	566.9	59.6
331	329.2	$\frac{34.6}{24.7}$	391	388.9 380.0	40.9	451	448.5	47.1	$511 \\ 10$	508.2	53.4	$571 \\ 79$	567.9	59.7 50 °
$\frac{52}{33}$	550, Z 331, 2	34.8	$\frac{\partial 2}{\partial 3}$	390.8	41.1	52 53	450.5	47.3	$12 \\ 13$	510.2	53.6	$\frac{72}{73}$	569.9	59.9
34	332.2	34.9	94	391.8	41.2	54	451.5	47.5	14	511.2	53.7	74	570.9	60.0
35 36	333.2 331 9	35.0 35.1	95 oe	392.8 392.9	$\begin{array}{c} 41.3\\ 41 \end{array}$	55 58	452.5 453 K	$\begin{array}{c}47.6\\47.7\end{array}$	15 16	$\begin{smallmatrix} 512.2\\512.2\end{smallmatrix}$	$\begin{array}{c} 53.8\\53.0\end{array}$	75 76	$\begin{array}{c} 571.9\\572.0\end{array}$	$\begin{smallmatrix} 60.1 \\ 60.2 \end{smallmatrix}$
$\frac{30}{37}$	335.2	35.2	97	394.8	41.5	57	454.5	47.8	17	510.2 514.2	54.0	77	572.9 573.9	60.2 60.3
38	336.1	35.3	98	395.8	41.6	58	455.5	47.9	18	515.2	54.1	78	574.9	60.4
39 40	ə37.1 338.1	35.4 35.5	99 400	396.8 397.8	$\frac{41.7}{41.8}$	59 60	400.5 457.5	48.0 48.1	$\frac{19}{20}$	$516.2 \\ 517.2$	$54.2 \\ 54.3$	79 80	075.8 576.8	00, 5 60, 6
341	339.1	35.6	401	398.8	41.9	461	458.5	48.2	521	518.1	54.5	581	577.8	60.7
42	340.1	35.7	02	399.8	42.0	62	459.5	48.3	22	519.1	54.6	82	578.8	60.8
43 44	ə41.1 342.1	ээ. 8 36. 0	03	400.8	$\frac{42.1}{42.9}$	63 64	400.5	48.4 48.5	$\frac{23}{24}$	520.1 521.1	04.7 54.8	83 84	979.8 580.8	60.9
45	343.1	36.1	05	402.8	42.3	65	462.5	48.6	25	522.1	54.9	85	581.8	61.2
46	344.1 345.1	$\frac{36.2}{36.2}$	06	403.8 401.9	42.4 49 =	66 87	$\begin{array}{c} 463.4\\ 46.1 \end{array}$	48.7	$\frac{26}{97}$	523.1 521 1	55.0	86 97	582.8 582	61.3 61.4
48	346.1	36.4	07	405.8	$\frac{12.9}{42.6}$	68	465.4	48.9	$\frac{27}{28}$	524.1 525.1	$55.1 \\ 55.2$	88	563.8 584.8	$61.4 \\ 61.5$
49	347.1	36.5	09	406.8	42.7	69	466.4	49.0	29	526.1	55.3	89	585.8	61.6
351	348.1	36.6	$\frac{10}{411}$	407.8	42.9	471	467.4	49.1	30	$\frac{327.1}{520}$	55 F	<u>-90</u> 501	587 0	61.7
$551 \\ 52$	350.1	36.8	$^{+11}_{12}$	409.7	$\frac{10.0}{43.1}$	72	469.4	$\frac{10.2}{49.3}$	$\frac{551}{32}$	528.1 529.1	55.6	$\frac{591}{92}$	588.8	61.8 61.9
53	351.1	36.9	13	410.7	43.2	73	470.4	49.4	33	530.1	55.7	93	589.8	62.0
54 55	352.1 353-1	$\begin{smallmatrix} 37.0\\37.1 \end{smallmatrix}$	14 15	$411.7 \\ 412.7$	$\begin{smallmatrix} 43.3\\ 43 & 4 \end{smallmatrix}$	$\begin{array}{c} 74 \\ 75 \end{array}$	$\frac{471.4}{472.4}$	$49.5 \\ 49.6$	$\frac{34}{35}$	$\begin{smallmatrix} 531.1\\ 532 \end{smallmatrix}$	55.8	94 95	590.8 591.8	$\begin{smallmatrix} 62.1 \\ 62.2 \end{smallmatrix}$
$56 \\ 56 \\ 100 \\ $	354.0	37.2	16	413.7	43.5	76	473.4	49.8	36	533.1	56.0	96	592.8	62.3
57	355.0	37.3	$17 \\ 10$	414.7	43.6	77	474.4	49.9	37	534.1	56.1	97	593.8	62.4
$\frac{58}{59}$	ວວວ. 0 357. 0	$37.4 \\ 37.5$	18 19	416.7	43.8	$\frac{78}{79}$	476.4	50.0 50.1	$\frac{38}{39}$	030. 1 536. 1	$\begin{bmatrix} 50.2 \\ 56.3 \end{bmatrix}$	- 98 - 99	094.7 595.7	$\begin{array}{c} 02.5\\ 62.6\end{array}$
$\tilde{60}$	358.0	37.6	$\hat{20}$	417.7	43.9	80	477.4	50.2	40	537.1	56.4	600	596.7	62.7
Dist.	Dep.	Lat.	Dist.	Dep.	Lat.	Dist.	Dep.	Lat.	Dist.	Dep.	Lat.	Dist.	Dep.	Lat.
						84° (96°, 264	°, 276°).		1			

Pag	ge 380]					T	ABLI	E 2.						
			Differ	ence of I	Latitud	le and	Depart	ure for	7° (17	73°, 187°	°, 353°)).		
Dist.	Lat.	Dep.	Dist.	Lat.	Dep.	Dist.	Lat.	Dep.	Dist.	Lat.	Dep.	Dist.	Lat.	Dep.
1	1.0	0.1	61 69	60.5	7.4	121	120.1	14.7	181	179.7	22.1	241	239.2	29.4
$\frac{2}{3}$	$\frac{2.0}{3.0}$	0.2	63	62.5	$7.0 \\ 7.7$	$\frac{22}{23}$	121.1 122.1	14.9	83	181.6	22.2 22.3	42 43	240.2 241.2	29.5 29.6
4	4.0	0.5	64	63.5	7.8	24	123.1	15.1	84	182.6	22.4	44	242.2	29.7
5 6	$0.0 \\ 6.0$	$0.6 \\ 0.7$	60 66	64. ə 65. 5	7.9 8.0	$\frac{25}{26}$	124.1 125.1	$15.2 \\ 15.4$	85 86	$183.6 \\ 184.6$	$\frac{22.5}{22.7}$	45 46	243.2 244.2	29.9 30.0
7	6.9	0.9	67	66.5	8.2	27	126.1	15.5	87	185.6	22.8	47	245.2	30.1
8	$\begin{array}{c c} 7.9 \\ 8.9 \end{array}$	$1.0 \\ 1.1$	$\frac{68}{69}$	$67.5 \\ 68.5$	8.3	$\frac{28}{29}$	127.0 128.0	$15.6 \\ 15.7$	88 89	186.6 187.6	22.9 23.0	48 19	246.2 247.1	30.2 30.3
10	9.9	1.1 1.2	70	69. 5	8.5	$\frac{10}{30}$	120.0 129.0	15.8	90	188.6	23.0 23.2	$\frac{19}{50}$	248.1	30.5
11	10.9	1.3	71	70.5	8.7	131	130.0	16.0	191	189.6	23.3	251	249.1	30.6
$12 \\ 13$	11.9 12.9	$1.0 \\ 1.6$	$\frac{12}{73}$	$71.5 \\ 72.5$	8.9	$\frac{32}{33}$	131.0 132.0	16.1 16.2	$\frac{92}{93}$	190.6	23.4 23.5	$\frac{52}{53}$	250.1 251.1	30.7
14	13.9	1.7	74	73.4	9.0	34	133.0	16.3	94	192.6	23.6	54	252.1	31.0
$\frac{15}{16}$	14.9 15.9	$1.8 \\ 1.9$	$\frac{75}{76}$	$\frac{14.4}{75.4}$	9.1 9.3	- 35 - 36	134.0 135.0	16.5 16.6	95 96	193.5 194.5	23.8 23.9	$\frac{55}{56}$	253.1 254.1	$\frac{31.1}{31.2}$
17	16.9	2.1	77	76.4	9.4	37	136.0	16.7	97	195.5	24.0	57	255.1	31.3
$18 \\ 19$	17.9 18.9	$\frac{2.2}{2.3}$	$\frac{78}{79}$	77.4 78.4	9.5	$-38 \\ -39$	137.0 138.0	$16.8 \\ 16.9$	98	196.5 197.5	24.1 91 3	58 59	256.1 257.1	31.4
20	19.9	2.4	80	79.4	9.7	40	139.0	17.1	200	198.5	24.4	60	258.1	31.7
21	20.8	2.6	81	80.4	9.9	141	139.9	17.2	201	199.5	24.5	261	259.1	31.8
$\begin{array}{c} 22\\23\end{array}$	$21.8 \\ 22.8$	$\frac{2.7}{2.8}$	$\frac{82}{83}$	81.4 82.4	10.0	$\frac{42}{43}$	140.9 141.9	$17.3 \\ 17.4$	02	200.5 201.5	24.6 24.7	$\frac{62}{63}$	260.0 261.0	31.9 32.1
24	23.8	2.9	84	83.4	10.2	44	142.9	17.5	04	202.5	24.9	64	262.0	32.2
$\frac{25}{26}$	24.8 25.8	$\frac{3.0}{3.2}$	85 86	84.4 85.4	10.4 10.5	$\frac{45}{46}$	$143.9 \\ 144.9$	17.7 17.8	05	203.5 204.5	25.0 25.1	$65 \\ 66$	263.0	32.3
$\frac{20}{27}$	$\frac{26.8}{26.8}$	3.2	87	86.4	10.6	47	145.9	17.9	07	205.5	25.2	67	265.0	32.5
28	27.8	$\frac{3.4}{2.5}$	88	87.3	10.7	48	146.9	18.0	08	206.4	25.3	68 60	266.0	32.7
$\frac{29}{30}$	$\frac{20.8}{29.8}$	3. 5	90	89.3	11.0	50	147.9	18.2	10	207.4	25.6	70	267.0	32.8
31	30.8	3.8	91	90.3	11.1	151	149.9	18.4	211	209.4	25.7	271	269.0	33.0
$\frac{32}{33}$	$\frac{31.8}{32.8}$	3.9	92 93	91.3 92.3	11.2 11.3	$\frac{52}{53}$	150.9 151.9	18.5	$\frac{12}{13}$	210.4 211.4	25.8 26.0	$\frac{72}{73}$	270.0 271.0	33.1 33.3
34	33.7	4.1	94	93.3	11.5	54	152.9	18.8	14	212.4	26.1	74	272.0	33.4
$\frac{35}{36}$	34.7 35.7	4.3	95 96	94.3	11.6 11.7	$55 \\ 56$	153.8 154.8	18.9	15 16	213.4 214 4	$\begin{array}{ c c c c c c c c c c c c c c c c c c c$	75	273.0	33.5
37	36.7	4.5	97	96.3	11.8	57	155.8	19.1	17	215.4	26.4	77	274.9	33.8
$\frac{38}{20}$	37.7	4.6	98	97.3	11.9	58 50	156.8 157.8	19.3	18	216.4	26.6	78	275.9	33.9
40	39.7	4.9	100	99.3	12.1 12.2	60	158.8	19.5	20	218.4	26.8	80	277.9	34.1
41	40.7	5.0	101	100.2	12.3	161	159.8	19.6	221	219.4	26.9	281	278.9	34.2
$\begin{array}{c c} 42\\ 43 \end{array}$	$41.7 \\ 42.7$	5.1 5.2	02	101.2 102.2	12.4 12.6	$\frac{62}{63}$	160.8	19.7	$\frac{22}{23}$	220.3 221.3	27.1 27.2	82	279.9	34.4
44	43.7	5.4	04	103.2	12.7	64	162.8	20.0	24	222.3	27.3	84	281.9	34.6
45 46	44.7 45.7	5.5	05	104.2 105.2	12.8 12.9	$65 \\ 66$	163.8 164.8	$\begin{array}{ c c c c c c c c c c c c c c c c c c c$	$\frac{25}{26}$	223.3 224.3	27.4 27.5	85 86	282.9	34.7 34.9
47	46.6	5.7	07	106.2 106.2	13.0	67	165.8	20.4	27	225.3	27.7	87	284.9	35.0
48	47.6	5.8	08	107.2	$ 13.2 \\ 13.3 $	68 69	166.7 167.7	20.5	$\frac{28}{20}$	226.3	27.8	88 80	285.9	35.1 35.2
49 50	48.0	6.1	10	108.2	13. 4	70	167.7	20.0 20.7	$\frac{29}{30}$	227.3 228.3	28.0	90	280.8	35.3
51	50.6	6.2	111	110.2	13.5	171	169.7	20.8	231	229.3	28.2	291	288.8	35.5
$52 \\ 53$	51.6 52.6	6.3	12	111.2 112.2	13.6 13.8	$\frac{72}{73}$	170.7	$\begin{vmatrix} 21.0\\21.1 \end{vmatrix}$	$\frac{32}{33}$	230.3 231.3	28.3 28.4	92 93	289.8 290.8	35.6 35.7
54	53.6	6.6	14	113.2	13.9	74	172.7	21.2	34	232.3	28.5	94	291.8	35.8
55 56	54.6 55.6	6.7	$15 \\ 16$	114.1 115.1	14.0 14 1	75 76	173.7 174.7	21.3 21.4	$\frac{35}{36}$	$\begin{vmatrix} 233.2\\ 234.2 \end{vmatrix}$	28.6 28.8	95 96	292.8 293.8	36.0 36.1
57	56.6	6.9	17	116.1	14.3	77	175.7	21.6	37	235.2	28.9	97	294.8	36.2
58	57.6	7.1	18	117.1	14.4	78	176.7	21.7	$\frac{38}{20}$	236.2	29.0	98	295.8	36.3
60	58.6 59.6	7.3	20	119.1	14.5	80	178.7	21.8	40	238.2	29.1	300	297.8	36.6
Dist.	Dep.	Lat.	Dist.	Dep.	Lat.	Dist.	Dep.	Lat.	Dist.	Dep.	Lat.	Dist.	Dep.	Lat.
1				1		83° (97°, 263	°, 277°).					

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			~			1.	ABLE	2.	FO (1		0 0500		Page	381
			Differ	rence of	Latituc	le and	Depart	ure tor	7° (1	73°, 187	°, 353°	').		
Dist.	Lat.	Dep.	Dist.	Lat.	Dep.	Dist.	Lat.	Dep.	Dist.	Lat.	Dep.	Dist.	Lat.	Dep.
301	298.7	36.7	361	358.3	44.0	421	417.9	51.3	481	477.4	58.6	541	537.0	65.9
02	299.7	36.8	$\frac{62}{63}$	359.3	44.1 44.2	$\frac{22}{23}$	418.8	51.4 51.5	$\frac{82}{83}$	478.4 479.4	58.7 58.8	$\frac{42}{43}$	537.9	66.0
04	301.7	37.0	64	361.3	44.4	24	420.8	51.7	84	480.4	59.0	44	539.9	66.3
05	302.7	37.2	65 66	362.3	44.5	$\frac{25}{26}$	421.8	51.8	85 96	481.4	59.1	45	540.9	66.4
06	303.7 304.7	37.4	60 67	364.3	44.0	$\frac{20}{27}$	422.8	$51.9 \\ 52.0$	80	482.4	59.4 59.4	40	542.9	66.7
08	305.7	37.5	68	365.2	44.8	28	424.8	52.2	88	484.3	59.5	48	543.9	66.8
09	306.7 307.7	$\begin{array}{c c} 37.7\\ 37.8 \end{array}$		366.2 367.2	45.0 45.1	$\frac{29}{30}$	425.8 426.8	52.3 52.4	89 90	485.3 186.3	59.6 59.7	49 50	544.9 545.9	66.9
311	308.7	$\frac{37.8}{37.9}$	371	368.2	45.2	431	$\frac{420.0}{427.8}$	$\frac{52.4}{52.5}$	491	487.3	59.8	551	$\frac{546.9}{546.9}$	67.1
12	309.7	38.0	72	369.2	45.3	32	428.8	52.6	92	488.3	59.9	52	547.9	67.2
$13 \\ 14$	310.7	38.1	$73 \\ 74$	370.2 371.2	45.5	33	429.8	52.8 52.9	93	489.3	60.1	53 54	548.9 549.9	67.4 67.5
15	312.6	38.4	75	372.2	45.7	35	431.7	53.0	95	491.3	60.3	55	550.8	67.6
16	313.6	38.5	76	373.2	45.8	36	432.7	53.1	96	492.3	60.5	56	551.8	67.8
$17 \\ 18$	314.6 315.6	38.6 38.7	78	374.2 375.2	45.9	37 38	433.7 434.7	53.3 53.4	97	493.3	60.6 60.7	57 58	552.8	67.9
19	316.6	38.9	79	376.2	46.2	39	435.7	53.5	99	495.3	60.8	59	554.8	68.1
20	317.6	39.0	80	377.2	46.3	40	436.7	53.6	500	496.3	61.0	60	555.8	68.3
$\frac{321}{22}$	318.6 219.6	39.1	381 82	378.1 379.1	46.4	$441 \\ 42$	437.7	53.7 53.9	501	497.2	61.1 61.2	$561 \\ 62$	556.8	68.4
$\frac{22}{23}$	320.6	39.2 39.4	83	380.1	46.7	43	439.7	54.0	03	499.2	61.3	63	558.8	68.6
24	321.6	39.5	84	381.1	46.8	44	440.7	54.1	04	500.2	61.4	64	559.8	68.7
$\frac{25}{26}$	322.6 323.6	39.6 39.7	85 86	382.1 383.1	46.9	$\frac{45}{46}$	441.7 442.7	$54.2 \\ 54.3$	00	501.2 502.2	$\begin{array}{c} 61.5\\ 61.6\end{array}$	69 66	560.8	68.9
27	324.6	39.8	87	384.1	47.2	47	443.7	54.5	07	503.2	61.8	67	562.8	69.1
28	325.5	40.0	88	385.1	47.3	48	444.7	54.6	08	504.2	61.9	68	563.8	69.2
$\frac{29}{30}$	326.5 327.5	40.1 40.2	89 90	386.1 387.1	47.4 47.5	49 50	445.6	54.8	10	500.2 506.2	62.0 62.1	$-\frac{69}{70}$	564.8 565.8	69.3 69.4
331	328.5	40.3	391	388.1	47.6	451	447.6	55.0	511	507.2	62.3	571	566.7	69.6
32	329.5	40.5	92	389.1	47.8	52	448.6	55.1	12	508.2	62.4	72	567.7	69.7
33	330.5 331.5	40.6	93	390.1	47.9	53 54	449.6	55.2 55.3	$13 \\ 14$	509.2 510.2	62. 5 62. 6	73 74	569.7	69, 8 69-9
35	332.5	40.8	95	392.0	48.1	55	451.6	55.4	15	511.1	62.7	75	570.7	70.1
36	333.5	40.9	96	393.0	48.3	56	452.6	55.6	16	512.1	62.9	76	571.7	70.2
37	334.5 335.5	$\frac{41.1}{41.2}$	97	394.0 395.0	48.4	57 58	453.0 454.6	55.7 55.8	18	513.1 514.1	63.0 63.1	78	573.7	70.3
39	336.5	41.3	99	396.0	48.6	59	455.6	55.9	19	515.1	63.2	79	574.7	70.5
40	337.5	41.4	400	397.0	48.7	$\frac{60}{101}$	456.6	56.1	20	516.1	63.4	80	575.7	70.7
$\frac{341}{42}$	338.4 339.4	41.6 41.7	401 02	398.0 399.0	48.9	$461 \\ 62$	457.6 458.5	56.2 56.3	$\frac{521}{22}$	517.1 518 1	63.5 63.6	581 82	577.6	70.8 70.9
43	340.4	41.8	03	400.0	49.1	63	459.5	56.4	23	519.1	63.7	83	578.6	71.0
44	341.4	41.9	04	401.0	49.2	64 65	460.5	56.5	24	520.1	63.8	84	579.6	71.2
$\frac{40}{46}$	342.4 343.4	42.0	00	402.0	49.4	66 66	461.5 462.5	56.7 56.8	$\frac{25}{26}$	521.1 522.1	64.0 64.1	80	580.6	71.3 71.4
47	344.4	42.3	07	404.0	49.6	67	463.5	56.9	27	523.1	64.2	· 87	582.6	71.5
48	345.4	42.4	08	405.0	49.7	68 60	464.5	57.0	28	524.1	64.3	88	583.6	71.6
49 50	347.4	42.6 42.6	10	405.9	49.8 50.0	- 09 70	405.5	$\frac{57.2}{57.3}$	$\frac{29}{30}$	526.0	64.6	90	585,6	71.8
351	348.4	42.8	411	407.9	50.1	471	467.5	57.4	531	527.0	64.7	591	586.6	72.0
$52 \\ 52$	349.4	42.9	12	408.9	50.2	72	468.5	57.5	$\frac{32}{22}$	528.0	64.8	92	587.6	72.1
$\frac{55}{54}$	350.4 351.4	43.0 43.1	$10 \\ 14$	409.9	50.5 50.4	73	409.5	57.0 57.8	35 34	529.0	64.9 65.1	93 94	588.0 589.6	72.2 72.4
55	352.3	43, 3	15	411.9	50.6	75	471.5	57.9	35	531.0	65.2	95	590.6	72.5
$56 \\ 57$	353.3	43.4	$16 \\ 17$	412.9	50.7	$\frac{76}{77}$	472.4	58.0	$\frac{36}{27}$	532.0	65.3	96 97	591.5	72.6
58	355.3	43.6	18	413.9	50.8 50.9	78	473.4	58.1 58.2	$\frac{37}{38}$	534.0	65.6	98	592.5 593.5	72.9
59	356.3	43.7	19	415.9	51.1	79	475.4	58.4	39	535.0	65.7	99	594.5	73.0
60	357.3	43.9	20	416.9	51.2	80	476.4	58.5	40	536.0	65.8	600	595.5	73.1
Dist.	Dep.	Lat.	Dist.	Dep.	Lat.	Dist.	Dep.	Lat.	Dist.	Dep.	Lat.	Dist.	Dep.	Lat.
						83° (9	97°, 263°	, 277°).		*			

Pa	ge 382]		-			Г	ABLE	2.2.						
			Differ	ence of	Latitud	le and	Depart	ure for	8° (1	72°, 188	°, 352°).		
Dist.	Lat.	Dep.	Dist.	Lat.	Dep.	Dist.	Lat.	Dep.	Dist.	Lat.	Dep.	Dist.	Lat.	Dep.
$ \begin{array}{c} 1 \\ 2 \\ 3 \\ 4 \\ 5 \end{array} $	$ \begin{array}{c} 1.0\\ 2.0\\ 3.0\\ 4.0\\ 5.0 \end{array} $	$\begin{array}{c} 0.1 \\ 0.3 \\ 0.4 \\ 0.6 \\ 0.7 \end{array}$		$\begin{array}{c} 60.\ 4\\ 61.\ 4\\ 62.\ 4\\ 63.\ 4\\ 64.\ 4\end{array}$	8.5 8.6 8.8 8.9 9.0	$121 \\ 22 \\ 23 \\ 24 \\ 25$	$119.8 \\ 120.8 \\ 121.8 \\ 122.8 \\ 123.8 $	$16.8 \\ 17.0 \\ 17.1 \\ 17.3 \\ 17.4$	$ \begin{array}{r} 181 \\ 82 \\ 83 \\ 84 \\ 85 \end{array} $	$179.2 \\180.2 \\181.2 \\182.2 \\183.2$	$\begin{array}{c} 25.2\\ 25.3\\ 25.5\\ 25.6\\ 25.6\\ 25.7\end{array}$	$241 \\ 42 \\ 43 \\ 44 \\ 45$	$\begin{array}{c} 238.\ 7\\ 239.\ 6\\ 240.\ 6\\ 241.\ 6\\ 242.\ 6\end{array}$	$\begin{array}{c} 33.5\\ 33.7\\ 33.8\\ 34.0\\ 34.1 \end{array}$
	5.96.97.98.99.9	$\begin{array}{c} 0.8 \\ 1.0 \\ 1.1 \\ 1.3 \\ 1.4 \end{array}$	$ \begin{array}{r} 66 \\ 67 \\ 68 \\ 69 \\ 70 \\ \end{array} $	$\begin{array}{c} 65.\ 4\\ 66.\ 3\\ 67.\ 3\\ 68.\ 3\\ 69.\ 3\end{array}$	9.29.39.59.69.7	$ \begin{array}{r} 26 \\ 27 \\ 28 \\ 29 \\ 30 \end{array} $	$124.8 \\ 125.8 \\ 126.8 \\ 127.7 \\ 128.7$	17.517.717.818.018.1	86 87 88 89 90	$184.2 \\185.2 \\186.2 \\187.2 \\188.2$	$\begin{array}{c} 25.9\\ 26.0\\ 26.2\\ 26.3\\ 26.4\end{array}$	$ 46 \\ 47 \\ 48 \\ 49 \\ 50 $	$\begin{array}{c} 243.\ 6\\ 244.\ 6\\ 245.\ 6\\ 246.\ 6\\ 247.\ 6\end{array}$	$\begin{array}{c} 34.2 \\ 34.4 \\ 34.5 \\ 34.7 \\ 34.8 \end{array}$
$ \begin{array}{r} 11 \\ 12 \\ 13 \\ 14 \\ 15 \\ 16 \\ 17 \\ 18 \\ 19 \\ 20 \\ \end{array} $	$\begin{array}{c} 10.9\\ 11.9\\ 12.9\\ 13.9\\ 14.9\\ 15.8\\ 16.8\\ 17.8\\ 18.8\\ 19.8\\ \end{array}$	$\begin{array}{c} 1.5 \\ 1.7 \\ 1.8 \\ 1.9 \\ 2.1 \\ 2.2 \\ 2.4 \\ 2.5 \\ 2.6 \\ 2.8 \end{array}$	$71 \\ 72 \\ 73 \\ 74 \\ 75 \\ 76 \\ 77 \\ 78 \\ 79 \\ 80$	$\begin{array}{c} 70.3\\ 71.3\\ 72.3\\ 73.3\\ 74.3\\ 75.3\\ 76.3\\ 77.2\\ 78.2\\ 79.2 \end{array}$	$\begin{array}{c} 9.9\\ 10.0\\ 10.2\\ 10.3\\ 10.4\\ 10.6\\ 10.7\\ 10.9\\ 11.0\\ 11.1 \end{array}$	$ \begin{array}{r} 131 \\ 32 \\ 33 \\ 34 \\ 35 \\ 36 \\ 37 \\ 38 \\ 39 \\ 40 \\ 40 \end{array} $	$\begin{array}{c} 129.\ 7\\ 130.\ 7\\ 131.\ 7\\ 132.\ 7\\ 133.\ 7\\ 134.\ 7\\ 135.\ 7\\ 135.\ 7\\ 136.\ 7\\ 137.\ 7\\ 138.\ 6\end{array}$	$18.2 \\ 18.4 \\ 18.5 \\ 18.6 \\ 18.8 \\ 18.9 \\ 19.1 \\ 19.2 \\ 19.3 \\ 19.5 $	$ \begin{array}{r} 191 \\ 92 \\ 93 \\ 94 \\ 95 \\ 96 \\ 97 \\ 98 \\ 99 \\ 200 \\ \end{array} $	$189.1 \\ 190.1 \\ 191.1 \\ 192.1 \\ 193.1 \\ 194.1 \\ 195.1 \\ 196.1 \\ 197.1 \\ 198.1$	$\begin{array}{c} 26.\ 6\\ 26.\ 7\\ 26.\ 9\\ 27.\ 0\\ 27.\ 1\\ 27.\ 3\\ 27.\ 4\\ 27.\ 6\\ 27.\ 7\\ 27.\ 8\end{array}$	$251 \\ 52 \\ 53 \\ 54 \\ 55 \\ 56 \\ 57 \\ 58 \\ 59 \\ 60$	$\begin{array}{c} 248.\ 6\\ 249.\ 5\\ 250.\ 5\\ 251.\ 5\\ 252.\ 5\\ 253.\ 5\\ 254.\ 5\\ 255.\ 5\\ 255.\ 5\\ 256.\ 5\\ 257.\ 5\end{array}$	$\begin{array}{c} 34.9\\ 35.1\\ 35.2\\ 35.3\\ 35.5\\ 35.6\\ 35.8\\ 35.9\\ 36.0\\ 36.2 \end{array}$
$21 \\ 22 \\ 23 \\ 24 \\ 25 \\ 26 \\ 27 \\ 28 \\ 29 \\ 30$	$\begin{array}{c} 20.8\\ 21.8\\ 22.8\\ 23.8\\ 24.8\\ 25.7\\ 26.7\\ 27.7\\ 28.7\\ 29.7\end{array}$	$\begin{array}{c} 2.9\\ 3.1\\ 3.2\\ 3.3\\ 3.5\\ 3.6\\ 3.8\\ 3.9\\ 4.0\\ 4.2 \end{array}$	$ \begin{array}{r} 81 \\ 82 \\ 83 \\ 84 \\ 85 \\ 86 \\ 87 \\ 88 \\ $	80. 2 81. 2 82. 2 83. 2 84. 2 85. 2 86. 2 87. 1 88. 1 89. 1	$\begin{array}{c} 11.3\\ 11.4\\ 11.6\\ 11.7\\ 11.8\\ 12.0\\ 12.1\\ 12.2\\ 12.4\\ 12.5\end{array}$	$ \begin{array}{r} 141 \\ 42 \\ 43 \\ 44 \\ 45 \\ 46 \\ 47 \\ 48 \\ 49 \\ 50 \\ \end{array} $	$\begin{array}{c} \hline 139.6\\ 140.6\\ 141.6\\ 142.6\\ 143.6\\ 144.6\\ 145.6\\ 146.6\\ 147.5\\ 148.5 \end{array}$	$\begin{array}{c} 19.\ 6\\ 19.\ 8\\ 19.\ 9\\ 20.\ 0\\ 20.\ 2\\ 20.\ 3\\ 20.\ 5\\ 20.\ 6\\ 20.\ 7\\ 20.\ 9\end{array}$	$201 \\ 02 \\ 03 \\ 04 \\ 05 \\ 06 \\ 07 \\ 08 \\ 09 \\ 10$	199. 0 200. 0 201. 0 202. 0 203. 0 204. 0 205. 0 206. 0 207. 0 208. 0	$\begin{array}{c} 28.0\\ 28.1\\ 28.3\\ 28.4\\ 28.5\\ 28.7\\ 28.8\\ 28.9\\ 29.1\\ 29.2 \end{array}$	$\begin{array}{c} 261 \\ 62 \\ 63 \\ 64 \\ 65 \\ 66 \\ 67 \\ 68 \\ 69 \\ 70 \end{array}$	$\begin{array}{c} 258.5\\ 259.5\\ 260.4\\ 261.4\\ 262.4\\ 263.4\\ 263.4\\ 264.4\\ 265.4\\ 266.4\\ 266.4\\ 267.4 \end{array}$	$\begin{array}{c} 36.3\\ 36.5\\ 36.6\\ 36.7\\ 36.9\\ 37.0\\ 37.2\\ 37.3\\ 37.4\\ 37.6 \end{array}$
$ \begin{array}{r} 31 \\ 32 \\ 33 \\ 34 \\ 35 \\ 36 \\ 37 \\ 38 \\ 39 \\ 40 \\ \end{array} $	$\begin{array}{c} 30.7\\ 31.7\\ 32.7\\ 33.7\\ 34.7\\ 35.6\\ 36.6\\ 37.6\\ 38.6\\ 39.6\\ \end{array}$	$\begin{array}{r} 4.3\\ 4.5\\ 4.6\\ 4.7\\ 4.9\\ 5.0\\ 5.1\\ 5.3\\ 5.4\\ 5.6\end{array}$	$91 \\ 92 \\ 93 \\ 94 \\ 95 \\ 96 \\ 97 \\ 98 \\ 99 \\ 100$	$\begin{array}{c} 90.1\\ 91.1\\ 92.1\\ 93.1\\ 94.1\\ 95.1\\ 96.1\\ 97.0\\ 98.0\\ 99.0\\ \end{array}$	$\begin{array}{c} 12.7\\ 12.8\\ 12.9\\ 13.1\\ 13.2\\ 13.4\\ 13.5\\ 13.6\\ 13.8\\ 13.9 \end{array}$	$ \begin{array}{r} 151 \\ 52 \\ 53 \\ 54 \\ 55 \\ 56 \\ 57 \\ 58 \\ 59 \\ 60 \\ \end{array} $	$\begin{array}{c} 149.5\\ 150.5\\ 151.5\\ 152.5\\ 153.5\\ 154.5\\ 155.5\\ 155.5\\ 156.5\\ 157.5\\ 158.4 \end{array}$	$\begin{array}{c} 21.0\\ 21.2\\ 21.3\\ 21.4\\ 21.6\\ 21.7\\ 21.9\\ 22.0\\ 22.1\\ 22.3\\ \end{array}$	$\begin{array}{c} 211 \\ 12 \\ 13 \\ 14 \\ 15 \\ 16 \\ 17 \\ 18 \\ 19 \\ 20 \end{array}$	$\begin{array}{c} 208.9\\ 209.9\\ 210.9\\ 211.9\\ 212.9\\ 213.9\\ 213.9\\ 214.9\\ 215.9\\ 216.9\\ 217.9 \end{array}$	$\begin{array}{c} 29.4\\ 29.5\\ 29.6\\ 29.8\\ 29.9\\ 30.1\\ 30.2\\ 30.3\\ 30.5\\ 30.6\end{array}$	$\begin{array}{r} 271 \\ 72 \\ 73 \\ 74 \\ 75 \\ 76 \\ 77 \\ 78 \\ 79 \\ 80 \end{array}$	$\begin{array}{c} 268.4\\ 269.4\\ 270.3\\ 271.3\\ 272.3\\ 273.3\\ 274.3\\ 275.3\\ 275.3\\ 276.3\\ 277.3\end{array}$	$\begin{array}{c} 37.7\\ 37.9\\ 38.0\\ 38.1\\ 38.3\\ 38.4\\ 38.6\\ 38.7\\ 38.8\\ 39.0\\ \end{array}$
$ \begin{array}{r} 41 \\ 42 \\ 43 \\ 44 \\ 45 \\ 46 \\ 47 \\ 48 \\ 49 \\ 50 \\ \end{array} $	$\begin{array}{c} 40.6\\ 41.6\\ 42.6\\ 43.6\\ 44.6\\ 45.6\\ 46.5\\ 47.5\\ 48.5\\ 49.5\\ \end{array}$	$5.7 \\ 5.8 \\ 6.0 \\ 6.1 \\ 6.3 \\ 6.4 \\ 6.5 \\ 6.7 \\ 6.8 \\ 7.0 $	$ \begin{array}{r} 101 \\ 02 \\ 03 \\ 04 \\ 05 \\ 06 \\ 07 \\ 08 \\ 09 \\ 10 \end{array} $	100. 0 101. 0 102. 0 103. 0 104. 0 105. 0 106. 0 106. 9 107. 9 108. 9	$\begin{array}{c} 14.1\\ 14.2\\ 14.3\\ 14.5\\ 14.6\\ 14.8\\ 14.9\\ 15.0\\ 15.2\\ 15.3\\ \end{array}$	$ \begin{array}{r} 161 \\ 62 \\ 63 \\ 64 \\ 65 \\ 66 \\ 67 \\ 68 \\ 69 \\ 70 \\ \end{array} $	$\begin{array}{c} 159.\ 4\\ 160.\ 4\\ 161.\ 4\\ 162.\ 4\\ 163.\ 4\\ 164.\ 4\\ 165.\ 4\\ 166.\ 4\\ 166.\ 4\\ 167.\ 4\\ 168.\ 3\\ \end{array}$	$\begin{array}{c} 22.4\\ 22.5\\ 22.7\\ 22.8\\ 23.0\\ 23.1\\ 23.2\\ 23.4\\ 23.5\\ 23.7\\ \end{array}$	$\begin{array}{r} 221\\ 22\\ 23\\ 24\\ 25\\ 26\\ 27\\ 28\\ 29\\ 30\\ \end{array}$	$\begin{array}{c} 218.8\\ 219.8\\ 220.8\\ 221.8\\ 222.8\\ 223.8\\ 223.8\\ 224.8\\ 225.8\\ 225.8\\ 226.8\\ 227.8\\ \end{array}$	$\begin{array}{c} 30.8\\ 30.9\\ 31.0\\ 31.2\\ 31.3\\ 31.5\\ 31.6\\ 31.7\\ 31.9\\ 32.0\\ \end{array}$	$\begin{array}{r} 281 \\ 82 \\ 83 \\ 84 \\ 85 \\ 86 \\ 87 \\ 88 \\ 89 \\ 90 \end{array}$	$\begin{array}{c} 278.3\\ 279.3\\ 280.2\\ 281.2\\ 282.2\\ 283.2\\ 283.2\\ 284.2\\ 285.2\\ 285.2\\ 286.2\\ 287.2\\ \end{array}$	$\begin{array}{c} 39.1\\ 39.2\\ 39.4\\ 39.5\\ 39.7\\ 39.8\\ 39.9\\ 40.1\\ 40.2\\ 40.4 \end{array}$
$51 \\ 52 \\ 53 \\ 54 \\ 55 \\ 56 \\ 57 \\ 58 \\ 59 \\ 60$	$\begin{array}{c} 50.5\\ 51.5\\ 52.5\\ 53.5\\ 54.5\\ 55.5\\ 56.4\\ 57.4\\ 58.4\\ 59.4 \end{array}$	$\begin{array}{c} 7.1 \\ 7.2 \\ 7.4 \\ 7.5 \\ 7.7 \\ 7.8 \\ 7.9 \\ 8.1 \\ 8.2 \\ 8.4 \end{array}$	$ \begin{array}{r} 111 \\ 12 \\ 13 \\ 14 \\ 15 \\ 16 \\ 17 \\ 18 \\ 19 \\ 20 \\ \end{array} $	$\begin{array}{c} 109.\ 9\\ 110.\ 9\\ 111.\ 9\\ 112.\ 9\\ 113.\ 9\\ 114.\ 9\\ 115.\ 9\\ 116.\ 9\\ 117.\ 8\\ 118.\ 8\end{array}$	$\begin{array}{c} 15.\ 4\\ 15.\ 6\\ 15.\ 7\\ 15.\ 9\\ 16.\ 0\\ 16.\ 1\\ 16.\ 3\\ 16.\ 4\\ 16.\ 6\\ 16.\ 7\end{array}$	$ \begin{array}{r} 171 \\ 72 \\ 73 \\ 74 \\ 75 \\ 76 \\ 77 \\ 78 \\ 79 \\ 80 \\ \end{array} $	$\begin{array}{c} 169.\ 3\\ 170.\ 3\\ 171.\ 3\\ 172.\ 3\\ 173.\ 3\\ 174.\ 3\\ 175.\ 3\\ 176.\ 3\\ 177.\ 3\\ 177.\ 3\\ 178.\ 2 \end{array}$	$\begin{array}{c} 23.8\\ 23.9\\ 24.1\\ 24.2\\ 24.4\\ 24.5\\ 24.6\\ 24.8\\ 24.9\\ 25.1\\ \end{array}$	$\begin{array}{r} 231 \\ 32 \\ 33 \\ 34 \\ 35 \\ 36 \\ 37 \\ 38 \\ 39 \\ 40 \end{array}$	$\begin{array}{c} 228.8\\ 229.7\\ 230.7\\ 231.7\\ 232.7\\ 233.7\\ 233.7\\ 234.7\\ 235.7\\ 236.7\\ 237.7\\ \end{array}$	$\begin{array}{c} 32.1\\ 32.3\\ 32.4\\ 32.6\\ 32.7\\ 32.8\\ 33.0\\ 33.1\\ 33.3\\ 33.4 \end{array}$	$\begin{array}{r} 291 \\ 92 \\ 93 \\ 94 \\ 95 \\ 96 \\ 97 \\ 98 \\ 99 \\ 300 \end{array}$	$\begin{array}{c} 288.\ 2\\ 289.\ 2\\ 290.\ 1\\ 291.\ 1\\ 292.\ 1\\ 293.\ 1\\ 293.\ 1\\ 295.\ 1\\ 295.\ 1\\ 296.\ 1\\ 297.\ 1 \end{array}$	$\begin{array}{r} 40.5\\ 40.6\\ 40.8\\ 40.9\\ 41.1\\ 41.2\\ 41.3\\ 41.5\\ 41.6\\ 41.8\end{array}$
Dist.	Dep.	Lat.	Dist.	Dep.	Lat.	Dist. 82° (9	Dep.	Lat. 9, 278°	Dist.	Dep.	Lat.	Dist.	Dep.	Lat.

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						Т	'ABLF	1 2.					[Page	383
			Differ	rence of	Latitu	le and	l Depart	ure for	8° (1	172°, 188	3°, 352°	°).		
Dist.	Lat.	Dep.	Dist.	Lat.	Dep.	Dist.	Lat.	Dep.	Dist.	Lat.	Dep.	Dist.	Lat.	Dep.
301 02	298.0 299.0	41.9 42.0	$\frac{361}{62}$	357.5	50.2 50.4	$\frac{421}{22}$	416.9	58.6 58.7	$\frac{481}{82}$	476.3 477.3	66.9 67.1	$\frac{541}{42}$	535.7 536.7	75.2 75.4
03	300.0	42.2	63	359.4	50.5	23	418.9	58.9	83	478.3	67.2	43	537.7	75.5
04	301.0	42.3	64	360.4	50.7	24	419.8	59.0	84	479.3	67.4	44	538.7	75.7
05	302.0	42.5	65 66	361.4 362.4	50.8	25 26	420.8	59.2 59.3	85 86	480.3	67.5	45 46	539.7	75.8
07	304.0	42.7	67	363.4	51.1	27	422.8	59.4	87	482.2	67.8	47	541.6	76.1
08	305.0	42.9	68	364.4	51.2	28	423.8	59.6	88	483.2	67.9	48	542.6	76.2
09	306.0	43.0	69 70	365.4 366.4	51.4	29	424.8	59.7	- 89 90	484.2 485.2	68.1	49 50	543.6	76.4
311	307.9	43.3	371	367.4	51.0	431	426.8	60.0	491	486.2	68.3	551	545.6	76.6
12	308.9	43.4	72	368.4	51.8	32	427.8	60.1	92	487.2	68.5	52	546.6	76.8
13	309.9	43.6	73	369.3	51.9	33	428.8	60.3	93	488.2	68.6	53	547.6	76.9
14	310.9	43.7	74	370.3	52.1 52.2	34 35	429.8	60.4	94	489.2	68.8	54 55	548.6	77 2
16	312.9	44.0	76	372.3	52.3	36	431.7	60.7	96	491.2	69.0	56	550.6	77.4
17	313.9	44.1	77	373.3	52.5	37	432.7	60.8	97	492.1	69.2	57	551.5	77.5
18	314.9	44.3	78	374.3	52.6 52.7	- 38 - 30	433.7 424.7	61.0	98	493.1	69.3	58 50	552.5	77.6
$\frac{19}{20}$	316.9	44.5	80	376.3	52.9	40	435.7	61.1	500	495.1	·69.6	60	554.5	77.9
321	317.9	44.7	381	377.3	53.0	441	436.7	61.4	501	496.1	69.7	561	555.5	78.1
22	318.8	44.8	82	378.3	53.2	42	437.7	61.5	02	497.1	69.9	62	556.5	78.2
$\frac{23}{21}$	319.8	45.0	83	379.2	53.3	43	438.7	61.7 61.8	03	498.1	70.0 70.2	$63 \\ 64$	558 5	78.3
25	320.8 321.8	45.2	85	381.2	53.6	45	440.6	61.9	05	500.1	70.3	65	559.5	78.6
26	322.8	45.4	86	382.2	53.7	46	441.6	62.1	06	501.0	70.4	66	560.5	78.8
27	323.8	45.5	87	383.2	53.9	47	442.6	$\begin{array}{c} 62.2\\ e9.4 \end{array}$	07	502.0	70.6	67	561.5	78.9
$\frac{20}{29}$	324.0 325.8	$\begin{array}{c} 40. \\ 45. 8 \end{array}$	89	384.2 385.2	54.0 54.1	40 49	444.6	$62.4 \\ 62.5$	09	503.0	70.8	69 69	563.5	79.0
30	326.8	45.9	90	386.2	54.3	50	445.6	62.6	10	505.0	70.9	70	564.5	79.3
331	327.8	46.1	391	387.2	54.4	451	446.6	62.8	511	506.0	71.1	571	565.4	79.4
$\frac{32}{33}$	328.7	46.2	92	388.2 289 1	54.6	$52 \\ 53$	447.6	62.9 63.0	12 13	507.0	$\begin{array}{c c} 71.2 \\ 71.4 \end{array}$	$\frac{72}{73}$	566.4	79.6
34	329. 7	46.5	94	390.1	54.8	54	449.6	63.2	14	509.0	71.5	74	568.4	79.8
35	331.7	46.6	95	391.1	55.0	55	450.5	63.3	15	510.0	71.6	75	569.4	80.0
$\frac{36}{27}$	332.7	46.8	96	392.1	55.1	56	451.5	63.5	16	510.9	71.8	$\frac{76}{77}$	570.4	80.1
38	335. 1	40.0	98	393.1 394.1	55.4	58	452.5	63.0 63.7	18	511.5 512.9	71.5 72.0	78	572.4	80.2
39	335.7	47.2	99	395.1	55.5	59	454.5	63.9	19	513.9	72.2	79	573.4	80.5
40	336.7	47.3	400	396.1	55.7	60	455.5	64.0	20	514.9	72.3	80	574.4	80.6
341	337.7	47.5	401	397.1	55.8	461	456.5	64.2	521	515.9	72.4	581	575.4	80.8
$\frac{42}{43}$	330.0	47.7	02	390.1 399.1	56.0 56.1	63	458.5	64.4	$\frac{24}{23}$	517.9	72.8	83	577.4	80. 5
44	340.6	47.9	04	400.0	56.2	64	459.5	64.6	24	518.9	73.0	84	578.4	81.3
45	341.6	48.0	05	401.0	56.4	65	460.4	64.7	25	519.9	73.1	85	579.4	81.4
40	342.0	48.2 48.3	00	402.0	56.0 56.6	60 67	461.4	64.9 65 0	$\frac{20}{27}$	520.9 521.8	$\begin{array}{c c} 73.2 \\ 73.4 \end{array}$	80 87	580.3 581-3	81.0
48	344.6	48.4	08	404.0	56.8	68	463.4	65.1	$\frac{2}{28}$	522.8	73.5	88	582.3	81.8
49	345.6	48.6	09	405.0	56.9	69	464.4	65.3	29	523.8	73.7	89	583.3	82.0
50	346.6	48.7	10	406.0	57.1		465.4	$\frac{65.4}{25.6}$	30	524.8	$\frac{73.8}{72.0}$	90	584.3	82.1
$\frac{351}{52}$	347.6 348.5	$\begin{array}{c} 48.9\\ 49.0 \end{array}$	$\frac{411}{12}$	407.0 408.0	57.2 57.3	$\frac{471}{72}$	466.4	$\begin{array}{c} 65.6 \\ 65.7 \end{array}$	531	525.8 526.8	73.9 74 1	591 92	585.3 586.3	82.2
53	349.5	49.1	13^{12}	409.0	57.5	73^{-1}	468.4	65.8	33	527.8	74.2	93	587.3	82.5
54	350.5	49.3	14	409.9	57.6	74	469.4	66.0	34	528.8	74.3	94	588.3	82.6
50 56	351.5 352.5	49.4	15	410.9	57.8	$\frac{75}{76}$	470.4	66.1	35	529.8	74.5	95	589.3	82.8
57	353.5	49.7	17	411.9	58.0	77	472.3	66.4	* 37	530.8 531.7	74.0	97	590.3 591.2	83.1
58	354.5	49.8	18	413.9	58.2	78	473.3	66.5	38	532.7	74.9	98	592.2	83.2
59 60	355.5	50.0 50.1	$\frac{19}{20}$	414.9	58.3	79	474.3	66.7	39	533.7	75.0	99	593.2	83.3
60	390. 9	50.1	20	415.9	88. 9	80	479.3	66.8	40	534.7	10.1	600	594.2	83.0
Dist.	Dep.	Lat.	Dist.	Dep.	Lat.	Dist.	Dep.	Lat.	Dist.	Dep.	Lat.	Dist.	Dep.	Lat.
						82° (§)8°, 262°	, 278°)).					
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Pa	ge 384_					Γ	ABLE	2.2.						
			Differ	ence of	Latitud	le and	Depart	ure for	9° (1	71°, 189	°, 351°).		
Dist.	Lat.	Dep.	Dist.	Lat.	Dep.	Dist.	Lat.	Dep.	Dist.	Lat.	Dep.	Dist.	Lat.	Dep.
1	1.0	0.2	61	60.2	9.5	121	119.5	18.9	181	178.8	28.3	241	238.0	37.7
2	2.0	0.3	-62	61.2	9.7	22	120.5	19.1	82	179.8	28.5	42	239.0	37.9
3	3.0	0.5	63	62.2	9.9	23	$ 121.5 \\ 120.5 $	19.2	83	180.7	28.6	43	240.0	38.0
4	4.0	0.6	65	61.9	10.0	24	122.5	19.4	84	181.7	28.8	44	241.0	38.2
5 6	5.9	0.8	66	65 2	10.2 10.3	20	125.0	19.0	86	182.7	28.9	40	242.0	38.5
7	6.9	1.1	67	66.2	10.5	$\frac{20}{27}$	125.4	19.9	87	184.7	29.3	47	243.0	38.6
8	7.9	1.3	68	67.2	10.6	28	126.4	20.0	88	185.7	29.4	48	244.9	38.8
9	8.9	1.4	-69	68.2	10.8	29	127.4	20, 2	89	186.7	29.6	49	245.9	39.0
10	9.9	1.6	_70	69.1	11.0	30	128.4	20.3	-90	187.7	29.7	50	246.9	39.1
11	10.9	1.7	71	70.1	11.1	131	129.4	20.5	191	188.6	29.9	251	247.9	39.3
12	11.9	1.9	$\frac{72}{72}$	71.1	11.3	32	130.4	20.6	92	189.6	30.0	$52 \\ 52$	248.9	39.4
10	12.8	$\frac{2.0}{2.9}$	70	72.1	11.4	2.1	131.4	20.8	93	190.0	30.2 30.2	- 00 - 54	249.9	39.0
15	14.8	2.3	75	74.1	11.7	35	132.4 133.3	21.0 21.1	95	192.6	30.5	55	250.9	39.9
16	15.8	2.5	76	75.1	11.9	36	134.3	21.3	96	193.6	30.7	56	252.8	40.0
17	16.8	2.7	77	76.1	12.0	37	135.3	21.4	97	194.6	30.8	57	253.8	40.2
18	17.8	2.8	78	77.0	12.2	38	136.3	21.6	98	195.6	31.0	58	254.8	40.4
19	18.8	3.0	79	78.0	12.4	39	137.3	21.7	99	196.5	31.1	59	255.8	40.5
	$\frac{19.8}{0.7}$	$\frac{3.1}{2}$	80	· 79.0	12.5	$\frac{40}{141}$	138.3	$\frac{21.9}{99.1}$	200	197.5	$\frac{31.3}{91.1}$	60	256.8	40.7
21	20.7 21.7	3.3	81	80.0	12.7	141	139.3	$\begin{bmatrix} 22.1\\ 99.9 \end{bmatrix}$	201	198.0	31.4	261	201.8	40.8
22	21.7	3.6	83	82 0	12.0	12	140.5	22.2	02	200 5	31.0	62	250.8	41.0
24	23.7	3.8	84	83.0	13.1	44	142.2	22.5	04	200.5	31.9	64	260.7	41.3
25	24.7	3.9	85	84.0	13.3	45	143.2	22.7	05	202.5	32.1	65	261.7	41.5
26	25.7	4.1	86	84.9	13.5	46	144.2	22.8	06	203.5	32.2	66	262.7	41.6
27	26.7	4.2	87	85.9	13.6	47	145.2	23.0	07	204.5	32.4	67	263.7	41.8
$\frac{28}{90}$	27.7	4.4	88	86.9	13.8	48	146.2	23.2	08	205.4	32.5	68	264.7	41.9
29	20.0	4.0	90	88.9	13.9 14 1	49	147.2	23.5	10	200.4	32.7	- 69 70	266.7	42.1
31	30.6	1.8	- 91	89.9	11.1	151	149 1	23.6	211	203.4	33.0	271	$\frac{200.1}{267.7}$	49 4
32	31.6	5.0	92^{-1}	90.9	14.4	$101 \\ 52$	150.1	23.8	12	209.4	33.2	72	268.7	42.6
33	32.6	5.2	93	91.9	14.5	53	151.1	23.9	13	210.4	33.3	73	269.6	42.7
34	33.6	5.3	94	92.8	14.7	54	152.1	24.1	14	211.4	33.5	74	270.6	42.9
35	34.6	5.5	95	93.8	14.9	55	153.1	24.2	15	212.4	33.6	75	271.6	43.0
36	35.6	5.6	96	94.8	15.0	56 57	154.1	24.4	16	213.3	33.8	76	272.6	43.2
38	37.5	5.9	97	96.8	15.2	58	150.1 156.1	24.0	18	214.5	34 1	78	274 6	43.5
39	38.5	6.1	. 99	97.8	15.5	59	157.0	24.9	19	216.3	34.3	79	275.6	43.6
40	39.5	6.3	100	98.8	15.6	60	158.0	25.0	20	217.3	34.4	80	276.6	43.8
41	40.5	6.4	101	99.8	15.8	161	159.0	25.2	221	218.3	34.6	281	277.5	44.0
42	41.5	6.6	02	100.7	16.0	62	160.0	25.3	22	219.3	34.7	82	278.5	44.1
43	42.5	6.7	03	101.7	16.1	63	161.0	25.5	23	220.3	34.9	83	279.5	44.3
44	45.0	0.9	04	102.7	10.3 16.4	04	162.0	20.7	24	221.2	35.9	85	280.0	44.4
46	45.4	7.2	06	104.7	16.6	66	164.0	26.0	26	223.2	35.4	86	282.5	44.7
47	46.4	7.4	07	105.7	16.7	67	164.9	26.1	27	224.2	35.5	87	283.5	44.9
48	47.4	7.5	08	106.7	16.9	68	165.9	26.3	28	225.2	35.7	- 88	284.5	45.1
49	48.4	7.7	09	107.7	17.1	69	166.9	26.4	29	226.2	35.8	89	285.4	45.2
-50	49.4	7.8	10	108.6	17.2	70	167.9	26.6	30	221.2	$\frac{36.0}{0.1}$	90	286. 4	45.4
51	51.4	8.0	111	109.6	17.4	171	168.9	26.8	231	228.2	36.1	291	287.4	40.0
$\frac{52}{53}$	52.3	8.2	12	110.0	17.0	72	109.9	20.9	32 33	229.1	36 1	92	289 4	45.8
54	53.3	8.4	14	112.6	17.8	74	171.9	27.2	34	231.1	36.6	94	290.4	46.0
55	54.3	8.6	15	113.6	18.0	75	172.8	27.4	35	232.1	36.8	95	291.4	46.1
56	55.3	8.8	16	114.6	18.1	76	173.8	27.5	- 36	233.1	36.9	96	292.4	46.3
57	56.3	8.9	17	115.6	18.3°	77	174.8	27.7	37	234.1	37.1	97	293.3	46.5
- 58 50	59 9	9.1	18	116.5	18.5	78	175.8	27.8	- 38 - 20	230.1	37.2	98	294.3	40.0
60	59.3	9.2 9.4	20	117.0	18.0	80	177.8	28.0		230.1 237.0	37.5	300	296.3	46.9
00	00.0	0. 1	20	110.0	10.0	00	111.0	20.2	10		01.0	000	200.0	10.0
Dist.	Dep.	Lat.	Dist.	Dep.	Lat.	Dist.	Dep.	Lat.	Dist.	Dep.	Lat.	Dist.	Dep.	Lat.
								0 0 7 0 7		·				1
						819 (997 96T	< 970°	1					

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						ТА	BLE 2	2.					[Page	385
			Differ	ence of	Latituo	le and	Depart	ure for	9° (1	71°, 189	°, 351°).		
Dist.	Lat.	Dep.	Dist.	Lat.	Dep.	Dist.	Lat.	Dep.	Dist.	Lat.	Dep.	Dist.	Lat.	Dep.]
$301 \\ 02 \\ 03 \\ 04 \\ 05 \\ 06$	$\begin{array}{c} 297.3\\ 298.3\\ 299.3\\ 300.3\\ 301.2\\ 302.2 \end{array}$	$\begin{array}{r} 47.1 \\ 47.2 \\ 47.4 \\ 47.6 \\ 47.7 \\ 47.9 \end{array}$	$ \begin{array}{r} 361 \\ 62 \\ 63 \\ 64 \\ 65 \\ 66 \end{array} $	$\begin{array}{c} 356.\ 6\\ 357.\ 5\\ 358.\ 5\\ 359.\ 5\\ 360.\ 5\\ 361.\ 5\end{array}$	56.5 56.7 56.8 56.9 57.1 57.3	$ \begin{array}{r} 421 \\ 22 \\ 23 \\ 24 \\ 25 \\ 26 \\ \end{array} $	$\begin{array}{r} 415.8\\ 416.8\\ 417.8\\ 418.8\\ 419.8\\ 420.8\end{array}$	$\begin{array}{c} 65.9\\ 66.0\\ 66.2\\ 66.3\\ 66.5\\ 66.6\end{array}$	$ 481 \\ 82 \\ 83 \\ 84 \\ 85 \\ 86 $	$\begin{array}{r} 475.1\\ 476.1\\ 477.1\\ 477.0\\ 479.0\\ 480.0 \end{array}$	75.2 75.3 75.5 75.6 75.8 75.9	$541 \\ 42 \\ 43 \\ 44 \\ 45 \\ 46$	534.4 535.4 536.3 537.3 538.3 539.3	84.684.784.985.185.385.4
$ \begin{array}{r} 07 \\ 08 \\ 09 \\ 10 \\ \overline{311} \\ \overline{311} \end{array} $	$ \begin{array}{r} 303. 2 \\ 304. 2 \\ 305. 2 \\ 306. 2 \\ \hline 307. 2 \\ 307. 2 \end{array} $	$\begin{array}{r} 48.0 \\ 48.2 \\ 48.3 \\ 48.5 \\ 48.5 \\ \hline 48.7 \\ 48.7 \\ \hline \end{array}$		$\begin{array}{r} 362.5\\ 363.5\\ 364.5\\ 365.4\\ \hline 366.4\\ 967.4\end{array}$	$57.4 \\ 57.6 \\ 57.7 \\ 57.9 \\ 58.1 \\ 59.9 \\ 58.1 \\ 59.9 \\ 50.1 \\ 50.9 \\ 50.1 \\ 50.9 \\ 50.1 \\ 50.9 \\ 50.1 \\ 50.9 \\ 50.1 \\ 50.9 \\ 50.1 \\ 50.9 \\ 50.1 \\ $	$ \begin{array}{r} 27 \\ 28 \\ 29 \\ 30 \\ \overline{431} \\ 29 \\ 30 \\ \overline{431} \\ 29 \\ 30 \\ \overline{431} \\ 30 \\ 30 \\ 30 \\ 30 \\ 30 \\ 431 \\ 30 \\ 30 \\ 431 \\ 30 \\ 30 \\ 431 \\ 30 \\ 30 \\ 431 \\ 30 \\ 30 \\ 431 \\ 30 \\ 30 \\ 431 \\ 30 \\ 30 \\ 431 \\ 30 \\ 30 \\ 431 \\ 30 \\ 30 \\ 431 \\ 30 \\ 30 \\ 431 \\ 30 \\ 30 \\ 431 \\ 30 \\ 30 \\ 431 \\ 30 \\ 30 \\ 431 \\ 30 \\ 30 \\ 30 \\ 431 \\ 30 \\ 30 \\ 431 \\ 30 \\ 30 \\ 431 \\ 30 \\ 30 \\ 431 \\ 30 \\ 30 \\ 431 \\ 30 \\ 30 \\ 431 \\ 30 \\ 30 \\ 431 \\ 30 \\ 30 \\ 30 \\ 431 \\ 30 \\$	$\begin{array}{r} 421.7\\ 422.7\\ 423.7\\ 423.7\\ 424.7\\ \hline 425.7\\ 425.7\\ \hline 120.7\\ \hline \end{array}$	$\begin{array}{c} 66.8 \\ 67.0 \\ 67.1 \\ 67.3 \\ \hline 67.4 \\ 37.4 \\ 37.6 \\ 7.4 \\ 37.6 \\ 7$		$ \begin{array}{r} 481.0\\ 482.0\\ 483.0\\ 484.0\\ \hline 485.0\\ 485.0\\ \end{array} $	$76.1 \\ 76.2 \\ 76.4 \\ 76.5 \\ 76.7 \\ 76.7 \\ 76.9 \\ 90000000000000000000000000000000000$	$47 \\ 48 \\ 49 \\ 50 \\ 551 \\ 50 \\ 551 \\ 50 \\ 50 \\ 50 \\ $	540.3541.3542.3543.3544.3544.3	$\begin{array}{c} 85.6 \\ 85.7 \\ 85.9 \\ 86.0 \\ \hline \\ 86.2 \\ 96.2 \\ \hline \end{array}$
12 13 14 15 16 17 18	$\begin{array}{c} 308.2\\ 309.1\\ 310.1\\ 311.1\\ 312.1\\ 313.1\\ 314.1 \end{array}$	$\begin{array}{r} 48.8 \\ 49.0 \\ 49.1 \\ 49.3 \\ 49.4 \\ 49.6 \\ 49.8 \end{array}$	$72 \\ 73 \\ 74 \\ 75 \\ 76 \\ 77 \\ 78$	$\begin{array}{c} 367.4\\ 368.4\\ 369.4\\ 370.4\\ 371.4\\ 372.4\\ 373.3 \end{array}$	58.2 58.4 58.5 58.7 58.8 59.0 59.1	$ \begin{array}{r} 32 \\ 33 \\ 34 \\ 35 \\ 36 \\ 37 \\ 38 \\ \end{array} $	$\begin{array}{r} 420.7\\ 427.7\\ 428.7\\ 429.6\\ 430.6\\ 431.6\\ 432.6\end{array}$	$\begin{array}{c} 67.6\\ 67.7\\ 67.9\\ 68.1\\ 68.2\\ 68.4\\ 68.5\end{array}$	92 93 94 95 96 97 98	$\begin{array}{r} 483.9\\ 486.9\\ 487.9\\ 488.9\\ 589.9\\ 490.9\\ 491.9\end{array}$	$\begin{array}{c} 70.8 \\ 77.0 \\ 77.1 \\ 77.3 \\ 77.5 \\ 77.7 \\ 77.9 \end{array}$	$52 \\ 53 \\ 54 \\ 55 \\ 56 \\ 57 \\ 58 $	$545.2 \\ 546.2 \\ 547.2 \\ 548.2 \\ 549.2 \\ 550.2 \\ 551.2$	$\begin{array}{c} 86.5 \\ 86.5 \\ 86.6 \\ 86.8 \\ 87.0 \\ 87.1 \\ 87.3 \end{array}$
$ \begin{array}{r} 19 \\ 20 \\ \overline{321} \\ 22 \\ 23 \\ 24 \\ 25 \end{array} $	$\begin{array}{r} 315.1\\ 316.1\\ \hline 317.0\\ 318.0\\ 319.0\\ 320.0\\ 991.0\\ \end{array}$	$\begin{array}{r} 49.9 \\ 50.1 \\ \hline 50.2 \\ 50.4 \\ 50.5 \\ 50.7 \\ \hline 50.7 \\ \end{array}$	$ \begin{array}{r} 79 \\ 80 \\ \overline{381} \\ 82 \\ 83 \\ 84 \\ 84 \\ 84 \\ 85 \\ 84 \\ 85 \\ 84 \\ 85 \\ 84 \\ 85 \\ 84 \\ 85 \\ 84 \\ 85 \\ 84 \\ 85 \\ 84 \\ 85 \\ 84 \\ 85 \\ 85 \\ 85 \\ 84 \\ 85 \\ 84 \\ 85 \\ 85 \\ 84 \\ 85 \\ 8$	$\begin{array}{c} 374.3\\ 375.3\\ \hline 376.3\\ 377.3\\ 378.3\\ 379.3\\ 329.3\\ \hline 379.3\\ 300.3\\ \hline	59.359.559.659.859.9 60.1	$ \begin{array}{r} 39 \\ 40 \\ \overline{} \\ 441 \\ 42 \\ 43 \\ 44 \\ 44 \\ 45 \\ \overline{} \\ 45 \\$	$\begin{array}{r} 433.\ 6\\ 434.\ 6\\ \hline 435.\ 6\\ 436.\ 6\\ 437.\ 5\\ 438.\ 5\\ 438.\ 5\\ \end{array}$	$\begin{array}{r} 68.7 \\ 68.8 \\ \hline 69.0 \\ 69.1 \\ 69.3 \\ 69.5 \\ 20.6 \\ \end{array}$	$ \begin{array}{r} 99 \\ 500 \\ \overline{501} \\ 02 \\ 03 \\ 04 \\ 05 \end{array} $	$\begin{array}{r} 492.9\\ 493.8\\ \hline 494.8\\ 495.8\\ 495.8\\ 496.8\\ 497.8\\ \hline 197.8\\ 192.9\\ \hline \end{array}$	$\begin{array}{c} 78.0 \\ 78.2 \\ 78.4 \\ 78.5 \\ 78.7 \\ 78.8 \\ 78.8 \\ 78.0 \\ \end{array}$	$59 \\ 60 \\ 561 \\ 62 \\ 63 \\ 64 \\ 64 \\ 65 \\ 64 \\ 65 \\ 64 \\ 65 \\ 64 \\ 65 \\ 64 \\ 65 \\ 64 \\ 65 \\ 64 \\ 65 \\ 64 \\ 65 \\ 65$	552. 2553. 1554. 1555. 1556. 1557. 1	$ \begin{array}{r} 87.4 \\ 87.6 \\ \overline{} \\ 87.7 \\ 87.9 \\ 88.0 \\ 88.2 \\ 88.2 \\ 88.2 \\ 6 \end{array} $
25 26 27 28 29 30 221	$\begin{array}{r} 321.0\\ 322.0\\ 323.0\\ 324.0\\ 324.9\\ 325.9\\ \hline 226.0\\ \hline \end{array}$	$50.8 \\ 51.0 \\ 51.2 \\ 51.3 \\ 51.5 \\ 51.7 \\ 51.7 \\ 51.9 \\ $		$ \begin{array}{r} 380.3 \\ 381.2 \\ 382.2 \\ 383.2 \\ 384.2 \\ 385.2 \\ \hline 286.2 \\ \hline \end{array} $	$\begin{array}{c} 60.2 \\ 60.4 \\ 60.5 \\ 60.7 \\ 60.9 \\ 61.0 \\ \hline \end{array}$	45 46 47 48 49 50 151	439.5 440.5 441.5 442.5 443.5 444.5 145.1	$\begin{array}{c} 69.6\\ 69.8\\ 69.9\\ 70.1\\ 70.2\\ 70.4\\ \hline \\ \hline \\ 70.6\\ \hline \end{array}$	$ \begin{array}{c} 05 \\ 06 \\ 07 \\ 08 \\ 09 \\ 10 \\ 511 \end{array} $	$\begin{array}{r} 498.8 \\ 499.8 \\ 500.8 \\ 501.7 \\ 502.7 \\ 503.7 \\ \hline 504.7 \end{array}$	$\begin{array}{c} 79.0 \\ 79.1 \\ 79.2 \\ 79.4 \\ 79.5 \\ 79.7 \\ \hline \\ 79.7 \\ \hline \\ 79.7 \\ \hline \end{array}$	$ \begin{array}{r} 65 \\ 66 \\ 67 \\ 68 \\ 69 \\ 70 \\ \overline{571} \end{array} $	$\begin{array}{c} 558.1 \\ 559.1 \\ 560.1 \\ 561.0 \\ 562.0 \\ 563.0 \\ \hline \end{array}$	
32 33 34 35 36 37 38 39	320. 9 327. 9 328. 9 329. 9 330. 9 331. 9 332. 8 333. 8 334. 8	$51.9 \\ 51.9 \\ 52.1 \\ 52.3 \\ 52.4 \\ 52.6 \\ 52.7 \\ 52.9 \\ 53.0 $	92 93 94 95 96 97 98 99	$\begin{array}{c} 380.\ 2\\ 387.\ 2\\ 388.\ 2\\ 389.\ 1\\ 390.\ 1\\ 391.\ 1\\ 392.\ 1\\ 393.\ 1\\ 394.\ 1\end{array}$	$\begin{array}{c} 61.2 \\ 61.3 \\ 61.5 \\ 61.6 \\ 61.8 \\ 62.0 \\ 62.1 \\ 62.3 \\ 62.4 \end{array}$	$51 \\ 52 \\ 53 \\ 54 \\ 55 \\ 56 \\ 57 \\ 58 \\ 59 \\ 59 \\ 59 \\ 59 \\ 51 \\ 59 \\ 59 \\ 59$	$\begin{array}{c} 446.4\\ 447.4\\ 448.4\\ 449.4\\ 450.4\\ 451.4\\ 452.4\\ 453.3\end{array}$	$\begin{array}{c} 70.\ 6\\ 70.\ 7\\ 70.\ 9\\ 71.\ 0\\ 71.\ 2\\ 71.\ 3\\ 71.\ 5\\ 71.\ 7\\ 71.\ 8\end{array}$	$ \begin{array}{c} 11\\ 12\\ 13\\ 14\\ 15\\ 16\\ 17\\ 18\\ 19\\ \end{array} $	$\begin{array}{c} 504.7\\ 505.7\\ 506.7\\ 507.7\\ 508.7\\ 509.6\\ 510.6\\ 511.6\\ 512.6\end{array}$	$\begin{array}{c} 80.1 \\ 80.2 \\ 80.3 \\ 80.5 \\ 80.6 \\ 80.8 \\ 80.9 \\ 81.1 \end{array}$	$ \begin{array}{r} 72 \\ 73 \\ 74 \\ 75 \\ 76 \\ 77 \\ 78 \\ 79 \\ \end{array} $	$\begin{array}{c} 564.0\\ 565.0\\ 566.0\\ 567.0\\ 568.0\\ 568.9\\ 569.9\\ 570.9\\ 571.9\end{array}$	89. 489. 489. 589. 789. 990. 190. 290. 390. 5
$ \begin{array}{r} 40 \\ \overline{341} \\ 42 \\ 43 \\ 44 \\ 45 \\ 46 \\ 47 \\ 48 \\ 49 \\ 50 \end{array} $	$\begin{array}{c} 335.8\\ 336.8\\ 337.8\\ 338.8\\ 339.8\\ 340.8\\ 341.7\\ 342.7\\ 343.7\\ 344.7\\ 344.7\\ 344.7\\ \end{array}$	$\begin{array}{c} 53.2\\ \hline 53.3\\ 53.5\\ 53.7\\ 53.8\\ 54.0\\ 54.1\\ 54.3\\ 54.4\\ 54.6\\ 54.6\end{array}$	$ \begin{array}{r} 400 \\ 401 \\ 02 \\ 03 \\ 04 \\ 05 \\ 06 \\ 07 \\ 08 \\ 09 \\ 10 \end{array} $	$\begin{array}{c} 395.1\\ \hline 396.1\\ 397.0\\ 398.0\\ 399.0\\ 400.0\\ 401.0\\ 402.0\\ 403.0\\ 404.0\\ 404.0\\ \end{array}$	$\begin{array}{c} 62.6\\ \hline 62.7\\ 62.9\\ 63.0\\ 63.2\\ 63.4\\ 63.5\\ 63.7\\ 63.8\\ 64.0\\ 04.1\end{array}$	$ \begin{array}{r} 60 \\ 461 \\ 62 \\ 63 \\ 64 \\ 65 \\ 66 \\ 67 \\ 68 \\ 69 \\ 70 \\ 70 \\ 80 \\ 70 \\ 70 \\ 70 \\ 70 \\ 70 \\ 70 \\ 70 \\ 7$	$\begin{array}{r} 454.3\\ \hline 455.3\\ 456.3\\ 457.3\\ 458.3\\ 459.3\\ 460.3\\ 461.2\\ 462.2\\ 462.2\\ 463.2\end{array}$	$\begin{array}{c} 72.0 \\ \hline 72.1 \\ 72.3 \\ 72.4 \\ 72.6 \\ 72.7 \\ 72.9 \\ 73.1 \\ 73.2 \\ 73.4 \\ 73.4 \\ 73.4 \\ \end{array}$	$ \begin{array}{r} 20 \\ 521 \\ 22 \\ 23 \\ 24 \\ 25 \\ 26 \\ 27 \\ 28 \\ 29 \\ 29 \end{array} $	$\begin{array}{c} 513.6\\ 514.6\\ 515.6\\ 516.6\\ 517.6\\ 518.6\\ 519.5\\ 520.5\\ 521.5\\ 522.5\\ \end{array}$	$\begin{array}{c} 81.3\\ \hline 81.4\\ 81.6\\ 81.8\\ 81.9\\ 82.1\\ 82.3\\ 82.4\\ 82.6\\ 82.7\\ \end{array}$	$ \begin{array}{r} 80 \\ 581 \\ 82 \\ 83 \\ 84 \\ 85 \\ 86 \\ 87 \\ 88 \\ 89 \\ 89 \\ \end{array} $	572.9 573.9 574.9 575.9 576.9 577.9 578.8 579.8 580.8 581.8	$\begin{array}{c} 90.7\\ \hline 90.9\\ 91.0\\ 91.2\\ 91.3\\ 91.5\\ 91.7\\ 91.8\\ 92.0\\ 92.1\\ \end{array}$
$\begin{array}{r} 50\\ 351\\ 52\\ 53\\ 54\\ 55\\ 56\\ 57\\ 58\\ 59\\ 60\\ \end{array}$	$\begin{array}{r} 345.7\\ 346.7\\ 347.7\\ 348.7\\ 349.6\\ 350.6\\ 351.6\\ 352.6\\ 353.6\\ 354.6\\ 355.6\end{array}$	$\begin{array}{r} 54.8\\ \hline 54.9\\ 55.1\\ 55.2\\ 55.4\\ 55.5\\ 55.7\\ 55.9\\ 56.0\\ 56.2\\ 56.3\end{array}$	$ \begin{array}{r} 10 \\ 411 \\ 12 \\ 13 \\ 14 \\ 15 \\ 16 \\ 17 \\ 18 \\ 19 \\ 20 \\ \end{array} $	$\begin{array}{r} 405.0\\ 405.9\\ 406.9\\ 407.9\\ 408.9\\ 409.9\\ 410.9\\ 411.9\\ 412.9\\ 413.8\\ 414.8\end{array}$	$\begin{array}{c} 64.1\\ 64.3\\ 64.5\\ 64.6\\ 64.8\\ 64.9\\ 65.1\\ 65.2\\ 65.4\\ 65.6\\ 65.7\end{array}$	$ \begin{array}{r} 70 \\ 471 \\ 72 \\ 73 \\ 74 \\ 75 \\ 76 \\ 77 \\ 78 \\ 79 \\ 80 \\ \end{array} $	$\begin{array}{r} 464.2\\ \hline 465.2\\ 465.2\\ 466.2\\ 467.2\\ 468.2\\ 469.2\\ 470.1\\ 471.1\\ 472.1\\ 473.1\\ 473.1\\ 474.1 \end{array}$	$\begin{array}{c} 73.5\\73.7\\73.8\\74.0\\74.2\\74.3\\74.5\\74.6\\74.8\\74.9\\75.0\end{array}$	$\begin{array}{r} 30\\ \overline{531}\\ 32\\ 33\\ 34\\ 35\\ 36\\ 37\\ 38\\ 39\\ 40 \end{array}$	$\begin{array}{c} 523.5\\ 524.5\\ 525.5\\ 526.5\\ 527.5\\ 528.4\\ 529.4\\ 530.4\\ 531.4\\ 532.4\\ 533.4\end{array}$	$\begin{array}{r} 82.9\\ 83.1\\ 83.2\\ 83.4\\ 83.5\\ 83.7\\ 83.8\\ 84.0\\ 84.1\\ 84.3\\ 84.4\end{array}$	$\begin{array}{r} 90\\ \overline{591}\\ 92\\ 93\\ 94\\ 95\\ 96\\ 97\\ 98\\ 99\\ 600 \end{array}$	$\begin{array}{r} 582.8\\ \hline 583.8\\ 583.8\\ 584.8\\ 585.7\\ 586.7\\ 587.7\\ 588.7\\ 589.7\\ 599.7\\ 590.7\\ 591.7\\ 592.6\end{array}$	$\begin{array}{r} 92.2\\ \hline 92.4\\ 92.5\\ 92.7\\ 92.9\\ 93.1\\ 93.2\\ 93.4\\ 93.5\\ 93.7\\ 93.8\\ \end{array}$
Dist.	Dep.	Lat.	Dist.	Dep.	Lat.	Dist.	Dep.	Lat.	Dist.	Dep.	Lat.	Dist.	Dep.	Lat.
						81° (9	99°, 261°	°, 279°).					

Pa	ge 386					Т	ABLE	2 2.						
			Differe	ence of l	Latitud	e and	Departu	ure for	10° (1	70°, 190)°, 350°).		
Dist.	Lat.	Dep.	Dist.	Lat.	Dep.	Dist.	Lat.	Dep.	Dist.	Lat,	Dep.	Dist.	Lat.	Dep.
$ \begin{array}{r} 1 \\ 2 \\ 3 \\ 4 \\ 5 \\ 6 \\ 7 \\ 8 \\ 9 \\ 10 \\ 10 \\ \end{array} $	$\begin{array}{c} 1.0\\ 2.0\\ 3.0\\ 3.9\\ 4.9\\ 5.9\\ 6.9\\ 7.9\\ 8.9\\ 9.8 \end{array}$	$\begin{array}{c} 0.\ 2\\ 0.\ 3\\ 0.\ 5\\ 0.\ 7\\ 0.\ 9\\ 1.\ 0\\ 1.\ 2\\ 1.\ 4\\ 1.\ 6\\ 1.\ 7\end{array}$	$\begin{array}{c} 61 \\ 62 \\ 63 \\ 64 \\ 65 \\ 66 \\ 67 \\ 68 \\ 69 \\ 70 \end{array}$	$\begin{array}{c} 60.\ 1\\ 61.\ 1\\ 62.\ 0\\ 63.\ 0\\ 64.\ 0\\ 65.\ 0\\ 66.\ 0\\ 67.\ 0\\ 68.\ 0\\ 68.\ 9\end{array}$	$\begin{array}{c} 10.\ 6\\ 10.\ 8\\ 10.\ 9\\ 11.\ 1\\ 11.\ 3\\ 11.\ 5\\ 11.\ 6\\ 11.\ 8\\ 12.\ 0\\ 12.\ 2 \end{array}$	$121 \\ 22 \\ 23 \\ 24 \\ 25 \\ 26 \\ 27 \\ 28 \\ 29 \\ 30$	$\begin{array}{c} 119.\ 2\\ 120.\ 1\\ 121.\ 1\\ 122.\ 1\\ 123.\ 1\\ 124.\ 1\\ 125.\ 1\\ 126.\ 1\\ 127.\ 0\\ 128.\ 0 \end{array}$	$\begin{array}{c} 21.\ 0\\ 21.\ 2\\ 21.\ 4\\ 21.\ 5\\ 21.\ 7\\ 21.\ 9\\ 22.\ 1\\ 22.\ 2\\ 22.\ 4\\ 22.\ 6\end{array}$	$ 181 \\ 82 \\ 83 \\ 84 \\ 85 \\ 86 \\ 87 \\ 88 \\ 89 \\ 90 $	$\begin{array}{c} 178.3\\ 179.2\\ 180.2\\ 181.2\\ 182.2\\ 183.2\\ 183.2\\ 184.2\\ 185.1\\ 186.1\\ 187.1 \end{array}$	$\begin{array}{c} 31.4\\ 31.6\\ 31.8\\ 32.0\\ 32.1\\ 32.3\\ 32.5\\ 32.6\\ 32.8\\ 33.0\\ \end{array}$	$241 \\ 42 \\ 43 \\ 44 \\ 45 \\ 46 \\ 47 \\ 48 \\ 49 \\ 50$	$\begin{array}{c} 237.\ 3\\ 238.\ 3\\ 239.\ 3\\ 240.\ 3\\ 241.\ 3\\ 242.\ 3\\ 243.\ 2\\ 243.\ 2\\ 244.\ 2\\ 245.\ 2\\ 246.\ 2\end{array}$	$\begin{array}{c} 41.8\\ 42.0\\ 42.2\\ 42.4\\ 42.5\\ 42.7\\ 42.9\\ 43.1\\ 43.2\\ 43.4 \end{array}$
$ \begin{array}{c} 11\\ 12\\ 13\\ 14\\ 15\\ 16\\ 17\\ 18\\ 19\\ 20\\ \end{array} $	$10.8 \\ 11 \\ 8 \\ 12.8 \\ 13.8 \\ 14.8 \\ 15.8 \\ 16.7 \\ 17.7 \\ 18.7 \\ 19.7 \\ 20.7 \\ 20.7 \\ 10.7 $	$ \begin{array}{c} 1.9\\ 2.1\\ 2.3\\ 2.6\\ 2.8\\ 3.0\\ 3.1\\ 3.5\\ 9 \end{array} $	71 72 73 74 75 76 77 78 79 80	$\begin{array}{c} 69.9\\ 70.9\\ 71.9\\ 72.9\\ 73.9\\ 74.8\\ 75.8\\ 76.8\\ 77.8\\ 78.8\\ 78.8\\ 78.8\\ 79.8\\ 79.8\\ 79.8\\ 79.8\\ 70.8\\$	$12.3 \\ 12.5 \\ 12.7 \\ 12.8 \\ 13.0 \\ 13.2 \\ 13.4 \\ 13.5 \\ 13.7 \\ 13.9 \\ 14.1 \\ $	$ \begin{array}{r} 131 \\ 32 \\ 33 \\ 34 \\ 35 \\ 36 \\ 37 \\ 38 \\ 39 \\ 40 \\ 141 \end{array} $	$\begin{array}{c} 129.0\\ 130.0\\ 131.0\\ 132.0\\ 132.9\\ 133.9\\ 134.9\\ 135.9\\ 136.9\\ 136.9\\ 137.9\\ \hline 128.0\\ \end{array}$	$\begin{array}{c} 22.7\\ 22.9\\ 23.1\\ 23.3\\ 23.4\\ 23.6\\ 23.8\\ 24.0\\ 24.1\\ 24.3\\ 24.5\\ \end{array}$	$ \begin{array}{r} 191 \\ 92 \\ 93 \\ 94 \\ 95 \\ 96 \\ 97 \\ 98 \\ 99 \\ 200 \\ \hline 201 \end{array} $	$\begin{array}{c} 188.1\\ 189.1\\ 190.1\\ 191.1\\ 192.0\\ 193.0\\ 194.0\\ 195.0\\ 196.0\\ 197.0\\ \hline \end{array}$	$\begin{array}{c} 33.2\\ 33.3\\ 33.5\\ 33.7\\ 33.9\\ 34.0\\ 34.2\\ 34.4\\ 34.6\\ 34.7\\ 34.6\\ 34.7\\ \end{array}$	$ \begin{array}{r} 251 \\ 52 \\ 53 \\ 54 \\ 55 \\ 56 \\ 57 \\ 58 \\ 59 \\ 60 \\ \hline 261 \end{array} $	$\begin{array}{c} 247.2\\ 248.2\\ 249.2\\ 250.1\\ 251.1\\ 252.1\\ 253.1\\ 254.1\\ 255.1\\ 256.1\\ \hline \end{array}$	$\begin{array}{c} 43.6\\ 43.8\\ 43.9\\ 44.1\\ 44.3\\ 44.5\\ 44.6\\ 44.8\\ 45.0\\ 45.1\\ 45.1\end{array}$
$ \begin{array}{c} 21\\ 22\\ 23\\ 24\\ 25\\ 26\\ 27\\ 28\\ 29\\ 30\\ \end{array} $	$\begin{array}{c} 20.1\\ 21.7\\ 22.7\\ 23.6\\ 24.6\\ 25.6\\ 26.6\\ 27.6\\ 28.6\\ 29.5\\ \end{array}$	$\begin{array}{c} 3.8\\ 3.8\\ 4.0\\ 4.2\\ 4.3\\ 4.5\\ 4.7\\ 4.9\\ 5.0\\ 5.2 \end{array}$	81 82 83 84 85 86 87 88 89 90	$\begin{array}{c} 80.8\\ 80.8\\ 81.7\\ 82.7\\ 83.7\\ 84.7\\ 85.7\\ 86.7\\ 87.6\\ 88.6\end{array}$	$\begin{array}{c} 14.1\\ 14.2\\ 14.4\\ 14.6\\ 14.8\\ 14.9\\ 15.1\\ 15.3\\ 15.5\\ 15.6\end{array}$	$ \begin{array}{r} 141 \\ 42 \\ 43 \\ 44 \\ 45 \\ 46 \\ 47 \\ 48 \\ 49 \\ 50 \\ \end{array} $	$\begin{array}{c} 133.3\\ 139.8\\ 140.8\\ 141.8\\ 142.8\\ 143.8\\ 144.8\\ 144.8\\ 145.8\\ 146.7\\ 147.7\end{array}$	$\begin{array}{c} 24.3\\ 24.7\\ 24.8\\ 25.0\\ 25.2\\ 25.4\\ 25.5\\ 25.7\\ 25.9\\ 26.0\\ \end{array}$	$ \begin{array}{c} 201 \\ 02 \\ 03 \\ 04 \\ 05 \\ 06 \\ 07 \\ 08 \\ 09 \\ 10 \end{array} $	$\begin{array}{c} 197.9\\ 198.9\\ 199.9\\ 200.9\\ 201.9\\ 202.9\\ 203.9\\ 204.8\\ 205.8\\ 206.8\\ \end{array}$	$\begin{array}{c} 35.3\\ 35.1\\ 35.3\\ 35.4\\ 35.6\\ 35.8\\ 35.9\\ 36.1\\ 36.3\\ 36.5\\ \end{array}$	$ \begin{array}{c} 201 \\ 62 \\ 63 \\ 64 \\ 65 \\ 66 \\ 67 \\ 68 \\ 69 \\ 70 \\ \end{array} $	$\begin{array}{c} 257.0\\ 258.0\\ 259.0\\ 260.0\\ 261.0\\ 262.0\\ 262.9\\ 263.9\\ 263.9\\ 264.9\\ 265.9\end{array}$	$\begin{array}{r} 45.3 \\ 45.5 \\ 45.7 \\ 45.8 \\ 46.0 \\ 46.2 \\ 46.4 \\ 46.5 \\ 46.7 \\ 46.9 \end{array}$
$31 \\ 32 \\ 33 \\ 34 \\ 35 \\ 36 \\ 37 \\ 38 \\ 39 \\ 40$	$\begin{array}{c} 30.5\\ 31.5\\ 32.5\\ 33.5\\ 34.5\\ 35.5\\ 36.4\\ 37.4\\ 38.4\\ 39.4 \end{array}$	$5.4 \\ 5.6 \\ 5.7 \\ 5.9 \\ 6.1 \\ 6.3 \\ 6.4 \\ 6.6 \\ 6.8 \\ 6.9 \\ 6.9 \\ 100000000000000000000000000000000000$	$91 \\ 92 \\ 93 \\ 94 \\ 95 \\ 96 \\ 97 \\ 98 \\ 99 \\ 100$	$\begin{array}{c} 89.\ 6\\ 90.\ 6\\ 91.\ 6\\ 92.\ 6\\ 93.\ 6\\ 94.\ 5\\ 95.\ 5\\ 96.\ 5\\ 97.\ 5\\ 98.\ 5\end{array}$	$\begin{array}{c} 15.8\\ 16.0\\ 16.1\\ 16.3\\ 16.5\\ 16.7\\ 16.8\\ 17.0\\ 17.2\\ 17.4 \end{array}$	$ \begin{array}{r} 151 \\ 52 \\ 53 \\ 54 \\ 55 \\ 56 \\ 57 \\ 58 \\ 59 \\ 60 \\ \end{array} $	$\begin{array}{c} 148.\ 7\\ 149.\ 7\\ 150.\ 7\\ 151.\ 7\\ 152.\ 6\\ 153.\ 6\\ 154.\ 6\\ 155.\ 6\\ 156.\ 6\\ 157.\ 6\end{array}$	$\begin{array}{c} 26.2\\ 26.4\\ 26.6\\ 26.7\\ 26.9\\ 27.1\\ 27.3\\ 27.4\\ 27.6\\ 27.8\end{array}$	$211 \\ 12 \\ 13 \\ 14 \\ 15 \\ 16 \\ 17 \\ 18 \\ 19 \\ 20$	$\begin{array}{c} 207.8\\ 208.8\\ 209.8\\ 210.7\\ 211.7\\ 212.7\\ 213.7\\ 214.7\\ 215.7\\ 216.7\\ \end{array}$	$\begin{array}{c} 36.6\\ 36.8\\ 37.0\\ 37.2\\ 37.3\\ 37.5\\ 37.7\\ 37.9\\ 38.0\\ 38.2 \end{array}$	$271 \\ 72 \\ 73 \\ 74 \\ 75 \\ 76 \\ 77 \\ 78 \\ 79 \\ 80$	$\begin{array}{c} 266. \ 9\\ 267. \ 9\\ 268. \ 9\\ 269. \ 8\\ 270. \ 8\\ 270. \ 8\\ 271. \ 8\\ 272. \ 8\\ 273. \ 8\\ 273. \ 8\\ 274. \ 8\\ 275. \ 7\end{array}$	$\begin{array}{r} 47.1\\ 47.2\\ 47.4\\ 47.6\\ 47.8\\ 47.9\\ 48.1\\ 48.3\\ 48.4\\ 48.6\end{array}$
$ \begin{array}{r} 41 \\ 42 \\ 43 \\ 44 \\ 45 \\ 46 \\ 47 \\ 48 \\ 49 \\ 50 \\ \end{array} $	$\begin{array}{r} 40.4\\ 41.4\\ 42.3\\ 43.3\\ 44.3\\ 45.3\\ 45.3\\ 46.3\\ 47.3\\ 48.3\\ 49.2\end{array}$	$\begin{array}{c} 7.1 \\ 7.3 \\ 7.5 \\ 7.6 \\ 7.8 \\ 8.0 \\ 8.2 \\ 8.3 \\ 8.5 \\ 8.7 \end{array}$	$ \begin{array}{r} 101 \\ 02 \\ 03 \\ 04 \\ 05 \\ 06 \\ 07 \\ 08 \\ 09 \\ 10 \\ \end{array} $	$\begin{array}{c} 99.5\\ 100.5\\ 101.4\\ 102.4\\ 103.4\\ 104.4\\ 105.4\\ 106.4\\ 107.3\\ 108.3 \end{array}$	$\begin{array}{c} 17.5\\ 17.7\\ 17.9\\ 18.1\\ 18.2\\ 18.4\\ 18.6\\ 18.8\\ 18.9\\ 19.1\\ \end{array}$	$ \begin{array}{r} 161 \\ 62 \\ 63 \\ 64 \\ 65 \\ 66 \\ 67 \\ 68 \\ 69 \\ 70 \\ \end{array} $	$\begin{array}{c} 158.6\\ 159.5\\ 160.5\\ 161.5\\ 162.5\\ 163.5\\ 163.5\\ 164.5\\ 165.4\\ 166.4\\ 167.4 \end{array}$	$\begin{array}{c} 28.0\\ 28.1\\ 28.3\\ 28.5\\ 28.7\\ 28.8\\ 29.0\\ 29.2\\ 29.3\\ 29.5\\ \end{array}$	$\begin{array}{c} 221 \\ 22 \\ 23 \\ 24 \\ 25 \\ 26 \\ 27 \\ 28 \\ 29 \\ 30 \end{array}$	$\begin{array}{c} 217.\ 6\\ 218.\ 6\\ 219.\ 6\\ 220.\ 6\\ 221.\ 6\\ 222.\ 6\\ 223.\ 6\\ 224.\ 5\\ 225.\ 5\\ 226.\ 5\\ \end{array}$	$\begin{array}{c} 38.4\\ 38.5\\ 38.7\\ 38.9\\ 39.1\\ 39.2\\ 39.4\\ 39.6\\ 39.8\\ 39.9 \end{array}$	$\begin{array}{c} 281 \\ 82 \\ 83 \\ 84 \\ 85 \\ 86 \\ 87 \\ 88 \\ 89 \\ 90 \end{array}$	$\begin{array}{c} 276.7\\ 277.7\\ 278.7\\ 279.7\\ 280.7\\ 281.7\\ 282.6\\ 283.6\\ 283.6\\ 284.6\\ 285.6\\ \end{array}$	$\begin{array}{r} 48.8\\ 49.0\\ 49.1\\ 49.3\\ 49.5\\ 49.7\\ 49.8\\ 50.0\\ 50.2\\ 50.4\\ \end{array}$
$51 \\ 52 \\ 53 \\ 54 \\ 55 \\ 56 \\ 57 \\ 58 \\ 59 \\ 60$	$\begin{array}{c} 50.2\\ 51.2\\ 52.2\\ 53.2\\ 54.2\\ 55.1\\ 56.1\\ 57.1\\ 58.1\\ 59.1\\ \end{array}$	$\begin{array}{r} 8.9\\ 9.0\\ 9.2\\ 9.4\\ 9.6\\ 9.7\\ 9.9\\ 10.1\\ 10.2\\ 10.4 \end{array}$	$ \begin{array}{r} 111 \\ 12 \\ 13 \\ 14 \\ 15 \\ 16 \\ 17 \\ 18 \\ 19 \\ 20 \\ \end{array} $	$\begin{array}{c} 109.\ 3\\ 110.\ 3\\ 111.\ 3\\ 112.\ 3\\ 113.\ 3\\ 114.\ 2\\ 115.\ 2\\ 116.\ 2\\ 117.\ 2\\ 118.\ 2 \end{array}$	$\begin{array}{c} 19.3\\ 19.4\\ 19.6\\ 19.8\\ 20.0\\ 20.1\\ 20.3\\ 20.5\\ 20.7\\ 20.8\\ \end{array}$	$ \begin{array}{r} 171 \\ 72 \\ 73 \\ 74 \\ 75 \\ 76 \\ 77 \\ 78 \\ 79 \\ 80 \\ \end{array} $	$\begin{array}{c} 168. \ 4\\ 169. \ 4\\ 170. \ 4\\ 171. \ 4\\ 172. \ 3\\ 173. \ 3\\ 174. \ 3\\ 175. \ 3\\ 176. \ 3\\ 177. \ 3\end{array}$	$\begin{array}{c} 29.\ 7\\ 29.\ 9\\ 30.\ 0\\ 30.\ 2\\ 30.\ 4\\ 30.\ 6\\ 30.\ 7\\ 30.\ 9\\ 31.\ 1\\ 31.\ 3\end{array}$	$\begin{array}{c} 231 \\ 32 \\ 33 \\ 34 \\ 35 \\ 36 \\ 37 \\ 38 \\ 39 \\ 40 \end{array}$	$\begin{array}{c} 227.5\\ 228.5\\ 229.5\\ 230.4\\ 231.4\\ 232.4\\ 233.4\\ 233.4\\ 235.4\\ 235.4\\ 236.4\\ \end{array}$	$\begin{array}{r} 40.1\\ 40.3\\ 40.5\\ 40.6\\ 40.8\\ 41.0\\ 41.2\\ 41.3\\ 41.5\\ 41.7\\ \end{array}$	291 92 93 94 95 96 97 98 99 300	$\begin{array}{c} 286.\ 6\\ 287.\ 6\\ 288.\ 5\\ 289.\ 5\\ 290.\ 5\\ 291.\ 5\\ 292.\ 5\\ 293.\ 5\\ 294.\ 5\\ 295.\ 4\end{array}$	$\begin{array}{c} 50.5\\ 50.7\\ 50.9\\ 51.1\\ 51.2\\ 51.4\\ 51.6\\ 51.7\\ 51.9\\ 52.1 \end{array}$
Dist.	Dep.	Lat.	Dist.	Dep.	Lat.	Dist.	Dep.	Lat.	Dist.	Dep.	Lat.	Dist.	Dep.	Lat.
					:	80° (1	00°, 260	°, 280°).					

						Т	ABLE	C 2.					[Page	e 387
			Differ	ence of I	Latitud	le and	Depart	are for	10° (1	170°, 190)°, <u>35</u> 0°	°)		
Dist.	Lat.	Dep.	Dist.	Lat.	Dep.	Dist.	Lat.	Dep.	Dist.	Lat.	Dep.	Dist.	Lat,	Dep,
$301 \\ 02 \\ 03 \\ 04$	$\begin{array}{c} 296.4 \\ 297.4 \\ 298.4 \\ 299.4 \end{array}$	52.3 52.5 52.6 52.8	$361 \\ 62 \\ 63 \\ 64$	$\begin{array}{c} 355.5\\ 356.5\\ 357.5\\ 358.5\end{array}$	$\begin{array}{c} 62.\ 7\\ 62.\ 9\\ 63.\ 0\\ 63.\ 2\end{array}$	$421 \\ 22 \\ 23 \\ 24$	$\begin{array}{c} 414.\ 6\\ 415.\ 6\\ 416.\ 6\\ 417.\ 6\end{array}$	$\begin{array}{c} 73.1 \\ 73.3 \\ 73.5 \\ 73.6 \end{array}$	$481 \\ 82 \\ 83 \\ 84$	$\begin{array}{r} 473.\ 7\\ 474.\ 7\\ 475.\ 7\\ 476.\ 6\end{array}$	83.5 83.7 83.9 84.1	$541 \\ 42 \\ 43 \\ 44$	$532. 8 \\ 533. 8 \\ 534. 8 \\ 535. 7$	93.994.194.394.5
05 06 07 08	300. 4 301. 4 302. 3 303. 3	53.0 53.1 53.3 53.5 53.5 53.7		359.5 360.4 361.4 362.4 262.4	$\begin{array}{c} 63.4 \\ 63.6 \\ 63.7 \\ 63.9 \\ 64.1 \end{array}$	$25 \\ 26 \\ 27 \\ 28 \\ 29$	$\begin{array}{r} 418.5 \\ 419.5 \\ 420.5 \\ 421.5 \\ 492.5 \end{array}$	73.874.074.274.374.3	85 86 87 88 88	$\begin{array}{r} 477.6 \\ 478.6 \\ 479.6 \\ 480.6 \\ 191.6 \end{array}$	84.2 84.4 84.6 84.7	45 46 47 48 19	536.7537.7538.7539.7540.7	$\begin{array}{c c} 94.6\\ 94.8\\ 95.0\\ 95.1\\ 05.2\end{array}$
10	304.5	53.8	$\frac{09}{70}$	$305. \pm 364.4$.	64.3	$\frac{29}{30}$	422.0 423.5 424.5	74.0	90	481.0	84.9	40 50	541.6	95.5 95.5 05.6
$ \begin{array}{r} 311 \\ 12 \\ 13 \\ 14 \\ 15 \\ 16 \\ 17 \\ 12 \end{array} $	$\begin{array}{c c} 306.5\\ 307.3\\ 308.2\\ 309.2\\ 310.2\\ 311.2\\ 312.2\\ \end{array}$	$\begin{array}{c} 54.0\\ 54.2\\ 54.3\\ 54.5\\ 54.7\\ 54.9\\ 55.1\\ -5.1\\ \end{array}$	$ \begin{array}{c} 371 \\ 72 \\ 73 \\ 74 \\ 75 \\ 76 \\ 77 \\ 77 \\ 77 \\ \end{array} $	360.4 366.4 367.3 368.3 369.3 370.3 371.3 371.3	$ \begin{array}{c} 0+. + \\ 64. 6 \\ 64. 8 \\ 65. 0 \\ 65. 1 \\ 65. 3 \\ 65. 5 $	431 32 35 34 35 36 37 37	$\begin{array}{c} +24.0 \\ +25.4 \\ +26.4 \\ +27.4 \\ +28.4 \\ +29.4 \\ +430.4 \\ \end{array}$	74.9 75.0 75.2 75.4 75.5 75.7 75.9	491 92 93 94 95 96 97	480. 5 484. 5 485. 5 486. 5 487. 5 488. 5 489. 4	$\begin{array}{c} 85.2 \\ 85.4 \\ 85.6 \\ 85.8 \\ 85.9 \\ 86.1 \\ 86.3 \\ \end{array}$	531 52 53 54 55 56 57 57	542.0 543.6 544.6 545.6 546.6 546.5 548.5 548.5	95. 0 95. 8 96. 0 96. 2 96. 3 96. 3 96. 5 96. 7
18 19 20	313.2 314.2 215.1	55.2 55.4 55.6	78 79 80	372.3 373.2 374.2	65.0 65.8 66.0	$ 38 \\ 39 \\ 40 $	431.3 432.3 432.3	$76.1 \\ 76.2 \\ 76.4$	98 99 500	490.4 491.4 192.4	86. ə 86. 6 86. 8	58 59 60	549.5 550.5 551.5	96.9 97.0 97.2
$\begin{array}{r} 20\\ 321\\ 22\\ 22\\ 22\end{array}$	315.1 316.1 317.1 319.1	55.8 55.9	381 82 93	$\frac{374.2}{375.2}$	$ \begin{array}{c} 66.2 \\ 66.3 \\ ee 5 \end{array} $	$ \frac{40}{441} 42 4 $	+35.3 +34.3 +35.3 +96.2	76.6	$ \begin{array}{r} 500\\ 501\\ 02\\ 03 \end{array} $	$\frac{492.4}{493.4}$ $\frac{494.4}{105.8}$	80. 8 87. 0 87. 2 87. 2		552.5 553.5	$ \begin{array}{r} 97.2 \\ 97.4 \\ 97.6 \\ 97.7 \\ 97.7 \\ 97.6 \\ 97.7 \\ 97.7 \\ 97.7 \\ 97.7 \\ 97.7 \\ 97.7 \\ 97.6 \\ 97.7 \\ 9$
$23 \\ 24 \\ 25 \\ 26 \\ 97$	$\begin{array}{c} 318.1 \\ 319.1 \\ 320.1 \\ 321.0 \\ 322.0 \end{array}$	$ \begin{array}{c} 56.1 \\ 56.3 \\ 56.4 \\ 56.6 \\ 56.8 \\ \end{array} $	85 84 85 86 87	377.2 378.2 379.2 380.1 381.1	$\begin{array}{c} 66.9 \\ 66.9 \\ 67.0 \\ 67.2 \end{array}$	43 44 45 46 47	$\begin{array}{r} 430.3 \\ 437.3 \\ 438.2 \\ 439.2 \\ 440.2 \end{array}$	76.9 77.1 77.3 77.5 77.6	$ \begin{array}{c} 05 \\ 04 \\ 05 \\ 06 \\ 07 \\ \end{array} $	496.3 497.3 498.3 499.3	87.5 87.7 87.9 88.0		$ \begin{array}{r} 304.4 \\ 555.4 \\ 556.4 \\ 557.4 \\ 558.4 \end{array} $	97.9 97.9 98.1 98.3 98.4
28 29 30	323.0 324.0 325.0	57.0 57.1 57.3	88 89 90	382.1 383.1 384.1 384.1	67.4 67.6 67.7	48 49 50	$ \begin{array}{r} 441.2 \\ 442.2 \\ 443.2 \\ \hline 443.2 \end{array} $	77.8 78.0 78.2	$ \begin{array}{c} 08 \\ 09 \\ 10 \end{array} $	500.3 501.3 502.2	88.2 88.4 88.6	68 69 70	559.4 560.3 561.3	98.6 98.8 99.0
$\begin{array}{c} 331 \\ 32 \\ 33 \\ 34 \\ 35 \\ 36 \\ 37 \\ 38 \\ 39 \\ 40 \end{array}$	$\begin{array}{c} 326.0\\ 327.0\\ 327.9\\ 328.9\\ 329.9\\ 330.9\\ 331.9\\ 332.9\\ 333.9\\ 234.8 \end{array}$	57.557.757.858.058.258.458.558.758.959.1	$ \begin{array}{r} 391 \\ 92 \\ 93 \\ 94 \\ 95 \\ 96 \\ 97 \\ 98 \\ 99 \\ 400 \\ \end{array} $	385.1 386.0 387.0 388.0 389.0 390.0 391.0 392.0 392.9 393.9	$\begin{array}{c} 67.9\\ 68.1\\ 68.2\\ 68.4\\ 68.6\\ 68.8\\ 68.9\\ 69.1\\ 69.3\\ 89.5\end{array}$	$\begin{array}{c} 451 \\ 52 \\ 53 \\ 54 \\ 55 \\ 56 \\ 57 \\ 58 \\ 59 \\ 60 \end{array}$	$\begin{array}{c} 444.2\\ 445.1\\ 446.1\\ 447.1\\ 448.1\\ 449.1\\ 450.1\\ 451.0\\ 452.0\\ 152.0\end{array}$	$\begin{array}{c} 78.3 \\ 78.5 \\ 78.7 \\ 78.8 \\ 79.0 \\ 79.2 \\ 79.4 \\ 79.5 \\ 79.7 \\ 79.9 \\ 9.7 \\ 79.9 \end{array}$	$511 \\ 12 \\ 13 \\ 14 \\ 15 \\ 16 \\ 17 \\ 18 \\ 19 \\ 20$	$\begin{array}{c} 503.2\\ 504.2\\ 505.2\\ 506.2\\ 507.2\\ 508.2\\ 509.1\\ 510.1\\ 511.1\\ 512.1 \end{array}$	88.7 88.9 89.1 89.2 89.4 89.6 89.8 89.9 90.1 90.1	$571 \\ 72 \\ 73 \\ 74 \\ 75 \\ 76 \\ 77 \\ 78 \\ 79 \\ 80 \\$	$\begin{array}{c} 562.3\\ 563.3\\ 564.3\\ 565.3\\ 566.3\\ 566.3\\ 567.2\\ 568.2\\ 568.2\\ 569.2\\ 570.2\\ 571.2\\ \end{array}$	$\begin{array}{c c} 99. 1 \\ 99. 3 \\ 99. 5 \\ 99. 6 \\ 99. 8 \\ 100. 0 \\ 100. 2 \\ 100. 3 \\ 100. 5 \\ 100. 7 \end{array}$
$ \begin{array}{r} 341 \\ 42 \\ 43 \\ 44 \\ 45 \end{array} $	335.8 336.8 337.8 338.8 339.8	59.259.459.659.859.9	$ \begin{array}{r} 401 \\ 02 \\ 03 \\ 04 \\ 05 \end{array} $	394. 9 395. 9 396. 9 397. 9 398. 9	$\begin{array}{c} 69.6\\ 69.8\\ 70.0\\ 70.2\\ 70.3 \end{array}$	$ \begin{array}{r} 461 \\ 62 \\ 63 \\ 64 \\ 65 \end{array} $	$\begin{array}{r} 454.0\\ 455.0\\ 455.0\\ 456.0\\ 457.0\\ 457.9\end{array}$	80.1 80.2 80.4 80.6 80.8	521 22 23 24 25	$512.1 \\ 513.1 \\ 514.1 \\ 515.1 \\ 516.0 \\ 517.0 \\$	90.5 90.6 90.8 91.0 91.2	$ \begin{array}{r} 581 \\ 82 \\ 83 \\ 84 \\ 85 \end{array} $	572.2573.2574.1575.1576.1	$\begin{array}{r} 100.9\\ 100.9\\ 101.0\\ 101.2\\ 101.4\\ 101.6 \end{array}$
$ \begin{array}{r} 46 \\ 47 \\ 48 \\ 49 \\ 50 \end{array} $	$\begin{array}{c} 340.\ 7\\ 341.\ 7\\ 342.\ 7\\ 343.\ 7\\ 344.\ 7\\ 344.\ 7\end{array}$	60.1 60.3 60.4 60.6 60.8	$ \begin{array}{r} 06 \\ 07 \\ 08 \\ 09 \\ 10 \end{array} $	$\begin{array}{c} 399.8 \\ 400.8 \\ 401.8 \\ 402.8 \\ 403.8 \end{array}$	$\begin{array}{c} 70.5\\ 70.7\\ 70.9\\ 71.0\\ 71.2 \end{array}$	$ \begin{array}{r} 66 \\ 67 \\ 68 \\ 69 \\ 70 \\ 70 \end{array} $	$\begin{array}{r} 458.9\\ 459.9\\ 460.9\\ 461.9\\ 462.9\end{array}$	$\begin{array}{c} 80.\ 9\\ 81.\ 1\\ 81.\ 3\\ 81.\ 5\\ 81.\ 6\end{array}$	$ \begin{array}{r} 26 \\ 27 \\ 28 \\ 29 \\ 30 \end{array} $	$518.0 \\ 519.0 \\ 520.0 \\ 521.0 \\ 521.9$	$\begin{array}{c} 91.\ 3\\ 91.\ 5\\ 91.\ 7\\ 91.\ 9\\ 92.\ 0 \end{array}$	86 87 88 89 90	$577.1 \\ 578.1 \\ 579.1 \\ 580.0 \\ 581.0$	$101.7 \\ 101.9 \\ 102.1 \\ 102.3 \\ 102.4$
$351 \\ 52 \\ 53 \\ 54 \\ 55$	$\begin{array}{c} 345.7\\ 346.7\\ 347.6\\ 348.6\\ 349.6\end{array}$	$\begin{array}{c} 61.0\\ 61.1\\ 61.3\\ 61.5\\ 61.7\\ \end{array}$	$ \begin{array}{c} 411 \\ 12 \\ 13 \\ 14 \\ 15 \\ 16 \\ 16 \\ 16 \\ 16 \\ 16 \\ 16 \\ 16 \\ 16$	$\begin{array}{r} 404.8\\ 405.7\\ 406.7\\ 406.7\\ 407.7\\ 408.7\end{array}$	71.471.671.771.972.1	$\begin{array}{r} 471 \\ 72 \\ 73 \\ 74 \\ 75 \\ 75 \\ 76 \\ 75 \\ 76 \\ 75 \\ 76 \\ 75 \\ 76 \\ 75 \\ 75$	$\begin{array}{r} 463.8\\ 464.8\\ 465.8\\ 465.8\\ 466.8\\ 467.8\end{array}$	81.882.082.182.382.5	$531 \\ 32 \\ 33 \\ 34 \\ 35 \\ 34 \\ 35 \\ 34 \\ 35 \\ 35$	522.9523.9524.9525.9526.9	92.2 92.4 92.5 92.7 92.9	$591 \\ 92 \\ 93 \\ 94 \\ 95 \\ 95$	$\begin{array}{c} 582.0\\ 583.0\\ 584.0\\ 585.0\\ 586.0\\ \end{array}$	102. 6102. 8102. 9103. 1103. 3
$56 \\ 57 \\ 58 \\ 59 \\ 60$	$\begin{array}{c} 350.\ 6\\ 351.\ 6\\ 352.\ 6\\ 353.\ 5\\ 354.\ 5\end{array}$	$\begin{array}{c} 61.8\\ 62.0\\ 62.2\\ 62.4\\ 62.5 \end{array}$	$ \begin{array}{r} 16 \\ 17 \\ 18 \\ 19 \\ 20 \end{array} $	$\begin{array}{c} 409.\ 7\\ 410.\ 7\\ 411.\ 7\\ 412.\ 6\\ 413.\ 6\end{array}$	72.272.472.672.872.9	$ \begin{array}{r} 76 \\ 77 \\ 78 \\ 79 \\ 80 \\ \end{array} $	$\begin{array}{r} 468.8\\ 469.8\\ 470.7\\ 471.7\\ 472.7\end{array}$	$\begin{array}{c} 82.\ 7\\ 82.\ 8\\ 83.\ 0\\ 83.\ 2\\ 83.\ 4\end{array}$	$ \begin{array}{r} 36 \\ 37 \\ 38 \\ 39 \\ 40 \end{array} $	$527.9 \\ 528.8 \\ 529.8 \\ 530.8 \\ 531.8 \\$	$\begin{array}{c} 93.1\\ 93.2\\ 93.4\\ 93.6\\ 93.8\end{array}$	96 97 98 99 600	586.9 587.9 588.9 589.9 590.9	$103.5 \\ 103.6 \\ 103.8 \\ 104.0 \\ 104.2$
Dist.	Dep.	Lat.	Dist.	Dep.	Lat.	Dist.	Dep.	Lat.	Dist.	Dep.	Lat.	Dist.	Dep.	Lat.
					1	80° (1	00°, 260	°, 280°).					

Pa	385						PARLI							
1.0	ige ooo	1 L	Differ	rence of	Latitud	de and	A DIA: Depart	ure for	· 11° (169°, 19	1°. 349	•)		
Dist.	Lat.	Dep.	Dist.	Lat.	Dep.	Dist.	Lat.	Dep.	Dist.	Lat.	Dep.). Dist.	Lat.	Dep.
1	1.0	0.2	61	59.9	11.6	121	118.8	23.1	181	177.7	34.5	241	236.6	46.0
$\frac{2}{2}$	2.0	0.4	62	60.9	11.8	$22 \\ 92$	119.8	23.3	82	178.7	34.7	42	237.6	46.2
4	$\frac{2}{3.9}$	0.0	05 64	62.8	12.0 12.2	23	120.7 121.7	$\frac{23.5}{23.7}$	83 84	179.6 180.6	34.9 35.1	43 44	238.5	$46.4 \\ 46.6$
5	4.9	1.0	65	63.8	12.4	25	122.7	23.9	85	181.6	35.3	45	240.5	46.7
$\frac{6}{7}$	5.9	1.1	66	64.8	12.6	$\frac{26}{97}$	123.7	24.0	86	182.6	35.5	46	241.5	46.9
8	$0.9 \\ 7.9$	1.5	68	66.8	12.0 13.0	$\frac{27}{28}$	124.7 125.6	24.2 94.4	87	183.0 184.5	35.7 35.9	47	242.5	47.1 17.3
9	8.8	1.7	69	67.7	13.2	29	126.6	24.6	89	185.5	36.1	49	244.4	47.5
10	9.8	1.9	70	68.7	13.4	30	127.6	24.8	90	186.5	36.3		245.4	47.7
$11 \\ 12$	10.8	2.1 2.3	$\begin{array}{c} 71\\72 \end{array}$	69.7 70.7	13.5 13.7	$\begin{array}{c} 131\\ 32 \end{array}$	128.6 129.6	25.01 25.2	$\frac{191}{92}$	187.5 188.5	36.4	$251 \\ 52$	246.4	47.9
13	12.8	2.5	73	71.7	13.9	33	130.6	25. 4	93	189.5	36.8	53	248.4	48.3
14	13.7	2.7	74	72.6	14.1	34	131.5	25.6	94	190.4	37.0	54	249.3	48.5
$10 \\ 16$	14.7	2.9	$\frac{75}{76}$	73.0	14.5 14.5	35 36	132.0 133.5	25.8 26.0	95 96	191.4	$\begin{vmatrix} 37.2 \\ 37.4 \end{vmatrix}$	55 56	250.3	48.7
17	16.7	$3.\hat{2}$	77	75.6	14.7	37	134.5	26.0 26.1	97	193.4	37.6	57	251.0 252.3	49.0
18	17.7	3.4	78	76.6	14.9	38	135.5	26.3	98	194.4	37.8	58	253.3	49.2
$\frac{19}{20}$	18.7	3.0	- 79 - 80	77.5	15.1 15.3	39 40	136.4 137.4	26.5 26.7	200	195.3 196.3	38.0 38.2	59 60	254.2	49.4
21	20.6	4.0	81	-79.5	15.5	141	138.4	$\frac{26.9}{26.9}$	201	197.3	$\frac{38.2}{38.4}$	261	256.2	49.8
22	21.6	4.2	82	80.5	15.6	42	139.4	27.1	02	198.3	38.5	62	257.2	50.0
$\frac{23}{24}$	22.0	4.4	83	81.5	15.8 16.0	$\frac{43}{44}$	140.4 141.4	27.3 97.5	03	199.3	38.7	$63 \\ 64$	258.2	50.2
25	24.5	4.8	85	83.4	$16.0 \\ 16.2$	45	141 4	27.7 27.7	05	200.3 201.2	39.1	65	259.1 260.1	50.4
26	25.5	5.0	86	84.4	16.4	46	143.3	27.9	06	202.2	39.3	66	261.1	50.8
$\frac{21}{28}$	26.5	5.2 5.3	87	85.4	$16.6 \\ 16.8$	47	144.3 145.3	28.0	07	203.2	39.5	67	262.1	50.9
29	28.5	5.5	89	87.4	17.0	49	146.3	28.4 28.4	09	204.2 205.2	39. 9 39. 9	69	263.1 264.1	51.1 51.3
30	29.4	5.7	90	88.3	17.2	50	147.2	28.6	10	206.1	40.1	70	265.0	51.5
$\frac{31}{32}$	30.4 31.4	5.9 6.1	91	89.3	17.4 17.6	$151 \\ 52$	148.2 149.2	28.8	$\begin{array}{c} 211 \\ 12 \end{array}$	207.1	40.3	$271 \\ 79$	266.0	51.7
33	32.4	6.3	93	91.3	17.7	53	145. 2	29.0	13^{12}	208.1 209.1	40.6	73^{-2}	267.0	51.5 52.1
34	33.4	6.5	94	92.3	17.9	54	151.2	29.4	14	210.1	40.8	74	269.0	52.3
35	34.4	6.7	95	93.3	18.1 18.3	55 56	152.2 153.1	29.6	15 + 16	211.0 912.0	41.0	$\frac{75}{76}$	269.9	52.5
37	36.3	7.1	97	95.2	18.5	57	155.1	30.0	17	212.0	41. 4	77	270.9 271.9	52.9
38	37.3	7.3	98	96.2	18.7	58	155.1	30.1	18	214.0	41.6	78	272.9	53.0
39 40	38.3 39.3	$\begin{array}{c} 7.4 \\ 7.6 \end{array}$	100	97.2	$\begin{array}{c}18.9\\19.1\end{array}$	59 60	156.1 157 1	30.3 30.5	19 20	215.0 216.0	41.8 42.0	79 80	273.9	53.2 53.4
41	40.2	7.8	101	$-\frac{30.2}{99.1}$	19.3	161	158.0	30.7	$\frac{20}{221}$	$\frac{210.0}{216.9}$	42.2	281	275.8	53.6
42	41.2	8.0	02	100.1	19.5	62	159.0	30.9	22	217.9	42.4	82	276.8	53.8
43	42.2	8.2	03	101.1	19.7	$63 \\ 61$	160.0	31.1	23	218.9	42.6	83	277.8	54.0
45	44.2	.8.6	05	102.1 103.1	19.0 20.0	65	162.0	31.5 31.5	$\frac{24}{25}$	219.9 220.9	$\frac{42.1}{42.9}$	85	278.8	54.4
46	45.2	8.8	06	104.1	20.2	66	163.0	31.7	26	221.8	43.1	86	280.7	54.6
47	46.1	9.0	07	105.0	20.4	67	163.9	31.9	27	222.8	43.3	87	281.7	54.8
49	48.1	9.3	09	100.0	20.0	69	165.9	$32.1 \\ 32.2$	$\frac{26}{29}$	225.8 224.8	43.0 43.7	89	282.7	55.0 55.1
50	49.1	9.5	10	108.0	21.0	70	166.9	32.4	30	225.8	43.9	90	284.7	55.3
$51 \\ 52$	50.1	9.7	111	109.0	21.2	171	167.9	32.6	231	226.8	44.1	291	285.7	55.5
53	51.0 52.0	9.9	$\frac{12}{13}$	109.9	21.4 21.6	$\frac{72}{73}$	168.8 169.8	32.8 33.0	$\frac{32}{33}$	227.7	41.3	92 93	286 b 287 6	55.7
54	53.0	10.3	14	111.9	21.8	74	170.8	33.2	34	229.7	44.6	94	288.6	56.1
55	54.0	10.5	$15 \\ 16$	112.9	21.9	75	171.8	33.4	$\frac{35}{26}$	230.7	44.8	95	. 289.6	56.3
57	56.0	10.7	10	113.9	22.1 22.3	77	1/2.8 173.7	33.0	$\frac{30}{37}$	231.7 232.6	$\frac{45.0}{45.2}$	90	290. b 291. 5	56.5
58	56.9	11.1	18	115.8	22.5	78	174.7	34.0	38	233.6	45.4	98	292.5	56.9
59	57.9	11.3	19	116.8	22.7	79	175.7	34.2	39	234.6	45.6	99	293.5	57.1
00	58.9	11.4	20	117.8	22.9	80	176.7	34.3	40	235.6	45.8	300	294.5	57. Z
Dist.	Dep.	Lat.	Dist.	Dep.	Lat.	Dist.	Dep.	Lat.	Dist.	Dep.	Lat.	Dist.	Dep.	Lat.
					7	79° (10)1°, 259'	°, 281°).					

		-				Т	ABLF	2.					Page	389
		3	Differe	ence of]	Latitud	e and	Departu	ire for	11° (1	.69°, 191	°, 349°).	L=0 -	
Dist.	Lat.	Dep.	Dist.	Lat.	Dep.	Dist.	Lat.	Dep.	Dist.	Lat.	Dep.	Dist.	Lat.	Dep.
$301 \\ 02$	295.4 296.4	57.4 57.6	$\frac{361}{62}$	354.3 355.3	68.9 69.1	421 22	$413.2 \\ 414.2$	80. 3 80. 5	$\begin{array}{c} 481\\82\end{array}$	$472.1 \\ 473.1$	91.8 92.0	$541 \\ 42$	531.0 532.0	103.2 103.4
03	297.4	57.8	63	356.3	69.3	23	415.2	80.7	83	474.1	92.2	43	533.0	103.6
04	298.4	58.0	64	357.3	69.5 69.6	24	416.2	80.9	84	475.1	92.4	44	534.0	103.8
05	299.4	58.2 58.4	60 66	358.3	69.6	$\frac{25}{26}$	417.2	81.1	80 86	476.1	92.6	45	535.0	104.0
07	300.3 301.3	58.6	67	360.2	70.0	$\frac{20}{27}$	419.1	81.5	87	478.0	93.0	47	536.9	104.4
08	302.3	58.8	68	361.2	70.2	28	420.1	81.7	88	479.0	93.2	48	537.9	104.6
09	303.3	59.0	69	362.2	70.4	29	421.1	81.9	89	480.0	93.3	49	538.9	104.8
$\frac{10}{011}$	304.3	59.2	70	363.2	70.6	$\frac{30}{491}$	422.1	82.1	90	481.0	93.5	50	539.9	105.0
$\frac{311}{12}$	305.3	59.3	$\frac{371}{79}$	364.1 365.1	70.8	$\frac{431}{32}$	423.0 494.0	82.2 82.4	491	481.9	93.0	$.\frac{551}{52}$	540.8	105.1
$12 \\ 13$	307.2	59.7	73^{-2}	366.1	71.2	33	425.0	82.6	93	483.9	94.0	53	542.8	105.5
14	308.2	59.9	74	367.1	71.4	34	426.0	82.8	94	484.9	94.2	54	543.8	105.7
15	309.2	,60.1	75	368.1	71.6	$\frac{35}{26}$	427.0	83.0	95	485.9	94.4	55	544.8	105.9
$\frac{16}{17}$	310.2	60.3	$\frac{76}{77}$	369.1 270.0	71.7	$\frac{36}{37}$	428.0	83.2	96 97	486.9	94.6	56 57	545.8	106.1
18	311.1 312.1	60.7	78	370.0 371.0	71.0 72.1	38	429.9	83.6	98	488.8	95.0	58	547.7	106.5
19	313.1	60.9	79	372.0	72.3	39	430.9	83.8	99	489.8	95.2	59	548.7	106.7
20	314.1	61.1	80	373.0	72.5	40	431.9	84.0	500	490.8	95.4	60	549.7	106.9
321	315.1	61.3	381	374.0	72.7	441	432.9	84.1	501	491.8	95.6	561	550.7	107.1
22	316.1 317.0	61.4	82 83	374.9	72.9 73.1	42	433.8	84.3	02	492.7	95.8	62 63	552 G	107.2
24	318.0	61.0	84	376.9	73.3	44	435.8	84.7	04	494.7	96.2	64	553, 6	107.6
25	319.0	62.0	85	377.9	73.5	45	436.8	84.9	05	495.7	96.4	65.	554.6	107.8
26	320.0	62.2	86	378.9	73.7	46	437.8	85.1	06	496.7	96.6	66	555.6	108.0
27	321.0	$\begin{bmatrix} 62.4 \\ 62.6 \end{bmatrix}$	87	379.9	73.8	47	438.8	85.3	07	497.7	96.8	67	556.6	108.2
$\frac{28}{29}$	321.9 322.9	62.0 62.8	89	380.8	74.0 74.2	40	439.7	85.5 85.7	08	498.0	97.0	69	558.6	108.4
30	323.9	63.0	90	382.8	74.4	50	441.7	85.9	10	500.6	97.3	70	559.5	108.8
331	324.9	63.2	391	383.8	74.6	451	442.7	86.1	511	501.6	97.5	571	560.5	109.0
32	325.9	63.4	92	384.8	74.8	52	443.7	86.2	12	502.6	97.6	72	561.5	109.1
33	326.8	63.5	93 04	385.7	75.0	53	444.6	86.4	$\frac{13}{14}$	503.5	97.8	$73 \\ 74$	562.5	109.3
35	328.8	63.9	95	380.7 387.7	75.4	55	445.0	86.8	$14 \\ 15$	505.5	98.0	75	564.5	109.5
36	329.8	64.1	96	388.7	75.6	56	447.6	87.0	16	506.5	98.4	76	565.4	109.9
37	330.8	64.3	97	389.7	75.8	57	448.6	87.2	17	507.5	98.6	77	566.4	110.1
38	331.8	64.5	98	390.7	75.9	58	449.6	87.4	18	508.5	98.8	78	567.4	110.3
39 40	332.7 333.7	64.9	400	391.0 392.6	$\frac{70.1}{76.3}$	- 60 - 60	450.5	87.8	$\frac{19}{20}$	510.4	99.0	80	569.3	110.5
341	334.7	65.1	401	393.6	76.5	461	452.5	88.0	521	511.4	99.4	581	570.3	110.9
42	335.7	65.3	02	394.6	76.7	62	453.5	88.2	22	512.4	99.6	82	571.3	111.1
43	336.7	65.5	03	395.6	76.9	63	454.5	88.3	23	513.4	99.8	83	572.3	111.3
44	337.6	65.6	04	396.5	77.1 77.2	64 65	455.4	88.0	$\frac{24}{25}$	514.3	100.0 100.2	84	573.2	111.5
46	339.6	66.0	06	398.5	77.5	66	457.4	88.9	$\frac{20}{26}$	516.3	100.2 100.4	86	575.2	111.8
47	340.6	66.2	07	399.5	77.7	67	458.4	89.1	27	517.3	100.6	87	576.2	112.1
48	341.6	66.4	08	400.5	77.9	68	459.4	89.3	28	518.3	100.8	88	577.2	112.3
49	342.6	66.6	09	401.5	78.1	69 70	460.4	89.5	29 20	519.3	101.0	89	578.2	112.4
251	214 5	87.0	-111	402.4	$-\frac{10.2}{78.4}$	471	401.0	80 0	531	520.2	$\frac{101.2}{101.4}$	501	520 1	112.0
52	345.5	67.2	$\frac{111}{12}$	404.4	78.6	72	463.3	90.1	32	521.2 522.2	101.4	92	581.1	112.0
53	346.5	67.4	13	405.4	78.8	73	464.3	90.3	33	523.2	101.7	93	582.1	113.2
54	347.5	67.5	14	406.4	79.0	74	465.3	90.4	34	524.2	101.8	94	583.1	113.3
50 56	348.4	67.7	10	407.3	79.2	75 76	466.2	90.6	35 36	525.1	102.0 102.2	95	584.0	113.5 112.7
57	350.4	68.1	17	409.3	79.6	77	468.2	91.0	37	520.1 527.1	102.2 102.4	97 97	586.0	113.7 113.9
58	351.4	68.3	18	410.3	79.8	78	469.2	91.2	- 38	528.1	102.6	98	587.0	114.1
59	352.4	68.5	19	411.3	80.0	79	470.2	91.4	39	529.1	102.8	99	588.0	114.3
60	353.4	68.7	,20	412.3	80.1	80	471.1	91.6	40	530.1	103.0	600	589.0	114.5
Dist.	Dep.	Lat.	Dist.	Dep.	Lat.	Dist.	Dep.	Lat.	Dist.	Dep.	Lat.	D'st.	Dep.	Lat.
						79° (1	$01^{\circ}, 259$	°, 281°).					

Pa	ge 390	1				T	ABL	E 2.						
		-	Diff	erence o	f Latit	ude a	nd Depa	rture f	or 12°	(168°,	192°, 3	48°).		
Dist.	Lat.	Dep.	Dist.	Lat.	Dep.	Dist.	Lat.	Dep.	Dist.	Lat.	Dep.	Dist.	Lat.	Dep.
1	1.0	0.2	61	59.7	12.7	121	118.4	25.2	181	177.0	37.6	241	235.7	50.1
$\frac{2}{3}$	$2.0 \\ 2.9$	0.4	$\frac{62}{63}$	60.6	12.9 13.1	$\frac{22}{23}$	119.3 120.3	25.4 25.6	82	178.0 179.0	37.8	$\frac{42}{43}$	230.7 237.7	50.3
4	3.9	0.8	64	62.6	13.3	24	121.3	25.8	84	180.0	38.3	44	238.7	50.7
5	4.9	1.0 1.2	65 66	63.6	13.5 13.7	25 96	122.3 123.2	26.0 26.2	85 86	181.0	38.5	45 46	239.6	50.9 51 1
7	6.8	1.5	67	65.5	13.9	$\tilde{27}$	124.2	26.4	87	182.9	38.9	47	241.6	51.4
8	7.8	1.7	68	66.5	14.1	28	125.2	26.6	88	183.9	39.1	48	242.6	51.6
10	8.8 9.8	$1.9 \\ 2.1$	- 69 - 70	67.5	14.6	$\frac{29}{30}$	126.2 127.2	20.8 27.0	- 89 - 90	184.9	39.3	49	243.6 244.5	51.8 52.0
11	10.8	2.3	71	69.4	14.8	131	128.1	27.2	$\frac{00}{191}$	186.8	39.7	251	245.5	52.2
12	11.7	2.5	$\frac{72}{72}$	70.4	15.0	32	129.1	27.4	92	187.8	39.9	$52 \\ 52$	246.5	52.4
$13 \\ 11$	12.7 13.7	2.7	73	71.4	15.2	33	130.1 131 1	27.7	93	188.8	40.1	53 54	247.5	52.6
15	14.7	3.1	75	73.4	15.6	35	132.0	28.1	95	190.7	40.5	55	249.4	53.0
16	15.7	3.3	76	74.3	15.8	36	133.0	28.3	96	191.7	40.8	56 - 57	250.4	53.2
$\frac{17}{18}$	16.6	$3.5 \\ 3.7$	$\frac{77}{78}$	70.3 76.3	16.0 16.2	$\frac{37}{38}$	134.0	28.5 28.7	97	192.7 193.7	41.0	07 58	251.4 252.4	53.4 53.6
19	18.6	4.0	79	77.3	16.4	39	136.0	28.9	99	194.7	41.4	59	253.3	53.8
20	19.6	4.2	80	78.3	16.6	40	136.9	29.1	200	195.6	41.6	60	254.3	54.1
$\frac{21}{22}$	20.5 21.5	4.4	81	79.2	16.8	$\frac{141}{42}$	137.9	29.3	$201 \\ 02$	196.6 197.6	41.8	$261 \\ 62$	200.3 256_3	54.3 54.5
23	22.5	4.8	83	81.2	17.3	43	139.9	29,7	03	198.6	42.2	63	257.3	54.7
24	23.5	5.0	84	82.2	17.5	44	140.9	29.9	04	199.5	42.4	64	258.2	54.9
$\begin{array}{c} 25\\ 26\end{array}$	24.5 25.4	5.2 5.4	80 86	83.1	17.9	45 46	141.8	30.1 30.4	00	200.5 201.5	42.6	60 66	259.2 260.2	55.3
27	26.4	5.6	87	85.1	18.1	$\tilde{47}$	143.8	30.6	07	202.5	43.0	67	261.2	55.5
$\frac{28}{20}$	27.4	5.8	88	86.1	18.3	48	144.8	30.8	08	203.5	43.2	68	262.1	55.7
$\frac{29}{30}$	$\frac{26.4}{29.3}$	6.0 6.2	90	88.0	18.5 18.7	49 50	140.7 146.7	31.0 31.2	10	204.4 205.4	43.7	70	203.1 264.1	55.9 56.1
31	30.3	6.4	91	89.0	18.9	151	147.7	31.4	211	206.4	43.9	271	265.1	56.3
$\frac{32}{22}$	31.3	6.7	92	90.0	19.1	52	148.7	31.6	12	207.4	44.1	$72 \\ 72$	266.1	56.6
$\frac{55}{34}$	ə⊿.ə 33.3	7.1	93 94	91.0 91.9	19.5	54	149.7	31.8 32.0	$13 \\ 14$	208.3 209.3	44.5	73	267.0	50.8 57.0
35	34.2	7.3	95	92.9	19.8	55	151.6	32.2	15	210.3	44.7	75	269.0	57.2
$\frac{36}{37}$	$\frac{35.2}{26.2}$	$\frac{7.5}{7.7}$	96 97	93.9	20.0	56 57	152.6	32.4	$16 \\ 17$	211.3	44.9	$\frac{76}{77}$	270.0 270.9	57.4
38	37.2	7.9	98	95.9	20.2 20.4	58	154.5	32.0 32.9	18	212.3	45.3	78	271.9	57.8
39	38.1	8.1	99	96.8	20.6	59	155.5	33.1	19	214.2	45.5	79	272.9	58.0
$\frac{40}{11}$	$\frac{39.1}{10.1}$	8.3	100	97.8	$\frac{20.8}{21.0}$	$\frac{60}{161}$	156.5	$\frac{33.3}{22.5}$	$\frac{20}{991}$	$\frac{215.2}{216.9}$	40.7	80	273.9	58.2
41 42	$\frac{40.1}{41.1}$	$\frac{8.0}{8.7}$	$101 \\ 02$	98.8	21.0 21.2	62^{101}	157.5 158.5	33.7	$\frac{221}{22}$	210.2 217.1	46.2	82	274.9	58.6
43	42.1	8.9	03	100.7	21.4	63	159.4	33.9	23	218.1	46.4	83	276.8	58.8
44	43.0 44 0	9.1 9.4	04	101.7 102.7	21.6 21.8	64 65	160.4 161 1	34.1 34.3	$\frac{24}{25}$	219.1 220.1	46.6	84 85	277.8 278.8	59.0 59.3
46	45.0	9.6	06	103.7	22.0	66	162.4	34.5	26	221.1	47.0	86	279.8	59.5
47	46.0	9.8	07	104.7	22.2	67	163.4	34.7	27	222.0	47.2	87	280.7	59.7
48	$47.0 \\ 47.9$	10.0 10.2	08	105.7	22.5 22.7	68 69	104.3 165.3	34.9	$\frac{28}{29}$	223.0	47.6	88 89	281.7 282.7	60.1
50	48.9	10.4	10	107.6	22.9	70	166.3	$35.\tilde{3}$	30	225.0	47.8	90	283.7	60.3
51	49.9	10.6	111	108.6	23.1	171	167.3	35.6	231	226.0	48.0	291	284.6	60.5
52 53	50.9 51.8	10.8 11 0	$\frac{12}{13}$	109.6 110.5	23.3 23.5	$\frac{72}{73}$	168.2 169.2	35.8	32 33	226.9 227.9	48.2 48.4	$\frac{92}{93}$	285.6 286.6	60.7
54	52.8	11.2	14	111.5	23.7	74	170.2	36.2	34	228.9	48.7	94	287.6	61.1
55	53.8	11.4	15	112.5	23.9	75	171.2	36.4	35	229.9	48.9	95 06	288.6	61.3
- 56 - 57	04.8 55.8	11.6	10	113.5	24.1 24.3	$\frac{70}{77}$	172.2 173.1	30. 0 36. 8	30	230.8 231.8	49.1	90 97	289.5 290.5	-61.7
58	56.7	12.1	18	115.4	24.5	78	174.1	37.0	38	232.8	49.5	98	291.5	62.0
59	57.7	12.3	19	116.4	24.7	79	175.1 176.1	37.2	39	233.8	49.7	99 300	292.5 202 1	$\begin{array}{c} 62.2\\ 62.4 \end{array}$
	00.1	12.0		117.4	2 4. 9		170.1	01.4		201.0	10.0		200.4	02.4
Dist.	Dep.	Lat.	Dist.	Dep.	Lat.	Dist.	Dep.	Lat.	Dist.	Dep.	Lat.	Dist.	Dep.	Lat.
						18~ (1	$02^{\circ}, 258$	~,.282°).					

<u> </u>	TABLE 2. [Page 391													
						T	ABLE	2.			- 010	-	Page	391
			Differ	ence of .	Latitua	le and	Departi	are for	12° (168°, 19	2°, 348	°).		
Dist.	Lat.	Dep.	Dist.	Lat.	Dep.	Dist.	Lat.	Dep.	Dist.	Lat.	Dep.	Dist.	Lat.	Dep.
301	294.4	62.6	361	353.1	75.0	421	411.8	87.5	481	470.5	100.0	541	529.2	112.5
$\frac{02}{03}$	295.4 208.4	62.8		354.1 355.1	$\begin{array}{c c} 75.2 \\ 75.4 \end{array}$	$\frac{22}{23}$	412.8 413.8	87.7	82 83	471.5	100.2 100.4	$\frac{42}{43}$	530.2	112.7 112.9
03	290.4 297.4	63.0 63.2	64	356.0	75.7	24	414.7	88.1	84	473.4	100.6	44	532.1	112.0
05	298.3	63.4	65	357.0	75.9	25	415.7	88.3	85	474.4	100.8	45	533.1	113.3
06	299.3	63.6	66 67	358.0 259.0	$[\frac{76.1}{76.3}]$	$ \frac{26}{97} $	416.7	88.6	86	475.4	101.01 101.2	$\frac{46}{47}$	534.1 525 1	113.5 112.7
08	300.3	64.0	68	360.0	76.5	$\frac{2}{28}$	418.6	89.0	88	477.3	101. 4	48	536.0	113.4
09	302.2	64.2	69	360.9	76.7	29.	419.6	89.2	89	478.3	101.6	49	537.0	114.1
10	303.2	64.4	70	361.9	76.9	30	420.6	89.4	90	479.3	101.9	50	538.0	114.4
$\begin{array}{c} 311 \\ 12 \end{array}$	304.2 305.2	64.6	$\frac{371}{72}$	362.9	$\begin{bmatrix} 77.1 \\ 77.3 \end{bmatrix}$	$\begin{array}{c} 431 \\ -32 \end{array}$	421.6	89.6	491 - 92	480.5 481.2	102.1 102.3	$551 \\ 52$	538.9 539.9	114.0
13	306.2	65.1	73	364.8	77.5	33	423.5	90.0	93	482.2	102.5	53	540.9	115.0
14	307.1	65.3	74	365.8	77.7	34	424.5	90.2	94	483.2	102.7	54	541.9	115.2
15	308.1	65.5	75	366.8	77.9	35	425.5	90.4	90	484.2 485.2	102.91	56 56	542.9 543.8	115.4
17	310.1	65.9	77	368.8	78.4	37	420.5	90.8	97	486.1	103.1 103.3	57	544.8	115.8
18	311.1	66.1	78	369.7	78.6	38	428.4	91.0	98	487.1	103.5	58	545.8	116.0
$19 \\ 20$	312.0	66.3	79	370.7	78.8	39	429.4	91.3	99 500	488.1	103.8	59 80	546.8	116.2
20	315.0	66.0	381	3/1.1	79.0	40	430. 4	91.0	501	400.0	104.0	561	548 7	110. +
22	315.0	66.9	82	373.7	79.4	42	432.3	91.9	02	491.0	104.4	62	549.7	116.8
23	315.9	67.1	83	374.6	79.6	43	433.3	92.1	03	492.0	104.6	63	550.7	117.0
24	316.9	67.3	84	375.6	79.8	44	434.3	92.3 02.5	04	493.0	104.8	64 65	551.7	117.2 117.4
$\frac{20}{26}$	317.0	67.8	86	377.6	80.0	46	436.3	92.0	06	494.0	105.0 105.2	66	552.7 553.7	117.6
27	319.9	68.0	87	378.5	80.4	47	437.2	92.9	07	495.9	105.4	67	554.6	117.8
28	320.8	68.2	88	379.5	80.7	48	438.2	93.1	08	496.9	105.6	68	555.6	118.0
$\frac{29}{30}$	321.8 322.8	68.4 68.6	89	380.9 381.5	80.9	$\frac{49}{50}$	439.2 440.2	93. 5 93. 5	10	491.9	105.8	09 70	557.5	118.2
331	323.8	68.8	391	382.5	81.3	451	441.1	93.7	511	499.8	106.2	571	558.5	118.7
32	324.7	69.0	92	383.4	81.5	52	442.1	93.9	12	500.8	106.4	72	559.5	118.9
33	325.7	69.2 60.4	93	384.4	81.7	53	443.1	94.1	$13 \\ 14$	501.8	106.6	73	560.5	119.1
35	320.7 327.7	69. 1 69. 6	91	380.4 386.4	81.0	- 01 55	444.1	94.4	$14 \\ 15$	502.0 503.7	100.0 107.0	$\frac{14}{75}$	561.5	119.5
36	328.7	69.8	96	387.3	82.3	56	446.0	94.8	16	504.7	107.2	76	563.4	119.7
37	329.6	70.0	97	388.3	82.5	57	447.0	95.0	17	505.7	107.4	77	564.4	119.9
38 39	330. o 331. 6	70.3 70.5	98	389.5	82. 1 82. 9	58 59	448.0	95.2 95.4	18 19	506.7	107.0 107.8	$\frac{18}{79}$	566.4	120.1 120.3
40	332.6	70.7	400	391.3	83.1	60	450.0	95.6	$\frac{10}{20}$	508.7	108.1	80	567.4	120.6
341	333.5	70.9	401	392.2	83.4	461	450.9	95.8	521	509.6	108.3	581	568.3	120.8
42	334.5	71.1	02	393.2	83.6	$\frac{62}{22}$	451.9	96.0	22	510.6	108.5	82	569.3	121.0
40 44	335.5	71.5	03	394.2	83.8	63 64	452.9	96.2 96.5	$\frac{25}{24}$	511.0	108.7 108.9	83	570.5 571.2	121.2 121.4
45	337.5	71.7	05	396.2	84.2	65	454.8	96.7	25	513.5	109.2	85	572.2	121.6
46	338.4	71.9	06	397.1	84.4	66	455.8	96.9	26	514.5	109.4	86	573.2	121.8
41	339.4	72.1	07	398.1	84.6	67 88	456.8	97.1 07.3	$\frac{27}{98}$	515.5	109.6	81	574.2 575.2	$\begin{array}{c}122.0\\192.9\end{array}$
49	341.4	72.5	09	400.1	85.0	69	458.8	97.5 97.5	$\frac{20}{29}$	510.5 517.5	110.0	89	576.2	122.2 122.4
50	342.4	72.7	10	401.0	85.2	70	459.7	97.7	- 30	518.4	110.2	- 90	577.1	122.6
351	343.3	73.0	411	402.0	85.4	471	460. 7	97.9	531	519.4	110.4	591	578.1	122.8
$\begin{array}{c} 52\\53\end{array}$	344.3	73.2 73.4	$\frac{12}{13}$	403.0	85.6	$\frac{72}{73}$	461.7	98.1 08.3	$\frac{32}{33}$	520.4	110.6 110.8	92 93	579.1	123.0 193.2
54	346.3	73.6	14	405.0	86.1	74	463.6	98.5	34	521.5 522.3	111.0	94	581.0	123.2 123.4
55	347.2	73.8	15	405.9	86.3	75	464.6	98.7	35	523.3	111.2	95	582.0	123.6
56 57	348.2	74.0	$16 \\ 17$	406.9	86.5	76	465.6	98.9	$\frac{36}{27}$	524.3	111.4	96	583.0	123.9
58	349.2	74.4	18	407.5	80. 6	78	400.0	99.1 99.4	38	525.5 526.2	111.0	98	584.9	124.1 124.3
59	351.2	74.6	19	409.8	87.1	79	468.5	99.6	39	527.2	112.0	99	585.9	124.5
60	352.1	74.8	20	410.8	87.3	80	469.5	99.8	40	528.2	112.3	600	586.9	124.7
Dist.	Dep.	Lat.	Dist.	Dep.	Lat.	Dist.	Dep.	Lat.	Dist.	Dep.	Lat.	Dist.	Dep.	Lat.
					7	78° (10	02°, 258	°, 282°).					

Pa	ge 392]	TABLE 2.											
Difference of Latitude and Departure for 13° (167°, 193°, 347°).														
Dist.	Lat.	Dep.	Dist.	Lat.	Dep.	Dist.	Lat.	Dep.	Dist.	Lat.	Dep.	Dist.	Lat.	Dep.
$\frac{1}{2}$	1.0 1.9	0.2	$61 \\ 62$	59.4 60.4	13.7 13.9	$\frac{121}{22}$	117.9 118.9	27.2 27.4	181 82	176.4 177.3	40.7	$241 \\ 42$	234.8 235.8	54.2 54.4
3	2.9	0.7	63	61.4	14.2	23	119.8	27.7	83	178.3	41.2	43	236.8	54.7
$\frac{4}{5}$	3.9	0.9	$64 \\ 65$	62.4 63.3	14.4	$\frac{24}{25}$	120.8 121.8	27.9 28.1	84. 85	179.3	41.4 41.6	$\frac{44}{45}$	237.7 238.7	54.9 55.1
6	5.8	1.3	66	64.3	14.8	26	122.8	28.3	86	181.2	41.8	46	239.7	55.3
8	$\frac{6.8}{7.8}$	1.0 1.8	68	66.3	15.1 15.3	$\frac{27}{28}$	123.7 124.7	28.6 28.8	87 88	182.2 183.2	42.1 42.3	47	240.7 241.6	55.8
9	8.8	$\frac{2.0}{2.0}$	69 70	67.2	15.5	29	125.7	29.0	89	184.2	42.5	49	242.6	56.0
$\frac{10}{11}$	$\frac{9.7}{10.7}$	$\frac{2.2}{2.5}$	$\frac{70}{71}$	$\frac{-68.2}{-69.2}$	$\frac{15.7}{16.0}$	$\frac{30}{131}$	$\frac{120.7}{127.6}$	$\frac{29.2}{29.5}$	191	$\frac{185.1}{186.1}$	$\frac{42.7}{43.0}$	$\frac{50}{251}$	$\frac{243.6}{244.6}$	$\frac{56.2}{56.5}$
12	11.7	2.7	$\frac{1}{72}$	70.2	16.2	32	128.6	29.7	92	187.1	43.2	52	245.5	56.7
$\frac{13}{14}$	$12.7 \\ 13.6$	2.9 3.1	$73 \\ 74$	71.1 72.1	16.4 16.6	33	129.6 130.6	29.9 30.1	93 94	188.1 189.0	43.4 43.6	53 54	246.5 247.5	56.9 57.1
15	14.6	3.4	$\overline{75}$	$73.\hat{1}$	16.9	35	131.5	30.4	95	190.0	43.9	55	248.5	57.4
$\begin{array}{c c} 16\\ 17\end{array}$	15.6 16.6	3.6 3.8	$76 \\ 77$	74.1	17.1 17.3	$\frac{36}{37}$	132.5 133.5	30.6	96 97	191.0 192.0	44.1 44.3	$\frac{56}{57}$	249.4 250.4	57.6 57.8
18	17.5	4.0	78	76.0	17.5	38	134.5	31.0	98	192.9	44.5	58	251.4	58.0
$\frac{19}{20}$	18.5 19.5	4.3	79 80	77.0	17.8	$\frac{39}{40}$	135.4 136.4	31.3 31.5	99	193.9	44.8	59 60	252.4 253.3	58.3 58.5
$\frac{20}{21}$	$\frac{10.0}{20.5}$	4.7	81	78.9	10.0 18.2	141	137.4	31.7	$\frac{200}{201}$	195.8	45.2	261	$\frac{253.3}{254.3}$	58.7
$\frac{22}{22}$	21.4	4.9	82	79.9	18.4	42	138.4	31.9	02	196.8	45.4	62 62	255.3	58.9
$\frac{23}{24}$	22.4 23.4	$5.2 \\ 5.4$	84	81.8	18.7	43	139.3	32.4 32.4	03	197.8	45.9	64	250.5 257.2	59.2 59.4
25	24.4	5.6	85	82.8	19.1	45	141.3	32.6	05	199.7	46.1		258.2	59.6
$\frac{20}{27}$	25.3 26.3	6.1	87	84.8	19.5	40	142.5 143.2	32.8 33.1	07	200.7	46.6	67	260.2	60.1
28	27.3	6.3	88	85.7	19.8	48	144.2	33.3	08	202.7	46.8	68	261.1	60.3
$\frac{29}{30}$	26.5 29.2	6.7	90	87.7	20.0 20.2	50	145.2 146.2	33.7	10	203.0	47.0	70	262.1 263.1	60.7
31	30.2	7.0	91	88.7	20.5	151	147.1	34.0	211	205.6	47.5	271	264.1	61.0
$\frac{32}{33}$	$31.2 \\ 32.2$	7.4	$\frac{92}{93}$	89.6 90.6	20.7 20.9	$\frac{52}{53}$	148.1 149.1	34.2 34.4	$\frac{12}{13}$	206.6 207.5	47.7	$\frac{72}{73}$	265.0 266.0	61.2 61.4
34	33.1	7.6	94	91.6	21.1	54	150.1	34.6	14	208.5	48.1	74	267.0	61.6
$\frac{35}{36}$	$34.1 \\ 35.1$	7.9	95 96	92.6 93.5	21.4 21.6	50 56	151.0 152.0	34.9 35.1	$15 \\ 16$	209.5 210.5	48.4	75 76	268.0 268.9	61.9 62.1
37	36.1	8.3	97	94.5	21.8	57	153.0	35.3	17	211.4	48.8	77	269.9	62.3
$\frac{38}{39}$	37.0 38.0	8.5	- 98 - 99	95.5 96.5	22.0 22.3	$\frac{58}{59}$	154.0 154.9	35.5	18	212.4 213.4	49.0	78	270.9 271.8	62.5 62.8
40	39.0	9.0	100	97.4	22.5	60	155.9	36.0	20	214.4	49.5	80	272.8	63.0
$ 41 \\ 42 $	39.9 40.9	9.2 9.4	$101 \\ 02$	98.4 99.4	22.7 22.9	$161 \\ 62$	156.9 157.8	$36.2 \\ 36.4$	$\frac{221}{22}$	215.3 216.3	49.7	$\frac{281}{82}$	273.8 274.8	63.2 63.4
43	41.9	9.7	03 /	100.4	23.2	63	158.8	36.7	23	217.3	50.2	83	275.7	63.7
44 45	$42.9 \\ 43.8$	9.9	04	101.3 102.3	23.4 23.6	$64 \\ 65$	159.8 160.8	36.9 37 1	$\frac{24}{25}$	$\begin{bmatrix} 218.3\\219.2 \end{bmatrix}$	50.4	84 85	276.7 277.7	63.9 64.1
46	44.8	10.3	06	103.3	23.8	66	161.7	37.3	26	220.2	50.8	86	278.7	64.3
47 48	45.8 46.8	$10.6 \\ 10.8$	07	104.3 105.2	24.1 24.3	67 68	162.7 163.7	37.6 37.8	$\frac{27}{28}$	221.2 222.2	51.1 51.3	87 88	279.6 280.6	64.6 64.8
49	47.7	11.0	09	106.2	24.5	69	164.7	38.0	29	223.1	51.5	89	281.6	65.0
$\frac{50}{51}$	$\frac{48.7}{49.7}$	$\frac{11.2}{11.5}$	$\frac{10}{111}$	$\frac{107.2}{108.2}$	24.7	$\frac{70}{171}$	$\frac{165.6}{166.6}$	$\frac{38.2}{38.5}$	$\frac{30}{931}$	$\frac{224.1}{225.1}$	$\frac{51.7}{52.0}$	<u>- 90</u> - 201	282.6	$\frac{65.2}{65.5}$
52	50.7	11.7	12	109.1	25.0 25.2	72	167.6	38.7	32	226.1 226.1	52.0 52.2	92	284.5	65.7
$53 \\ 54$	51.6	11.9	13	110.1	25.4 25.6	$73 \\ 74$	168.6 169.5	38.9 39-1	33	227.0 228.0	52.4 52.6	93 94	285.5 286.5	65.9
55	53.6	12.4	15	112.1	25.0 25.9	75	170.5	39.4	35	229.0	52.9	95	287.4	66.4
$56 \\ 57$	54.6 55.5	12.6 12.8	$16 \\ 17$	113.0 114.0	26.1 26.3	$\frac{76}{77}$	$171.5 \\ 172.5$	39.6 39.8	$\frac{36}{37}$	230.0 230.9	53.1 53.3	96 97	$288.4 \\ 289.4$	66.6
58	56.5	13.0	18	115.0	26.5 26.5	78	173.4	40.0	38	231.9	53.5	98	290.4	67.0
59 60	57.5 58.5	13.3 13.5	19 20	116.0 116.9	26.8 27.0	79 80	174.4 175.4	40.3 40.5	39 40	232.9 233.8	53.8 54.0	$\frac{99}{300}$	291.3 292.3	67.3 67.5
Dist		10.0				Diat		10.0	Dist			Dist		Lat
Dist.	Dep.	Lat.	Dist.	Dep.	Lat.	Dist.	Dep.	Lat.	Dist.	Dep.	Lat.	Dist.	Dep.	1.H.C.
						11 (1	00,201	, 200*).					
						. T	ABLE	2.			·		Page	393
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		I	Differe	ence of I	atitud	e and	Departu	re for 1	13° (1	67°, 193	°, 347°).	[- 450	500
Dist.	Lat.	Dep.	Dist.	Lat.	Dep.	Dist.	Lat.	Dep,	Dist.	Lat.	Dep.	Dist.	Lat.	Dep.
301	293.3	67.7	361	351.8	81.2	421	410.2	94.7	481	468.7	108.2	541	527.2	121.7
02	294.3	67.9	$62 \\ c^{2}$	352.7	81.4	22	411.2	94.9	82	469.7	108.4	42	528.1	121.9
03	295.2	68.1	60 61	351 7	81.0	20 94	412.2	95.1	81	471 6	108.0	40	529.1 530-1	122, 1 199.3
05	297.2	68.6	65	355.6	82.1	25	414.1	95.6	85	472.6	109.0	45	531.1	122.5 122.5
- 06	298.2	68.8	66	356.6	82.3	26	415.1	95.8	86	473.6	109.3	46	532.0	122.8
07	299.1	69.0	67	357.6	82.5	27	416.1	96.0	87	474.5	109.5	47	533.0	123.0
08	300.1	69.3 60.5	68 60	358.6	82.8	28	417.0	96.2	88	475.5	109.7	48	534.0	123.2
10	301.1 302.1	69.5 69.7	70	360, 5	83.0 83.2	$\frac{29}{30}$	419.0	96.5 96.7	90	477.5	109.9 110.1	$\frac{49}{50}$	535.0	123.4 123.7
311	303.0	69.9	371	361.5	83.4	431	420.0	96.9	491	478.4	110.4	551	536.9	123.9
12	304.0	70.2	$\frac{72}{72}$	362.5	83.7	$\frac{32}{22}$	420.9	97.1	$\frac{92}{02}$	479.4	110.6	52	537.9	124.1
13	305.0	70.4	$\frac{13}{74}$	363.4	83.9	55 21	421.9	97.4 97.6	93	480.4	110.9 111 1	- 03 54	- 539-8 - 539-8	124.4
15	306.9	70.8	75	365.4	84.3	35	423.9	97.8	95	482.3	111.3	55	540.8	124.9
16	307.9	71.1	76	366.4	84.6	36	424.8	98.0	96	483.3	111.5	56	541.8	125.1
17	308.9	71.3	77	367.3	84.8	37	425.8	98.3	97	484.3	111.8	57	542.8	125.3
18	309.9	71.5	78	368.3	85.0	38	426.8	98.5	98	485.3	112.0 119.9	58 50	543.7	125.0
$\frac{19}{20}$	310.8 311.8	71.7 72.0	80	370.3	85.2 85.5	40	427.8	98.9	500	487.2	112. 4	60	545.7	120.8 126.0
321	312.8	72.2	381	371.2	85.7	441	429.7	99.2	501	488.2	112.6	561	546.7	126.2
22	313.8	72.4	82	372.2	85.9	42	430.7	99.4	02	489.2	112.9	62	547.6	126.4
23	314.7	72.6	83	373.2	86.1	43	431.6	99.6	03	490.1	113.1	63	548.6	126.7
24	315.7	$\frac{72.9}{73.1}$	84	374.2	86.4	44	432.0	99.8	04	491.1	113.3 113.5	0 1 65	049.0 550.6	126.9 1971
$\frac{20}{26}$	310.7 317.6	73.1 73.3	86	376.1	86.8	46	434.6	100.1 100.3	06	493.1	113.9 113.8	66	550.0 551.5	127.1 127.3
27	318.6	73.5	87	377.1	87.0	47	435.5	100.5	07	494.0	114.0	67	552.5	127.6
28	319.6	73.8	88	378.1	87.3	48	436.5	100.7	08	495.0	114.2	68	553.5	127.8
29	320.6 321.5	74.0 71.9	89	379.0	87.5	49	437.5	101.0 101.2	09	496.0	114.5 114.7	69 70	554.5	128.0 198.2
331	322 5	74.2	391	381.0	87.9	451	130.0	$\frac{101.2}{101.4}$	511	490.9	$\frac{114.7}{114.9}$	571	556 4	120.5 128.5
32	323.5	74.7	92	382.0	88.2	52	440.4	101. 6	12	498.9	115.1	72	557.4	120.0 128.7
- 33	324.5	74.9	93	382.9	88.4	53	441.4	101.9	13	499.9	115.4	73	558.4	128.9
34	325.4	75.1	94	383.9	88.6	54	442.4	102.1	14	500.8	115.6	- 74	559.3	129.2
- 30 - 36	326.4	75.8	90	384.9	88.8	00 56	443.3	102.3 102.5	10	502 8	115.8	10	561 3	129.4
37	327.4 328.4	75.8	97	386.8	89.3	57	445.3	102.9 102.8	17	503.8	116.3	77	562.3	129.8
38	329.3	76.0	98	387.8	89.5	58	446.3	103.0	18	504.7	116.5	78	563.2	130.0
39	330.3	76.2	99	388.8	89.7	59	.447.2	103.2	19	505.7	116.7	79	564.2	130.2
40	331.3	76.5	400	389.8	90.0	60	448.2	103.4	20	506.7	116.9	80	565.2	130.4
341	332.3 333.9	76.9	401	390.7	90.2	461	449.2	103.7	$\frac{521}{22}$	508 6	117.2 117.5	82	567.2	130.7
43	334.2	77.1	03	392.7	90.6	63	450.2	103.5 104.1	$\frac{22}{23}$	509.6	117.7	83	567.1 568.1	131.0
44	335.2	77.4	04	393.6	90.8	64	452.1	104.3	24	510.6	117.9	84	569.1	131.4
45	336.2	77.6	05	394.6	91.1	65	453.1	104.6	25	511.6	118.1	85	570.1	131.6
40 17	337.1	78.0	06	395.6	91.3	$\frac{66}{67}$	454.1	104.8	$\frac{26}{97}$	512.5	118.3	86	571.0 572.0	131.8
48	339.1	78.3	08	397.5	91.7	68	456.0	105.0 105.2	28	514.5	110.5 118.7	88	572.0 573.0	132.0 132.3
49	340.1	78.5	09	398.5	92.0	69	457.0	105.5	29	515.5	119.0	89	573.9	132.5
50	341.0	78.7	10	399.5	92.2	70	458.0	105.7	- 30	516.4	119.2	_ 90	574.9	132.8
$\frac{351}{50}$	342.0	78.9	411	400.5	92.4	471	458.9	105.9	531	517.4	119.4	591	575.9	133.0
$\frac{52}{53}$	343.0	79.2	12	401.4	92.6	72	459.9	106.1	32	518.4	119.6	92	576.9	133.2
$\frac{55}{54}$	344.9	79.6	14	403.4	92.9 93.1	74	461 9	106.6	- 00 - 34	519.4 520.3	120.1	95	578.8	133.4 133.6
55	345.9	79.8	15	404.4	93.3	75	462.8	106.8	35	521.3	120.3	95	579.8	133.8
56	346.9	80.1	16	405.3	93.5	76	463.8	107.0	36	522.3	120.5	96	580.8	134.0
- 57 59	347.9	80.3	17	406.3	93.8	77	464.8	107.3	37	523.3	120.8	97	581.7	134.3
59	349.8	80.3	10	407.3	94.2	79	466.7	107.5	- 38 - 39	524.2 525 9	121.0 121.9	90	583.7	134.8
60	350.8	81.0	20	409.2	94.4	80	467.7	107.9	40	526.2	121.5	600	584.6	135.0
Dist.	Dep.	Lat.	Dist	Dep.	Lat.	Dist.	Dep,	Lat.	Dist.	Dep.	Lat.	Dist.	Dep.	Lat.
						77° (1	03°, 257	°, 283°).					

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]	Differe	ence of I	Latitud	e and	Departu	re for	14° (1	66°, 194	°, 346°).		
Dist.	Lat.	Dep.	Dist.	Lat.	Dep.	Dist.	Lat.	Dep.	Dist.	Lat.	Dep.	Dist.	Lat.	Dep.
1	10	0.2	61	59.2	14.8	121	117.4	29.3	181	175.6	43.8	241	233.8	58.3
2	$\frac{1.9}{2.9}$	0.5	62 63	60.2 61.1	15.0	22	118.4	29.5 20.8	82	176.6 177.6	44.0	42	234.8	58.5
4	3.9	1.0	64	62.1	15.5 15.5	24	120.3	$\frac{29.8}{30.0}$	84	178.5	44.5	40	230.8 236.8	59.0
5	4.9	1.2	65	63.1	15.7	25	121.3	30.2	85	179.5	44.8	45	237.7	59.3
$\frac{6}{7}$	5, 8 6, 8	$1.0 \\ 1.7$	67	64.0 65.0	16.0 16.2	$\frac{26}{97}$	122.3 123.2	30.5	86	180.5	45.0 45.2	46	238.7 239.7	59.5
8	7.8	1.9	68	66.0	16.5	28	124.2	31.0	- 88	182.4	45.5	48	240.6	60.0
9	8.7	2.2	69	67.0	16.7	29	125.2	31.2	89	183.4	45.7	49	241.6	60.2
10	9.7	- <u>2.4</u> - 9 7	$\frac{70}{71}$	67.9	$\frac{10.9}{17.9}$	$\frac{30}{131}$	$\frac{126.1}{127.1}$	31.4	101	184.4	46.0	$\frac{50}{251}$	242.6	60.5
12	11.6	$\tilde{2}.9$	72	69.9	17.4	32	128.1	31.9	92	186.3	46.4	$52^{-2.01}$	244.5	61.0
13	12.6	$\frac{3.1}{1}$	73	70.8	17.7	33	129.0	32.2	93	187.3	46.7	53	245.5	61.2
14	13.6	3.4	$\frac{74}{75}$	$\frac{71.8}{72.8}$	17.9	34	130.0 131.0	$\frac{32.4}{32.7}$	94	188.2	46.9	54 55	246.5 247.4	61.4 61.7
16	15.5	3.9	76	73.7	18.4	36	132.0	32.9	96	190.2	47.4	56	248.4	61.9
17	16.5	4.1	77	74.7	18.6	37	132.9	33.1	97	191.1	47.7	57	249.4	62.2
$\frac{18}{19}$	17.0	4.6	78 79	76.7	18.9	- 38 - 39	133.9 134.9	33.4 33.6	98	192.1 193.1	47.9	58 59	250.3 251.3	$\begin{array}{c} 62.4 \\ 62.7 \end{array}$
20	19.4	4.8	80	77.6	19.4	40	135.8	33.9	200	194.1	48.4	60	251.3 252.3	62.9
21	20.4	5.1	81	78.6	19.6	141	136.8	34.1	201	195.0	48.6	261	253.2	63.1
$\frac{22}{23}$	$\frac{21.3}{22.3}$	$5.3 \\ 5.6$	82 83	79.6	19.8 20.1	$\frac{42}{43}$	137.8	34.4 34.6	02	196.0	48.9	$62 \\ 63$	254.2 255.2	63.4
24	23.3	5.8	84	81.5	20.3	44	139.7	34.8	04	197.9	49.4	64	256, 2	63.9
25	24.3	6.0'	85	82.5	20.6	45	140.7	35.1	05	198.9	49.6	65	257.1	64.1
$\frac{26}{27}$	$\frac{25.2}{26.2}$	$0.3 \\ 6.5$	80 87	83.4	20.8 21.0	40	141.7	35.3 35.6	06	199.9	49.8 501	66 67	258.1 259.1	64.4
28	27.2	6.8	88	85.4	21.3	48	143.6	35.8	08	201.8	50.3	68	260.0	64.8
29	28.1	$\frac{7.0}{7.2}$	89	86.4	21.5	49	144.6	36.0	09	202.8	50.6	69	261.0	65.1
$\frac{30}{31}$	$\frac{29.1}{30.1}$	$\frac{7.5}{7.5}$	90	88.3	$\frac{21.8}{22.0}$	$\frac{50}{151}$	$\frac{143.5}{146.5}$	36.5	$\frac{10}{211}$	203.8	$\frac{50.8}{51.0}$	$\frac{70}{271}$	$\frac{262.0}{263.0}$	65 6
32	31.0	7.7	92	89.3	22.3	52	147.5	36.8	12	205.7	51.3	72	263.9	65.8
33	$\frac{32.0}{22.0}$	8.0	93	90.2	$\frac{22.5}{22.7}$	53	148.5	$\frac{37.0}{27.2}$	13	206.7	51.5	73	264.9	66.0
35	34.0	8.5	95	92.2	$\frac{22.1}{23.0}$	55	150.4	37.5	14	207.0	51.8 52.0	74	265.9 266.8	66.5
$36 \cdot$	34.9	8.7	96	93.1	23.2	56	151.4	37.7	16	209.6	52.3	76	267.8	66.8
37	35.9	9.0	97 98	94. 1 95. 1	23.5 23.7	57 58	152.3 153.3	38.0	17	210.6 211 5	52.5 52.7	77	268.8 269.7	67.0 67.3
39	37.8	9.4	99	96.1	24.0	59	153.3 154.3	. 38. 5	19	211.5	53.0	79	270.7	67.5
40	38.8	9.7	100	97.0	24.2	60	155.2	38.7	20	213.5	53.2	80	271.7	67.7
41	39.8	9.9 10-2	$101 \\ 02$	98.0	24.4 24.7	161	$156.2 \\ 157.2$	38.9 39.2	$221 \\ 29$	214.4 215.4	$53.5 \\ 53.7$	281 89	272.7 273.6	68.0
43	41.7	10.4	03	99.9	24.9	63	158.2	39.4	23	216.4	53.9	83	274.6	68.5
44	42.7	10.6	04	100.9	25.2	64	159.1	39.7	24	217.3	54.2	84	275.6	68.7
40 46	43.7	10.9 11.1	00 06	101.9 102.9	25.4 25.6	66 66	160.1 161.1	39.9 40.2	$\frac{25}{26}$	218.3	54.4 54 7	89 86	276.5 277.5	68.9
47	45.6	11.4	07	103.8	25.9	67	162.0	40.4	27	220.3	54.9	87	278.5	69.4
48	46.6	11.6	08	104.8	26.1	68	163.0	40.6	28	221.2	55.2	88	279.4	69.7
$\frac{49}{50}$	48.5	11.9 12.1	10	105.8 106.7	26.4 26.6	- 09 70	164.0 165.0	40.9	29 30	222.2 223.2	55.4 55.6	- 89 - 90	280.4 281.4	09.9 70.2
51	49.5	12.3	111	107.7	26.9	171	165.9	41.4	231	224.1	55.9	291	282.4	70.4
52	50.5	12.6	12	108.7	27.1	72	166.9	41.6	32	225.1	56.1	92	283.3	70.6
54 54	51.4 52.4	$12.8 \\ 13.1$	13	109.6	27.3 27.6	73	167.9	42.1	33 34	220.1 227.0	56. 6	93 94	284.3 285.3	70.9 71.1
55	53.4	13.3	15	111.6	27.8	75	169.8	42.3	35	228.0	56.9	95	286.2	71.4
$\frac{56}{57}$	54.3	13.5	$\frac{16}{17}$	112,6	28.1	76	170.8	42.6	$\frac{36}{97}$	229.0	57.1	96	287.2	71.6
58	56.3	14.0	18	113.5	$\frac{20.5}{28.5}$	78	171.7 172.7	42.8 43.1	37	230.0 230.9	57.6	98	200.2 289.1	72.1
59	57.2	14.3	19	115.5	28.8	79	173.7	43.3	39	231.9	57.8	99	290.1	72.3
60	58.2	14.5	20	116.4	29.0	80	174.7	43.5	40	232.9	58.1	300	291.1	72.6
Dist.	Dep,	Lat.	Dist.	Dep.	· Lat.	Dist.	Dep.	Lat.	Dist.	Dep.	Lat.	Dist.	Dep.	Lat.

						Т	ABLE	2 2.					Page	395
]	Differe	ence of I	Latitud	e and	Departu	re for i	14° (1	66°, 194	°, 346°).		
Dist.	Lat.	Dep.	Dist.	Lat.	Dep.	Dist.	Lat.	Dep.	Dist.	Lat.	Dep.	Dist.	Lat.	Dep.
$\frac{301}{02}$	292.0 293.0	72.8 73.0	$\frac{361}{62}$	$350.2 \\ 351.2$	$87.3 \\ 87.6$	$\frac{421}{22}$	408.5 409.4	$101.8 \\ 102.1$	$\frac{481}{82}$	$466.7 \\ 467.7$	$116.3 \\ 116.6$	$\begin{array}{c} 541 \\ 42 \end{array}$	525.0 525.9	$130, 9 \\ 131, 2$
03 04	294.0 294.9	73.3 73.5	$\frac{63}{64}$	$352.2 \\ 353.2$	87.8 88.0	$\frac{23}{24}$	410.4	$102.3 \\ 102.6$	$\frac{83}{84}$	468.6	$116.8 \\ 117.1$	$\frac{43}{44}$	$526.9 \\ 527.9$	$131.4 \\ 131.6$
05	295.9 206.0	73.8	$65 \\ 66$	354.1 355.1	88.3	$\frac{25}{26}$	412.3	102.8 103.0	85 86	470.6 471.5	117.3 117.6	$\frac{45}{46}$	528.8	131.9 132.1
00	290. 9 297. 8	74.2	67	356.1	88.8	27	414.3	103.0 103.3	87	472.5	117.8	47	530.8	132.1 132.3
$\begin{array}{c} 08\\ 09\end{array}$	298.8 299.8	74.5	68 69	357.0 358.0	89.0 89.2	$\frac{28}{29}$	415.3	103.5 103.8	88 89	473.5	118.0 118.3	$\frac{48}{49}$	531.7 532.7	$132.6 \\ 132.8$
$\frac{10}{311}$	$\frac{300.8}{301.7}$	75.0	$\frac{70}{371}$	$\frac{359.0}{359.9}$	89.5	$\frac{30}{431}$	$\frac{417.2}{418.2}$	$\frac{104.0}{104.2}$	$\frac{90}{491}$	475.4	$\frac{118.5}{118.8}$	$\frac{50}{551}$	$\frac{533.7}{534.6}$	133.0 133.3
12	302.7	75.5	72	360.9	90.0	32	419.1	104.5	92	477.4	119.0	$52 \\ 52 \\ 59$	535.6	133.6
13 14	303.7 304.6	$\begin{bmatrix} 75.7\\75.9 \end{bmatrix}$	$73 \\ 74$	361.9 362.9	90. 2 90. 5	$\frac{33}{34}$	420.1	104.7 105.0	93 94	478.3	119.2 119.5	эз 54	530.0 537.5	133.8 134.0
$\frac{15}{16}$	305.6 306.6	$76.2 \\ 76.4$	$\frac{75}{76}$	363.8 364.8	90.7 90.9	$\frac{35}{36}$	422.0 423.0	$105.2 \\ 105.5$	$95 \\ 96$	$ 480.3 \\ 481.3 $	$119.7 \\ 120.0$	$\frac{55}{56}$	$538.5 \\ 539.5$	$134.3 \\ 134.5$
17.	307.6	76.7	77	365.8	91.2	37	424.0	105.7	97	482.2	120.2	57	540.5	134.8
18	308.5 309.5	70.9 77.2	$78 \\ 79$	367.7°	91.4 91.7	38 39	425.0 425.9	105.9 106.2	98 99	484.2	120.4 120.7	$\frac{58}{59}$	541.4 542.4	135.0 135.2
$\frac{20}{321}$	$\frac{310.5}{311.4}$	77.4	$\frac{80}{381}$	368.7	91.9	40	426.9	106.4 106.7	$500 \\ 501$	485.1	$\frac{121.0}{121.2}$	$\frac{60}{561}$	543.4	135.5 135.7
22	312.4	77.9	82	370.6	92.4	42	428.8	106.9	02	487.1	121.4	62	545.3	135.9
$\frac{23}{24}$	313.4 314.3	78.1	83 84	$371.6 \\ 372.6$	92.6 92.9	$\frac{43}{44}$	429.8 430.8	107.1 107.4	03 04	488.0	121.7 122.0	$63 \\ 64$	546.3 547.2	136.2 136.5
$\frac{25}{26}$	315.3 316.3	78.6 78.8	85 86	373.5 374.5	93.1 93.4	$\frac{45}{46}$	431.7	107.6 107.9	05 06	490.0	122.1 122.4	$65 \\ 66$	548.2 549.2	136.6 136.9
27	317.3	79.1	87	375.5	93.6	47	433.7	108.1	07	491.9	122.6 122.6	67	550.1	137.1
$\frac{28}{29}$	318.2 319.2	79.3	88 89	376.4 377.4	93.8 94.1	48 49	434.7 435.6	108.4 108.6	08	492.9 493.9	122.9 123.1	68 69	551.1 552.1	137.4 137.6
$\frac{30}{291}$	$\frac{320.2}{221.1}$	79.8	90	378.4	94.3	50	$\frac{436.6}{127.6}$	108.8	10	494:9	$\frac{123.4}{192.6}$	70	553.1	137.9
$\frac{331}{32}$	321.1 322.1	80.1	92	379.4 380.3	94. 0 94. 8	451 52	437.0	109.1 109.3	12	496.8	123.0 123.8	72	555.0	138.3 138.3
$\frac{33}{34}$	323.1 324.0	$ 80.5 \\ 80.8 $	$\frac{93}{94}$	$381.3 \\ 382.3$	95.1 95.3	$\frac{53}{54}$	439.5 440.5	$109.6 \\ 109.8$	$\frac{13}{14}$	497.8 498.7	$124.1 \\ 124.3$	$\frac{73}{74}$	556.0 557.0	138.6 138.8
$\frac{35}{26}$	325.0	81.0 81.3	95 96	383.2	95.5	$55 \\ 56$	441.5	110.1	15 16	499.7	124.6	$75 \\ 76$	557.9	139.1 120.2
37	320.0 327.0	81.5	97 97	385.2	96.0	57	443.4	110.5	17	501.7	124.0 125.0	77	559.9	139.5
$\frac{38}{39}$	327.9 328.9	$\begin{array}{c} 81.7\\ 82.0\end{array}$	$\frac{98}{99}$	$386.1 \\ 387.1$	96.3 96.5	$\frac{58}{59}$	$444.4 \\ 445.3$	110.8 111.0	$\frac{18}{19}$	502.6 503.6	$125.3 \\ 125.6$	$\frac{78}{79}$	560.9 561.8	139.8 140.0
$\frac{40}{241}$	329.9	82.2	400	388.1	96.7	$\frac{60}{161}$	446.3	$\frac{111.3}{111.5}$	$\frac{20}{591}$	504.6	125.8	80	562.8	140.3
$\frac{341}{42}$	330.8 331.8	82. 5 82. 7	$401 \\ 02$	389.1 390.0	97.0 97.2	401 62	448.2	111.5 111.7	$\frac{521}{22}$	505.5 506.5	126.0 126.2	82	564.7	140.5
$\frac{43}{44}$	332.8 333.7	83.0 83.2	`03 04	391.0 392.0	97.5 97.7	$\frac{63}{64}$	449.2 450.2	112.0 112.2	$\frac{23}{24}$	507.5 508.4	126.5 126.8	83 84	565.7 566.7	141.0 141.3
45	334.7	83.4	05	392.9	98.0	65 66	451.2	112.5	25	509.4	127.0	85	567.6	141.5
40	330.7 336.7	83.9	06	393.9 394.9	98. 2 98. 4	$67 \\ 67$	452. 1 453. 1	112.7 113.0	$\frac{26}{27}$	510.4	127.2 127.5	80 87	569, 6	141.8 142.0
$\frac{48}{49}$	337.6 338.6	84.2	08 09	395.8 396.8	98.7 98.9	$\frac{68}{69}$	454.1 455.0	113.2 113.4	$\frac{28}{29}$	512.3 513.3	127.8 128.0	88 89	570.6 571.5	142.3 142.5
50	339.6	84.7	10	397.8	99.2	70	456.0	113.7	30	514.3	128.2	90	572.5	142.8
$\frac{351}{52}$	$340.5 \\ 341.5$	$84.9 \\ 85.1$	$\frac{411}{12}$	398.8 399.7	99.4 99.7	$\frac{471}{72}$	$457.0 \\ 457.9$	$113.9 \\ 114.2$	$^{531}_{-32}$	515.3 516.2	$ 128.5 \\ 128.8 $	$\frac{591}{92}$	573.5 574.4	$143.0 \\ 143.3$
53 51	342.5 343.5	85.4 85.6	13	400.7 401.7	99.9	73 74	458.9 459.9	114.4 114.6	33 34	517.2 518.2	129.0 129.9	93 94	575.4 576.4	143.5 143.8
55	344.4	85.9	15	402.6	100.4	75	460.9	114.9	35	519.1	129.4	95	577.3	144.0
$\frac{56}{57}$	$345.4 \\ 346.4$	86.1 86.3	$\begin{array}{c} 16\\17\end{array}$	403.6 404.6	100.6 100.9	$\frac{76}{77}$	461.8 462.8	$115.1 \\ 115.4$	$\frac{36}{37}$	520.1 521.1	$\begin{bmatrix} 129.7\\ 129.9 \end{bmatrix}$	96 97	578.3 579.3	144.2 144.5
$\frac{58}{59}$	347.3 348.3	86.6	18 19	405.5 406.5	$101.1 \\ 101.3$	$\frac{78}{79}$	463.8 464.7	115.6 115.9	$\frac{38}{39}$	522.1 523 0	130.2	- 98 99	580.3 581.2	144.7 144.9
60	349.3	87.1	20	407.5	101.6	80	465.7	116.1	40	524.0	130.6	600	582.2	145.1
Dist.	Dep.	Lat.	Dist.	Dep.	Lat.	Dist.	Dep.	Lat.	Dist.	Dep.	Lat.	Dist.	Dep.	Lat.
				•		76° (1	04°, 256	3°, 284°).					

Pa	ge 396]				ŤA	BLE	2.						
		D	ifferen	ice of L	atitude	and I	Departu	re for 1	5° (16	5°, 195°	, 345°)	•		
Dist.	Lat.	Dep.	Dist.	Lat.	Dep.	Dist.	Lat.	Dep.	Dist.	Lat.	Dep.	Dist.	Lat.	Dep.
$ \begin{array}{c} 1\\2\\3\\4\\5\\6\\7\\8\\9\\10\\11\\12\\13\\14\\15\\16\\17\\18\\19\end{array} $	$\begin{array}{c} 1.0\\ 1.9\\ 2.9\\ 3.9\\ 4.8\\ 5.8\\ 6.8\\ 7.7\\ 9.7\\ 10.6\\ 11.6\\ 12.6\\ 13.5\\ 15.5\\ 15.5\\ 16.4\\ 17.4\\ 18\\ J\end{array}$	$\begin{array}{c} 0.3\\ 0.5\\ 0.8\\ 1.0\\ 1.3\\ 1.6\\ 1.8\\ 2.6\\ 2.8\\ 3.1\\ 3.6\\ 3.9\\ 4.1\\ 4.4\\ 7\\ 4.9\end{array}$	$\begin{array}{c} 61\\ 62\\ 63\\ 64\\ 65\\ 66\\ 66\\ 67\\ 68\\ 69\\ 70\\ 71\\ 72\\ 73\\ 74\\ 75\\ 76\\ 77\\ 78\\ 79\\ \end{array}$	$\begin{array}{c} 58,9\\ 59,9\\ 60,9\\ 61,8\\ 62,8\\ 63,8\\ 64,7\\ 65,7\\ 65,6\\ 66,6\\ 69,5\\ 70,5\\ 71,5\\ 71,5\\ 72,4\\ 73,4\\ 74,4\\ 75,3\\ 4\\ 76,3\\ 76,3\\ \end{array}$	$\begin{array}{c} 15.8\\ 16.0\\ 16.3\\ 16.6\\ 17.1\\ 17.3\\ 17.6\\ 17.9\\ 18.1\\ 18.4\\ 18.6\\ 18.9\\ 19.2\\ 19.4\\ 19.7\\ 19.9\\ 20.2\\ 20.4 \end{array}$	$\begin{array}{c} 121\\ 22\\ 23\\ 24\\ 25\\ 26\\ 27\\ 28\\ 29\\ 30\\ \hline 131\\ 32\\ 33\\ 34\\ 35\\ 36\\ 37\\ 38\\ 39\\ \end{array}$	$\begin{array}{c} 116. \ 9\\ 117. \ 8\\ 118. \ 8\\ 119. \ 8\\ 120. \ 7\\ 121. \ 7\\ 122. \ 7\\ 122. \ 7\\ 122. \ 6\\ 124. \ 6\\ 125. \ 6\\ 126. \ 5\\ 127. \ 5\\ 128. \ 4\\ 122. \ 8\\ 128. \ 4\\ 131. \ 4\\ 132. \ 3\\ 133. \ 3\\ 134. \ 9\end{array}$	$\begin{array}{c} 31.3\\ 31.6\\ 31.8\\ 32.1\\ 32.4\\ 32.6\\ 32.9\\ 33.4\\ 33.6\\ 33.4\\ 33.6\\ 33.9\\ 34.2\\ 34.2\\ 34.4\\ 7\\ 34.9\\ 35.2\\ 35.5\\ 55.7\\ 36.0\\ \end{array}$	$\begin{array}{c} 181\\82\\83\\84\\85\\86\\87\\88\\89\\90\\191\\92\\93\\94\\95\\96\\97\\98\\99\\99\\99\\99\\99\\99\\99\\99\\99\\99\\99\\99\\$	$\begin{array}{c} 174.8\\ 175.8\\ 176.8\\ 177.7\\ 178.7\\ 179.7\\ 180.6\\ 181.6\\ 182.6\\ 183.5\\ 184.5\\ 185.5\\ 185.5\\ 185.4\\ 187.4\\ 188.4\\ 188.3\\ 190.3\\ 191.3\\ 192.9\end{array}$	$\begin{array}{c} 46.8\\ 47.1\\ 47.4\\ 47.6\\ 47.9\\ 48.1\\ 48.4\\ 48.7\\ 48.9\\ 49.2\\ 49.4\\ 49.7\\ 50.0\\ 50.2\\ 50.5\\ 50.7\\ 51.0\\ 51.2\\ 51.5\\ \end{array}$	$\begin{array}{c} 241 \\ 42 \\ 43 \\ 44 \\ 45 \\ 46 \\ 47 \\ 48 \\ 49 \\ 50 \\ 251 \\ 52 \\ 53 \\ 54 \\ 55 \\ 56 \\ 57 \\ 58 \\ 59 \end{array}$	$\begin{array}{c} 232.8\\ 233.8\\ 234.7\\ 235.7\\ 235.7\\ 236.7\\ 237.6\\ 238.6\\ 239.5\\ 240.5\\ 240.5\\ 241.5\\ 242.4\\ 243.4\\ 244.4\\ 245.3\\ 246.3\\ 247.3\\ 246.3\\ 247.3\\ 248.2\\ 249.2\\ 249.2\\ 249.2\\ 250.9\end{array}$	$\begin{array}{c} 62.4\\ 62.6\\ 62.9\\ 63.2\\ 63.4\\ 63.7\\ 63.9\\ 64.2\\ 64.4\\ 64.7\\ 65.0\\ 65.2\\ 65.5\\ 65.5\\ 66.0\\ 66.3\\ 66.5\\ 66.5\\ 66.5\\ 66.5\\ 66.5\\ 67.0\\ \end{array}$
$ \begin{array}{r} 19 \\ 20 \\ 21 \\ 22 \\ 23 \\ 24 \\ 25 \\ 26 \\ 27 \\ 28 \\ 29 \\ 30 \\ 31 \\ 32 \\ 33 \\ 34 \\ 35 \\ 36 \\ 37 \\ 37 \\ 37 \\ 37 \\ 37 \\ 36 \\ 37 \\ 37 \\ 37 \\ 37 \\ 36 \\ 37 \\ 37 \\ 37 \\ 37 \\ 37 \\ 36 \\ 37 \\ 37 \\ 37 \\ 37 \\ 36 \\ 37 \\ 37 \\ 37 \\ 37 \\ 37 \\ 37 \\ 37 \\ 37 \\ 36 \\ 37 \\ 37 \\ 37 \\ 37 \\ 37 \\ 37 \\ 36 \\ 37 \\$	$\begin{array}{c} 18. + \\ 19. 3 \\ 20. 3 \\ 21. 3 \\ 22. 2 \\ 23. 2 \\ 24. 1 \\ 25. 1 \\ 25. 1 \\ 26. 1 \\ 27. 0 \\ 28. 0 \\ 29. 0 \\ 29. 9 \\ 30. 9 \\ 31. 9 \\ 32. 8 \\ 33. 8 \\ 33. 8 \\ 34. 8 \\ 35. 7 \end{array}$	$\begin{array}{c} 4.9\\ 5.2\\ 1.5\\ 5.7\\ 6.2\\ 5.7\\ 6.2\\ 5.7\\ 6.2\\ 5.7\\ 7.2\\ 8.3\\ 8.3\\ 8.5\\ 8.8\\ 1\\ 9.3\\ 6\\ 9.6\\ 1\end{array}$	79 80 81 82 83 84 85 86 87 88 90 91 92 93 94 95 96 97	10.3 77.3 78.2 79.2 80.2 81.1 82.1 83.1 83.1 84.0 85.0 86.9 87.9 88.9 80.8 90.8 90.8 91.8 91.7 93.7	$\begin{array}{c} 20.4\\ 20.7\\ 1.0\\ 21.2\\ 21.5\\ 21.5\\ 21.7\\ 22.0\\ 22.3\\ 22.5\\ 22.8\\ 23.6\\ 23.8\\ 24.1\\ 24.8\\ 25.1\\ 24.8\\ 25.1\\ 24.8\\ 25.1\\ \end{array}$		$\begin{matrix} 104.3\\ 135.2\\ 136.2\\ 137.2\\ 138.1\\ 139.1\\ 140.1\\ 140.0\\ 142.0\\ 143.0\\ 144.9\\ 144.9\\ 144.9\\ 145.9\\ 146.8\\ 147.8\\ 148.8\\ 147.8\\ 149.7\\ 150.7\\ 151.7\\ 151.7\\ \end{matrix}$	$\begin{array}{c} 30.0\\ 36.2\\ 36.5\\ 36.8\\ 37.0\\ 37.3\\ 37.5\\ 37.8\\ 38.0\\ 38.3\\ 38.6\\ 38.8\\ 39.1\\ 39.3\\ 39.6\\ 39.9\\ 40.1\\ 40.4\\ 40.6\\ \end{array}$	$\begin{array}{r} 59\\ 200\\ 201\\ 02\\ 03\\ 04\\ 05\\ 06\\ 07\\ 08\\ 09\\ 10\\ \hline 211\\ 12\\ 13\\ 14\\ 15\\ 16\\ 17\\ \end{array}$	$\begin{array}{c} 192.2\\ 193.2\\ 194.2\\ 195.1\\ 195.1\\ 196.1\\ 197.0\\ 199.0\\ 199.0\\ 199.9\\ 200.9\\ 200.9\\ 200.9\\ 200.8\\ 203.8\\ 204.8\\ 205.7\\ 206.7\\ 206.6\\ 209.6\\ 209.6\\ \end{array}$	$\begin{array}{c} 51.8\\ 52.0\\ 52.3\\ 52.5\\ 52.8\\ 53.3\\ 53.6\\ 53.8\\ 54.4\\ 54.6\\ 54.9\\ 55.6\\ 55.9\\ 55.9\\ 56.2\\ \end{array}$	$\begin{array}{c} 39\\ 60\\ 261\\ 62\\ 63\\ 64\\ 65\\ 66\\ 67\\ 68\\ 69\\ 70\\ \hline 271\\ 72\\ 73\\ 74\\ 75\\ 76\\ 77\\ 76\\ 76$	$\begin{array}{c} 200.2\\ 251.1\\ \hline\\ 252.1\\ 253.1\\ 254.0\\ 255.0\\ 255.0\\ 256.0\\ 256.0\\ 256.9\\ 257.9\\ 258.9\\ 259.8\\ 260.8\\ 260.8\\ 260.8\\ 260.8\\ 260.7\\ 263.7\\ 264.7\\ 264.6\\ 265.6\\ 265.6\\ 266.6\\ 267.6\\ 267.6\\ 266.6\\ 267.6\\$	$\begin{array}{c} 67.0\\ 67.3\\ 67.6\\ 67.8\\ 68.1\\ 68.3\\ 68.6\\ 68.8\\ 69.1\\ 69.4\\ 69.6\\ 99.9\\ 70.1\\ 70.4\\ 70.7\\ 70.9\\ 71.2\\ 71.4\\ 71.7\\ 72.9\\ 71.4\\ 71.7\\ 72.7\\ 72.9\\ 72.7\\$
$\begin{array}{c} 38\\ 39\\ 40\\ 41\\ 42\\ 43\\ 44\\ 45\\ 46\\ 47\\ 48\\ 49\\ 50\\ 51\\ 52\\ 53\\ 54\\ 55\\ 56\\ 57\\ 56\\ 57\\ 56\end{array}$	$\begin{array}{c} 36.7\\ 37.7\\ 38.6\\ 39.6\\ 40.6\\ 41.5\\ 42.5\\ 43.5\\ 43.5\\ 44.4\\ 45.4\\ 45.4\\ 45.4\\ 45.4\\ 45.4\\ 46.4\\ 47.3\\ 50.2\\ 51.2\\ 55.1\\ 55.1\\ 55.1\\ 55.1\\ \end{array}$	$\begin{array}{c} 9.8\\ 10.1\\ 10.6\\ 10.9\\ 11.1\\ 11.6\\ 11.9\\ 12.2\\ 12.4\\ 12.7\\ 12.9\\ 13.2\\ 13.5\\ 13.7\\ 14.0\\ 14.2\\ 14.5\\ 14.8\\ \end{array}$	$\begin{array}{r} 98\\999\\100\\\hline 101\\02\\03\\04\\05\\06\\07\\08\\09\\10\\\hline 111\\12\\13\\14\\15\\16\\17\\\end{array}$	94.7 95.6 96.6 97.6 98.5 99.5 100.5 101.4 102.4 103.4 104.3 105.3 106.3 107.2 108.2 109.1 110.1 111.1 112.0 113.0	$\begin{array}{c} 25.4\\ 25.6\\ 25.9\\ 26.1\\ 26.4\\ 26.7\\ 26.9\\ 27.2\\ 4\\ 27.7\\ 28.0\\ 28.5\\ 28.5\\ 28.7\\ 29.0\\ 29.2\\ 29.5\\ 29.5\\ 30.0\\ 30.3\\ 30.3\\ \end{array}$	$\begin{array}{c} 58\\ 59\\ 60\\ 161\\ 62\\ 63\\ 64\\ 65\\ 66\\ 67\\ 68\\ 69\\ 70\\ \hline 171\\ 72\\ 73\\ 74\\ 75\\ 76\\ 77\\ 76\\ 77\\ 76\end{array}$	$\begin{array}{c} 152.\ 6\\ 153.\ 6\\ 154.\ 5\\ 155.\ 5\\ 156.\ 5\\ 157.\ 4\\ 158.\ 4\\ 159.\ 4\\ 160.\ 3\\ 161.\ 3\\ 162.\ 3\\ 163.\ 2\\ 163.\ 2\\ 164.\ 2\\ 165.\ 2\\ 166.\ 1\\ 167.\ 1\\ 168.\ 1\\ 168.\ 1\\ 169.\ 0\\ 170.\ 0\\ 171.\ 0\end{array}$	$\begin{array}{c} 40.9\\ 41.2\\ 41.4\\ 41.7\\ 41.9\\ 42.2\\ 42.4\\ 42.7\\ 43.0\\ 43.2\\ 43.5\\ 43.5\\ 43.5\\ 43.5\\ 43.5\\ 44.0\\ 44.3\\ 44.5\\ 44.8\\ 45.6\\ 45.3\\ 45.6\\ 45.8\\ \end{array}$	$\begin{array}{c} 18\\ 19\\ 20\\ 221\\ 22\\ 23\\ 24\\ 25\\ 26\\ 27\\ 28\\ 29\\ 30\\ \hline 231\\ 32\\ 33\\ 34\\ 35\\ 36\\ 37\\ \end{array}$	$\begin{array}{c} 210.6\\ 211.5\\ 212.5\\ 213.5\\ 214.4\\ 215.4\\ 216.4\\ 217.3\\ 218.3\\ 219.3\\ 220.2\\ 221.2\\ 222.2\\ 222.1\\ 222.1\\ 222.1\\ 222.1\\ 222.1\\ 222.0\\ 222.2\\ 223.1\\ 224.1\\ 225.1\\ 226.0\\ 228.0\\ 227.0\\ 228.0\\ 228.9\\ 228.9\\ 220.2\\ 220.2\\ 22$	$\begin{array}{c} 56.4\\ 56.7\\ 56.9\\ 57.2\\ 57.5\\ 57.7\\ 58.0\\ 58.5\\ 58.8\\ 59.0\\ 59.3\\ 59.5\\ 59.8\\ 60.0\\ 60.3\\ 60.6\\ 60.8\\ 61.1\\ 61.3\\ 61.6\\ 61.1\\ 61.3\\ 61.6\\ 61.1\\ 61.3\\ 61.6\\ 61.1\\ 61.3\\ 61.6\\ 61.1\\ 61.3\\ 61.6\\ 61.1\\ 61.3\\ 61.6\\$	$\begin{array}{c} 78\\799\\281\\82\\83\\84\\85\\86\\87\\88\\89\\90\\291\\92\\93\\94\\95\\96\\97\\22\end{array}$	$\begin{array}{c} 208.5\\ 269.5\\ 270.5\\ 271.4\\ 272.4\\ 273.4\\ 274.3\\ 275.3\\ 275.3\\ 277.2\\ 278.2\\ 279.2\\ 280.1\\ 281.1\\ 282.1\\ 283.0\\ 284.9\\ 284.9\\ 284.9\\ 285.9\\ 285.9\\ 286.9\\ 28$	$\begin{array}{c} 72.0\\ 72.2\\ 72.5\\ 72.7\\ 73.0\\ 73.2\\ 73.5\\ 73.8\\ 74.0\\ 74.3\\ 74.5\\ 74.5\\ 74.5\\ 75.1\\ 75.3\\ 75.6\\ 75.8\\ 75.1\\ 75.8\\ 76.4\\ 76.6\\ 76.9\\ 76.9\\ 75.9\\ 76.4\\ 76.6\\ 76.9\\ 75.9\\$
$58 \\ 59 \\ 60$	$56.0 \\ 57.0 \\ 58.0$	$\begin{array}{c} 15.\ 0\\ 15.\ 3\\ 15.\ 5\end{array}$	18 19 20	$114.0 \\ 114.9 \\ 115.9$	$30.5 \\ 30.8 \\ 31.1$	78 79 80	171.9 172.9 173.9	$\begin{array}{c} 46.1 \\ 46.3 \\ 46.6 \end{array}$	38 39 40	$229.9 \\ 230.9 \\ 231.8$	$\begin{array}{c} 61. \ 6\\ 61. \ 9\\ 62. \ 1\end{array}$	98 99 300	$287.8 \\ 288.8 \\ 289.8$	77.177.477.6
Dist.	Dep.	Lat.	Dist.	Dep.	Lat.	Dist.	Dep.	Lat.	Dist.	Dep.	Lat.	Dist.	Dep.	Lat.
						75° (1	$105^{\circ}, 255$	5°, 285°	°).	_				

						ľ	CABLI	E 2.					[Page	397
			Differ	ence of	Latitud	e and	Departi	are for	15° (1	.65°, 195	5°, 345°	').		
Dist,	Lat.	Dep.	Dist.	Lat.	Dep.	Dist.	Lat.	Dep.	Dist.	Lat.	Dep.	Dist,	Lat.	Dep.
301	290.7	77.9	$\frac{361}{62}$	348.7 349.6	93.4 93.7	$\frac{421}{22}$	406.6	109.0 109.2	481 82	464.6 465.6	124.5 124.8	$541 \\ 42$	522.6 523.5	140.0
03	292.7	78.4	63	350.6	94.0	$\frac{22}{23}$	408.6	109.5	83	466.5	121.0 125.0	43	524.5	140.5 140.5
04	293.6	78.7	$64 \\ 65$	351.6 352.5	94.2	$\frac{24}{25}$	$ 409.5 \\ 410.5 $	109.7	84	467.5 468.5	125.3 125.6	44	525.5 526.4	140.8 141 1
06	295.6	79.2	66	353.5	94.7	$\frac{1}{26}$	411.5	110.3	86	469.4	125.8	46	527.4	141.4
07	296.5	79.5	67 69	354.5	95.0	27	412.4	110.5	87	470.4	126.1	47	528.4	141.6
08	297.5	80.0	69	355.4 356.4	95.5	$\frac{26}{29}$	414.4	111.0	89	472.3	120.4 126.6	49	529.3 530.3	141.5 142.1
10	299.4	80.2	70	357.4	95.8	$\frac{30}{421}$	415.3	111.3	90	473.3	126.9	50	531.3	142.4
$\frac{311}{12}$	300.4 301.3	80.5	$\frac{371}{72}$	358.3	96.0	$\frac{431}{32}$	416.3 417.3	111.6 111.8	491 92	474.3 475.2	127.1 127.4	$\frac{551}{52}$	532.2 533.2	142.6 142.9
$\overline{13}$	302.3	81.0	173	360.3	96.5	33	418.2	112.1	93	476.2	127.6	53	534.2	143.1
14	303.3	81.3 81.5	74	361.2 362.2	96.8	$\frac{34}{35}$	419.2 420.2	112.3 112.6	$94 \\ 95$	477.2 478.1	127.9 128 1	-54 -55	535.1 536.1	143.4 143.7
16	305.2	81.8	76	363.2	97.3	36	421.1	112.9	96	479.1	120.1 128.4	56	537.1	143.9
17	306.2	82.1	77	364.1	97.6	37	422.1	113.1	97	480.1	128.6	57	538.0	144.2
$18 \\ 19$	307.1 308.1	82.5 82.6	79	366.1	97.8 98.1	$\frac{30}{39}$	425.1 424.0	113.4	99	481.0	128.9 129.1	59	540.0	144.4
20	309.1	82.8	80	367.0	98.4		425,0	113.9	500	483.0	129.4	60	540.9	144.9
$\frac{321}{22}$	310.0 311.0	$ \begin{array}{c} 83.1 \\ 83.3 \end{array} $	$\frac{381}{82}$	368.0	98.6	441	$\begin{array}{c} 426.0 \\ 126.9 \end{array}$	114.1	$501 \\ 02$	483.9	129.7	$561 \\ 62$	541.9 542.9	145.2 145.4
$\tilde{23}$	312.0	83.6	83	369.9	99.1	43	427.9	114.7	03	485.9	130.2	63	543.8	145.7
24 25	312.9	83.9	84 85	370.9 371.9	99.4	44	428.8	114.9	04	486.8	130.4	64	544.8	146.0
$\frac{23}{26}$	313.9 314.9	84.4	86	371.9 372.8	99.9	46	430.8	115.4	06	488.8	131.0	66	546.7	140.2 146.5
27	315.8	84.6	87	373.8	100.2	47	431.7	115.7	07	489.7	131.2	67	547.7	146.7
$\frac{28}{29}$	316.8 317.8	84.9 85.1	88	374.8 375.7	100.4 100.7	$\frac{48}{49}$	432.7	116.0 116.2	$08 \\ 09$	490.7	131.5 131.7	$\frac{68}{69}$	549.6	147.0 147.2
30	318.7	85.4	90	376.7	100.9	50	434.6	116.5	10	492.6	132.0	70	550.6	147.5
331	319.7 320.7	85.7	$\frac{391}{92}$	377.7 378.6	101.2 101.5	$451 \\ 52$	435.6	116.7 117.0	$511 \\ 19$	493.6	132.3 132.5	$571 \\ 72$	551.6 552 5	147.8 148.0
33	321.6	86.2	93^{-92}	379.6	101.5 101.7	53^{-52}	437.5	117.3	$12 \\ 13$	495.5	132.8	$7\overline{3}$	553.5	148.3
$\frac{34}{25}$	322.6	86.5	94	380.6	102.0 102.2	54 55	438.5	117.5	14	496.5	133.0	74	554.4	148.5
36	323.0 324.5	87.0	96	382.5	102.2 102.5	56	439.0	117.8	16	497.4	133.5 133.5	76	556.4	149.0
37	325.5	87.2	97	383.4	102.8 102.0	57	441.4	118.3	17	499.4	133.8	77	557.3	149.3
$\frac{38}{39}$	320.5 327.4	87.5	98	385.4	103.0 103.3	$\frac{58}{59}$	443.3	118.8	18	500.3 501.3	134.0 134.3	$\frac{78}{79}$	559.3	149.3
	328.4	88.0	400	386.3	103.5	60	444.3	119.1	20	502.3	134.6	80	560.2	150, 1
$\frac{341}{42}$	329.4 330.3	$\frac{88.3}{88.5}$	$401 \\ 02$	$\frac{387.3}{388.3}$	103.8 104.1	$461 \\ 62$	445.3	119.3 119.6	$521 \\ -92$	503.2	134.8 135.1	$581 \\ 82$	561.2 562.2	150.3 150.6
43^{12}	331.3	88.8	03	389.2	104.3	63	447.2	119.8	$\frac{22}{23}$	505.2	135.3	83	563.1	150.8
44	332.3	89.0	04	390.2	104.6	$64 \\ 65$	448.2	120.1 120.4	24	506.1	135.6 125.0	84 85	564.1 565.1	151.1 151.1
40	334.2	89.6	06	391.2 392.1	104.8 105.1	66	450.1	120.4 120.6	$\frac{20}{26}$	507.1	135.9 136.1	86	566.0	151.4 151.6
47	335.2	89.8	07	393.1	105.3	67	451.1	120.9	27	509.0	136.4	87	567.0	151.9
$\frac{48}{49}$	330.1 337.1	90.1 90.3	$08 \\ 09$	394.1 395.0	105.6 105.9	$\frac{68}{69}$	452.0	121.1 121.4	$\frac{28}{29}$	510.0 511.0	$136.0 \\ 136.9$	$\frac{88}{89}$	568.0 568.9	152.2 152.4
50	338.1	90.6	10	396.0	106.1	70	454.0	121.7	30	511.9	137.2	90	569.9	152.7
$\frac{351}{52}$	339.0	90.9	411	397.0	106.4	$471 \\ 79$	454.9	121.9	$531 \\ 22$	512.9	137.4 197.7	591	570.9	153.0 152.9
53	340.0 340.9	91.4	$12 \\ 13$	398.9	100.0 106.9	73^{-2}	456.9	122.2 122.4	$\frac{32}{33}$	515.9 514.8	137.9	92 93	571.8 572.8	153.2 153.5
54	341.9	91.6	14	399.9	107.2	74	457.8	122.7	34	515.8	138.2	94	573.8	153.7
$\begin{array}{c} 50\\56\end{array}$	342, 9 343, 8	91.9 92.1	$15 \\ 16$	400.8 401.8	107.4 107.7	$\frac{75}{76}$	$458.8 \\ 459.8$	$122.9 \\ 123.2$	$\frac{35}{36}$	516.8 517.7	$138.4 \\ 138.7$	90 96	574.7 575.7	154.0 154.2
57	344.8	92.4	17	402.8	107.9	77	460.7	123.5	37	518.7	139.0	97	576.7	154.5
$\begin{array}{c} 58\\59\end{array}$	$345.8 \\ 346.7$	92.7 92.9	$\frac{18}{19}$	403.7 404.7	108.2 108.5	$\begin{array}{c} 78 \\ 79 \end{array}$	$\frac{461.7}{462.7}$	123.7 124.0	$\frac{38}{39}$	$519.7 \\ 520.6$	$139.2 \\ 139.5$	98 99	577.6 578.6	$154.8 \\ 155.0$
60	347.7	93.2	20	405.7	108.7	80	463.6	124.2	40	521.6	139.7	600	579.5	155.3
Dist.	Dep.	Lar.	Dist.	Dep.	Lat.	Dist.	Dep.	Lat.	Dist.	Dep.	Lat.	Dist.	Dep.	Lat.
					7	75° (1	05°, 255	°, 285°).					

Pa	ge 398]					ΓABL	E 2.		1				
		,	Differ	ence of	Latitud	le and	Depart	ure for	16° (164°, 190	3°, 344	°).		
Dist.	Lat.	Dep,	Dist.	Lat.	Dep.	Dist.	Lat.	Dep.	Dist.	Lat.	Dep.	Dist.	Lat.	Dep.
$\begin{array}{c}1\\2\\3\\4\\5\end{array}$	$ \begin{array}{c} 1.0\\ 1.9\\ 2.9\\ 3.8\\ 4.8\\ 4.8 \end{array} $	$\begin{array}{c} 0.3 \\ 0.6 \\ 0.8 \\ 1.1 \\ 1.4 \\ 1.5 \end{array}$		58.659.660.661.562.5	$16.8 \\ 17.1 \\ 17.4 \\ 17.6 \\ 17.9 \\ 17.9 \\ 17.9 \\ 17.9 \\ 17.9 \\ 17.9 \\ 17.9 \\ 17.9 \\ 17.9 \\ 17.9 \\ 17.9 \\ 10.9 \\ $	$ \begin{array}{r} 121 \\ 22 \\ 23 \\ 24 \\ 25 \\ 22 \end{array} $	$116.3 \\ 117.3 \\ 118.2 \\ 119.2 \\ 120.2 \\ 121.1 \\ 121.$	$\begin{array}{c} 33.4\\ 33.6\\ 33.9\\ 34.2\\ 34.5\\ 24.5\\ \end{array}$	$ 181 \\ 82 \\ 83 \\ 84 \\ 85 \\ 82 $	$174.0 \\ 174.9 \\ 175.9 \\ 176.9 \\ 177.8 \\ 177.8 \\ 0 \\ 0 \\ 0 \\ 0 \\ 0 \\ 0 \\ 0 \\ 0 \\ 0 \\ $	$\begin{array}{r} 49.\ 9\\ 50.\ 2\\ 50.\ 4\\ 50.\ 7\\ 51.\ 0\end{array}$	$241 \\ 42 \\ 43 \\ 44 \\ 45 \\ 45 \\ 12$	$\begin{array}{c} 231.\ 7\\ 232.\ 6\\ 233.\ 6\\ 234.\ 5\\ 235.\ 5\end{array}$	$\begin{array}{c} 66.\ 4\\ 66.\ 7\\ 67.\ 0\\ 67.\ 3\\ 67.\ 5\end{array}$
$ \begin{array}{r} 6 \\ 7 \\ 8 \\ 9 \\ 10 \\ -11 \end{array} $	$ \begin{array}{r} 5.8\\ 6.7\\ 7.7\\ 8.7\\ 9.6\\ \hline 10.6 \end{array} $	$ \begin{array}{r} 1. \\ 1.9\\ 2.2\\ 2.5\\ 2.8\\ 3.0\\ \end{array} $		$ \begin{array}{r} 63.4 \\ 64.4 \\ 65.4 \\ 66.3 \\ 67.3 \\ \hline 88.2 \end{array} $	$ 18.2 \\ 18.5 \\ 18.7 \\ 19.0 \\ 19.3 \\ 19.6 $	$ \begin{array}{r} 26 \\ 27 \\ 28 \\ 29 \\ 30 \\ 131 \end{array} $	$ \begin{array}{c} 121. 1 \\ 122. 1 \\ 123. 0 \\ 124. 0 \\ 125. 0 \\ 125. 9 \end{array} $	$ \begin{array}{r} 34.7\\ 35.0\\ 35.3\\ 35.6\\ 35.8\\ -26.1 \end{array} $	86 87 88 89 90	$ \begin{array}{r} 178.8 \\ 179.8 \\ 180.7 \\ 181.7 \\ 182.6 \\ 193.6 \end{array} $	$ \begin{array}{r} 51.3 \\ 51.5 \\ 51.8 \\ 52.1 \\ 52.4 \\ 52.6 \\ \end{array} $	$ \begin{array}{r} 46 \\ 47 \\ 48 \\ 49 \\ 50 \\ \hline 251 \end{array} $	236.5237.4238.4239.4240.3241.3	$\begin{array}{c} 67.8 \\ 68.1 \\ 68.4 \\ 68.6 \\ 68.9 \\ \hline 69.2 \end{array}$
12 13 14 15 16 17 18 19 1	$\begin{array}{c} 11.5\\ 12.5\\ 13.5\\ 14.4\\ 15.4\\ 16.3\\ 17.3\\ 18.3 \end{array}$	$\begin{array}{c} 3.3\\ 3.6\\ 3.9\\ 4.1\\ 4.4\\ 4.7\\ 5.0\\ 5.2\end{array}$	$72 \\ 73 \\ 74 \\ 75 \\ 76 \\ 77 \\ 78 \\ 79$	$\begin{array}{c} 69.2\\ 69.2\\ 70.2\\ 71.1\\ 72.1\\ 73.1\\ 74.0\\ 75.0\\ 75.9\end{array}$	$\begin{array}{c} 19.8\\ 19.8\\ 20.1\\ 20.4\\ 20.7\\ 20.9\\ 21.2\\ 21.5\\ 21.8\end{array}$	32 33 34 35 36 37 38 39	$\begin{array}{c} 126.9\\ 126.9\\ 127.8\\ 128.8\\ 129.8\\ 130.7\\ 131.7\\ 132.7\\ 133.6\end{array}$	$\begin{array}{c} 36.4\\ 36.7\\ 36.9\\ 37.2\\ 37.5\\ 37.8\\ 38.0\\ 38.3 \end{array}$	92 93 94 95 96 97 98 99	$184.6 \\ 185.5 \\ 186.5 \\ 187.4 \\ 188.4 \\ 189.4 \\ 190.3 \\ 191.3 $	$\begin{array}{c} 52.0\\ 52.9\\ 53.2\\ 53.5\\ 53.7\\ 54.0\\ 54.3\\ 54.6\\ 54.9\end{array}$	$52 \\ 53 \\ 54 \\ 55 \\ 56 \\ 57 \\ 58 \\ 59$	241. 0 242. 2 243. 2 244. 2 245. 1 246. 1 247. 0 248. 0 249. 0	$\begin{array}{c} 69.5\\ 69.5\\ 69.7\\ 70.0\\ 70.3\\ 70.6\\ 70.8\\ 71.1\\ 71.4 \end{array}$
$ \begin{array}{r} 20 \\ \hline 21 \\ 22 \\ 23 \\ 24 \\ 25 \\ 26 \\ 27 \\ 28 \\ 29 \\ 30 \\ \end{array} $	$\begin{array}{c} 19.2 \\ 20.2 \\ 21.1 \\ 22.1 \\ 23.1 \\ 24.0 \\ 25.0 \\ 26.0 \\ 26.9 \\ 27.9 \\ 28.8 \end{array}$	$ \begin{array}{r} 5.5\\ 5.8\\ 6.1\\ 6.3\\ 6.6\\ 6.9\\ 7.2\\ 7.4\\ 7.7\\ 8.0\\ 8.3 \end{array} $	80 81 82 83 84 85 86 87 88 89 90	$\begin{array}{c} 76.9 \\ 77.9 \\ 78.8 \\ 79.8 \\ 80.7 \\ 81.7 \\ 82.7 \\ 83.6 \\ 84.6 \\ 85.6 \\ 86.5 \end{array}$	$\begin{array}{c} 22.1 \\ \hline 22.3 \\ 22.6 \\ 22.9 \\ 23.2 \\ 23.4 \\ 23.7 \\ 24.0 \\ 24.3 \\ 24.5 \\ 24.8 \end{array}$	$ \begin{array}{r} 40 \\ 141 \\ 42 \\ 43 \\ 44 \\ 45 \\ 46 \\ 47 \\ 48 \\ 49 \\ 50 \\ \end{array} $	$\begin{array}{c} 134.6\\ \hline 135.5\\ 136.5\\ 137.5\\ 138.4\\ 139.4\\ 140.3\\ 141.3\\ 142.3\\ 142.3\\ 143.2\\ 144.2 \end{array}$	$\begin{array}{r} 38.6\\ \hline 38.9\\ 39.1\\ 39.4\\ 39.7\\ 40.0\\ 40.2\\ 40.5\\ 40.8\\ 41.1\\ 41.3\\ \end{array}$	$ \begin{array}{r} 200 \\ \hline 201 \\ 02 \\ 03 \\ 04 \\ 05 \\ 06 \\ 07 \\ 08 \\ 09 \\ 10 \end{array} $	$\begin{array}{r} 192.3\\ \hline 193.2\\ 194.2\\ 195.1\\ 196.1\\ 197.1\\ 198.0\\ 199.0\\ 199.9\\ 200.9\\ 201.9\end{array}$	$\begin{array}{c} 55.1 \\ 55.4 \\ 55.7 \\ 56.0 \\ 56.2 \\ 56.5 \\ 56.8 \\ 57.1 \\ 57.3 \\ 57.6 \\ 57.9 \end{array}$	$ \begin{array}{r} 60 \\ 261 \\ 62 \\ 63 \\ 64 \\ 65 \\ 66 \\ 67 \\ 68 \\ 69 \\ 70 \\ \end{array} $	$\begin{array}{c} 249.9\\ \hline 250.9\\ 251.9\\ 252.8\\ 253.8\\ 254.7\\ 255.7\\ 255.7\\ 256.7\\ 257.6\\ 258.6\\ 259.5\end{array}$	$\begin{array}{c} 71.7\\71.9\\72.2\\72.5\\72.8\\73.0\\73.3\\73.6\\73.9\\74.1\\74.4\end{array}$
$ \begin{array}{r} 31 \\ 32 \\ 33 \\ 34 \\ 35 \\ 36 \\ 37 \\ 38 \\ 39 \\ 40 \\ 40 \end{array} $	$\begin{array}{c} 29.8\\ 30.8\\ 31.7\\ 32.7\\ 33.6\\ 34.6\\ 35.6\\ 36.5\\ 37.5\\ 38.5 \end{array}$	$\begin{array}{r} 8.5\\ 8.8\\ 9.1\\ 9.4\\ 9.6\\ 9.9\\ 10.2\\ 10.5\\ 10.7\\ 11.0 \end{array}$	$91 \\ 92 \\ 93 \\ 94 \\ 95 \\ 96 \\ 97 \\ 98 \\ 99 \\ 100$	$\begin{array}{c} 87.5\\ 88.4\\ 89.4\\ 90.4\\ 91.3\\ 92.3\\ 93.2\\ 94.2\\ 95.2\\ 96.1 \end{array}$	$\begin{array}{c} 25.1\\ 25.4\\ 25.6\\ 25.9\\ 26.2\\ 26.5\\ 26.7\\ 27.0\\ 27.3\\ 27.6\\ \end{array}$	$ \begin{array}{r} 151 \\ 52 \\ 53 \\ 54 \\ 55 \\ 56 \\ 57 \\ 58 \\ 59 \\ 60 \\ \end{array} $	$\begin{array}{c} 145.\ 2\\ 146.\ 1\\ 147.\ 1\\ 148.\ 0\\ 149.\ 0\\ 150.\ 0\\ 150.\ 9\\ 151.\ 9\\ 152.\ 8\\ 153.\ 8\end{array}$	$\begin{array}{c} 41.6\\ 41.9\\ 42.2\\ 42.4\\ 42.7\\ 43.0\\ 43.3\\ 43.6\\ 43.8\\ 44.1\end{array}$	$\begin{array}{c} 211 \\ 12 \\ 13 \\ 14 \\ 15 \\ 16 \\ 17 \\ 18 \\ 19 \\ 20 \end{array}$	$\begin{array}{c} 202.\ 8\\ 203.\ 8\\ 204.\ 7\\ 205.\ 7\\ 205.\ 7\\ 206.\ 7\\ 207.\ 6\\ 208.\ 6\\ 209.\ 6\\ 210.\ 5\\ 211.\ 5\\ \end{array}$	$\begin{array}{c} \overline{58.2} \\ 58.4 \\ 58.7 \\ 59.0 \\ 59.3 \\ 59.5 \\ 59.8 \\ 60.1 \\ 60.4 \\ 60.6 \end{array}$	$ \begin{array}{r} 271 \\ 72 \\ 73 \\ 74 \\ 75 \\ 76 \\ 77 \\ 78 \\ 79 \\ 80 \\ \end{array} $	$\begin{array}{c} 260.\ 5\\ 261.\ 5\\ 262.\ 4\\ 263.\ 4\\ 264.\ 3\\ 265.\ 3\\ 265.\ 3\\ 266.\ 3\\ 267.\ 2\\ 268.\ 2\\ 269.\ 2\\ \end{array}$	$\begin{array}{c} 74.7\\75.0\\75.2\\75.5\\75.8\\76.1\\76.4\\76.6\\76.9\\77.2\end{array}$
$\begin{array}{r} 41 \\ 42 \\ 43 \\ 44 \\ 45 \\ 46 \\ 47 \\ 48 \\ 49 \\ 50 \end{array}$	$\begin{array}{c} 39.\ 4\\ 40.\ 4\\ 41.\ 3\\ 42.\ 3\\ 43.\ 3\\ 44.\ 2\\ 45.\ 2\\ 46.\ 1\\ 47.\ 1\\ 48.\ 1\end{array}$	$\begin{array}{c} 11.3\\ 11.6\\ 11.9\\ 12.1\\ 12.4\\ 12.7\\ 13.0\\ 13.2\\ 13.5\\ 13.8 \end{array}$	$ \begin{array}{r} 101 \\ 02 \\ 03 \\ 04 \\ 05 \\ 06 \\ 07 \\ 08 \\ 09 \\ 10 \\ \end{array} $	$\begin{array}{c} 97.1\\ 98.0\\ 99.0\\ 100.0\\ 100.9\\ 101.9\\ 102.9\\ 103.8\\ 104.8\\ 105.7\end{array}$	$\begin{array}{c} 27.8\\ 28.1\\ 28.4\\ 28.7\\ 28.9\\ 29.2\\ 29.5\\ 29.8\\ 30.0\\ 30.3 \end{array}$	$ \begin{array}{r} 161 \\ 62 \\ 63 \\ 64 \\ 65 \\ 66 \\ 67 \\ 68 \\ 69 \\ 70 \\ 70 \\ \end{array} $	$\begin{array}{c} 154.8\\ 155.7\\ 156.7\\ 157.6\\ 158.6\\ 159.6\\ 160.5\\ 161.5\\ 162.5\\ 163.4 \end{array}$	$\begin{array}{r} 44.4\\ 44.7\\ 44.9\\ 45.2\\ 45.5\\ 45.5\\ 45.8\\ 46.0\\ 46.3\\ 46.6\\ 46.9\end{array}$	$\begin{array}{c} 221 \\ 22 \\ 23 \\ 24 \\ 25 \\ 26 \\ 27 \\ 28 \\ 29 \\ 30 \end{array}$	$\begin{array}{c} 212.\ 4\\ 213.\ 4\\ 214.\ 4\\ 215.\ 3\\ 216.\ 3\\ 217.\ 2\\ 218.\ 2\\ 219.\ 2\\ 220.\ 1\\ 221.\ 1 \end{array}$	$\begin{array}{c} 60.9\\ 61.2\\ 61.5\\ 61.7\\ 62.0\\ 62.3\\ 62.6\\ 62.8\\ 63.1\\ 63.4 \end{array}$	$281 \\ 82 \\ 83 \\ 84 \\ 85 \\ 86 \\ 87 \\ 88 \\ 89 \\ 90$	$\begin{array}{c} 270. \cdot 1 \\ 271. 1 \\ 272. 0 \\ 273. 0 \\ 274. 0 \\ 274. 9 \\ 275. 9 \\ 276. 8 \\ 277. 8 \\ 278. 8 \\ 278. 8 \end{array}$	$\begin{array}{c} 77.5\\ 77.7\\ 78.0\\ 78.3\\ 78.6\\ 78.8\\ 79.1\\ 79.4\\ 79.7\\ 79.9\end{array}$
$51 \\ 52 \\ 53 \\ 54 \\ 55 \\ 56 \\ 57 \\ 58 \\ 59 \\ 60$	$\begin{array}{r} 49.0\\ 50.0\\ 50.9\\ 51.9\\ 52.9\\ 53.8\\ 54.8\\ 55.8\\ 56.7\\ 57.7\end{array}$	$\begin{array}{c} 14. 1 \\ 14. 3 \\ 14. 6 \\ 14. 9 \\ 15. 2 \\ 15. 4 \\ 15. 7 \\ 16. 0 \\ 16. 3 \\ 16. 5 \end{array}$	$ \begin{array}{r} 111 \\ 12 \\ 13 \\ 14 \\ 15 \\ 16 \\ 17 \\ 18 \\ 19 \\ 20 \\ \end{array} $	$\begin{array}{c} 106.\ 7\\ 107.\ 7\\ 108.\ 6\\ 109.\ 6\\ 110.\ 5\\ 111.\ 5\\ 112.\ 5\\ 113.\ 4\\ 114.\ 4\\ 115.\ 4 \end{array}$	$\begin{array}{c} 30.\ 6\\ 30.\ 9\\ 31.\ 1\\ 31.\ 4\\ 31.\ 7\\ 32.\ 0\\ 32.\ 2\\ 32.\ 5\\ 32.\ 8\\ 33.\ 1\\ \end{array}$	$ \begin{array}{r} 171 \\ 72 \\ 73 \\ 74 \\ 75 \\ 76 \\ 77 \\ 78 \\ 79 \\ 80 \\ \end{array} $	$\begin{array}{c} 164.4\\ 165.3\\ 166.3\\ 167.3\\ 168.2\\ 169.2\\ 170.1\\ 171.1\\ 172.1\\ 173.0\\ \end{array}$	$\begin{array}{r} 47.1\\ 47.4\\ 47.7\\ 48.0\\ 48.2\\ 48.5\\ 48.5\\ 48.8\\ 49.1\\ 49.3\\ 49.6\end{array}$	$231 \\ 32 \\ 33 \\ 34 \\ 35 \\ 36 \\ 37 \\ 38 \\ 39 \\ 40$	$\begin{array}{c} 222.1\\ 223.0\\ 224.0\\ 224.9\\ 225.9\\ 225.9\\ 226.9\\ 227.8\\ 228.8\\ 229.7\\ 230.7 \end{array}$	$\begin{array}{c} 63.\ 7\\ 63.\ 9\\ 64.\ 2\\ 64.\ 5\\ 64.\ 8\\ 65.\ 1\\ 65.\ 3\\ 65.\ 6\\ 65.\ 9\\ 66.\ 2\end{array}$	$291 \\ 92 \\ 93 \\ 94 \\ 95 \\ 96 \\ 97 \\ 98 \\ 99 \\ 300$	$\begin{array}{c} 279.\ 7\\ 280.\ 7\\ 281.\ 6\\ 282.\ 6\\ 283.\ 6\\ 284.\ 5\\ 285.\ 5\\ 286.\ 5\\ 287.\ 4\\ 288.\ 4 \end{array}$	$\begin{array}{c} 80.\ 2\\ 80.\ 5\\ 80.\ 8\\ 81.\ 0\\ 81.\ 3\\ 81.\ 6\\ 81.\ 9\\ 82.\ 1\\ 82.\ 4\\ 82.\ 7\end{array}$
Dist.	Dep.	Lat.	Dist.	Dep.	Lat.	Dist. 74° (1	Dep. 06°, 254	Lat. °, 286°	Dist.	Dep.	Lat.	Dist.	Dep.	Lat.

						rī -	FABL	E 2.					[Page	399
		?	Differe	ence of J	Latitud	e and	Departi	ure for	16° (1	164°, 196	3°, 344°	°).		
Dist.	Lat.	Dep.	Dist.	Lat.	Dep.	Dist.	Lat.	Dep.	Dist.	Lat.	Dep.	Dist.	Lat.	Dep.
301	289.3	82.9	$\frac{361}{62}$	347.0	99.5	$421 \\ 22$	404.7	116.0 116.3	481	462.4	132.5 132.8	$541 \\ 42$	520.1	149.1
02	290.5 291.2	83. 5	63	348.9	100.0	23	406.6	116.6	83	464.3	132.0	42	521.0 522.0	149.4 149.7
$ \begin{array}{c} 04 \\ 05 \end{array} $	292.2 293.2	83.8 84.0	$\begin{array}{c} 64 \\ 65 \end{array}$	349.9 350.8	100.3 100.6	$ \begin{array}{c} 24 \\ 25 \end{array} $	$407.6 \\ 408.5$	$116.8 \\ 117.1$	$\frac{84}{85}$	$465.2 \\ 466.2$	133.4 133.6	$\begin{array}{c} 44 \\ 45 \end{array}$	523.0 523.9	150.0 150.2
06	294.1	84.3	66	351.8	100.8	$\frac{26}{97}$	409.5	117.4	86 97	467.2	133.9	46	524.9	150.4
07 08	295.1 296.0	84. 0 84. 9	67 68	352. 8 353. 7	101.1 101.4	$\frac{27}{28}$	410. 4	117.7 117.9	87 88	468.1 469.1	134.2 134.5	$\frac{47}{48}$	525. 9 526. 8	150.7 151.0
09	297.0	85.1 85.4		354.7 355.6	101.7 101.9	$\frac{29}{30}$	412.4	118.2 118.5	89 90	470.1 471.0	134.8 135.0	$\frac{49}{50}$	527.8 528 7	151.3 151.6
$\frac{10}{311}$	$\frac{298.0}{298.9}$	85.7	371	356.6	101.0 102.2	431	414.3	118.8	491	472.0	135.0 135.3	551	529.7	151.0 151.9
12	299.9	86.0	$\frac{72}{73}$	357.6 258.5	102.5	$\frac{32}{22}$	415.2	119.0 110.3	$92 \\ 93$	472.9	135.6 125.9	$\frac{52}{53}$	530.6	152.2
10	300. 8	86.2	74	359.5	102.0	34	417.2	110.0 119.6	94	474.9	136.2	- 55 - 54	532.6	152.0 152.8
15 16	302.8 303.7	86.8	$\frac{75}{76}$	360.4 361.4	103.3 103.6	$\frac{35}{36}$	418.1	$119.9 \\ 120.1$	95 96	475.8 476.8	136.4 136.7	$55 \\ 56$	533.5 534-5	153.0 153.2
17	304.7	87.3	77	362.4	103.9	37	420.0	120.4	97	477.7	137.0	57	535.4	153.5
18 19	305.7	87.6	$\frac{78}{79}$	363.3 364-3	104.2 104.4	$\frac{38}{39}$	421.0 492.0	120.7 121.0	$\frac{98}{99}$	478.7	137.31 137.5	$\frac{58}{59}$	536, 4 537 4	153.8 154.1
$\frac{10}{20}$	307.6	88.2	80	365.3	104.7	40	422.9	121.2	500	480.6	137.8	60	538.3	154.4
$\frac{321}{22}$	308.5	83.4	$\frac{381}{82}$	$\frac{366.2}{267.2}$	105.0 105.3	441	423.9 124.9	121.5	$501 \\ 02$	481.6	138.1 128.3	$\frac{561}{62}$	539.3 540.3	154.7
23	310.5	89.0	83	368.1	105.5	43	425.8	122.1	03	483.5	138.6	63	541.2	155.2
$\frac{24}{25}$	311.4	89.3	$\frac{84}{85}$	$\begin{array}{c c} 369.1 \\ 370.1 \end{array}$	105.8 106.1	$\frac{44}{45}$	$\begin{array}{c} 426.8 \\ 427.7 \end{array}$	122.3 122.6	$ \begin{array}{c} 04 \\ 05 \end{array} $	484.5	138.91 139.2	64 65	542.2 543 1	155.4
26	313.3	89.8	86	371.0	106.4	46	428.7	122.9	06	486.4	139.4	66	544.1	156.0
$\begin{bmatrix} 27\\ 28 \end{bmatrix}$	314.3 315.3	90.1 90.4	$\frac{87}{88}$	$\begin{vmatrix} 372.0 \\ 372.9 \end{vmatrix}$	106.6 106.9	47 48	429.7 430.6	$123.2 \\ 123.4$	$ \begin{array}{c} 07 \\ 08 \end{array} $	487.3	139.7 140.0		545.1 546.0	156.3 156.6
29	316.2	90.6	89	373.9	107.2	49	431.6	123.7	09	489.3	140.3	69	547.0	156.9
30	317.2	90.9	<u>90</u> 391	374.9	107.5 107.7	<u>50</u> 451	432.6	$\frac{124.0}{194.3}$	$\frac{10}{511}$	490.2	140.6 140.8	$\frac{70}{571}$	547.9	157.1 157.3
32	319.1	91.5	92	376.8	108.0	52	434.5	124.6	12	492.1	141.1	72	549.8	157.6
$\frac{33}{34}$	320.1 321.0	$\begin{array}{c}91.8\\92.0\end{array}$	$\begin{array}{c} 93 \\ 94 \end{array}$	377.8	$108.3 \\ 108.6$	$53 \\ 54$	435.4 436.4	124.8 125.1	13 14	493.1 494.1	$141.4 \\ 141.7$	73 74	550.8 551.8	$ 157.9 \\ 158.2$
35	322.0	92.3	95	379.7	108.8	55	437.4	125.4	15	495.0	141.9	75	552.7	158.4
$\begin{vmatrix} 36\\ 37 \end{vmatrix}$	$\begin{array}{c} 323.0 \\ 323.9 \end{array}$	$\begin{array}{c}92.6\\92.9\end{array}$	96 97	$380.6 \\ 381.6$	109.1 109.4	$\frac{56}{57}$	$\begin{array}{c} 438.3 \\ 439.3 \end{array}$	125.7 125.9	$\begin{array}{c} 16\\17\end{array}$	496.0	$142.2 \\ 142.5$	$\begin{array}{c} 76 \\ 77 \end{array}$	553.7 554.6	$\begin{array}{c c} 158.7 \\ 159.0 \end{array}$
38	324.9	93.1	98	382.6	109.7	58	440.2	126.2	18	497.9	142.8	78	555.6	159.3
$\frac{39}{40}$	$\begin{array}{c} 325.8 \\ 326.8 \end{array}$	$\begin{array}{c}93.4\\93.7\end{array}$	$\begin{array}{c} 99\\400 \end{array}$	$383.5 \\ 384.5$	$109.9 \\ 110.2$	$\begin{array}{c} 59\\ 60\end{array}$	$441.2 \\ 442.2$	$126.5 \\ 126.8$	$\begin{array}{c} 19\\20 \end{array}$	498.9 499.8	$143.0 \\ 143.3$	79 80	556.5 557.5	159. ə 159. 8
341	327.8	94.0	401	385.4	110.5	461	443.1	127.0	521	500.8	143.6	581	558.4	160.1
$\begin{array}{c} 42 \\ 43 \end{array}$	328.7 329.7	$94.2 \\ 94.5$	$\begin{bmatrix} 02\\ 03 \end{bmatrix}$	386.4 387.4	$110.8 \\ 111.0$	$\begin{array}{c c} 62\\ 63\end{array}$	444.1	$127.3 \\ 127.6$	$\frac{22}{23}$	501.7 502.7	$143.9 \\ 144.1$	$\frac{82}{83}$	559.4 560.4	160.4 160.6
44	330.7	94.8	04	388.3	111.3	64	446.0	127.9	24	503.7	144.4	84	561.3	161.0
$\begin{array}{c c} 45\\ 46\end{array}$	$331.6 \\ 332.6$	$95.1 \\ 95.3$	$\left \begin{array}{c} 05\\ 06 \end{array} \right $	389.3 390.2	$\begin{array}{c}111.6\\111.9\end{array}$	$\begin{array}{c c} 65\\ 66\end{array}$	$447.0 \\ 447.9$	$128.1 \\ 128.4$	$\begin{array}{c c} 25\\ 26\end{array}$	504.6 505.6	$144.7 \\ 145.0$	$\frac{85}{86}$	$562.3 \\ 563.2$	$\begin{array}{c}161.3\\161.6\end{array}$
47	333.5	95.6	07	391.2	112.1	67	448.9	128.7	27	506.6	145.3	87	564.2	161.8
$\frac{48}{49}$	334. ə 335. 5	95.9 96.2	$\begin{bmatrix} 08\\09 \end{bmatrix}$	392.2 393.1	$112.4 \\ 112.7$	$\begin{array}{c} 68 \\ 69 \end{array}$	449.8 450.8	$129.0 \\ 129.2$	$\frac{28}{29}$	507.5 508.5	$145.6 \\ 145.8$	$\frac{88}{89}$	$565.2 \\ 566.1$	$162.1 \\ 162.4$
50	336.4	96.4	10	394.1	113.0	_70_	451.8	129.5	_ 30	509.4	146.1	90	567.1	162.7
$\frac{351}{52}$	$\begin{array}{c c} 337.4 \\ 338.3 \end{array}$	96.7 97.0	$\begin{bmatrix} 411 \\ 12 \end{bmatrix}$	395.1 396.0	$\begin{array}{c}113.3\\113.5\end{array}$	$\begin{array}{c} 471 \\ 72 \end{array}$	452.7 453.7	$\begin{array}{c}129.8\\130.1\end{array}$	$\frac{531}{32}$	510.4 511.4	$146.4 \\ 146.7$	$591 \\ 92$	568.1 569.0	162.9 163.2
53	339.3	97.3	13	397.0	113.8	73	454.7	130.3	33	512.3	146.9	93	570.0	163.5
$54 \\ 55$	340, 3 341, 2	97.5 97.8	$\begin{array}{c c} 14\\ 15 \end{array}$	397.9 398.9	$114.1 \\ 114.4$	$\left \begin{array}{c} 74 \\ 75 \end{array} \right $	$\begin{array}{c c} 455.6\\ 456.6 \end{array}$	$130.6 \\ 130.9$	$\begin{array}{c} 34\\ 35\end{array}$	$\begin{array}{c}513.3\\514.3\end{array}$	$147.2 \\ 147.5$	$\frac{94}{95}$	571.0 571.9	163.8 164.0
56	342.2	98.1	16	399.9	114.6	76	457.5	131.2	36	515.2	147.8	96	572.9	164.3
$57 \\ 58$	$\begin{array}{c}343.1\\344.1\end{array}$	98.4 98.6	$\begin{bmatrix} 17 \\ 18 \end{bmatrix}$	400.8 401.8	$114.9 \\ 115.2$	$\begin{bmatrix} 77\\78 \end{bmatrix}$	$\left \begin{array}{c} 458.5 \\ 459.5 \end{array} \right $	$\begin{array}{c}131.4\\131.7\end{array}$	$\begin{vmatrix} 37\\-38\end{vmatrix}$	$516.2 \\ 517.2$	$148.0 \\ 148.2$	$\frac{97}{98}$	$573.9 \\ 574.8$	164.6 164.9
59	345.1	98.9	19	402.7	115.5	79	460.4	132.0	39	518.1	148.5	99	575.8	165.1
60	346.0	99.2	20	403.7	115.8	80	461.4	132.3	40	519.1	148.8	600	576.8	165.4
Dist.	Dep.	Lat.	Dist.	Dep.	Lat.	Dist.	Dep.	Lat.	Dist.	Dep.	Lat.	Dist.	Dep.	Lat.
					7	i4° (10	06°, 254	°, 286°)).					

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Pa	ze 400]	1				T.	ABLE	2.			۲.			
		1	Differe	nce of I	atitude	e and	Departu	re for 1	17° (10	63°, 197°	°, 343°).		
Dist.	Lat.	Dep.	Dist.	Lat.	Dep.	Dist.	Lat.	Dep.	Dist.	Lat.	Dep.	Dist.	Lat.	Dep.
1	1.0	0.3	61	58.3	17.8	121	115.7	35, 4	181	173.1	52.9	241	230, 5	70.5
$\frac{2}{3}$	$1.9 \\ 2.9$	0.6	$\begin{array}{c} 62 \\ 63 \end{array}$	$\begin{array}{c} 59.3\\ 60.2 \end{array}$	$18.1 \\ 18.4$	$\frac{22}{23}$	110.7 117.6	36. 0	$\frac{82}{83}$	174.0	53.2 53.5	42 43	231.4 232.4	70.8 71.0
4	3.8	1.2	64 65	61.2	18.7 19.0	24 95	118.6 119 E	36.3 36 =	84 85	176.0 176.0	53.8	44	233.3	71.3
$\begin{bmatrix} 0\\ 6\end{bmatrix}$	4.8	1.0 1.8		$\begin{array}{c} 62.2\\ 63.1 \end{array}$	19.0 19.3	$\begin{array}{c} 20\\ 26\end{array}$	119.5	36. 8	80 86	177.9	54.1 54.4	40 46	234.3 235.3	71.0 71.9
7	6.7	2.0	67	64.1	19.6	27	121.5	37.1	87	178.8	54.7	47	236.2	72.2
$\frac{8}{9}$	8.6	$2.3 \\ 2.6$	68 69	66.0	19.9 20.2	$\begin{array}{c} 28\\29\end{array}$	$122.4 \\ 123.4$	37.7	88 89	179.8	55.0 55.3	48 49	237.2 238.1	$72.0 \\ 72.8$
10	9.6	2.9	70	66.9	$\frac{20.5}{20.2}$	$\frac{30}{191}$	124.3	38.0	90	181.7	55.6	50	239.1	73.1
$11 \\ 12$	$10.5 \\ 11.5$	$\frac{3.2}{3.5}$	$\frac{71}{72}$	$\begin{array}{c} 07.9\\68.9\end{array}$	$20.8 \\ 21.1$	$\begin{vmatrix} 131\\ 32 \end{vmatrix}$	$120.3 \\ 126.2$	58.3 38.6	$\begin{array}{c}191\\92\end{array}$	182.7 183.6	$\begin{array}{c} \text{oo. 8} \\ 56.1 \end{array}$	52	240.0 241.0	73.4 73.7
13	12.4	3.8	73	69.8 70.0	21.3	33	127.2	38.9	93	184.6	56.4	53	241.9	74.0
14 15	13.4 14.3	4.1 4.4	$\frac{74}{75}$	70.8 71.7	$\begin{array}{c} 21.6\\ 21.9 \end{array}$	$\frac{34}{35}$	128.1 129.1	$39.2 \\ 39.5$	$\frac{94}{95}$	180.5 186.5	$ \frac{56.7}{57.0} $	55	242.9 243.9	74.3 74.6
16	15.3	4.7	76	72.7	22.2	36	130.1	39.8	96	187.4	57.3	56	244.8	74.8
17 18	$\begin{array}{c} 16.3\\ 17.2 \end{array}$	$\begin{array}{c} {\rm o.}\ 0 \\ {\rm 5.3} \end{array}$	$\frac{11}{78}$	$\begin{array}{c} 73.6\\74.6\end{array}$	$22.5 \\ 22.8$	$\frac{37}{38}$	$131.0 \\ 132.0$	40.1 40.3	97 98	$188.4 \\ 189.3$	$\begin{array}{c} 57.6\\ 57.9\end{array}$	$\frac{57}{58}$	245.8 246.7	$\begin{array}{c} 75.1 \\ 75.4 \end{array}$
19	18.2	5.6	79	75.5	23.1	39	132.9	40.6	99	190.3	58.2	59	247.7	75.7
$\frac{20}{21}$	$\frac{19,1}{20,1}$	$\frac{0.8}{6.1}$	$-\frac{80}{81}$	77.5	$\frac{23.4}{23.7}$	$\frac{40}{141}$	$\frac{133.9}{134.8}$	40.9	$\frac{200}{201}$	$\frac{191.3}{192.2}$	08.5 58.8	$\frac{60}{261}$	$\frac{248.6}{249.6}$	$\frac{70.0}{76.3}$
22	21.0	6.4	82	78.4	24.0	42	135.8	41.5	02	193.2	59.1	62	250.6	76.6
$\begin{array}{c} 23 \\ 24 \end{array}$	$22.0 \\ 23.0$	$ \begin{array}{c} 6.7 \\ 7.0 \end{array} $	83 84	79.4 80.3	$24.3 \\ 24.6$	$ \frac{43}{44} $	$136.8 \\ 137.7$	$41.8 \\ 42.1$	$\begin{array}{c} 03\\ 04 \end{array}$	194.1 195.1	$59.4 \\ 59.6$	$63 \\ 64$	251.5 252.5	$\begin{array}{c} 76.9 \\ 77.9 \end{array}$
25	23.9	7.3	85	81.3	24.9	45	138.7	42.4	05	196.0	59.9	65	253.4	77.5
$\begin{array}{c} 26 \\ 27 \end{array}$	$24.9 \\ 25.8$	$7.6 \\ 7.9$	$\frac{86}{87}$	$\begin{array}{c} 82.2\\ 83.2\end{array}$	$25.1 \\ 25.4$	$\begin{array}{c} 46\\ 47\end{array}$	$139.6 \\ 140.6$	$\begin{array}{c}42.7\\43.0\end{array}$	$\begin{array}{c} 06\\ 07\end{array}$	197.0 198.0	$\begin{array}{c} 60.2\\ 60.5\end{array}$	$66 \\ 67$	$254.4 \\ 255.3$	77.8
28	26.8	8.2	88	84.2	25.7	48	141.5	43.3	08	198.9	60.8	68	256.3	78.4
$ \frac{29}{30} $	$27.7 \\ 28.7$	$8.5 \\ 8.8$	89 90	85.1 86.1	$26.0 \\ 26.3$	$\begin{array}{c} 49 \\ 50 \end{array}$	$142.5 \\ 143.4$	$ \begin{array}{c} 43.6 \\ 43.9 \end{array} $	09 10	199.9 200.8	$\begin{array}{c} 61.1\\ 61.4\end{array}$		$257.2 \\ 258.2$	78.6 78.9
31	29.6	9.1	91	87.0	26.6	151	144.4	44.1	211	201.8	61.7	271	259.2	79.2
$\frac{32}{33}$	30.6 31.6	9.4 9.6	92 93	88.0 88.0	$\begin{array}{c} 26.9 \\ 27.2 \end{array}$	$52 \\ 53$	145.4 146.3	44.4	12 13	202.7 203.7	$\begin{array}{c} 62.0\\ 62.2 \end{array}$	$72 \\ 73$	260.1 261.1	79.5
34	32.5	9.9	94	89.9	27.5	54	147.3	45.0	14	204.6	62.6	74	262.0	80.1
35 36	33.5	$10.2 \\ 10.5$	95 96	90.8 91.8	27.8 28 1	$55 \\ 56$	148.2 149.9	45.3 45.6	$15 \\ 16$	205.6 206.6	62.9 63.2	75	$\begin{array}{c} 263.0\\ 263.0 \end{array}$	80.4
37	35.4	10.8	97	92.8	28.4	57	150.1	45.9	17	200.0 207.5	63.4	77	264.9	81.0
38 30	$\frac{36.3}{37.3}$	11.1 11.4	98 90	93.7 94.7	28.7 28.9	$58 \\ 59$	151.1 152.1	$46.2 \\ 46.5$	18 19	208.5 209.4	63.7	78 70	265.9 266.8	81.3
.40	38.3	11.4 11.7	100	95.6	20.9 29.2	60	153.0	46.8	20^{19}	210.4	64.3	80	267.8	81.9
41	39.2	12.0 12.2	101	96.6	29.5	161	154.0 154.0	47.1	221	211.3 212.2	64.6 64.0	281	268.7 260.7	82.2
$\begin{array}{c} 42\\ 43\end{array}$	40.2 41.1	12.3 12.6	02	97.5 98.5	30.1	63	154.9	47.7	$\frac{22}{23}$	212.3 213.3	04.9 65.2	82 83	209.7 270.6	82.4 82.7
44	42.1	12.9 12.9	04	99.5	30.4	64 e=	156.8	47.9	24	214.2 215.2	65.5	84	271.6	83.0
$\frac{45}{46}$	43.0 44.0	$13.2 \\ 13.4$	05	100.4	30.7 31.0	60 66	157.8	48.2 48.5	$\frac{25}{26}$	210.2 216.1	-66, 1	85 86	272.5 273.5	00.3 83.6
47	44.9	13.7	07	102.3	31.3	67	159.7	48.8	27	217.1	66.4	87	274.5	83.9
$\begin{array}{c} 48\\ 49\end{array}$	45.9 46.9	14.0 14.3	08 09	103.3 104.2	$31.6 \\ 31.9$	$\begin{array}{c} 68\\ 69\end{array}$	160.7 161.6	49.1 49.4	$\frac{28}{29}$	218.0 219.0	67. 0	88 89	275.4 276.4	84.5
_50	47.8	14.6	10	105.2	32.2	70	162.6	49.7	30	220.0	67.2	90	277.3	84.8
$51 \\ 52$	$48.8 \\ 49.7$	$14.9 \\ 15.2$	$111 \\ 12$	106.1 107.1	32.5 32.7	$\begin{array}{c} 171 \\ 72 \end{array}$	163.5 164.5	50.0 50.3	$\frac{231}{32}$	220.9 221.9	$67.5 \\ 67.8$	$291 \\ 92$	278.3 279.2	
53	50.7	15.5	13	108.1	33.0	73	165.4	50.6	33	222.8	68.1	93	280.2	85.7
54 55	$51.6 \\ 52.6$	$15.8 \\ 16.1$	$14 \\ 15$	109.0	33.3 33.6	$\frac{74}{75}$	166.4 167.4	$50.9 \\ 51.2$	$\frac{34}{35}$	223.8 224.7	$68.4 \\ 68.7$	94 95	$ \begin{array}{c} 281.2 \\ 282.1 \end{array} $	86.0 86.2
56	53.6	16.4	16	110.9	33.9	76	168.3	51.5	36	225.7	69.0	96	283.1	86.5
$57 \\ 58$	$54.5 \\ 55.5$	$\begin{array}{c}16.7\\17.0\end{array}$	$17 \\ 18$	$111.9 \\ 112.8$	$34.2 \\ 34.5$	$\begin{array}{c} 77 \\ 78 \end{array}$	$169.3 \\ 170.2$	$51.7 \\ 52.0$	$\frac{37}{38}$	226.6 227.6	69.3 69.6	97 98	284.0 285.0	86.8 87.1
59	56.4	17.2	19	113.8	34.8	79	171.2	52.3	39	228.6	69.9	99	285.9	87.4
60	57.4	17.5	20	114.8	35.1	80	172.1	ə2. 6	40	229.5	70.2	300	286.9	87.7
Dist.	Dep.	Lat.	Dist.	Dep.	Lat.	Dist.	Dep.	Lat,	Dist.	Dep.	Lat,	Dist.	Dep.	Lat.
						13~ (1	07~, 253	·-, 287°).					

						ſ	TABLI	E 2.					[Page	e 40 1
			Diffe	rence of	Latitu	de an	d Depar	ture for	r 17°	(163°, 19	97°, 343	3°).		
Dist.	Lat.	Dep.	Dist.	Lat.	Dep.	Dist.	Lat.	Dep.	Dist.	Lat.	Dep.	Dist.	Lat.	Dep.
$301 \\ 02$	287.8	88.0	$\frac{361}{62}$	345.2 346.1	105.5 105.8	$\frac{421}{22}$	402.6 403.5	123.1 123.4	481 82	460.0	140.6	$541 \\ 49$	517.3 518.3	158.2 158.5
03	289.7	88.6	63	347.1	106.1	23	404.5	123.7	83	461.9	141.2	43	519.2	158.8
$04 \\ 05$	290.7 291.6	88.9 89.2	$64 \\ 65$	348.1 349.0	106.4	$\frac{24}{25}$	405.4	124.0 124.3	84 85	$\begin{array}{c c} 462.8 \\ 463.8 \end{array}$	141.0 141.8	44 45	520.2 521.2	159.1 159.3
06	292.6	89.5		350.0 350.9	107.0 107.3	$\frac{26}{27}$	407.3 408.3	124.6 124.8	86 87	464.7 465.7	142.1 142.3	$\frac{46}{47}$	522.1 523.1	159.6 159.9
08	294.5	90.1	68	351.9	107.6	28	409.3	125.1	88	466.7	142.6	48	524.0	160.2
09	295.5	90.3	69 70	352.8 353.8	107.9 108.2	$\frac{29}{30}$	410.2 411.2	$\begin{array}{c c} 125. \\ 125. \\ 7 \end{array}$	89 90	467.6	142.9 143.2	$\frac{49}{50}$	525.0 526.0	160.5 160.8
$\frac{311}{12}$	297.4	90.9	$\frac{371}{79}$	354.8 355.7	108.5 108.8	431	412.1	126.0 126.3	491	469.5 470.5	143.5 113.8	$551 \\ 52$	526.9 527 9	161.1 161.1
$12 \\ 13 \\ 13$	299.3	91.5	73	356.7	109.1	33	414.0	126.6	93	471.4	144.1	53	528.8	161.7
$14 \\ 15$	300.2 301.2	91.8 92.1	$ \begin{array}{c} 74 \\ 75 \end{array} $	357.6 358.6	109.4	$\frac{34}{35}$	415.0 416.0	$126.9 \\ 127.2$	$94 \\ 95$	472.4	144.4	$\frac{54}{55}$	$\begin{array}{c} 529.8 \\ 530.8 \end{array}$	$ \begin{array}{c c} 162.0 \\ 162.3 \end{array} $
$16 \\ 17$	302.2	92.4	76	359.5	109.9	$\frac{36}{37}$	416.9	127.5 197.8	96 97	474.3	145.0 1.15 3	$\frac{56}{57}$	531.7 532.7	162.6
18	305.1 304.1	93.0	78	361.4	110.2 110.5	38	418.8	127.0	98	476.2	145.6	58	533.6	162.5 163.2
$\frac{19}{20}$	305.0 306.0	93.3 93.6	$\begin{array}{c} 79 \\ 80 \end{array}$	$362.4 \\ 363.4$	$110.8 \\ 111.1$	$\frac{39}{40}$	$419.8 \\ 420.7$	128.4 128.6	$\frac{99}{500}$	$ 477.2 \\ 478.1 $	$145.9 \\ 146.2$	$\frac{59}{60}$	534.6 535.5	163.5 163.8
321	306.9	93.9	381	364.3	111.4	441	421.7	128.9	501	479.1	146.5	561	536.5	164.1
$\frac{22}{23}$	307.9	94.1 94.4	$\frac{82}{83}$	365.3 366.2	111.7 112.0	42 43	422.7 423.6	129.2 129.5	$ \begin{array}{c} 02 \\ 03 \end{array} $	481.0	140.8 147.1	$\frac{62}{63}$	538.4	164.4 164.6
$\frac{24}{25}$	309.8 310.8	94.7 95.0	84 85	$367.2 \\ 368.1$	112.3 112.6	44 45	424.6 425.5	129.8 130.1	$04 \\ 05$	482.0	147.4 147.7	$64 \\ 65$	539.4 540.3	164.8 165.1
26 26	311.7	95.3	86 87	369.1	112.9	46	426.5	130.4	06	483.9	148.0	66 67	541.3	165.4
$\frac{27}{28}$	312.7 313.6	95.6 95.9	87 88	370.1 371.0	113.2 113.4	47	427.4	130.7 131.0	07	484.8	148.3 148.6	$\frac{67}{68}$	542.2 543.2	165.7 166.0
$\frac{29}{30}$	$314.6 \\ 315.5$	96.2 96.5	- 89 90	$372.0 \\ 372.9$	113.7 114 0	$\frac{49}{50}$	429.3 430.3	$131.3 \\ 131.6$	09 10	486.7 487.7	148.9 149.1	$\frac{69}{70}$	$544.1 \\ 545.1$	$166.4 \\ 166.7$
331	316.5	96.8	391	373.9	114.3	451	431.3	131.9	511	488.7	149.4	571	546.1	167.0
$\begin{array}{c} 32\\ 33\end{array}$	$317.5 \\ 318.4$	$\begin{array}{c}97.1\\97.4\end{array}$	$\frac{92}{93}$	$374.8 \\ 375.8$	$114.6 \\ 114.9$	$\frac{52}{53}$	$\frac{432.2}{433.2}$	$132.2 \\ 132.4$	$12 \\ 13$	489.6 490.6	149.7 150.0	$72 \\ 73$	$547.0 \\ 548.0$	$167.2 \\ 167.5$
34	319.4	97.7	94 95	376.7	115.2	54 55	434.1	132.7 123.0	14 15	491.5	150.2 150.5	$\frac{74}{75}$	548.9 549.9	167.8 168 1
36 36	320.3 321.3	97.9 98.2	95 96	377.7 378.7	115.0 115.8	$\frac{55}{56}$	435.1	133.0 133.3	16	492. 3	150.5 150.8	76 76	550.8	168.1 168.4
$\frac{37}{38}$	$\begin{array}{c} 322.\ 2\\ 323 \end{array}$	98.5 98.8	97 98	379.6 380.6	$116.1 \\ 116.4$	$\frac{57}{58}$	437.0 438.0	133.6 133.9	$17 \\ 18$	494.4	151.1 151.4	$77 \\ 78$	551.8 552.7	$168.7 \\ 169.0$
39	324.2	99.1	99	381.5	116.7	59 60	438.9	134.2	19	496.3	151.7	79	553.7	169.3
$\frac{40}{341}$	$\frac{329.1}{326.1}$	$\frac{99.4}{99.7}$	$\frac{400}{401}$	$\frac{382.9}{383.4}$	$\frac{117.0}{117.2}$	$\frac{60}{461}$	439.9	$\frac{134.9}{134.8}$	$\frac{20}{521}$	$\frac{497.2}{498.2}$	$\frac{152.0}{152.3}$	$\frac{80}{581}$	555.6	$\frac{109.0}{169.9}$
42	327.0	100.0 100.3	$\frac{02}{03}$	384.4	117.5 117.8	$62 \\ 63$	441.8	135.1 135.1	22 23	499.2 500.1	152.6 152.9	82 83	556.5 557.5	170.2 170.5
44	328.9 328.9	100.5 100.6	03	386.3	117.8	64	442.7	135.4 135.7	23 24	500.1 501.1	152.5 153.2	84 84	557.5 558.4	170.8
$\frac{45}{46}$	329.9 330.8	$100.9 \\ 101.2$	$\begin{array}{c} 05\\ 06\end{array}$	$387.3 \\ 388.2$	118.4 118.7	$\begin{array}{c} 65\\ 66\end{array}$	$444.6 \\ 445.6$	$136.0 \\ 136.2$	$\frac{25}{26}$	502.0 503.0	$153.5 \\ 153.8$	$\frac{85}{86}$	$559.4 \\ 560.4$	$171.1 \\ 171.3$
47	331.8	101.5	07	389.2	119.0	67	446.6	136.5	27	503.9	154.1 151 1	87	561.3	171.6
48 49	333.7	101.8 102.0	08	390.1 391.1	119.5	69	447.5	130.8 137.1	$\frac{28}{29}$	504. 9 505. 9	154.4 154.7	89 89	562.5 563.2	171.9 172.2
$\frac{50}{351}$	$\frac{334.7}{335.6}$	$\frac{102.3}{102.6}$	$\frac{10}{111}$	$\frac{392.0}{393.0}$	$\frac{119.9}{120.2}$	$\frac{70}{171}$	$\frac{449.4}{150.4}$	$\frac{137.4}{137.7}$	$\frac{30}{531}$	$\frac{506.8}{507.8}$	$\frac{155.0}{155.3}$	$\frac{90}{591}$	$\frac{564.2}{565.1}$	$\frac{172.5}{172.8}$
$551 \\ 52 \\ 52 \\ 52 \\ 52 \\ 52 \\ 52 \\ 52 \\$	336.6	102.0 102.9	12	393.0 394.0	120.2 120.5	72	450.4 451.3	137.7	32	507.8 508.7	155.6 155.6	92	566.1	172.3 173.1
$\frac{53}{54}$	337.5 338.5	$103.2 \\ 103.5$	$\begin{array}{c}13\\14\end{array}$	394.9 395.9	$\begin{array}{c} 120.8\\ 121.0 \end{array}$	$\begin{bmatrix} 73\\74 \end{bmatrix}$	$452.3 \\ 453.3$	$138.3 \\ 138.6$	- 33 - 34	509.7 510.6	$155.9 \\ 156.2$	$\frac{93}{94}$	$567.1 \\ 568.0$	$173.4 \\ 173.7$
55	339.5	103.8	15	396.8	121.3	75	454.2	138.9	35	511.6	156.5	95 06	569.0	174.0
57	341.4	104.1	10	397.8 398.7	$121.0 \\ 121.9$	77	456.2 456.1	139. 2 139. 5	30 37	512.6 513.5	150.8 157.1	96 97	569.9 570.9	174.6
$58 \\ 59$	$\begin{array}{c} 342.3 \\ 343.3 \end{array}$	104.7 105.0	$\frac{18}{19}$	399.7 400.7	122.2 122.5	$\frac{78}{79}$	$457.1 \\ 458.0$	139.8 140.0	$\frac{38}{39}$	514.5 515.4	157.3 157.6	- 98 - 99	$571.8 \\ 572.8$	$174.9 \\ 175.2$
60	344.2	105.3	$\frac{10}{20}$	401.6	122.8	80	459.0	140.3	40	516.4	157.9	600	573.8	175.4
Dist.	Dep.	Lat.	Dist.	Dep.	Lat.	Dist.	Dep.	Lat.	Dist.	Dep.	Lat.	Dist.	Dep.	Lat.
					7	73° (1	07°, 253	°, 287°).					

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Pa	ge 402]				Г	ABLE	2.						
		J	Differe	ence of J	Latitud	e and	Departu	ire for	18° (1	.62°, 198	°, 342°	').		·
Dist.	Lat.	Dep.	Dist.	Lat.	Dep.	Dist.	Lat.	Dep.	Dist.	Lat.	Dep.	Dist.	Lat.	Dep.
$\begin{array}{c}1\\2\\3\end{array}$	1.0 1.9 2.9	$0.3 \\ 0.6 \\ 0.9 \\ 1.9$		58.0 59.0 59.9 30.0	$ \begin{array}{r} 18.9 \\ 19.2 \\ 19.5 \\ 10.8 \end{array} $	$121 \\ 22 \\ 23 \\ 24$	$115.1 \\ 116.0 \\ 117.$	37.4 37.7 38.0	181 82 83	$172.1 \\ 173.1 \\ 174.0 \\ 175.$	$55.9 \\ 56.2 \\ 56.6 \\ 56.0 \\ 100 $	$241 \\ 42 \\ 43 \\ 41$	$\begin{array}{c} 229.\ 2\\ 230.\ 2\\ 231.\ 1\\ 232.\ 1\end{array}$	74.5 74.8 75.1
+ 5 - 6 - 7	$ \begin{array}{r} 0.0 \\ 4.8 \\ 5.7 \\ 6.7 \\ \end{array} $	$1.2 \\ 1.5 \\ 1.9 \\ 2.2$	65 66 67	$\begin{array}{c} 60.9 \\ 61.8 \\ 62.8 \\ 63.7 \end{array}$	$ \begin{array}{c c} 19.8 \\ 20.1 \\ 20.4 \\ 20.7 \end{array} $	$ \begin{array}{r} 24 \\ 25 \\ 26 \\ 27 \end{array} $	$ \begin{array}{r} 117.9 \\ 118.9 \\ 119.8 \\ 120.8 \end{array} $	38.6 38.9 39.2	84 85 86 87	$ \begin{array}{r} 175.0 \\ 175.9 \\ 176.9 \\ 177.8 \\ \end{array} $	50.9 57.2 57.5 57.8	44 45 46 47	$232.1 \\ 233.0 \\ 234.0 \\ 234.9$	75.4 75.7 76.0 76.3
$\begin{array}{r} 8\\9\\10\end{array}$	7.6 8.6 9.5	2.5 2.8 3.1		$\begin{array}{c} 64.7 \\ 65.6 \\ 66.6 \end{array}$	$\begin{array}{c} 21.0 \\ 21.3 \\ 21.6 \\ \end{array}$	$ \begin{array}{r} 28 \\ 29 \\ 30 \\ \hline 121 \end{array} $	$121.7 \\ 122.7 \\ 123.6 \\ 124.9 \\ 124.$	39.6 39.9 40.2	88 89 90	$178.8 \\ 179.7 \\ 180.7 \\ 101.5 \\ 101.5 \\ 101.5 \\ 101.5 \\ 100.$	58.1 58.4 58.7	48 49 50	$\begin{array}{c} 235.9 \\ 236.8 \\ 237.8 \end{array}$	$\begin{array}{c} 76.6 \\ 76.9 \\ 77.3 \end{array}$
$ \begin{array}{c} 11 \\ 12 \\ 13 \\ 14 \\ 15 \\ 16 \\ \end{array} $	$10.5 \\ 11.4 \\ 12.4 \\ 13.3 \\ 14.3 \\ 15.9 \\ 15.9 \\ 10.5 \\ $	3.4 3.7 4.0 4.3 4.6	$71 \\ 72 \\ 73 \\ 74 \\ 75 \\ 76$	$\begin{array}{c} 67.5\\ 68.5\\ 69.4\\ 70.4\\ 71.3\\ 72.9\end{array}$	$\begin{array}{c} 21.9\\ 22.2\\ 22.6\\ 22.9\\ 23.2\\ 23.2\\ 22.5\\ 23.2\\ 23.5\\$	$ \begin{array}{r} 131 \\ 32 \\ 33 \\ 34 \\ 35 \\ 26 \end{array} $	$124.6 \\ 125.5 \\ 126.5 \\ 127.4 \\ 128.4 \\ 120.9 \\ 120.$	$\begin{array}{c} 40.5 \\ 40.8 \\ 41.1 \\ 41.4 \\ 41.7 \\ 42.0 \end{array}$	191 92 93 94 95	$181.7 \\ 182.6 \\ 183.6 \\ 184.5 \\ 185.5 \\ 185.4 \\ 185.5 \\ 185.4 \\ 185.5 \\ 185.4 \\ 185.5 \\ 185.4 \\ 185.$	$59.0 \\ 59.3 \\ 59.6 \\ 59.9 \\ 60.3 \\ $	$251 \\ 52 \\ 53 \\ 54 \\ 55 \\ 55 \\ 55 \\ 55 \\ 55 \\ 55$	$238.7 \\ 239.7 \\ 240.6 \\ 241.6 \\ 242.5 \\ 242.$	77.677.978.278.578.8
$ \begin{array}{r} 16 \\ 17 \\ 18 \\ 19 \\ 20 \end{array} $	$ \begin{array}{r} 15.2 \\ 16.2 \\ 17.1 \\ 18.1 \\ 19.0 \\ \end{array} $	$\begin{array}{c} 4.9 \\ 5.3 \\ 5.6 \\ 5.9 \\ 6.2 \end{array}$	76 77 78 79 80	$\begin{array}{c} 72.3 \\ 73.2 \\ 74.2 \\ 75.1 \\ 76.1 \end{array}$	$23.5 \\ 23.8 \\ 24.1 \\ 24.4 \\ 24.7$	$ 36 \\ 37 \\ 38 \\ 39 \\ 40 $	129.3130.3131.2132.2133.1	$\begin{array}{c} 42.0 \\ 42.3 \\ 42.6 \\ 43.0 \\ 43.3 \end{array}$	96 97 98 99 200	$186. + 187. + 187. + 188 3 \\189 3 \\190 2$	$\begin{array}{c} 60.\ 6\\ 60.\ 9\\ 61.\ 2\\ 61.\ 5\\ 61.\ 8\end{array}$	56 57 58 59 60	243. 5244. 4245. 4246. 3247. 3	79. 1 79. 4 79. 7 80. 0 80. 3
$21 \\ 22 \\ 23 \\ 24 \\ 25$	$\begin{array}{c} 20.\ 0\\ 20.\ 9\\ 21.\ 9\\ 22.\ 8\\ 22.\ 8\\ 22.\ 8\end{array}$	$\begin{array}{c} 6.5 \\ 6.8 \\ 7.1 \\ 7.4 \\ 7.4 \end{array}$	81 82 83 84	77.078.078.979.920.8	$\begin{array}{c} 25.0 \\ 25.3 \\ 25.6 \\ 26.0 \\ 26.2 \end{array}$	$ \begin{array}{r} 141 \\ 42 \\ 43 \\ 44 \\ 45 \end{array} $	$ \begin{array}{r} 134.1 \\ 135.1 \\ 136.0 \\ 137.0 \\ 127.0 \\ \end{array} $	$\begin{array}{r} 43.6 \\ 43.9 \\ 44.2 \\ 44.5 \\ 44.5 \\ 44.8 \end{array}$	$201 \\ 02 \\ 03 \\ 04 \\ 05$	$ \begin{array}{r} 191.2 \\ 192.1 \\ 193.1 \\ 194.0 \\ 105.0 \\ \end{array} $	$\begin{array}{c} 62.1 \\ 62.4 \\ 62.7 \\ 63.0 \\ 63.2 \end{array}$	$ \begin{array}{r} 261 \\ 62 \\ 63 \\ 64 \\ e5 \end{array} $	$\begin{array}{c} 248.\ 2\\ 249.\ 2\\ 250.\ 1\\ 251.\ 1\\ 252.\ 0\end{array}$	$ \begin{array}{r} 80.7 \\ 81.0 \\ 81.3 \\ 81.6 \\ 01.0 \end{array} $
$ \begin{array}{r} 25 \\ 26 \\ 27 \\ 28 \\ 29 \end{array} $	$23.8 \\ 24.7 \\ 25.7 \\ 26.6 \\ 27.6$	8.0 8.3 8.7 9.0	89 86 87 88 89	$ \begin{array}{c} 80.8\\ 81.8\\ 82.7\\ 83.7\\ 84.6 \end{array} $	$20.5 \\ 26.6 \\ 26.9 \\ 27.2 \\ 27.5$	40 46 47 48 49	$137.9 \\138.9 \\139.8 \\140.8 \\141.7$	$\begin{array}{r} 44.0 \\ 45.1 \\ 45.4 \\ 45.7 \\ 46.0 \end{array}$	05 06 07 08 09	$ 195.0 \\ 195.9 \\ 196.9 \\ 197.8 \\ 198.8 $	$\begin{array}{c} 63. \ 5\\ 63. \ 7\\ 64. \ 0\\ 64. \ 3\\ 64. \ 6\end{array}$	66 67 68 69	252.0 253.0 253.9 254.9 255.8	81.982.282.582.883.1
$\begin{array}{r} 30\\ \hline 31\\ 32 \end{array}$	$ \begin{array}{r} 28.5 \\ \hline 29.5 \\ 30.4 \end{array} $	$ \begin{array}{r} 9.3 \\ 9.6 \\ 9.9 \end{array} $	$\begin{array}{r} 90\\ \hline 91\\ 92 \end{array}$	$ \frac{85.6}{86.5} \\ 87.5 $	$ \begin{array}{r} 27.8 \\ \overline{28.1} \\ 28.4 \end{array} $		$\frac{142.7}{143.6}\\144.6$	$ \begin{array}{r} 46.4 \\ 46.7 \\ 47.0 \\ \end{array} $	$\begin{array}{r}10\\\hline 211\\12\end{array}$	$ \begin{array}{r} 199.7 \\ \overline{200.7} \\ 201.6 \end{array} $	$ \begin{array}{r} 64.9 \\ \overline{65.2} \\ \overline{65.5} \end{array} $	$ \begin{array}{r} 70 \\ \hline 271 \\ 72 \\ \end{array} $	$\frac{256.8}{257.7}\\258.7$	$\frac{83.4}{83.7}$ 84.1
$\begin{array}{c} 33 \\ 34 \\ 35 \\ 36 \end{array}$	$\begin{array}{c} 31.4\\ 32.3\\ 33.3\\ 34.2\end{array}$	$\begin{array}{c} 10.\ 2 \\ 10.\ 5 \\ 10.\ 8 \\ 11.\ 1 \end{array}$	93 94 95 96	88.4 89.4 90.4 91.3	$\begin{array}{c} 28.7 \\ 29.0 \\ 29.4 \\ 29.7 \end{array}$	$53 \\ 54 \\ 55 \\ 56$	$145.5 \\ 146.5 \\ 147.4 \\ 148.4$	$\begin{array}{r} 47.3 \\ 47.6 \\ 47.9 \\ 48.2 \end{array}$	$ \begin{array}{c} 13 \\ 14 \\ 15 \\ 16 \end{array} $	$\begin{array}{c} 202.\ 6\\ 203.\ 5\\ 204.\ 5\\ 205.\ 4\end{array}$	$\begin{array}{c} 65.8 \\ 66.1 \\ 66.4 \\ 66.7 \end{array}$	73 74 75 76	$\begin{array}{c} 259.\ 6\\ 260.\ 6\\ 261.\ 5\\ 262.\ 5\end{array}$	$\begin{array}{c} 84.4\\ 84.7\\ 85.0\\ 85.3\end{array}$
$ \begin{array}{r} 37 \\ 38 \\ 39 \\ 40 \end{array} $	$35.2 \\ 36.1 \\ 37.1 \\ 38.0$	$11.4 \\ 11.7 \\ 12.1 \\ 12.4$	$97 \\ 98 \\ 99 \\ 100$	$\begin{array}{c} 92.\ 3\\ 93.\ 2\\ 94.\ 2\\ 95.\ 1\end{array}$	$\begin{array}{c} 30.\ 0\\ 30.\ 3\\ 30.\ 6\\ 30.\ 9\end{array}$	$57 \\ 58 \\ 59 \\ 60$	$149.3 \\ 150.3 \\ 151.2 \\ 152.2$	$\begin{array}{r} 48.5 \\ 48.8 \\ 49.1 \\ 49.4 \end{array}$	$ \begin{array}{c} 17 \\ 18 \\ 19 \\ 20 \end{array} $	$206.4 \\ 207.3 \\ 208.3 \\ 209.2$	$\begin{array}{c} 67.1 \\ 67.4 \\ 67.7 \\ 68.0 \end{array}$	77 78 79 80	263. 4264. 4265. 3266. 3	$\begin{array}{c} 85.\ 6\\ 85.\ 9\\ 86.\ 2\\ 86.\ 5\end{array}$
$41 \\ 42 \\ 43 \\ 44$	$\begin{array}{c} 39.0\\ 39.9\\ 40.9\\ 41.8\end{array}$	$ \begin{array}{c} 12.7\\ 13.0\\ 13.3\\ 13.6\\ \end{array} $	$ \begin{array}{c} 101 \\ 02 \\ 03 \\ 04 \\ \end{array} $	$\begin{array}{c} 96.1\\ 97.0\\ 98.0\\ 98.9\\ \end{array}$	$31.2 \\ 31.5 \\ 31.8 \\ 32.1 $	$ \begin{array}{r} 161 \\ 62 \\ 63 \\ 64 \\ 35 \end{array} $	$\begin{array}{c} 153.1\\ 154.1\\ 155.0\\ 156.0\end{array}$	$\begin{array}{r} 49.8 \\ 50.1 \\ 50.4 \\ 50.7 \end{array}$	$221 \\ 22 \\ 23 \\ 24 \\ 25$	$\begin{array}{c} 210.\ 2\\ 211.\ 1\\ 212.\ 1\\ 213.\ 0 \end{array}$	$\begin{array}{c} 68.3 \\ 68.6 \\ 68.9 \\ 69.2 \end{array}$		$\begin{array}{c} 267.\ 2\\ 268.\ 2\\ 269.\ 1\\ 270.\ 1\\ \end{array}$	86.8 87.1 87.5 87.8
45 46 47 48 40	$\begin{array}{c} 42.8\\ 43.7\\ 44.7\\ 45.7\\ \end{array}$	$13.9 \\ 14.2 \\ 14.5 \\ 14.8 \\ 15.1 \\ $	$ \begin{array}{c} 05 \\ 06 \\ 07 \\ 08 \\ 20 \\ \end{array} $	99.9100.8101.8102.7102.7	32.4 32.8 33.1 33.4 22.7		$156.9 \\ 157.9 \\ 158.8 \\ 159.8 \\ 169.7 \\ 160.7 \\ 100.$	51.0 51.3 51.6 51.9 52.9	$ \begin{array}{c} 25 \\ 26 \\ 27 \\ 28 \\ 20 \end{array} $	$\begin{array}{c} 214.\ 0\\ 214.\ 9\\ 215.\ 9\\ 216.\ 8\\ 217.\ 9\end{array}$	$\begin{array}{c} 69.5\\ 69.8\\ 70.1\\ 70.5\\ -0.5\\ -0.8\\ \end{array}$	85 86 87 88	$271.1 \\ 272.0 \\ 273.0 \\ 273.9 \\ 271.0 \\ 273.9 \\ 271.0 \\ 271.$	88.1 88.4 88.7 89.0
$ \frac{49}{50} 51 51 $	$ \frac{46.6}{47.6} \frac{48.5}{10.5} $	$15.1 \\ 15.5 \\ 15.8 \\ 10.1 \\ $	$ \begin{array}{r} 09 \\ 10 \\ 111 \\ 12 \end{array} $	$ \begin{array}{r} 103. \\ 104. \\ \overline{105. 6} \\ 103. \\ \hline \end{array} $	33.7 34.0 34.3	$ \frac{69}{70} 171 70 7$	$ \begin{array}{r} 160.7 \\ 161.7 \\ \overline{162.6} \\ 162.6 \end{array} $	52.2 52.5 52.8 52.8	$ \frac{29}{30} \overline{231} $	$ \begin{array}{r} 217.8 \\ 218.7 \\ \hline 219.7 \\ \hline 220.6 \\ \end{array} $	70.8 71.1 71.4	89 90 291	$ \begin{array}{r} 274.9 \\ 275.8 \\ \hline 276.8 \\ 277.7 \\ \end{array} $	89.3 89.6 89.9
$52 \\ 53 \\ 54 \\ 55 \\ 55 \\ 20 \\ 20 \\ 20 \\ 20 \\ 20 \\ 20$	$\begin{array}{c} 49.5 \\ 50.4 \\ 51.4 \\ 52.3 \end{array}$	$ \begin{array}{r} 16.1 \\ 16.4 \\ 16.7 \\ 17.0 \\ \end{array} $	$ \begin{array}{c} 12 \\ 13 \\ 14 \\ 15 \\ 12 \end{array} $	$ \begin{array}{r} 106.5 \\ 107.5 \\ 108.4 \\ 109.4 \end{array} $	34.6 34.9 35.2 35.5	$72 \\ 73 \\ 74 \\ 75 \\ 75 \\ 75 \\ 75 \\ 75 \\ 75 \\ 75$	163. 6164. 5165. 5166. 4	$53.2 \\ 53.5 \\ 53.8 \\ 54.1 \\ 1$	$ \begin{array}{r} 32 \\ 33 \\ 34 \\ 35 \\ 32 \end{array} $	$\begin{array}{c} 220.\ 6\\ 221.\ 6\\ 222.\ 5\\ 223.\ 5\\ \end{array}$	$71.7 \\72.0 \\72.3 \\72.6 \\72.6$	92 93 94 95	$277.7 \\ 278.7 \\ 279.6 \\ 280.6 \\ 201.6 \\ 201.6 \\ 0.6 $	$\begin{array}{c} 90.2 \\ 90.5 \\ 90.9 \\ 91.2 \end{array}$
$56 \\ 57 \\ 58 \\ 59 \\ 30$	53.3 54.2 55.2 56.1	$17.3 \\ 17.6 \\ 17.9 \\ 18.2 \\ 10.5 \\ $	$ \begin{array}{c} 16 \\ 17 \\ 18 \\ 19 \\ 20 \end{array} $	$110.3 \\ 111.3 \\ 112.2 \\ 113.2 \\ 114.1 \\ 114.$	35.8 36.2 36.5 36.8 37.1	76 77 78 79	167.4 168.3 169.3 170.2	54.4 54.7 55.0 55.3	$ 36 \\ 37 \\ 38 \\ 39 \\ 10 $	224.4225.4226.4227.3222.3	72.973.273.573.973.9	96 97 98 99	$281.5 \\ 282.5 \\ 283.4 \\ 284.4 \\ 205.2 \\ 205.$	91.591.892.192.400.7
Dist.	Dep.	18. 5 Lat.	Dist.	114, 1 Dep.	37. 1 	Dist.	Dep.	- 55, б 	40 Dist.	228. 3 Dep.	74. 2 Lat.	Dist.	285. 5 Dep.	92. 7 Lat.
						72° (10	08°, 252	°, 288°).	1				

						[]	[ABL]	E 2.					Page	403
			Differ	ence of	Latituo	de and	l Depart	ure for	18° (162°, 19	8°, 342°	°).		
Dist.	Lat.	Dep.	Dist.	Lat.	Dep.	Dist.	Lat.	Dep.	Dist.	Lat.	Dep.	Dist.	Lat.	Dep.
301	286.3	93.0	361	343.3	111.6	$421 \\ 22$	400.4	130.1 130.4	481 82	457.5	148.6 148.9	541	514.5 515.5	167.2 167.5
02	288.2	93.7	63	345.2	112.2	23	402.3	130.7	83	459.4	149.3	43	516.4	167.9
04	$ 289.1 \\ 290.1 $	94.0 94.3		346.2 347.1	$ 112.5 \\ 112.8 $	$\frac{24}{25}$	403.3 404.2	$131.0 \\ 131.3$	$\frac{84}{85}$	460.4 461.3	149.6 149.9	$\frac{44}{45}$	517.4 518.3	168.2 168.5
06	291.0	94.6	66	348.1	113.1	26	405.2	131.7	86	462.3	150.2 150.5	46	519.3	168.8
07	292.0	94.9	68 68	349.0	113.4 113.7	$\frac{27}{28}$	400.1	132.0 132.3	88	464.2	150. 5	48	520.2 521.2	169.1
09	293.9	95.5	$\frac{69}{70}$	350.9	114.0	29 30	408.0	132.6	89 90	465.1 466.1	151.1 151.4	49 50	522.1 523 1	169.7 170.0
311	295.8	96.1	371	352.9	114.7	431	409.9	102.0 133.2	491	467.0	151.7	551	524.0	170.3
12	296.7	96.4	$72 \\ 73$	353.8	115.0	$\frac{32}{33}$	410.9	133.5	92 93	468.0	152.0 152.3	$\frac{52}{53}$	525.0 525.9	170.6 170.9
13	298.6	97.0	74	355.7	115.5 115.6	34	412.8	134.1	94	469.8	152.6	54	526.9	171.2
15	299.6 300.5	97.4	75 76	356.7 357.6	115.9 116.2	35 36	413.7 414.7	134.4 134.7	95 96	470.8	153.0 153.3	$\frac{55}{56}$	527.8 528.8	171.5 171.8
17	301.5	98.0	77	358.6	116.5	37	415.6	135.1	97	472.7	153.6	57	529.7	172.1
$18 \\ 19$	302.4 303.4	98.3 98.6	$\frac{78}{79}$	359.5 360.5	116.8 117.1	$\frac{38}{39}$	416.6 417.5	$135.4 \\ 135.7$	$\frac{98}{99}$	473.6	153.9 154.2	$\frac{58}{59}$	530.7	172.4 172.7
20	304.3	98.9	80	361.4	117.4	40	418.5	136.0	500	475.5	154.5	60	532.6	173.0
$rac{321}{22}$	305.3 306.2	99.2 99.5	$\frac{381}{82}$	362.4 363.3	117.7 118.1	$\frac{441}{42}$	419.4	136.3 136.6	$501 \\ 02$	476.5	154.8 155.1	$ 561 \\ 62 $	533.5 534.5	$ 173.3 \\ 173.6 $
23	307.2	99.8	83	364.3	118.4	43	421.3	136.9	03	478.4	155.4	63	535.4	173.9
$\frac{24}{25}$	308.2 309.1	100.1 100.4	$\frac{84}{85}$	$365.2 \\ 366.2$	118.7 119.0	44	422.3 423.2	137.2 137.5	$04 \\ 05$	480.3	155.7 156.1	$ \begin{array}{c} 64 \\ 65 \end{array} $	536.4 537.3	174.2 174.6
26	310.1	100.7	86	367.1	119.3	46	424.2	137.8	06	481.2	156.4	66 67	538.3	174.9
$\frac{27}{28}$	311.0 312.0	101.1 101.4	88	369.0	119.0	48	425.1 426.1	138.1 138.4	07	482.2	150.7 157.0	68	539.2 540.2	175.2 175.5
$\frac{29}{30}$	312.9 313.9	101.7 102 0	89	370.0 370.9	120.2 120.5	$\frac{49}{50}$	427.0 428.0	138.8 139.1	09	484.1	157.3 157.6	69 70	541.1 542 1	$175.8 \\ 176.1$
331	314.8	102.3	391	371.9	120.0 120.8	451	428.9	139.4	511	486.0	157.9	571	543.0	176.4
32 33	315.8 316.7	102.6 102.9	92 93	372.8 373.8	121.1 121.5	$\frac{52}{53}$	429.9	139.7 140.0	$12 \\ 13$	487.0	158.2 158.5	$\frac{72}{73}$	544.0 544.9	176.7 177.0
34	317.7	102.0 103.2	94	374.7	121.8	54	431.8	140.3	14	488.9	158.8	74	545.9	177.3
35 36	$318.6 \\ 319.6$	103.5 103.8	$\frac{95}{96}$	$375.7 \\ 376.6$	$122.1 \\ 122.4$	$\frac{55}{56}$	432.7 433.7	140.6 140.9	$\frac{15}{16}$	489.8 490.8	159.1 159.4	75 76	546.8 547.8	177.6 178.0
37	320.5	104.1	97	377.6	122.7	57	434.6	141.2	17	491.7	159.7	77	548.7	178.3 178.6
$\frac{38}{39}$	321.0 322.4	104.5 104.8	98 99	379.5	123.0 123.3	$\frac{58}{59}$	436.5	141.8	19	493.6	160.0 160.3	79^{78}	550.6	178.9
40	$\frac{323.4}{224.2}$	$\frac{105.1}{105.1}$	$\frac{400}{101}$	$\frac{380.4}{281.4}$	123.6	60	$\frac{437.5}{129.1}$	$\frac{142.2}{149.5}$	20	494.6	160.7	80	551.6	$\frac{179.2}{170.5}$
$\frac{341}{42}$	324.3 325.3	105.4 105.7	$\frac{401}{02}$	381.4 382.3	125.9 124.2	$\frac{+61}{62}$	438.4	142. 5	$\frac{521}{22}$	495.5	161.0 161.3	82 82	552.5 553.5	179.8
43 44	326.2 327.2	106.0 106.3	03	383.3 384.9	124.5 124 0	63 64	440.3 441.3	143.1 143 J	23 94	497.4	$161.6 \\ 161.0$	83 84	554.4 555.4	180.1 180.4
45	328.1	106.6	05	385.2	125.2	65	442.2	143.7	25	499.3	162.2	85	556.3	180.7
$\frac{46}{47}$	$329.1 \\ 330.0$	$106.9 \\ 107.2$	$\begin{array}{c} 06\\ 07\end{array}$	$386.1 \\ 387.1$	$125.5 \\ 125.8$	$\begin{array}{c} 66 \\ 67 \end{array}$	$443.2 \\ 444.2$	144.0 144.3	$\frac{26}{27}$	500.3 501.2	$162.5 \\ 162.9$	$\frac{86}{87}$	557.3 558.2	181.1 181.4
48	331.0	107.5	08	388.0	126.1	68	445.1	144.6	28	502.2	163.2	88	559.2	181.7
$\frac{49}{50}$	$331.9 \\ 332.9$	$107.9 \\ 108.2$	$\frac{09}{10}$	389.0 389.9	126.4 126.7	$\frac{69}{70}$	446.1 447.0	$144.9 \\ 145.2$	$\frac{29}{30}$	503.1 504.1	$163.5 \\ 163.8$	$\frac{89}{90}$	560.1 561.1	$182.0 \\ 182.3$
351	333.8	108.5	411	390.9	127.0	471	448.0	145.6	531	505.0	164.1	591	562.0	182.7
$\begin{array}{c} 52\\ 53\end{array}$	$334.8 \\ 335.7$	108.8 109.1	12 13	$391.8 \\ 392.8$	$127.3 \\ 127.6$	$\frac{72}{73}$	448.9 449.9	$145.9 \\ 146.2$	$\frac{32}{33}$	506.0 506.9	$164.4 \\ 164.7$	$\frac{92}{93}$	563.0 563.9	$183.0 \\ 183.3$
54	336.7	109.4	14	393.7	127.9	74	450.8	146.5	34	507.9	165.0	94	564.9	183.6
ээ 56	338.6	109.7 110.0	$10 \\ 16$	394.7 395.6	$128.3 \\ 128.6$	$\frac{75}{76}$	452.7	140.8 147.1	39 36	508.8 509.8	165.3 165.6	99 96	566.8	183.9 184.2
57	339.5 340.5	110.3	17	396.6 307.5	128.9 120.9	77	453.7	147.4 147.7	37	510.7	165.9	97	567.7 568 7	184.5
$\frac{58}{59}$	341.4	110.0	$10 \\ 19$	398.5	129.2 129.5	79	455.6	148.0	39	511.7 512.6	166.2 166.5	98 99	569.6	185.1
60	342, 4	111.3	20	399.5	129.8	80	456.5	148.3	40	513.6	166.9	600	570.6	185.4
Dist.	Dep.	Lat.	Dist.	Dep.	Lat.	Dist.	Dep.	Lat.	Dist.	Dep.	Lat.	Dist.	Dep.	Lat.
						72° (108, 252	°, 288°).					

Pa	ge 404]			-	Г	ABL	E 2.						
		,	Differe	ence of 1	Latitud	e and	Departu	ire for	19° (1	6 1°, 199	°, 341°).		
Dist.	Lat.	Dep.	Dist.	Lat.	Dep.	Dist.	Lat.	Dep.	Dist.	Lat.	Dep.	Dist.	Lat.	Dep.
$ \begin{array}{c} 1 \\ 2 \\ 3 \\ 4 \\ 5 \\ 6 \end{array} $	$\begin{array}{c} 0.9 \\ 1.9 \\ 2.8 \\ 3.8 \\ 4.7 \\ 5.7 \end{array}$	$\begin{array}{c} 0.3 \\ 0.7 \\ 1.0 \\ 1.3 \\ 1.6 \\ 2.0 \end{array}$	$\begin{array}{c} 61 \\ 62 \\ 63 \\ 64 \\ 65 \\ 66 \end{array}$	57.7 58.6 59.6 60.5 61.5 62.4	$19.9 \\ 20.2 \\ 20.5 \\ 20.8 \\ 21.2 \\ 21.5$	$121 \\ 22 \\ 23 \\ 24 \\ 25 \\ 26$	114. 4115. 4116. 3117. 2118. 2119. 1	$\begin{array}{r} 39.4\\ 39.7\\ 40.0\\ 40.4\\ 40.7\\ 41.0\end{array}$	$ 181 \\ 82 \\ 83 \\ 84 \\ 85 \\ 86 $	$171.1 \\ 172.1 \\ 173.0 \\ 174.0 \\ 174.9 \\ 175.9$	$58.9 \\ 59.3 \\ 59.6 \\ 59.9 \\ 60.2 \\ 60.6$	$241 \\ 42 \\ 43 \\ 44 \\ 45 \\ 46$	$\begin{array}{c} 227.9\\ 228.8\\ 229.8\\ 230.7\\ 231.7\\ 232.6 \end{array}$	78.578.879.179.479.880.1
$ \begin{array}{r} 7 \\ 8 \\ 9 \\ 10 \\ -11 \end{array} $	$ \begin{array}{r} 6.6\\ 7.6\\ 8.5\\ 9.5\\ \hline 10.4 \end{array} $	2.3 2.6 2.9 3.3 2.6		$\begin{array}{r} 63.3\\ 64.3\\ 65.2\\ 66.2\\ \hline \end{array}$	$ \begin{array}{c} 21.8 \\ 22.1 \\ 22.5 \\ 22.8 \\ \hline 22.8 \\ \hline 22.1 \\ \hline 22.8 \\ \hline 22.1 \\ \hline 22.1 \\ \hline 22.8 \\ \hline 22.8 \\ \hline 22.8 \\ \hline 22.8 \\ \hline 22.1 \\ \hline 22.8 \\ \hline 2$	$ \begin{array}{r} 27 \\ 28 \\ 29 \\ 30 \\ 121 \end{array} $	$120.1 \\ 121.0 \\ 122.0 \\ 122.9 \\ 192.0 \\ 192.$	$ \begin{array}{r} 41.3\\ 41.7\\ 42.0\\ 42.3\\ \hline 12.6 \end{array} $	87 88 89 90	$176.8 \\ 177.8 \\ 178.7 \\ 179.6 \\ 180.$	$\begin{array}{r} 60.9 \\ 61.2 \\ 61.5 \\ 61.9 \\ \hline \end{array}$	$47 \\ 48 \\ 49 \\ 50 \\ 951$	233.5234.5235.4236.4 236.4	80. 4 80. 7 81. 1 81. 4
$ \begin{array}{r} 11 \\ 12 \\ 13 \\ 14 \\ 15 \\ 16 \\ 17 \\ 18 \\ 19 \\ 20 \\ \end{array} $	$\begin{array}{c} 10.4\\ 11.3\\ 12.3\\ 13.2\\ 14.2\\ 15.1\\ 16.1\\ 17.0\\ 18.0\\ 18.9 \end{array}$	3.9 4.26 4.925 5.5926 5.5926 6.25	$71 \\ 72 \\ 73 \\ 74 \\ 75 \\ 76 \\ 77 \\ 78 \\ 79 \\ 80$	$\begin{array}{c} 68.1\\ 69.0\\ 70.0\\ 70.9\\ 71.9\\ 72.8\\ 73.8\\ 74.7\\ 75.6\end{array}$	$\begin{array}{c} 23.4\\ 23.8\\ 24.1\\ 24.4\\ 24.7\\ 25.1\\ 25.4\\ 25.7\\ 26.0\\ \end{array}$	$ \begin{array}{r} 31 \\ 32 \\ 33 \\ 34 \\ 35 \\ 36 \\ 37 \\ 38 \\ 39 \\ 40 \\ 40 \\ \end{array} $	$\begin{array}{c} 123.\ 3\\ 124.\ 8\\ 125.\ 8\\ 126.\ 7\\ 127.\ 6\\ 128.\ 6\\ 129.\ 5\\ 130.\ 5\\ 131.\ 4\\ 132.\ 4 \end{array}$	$\begin{array}{c} 43.0 \\ 43.3 \\ 43.6 \\ 44.0 \\ 44.3 \\ 44.6 \\ 44.9 \\ 45.3 \\ 45.6 \end{array}$	$ \begin{array}{r} 191 \\ 92 \\ 93 \\ 94 \\ 95 \\ 96 \\ 97 \\ 98 \\ 99 \\ 200 \\ \end{array} $	$181.5 \\ 181.5 \\ 182.5 \\ 183.4 \\ 184.4 \\ 185.3 \\ 186.3 \\ 187.2 \\ 188.2 \\ 189.1 \\ 189.1 \\ 180.5 \\ 180.$	$\begin{array}{c} 62.2 \\ 62.5 \\ 62.8 \\ 63.2 \\ 63.5 \\ 63.8 \\ 64.1 \\ 64.5 \\ 64.8 \\ 65.1 \end{array}$	52 53 54 55 56 57 58 59 60	$\begin{array}{c} 237.3\\ 238.3\\ 239.2\\ 240.2\\ 241.1\\ 242.1\\ 243.0\\ 243.9\\ 244.9\\ 245.8\end{array}$	82. 0 82. 4 82. 7 83. 0 83. 3 83. 7 84. 0 84. 3 84. 6
$\begin{array}{c} 21 \\ 22 \\ 23 \\ 24 \\ \cdot 25 \\ 26 \\ 27 \\ 28 \\ 29 \\ 30 \end{array}$	$\begin{array}{c} 19.\ 9\\ 20.\ 8\\ 21.\ 7\\ 22.\ 7\\ 23.\ 6\\ 24.\ 6\\ 25.\ 5\\ 26.\ 5\\ 27.\ 4\\ 28.\ 4\end{array}$	$\begin{array}{c} 6.8\\ 7.2\\ 5.8\\ 7.5\\ 8.1\\ 8.5\\ 8.8\\ 9.1\\ 9.4\\ 9.8\\ \end{array}$	81 82 83 84 85 86 87 88 89 90	$\begin{array}{c} 76.\ 6\\ 77.\ 5\\ 78.\ 5\\ 79.\ 4\\ 80.\ 4\\ 81.\ 3\\ 82.\ 3\\ 83.\ 2\\ 84.\ 2\\ 85.\ 1\end{array}$	$\begin{array}{c} 26.4\\ 26.7\\ 27.0\\ 27.3\\ 27.7\\ 28.0\\ 28.3\\ 28.7\\ 29.0\\ 29.3\\ \end{array}$	$ \begin{array}{r} 141 \\ 42 \\ 43 \\ 44 \\ 45 \\ 46 \\ 47 \\ 48 \\ 49 \\ 50 \end{array} $	$\begin{array}{c} 133.\ 3\\ 134.\ 3\\ 135.\ 2\\ 136.\ 2\\ 137.\ 1\\ 138.\ 0\\ 139.\ 0\\ 139.\ 9\\ 140.\ 9\\ 141.\ 8\end{array}$	$\begin{array}{r} 45.9\\ 46.2\\ 46.6\\ 46.9\\ 47.2\\ 47.5\\ 47.5\\ 47.9\\ 48.2\\ 48.5\\ 48.8\end{array}$	$ \begin{array}{r} 201 \\ 02 \\ 03 \\ 04 \\ 05 \\ 06 \\ 07 \\ 08 \\ 09 \\ 10 \end{array} $	$\begin{array}{c} 190.\ 0\\ 191.\ 0\\ 191.\ 9\\ 192.\ 9\\ 193.\ 8\\ 194.\ 8\\ 195.\ 7\\ 196.\ 7\\ 196.\ 7\\ 197.\ 6\\ 198.\ 6\end{array}$	$\begin{array}{c} 65.4\\ 65.8\\ 66.1\\ 66.4\\ 66.7\\ 67.1\\ 67.4\\ 67.7\\ 68.0\\ 68.4 \end{array}$	$\begin{array}{c} 261 \\ 62 \\ 63 \\ 64 \\ 65 \\ 66 \\ 67 \\ 68 \\ 69 \\ 70 \end{array}$	$\begin{array}{c} 246.8\\ 247.7\\ 248.7\\ 249.6\\ 250.6\\ 251.5\\ 252.5\\ 253.4\\ 254.3\\ 255.3\\ \end{array}$	85.0 85.3 85.6 86.0 86.3 86.6 86.9 87.3 87.6 87.9
$ \begin{array}{r} 31 \\ 32 \\ 33 \\ 34 \\ 35 \\ 36 \\ 37 \\ 38 \\ 39 \\ 40 \\ \end{array} $	$\begin{array}{c} 29.3\\ 30.3\\ 31.2\\ 32.1\\ 33.1\\ 34.0\\ 35.0\\ 35.9\\ 36.9\\ 37.8 \end{array}$	$\begin{array}{c} 10.1\\ 10.4\\ 10.7\\ 11.1\\ 11.4\\ 11.7\\ 12.0\\ 12.4\\ 12.7\\ 13.0 \end{array}$	$91 \\ 92 \\ 93 \\ 94 \\ 95 \\ 96 \\ 97 \\ 98 \\ 99 \\ 100$	86.0 87.0 87.9 88.9 89.8 90.8 91.7 92.7 93.6 94.6	$\begin{array}{c} 29.6\\ 30.0\\ 30.3\\ 30.6\\ 30.9\\ 31.3\\ 31.6\\ 31.9\\ 32.2\\ 32.6 \end{array}$	$ \begin{array}{r} 151 \\ 52 \\ 53 \\ 54 \\ 55 \\ 56 \\ 57 \\ 58 \\ 59 \\ 60 \\ \end{array} $	$\begin{array}{r} 142.8\\ 143.7\\ 144.7\\ 145.6\\ 146.6\\ 147.5\\ 148.4\\ 149.4\\ 150.3\\ 151.3\\ \end{array}$	$\begin{array}{r} 49.2\\ 49.5\\ 49.8\\ 50.1\\ 50.5\\ 50.8\\ 51.1\\ 51.4\\ 51.8\\ 52.1 \end{array}$	$\begin{array}{c} 211\\ 12\\ 13\\ 14\\ 15\\ 16\\ 17\\ 18\\ 19\\ 20\\ \end{array}$	$\begin{array}{c} 199.5\\ 200.4\\ 201.4\\ 202.3\\ 203.3\\ 204.2\\ 205.2\\ 206.1\\ 207.1\\ 208.0\\ \end{array}$	$\begin{array}{c} 68.7\\ 69.0\\ 69.3\\ 69.7\\ 70.0\\ 70.3\\ 70.6\\ 71.0\\ 71.3\\ 71.6 \end{array}$	$\begin{array}{r} 271 \\ 72 \\ 73 \\ 74 \\ 75 \\ 76 \\ 77 \\ 78 \\ 79 \\ 80 \end{array}$	$\begin{array}{c} 256.\ 2\\ 257.\ 2\\ 258.\ 1\\ 259.\ 1\\ 260.\ 0\\ 261.\ 0\\ 261.\ 9\\ 262.\ 9\\ 263.\ 8\\ 264.\ 7\end{array}$	88. 2 88. 6 88. 9 89. 2 89. 5 89. 9 90. 2 90. 5 90. 8 91. 2
$ \begin{array}{r} 41\\ 42\\ 43\\ 44\\ 45\\ 46\\ 47\\ 48\\ 49\\ 50\\ \end{array} $	$\begin{array}{c} 38.8\\ 39.7\\ 40.7\\ 41.6\\ 42.5\\ 43.5\\ 44.4\\ 45.4\\ 46.3\\ 47.3\end{array}$	$\begin{array}{c} 13.3\\ 13.7\\ 14.0\\ 14.3\\ 14.7\\ 15.0\\ 15.3\\ 15.6\\ 16.0\\ 16.3\\ \end{array}$	$ \begin{array}{r} 101 \\ 02 \\ 03 \\ 04 \\ 05 \\ 06 \\ 07 \\ 08 \\ 09 \\ 10 \\ \end{array} $	$\begin{array}{c} 95.5\\ 96.4\\ 97.4\\ 98.3\\ 99.3\\ 100.2\\ 101.2\\ 102.1\\ 103.1\\ 104.0 \end{array}$	$\begin{array}{c} 32.9\\ 33.2\\ 33.5\\ 33.9\\ 34.2\\ 34.5\\ 34.8\\ 35.2\\ 35.5\\ 35.8\\ 35.8\end{array}$	$ \begin{array}{r} 161 \\ 62 \\ 63 \\ 64 \\ 65 \\ 66 \\ 67 \\ 68 \\ 69 \\ 70 \\ 70 \\ \end{array} $	$\begin{array}{c} 152.\ 2\\ 153.\ 2\\ 154.\ 1\\ 155.\ 1\\ 156.\ 0\\ 157.\ 0\\ 157.\ 9\\ 158.\ 8\\ 159.\ 8\\ 160.\ 7\end{array}$	$\begin{array}{c} 52.4\\ 52.7\\ 53.1\\ 53.4\\ 53.7\\ 54.0\\ 54.4\\ 54.7\\ 55.0\\ 55.3\end{array}$	$221 \\ 22 \\ 23 \\ 24 \\ 25 \\ 26 \\ 27 \\ 28 \\ 29 \\ 30$	$\begin{array}{c} 209.\ 0\\ 209.\ 9\\ 210.\ 9\\ 211.\ 8\\ 212.\ 7\\ 213.\ 7\\ 214.\ 6\\ 215.\ 6\\ 216.\ 5\\ 217.\ 5\end{array}$	$\begin{array}{c} 72.\ 0\\ 72.\ 3\\ 72.\ 6\\ 72.\ 9\\ 73.\ 3\\ 73.\ 6\\ 73.\ 9\\ 74.\ 2\\ 74.\ 6\\ 74.\ 9\end{array}$	$281 \\ 82 \\ 83 \\ 84 \\ 85 \\ 86 \\ 87 \\ 88 \\ 89 \\ 90$	$\begin{array}{c} 265.\ 7\\ 266.\ 6\\ 267.\ 6\\ 268.\ 5\\ 269.\ 5\\ 270.\ 4\\ 271.\ 4\\ 272.\ 3\\ 273.\ 3\\ 274.\ 2\end{array}$	$\begin{array}{c} 91.5\\ 91.8\\ 92.1\\ 92.5\\ 92.8\\ 93.1\\ 93.4\\ 93.8\\ 94.1\\ 94.4 \end{array}$
51 52 53 54 55 56 57 58 59 60	$\begin{array}{r} 48.2\\ 49.2\\ 50.1\\ 51.1\\ 52.0\\ 52.9\\ 53.9\\ 54.8\\ 55.8\\ 56.7\end{array}$	$\begin{array}{c} 16.\ 6\\ 16.\ 9\\ 17.\ 3\\ 17.\ 6\\ 17.\ 9\\ 18.\ 2\\ 18.\ 6\\ 18.\ 9\\ 19.\ 2\\ 19.\ 5\\ \end{array}$	$ \begin{array}{r} 111 \\ 12 \\ 13 \\ 14 \\ 15 \\ 16 \\ 17 \\ 18 \\ 19 \\ 20 \\ \end{array} $	$\begin{array}{c} 105.0\\ 105.9\\ 106.8\\ 107.8\\ 108.7\\ 109.7\\ 110.6\\ 111.6\\ 112.5\\ 113.5 \end{array}$	$\begin{array}{c} 36.1\\ 36.5\\ 36.8\\ 37.1\\ 37.4\\ 37.8\\ 38.1\\ 38.4\\ 38.7\\ 39.1 \end{array}$	$ \begin{array}{r} 171 \\ 72 \\ 73 \\ 74 \\ 75 \\ 76 \\ 77 \\ 78 \\ 79 \\ 80 \\ \end{array} $	$\begin{array}{c} 161.7\\ 162.6\\ 163.6\\ 164.5\\ 165.5\\ 165.5\\ 166.4\\ 167.4\\ 168.3\\ 169.2\\ 170.2 \end{array}$	$\begin{array}{c} 55.\ 7\\ 56.\ 0\\ 56.\ 3\\ 56.\ 6\\ 57.\ 0\\ 57.\ 3\\ 57.\ 6\\ 58.\ 0\\ 58.\ 3\\ 58.\ 6\end{array}$	$231 \\ 32 \\ 33 \\ 34 \\ 35 \\ 36 \\ 37 \\ 38 \\ 39 \\ 40$	$\begin{array}{c} 218. \ 4\\ 219. \ 4\\ 220. \ 3\\ 221. \ 3\\ 222. \ 2\\ 223. \ 1\\ 224. \ 1\\ 225. \ 0\\ 226. \ 0\\ 226. \ 9\end{array}$	$\begin{array}{c} 75.2\\ 75.5\\ 75.9\\ 76.2\\ 76.5\\ 76.8\\ 77.2\\ 77.5\\ 77.8\\ 78.1 \end{array}$	$291 \\ 92 \\ 93 \\ 94 \\ 95 \\ 96 \\ 97 \\ 98 \\ 99 \\ 300$	$\begin{array}{c} 275.1\\ 276.1\\ 277.0\\ 278.0\\ 278.9\\ 279.9\\ 280.8\\ 281.8\\ 282.7\\ 283.7 \end{array}$	$\begin{array}{c} 94.7\\ 95.1\\ 95.4\\ 95.7\\ 96.0\\ 96.4\\ 96.7\\ 97.0\\ 97.3\\ 97.7\end{array}$
Dist.	Dep.	Lat.	Dist.	Dep.	Lat.	Dist.	Dep.	Lat.	Dist.	Dep.	Lat.	Dist.	Dep.	Lat.
						71° (1	09°, 251	°, 289°).					

						Г	ABL	E 2.					[Page	405
		1	Differe	ence of I	Latitud	e and	Departu	ire for	19° (1	.61°, 199)°, 341°	°).		
Dist.	Lat.	Dep.	Dist.	Lat.	Dep.	Dist.	Lat.	Dep.	Dist.	Lat.	Dep.	Dist.	Lat.	Dep.
301	284.6	98.0	361	341.3	117.5	421	398.1	137.0	481	454.8	156.6	541	511.5	176.1
02	285.5	98.3	62	342.3	117.8	22	399.0	137.4	$\frac{82}{22}$	455.7	156.9	42	512.4	176.4
03	286.5	98.6	63 64	343.2	118.2 118.5	23	400.0	137.7	- 85 - 84	400.7	137.2 157.6	43	013.4 51.1 9	176.8 177.1
05	288.4	99.3	65	345.1	118.8	25	401.8	138.4	85	458.6	157.9	45	515.3	177.4
06	289.3	99.6	66	346.1	119.1	26	402.8	138.7	86	459.5	158.2	46	516.2	177.7
07	290.3	99.9	67	347.0	119.5	27	403.7	139.0	87	460.5	158.5	47	517.2	178.1
08	291.2	100.3 100.6	68 60	348.0	119.8 120.1	28	404.7	139.3 120 7	88	461.4	158.9	48	518. l 519-1	178.4
10	292.2 293.1	100.0 100.9	70	349.8	120.1 120.4	$\frac{29}{30}$	405.0	139.7 140.0	90	463.3	159.2 159.5	- 4 9 50	519.1 520.0	178.7 179.0
311	294.1	101.2	371	350.8	120.8	431	407.5	140.3	491	464.3	159.8	551	521.0	179.4
12	295.0	101.6	72	351.7	121.1	32	408.5	140.6	92	465.2	160.2	52	521.9	179.7
13	295.9	101.9	73	352.7	121.4	33	409.4	141.0	93	466.1	160.5	53	522.8	180.0
14	296.9	102.2 102.5	74	353.6	121.7 199.1	34	410.4	141.5	94	407.1	160.8 161.1	04	523.8 524 7	180.3
16	297.8 298.8	102.9 102.9	76	355.5	122.1 122.4	36	412.2	141.9	96	469.0	161.1 161.5	56	524.7 525.7	180.7
17	299.7	103.2	77	356.5	122.7	37	413.2	142.3	97	469.9	161.8	57	526.6	181.3
18	300.7	103.5	78	357.4	123.0	38	414.1	142.6	98	470.9	162.1	58	527.6	181.6
19	301.6 302.6	103.8 10.1.2	- 79 80	358.4	123.4 193.7	39	415.1	142.9	500	471.8	162.4 162.8	- 59 - 60	528.5 520.5	182.0
321	302.0	104.2	381	$\frac{359.5}{360.2}$	120.7 124 0	141	$\frac{410.0}{417.0}$	143.6	501	472.0	102.0 163 1	561	530 1	182.5
22	304.5	104.8	82	361.2	124.4	42	417.9	143.9	02	474.7	163.4	62	531.4	182.9
23	305.4	105.1	83	362.1	124.7	43	418.9	144.2	- 03	475.6	163.7	63	532.3	183.3
24	306.3	105.5	84	363.1	125.0	44	419.8	144.5	04	476.5	164.1	64	533.2	183.6
20 26	307.3	105.8 106.1	80 86	364.0	120.3 125.7	40	420.8	144.9	00	477.0	164.4	60 66	534.2 535-1	183.9
$\frac{20}{27}$	309.2	100.1 106.4	87	365.9	126.0	47	422.6	145.5	07	479.4	165.0	67	536.1	184.6
28	310.1	106.8	88	366.9	126.3	48	423.6	145.8	08	480.3	165.4	68	537.0	184.9
29	311.1	107.1	89	367.8	126.6	49	424.5	146.2	09	481.2	165.7	- 69	538.0	185.2
$\frac{30}{-991}$	$\frac{312.0}{212.0}$	107.4	90	368.8	127.0 107.0	50	$\frac{425.5}{100.4}$	146.5	$\frac{10}{511}$	482.2	166.1	70	538.9	$\frac{185.6}{105.0}$
331 32	313.0	107.7 108.1	391 - 92	309.7 370.6	127.5 127.6	+01	$\frac{420.4}{197.4}$	140.8 147 1	$\frac{011}{12}$	485.1	100.4 166.7	$\frac{271}{72}$	540 S	180.9 186.2
33	314.9	108.4	93	371.6	127.9	53	428.3	147.5	13	485.0	167.0	73	541.7	186.5
34	315.8	108.7	-94	372.5	128.3	54	429.3	147.8	14	486.0	167.4	74	542.7	186.9
35	316.7	109.1	- 95 06	373.5	128.6	55 50	430.2	148.1	15	486.9	167.7	$-75 \\ -76$	543.6	187.2
$\frac{30}{37}$	318.6	109.4 109.7	90 97	375.4	120.9 129.2	57	432.1	148.8	17	488.8	168.0 168.3	77	545.5	187.8
38	319.6	110.0	98	376.3	129.6	58	433.0	149.1	18	489.7	168.7	78	546.5	188.2
39	320.5	110.4	99	377.3	129.9	- 59	434.0	149.4	19	490.7	169.0	-79	547.4	188.5
$\frac{40}{241}$	$\frac{321.5}{200}$	110.7	400	$\frac{378.2}{270.2}$	130.2	$\frac{60}{101}$	434.9	149.7	$\frac{20}{501}$	<u>491.6</u>	169.3	80	548.4	188.8
42	322.4 323.4	111.0 111.3	401	379.2 380.1	130.9 130.9	+01 62	436.8	150.1 150.4	921	492.0 493.5	109.0 170.0	82	049.0 550-3	189.5
43	324.3	111.7	03	381.0	131.2	63	437.8	150.7	23	494.5	170.3	83	551.2	189.8
44	325.3	112.0	04	382.0	131.5	64	438.7	151.0	24	495.4	170.6	84	552.2	190.1
40	326.2 297.1	112.3 119.6	00	382.9 282.0	131.8 122.9	60 86	439.7	101.4 151.7	20 96	496.4 107.2	170.9 171.9	85	003.1 55.1_1	190.4
47	328.1	112.0 113.0	07	384.8	132.5 132.5	67	441.6	151.7 152.0	$\frac{20}{27}$	498.3	171.2 171.6	87	555.0	190.0 191.1
48	329.0	113.3	08	385.8	132.8	68	442.5	152.4	28	499.2	171.9	88	555.9	191.4
$\frac{49}{50}$	330.0	113.6	09	386.7	133.1	69	443.4	152.7	29	500.1	172.2	89	556.9	191.7
$\frac{50}{951}$	$\frac{330.9}{991.0}$	113.9	111	381.1	133.5	171	444.4	153.0 159.9	$\frac{30}{591}$	501.1	$\frac{172.9}{179.0}$	90	001.8	192.1 109_1
$\frac{551}{52}$	332.8	114.5 114.6	12	389.6	133.8 134.1	$\frac{471}{72}$	446.3	153.5 153.7	$\frac{551}{32}$	502.0 503.0	172.9 173.2	$\frac{591}{92}$	558.8 559.7	192.4 192.7
53	333.8	114.9	13	390.5	134.4	73	447.2	154.0	- 33	503.9	173.5	- 93	560.7	193.0
54	334.7	115.2	14	391.4	134.8	74	448.2	154.3	34	504.9	173.8	94	561.6	193.4
- 00 58	339.7 336 e	115.6	15 18	392.4	135.1 135.1	70 78	449.1	155.0	35 92	506 9	174.2 174.5	95 08	562.6 562.5	193.7
57	337.5	110.9 116.2	17	394.3	135.4 135.7	77	451.0	155.0 155.3	30	500.8 507.7	174.8	97	564.5	194.3
58	338.5	116.5	18	395.2	136.1	78	452.0	155.6	- 38	508.7	175.1	98	565.4	194.7
59	339.4	116.9	19	396.2	136.4	79	452.9	155.9	- 39	509.6	175.5	99	566.4	195.0
. 60	340, 4	117.2	20	397.1	136.7	80	453.8	156.3	40	510, 6	175.8	600	567.3	195.3
Dist.	Dep.	Lat.	Dist.	Dep.	Lat.	Dist.	Dep.	Lat.	Dist,	Dep,	Lat.	Dist.	Dep.	Lat.
						71° (1	09°, 251	°, 289°).					
		•		,										

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	Differe

TABLE 2.

ifference of Latitude and Departure for 20° (160°, 200°, 340°).

							Departe		-0 (1		, 010)•		
Dist.	Lat.	Dep.	Dist.	Lat.	Dep.	Dist.	Lat.	Dep.	Dist.	Lat.	Dep.	Dist.	Lat.	Dep.
1	0.9	0.3	61	57.3	20.9	191	113 7	11 1	191	170 1	61.0	0.11	000 5	00.1
9	1.9	0.7	62	58.3	21 2	22	114 6	41 7	82	171.0	69 9	49	220.0	82.4
3	2.8	1.0	63	59.2	21.5	23	115 6	42 1	83	172 0	62.2	42	221. 4	04.0
4	3.8	1.4	64	60.1	21.9	24	116.5	42.4	84	172.9	62.9	44	220.0	83.5
$\hat{5}$	4.7	1.7	65	61.1	22.2	25	117.5	42.8	85	173.8	63 3	45	220.0	83.8
6	5.6	2.1	66	62.0	22.6	$\overline{26}$	118.4	43.1	86	174 8	63 6	46	231 2	84 1
7	6.6	2.4	@ 67	63.0	22.9	$\overline{27}$	119.3	43.4	87	175.7	64.0	47	232 1	84.5
8	7.5	2.7	68	63.9	23.3	28	120.3	43.8	88	176.7	64.3	48	233.0	84.8
9	8.5	3.1	69	64.8	23.6	29	121.2	44.1	89	177.6	64.6	49	234 0	85.2
10	9.4	3.4	70	65.8	23.9	30	122.2	44.5	90	178.5	65.0	50	234.9	85.5
-11	10.3	3.8	71	66.7	24.3	131	123 1	44 8	191	179.5	65 3	251	235 0	85.9
12	11.3	4.1	72	67.7	24.6	32	124.0	45 1	92	180 4	65 7	59	236 8	86.2
13	12.2	4.4	73	68.6	25.0	33	125.0	45 5	93	181 4	66 0	53	230.0 237.7	86.5
14	13.2	4.8	74	69.5	25.3	34	125.9	45.8	94	182 3	66 4	54	238 7	86.9
15	14.1	5.1	75	70.5	25.7	35	126.9	46.2	95	183.2	66.7	55	239 6	87.2
16	15.0	5.5	76	71.4	26.0	36	127.8	46.5	96	184.2	67.0	56	240 6	87 6
17	16.0	5.8	77	72.4	26.3	37	128.7	46.9	97	185.1	67.4	57	241.5	87.9
18	16.9	6.2	78	73.3	26.7	38	129.7	47.2	98	186.1	67.7	58	242.4	88.2
19	17.9	6.5	79	74.2	27.0	39	130.6	47.5	99	187.0	68.1	59	243.4	88.6
20	18.8	6.8	80	75.2	27.4	40	131.6	47.9	200	187.9	68.4	60	244.3	88.9
21	19.7	7.2	81	76.1	27.7	141	132 5	48.2	201	188.9	68 7	261	215 3	89 3
22	20.7	7.5	82	77.1	28.0	42	133.4	48.6	02	189.8	69 1	62	246 2	89.6
23	$\frac{20.1}{21.6}$	7.9	83	78.0	28.4	43	134 4	48 9	03	190.8	69 4	63	247 1	90.0
24	22.6	8.2	84	78.9	28.7	44	135 3	49.3	01	191 7	69.8	64	248 1	90.3
25	23. 5	8.6	85	79.9	29.1	45	136.3	49.6	05	192.6	70 1	65	249 0	90.6
26	24.4	8.9	86	80.8	29.4	46	137.2	49.9	06	193 6	70.5	66	250 0	91 0
27	25.4	9.2	87	81.8	29.8	47	138.1	50.3	07	194.5	70.8	67	250.9	91.3
28	26.3	9.6	88	82.7	30.1	48	139.1	50.6	08	195.5	71.1	68	251.8	91.7
29	27.3	9.9	89	83.6	30.4	49	140.0	51.0	09	196.4	71.5	69	252.8	92.0
30	28.2	10.3	90	84.6	30.8	50	140.9	51.3	10	197.3	71.8	70	253.7	92.3
31	29.1	10.6	91	85.5	31.1	151	141.9	51 6	211	198.3	72.2	271	254 7	99 7
32	30 1	10.9	92	86.5	31.5	52	142.8	52 0	12	199 2	72.5	72	255 6	93.0
33	31.0	11.3	93	87.4	31.8	53	143.8	52.3	13	200.2	72.9	73	256.5	93.4
34	31.9	11.6	94	88.3	32.1	54	144.7	52.7	14	201.1	73.2	74	257.5	93.7
35	32.9	12.0	95	89.3	32.5	55	145.7	53.0	15	202.0	73.5	75	258.4	94.1
36	33.8	12.3	96	90.2	32.8	56	146.6	53.4	16	203.0	73.9	76	259.4	94.4
37	34.8	12.7	97	91.2	33.2	57	147.5	53.7	17	203.9	74.2	77	260.3	94.7
38	35.7	13.0	98	92.1	33.5	58	148.5	54.0	18	204.9	74.6	78	261.2	95.1
39	36.6	13.3	99	93.0	33.9	59	149.4	54.4	19	205.8	74.9	79	262.2	95.4
40	37.6	13.7	100	94.0	34.2	60	150.4	54.7	20	206.7	75.2	80	263.1	95.8
41	38.5	14.0	101	94.9	34.5	161	151.3	55.1	221	207.7	75.6	281	264.1	96.1
42	39.5	14.4	02	95.8	34.9	62	152.2	55.4	22	208.6	75.9	82	265.0	96.4
43	40.4	14.7	03	96.8	35.2	63	153.2	55.7	23	209.6	76.3	83	265.9	96.8
44	41.3	15.0	04	97.7	35.6	64	154.1	56.1	24	210.5	76.6	84	266.9	97.1
45	42.3	15.4	05	98.7	35.9	65	155.0	56.4	25	211.4	77.0	85	267.8	97.5
46	43.2	15.7	06	99.6	36.3	66	156.0	56.8	26	212.4	77.3	86	268.8	97.8
47	44.2	16.1	07	100.5	36.6	67	156.9	57.1	27	213.3	77.6	87	269.7	98.2
48	45.1	16.4	08	101.5	36.9	68	157.9	57.5	28	214.2	78.0	88	270.6	98.5
49	46.0	16.8	09	102.4	37.3	69	158.8	57.8	29	215.2	78.3	- 89	271.6	98.8
50	47.0	17.1	10	103.4	37.6	70	159.7	58.1	- 30	216.1	78.7	90	272.5	99.2
51	47.9	17.4	111	104.3	38.0	171	160.7	58.5	231	217.1	79.0	291	273.5	99.5
52	48.9	17.8	12	105.2	38.3	72	161.6	58.8	32	218.0	79.3	92	274.4	99.9
53	49.8	18.1	13	106.2	38.6	73	162.6	59.2	- 33	218.9	79.7	93	275.3	100.2
54	50.7	18.5	14	107.1	39.0	74	163.5	59.5	34	219.9	80.0	94	276.3	100.6
55	51.7	18.8	15	108.1	39.3	75	164.4	59.9	35	220.8	80.4	95	277.2	100.9
56	52.6	19.2	16	109.0	39.7	76	165.4	60.2	36	221.8	80.7	96	278.1	101.2
57	53.6	19.5	17	109.9	40.0	77.	166.3	60.5	37	222.7	81.1	97	279.1	101.6
58	54.5	19.8	18	110.9	40.4	78	167.3	60.9	38	223.6	81.4	98	280.0	101.9
59	55.4	20.2	19	111.8	40.7	79	168.2	61.2	39	224.6	81.7	99	281.0	102.3
60	56.4	20.5	20	112.8	41.0	80	169.1	61.6	40	225.5	82.1	300	281.9	102.6
Dist.	Dep.	Lat.	Dist.	Dep.	Lat.	Dist.	Dep.	Lat.	Dist.	Dep.	Lat.	Dist.	Dep.	Lat.
							100 050	0.0000	\ \					·
						0° (1	10°, 250	°. 290°	1.					

						Т	ABLE	2.					[Page	407
]	Differe	ence of I	Latitud	e and	Depart	ure for	20° (160°, 20	0°, 340°	°).		
Dist.	Lat.	Dep.	Dist.	Lat.	Dep.	Dist.	Lat.	Dep.	Dist.	Lat.	Dep.	Dist.	Lat.	Dep.
301	282.9	103.0	361	339.2	123.5	421	395.6	144.0	481	452.0	164.5	541	508.4	185.0
$02 \\ 03$	283.8 284.7	103.3 103.6	$\frac{62}{63}$	340.2 341.1	123.8 124.2	$\frac{22}{23}$	396.6 397.5	144.7	82 83	453.0	164.8 165.2	$\frac{42}{43}$	509.3 510.3	185.4 185.7
04	285.7	104.0	64	342.1	124.5	24	398.4	145.0	84	454.8	165.5	44	511.2	186.0
05 06	$286.6 \\ 287.6$	104.3 104.7	69 66	343.0 343.9	124.8 125.2	$\frac{2\mathfrak{d}}{26}$	399.4 400.3	140.4 145.7	80 86	455.8 456.7	165.9 166.3	45 46	512.1 513.1	186.4 186.8
07	288.5	105.0	67	344.9	125.5	$\overline{27}$	401.3	146.1	87	457.7	166.6	47	514.0	187.1
08	289.4	105.4 105.7	$-68 \\ -69$	345.8	125.9 126.2	$\frac{28}{29}$	402.2 403.1	146.4 146.7	88	458.6	166.9 167.3	48	515.0 515.9	187.4 187.8
10	291.3	106.0	70	347.7	120.2 126.6	$\frac{20}{30}$	404.1	147.1	90	460.5	167.7	50	516.8	188.2
311	292.3	106.4	371	348.6	126.9	431	405.0	147.4	491	461.4	168.0	551	517.8	188.5
$\frac{12}{13}$	293.2 294.1	106.7 107.1	$\frac{72}{73}$	349.0	$127.2 \\ 127.6$	$\frac{32}{33}$	406.0	147.8 148.1	92 93	462.4 463.3	108.3 168.6	$\frac{52}{53}$	518.7 519.7	188.8 189.1
14	395.1	107.4	74	351.5	127.9	34	407.8	148.4	94	464.2	168.9	54	520.6	189.4
$15 \\ 16$	296.0 297.0	107.7 108.1	$75 \\ 76$	352.4 353.3	128.3 128.6	35 36	408.8 409.7	148.8 149.1	- 95 - 96	465.2 466.1	169.3 169.6	55 56	521.5 522.5	189.8 190.2
17	297.9	108.4	77	354.3	120.0 129.0	37	410.7	149.5	97	467.0	170.0	57	523.4	190.5
18	298.8	108.8	78	355.2	129.3	38	411.6	149.8	98	468.0	170.3 170.7	58	524.4 595.9	190.8
$\frac{19}{20}$	299.8	109.1	80	350.2 357.1	129.0	40	413.5	150.2 150.5	500	469.9	171.0	60	526.2	191.2 191.6
321	301.6	109.8	381	358.0	130.3	441	414.4	150.8	501	470.8	171.3	561	527.2	191.9
$\frac{22}{93}$	302.6 303.5	110.1 110.5	82 83	359.0	130.7 131 0	$\frac{42}{43}$	415.4	$151.2 \\ 151.5$	$02 \\ 03$	471.7 479.7	171.7 172.0	$\frac{62}{63}$	528.1 529.0	192.2 192.5
$\frac{23}{24}$	303.5 304.5	110.8	84	360.8	131.3	44	417.2	151.9	04	473.6	172.4	64	530.0	192.9
$\frac{25}{96}$	305.4	111.2	85	361.8	131.7	45	418.2	152.2	05	474.5	172.7	65 ee	530.9	193.2
$\frac{20}{27}$	306.3 307.3	111.8	80	363.7	132.0 132.4	40	419.1	152.9 152.9	07	476.4	173.4	67	531.8 532.8	193.0 193.9
28	308.2	112.2	88	364.6	132.7	48	421.0	153.2	08	477.3	173.7	68	533.7	194.2
$\frac{29}{30}$	309.2 310.1	112.5 112.9	- 89 - 90	366.5	133.1 133.4	-49 50	421.9 422.9	153.0 153.9	10	478.3	174.1 174.4	69 70	535.6	194.0 195.0
331	311.0	113.2	391	367.4	133.7	451	423.8	154.3	511	480.2	174.8	571	536.6	195.3
$\frac{32}{33}$	312.0 312.9	113.6	92 93	368.4	134.1	$52 \\ 53$	424.7 425.7	154.6 154.9	12	481.1	175.1 175.4	$72 \\ 73$	537.5 538.5	195.6
$\frac{33}{34}$	312.9 313.9	113. 3	94	370.2	134.8	54	426.6	155.3	14	483.0	175.8	74	539.4	196.3
$\frac{35}{26}$	314.8 215.7	114.6	95	371.2	135.1 125.1	55	427.6	155.6 156.0	15	484.0	176.1	$\frac{75}{76}$	540.3	196.6
$\frac{30}{37}$	310.7 316.7	114.9	97	372.1 373.1	135.8	57	428.0	156.3	17	485.8	176.8	$\frac{70}{77}$	541.5 542.2	197.0 197.3
38	317.6	115.6	98	374.0	136.1	58	430.4	156.7	18	486.8	177.2	78	543.2	197.7
$-39 \\ -40$	318.6 319.5	116.0 116.3	400	374.9 375.9	130.5 136.8	- 59 - 60	431.3 432.3	157.4	$\frac{19}{20}$	487.7	177.9	- 19 - 80	544.1 545.0	198.0 198.4
341	320.4	116.6	401	376.8	137.2	461	433.2	157.7	521	489.6	178.2	581	546.0	198.7
42	321.4	117.0	$\frac{02}{02}$	377.8 278.7	137.5	62	434.1	158.0	22	490.5	178.5	82	546.9	199.0
43	323.3	117.5	03	379.6	137.8	64	436.0	158.7	$\frac{23}{24}$	491.0	178.9	84 84	548.8	199.4
45	324.2	118.0		380.6	138.5	65	437.0	159.0	25	493.4	179.6	85	549.8	200.1
40 47	320.1 326.1	118.4	00	382.5	138.9 139.2	66 67	437.9	159.4 159.7	20	494.3	179.9	80 87	550.7 551.7	200.4 200.8
48	327.0	119.0	08	383.4	139.6	68	439.8	160.1	28	496.2	180.6	88	552.6	201.2
$\frac{49}{50}$	328.0 328.9	119.4 119.7	10	384.3 385.3	139.9 140.2	69 70	$ 440.7 \\ 441.7 $	160.4 160.8	29 30	497.1 498.1	181.0 181.3	- 89 - 90	553.5	201.5 201.8
351	329.8	120.1	411	386.2	140.6	471	442.6	161.1	531	499.0	181.6	591	555.4	202.1
52 E 2	330.8	120.4	12	387.2	140.9	72	443.5	161.4	32	499.9	181.9	92	556.3	202.4
$\frac{53}{54}$	332.7	120.7 121.1	$13 \\ 14$	389.0	141.3 141.6	74 74	444.0	101.8 162.1	- 33 - 34	500.9 501.8	182.3 182.6	93 94	557.3 558.2	$\begin{array}{c c} 202.8\\ 203.2 \end{array}$
55	333.6	121.4	15	390.0	141.9	75	446.4	162.5	35	502.7	183.0	95	559.1	203.5
- 56 - 57	334.5	121.8 122.1	16 17	390.9	142.3	$\frac{76}{77}$	447.3	162.8 163.9	$\frac{36}{37}$	503.7	$ 183.3 \\ 183.7 $	96 97	560.0 561.0	203.8 204.9
58	336.4	122.5	18	392.8	143.0	78	449.2	163.5	38	505.5	184.0	98	561.9	204.6
59 60	$\begin{vmatrix} 337.4\\ 338 2 \end{vmatrix}$	122.8	19	393.7	143.3 142.7	79	450.1	163.8 164.9	39	506.5	184.3	99 600	562.9	204.9
		1			110.1		T.10F	104.2	40	001.4	104.1	000	000.0	
Dist.	Dep.	Lat.	Dist.	Dep.	Lat.	Dist.	Dep.	Lat.	Dist.	Dep, ·	Lat,	Dist.	Dep.	Lat.
						705 ($110^{\circ}, 25$	0~, 2909	-).					

	TABLE 2. Difference of Latitude and Departure for 21° (159°, 201°, 339°). tist Lat. Dep. Dist. Lat. Dep. 1 Dist. Lat. Dep. Dist. Lat. Dep. Dist. Lat. Dep. Dist. Lat. Dep. 1 0.9 0.4 61 56.9 21.9 121 113.0 43.4 181 169.0 64.9 241 225.0 86.4													
D]	Differe	ence of 1	Latitud	e and	Departu	ire for	21° (1	.59°, 201	°, 339°	°).		1
Dist	Lat.	Dep.	Dist.	Lat.	Dep.	Dist.	Lat.	Dep.	Dist.	Lat.	Dep.	Dist.	Lat.	Dep.
1	0.9	0.4	61	56.9	21.9	121	113.0	43.4	181	169.0	64.9	241	225.0	86.4
$\frac{2}{2}$	1.9	0.7	62	57.9	22.2	22	113.9	43.7	82	169.9	65.2	42	225.9	86.7
3	$\frac{2.8}{2.7}$		63 6 t	50.7	22.6	23	114.8	44.1	83	170.8	65.6	43	226.9	87.1
5	$\frac{3.7}{4.7}$	1.4	65	60.7	$\frac{22.9}{23.3}$	24	110.0 116.7	44.4	85	171.0	66.3	44	221.8	87.9
6	5.6	2.2	66	61.6	23.7	-26	117.6	45.2	86	173.6	66.7	46	229.7	88.2
7	6.5	2.5	67	62.5	24.0	27	118,6	45.5	87	174.6	67.0	47	230.6	88.5
8	7.5	2.9	68	63.5	24.4	28	119.5	45.9	88	475.5	67.4	48	231.5	88.9
10	8.4	$\frac{3.2}{2.6}$	- 69 - 70	65.4	24.7	29	120.4 121.4	46.2	89	176.4	67.7	49	232.5	89.2
-10	10.3	$\frac{3.0}{2.0}$	$\frac{70}{71}$	66.3	$\frac{20.1}{25.4}$	131	121.4	40.0	101	178 2	<u> </u>	951	200.4	$-\frac{89.0}{00.0}$
$\frac{11}{12}$	10.3 11.2	4.3	72^{-1}	67.2	25.4 25.8	32	122.5 123.2	47.3	$\frac{101}{92}$	170.0 179.2	68.8	52	235.3	90.0
13	12.1	4.7	73	68.2	26.2	33	124.2	47.7	93	180.2	69.2	53	236.2	90.7
14	13.1	5.0	74	69.1	26.5	- 34	125.1	48.0	94	181.1	69.5	54	237.1	91.0
15	14.0	$\frac{5.4}{-1}$	$\frac{75}{76}$	70.0	26.9	35	126.0	48.4	95	182.0	69.9 70.9	55	238.1	91.4
10	14.9	0.7 6.1	$\frac{70}{77}$	71.0 71.9	$\frac{27.2}{27.6}$	30	127.0 197.0	48.7	90	183.0	70.2	- 00 - 57	239.0	91.7
18	16.8	6.5	78	72.8	$\frac{27.0}{28.0}$	38	121.3 128.8	49.5	98	184.8	71.0	58	240.9	92.5
19	17.7	6.8	79	73.8	28.3	39	129.8	49.8	99	185.8	71.3	59	241.8	92.8
20	18.7	7.2	80	74.7	28.7	_40	130.7	50.2	200	186.7	71.7	60	242.7	93.2
21	19.6	7.5	81	75.6	29.0	141	131.6	50.5	201	187.6	72.0	261	243.7	93.5
22	20.5	. 7.9	82	76.6	$\frac{29.4}{20.7}$	42	132.6 122.5	50.9 51.9	02	188.6	72.4	$62 \\ 62$	244.6	93.9
$\frac{23}{24}$	21.0	8.2 8.6	84	78.4	$\frac{29.7}{30.1}$	40	133.0 134.4	51.2 51.6	05	189.5	73 1	60 61	240.0	94.3
25	$\tilde{23.3}$	9.0	85	79.4	30.5	45	135.4	52.0	05	191.4	73.5	65	247.4	95.0
26	24.3	9.3	86	80.3	30.8	46	136.3	52.3	-06	192.3	73.8	66	248.3	95.3
27	25.2	9.7	87	81.2	$\frac{31.2}{51}$	47	137.2	52.7	07	193.3	74.2	67	249.3	95.7
28	$\frac{26.1}{27.1}$	10.0 10.4	88	82.2	31.0	48	138.2 130.1	03.0 53.1	08	194.2	74.5	68	250.2 251.1	96.0
$\frac{29}{30}$	$\frac{27.1}{28.0}$	10.4 10.8	90	84.0	32.3	50	139.1 140.0	53.8	10	190.1 196.1	74.5 75.3	70	251.1 252.1	96.8
31	28.9	11.1	- 91	85.0	32.6	151	141.0	54.1	211	197.0	75.6	271	253.0	97.1
32	29.9	11.5	-92°	85.9	33.0	- 52	141.9	54.5	12	197.9	76.0	72	253.9	97.5
33	30.8	11.8	93	86.8	33.3	53	142.8	54.8	13	198.9	76.3	73	254.9	97.8
34	31.7	12.2 12.5	94	81.8	33.7	04	143.8 144.7	55.Z	14	199.8	76.7	14	200.8	98.2
36	33.6	12.9 12.9	96	89.6	34.4	56	145.6	55.9	16	200.7	77 4	76	250.7	- 98.9
37	34.5	13.3	97	90.6	34.8	57	146.6	56.3	17	202.6	77.8	77	258.6	99.3
38	35.5	13.6	- 98	91.5	35.1	58	147.5	56.6	18	203.5	78.1	78	259.5	99.6
39	36.4	14.0	99	92.4	35.5	59	148.4	57.0	19	204.5	78.5	79	260.5	100.0
40	31.3	14.0	$\frac{100}{101}$	95.4	30.8	101	149.4	01.0	20	205.4	18.8	-301	201.4	100.3
41	30.5 30.2	14.7 15.1	$101 \\ 02$	94.5	36.2	101 62	150.5 151.2	58 1	221	200.3	79.2	281	262.3	100.7
43	40.1	15.4	03	96.2	86.9	63	152.2	58.4	$\frac{22}{23}$	201.0 208.2	79.9	83	263.3 264.2	101.1
44	41.1	15.8	04	97.1	37.3	64	153.1	58.8	24	209.1	80.3	84	265.1	101.8
45	42.0	16.1	05	98.0	37.6	65	154.0	59.1	25	210.1	80.6	85	266.1	102.1
46	42.9	16.5 16.9	06	99.0	38.0	66	155.0 155.0	50 °	26	211.0 911.0	81.0	86	267.0	102.5
48	44 8	10.8 17.2	08	100.8	38.7	68	156.8	60.2	$\frac{27}{28}$	211.9 212.9	81.5	88	267.9	102.9 103.9
49	45.7	17.6	09	101.8	39.1	69	157.8	60.6	29	213.8	82.1	89	269.8	103.6
50	46.7	17.9	10	102.7	39.4	70	158.7	60.9	30	214.7	82.4	-90	270.7	103.9
51	47.6	18.3	111	103.6	39.8	171	159.6	61.3	231	215.7	82.8	291	271.7	104.3
52	48.5	18.6	12	104.6 105.5	40.1 40.5	72	160.6 161.5	61.6	32	216.6 917.5	83.1	92	272.6	104.6
54	49.0 50.4	19.0	10	105.5 106.4	40.9	70	162 4	62.0 62.4	- 30 - 31	$\frac{217.9}{318.5}$	83.9	90	273.0	105.0
55	51.3	19.7	15	107.4	41.2	75	163.4	62.7	35	219.4	84.2	95	275.4	105.7
56	52.3	20.1	16	108.3	41.6	76	164.3	63.1	- 36	220.3	84.6	96	276.3	106.1
57	53.2	20.4	17	109.2	41.9	77	165.2	63.4	37	221.3	84.9	97	277.3	106.4
50 50	54.1 55.1	20.8	18	110.2 111 1	42.3	78 79	166.2 167.1	63.8	38	222.2	85.6	98	278.2 970.1	106.8 107.9
60	56.0	21.5	$\frac{10}{20}$	112.0	43.0	80	168.0	64.5	40	233.1 224.1	- 86.0	300	280.1	107.5
Dict	Den	Let	Diet	Den	Let	Diet	Dep	Lat	Dist	Den	Lat	Dist	Den	Lat
Dist.	Dep.	Lat.	Dist.	Deb*	Lat,	Dist.	Dep.		UDISC.	pep.	Lat,	Dist.	Deb.	LAUG

						Т	ABLF	E 2.					[Page	• 4 09
	_		Differ	ence of	Latituc	le and	Depart	ure for	21° (159°, 20	1°, 339	°).		
Dist.	Lat.	Dep.	Dist.	Lat.	Dep.	Dist.	Lat.	Dep.	Dist.	Lat.	Dep.	Dist.	Lat.	Dep.
301	281.0	107.9	361	337.0	129.4	421	393.0	150.9	481	449.0	172.4	541	505.1	193.9
$\frac{02}{03}$	281.9 282.9	108.2 108.6	$62 \\ 63$	337.9 338.9	129.7 130.1	$\frac{22}{23}$	394.0 394.9	151.2 151.6	82 83	450.0 450.9	172.7 173.1	42	506.0 507.0	194.2 194.6
04	283.8	108.9	64	339.8	130.4	24	395.8	152.0	84	451.8	173.5	44	507.9	195.0
05 06	284.7 285.7	109.3 109.7	65 66	340.7 341.7	130.8 131.2	$\frac{25}{26}$	396.8 397 7	152.3 152.7	85 86	$ 452.8 \\ 153.7 $	173.8 171.9	45	508.8 509.8	$ 195.3 \\ 195.7$
07	286.6	110.0	67	342.6	131.5	27	398.6	153.0	87	454.6	174.5	47	510.7	196.0
08	287.5	110.4	$\frac{68}{79}$	343.5 314.5	131.9 132.2	28	399.6	153.4 153.7	88	455.6	174.9 175.9	48	511.6 512.6	196.4
10	289.4	111.1	70	345.4	132.6	$\frac{20}{30}$	401.4	154.1	90	457.4	175.6	50	513.5	190.0 197.1
311	290.3	111.5	371	346.3	133.0	431	402.4	154.5	491	458.4	176.0	551	514.4	197.5
$\frac{12}{13}$	291.3 292.2	111.8 112.2	$\frac{72}{73}$	347.3	133.3 133.7	$\frac{32}{33}$	403.3	154.8 155.2	92 93	459.3	176.3 176.7	53	515.4 516.3	197.8 198.2
14	293.1	112.5	74	349.1	134.0	34	405.2	155.5	94	461.2	177.0	54	517.2	198.6
$\frac{15}{16}$	294.1 295.0	112.9 113.2	75	350.1 351.0	134.4 134.7	35 36	406.1	155.9 156.3	95 96	462.1	$177.4 \\ 177.8$	- 55 - 56	518.2 519.1	198.9 199.3
17	295.9	113.6	77	351.9	135.1	37	408.0	156.6	97	464.0	178.1	57	520.0	199.6
$\frac{18}{19}$	296.9 297.8	114.0 114.3	$\frac{78}{79}$	352.9 353.8	$135.5 \\ 135.8$	$\frac{38}{39}$	408.9	157.0 157.3	98 99	464.9 465.8	178.5 178.8	58 59	521.0 521.9	200.0 200.3
$\frac{10}{20}$	298.7	114.7	80	354.7	136.2	40	410.8	157.7	500	566.8	179.2	60	522.8	200.7
321	299.7	115.0	381	355.7	136.5	441	411.7	158.0 158.1	501	467.7	179.5 170.0	561	523.8	201.0
$\frac{22}{23}$	300.0 301.5	115.4 115.8	83	350.0 357.5	130.9 137.3	$\frac{42}{43}$	412.6	158.4 158.8	$\cdot \frac{02}{03}$	408.0	179.9 180.3	62 63	524.7 525.6	201.4
24	302.5	116.1	84	358.5	137.6	44	414.5	159.1	04	470.5	180.6	64	526.6	202.1
$\frac{25}{26}$	303.4 304.3	116.5 116.8	$-85 \\ -86$	359.4	138.0 138.3	45 46	415.4	159.5 159.8	05	471.5 472.4	181.0 181.3	60 66	527.5 528.4	202.5 202.8
27	305.3	117.2	87	361.3	138.7	47	417.3	160.2	07	473.3	181.7	67	529.4	203.2
$\frac{28}{29}$	$306.2 \\ 307.1$	$117.5 \\ 117.9$	$\frac{88}{89}$	362.2 363.1	139.1 139.4	$\frac{48}{49}$	418.2	160.5 160.9	08	474.3 475.2	182.0 182.4	$\frac{68}{69}$	530.3 531.2	203.5 203.9
30	308.1	118.3	90	364.1	139.8	50	420.1	161.3	10	476.1	182.8	70	532.2	204.3
$\frac{331}{29}$	309.0 309.0	118.6 110.0	391	365.0	140.1 140.5	451	421.0	161.6 162.0	$511 \\ 19$	477.1	183.1 183.5	571	533.1 531.0	204.6
33	310.9	119.3	93^{-92}	366.9	140.8	53^{-52}	422.9	162.3	13	478.9	183.8	$\frac{12}{73}$	535.0	205.4
$\frac{34}{25}$	311.8	119.7 120.1	94	367.8	141.2	$54 \cdot 55$	423.8	162.7	14	479.9	184.2	74	535.9	205.7
36	312.7 313.7	120.1 120.4	- 3 5 - 96	369.7	141.9	56	424.8	163.1 163.4	$10 \\ 16$	480.8	184.9	76 76	537.8	206.4
$\frac{37}{20}$	314.6	120.8	· 97	370.6 271.5	142.3	57	426.6	163.8	17	482.7	185.3	77	538.7	206.8
$\frac{30}{39}$	316.5 316.5	121.1 121.5	99 99	371.5 372.5	142.0 143.0	$58 \\ 59$	427.0	164.1	19	484.5	185.0 186.0	79^{18}	540.6	207.1 207.5
40	317.4	121.8	400	373.4	143.4	60	429.4	164.9	20	485.5	186.4	80	541.5	207.9
$\frac{341}{42}$	318.3 319.3	122.2 122.6	$ \frac{401}{02} $	374.3 375.3	143.7 144.1	$\frac{461}{62}$	430.4 431.3	$165.2 \\ 165.6$	$\frac{521}{22}$	486.4 487.3	186.7 187.1	581 82	542.4 543.4	208.2 208.6
43	320.2	122.9	03	376.2	144.4	63	432.2	165.9	23	488.3	187.4	83	544.3	208.9
44 45	$\frac{321.1}{322}$	$\begin{array}{c} 123.2 \\ 123.6 \end{array}$	$04 \\ 05$	$377.1 \\ 378.1$	$144.8 \\ 145.1$	$64 \\ 65$	433.2 434.1	166.3 166.6	$\frac{24}{25}$	489.2 490.1	$187.8 \\ 188.1$	84 85	545.2 546 2	209.3 209.6
46	323.0	124.0	06	379.0	145.5	66	435.0	167.0	26	491.1	188.5	86	547.1	210.0
47	323.9 324.9	124.4 191 7	07	379.9 380.9	145.9 146.9	67 68	436.0 436.0	$167.4 \\ 167.7$	27 28	492.0	188.9 189.9	87 89	548.0 549.0	210.4 210.7
49	325.8	125.1	09	381.8	146.6	69	437.8	168.1	29	493.9	189.6	89	549.9	211.1
50	326.7	125.4	10	382.7	146.9	70	438.8	168.4	30	494.8	189.9	90	550.8	211.4
$\begin{array}{c c} 351 \\ 52 \end{array}$	327.7 328.6	125.8 126.1	411 12	383.7 384.6	147.3 147.7	$\frac{471}{72}$	439.7 440.6	168.8 169.2	$\frac{531}{32}$	495.7	190.3 190.7	$\frac{591}{92}$	551.8 552.7	211.8 212.2
$\overline{53}$	329.5	126.5	13	385.5	148.0	73	441.6	169.5	33	497.6	191.0	93	553.6	212.5
$\frac{54}{55}$	330.5 331.4	$126.9 \\ 127.2$	14 15	386.5 387.4	$148.4 \\ 148.7$	$\frac{74}{75}$	442.5 443.4	$169.9 \\ 170.2$	34 35	498.5 499.5	$191.4 \\ 191.7$	94 95	554.6 555.5	212.9 213.2
56	332.3	127.6	16	388.4	149.1	76	444.4	170.6	36	500.4	192.1	96	556.4	213.6
$57 \\ 58$	333.3 334.9	127.9 128.3	17	389.3 390.2	$149.4 \\ 149.8$	$77 \\ 78$	445.3 446.2	170.9 171.3	37	501.3 502.3	192.4 192.8	97 98	557.4 558.2	213.9 214.3
59	335.1	128.7	19	391.2	150.2	79	447.2	171.7	39	503.2	193.2	99	559.2	214.7
60	336.1	129.0	20	392.1	150.5	80	448.1	172.0	40	504.1	193.5	60 0	560.1	215.0
Dist.	Dep.	Lat.	Dist.	Dep.	Lat.	Dist.	Dep.	Lat,	Dist.	Dep.	Lat.	Dist.	Dep.	Lat.
					(69° (1	11°, 249	°, 291°).					

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Page 410] TABLE 2.

Difference of Latitude and Departure for 22° (158°, 202, 338°).

Dist.	Lat.	Dep.	Dist.	Lat.	Dep.	Dist.	Lat.	Dep.	Dist.	Lat.	Dep.	Dist.	Lat.	Dep.
					~ · · · ·									
1	0.9	0.4	61	56.6	22.9	121	112.2	45.3	181	167.8	67.8	241	223.5	90.3
$\frac{2}{2}$	1.9	0.7	62 69	07.5 59 1	23.2	22	113.1	45.7	82	168.7	68.2 69.0	42	224.4	90.7
$\frac{3}{4}$	$\frac{2.8}{3.7}$	1.1 1.5	03 64	59 3	24.0	20	115.0	46.5	84	170 6	68.9	45	226.3 226.2	91.0
$\hat{5}$	4.6	1.9	65	60.3	24.3	25	115.9	46.8	85	171.5	69.3	45	227.2	91.8
6	5.6	2.2	66	61.2	24.7	26	116.8	47.2	86	172.5	69.7	46	228.1	92.2
7	6.5	2.6	67	62.1	25.1	27	117.8	47.6	87	173.4	70.1	47	229.0	92.5
0	8.3	3.0	- 68 - 69	64 0	20.0 25.8	28 29	118.7	47.9	89	174.3 175.9	70.4 70.8	48	229.9 230.9	92.9
10	9.3	3.7	70	64.9	26.2	30	120.5	48.7	90	176.2	71.2	50	231.8	93.7
11	10.2	4.1	71	65.8	26.6	131	121.5	49.1	191	177.1	71.5	251	232.7	94.0
12	11.1	4.5	72	66.8	27.0	32	122.4	49.4	92	178.0	71.9	52	233.7	94.4
13	12.1	4.9 5.9	$\frac{73}{74}$	67.7 68 c	27.3 27.7	33	123.3 124.9	49.8 50.2	93	178.9	72.3	53	234.6	94.8
14	13.0	$5.2 \\ 5.6$	75^{+}	69.5	28.1	34	124.2 125.2	50.2 50.6	95	180.8	73.0	04 55	250.5 236.4	95.2 95.5
16	14.8	6.0	76	70.5	28.5	36	126.1	50.9	- 96	181.7	73.4	56	237, 4	95.9
17	15.8	6.4	77	71.4	28.8	37	127.0	51.3	97	182.7	73.8	57	238.3	96.3
18	16.7 17.8	6.7 7 1	78	72.3	29.2	38	128.0 129.0	51.7 59.1	98	183.6	74.2	58	239.2	96.6
20	17.0 18.5	7.5	80	73.2 74.2	29.0 30.0	- 39 - 40	128.9 129.8	52.1 52.4	200	184.0	74.9	- 69 - 60	240.1	97.0
$\frac{-0}{21}$	19.5	7.9	81	75.1	30.3	141	130.7	52.8	201	186.4	75.3	261	242.0	97.8
22	20.4	8.2	82	76.0	30.7	42	131.7	53.2	02	187.3	75.7	62	242.9	98.1
23	21.3	8.6	83	77.0	31.1	43	132.6	53.6	03	188.2	76.0	63	243.8	98.5
24	$\frac{22.3}{23.2}$	9.0	84	71.9	31.5	44	133.5 131.4	53.9	04	189.1	76.4	64 65	244.8	98.9
$\frac{23}{26}$	$\frac{23.2}{24.1}$	9.4 9.7	86	79.7	31.0 32.2	46	134.4 135.4	54.7	06	190.1	70.8 77.2	66	246.6	99. 3 99. 6
27	25.0	10.1	87	80.7	32.6	47	136.3	55.1	07	191.9	77.5	67	247.6	100.0
28	26.0	10.5	88	81.6	33.0	48	137.2	55.4	08	192.9	77.9	68	248.5	100.4
29	$\frac{26.9}{27.8}$	10.9 11.9	89	82.5	33.3	49	138.2	55.8 56.9	09	193.8	78.3	$\frac{69}{70}$	249.4	100.8
31	28.7	$\frac{11.4}{11.6}$	- 91	84 4	34 1	151	$\frac{133.1}{140.0}$	56 6	211	194.7	79.0	271	250.3	101.1
32	29.7	12.0	92	85.3	34.5	52	140.9	56.9	12	196.6	79.4	72	252.2	101.9
33	30.6	12.4	93	86.2	34.8	53	141.9	57.3	13	197.5	79.8	73	253.1	102.3
34	31.5	12.7	94	87.2	35.2	54	142.8	57.7	14	198.4	80.2	74	254.0	102.6
30 36	32.0 33.4	13.1 13.5	95 96	88.1	30.6	00 56	143,7	58.1 58.4	10 16	199.3	80.5	70 76	255.0 255.9	103.0 103.4
37	34.3	13.9	97	89.9	36.3	57	145.6	58.8	17	201.2	81.3	77	256.8.	103.8
38	35.2	14.2	98	90.9	36.7	58	146.5	59.2	18	202.1	81.7	78	257.8	104.1
39	$\frac{36.2}{27}$	14.6	99	91.8	37.1	59 60	147.4	59.6	19	203.1	82.0	79	258.7	104.5
40	38.0	15.0 15.4	100	92.1	31.0	$\frac{00}{161}$	148.3	<u>80 2</u>	$\frac{20}{991}$	204.0	82.4	- 80	209.0	104.9
42	38.9	15.4 15.7	02	93.0	38.2	62^{101}	149.3 150.2	60.3	$\frac{221}{22}$	204.9 205.8	83.2	82	260.5 261.5	105.6
43	39.9	16.1	03	95.5	38.6	63	151.1	61.1	23	206.8	83.5	83	262.4	106.0
44	40.8	16.5	04	96.4	39.0	64	152.1	61.4	24	207.7	83.9	84	263.3	106.4
45	41.7	16.9	05	97.4	39.3	65 66	153.0	61.8	25	208.6	84.3	85	264.2	106.8
47	43.6	17.6	07	99.2	40.1	67	153.9	62.2 62.6	27	209.5 210.5	85.0	87	266.2 266.1	107.5
48	44.5	18.0	08	100.1	40.5.	68	155.8	62.9	28	211.4	85.4	88	267.0	107.9
49	45.4	18.4	09	101.1	40.8	69	156.7	63.3	29	212.3	85.8	89	268.0	108.3
50	46.4	18.7	$\frac{10}{111}$	102.0	41.2	70	157.6	63.7	$\frac{30}{001}$	213.3	86.2	90	268.9	108.6
$\frac{51}{59}$	47.3	19.1	111 19	102.9	41.6	271	158.5 150.5	64.1 64.4	231 39	214.2 215.1	86.5	291	269,8	109.0
53	49.1	19.9	$12 \\ 13$	104.8	42.3	73^{-2}	160.4	64.8	33	210.1 216.0	87.3	93	271.7	109.4
54	50.1	20.2	14	105.7	42.7	74	161.3	65.2	34	217.0	87.7	94	272.6	110.1
55	51.0	20.6	15	106.6	43.1	75	162.3	65.6	35	217.9	88.0	95	273.5	110.5
$\frac{56}{57}$	51.9 52.8	21.0 21.4	16	107.6	43.5	$\frac{76}{77}$	163.2 164.1	65.9	$\frac{36}{27}$	218.8 210.7	88.4	96 97	274.4 275.4	110.9
58	53.8	21.4 21.7	18	109.4	44.2	78	165.0	66.7	- 38	220.7	89.2	98	276.3	111.6
59	54.7	22.1	19	110.3	44.6	79	166.0	67.1	39	221.6	89.5	99	277.2	112, 0
60	55.6	22.5	20	111.3	45.0	80	166.9	67.4	40	222.5	89.9	300	278.2	112.4
Dist.	Dep.	Lat.	Dist.	Dep.	Lat.	Dist.	Dep.	Lat.	Dist.	Dep.	Lat.	Dist.	Dep.	Lat.
				1	1	000 /	1100 04	00 000	9)					
						08* (112-, 24	5', 292).					

						Ľ	ABLI	E 2.					[Page	e 411
			Differe	ence of l	Latitud	e and	Departu	ire for	22° (1	58°, 202	?°, 338°	') .		
Dist.	. Lat.	Dep.	Dist.	Lat.	Dep.	Dist.	Lat.	Dep.	Dist.	Lat.	Dep.	Dist.	Lat.	Dep.
301	279.1	112.7	361	334.7	135.2	421	390.3	157.7	481	446.0	180.2	541	501.6	202.7
$02 \\ 03$	280.0 280.9	113.1 113.5	$62 \\ 63$	336.6	136.0	$\frac{22}{23}$	392.2	158.1 158.4	83	447.8	180.0 180.9	43	502.5 503.4	203.1
04	281.9	113.9	64	337.5	136.3	24	393.1	158.8	84	448.8	181.3	44	504.4	203.8
05	282.8	114.2 114.6	$65 \\ 66$	338.4	136.7 137 1	25 26	394.1 395.0	159.2 159.6	85 86	449.7	181.7 182 1	45 46	505.3	204.2 204.6
07	283.7 284.6	115.0	67	340.3	137.5	27	395.9	159.9	87	451.6	182.4	47	500.2 507.2	205.0
08	285.6	115.4	68	341.2	137.8	28	396.8	160.3	88	452.5	182.8	48	508.1	205.3
$ \begin{array}{c} 09 \\ 10 \end{array} $	286.5	115.7 116.1	$\frac{69}{70}$	342.1 343.1	138.2 138.6	29 30	397.8	160.7 161 1	- 89 - 90	453.4	$183.2 \\ 183.6$	49 50	509.0	205.7 206.1
$\frac{10}{311}$	288.4	$\frac{110.1}{116.5}$	371	344.0	130.0 139.0	431	399.6	101.1 161.4	491	455.3	184.0	551	510.9	$\frac{200.1}{206.5}$
12	289.3	116.8	72	344.9	139.3	32	400.5	161.8	92	456.2	184.3	52	511.8	206.8
13	290.2	117.2	$73 \\ 74$	345.8	139.7	33	401.5	162.2	93	457.1	184.7	53 54	512.7	207.2
15	291.1 292.1	117.0	75	347.7	140.1	35	402.4	162.9	95	459.0	185.1 185.4	55	514.6	207.0
16	293.0	118.3	76	348.6	140.8	36	404.3	163.3	96	459.9	185.8	56	515.5	208.3
17	293.9	118.7	$77 \\ 78$	349.5	141.2 1.11.6	37	405.2 406.1	163.7	97	460.8	186.2 186.6	57 58	516.4	208.7
19	295.8	119.1	79	351.4	141.9	39	407.0	164.4	99	462.7	186.9	59	518.3	209.4
20	296.7	119.8	80	352.3	142.3	40	408.0	164.8	500	463.6	187.3	60	519.2	209.8
$\frac{321}{22}$	297.6	120.2	$\frac{381}{82}$	353.3	142.7 142.1	441	408.9	165.2	501	464.5	187.7	$561 \\ 62$	520.1 521.0	210.2
$\frac{24}{23}$	298.0 299.5	120.0 121.0	82	355.1	140.1 143.4	42	410.7	165.9	02	466.4	188.4	63	521.0 522.0	210.9
24	300.4	121.3	84	356.0	143.8	44	411.7	166.3	04	467.3	188.8	64	522.9	211.3
$\frac{25}{26}$	301.3	121.7 1991	85 86	357.0	144.2 144.6	45 46	412.6 413.5	166.7 167.0	05	468.2	189.2	65 66	523.8 524.8	211.7
$\frac{20}{27}$	302.5 303.2	122.1 122.5	80	358.8	144.9	40	414.5	167.4	07	409.2	189.9	67	525.7	212.0
28	304.1	122.8	88	359.7	145.3	48	415.4	167.8	08	471.0	190.3	68	526.6	212.8
$\frac{29}{30}$	305.0	$123.2 \\ 193.6$	89 90	360.7	$145.7 \\ 146.1$	49 50	416.3 417.2	$168.2 \\ 168.5$	09 10	471.9 472.9	190.7	69 70	527.5	213.2
331	306.9	$\frac{120.0}{124.0}$	391	362.5	$\frac{140.1}{146.4}$	451	418.2	168.9	511	473.8	$\frac{101.1}{191.4}$	571	529.4	213.9
32	307.8	124.3	92	363.5	146.8	52	419.1	169.3	12	474.7	191.8	72	530.3	214.3
33 31	308.8 309.7	124.7 125.1	93	364.4 365.3	147.2 147.6	53 54	420.0	169.7 170.0	$13 \\ 14$	475.6	192.2 192.5	73	531.2 532.2	214.7
35	310.6	125.5 125.5	95	366.2	147.9	55	421.9	170.4	15	477.5	192.9	75	533.1	215.4
36	311.5	125.8	96	367.2	148.3	56	422.8	170.8	16	478.4	193.3	76	534.0	215.8
37	312.5	126.2 126.6	97	368.1	148.7 149 1	57 58	423.7	$171.2 \\ 171.5$	11/	479.3	193.7 194.0	78	534.9	216.2 216.5
39	314.3	127.0	99	369.9	149.4	59	425.6	171.9	19	481.2	194.4	79	536.8	216.9
40	315.2	127.3	400	370.9	149.8	60	426.5	172.3	20	482.1	194.8	80	537.7	217.3
$\frac{341}{42}$	316.2 317.1	127.7 128 1	$401 \\ 02$	371.8 372.7	150.2 150.6	461 62	427.4 198.4	172.7 173.0	$\frac{521}{22}$	483.0 184.0	195.2 195.5	$\frac{581}{82}$	538.6 539.6	217.7 218 0
43	318.0	128.5 128.5	03	373.7	150.9	63	429.3	173.4	$\frac{22}{23}$	484.9	195.9	83	540.5	218.4
44	319.0	128.8	04	374.6	151.3	64	430.2	173.8	24	485.8	196.3	84	541.4	218.8
45 46	319.9 320.8	129.2 129.6	00 06	375.5	151.7 152.1	- 65 - 66	431.1 432.1	174.2 174.5	25 26	486.7	196.7 197.0	85 86	542.4	219.2 219.5
47	321.7	130.0	07	377.4	152.4	67	433.0	174.9	27	488.6	197.4	87	544.2	219.9
48	322.7	130.3	08	378.3	152.8	68	433.9	175.3	28	489.5	197.8	88	545.1	220.3
49 50	323.0 324.5	130.7 131.1	- 09 - 10	379.2 380.1	153.2 153.6	$\frac{69}{70}$	434.8 435.8	175.7 176.0	$\frac{29}{30}$	490.4	198.2 198.5	- 89 - 90	546.1 547.0	220.7 221.0
351	325.4	131.5	411	381.1	153.9	471	436.7	176.4	531	492.3	198.9	591	547.9	221.4
52	326.4	131.8	12	382.0	154.3	72	437.6	176.8	32	493.2	199.3	92	548.9	221.8
53 54	$\frac{327.3}{328.2}$	132.2 132.6	13 14	382.9	104.7 155.1	$\frac{73}{74}$	438.0	177.2 177.5	- 33 - 34	494.2 495.1	199.7	93 94	549.8 550 7	222.2 222.5
55	329.2	133.0	15	384.8	155.4	75	440.4	177.9	35	496.0	200.4	95	551.7	222.9
$56 \\ 57$	330.1	133.3	$16 \\ 17$	385.7	155.8	$\frac{76}{77}$	441.3	178.3	$\frac{36}{97}$	496.9	200.8	96	552.6	223.3
$\frac{57}{58}$	331.0 332.0	133.7 134.1	$\frac{17}{18}$	386.0	150.2 156.6	78	442.5	178.7 179.0	37	497.9	201.2 201.5	97	554.4	223. 1
59	332.9	134.5	19	388.5	156.9	79	444.1	179.4	39	499.7	201.9	99	555.4	224.4
60	333.8	134.8	20	389.4	157.3	80	445.0	179.8	40	500.7	202.3	600	556.3	224.8
Dist.	Dep.	Lat.	Dist.	Dep.	Lat.	Dist.	Dep.	Lat.	Dist.	Dep.	Lat.	Dist.	Dep.	Lat.
					6	68° (1	12°, 248	°, 292°).			1		

Pa	ge 412]				Т	ABL	2 2.						
			Diffe	rence of	Latitu	de and	l Dep ar	ture for	r 23° (157°, 20)3°, 337	°).		
Dist.	Lat.	Dep.	Dist.	Lat.	Dep.	Dist.	Lat.	Dep.	Dist.	Lat.	Dep.	Dist.	Lat.	Dep.
1	0.9	0.4	61	56.2	23.8	121	111.4	47.3	181	166.6	70.7	241	221.8	94.2
$\frac{2}{2}$	1.8	0.8	62	59.0	24.2	22	112.3	10 1	82	167.0	71.1	42	222.8	94.6
4	3.7	1.6	64	58.9	25.0	24	114.1	48.5	84	169.4	71.9	44	220.7	94.9
5	4.6	2.0	65	59.8	25.4	25	115.1	48.8	85	170.3	72.3	45	225.5	95.7
6	5.5	2.3	66	60.8	25.8	26	116.0	49.2	86	171.2	72.7	-46	226.4	96.1
7	6.4	2.7	67	61.7	26.2	27	116.9	49.6	· 87	$ 172.1 \\ 172.1$	73.1	47	227.4	96.5
å	83	3.1 3.5	60	63.5	20.0	28	117.8	50.0	88	173.1	73.0	48	228.3	96.9
10	9.2	3.9	70	64.4	27.4	30	119.7	50.8	90	174.9	74.2	50	229.2 230.1	97.7
11	10.1	4.3	71	65.4	27.7	.131	120.6	51.2	191	175.8	74.6	251	231.0	98.1
12	11.0	4.7	72	66.3	28.1	32	121.5	51.6	92	176.7	75.0	52	232.0	98.5
13	12.0	5.1	73	67.2	28.5	33	122.4	52.0	93	177.7	75.4	53	232.9	98.9
14	12.9 13.8	0.0 5.0	14	69.1	28.9	34	123.3	52.4	94	178.0	10.8	- 04 55	233.8	99.2
16	14.7	-6.3	76	70.0	29.7	36	121.0 125.2	53.1	96	180.4	76.6	56 - 56	235.6	100.0
17	15.6	6.6	77	70.9	30.1	· 37	126.1	53.5	97	181.3	77.0	57	236.6	100.4
18	16.6	7.0	78	71.8	30.5	38	127.0	53.9	98	182.3	77.4	58	237.5	100.8
19	17.5	1.4	79	$\begin{bmatrix} 72.7\\ 73.6 \end{bmatrix}$	30.9	39	128.0	54.3	99	183.2	77.8	59 60	238.4	101.2
-20	10.4	8.9	- 81	$\frac{73.0}{71.6}$	31.6	141	120. 9	55 1	200	185.0	78.5	261	$\frac{239.3}{940.3}$	101.0
22	20.3	8.6	- 82	75.5	32.0	42	130.7	55.5	02	185.9	78.9	62	241.2	102.4
23	21.2	9.0	-83	76.4	32.4	43	131.6	55.9	03	186.9	79.3	63	242.1	102.8
24	22.1	9.4	84	77.3	32.8	-44	132.6	56.3	04	187.8	79.7	64	243.0	103.2
20	23.0	9.8	80 86	79.2	33.2	40	133.0	57 0	05	188.7 189.6	80.1	60 88	243.9	103.5
27	$\frac{20.0}{24.9}$	10.2 10.5	87	80.1	34.0	47	135.3	57.4	07	190.5	80.9	67	245.8	103.3 104.3
28	25.8	10.9	88	81.0	34.4	48	136.2	57.8	08	191.5	81.3	68	246.7	104.7
29	26.7	11.3	89	81.9	34.8	49	137.2	58.2	09	192.4	81.7	69	247.6	105.1
30	27.6	$\frac{11.1}{10.1}$	$\frac{90}{01}$	82.8	$\frac{30.2}{95.6}$	$\frac{30}{151}$	138,1	50.0	$\frac{10}{911}$	193.3 101.9	82.1	$\frac{70}{-971}$	248.0	105.0
32	$\frac{26.5}{29.5}$	12.1 12.5	92	84.7	35.9	$\frac{151}{52}$	139.9	59.0 59.4	$\frac{211}{12}$	194.2 195.1	82.8	$\frac{271}{72}$	249.0 250.4	105.9 106.3
33	30.4	12.9	93	85.6	36.3	53	140.8	59.8	13	196.1	83.2	73	251.3	106.7
34	31.3	13.3	94	86.5	36.7	54	141.8	60.2	14	197.0	83.6	74	252.2	107.1
30	32.2	13.7	90	87.4	$\frac{37.1}{27.5}$	- 50 56	142.7	60.6	10	197.9	84.0	10 76	253.1	107.5
37	34 1	14.1 14.5	97	89.3	37.9	57	144 5	61.0	$10 \\ 17$	198.8	84.8	77	254.1 255.0	107.8
38	35.0	14.8	98	90.2	38.3	58	145.4	61.7	18	200.7	85.2	78	255.9	108.6
39	35.9	15.2	99	91.1	38.7	59	146.4	62.1	19	201.6	85.6	79	256.8	109.0
	36.8	15.6	100	-92.1	$\frac{39.1}{29.1}$	$\frac{60}{101}$	147.3	62.5	$\frac{20}{0.01}$	202.5	86.0	80	257.7	109.4
41	37.7	16.0	101	93.0	39.5	$161 \\ 69$	148.2 149.1	62.9	221	203.4	$ 86.4 \\ 86.7 $	281	258.7 250 6	109.8
42	39.6	10.4 16.8	$02 \\ 03$	94.8	$\frac{39.9}{40.2}$	63	149.1 150.0	63.5	$\frac{22}{23}$	204.4 205.3	87.1	83	260.5	110.2
44	40.5	17.2	04	95.7	40.6	64	151.0	64.1	24	206.2	87.5	84	261.4	111.0
45	41.4	17.6	05	96.7	41.0	65	151.9	64.5	25	207.1	87.9	85	262.3	111.4
46	42.3	18.0	06	97.6	41.4	66	152.8	64.9	26	208.0	88.3	86	263.3	111.7
-11 :	43.3	18.4	07	98.0	41.8	68	155.7	65 6	21	209.0	89 1	88	264.2 265.1	112.1 112.5
49	45.1	10.0 19.1	09	100.3	42.6	69	155.6	66.0	29	210.8	89.5	89	266.0	112.9
50	46.0	19.5	10	101.3	43.0	70	156.5	66.4	30	211.7	89.9	90	266.9	113.3
51	46.9	19.9	111	102.2	43.4	171	157.4	66.8	231	212.6	90.3	291	267.9	113.7
52 52	47.9	20.3	12	103.1	43.8	$\frac{72}{72}$	158.3 159.2	$\begin{bmatrix} 67.2\\ 87.6 \end{bmatrix}$	32	213.6	90.6	92	268.8 269.7	114.1 114.5
54	49.7	$\frac{20.7}{21.1}$	10	104.9	44.5	74	160.2	68.0	34	215.4	91.4	94	270.6	114.9
55	50.6	21.5	15	105.9	44.9	75	161.1	68.4	35	216.3	91.8	95	271.5	115.3
56	51.5	21.9	16	106.8	45.3	76	162.0	68.8	36	217.2	92.2	96	272.5	115.7
07 59	92, 9 53 4	$\frac{22.3}{59.7}$	17	107.7	40.7	79	162.9 162.8	69.2 69.6	38	218.2 919 1	92.0	97	273.4	116.0
59	54.3	$\frac{1}{23.1}$	19	109.5	46.5	79	164.8	69.9	39	220.0	93.4	99	275.2	116.8
60	55.2	23.4	20	110.5	46.9	80	165.7	70.3	40	220.9	93.8	300	276.2	117.2
Dist.	Dep.	Lat.	Dist.	Dep.	Lat.	Dist.	Dep.	Lat.	Dist.	Dep.	Lat.	Dist.	Dep,	Lat.
						67° (1	13°, 247	r°, 293°	°).					

						Г	ABL	E 2.	-				[Page	413
		J	Differe	ence of	Latitud	e and	Depart	ure for	23° (2	157°, 203	3°, 337°	°).		
Dist.	Lat.	Dep.	Dist.	Lat.	Dep.	Dist.	Lat.	Dep.	Dist.	Lat.	Dep.	Dist.	Lat.	Dep.
301	277.1	117.6	361	332.3	141.1	421	387.5	164.5	481	442.7	188.0	541	498.0	211.4
02	278.0	118.0	62	333.2	141.0	22	388.0	104.9	82	111 6	188.4	42	498.9	211.8
03	278.9	118.8	64	335 1	141.0	20	300 3	165.5 165.7	8.1	445.5	189.9	40	499.8	212.2
05	279.8	110.0 119.2	65	336.0	142.6	$\tilde{25}$	391.2	166.1	85	446.4	189.5	45	501.7	$\frac{212.0}{213.0}$
06	281.7	119.6	66	336.9	143.0	26	392.1	166.5	86	447.3	189.9	46	502.6	213.4
07	282.6	120.0	67	337.8	143.4	27	393.1	166.8	87	448.3	190.2	47	503.5	213.8
08	283.5	120.4	68	338.7	143.8	28	394.0	167.2	88	449.2	190.6	48	504.4	214.2
- 09	284.4	120.8	69	339.7	144.2	29	394.9	167.6	89	450.1	191.0	49	505.3	214.6
10	285.4	121.2	70	340.6	144.6	30	395.8	168.0	90	451.0	191.4	50	506.3	215.0
311	286.3	121.6	371	341.5	145.0	431	396.7	168.4	491	451.9	191.8	551	507.2	215.3
12	287.2	121.9	$\frac{72}{72}$	342.4	145.4	32	397.7	168.8	92	452.9	192.2	52	508.1	215.6
13	288.1	122.3 199.7	73	343.4	140.7	33	398.0	169.2	93	403.8	192.6	- 33 - 54	509.0	216.0
15	209.0	122.7 192 1	75	315 9	140.1 146.5	35	400 4	105.0 170.0	95	455 6	193.0	55	510.9	210.4
16	290.9	123.5 123.5	76	346.1	146.9	36	401.3	170.4	96	456 6	193.8	56	511.8	217.2
17	291.8	123.9	77	347.0	147.3	37	402.3	170.8	· 97	457.5	194.2	57	512.7	217.6
18	292.7	124.3	78 -	348.0	147.7	38	403.2	171.1	98	458.4	194.6	58	513.6	218.0
19	293.6	124.6	79	348.9	148.1	- 39	404.1	171.5	- 99	459.3	195.0	59	514.5	218.4
20	294.6	125.0	80	349.8	148.5	40	405.0	171.9	500	460.2	195.4	60	515.5	218.8
321	295.5	125.4	381	350.7	148.9	441	405.9	172.3	501	461.2	195.8	561	516.4	219.2
22	296.4	125.8	82	351.6	149.3	42	406.9	172.7	02	462.1	196.2	62	517.3	219.6
23	297.3	126.2	83	352.6	149.7	43	407.8	173.1	03	463.0	196.6	63	518.2	220.0
24	298.2	126.6 197.0	84 05	353.5	150.0 150.1	44	408.7	173.0 172.0	04	463.9	197.0 107.1	64	519.2	220.4
20	299.2	127.0	- 60 - 86	255 2	150.4 150.8	45	409.0	175.9	00	404.9	197.4	66	520.1 521.0	220.8
27	301.0	127.8	87	356.2	150.0 151.2	47	411.5	174.0 174.7	07	466 7	198 1	67	521.0 521.9	221.2
28	301.9	128.2	88	357.2	151.6	48	412.4	175.1	08	467.6	198.5	68	522.8	221.0 222.0
29	302.8	128.6	89	358.1	152.0	49	413.3	175.4	09	468.5	198.8	69	523.8	222.3
30	303.8	128.9	90	359.0	152.4	-50	414.2	175.8	10	469.5	199.3	70	524.7	222.7
331	304.7	129.3	391	359.9	152.8	451	415.2	176.2	511	470.4	199.7	571	525.6	223.1
32	305.6	129.7	92	360.8	153.2	52	416.1	176.6	12	471.3	200.0	$\frac{72}{72}$	526.5	223.4
33	306.5	130.1	93	361.8	153.6	53	417.0	177.0	13	472.2	200.4	73	527.4	223.8
25	307.0	130.0	94	- 304. 7 - 262 - 6	104.0 151.2	55	417.9	177 9	14	473.1	200.8 201.2	74	028, 4 590-9	224.2
36	309.3	131.3	96	364.5	154.7	56	419.8	178 2	16	475 0	201 6	76	530.2	224.0
37	310.2	131.7	97	365.4	155.1	57	420.7	178.6	17	475.9	202.0	77	531.1	225.4
38	311.1	132.1	98	366.4	155.5	58	421.6	179.0	18	476.8	202.4	78	532.0	225.8
- 39	312.1	132.5	- 99	367.3	155.9	59	422.5	179.4	19	477.7	202.8	79	533.0	226.2
40	313.0	132.9	400	368.2	156.3	60	423.4	179.7	20	478.6	203.2	80	533.9	226.6
341	313.9	133.2	401	369.1	156.7	461	424.4	180.1	521	479.6	203.6	581	534.8	227.0
42	314.8	133.6	$02 \\ 02$	370.0	157.1	62	425.3	180.5	22	480.5	204.0	82	535.7	227.4
43	310.7 916 7	134.0	03	$\frac{371.0}{271.0}$	137.3 157.0	03	420.2	180.9 101.9	23	481.4	204.4	83	030.0 297.0	227.8
15	310.7 317.6	134.4	04	372.8	157.9	65	427.1	181.0 181.7	24	482.0	204.0	85	007.0 538 5	228. Z 228. G
46	318.5	134.0 135.2	06	373.7	158.6	66	429.0	181.7 182 1	26	484 2	205.2 205.5	86	539.4	229.0
47	319.4	135.6	07	374.6	159.0	67	429.9	182.5	27	485.1	205.9	87	540.3	229.4
48	320.3	136.0	08	375.6	159.4	68	430.8	182.9	28	486.0	206.3	88	541.2	229.8
49	321.3	136.4	- 09	376.5	159.8	69	431.7	183.3	29	486.9	206.7	89	542.2	230.2
$_{-50}$	322.2	136.8	10	377.4	160.2	70	432.6	183.7	30	487.8	207.1	90	543.1	230.6
351	323.1	137.2	411	378.3	160.6	471	433.6	184.0	531	488.8	207.4	591	544.0	231.0
52	324.0	137.5	12	379.3	161.0	$72 \\ 72$	434.5	184.4	$\frac{32}{2}$	489.7	207.8	92	544.9	231.3
- 03 - 51	324.9 295 0	137.9	13	380.2 201 1	101.4	73	430,4	184.8	33	490.6	208.2	93	040.8 540.9	231.7
55	326 8	130.0 138.7	14	382.0	101.8 169.9	75	437 9	185 G	- 04 - 25	491.0	208.0	94	540.8 547.7	202.U 939_1
56	327.7	139.1	16	382.9	162.5	76	438.2	186.0	36	493.4	209.4	- 96	548 6	232.4
57	328.6	139.5	17	383.9	162.9	77	439.1	186.4	37	494.3	209.8	97	549.5	233.2
58	329.5	139.9	18	384.8	163.3	78	440.0	186.8	- 38	495.2	210.2	- 98	550.4	233.6
59	330.5	140.3	19	385.7	163.7	79	440.9	187.2	- 39	496.1	210.6	-99	551.3	234.0
60	331.4	140.7	20	386.6	164.1	80	441.8	187.6	40	497.1	211.0	600	552.3	234, 4
Dist.	Dep.	Lat.	Dist.	Dep.	Lat.	Dist.	Dep.	Lat.	Dist.	Dep,	Lat,	Dist.	Dep.	Lat.
					(37°(11	3°, 247°	, 293°)						

Pa	gə 414					Т	ABLF	2.						
		D	ifferei	nce of La	titude	and D	eparture	e for 249	° (156	°, 204°, 3	336°).			
Dist.	Lat.	Dep.	Dist.	Lat.	Dep.	Dist.	Lat.	Dep.	Dist.	Lat.	Dep.	Dist,	Lat.	Dep.
$ \begin{array}{c} 1 \\ 2 \\ 3 \\ 4 \\ 5 \\ 6 \\ 7 \\ 8 \\ 9 \\ 10 \\ \end{array} $	$\begin{array}{c} 0.9\\ 1.8\\ 2.7\\ 3.7\\ 4.6\\ 5.5\\ 6.4\\ 7.3\\ 8.2\\ 9.1\\ \end{array}$	$\begin{array}{c} 0.4\\ 0.8\\ 1.2\\ 1.6\\ 2.0\\ 2.4\\ 2.8\\ 3.3\\ 3.7\\ 4.1 \end{array}$	$\begin{array}{c} 61 \\ 62 \\ 63 \\ 64 \\ 65 \\ 66 \\ 67 \\ 68 \\ 69 \\ 70 \\ \hline \end{array}$	$55.7 \\ 56.6 \\ 57.6 \\ 58.5 \\ 59.4 \\ 60.3 \\ 61.2 \\ 62.1 \\ 63.0 \\ 63.9 \\ \hline$	$\begin{array}{c} 24.8\\ 25.2\\ 25.6\\ 26.0\\ 26.4\\ 26.8\\ 27.3\\ 27.7\\ 28.1\\ 28.5\\ \end{array}$	$ \begin{array}{c} 121\\22\\23\\24\\25\\26\\27\\28\\29\\30\\\end{array} $	$\begin{array}{c} 110.5\\ 111.5\\ 112.4\\ 113.3\\ 114.2\\ 115.1\\ 116.0\\ 116.9\\ 117.8\\ 118.8\\ \end{array}$	$\begin{array}{r} 49.\ 2\\ 49.\ 6\\ 50.\ 0\\ 50.\ 4\\ 50.\ 8\\ 51.\ 2\\ 51.\ 7\\ 52.\ 1\\ 52.\ 5\\ 52.\ 9\end{array}$	$ 181 \\ 82 \\ 83 \\ 84 \\ 85 \\ 86 \\ 87 \\ 88 \\ 89 \\ 90 \\ 90 10 $	$\begin{array}{c} 165.\ 4\\ 166.\ 3\\ 167.\ 2\\ 168.\ 1\\ 169.\ 0\\ 169.\ 9\\ 170.\ 8\\ 171.\ 7\\ 172.\ 7\\ 173.\ 6\end{array}$	$\begin{array}{c} 73.\ 6\\ 74.\ 0\\ 74.\ 4\\ 74.\ 8\\ 75.\ 2\\ 75.\ 7\\ 76.\ 1\\ 76.\ 5\\ 76.\ 9\\ 77.\ 3\end{array}$	$241 \\ 42 \\ 43 \\ 44 \\ 45 \\ 46 \\ 47 \\ 48 \\ 49 \\ 50$	$\begin{array}{c} 220, 2\\ 221, 1\\ 222, 0\\ 222, 9\\ 223, 8\\ 224, 7\\ 225, 6\\ 226, 6\\ 227, 5\\ 228, 4\end{array}$	98.0 98.4 98.8 99.2 99.7 100.1 100.5 100.9 101.3 101.7
$ \begin{array}{c} 11\\ 12\\ 13\\ 14\\ 15\\ 16\\ 17\\ 18\\ 19\\ 20\\ \hline 21\\ 22\\ 23\\ 24\\ \end{array} $	$\begin{array}{c} 10.\ 0\\ 11.\ 0\\ 11.\ 9\\ 12.\ 8\\ 13.\ 7\\ 14.\ 6\\ 15.\ 5\\ 16.\ 4\\ 17.\ 4\\ 18.\ 3\\ \hline 19.\ 2\\ 20.\ 1\\ 21.\ 0\\ 21.\ 9\end{array}$	$\begin{array}{c} 4.5\\ 5.7\\ 5.7\\ 5.7\\ 6.5\\ 9\\ 7.3\\ 7.7\\ 8.\\ 8.9\\ 9.8\\ 9.8\\ 9.8\\ \end{array}$	$ \begin{array}{c} 71\\ 72\\ 73\\ 74\\ 75\\ 76\\ 77\\ 78\\ 79\\ 80\\ 81\\ 82\\ 83\\ 84\\ \end{array} $	$\begin{array}{c} 64.9\\ 65.8\\ 66.7\\ 67.6\\ 68.5\\ 69.4\\ 70.3\\ 71.3\\ 72.2\\ 73.1\\ \hline 74.0\\ 74.9\\ 75.8\\ 76.7\\ \end{array}$	$\begin{array}{c} 28.9\\ 29.3\\ 29.7\\ 30.1\\ 30.5\\ 30.9\\ 31.3\\ 31.7\\ 32.1\\ 32.5\\ \hline 32.9\\ 33.4\\ 33.8\\ 34.2 \end{array}$	$\begin{array}{c} 131\\ 32\\ 33\\ 34\\ 35\\ 36\\ 37\\ 38\\ 39\\ 40\\ \hline 141\\ 42\\ 43\\ 44\\ \end{array}$	$\begin{array}{c} 119.\ 7\\ 120.\ 6\\ 121.\ 5\\ 122.\ 4\\ 123.\ 3\\ 124.\ 2\\ 125.\ 2\\ 126.\ 1\\ 127.\ 0\\ 127.\ 9\\ 128.\ 8\\ 129.\ 7\\ 130.\ 6\\ 131.\ 6\\ \end{array}$	$\begin{array}{c} 53.3\\ 53.7\\ 54.1\\ 54.5\\ 54.9\\ 55.3\\ 55.7\\ 56.1\\ 56.5\\ 56.9\\ 57.3\\ 57.8\\ 58.2\\ 58.6\end{array}$	$ \begin{array}{r} 191 \\ 92 \\ 93 \\ 94 \\ 95 \\ 96 \\ 97 \\ 98 \\ 99 \\ 200 \\ 201 \\ 02 \\ 03 \\ 04 \\ \end{array} $	$\begin{array}{c} 174.5\\ 175.4\\ 176.3\\ 177.2\\ 178.1\\ 179.1\\ 180.0\\ 180.9\\ 181.8\\ 182.7\\ 183.6\\ 184.5\\ 185.4\\ 186.4\end{array}$	$\begin{array}{c} 77.7\\ 78.1\\ 78.5\\ 78.9\\ 79.3\\ 79.7\\ 80.5\\ 80.9\\ 81.3\\ 81.8\\ 82.2\\ 82.6\\ 83.0 \end{array}$	$\begin{array}{c} 251 \\ 52 \\ 53 \\ 54 \\ 55 \\ 56 \\ 57 \\ 58 \\ 59 \\ 60 \\ \hline 261 \\ 62 \\ 63 \\ 64 \end{array}$	$\begin{array}{c} 229, 3\\ 230, 2\\ 231, 1\\ 232, 0\\ 233, 0\\ 233, 9\\ 234, 8\\ 235, 7\\ 236, 6\\ 237, 5\\ \hline 238, 4\\ 239, 3\\ 240, 3\\ 240, 3\\ 241, 2\\ \end{array}$	$\begin{array}{c} 102.1\\ 102.5\\ 102.9\\ 103.3\\ 103.7\\ 104.1\\ 104.5\\ 104.9\\ 105.3\\ 105.8\\ 106.2\\ 106.6\\ 107.0\\ 107.4 \end{array}$
$ \begin{array}{r} 25 \\ 26 \\ 27 \\ 28 \\ 29 \\ 30 \\ \overline{31} \\ 32 \end{array} $	$\begin{array}{r} 22.8\\ 23.8\\ 24.7\\ 25.6\\ 26.5\\ 27.4\\ \hline 28.3\\ 29.2\\ \end{array}$	$\begin{array}{c} 10.2\\ 10.6\\ 11.0\\ 11.4\\ 11.8\\ 12.2\\ \hline 12.6\\ 13.0\\ \end{array}$	$ \begin{array}{r} 85 \\ 86 \\ 87 \\ 88 \\ 89 \\ 90 \\ 91 \\ 92 \end{array} $	$\begin{array}{r} 77.\ 7\\ 78.\ 6\\ 79.\ 5\\ 80.\ 4\\ 81.\ 3\\ 82.\ 2\\ \hline 83.\ 1\\ 84.\ 0\\ \end{array}$	$\begin{array}{c} 34. \ 6\\ 35. \ 0\\ 35. \ 4\\ 35. \ 8\\ 36. \ 2\\ 36. \ 6\\ \hline 37. \ 0\\ 37. \ 4\end{array}$	$ \begin{array}{r} 45\\ 46\\ 47\\ 48\\ 49\\ 50\\ \hline 151\\ 52\\ \end{array} $	$\begin{array}{c} 132.5\\ 133.4\\ 134.3\\ 135.2\\ 136.1\\ 137.0\\ \hline 137.9\\ 138.9 \end{array}$	$59.0 \\ 59.4 \\ 59.8 \\ 60.2 \\ 60.6 \\ 61.0 \\ \hline 61.4 \\ 61.8$	$ \begin{array}{r} 05 \\ 06 \\ 07 \\ 08 \\ 09 \\ 10 \\ \hline 211 \\ 12 \\ \end{array} $	$\begin{array}{c} 187.3\\ 188.2\\ 189.1\\ 190.0\\ 190.9\\ 191.8\\ \hline 192.8\\ 193.7\\ \end{array}$	$\begin{array}{c} 83.4\\ 83.8\\ 84.2\\ 84.6\\ 85.0\\ 85.4\\ \hline 85.8\\ 86.2 \end{array}$	$ \begin{array}{r} 65\\ 66\\ 67\\ 68\\ 69\\ 70\\ \hline 271\\ 72 \end{array} $	$\begin{array}{c} 242.1\\ 243.0\\ 243.9\\ 244.8\\ 245.7\\ 246.7\\ \hline 246.7\\ \hline 247.6\\ 248.5\\ \end{array}$	$107.8 \\ 108.2 \\ 108.6 \\ 109.0 \\ 109.4 \\ 109.8 \\ \hline 110.2 \\ 110.6 \\ \hline$
$ \begin{array}{r} 33 \\ 34 \\ 35 \\ 36 \\ 37 \\ 38 \\ 39 \\ 40 \\ 40 \\ 41 \\ \end{array} $	$\begin{array}{c} 30.1\\ 31.1\\ 32.0\\ 32.9\\ 33.8\\ 34.7\\ 35.6\\ 36.5\\ \hline \end{array}$	$13.4 \\ 13.8 \\ 14.2 \\ 14.6 \\ 15.0 \\ 15.5 \\ 15.9 \\ 16.3 \\ 16.3 \\ 10.5 \\ $	$93 \\ 94 \\ 95 \\ 96 \\ 97 \\ 98 \\ 99 \\ 100 \\ 101$	85.085.986.887.788.689.590.491.4	$\begin{array}{c} 37.8\\ 38.2\\ 38.6\\ 39.0\\ 39.5\\ 39.9\\ 40.3\\ 40.7\\ \end{array}$	$53 \\ 54 \\ 55 \\ 56 \\ 57 \\ 58 \\ 59 \\ 60 \\ 161$	$\begin{array}{c} 139.8 \\ 140.7 \\ 141.6 \\ 142.5 \\ 143.4 \\ 144.3 \\ 145.3 \\ 146.2 \\ \end{array}$	$\begin{array}{c} 62.2 \\ 62.6 \\ 63.0 \\ 63.5 \\ 63.9 \\ 64.3 \\ 64.7 \\ 65.1 \\ \end{array}$	$ \begin{array}{r} 13\\14\\15\\16\\17\\18\\19\\20\\\hline\\20\\\hline\\201\end{array} $	194. 6 195. 5 196. 4 197. 3 198. 2 199. 2 200. 1 201. 0	$\begin{array}{c} 86.6\\ 87.0\\ 87.4\\ 87.9\\ 88.3\\ 88.7\\ 89.1\\ 89.5\\ \hline \\ 89.5\\ \hline \end{array}$	73 74 75 76 77 78 79 80	$\begin{array}{c} 249.\ 4\\ 250.\ 3\\ 251.\ 2\\ 252.\ 1\\ 253.\ 1\\ 254.\ 0\\ 254.\ 9\\ 255.\ 8\\ \hline\end{array}$	$\begin{array}{c} 111.0\\ 111.4\\ 111.9\\ 112.3\\ 112.7\\ 113.1\\ 113.5\\ 113.9\\ 111.9\\ \end{array}$
$ \begin{array}{r} 41\\ 42\\ 43\\ 44\\ 45\\ 46\\ 47\\ 48\\ 49\\ 50\\ 50\\ 51\\ 51\\ 51\\ 51\\ 51\\ 51\\ 51\\ 51\\ 51\\ 51$	$57.5 \\ 38.4 \\ 39.3 \\ 40.2 \\ 41.1 \\ 42.0 \\ 42.9 \\ 43.9 \\ 44.8 \\ 45.7 \\ 46.6 \\ 100000000000000000000000000000000000$	$\begin{array}{c} 10. \ 7\\ 17. \ 1\\ 17. \ 5\\ 17. \ 9\\ 18. \ 3\\ 18. \ 7\\ 19. \ 1\\ 19. \ 5\\ 19. \ 9\\ 20. \ 3\\ 20. \ 7\end{array}$	$ \begin{array}{c} 101 \\ 02 \\ 03 \\ 04 \\ 05 \\ 06 \\ 07 \\ 08 \\ 09 \\ 10 \\ 111 \end{array} $	$\begin{array}{c} 92.3\\ 93.2\\ 94.1\\ 95.0\\ 95.9\\ 96.8\\ 97.7\\ 98.7\\ 99.6\\ 100.5\\ \hline 101.4\\ \end{array}$	$\begin{array}{r} +1.1\\ 41.5\\ 41.9\\ 42.3\\ 42.7\\ 43.1\\ 43.5\\ 43.9\\ 44.3\\ 44.7\\ 15\\ 11\\ 12\\ 12\\ 12\\ 12\\ 12\\ 12\\ 12\\ 12\\ 12$	$ \begin{array}{r} 101 \\ 62 \\ 63 \\ 64 \\ 65 \\ 66 \\ 67 \\ 68 \\ 69 \\ 70 \\ \hline 151 \end{array} $	$\begin{array}{c} 147.1\\ 148.0\\ 148.9\\ 149.8\\ 150.7\\ 151.6\\ 152.6\\ 153.5\\ 154.4\\ 155.3\\ 156.2\\ \end{array}$	$\begin{array}{c} 05.5\\ 65.9\\ 66.3\\ 66.7\\ 67.1\\ 67.5\\ 67.9\\ 68.3\\ 68.7\\ 69.1\\ -0.5\end{array}$	$\begin{array}{c} 221 \\ 22 \\ 23 \\ 24 \\ 25 \\ 26 \\ 27 \\ 28 \\ 29 \\ 30 \\ \hline \end{array}$	$\begin{array}{c} 201.9\\ 202.8\\ 203.7\\ 204.6\\ 205.5\\ 206.5\\ 207.4\\ 208.3\\ 209.2\\ 210.1\\ \end{array}$	89.9 90.3 90.7 91.1 91.5 91.9 92.3 92.7 93.1 93.5	281 82 83 84 85 86 87 88 89 90	$\begin{array}{c} 250.\ 7\\ 257.\ 6\\ 258.\ 5\\ 259.\ 4\\ 260.\ 4\\ 261.\ 3\\ 262.\ 2\\ 263.\ 1\\ 264.\ 0\\ 264.\ 9\\ \hline \\ 264.\ 9\\ \hline \end{array}$	$\begin{array}{c} 114.3\\ 114.7\\ 115.1\\ 115.5\\ 115.9\\ 116.3\\ 116.7\\ 117.1\\ 117.5\\ 118.0\\ \hline \end{array}$
$51 \\ 52 \\ 53 \\ 54 \\ 55 \\ 56 \\ 57 \\ 58 \\ 59 \\ 60$	$\begin{array}{c} 46.\ 6\\ 47.\ 5\\ 48.\ 4\\ 49.\ 3\\ 50.\ 2\\ 51.\ 2\\ 52.\ 1\\ 53.\ 0\\ 53.\ 9\\ 54.\ 8\end{array}$	$\begin{array}{c} 20.\ 7\\ 21.\ 2\\ 21.\ 6\\ 22.\ 0\\ 22.\ 4\\ 22.\ 8\\ 23.\ 2\\ 23.\ 6\\ 24.\ 0\\ 24.\ 4\end{array}$	$ \begin{array}{r} 111 \\ 12 \\ 13 \\ 14 \\ 15 \\ 16 \\ 17 \\ 18 \\ 19 \\ 20 \\ \end{array} $	$101. 4 \\ 102. 3 \\ 103. 2 \\ 104. 1 \\ 105. 1 \\ 106. 0 \\ 106. 9 \\ 107. 8 \\ 108. 7 \\ 109. 6$	$\begin{array}{r} 45.1\\ 45.6\\ 46.0\\ 46.4\\ 46.8\\ 47.2\\ 47.6\\ 48.0\\ 48.4\\ 48.8\end{array}$	$ \begin{array}{r} 171 \\ 72 \\ 73 \\ 74 \\ 75 \\ 76 \\ 77 \\ 78 \\ 79 \\ 80 \\ \end{array} $	$\begin{array}{c} 156.2\\ 157.1\\ 158.0\\ 159.0\\ 159.9\\ 160.8\\ 161.7\\ 162.6\\ 163.5\\ 164.4 \end{array}$	$\begin{array}{c} 69.6\\ 70.0\\ 70.4\\ 70.8\\ 71.2\\ 71.6\\ 72.0\\ 72.4\\ 72.8\\ 73.2 \end{array}$	$231 \\ 32 \\ 33 \\ 34 \\ 35 \\ 36 \\ 37 \\ 38 \\ 38 \\ 40$	$\begin{array}{c} 211. \ 0\\ 211. \ 9\\ 212. \ 9\\ 213. \ 8\\ 214. \ 7\\ 215. \ 6\\ 216. \ 5\\ 217. \ 4\\ 218. \ 3\\ 219. \ 3 \end{array}$	94. 0 94. 4 94. 8 95. 2 95. 6 96. 0 96. 4 96. 8 97. 2 97. 6	291 92 93 94 95 96 97 98 99 300	$\begin{array}{c} 265.8\\ 266.8\\ 267.7\\ 268.6\\ 269.5\\ 270.4\\ 271.3\\ 272.2\\ 273.2\\ 274.1 \end{array}$	$\begin{array}{c} 118.4\\ 118.8\\ 119.2\\ 119.6\\ 120.0\\ 120.4\\ 120.8\\ 121.2\\ 121.6\\ 122.0\\ \end{array}$
Dist.	Dep.	Lat.	Dist.	Dep.	Lat.	Dist. 36° (1	Dep. 14°, 246	Lat. °, 294°	Dist.	Dep.	Lat.	Dist.	Dep.	Lat.

						Г	ABLE	2.					[Page	415
		1	Differe	nce of I	Latitude	e and l	Departu	re for 1	2 4° (1	56°, 204	°, 336°).		
Dist.	Lat.	Dep.	Dist.	Lat,	Dep.	Dist.	Lat.	Dep.	Dist.	Lat.	Dep.	Dist.	Lat.	Dep.
$301 \\ 02$	275.0	122.4	$\frac{361}{62}$	329.8 330.7	146.8 147.2	421	384.6 385.5	171.2 171.6	481	439.4	195.6 196.0	541 .12	494.2	220.0
$02 \\ 03$	276.8	122.8 123.2	63	331.6	147.2 147.6	$\frac{22}{23}$	386.4	171.0 172.1	83	441.2	190.0 196.5	42	496.0	220.4 220.9
04	277.7	123.7	64	332.5	148.1	24	387.3	172.5	84	442.1	196.9	44	496.9	221.3
05	278.6	124.1	65	333.4	148.5	$\frac{25}{26}$	388.2	172.9	85	443.0	197.3	45	497.8	221.7
06	279.0	124.0	00 67	334.3	148.9	$\frac{20}{27}$	389.2 390-1	173.3 173.7	80	444.0	197.7	40	498.8	222.1 999.5
08	280.4 281.4	124.0 125.3	68	336.2	149.7	-28	391.0	174.1	88	445.8	198.5	48	500.6	222.9
09	282.3	125.7	69	337.1	150.1	29	391.9	174.5	89	446.7	198.9	49	501.5	223.3
	283.2	126.1		338.0	150.5	30	392.8	174.9	90	447.6	199.3		502.4	223.7
$\frac{311}{19}$	284.1	126.5	$\frac{371}{79}$	338.9	150.9	431	393.7	175.3	491	448.6	199.7	551	503.4	224.1
$\frac{12}{13}$	285.0 285.9	120.9 127.3	$\frac{72}{73}$	340 7	151.5 151.7	33	395.6	176.1	92	449.0	200.1 200.5	-52	504.5 505.2	224.0
14	286.8	127.7	74	341.7	152.1	34	396.5	176.5	94	451.3	200.9	54	506.1	225.3
15	287.8	128.1	75	342.6	152.5	35	397.4	176.9	95	452.2	201.3	55	507.0	225.7
$\frac{16}{17}$	288.7	128.5	$\frac{76}{77}$	343.5	152.9	36	398.3	177.3	96	453.1	201.7	56	507.9	226.1
18	289.0	128.9 199.3	$\frac{11}{78}$	345 3	100.0 153.7	38	399.2	177.7	97	404.0	202.2 202.6	- 07 - 58	508.8 509.7	220.0
19	291.4	129.8	79	346.2	154.2	39	401.0	178.6	- 99	455.8	203.0	59	510.6	227.4
20	292.3	130.2	80	347.1	154.6	40	402.0	179.0	500	456.8	203.4	60	511.6	227.8
321	293.2	130.6	381	348.1	155.0	441	402.9	179.4	501	457.7	203.8	561	512.5	228.2
22	294.2	131.0	82	349.0	155.4	42	403.8	179.8	$02 \\ 02$	458.6	204.2	$\frac{62}{22}$	513.4	228.6
$\frac{23}{24}$	295.1 296.0	131.4	- 84	350 8	150.8 156.2	40	404.7	180.2	05	459.5	204.0	64	514.5 515.2	229.0 229.1
$\overline{25}$	296.9	132.2	85	351.7	156.6	45	406.5	181.0	05	461.3	205.4	65	516.1	229.8
26	297.8	132.6	86	352.6	157.0	46	407.4	181.4	-06	462.2	205.8	66	517.0	230.2
$\frac{27}{99}$	298.7	133.0	87	353.5	157.4	47	408.3	181.8	07	463.2	206.2	-67	518.0	230.6
28	299.6 300.5	135.4	88	355 4	107.8 158.2	48	409.3	182.2 182.6	08	404.1	200.0	-08 -00	518.9 519-8	231.0
$\frac{20}{30}$	301.5	133.8 134.2	90	356.3	158.6 158.6	50	411.1	182.0	10	465.9	207.4	70	519.8 520.7	231.4
331	302.4	134.6 125.0	391	357.2	159.0 150.4	451	412.0	183.4	511	466.8	207.8	$571 \\ 79$	521.6	232.2
33	303.3 304.2	135.0 135.4	92 93	359.0	159.4	$\frac{52}{53}$	412.9	103.0 184.3	$12 \\ 13$	467.7	208.2 208.7	73^{-72}	522.5 523.4	232.7 233.1
34	305.1	135.9	94	359.9	160.3	54	414.7	184.7	14	469.5	209.1	74	524.3	233.5
35	306.0	136.3	95	360.8	160.7	55	415.7	185.1	15	470.5	209.5	75	525.3	233.9
36	306.9	136.7 137.1	96	361.8 362.7	161.1 161.5	56 57	416.6	185.9 185.9	16	4/1.4	209.9	$\frac{76}{77}$	526.2 527.1	234.3 934.7
38	308.8	137.1 137.5	- 98	363.6	101.9 161.9	58	418.4	185.5 186.3	18	473.2	210.3 210.7	78	527.1 528.0	235.1
- 39	309.7	137.9	99	364.5	162.3	$\overline{59}$	419.3	186.7	19	474.1	211.1	79	528.9	235.5
40	$\frac{310.6}{211.5}$	138.3	400	$\frac{365.4}{266.2}$	162.7	$\frac{60}{461}$	420.2	$\frac{187.1}{187.5}$	$\frac{20}{521}$	475.0	211.5	80	529.8	235.9
42	312.4	130.7 139.1	401	367.2	103.1 163.5	401 62	421.1	187.9	$\frac{521}{22}$	476.8	211.9	82	530.8 531.7	236.5 236.7
43	313.3	139.5	03	368.2	163.9	63	423.0	188.3	23	477.8	212.7	.83	532.6	237.1
44	314.3	139.9	04	369.1	164.3	64	423.9	188.7	24	478.7	213.1	84	533.5	237.5
45	315.2	140.3	05	370.0	164.7	65 66	424.8	189.1	25 96	479.6	213.5	85	534.4	237.9
40	310.1 317.0	140.7	07	370.9 371.8	165.1 165.5	67	426.6	189.9 189.9	$\frac{20}{27}$	481.4	213.9	87	536.2	238.8
48	317.9	141.5	08	372.7	165.9	68	427.5	190.4	28	482.3	214.8	88	537.1	239.2
49	318.8	142.0	09	373.6	166.4	69	428.4	190.8	29	483.2	215.2	89	538.0	239.6
$\frac{50}{051}$	$\frac{319.7}{999.6}$	142.4	10	374.5	166.8	70	429.4	$\frac{191.2}{101.0}$	30	484.2	$\frac{215.6}{216.0}$	90	539.0	$\frac{240.0}{240.1}$
301 59	320.6	142.8	411	375.5	167.2	4/1	430.3	191.6	231	485.1	216.0 216.4	- 091 - 09	540.8	240.4
$52 \\ 53$	322.5	143.6	$112 \\ 13$	377.3	168.0	73	432.1	192.4	33	486.9	216.8	93	541.7	241.2
54	323.4	144.0	14	378.2	168.4	74	433.0	192.8	34	487.8	217.2	94	542.6	241.6
55	324.3	144.4	15	379.1	168.8	75	433.9	193.2	35	488.7	217.6	95	543.5	242.0
	320, 2 326, 1	144.8	16 17	380.0	169.2 160 g	76	434.8	193.6 194 0	$\frac{36}{27}$	489.6 190 B	218.0	96	044.4 515.4	242.4
58	327.0	145.6	18	381.9	170.0	78	436.7	194.4	- 38	491.5	218.4	98	546.3	243.2
59	328.0	146.0	19	382.8	170.4	79	437.6	194.8	39	492.4	219.2	99	547.2	243.6
60	328.9	146.4	20	383.7	170.8	80	438.5	195.2	40	493.3	219.6	600	548.1	244.0
Dist.	Dep.	Lat.	Dist.	Dep.	Lat,	Dist.	Dep.	Lat.	Dist.	Dep.	Lat.	Dist.	.Dep.	Lat.
					(66° (1	14°, 246	°, 294°).					

Pa	ge 416]				Т	ABLE	2.						
		1	Differe	ence of I	atitude	e and	Departu	re for :	25° (1	55°, 205	°, 335°).		
Dist.	Lat.	Dep.	Dist.	Lat.	Dep.	Dist.	Lat.	Dep.	Dist.	Lat.	Dep.	Dist.	Lat.	Dep.
$ \begin{array}{c} 1 \\ 2 \\ 3 \\ 4 \\ 5 \\ 6 \end{array} $	$\begin{array}{c} 0.9 \\ 1.8 \\ 2.7 \\ 3.6 \\ 4.5 \\ 5.4 \end{array}$	$\begin{array}{c} 0.4 \\ 0.8 \\ 1.3 \\ 1.7 \\ 2.1 \\ 2.5 \\ \end{array}$	$\begin{array}{c} 61 \\ 62 \\ 63 \\ 64 \\ 65 \\ 66 \\ \end{array}$	$55.3 \\ 56.2 \\ 57.1 \\ 58.0 \\ 58.9 \\ 59.8 \\ $	$\begin{array}{c} 25.8\\ 26.2\\ 26.6\\ 27.0\\ 27.5\\ 27.9\\ 27.9\\ 20.2\\ 27.9\\ 20.2\\$	$ \begin{array}{r} 121 \\ 22 \\ 23 \\ 24 \\ 25 \\ 26 \\ 25 \end{array} $	$109.7 \\ 110.6 \\ 111.5 \\ 112.4 \\ 113.3 \\ 114.2 \\ 114.$	$51.1 \\ 51.6 \\ 52.0 \\ 52.4 \\ 52.8 \\ 53.2 \\ $	$ 181 \\ 82 \\ 83 \\ 84 \\ 85 \\ 86 \\ 86 $	$\begin{array}{c} 164.0\\ 164.9\\ 165.9\\ 166.8\\ 167.7\\ 168.6\\ \end{array}$	$\begin{array}{c} 76.5\\ 76.9\\ 77.3\\ 77.8\\ 78.2\\ 78.6\\ 78.6\\ \end{array}$	$241 \\ 42 \\ 43 \\ 44 \\ 45 \\ 46 \\ 46$	$\begin{array}{c} 218.\ 4\\ 219.\ 3\\ 220.\ 2\\ 221.\ 1\\ 222.\ 0\\ 223.\ 0\\ \end{array}$	$101.9 \\ 102.3 \\ 102.7 \\ 103.1 \\ 103.5 \\ 104.0$
	$ \begin{array}{r} 6.3 \\ 7.3 \\ 8.2 \\ 9.1 \\ 10 0 \end{array} $	3.0 3.4 3.8 4.2 4.6		$ \begin{array}{r} 60.7 \\ 61.6 \\ 62.5 \\ 63.4 \\ \hline 64.3 \\ \end{array} $	$ \begin{array}{r} 28.3 \\ 28.7 \\ 29.2 \\ 29.6 \\ \hline 30.0 \\ \end{array} $	$ \begin{array}{r} 27 \\ 28 \\ 29 \\ 30 \\ 131 \end{array} $	$ \begin{array}{r} 115.1 \\ 116.0 \\ 116.9 \\ 117.8 \\ \overline{118.7} \end{array} $	53.7 54.1 54.5 54.9 55.4		$ \begin{array}{r} 169.5 \\ 170.4 \\ 171.3 \\ 172.2 \\ 173.1 \\ \end{array} $	$ \begin{array}{r} 79.0\\ 79.5\\ 79.9\\ 80.3\\ \hline 80.7 \end{array} $		$\begin{array}{r} 223.9\\ 224.8\\ 225.7\\ 226.6\\ \hline 227.5\end{array}$	$ \begin{array}{r} 104.4 \\ 104.8 \\ 105.2 \\ 105.7 \\ 106.1 \end{array} $
$ \begin{array}{r} 12 \\ 13 \\ 14 \\ 15 \\ 16 \\ 17 \\ 18 \\ 19 \\ 20 \\ \end{array} $	$\begin{array}{c} 10.9\\ 10.9\\ 11.8\\ 12.7\\ 13.6\\ 14.5\\ 15.4\\ 16.3\\ 17.2\\ 18.1 \end{array}$	$\begin{array}{c} 1.0\\ 5.1\\ 5.5\\ 6.9\\ 6.3\\ 6.8\\ 7.2\\ 7.6\\ 8.0\\ 8.5\end{array}$	$72 \\ 73 \\ 74 \\ 75 \\ 76 \\ 77 \\ 78 \\ 79 \\ 80$	$\begin{array}{c} 65.3\\ 65.3\\ 66.2\\ 67.1\\ 68.0\\ 68.9\\ 69.8\\ 70.7\\ 71.6\\ 72.5\end{array}$	$\begin{array}{c} 30.4\\ 30.9\\ 31.3\\ 31.7\\ 32.1\\ 32.5\\ 33.0\\ 33.4\\ 33.8 \end{array}$		$\begin{array}{c} 119.6\\ 120.5\\ 121.4\\ 122.4\\ 123.3\\ 124.2\\ 125.1\\ 126.0\\ 126.9 \end{array}$	55.8 56.2 56.6 57.1 57.5 57.9 58.3 58.7 59.2	92 93 94 95 96 97 98 99 200	74.0 174.9 175.8 176.7 177.6 178.5 179.4 180.4 181.3	$\begin{array}{c} 81.1\\ 81.6\\ 82.0\\ 82.4\\ 82.8\\ 83.3\\ 83.7\\ 84.1\\ 84.5 \end{array}$	$52 \\ 53 \\ 54 \\ 55 \\ 56 \\ 57 \\ 58 \\ 59 \\ 60$	$\begin{array}{c} 228.4\\ 229.3\\ 230.2\\ 231.1\\ 232.0\\ 232.9\\ 233.8\\ 234.7\\ 235.6\\ \end{array}$	$\begin{array}{c} 106.5\\ 106.9\\ 107.3\\ 107.8\\ 108.2\\ 108.6\\ 109.0\\ 109.5\\ 109.9 \end{array}$
$\begin{array}{c} 21 \\ 22 \\ 23 \\ 24 \\ 25 \\ 26 \\ 27 \\ 28 \\ 29 \\ 30 \end{array}$	$\begin{array}{c} 19.\ 0\\ 19.\ 9\\ 20.\ 8\\ 21.\ 8\\ 22.\ 7\\ 23.\ 6\\ 24.\ 5\\ 25.\ 4\\ 26.\ 3\\ 27.\ 2\end{array}$	$\begin{array}{c} 8.9\\ 9.3\\ 9.7\\ 10.1\\ 10.6\\ 11.0\\ 11.4\\ 11.8\\ 12.3\\ 12.7\\ \end{array}$	81 82 83 84 85 86 87 88 89 90	$\begin{array}{c} 73.4\\74.3\\75.2\\76.1\\77.0\\77.9\\78.8\\79.8\\80.7\\81.6\end{array}$	$\begin{array}{c} 34.2\\ 34.7\\ 35.1\\ 35.5\\ 35.9\\ 36.3\\ 36.8\\ 37.2\\ 37.6\\ 38.0 \end{array}$	$ \begin{array}{r} 141 \\ 42 \\ 43 \\ 44 \\ 45 \\ 46 \\ 47 \\ 48 \\ 49 \\ 50 \\ 50 \end{array} $	$\begin{array}{c} 127.8\\ 128.7\\ 129.6\\ 130.5\\ 131.4\\ 132.3\\ 133.2\\ 134.1\\ 135.0\\ 135.9 \end{array}$	59.660.060.460.961.361.762.162.563.063.4	$ \begin{array}{c} 201 \\ 02 \\ 03 \\ 04 \\ 05 \\ 06 \\ 07 \\ 08 \\ 09 \\ 10 \end{array} $	$\begin{array}{c} 182.\ 2\\ 183.\ 1\\ 184.\ 0\\ 184.\ 9\\ 185.\ 8\\ 186.\ 7\\ 187.\ 6\\ 188.\ 5\\ 189.\ 4\\ 190.\ 3\end{array}$	84.9 85.4 85.8 86.2 86.6 87.1 87.5 87.9 88.3 88.7	$\begin{array}{c} 261 \\ 62 \\ 63 \\ 64 \\ 65 \\ 66 \\ 67 \\ 68 \\ 69 \\ 70 \end{array}$	$\begin{array}{c} 236.5\\ 237.5\\ 238.4\\ 239.3\\ 240.2\\ 241.1\\ 242.0\\ 242.9\\ 243.8\\ 244.7 \end{array}$	$\begin{array}{c} 110.\ 3\\ 110.\ 7\\ 111.\ 1\\ 111.\ 6\\ 112.\ 0\\ 112.\ 4\\ 112.\ 8\\ 113.\ 3\\ 113.\ 7\\ 114.\ 1 \end{array}$
$ \begin{array}{r} 31\\ 32\\ 33\\ 34\\ 35\\ 36\\ 37\\ 38\\ 39\\ 40\\ \end{array} $	$\begin{array}{c} 28.1\\ 29.0\\ 29.9\\ 30.8\\ 31.7\\ 32.6\\ 33.5\\ 34.4\\ 35.3\\ 36.3 \end{array}$	$\begin{array}{c} 13.1\\ 13.5\\ 13.9\\ 14.4\\ 14.8\\ 15.2\\ 15.6\\ 16.1\\ 16.5\\ 16.9\end{array}$	$91 \\ 92 \\ 93 \\ 94 \\ 95 \\ 96 \\ 97 \\ 98 \\ 99 \\ 100$	$\begin{array}{c} 82.5\\ 83.4\\ 84.3\\ 85.2\\ 86.1\\ 87.0\\ 87.9\\ 88.8\\ 89.7\\ 90.6\end{array}$	$\begin{array}{r} 38.5\\ 38.9\\ 39.3\\ 39.7\\ 40.1\\ 40.6\\ 41.0\\ 41.4\\ 41.8\\ 42.3 \end{array}$	$ \begin{array}{r} 151 \\ 52 \\ 53 \\ 54 \\ 55 \\ 56 \\ 57 \\ 58 \\ 59 \\ 60 \\ \end{array} $	$\begin{array}{c} 136.9\\ 137.8\\ 138.7\\ 139.6\\ 140.5\\ 141.4\\ 142.3\\ 143.2\\ 144.1\\ 145.0\\ \end{array}$	$\begin{array}{c} 63.8\\ 64.2\\ 64.7\\ 65.1\\ 65.5\\ 65.9\\ 66.4\\ 66.8\\ 67.2\\ 67.6\end{array}$	$ \begin{array}{r} 211 \\ 12 \\ 13 \\ 14 \\ 15 \\ 16 \\ 17 \\ 18 \\ 19 \\ 20 \\ \end{array} $	191. 2 192. 1 193. 0 193. 9 194. 9 195. 8 196. 7 197. 6 198. 5 199. 4	89.2 89.6 90.0 90.4 90.9 91.3 91.7 92.1 92.6 93.0	$\begin{array}{r} 271 \\ 72 \\ 73 \\ 74 \\ 75 \\ 76 \\ 77 \\ 78 \\ 79 \\ 80 \end{array}$	$\begin{array}{c} 245.\ 6\\ 246.\ 5\\ 247.\ 4\\ 248.\ 3\\ 249.\ 2\\ 250.\ 1\\ 251.\ 0\\ 252.\ 0\\ 252.\ 9\\ 253.\ 8\end{array}$	$\begin{array}{c} 114.5\\ 115.0\\ 115.4\\ 115.8\\ 116.2\\ 116.6\\ 117.1\\ 117.5\\ 117.9\\ 118.3 \end{array}$
$ \begin{array}{r} 41 \\ 42 \\ 43 \\ 44 \\ 45 \\ 46 \\ 47 \\ 48 \\ 49 \\ 50 \\ \end{array} $	$\begin{array}{c} 37.\ 2\\ 38.\ 1\\ 39.\ 0\\ 39.\ 9\\ 40.\ 8\\ 41.\ 7\\ 42.\ 6\\ 43.\ 5\\ 44.\ 4\\ 45.\ 3\end{array}$	$17.3 \\ 17.7 \\ 18.2 \\ 18.6 \\ 19.0 \\ 19.4 \\ 19.9 \\ 20.3 \\ 20.7 \\ 21.1 \\ 100 \\ 21.1 \\ 200 \\ 21.1 \\ 21.1 \\ 200 \\ 21.1 \\ 21.1 \\ 200 \\ 21.1 \\ 200 \\ 21.1 \\ 200 \\ 21.1 \\ 200 \\ 21.1 \\ 200 \\ 21.1 \\ 200 \\ 21.1 \\ 200 \\ 21.1 \\ 200 \\ 21.1 \\ 200 \\ 200 \\ 21.1 \\ 200 $	$ \begin{array}{r} 101 \\ 02 \\ 03 \\ 04 \\ 05 \\ 06 \\ 07 \\ 08 \\ 09 \\ 10 \\ \end{array} $	$\begin{array}{c} 91.5\\92.4\\93.3\\94.3\\95.2\\96.1\\97.0\\97.9\\98.8\\99.7 \end{array}$	$\begin{array}{r} 42.7\\ 43.1\\ 43.5\\ 44.0\\ 44.4\\ 44.8\\ 45.2\\ 45.6\\ 46.1\\ 46.5\end{array}$	$ \begin{array}{r} 161 \\ 62 \\ 63 \\ 64 \\ 65 \\ 66 \\ 67 \\ 68 \\ 69 \\ 70 \\ \end{array} $	$\begin{array}{c} 145.\ 9\\ 146.\ 8\\ 147.\ 7\\ 148.\ 6\\ 149.\ 5\\ 150.\ 4\\ 151.\ 4\\ 152.\ 3\\ 153.\ 2\\ 154.\ 1\end{array}$	$\begin{array}{c} 68. \ 0\\ 68. \ 5\\ 68. \ 9\\ 69. \ 3\\ 69. \ 7\\ 70. \ 2\\ 70. \ 6\\ 71. \ 0\\ 71. \ 4\\ 71. \ 8\end{array}$	$\begin{array}{r} 221 \\ 22 \\ 23 \\ 24 \\ 25 \\ 26 \\ 27 \\ 28 \\ 29 \\ 30 \end{array}$	$\begin{array}{c} 200.\ 3\\ 201.\ 2\\ 202.\ 1\\ 203.\ 0\\ 203.\ 9\\ 204.\ 8\\ 205.\ 7\\ 206.\ 6\\ 207.\ 5\\ 208.\ 5 \end{array}$	$\begin{array}{c} 93.4\\ 93.8\\ 94.2\\ 94.7\\ 95.1\\ 95.5\\ 95.9\\ 96.4\\ 96.8\\ 97.2\end{array}$	281 82 83 84 85 86 87 88 89 90	$\begin{array}{c} 254.\ 7\\ 255.\ 6\\ 256.\ 5\\ 257.\ 4\\ 258.\ 3\\ 259.\ 2\\ 260.\ 1\\ 261.\ 0\\ 261.\ 9\\ 262.\ 8\end{array}$	$\begin{array}{c} 118.8\\ 119.2\\ 119.6\\ 120.0\\ 120.4\\ 120.9\\ 121.3\\ 121.7\\ 122.1\\ 122.6 \end{array}$
$51 \\ 52 \\ 53 \\ 54 \\ 55 \\ 56 \\ 57 \\ 58 \\ 59 \\ 60$	$\begin{array}{r} 46.2\\ 47.1\\ 48.0\\ 48.9\\ 49.8\\ 50.8\\ 51.7\\ 52.6\\ 53.5\\ 54.4 \end{array}$	$\begin{array}{c} 21.6\\ 22.0\\ 22.4\\ 22.8\\ 23.2\\ 23.7\\ 24.1\\ 24.5\\ 24.9\\ 25.4\\ \end{array}$	$ \begin{array}{r} 111 \\ 12 \\ 13 \\ 14 \\ 15 \\ 16 \\ 17 \\ 18 \\ 19 \\ 20 \\ \end{array} $	$\begin{array}{c} 100.\ 6\\ 101.\ 5\\ 102.\ 4\\ 103.\ 3\\ 104.\ 2\\ 105.\ 1\\ 106.\ 0\\ 106.\ 9\\ 107.\ 9\\ 108.\ 8 \end{array}$	$\begin{array}{r} 46.9\\ 47.3\\ 47.8\\ 48.2\\ 48.6\\ 49.0\\ 49.4\\ 49.9\\ 50.3\\ 50.7\\ \end{array}$	$ \begin{array}{r} 171 \\ 72 \\ 73 \\ 74 \\ 75 \\ 76 \\ 77 \\ 78 \\ 79 \\ 80 \\ \end{array} $	$\begin{array}{c} 155. \ 0\\ 155. \ 9\\ 156. \ 8\\ 157. \ 7\\ 158. \ 6\\ 159. \ 5\\ 160. \ 4\\ 161. \ 3\\ 162. \ 2\\ 163. \ 1\end{array}$	$\begin{array}{c} 72.3\\ 72.7\\ 73.1\\ 73.5\\ 74.0\\ 74.4\\ 74.8\\ 75.2\\ 75.6\\ 76.1 \end{array}$	$231 \\ 32 \\ 33 \\ 34 \\ 35 \\ 36 \\ 37 \\ 38 \\ 39 \\ 40$	$\begin{array}{c} 209.\ 4\\ 210.\ 3\\ 211.\ 2\\ 212.\ 1\\ 213.\ 0\\ 213.\ 9\\ 214.\ 8\\ 215.\ 7\\ 216.\ 6\\ 217.\ 5 \end{array}$	$\begin{array}{c} 97. \ 6\\ 98. \ 0\\ 98. \ 5\\ 98. \ 9\\ 99. \ 3\\ 99. \ 7\\ 100. \ 2\\ 100. \ 6\\ 101. \ 0\\ 101. \ 4\end{array}$	$291 \\ 92 \\ 93 \\ 94 \\ 95 \\ 96 \\ 97 \\ 98 \\ 99 \\ 300$	$\begin{array}{c} 263.\ 7\\ 264.\ 6\\ 265.\ 5\\ 266.\ 5\\ 267.\ 4\\ 268.\ 3\\ 269.\ 2\\ 270.\ 1\\ 271.\ 0\\ 271.\ 9\end{array}$	$\begin{array}{c} 123. \ 0\\ 123. \ 4\\ 123. \ 8\\ 124. \ 2\\ 124. \ 7\\ 125. \ 1\\ 125. \ 5\\ 125. \ 9\\ 126. \ 4\\ 126. \ 8\end{array}$
Dist.	Dep.	Lat.	Dist.	Dep.	Lat.	Dist. 65° (1	Dep. 15°, 245	Lat. °, ·295°	Dist.	Dep.	Lat.	Dist.	Dep.	Lat.

Dist. Lat. Dep. 211 272.8 127.6 62 282.0 153.0 22 382.4 177.9 481 435.9 203.3 541 400.0 229.0 05 276.3 128.9 465 330.8 154.2 25 385.1 170.2 84 488.5 204.1 43 492.0 229.0 65 276.3 128.9 465 330.8 155.1 27 387.0 180.0 86 483.5 204.1 44 445.7 231.1 100.6 469 433.2 121.1 111.4 440.7 235.2 133.2 133.2 133.2 133.2 133.2 133.2 133.2 133.2 133.2 141.2 207.1 104 483.2 <t< th=""><th></th><th></th><th></th><th>0</th><th></th><th></th><th>Т</th><th>ABLF</th><th>L 2.</th><th></th><th></th><th></th><th></th><th>[Page</th><th>417</th></t<>				0			Т	ABLF	L 2.					[Page	417
Dat. Dat. Dat. Lat. Dep. Dist. Lat. Dep. Dist. Lat. Dep. 301 272.8 177.6 663 328.0 153.4 173.9 481 455.9 203.3 741 491.2 229.0 03 274.6 128.4 64 329.0 153.4 22 382.4 177.8 83 435.7 204.1 449.2 229.0 229.0 153.4 223.82.4 170.2 84 435.6 204.5 144 493.0 229.0 05 276.4 128.9 66 330.8 154.2 25 385.7 185.1 223 385.7 185.6 421 444.0 205.8 474 444.0 205.8 474 444.0 206.4 494 475.7 223 445.8 206.4 494 490.6 224.9 236.0 136.5 136.3 436.3 338.4 186.8 444.0 207.1 551 496.3 237.1 137.2			נ	Differ€	ence of I	Latitud	e and	Departu	ire for 2	25° (1	55°, 205	°, 335°).		
301 272.8 177.6 643 287.0 153.4 173.5 87.3 88.3 35.7 173.5 87.3 88.3 35.7 12 190.2 223.8 173.5 87.3 88.3 35.7 12 190.2 229.0 10 125.5 144 143.0 229.0 10 128.5 133.6 147.5 88.3 157.7 83.4 457.7 28.1 143.8 20.4.0 144 493.0 229.0 100.0 85 433.5 143.5 144.0 205.7 441.4 205.8 47.4 490.6 223.4 243.4 243.4 243.4 243.4 243.6 243.4	Dist.	Lat.	Dep.	Dist.	Lat.	Dep.	Dist.	Lat.	Dep.	Dist.	Lat.	Dep.	Dist.	Lat.	Dep.
$\begin{array}{cccccccccccccccccccccccccccccccccccc$	$301 \\ 02 \\ 03 \\ 04$	272.8 273.7 274.6 275.5	127.2 127.6 128.0 128.4	$361 \\ 62 \\ 63 \\ 64$	327.1 328.0 329.0 329.9	152.5 153.0 153.4 153.8	$421 \\ 22 \\ 23 \\ 24$	381.5 382.4 383.3 384.2	177.9 178.3 178.7 179.2	$ \begin{array}{r} 481 \\ 82 \\ 83 \\ 84 \end{array} $	$\begin{array}{r} 435.9\\ 436.8\\ 437.7\\ 438.6\end{array}$	203.3 203.7 204.1 204.5	$541 \\ 42 \\ 43 \\ 44$	$\begin{array}{r} 490.\ 3\\ 491.\ 2\\ 492.\ 1\\ 493.\ 0\end{array}$	228.6229.0229.4229.9
$\begin{array}{c c c c c c c c c c c c c c c c c c c $	$ \begin{array}{c} 05 \\ 06 \\ 07 \\ 08 \end{array} $	$276.4 \\ 277.3 \\ 278.2 \\ 279.1$	$128.9 \\ 129.3 \\ 129.7 \\ 130.1$		$\begin{array}{c} 330.\ 8\\ 331.\ 7\\ 332.\ 6\\ 333\ 5\end{array}$	154.2 154.6 155.1 155.5	$25 \\ 26 \\ 27 \\ 28$	385.1 386.0 387.0 387.9	179.6 180.0 180.4 180.9	85 86 87 88	$\begin{array}{r} 439.5 \\ 440.4 \\ 441.3 \\ 442.2 \end{array}$	204.9 205.4 205.8 206.2	$45 \\ 46 \\ 47 \\ 48$	$\begin{array}{r} 493.9\\ 494.8\\ 495.7\\ 496.6\end{array}$	$\begin{array}{c} 230.\ 3\\ 230.\ 7\\ 231.\ 1\\ 231.\ 6\end{array}$
311 281. 8 131. 4 371 335. 2 156. 8 431 390. 6 182. 1 491. 4+4. 9 207. 9 52 500. 2 232. 8 12 282. 6 132. 2 73 335. 0 157. 6 33 392. 4 183. 0 93 446. 8 208. 3 53 501. 1 233. 7 14 284. 5 133. 1 75 338. 0 157. 6 33 302. 4 183. 8 49 447. 7 208. 7 55 503. 0 233. 7 15 285. 4 133. 1 77 341. 6 159. 3 37 306. 0 185. 1 94 450. 4 210. 0 55 506. 8 236. 7 236. 9 290. 0 135. 6 384. 1 160. 6 403 397. 8 185. 5 190 452. 2 210. 9 506. 6 507. 5 236. 6 327. 5 334. 7 161. 8 43 480. 1 161. 8 43 490. 1 143. 9 211. 7 561 506. 9 50. 7 255. 8 337. 5 160. 1 335. 8 161. 4 42 400. 6 18	$\begin{array}{r} 00\\09\\10\end{array}$	280.0 280.9	$130.6 \\ 131.0$	$\begin{array}{r} 69 \\ 70 \end{array}$	$334.4 \\ 335.3$	$155.9 \\ 156.3$	$\frac{\overline{29}}{30}$	$388.8 \\ 389.7$	$181.3 \\ 181.7$	89 90	$\begin{array}{c} 443.1\\ 444.0\end{array}$	$\frac{206.6}{207.1}$	$\begin{array}{r} 49 \\ 50 \end{array}$	$497.5 \\ 498.4$	$232.0 \\ 232.4$
$ \begin{array}{ccccccccccccccccccccccccccccccccccc$	$311 \\ 12 \\ 13 \\ 14 \\ 15 \\ 16$	$281.8 \\ 282.7 \\ 283.6 \\ 284.5 \\ 285.4 \\ 286.4$	$131.4 \\ 131.8 \\ 132.2 \\ 132.7 \\ 133.1 \\ 133.5$	$371 \\ 72 \\ 73 \\ 74 \\ 75 \\ 76$	$\begin{array}{c} 336.\ 2\\ 337.\ 1\\ 338.\ 0\\ 338.\ 9\\ 339.\ 8\\ 340.\ 7\end{array}$	$156.8 \\ 157.2 \\ 157.6 \\ 158.0 \\ 158.5 \\ 158.9$	$ \begin{array}{r} 431 \\ 32 \\ 33 \\ 34 \\ 35 \\ 36 \end{array} $	$\begin{array}{c} 390.\ 6\\ 391.\ 5\\ 392.\ 4\\ 393.\ 3\\ 394.\ 2\\ 395.\ 1\end{array}$	$182.1 \\182.5 \\183.0 \\183.4 \\183.8 \\184.2$	$ \begin{array}{r} 491 \\ 92 \\ 93 \\ 94 \\ 95 \\ 96 \\ \end{array} $	$\begin{array}{r} 444.9\\ 445.9\\ 446.8\\ 447.7\\ 448.6\\ 449.5\end{array}$	$\begin{array}{c} 207.5\\ 207.9\\ 208.3\\ 208.7\\ 209.1\\ 209.6 \end{array}$	$551 \\ 52 \\ 53 \\ 54 \\ 55 \\ 56$	$\begin{array}{r} 499.\ 3\\ 500.\ 2\\ 501.\ 1\\ 502.\ 0\\ 503.\ 0\\ 503.\ 9\end{array}$	$\begin{array}{c} 232.8\\ 233.2\\ 233.7\\ 234.1\\ 234.5\\ 235.0 \end{array}$
$\begin{array}{cccccccccccccccccccccccccccccccccccc$	$ \begin{array}{r} 17 \\ 18 \\ 19 \\ 20 \\ \hline 201 \end{array} $	$ \begin{array}{r} 287.3 \\ 288.2 \\ 289.1 \\ 290.0 \\ \end{array} $	$ \begin{array}{r} 133.9 \\ 134.4 \\ 134.8 \\ 135.2 \\ 125.6 \end{array} $	$77 \\ 78 \\ 79 \\ 80 \\ -281 \\ -$	341.6 342.5 343.5 344.4	$ \begin{array}{r} 159.3 \\ 159.7 \\ 160.1 \\ 160.6 \\ \hline 161.0 \\ \end{array} $	$ \begin{array}{r} 37 \\ 38 \\ 39 \\ 40 \\ 111 \end{array} $	$ \begin{array}{r} 396.0 \\ 396.9 \\ 397.8 \\ 398.7 \\ \hline 200.6 \end{array} $	$184.7 \\185.1 \\185.5 \\185.9 \\186.9$	$97 \\ 98 \\ 99 \\ 500 \\ 501$	$\begin{array}{r} 450.4\\ 451.3\\ 452.2\\ 453.1\\ \hline 154.0\\ \end{array}$	$210.0 \\ 210.4 \\ 210.9 \\ 211.3 \\ 211.7 $	$57 \\ 58 \\ 59 \\ 60 \\ 561 $	$504.8 \\ 505.7 \\ 506.6 \\ 507.5 \\ 508.4$	235.4235.8236.2236.6227.1
$\begin{array}{cccccccccccccccccccccccccccccccccccc$	$ \begin{array}{r} 321 \\ 22 \\ 23 \\ 24 \\ 25 \\ 26 \end{array} $	290.9 291.8 292.7 293.6 294.5 295.1	$136. 0 \\ 136. 1 \\ 136. 5 \\ 136. 9 \\ 137. 3 \\ 137. 7$	82 83 84 85 86	$\begin{array}{c} 345. \\ 346. \\ 347. \\ 348. \\ 348. \\ 348. \\ 349. \\ 349. \\ 8\end{array}$	$ \begin{array}{c} 161.0\\ 161.4\\ 161.8\\ 162.3\\ 162.7\\ 163.1\\ \end{array} $		$\begin{array}{c} 393.0 \\ 400.6 \\ 401.5 \\ 402.4 \\ 403.3 \\ 404.2 \end{array}$	186.8 186.8 187.2 187.6 188.0 188.5	$ \begin{array}{c} 02 \\ 03 \\ 04 \\ 05 \\ 06 \end{array} $	$\begin{array}{r} 451.0\\ 454.9\\ 455.8\\ 456.7\\ 457.7\\ 458.6\end{array}$	$\begin{array}{c} 211. \\ 212. \\ 1\\ 212. \\ 5\\ 213. \\ 0\\ 213. \\ 4\\ 213. \\ 8\end{array}$		509.3 510.2 511.1 512.0 512.9	237.5 237.9 238.3 238.7 239.2
$\begin{array}{cccccccccccccccccccccccccccccccccccc$	$ \begin{array}{r} 20 \\ 27 \\ 28 \\ 29 \\ 30 \end{array} $	$\begin{array}{c} 296.1\\ 296.3\\ 297.2\\ 298.1\\ 299.0\\ \hline \end{array}$	$ \begin{array}{r} 138.2 \\ 138.6 \\ 139.0 \\ 139.4 \\ \end{array} $	87 88 89 90	$\begin{array}{r} 350.7\\ 351.6\\ 352.5\\ 353.4\\ \hline \end{array}$	$ \begin{array}{r} 163.5 \\ 163.9 \\ 164.4 \\ 164.8 \\ \end{array} $	$ \begin{array}{r} 10 \\ 47 \\ 48 \\ 49 \\ 50 \end{array} $	$ \begin{array}{r} 101.2\\ 405.1\\ 406.0\\ 406.9\\ 407.8\\ \hline 102.2\\ \hline 102$	188.9 189.3 189.7 190.1	$ \begin{array}{r} 00 \\ 07 \\ 08 \\ 09 \\ 10 \\ \hline 511 \end{array} $	$\begin{array}{r} 150.5\\ 459.5\\ 460.4\\ 461.3\\ 462.2\\ \hline 100000000000000000000000000000000000$	$\begin{array}{c} 214.2 \\ 214.7 \\ 215.1 \\ 215.5 \\ \hline \\ 215.0 \end{array}$		513.8 514.8 515.7 516.6	$ \begin{array}{r} 239.6\\ 240.1\\ 240.5\\ 240.9\\ \hline 241.9\\ \hline 241.2\\ \hline 2$
$\begin{array}{c ccccccccccccccccccccccccccccccccccc$	$331 \\ 32 \\ 33 \\ 34 \\ 35 \\ 36 \\ 37 \\ 38 \\ 20$	$\begin{array}{c} 300.0\\ 300.9\\ 301.8\\ 302.7\\ 303.6\\ 304.5\\ 305.4\\ 306.3\\ 307.9\end{array}$	$\begin{array}{c} 139.9\\ 140.3\\ 140.7\\ 141.1\\ 141.5\\ 142.0\\ 142.4\\ 142.8\\ 142.8\\ 143.9\end{array}$	391 92 93 94 95 96 97 98 90	354.3 355.2 356.1 357.0 358.0 358.9 359.8 360.7 361.6	$\begin{array}{c} 165.2\\ 165.6\\ 166.1\\ 166.5\\ 166.9\\ 167.3\\ 167.7\\ 168.2\\ 168.6\end{array}$		$\begin{array}{c} 408.7\\ 409.6\\ 410.5\\ 411.4\\ 412.3\\ 413.2\\ 414.1\\ 415.1\\ 416.0\end{array}$	$190. 6 \\ 191. 0 \\ 191. 4 \\ 191. 8 \\ 192. 3 \\ 192. 7 \\ 193. 1 \\ 193. 5 \\ 194. 0 \\ 1$	$ \begin{array}{c} 511\\ 12\\ 13\\ 14\\ 15\\ 16\\ 17\\ 18\\ 19\\ \end{array} $	$\begin{array}{c} 403.1\\ 464.0\\ 464.9\\ 465.8\\ 466.7\\ 467.6\\ 468.5\\ 469.4\\ 470.3\end{array}$	$\begin{array}{c} 213.9\\ 216.4\\ 216.8\\ 217.2\\ 217.7\\ 218.1\\ 218.5\\ 218.9\\ 219.3\end{array}$	$571 \\ 72 \\ 73 \\ 74 \\ 75 \\ 76 \\ 77 \\ 78 \\ 79 $	517.5 518.4 519.3 520.2 521.1 522.0 522.9 523.8 524.7	$\begin{array}{c} 241.3\\ 241.7\\ 242.1\\ 242.6\\ 243.0\\ 243.4\\ 243.8\\ 244.3\\ 244.3\\ 244.7\end{array}$
$\begin{array}{c ccccccccccccccccccccccccccccccccccc$	$\frac{39}{40}$ $\overline{341}$	$\frac{307.2}{308.1}$	$ \begin{array}{r} 143.2 \\ 143.7 \\ 144.1 \\ \end{array} $	$\frac{400}{401}$	361.0 362.5 363.4	$ \begin{array}{r} 108.0 \\ 169.0 \\ \overline{169.4} \end{array} $	$\frac{60}{461}$	$ \begin{array}{r} 416.0 \\ 416.9 \\ \overline{} \\ 417.8 \\ \end{array} $	$194.0 \\ 194.4 \\ 194.8 \\ 194.$	$\frac{19}{20}$	471.2	$\begin{array}{r} 219.5 \\ 219.8 \\ \hline 220.2 \\ \end{array}$	$\frac{79}{80}$ $\overline{581}$	524.7 525.6 526.5	244.7 245.1 245.5
$ \begin{array}{c ccccccccccccccccccccccccccccccccccc$	$ \begin{array}{r} 42\\ 43\\ 44\\ 45\\ 46\\ 47\\ 48\\ 49\\ \end{array} $	$\begin{array}{c} 309.\ 9\\ 310.\ 8\\ 311.\ 7\\ 312.\ 6\\ 313.\ 5\\ 314.\ 5\\ 315.\ 4\\ 316.\ 3\end{array}$	$144.5 \\ 144.9 \\ 145.4 \\ 145.8 \\ 146.2 \\ 146.6 \\ 147.0 \\ 147.5 \\ 147.$	$\begin{array}{c} 02 \\ 03 \\ 04 \\ 05 \\ 06 \\ 07 \\ 08 \\ 09 \end{array}$	$\begin{array}{c} 364. \\ 365. \\ 2\\ 366. \\ 1\\ 367. \\ 0\\ 367. \\ 9\\ 368. \\ 8\\ 369. \\ 7\\ 370. \\ 6\end{array}$	$\begin{array}{c} 169.\ 9\\ 170.\ 3\\ 170.\ 7\\ 171.\ 1\\ 171.\ 6\\ 172.\ 0\\ 172.\ 4\\ 172.\ 8\end{array}$		$\begin{array}{c} 418.7\\ 419.6\\ 420.5\\ 421.4\\ 422.3\\ 423.2\\ 424.1\\ 425.0\\ \end{array}$	$195.2 \\ 195.6 \\ 196.1 \\ 196.5 \\ 196.9 \\ 197.3 \\ 197.8 \\ 198.2$	$22 \\ 23 \\ 24 \\ 25 \\ 26 \\ 27 \\ 28 \\ 29$	$\begin{array}{r} 473.1\\ 474.0\\ 474.9\\ 475.8\\ 476.7\\ 477.6\\ 477.6\\ 478.5\\ 479.4 \end{array}$	$\begin{array}{c} 220.\ 6\\ 221.\ 0\\ 221.\ 4\\ 221.\ 9\\ 222.\ 3\\ 222.\ 7\\ 223.\ 2\\ 223.\ 6\end{array}$	82 83 84 85 86 87 88 89	$\begin{array}{c} 527.4\\ 528.3\\ 529.3\\ 530.2\\ 531.1\\ 532.0\\ 532.9\\ 533.8\end{array}$	$\begin{array}{c} 246.0\\ 246.4\\ 246.8\\ 247.2\\ 247.7\\ 248.1\\ 248.5\\ 248.9\end{array}$
$\begin{array}{c ccccccccccccccccccccccccccccccccccc$	$50 \\ 351 \\ 52 \\ 52 \\ 52 \\ 52 \\ 53 \\ 53 \\ 53 \\ 53$	$\frac{317.2}{318.1}\\319.0\\210.0$	$\frac{147.9}{148.3}$ 148.7	$\begin{array}{r}10\\411\\12\\19\end{array}$	$ \begin{array}{r} 371.5 \\ \overline{372.5} \\ \overline{373.4} \\ \overline{271.9} \end{array} $	$ \begin{array}{r} 173.2 \\ \overline{173.7} \\ \overline{174.1} \\ \overline{174.5} \end{array} $	$ \begin{array}{r} 70 \\ \overline{471} \\ 72 \\ 72 \\ 72 \end{array} $	$\begin{array}{r} 425.9 \\ 426.8 \\ 427.7 \\ 429.6 \end{array}$	$ \begin{array}{r} 198.6 \\ \overline{199.0} \\ 199.4 \\ 100.0 \end{array} $	$\frac{30}{531}$	$ 480.3 \\ 481.2 \\ 482.1 \\ 182.0 $	$\begin{array}{r} 224.0 \\ 224.4 \\ 224.8 \\ 995 \\ 995 \\ 905 \\$	$90 \\ 591 \\ 92 \\ 02$	$\frac{534.7}{535.6}$ $\frac{536.5}{527.1}$	$ \begin{array}{r} 249.4 \\ \hline 249.8 \\ 250.2 \\ 250.6 \\ \end{array} $
60 326. 2 152. 1 20 380. 6 177. 5 80 435. 0 202. 8 40 489. 4 228. 2 600 543. 8 253. 6 Dist. Dep. Lat.	$53 \\ 54 \\ 55 \\ 56 \\ 57 \\ 58 \\ 59$	$\begin{array}{c} 319. \ 9 \\ 320. \ 8 \\ 321. \ 7 \\ 322. \ 6 \\ 323. \ 5 \\ 324. \ 4 \\ 325. \ 3 \end{array}$	$\begin{array}{c} 149.\ 2\\ 149.\ 6\\ 150.\ 0\\ 150.\ 4\\ 150.\ 8\\ 151.\ 3\\ 151.\ 7\end{array}$	13 14 15 16 17 18 19	$\begin{array}{c} 374. \ 3\\ 375. \ 2\\ 376. \ 1\\ 377. \ 0\\ 377. \ 9\\ 378. \ 8\\ 379. \ 7\end{array}$	174.5174.9175.4175.8176.2176.6177.0	$73 \\ 74 \\ 75 \\ 76 \\ 77 \\ 78 \\ 79$	$\begin{array}{r} 428.6\\ 429.6\\ 430.5\\ 431.4\\ 432.3\\ 433.2\\ 434.1\end{array}$	$\begin{array}{c} 199.9\\ 200.3\\ 200.7\\ 201.1\\ 201.6\\ 202.0\\ 202.4 \end{array}$	33 34 35 36 37 38 39	$\begin{array}{r} 483.0\\ 483.9\\ 484.8\\ 485.7\\ 486.7\\ 486.7\\ 487.6\\ 488.5\end{array}$	$\begin{array}{c} 225.3 \\ 225.7 \\ 226.1 \\ 226.5 \\ 226.9 \\ 227.4 \\ 227.8 \end{array}$	93 94 95 96 97 98 99	$\begin{array}{c} 537.4\\ 538.3\\ 539.2\\ 540.1\\ 541.0\\ 541.9\\ 542.8 \end{array}$	$\begin{array}{c} 200.\ 6\\ 251.\ 1\\ 251.\ 5\\ 251.\ 9\\ 252.\ 3\\ 252.\ 7\\ 253.\ 1\end{array}$
Dist. Dep. Lat.	60	326.2	152.1	20	380.6	177.5	80	435.0	202.8	$\frac{40}{10}$	489.4	228.2	600	543.8	253.6
65° (115°, 245°, 295°).	Dist.	Dep.	Lat.	Dist.	Dep.	Lat.	^{Dist.} 35° (1	Dep. 15°, 245	°, 295°).	neb.	Lat.	Dist.	Dep.	Lat.

22489-03-27

Pa	ge 418]				Т	ABLE	2.			6			
			Differ	ence of	Latitud	le and	Depart	ure for	26° (154°, 20	6°, 334°	°).		
Dist.	Lat.	Dep.	Dist.	Lat.	Dep,	Dist.	Lat.	Dep.	Dist.	Lat.	Dep.	Dist.	Lat.	Dep.
$ \begin{array}{c} 1 \\ 2 \\ 3 \\ 4 \\ 5 \\ 6 \\ 7 \end{array} $	$\begin{array}{c} 0.9 \\ 1.8 \\ 2.7 \\ 3.6 \\ 4.5 \\ 5.4 \end{array}$	$\begin{array}{c} 0.4 \\ 0.9 \\ 1.3 \\ 1.8 \\ 2.2 \\ 2.6 \\ 2.1 \end{array}$	$\begin{array}{c} 61 \\ 62 \\ 63 \\ 64 \\ *65 \\ 66 \\ 66 \end{array}$	$54.8 \\ 55.7 \\ 56.6 \\ 57.5 \\ 58.4 \\ 59.3 \\ 29.3 \\ 20.2 \\ $	$\begin{array}{c} 26.7\\ 27.2\\ 27.6\\ 28.1\\ 28.5\\ 28.9\\ \end{array}$	$ \begin{array}{r} 121 \\ 22 \\ 23 \\ 24 \\ 25 \\ 26 \\ 26 \end{array} $	$108.8 \\ 109.7 \\ 110.6 \\ 111.5 \\ 112.3 \\ 113.2$	$53.0 \\ 53.5 \\ 53.9 \\ 54.4 \\ 54.8 \\ 55.2$	$ 181 \\ 82 \\ 83 \\ 84 \\ 85 \\ 86 \\ 86 $	$\begin{array}{c} 162.\ 7\\ 163.\ 6\\ 164.\ 5\\ 165.\ 4\\ 166.\ 3\\ 167.\ 2\end{array}$	79.3 79.8 80.2 80.7 81.1 81.5	$241 \\ 42 \\ 43 \\ 44 \\ 45 \\ 46$	$\begin{array}{c} 216.\ 6\\ 217.\ 5\\ 218.\ 4\\ 219.\ 3\\ 220.\ 2\\ 221.\ 1 \end{array}$	$105.6 \\ 106.1 \\ 106.5 \\ 107.0 \\ 107.4 \\ 107.8$
7 8 9 10	$ \begin{array}{r} 6.3 \\ 7.2 \\ 8.1 \\ -9.0 \\ 0 \end{array} $	3.1 3.5 3.9 4.4	67 68 69 70	$ \begin{array}{c} 60.2 \\ 61.1 \\ 62.0 \\ 62.9 \end{array} $	$ \begin{array}{c} 29.4 \\ 29.8 \\ 30.2 \\ 30.7 \\ \end{array} $	$ \begin{array}{r} 27 \\ 28 \\ 29 \\ 30 \\ \hline 19 \\ 10 \\ \end{array} $	$ \begin{array}{r} 114.1 \\ 115.0 \\ 115.9 \\ 116.8 \\ \end{array} $	55.7 56.1 56.5 57.0	87 88 89 90	$ \begin{array}{c} 168.1\\ 169.0\\ 169.9\\ 170.8 \end{array} $	82.0 82.4 82.9 83.3	$ \begin{array}{r} 47 \\ 48 \\ 49 \\ 50 \end{array} $	$\begin{array}{c} 222.\ 0\\ 222.\ 9\\ 223.\ 8\\ 224.\ 7\end{array}$	$\begin{array}{c} 108.\ 3\\ 108.\ 7\\ 109.\ 2\\ 109.\ 6\end{array}$
$ \begin{array}{r} 11 \\ 12 \\ 13 \\ 14 \\ 15 \\ 16 \\ 17 \\ 18 \\ 19 \\ 20 \\ \end{array} $	$\begin{array}{c} 9,9\\ 10,8\\ 11,7\\ 12,6\\ 13,5\\ 14,4\\ 15,3\\ 16,2\\ 17,1\\ 18,0 \end{array}$	$\begin{array}{c} 4.8\\ 5.3\\ 5.7\\ 6.1\\ 6.6\\ 7.0\\ 7.5\\ 7.9\\ 8.3\\ 8.8\end{array}$	$71 \\ 72 \\ 73 \\ 74 \\ 75 \\ 76 \\ 77 \\ 78 \\ 79 \\ 80$	$\begin{array}{c} 0.3,8\\ 64,7\\ 65,6\\ 66,5\\ 67,4\\ 68,3\\ 69,2\\ 70,1\\ 71,0\\ 71,9\end{array}$	$\begin{array}{c} 31.1\\ 31.6\\ 32.0\\ 32.4\\ 32.9\\ 33.3\\ 33.8\\ 34.2\\ 34.6\\ 35.1\end{array}$	$ \begin{array}{r} 131 \\ 32 \\ 33 \\ 34 \\ 35 \\ 36 \\ 37 \\ 38 \\ 39 \\ 40 \\ \end{array} $	$\begin{array}{c} 117. \ 7\\ 118. \ 6\\ 119. \ 5\\ 120. \ 4\\ 121. \ 3\\ 122. \ 2\\ 123. \ 1\\ 124. \ 0\\ 124. \ 9\\ 125. \ 8\end{array}$	57. + 57.9 58.3 58.7 59.2 59.6 60.1 60.5 60.9 61.4	$ \begin{array}{r} 191 \\ 92 \\ 93 \\ 94 \\ 95 \\ 96 \\ 97 \\ 98 \\ 99 \\ 200 \\ \end{array} $	$\begin{array}{c} 171.7\\ 172.6\\ 173.5\\ 174.4\\ 175.3\\ 176.2\\ 177.1\\ 178.0\\ 178.9\\ 179.8 \end{array}$	83.7 84.2 84.6 85.0 85.5 85.9 86.4 86.8 87.2 87.7	$251 \\ 52 \\ 53 \\ 54 \\ 55 \\ 56 \\ 57 \\ 58 \\ 59 \\ 60$	$\begin{array}{c} 225.\ 6\\ 226.\ 5\\ 227.\ 4\\ 228.\ 3\\ 229.\ 2\\ 230.\ 1\\ 231.\ 0\\ 231.\ 9\\ 232.\ 8\\ 233.\ 7\end{array}$	$\begin{array}{c} 110.0\\ 110.5\\ 110.9\\ 111.3\\ 111.8\\ 112.2\\ 112.7\\ 113.1\\ 113.5\\ 114.0 \end{array}$
$\begin{array}{c} 21 \\ 22 \\ 23 \\ 24 \\ 25 \\ 26 \\ 27 \\ 28 \\ 29 \\ 30 \end{array}$	$18.9 \\ 19.8 \\ 20.7 \\ 21.6 \\ 22.5 \\ 23.4 \\ 24.3 \\ 25.2 \\ 26.1 \\ 27.0 \\ $	$\begin{array}{c} 9.2\\ 9.6\\ 10.1\\ 10.5\\ 11.0\\ 11.4\\ 11.8\\ 12.3\\ 12.7\\ 13.2 \end{array}$	81 82 83 84 85 86 87 88 89 90	$\begin{array}{c} 72.8\\ 73.7\\ 74.6\\ 75.5\\ 76.4\\ 77.3\\ 78.2\\ 79.1\\ 80.0\\ 80.9 \end{array}$	$\begin{array}{c} 35.5\\ 35.9\\ 36.4\\ 36.8\\ 37.3\\ 37.7\\ 38.1\\ 38.6\\ 39.0\\ 39.5\\ \end{array}$	$ \begin{array}{r} 141 \\ 42 \\ 43 \\ 44 \\ 45 \\ 46 \\ 47 \\ 48 \\ 49 \\ 50 \end{array} $	$\begin{array}{c} 126.\ 7\\ 127.\ 6\\ 128.\ 5\\ 129.\ 4\\ 130.\ 3\\ 131.\ 2\\ 132.\ 1\\ 133.\ 0\\ 133.\ 9\\ 134.\ 8\end{array}$	$\begin{array}{c} 61.8\\62.2\\62.7\\63.1\\63.6\\64.0\\64.4\\64.9\\65.3\\65.8\end{array}$	$\begin{array}{c} 201 \\ 02 \\ 03 \\ 04 \\ 05 \\ 06 \\ 07 \\ 08 \\ 09 \\ 10 \end{array}$	$\begin{array}{c} 180.7\\ 181.6\\ 182.5\\ 183.4\\ 184.3\\ 185.2\\ 186.1\\ 186.9\\ 187.8\\ 188.7 \end{array}$	$\begin{array}{c} 88.1\\ 88.6\\ 89.0\\ 89.4\\ 89.9\\ 90.3\\ 90.7\\ 91.2\\ 91.6\\ 92.1 \end{array}$	$ \begin{array}{r} 3.8 \\ \hline 261 \\ 62 \\ 63 \\ 64 \\ 65 \\ 66 \\ 67 \\ 68 \\ 69 \\ 70 \\ \end{array} $	$\begin{array}{c} 234.6\\ 235.5\\ 236.4\\ 237.3\\ 238.2\\ 239.1\\ 240.0\\ 240.9\\ 241.8\\ 242.7\end{array}$	$\begin{array}{c} 111.0\\ \hline 114.4\\ 114.9\\ 115.3\\ 115.7\\ 116.2\\ 116.6\\ 117.0\\ 117.5\\ 117.9\\ 118.4 \end{array}$
$ \begin{array}{r} 31\\32\\33\\34\\35\\36\\37\\38\\39\\40\\\end{array} $	$\begin{array}{c} 27.9\\ 28.8\\ 29.7\\ 30.6\\ 31.5\\ 32.4\\ 33.3\\ 34.2\\ 35.1\\ 36.0 \end{array}$	$\begin{array}{c} 13.6\\ 14.0\\ 14.5\\ 14.9\\ 15.3\\ 15.8\\ 16.2\\ 16.7\\ 17.1\\ 17.5 \end{array}$	$91 \\ 92 \\ 93 \\ 94 \\ 95 \\ 96 \\ 97 \\ 98 \\ 99 \\ 100$	$\begin{array}{c} 81.8\\ 82.7\\ 83.6\\ 84.5\\ 85.4\\ 86.3\\ 87.2\\ 88.1\\ 89.0\\ 89.9\end{array}$	$\begin{array}{r} 39.9\\ 40.3\\ 40.8\\ 41.2\\ 41.6\\ 42.1\\ 42.5\\ 43.0\\ 43.4\\ 43.8 \end{array}$	$151 \\ 52 \\ 53 \\ 54 \\ 55 \\ 56 \\ 57 \\ 58 \\ 59 \\ 60$	$\begin{array}{c} 135.\ 7\\ 136.\ 6\\ 137.\ 5\\ 138.\ 4\\ 139.\ 3\\ 140.\ 2\\ 141.\ 1\\ 142.\ 0\\ 142.\ 9\\ 143.\ 8\end{array}$	66. 2 66. 6 67. 1 67. 5 67. 9 68. 4 68. 8 69. 3 69. 7 70. 1	$\begin{array}{c} 211 \\ 12 \\ 13 \\ 14 \\ 15 \\ 16 \\ 17 \\ 18 \\ 19 \\ 20 \end{array}$	$\begin{array}{c} 189.\ 6\\ 190.\ 5\\ 191.\ 4\\ 192.\ 3\\ 193.\ 2\\ 194.\ 1\\ 195.\ 0\\ 195.\ 9\\ 196.\ 8\\ 197.\ 7\end{array}$	$\begin{array}{c} 92.5\\92.9\\93.4\\93.8\\94.2\\94.7\\95.1\\95.6\\96.0\\96.4\end{array}$	$\begin{array}{r} 271 \\ 72 \\ 73 \\ 74 \\ 75 \\ 76 \\ 77 \\ 78 \\ 79 \\ 80 \end{array}$	$\begin{array}{c} 243.\ 6\\ 244.\ 5\\ 245.\ 4\\ 246.\ 3\\ 247.\ 2\\ 248.\ 1\\ 249.\ 0\\ 249.\ 9\\ 250.\ 8\\ 251.\ 7\end{array}$	$\begin{array}{c} 118.8\\ 119.2\\ 119.7\\ 120.1\\ 120.6\\ 121.0\\ 121.4\\ 121.9\\ 122.3\\ 122.7\\ \end{array}$
$\begin{array}{c} 41 \\ 42 \\ 43 \\ 44 \\ 45 \\ 46 \\ 47 \\ 48 \\ 49 \\ 50 \end{array}$	$\begin{array}{c} 36.9\\ 37.7\\ 38.6\\ 39.5\\ 40.4\\ 41.3\\ 42.2\\ 43.1\\ 44.0\\ 44.9 \end{array}$	$\begin{array}{c} 18.0\\ 18.4\\ 18.8\\ 19.3\\ 19.7\\ 20.2\\ 20.6\\ 21.0\\ 21.5\\ 21.9 \end{array}$	$ \begin{array}{c} 101 \\ 02 \\ 03 \\ 04 \\ 05 \\ 06 \\ 07 \\ 08 \\ 09 \\ 10 \end{array} $	$\begin{array}{c} 90.8\\ 91.7\\ 92.6\\ 93.5\\ 94.4\\ 95.3\\ 96.2\\ 97.1\\ 98.0\\ 98.9\end{array}$	$\begin{array}{r} 44.3\\ 44.7\\ 45.2\\ 45.6\\ 46.0\\ 46.5\\ 46.9\\ 47.3\\ 47.8\\ 48.2 \end{array}$	$ \begin{array}{r} 161 \\ 62 \\ 63 \\ 64 \\ 65 \\ 66 \\ 67 \\ 68 \\ 69 \\ 70 \\ \end{array} $	$144.7 \\ 145.6 \\ 146.5 \\ 147.4 \\ 148.3 \\ 149.2 \\ 150.1 \\ 151.0 \\ 151.9 \\ 152.8 \\$	$\begin{array}{c} 70.\ 6\\ 71.\ 0\\ 71.\ 5\\ 71.\ 9\\ 72.\ 3\\ 72.\ 8\\ 73.\ 2\\ 73.\ 6\\ 74.\ 1\\ 74.\ 5\end{array}$	$\begin{array}{r} 221\\ 22\\ 23\\ 24\\ 25\\ 26\\ 27\\ 28\\ 29\\ 30\\ \end{array}$	$\begin{array}{c} 198.\ 6\\ 199.\ 5\\ 200.\ 4\\ 201.\ 3\\ 202.\ 2\\ 203.\ 1\\ 204.\ 0\\ 204.\ 9\\ 205.\ 8\\ 206.\ 7\\ \end{array}$	96. 9 97. 3 97. 8 98. 2 98. 6 99. 1 99. 5 99. 9 100. 4 100. 8	$281 \\ 82 \\ 83 \\ 84 \\ 85 \\ 86 \\ 87 \\ 88 \\ 89 \\ 90$	$\begin{array}{c} 252.\ 6\\ 253.\ 5\\ 254.\ 4\\ 255.\ 3\\ 256.\ 2\\ 257.\ 1\\ 258.\ 0\\ 258.\ 9\\ 259.\ 8\\ 260.\ 7\end{array}$	$\begin{array}{c} 123.\ 2\\ 123.\ 6\\ 124.\ 1\\ 124.\ 5\\ 124.\ 9\\ 125.\ 4\\ 125.\ 8\\ 126.\ 3\\ 126.\ 7\\ 127.\ 1 \end{array}$
51 52 53 54 55 56 57 58 59 60	$\begin{array}{r} 45.8\\ 46.7\\ 47.6\\ 48.5\\ 49.4\\ 50.3\\ 51.2\\ 52.1\\ 53.0\\ 53.9\end{array}$	$\begin{array}{c} 22.4\\ 22.8\\ 23.2\\ 23.7\\ 24.1\\ 24.5\\ 25.0\\ 25.4\\ 25.9\\ 26.3\\ \end{array}$	$ \begin{array}{r} 1111 \\ 12 \\ 13 \\ 14 \\ 15 \\ 16 \\ 17 \\ 18 \\ 19 \\ 20 \\ \end{array} $	$\begin{array}{c} 99.\ 8\\ 100.\ 7\\ 101.\ 6\\ 102.\ 5\\ 103.\ 4\\ 104.\ 3\\ 105.\ 2\\ 106.\ 1\\ 107.\ 0\\ 107.\ 9\end{array}$	$\begin{array}{r} 48.7\\ 49.1\\ 49.5\\ 50.0\\ 50.4\\ 50.9\\ 51.3\\ 51.7\\ 52.2\\ 52.6\end{array}$	$ \begin{array}{r} 171 \\ 72 \\ 73 \\ 74 \\ 75 \\ 76 \\ 77 \\ 78 \\ 79 \\ 80 \\ \end{array} $	$\begin{array}{c} 153.7\\ 154.6\\ 155.5\\ 156.4\\ 157.3\\ 158.2\\ 159.1\\ 160.0\\ 160.9\\ 161.8\\ \end{array}$	$\begin{array}{c} 75. \ 0\\ 75. \ 4\\ 75. \ 8\\ 76. \ 3\\ 76. \ 7\\ 77. \ 2\\ 77. \ 6\\ 78. \ 0\\ 78. \ 5\\ 78. \ 9\end{array}$	$\begin{array}{c} 231 \\ 32 \\ 33 \\ 34 \\ 35 \\ 36 \\ 37 \\ 38 \\ 39 \\ 40 \end{array}$	$\begin{array}{c} 207.\ 6\\ 208.\ 5\\ 209.\ 4\\ 210.\ 3\\ 211.\ 2\\ 212.\ 1\\ 213.\ 0\\ 213.\ 9\\ 214.\ 8\\ 215.\ 7 \end{array}$	$\begin{array}{c} 101.3\\ 101.3\\ 101.7\\ 102.1\\ 102.6\\ 103.0\\ 103.5\\ 103.9\\ 104.3\\ 104.8\\ 105.2 \end{array}$	291 92 93 94 95 96 97 98 99 300	$\begin{array}{c} 261.5\\ 262.4\\ 263.3\\ 264.2\\ 265.1\\ 266.0\\ 266.9\\ 267.8\\ 268.7\\ 269.6\\ \end{array}$	$\begin{array}{c} 127.6\\ 128.0\\ 128.4\\ 128.9\\ 129.3\\ 129.8\\ 130.2\\ 130.6\\ 131.1\\ 131.5\\ \end{array}$
Dist.	Dep.	Lat.	Dist.	Dep.	Lat.	Dist.	Dep.	Lat.	Dist.	Dep.	Lat.	Dist.	Dep.	Lat.
					(54° (1	16°, 244	°, 296°).					

						Т	ABLE	2.					[Page	419
			Differ	ence of	Latituć	le and	Depart	ure for	26° (1	154°, 20	6°, 334).		
Dist.	Lat.	Dep.	Dist.	Lat.	Dep.	Dist.	Lat.	Dep.	Dist.	Lat.	Dep.	Dist.	Lat,	Dep.
301	270.5	132.0 132.1	$\frac{361}{62}$	324.5 325.4	158.3 158.7	421	378.4 379.3	184.6 185.0	481	432.3 433.2	210.9 211.3	$541 \\ 49$	486.2 487.1	237.2 237.6
02	271.4 272.3	132.4 132.8	63	326.3	159.1	23	380.2	185.4	83	434.1	211.7	43	488.0	238.0
$\begin{array}{c} 04\\ 05\end{array}$	$273.2 \\ 274.1$	$133.3 \\ 133.7$	$\begin{array}{c} 64 \\ 65 \end{array}$	$327.2 \\ 328.1$	$159.6 \\ 160.0$	$\frac{24}{25}$	381.1 382.0	185.9 186.3	84 85	435.9	212.2 212.6	44 45	488.9 489.8	238.5 238.9
~06 07	275.0 275.9	$134.1 \\ 134.6$	$\begin{array}{c} 66 \\ 67 \end{array}$	329.0 329.9	$160.4 \\ 160.9$	$\frac{26}{27}$	382.9 383.8	$186.7 \\ 187.2$	$\frac{86}{87}$	$436.8 \\ 437.7$	213.0 213.5	$\frac{46}{47}$	490.7 491.6	239.3 239.8
08	276.8	135.0	68 60	330.8	161.3	28 20	384.7 285.6	187.6	88 80	438.6	213.9	48	492.5	240.2
10	$\frac{271.7}{278.6}$	$135.9 \\ 135.9$	- 70	331. 7 332. 6	161.8 162.2	30	386.5	188.5 188.5	90	440.4	214. 4 214. 8	- 4 9 - 50	494.3	240.7 241.1
$\frac{311}{12}$	279.5 280.4	$136.3 \\ 136.8$	$\frac{371}{72}$	333.5 334.4	$162.6 \\ 163.1$	$\frac{431}{32}$	387.4 388.3	$188.9 \\ 189.4$	491 92	441.3 442.2	215.2 215.7	$551 \\ 52$	495.2 496.1	241.5 242.0
13	281.3	137.2	73	335.3	163.5	33	389.2	189.8	93	443.1	216.1	53	497.0	242.4
$\frac{14}{15}$	282.2 283.1	137.7 138.1	$\frac{74}{75}$	$336.2 \\ 337.1$	164.0 164.4	$\frac{34}{35}$	390.1 391.0	190.5	$\frac{94}{95}$	$\frac{444.0}{444.9}$	216.6 217.0	04 55	497.9	242.9 243.3
$\begin{array}{c} 16\\ 17\end{array}$	284.0 284.9	138.5 139.0	$\frac{76}{77}$	338.0 338.9	$164.8 \\ 165.3$	$\frac{36}{37}$	391.9 392.8	$191.1 \\ 191.6$	$-96 \\ -97$	445.8 446.7	$217.4 \\ 217.9$	$\frac{56}{57}$	499.7 500.6	243.7 244.2
18	285.8	139,4	78 70	339.8	165.7	38	393.7	192.0	98 99	447.6	218.3	58 50	501.5	244.6
$\frac{19}{20}$	286.7 287.6	139.8 140.3	80	340.7 341.5	166.2 166.6	$-39 \\ -40$	394.0 395.5	192.4	500	449.4	218.7 219.2	- 59 - 60	502.4 503.3	245.0 245.5
$\frac{321}{22}$	288.5 289.4	140.7 141.2	$\frac{381}{82}$	342.4 343.3	167.0 167.5	$\frac{441}{42}$	396.4 397.3	193.3 193.8	$\begin{array}{c} 501 \\ 02 \end{array}$	450.3 451.2	219.6 220.1	$\frac{561}{62}$	504.2 505.1	245.9 246.4
23	290.3	141.6	83	344.2	167.9	43	398.2	194.2	03	452.1	220.5	63	506.0	246.8
$\frac{24}{25}$	291.2 292.1	142.0 142.5	84 85	346.0	168.5 168.8	44	400.0	194.7	04	453.9	221.0 221.4	65 65	506.9 507.8	247.3 247.7
$\begin{array}{c c} 26\\ 27\end{array}$	293.0 293.9	142.9 143.4	$\frac{86}{87}$	346.9 347.8	$169.2 \\ 169.7$	$\frac{46}{47}$	400.9 401.8	195.5 196.0	$ \begin{array}{c} 06 \\ 07 \end{array} $	454.8 455.7	221.8 222.3	$\begin{array}{c} \cdot & 66 \\ & 67 \end{array}$	508.7 509.6	248.1 248.6
28	294.8	143.8	88	348.7	170.1	48	402.7	196.4	08	456.6	222.7	68	510.5	249.0
$\frac{29}{30}$	295.7 296.6	$144.2 \\ 144.7$	- 89 - 90	349.6 350.5	170.5 171.0	$\frac{49}{50}$	403.6 404.5	196.8 197.3	09 10	457.5	223.1 223.6	$\frac{69}{70}$	511.4 512.3	249.4 249.9
$\frac{331}{32}$	297.5	145.1 145.6	$\frac{391}{92}$	$\frac{351.4}{252.2}$	171.4 171.8	$\frac{451}{52}$	405.4	197.7 198_1	$511 \\ 12$	459.3	224.0 224.1	$571 \\ 72$	513.2	250.3 250.8
33	299.3	146.0	93	353.2	172.3	53	407.2	198.6	13	461.1	224.9	73	515.0	250.0 251.2
$\begin{vmatrix} 34\\35\end{vmatrix}$	300.,2 301.1	$146.4 \\ 146.9$	$\begin{array}{c} 94\\95\end{array}$	354.1 355.0	$\frac{172.7}{173.2}$	$\begin{array}{c} 54 \\ 55 \end{array}$	$408.1 \\ 409.0$	$\frac{199.0}{199.5}$	$^{-14}_{-15}$	$\begin{array}{c c} 462.0 \\ 462.9 \end{array}$	$\begin{vmatrix} 225.3\\225.8 \end{vmatrix}$	$\begin{array}{c} 74 \\ 75 \end{array}$	515.9 516.8	251.6 252.1
$\frac{36}{37}$	302.0	147.3 147.7	96	355.9 356.8	173.6 174.0	$\frac{56}{57}$	409.9	199.9	$\frac{16}{17}$	463.8	226.2	$\frac{76}{77}$	517.7 518.6	252.5 252.0
,38	303.8	148.2	98	357.7	174.5	58	411.7	200.8	18	465.6	220.0 227.1	78	519.5	252.0
$\begin{array}{c} 39\\ 40 \end{array}$	$304.7 \\ 305.6$	$148.6 \\ 149.0$	99 400	358.6 359.5	$174.9 \\ 175.4$	$\begin{array}{c} 59 \\ 60 \end{array}$	$\begin{array}{c} 412.\ 6\\ 413.\ 5\end{array}$	$\begin{bmatrix} 201.\ 2\\ 201.\ 7 \end{bmatrix}$	$\frac{19}{20}$	466.5 467.4	227.5 228.0	79 80	$520.4 \\ 521.3$	$253.8 \\ 254.3$
341	306.5	149.5	401	$\frac{360.4}{201.2}$	175.8	461	414.4	202.1	521	468.3	228.4	581	522.2	254.7
$\frac{42}{43}$	307. 4 308. 3	149.9 150.4	$02 \\ 03$	361.3 362.2	176.2 176.7	$62 \\ 63$	410.2 416.1	202.5 203.0	$\frac{22}{23}$	469.2	228.8 229.3	82 83	523.1 524.0	255.1 255.6
$\begin{array}{c} 44 \\ 45 \end{array}$	$309.2 \\ 310.1$	150.8 151.2	$ \begin{array}{c} 04 \\ 05 \end{array} $	363.1 364.0	$177.1 \\ 177.5$	$\begin{array}{c} 64\\ 65\end{array}$	417.0 417.9	203.4 203.8	$\frac{24}{25}$	471.0 471.9	229.7 230.1	$\frac{84}{85}$	524.9 525.8	256.0 256.4
$\frac{46}{17}$	311.0	151.7	06	364.9	178.0	$-\frac{66}{97}$	418.8	204.3	$\frac{26}{27}$	472.8	230.6	86	526.7	256.9
47 48	311.9 312.8	152.1 152.6	08	365.8 366.7	178.4 178.9	68	419.7	204.7 205.2	$\frac{27}{28}$	474.6	231.0 231.5	87 88	527.0 528.5	257.5 257.8
$\begin{array}{c} 49 \\ 50 \end{array}$	$313.7 \\ 314.6$	153.0 153.4	$\begin{array}{c c} 09 \\ 10 \end{array}$	367.6 368.5	$179.3 \\ 179.7$	$\begin{array}{c} 69 \\ 70 \end{array}$	421.5 422.4	205.6 206.0	$\frac{29}{30}$	$475.5 \\ 476.4$	231.9 232.3	$\frac{89}{90}$	$529.4 \\ 530.3$	258.2 258.6
351	315.5	153.9	411	369.4	180.2	471	423.3	206.5	531	477.3	232.8	591	531.2	259.1
$\frac{52}{53}$	$316.4 \\ 317.3$	$154.3 \\ 154.7$	$\begin{array}{c} 12\\ 13\end{array}$	370.3 371.2	$180.6 \\ 181.1$	$\frac{72}{73}$	$\begin{array}{c} 424.2\\ 425.1\end{array}$	$206.9 \\ 207.3$	$\frac{32}{33}$	$\begin{array}{c} 478.2 \\ 479.1 \end{array}$	$\begin{vmatrix} 233.2\\233.6 \end{vmatrix}$	$\frac{92}{93}$	$532.1 \\ 533.0$	259.5 259.9
54 55	318.2 319.1	155.2 155.6	14 15	$\begin{vmatrix} 372.1\\ 373.0 \end{vmatrix}$	181.5 181.9	$\frac{74}{75}$	426.0	207.8 208.2	$\frac{34}{35}$	480.0	234.1 234.5	$94 \\ 95$	533.9 534.8	260.4
56	320.0	156.1	16	373.9	181.0	76	427.8	208.2 208.7	36	481.8	235.0	- 96 - 96	535.7	260.8 261.3
57 58	$320.9 \\ 321.8$	$156.5 \\ 156.9$	$\begin{array}{c} 17\\18\end{array}$	374.8 375.7	$182.8 \\ 183.2$	77 78,	428.7 429.6	$209.1 \\ 209.5$	$\frac{37}{38}$	$\begin{array}{c} 482.7 \\ 483.6 \end{array}$	$235.4 \\ 235.8$	$\frac{97}{98}$	$536.6 \\ 537.5$	$261.7 \\ 262.1$
59 60	322.7 323.6	157.4 157.8	19	376.6 377.5	183.7	79 80	430.5	210.0	39	484.5	$\frac{236.3}{226.7}$	90 600	538.4	262.6
- 00	020.0	107.0		011.0	184.1		491.4	210.4	-40	480, 5	230. 1	000	039. 0	2001.0
Dist.	Dep.	Lat.	Dist.	Dep.	Lat.	Dist.	Dep.	Lat.	Dist.	Dep.	Lat.	Dist.	Dep.	Lat.
					64°	(116°	', 244°, :	296°).						

Pa	ge 420] -				Т	ABLE	2.						
		-	Differe	ence of I	Latitud	e and	Departu	re for	27° (1	53°, 207	°, 333°).		
Dist.	Lat.	Dep.	Dist.	Lat.	Dep.	Dist.	Lat.	Dep.	Dist.	Lat.	Dep.	Dist.	Lat.	Dep.
$ \begin{array}{c} 1 \\ 2 \\ 3 \\ 4 \\ 5 \\ 6 \\ 7 \\ 8 \end{array} $	$\begin{array}{c} 0.9 \\ 1.8 \\ 2.7 \\ 3.6 \\ 4.5 \\ 5.3 \\ 6.2 \\ 7.1 \end{array}$	$\begin{array}{c} 0.5 \\ 0.9 \\ 1.4 \\ 1.8 \\ 2.3 \\ 2.7 \\ 3.2 \\ 3.6 \end{array}$	$\begin{array}{c} 61 \\ 62 \\ 63 \\ 64 \\ 65 \\ 66 \\ 67 \\ 68 \end{array}$	$54.4 \\ 55.2 \\ 56.1 \\ 57.0 \\ 57.9 \\ 58.8 \\ 59.7 \\ 60.6 \\ $	$\begin{array}{c} 27.7\\ 28.1\\ 28.6\\ 29.1\\ 29.5\\ 30.0\\ 30.4\\ 30.9 \end{array}$	$121 \\ 22 \\ 23 \\ 24 \\ 25 \\ 26 \\ 27 \\ 28$	$107.8 \\ 108.7 \\ 109.6 \\ 110.5 \\ 111.4 \\ 112.3 \\ 113.2 \\ 114.0 \\ 114.0 \\ 105.$	54.9 55.4 55.8 56.3 56.7 57.2 57.7 58.1	$ 181 \\ 82 \\ 83 \\ 84 \\ 85 \\ 86 \\ 87 \\ 88 $	$\begin{array}{c} 161.\ 3\\ 162.\ 2\\ 163.\ 1\\ 163.\ 9\\ 164.\ 8\\ 165.\ 7\\ 166.\ 6\\ 167.\ 5\end{array}$	$\begin{array}{c} 82.2\\ 82.6\\ 83.1\\ 83.5\\ 84.0\\ 84.4\\ 84.9\\ 85.4\end{array}$	$241 \\ 42 \\ 43 \\ 44 \\ 45 \\ 46 \\ 47 \\ 48$	$\begin{array}{c} 214.\ 7\\ 215.\ 6\\ 216.\ 5\\ 217.\ 4\\ 218.\ 3\\ 219.\ 2\\ 220.\ 1\\ 221.\ 0\end{array}$	109. 4109. 9110. 3110. 8111. 2111. 7112. 1112. 6
9 10	8.0 8.9	$4.1 \\ 4.5$	$\begin{array}{c} 69 \\ 70 \end{array}$	$61.5 \\ 62.4$	$31.3 \\ 31.8$	$\frac{29}{30}$	$114.9 \\ 115.8$	$58.6 \\ 59.0$	89 90	$168.4 \\ 169.3$	$85.8 \\ 86.3$	$ 49 \\ 50 $	221.9 222.8	$\begin{array}{c} 112.0 \\ 113.0 \\ 113.5 \end{array}$
$ \begin{array}{c} 11\\ 12\\ 13\\ 14\\ 15\\ 16\\ 17\\ 18\\ 19\\ 20\\ \end{array} $	$\begin{array}{c} 9.8\\ 10.7\\ 11.6\\ 12.5\\ 13.4\\ 14.3\\ 15.1\\ 16.0\\ 16.9\\ 17.8\end{array}$	$5.0 \\ 5.4 \\ 5.9 \\ 6.4 \\ 6.8 \\ 7.3 \\ 7.7 \\ 8.2 \\ 8.6 \\ 9.1$	$71 \\ 72 \\ 73 \\ 74 \\ 75 \\ 76 \\ 77 \\ 78 \\ 79 \\ 80$	$\begin{array}{c} 63.\ 3\\ 64.\ 2\\ 65.\ 0\\ 65.\ 9\\ 66.\ 8\\ 67.\ 7\\ 68.\ 6\\ 69.\ 5\\ 70.\ 4\\ 71.\ 2\end{array}$	$\begin{array}{c} 32.2 \\ 32.7 \\ 33.1 \\ 33.6 \\ 34.0 \\ 34.5 \\ 35.0 \\ 35.4 \\ 35.9 \\ 26.2 \end{array}$	$ \begin{array}{r} 131 \\ 32 \\ 33 \\ 34 \\ 35 \\ 36 \\ 37 \\ 38 \\ 39 \\ 10 \\ \end{array} $	$\begin{array}{c} 116.\ 7\\ 117.\ 6\\ 118.\ 5\\ 119.\ 4\\ 120.\ 3\\ 121.\ 2\\ 122.\ 1\\ 123.\ 0\\ 123.\ 8\\ 121.\ 7\end{array}$	$59.5 \\ 59.9 \\ 60.4 \\ 60.8 \\ 61.3 \\ 61.7 \\ 62.2 \\ 62.7 \\ 63.1 \\ 62.6 \\ 63.1 \\ 62.6 \\ 63.1 \\ 63.6 \\ $	$ \begin{array}{r} 191 \\ 92 \\ 93 \\ 94 \\ 95 \\ 96 \\ 97 \\ 98 \\ 99 \\ 99 \\ 200 \\ \end{array} $	$\begin{array}{c} 170.\ 2\\ 171.\ 1\\ 172.\ 0\\ 172.\ 9\\ 173.\ 7\\ 174.\ 6\\ 175.\ 5\\ 176.\ 4\\ 177.\ 3\\ 178.\ 9\end{array}$	86.7 87.2 87.6 88.1 88.5 89.0 89.4 89.9 90.3 90.3	$\begin{array}{r} 251 \\ 52 \\ 53 \\ 54 \\ 55 \\ 56 \\ 57 \\ 58 \\ 59 \\ 60 \end{array}$	$\begin{array}{c} 223.\ 6\\ 224.\ 5\\ 225.\ 4\\ 226.\ 3\\ 227.\ 2\\ 228.\ 1\\ 229.\ 0\\ 229.\ 9\\ 230.\ 8\\ 921.\ 7\end{array}$	$\begin{array}{c} 114.0\\ 114.4\\ 114.9\\ 115.3\\ 115.8\\ 116.2\\ 116.7\\ 117.1\\ 117.6\\ 117.6\\ 117.6\\ 117.6\\ 117.6\\ 117.6\\ 111.6\\ 11$
$ \begin{array}{r} 20 \\ \hline 21 \\ 22 \\ 23 \\ 24 \\ 25 \\ 26 \\ 27 \\ 28 \\ 29 \\ 30 \\ \end{array} $	$\begin{array}{c} 17.3 \\ \hline 18.7 \\ 19.6 \\ 20.5 \\ 21.4 \\ 22.3 \\ 23.2 \\ 24.1 \\ 24.9 \\ 25.8 \\ 26.7 \end{array}$	$\begin{array}{r} 3.1\\ 9.5\\ 10.0\\ 10.4\\ 10.9\\ 11.3\\ 11.8\\ 12.3\\ 12.7\\ 13.2\\ 13.6\end{array}$	80 81 82 83 84 85 86 87 88 89 90	$\begin{array}{c} 71.3\\ \hline 72.2\\ 73.1\\ 74.0\\ 74.8\\ 75.7\\ 76.6\\ 77.5\\ 78.4\\ 79.3\\ 80.2 \end{array}$	$\begin{array}{c} 36.8\\ 37.2\\ 37.7\\ 38.1\\ 38.6\\ 39.0\\ 39.5\\ 40.0\\ 40.4\\ 40.9 \end{array}$	$ \begin{array}{r} 40 \\ 141 \\ 42 \\ 43 \\ 44 \\ 45 \\ 46 \\ 47 \\ 48 \\ 49 \\ 50 \\ \end{array} $	$\begin{array}{c} 124.7\\ 125.6\\ 126.5\\ 127.4\\ 128.3\\ 129.2\\ 130.1\\ 131.0\\ 131.9\\ 132.8\\ 133.7 \end{array}$	$\begin{array}{c} 63.6\\ 64.0\\ 64.5\\ 64.9\\ 65.4\\ 65.8\\ 66.3\\ 66.7\\ 67.2\\ 67.6\\ 68.1 \end{array}$	$\begin{array}{c} 200\\ 201\\ 02\\ 03\\ 04\\ 05\\ 06\\ 07\\ 08\\ 09\\ 10\\ \end{array}$	$\begin{array}{c} 173.2\\ \hline 179.1\\ 180.0\\ 180.9\\ 181.8\\ 182.7\\ 183.5\\ 184.4\\ 185.3\\ 186.2\\ 187.1 \end{array}$	$\begin{array}{r} 50.8\\ \hline 91.3\\ 91.7\\ 92.2\\ 92.6\\ 93.1\\ 93.5\\ 94.0\\ 94.4\\ 94.9\\ 95.3\end{array}$	$ \begin{array}{r} 30 \\ 261 \\ 62 \\ 63 \\ 64 \\ 65 \\ 66 \\ 67 \\ 68 \\ 69 \\ 70 \\ 70 \end{array} $	$\begin{array}{c} 231.7\\ \hline 232.6\\ 233.4\\ 234.3\\ 235.2\\ 236.1\\ 237.0\\ 237.9\\ 238.8\\ 239.7\\ 240.6\\ \end{array}$	$\begin{array}{c} 118.0\\ \hline 118.5\\ 118.9\\ 119.4\\ 119.9\\ 120.3\\ 120.8\\ 121.2\\ 121.7\\ 122.1\\ 122.6\end{array}$
$ \begin{array}{r} 31 \\ 32 \\ 33 \\ 34 \\ 35 \\ 36 \\ 37 \\ 38 \\ 39 \\ 40 \\ 40 \end{array} $	$\begin{array}{c} 27.6\\ 28.5\\ 29.4\\ 30.3\\ 31.2\\ 32.1\\ 33.0\\ 33.9\\ 34.7\\ 35.6\end{array}$	$\begin{array}{c} 14.1\\ 14.5\\ 15.0\\ 15.4\\ 15.9\\ 16.3\\ 16.8\\ 17.3\\ 17.7\\ 18.2 \end{array}$	$ \begin{array}{r} 91\\ 92\\ 93\\ 94\\ 95\\ 96\\ 97\\ 98\\ 99\\ 100\\ \end{array} $	$\begin{array}{c} 81.1\\ 82.0\\ 82.9\\ 83.8\\ 84.6\\ 85.5\\ 86.4\\ 87.3\\ 88.2\\ 89.1\end{array}$	$\begin{array}{r} 41.3\\ 41.8\\ 42.2\\ 42.7\\ 43.1\\ 43.6\\ 44.0\\ 44.5\\ 44.9\\ 45.4\end{array}$	$ \begin{array}{r} 151 \\ 52 \\ 53 \\ 54 \\ 55 \\ 56 \\ 57 \\ 58 \\ 59 \\ 60 \\ \end{array} $	$\begin{array}{c} 134.5\\ 135.4\\ 136.3\\ 137.2\\ 138.1\\ 139.0\\ 139.9\\ 140.8\\ 141.7\\ 142.6\end{array}$	$\begin{array}{c} 68.6\\ 69.0\\ 69.5\\ 69.9\\ 70.4\\ 70.8\\ 71.3\\ 71.7\\ 72.2\\ 72.6\end{array}$	$ \begin{array}{r} 211\\ 12\\ 13\\ 14\\ 15\\ 16\\ 17\\ 18\\ 19\\ 20\\ \end{array} $	$\begin{array}{c} 188.0\\ 188.9\\ 189.8\\ 190.7\\ 191.6\\ 192.5\\ 193.3\\ 194.2\\ 195.1\\ 196.0\\ \end{array}$	95.8 96.2 96.7 97.2 97.6 98.1 98.5 99.0 99.4 99.4	$ \begin{array}{r} 271 \\ 72 \\ 73 \\ 74 \\ 75 \\ 76 \\ 77 \\ 78 \\ 79 \\ 80 \\ \end{array} $	$\begin{array}{c} 241.5\\ 242.4\\ 243.2\\ 244.1\\ 245.0\\ 245.^{6}9\\ 246.8\\ 247.7\\ 248.6\\ 249.5\\ \end{array}$	$\begin{array}{c} 123.\ 0\\ 123.\ 5\\ 123.\ 9\\ 124.\ 4\\ 124.\ 8\\ 125.\ 3\\ 125.\ 8\\ 126.\ 2\\ 126.\ 7\\ 127.\ 1\end{array}$
$ \begin{array}{r} 10 \\ 41 \\ 42 \\ 43 \\ 44 \\ 45 \\ 46 \\ 47 \\ 48 \\ 49 \\ 50 \\ \end{array} $	$\begin{array}{r} 36.5\\ 36.5\\ 37.4\\ 38.3\\ 39.2\\ 40.1\\ 41.0\\ 41.9\\ 42.8\\ 43.7\\ 44.6\end{array}$	$\begin{array}{c} 18.6\\ 19.1\\ 19.5\\ 20.0\\ 20.4\\ 20.9\\ 21.3\\ 21.8\\ 22.2\\ 22.7 \end{array}$	$ \begin{array}{r} 100 \\ 101 \\ 02 \\ 03 \\ 04 \\ 05 \\ 06 \\ 07 \\ 08 \\ 09 \\ 10 \\ \end{array} $	$\begin{array}{c} 90.0\\ 90.9\\ 91.8\\ 92.7\\ 93.6\\ 94.4\\ 95.3\\ 96.2\\ 97.1\\ 98.0\\ \end{array}$	$\begin{array}{r} 10.1\\ \hline 45.9\\ 46.3\\ 46.8\\ 47.2\\ 47.7\\ 48.1\\ 48.6\\ 49.0\\ 49.5\\ 49.9\end{array}$	$ \begin{array}{r} 60 \\ 161 \\ 62 \\ 63 \\ 64 \\ 65 \\ 66 \\ $	$\begin{array}{c} 143.5\\ 144.3\\ 145.2\\ 146.1\\ 147.0\\ 147.9\\ 148.8\\ 149.7\\ 150.6\\ 151.5\\ \end{array}$	$\begin{array}{c} 73.1\\ 73.5\\ 74.0\\ 74.5\\ 74.9\\ 75.4\\ 75.8\\ 76.3\\ 76.7\\ 77.2 \end{array}$	$ \begin{array}{r} 221 \\ 221 \\ 22 \\ 23 \\ 24 \\ 25 \\ 26 \\ 27 \\ 28 \\ 29 \\ 30 \\ \end{array} $	$\begin{array}{c} 196.0\\ \hline 196.9\\ 197.8\\ 198.7\\ 199.6\\ 200.5\\ 201.4\\ 202.3\\ 203.1\\ 204.0\\ 204.9 \end{array}$	$\begin{array}{c} 100.3\\ 100.8\\ 101.2\\ 101.7\\ 102.1\\ 102.6\\ 103.1\\ 103.5\\ 104.0\\ 104.4 \end{array}$	281 82 83 84 85 86 87 88 89 90	$\begin{array}{c} 250.4\\ 250.4\\ 251.3\\ 252.2\\ 253.0\\ 253.9\\ 254.8\\ 255.7\\ 256.6\\ 257.5\\ 258.4 \end{array}$	$\begin{array}{c} 127.1\\ \hline 127.6\\ 128.0\\ 128.5\\ 128.9\\ 129.4\\ 129.8\\ 130.3\\ 130.7\\ 131.2\\ 131.7 \end{array}$
$51 \\ 52 \\ 53 \\ 54 \\ 55 \\ 56 \\ 57 \\ 58 \\ 59 \\ 60$	$\begin{array}{c} 45.\ 4\\ 46.\ 3\\ 47.\ 2\\ 48.\ 1\\ 49.\ 0\\ 49.\ 9\\ 50.\ 8\\ 51.\ 7\\ 52.\ 6\\ 53.\ 5\end{array}$	$\begin{array}{c} 23.2\\ 23.6\\ 24.1\\ 24.5\\ 25.0\\ 25.4\\ 25.9\\ 26.3\\ 26.8\\ 27.2 \end{array}$	$ \begin{array}{c} 111\\12\\13\\14\\15\\16\\17\\18\\19\\20\\\end{array} $	$\begin{array}{c} 98.9\\99.8\\100.7\\101.6\\102.5\\103.4\\104.2\\105.1\\106.0\\106.9\end{array}$	$\begin{array}{c} 50. \ 4\\ 50. \ 8\\ 51. \ 3\\ 51. \ 8\\ 52. \ 2\\ 52. \ 7\\ 53. \ 1\\ 53. \ 6\\ 54. \ 0\\ 54. \ 5\end{array}$	$ \begin{array}{r} 171 \\ 72 \\ 73 \\ 74 \\ 75 \\ 76 \\ 77 \\ 78 \\ 79 \\ 80 \\ \end{array} $	$\begin{array}{c} 152.\ 4\\ 153.\ 3\\ 154.\ 1\\ 155.\ 0\\ 155.\ 9\\ 156.\ 8\\ 157.\ 7\\ 158.\ 6\\ 159.\ 5\\ 160.\ 4\end{array}$	$\begin{array}{c} 77.6\\ 78.1\\ 78.5\\ 79.0\\ 79.4\\ 79.9\\ 80.4\\ 80.8\\ 81.3\\ 81.7\end{array}$	$\begin{array}{c} 231 \\ 32 \\ 33 \\ 34 \\ 35 \\ 36 \\ 37 \\ 38 \\ 39 \\ 40 \end{array}$	$\begin{array}{c} 205.8\\ 206.7\\ 207.6\\ 208.5\\ 209.4\\ 210.3\\ 211.2\\ 212.1\\ 213.0\\ 213.8\\ \end{array}$	$\begin{array}{c} 104.9\\ 105.3\\ 105.8\\ 106.2\\ 106.7\\ 107.1\\ 107.6\\ 108.0\\ 108.5\\ 109.0\\ \end{array}$	$\begin{array}{c} 291\\ 92\\ 93\\ 94\\ 95\\ 96\\ 97\\ 98\\ 99\\ 300 \end{array}$	$\begin{array}{c} 259.\ 3\\ 260.\ 2\\ 261.\ 1\\ 262.\ 0\\ 262.\ 8\\ 263.\ 7\\ 264.\ 6\\ 265.\ 5\\ 266.\ 4\\ 267.\ 3\\ \end{array}$	$\begin{array}{c} 132. \ 1\\ 132. \ 6\\ 133. \ 0\\ 133. \ 5\\ 133. \ 9\\ 134. \ 4\\ 134. \ 8\\ 135. \ 3\\ 135. \ 7\\ 136. \ 2 \end{array}$
Dist.	Dep.	Lat.	Dist.	Dep.	Lat.	Dist.	Dep.	Lat.	Dist.	Dep.	Lat.	Dist.	Dep.	Lat.
						00 (1	., 240	, 201	<i>)</i> .					

						Г	ABL	£ 2.					[Page	421
		1	Differe	ence of 1	Latitud	e and	Departi	ire for	27° (1	.53°, 207	°, 333°).		
Dist.	Lat.	Dep.	Dist.	Lat.	Dep.	Dist.	Lat.	Dep.	Dist.	Lat.	Dep.	Dist.	Lat.	Dep.
$\begin{array}{c} 301 \\ 02 \\ 03 \\ 04 \\ 05 \\ 06 \end{array}$	$\begin{array}{c} 268.\ 2\\ 269.\ 1\\ 270.\ 0\\ 270.\ 9\\ 271.\ 8\\ 272.\ 7\end{array}$	$136.7 \\ 137.1 \\ 137.6 \\ 138.0 \\ 138.5 \\ 138.9$	$361 \\ 62 \\ 63 \\ 64 \\ 65 \\ 66$	$\begin{array}{c} 321.\ 7\\ 322.\ 5\\ 323.\ 4\\ 324.\ 3\\ 325.\ 2\\ 326.\ 1\end{array}$	$163.9 \\ 164.4 \\ 164.8 \\ 165.3 \\ 165.7 \\ 166.2$	$\begin{array}{c} 421 \\ 22 \\ 23 \\ 24 \\ 25 \\ 26 \end{array}$	$\begin{array}{c} 375.1\\ 376.0\\ 376.9\\ 377.8\\ 378.7\\ 379.6\end{array}$	$191.1\\191.6\\192.0\\192.5\\193.0\\193.4$	$\begin{array}{c} 481 \\ 82 \\ 83 \\ 84 \\ 85 \\ 86 \\ \end{array}$	$\begin{array}{c} 428.\ 6\\ 429.\ 4\\ 430.\ 3\\ 431.\ 2\\ 432.\ 1\\ 433.\ 0\end{array}$	$\begin{array}{c} 218.3\\ 218.8\\ 219.2\\ 219.7\\ 220.1\\ 220.6 \end{array}$	$541 \\ 42 \\ 43 \\ 44 \\ 45 \\ 46 \\ 46$	$\begin{array}{c} 482.\ 0\\ 482.\ 9\\ 483.\ 8\\ 484.\ 7\\ 485.\ 6\\ 486.\ 4\end{array}$	$\begin{array}{c} 245.\ 6\\ 246.\ 1\\ 246.\ 5\\ 247.\ 0\\ 247.\ 4\\ 247.\ 9\end{array}$
$ \begin{array}{r} 07 \\ 08 \\ 09 \\ 10 \\ \hline 011 \end{array} $	$\begin{array}{c} 273.5 \\ 274.4 \\ 275.3 \\ 276.2 \\ \end{array}$	139.4139.8140.3140.7		$\begin{array}{r} 327.0 \\ 327.9 \\ 328.8 \\ 329.7 \\ \hline 220.6 \end{array}$	$ \begin{array}{r} 166.6 \\ 167.1 \\ 167.5 \\ 168.0 \\ \hline 168.4 \\ \end{array} $	$ \begin{array}{r} 27 \\ 28 \\ 29 \\ 30 \\ 421 \end{array} $	$ \begin{array}{r} 380.5 \\ 381.4 \\ 382.2 \\ 383.1 \\ \hline 281.0 \\ \end{array} $	$ \begin{array}{r} 193.9 \\ 194.3 \\ 194.8 \\ 195.2 \\ 105.7 \end{array} $		$ \begin{array}{r} 433.9\\ 434.8\\ 435.7\\ 436.6\\ \hline 437.5 \end{array} $	$\begin{array}{c} 221. \\ 221. 5 \\ 222. 0 \\ 222. 4 \\ \hline 222. 0 \\ \hline 222. 4 \\ \hline 222. 0 \\ \hline \end{array}$	47 48 49 50	487.3 488.2 489.1 490.0 100.0 100.0 100.0 100.0 100.0 100.0 100.0 100.0 100.0	$\begin{array}{r} 248.4 \\ 248.8 \\ 249.2 \\ 249.7 \\ \hline \\ 250.1 \end{array}$
$ \begin{array}{r} 12 \\ 13 \\ 14 \\ 15 \\ 16 \\ 17 \\ 18 \\ 19 \\ 20 \\ \end{array} $	$\begin{array}{c} 277.1\\ 278.0\\ 278.9\\ 279.8\\ 280.7\\ 281.6\\ 282.5\\ 283.3\\ 284.2\\ 285.1 \end{array}$	$\begin{array}{c} 141.\ 2\\ 141.\ 7\\ 142.\ 1\\ 142.\ 6\\ 143.\ 0\\ 143.\ 5\\ 143.\ 9\\ 144.\ 4\\ 144.\ 8\\ 145.\ 3\end{array}$	$ \begin{array}{r} 72 \\ 73 \\ 74 \\ 75 \\ 76 \\ 77 \\ 78 \\ 79 \\ 80 \\ \end{array} $	$\begin{array}{c} 331.5\\ 332.3\\ 333.2\\ 333.2\\ 334.1\\ 335.0\\ 335.9\\ 336.8\\ 337.7\\ 338.6 \end{array}$	$\begin{array}{c} 103. \\ 168. \\ 9\\ 169. \\ 3\\ 169. \\ 8\\ 170. \\ 3\\ 170. \\ 7\\ 171. \\ 2\\ 171. \\ 6\\ 172. \\ 1\\ 172. \\ 5\end{array}$	32 33 34 35 36 37 38 39 40	384. 9 385. 8 386. 7 387. 6 388. 5 389. 4 390. 3 391. 2 392. 0	$195. 4 \\ 196. 1 \\ 196. 6 \\ 197. 0 \\ 197. 5 \\ 197. 9 \\ 198. 4 \\ 198. 9 \\ 199. 3 \\ 199. 8 \\ 1$	92 93 94 95 96 97 98 99 500	$\begin{array}{r} 431.3\\ 438.3\\ 439.2\\ 440.1\\ 441.0\\ 441.9\\ 442.8\\ 443.7\\ 444.6\\ 445.5\end{array}$	$\begin{array}{c} 222.5\\ 223.3\\ 223.8\\ 224.2\\ 224.7\\ 225.2\\ 225.6\\ 226.1\\ 226.5\\ 227.0\\ \end{array}$	$51 \\ 52 \\ 53 \\ 54 \\ 55 \\ 56 \\ 57 \\ 58 \\ 59 \\ 60$	$\begin{array}{c} 490.\ 3\\ 491.\ 8\\ 492.\ 7\\ 493.\ 6\\ 494.\ 5\\ 495.\ 4\\ 496.\ 3\\ 497.\ 2\\ 498.\ 1\\ 499.\ 0\end{array}$	$\begin{array}{c} 250.1\\ 250.6\\ 251.0\\ 251.5\\ 252.0\\ 252.4\\ 252.9\\ 253.3\\ 253.8\\ 254.2 \end{array}$
$\begin{array}{r} 321 \\ 22 \\ 23 \\ 24 \\ 25 \\ 26 \\ 27 \\ 28 \\ 29 \\ 30 \end{array}$	$\begin{array}{c} 286.0\\ 286.9\\ 287.8\\ 288.7\\ 289.6\\ 290.5\\ 291.4\\ 292.3\\ 293.2\\ 294.0 \end{array}$	$\begin{array}{c} 145.\ 7\\ 146.\ 2\\ 146.\ 6\\ 147.\ 1\\ 147.\ 6\\ 148.\ 0\\ 148.\ 5\\ 148.\ 9\\ 149.\ 4\\ 149.\ 8\end{array}$	$ \begin{array}{r} 381 \\ 82 \\ 83 \\ 84 \\ 85 \\ 86 \\ 87 \\ 88 \\ 89 \\ 90 \\ 90 \end{array} $	$\begin{array}{c} 339.5\\ 340.4\\ 341.3\\ 342.1\\ 343.0\\ 343.9\\ 344.8\\ 345.7\\ 346.6\\ 347.5\\ \end{array}$	$\begin{array}{c} 173.\ 0\\ 173.\ 4\\ 173.\ 9\\ 174.\ 3\\ 174.\ 8\\ 175.\ 2\\ 175.\ 7\\ 176.\ 2\\ 176.\ 6\\ 177.\ 1\end{array}$	$ \begin{array}{r} 441\\ 42\\ 43\\ 44\\ 45\\ 46\\ 47\\ 48\\ 49\\ 50\\ \end{array} $	$\begin{array}{c} 392.9\\ 393.8\\ 394.7\\ 395.6\\ 396.5\\ 397.4\\ 398.3\\ 399.2\\ 400.1\\ 401.0 \end{array}$	$\begin{array}{c} 200.\ 2\\ 200.\ 7\\ 201.\ 1\\ 201.\ 6\\ 202.\ 0\\ 202.\ 5\\ 202.\ 9\\ 203.\ 4\\ 203.\ 8\\ 204.\ 3\end{array}$	$ \begin{array}{c} 501\\ 02\\ 03\\ 04\\ 05\\ 06\\ 07\\ 08\\ 09\\ 10\\ \end{array} $	$\begin{array}{r} 446.4\\ 447.3\\ 448.2\\ 449.0\\ 449.9\\ 450.8\\ 451.7\\ 452.6\\ 453.5\\ 454.4\end{array}$	$\begin{array}{c} 227.5\\ 227.9\\ 228.4\\ 228.8\\ 229.3\\ 229.8\\ 230.2\\ 230.6\\ 231.0\\ 231.5\\ \end{array}$	$ \begin{array}{r} 561 \\ 62 \\ 63 \\ 64 \\ 65 \\ 66 \\ 67 \\ 68 \\ 69 \\ 70 \\ 70 \end{array} $	$\begin{array}{r} 499.8\\ 500.7\\ 501.6\\ 502.5\\ 503.4\\ 504.3\\ 505.2\\ 506.1\\ 507.0\\ 507.9\end{array}$	$\begin{array}{c} 254.7\\ 255.1\\ 255.6\\ 256.0\\ 256.5\\ 257.0\\ 257.4\\ 257.9\\ 258.3\\ 258.8 \end{array}$
331 32 33 34 35 36 37 38 39 40	$\begin{array}{c} 294.9\\ 295.8\\ 296.7\\ 297.6\\ 298.5\\ 299.4\\ 300.3\\ 301.2\\ 302.1\\ 302.9 \end{array}$	$\begin{array}{c} 150.\ 3\\ 150.\ 7\\ 151.\ 2\\ 151.\ 6\\ 152.\ 1\\ 152.\ 5\\ 153.\ 0\\ 153.\ 5\\ 153.\ 9\\ 154.\ 4 \end{array}$	$ \begin{array}{r} 391 \\ 92 \\ 93 \\ 94 \\ 95 \\ 96 \\ 97 \\ 98 \\ 99 \\ 400 \\ \end{array} $	$\begin{array}{c} 348.4\\ 349.3\\ 350.2\\ 351.1\\ 352.0\\ 352.8\\ 353.7\\ 354.6\\ 355.5\\ 356.4 \end{array}$	$\begin{array}{c} 177.5\\ 178.0\\ 178.4\\ 178.9\\ 179.3\\ 179.8\\ 180.2\\ 180.7\\ 181.2\\ 181.6 \end{array}$	$\begin{array}{r} 451 \\ 52 \\ 53 \\ 54 \\ 55 \\ 56 \\ 57 \\ 58 \\ 59 \\ 60 \end{array}$	$\begin{array}{r} 401.8\\ 402.7\\ 403.6\\ 404.5\\ 405.4\\ 406.3\\ 407.2\\ 408.1\\ 409.0\\ 409.9\end{array}$	$\begin{array}{c} 204.\ 7\\ 205.\ 2\\ 205.\ 7\\ 206.\ 1\\ 206.\ 6\\ 207.\ 0\\ 207.\ 5\\ 207.\ 9\\ 208.\ 4\\ 208.\ 8\end{array}$	$ \begin{array}{r} 511 \\ 12 \\ 13 \\ 14 \\ 15 \\ 16 \\ 17 \\ 18 \\ 19 \\ 20 \\ \end{array} $	$\begin{array}{c}$	$\begin{array}{c} 231.9\\ 232.4\\ 232.9\\ 233.3\\ 233.8\\ 234.2\\ 234.7\\ 235.2\\ 235.7\\ 236.1 \end{array}$	$ \begin{array}{r} 571 \\ 72 \\ 73 \\ 74 \\ 75 \\ 76 \\ 77 \\ 78 \\ 79 \\ 80 \\ \end{array} $	$\begin{array}{c} 508.7\\ 509.6\\ 510.5\\ 511.4\\ 512.3\\ 513.2\\ 514.1\\ 515.0\\ 515.9\\ 516.8 \end{array}$	$\begin{array}{c} 259.\ 2\\ 259.\ 7\\ 260.\ 1\\ 260.\ 6\\ 261.\ 1\\ 261.\ 5\\ 262.\ 0\\ 262.\ 4\\ 262.\ 9\\ 263.\ 4\end{array}$
$ \begin{array}{r} 341 \\ 42 \\ 43 \\ 44 \\ 45 \\ 46 \\ 47 \\ 48 \\ 49 \\ 50 \\ 50 \\ \hline $	303.8 304.7 305.6 306.5 307.4 308.3 309.2 310.1 311.0 311.9	$\begin{array}{c} 154.8\\ 155.3\\ 155.7\\ 156.2\\ 156.6\\ 157.1\\ 157.5\\ 158.0\\ 158.5\\ 158.9 \end{array}$	$ \begin{array}{r} 100 \\ 401 \\ 02 \\ 03 \\ 04 \\ 05 \\ 06 \\ 07 \\ 08 \\ 09 \\ 10 \\ \end{array} $	$\begin{array}{c} 357.\ 3\\ 358.\ 2\\ 359.\ 1\\ 360.\ 0\\ 360.\ 9\\ 361.\ 8\\ 362.\ 6\\ 363.\ 5\\ 364.\ 4\\ 365.\ 3\end{array}$	182.1 182.5 183.0 183.4 183.9 184.3 184.8 185.2 185.7 186.1	$\begin{array}{c} 60\\ \hline 461\\ 62\\ 63\\ 64\\ 65\\ 66\\ 67\\ 68\\ 69\\ 70\\ \end{array}$	$\begin{array}{r} 102.2\\\hline 410.8\\411.6\\412.5\\413.4\\414.3\\415.2\\416.1\\417.0\\417.9\\418.8\end{array}$	$\begin{array}{c} 209.3\\ 209.8\\ 210.2\\ 210.7\\ 211.1\\ 211.6\\ 212.0\\ 212.5\\ 212.9\\ 213.4\\ \end{array}$	$ \begin{array}{r} 22 \\ 521 \\ 22 \\ 23 \\ 24 \\ 25 \\ 26 \\ 27 \\ 28 \\ 29 \\ 30 \\ \end{array} $	$\begin{array}{c} 464.2\\ 465.1\\ 466.0\\ 466.9\\ 467.8\\ 468.7\\ 469.5\\ 470.4\\ 471.3\\ 472.2 \end{array}$	$\begin{array}{c} 236.6\\ 237.0\\ 237.5\\ 237.9\\ 238.4\\ 238.8\\ 239.3\\ 239.7\\ 240.2\\ 240.6\\ \end{array}$	581 82 83 84 85 86 87 88 89 90	517.7 518.5 519.4 520.3 521.2 522.1 523.0 523.9 524.8 525.7	$\begin{array}{c} 263.\ 8\\ 264.\ 3\\ 264.\ 7\\ 265.\ 2\\ 265.\ 6\\ 266.\ 0\\ 266.\ 5\\ 267.\ 0\\ 267.\ 4\\ 267.\ 9\end{array}$
$351 \\ 52 \\ 53 \\ 54 \\ 55 \\ 56 \\ 57 \\ 58 \\ 59 \\ 60$	$\begin{array}{c} 312.\ 7\\ 313.\ 6\\ 314.\ 5\\ 315.\ 4\\ 316.\ 3\\ 317.\ 2\\ 318.\ 1\\ 319.\ 0\\ 319.\ 9\\ 320.\ 8 \end{array}$	$\begin{array}{c} 159.\ 4\\ 159.\ 8\\ 160.\ 3\\ 160.\ 7\\ 161.\ 2\\ 161.\ 6\\ 162.\ 1\\ 162.\ 5\\ 163.\ 0\\ 163.\ 4 \end{array}$	$ \begin{array}{r} 411\\ 12\\ 13\\ 14\\ 15\\ 16\\ 17\\ 18\\ 19\\ 20\\ \end{array} $	$\begin{array}{c} 366.\ 2\\ 367.\ 1\\ 368.\ 0\\ 368.\ 9\\ 369.\ 8\\ 370.\ 7\\ 371.\ 6\\ 372.\ 4\\ 373.\ 3\\ 374.\ 2\\ \end{array}$	186. 6 187. 1 187. 5 188. 0 188. 4 188. 9 189. 3 189. 8 190. 2 190. 7	$\begin{array}{r} 471 \\ 72 \\ 73 \\ 74 \\ 75 \\ 76 \\ 77 \\ 78 \\ 79 \\ 80 \end{array}$	$\begin{array}{c} 419.\ 7\\ 420.\ 6\\ 421.\ 4\\ 422.\ 3\\ 423.\ 2\\ 424.\ 1\\ 425.\ 0\\ 425.\ 9\\ 426.\ 8\\ 427.\ 7\end{array}$	$\begin{array}{c} 213.8\\ 214.3\\ 214.7\\ 215.2\\ 215.7\\ 216.1\\ 216.6\\ 217.0\\ 217.5\\ 217.9 \end{array}$	$531 \\ 32 \\ 33 \\ 34 \\ 35 \\ 36 \\ 37 \\ 38 \\ 39 \\ 40$	$\begin{array}{r} 473.1\\ 474.0\\ 474.9\\ 475.8\\ 476.7\\ 477.6\\ 478.4\\ 479.3\\ 480.2\\ 481.1 \end{array}$	$\begin{array}{c} 241.1\\ 241.5\\ 242.0\\ 242.4\\ 242.9\\ 243.4\\ 243.8\\ 244.3\\ 244.3\\ 244.7\\ 245.2 \end{array}$	$591 \\ 92 \\ 93 \\ 94 \\ 95 \\ 96 \\ 97 \\ 98 \\ 99 \\ 600$	526. 6527. 5528. 4529. 3530. 1531. 0531. 9532. 8533. 7534. 6	$\begin{array}{c} 268.3\\ 268.8\\ 269.2\\ 269.7\\ 270.1\\ 270.6\\ 271.1\\ 271.5\\ 272.0\\ 272.4\\ \end{array}$
Dist.	Dep.	Lat.	Dist.	Dep.	Lat.	Dist.	Dep.	Lat.	Dist.	Dep.	Lat.	Dist.	Dep.	Lat.
					6	33° (11	17°, 243	°, 297°)	1.					

Pa	ge 422]				1	ABL	2 2.				0		
			Differe	ence of l	Latitud	e and	Departu	re for	28° (1	.52°, 208	s°, 332°).		
Dist.	Lat.	Dep.	Dist.	Lat.	Dep.	Dist.	Lat.	Dep.	Dist.	Lat.	Dep.	Dist.	Lat.	Dep.
1	0.9	0.5	61	53.9	28.6	121	106.8	56.8	181	159.8	85.0	241	212.8	113.1
$\frac{2}{3}$	$\frac{1.8}{2.6}$	$0.9 \\ 1.4$	$\frac{62}{63}$	54.7 55.6	29.1 29.6	$\frac{22}{23}$	107.7	57.3	$\frac{82}{83}$	160.7 161.6	85.4	$\frac{42}{43}$	213.7 214.6	113.6 114.1
4	3.5	1.9	64 65	56.5	30.0	24	109.5	58.2	84	162.5	86.4	44	215.4	114.6
6	5.3	2.8	66	58.3	31.0	$\frac{26}{26}$	111.3	59.2	86	164.2	87.3	40	210.3	115.0
7	$\begin{array}{c} 6.2 \\ 7 1 \end{array}$	3.3		59.2 60.0	31.5 31.9	$\frac{27}{28}$	112.1 113 0	59.6 60.1	87 88	165.1 166 0	87.8	47	218.1	116.0 116.4
9	7.9	4.2	69 50	60.9	32.4	29 29	113.9	60.6	89	166.9	88.7	49	219.9	116.9
$\frac{10}{11}$	$\frac{8.8}{9.7}$	$\frac{4.7}{5.2}$	$\frac{70}{71}$	$\frac{-61.8}{-62.7}$	$\frac{32.9}{33.3}$	$\frac{30}{131}$	114.8 115.7	$\frac{61.0}{61.5}$	$\frac{90}{191}$	$\frac{167.8}{168.6}$	89.2 89.7	$\frac{50}{251}$	$\frac{220.7}{221.6}$	$\frac{117.4}{117.8}$
12	10.6	5.6	72	63.6	33.8	32	116.5	62.0	92	169.5	90.1	52	222.5	118.3
$\frac{13}{14}$	11.5 12.4	$\begin{bmatrix} 6.1\\ 6.6 \end{bmatrix}$	73 74	64.5 65.3	$34.3 \\ 34.7$	$\frac{33}{34}$	117.4	62.4 62.9	93 94	170.4 171.3	90.6	$\frac{53}{54}$	223.4 224.3	118.8 119.2
$15 \\ 16$	13.2	7.0	75	66.2	35.2	-35	119.2	63.4	95 96	172.2	91.5	55 50	225.2	119.7
17	14.1 15.0	8.0	$\frac{70}{77}$	68.0	36.1	$\frac{30}{37}$	120.1 121.0	64.3	97 97	$ 173.1 \\ 173.9 $	92.0	50 57	226.0 226.9	120.2 120.7
$\frac{18}{19}$	15.9 16.8	8.5	$\frac{78}{79}$	68.9 69.8	36.6 37.1	- 38 39	121.8 122.7	64.8	98 99	174.8	93.0	58 59	227.8	$ 121.1 \\ 121.6 $
20	17.7	9.4	80	70.6	37.6	40	123.6.	65.7	200	176.6	93.9	60	229.6	121.0 122.1
$\frac{21}{22}$	18.5 19.4	9.9 10.3	81 82	71.5 72.4	38.0	141 49	124.5 125.4	66.2 66.7	$201 \\ 02$	177.5 178.4	94.4	$\frac{261}{62}$	230.4 231.3	122.5 123.0
23	20.3	10.8	83	73.3	39.0	43	126.3	67.1	03	179.2	95.3	63	232.2	123.5
$\frac{24}{25}$	$\begin{array}{c} 21.2\\22.1 \end{array}$	11.3 11.7	$\frac{84}{85}$	$74.2 \\ 75.1$	39.4 39.9	$\frac{44}{45}$	127.1 128.0	67.6 68.1	$ 04 \\ 05 $	180.1	$\begin{bmatrix} 95.8\\ 96.2 \end{bmatrix}$	$64 \\ 65$	233.1 234.0	$ 123.9 \\ 124.4$
26	23.0	12.2	86	75.9	40.4	46	128.9	68.5	06	181.9	96.7	66	234.9	124.9
$\frac{27}{28}$	$23.8 \\ 24.7$	12.7 13.1	87 88	76.8	40.8	41 48	129.8 130.7	69.0 69.5	07	182.8 183.7	$\begin{vmatrix} 97.2\\97.7 \end{vmatrix}$	67 68	235.7	125.3 125.8
29 30	25.6 26.5	13.6 14 1	89 90	78.6	41.8	49 50	131.6 132 1	$\begin{bmatrix} 70.0\\ 70.4 \end{bmatrix}$	09	184.5	98.1	$\frac{69}{70}$	237.5 238.4	126.3 126.8
$\frac{30}{31}$	$\frac{20.0}{27.4}$	$\frac{14.1}{14.6}$	$\frac{30}{91}$	80.3	42.7	$\frac{50}{151}$	132.4 133.3	70.9	$\frac{10}{211}$	186.3	99.1	$\frac{70}{271}$	239.3	$\frac{120.8}{127.2}$
$\frac{32}{33}$	28.3	15.0	92 03	81.2	43.2	52 52	134.2 135.1	71.4	$12 \\ 13$	187.2	99.5	$\frac{72}{72}$	240.2	127.7
34	30.0	16.0	94	83.0	44.1	$53 \\ 54$	136.0	72.3	13	189.0	100.0	74	241.9	128.2 128.6
$\frac{35}{36}$	30.9 31.8	$16.4 \\ 16.9$	95 96	83.9 84.8	44.6	$55 \\ 56$	136.9 137.7	$\begin{array}{c} 72.8 \\ 73.2 \end{array}$	$15 \\ 16$	189.8	100.9 101.4	$75 \\ 76$	242.8 243.7	$ 129.1 \\ 129.6$
37	32.7	17.4	97	85.6	45.5	57	138.6	73.7	17	191.6	101.9	77	244.6	130.0
$\frac{38}{39}$	33.6 34.4	$17.8 \\ 18.3$	$\frac{98}{99}$	86.5	46.0	$\frac{58}{59}$	139.5	74.2	18 19	192.5 193.4	102.3 102.8	78	245.5 246.3	130.5 131.0
40	35.3	18.8	100	88.3	46.9	60	141.3	75.1	20	194.2	103.3	80	247.2	131.5
$\frac{41}{42}$	36.2 37.1	$19.2 \\ 19.7$	$101 \\ 02$	89.2 90.1	47.9	$161 \\ 62$	142.2 143.0	75.6 76.1	$\frac{221}{22}$	195.1 196.0	103.8 104.2	$\frac{281}{82}$	248.1 249.0	$ 131.9 \\ 132.4$
43	38.0	20.2	03	90.9	48.4	63	143.9	76.5	23	196.9	104.7	83	249.9	132.9
45	30.0 39.7	20.7 21.1	05	91.8 92.7	49.3	65	144.8	77.5	$\frac{24}{25}$	197.8 198.7	105.2 105.6	85	250.8 251.6	133.8
$\begin{array}{c c} 46\\ 47\end{array}$	$40.6 \\ 41.5$	21.6 22.1	06	93.6 94.5	49.8	$\frac{66}{67}$	146.6 147.5	77.9 78.4	$\frac{26}{27}$	199.5 200.4	106.1 106.6	$\frac{86}{87}$	252.5 253.4	134.3 134.7
48	42.4	22.5	08	95.4	50.7	68	148.3	78.9	28	201.3	107.0	88	254.3	135.2
$\frac{49}{50}$	$43.3 \\ 44.1$	23.0 23.5	$ \begin{array}{c} 09 \\ 10 \end{array} $	96.2 97.1	$51.2 \\ 51.6$	$\begin{array}{c} 69 \\ 70 \end{array}$	149.2 150.1	79.3 79.8	$\frac{29}{30}$	$\begin{array}{c c} 202.2\\ 203.1 \end{array}$	107.5 108.0	89 90	$\begin{array}{c c} 255.2\\ 256.1 \end{array}$	135.7 136.1
51	45.0	23.9	111	98.0	52.1	171	151.0	80.3	231	204.0	108.4	291	256.9	136.6
$\frac{52}{53}$	45.9 46.8	24.4 24.9	$12 \\ 13$	98.9 99.8	52.6 53.1	$\frac{72}{73}$	151.9 152.7	80.7 81.2	$\frac{32}{33}$	$\begin{array}{c c} 204.8\\ 205.7 \end{array}$	108.9 109.4	92 93	257.8 258.7	137.1 137.6
54	47.7	25.4	14	100.7	53.5	74	153.6	81.7	34	206.6	109.9	94	259.6	138.0
56 56	49.4	25.8 26.3	$10 \\ 16$	101.5 102.4	54.0	75	154. 5	82.6	36 36	207.5	110.3	95 96	260.5 261.4	130.0 139.0
57 58	50.3 51.2	26.8	17	103.3 104.2	54.9	77	156.3 157.2	83.1	37	209.3 210.1	111.3 111.7	97 98	262.2 263 1	139.4
59	52.1	27.7	19	105.1	55.9	79	158.0	84.0	39	211.0	112.2	99	264.0	140.4
60	53.0	28.2	20	106.0	56.3	80	158.9	84.5	40	211.9	112.7	300	264.9	140.8
Dist.	Dep.	Lat.	Dist.	Dep.	Lat.	Dist.	Dep.	Lat.	Dist.	Dep.	Lat.	Dist.	Dep.	Lat.
						62° (1	$18^{\circ}, 242$	29, 298	').					

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						T	ABLE	2.				oja Kara	[Page	423
		1	Differe	ence of	Latitud	le and	Depart	ure for	28° (2	152°, 208	8°, 332°	°).		
Dist.	Lat.	Dep.	Dist.	Lat.	Dep.	Dist.	Lat.	Dep.	Dist.	Lat.	Dep.	Dist.	Lat.	Dep.
$\begin{array}{c} 301 \\ 02 \\ 03 \\ 04 \\ 05 \\ 06 \\ 07 \\ 08 \\ 09 \\ 10 \\ \hline 311 \\ 12 \\ 12 \\ 12 \\ 12 \\ 12 \\ 12 \\ 12 $	$\begin{array}{c} 265.\ 7\\ 266.\ 6\\ 267.\ 5\\ 268.\ 4\\ 269.\ 3\\ 270.\ 2\\ 271.\ 0\\ 271.\ 9\\ 272.\ 8\\ 273.\ 7\\ \hline 274.\ 6\\ 275.\ 5\\ 275.\ 5\\ \end{array}$	$\begin{array}{c} 141.\ 3\\ 141.\ 8\\ 142.\ 3\\ 142.\ 7\\ 143.\ 2\\ 143.\ 7\\ 144.\ 1\\ 144.\ 6\\ 145.\ 1\\ 145.\ 5\\ 146.\ 0\\ 146.\ 5\\ 146.\ 0\\ 146.\ 5\\ 146.\$	$\begin{array}{c} 361 \\ 62 \\ 63 \\ 64 \\ 65 \\ 66 \\ 67 \\ 68 \\ 69 \\ 70 \\ \hline 371 \\ 72 \\ 72 \\ \end{array}$	$\begin{array}{c} 318.\ 7\\ 319.\ 6\\ 320.\ 5\\ 321.\ 4\\ 322.\ 2\\ 323.\ 1\\ 324.\ 0\\ 324.\ 9\\ 325.\ 8\\ 326.\ 7\\ 327.\ 5\\ 328.\ 4\\ 329.\ 4\\ 4\ 4\$	$\begin{array}{c} 169.5\\ 170.0\\ 170.4\\ 170.9\\ 171.4\\ 171.8\\ 172.3\\ 172.8\\ 173.2\\ 173.7\\ 174.2\\ 174.6\\ 175.4\\ \end{array}$	$\begin{array}{r} 421 \\ 222 \\ 23 \\ 24 \\ 25 \\ 26 \\ 27 \\ 28 \\ 29 \\ 30 \\ \hline 431 \\ 32 \\ 32 \\ \end{array}$	$\begin{array}{c} 371.\ 7\\ 372.\ 6\\ 373.\ 5\\ 374.\ 3\\ 375.\ 2\\ 376.\ 1\\ 377.\ 0\\ 377.\ 9\\ 378.\ 8\\ 379.\ 6\\ 380.\ 5\\ 381.\ 4\\ 999.\$	$\begin{array}{c} 197.\ 7\\ 198.\ 1\\ 198.\ 6\\ 199.\ 1\\ 199.\ 5\\ 200.\ 0\\ 200.\ 5\\ 200.\ 9\\ 201.\ 4\\ 201.\ 9\\ 202.\ 3\\ 202.\ 8\\ 202.\ 8\\ 202.\ 8\end{array}$	$ \begin{array}{r} 481 \\ 82 \\ 83 \\ 84 \\ 85 \\ 86 \\ 87 \\ 88 \\ 89 \\ 90 \\ \hline 491 \\ 92 \\ 92 \\ 92 \\ 92 \\ 92 \\ 92 \\ 92 \\ 92$	$\begin{array}{r} 424.7\\ 425.6\\ 426.5\\ 427.4\\ 428.3\\ 429.2\\ 430.1\\ 430.9\\ 431.8\\ 432.6\\ 433.5\\ 433.5\\ 434.2\\ 435.4\\ 43$	$\begin{array}{c} 225.\ 8\\ 226.\ 3\\ 226.\ 8\\ 227.\ 3\\ 227.\ 7\\ 228.\ 2\\ 228.\ 6\\ 229.\ 1\\ 229.\ 6\\ 230.\ 0\\ 230.\ 5\\ 231.\ 0\\ \end{array}$	$541 \\ 42 \\ 43 \\ 44 \\ 45 \\ 46 \\ 47 \\ 48 \\ 49 \\ 50 \\ 551 \\ 52 \\ 52 \\ 52 \\ 52 \\ 52 \\ 52 \\ 5$	$\begin{array}{r} 477.7\\ 478.6\\ 479.4\\ 480.3\\ 481.1\\ 482.0\\ 482.9\\ 483.8\\ 484.7\\ 485.6\\ \hline 486.5\\ 487.4\\ 489.4\\ \end{array}$	$\begin{array}{c} 254.\ 0\\ 254.\ 5\\ 255.\ 0\\ 255.\ 5\\ 255.\ 9\\ 256.\ 4\\ 256.\ 9\\ 257.\ 3\\ 257.\ 8\\ 258.\ 2\\ 258.\ 7\\ 259.\ 1\\ 259.\ 1\\ 259.\ 1\\ 259.\ 1\\ \end{array}$
$ \begin{array}{r} 13 \\ 14 \\ 15 \\ 16 \\ 17 \\ 18 \\ 19 \\ 20 \\ \hline 221 \end{array} $	$\begin{array}{c} 276.3 \\ 277.2 \\ 278.1 \\ 279.0 \\ 279.9 \\ 280.7 \\ 281.6 \\ 282.5 \\ \hline \end{array}$	$146.9 \\ 147.4 \\ 147.9 \\ 148.4 \\ 148.8 \\ 149.3 \\ 149.3 \\ 149.8 \\ 150.2 \\ 150.7 \\ 150.7 \\ 150.7 \\ 150.7 \\ 150.7 \\ 100.00$	$ \begin{array}{r} 73 \\ 74 \\ 75 \\ 76 \\ 77 \\ 78 \\ 79 \\ 80 \\ \hline 80 \\ \hline 391 \end{array} $	$\begin{array}{c} 329.3\\ 330.2\\ 331.1\\ 332.0\\ 332.8\\ 333.7\\ 334.6\\ 335.5\\ \hline 226.4 \end{array}$	$175.1 \\ 175.6 \\ 176.1 \\ 176.5 \\ 177.0 \\ 177.5 \\ 177.9 \\ 178.4 \\ 178.9 \\ 188.9 \\ 188.9 \\ 188.9 \\ 188.9 \\ 188.9 \\ 188.9 \\ 188.9 \\ 188.9 \\ 188.9 \\ 188.9 \\ 188.9 \\ 188.9 \\ 188.9 \\ 188.9 \\ 188.9 \\ 188.9 \\ 188.9 \\ 188.9 \\ 188.9 \\ 188.$	$ \begin{array}{r} 33 \\ 34 \\ 35 \\ 36 \\ 37 \\ 38 \\ 39 \\ 40 \\ 11 \end{array} $	$\begin{array}{r} 382.3\\ 383.2\\ 384.1\\ 384.9\\ 385.8\\ 386.7\\ 387.6\\ 388.5\\ \hline 389.4 \end{array}$	$\begin{array}{c} 203.3\\ 203.8\\ 204.2\\ 204.7\\ 205.2\\ 205.6\\ 206.1\\ 206.6\\ \hline 207.0\\ \end{array}$	9394959697. 9899500501	$\begin{array}{r} 435.3\\ 436.2\\ 437.1\\ 437.9\\ 438.8\\ 439.7\\ 440.6\\ 441.5\\ \hline\end{array}$	$\begin{array}{c} 231.4 \\ 231.9 \\ 232.4 \\ 232.9 \\ 233.4 \\ 233.8 \\ 234.3 \\ 234.7 \\ 235.9 \end{array}$	53 54 55 56 57 58 59 60 561 $ 561 $	$\begin{array}{r} 488.3\\ 489.2\\ 490.1\\ 490.9\\ 491.8\\ 492.7\\ 493.5\\ 494.4\\ \hline 495.3\end{array}$	$\begin{array}{c} 259.\ 6\\ 260.\ 1\\ 260.\ 6\\ 261.\ 0\\ 261.\ 5\\ 262.\ 0\\ 262.\ 5\\ 262.\ 9\\ \hline \end{array}$
22 23 24 25 26 27 28 29 30	$\begin{array}{c} 283.4\\ 284.3\\ 285.2\\ 286.0\\ 286.9\\ 287.8\\ 288.7\\ 289.6\\ 290.5\\ 291.3 \end{array}$	$\begin{array}{c} 150.\ 7\\ 151.\ 2\\ 151.\ 6\\ 152.\ 1\\ 152.\ 6\\ 153.\ 1\\ 153.\ 5\\ 154.\ 0\\ 154.\ 5\\ 154.\ 9\end{array}$	82 83 84 85 86 87 88 89 90	$\begin{array}{c} 330.4\\ 337.3\\ 338.1\\ 339.0\\ 339.9\\ 340.8\\ 341.7\\ 342.6\\ 343.4\\ 344.3\\ \end{array}$	$\begin{array}{c} 178.9\\ 179.3\\ 179.8\\ 180.3\\ 180.8\\ 181.2\\ 181.7\\ 182.2\\ 182.6\\ 183.1 \end{array}$	$\begin{array}{c} 441 \\ 42 \\ 43 \\ 44 \\ 45 \\ 46 \\ 47 \\ 48 \\ 49 \\ 50 \end{array}$	$\begin{array}{c} 383.4\\ 390.2\\ 391.1\\ 392.0\\ 392.9\\ 393.8\\ 394.6\\ 395.5\\ 396.4\\ 397.3\\ \end{array}$	$\begin{array}{c} 207.0\\ 207.5\\ 208.0\\ 208.4\\ 209.9\\ 209.4\\ 209.9\\ 210.3\\ 210.8\\ 211.3\\ \end{array}$	$ \begin{array}{c} 01 \\ 02 \\ 03 \\ 04 \\ 05 \\ 06 \\ 07 \\ 08 \\ 09 \\ 10 \end{array} $	$\begin{array}{c} 442.3\\ 443.2\\ 444.1\\ 445.0\\ 445.9\\ 446.8\\ 447.6\\ 448.5\\ 449.4\\ 450.3\end{array}$	$\begin{array}{c} 235.2\\ 235.6\\ 236.1\\ 236.6\\ 237.1\\ 237.5\\ 238.0\\ 238.5\\ 239.0\\ 239.4 \end{array}$	$ \begin{array}{c} 61 \\ 62 \\ 63 \\ 64 \\ 65 \\ 66 \\ $	$\begin{array}{c} 496.2 \\ 496.2 \\ 497.1 \\ 498.0 \\ 498.9 \\ 499.8 \\ 500.7 \\ 501.6 \\ 502.4 \\ 503.3 \end{array}$	$\begin{array}{c} 263.4\\ 263.8\\ 264.3\\ 264.7\\ 265.2\\ 265.7\\ 266.2\\ 266.6\\ 267.1\\ 267.6\\ \end{array}$
$331 \\ 32 \\ 33 \\ 34 \\ 35 \\ 36 \\ 37 \\ 38 \\ 39 \\ 40$	$\begin{array}{r} 292.\ 2\\ 293.\ 1\\ 294.\ 0\\ 294.\ 9\\ 295.\ 8\\ 296.\ 6\\ 297.\ 5\\ 298.\ 4\\ 299.\ 3\\ 300.\ 2 \end{array}$	$\begin{array}{c} 155.4\\ 155.9\\ 156.3\\ 156.8\\ 157.3\\ 157.7\\ 158.2\\ 158.7\\ 159.2\\ 159.6\end{array}$	$ \begin{array}{r} 391 \\ 92 \\ 93 \\ 94 \\ 95 \\ 96 \\ 97 \\ 98 \\ 99 \\ 400 \end{array} $	$\begin{array}{r} 345.2\\ 346.1\\ 347.0\\ 347.9\\ 348.7\\ 349.6\\ 350.5\\ 351.4\\ 352.3\\ 353.1 \end{array}$	$\begin{array}{c} 183.6\\ 184.0\\ 184.5\\ 185.0\\ 185.4\\ 185.9\\ 186.4\\ 186.9\\ 187.3\\ 187.8 \end{array}$	$\begin{array}{r} 451 \\ 52 \\ 53 \\ 54 \\ 55 \\ 56 \\ 57 \\ 58 \\ 59 \\ 60 \end{array}$	$\begin{array}{r} 398.2\\ 399.1\\ 399.9\\ 400.8\\ 401.7\\ 402.6\\ 403.5\\ 404.4\\ 405.2\\ 406.1 \end{array}$	$\begin{array}{c} 211.7\\ 212.2\\ 212.7\\ 213.1\\ 213.6\\ 214.1\\ 214.6\\ 215.0\\ 215.5\\ 216.0\\ \end{array}$	$511 \\ 12 \\ 13 \\ 14 \\ 15 \\ 16 \\ 17 \\ 18 \\ 19 \\ 20$	$\begin{array}{r} 451.2\\ 452.1\\ 452.9\\ 453.8\\ 454.7\\ 455.6\\ 456.4\\ 457.3\\ 458.2\\ 459.1 \end{array}$	$\begin{array}{c} 239.9\\ 240.4\\ 240.8\\ 241.3\\ 241.8\\ 242.2\\ 242.7\\ 243.2\\ 243.7\\ 243.7\\ 244.1\end{array}$	$571 \\ 72 \\ 73 \\ 74 \\ 75 \\ 76 \\ 77 \\ 78 \\ 79 \\ 80$	$\begin{array}{c} 504.\ 2\\ 505.\ 1\\ 505.\ 9\\ 506.\ 8\\ 507.\ 7\\ 508.\ 6\\ 509.\ 4\\ 510.\ 3\\ 511.\ 2\\ 512.\ 1\end{array}$	$\begin{array}{c} 268.\ 0\\ 268.\ 5\\ 269.\ 0\\ 269.\ 4\\ 269.\ 9\\ 270.\ 4\\ 270.\ 9\\ 271.\ 3\\ 271.\ 8\\ 272.\ 3\end{array}$
$ \begin{array}{r} 341 \\ 42 \\ 43 \\ 44 \\ 45 \\ 46 \\ 47 \\ 48 \\ 49 \\ 50 \\ 50 \end{array} $	$\begin{array}{c} 301.\ 0\\ 301.\ 9\\ 302.\ 8\\ 303.\ 7\\ 304.\ 6\\ 305.\ 5\\ 306.\ 4\\ 307.\ 2\\ 308.\ 1\\ 309.\ 0\\ \end{array}$	$\begin{array}{c} 160. \ 1\\ 160. \ 6\\ 161. \ 0\\ 161. \ 5\\ 162. \ 0\\ 162. \ 4\\ 162. \ 9\\ 163. \ 4\\ 163. \ 8\\ 164. \ 3\\ \end{array}$	$\begin{array}{r} 401 \\ 02 \\ 03 \\ 04 \\ 05 \\ 06 \\ 07 \\ 08 \\ 09 \\ 10 \end{array}$	$\begin{array}{c} 354.\ 0\\ 354.\ 9\\ 355.\ 8\\ 356.\ 7\\ 357.\ 6\\ 358.\ 4\\ 359.\ 3\\ 360.\ 2\\ 361.\ 1\\ 362.\ 0\end{array}$	$\begin{array}{c} 188.3\\ 188.7\\ 189.2\\ 189.7\\ 190.1\\ 190.6\\ 191.1\\ 191.5\\ 192.0\\ 192.5\\ \end{array}$	$\begin{array}{r} 461 \\ 62 \\ 63 \\ 64 \\ 65 \\ 66 \\ 67 \\ 68 \\ 69 \\ 70 \end{array}$	$\begin{array}{r} 407.\ 0\\ 407.\ 9\\ 408.\ 8\\ 409.\ 7\\ 410.\ 5\\ 411.\ 4\\ 412.\ 3\\ 413.\ 2\\ 414.\ 1\\ 415.\ 0\end{array}$	$\begin{array}{c} 216.4\\ 216.9\\ 217.4\\ 217.8\\ 218.3\\ 218.8\\ 219.2\\ 219.7\\ 220.2\\ 220.7 \end{array}$	$521 \\ 22 \\ 23 \\ 24 \\ 25 \\ 26 \\ 27 \\ 28 \\ 29 \\ 30$	$\begin{array}{c} 460.\ 0\\ 460.\ 9\\ 461.\ 8\\ 462.\ 7\\ 463.\ 5\\ 464.\ 4\\ 465.\ 3\\ 466.\ 2\\ 467.\ 1\\ 468.\ 0\end{array}$	$\begin{array}{c} 244.\ 6\\ 245.\ 0\\ 245.\ 5\\ 246.\ 0\\ 246.\ 5\\ 246.\ 9\\ 247.\ 4\\ 247.\ 9\\ 248.\ 3\\ 248.\ 8\end{array}$	581 82 83 84 85 86 87 88 89 90	$\begin{array}{c} 513.\ 0\\ 513.\ 9\\ 514.\ 8\\ 515.\ 7\\ 516.\ 5\\ 517.\ 4\\ 518.\ 3\\ 519.\ 2\\ 520.\ 1\\ 521.\ 0\end{array}$	$\begin{array}{c} 272.\ 7\\ 273.\ 2\\ 273.\ 7\\ 274.\ 2\\ 274.\ 7\\ 275.\ 1\\ 275.\ 5\\ 276.\ 0\\ 276.\ 5\\ 277.\ 0 \end{array}$
$351 \\ 52 \\ 53 \\ 54 \\ 55 \\ 56 \\ 57 \\ 58 \\ 59 \\ 60$	$\begin{array}{c} 309.9\\ 310.8\\ 311.7\\ 312.5\\ 313.4\\ 314.3\\ 315.2\\ 316.1\\ 316.9\\ 317.8 \end{array}$	$\begin{array}{c} 164.8\\ 165.3\\ 165.7\\ 166.2\\ 166.7\\ 167.1\\ 167.6\\ 168.1\\ 168.5\\ 169.0\\ \end{array}$	$\begin{array}{c} 411\\ 12\\ 13\\ 14\\ 15\\ 16\\ 17\\ 18\\ 19\\ 20\\ \end{array}$	$\begin{array}{c} 362.9\\ 363.7\\ 364.6\\ 365.5\\ 366.4\\ 367.3\\ 368.2\\ 369.0\\ 369.9\\ 370.8 \end{array}$	$193.0 \\ 193.4 \\ 193.9 \\ 194.4 \\ 194.8 \\ 195.3 \\ 195.8 \\ 196.2 \\ 196.7 \\ 197.2 \\$	$\begin{array}{r} 471 \\ 72 \\ 73 \\ .74 \\ 75 \\ 76 \\ 77 \\ 78 \\ 79 \\ 80 \end{array}$	$\begin{array}{c} 415.8\\ 416.7\\ 417.6\\ 418.5\\ 419.4\\ 420.3\\ 421.1\\ 422.0\\ 422.9\\ 423.8 \end{array}$	$\begin{array}{c} 221.1\\ 221.6\\ 222.1\\ 222.5\\ 223.0\\ 223.5\\ 223.9\\ 224.4\\ 224.9\\ 225.3\\ \end{array}$	$531 \\ 32 \\ 33 \\ 34 \\ 35 \\ 36 \\ 37 \\ 38 \\ 39 \\ 40$	$\begin{array}{r} 468.9\\ 469.8\\ 470.7\\ 471.5\\ 472.4\\ 473.3\\ 474.2\\ 475.1\\ 476.0\\ 476.8 \end{array}$	$\begin{array}{c} 249.\ 3\\ 249.\ 8\\ 250.\ 2\\ 250.\ 7\\ 251.\ 1\\ 251.\ 6\\ 252.\ 1\\ 252.\ 6\\ 253.\ 1\\ 253.\ 6\end{array}$	$591 \\ 92 \\ 93 \\ 94 \\ 95 \\ 96 \\ 97 \\ 98 \\ 99 \\ 600$	$521.8 \\ 522.6 \\ 523.5 \\ 524.4 \\ 525.3 \\ 526.2 \\ 527.1 \\ 528.0 \\ 528.9 \\ 529.8 $	$\begin{array}{c} 277.4\\ 277.9\\ 278.4\\ 278.8\\ 279.3\\ 279.8\\ 280.3\\ 280.8\\ 281.3\\ 281.7 \end{array}$
Dist.	Dep.	Lat.	Dist.	Dep.	Lat.	Dist.	Dep.	Lat.	Dist.	Dep.	Lat.	Dist.	Dep.	Lat.
						62° (1	18°, 242	°, 298°).					

Pag	e 4941					т	ABLE	2						
rag	Tot		Differ	ence of 1	Latitud	le and	Departu	are for	29° (151°, 20	9°, 331	°).		
Dist.	Lat.	Dep.	Dist.	Lat.	Dep.	Dist.	Lat.	Dep.	Dist.	Lat.	Dep,	Dist.	Lat.	Dep.
$\begin{array}{c c} 1\\ 1\\ 2\\ 3\\ 4\\ 5\\ 6\\ 7\\ 8\\ 9\\ 10\\ 11\\ 12\\ 13\\ 14\\ 15\\ 16\\ 17\\ 18\\ 19\\ 20\\ 21\\ 22\\ 23\\ 24\\ 25\\ \end{array}$	$\begin{array}{c} 0.9\\ 1.7\\ 2.6\\ 3.5\\ 2.6\\ 3.4\\ 4.4\\ 5.2\\ 6.1\\ 7.9\\ 8.7\\ 9.6\\ 10.5\\ 11.4\\ 12.2\\ 13.1\\ 14.0\\ 14.9\\ 15.7\\ 16.6\\ 17.5\\ 18.4\\ 19.2\\ 20.1\\ 18.4\\ 19.2\\ 20.1\\ 21.9\\ \end{array}$	$\begin{array}{c} 0.5\\ 1.0\\ 1.5\\ 1.9\\ 2.4\\ 2.9\\ 3.4\\ 3.9\\ 4.8\\ 5.3\\ 5.8\\ 6.8\\ 7.3\\ 7.8\\ 8.2\\ 9.7\\ 10.2\\ 10.7\\ 11.2\\ 1.2\\ 11.6\\ 12.1\\ \end{array}$	$\begin{array}{c c} 61 \\ 62 \\ 63 \\ 64 \\ 65 \\ 66 \\ 67 \\ 68 \\ 69 \\ 70 \\ \hline 71 \\ 72 \\ 73 \\ 74 \\ 75 \\ 76 \\ 77 \\ 78 \\ 80 \\ \hline 81 \\ 82 \\ 83 \\ 84 \\ 85 \\ \end{array}$	$\begin{array}{c} 53.4\\ 54.2\\ 55.1\\ 56.0\\ 56.9\\ 57.7\\ 58.6\\ 59.5\\ 60.3\\ 61.2\\ 62.1\\ 63.0\\ 63.8\\ 64.7\\ 65.6\\ 66.5\\ 67.3\\ 68.2\\ 1\\ 70.0\\ 70.8\\ 71.7\\ 72.6\\ 69.1\\ 73.5\\ 74.3\\ \end{array}$	$\begin{array}{c} 29.\ 6\\ 30.\ 1\\ 30.\ 5\\ 31.\ 0\\ 32.\ 5\\ 33.\ 0\\ 33.\ 5\\ 33.\ 9\\ 34.\ 4\\ 35.\ 9\\ 36.\ 4\\ 35.\ 9\\ 36.\ 4\\ 36.\ 8\\ 37.\ 3\\ 38.\ 8\\ 39.\ 3\\ 39.\ 8\\ 40.\ 7\\ 41.\ 2\\ \end{array}$	$\begin{array}{c} 121\\ 121\\ 22\\ 23\\ 24\\ 25\\ 26\\ 27\\ 28\\ 29\\ 30\\ \hline 131\\ 32\\ 33\\ 34\\ 35\\ 36\\ 37\\ 38\\ 39\\ 40\\ \hline 141\\ 42\\ 43\\ 44\\ 45\\ \hline \end{array}$	$\begin{array}{c} 105.8\\ 106.7\\ 107.6\\ 108.5\\ 109.3\\ 110.2\\ 111.1\\ 112.0\\ 112.8\\ 113.7\\ 114.6\\ 115.4\\ 116.3\\ 117.2\\ 118.1\\ 118.9\\ 119.8\\ 120.7\\ 121.6\\ 122.4\\ 123.3\\ 124.2\\ 125.1\\ 125.9\\ 126.8\\ \end{array}$	$\begin{array}{c} 5ep.\\ \hline 58.7\\ 59.1\\ 59.6\\ 60.1\\ 60.6\\ 11\\ 61.6\\ 62.1\\ 63.5\\ 64.0\\ 63.5\\ 64.0\\ 64.5\\ 65.9\\ 65.4\\ 65.8\\$	$\begin{array}{c c} 181 \\ 82 \\ 83 \\ 84 \\ 85 \\ 86 \\ 87 \\ 88 \\ 89 \\ 90 \\ \hline 191 \\ 92 \\ 934 \\ 95 \\ 96 \\ 97 \\ 98 \\ 99 \\ 200 \\ \hline 201 \\ 02 \\ 03 \\ 04 \\ 05 \\ \end{array}$	Lat. 158.3 159.2 160.1 160.9 161.8 162.7 163.6 164.4 165.3 166.2 167.1 167.9 168.8 169.7 170.6 171.4 172.3 173.6 171.4 172.3 173.6 174.0 174.9 175.8 176.7 175.8 176.7 177.8 178.4 179.3	$\begin{array}{c} 87.8\\ 88.2\\ 88.7\\ 89.2\\ 90.2\\ 90.7\\ 91.1\\ 91.6\\ 92.1\\ 92.6\\ 93.1\\ 92.6\\ 93.1\\ 92.6\\ 93.1\\ 92.6\\ 93.1\\ 92.6\\ 93.1\\ 92.6\\ 93.1\\ 92.6\\ 93.4\\ 94.5\\ 95.0\\ 95.5\\ 97.0\\ 97.4\\ 97.9\\ 98.4\\ 98.9\\ 99.4\\ \end{array}$	$\begin{array}{c} 241\\ 42\\ 43\\ 44\\ 45\\ 46\\ 47\\ 48\\ 49\\ 50\\ 251\\ 52\\ 53\\ 56\\ 57\\ 58\\ 60\\ 261\\ 62\\ 63\\ 64\\ 65\\ \end{array}$	$\begin{array}{c} 210.8\\ 211.7\\ 212.5\\ 213.4\\ 214.3\\ 215.2\\ 216.0\\ 216.9\\ 217.8\\ 218.7\\ 219.5\\ 220.4\\ 221.3\\ 222.2\\ 223.0\\ 223.9\\ 224.8\\ 225.7\\ 222.4\\ 8\\ 225.7\\ 224.8\\ 225.7\\ 226.5\\ 227.4\\ 228.3\\ 229.2\\ 230.0\\ 230.9\\ 331.8\\ \end{array}$	$\begin{array}{c} 1669.\\ 116.8\\ 117.3\\ 117.8\\ 118.3\\ 119.3\\ 119.7\\ 120.2\\ 120.2\\ 120.2\\ 121.2\\ 122.7\\ 122.2\\ 122.7\\ 122.2\\ 122.7\\ 123.6\\ 124.1\\ 123.6\\ 125.1\\ 125.6\\ 126.1\\ 126.5\\ 127.0\\ 127.5\\ 128.0\\ 0\\ 128.5\\ \end{array}$
$\begin{array}{c} 26\\ 27\\ 28\\ 29\\ 30\\ 31\\ 32\\ 33\\ 34\\ 35\\ 36\\ 37\\ 38\\ 39\\ 40\\ \end{array}$	$\begin{array}{c} 22.7\\ 23.6\\ 24.5\\ 25.4\\ 26.2\\ \hline \\ 27.1\\ 28.0\\ 28.9\\ 29.7\\ 30.6\\ 31.5\\ 32.4\\ 33.2\\ 33.1\\ \\ 35.0\\ \end{array}$	$\begin{array}{c} 12.6\\ 13.1\\ 13.6\\ 14.1\\ 14.5\\ 15.0\\ 15.5\\ 16.0\\ 16.5\\ 17.0\\ 17.5\\ 17.9\\ 18.4\\ 18.9\\ 19.4\end{array}$	$\begin{array}{c} 86\\ 87\\ 88\\ 89\\ 90\\ \hline 91\\ 92\\ 93\\ 94\\ 95\\ 96\\ 97\\ 98\\ 99\\ 100\\ \end{array}$	$\begin{array}{c} 75.2\\ 76.1\\ 77.0\\ 77.8\\ 78.7\\ 79.6\\ 80.5\\ 81.3\\ 82.2\\ 83.1\\ 84.0\\ 84.8\\ 85.7\\ 86.6\\ 87.5\\ \end{array}$	$\begin{array}{c} 41.7\\ 42.2\\ 42.7\\ 43.1\\ 43.6\\ 44.1\\ 44.6\\ 45.1\\ 45.6\\ 46.1\\ 45.6\\ 46.1\\ 46.5\\ 47.0\\ 47.5\\ 48.5\\ \end{array}$	$\begin{array}{r} 46\\ 47\\ 48\\ 49\\ 50\\ \hline 151\\ 52\\ 53\\ 54\\ 55\\ 56\\ 57\\ 58\\ 59\\ 60\\ \end{array}$	$\begin{array}{c} 127.7\\ 128.6\\ 129.4\\ 130.3\\ 131.2\\ \hline 132.1\\ 132.9\\ 133.8\\ 134.7\\ 135.6\\ 136.4\\ 137.3\\ 138.2\\ 139.1\\ 139.9\\ \end{array}$	$\begin{array}{c} 70.8\\ 71.3\\ 71.8\\ 72.2\\ 72.7\\ 73.2\\ 73.7\\ 74.2\\ 74.7\\ 75.1\\ 75.6\\ 76.1\\ 76.6\\ 77.1\\ 77.6\end{array}$	$\begin{array}{c} 06\\ 07\\ 08\\ 09\\ 10\\ \hline 211\\ 12\\ 13\\ 14\\ 15\\ 16\\ 17\\ 18\\ 19\\ 20\\ \end{array}$	$\begin{array}{c} 180.2\\ 181.0\\ 181.9\\ 182.8\\ 183.7\\ 184.5\\ 185.4\\ 186.3\\ 187.2\\ 188.0\\ 188.9\\ 189.8\\ 190.7\\ 191.5\\ 192.4 \end{array}$	99, 9 100, 4 100, 8 101, 3 101, 8 102, 3 102, 8 103, 3 103, 7 104, 2 104, 7 105, 2 105, 7 106, 2 106, 7	$\begin{array}{c} 66\\ 67\\ 68\\ 69\\ 70\\ \hline 271\\ 72\\ 73\\ 74\\ 75\\ 76\\ 77\\ 78\\ 79\\ 80\\ \end{array}$	$\begin{array}{c} 232.\ 6\\ 233.\ 5\\ 234.\ 4\\ 235.\ 3\\ 236.\ 1\\ 237.\ 0\\ 237.\ 9\\ 238.\ 6\\ 240.\ 5\\ 241.\ 4\\ 242.\ 3\\ 243.\ 1\\ 244.\ 9\\ 244.\ 9\end{array}$	$\begin{array}{c} 129.0\\ 129.4\\ 129.9\\ 130.4\\ 130.9\\ 131.4\\ 131.9\\ 132.4\\ 132.8\\ 133.3\\ 133.8\\ 134.3\\ 134.8\\ 135.3\\ 135.7\end{array}$
$\begin{array}{r} 40\\ 41\\ 42\\ 43\\ 44\\ 45\\ 46\\ 47\\ 48\\ 49\\ 50\\ 51\\ 52\\ 53\\ 54\\ 55\\ \end{array}$	$\begin{array}{c} 35.0\\ \hline 35.9\\ 36.7\\ 37.6\\ 38.5\\ 39:4\\ 40.2\\ 41.1\\ 42.0\\ 42.9\\ 43.7\\ \hline 44.6\\ 45.5\\ 46.4\\ 47.2\\ 48.1 \end{array}$	$\begin{array}{c} 19.4\\ \hline 19.9\\ 20.4\\ 20.8\\ 21.3\\ 21.8\\ 22.3\\ 22.8\\ 23.3\\ 23.8\\ 24.2\\ 24.7\\ 25.7\\ 25.7\\ 26.2\\ 26.7\\ \end{array}$	$\begin{array}{c} 100\\ \hline 101\\ 02\\ 03\\ 04\\ 05\\ 06\\ 07\\ 08\\ 09\\ 10\\ \hline 111\\ 12\\ 13\\ 14\\ 15\\ \end{array}$	87.5 88.3 89.2 90.1 91.0 91.8 92.7 93.6 94.5 95.3 96.2 97.1 98.0 98.7 90.6 99.7 100.6	$\begin{array}{r} 40.5\\ \hline 49.0\\ 49.5\\ 49.9\\ 50.4\\ 50.9\\ 51.4\\ 51.9\\ 52.4\\ 52.8\\ 53.3\\ 54.8\\ 54.8\\ 55.3\\ 55.8\end{array}$	$\begin{array}{c} 60\\ 161\\ 62\\ 63\\ 64\\ 65\\ 66\\ 67\\ 68\\ 69\\ 70\\ \hline 171\\ 72\\ 73\\ 74\\ 75\\ \end{array}$	$\begin{array}{c} 137,9\\ 140,8\\ 141,7\\ 142,6\\ 143,4\\ 144,3\\ 145,2\\ 146,1\\ 146,9\\ 147,8\\ 148,7\\ 149,6\\ 150,4\\ 151,3\\ 152,2\\ 153,1\\ \end{array}$	$\begin{array}{c} 71.0\\ \hline 78.1\\ 78.5\\ 79.0\\ 79.5\\ 80.0\\ 80.5\\ 81.0\\ 81.4\\ 81.9\\ 82.4\\ \hline 82.9\\ 83.9\\ 83.9\\ 83.4\\ 84.8\\ \end{array}$	$\begin{array}{c} 20\\ \hline 221\\ 22\\ 23\\ 24\\ 25\\ 26\\ 27\\ 28\\ 29\\ 30\\ \hline 231\\ 32\\ 33\\ 34\\ 35\\ \end{array}$	$\begin{array}{c} 192.4\\ 193.3\\ 194.2\\ 195.0\\ 195.9\\ 196.8\\ 197.7\\ 198.6\\ 200.3\\ 201.2\\ 202.0\\ 202.9\\ 203.9\\ 204.7\\ 205.5\end{array}$	$\begin{array}{c} 100.\ l\\ 107.\ l\\ 107.\ l\\ 107.\ l\\ 108.\ l\\ 108.\ l\\ 109.\ l\\ 110.\ l\\ 110.\ s\\ 111.\ c\\ 111.\ c\\ 111.\ c\\ 112.\ c\\ 112.\ c\\ 113.\ q\\ 113.\ q\end{array}$	$\begin{array}{c} 30\\ \hline 281\\ 82\\ 83\\ 84\\ 85\\ 86\\ 87\\ 88\\ 89\\ 90\\ \hline 291\\ 92\\ 93\\ 94\\ 95\\ \end{array}$	$\begin{array}{c} 241.9\\ 245.8\\ 246.6\\ 247.5\\ 248.4\\ 249.3\\ 250.1\\ 251.0\\ 251.9\\ 252.8\\ 253.6\\ 254.5\\ 255.4\\ 256.3\\ 257.1\\ 258.0\\ \end{array}$	$\begin{array}{c} 135.7\\ 136.2\\ 136.7\\ 137.2\\ 137.7\\ 138.2\\ 138.7\\ 139.1\\ 149.6\\ 140.1\\ 140.6\\ 141.1\\ 141.6\\ 142.0\\ 142.5\\ 143.0\\ \end{array}$
56 57 58 59 60 Dist.	49. 0 49. 9 50. 7 51. 6 52. 5 Dep.	27.1 27.6 28.1 28.6 29.1 Lat.	16 17 18 19 20 Dist.	101.5 102.3 103.2 104.1 105.0	56.2 56.7 57.2 57.7 58.2 Lat.	76 77 78 79 80 Dist. 61° (1	153. 9 154. 8 155. 7 156. 6 157. 4 Dep.	85.3 85.8 86.3 86.8 87.3 Lat.	36 37 38 39 40 Dist.	206. 4 207. 3 208. 2 209. 0 209. 9 Dep.	114. 4 114. 9 115. 4 115. 9 116. 4 Lat.	96 97 98 99 300 Dist.	258, 9 259, 8 260, 6 261, 5 262, 4 Dep.	143.5 144.0 144.5 145.0 145.4 Lat.

						Г	ABLE	£ 2.					[Page	e 425
			Differ	ence of [Latitud	e and	Departi	ure for	29° (J	151°, 209	€°, 331°,	').		
Dist.	Lat.	Dep.	Dist.	Lat.	Dep.	Dist.	Lat.	Dep.	Dist.	Lat.	Dep.	Dist.	Lat.	Dep.
301	263.2 264.1	145.9 146.4	$\frac{361}{62}$	315.7 316.6	175.0 175.5	421 99	368.2 369.1	204.1 204.6	481	420.7 421.5	233.2 233.7	$541 \\ -49$	473.2	262.3
03	265.0	146.9	63	317.5	176.0	23	369.9	205.1	83	422.4	234.2	43	474.9	263.2
$04 \\ 05$	265.9 266.7	147.4 147.9	$64 \\ 65$	318.3 319.2	176.5 177.0	$\frac{24}{25}$	370.8 371.7	205.6	84 85	423.3 424.2	234.0 235.1	44 45	475.8	$\begin{array}{ c c c c c c c c c c c c c c c c c c c$
06	267.6	148.4	66 67	320.1	177.4	$\frac{26}{27}$	372.6 373.4	206.5 207.0	86 87	425.0	235.6 226.1	46	477.5	264.7
08	269.0 269.4	149.3	68	321.0 321.8	178.4	28	$373. \frac{1}{3}$	207.5	88	426.8	236.1 236.6	48	479.3	$\begin{vmatrix} 205, 2\\ 265, 7 \end{vmatrix}$
$ \begin{array}{c} 09 \\ 10 \end{array} $	270.2 271.1	$149.8 \\ 150.3$	69 70	322.7 323.6	$178.9 \\ 179.4$	$ \frac{29}{30} $	$375.2 \\ 376.1$	208.0 208.5	89 90	427.7 428.5	$237.1 \\ 237.6$	$ \frac{49}{50} $	480.1 481.0	$\begin{array}{ c c c c c c c c c c c c c c c c c c c$
311	272.0	150.8	371	324.5	179.9	431	376.9	209.0	491	429.4	$\frac{238.0}{238.0}$	551	481.9	267.1
$\frac{12}{13}$	272.9 273.7	151.3 151.7	$72 \\ 73$	325.3 326.2	180.4 180.8	$\frac{32}{33}$	377.8 378.7	209.4 209.9	$92 \\ 93$	430.3 431.2	238.5 239.0	$52 \\ 53$	482.8	267.6 268.1
14	274.6	152.2	74	327.1	181.3	34	379.6	210.4	94	432.0	239.5	54	484.5	268.6
$15 \\ 16$	275.5 276.3	152.7 153.2	$75 \\ 76$	328.0 328.8	$181.8 \\ 182.3$	$\frac{35}{36}$	$\frac{380.4}{381.3}$	$\begin{array}{c} 210.9\\211.4\end{array}$	95 96	432.9 433.8	240.0 240.5	$\frac{55}{56}$	$ 485.4 \\ 486.3 $	$\begin{array}{ c c c c c c c c c c c c c c c c c c c$
17	277.2	153.7	77	329.7	182.8	37	382.2	211.9	97	434.7	240.9	57	487.1	270.0
$\frac{18}{19}$	278.1 279.0	$104.2 \\ 154.7$	$\frac{18}{79}$	230.6	183.5 183.7	$\frac{38}{39}$	383.1 383.9	212.3 212.8	$\frac{98}{99}$	435.5	241.4 241.9	$\frac{58}{59}$	488.0	270.5
20	279.8	155.1	80	332.3	184.2	40	384.8	213.3	500	437.3	242.4	60	489.8	271.5
$\frac{321}{22}$	$ \begin{array}{c} 280.7 \\ 281.6 \end{array} $	$155.6 \\ 156.1$	$\frac{381}{82}$	333.2 334.1	184.7 185.2	441 42	385.7 386.6	213.8 214.3	$ \begin{array}{c} 501 \\ 02 \end{array} $	438.2 439.0	242.9 243.4	$\frac{561}{62}$	490.6 491.5	$\begin{array}{ }272.0\\272.5\end{array}$
23	282.5	156.6	83	334.9	185.7	43	387.4	214.8	03	439.9	243.9	63	492.4	272.9
$\frac{24}{25}$	$283.3 \\ 284.2$	$157.1 \\ 157.6$	$\frac{84}{85}$	335.8 336.7	$186.2 \\ 186.7$	44 45	$388.3 \\ 389.2$	215.3 215.7	$ \begin{array}{c} 04 \\ 05 \end{array} $	440.8 441.6	244.3 244.8	$\frac{64}{65}$	$\begin{array}{c} 493.2 \\ 494.1 \end{array}$	273.4 273.9
26	285.1	158.1	86	337.6	187.1	46	390.0	216.2	06	442.5	245.3	66	495.0	274.4
$\frac{27}{28}$	286.0 286.8	158.9 159.0	87 88	338.4 339.3	187.0 188.1	$\frac{47}{48}$	390.9 391.8	216.7 217.2	07	443.4 444.3	245.8 246.3	$\frac{67}{68}$	495.9	274.9 275.4
29 20	287.7	159.5	89 90	340.2	188.6	49	392.7	217.7	09	445.2	246.8	69 70	497.7	275.9
$\frac{30}{31}$	288.0 289.5	$\frac{100.0}{160.5}$	$\frac{90}{391}$	341.4 341.9	$\frac{189.1}{189.6}$	$\frac{50}{451}$	$\frac{393.5}{394.4}$	$\frac{218.2}{218.7}$	$\frac{10}{511}$	$\frac{440.1}{447.0}$	$\frac{247.5}{247.8}$	$\frac{70}{571}$	498.0	276.8
32	290.3	161.0	92	342.8	190.0	52	395.3	219.1	12	447.8	248.2	72	500.3	277.3
$\frac{33}{34}$	$291.2 \\ 292.1$	$161.4 \\ 161.9$	$\frac{93}{94}$	343.7	190.5 191.0	$\frac{53}{54}$	$396.2 \\ 397.0$	219.6 220.1	$13 \\ 14$	448.0 449.5	248.7 249.2	73 74	501.1 502.0	277.8 278.3
35	293.0	162.4	95	345.4	191.5	55	397.9	220.6	15	450.4	249.7	$75 \\ 76$	502.9	278.8
$\frac{30}{37}$	293.8 294.7	102.9 163.4	90 97	347.2	192.0 192.5	$\frac{50}{57}$	398.8 399.7	221.1 221.6	10	451.5 452.2	250.2 250.6	$\frac{10}{77}$	504.6	279.2
38 30	295.6	163.9	98	348.1	193.0	$58 \\ 59$	400.5	222.0	18	453.1	251.1 951.6	$\frac{78}{70}$	505.5	280.2
40	290.0 297.3	104.4 164.8	400	349.8	195.4 193.9	$\frac{59}{60}$	401.4	222.0 223.0	$\frac{19}{20}$	454.8	251.0 252.1	80	500.4 507.2	280.7 281.2
341	298.2	165.3	401	350.7	194.4	461	403.2	223.5	521	455.6	252.6	581	508.1	281.7
$\frac{42}{43}$	299.1 300.0	165.8 166.3	$\begin{bmatrix} 02\\ 03 \end{bmatrix}$	351.0 352.4	194.9 195.4	$\frac{62}{63}$	404.0	224.0 224.5	$\frac{22}{23}$	400.0 457.4	$\begin{array}{c} 253.1\\ 253.6\end{array}$	$\frac{82}{83}$	509.0 509.9	282.2 282.7
44	300.8	166.8	04	353.3	195.9	64	405.8	225.0	24	458.3	254.0	84	510.7	283.2
45 46	301.7 302.6	$167.3 \\ 167.7$	$\begin{array}{c} 00\\ 06\end{array}$	354.2 355.1	196.3	60 66	406.7	$220.4 \\ 225.9$	$\frac{25}{26}$	459.1 460.0	204.0 255.0	85 86	$511.6 \\ 512.5$	$\frac{283.6}{284.1}$
47	303.5	168.2	07	355.9	197.3	67	408.4	226.4	27	460.9	255.5	87	513.4	284.6
49	304.5 305.2	169.2	09	357.7	197.8	$69 \\ 69$	409.3	220.5 227.4	$\frac{28}{29}$	462.6	256.0 256.5	89 89	514.5 515.1	285.0 285.5
$\frac{50}{251}$	$\frac{306.1}{207.0}$	$\frac{169.7}{170.9}$	10	358.6	198.8	70	411.0	227.9	30	463.5	256.9	90	516.0	286.0
$\frac{351}{52}$	307.0 307.8	170.2 170.7	$\frac{411}{12}$	359.4 360.3	199.3 199.7	$\frac{471}{72}$	411.9	228.3 228.8	$\frac{531}{32}$	$464.4 \\ 465.3$	257.4 257.9	$\frac{591}{92}$	516.9 517.7	286.5 287.0
53 54	308.7	171.1 171.6	13	361.2	200.2	73	413.7	229.3	33	466.1	258.4	93	518.6	287.5
04 55	309.0 310.5	171.0 172.1	$14 \\ 15$	362.1 362.9	200.7 201.2	$\frac{74}{75}$	414.0	229.8 230.3	$\frac{34}{35}$	467.0 467.9	$258.9 \\ 259.4$	$\frac{94}{95}$	519.5 520.4	288.0 288.5
$\frac{56}{57}$	311.3	172.6	$\frac{16}{17}$	363.8	201.7	$\frac{76}{77}$	416.3	230.8	$\frac{36}{27}$	468.8	259.9	96 97	521.2	288.9
58	312.2 313.1	173.1 173.6	18	365.6	202.2 202.7	78	417.2 418.0	$\frac{231.3}{231.7}$	$\frac{37}{38}$	409.0	260.3 260.8	97 98	522.1 523.0	289.4 289.9
59 60	314.0	174.0 171.5	19 20	$\frac{366.4}{207.2}$	203.1	79	418.9	232.2	- <u>39</u>	471.4	261.3	99	523.9	290.4
00	914.0	1/4.0	20	307.9	203.0	80	419.0	232. 1	40	4/2.3	201. 8	600	524, 8	290, 9
Dist.	Dep.	Lat.	Dist.	Dep.	Lat.	Dist.	Dep.	Lat.	Dist.	Dep.	Lat.	Dist.	Dep.	Lat.
					6	1° (1	19°, 241	°, 299°)).					

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Page	4261

TABLE 2.

Difference of Latitude and Departure for 30° (150°, 210°, 320°).

							-			· · · · · · · · · · · · · · · · · · ·	,			
Dist.	Lat.	Dep.	Dist.	Lat.	Dep.	Dist.	Lat.	Dep.	Dist.	Lat.	Dep.	Dist.	Lat.	Dep.
11	0.9	0.5	61	52.8	30.5	121	104.8	60.5	181	156-8	90.5	911	208 7	120 5
$\frac{1}{2}$	1.7	1.0	62	53.7	31.0	22	105.7	61.0	82	157.6	91.0	42	209.6	120.0 121.0
3	$\hat{2}.6$	1.5	63	54.6	31.5	$\bar{23}$	106.5	61.5	83	158.5	91.5	43	210.4	121.5
4	3.5	2.0	64	55.4	32.0	24	107.4	62.0	84	159.3	92.0	-44	211.3	122.0
5	4.3	2, 5	65	56.3	32.5	25	108.3	62.5	85	160.2	92.5	45	212.2	122.5
6	5.2	3.0	66	57.2	33.0	26	109.1	63.0	- 86	161.1	93.0	-46	213.0	123.0
7	6.1	3.5	.67	58.0	33.5	27	110.0	63.5	87	161.9	93.5	47	213.9	123.5
8	6.9	4.0	68	58.9	34.0	28	110.9	64.0	88	162.8	94.0	48	214.8	124.0
9	7.8	4.5	69	59.8	34.5	$\frac{29}{20}$	111.7	64.5	89	163.7	94.5	49	215.6	124.5
10	8.7	5.0	_70_	60.6	35.0	30	112.6	65.0	90	164.5	95.0	_50_	216.5	125,0
	9.5	5.5	71	61.5	35.5	131	113.4	65.5	191	165.4	95.5	251	217.4	125.5
12	10.4	6.0	$\frac{12}{79}$	02.4	30.0	32	114.3	00.0	92	100.3	90.0	52	218.2	120.0
10	11.0	0.0	70	00.2	30.0	- 00 - 94	110.2	67 0	95	107.1	90.0	51	219.1	120.0
15	12.1 12.0	7.0	74	65.0	37.5	35	116.0	67.5	94	168 0	97.0	55	220.0	127.0 197.5
16	13.0	8.0	76	65.8	38.0	36	117.8	68 0	96	169.7	98.0	56	220.8	127.0
17	10.0 14.7	8.5	77	66.7	38.5	37	118.6	68.5	97	170.6	98.5	57	222.6	128.5
18	15.6	9.0	78	67.5	39.0	38	119.5	69.0	98	171.5	99.0	58	223.4	129.0
19	16.5	9.5	79	68.4	39.5	39	120.4	69.5	99	172.3	99.5	59	224.3	129.5
20	17.3	10.0	- 80	69.3	40.0	40	121.2	70.0	200	173.2	100.0	60	225.2	130.0
21	18.2	10.5	81	70.1	40.5	141	122.1	70.5	201	174.1	100.5	261	226.0	130.5
22	19.1	11.0	82	71.0	41.0	42	123.0	71.0	02	174.9	101.0	62	226.9	131.0
23	19.9	11.5	- 83	71.9	41.5	43	123.8	71.5	- 03	175.8	101.5	63	227.8	131.5
24	20.8	12.0	84	72.7	42.0	44	124.7	72.0	04	176.7	102.0	64	228.6	132.0
25	21.7	12.5	85	73.6	42.5	45	125.6	72.5	05	177.5	102.5	65	229.5	132.5
26	22.5	13.0	86	74.5	43.0	46	126.4	73.0	06	178.4	103.0	66	230.4	133.0
	23.4	13.5	87	75.3	43.5	47	127.3	73.5	07	179.3	103.5	67	231.2	133.5
28	24.2	14.0	88	16. Z	44.0	48	128.2	14.0	08	180.1	104.0	68	232.1	134.0
29	20.1	14.0	89	$1 \frac{11.1}{77.0}$	44.0	49	129.0	75.0	10	181.0	104.0	- 70	233.0	134.0
21	20.0	15.5	- 01	70.0	15.5	151	120.0	75 5	$\frac{10}{911}$	189 7	105.5	971	921 7	125 5
20	20.8	18.0	91	70.0	40.0	101	130. 8	76.0	19	182.7	105.5	211	204.1	130.0
33	21.1	16.5	92	80.5	46.5	53	131.0 132 5	76.5	12	184 5	106.5	73^{-2}	236 4	136.5
34	29 4	17.0	94	81.4	47.0	54	133 4	77.0	14	185.3	107.0	74	237.3	137.0
35	30.3	17.5	95	82.3	47.5	55	134.2	77.5	15	186.2	107.5	75	238.2	137.5
36	31.2	18.0	96	83.1	48.0	56	135.1	78.0	16	187.1	108.0	76	239.0	138.0
37	32.0	18.5	97	84.0	48.5	57	136.0	78.5	17	187.9	108.5	77	239.9	138.5
38	32.9	19.0	- 98	84.9	49.0	58	136.8	79.0	18	188.8	109.0	78	240.8	139.0
39	33.8	19.5	- 99	85.7	49.5	59	137.7	79.5	19	189.7	109.5	79	241.6	139.5
40	34.6	20.0	100	86.6	50.0	60	138.6	80.0	20	190.5	110.0	80	242.5	140.0
41	35.5	20.5	$101 \\ 02$	87.5	50.5	161	139.4	80.5	221	191.4	110.5	281	243.4	140.5
42	36.4	21.0	02	88.3	51.0	62	140.3	81.0	22	192.3	111.0	82	244.2	141.0
40	37.2 90-1	21.0	03	89.2	52 0	03	141.2	61.0	23	195.1	111.0	81	240.1	141.0
45	30.1	22.0	04	90.1	52.0	65	142.0	82.5	24	194.0	112.0	85	240.0	142.0
46	39.8	93.0	06	91.8	53 0	66	143.8	83.0	26	195 7	112.0	86	247 7	143.0
47	40.7	23.5	07	92.7	53.5	67	144.6	83.5	27	196.6	113.5	87	248.5	143.5
48	41.6	24.0	08	93.5	54.0	68	145.5	84.0	28	197.5	114.0	88	249.4	144.0
49	42.4	24.5	09	94.4	54.5	69	146.4	84.5	29	198.3	114.5	89	250.3	144.5
50	43.3	25.0	10	95.3	55.0	70	147.2	85.0	- 30	199.2	115.0	- 90	251.1	145.0
51	44.2	25.5	111	96.1	55.5	171	148.1	85.5	231	200.1	115.5	291	252.0	145.5
52	45.0	26.0	12	97.0	56.0	72	149.0	86.0	32	200.9	116.0	92	252.9	146.0
53	45.9	26.5	13	97.9	56.5	73	149.8	86.5	- 33	201.8	116.5	93	253.7	146.5
54	46.8	27.0	14	98.7	57.0	74	150.7	87.0	34	202.6	117.0	94	254.6	147.0
66	47.6	27.5	15	99.6	01.5	75	151.6	87.5	35	203.5	117.5	95	200.5	147.5
57	48.5		10	100.5	08.0	10	152.4	88.0	30	204.4	118.0	96	200.3	148.0
50	49.4	28.5	1/	101.3	08.0 50.0	70	103.3	88.0	01 90	200.2	118:0	91	201.2	148.0
59	50.2 51.1	29.0	10	102.2 103.1	59.0	70	155.0	89.5	- 30 - 30	200.1	119.0	00	258 0	149.0
60	52.0	30.0	20	103.9	60.0	80	155.9	90.0	40	207.8	120.0	300	259.8	150.0
00	02.0	00.0	-0	100.0	00.0	00	100.0	00.0	10	20110	1	000		100.0
Dist.	Dep.	Lat.	Dist.	Dep.	Lat.	Dist.	Dep.	Lat.	Dist.	Dep.	Lat.	Dist.	Dep.	Lat.
	-	1			1			0.000					1	1
						60° (1	20°, 240	°, 300°).					

$\begin{array}{ c c c c c c c c c c c c c c c c c c c$															
Difference of Latifunde simil begarrane for a field (1.00, 210), 307). ies. Lat. Dep. Dist. Dist. <thdist.< th=""> Dist. Dist.</thdist.<>	TABLE 2.												Page	427	
Ibb. Iat. Dep. Dist. Iat. Dist. I	Difference of Latitude and Departure for 50 (100, 210, 500).														
$ \begin{array}{ c c c c c c c c c c c c c c c c c c c$	Dist.	Lat.	Dep.	Dist.	Lat.	Dep.	Dist.	Lat.	Dep.	Dist.	Lat.	Dep.	Dist.	Lat.	Dep.
$ \begin{array}{ c c c c c c c c c c c c c c c c c c c$	$\frac{301}{02}$	260.7 261.5	150.5 151.0	$\frac{361}{62}$	312.6 313.5	180.5 181.0	421	364.6 365.5	210.5 211.0	481 82	416.6 417.4	240.5 241.0	$541 \\ 42$	468.5 469.4	270.5 271.0
$\begin{array}{c} (a) & 233, 3 \\ (b) & 263, 1 \\ (b) & 264, 1 \\ (b) & 265, 0 \\ (b) & 264, 1 \\ (b) & 265, 0 \\$	03	262.4	151.5 151.5	63	314.4	181.5	23	366.3	211.5	83	418.3	241.5	43	470.3	271.5
$ \begin{array}{c} 0.9 & 20.1 & 1 & 20.2 & 0 & 30.0 & 1 & 10.1 & 10.5 & 20 & 20.6 & 1 & 20.0 & 10.5 & 10.0 & 20.1 & 10.0 & 20$	04	263.3	152.0	64	315.2	182.0	24	367.2	212.0	84	419.2	242.0	44	471.1	272.0
$\begin{array}{c c c c c c c c c c c c c c c c c c c $	05	264.1 265.0	152.0 153.0	66	317.0	182.0 183.0	$\frac{20}{26}$	368.9	212.9	86	420.9	242.0 243.0	46	472.9	272.0 273.0
$\begin{array}{c} 0& 266.7 \\ 0& 267.6 \\ 10& 268.5 \\ 154.5 \\ 10& 268.5 \\ 155.5 \\ 10& 268.5 \\ 155.6 \\ 155.6 \\ 10& 270.2 \\ 156.5 \\ 155.7 \\ 12& 270.2 \\ 156.6 \\ 155.6 \\ 155.7 \\ 12& 270.2 \\ 156.6 \\ 155.7 \\ 12& 270.2 \\ 156.6 \\ 155.7 \\ 12& 270.2 \\ 156.6 \\ 172& 232.2 \\ 186.0 \\ 132& 271.1 \\ 156.5 \\ 13& 271.1 \\ 156.5 \\ 13& 271.1 \\ 156.5 \\ 13& 271.1 \\ 156.5 \\ 157. \\ 156.5 \\ 13& 271.1 \\ 156.5 \\ 157. \\ 156.5 \\ 157. \\ 157. \\ 158.5 \\ 157. \\ 158.5 \\ 157. \\ 158.2 \\ 157. \\ 158.5 \\ 157. \\ 158.5 \\ 157. \\ 158.5 \\ 157. \\ 158.5 \\ 157. \\ 158.2 \\ 158.5 \\ 157. \\ 158. \\ 157. \\ 158. \\ 150. \\ 159. \\ 158. \\ 150. \\ 159$	07	265.9	153.5	67	317.8	183.5	27.	369.8	213.5	87	421.8	243.5	47	473.7	273.5
$\begin{array}{ c c c c c c c c c c c c c c c c c c c$	$\frac{08}{09}$	266.7 267.6	154.0 154.5	68 60	318.7 319.6	184.0 184.5	$\frac{28}{29}$	370.7 371.5	214.0	88	422.6	244.0 244.5	- <u>48</u> -49	$\frac{1}{474.6}$	274.0 274.5
$ \begin{array}{ c c c c c c c c c c c c c c c c c c c$	10	268.5	155.0	70	320.4	185.0	30	372.4	215.0	90	424.4	245.0	50	476.3	275.0
$ \begin{array}{ c c c c c c c c c c c c c c c c c c c$	311	269.3	155.5	371	321.3	185.5	431	373.3	215.5	491	425.2	245.5	551	477.2	275.5
$ \begin{array}{cccccccccccccccccccccccccccccccccccc$	$\frac{12}{13}$	270.2 271.1	156.0 156.5	$\frac{72}{73}$	322.2 323.0	180.0 186.5	$\frac{32}{33}$	374.1 375.0	216.0 216.5	92 93	426.1 426.9	246.0 246.5	$\frac{52}{53}$	478.1	276.0 276.5
$ \begin{array}{ c c c c c c c c c c c c c c c c c c c$	14	271.9	157.0	74	323.9	187.0	34	375.9	217.0	94	427.8	247.0	54	479.8	277.0
$\begin{array}{c c c c c c c c c c c c c c c c c c c $	15	272.8 273.7	157.5 158.0	75	324.8	187.5	35	376.7 377.6	217.5	95 96	428.7 129.6	247.5 248.0	55	480.7	277.5 278.0
$ \begin{array}{ c c c c c c c c c c c c c c c c c c c$	17	273.7 274.5	153.0 158.5	77	326.5	188.5	37	378.5	218.5	97	430.4	248.5	57	482.4	278.5
$ \begin{array}{cccccccccccccccccccccccccccccccccccc$	18	275.4	159.0	78	327.4	189.0	38	379.3	219.0	98	431.3	249.0	58	483.3	279.0
$ \begin{array}{ c c c c c c c c c c c c c c c c c c c$	$\frac{19}{20}$	276.3 277.1	159.5	80	328.2 329.1	189.5	$\frac{39}{40}$	380.2 381.1	219.5 220.0	500	$\frac{432.2}{433.0}$	249.5 250.0	- 59 - 60	484.1	279.5 280.0
$\begin{array}{cccccccccccccccccccccccccccccccccccc$	321	278.0	160.5	381	330.0	190.5	441	381.9	220.5	501	433.9	250.5	561	485.9	280.5
$ \begin{array}{c} 23 \\ 24 \\ 280.6 \\ 162.0 \\ 163.5 \\ 281.5 \\ 162.5 \\ 281.5 \\ 162.5 \\ 281.5 \\ 162.5 \\ 281.5 \\ 162.5 \\ 281.5 \\ 162.5 \\ 281.5 \\ 162.5 \\ 281.5 \\ 162.5 \\ 281.5 \\ 162.5 \\ 281.5 \\ 162.5 \\ 281.5 \\ 162.5 \\ 281.5 \\ 164.5 \\ 183.5 \\ 183.5 \\ 192.5 \\ 183.5 \\ 192.5 \\ 164 \\ 183.5 \\ 183.5 \\ 192.5 \\ 164 \\ 183.5 \\ 183.5 \\ 192.5 \\ 164 \\ 183.5 \\ 192.5 \\ 164 \\ 183.5 \\ 192.5 \\ 164 \\ 183.5 \\ 192.5 \\ 104 \\ 141.5 \\ 183.5 \\ 192.5 \\ 104 \\ 141.5 \\ 183.5 \\ 194.5 \\ 183.5 \\ 194.5 \\ 183.5 \\ 194.5 \\ 183.5 \\ 194.5 \\ 183.5 \\ 194.5 \\ 183.5 \\ 194.5 \\ 183.5 \\ 194.5 \\ 183.5 \\ 194.5 \\ 183.5 \\ 194.5 \\ 183.5 \\ 194.5 \\ 183.5 \\ 194.5 \\ 183.5 \\ 194.5 \\ 183.5 \\ 194.5 \\ 183.5 \\ 194.5 \\ 18$	$\frac{22}{22}$	278.9 270.7	161.0	82	330.8	191.0	42	382.8.	221.0	$02 \\ 03$	434.8	251.0 251.5	$62 \\ 63$	486.7	281.0
$\begin{array}{cccccccccccccccccccccccccccccccccccc$	$-\frac{23}{24}$	280.6	161.0 162.0	84	332.6	191.0	44	384.5	2222.0	04	436.5	251.0 252.0	64	488.5	281.0
$ \begin{array}{c} 26 \\ 27 \\ 282 \\ 284 \\ 284 \\ 1 \\ 164 \\ 0 \\ 89 \\ 284 \\ 1 \\ 164 \\ 0 \\ 89 \\ 284 \\ 1 \\ 164 \\ 0 \\ 89 \\ 285 \\ 165 \\ 0 \\ 10 \\ 17 \\ 10 \\ 10 \\ 10 \\ 17 \\ 10 \\ 10$	$\frac{25}{22}$	281.5	162.5	85	333.4	192.5	45	385.4	222.5	05	437.4	252.5	65 00	489.3	282.5
$\begin{array}{c c c c c c c c c c c c c c c c c c c $	$\frac{26}{27}$	282.3 283.2	163.0 163.5	86	334.3 335.2	193.0 193.5	46	386.3 387.1	223.0 223.5	06	438.2 439.1	253.0 253.5	66	490.2 491.1	283.0 283.5
$\begin{array}{cccccccccccccccccccccccccccccccccccc$	$\frac{1}{28}$	284.1	164.0	88	336.0	194.0	48	388.0	224.0	08	440.0	254.0	68	491.9	284.0
$ \begin{array}{c} 331 & 286.7 & 165.6 & 391 & 386.6 & 195.5 & 451 & 390.6 & 225.5 & 511 & 442.6 & 255.5 & 571 & 494.5 & 285.5 \\ 32 & 287.5 & 166.0 & 92 & 339.5 & 196.0 & 52 & 391.5 & 226.0 & 12 & 443.4 & 256.6 & 72 & 495.4 & 286.6 \\ 33 & 288.4 & 166.5 & 93 & 340.4 & 196.5 & 53 & 392.2 & 226.6 & 13 & 444.3 & 256.6 & 73 & 496.3 & 286.5 \\ 34 & 289.3 & 167.0 & 94 & 341.2 & 197.5 & 55 & 394.0 & 227.5 & 15 & 446.0 & 257.5 & 75 & 497.9 & 287.5 \\ 36 & 291.0 & 168.0 & 96 & 343.0 & 198.0 & 56 & 394.9 & 228.0 & 16 & 446.9 & 257.5 & 75 & 497.9 & 287.5 \\ 36 & 291.0 & 168.0 & 96 & 343.8 & 198.5 & 57 & 395.8 & 228.5 & 17 & 447.8 & 258.5 & 77 & 499.7 & 288.5 \\ 37 & 291.9 & 168.5 & 97 & 343.8 & 198.5 & 57 & 395.8 & 228.5 & 17 & 447.8 & 258.5 & 77 & 499.7 & 288.5 \\ 38 & 292.7 & 169.0 & 98 & 344.7 & 199.0 & 58 & 396.6 & 229.0 & 18 & 448.6 & 259.0 & 78 & 500.5 & 289.0 \\ 90 & 294.5 & 170.0 & 400 & 346.4 & 200.0 & 60 & 398.4 & 230.0 & 20 & 450.3 & 260.0 & 80 & 502.2 & 290.0 \\ 341 & 295.3 & 170.5 & 401 & 347.3 & 200.5 & 461 & 399.2 & 230.5 & 521 & 1451.2 & 260.5 & 581 & 503.1 & 290.5 \\ 42 & 296.2 & 171.0 & 02 & 348.1 & 201.0 & 62 & 400.1 & 231.0 & 22 & 452.1 & 261.0 & 82 & 504.0 & 291.0 \\ 43 & 297.1 & 171.5 & 03 & 349.0 & 201.5 & 63 & 401.0 & 231.5 & 23 & 452.9 & 261.5 & 83 & 504.9 & 291.6 \\ 44 & 207.9 & 172.0 & 04 & 349.9 & 202.0 & 64 & 401.8 & 232.0 & 24 & 453.8 & 262.0 & 84 & 505.8 & 292.6 \\ 45 & 298.8 & 172.5 & 505 & 350.7 & 202.5 & 65 & 402.7 & 232.5 & 25 & 454.7 & 262.5 & 85 & 506.6 & 692.5 \\ 45 & 299.7 & 173.0 & 06 & 351.6 & 203.0 & 66 & 403.6 & 233.0 & 26 & 455.5 & 263.0 & 86 & 507.5 & 293.0 \\ 47 & 300.5 & 173.5 & 07 & 352.5 & 203.5 & 67 & 404.4 & 233.5 & 27 & 456.4 & 263.5 & 87 & 508.4 & 292.5 \\ 50 & 303.1 & 175.0 & 10 & 355.1 & 205.0 & 77 & 406.2 & 234.5 & 29 & 456.5 & 595 & 506.6 & 292.5 \\ 51 & 304.8 & 176.0 & 12 & 356.8 & 206.0 & 72 & 408.8 & 236.0 & 32 & 460.7 & 266.0 & 92 & 512.7 & 296.0 \\ 53 & 305.7 & 176.5 & 13 & 357.7 & 206.5 & 73 & 409.6 & 233.5 & 33 & 461.6 & 266.5 & 93 & 511.0 & 295.5 \\ 59 & 301.4 & 177.5 & 15 & 339.4 & 207$	29 30	284.9 285.8	164.5 165.0	- 89 90	336.9	194.5 195.0	49 50	388.9 389.7	224.5	09	440.8	254.5 255.0	$\frac{69}{70}$	492.8	284.5 285.0
$\begin{array}{cccccccccccccccccccccccccccccccccccc$	331	$\frac{286.8}{286.7}$	165.0 165.5	391	338.6	195.5	451	390.6	225.5	511	442.6	$\frac{250.0}{255.5}$	571	494.5	$\frac{285.0}{285.5}$
$\begin{array}{cccccccccccccccccccccccccccccccccccc$	32	287.5	166.0	92	339.5	196.0	52	391.5	226.0	12	443.4	256.0	$\frac{72}{70}$	495.4	286.0
$\begin{array}{c ccccccccccccccccccccccccccccccccccc$	33	288.4 289.3	166.5 167.0	93	340.4 341.2	196.5 197.0	- 53 - 54	392.3 393.2	226.5 227.0	13	$\frac{444.3}{445.2}$	256.5 257.0	$\frac{73}{74}$	$\frac{496.3}{497.1}$	286.5
$\begin{array}{cccccccccccccccccccccccccccccccccccc$	35	290.1	167.5	95	342.1	197.5	$5\overline{5}$	394.0	227.5	15	446.0	257.5	75	497.9	287.5
$\begin{array}{c c c c c c c c c c c c c c c c c c c $	$\frac{36}{37}$	291.0 291.9	$168.0 \\ 168.5$	96	343.0	198.0 198.5	$56 \\ 57$	394.9	228.0 228.5	$.16 \\ 17$	$\frac{146.9}{147.8}$	258.0 258.5	$\frac{76}{77}$	498.8	288.0 288.5
$\begin{array}{c ccccccccccccccccccccccccccccccccccc$	38	292.7	169.0	98	344.7	199.0	58	396.6	229.0	18	448.6	259.0	78	500.5	289.0
$\begin{array}{c ccccccccccccccccccccccccccccccccccc$	39	293.6	169.5	-99	345.6	199.5	59 60	397.5	229.5	19	449.4	259.5	79	501.3	289.5
$\begin{array}{c ccccccccccccccccccccccccccccccccccc$	341	$\frac{294.3}{295.3}$	170.0 170.5	400	347.3	$\frac{200.0}{200.5}$	461	399.2	$\frac{230.0}{230.5}$	$\frac{20}{521}$	+50.5 +51.2	260.0 260.5	581	503.1	290.0
$\begin{array}{c ccccccccccccccccccccccccccccccccccc$	42	296.2	171.0	02	348.1	201.0	62	400.1	231.0	22	452.1	261.0	82	504.0	291.0
$\begin{array}{c ccccccccccccccccccccccccccccccccccc$	43	297.1	171.5 172.0	$\frac{03}{01}$	349.0	201.5	63	401.0	231.5	23	452.9	261.5	83	504.9	291.5
$\begin{array}{c ccccccccccccccccccccccccccccccccccc$	45	297.9	172.0 172.5	04	350.7	202.0 202.5	65	401.8	232.0 232.5	25	455.8	262.0 262.5	85	505.8 506.6	292.0 292.5
$ \begin{array}{cccccccccccccccccccccccccccccccccccc$	46	299.7	173.0	06	351.6	203.0	66	403.6	233.0	26	455.5	263.0	86	507.5	293.0
$\begin{array}{cccccccccccccccccccccccccccccccccccc$	$\frac{47}{48}$	300.5 301.4	173.5 174.0	07	352.5 353.3	203.5 204.0	67 68	404.4	233.5 234.0	$\frac{27}{28}$	450.4 457.3	263.5 264.0	87 88	509.2	293.5 294.0
$\begin{array}{ c c c c c c c c c c c c c c c c c c c$	49	302.3	174.5	09	354.2	204.5	69	406.2	234.5	29	458.1	264.5	89	510.1	294.5
$\begin{array}{c ccccccccccccccccccccccccccccccccccc$	<u>50</u> 951	$\frac{303.1}{204.0}$	175.0	10	355.1	$\frac{205.0}{205}$	$\frac{70}{171}$	407.0	$\frac{235.0}{925.5}$	30	459.0	$\frac{265.0}{965.5}$	90	511.0	295.0
$\begin{array}{cccccccccccccccccccccccccccccccccccc$	52	304.0 304.8	170.0 176.0	12	356.8	200.0 206.0	$\frac{471}{72}$	408.8	230.0 236.0	$\frac{331}{32}$	409.9	200.0 266.0	$\frac{591}{92}$	511.8 512.7	290.0 296.0
$\begin{array}{c ccccccccccccccccccccccccccccccccccc$	53	305.7	176.5	13	357.7	206.5	73	409.6	236.5	33	461.6	266.5	93	513.6	296.5
$ \begin{array}{c ccccccccccccccccccccccccccccccccccc$	54 55	305, 6 307, 4	177.0 177.5	14	358.5 359.4	207.0 207.5	$\frac{74}{75}$	410.5	237.0 237.5	$\frac{34}{35}$	462.5 463.3	267.0 267.5	94 95	514.4 515.3	297.0 297.5
$ \begin{array}{c ccccccccccccccccccccccccccccccccccc$	56	308.3	178.0	16	360.3	208.0	76	412.2	238.0	36	464.2	268.0	96	516.2	298.0
$ \begin{array}{c ccccccccccccccccccccccccccccccccccc$	57	309.2	178.5 170.0	17	361.1	208.5	77	413.1	238.5	37	465.1	268.5	97	517.0 517.0	298.5
$ \begin{array}{c c c c c c c c c c c c c c c c c c c $	$\frac{58}{59}$	310.0	179.0 179.5	18	362.0 362.9	209.0 209.5	78 79	414.0	239.0 239.5	- 38 - 39	466.8	269.0 269.5	99	518.8	299.0 299.5
Dist. Dep. Lat. 60° (120°, 240°, 300°).	60	311.8	180.0	20	363.7	210.0	80	415.7	240.0	-10	467.7	270.0	600	519.6	300.0
6Ò° (120°, 240°, 300°).	Dist.	Dep.	Lat.	Dist.	Dep.	Lat.	Dist.	Dep.	Lat.	Dist.	Dep.	Lat.	Dist.	Dep.	Lat.
	60° (120°, 240°, 300°).														

Page 428] TABLE 2.														
Difference of Latitude and Departure for 31° (149°, 211°, 329°).														
Dist.	Lat.	Dep.	Dist.	Lat,	Dep.	Dist.	Lat.	Dep.	Dist.	Lat.	Dep.	Dist.	Lat.	Dep.
1	0.9	0.5	61	52.3	31.4	121	103.7	62.3	181	155.1	93.2	241	206.6	124.1
$\frac{2}{2}$	1.7	1.0	$62 \\ 62$	53.1	31.9	$\frac{22}{22}$	104.6 105.1	62.8	82	156.0 156.0	93.7	42	207.4	124.6
0 4	2.0	2.1	64	54.9	32.4 33.0	20	105.4 106.3	63.9	84	150.9	94. 3	44	208.5 209.1	125.2 125.7
5	4.3	2.6	65	55.7	33.5	$\overline{25}$	107.1	64.4	85	158.6	95.3	45	210.0	126.2
$\frac{6}{2}$	5.1	3.1	66	56.6	34.0	26	108.0	64.9	86	159.4	95.8	46	210.9	126.7
7	6.0	3.6	67	59.4	34.5 35.0	27	108.9 100.7	65.4	87	160.3	96.3	47	211.7	127.2
9	77	4.1	69	59.1	35.0 35.5	20	110.6	66.4	89	161.1 162.0	90.8	48	212.0 213.4	127.7
10	8.6	5.2	70	60.0	36.1	30	111.4	67.0	90	162.9	97.9	50	214.3	128.8
11	9.4	5.7	71	60.9	36.6	131	112:3	67.5	191	163.7	98.4	251	215.1	129.3
12	10.3	6.2	72	61.7	37.1	32	113.1	68.0	92	164.6	98.9	52	216.0	129.8
13	11.1	6.7	73	62.6	37.6	33	114.0	68.5	93	165.4	99.4	53	216.9	130.3
14	12.0	$\frac{7.2}{7.7}$	75	64 3	38.6	35	114.9	69.0 69.5	94	100.3 167.1	99.9	- 04 55	217.7	130.8
16	12.5 13.7	8.2	76	65.1	39.1	36	116.6	70.0	96	168.0	100.4 100.9	56	210.0 219.4	131.8
17	14.6	8.8	77	66.0	39.7	37	117.4	70.6	97	168.9	101.5	57	220.3	132.4
18	15.4	9.3	78	66.9	40.2	- 38	118.3	71.1	98	169.7	102.0	58	221.1	132.9
19	16.3	9.8	79	67.7	40.7	39	119.1	71.6	99	170.6	102.5	59	222.0	133.4
20	12.0	10.5	- 80	<u>- 08.0</u> 	41.2	40	$\frac{120.0}{120.0}$	$\frac{72.1}{79.6}$	200	171.4	103.0	00	222.9	133.9
$\frac{21}{22}$	18.0	10.8 11.3	82	70.3	42.2	42	120.9 121 7	72.0 73.1	201	172.5 173 1	103.0 104.0	$\frac{201}{62}$	225.7	134.4
$\frac{22}{23}$	19.7	11.8	83	71.1	42.7	43	122.6	73.7	03	174.0	104.6	63	225.4	135.5
24	20.6	12.4	84	72.0	43.3	44	123.4	74.2	04	174.9	105.1	64	226.3	136.0
25	21.4	12.9	85	72.9	43.8	45	124.3	74.7	-05	175.7	105.6	65	227.1	136.5
$\frac{26}{27}$	22.3	13.4	86	73.7	44.3	46	125.1	75.2	06	176.6	-106.1	66	228.0	137.0
27	23.1 24.0	13.9	87	74.0	15 2	+1	126.0 196.0	10.1	07	111.4	106.6 107.1	67	228.9	137.5
20	24.0	14.4	89	76.4	45.8	49	120.5 127.7	76.2	09	179.1	107.1	69	229.7	138.0 138.5
30	25.7	15.5	90	77.1	46.4	50	128.6	77.3	10	180.0	108.2	70	231.4	139.1
31	26.6	16.0	91	78.0	46.9	151	129.4	77.8	211	180.9	108.7	271	232.3	139.6
32	27.4	16.5	92	78.9	47.4	52	130.3	78.3	12	181.7	109.2	72	233.1	140.1
33	28.3	17.0	93	79.7	47.9	53	131.1	78.8	13	182.6	109.7	73	234.0	140.6
34	29.1	11.0	94	80.0	48.4	04 55	132.0 122.0	79.3	14	183.4	110.2 110.7	74	234.9 925.7	141, 1
36	30.9	18.5	96	82.3	49.4	56	132.5 133.7	80.3	16	185 1	111.7	76	236 6	141.0
37	31.7	19.1	97	83.1	50.0	57	134.6	80.9	17	186.0	111.8	77	237.4	142.7
- 38	32.6	19.6	98	84.0	50.5	58	135.4	81.4	18	186.9	112.3	78	238.3	143.2
39	33.4	20.1	99	84.9	51.0	59	136.3	81.9	19	187.7*	112.8	79	239.1	143.7
40	$\frac{34.3}{2}$	20.6	100	85.7	51.5	$\frac{60}{101}$	$\frac{137.1}{100.0}$	82.4	20	188.6	113.3	80	240.0	144.2
41	35.1	21.1 21.6	101	86.6	52.0	161	138.0	82.9	221	189.4	113.8	281	240.9	144.7
$\frac{42}{13}$	36.9	21.0 22.1	02	88 3	52.0 53.0	63	138.9	81 0	22	190. a	114.0	82	241.7	140.2 145.8
44	37.7	22.7	04	89.1	53.6	64	140.6	84.5	24	192.0	115.4	84	243.4	146.3
45	38.6	23.2	05	90.0	54.1	65	141.4	85.0	25	192.9	115.9	85	244.3	146.8
46	39.4	23.7	06	90.9	54.6	66	142.3	85.5	26	193.7	116.4	86	245.1	147.3
47	40.3	24.2	07	91.7	55.1	67	143.1	86.0	27	194.6	116.9	87	246.0	147.8
40	41.1	25 9	08	92.0	55.0 56.1	69	144.0	87.0	28	195.4	117.4	80	240.9	148.3
50	42.9	25.8	10	94.3	56.7	70	145.7	87.6	30	197.1	118.5	90	248.6	149.4
51	43.7	26.3	111	95.1	57.2	171	146.6	88.1	231	198.0	119.0	291	249.4	149.9
52	44.6	26.8	12	96.0	57.7	72	147.4	88.6	32	198.9	119.5	92	250.3	150.4
53	45.4	27.3	13	96.9	58.2	73	148.3	89.1	33	199.7	120.0	93	251.2	150.9
04 55	46.3	27.8	14	97.7	50.7	74	149.1	89.6	34	200.6	120.5	94	252.0	151.4
- 50 - 56	48 0	28.3	10	98.0	59.2 59.7	70 76	150.0	90. 1 90. 6	- 50 - 26	201.4	121.0 191 5	66 90	202.9 253.7	151.9 152.5
57	48.9	29.4	17	100.3	60.3	77	151.7	91.2	37	202.3	122.1	97	253.1 254.6	153.0
58	49.7	29.9	18	101.1	60.8	78	152.6	91.7	38	204.0	122.6	98	255.4	153.5
59	50.6	30.4	19	102.0	61.3	79	153.4	92.2	- 39	204.9	123.1	99	256.3	154.0
60	51.4	30.9	20	102.9	61.8	80	154.3	92.7	40	205.7	123.6	300	257.1	154.5
Dist.	Dep.	Lat.	Dist.	Dep.	Lat.	Dist.	Dep.	Lat.	Dist.	Dep.	Lat.	Dist.	Dep.	Lat.
	59° (121°, 239°, 301°).													

t
					-	Г	ABLI	E-2.					[Page	9 429
			Differ	ence of	Latitud	le ånd	Depart	ure for	31° (1	149°, 21	1°, 329°	°).		
Dist.	Lat,	Dep.	Dist.	Lat.	Dep.	Dist.	Lat.	Dep.	Dist.	Lat.	Dep.	Dist.	Lat.	Dep.
$\begin{array}{c} 301\\ 02\\ 03\\ 04\\ 05\\ 06\\ 07\\ 08\\ 09\\ 10\\ 311\\ 12\\ 13\\ 14\\ 15\\ 16\\ \end{array}$	$\begin{array}{c} 258.0\\ 258.9\\ 259.7\\ 260.6\\ 261.4\\ 262.3\\ 263.2\\ 263.2\\ 264.9\\ 265.7\\ 265.6\\ 267.4\\ 267.4\\ 268.3\\ 269.2\\ 270.0\\ 970.9\\ \end{array}$	$\begin{array}{c} 155.\ 0\\ 155.\ 5\\ 156.\ 1\\ 156.\ 6\\ 157.\ 1\\ 157.\ 6\\ 158.\ 1\\ 158.\ 6\\ 159.\ 2\\ 159.\ 7\\ 160.\ 2\\ 160.\ 7\\ 161.\ 2\\ 161.\ 7\\ 162.\ 2\\ 162.\ 2\\ 162.\ 3\\ 162.\ 2\\ 162.\ 3\\ 162.\$	$\begin{array}{c} 361 \\ 62 \\ 63 \\ 64 \\ 65 \\ 66 \\ 67 \\ 68 \\ 69 \\ 70 \\ \hline 371 \\ 72 \\ 73 \\ 74 \\ 75 \\ 76 \\ \end{array}$	$\begin{array}{c} 309, 4\\ 310, 3\\ 311, 2\\ 312, 0\\ 312, 9\\ 313, 7\\ 314, 6\\ 315, 4\\ 316, 3\\ 317, 2\\ 318, 0\\ 318, 9\\ 319, 7\\ 320, 6\\ 321, 4\\ 329, 3\\$	$185.9 \\ 186.4 \\ 187.0 \\ 187.5 \\ 188.0 \\ 189.5 \\ 189.0 \\ 189.5 \\ 190.1 \\ 190.6 \\ 191.1 \\ 191.6 \\ 192.1 \\ 192.6 \\ 193.1 \\ 193.7 \\ 193.1 \\ 193.7 \\ 193.$	$\begin{array}{c} 421\\ 22\\ 23\\ 24\\ 25\\ 26\\ 27\\ 28\\ 29\\ 30\\ 431\\ 32\\ 33\\ 34\\ 35\\ 36\end{array}$	$\begin{array}{c} 360,9\\ 361,7\\ 362,6\\ 363,4\\ 364,3\\ 365,2\\ 366,0\\ 366,9\\ 367,7\\ 368,6\\ 369,6\\ 369,4\\ 370,3\\ 371,2\\ 372,0\\ 372,7\\ 373,7\\$	$\begin{array}{c} 216.8\\ 217.3\\ 217.9\\ 218.4\\ 219.9\\ 220.4\\ 221.0\\ 221.5\\ 222.0\\ 222.5\\ 223.0\\ 222.5\\ 223.0\\ 223.5\\ 224.0\\ 22$	$\begin{array}{c} 481\\ 82\\ 83\\ 84\\ 85\\ 86\\ 87\\ 88\\ 89\\ 90\\ 491\\ 92\\ 93\\ 94\\ 95\\ 96\end{array}$	$\begin{array}{c} 412.3\\ 413.2\\ +14.0\\ +14.9\\ +15.7\\ +16.6\\ +17.4\\ +18.3\\ +19.2\\ +20.9\\ +20.9\\ +21.7\\ +22.6\\ +23.4\\ +24.3\\ +24.3\\ +25.9\end{array}$	$\begin{array}{c} 247.7\\ 248.2\\ 248.8\\ 249.3\\ 249.8\\ 250.3\\ 250.8\\ 251.9\\ 252.4\\ 252.9\\ 253.4\\ 253.9\\ 254.4\\ 254.9\\ 255.5\\ \end{array}$	$\begin{array}{r} 541\\ 42\\ 43\\ 44\\ 45\\ 46\\ 47\\ 48\\ 49\\ 50\\ \hline 551\\ 52\\ 53\\ 54\\ 55\\ 56\\ \end{array}$	$\begin{array}{c} 463,7\\ 464,6\\ 465,4\\ 466,3\\ 467,2\\ 468,0\\ 468,9\\ 469,7\\ 470,6\\ 471,6\\ 472,3\\ 473,2\\ 473,2\\ 474,0\\ 474,9\\ 475,7\\ 476,6\\ 476,6\\ 476,9\\ 476,6\\ 476,9\\ 476,6\\ 47$	$\begin{array}{c} 278.\ 6\\ 279.\ 1\\ 279.\ 7\\ 280.\ 2\\ 280.\ 7\\ 281.\ 2\\ 281.\ 7\\ 282.\ 3\\ 282.\ 8\\ 283.\ 8\\ 283.\ 8\\ 284.\ 8\\ 284.\ 8\\ 285.\ 3\\ 284.\ 8\\ 285.\$
$ \begin{array}{c} 17 \\ 18 \\ 19 \\ 20 \end{array} $	$\begin{array}{c} 271.7\\ 272.6\\ 273.4\\ 274.3\end{array}$	$ \begin{array}{r} 163.3 \\ 163.8 \\ 164.3 \\ 164.8 \end{array} $	$ \begin{array}{r} 77 \\ 78 \\ 79 \\ 80 \end{array} $	323.2 324.0 324.9 325.7	$ \begin{array}{r} 194.2 \\ 194.7 \\ 195.2 \\ 195.7 \end{array} $	$ \begin{array}{r} 37 \\ 38 \\ 39 \\ 40 \end{array} $	374.6 375.4 376.3 377.2	$\begin{array}{c} 225.1 \\ 225.6 \\ 226.1 \\ 226.6 \end{array}$	$97 \\ 98 \\ 99 \\ 500$	$\begin{array}{r} 426.0\\ 426.9\\ 427.7\\ 428.6\end{array}$	256.0 256.5 257.0 257.5	$57 \\ 58 \\ 59 \\ 60$	477.4 478.3 479.2 480.0	$ \begin{array}{r} 286.9 \\ 287.4 \\ 287.9 \\ 288.4 \end{array} $
$ \begin{array}{r} 321 \\ 22 \\ 23 \\ 24 \\ 25 \\ 26 \\ 27 \\ 28 \\ 29 \\ 30 \end{array} $	$\begin{array}{c} 275.\ 2\\ 276.\ 0\\ 276.\ 9\\ 277.\ 7\\ 278.\ 6\\ 279.\ 4\\ 280.\ 3\\ 281.\ 2\\ 282.\ 0\\ 282.\ 9\end{array}$	$\begin{array}{c} 165.3\\ 165.8\\ 166.4\\ 166.9\\ 167.4\\ 167.9\\ 168.4\\ 168.9\\ 169.5\\ 170.0 \end{array}$	$ \begin{array}{r} 381 \\ 82 \\ 83 \\ 84 \\ 85 \\ 86 \\ 87 \\ 88 \\ 89 \\ 90 \\ 90 \end{array} $	$\begin{array}{c} 326.\ 6\\ 327.\ 4\\ 328.\ 3\\ 329.\ 2\\ 330.\ 0\\ 330.\ 9\\ 331.\ 7\\ 332.\ 6\\ 333.\ 4\\ 334.\ 3\end{array}$	$196. 2 \\ 196. 7 \\ 197. 3 \\ 197. 8 \\ 198. 3 \\ 198. 8 \\ 199. 3 \\ 199. 8 \\ 200. 4 \\ 200. 9 \\$	$\begin{array}{r} 441 \\ 42 \\ 43 \\ 44 \\ 45 \\ 46 \\ 47 \\ 48 \\ 49 \\ 50 \end{array}$	$\begin{array}{c} 378.0\\ 378.9\\ 379.7\\ 380.6\\ 381.4\\ 382.3\\ 383.2\\ 383.2\\ 384.0\\ 384.9\\ 385.7\\ \end{array}$	$\begin{array}{c} 227.1\\ 227.7\\ 228.2\\ 228.7\\ 229.2\\ 229.7\\ 230.2\\ 230.7\\ 231.3\\ 231.8\\ \end{array}$	$ \begin{array}{r} 501 \\ 02 \\ 03 \\ 04 \\ 05 \\ 06 \\ 07 \\ 08 \\ 09 \\ 10 \end{array} $	$\begin{array}{r} 429. \ 4\\ 430. \ 3\\ 431. \ 2\\ 432. \ 0\\ 432. \ 9\\ 433. \ 7\\ 434. \ 6\\ 435. \ 4\\ 436. \ 3\\ 437. \ 2\end{array}$	$\begin{array}{c} 258.0\\ 258.6\\ 259.1\\ 259.6\\ 260.1\\ 260.6\\ 261.1\\ 261.6\\ 262.2\\ 262.7\\ \end{array}$	$\begin{array}{r} 561 \\ 62 \\ 63 \\ 64 \\ 65 \\ 66 \\ 67 \\ 68 \\ 69 \\ 70 \end{array}$	$\begin{array}{r} 480.9\\ 481.7\\ 482.6\\ 483.4\\ 484.3\\ 485.2\\ 486.0\\ 486.9\\ 487.7\\ 488.6\end{array}$	$\begin{array}{c} 288.9\\ 289.5\\ 290.0\\ 290.5\\ 291.0\\ 291.5\\ 292.0\\ 292.5\\ 293.1\\ 293.6\end{array}$
$\begin{array}{r} 331 \\ 32 \\ 33 \\ 34 \\ 35 \\ 36 \\ 37 \\ 38 \\ 39 \\ 40 \end{array}$	$\begin{array}{c} 283.\ 7\\ 284.\ 6\\ 285.\ 4\\ 286.\ 3\\ 287.\ 2\\ 288.\ 0\\ 288.\ 9\\ 289.\ 7\\ 290.\ 6\\ 291.\ 4 \end{array}$	$\begin{array}{c} 170.\ 5\\ 171.\ 0\\ 171.\ 5\\ 172.\ 0\\ 172.\ 5\\ 173.\ 1\\ 173.\ 6\\ 174.\ 1\\ 174.\ 6\\ 175.\ 1\end{array}$	$\begin{array}{r} 391 \\ 92 \\ 93 \\ 94 \\ 95 \\ 96 \\ 97 \\ 98 \\ 99 \\ 400 \end{array}$	$\begin{array}{c} 335.\ 2\\ 336.\ 0\\ 336.\ 9\\ 337.\ 7\\ 338.\ 6\\ 339.\ 4\\ 340.\ 3\\ 341.\ 2\\ 342.\ 0\\ 342.\ 9\end{array}$	$\begin{array}{c} 201.\ 4\\ 201.\ 9\\ 202.\ 4\\ 202.\ 9\\ 203.\ 4\\ 204.\ 0\\ 204.\ 5\\ 205.\ 0\\ 205.\ 5\\ 206.\ 0 \end{array}$	$\begin{array}{r} 451 \\ 52 \\ 53 \\ 54 \\ 55 \\ 56 \\ 57 \\ 58 \\ 59 \\ 60 \end{array}$	$\begin{array}{c} 386.\ 6\\ 387.\ 4\\ 388.\ 3\\ 389.\ 2\\ 390.\ 0\\ 390.\ 9\\ 391.\ 7\\ 392.\ 6\\ 393.\ 4\\ 394.\ 3\end{array}$	$\begin{array}{c} 232.\ 3\\ 232.\ 8\\ 233.\ 3\\ 233.\ 8\\ 234.\ 3\\ 234.\ 9\\ 235.\ 4\\ 235.\ 9\\ 236.\ 4\\ 236.\ 9\end{array}$	$ \begin{array}{r} 511\\ 12\\ 13\\ 14\\ 15\\ 16\\ 17\\ 18\\ 19\\ 20 \end{array} $	$\begin{array}{c} 438.\ 0\\ 438.\ 9\\ 439.\ 7\\ 440.\ 6\\ 441.\ 4\\ 442.\ 3\\ 443.\ 2\\ 443.\ 2\\ 444.\ 0\\ 444.\ 9\\ 445.\ 7\end{array}$	$\begin{array}{c} 263.\ 2\\ 263.\ 7\\ 264.\ 2\\ 264.\ 7\\ 265.\ 2\\ 265.\ 8\\ 266.\ 8\\ 266.\ 8\\ 266.\ 8\\ 267.\ 3\\ 267.\ 8\end{array}$	$\begin{array}{r} 571 \\ 72 \\ 73 \\ 74 \\ 75 \\ 76 \\ 77 \\ 78 \\ 79 \\ 80 \end{array}$	$\begin{array}{c} 489.\ 4\\ 490.\ 3\\ 491.\ 2\\ 492.\ 0\\ 492.\ 9\\ 493.\ 7\\ 494.\ 6\\ 495.\ 4\\ 496.\ 3\\ 497.\ 2\end{array}$	$\begin{array}{c} 294.1\\ 294.6\\ 295.1\\ 295.6\\ 296.1\\ 296.7\\ 297.2\\ 297.2\\ 297.7\\ 298.2\\ 298.7\\ \end{array}$
$ \begin{array}{r} 341 \\ 42 \\ 43 \\ 44 \\ 45 \\ 46 \\ 47 \\ 48 \\ 49 \\ 50 \\ 50 \end{array} $	$\begin{array}{c} 292.\ 3\\ 293.\ 2\\ 294.\ 0\\ 294.\ 9\\ 295.\ 7\\ 296.\ 6\\ 297.\ 4\\ 298.\ 3\\ 299.\ 2\\ 300.\ 0 \end{array}$	$\begin{array}{c} 175.\ 6\\ 176.\ 1\\ 176.\ 7\\ 177.\ 2\\ 177.\ 7\\ 178.\ 2\\ 178.\ 7\\ 179.\ 2\\ 179.\ 8\\ 180.\ 3 \end{array}$	$\begin{array}{c} .401\\ 02\\ 03\\ 04\\ 05\\ 06\\ 07\\ 08\\ 09\\ 10\\ \end{array}$	$\begin{array}{c} 343.7\\ 344.6\\ 345.4\\ 346.3\\ 347.2\\ 348.0\\ 348.9\\ 349.7\\ 350.6\\ 351.4 \end{array}$	$\begin{array}{c} 206.5\\ 207.0\\ 207.6\\ 208.1\\ 208.6\\ 209.1\\ 209.6\\ 210.1\\ 210.7\\ 211.2 \end{array}$	$\begin{array}{r} 461 \\ 62 \\ 63 \\ 64 \\ 65 \\ 66 \\ 67 \\ 68 \\ 69 \\ 70 \end{array}$	$\begin{array}{c} 395.\ 2\\ 396.\ 0\\ 396.\ 9\\ 397.\ 7\\ 398.\ 6\\ 399.\ 4\\ 400.\ 3\\ 401.\ 2\\ 402.\ 0\\ 402.\ 9\end{array}$	$\begin{array}{c} 237.4\\ 238.0\\ 238.5\\ 239.0\\ 239.5\\ 240.0\\ 240.5\\ 241.0\\ 241.5\\ 242.1 \end{array}$	$ \begin{array}{r} 521 \\ 22 \\ 23 \\ 24 \\ 25 \\ 26 \\ 27 \\ 28 \\ 29 \\ 30 \\ \end{array} $	$\begin{array}{c} 446.\ 6\\ 447.\ 4\\ 448.\ 3\\ 449.\ 2\\ 450.\ 0\\ 450.\ 9\\ 451.\ 7\\ 452.\ 6\\ 453.\ 4\\ 454.\ 3\end{array}$	$\begin{array}{c} 268.3\\ 268.9\\ 269.4\\ 269.9\\ 270.4\\ 270.9\\ 271.4\\ 271.9\\ 272.4\\ 273.0 \end{array}$	581 82 83 84 85 86 87 88 89 90	$\begin{array}{r} 498.0\\ 498.9\\ 499.7\\ 500.6\\ 501.4\\ 502.3\\ 503.2\\ 504.0\\ 504.9\\ 505.7\end{array}$	299. 2 299. 8 300. 3 300. 8 301. 3 301. 8 302. 3 302. 8 303. 3 303. 9
$\begin{array}{r} 351 \\ 52 \\ 53 \\ 54 \\ 55 \\ 56 \\ 57 \\ 58 \\ 59 \\ 60 \end{array}$	$\begin{array}{c} 300. \ 9\\ 301. \ 7\\ 302. \ 6\\ 303. \ 4\\ 3043\\ 305. \ 2\\ 306. \ 0\\ 306. \ 9\\ 307. \ 7\\ 308. \ 6\end{array}$	$180.8 \\ 181.3 \\ 181.8 \\ 182.3 \\ 182.8 \\ 183.4 \\ 183.9 \\ 184.4 \\ 184.9 \\ 185.4 \\ 185.$	$\begin{array}{r} 411\\12\\13\\14\\15\\16\\17\\18\\19\\20\end{array}$	$\begin{array}{c} 352.3\\ 353.2\\ 354.0\\ 354.9\\ 355.7\\ 356.6\\ 357.4\\ 358.3\\ 359.2\\ 360.0\\ \end{array}$	$\begin{array}{c} 2\bar{1}1.\ 7\\ 212.\ 2\\ 212.\ 7\\ 213.\ 2\\ 213.\ 7\\ 214.\ 3\\ 214.\ 8\\ 215.\ 3\\ 215.\ 8\\ 216.\ 3\\ \end{array}$	$\begin{array}{r} 471 \\ 72 \\ 73 \\ 74 \\ 75 \\ 76 \\ 77 \\ 78 \\ 79 \\ 80 \end{array}$	$\begin{array}{c} 403.\ 7\\ 404.\ 6\\ 405.\ 4\\ 406.\ 3\\ 407.\ 2\\ 408.\ 0\\ 408.\ 9\\ 409.\ 7\\ 410.\ 6\\ 411.\ 4\end{array}$	$\begin{array}{c} 242. \ \overline{6} \\ 243. \ 1 \\ 243. \ 6 \\ 244. \ 1 \\ 244. \ 6 \\ 245. \ 2 \\ 245. \ 7 \\ 246. \ 2 \\ 246. \ 7 \\ 246. \ 7 \\ 247. \ 2 \end{array}$	$531 \\ 32 \\ 33 \\ 34 \\ 35 \\ 36 \\ 37 \\ 38 \\ 39 \\ 40$	$\begin{array}{c} 455.\ 2\\ 456.\ 0\\ 456.\ 9\\ 457.\ 7\\ 458.\ 6\\ 459.\ 4\\ 460.\ 3\\ 461.\ 2\\ 462.\ 0\\ 462.\ 9\end{array}$	$\begin{array}{c} 273.5\\ 274.0\\ 274.5\\ 275.0\\ 275.5\\ 276.1\\ 276.6\\ 277.1\\ 277.6\\ 277.1\\ 277.6\\ 278.1 \end{array}$	$591 \\ 92 \\ 93 \\ 94 \\ 95 \\ 96 \\ 97 \\ 98 \\ 99 \\ 600$	$\begin{array}{c} 506.\ 6\\ 507.\ 4\\ 508.\ 3\\ 509.\ 2\\ 510.\ 0\\ 510.\ 9\\ 511.\ 7\\ 512.\ 6\\ 513.\ 4\\ 514.\ 3\end{array}$	$\begin{array}{c} 304.\ 4\\ 304.\ 9\\ 305.\ 4\\ 305.\ 9\\ 306.\ 4\\ 307.\ 0\\ 307.\ 5\\ 308.\ 0\\ 308.\ 5\\ 309.\ 0 \end{array}$
Dist.	Dep.	Lat.	Dist.	Dep.	Lat.	Dist.	Dep.	Lat.	Dist.	Dep.	Lat,	Dist.	Dep.	Lat.
					į	59° (12	21°, 239	°, 301°).					

Pa	ge 430			-		Т	ABLE	2. 2						
		1	Differe	ence of 1	Latitud	e and	Departu	ire for	32° (1	48°, 212	?°, 328°	°).		
Dist.	Lat.	Dep.	Dist.	Lat.	Dep.	Dist.	Lat.	Dep.	Dist.	Lat.	Dep.	Dist.	Lat.	Dep.
$ \begin{array}{c} 1\\ 2\\ 3\\ 4\\ 5\\ 6\\ 7\\ 8\\ 9\\ 10\\ 11\\ 12\\ 13\\ 14\\ 15\\ 16\\ 17\\ 18\\ 14\\ 15\\ 16\\ 17\\ 18\\ 18\\ 18\\ 18\\ 18\\ 18\\ 18\\ 18\\ 18\\ 18$	$\begin{array}{c} 0.8\\ 1.7\\ 2.5\\ 3.4\\ 2\\ 5.1\\ 5.9\\ 6.8\\ 7.6\\ 8.5\\ 9.3\\ 10.2\\ 11.0\\ 11.9\\ 12.7\\ 13.6\\ 14.4\\ 15.9\end{array}$	0.5 1.16 1.6 2.5 1.16 2.5 4.28 3.77 4.28 5.3 5.8 4.6.9 4.9 5.5 0.5 7.7 8.00 5 9.05	$\begin{array}{c} 61\\ 62\\ 63\\ 64\\ 65\\ 66\\ 67\\ 68\\ 69\\ 70\\ \hline 71\\ 72\\ 73\\ 74\\ 75\\ 76\\ 77\\ 78\end{array}$	$\begin{array}{c} 51.7\\ 52.6\\ 53.4\\ 54.1\\ 56.0\\ 56.8\\ 57.7\\ 58.5\\ 59.4\\ \hline 60.2\\ 61.1\\ 61.9\\ 62.8\\ 63.6\\ 64.5\\ 65.3\\ 66.1\\ \end{array}$	$\begin{array}{c} 32.3\\ 32.9\\ 33.4\\ 33.9\\ 34.4\\ 35.0\\ 35.5\\ 36.6\\ 37.1\\ 37.6\\ 38.2\\ 38.7\\ 39.2\\ 39.7\\ 40.3\\ 40.8\\ 112\\ \end{array}$	$\begin{array}{c} 121\\ 22\\ 23\\ 24\\ 25\\ 26\\ 27\\ 28\\ 29\\ 30\\ \hline 131\\ 32\\ 33\\ 34\\ 35\\ 36\\ 37\\ 9\end{array}$	$\begin{array}{c} 102.\ 6\\ 103.\ 5\\ 104.\ 3\\ 105.\ 2\\ 106.\ 0\\ 106.\ 9\\ 107.\ 7\\ 108.\ 6\\ 109.\ 4\\ 110.\ 2\\ \hline 111.\ 1\\ 111.\ 9\\ 112.\ 8\\ 113.\ 6\\ 114.\ 5\\ 115.\ 3\\ 116.\ 2\\ 115.\ 3\\ 116.\ 2\\ 117.\ 0\\ 117.\ 6\\ 117$	$\begin{array}{c} 64.1\\ 64.7\\ 65.2\\ 65.2\\ 66.2\\ 66.8\\ 67.3\\ 67.8\\ 68.9\\ 69.4\\ 69.9\\ 70.5\\ 71.0\\ 71.5\\ 72.1\\ 72.6\\ 72.1\\ 72.6\\ 72.1\\ 72.6\\ 72.1\\ 72.6\\ 72.1\\ 72.6\\ 73.6\\$	$\begin{array}{c} 181\\ 82\\ 83\\ 84\\ 85\\ 86\\ 87\\ 88\\ 89\\ 90\\ \hline 191\\ 92\\ 93\\ 94\\ 95\\ 96\\ 97\\ 98\\ 96\\ 97\\ 98\\ 96\\ 97\\ 98\\ 96\\ 97\\ 98\\ 96\\ 97\\ 98\\ 98\\ 98\\ 98\\ 98\\ 98\\ 98\\ 98\\ 98\\ 98$	$\begin{array}{c} 153.5\\ 154.3\\ 155.2\\ 156.9\\ 157.7\\ 158.6\\ 159.4\\ 160.3\\ 161.1\\ 162.0\\ 162.8\\ 163.7\\ 164.5\\ 165.4\\ 166.2\\ 167.1\\ 167.0\\ \end{array}$	95, 9 96, 4 97, 0 97, 5 98, 0 98, 6 99, 1 99, 6 100, 7 101, 2 101, 7 102, 3 102, 8 103, 3 103, 9 104, 4	$\begin{array}{c} 241 \\ 42 \\ 43 \\ 44 \\ 45 \\ 46 \\ 47 \\ 48 \\ 49 \\ 50 \\ \hline 251 \\ 52 \\ 53 \\ 54 \\ 55 \\ 56 \\ 57 \\ 50 \\ \hline \end{array}$	$\begin{array}{c} 204. \ 4\\ 205. \ 2\\ 206. \ 1\\ 206. \ 9\\ 207. \ 8\\ 208. \ 6\\ 209. \ 5\\ 210. \ 3\\ 211. \ 2\\ 0\\ 212. \ 0\\ 212. \ 0\\ 212. \ 9\\ 213. \ 7\\ 214. \ 6\\ 215. \ 4\\ 216. \ 3\\ 217. \ 1\\ 217. \ 9\\ 216. \$	$\begin{array}{c} 127.\ 7\\ 128.\ 2\\ 128.\ 8\\ 129.\ 3\\ 129.\ 8\\ 130.\ 4\\ 130.\ 9\\ 131.\ 4\\ 131.\ 9\\ 132.\ 5\\ 133.\ 0\\ 133.\ 5\\ 134.\ 1\\ 134.\ 1\\ 134.\ 1\\ 135.\ 7\\ 136.\ 2\\ 126.\ 7\\ 136.\ 2\\ 126.\ 7\\ 136.\ 2\\ 126.\ 7\\ 136.\ 2\\ 126.\ 7\\ 136.\ 2\\ 126.\ 7\\ 136.\ 2\\ 126.\ 7\\ 136.\ 2\\ 126.\ 7\\ 136.\ 2\\ 126.\ 7\\ 136.\ 2\\ 126.\ 7\\ 136.\ 2\\ 126.\ 7\\ 136.\ 2\\ 126.\ 7\\ 136.\ 2\\ 126.\ 7\\ 136.\ 2\\ 126.\ 7\\ 136.\ 7\\ 136.\ 7\\ 136.\ 2\\ 126.\ 7\\ 136.\$
19	10.5 16.1 17.0	10.1	79 79	67.0	$\frac{41.5}{41.9}$	39	117.0 117.9 118.7	73.7	98	167.9 168.8	104.9 105.5	59	218.8 219.6	130.7 137.2 107.0
$\begin{array}{c} 20\\ 21\\ 22\\ 23\\ 24\\ 25\\ 26\\ 27\\ 28\\ 29\\ 30\\ 31\\ 32\\ 33\\ 34\\ 35\\ 36\\ 37\\ 38\\ 39\\ 40\\ 41\\ \end{array}$	$\begin{array}{c} 17.0\\ 17.8\\ 18.7\\ 19.5\\ 20.4\\ 21.2\\ 22.0\\ 22.9\\ 23.7\\ 24.6\\ 25.4\\ 26.3\\ 27.1\\ 28.0\\ 28.8\\ 29.7\\ 30.5\\ 31.4\\ 32.2\\ 33.1\\ 33.9\\ 34.8\\ \end{array}$	$\begin{array}{c} 10.6\\ 11.1\\ 11.7\\ 12.2\\ 12.7\\ 13.2\\ 13.8\\ 14.3\\ 14.8\\ 15.4\\ 15.9\\ 16.4\\ 17.0\\ 17.5\\ 18.0\\ 17.5\\ 18.0\\ 19.1\\ 19.6\\ 20.1\\ 20.1\\ 21.7\\ 21.2\\ 21.7\\ \end{array}$	$\begin{array}{c c} 80 \\ \hline 81 \\ 82 \\ 83 \\ 84 \\ 85 \\ 86 \\ 87 \\ 88 \\ 89 \\ 90 \\ 91 \\ 92 \\ 93 \\ 94 \\ 95 \\ 97 \\ 98 \\ 99 \\ 90 \\ 100 \\ 101 \\ \end{array}$	$\begin{array}{c} 61.8\\ 68.7\\ 69.5\\ 70.4\\ 71.2\\ 72.1\\ 72.1\\ 72.8\\ 74.6\\ 75.5\\ 76.3\\ 77.2\\ 78.0\\ 78.0\\ 78.9\\ 79.7\\ 80.6\\ 81.4\\ 82.3\\ 83.1\\ 84.8\\ 85.7\\ \end{array}$	$\begin{array}{c} 42.4\\ 42.9\\ 43.5\\ 44.0\\ 44.5\\ 45.0\\ 45.6\\ 146.6\\ 47.2\\ 47.7\\ 48.8\\ 49.3\\ 49.8\\ 50.9\\ 50.9\\ 51.4\\ 51.9\\ 52.5\\ 53.0\\ 53.5\end{array}$	$\begin{array}{r} 40\\ 141\\ 42\\ 43\\ 44\\ 45\\ 46\\ 47\\ 48\\ 49\\ 50\\ 151\\ 52\\ 53\\ 54\\ 55\\ 56\\ 57\\ 58\\ 9\\ 60\\ 161\end{array}$	$\begin{array}{c} 118.7\\ 119.6\\ 120.4\\ 121.3\\ 122.1\\ 123.0\\ 123.8\\ 124.7\\ 125.5\\ 126.4\\ 127.2\\ 128.9\\ 128.9\\ 129.8\\ 130.6\\ 131.4\\ 128.9\\ 129.8\\ 130.6\\ 131.4\\ 132.3\\ 133.1\\ 134.0\\ 134.8\\ 135.7\\ 136.5\end{array}$	$\begin{array}{c} 74.2\\ 74.7\\ 75.2\\ 75.8\\ 76.3\\ 76.8\\ 77.9\\ 78.4\\ 79.0\\ 79.5\\ 80.5\\ 81.1\\ 81.6\\ 82.1\\ 83.2\\ 83.7\\ 83.2\\ 83.7\\ 83.2\\ 83.7\\ 84.3\\ 85.3\\ \end{array}$	$\begin{array}{c} 200\\ \hline 201\\ 02\\ 03\\ 04\\ 05\\ 06\\ 07\\ 08\\ 09\\ 10\\ \hline 211\\ 12\\ 13\\ 14\\ 15\\ 16\\ 17\\ 18\\ 19\\ 20\\ \hline 221\\ \end{array}$	$\begin{array}{c} 169.\ 6\\ 170.\ 5\\ 171.\ 3\\ 172.\ 2\\ 173.\ 0\\ 173.\ 8\\ 174.\ 5\\ 175.\ 5\\ 176.\ 4\\ 177.\ 2\\ 178.\ 9\\ 179.\ 8\\ 180.\ 6\\ 181.\ 5\\ 182.\ 3\\ 183.\ 2\\ 184.\ 0\\ 184.\ 9\\ 185.\ 7\\ 186.\ 6\\ 187.\ 4\end{array}$	$\begin{array}{c} 106.\ 0\\ 106.\ 5\\ 107.\ 0\\ 107.\ 6\\ 108.\ 1\\ 108.\ 6\\ 109.\ 2\\ 110.\ 2\\ 110.\ 2\\ 110.\ 2\\ 110.\ 2\\ 110.\ 2\\ 110.\ 2\\ 111.\ 3\\ 111.\ 3\\ 112.\ 9\\ 113.\ 4\\ 113.\ 9\\ 114.\ 5\\ 115.\ 0\\ 115.\ 5\\ 115.\ 0\\ 115.\ 5\\ 116.\ 6\\ 117.\ 1\end{array}$	$\begin{array}{c} 60\\ \hline 261\\ 62\\ 63\\ 64\\ 65\\ 66\\ 67\\ 68\\ 69\\ 70\\ \hline 271\\ 72\\ 73\\ 74\\ 75\\ 76\\ 77\\ 78\\ 79\\ 80\\ \hline 281\\ \end{array}$	$\begin{array}{c} 220, 5\\ 221, 3\\ 222, 2\\ 223, 0\\ 223, 9\\ 224, 7\\ 225, 6\\ 226, 4\\ 227, 3\\ 228, 1\\ 229, 0\\ 229, 0\\ 229, 8\\ 230, 7\\ 231, 5\\ 232, 4\\ 233, 2\\ 233, 4\\ 233, 2\\ 234, 9\\ 235, 8\\ 236, 8\\ 237, 5\\ 238, 3\\ \end{array}$	$\begin{array}{c} 137.8\\ 138.3\\ 138.3\\ 139.9\\ 140.4\\ 141.5\\ 142.0\\ 141.5\\ 142.0\\ 142.5\\ 143.1\\ 143.6\\ 144.1\\ 144.7\\ 145.2\\ 145.7\\ 146.3\\ 146.8\\ 147.3\\ 146.8\\ 147.3\\ 146.8\\ 147.3\\ 146.8\\ 147.3\\ 148.9\\ \end{array}$
$ \begin{array}{r} 42\\ 43\\ 44\\ 45\\ 46\\ 47\\ 48\\ 49\\ 50\\ \end{array} $	$\begin{array}{c} 35.6\\ 36.5\\ 37.3\\ 38.2\\ 39.0\\ 39.9\\ 40.7\\ 41.6\\ 42.4 \end{array}$	$\begin{array}{c} 22.3\\ 22.8\\ 23.3\\ 23.8\\ 24.4\\ 24.9\\ 25.4\\ 26.0\\ 26.5\\ \end{array}$	$\begin{array}{c} 02\\ 03\\ 04\\ 05\\ 06\\ 07\\ 08\\ 09\\ 10\\ \end{array}$	$\begin{array}{c} 86.5 \\ 87.3 \\ 88.2 \\ 89.0 \\ 89.9 \\ 90.7 \\ 91.6 \\ 92.4 \\ 93.3 \end{array}$	$54.1 \\ 54.6 \\ 55.1 \\ 55.6 \\ 56.2 \\ 56.7 \\ 57.2 \\ 57.8 \\ 58.3 \\$	$ \begin{array}{c} 62\\ 63\\ 64\\ 65\\ 66\\ 67\\ 68\\ 69\\ 70\\ \end{array} $	$\begin{array}{c} 137. \ 4\\ 138. \ 2\\ 139. \ 1\\ 139. \ 9\\ 140. \ 8\\ 141. \ 6\\ 142. \ 5\\ 143. \ 3\\ 144. \ 2\end{array}$	85.8 86.4 86.9 87.4 88.0 88.5 89.0 89.6 90.1	$ \begin{array}{r} 22 \\ 23 \\ 24 \\ 25 \\ 26 \\ 27 \\ 28 \\ 29 \\ 30 \end{array} $	$\begin{array}{c} 188.3\\ 189.1\\ 190.0\\ 190.8\\ 191.7\\ 192.5\\ 193.4\\ 194.2\\ 195.1 \end{array}$	$\begin{array}{c} 117.6\\ 118.2\\ 118.7\\ 119.2\\ 119.8\\ 120.3\\ 120.8\\ 121.4\\ 121.9\end{array}$	82 83 84 85 86 87 88 89 90	$\begin{array}{c} 239.1 \\ 240.0 \\ 240.8 \\ 241.7 \\ 242.5 \\ 243.4 \\ 244.2 \\ 245.1 \\ 245.9 \end{array}$	$\begin{array}{c} 149.\ 4\\ 150.\ 0\\ 150.\ 5\\ 151.\ 0\\ 151.\ 6\\ 152.\ 1\\ 152.\ 6\\ 153.\ 1\\ 153.\ 7\end{array}$
$51 \\ 52 \\ 53 \\ 54 \\ 55 \\ 56 \\ 57 \\ 58 \\ 59 \\ 60$	$\begin{array}{c} 12.1\\ 43.3\\ 44.1\\ 44.9\\ 45.8\\ 46.6\\ 47.5\\ 48.3\\ 49.2\\ 50.0\\ 50.9\end{array}$	$\begin{array}{c} 27.0\\ 27.6\\ 28.1\\ 28.6\\ 29.1\\ 29.7\\ 30.2\\ 30.7\\ 31.3\\ 31.8 \end{array}$	$ \begin{array}{r} 10 \\ 111 \\ 12 \\ 13 \\ 14 \\ 15 \\ 16 \\ 17 \\ 18 \\ 19 \\ 20 \\ \end{array} $	$\begin{array}{c} 23.9\\ \hline 94.1\\ 95.0\\ 95.8\\ 96.7\\ 97.5\\ 98.4\\ 99.2\\ 100.1\\ 100.9\\ 101.8 \end{array}$	$\begin{array}{c} 53.8\\ 58.8\\ 59.4\\ 59.9\\ 60.4\\ 60.9\\ 61.5\\ 62.0\\ 62.5\\ 63.1\\ 63.6\end{array}$	$ \begin{array}{r} 171 \\ 72 \\ 73 \\ 74 \\ 75 \\ 76 \\ 77 \\ 78 \\ 79 \\ 80 \\ \end{array} $	$\begin{array}{c} 145.0\\ 145.9\\ 146.7\\ 147.6\\ 148.4\\ 149.3\\ 150.1\\ 151.0\\ 151.8\\ 152.6 \end{array}$	$\begin{array}{c} 90.6\\ 91.1\\ 91.7\\ 92.2\\ 92.7\\ 93.3\\ 93.8\\ 94.3\\ 94.9\\ 95.4 \end{array}$	$ \begin{array}{r} 33 \\ 231 \\ 32 \\ 33 \\ 34 \\ 35 \\ 36 \\ 37 \\ 38 \\ 39 \\ 40 \\ \end{array} $	$\begin{array}{r} 195.9\\ 195.9\\ 196.7\\ 197.6\\ 198.4\\ 199.3\\ 200.1\\ 201.0\\ 201.8\\ 202.7\\ 203.5 \end{array}$	$\begin{array}{c} 121.3\\ \hline 122.4\\ 122.9\\ 123.5\\ 124.0\\ 124.5\\ 125.1\\ 125.6\\ 126.1\\ 126.7\\ 127.2 \end{array}$	$ \begin{array}{r} 30 \\ \hline 291 \\ 92 \\ 93 \\ 94 \\ 95 \\ 96 \\ 97 \\ 98 \\ 99 \\ 300 \\ \end{array} $	$\begin{array}{c} 246.8\\ 247.6\\ 248.5\\ 249.3\\ 250.2\\ 251.0\\ 251.9\\ 252.7\\ 253.6\\ 254.4 \end{array}$	$\begin{array}{c} 153.1\\ \hline 154.2\\ 154.7\\ 155.3\\ 155.8\\ 156.3\\ 156.9\\ 157.4\\ 157.9\\ 158.4\\ 159.0 \end{array}$
Dist.	Dep.	Lat.	Dist.	Dep.	Lat.	Dist.	Dep.	Lat.	Dist.	Dep.	Lat.	Dist.	Dep.	Lat.
						58° (1	22°, 238	3°, 302°	°).					

						Т	ABLE	2 2.					[Page	e 431
]	Differe	ence of 1	Latitud	e and	Departı	ire for	32° (1	48°, 212	2°, 328°	°).		
Dist.	Lat.	Dep.	Dist.	Lat.	Dep.	Dist.	Lat.	Dep.	Dist.	Lat.	Dep.	Dist.	Lat.	Dep.
$\begin{array}{c} 301\\ 02\\ 03\\ 04\\ 05\\ 06\\ 07\\ 08\\ 09\\ 10\\ \hline 311\\ 12\\ 13\\ 14\\ 15\\ 16\\ 17\\ \end{array}$	$\begin{array}{c} 255.\ 3\\ 256.\ 1\\ 257.\ 0\\ 257.\ 8\\ 258.\ 7\\ 259.\ 5\\ 260.\ 4\\ 261.\ 2\\ 262.\ 1\\ 262.\ 9\\ 263.\ 8\\ 264.\ 6\\ 265.\ 8\\ 266.\ 3\\ 267.\ 1\\ 268.\ 0\\ 266.\ 8\\ 0\\ 267.\ 1\\ 268.\ 0\\ \end{array}$	$\begin{array}{c} 159.5\\ 160.0\\ 160.5\\ 161.1\\ 161.6\\ 162.1\\ 162.7\\ 163.2\\ 163.7\\ 164.3\\ 164.8\\ 165.3\\ 164.8\\ 165.4\\ 166.9\\ 167.4\\ 166.9\\ 167.4\\ 160.9\\ 167.4\\ 160.9\\ 167.4\\ 160.9\\ 167.4\\ 160.9\\ 160.4\\ 160.9\\ 160.4\\ 160.9\\ 160.4\\ 160.9\\ 160.4\\ 160.9\\ 160.4\\ 160.9\\ 160.4\\ 160.9\\ 160.4\\ 160.9\\ 160.4\\ 160.9\\ 160.4\\ 160.4\\ 160.5\\ 160.4\\ 100.4\\ 10$	$\begin{array}{c} 361 \\ 62 \\ 63 \\ 64 \\ 65 \\ 66 \\ 67 \\ 68 \\ 69 \\ 70 \\ \hline 371 \\ 72 \\ 73 \\ 74 \\ 75 \\ 76 \\ 77 \\ 76 \\ 77 \\ 77 \\ 77 \\ 77$	$\begin{array}{c} 306.\ 2\\ 307.\ 0\\ 307.\ 9\\ 308.\ 7\\ 309.\ 5\\ 310.\ 4\\ 311.\ 2\\ 312.\ 1\\ 312.\ 9\\ 313.\ 8\\ 314.\ 6\\ 315.\ 5\\ 316.\ 3\\ 317.\ 2\\ 318.\ 0\\ 318.\ 9\\ 318.\ 9\\ 310.\ 1\\ 318.\ 9\\ 310.\ 1\\ 310.\$	$\begin{array}{c} 191.\ 3\\ 191.\ 3\\ 192.\ 3\\ 192.\ 9\\ 193.\ 4\\ 193.\ 9\\ 194.\ 5\\ 195.\ 0\\ 195.\ 5\\ 195.\ 0\\ 195.\ 5\\ 196.\ 0\\ 196.\ 6\\ 197.\ 1\\ 197.\ 6\\ 198.\ 2\\ 198.\ 7\\ 199.\ 2\\ 198.\ 7\\ 199.\ 2\\ 199.\ 7\\ 199.\ 199.\ 19\\ 199.$	$\begin{array}{c} 421 \\ 222 \\ 233 \\ 244 \\ 255 \\ 266 \\ 277 \\ 288 \\ 299 \\ 300 \\ 431 \\ 322 \\ 333 \\ 344 \\ 355 \\ 366 \\ 367 \end{array}$	$\begin{array}{c} 357.\ 0\\ 357.\ 9\\ 358.\ 7\\ 359.\ 6\\ 360.\ 4\\ 361.\ 3\\ 362.\ 1\\ 362.\ 1\\ 363.\ 0\\ 363.\ 0\\ 363.\ 8\\ 364.\ 7\\ 365.\ 5\\ 366.\ 4\\ 367.\ 2\\ 368.\ 9\\ 368.\ 9\\ 368.\ 8\\ 9\\ 369.\ 8\\ 8\\ 8\\ 369.\ 8\\ 8\\ 369.\ 8\\ 8\\ 8\\ 369.\ 8\\ 8\\ 8\\ 8\\ 8\\ 8\\ 8\\ 8\\ 8\\ 8\\ 8\\ 8\\ 8\\ $	$\begin{array}{c} 223.1\\ 223.6\\ 224.1\\ 224.7\\ 225.2\\ 225.7\\ 226.3\\ 226.8\\ 227.3\\ 226.8\\ 227.3\\ 227.8\\ 228.9\\ 229.4\\ 228.9\\ 229.4\\ 230.0\\ 230.5\\ 231.0\\ 23$	481 82 83 84 85 86 87 88 89 90 491 92 93 94 95 96	$\begin{array}{c} 407. 9\\ 408. 8\\ 409. 6\\ 410. 5\\ 410. 5\\ 411. 3\\ 412. 2\\ 413. 0\\ 413. 9\\ 414. 7\\ 415. 6\\ 416. 4\\ 417. 3\\ 418. 1\\ 419. 0\\ 419. 8\\ 420. 6\\ 420. 6\end{array}$	$\begin{array}{c} 254.9\\ 255.4\\ 255.9\\ 256.5\\ 257.0\\ 257.5\\ 258.1\\ 258.6\\ 259.1\\ 259.6\\ 260.2\\ 260.7\\ 261.2\\ 261.8\\ 262.3\\ 262.8\\ 262.8\\ 262.8\end{array}$	$541 \\ 42 \\ 43 \\ 44 \\ 45 \\ 46 \\ 47 \\ 48 \\ 49 \\ 50 \\ 551 \\ 52 \\ 53 \\ 54 \\ 55 \\ 56 \\ -7 \\ -7 \\ -7 \\ -7 \\ -7 \\ -7 \\ -7 \\ -$	$\begin{array}{c} 458.\ 8\\ 459.\ 6\\ 460.\ 6\\ 461.\ 3\\ 462.\ 2\\ 463.\ 0\\ 463.\ 9\\ 464.\ 7\\ 465.\ 6\\ 466.\ 4\\ 467.\ 3\\ 468.\ 1\\ 469.\ 0\\ 469.\ 0\\ 469.\ 0\\ 469.\ 0\\ 470.\ 7\\ 471.\ 5\\ 471.\ 5\\ \end{array}$	$\begin{array}{c} 286.7\\ 287.2\\ 287.2\\ 288.3\\ 288.8\\ 289.9\\ 290.9\\ 290.9\\ 291.5\\ 292.0\\ 292.5\\ 293.6\\ 293.6\\ 294.1\\ 294.4\\ \end{array}$
18	268.8 269.7	168.0 168.5	78	320.6	199.8 200.3	$\frac{37}{38}$	370.6 371.5	231.0 232.1	97	421.0 422.3	263.4 263.9	$\frac{57}{58}$	472.4 473.2	295.2 295.7
$\frac{19}{20}$	$270.5 \\ 271.4$	$169.0 \\ 169.6$	79 80	$321.4 \\ 322.3$	200.8 201.3	$\frac{39}{40}$	$372.3 \\ 373.2$	232.6 233.1	$\begin{array}{c} 99 \\ 500 \end{array}$	$423.2 \\ 424.0$	264.4 265.0	$59 \\ 60$	$474.1 \\ 474.9$	296.2 296.7
$ \begin{array}{r} 321 \\ 22 \\ 23 \\ 24 \\ 25 \\ 26 \\ 27 \\ 28 \\ 29 \\ 30 \\ 331 \end{array} $	272.2 273.1 273.9 274.8 275.6 276.5 277.3 278.2 279.0 279.9 280.7	$\begin{array}{c} 170.1\\ 170.6\\ 171.1\\ 171.7\\ 172.2\\ 172.7\\ 173.3\\ 173.8\\ 174.3\\ 174.9\\ 175.4 \end{array}$	381 82 83 84 85 86 87 88 89 90 391	$\begin{array}{c} 323. 1 \\ 324. 0 \\ 324. 8 \\ 325. 7 \\ 326. 5 \\ 327. 4 \\ 328. 2 \\ 329. 1 \\ 329. 9 \\ 330. 8 \\ 331. 6 \end{array}$	$\begin{array}{c} 201. 9\\ 202. 4\\ 202. 9\\ 203. 5\\ 204. 0\\ 204. 5\\ 205. 1\\ 205. 6\\ 206. 1\\ 206. 6\\ 207. 2\end{array}$	$ \begin{array}{r} 441 \\ 42 \\ 43 \\ 44 \\ 45 \\ 46 \\ 47 \\ 48 \\ 49 \\ 50 \\ \overline{451} \end{array} $	$\begin{array}{r} 374.0\\ 374.8\\ 375.7\\ 376.5\\ 377.4\\ 378.2\\ 379.1\\ 379.9\\ 380.8\\ 381.6\\ 382.5\\ \end{array}$	$\begin{array}{c} 233.7\\ 234.2\\ 234.7\\ 235.3\\ 235.8\\ 236.3\\ 236.9\\ 237.4\\ 237.9\\ 238.4\\ 239.0 \end{array}$	$ \begin{array}{r} 501 \\ 02 \\ 03 \\ 04 \\ 05 \\ 06 \\ 07 \\ 08 \\ 09 \\ 10 \\ 511 \end{array} $	$\begin{array}{r} 424.9\\ 425.7\\ 426.6\\ 427.4\\ 428.3\\ 429.1\\ 430.0\\ 430.8\\ 431.7\\ 432.5\\ 433.4\end{array}$	$\begin{array}{c} 265.5\\ 266.0\\ 266.5\\ 267.1\\ 267.6\\ 268.1\\ 268.7\\ 269.2\\ 269.7\\ 270.3\\ 270.8 \end{array}$	$\begin{array}{c} 561 \\ 62 \\ 63 \\ 64 \\ 65 \\ 66 \\ 67 \\ 68 \\ 69 \\ 70 \\ 571 \end{array}$	$\begin{array}{r} 475.8\\ 476.6\\ 477.5\\ 478.3\\ 479.2\\ 480.0\\ 480.9\\ 481.7\\ 482.6\\ 483.4\\ \hline 484.3 \end{array}$	$\begin{array}{c} 297.3\\ 297.8\\ 298.3\\ 298.9\\ 299.4\\ 299.9\\ 300.5\\ 301.0\\ 301.5\\ 302.1\\ 302.6 \end{array}$
$32 \\ 33 \\ 34 \\ 35 \\ 36 \\ 37 \\ 38 \\ 39 \\ 40$	281. 6 282. 4 283. 3 284. 1 285. 0 285. 8 286. 7 287. 5 288. 3	175.9 176.4 177.0 177.5 178.0 178.6 179.1 179.6 180.2	92 93 94 95 96 97 98 99 400	332. 5 333. 3 334. 2 335. 0 335. 8 336. 7 337. 5 338. 4 339. 2	$\begin{array}{c} 207.7\\ 208.2\\ 208.8\\ 209.3\\ 209.8\\ 210.4\\ 210.9\\ 211.4\\ 211.9 \end{array}$	$52 \\ 53 \\ 54 \\ 55 \\ 56 \\ 57 \\ 58 \\ 59 \\ 60$	383.3 384.2 385.0 385.9 386.7 387.6 388.4 389.3 390.1	$\begin{array}{c} 239.5\\ 240.0\\ 240.6\\ 241.1\\ 241.6\\ 242.2\\ 242.2\\ 242.7\\ 243.2\\ 243.8 \end{array}$	$ \begin{array}{r} 12 \\ 13 \\ 14 \\ 15 \\ 16 \\ 17 \\ 18 \\ 19 \\ 20 \\ \end{array} $	$\begin{array}{c} 434.2\\ 435.1\\ 435.9\\ 436.8\\ 437.6\\ 438.5\\ 439.3\\ 440.2\\ 441.0\end{array}$	$\begin{array}{c} 271.4\\ 271.9\\ 272.4\\ 272.9\\ 273.5\\ 274.0\\ 274.5\\ 275.0\\ 275.6\\ \end{array}$	$\begin{array}{c} 72 \\ 73 \\ 74 \\ 75 \\ 76 \\ 77 \\ 78 \\ 79 \\ 80 \end{array}$	$\begin{array}{c} 485.1 \\ 486.0 \\ 486.8 \\ 487.7 \\ 488.5 \\ 489.4 \\ 490.2 \\ 491.1 \\ 491.9 \end{array}$	303. 2 303. 7 304. 2 304. 7 305. 3 305. 8 306. 3 306. 8 307. 4
$\begin{array}{r} 341 \\ 42 \\ 43 \\ 44 \\ 45 \\ 46 \\ 47 \\ 48 \\ 49 \\ 50 \\ 351 \\ 52 \\ 53 \\ 54 \end{array}$	$\begin{array}{r} \hline 289.2 \\ 290.0 \\ 290.9 \\ 291.7 \\ 292.6 \\ 293.4 \\ 294.3 \\ 295.1 \\ 296.0 \\ 296.8 \\ \hline 297.7 \\ 298.5 \\ 299.5 \\ 300.9 \\ \end{array}$	$\begin{array}{c} 180.7\\ 181.2\\ 181.7\\ 182.3\\ 182.8\\ 183.3\\ 183.9\\ 184.4\\ 184.9\\ 185.4\\ 186.0\\ 186.5\\ 187.0\\ 187.6\\ \end{array}$	$\begin{array}{r} 401\\ 02\\ 03\\ 04\\ 05\\ 06\\ 07\\ 08\\ 09\\ 10\\ \hline 411\\ 12\\ 13\\ 14\\ \end{array}$	$\begin{array}{r} 340.1\\ 340.9\\ 341.8\\ 342.6\\ 343.5\\ 344.3\\ 345.2\\ 346.0\\ 346.9\\ 347.7\\ \hline 348.6\\ 349.4\\ 350.3\\ 351.1\\ \end{array}$	$\begin{array}{c} 212.5\\ 213.0\\ 213.5\\ 214.1\\ 214.6\\ 215.1\\ 215.7\\ 216.2\\ 216.7\\ 217.8\\ 217.8\\ 218.3\\ 218.3\\ 218.8\\ 310.4\\ \end{array}$	$\begin{array}{r} 461\\62\\63\\64\\65\\66\\67\\68\\69\\70\\\hline 471\\72\\73\\74\end{array}$	$\begin{array}{c} 391. \\ 0\\ 391. \\ 8\\ 392. \\ 7\\ 393. \\ 5\\ 394. \\ 4\\ 395. \\ 2\\ 396. \\ 9\\ 397. \\ 7\\ 398. \\ 6\\ 399. \\ 4\\ 400. \\ 3\\ 401. \\ 1\\ 402. \\ 0\end{array}$	$\begin{array}{c} 244.\ 3\\ 244.\ 8\\ 245.\ 9\\ 245.\ 9\\ 246.\ 9\\ 247.\ 5\\ 248.\ 0\\ 247.\ 5\\ 248.\ 0\\ 248.\ 5\\ 249.\ 0\\ 249.\ 6\\ 250.\ 6\\ 250.\ 1\\ 250.\ 6\\ 251.\ 2\\ \end{array}$	$\begin{array}{c} 521\\ 22\\ 23\\ 24\\ 25\\ 26\\ 27\\ 28\\ 29\\ 30\\ \hline 531\\ 32\\ 33\\ 34\\ \end{array}$	$\begin{array}{r} \hline 441.9\\ 442.7\\ 443.6\\ 444.4\\ 445.3\\ 446.9\\ 447.8\\ 446.6\\ 449.5\\ 450.3\\ 451.1\\ 452.0\\ 452.8\\ \end{array}$	$\begin{array}{c} 276.1\\ 276.6\\ 277.2\\ 277.7\\ 278.2\\ 278.7\\ 279.3\\ 279.8\\ 280.3\\ 280.9\\ 281.4\\ 281.4\\ 281.9\\ 282.4\\ 282.0\\ \end{array}$	$\begin{array}{c} 581\\ 82\\ 83\\ 84\\ 85\\ 86\\ 87\\ 88\\ 89\\ 90\\ \overline{591}\\ 92\\ 93\\ 94\\ \end{array}$	$\begin{array}{r} 492.8\\ 493.6\\ 494.5\\ 495.3\\ 496.2\\ 497.0\\ 497.8\\ 498.7\\ 499.5\\ 500.3\\ 501.2\\ 502.0\\ 502.9\\ 503.7\end{array}$	$\begin{array}{c} 307. \ 9\\ 308. \ 4\\ 309. \ 0\\ 309. \ 5\\ 310. \ 0\\ 310. \ 5\\ 311. \ 1\\ 311. \ 6\\ 312. \ 1\\ 312. \ 6\\ 313. \ 2\\ 313. \ 7\\ 314. \ 2\\ 314. \ 8\end{array}$
$ \begin{array}{r} 54 \\ 55 \\ 56 \\ 57 \\ 58 \\ 59 \\ 60 \\ \hline 60 \\ \hline } $	300. 2 301. 1 301. 9 302. 8 303. 6 304. 5 305. 3	187.6 188.1 188.6 189.2 189.7 190.2 190.8	$ \begin{array}{r} 14 \\ 15 \\ 16 \\ 17 \\ 18 \\ 19 \\ 20 \\ \end{array} $	351.1 352.0 352.8 353.6 354.5 355.3 356.2	$\begin{array}{c} 219.4\\ 219.9\\ 220.4\\ 221.0\\ 221.5\\ 222.0\\ 222.5\\ \end{array}$	74 75 76 77 78 79 80	$\begin{array}{r} +02.0\\ +02.8\\ +03.7\\ +04.5\\ +05.4\\ +06.2\\ +07.1 \end{array}$	$\begin{array}{c} 251.2\\ 251.7\\ 252.2\\ 252.8\\ 253.3\\ 253.8\\ 253.8\\ 254.3\\ \end{array}$	34 35 36 37 38 39 40	$\begin{array}{c} 452.8\\ 453.7\\ 454.5\\ 455.4\\ 456.2\\ 457.1\\ 457.9\end{array}$	$\begin{array}{c} 283.0\\ 283.5\\ 284.0\\ 284.6\\ 285.1\\ 285.6\\ 286.2\\ \end{array}$	94 95 96 97 98 99 600	$\begin{array}{c} 503.\ 7\\ 504.\ 6\\ 505.\ 4\\ 506.\ 2\\ 507.\ 1\\ 508.\ 0\\ 508.\ 8\end{array}$	$\begin{array}{c} 314.8\\ 315.3\\ 315.8\\ 316.4\\ 316.9\\ 317.4\\ 318.0 \end{array}$
Dist.	Dep.	Lat.	Dist.	Dep.	Lat.	Dist.	Dep.	Lat.	Dist.	Dep.	Lat.	Dist.	Dep.	Lat.
					õ	8° (1	22°, 238	°, 302°).					

Pa	ge 432]				Т	ABLE	2.2.						
			Differ	ence of 1	Latitud	e and	Departu	ire for	33° (1	47°, 213	3°, 327°	?).		
Dist.	Lat.	Dep.	Dist.	Lat.	Dep.	Dist.	Lat.	Dep.	Dist.	Lat.	Dep.	Dist.	Lat.	Dep.
$ \begin{array}{c} 1\\2\\3\\4\\5\\6\\7\\8\\9\\10\\11\\12\\13\end{array} $	$\begin{array}{c} 0.8\\ 1.7\\ 2.5\\ 3.4\\ 4.2\\ 5.0\\ 5.9\\ 6.7\\ 7.5\\ 8.4\\ \hline 9.2\\ 10.1\\ 10.9\\ \end{array}$	$\begin{array}{c} 0.5\\ 1.1\\ 1.6\\ 2.2\\ 2.7\\ 3.3\\ 3.8\\ 4.4\\ 4.9\\ 5.4\\ \hline 6.0\\ 6.5\\ 7.1\\ \end{array}$	$\begin{array}{c} 61\\ 62\\ 63\\ 64\\ 65\\ 66\\ 67\\ 68\\ 69\\ 70\\ \hline 71\\ 72\\ 73\\ \hline 73\\ \end{array}$	$51.2 \\ 52.0 \\ 52.8 \\ 53.7 \\ 54.5 \\ 55.4 \\ 56.2 \\ 57.0 \\ 57.9 \\ 58.7 \\ 59.5 \\ 60.4 \\ 61.2 \\ $	$\begin{array}{c} 33.2\\ 33.8\\ 34.3\\ 34.9\\ 35.4\\ 35.9\\ 36.5\\ 37.0\\ 37.6\\ 38.1\\ 38.7\\ 39.2\\ 39.8 \end{array}$	$\begin{array}{c} 121\\ 22\\ 23\\ 24\\ 25\\ 26\\ 27\\ 28\\ 29\\ 30\\ \hline 131\\ 32\\ 33\\ \end{array}$	$\begin{array}{c} 101.5\\ 102.3\\ 103.2\\ 104.0\\ 104.8\\ 105.7\\ 106.5\\ 107.3\\ 108.2\\ 109.0\\ \hline 109.9\\ 110.7\\ 111.5\\ \end{array}$	$\begin{array}{c} 65.\ 9\\ 66.\ 4\\ 67.\ 0\\ 67.\ 5\\ 68.\ 1\\ 68.\ 6\\ 69.\ 2\\ 69.\ 7\\ 70.\ 3\\ 70.\ 8\\ \hline 71.\ 3\\ 71.\ 9\\ 72.\ 4 \end{array}$	$ 181 \\ 82 \\ 83 \\ 84 \\ 85 \\ 86 \\ 87 \\ 88 \\ 89 \\ 90 \\ 191 \\ 92 \\ 93 $	$\begin{array}{c} 151.8\\ 152.6\\ 153.5\\ 154.3\\ 155.2\\ 156.0\\ 156.8\\ 157.7\\ 158.5\\ 159.3\\ \hline 160.2\\ \cdot 161.0\\ 161.9 \end{array}$	$\begin{array}{c} 98.\ 6\\ 99.\ 1\\ 99.\ 7\\ 100.\ 2\\ 100.\ 8\\ 101.\ 3\\ 101.\ 8\\ 102.\ 4\\ 102.\ 9\\ 103.\ 5\\ 104.\ 0\\ 104.\ 6\\ 105.\ 1\end{array}$	$241 \\ 42 \\ 43 \\ 44 \\ 45 \\ 46 \\ 47 \\ 48 \\ 49 \\ 50 \\ 251 \\ 52 \\ 53 \\ 53 \\ 53 \\ 51 \\ 52 \\ 53 \\ 53 \\ 53 \\ 51 \\ 51 \\ 52 \\ 53 \\ 53 \\ 51 \\ 51 \\ 51 \\ 51 \\ 51 \\ 51$	$\begin{array}{c} 202.1\\ 203.0\\ 203.8\\ 204.6\\ 205.5\\ 206.3\\ 207.2\\ 208.0\\ 208.8\\ 209.7\\ 210.5\\ 211.3\\ 212.2 \end{array}$	$\begin{array}{c} 131.3\\ 131.8\\ 132.3\\ 132.9\\ 133.4\\ 134.0\\ 134.5\\ 135.6\\ 136.2\\ \hline 136.7\\ 137.2\\ 137.8\\ \end{array}$
$ \begin{array}{r} 14 \\ 15 \\ 16 \\ 17 \\ 18 \\ 19 \\ 20 \\ 20 \\ \end{array} $	$11.7 \\ 12.6 \\ 13.4 \\ 14.3 \\ 15.1 \\ 15.9 \\ 16.8$	7.6 8.2 8.7 9.3 9.8 10.3 10.9	$74 \\ 75 \\ 76 \\ 77 \\ 78 \\ 79 \\ 80$	$\begin{array}{c} 62.1 \\ 62.9 \\ 63.7 \\ 64.6 \\ 65.4 \\ 66.3 \\ 67.1 \end{array}$	$\begin{array}{r} 40.3 \\ 40.8 \\ 41.4 \\ 41.9 \\ 42.5 \\ 43.0 \\ 43.6 \end{array}$	$ \begin{array}{r} 34 \\ 35 \\ 36 \\ 37 \\ 38 \\ 39 \\ 40 \end{array} $	112. 4113. 2114. 1114. 9115. 7116. 6117. 4	$\begin{array}{c} 73.0\\ 73.5\\ 74.1\\ 74.6\\ 75.2\\ 75.7\\ 76.2 \end{array}$	$94 \\ 95 \\ 96 \\ 97 \\ 98 \\ 99 \\ 200$	$\begin{array}{c} 162.\ 7\\ 163.\ 5\\ 164.\ 4\\ 165.\ 2\\ 166.\ 1\\ 166.\ 9\\ 167.\ 7\end{array}$	$105.7 \\ 106.2 \\ 106.7 \\ 107.3 \\ 107.8 \\ 108.4 \\ 108.9$	$54 \\ 55 \\ 56 \\ 57 \\ 58 \\ 59 \\ 60$	$\begin{array}{c} 213. \ 0\\ 213. \ 9\\ 214. \ 7\\ 215. \ 5\\ 216. \ 4\\ 217. \ 2\\ 218. \ 1\end{array}$	$138.3 \\ 138.9 \\ 139.4 \\ 140.0 \\ 140.5 \\ 141.1 \\ 141.6$
$ \begin{array}{r} 21 \\ 22 \\ 23 \\ 24 \\ 25 \\ 26 \\ 27 \\ 28 \\ 29 \\ 30 \\ \end{array} $	$\begin{array}{c} 17. \ 6\\ 18. \ 5\\ 19. \ 3\\ 20. \ 1\\ 21. \ 0\\ 21. \ 8\\ 22. \ 6\\ 23. \ 5\\ 24. \ 3\\ 25. \ 2 \end{array}$	$\begin{array}{c} 11.4\\ 12.0\\ 12.5\\ 13.1\\ 13.6\\ 14.2\\ 14.7\\ 15.2\\ 15.8\\ 16.3\\ \end{array}$	$ \begin{array}{r} 81 \\ 82 \\ 83 \\ 84 \\ 85 \\ 86 \\ 87 \\ 88 \\ $	$\begin{array}{c} 67.9\\ 68.8\\ 69.6\\ 70.4\\ 71.3\\ 72.1\\ 73.0\\ 73.8\\ 74.6\\ 75.5\end{array}$	$\begin{array}{r} 44.1\\ 44.7\\ 45.2\\ 45.7\\ 46.3\\ 46.8\\ 47.4\\ 47.9\\ 48.5\\ 49.0 \end{array}$	$ \begin{array}{r} 141 \\ 42 \\ 43 \\ 44 \\ 45 \\ 46 \\ 47 \\ 48 \\ 49 \\ 50 \\ 50 \end{array} $	$\begin{array}{c} 118.3\\119.1\\119.9\\120.8\\121.6\\122.4\\123.3\\124.1\\125.0\\125.8\\\end{array}$	76.8 77.3 77.9 78.4 79.0 79.5 80.1 80.6 81.2 81.7	$201 \\ 02 \\ 03 \\ 04 \\ 05 \\ 06 \\ 07 \\ 08 \\ 09 \\ 10$	$\begin{array}{c} 168.6\\ 169.4\\ 170.3\\ 171.1\\ 171.9\\ 172.2\\ 173.6\\ 174.4\\ 175.3\\ 176.1 \end{array}$	$\begin{array}{c} 109.5\\ 110.0\\ 110.6\\ 111.1\\ 111.7\\ 112.2\\ 112.7\\ 113.3\\ 113.8\\ 114.4 \end{array}$	$ \begin{array}{r} 261 \\ 62 \\ 63 \\ 64 \\ 65 \\ 66 \\ 67 \\ 68 \\ 69 \\ 70 \\ 70 \end{array} $	$\begin{array}{c} 218.9\\ 219.7\\ 220.6\\ 221.4\\ 222.2\\ 223.1\\ 223.9\\ 224.8\\ 225.6\\ 226.4 \end{array}$	$\begin{array}{r} \hline 142.2 \\ 142.7 \\ 143.2 \\ 143.8 \\ 144.3 \\ 144.9 \\ 145.4 \\ 146.0 \\ 146.5 \\ 147.1 \end{array}$
$31 \\ 32 \\ 33 \\ 34 \\ 35 \\ 36 \\ 37 \\ 38 \\ 39 \\ 40$	$\begin{array}{c} 26.\ 0\\ 26.\ 8\\ 27.\ 7\\ 28.\ 5\\ 29.\ 4\\ 30.\ 2\\ 31.\ 0\\ 31.\ 9\\ 32.\ 7\\ 33.\ 5\end{array}$	$\begin{array}{c} 16.9\\ 17.4\\ 18.0\\ 18.5\\ 19.1\\ 19.6\\ 20.2\\ 20.7\\ 21.2\\ 21.8 \end{array}$	$91 \\ 92 \\ 93 \\ 94 \\ 95 \\ 96 \\ 97 \\ 98 \\ 99 \\ 100$	$\begin{array}{c} 76.3\\ 77.2\\ 78.0\\ 78.8\\ 79.7\\ 80.5\\ 81.4\\ 82.2\\ 83.0\\ 83.9 \end{array}$	$\begin{array}{r} 49.\ 6\\ 50.\ 1\\ 50.\ 7\\ 51.\ 2\\ 51.\ 7\\ 52.\ 3\\ 52.\ 8\\ 53.\ 4\\ 53.\ 9\\ 54.\ 5\end{array}$	$ \begin{array}{r} 151 \\ 52 \\ 53 \\ 54 \\ 55 \\ 56 \\ 57 \\ 58 \\ 59 \\ 60 \\ \end{array} $	$\begin{array}{c} 126.\ 6\\ 127.\ 5\\ 128.\ 3\\ 129.\ 2\\ 130.\ 0\\ 130.\ 8\\ 131.\ 7\\ 132.\ 5\\ 133.\ 3\\ 134.\ 2\\ \end{array}$	$\begin{array}{c} 82.2\\ 82.8\\ 83.3\\ 83.9\\ 84.4\\ 85.0\\ 85.5\\ 86.1\\ 86.6\\ 87.1 \end{array}$	$211 \\ 12 \\ 13 \\ 14 \\ 15 \\ 16 \\ 17 \\ 18 \\ 19 \\ 20$	$\begin{array}{c} 177.\ 0\\ 177.\ 8\\ 178.\ 6\\ 179.\ 5\\ 180.\ 3\\ 181.\ 2\\ 182.\ 0\\ 182.\ 8\\ 183.\ 7\\ 184.\ 5\end{array}$	$\begin{array}{c} 114.9\\ 115.5\\ 116.0\\ 116.6\\ 117.1\\ 117.6\\ 118.2\\ 118.7\\ 119.3\\ 119.8 \end{array}$	$271 \\ 72 \\ 73 \\ 74 \\ 75 \\ 76 \\ 77 \\ 78 \\ 79 \\ 80$	$\begin{array}{r} 227.3\\ 228.1\\ 229.0\\ 229.8\\ 230.6\\ 231.5\\ 232.3\\ 233.2\\ 234.0\\ 234.8\\ \end{array}$	$\begin{array}{c} 147.\ 6\\ 148.\ 1\\ 148.\ 7\\ 149.\ 2\\ 149.\ 8\\ 150.\ 3\\ 150.\ 9\\ 151.\ 4\\ 152.\ 0\\ 152.\ 5\end{array}$
$ \begin{array}{r} 41\\ 42\\ 43\\ 44\\ 45\\ 46\\ 47\\ 48\\ 49\\ 50\\ \end{array} $	$\begin{array}{c} 34.4\\ 35.2\\ 36.1\\ 36.9\\ 37.7\\ 38.6\\ 39.4\\ 40.3\\ 41.1\\ 41.9\end{array}$	$\begin{array}{c} 22.3\\ 22.9\\ 23.4\\ 24.0\\ 24.5\\ 25.1\\ 25.6\\ 26.1\\ 26.7\\ 27.2 \end{array}$	$ \begin{array}{r} 101 \\ 02 \\ 03 \\ 04 \\ 05 \\ 06 \\ 07 \\ 08 \\ 09 \\ 10 \\ \end{array} $	$\begin{array}{c} 84.7\\ 85.5\\ 86.4\\ 87.2\\ 88.1\\ 88.9\\ 89.7\\ 90.6\\ 91.4\\ 92.3\end{array}$	55.0 55.6 56.1 56.6 57.2 57.7 58.3 58.8 59.4 59.9	$ \begin{array}{r} 161 \\ 62 \\ 63 \\ 64 \\ 65 \\ 66 \\ 67 \\ 68 \\ 69 \\ 70 \\ \hline \end{array} $	$\begin{array}{c} 135.0\\ -135.9\\ 136.7\\ 137.5\\ 138.4\\ 139.2\\ 140.1\\ 140.9\\ 141.7\\ 142.6 \end{array}$	$\begin{array}{c} 87.7\\ 88.2\\ 88.8\\ 89.3\\ 89.9\\ 90.4\\ 91.0\\ 91.5\\ 92.0\\ 92.6\end{array}$	$221 \\ 22 \\ 23 \\ 24 \\ 25 \\ 26 \\ 27 \\ 28 \\ 29 \\ 30$	$185.3 \\ 186.2 \\ 187.0 \\ 187.9 \\ 188.7 \\ 189.5 \\ 190.4 \\ 191.2 \\ 192.1 \\ 192.9$	$\begin{array}{c} 120.\ 4\\ 120.\ 9\\ 121.\ 5\\ 122.\ 0\\ 122.\ 5\\ 123.\ 1\\ 123.\ 6\\ 124.\ 2\\ 124.\ 7\\ 125.\ 3\end{array}$	$281 \\ 82 \\ 83 \\ 84 \\ 85 \\ 86 \\ 87 \\ 88 \\ 89 \\ 90 \\ 90 \\ 10$	$\begin{array}{c} 235.\ 7\\ 236.\ 5\\ 237.\ 3\\ 238.\ 2\\ 239.\ 0\\ 239.\ 9\\ 240.\ 7\\ 241.\ 5\\ 242.\ 4\\ 243.\ 2\end{array}$	$\begin{array}{c} 153.0\\ 153.6\\ 154.1\\ 154.7\\ 155.2\\ 155.8\\ 156.3\\ 156.9\\ 157.4\\ 157.9\end{array}$
$51 \\ 52 \\ 53 \\ 54 \\ 55 \\ 56 \\ 57 \\ 58 \\ 59 \\ 60$	$\begin{array}{c} 42.8\\ 43.6\\ 44.4\\ 45.3\\ 46.1\\ 47.0\\ 47.8\\ 48.6\\ 49.5\\ 50.3\end{array}$	$\begin{array}{c} 27.8\\ 28.3\\ 28.9\\ 29.4\\ 30.0\\ 30.5\\ 31.0\\ 31.6\\ 32.1\\ 32.7 \end{array}$	$ \begin{array}{r} 111 \\ 12 \\ 13 \\ 14 \\ 15 \\ 16 \\ 17 \\ 18 \\ 19 \\ 20 \\ \end{array} $	$\begin{array}{c} 93.1\\ 93.9\\ 94.8\\ 95.6\\ 96.4\\ 97.3\\ 98.1\\ 99.0\\ 99.8\\ 100.6\end{array}$	$\begin{array}{c} 60.5\\ 61.0\\ 61.5\\ 62.1\\ 62.6\\ 63.2\\ 63.7\\ 64.3\\ 64.8\\ 65.4 \end{array}$	$ \begin{array}{r} 171 \\ 72 \\ 73 \\ 74 \\ 75 \\ 76 \\ 77 \\ 78 \\ 79 \\ 80 \\ \end{array} $	$143. 4 \\ 144. 3 \\ 145. 1 \\ 145. 9 \\ 146. 8 \\ 147, 6 \\ 148. 4 \\ 149. 3 \\ 150. 1 \\ 151. 0$	$\begin{array}{c} 93.1\\ 93.7\\ 94.2\\ 94.8\\ 95.3\\ 95.9\\ 96.4\\ 96.9\\ 97.5\\ 98.0\\ \end{array}$	$231 \\ 32 \\ 33 \\ 34 \\ 35 \\ 36 \\ 37 \\ 38 \\ 39 \\ 40$	$\begin{array}{c} 193.\ 7\\ 194.\ 6\\ 195.\ 4\\ 196.\ 2\\ 197.\ 1\\ 197.\ 9\\ 198.\ 8\\ 199.\ 6\\ 200.\ 4\\ 201.\ 3\end{array}$	$125.8 \\ 126.4 \\ -126.9 \\ 127.4 \\ 128.0 \\ 128.5 \\ 129.1 \\ 129.6 \\ 130.2 \\ 130.7 \\ 130.7 \\ 120.6 \\ 130.7 \\ 120.6 \\ 130.7 \\ 120.6 \\ 130.7 \\ 120.6 \\ 130.7 \\ 120.6 \\ 130.7 \\ 120.6 \\ 130.7 \\ 120.6 \\ 130.7 \\ 120.6 \\ 130.7 \\ 120.6 \\ 130.7 \\ 120.6 \\ 130.7 \\ 120.6 \\ 130.7 \\ 120.6 \\ 130.7 \\ 120.6 \\ 130.7 \\ 120.6 \\ 130.7 \\ 120.6 \\ 120$	291 92 93 94 95 96 97 98 99 300	$\begin{array}{c} 244. 1 \\ 244. 9 \\ 245. 7 \\ 246. 6 \\ 247. 4 \\ 248. 2 \\ 249. 1 \\ 249. 9 \\ 250. 8 \\ 251. 6 \end{array}$	$\begin{array}{c} 158.5\\ 159.0\\ 159.6\\ 160.1\\ 160.7\\ 161.2\\ 161.8\\ 162.3\\ 162.8\\ 163.4 \end{array}$
Dist.	Dep.	Lat.	Dist.	Dep.	Lat.	Dist.	Dep.	Lat,	Dist.	Dep.	Lat.	Dist.	Dep.	Lat.
					Ę	ov (1	23°, 237	, 303°).					

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						Г	ABLI	E 2.					[Page	433
			Differ€	ence of 1	Latitud	e and	Depart	ure for	33° (1	47°, 21	3°, 327°	°).		
Dist.	Lat.	Dep.	Dist.	Lat.	Dep.	Dist.	Lat.	Dep.	Dist.	Lat.	Dep.	Dist.	Lat.	Dep.
301 02	252.4	163.9	$\frac{361}{62}$	302.8 303.6	196.6 197 1	$\frac{421}{22}$	353.1 353.9	229.3 229.8	481 82	403.4 404.2	262.0 262.5	$541 \\ 42$	453.7 454.6	294.6 295.9
03	254.1	165.0	63	304.4	197.7	23	354.7	230.4	83	405.1	263.1	43	455.4	295.7
04	255.0	165.5	64	305.3	198.2	24	355.6	230.9	84	405.9	263.6	44	456.2	296.2
05	255.8	166.1	65	306.1	198.8	25	356.4	231.4	85	406.7	264.1	45	457.1	296.8
06	256.6	166.6	66	307.0	199.3	26	357.3	232.0	86	407.6	264.7	46	457.9	297.3
07	257.5	$ \frac{167.2}{167.2} $	67	307.8	199.8	27	358.1	232.5	87	± 100.2	265.2	+1	408.8	297.9
08	208.0	164.7	00 60	308.0	200.4	20	359.0	233 6	89	409.5	266 3	48	459.0	298.4
10	260.0	168.8		310.3	200.5 201.5	30	360.6	234.2	90	411.0	266.8	50	461.3	299.5
311	260.8	169.3	371	311.2	$\frac{202.0}{202.0}$	431	361.5	234.7	491	411.8	267.4	551	462.1	300.1
12	261.7	169.9	72	312.0	202.6	32	362.3	235.2	92	412.6	267.9	52	463.0	300.6
13	262.5	170.4	73	312.8	203.1	- 33	363.1	235.8	-93	413.5	268.5	53	463.8	301.2
14	263.3	171.0	74	313.7	203.7	- 34	364.0	236.3	94	414.3	269.0	54	464.6	301.7
15	264.2	171.5	75	314.5	204.2	35	364.8	236.9	95	415.1	269.6	55	465.5	302.3
16	265.0	172.1	76	315.3	204.7	36	360.7	231.4	96	416.0	270.1	56	466.3	302.9
17	205.9	172.0	78	310.2	205.8	20	367 3	238.5	97	417 6	270.7	59	407.2	- 303. 4 - 303. 4
10	267 5	173.2 173.7	$\frac{70}{79}$	317.0 317.9	206.4	39	368.2	239.1	99	418.5	271.8	59	468.8	304.5
20	268.4	174.2	80	318.7	206.9	40	369.0	239.6	500	419.3	272.3	60	469.7	305.0
321	269.2	174.8	381	319.5	207.5	441	369.9	240.1	501	420.2	272.8	561	470.5	305.5
22	270.1	175.3	82	320.4	208.0	42	370.7	240.7	02	421.0	273.4	62	471.3	306.1
23	270.9	175.9	83	321.2	208.6	43	371.5	241.2	03	421.9	273.9	63	472.2	306.6
24	271.7	176.4	84	322.1	209.1	-44	372.4	241.8	04	422.7	274.5	64	473.0	307.2
25	272.6	177.0	85	322.9	209.6	45	3/3.2	242.3	05	423.5	275.0	65	473.8	307.7
26	213.4	179 1	80 97	323.7 29.1 G	210.2	40	374.1	242.9	00	424.4	270.0	00 87	175 5	308.3
21	275.1	178.6	88	324.0 325.4	210.7	48	375 7	245.4	08	426.0	276.1	68	476 4	309.3
29	275.9	179.1	89	326.2	211.8	49	376.6	244.5	09	426.9	277.2	69	477.2	309.9
30	276.8	179.7	90	327.1	212.4	50	377.4	245.1	10	427.7	277.8	70	478.0	310.4
331	277.6	180.2	391	327.9	212.9	451	378.2	245.6	511	428.5	278.3	571	478.9	311.0
32	278.4	180.8	92	328.8	213.5	52	379.1	246.1	12	429.4	278.8	72	479.7	311.5
- 33	279.3	181.3	93	329.6	214.0	53	379.9	246.7	13	430.2	279.4	73	480.6	312.0
34	280.1	181.9	94	330.4	214.0 915.1	04 55	380.8	247.2	14	431.1	279.9	74	481.4	312.0
- 30 - 36	281.0	182.4	90	339-1	215.1	- 56 - 56	382 1	247.0	16	431. 9	280.4	76	482.2	313.1 313.7
37	282.6	183.5	97	333.0	216.2	57	383.3	248.9	17	433.6	281.5	77	483.9	314.2
38	283.5	184.1	98	333.8	216.7	58	384.1	249.4	18	434.4	282.1	78	484.7	314.8
39	284.3	184.6	- 99	334.6	217.3	59	385.0	250.0	19	435.3	282.6	79	485.6	315.3
40	285.2	185.1	400	335.5	217.8	60	385.8	250.5	20	436.1	283.2	80	486.4	315.9
341	286.0	185.7	401	336.3	218.4	461	386.6	251.0	521	436.9	283.7	581	487.2	316.4
42	286.8	186.2	02	337.1	218.9	$\frac{62}{20}$	387.5	251.6	22	437.8	284.3	82	488.1	317.0
43	287.7	186.8	03	338.0	219.5	63	388.3	252.1	23	438.6	284.8	83	488.9	317.0
44	280.0	187.9	04	330.7	220.0 220.5	65	300.0	252.7	24	110 3	285 9	85	409.0 400 B	318 B
46	200.3 290.2	188.4	06	340.5	$\frac{220.0}{221.1}$	66	390.8	253.8	$\frac{26}{26}$	441.1	286.5	86	491.5	319.2
47	291.0	189.0	07	341.3	221.6	67	391.7	254.3	$\frac{1}{27}$	442.0	287.0	87	492.3	319.7
48	291.9	189.5	- 08	342.2	222.2	68	392.5	254.9	28	442.8	287.5	88	493.1	320.2
49	292.7	190.0	09	343.0	222.7	69	393.3	255.4	29	443.6	288.1	89	494.0	320.8
50	293.5	190.6	10	343.9	223.3	_70_	394.2	255.9	30	444.5	288.6	90	494.8	321.3
351	294.4	191.1	411	344.7	223.8	471	395.0	256.5	531	445.3	289.2	591	495.7	321.9
52	295.2	191.7	12	345.5	224.4	$\frac{72}{72}$	395.8	257.0	$\frac{32}{22}$	446.1	289.7	92	496.5	322.4
- 03 5 1	296, 1 906, 0	192.2	13	340.4	224.9 995.1	13	390.7	257.6	- 33 - 24	447.0	290.3	93	497.3	322.9
55	290.9 297.7	192.8	15	348 1	220.4	74	398.3	258.1 258.7	35	118 7	200.0	94	100.1	323.0 394.1
56	298.6	193.9	$-16 \\ 16$	348.9	226.5	76	399.2	259.2	36	449.5	291.9	96	499.8	324.6
57	299.4	194.4	$\hat{1}\tilde{7}$	349.7	227.1	77	400.0	259.8	37	450.3	292.5	97	500.6	325.1
58	300.2	194.9	18	350.6	227.6	78	400.9	260.3	- 38	451.2	293.0	- 98	501.5	325.7
59	301.1	195.5	19	351.4	228.2	79	401.7	260.9	39	452.0	293.6	99	502.3	326.2
60	301.9	196 . 0	20	352.2	228.7	80	402.6	261.4	40	452.9	294.1	600	503.2	326, 8
Dist.	Dep.	Lat,	Dist.	Dep.	Lat.	Dist.	Dep.	Lat,	Dist.	Dep.	Lat.	Dist.	Dep.	Lat.
									1				1 -	
					é	$n^{*}(1)$	23°, 237	°, 303°)).					

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22489-03-28

Pa	ge 434						ſABL	E 2.						
]	Differe	nce of I	atitud	e and	Departu	ire for a	34° (1	46°, 214	°, 326°).		
Dist.	Lat.	Dep.	Dist.	Lat.	Dep.	Dist.	Lat,	Dep.	Dist.	Lat.	Dep.	Dist.	Lat.	Dep.
1	0.8	0.6	61 69	50.6	$\frac{34.1}{21}$	121	100.3	67.7	181	150.1	101.2	241	199.8	134.8
$\frac{2}{3}$	$\frac{1.7}{2.5}$	$1.1 \\ 1.7$	$\frac{62}{63}$	51.4 52.2	35.2	$\frac{22}{23}$	101.1 102.0	$68.2 \\ 68.8$	82	150.9 151.7	101.8 102.3	$\frac{42}{43}$	200.6 201.5	135.3 135.9
4	3.3	2.2	64	53.1	35.8	24	102.8	69.3	84	152.5	102.9	44	202.3	136.4
5	$\frac{4.1}{5.0}$	$\frac{2.8}{3.4}$	65 66	53.9 54.7	36.3 36.9	$\frac{25}{26}$	103.6 104.5	69.9 70.5	85 86	153.4 154.9	103.5 104.0	45 46	203.1 203.9	$\begin{array}{c}137.0\\137.6\end{array}$
7	5.8	3.9	67	55.5	37.5	$\frac{20}{27}$	105.3	71.0	87	151.2 155.0	104.6	47	203.3 204.8	138.1
1 8	6.6	4.5	68	56.4	38.0	28	106.1	71.6	88	155.9	105.1	48	205.6	138.7
10	7.0	5.0 5.6	$\frac{69}{70}$	$\frac{57.2}{58.0}$	38.6 39.1	$\frac{29}{30}$	106.9 107.8	72.1 72.7	- 89 - 90	150.7 157.5	105.7 106.2	49 50	206.4 207.3	139.2 139.8
11	9.1	6.2	71	58.9	39.7	131	108.6	73.3	191	158.3	106.8	251	208.1	140.4
12	9.9	$\frac{6.7}{7}$	72	59.7	40.3	32	109.4	73.8	92	159.2	107.4	52	208.9	140.9
$13 \\ 14$	10.8 11.6	$\frac{7.3}{7.8}$	73	60.5 61.3	40.8	33	110.3	74.9	93 94	160.0	107.9 108.5	- 53 - 54	209.7 210-6	141.5 142.0
15	12.4	8.4	75	62.2	41.9	35	111.9	75.5	95	161.7	109.0	55	211.4	142.6
16	13.3	8.9	76	63.0	42.5	$\frac{36}{27}$	112.7	76.1	96	162.5	109.6	$\frac{56}{57}$	212.2	143.2
18	14.1 14.9	9.5 10.1	78	64.7	43.6	38	113.0	70.0 77.2	97 98	105.5 164.1	110.2 110.7	$\frac{57}{58}$	$\frac{213.1}{213.9}$	143.7 144.3
19	15.8	10.6	79	65.5	44.2	39	115.2	77.7	99	165.0	111.3	59	214.7	144.8
$\frac{20}{21}$	16.6	11.2	80	66.3	44.7	40	116.1	78.3	$\frac{200}{201}$	165.8	$\frac{111.8}{119.4}$	$\frac{60}{901}$	$\frac{215.5}{216.1}$	145.4
$\frac{21}{22}$	17.4 18.2	$\frac{11.}{12.3}$	$\frac{81}{82}$	67.2 68.0	40.3	42	116.9 117.7	78.8 79.4	$\frac{201}{02}$	160.6 167.5	112.4 113.0	$\frac{261}{62}$	216.4 217.2	140.9 146.5
23	19.1	12.9	83 -	68.8	46.4	43	118.6	80.0	03	168.3	113.5	63	218.0	147.1
24	19.9	13.4	84	69.6	47.0	44	119.4	80.5	04	169.1 170.0	114.1	64	218.9	147.6
$\frac{20}{26}$	$\frac{20.7}{21.6}$	14.0 14.5	80 86	70.3 71.3	47.5	40	120.2 121.0	81.6	06	170.0 170.8	114.0 115.2	66	219.7 220.5	148.7
27	22.4	15.1	87	72.1	48.6	47	121.9	82.2	07	171.6	115.8	67	221.4	149.3
28	23.2	15.7 16.2	88	73.0	49.2	48	122.7 123.5	82.8	08	172.4 173.3	116.3	68	222.2 223.0	149.9 150.4
$\frac{29}{30}$	24.0 24.9	16.2 16.8	90	74.6	50.3	50	123. 0	83.9	10	174.1	117.4	70	223.8	151.0
31	25.7	17.3	91	75.4	50.9	151	125.2	84.4	211	174.9	118.0	271	224.7	151.5
$\frac{32}{22}$	$\frac{26.5}{27.4}$	17.9 18.5	92	76.3 77.1	51.4 52.0	52	126.0 126.8	85.0	$\frac{12}{13}$	175.8 176.6	118.5 119 1	$72 \\ 73$	225.5 226.3	152.1 152.7
34	27.4 28.2	19.0	94	77.9	52.6	54	120.8	86.1	14	177.4	119.7	74	227.2	152.7 153.2
35	29.0	19.6	95	78.8	53.1	55	128.5	86.7	15	178.2	120.2	75	228.0	153.8
$\frac{36}{37}$	29.8 30.7	20.1 20.7	96 97	79.6	53.7 54.2	- 5 7	129.3	87.8	10	179.1 179.9	120.8 121.3	$\frac{70}{77}$	228.8 229.6	154.3 154.9
38	31.5	21.2	- 98	81.2	54.8	58	131.0	88.4	18	180.7	121.9	78	230.5	155.5
39	32.3	21.8	99	82.1	55.4	59	131.8	88.9	19	181.6	122.5	79	231.3	156.0 156.6
40	$\frac{33.2}{34.0}$	22.4	$\frac{100}{101}$	83.7	56 5	161	132.0 133.5	90.0	$\frac{20}{221}$	182.4 183.2	$\frac{123.0}{123.6}$	$\frac{60}{281}$	$\frac{232.1}{233.0}$	150.0 157.1
42	34.8	23.5	02	84.6	57.0	62	134.3	90.6	22	184.0	124.1	82	233.8	157.7
43	$\frac{35.6}{26.5}$	24.0	03	85.4	57.6	63	135.1	91.1	23	184.9 185.7	124.7 195.2	83	234.6 935.4	158.3 158.8
44	37.3	24.0 25.2	$04 \\ 05$	87.0	58.2 58.7	65	136.0 136.8	91.7 92.3	$\frac{1}{25}$	186.5	125.8	85	236.3	159.4
46	38.1	25.7	06	87.9	59.3	66	137.6	92.8	26	187.4	126.4	86	237.1	159.9
47	39.0	26.3	07	88.7 89.5	59.8	67	138.4	93.4	$\frac{27}{28}$	188.2 189.0	126.9 127.5	87	237.9 238.8	160.5
49	40.6	20.0 27.4	09	90, 4	61.0	69	140.1	94.5	29	189.8	128.1	89	239.6	161.6
_50	41.5	28.0	10	91.2	61.5	70	140.9	95.1	30	190.7	128.6	90	240.4	162.2
51	42.3	28.5	$111 \\ 12$	92.0	62.1	$\frac{171}{72}$	141.8 142.6	95.6	$\frac{231}{39}$	191.5	129.2 129.7	$\frac{291}{92}$	241.2 949.1	162.7 163.3
$52 \\ 53$	43.9	29.1 29.6	$12 \\ 13$	93.7	63.2	73	143.4	96.7	33	193.2	130.3	93	242.9	163.8
54	44.8	30.2	14	94.5	63.7	74	144.3	97.3	34	194.0	130.9	94	243.7	164.4
00 56	45.6 46.4	30.8 31.3	10 16	95.3	64.3 64.9	- 70 76	145.9	91.9	- 30 - 36	194.8	131.4 132.0	95 96	244.0	100.0 165.5
57	47.3	31.9	17	97.0	65.4	77	146.7	99.0	37	196.5	132.5	97	246.2	166.1
58	48.1	32.4	18	97.8	66.0	78	147.6	99.5	38	197.3	133.1 132_6	98	247.1	166.6 167.9
- 60 - 60	48.9	33.6	$\frac{19}{20}$	99. 5	67.1	80	140.4 149.2	100.1	40	199.0	133.0 134.2	300	248.7	167.8
Dist.	Den.	Lat.	Dist.	Dep.	Lat.	Dist	Dep.	Lat.	Dist.	Dep.	Lat.	Dist.	Dep.	Lat.
4.500	Dob.		1	a.c.I.i		56° (1	24°, 236	s°, 304°).					1

						Т	ABLE	2.					[Page	435
		J	Differe	ence of 1	Latitud	e and	Departu	ire for	34° (1	46°, 214	°, 326°).	_	
Dist.	Lat.	Dep.	Dist.	Lat.	Dep.	Dist.	Lat.	Dep.	Dist.	Lat.	Dep.	Dist.	Lat.	Dep.
301	249.5	168.3 168.0	$\frac{361}{62}$	299.3 300.1	$201.9 \\ 202.4$	$\frac{421}{22}$	349.0 349.9	235.4 236.0	$\begin{array}{c} 481 \\ 82 \end{array}$	398.8 399.6	$269.0 \\ 269.5$	$541 \\ 42$	$448.5 \\ 449.4$	302.5 303.1
02	250.4 251.2	169.4	63	300.9	203.0	23	350.7	236.5	83	400.4	270.1	43	450.2	303.6
04	252.0 252.9	170.0 170.6	$64 \\ 65$	$301.8 \\ 302.6$	203.5 204.1	$\frac{24}{25}$	351.5 352.3	$237.1 \\ 237.7$	84 85	401.3 402.1	$\frac{270.6}{271.2}$	$\frac{44}{45}$	451.0 451.8	304.2 304.8
06	252.5 253.7	171.1	66	303.4	204.7	$\frac{10}{26}$	353.2	238.2	86	402.9	271.8	46	452.6	305.3
07	254.5	171.7	67 69	304.3	205.2 205.8	$\frac{27}{28}$	354.0 354.8	238.8 239.3	87 88	403.8	272.3 272.8	47	453.5 454.3	305.9
08	255.5 256.2	172.2 172.8	69	305.9	205.0 206.3	$\frac{20}{29}$	355.7	239.9	89	405.4	273.4	49	455.2	307.0
10	257.0	173.3	70	306.7	206.9	$\frac{30}{131}$	356.5	$\frac{240.4}{241.0}$	90	406.2	274.0	$\frac{50}{551}$	$\frac{456.0}{156.0}$	$\frac{307.5}{208.1}$
$\begin{array}{c} 311 \\ 12 \end{array}$	257.8 258.7	173.9 174.5	$\frac{371}{72}$	307.6	207.5 208.0	$\frac{431}{32}$	357.3 358.1	241.0 241.6	491 92	407.1	274.0 275.1	$\frac{551}{52}$	457.6	308.1
$1\overline{3}$	259.5	175.0	73	309.2	208.6	33	359.0	242.1	93	408.7	275.7	53	458.4	309.2
14	260.3 261.2	175.6 176.1	74	310.1 310.9	209.1 209.7	$\frac{34}{35}$	359.8 360.6	242.7 243.2	94 95	409.5	$276.2 \\ 276.8$	- 04 - 55	460.1	309.8
$10 \\ 16$	261.2 262.0	176.7	76	311.7	210.3	36	361.5	243.8	- 96	411.2	277.4	56	460.9	310.9
17	262.8	177.3	77	312.6	210.8	$\frac{37}{38}$	362.3	244.4	97	412.0 412.8	277.9 278 1	57 58	461.7	311.5
18	263.7 264.5	177.8 178.4	79	313.4 314.2	211.4 211.9	39	364.0	245.5	99	413.7	279.0	$59 \\ 59$	463.4	312.6
20	265.3	178.9	80	315.0	212.5	40	364.8	246.0	500	414.5	279.6	60	464.2	313.1
321	266.1	179.5	$\frac{381}{22}$	315.9	213.0 213.6	441	365.6 366.4	246.6 247.2	$501 \\ 02$	415.3	280.1 280.7	$\frac{561}{62}$	465.1 465.9	313.7 314.3
$\frac{22}{23}$	267.0 267.8	180.1 180.6	83	310.7 317.5	213.0 214.2	43	367.3	247.7	03	417.0	281.3	63	466.8	314.8
24	268.6	181.2	84	318.4	214.7	44	368.1	248.3	04	417.8	281.8	64	467.6	315.4
$\frac{25}{26}$	269.5 270.3	181.7 182.3	85 86	319.2 320.0	215.3 215.8	45 46	368.9 369.8	248.8 249.4	05	418.6	282.4 282.9	- 66 - 66	468.4	315.9 316.5
20	270.3 271.1	182.9	87	320.8	216.4	47	370.6	250.0	07	420.3	283.5	67	470.1	317.1
28	271.9	183.4	88	321.7	217.0	48	371.4	250.5 251.1	08	421.1	284.1 284.6	68 60	470.9	317.6 318.9
$\frac{29}{30}$	272.8 273.6	184.5	- 89 - 90	322.0 323.3	217.5 218.1	49 50	372.2 373.1	251.1 251.6	10	421.9	284.0 285.2	70	472.6	318.7
331	274.4	185.1	391	324.2	218.6	451	373.9	252.2	511	423.6	285.8	571	473.4	319.3
$\frac{32}{33}$	275.2 276.1	185.0 186.2	$\frac{92}{93}$	325.0 325.8	219.2 219.8	$\frac{52}{53}$	375.6	252.8 253.3	13	424.4	280.5 286.9	$\frac{12}{73}$	474.2	319.9
34	276.9	186.8	94	326.6	220.3	54	376.4	253.9	14	426.1	287.4	74	475.9	321.0
35	277.7 278.6	187.3	95	327.5 328.3	220.9 221.4	- 55 - 56	$377.2 \\ 378.0$	254.4 255.0	15 16	426.9 427.8	288.0 288.5	70	476.7	321.5 322.1
37	279.4	187.5	97	329.1	222.0	57	378.9	255.5	17	428.6	289.1	77	478.3	322.7
38	280.2	189.0	98	330.0	222.6	58	379.7	256.1	18	429.4	289.6	78	479.2	323.2
$\frac{39}{40}$	281.0 281.9	189.0	400	330.8 331.6	223.7	60	381.3	250.7 257.2	$\frac{19}{20}$	431.1	290.2	80	480.8	323.8 324.3
341	282.7	190.7	401	332.4	224.2	461	382.2	257.8	521	431.9	291.3	581	481.6	324.9
42	283.5	191.2	$02 \\ 03$	333.3	224.8	$62 \\ 63$	383.0	258.3 258.9	$\frac{22}{93}$	432.8	291.9 292.5	82	482.5 483.3	325.4 326.0
40 44	285.2	191.8 192.4	04	334.9	225.9	64	384.7	259.5	20	434.4	293.0	84	484.1	326.6
45	286.0	192.9	05	335.8	226.5	65 60	385.5	260.0	25	435.3	293.6	85	485.0	$\frac{327.2}{207.7}$
$\frac{46}{47}$	286.9 287.7	193.5 194.0	06	337.4	227.0 227.6	00 67	380.3 387.2	260.6 261.1	$\frac{20}{27}$	436.9	294.1 294.7	80	486.6	328.2
48	288.5	194.6	08	338.3	228.1	68	388.0	261.7	28	437.8	295.3	88	487.5	328.8
49 50	289.3	195.2 195.7	09	339.1	228.7 229.3	$\frac{69}{70}$	388.8 389.7	262.3 262.8	29 30	438.6 439.4	295.8 296 1	- 89 - 90	488.3 489.2	329.4 329.9
$\frac{-50}{351}$	$\frac{290.2}{291.0}$	$\frac{100.7}{196.3}$	411	340.7	229.8	471	390.5	$\frac{262.8}{263.4}$	531	440.3	296.9	591	490.0	330.5
52	291.8	196.8	12	341.6	230.4	72	391.3	263.9	32	441.1	297.4	92	490.8	331.0
53	292.7	197.4	$\frac{13}{14}$	342.4 343.2	230.9 231.5	73	392.1 393.0	264.5 265.0	33 34	441.9 442.7	298.0 298.6	93 94	491.6	331.6 332.2
55	294.3	198.5	15	344.1	232.1	75	393.8	265.6	35	443.6	299.1	95	493.3	332.7
56	295.1	199.1	$16 \\ 17$	344.9	232.6	$\frac{76}{77}$	394.6	266.2	36	444.4	299.7	96	494.1	333.3
58	296.0 296.8	199.6 200.2	18	346.5	$\begin{vmatrix} 233.2\\233.7 \end{vmatrix}$	78	396.3	260.7 267.3	38	446.1	300.2	98	495.8	334.4
59	297.6	200.7	19	347.4	234.3	79	397.1	267.9	39	446.9	301.4	99	496.6	334.9
60	298.5	201.3	20	348.2	234.9	80	397.9	268.4	40	447.7	302.0	600	497.4	335, 5
Dist.	Dep.	Lat.	Dist.	Dep.	Lat.	Dist.	Dep.	Lat.	Dist.	Dep.	Lat.	Dist.	Dep.	Lat.
						56° (1	.24°, 236	3°, 304°	°).					

Pa	To 436	1				T	ARLE							
14	50 - 100]	Differ€	ence of I	Latitud	e and	Departu	ire for :	35° (1	45° , 215	°, 325°).		
Dist.	Lat.	Dep,	Dist.	Lat.	Dep,	Dist.	Lat.	Dep.	Dist.	Lat.	Dep.	Dist.	Lat.	Dep.
$ \begin{array}{c} 1 \\ 2 \\ 3 \\ 4 \\ 5 \\ 6 \\ 7 \\ 8 \\ 9 \\ 10 \\ \end{array} $	$\begin{array}{c} 0.8\\ 1.6\\ 2.5\\ 3.3\\ 4.1\\ 4.9\\ 5.7\\ 6.6\\ 7.4\\ 2.9\end{array}$	$\begin{array}{c} 0.6\\ 1.1\\ 1.7\\ 2.3\\ 2.9\\ 3.4\\ 4.0\\ 4.6\\ 5.2\\ 5.7\end{array}$	$\begin{array}{c} 61 \\ 62 \\ 63 \\ 64 \\ 65 \\ 66 \\ 67 \\ 68 \\ 69 \\ 70 \end{array}$	$50.0 \\ 50.8 \\ 51.6 \\ 52.4 \\ 53.2 \\ 54.1 \\ 54.9 \\ 55.7 \\ 56.5 \\ 57.3 $	$\begin{array}{c} 35.\ 0\\ 35.\ 6\\ 36.\ 1\\ 36.\ 7\\ 37.\ 3\\ 37.\ 9\\ 38.\ 4\\ 39.\ 0\\ 39.\ 6\\ 40.\ 2\end{array}$	$121 \\ 22 \\ 23 \\ 24 \\ 25 \\ 26 \\ 27 \\ 28 \\ 29 \\ 30$	$\begin{array}{c} 99.1\\ 99.9\\ 100.8\\ 101.6\\ 102.4\\ 103.2\\ 104.0\\ 104.9\\ 105.7\\ 106.5\end{array}$	$\begin{array}{c} 69.\ 4\\ 70.\ 0\\ 70.\ 5\\ 71.\ 1\\ 71.\ 7\\ 72.\ 3\\ 72.\ 8\\ 73.\ 4\\ 74.\ 0\\ 74.\ 6\end{array}$	$ 181 \\ 82 \\ 83 \\ 84 \\ 85 \\ 86 \\ 87 \\ 88 \\ 89 \\ 90 $	$\begin{array}{c} 148.\ 3\\ 149.\ 1\\ 149.\ 9\\ 150.\ 7\\ 151.\ 5\\ 152.\ 4\\ 153.\ 2\\ 154.\ 0\\ 154.\ 8\\ 155.\ 6\end{array}$	$103.8 \\ 104.4 \\ 105.0 \\ 105.5 \\ 106.1 \\ 106.7 \\ 107.3 \\ 107.8 \\ 108.4 \\ 109.0 \\ 100.4 \\ 100.0 \\ 100.4 \\ 100.0 \\ 100.$	$241 \\ 42 \\ 43 \\ 44 \\ 45 \\ 46 \\ 47 \\ 48 \\ 49 \\ 50$	197. 4 198. 2 199. 1 199. 9 200. 7 201. 5 202. 3 203. 1 204. 0	$\begin{array}{c} 138.\ 2\\ 138.\ 8\\ 139.\ 4\\ 140.\ 0\\ 140.\ 5\\ 141.\ 1\\ 141.\ 7\\ 142.\ 2\\ 142.\ 8\\ 142.\ 8\\ 142.\ 4\end{array}$
$ \begin{array}{r} 10 \\ 11 \\ 12 \\ 13 \\ 14 \\ 15 \\ 16 \\ 17 \\ 18 \\ 19 \\ 20 \\ \end{array} $	$\begin{array}{r} 5.2\\ \hline 9.0\\ 9.8\\ 10.6\\ 11.5\\ 12.3\\ 13.1\\ 13.9\\ 14.7\\ 15.6\\ 16.4 \end{array}$	$\begin{array}{c} 6.3 \\ 6.9 \\ 7.5 \\ 8.0 \\ 8.6 \\ 9.2 \\ 9.8 \\ 10.3 \\ 10.9 \\ 11.5 \end{array}$	$ \begin{array}{r} 71 \\ 72 \\ 73 \\ 74 \\ 75 \\ 76 \\ 77 \\ 78 \\ 79 \\ 80 \\ \end{array} $	$ \begin{array}{r} -51.6 \\ 58.2 \\ 59.0 \\ -59.8 \\ 60.6 \\ 61.4 \\ 62.3 \\ 63.1 \\ 63.9 \\ 64.7 \\ 65.5 \end{array} $	$\begin{array}{c} 10.2 \\ \hline 40.7 \\ 41.3 \\ 41.9 \\ 42.4 \\ 43.0 \\ 43.6 \\ 44.2 \\ 44.7 \\ 45.3 \\ 45.9 \end{array}$	$ \begin{array}{r} 30 \\ 131 \\ 32 \\ 33 \\ 34 \\ 35 \\ 36 \\ 37 \\ 38 \\ 39 \\ 40 \\ \end{array} $	$\begin{array}{c} 100.9\\ \hline 107.3\\ 108.1\\ 108.9\\ 109.8\\ 110.6\\ 111.4\\ 112.2\\ 113.0\\ 113.9\\ 114.7 \end{array}$	$\begin{array}{c} 73.0\\ \hline 75.1\\ 75.7\\ 76.3\\ 76.9\\ 77.4\\ 78.0\\ 78.6\\ 79.2\\ 79.7\\ 80.3 \end{array}$	$ \begin{array}{r} 30 \\ 191 \\ 92 \\ 93 \\ 94 \\ 95 \\ 96 \\ 97 \\ 98 \\ 99 \\ 200 \\ \end{array} $	$\begin{array}{c} 153.0\\ \hline 156.5\\ 157.3\\ 158.1\\ 158.9\\ 159.7\\ 160.6\\ 161.4\\ 162.2\\ 163.0\\ 163.8 \end{array}$	$\begin{array}{c} 103.0\\ \hline 109.6\\ 110.1\\ 110.7\\ 111.3\\ 111.8\\ 112.4\\ 113.0\\ 113.6\\ 114.1\\ 114.7 \end{array}$	$\begin{array}{r} 50\\ \hline 251\\ 52\\ 53\\ 54\\ 55\\ 56\\ 57\\ 58\\ 59\\ 60\\ \end{array}$	$\begin{array}{c} 205.6\\ 206.4\\ 207.2\\ 208.1\\ 208.9\\ 209.7\\ 210.5\\ 211.3\\ 212.2\\ 213.0\\ \end{array}$	$\begin{array}{c} 143.4\\ 144.0\\ 144.5\\ 145.1\\ 145.7\\ 146.3\\ 146.8\\ 147.4\\ 148.0\\ 148.6\\ 149.1 \end{array}$
$ \begin{array}{r} 21\\ 22\\ 23\\ 24\\ 25\\ 26\\ 27\\ 28\\ 29\\ 30\\ \end{array} $	$17.2 \\ 18.0 \\ 18.8 \\ 19.7 \\ 20.5 \\ 21.3 \\ 22.1 \\ 22.9 \\ 23.8 \\ 24.6 \\ 100 \\ $	$\begin{array}{c} 12.0\\ 12.6\\ 13.2\\ 13.8\\ 14.3\\ 14.9\\ 15.5\\ 16.1\\ 16.6\\ 17.2 \end{array}$	81 82 83 84 85 86 87 88 89 90	$\begin{array}{c} 66.\ 4\\ 67.\ 2\\ 68.\ 0\\ 68.\ 8\\ 69.\ 6\\ 70.\ 4\\ 71.\ 3\\ 72.\ 1\\ 72.\ 9\\ 73.\ 7\end{array}$	$\begin{array}{r} 46.5\\ 47.0\\ 47.6\\ 48.2\\ 48.8\\ 49.3\\ 49.9\\ 50.5\\ 51.0\\ 51.6\end{array}$	$ \begin{array}{r} 141 \\ 42 \\ 43 \\ 44 \\ 45 \\ 46 \\ 47 \\ 48 \\ 49 \\ 50 \end{array} $	$\begin{array}{c} 115.5\\ 116.3\\ 117.1\\ 118.0\\ 118.8\\ 119.6\\ 120.4\\ 121.2\\ 122.1\\ 122.0\\ 122.1\\ 122.0\\ 12$	$\begin{array}{c} 80.9\\ 81.4\\ 82.0\\ 82.6\\ 83.2\\ 83.7\\ 84.3\\ 84.9\\ 85.5\\ 86.0\\ \end{array}$	$ \begin{array}{r} 201 \\ 02 \\ 03 \\ 04 \\ 05 \\ 06 \\ 07 \\ 08 \\ 09 \\ 10 \end{array} $	$\begin{array}{c} 164.\ 6\\ 165.\ 5\\ 166.\ 3\\ 167.\ 1\\ 167.\ 9\\ 168.\ 7\\ 169.\ 6\\ 170.\ 4\\ 171.\ 2\\ 172.\ 0\end{array}$	$\begin{array}{c} 115.3\\ 115.9\\ 116.4\\ 117.0\\ 117.6\\ 118.2\\ 118.7\\ 119.3\\ 119.9\\ 1205\end{array}$	$ \begin{array}{r} 261 \\ 62 \\ 63 \\ 64 \\ 65 \\ 66 \\ 67 \\ 68 \\ 69 \\ 70 \end{array} $	$\begin{array}{c} 213.8\\ 214.6\\ 215.4\\ 216.3\\ 217.1\\ 217.9\\ 218.7\\ 219.5\\ 220.4\\ 221.4\\ 22$	$\begin{array}{c} 149.\ 7\\ 150.\ 3\\ 150.\ 9\\ 151.\ 4\\ 152.\ 0\\ 152.\ 6\\ 153.\ 1\\ 153.\ 7\\ 154.\ 3\\ 154.\ 9\end{array}$
$ \begin{array}{r} 30 \\ 31 \\ 32 \\ 33 \\ 34 \\ 35 \\ 36 \\ 37 \\ 38 \\ 39 \\ 40 \\ 40 \end{array} $	$\begin{array}{c} 24.6\\ \hline 25.4\\ 26.2\\ 27.0\\ 27.9\\ 28.7\\ 29.5\\ 30.3\\ 31.1\\ 31.9\\ 32.8 \end{array}$	$\begin{array}{c} 17.2 \\ \hline 17.8 \\ 18.4 \\ 18.9 \\ 19.5 \\ 20.1 \\ 20.6 \\ 21.2 \\ 21.8 \\ 22.4 \\ 22.9 \end{array}$	$ \begin{array}{r} 30 \\ 91 \\ 92 \\ 93 \\ 94 \\ 95 \\ 96 \\ 97 \\ 98 \\ 99 \\ 100 \\ \end{array} $	$\begin{array}{c} 73.1\\ 74.5\\ 75.4\\ 76.2\\ 77.0\\ 77.8\\ 78.6\\ 79.5\\ 80.3\\ 81.1\\ 81.9\end{array}$	51.0 52.2 52.8 53.3 53.9 54.5 55.1 55.6 56.2 56.8 57.4	$ \begin{array}{r} 50 \\ 151 \\ 52 \\ 53 \\ 54 \\ 55 \\ 56 \\ 57 \\ 58 \\ 59 \\ 60 \\ \end{array} $	$\begin{array}{c} 122.9\\ \hline 123.7\\ 124.5\\ 125.3\\ 126.1\\ 127.0\\ 127.8\\ 128.6\\ 129.4\\ 130.2\\ 131.1 \end{array}$	86.6 86.6 87.2 87.8 88.3 88.9 89.5 90.1 90.6 91.2 91.8	$ \begin{array}{r} 10 \\ \hline 211 \\ 12 \\ 13 \\ 14 \\ 15 \\ 16 \\ 17 \\ 18 \\ 19 \\ 20 \\ \end{array} $	$\begin{array}{c} 172.0\\ 172.8\\ 173.7\\ 174.5\\ 175.3\\ 176.1\\ 176.9\\ 177.8\\ 178.6\\ 179.4\\ 180.2 \end{array}$	$\begin{array}{c} 120.3\\ 121.0\\ 121.6\\ 122.2\\ 122.7\\ 123.3\\ 123.9\\ 124.5\\ 125.0\\ 125.6\\ 126.2 \end{array}$	$ \begin{array}{r} 70 \\ \hline 271 \\ 72 \\ 73 \\ 74 \\ 75 \\ 76 \\ 77 \\ 78 \\ 79 \\ 80 \\ \end{array} $	$\begin{array}{c} 221.2\\ \hline 222.0\\ 222.8\\ 223.6\\ 224.4\\ 225.3\\ 226.1\\ 226.9\\ 227.7\\ 228.5\\ 229.4 \end{array}$	$\begin{array}{c} 134.9\\ \hline 155.4\\ 156.0\\ 156.6\\ 157.2\\ 157.7\\ 158.3\\ 158.9\\ 159.5\\ 160.0\\ 160.6\end{array}$
$ \begin{array}{r} 41 \\ 42 \\ 43 \\ 44 \\ 45 \\ 46 \\ 47 \\ 48 \\ 49 \\ 50 \\ \end{array} $	$\begin{array}{c} 33.6\\ 34.4\\ 35.2\\ 36.0\\ 36.9\\ 37.7\\ 38.5\\ 39.3\\ 40.1\\ 41.0\\ \end{array}$	$\begin{array}{c} 23.5\\ 24.1\\ 24.7\\ 25.2\\ 25.8\\ 26.4\\ 27.0\\ 27.5\\ 28.1\\ 28.7 \end{array}$	$ \begin{array}{r} 101 \\ 02 \\ 03 \\ 04 \\ 05 \\ 06 \\ 07 \\ 08 \\ 09 \\ 10 \end{array} $	$\begin{array}{c} 82.7\\ 83.6\\ 84.4\\ 85.2\\ 86.0\\ 86.8\\ 87.6\\ 88.5\\ 89.3\\ 90.1 \end{array}$	$\begin{array}{c} 57.9\\ 58.5\\ 59.1\\ 59.7\\ 60.2\\ 60.8\\ 61.4\\ 61.9\\ 62.5\\ 63.1 \end{array}$	$ \begin{array}{r} 161 \\ 62 \\ 63 \\ 64 \\ 65 \\ 66 \\ 67 \\ 68 \\ 69 \\ 70 \\ \end{array} $	$\begin{array}{c} 131.9\\ 132.7\\ 133.5\\ 134.3\\ 135.2\\ 136.0\\ 136.8\\ 137.6\\ 138.4\\ 139.3\\ \end{array}$	$\begin{array}{c} 92.3\\ 92.9\\ 93.5\\ 94.1\\ 94.6\\ 95.2\\ 95.8\\ 96.4\\ 96.9\\ 97.5\\ \end{array}$	$ \begin{array}{r} 221 \\ 22 \\ 23 \\ 24 \\ 25 \\ 26 \\ 27 \\ 28 \\ 29 \\ 30 \end{array} $	$\begin{array}{c} 181.0\\ 181.9\\ 182.7\\ 183.5\\ 184.3\\ 185.1\\ 185.9\\ 186.8\\ 187.6\\ 188.4\\ \end{array}$	$\begin{array}{c} 126.8\\ 126.8\\ 127.3\\ 127.9\\ 128.5\\ 129.1\\ 129.6\\ 130.2\\ 130.8\\ 131.3\\ 131.9 \end{array}$	281 82 83 84 85 86 87 88 89 90	$\begin{array}{c} 230.\ 2\\ 231.\ 0\\ 231.\ 8\\ 232.\ 6\\ 233.\ 5\\ 234.\ 3\\ 235.\ 1\\ 235.\ 9\\ 236.\ 7\\ 237.\ 6\end{array}$	$\begin{array}{c} 161.2\\ 161.2\\ 161.7\\ 162.3\\ 162.9\\ 163.5\\ 164.0\\ 164.6\\ 165.2\\ 165.8\\ 166.3\\ \end{array}$
51 52 53 54 55 56 57 58 59 60	$\begin{array}{r} 41.8\\ 42.6\\ 43.4\\ 44.2\\ 45.1\\ 45.9\\ 46.7\\ 47.5\\ 48.3\\ 49.1 \end{array}$	$\begin{array}{c} 29.3\\ 29.8\\ 30.4\\ 31.0\\ 31.5\\ 32.1\\ 32.7\\ 33.3\\ 33.8\\ 34.4 \end{array}$	$ \begin{array}{c} 111\\ 12\\ 13\\ 14\\ 15\\ 16\\ 17\\ 18\\ 19\\ 20\\ \end{array} $	$\begin{array}{c} 90.\ 9\\ 91.\ 7\\ 92.\ 6\\ 93.\ 4\\ 94.\ 2\\ 95.\ 0\\ 95.\ 8\\ 96.\ 7\\ 97.\ 5\\ 98.\ 3\end{array}$	$\begin{array}{c} 63.\ 7\\ 64.\ 2\\ 64.\ 8\\ 65.\ 4\\ 66.\ 0\\ 66.\ 5\\ 67.\ 1\\ 67.\ 7\\ 68.\ 3\\ 68.\ 8\end{array}$	$ \begin{array}{r} 171 \\ 72 \\ 73 \\ 74 \\ 75 \\ 76 \\ 77 \\ 78 \\ 79 \\ 80 \\ \end{array} $	$\begin{array}{c} 140.\ 1\\ 140.\ 9\\ 141.\ 7\\ 142.\ 5\\ 143.\ 4\\ 144.\ 2\\ 145.\ 0\\ 145.\ 8\\ 146.\ 6\\ 147.\ 4\end{array}$	$\begin{array}{c} 98.1\\ 98.7\\ 99.2\\ 99.8\\ 100.4\\ 100.9\\ 101.5\\ 102.1\\ 102.7\\ 103.2 \end{array}$	$ \begin{array}{r} 231 \\ 32 \\ 33 \\ 34 \\ 35 \\ 36 \\ 37 \\ 38 \\ 39 \\ 40 \end{array} $	$\begin{array}{c} 189.\ 2\\ 190.\ 0\\ 190.\ 9\\ 191.\ 7\\ 192.\ 5\\ 193.\ 3\\ 194.\ 1\\ 195.\ 0\\ 195.\ 8\\ 196.\ 6\end{array}$	$\begin{array}{c} 132.5\\ 133.1\\ 133.6\\ 134.2\\ 134.8\\ 135.4\\ 135.9\\ 136.5\\ 137.1\\ 137.7 \end{array}$	$\begin{array}{r} 291\\ 92\\ 93\\ 94\\ 95\\ 96\\ 97\\ 98\\ 99\\ 300\\ \end{array}$	$\begin{array}{c} 238.4\\ 239.2\\ 240.0\\ 240.8\\ 241.6\\ 242.5\\ 243.3\\ 244.1\\ 244.9\\ 245.7\end{array}$	$\begin{array}{c} 166. \ 9 \\ 167. \ 5 \\ 168. \ 1 \\ 168. \ 6 \\ 169. \ 2 \\ 169. \ 8 \\ 170. \ 4 \\ 170. \ 9 \\ 171. \ 5 \\ 172. \ 1 \end{array}$
Dist.	Dep.	Lat.	Dist.	Dep.	Lat.	Dist. 55° (1	Dep. 25°, 235	Lat. °, 305°	Dist.	Dep.	Lat.	Dist.	Dep.	Lat.

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						Γ	ABL	E 2.					[Page	437
			Differ	ence of I	Latitud	e and	Departu	ire for	35° (1	45°, 213	5°, 325°).		
Dist.	Lat.	Dep.	Dist.	Lat.	Dep.	Dist.	Lat.	Dep.	Dist.	Lat.	Dep.	Dist.	Lat.	Dep.
301	246.6	172.6	$\frac{361}{62}$	295.7	207.0	421	344.9	241.5	481	394.0	275.9	541	443.2	310.3
02	247.4	173.8	63	290.0	207.0	$\frac{22}{23}$	346.5	242.0	83	395.7	270.4	42	111 8	310.9
04	249.0	174.3	64	298.2	208.8	24	347.3	243.2	84	396.5	277.6	44	445.6	312.0
05	249.9	174.9	65	299.0	209.3	25	348.1	243.8	85	397.3	278.2	-45	446.4	312.6
06	250.7	175.5	66	299.8	209.9	26	349.0	244.3	86	398.1	278.7	-46	447.3	313.2
07	251.5	176.1	67	300.6	210.5	27	349.8	244.9	87	398.9	279.3	47	448.1	313.7
08	252.3	170.0	- 68 - 69	301.0	211.1	28	300.0	240.0	88	399.8	279.9	48	448.9	314.3
10	253.1 253.9	177.8	70	303.1	211.0	30	352.2	246.6	90	401.4	280.0	50	450.5	315.4
311	254.8	178.4	371	303.9	212.8	431	353.1	247.2	491	402.2	281.6	551	451.4	316.0
12	255.6	178.9	72	304.7	213.4	32	353.9	247.8	92	403.0	282.2	52	452.2	316.6
13	256.4	179.5	73	305.6	213.9	- 33	354.7	248.3	- 93	403.9	282.8	53	453.0	317.2
14	257.2	180.1	74	306.4	214.5	34	355.5	248.9	94	404.7	283.3	54	453.8	317.7
15	258.0	180.7	10	307.2	215.1	30	306.3	249.0	90	400.5	283.9	- 50 50	404.6	318.3
10	208.9	181.2	$\frac{70}{77}$	308.8	215.0	30	358 0	250.1	90	400.5	284.0	57	400.0	318.9
18	$\frac{260.7}{260.5}$	182.4	78	309.6	216.8	38	358.8	250.0 251.2	98	408.0	285.6	58	457.1	320.0
19	261.3	183.0	79	310.5	217.4	39	359.6	251.8	99	408.8	286.2	59	457.9	320.6
20	262.1	183.5	80	311.3	217.9	40	360.4	252.4	500	409.6	286.8	60	458.7	321.2
321	263.0	184.1	381	312.1	218.5	441	361.3	252.9	501	410.4	287.4	561	459.6	321.8
22	263.8	184.7	82	312.9	219.1	42	362.1	253.5	02	411.2	287.9	$62 \\ 62$	460.4	322.3
23	264.6	185.2	83	313.7	219.7	43	362.9	204.1	03	412.1	288.5	03	461.2	322.9
24	200.4	186 4	85	315 4	220.2	45	364 5	254.7	04	412.9	289.1 289.7	65	462.0	- 545. 0 - 394-1
26	267.1	187.0	86	316.2	221.4	-16	365.4	255.8	06	414.5	290.2	66	463.7	324.6
27	267.9	187.5	87	317.0	222.0	47	366.2	256.4	07	415.3	290.8	67	464.5	325.2
28	268.7	188.1	88	317.8	222.5	48	367.0	256.9	08	416.1	291.4	68	465.3	325.8
29	269.5	188.7	89	318.7	223.1	49	367.8	257.5	09	+417.0	291.9	69 70	466.1	326.4
30	270.3	189.0	90	319.0	223.7	151	308.0 260 t	$\frac{258.1}{258.7}$	511	417.8	292.0	571	400.9	326.9
20	271.1 272.0	190.4	92	320.3 321.1	224.0	401 52	370 3	259 2	12^{-11}	410.0	293.1 293.7	72	467.8	328 1
33	272.8	191.0	93	321.9	225.4	53	371.1	259.8	13	420.2	294.2	73	469.4	328.7
. 34	273.6	191.6	94	322.8	226.0	54	371.9	260.4	14	421.1	294.8	74	470.2	329.2
35	274.4	192.1	95	323.6	226.5	55	372.7	261.0	15	421.9	295.4	75	471.0	329.8
36	275.2	192.7	96	324.4	227.1	56	373.5	261.5	$16 \\ 17$	422.7	296.0	76	471.9	330.4
31	276.1	193.3	97	320. Z 326 0	227.7	- 57 - 58	375 9	262.1 969.7	11	423.5	296. 0	$\frac{11}{78}$	472.7	331.0
39	270. 5	190.9 194.4	99	320.0 326.9	228.8	59	376.0	263.3	19	425.2	297.1 297.7	79	474 3	- 339-1
40	278.5	195.0	400	327.7	229.4	60	376.8	263.8	20	426.0	298.3	80	475.1	332.7
341	279.3	195.6	401	328.5	230.0	461	377.6	264.4	521	426.8	298.8	581	476.0	333.3
42	280.2	196.1	02	329.3	230.6	62	378.5	265.0	22	427.6	299.4	82	476.8	333.8
43	281.0	196.7	03	330.1	231.1	63	379.3	265.5	23	428.4	300.0	83	477.6	334.4
44	281.8	197.3	04	330.9	231.7	64	380.1	200.1	24	429.3	300.5	84	4/8.4	335.0
40	282.0	197.9	00 06	332 6	232 9	66	380.9 381.7	260.7 267.3	20 26	430.1	301.1 301.7	86	480 1	336 1
47	284.3	199.0	07	333.4	233.4	67	382.6	267.8	27	431.7	302.3	87	480.9	336.7
48	285.1	199.6	08	334.2	234.0	68	383.4	268.4	28	432.5	302.8	88	481.7	337.3
49	285.9	200.2	09	335.0	234.6	69	384.2	269.0	29	433.4	303.4	89	482.5	337.9
50	286.7	200.7	10	335.9	235.1	_70_	385.0	269.6	30	434.2	304.0	90	483.3	338.4
351	287.5	201.3	411	336.7	235.7	471	$\frac{385.8}{286.6}$	270.1	- 031 - 90	435.0	304.5	091	484.2	339.0
- 02 - 53	288.3 289.9	201.9	12	338 3	236 0	$\frac{12}{73}$	387.5	271 2	32 33	436 6	305.1 305.7	92	485.8	340 9
54	290.0	203.0	14	339.1	237.4	74	388.3	271.9	34	437.5	306.3	94	486.6	340.7
55	290.8	203.6	15	340.0	238.0	75	389.1	272.4	35	438.3	306.8	95	487.4	341.3
56	291.6	204.2	16	340.8	238.6	76	389.9	273.0	- 36	439.1	307.4	- 96	488.3	341.9
57	292.4	204.7	17	341.6	239.2	17	390.7	273.6	37	439.9	308.0	97	489.1	342.5
- 58 - 50	293.3 201 1	205.3	18	342.4	239.7	$\frac{78}{70}$	391.6	274.2 97.1	- 38 - 20	440.7	308.6	98	489.9	343.0 319.6
60	294.9	206.5	20	344.1	240.9	80	393.2	275.3	40	442.3	309.7	600	491.5	344.1
Dist.	Dep.	Lat.	Dist.	Dep.	Lat.	Dist.	Dep.	Lat.	Dist.	Dep.	Lat.	Dist.	Dep.	Lat.
						55° (1	25°, 235	°. 305°).					

Pa	re 438]				т	ABLE	2.2						
	,	1	Differe	ence of l	Latitud	le and	Depart	ure for	36° (1	44°, 216	3°, 324°	°).		
Dist.	Lat.	Dep.	Dist.	Lat.	Dep.	Dist.	Lat.	Dep.	Dist.	Lat.	Dep.	Dist.	Lat.	Dep.
$ \begin{array}{c} 1 \\ 2 \\ 3 \\ 4 \\ 5 \\ 6 \end{array} $	$\begin{array}{c} 0.8 \\ 1.6 \\ 2.4 \\ 3.2 \\ 4.0 \\ 1.9 \end{array}$	$\begin{array}{c} 0.\ 6 \\ 1.\ 2 \\ 1.\ 8 \\ 2.\ 4 \\ 2.\ 9 \\ 2.\ 5 \end{array}$		$ \begin{array}{r} 49.4\\ 50.2\\ 51.0\\ 51.8\\ 52.6\\ 52.1 \end{array} $	35.9 36.4 37.0 37.6 38.2 28.8	$ \begin{array}{r} 121 \\ 22 \\ 23 \\ 24 \\ 25 \\ 96 \end{array} $	97.998.799.5100.3101.1101.9	71.171.772.372.973.571.1	$ 181 \\ 82 \\ 83 \\ 84 \\ 85 \\ 86 $	$146. 4 \\ 147. 2 \\ 148. 1 \\ 148. 9 \\ 149. 7 \\ 150. 5$	$106, 4 \\ 107, 0 \\ 107, 6 \\ 108, 2 \\ 108, 7 \\ 109, 2$	$241 \\ 42 \\ 43 \\ 44 \\ 45 \\ 16$	$195.0 \\ 195.8 \\ 196.6 \\ 197.4 \\ 198.2 \\ 199.0 \\ 0 \\ 0 \\ 0 \\ 0 \\ 0 \\ 0 \\ 0 \\ 0 \\ 0 \\$	$141.7 \\ 142.2 \\ 142.8 \\ 143.4 \\ 144.0 \\ 144.6 \\ 144.$
	$ \begin{array}{r} 4.5 \\ 5.7 \\ 6.5 \\ 7.3 \\ 8.1 \\ \end{array} $	$ \begin{array}{c} 5.5 \\ 4.1 \\ 4.7 \\ 5.3 \\ 5.9 \\ \end{array} $		53.4 54.2 55.0 55.8 56.6	$ \begin{array}{r} 39.4 \\ 40.0 \\ 40.6 \\ 41.1 \end{array} $	$ \begin{array}{r} 20 \\ 27 \\ 28 \\ 29 \\ 30 \\ \hline 121 \end{array} $	$ \begin{array}{r} 101.9 \\ 102.7 \\ 103.6 \\ 104.4 \\ 105.2 \\ \end{array} $	$74.1 \\ 74.6 \\ 75.2 \\ 75.8 \\ 76.4 \\ 76.4$	87 88 89 90	$ \begin{array}{r} 150.5 \\ 151.3 \\ 152.1 \\ 152.9 \\ 153.7 \\ \end{array} $	$ \begin{array}{c} 109.5 \\ 109.9 \\ 110.5 \\ 111.1 \\ 111.7 \\ \end{array} $	$40 \\ 47 \\ 48 \\ 49 \\ 50$	$ \begin{array}{r} 199.8 \\ 200.6 \\ 201.4 \\ 202.3 \end{array} $	$144.0 \\ 145.2 \\ 145.8 \\ 146.4 \\ 146.9 $
$ \begin{array}{r} 11 \\ 12 \\ 13 \\ 14 \\ 15 \\ 16 \\ 17 \\ 18 \\ 19 \\ 20 \\ 20 \\ \end{array} $	$\begin{array}{c} 8.9\\ 9.7\\ 10.5\\ 11.3\\ 12.1\\ 12.9\\ 13.8\\ 14.6\\ 15.4\\ 16.2 \end{array}$	$\begin{array}{c} 6.5 \\ 7.1 \\ 7.6 \\ 8.2 \\ 8.8 \\ 9.4 \\ 10.0 \\ 10.6 \\ 11.2 \\ 11.8 \end{array}$	$71 \\ 72 \\ 73 \\ 74 \\ 75 \\ 76 \\ 77 \\ 78 \\ 79 \\ 80$	$\begin{array}{c} 57.4\\ 58.2\\ 59.1\\ 59.9\\ 60.7\\ 61.5\\ 62.3\\ 63.1\\ 63.9\\ 64.7\end{array}$	$\begin{array}{c} 41. \ 7\\ 42. \ 3\\ 42. \ 9\\ 43. \ 5\\ 44. \ 1\\ 44. \ 7\\ 45. \ 3\\ 45. \ 8\\ 46. \ 4\\ 47. \ 0\end{array}$	$ \begin{array}{r} 131 \\ 32 \\ 33 \\ 34 \\ 35 \\ 36 \\ 37 \\ 38 \\ 39 \\ 40 \\ 40 \\ \end{array} $	$\begin{array}{c} 106.0\\ 106.8\\ 107.6\\ 108.4\\ 109.2\\ 110.0\\ 110.8\\ 111.6\\ 112.5\\ 113.3 \end{array}$	$\begin{array}{c} 77.0\\ 77.6\\ 78.2\\ 78.8\\ 79.4\\ 79.9\\ 80.5\\ 81.1\\ 81.7\\ 82.3 \end{array}$	$ \begin{array}{r} 191 \\ 92 \\ 93 \\ 94 \\ 95 \\ 96 \\ 97 \\ 98 \\ 99 \\ 200 \\ \end{array} $	$\begin{array}{c} 154.5\\ 155.3\\ 156.1\\ 156.9\\ 157.8\\ 158.6\\ 159.4\\ 160.2\\ 161.0\\ 161.8 \end{array}$	$\begin{array}{c} 112.3\\ 112.9\\ 113.4\\ 114.0\\ 114.6\\ 115.2\\ 115.8\\ 116.4\\ 117.0\\ 117.6 \end{array}$	$ \begin{array}{r} 251 \\ 52 \\ 53 \\ 54 \\ 55 \\ 56 \\ 57 \\ 58 \\ 59 \\ 60 \\ \end{array} $	$\begin{array}{c} 203.1\\ 203.9\\ 204.7\\ 205.5\\ 206.3\\ 207.1\\ 207.9\\ 208.7\\ 209.5\\ 210.3\\ \end{array}$	$\begin{array}{c} 147.5\\ 148.1\\ 148.7\\ 149.3\\ 149.9\\ 150.5\\ 151.1\\ 151.6\\ 152.2\\ 152.8 \end{array}$
$ \begin{array}{r} 21 \\ 22 \\ 23 \\ 24 \\ 25 \\ 26 \\ 27 \\ 28 \\ 29 \\ 30 \\ \end{array} $	$\begin{array}{c} 17.0\\ 17.8\\ 18.6\\ 19.4\\ 20.2\\ 21.0\\ 21.8\\ 22.7\\ 23.5\\ 24.3 \end{array}$	$\begin{array}{c} 12.3\\ 12.9\\ 13.5\\ 14.1\\ 14.7\\ 15.3\\ 15.9\\ 16.5\\ 17.0\\ 17.6\end{array}$	81 82 83 84 85 86 87 88 89 90	$\begin{array}{c} 65.5\\ 66.3\\ 67.1\\ 68.0\\ 68.8\\ 69.6\\ 70.4\\ 71.2\\ 72.0\\ 72.8\end{array}$	$\begin{array}{r} 47.6\\ 48.2\\ 48.8\\ 49.4\\ 50.0\\ 50.5\\ 51.1\\ 51.7\\ 52.3\\ 52.9\end{array}$	$ \begin{array}{r} 141 \\ 42 \\ 43 \\ 44 \\ 45 \\ 46 \\ 47 \\ 48 \\ 49 \\ 50 \\ 50 \end{array} $	$\begin{array}{c} 114. 1 \\ 114. 9 \\ 115. 7 \\ 116. 5 \\ 117. 3 \\ 118. 1 \\ 118. 9 \\ 119. 7 \\ 120. 5 \\ 121. 4 \end{array}$	$\begin{array}{c} 82.9\\ 83.5\\ 84.1\\ 84.6\\ 85.2\\ 85.8\\ 86.4\\ 87.0\\ 87.6\\ 88.2 \end{array}$	$201 \\ 02 \\ 03 \\ 04 \\ 05 \\ 06 \\ 07 \\ 08 \\ 09 \\ 10$	$\begin{array}{c} 162.\ 6\\ 163.\ 4\\ 164.\ 2\\ 165.\ 0\\ 165.\ 8\\ 166.\ 7\\ 167.\ 5\\ 168.\ 3\\ 169.\ 1\\ 169.\ 9\end{array}$	$\begin{array}{c} 118.1\\ 118.7\\ 119.3\\ 119.9\\ 120.5\\ 121.1\\ 121.7\\ 122.3\\ 122.8\\ 123.4 \end{array}$	$ \begin{array}{r} 261 \\ 62 \\ 63 \\ 64 \\ 65 \\ 66 \\ 67 \\ 68 \\ 69 \\ 70 \end{array} $	$\begin{array}{c} 211.2\\ 212.0\\ 212.8\\ 213.6\\ 214.4\\ 215.2\\ 216.0\\ 216.8\\ 217.6\\ 218.4 \end{array}$	$\begin{array}{c} 153.\ 4\\ 154.\ 0\\ 154.\ 6\\ 155.\ 2\\ 155.\ 8\\ 156.\ 4\\ 156.\ 9\\ 157.\ 5\\ 158.\ 1\\ 158.\ 7\end{array}$
$ \begin{array}{r} 31 \\ 32 \\ 33 \\ 34 \\ 35 \\ 36 \\ 37 \\ 38 \\ 39 \\ 40 \\ 40 \end{array} $	$\begin{array}{c} 25.1\\ 25.9\\ 26.7\\ 27.5\\ 28.3\\ 29.1\\ 29.9\\ 30.7\\ 31.6\\ 32.4 \end{array}$	$\begin{array}{c} 18.2 \\ 18.8 \\ 19.4 \\ 20.0 \\ 20.6 \\ 21.2 \\ 21.7 \\ 22.3 \\ 22.9 \\ 23.5 \end{array}$	$\begin{array}{r} 91 \\ 92 \\ 93 \\ 94 \\ 95 \\ 96 \\ 97 \\ 98 \\ 99 \\ 100 \end{array}$	$\begin{array}{c} 75.\ 6\\ 74.\ 4\\ 75.\ 2\\ 76.\ 0\\ 76.\ 9\\ 77.\ 7\\ 78.\ 5\\ 79.\ 3\\ 80.\ 1\\ 80.\ 9\end{array}$	$\begin{array}{c} 53.5\\ 54.1\\ 54.7\\ 55.3\\ 55.8\\ 56.4\\ 57.0\\ 57.6\\ 58.2\\ 58.8\end{array}$	$\begin{array}{r} 151 \\ 52 \\ 53 \\ 54 \\ 55 \\ 56 \\ 57 \\ 58 \\ 59 \\ 60 \end{array}$	$\begin{array}{c} 122.\ 2\\ 123.\ 0\\ 123.\ 8\\ 124.\ 6\\ 125.\ 4\\ 126.\ 2\\ 127.\ 0\\ 127.\ 8\\ 128.\ 6\\ 129.\ 4 \end{array}$	$\begin{array}{c} 88.8\\ 89.3\\ 89.9\\ 90.5\\ 91.1\\ 91.7\\ 92.3\\ 92.9\\ 93.5\\ 94.0 \end{array}$	$\begin{array}{r} 211 \\ 12 \\ 13 \\ 14 \\ 15 \\ 16 \\ 17 \\ 18 \\ 19 \\ 20 \end{array}$	$\begin{array}{c} 170.\ 7\\ 171.\ 5\\ 172.\ 3\\ 173.\ 1\\ 173.\ 9\\ 174.\ 7\\ 175.\ 6\\ 176.\ 4\\ 177.\ 2\\ 178.\ 0 \end{array}$	$\begin{array}{c} 124.0\\ 124.6\\ 125.2\\ 125.8\\ 126.4\\ 127.0\\ 127.5\\ 128.1\\ 128.7\\ 129.3 \end{array}$	$\begin{array}{r} 271 \\ 72 \\ 73 \\ 74 \\ 75 \\ 76 \\ 77 \\ 78 \\ 79 \\ 80 \end{array}$	$\begin{array}{c} 219.\ 2\\ 220.\ 1\\ 220.\ 9\\ 221.\ 7\\ 222.\ 5\\ 223.\ 3\\ 224.\ 1\\ 224.\ 9\\ 225.\ 7\\ 226.\ 5\\ \end{array}$	$\begin{array}{c} 159.\ 3\\ 159.\ 9\\ 160.\ 5\\ 161.\ 1\\ 161.\ 6\\ 162.\ 2\\ 162.\ 8\\ 163.\ 4\\ 164.\ 0\\ 164.\ 6\end{array}$
$ \begin{array}{r} 41\\ 42\\ 43\\ 44\\ 45\\ 46\\ 47\\ 48\\ 49\\ 50\\ \end{array} $	$\begin{array}{c} 33.2\\ 34.0\\ 34.8\\ 35.6\\ 36.4\\ 37.2\\ 38.0\\ 38.8\\ 39.6\\ 40.5\\ \end{array}$	$\begin{array}{c} 24.1\\ 24.7\\ 25.3\\ 25.9\\ 26.5\\ 27.0\\ 27.6\\ 28.2\\ 28.8\\ 29.4 \end{array}$	$ \begin{array}{c} 101 \\ 02 \\ 03 \\ 04 \\ 05 \\ 06 \\ 07 \\ 08 \\ 09 \\ 10 \end{array} $	$\begin{array}{c} 81.7\\ 82.5\\ 83.3\\ 84.1\\ 84.9\\ 85.8\\ 86.6\\ 87.4\\ 88.2\\ 89.0\\ \end{array}$	$\begin{array}{c} 59. \ 4\\ 60. \ 0\\ 60. \ 5\\ 61. \ 1\\ 61. \ 7\\ 62. \ 3\\ 62. \ 9\\ 63. \ 5\\ 64. \ 1\\ 64. \ 7\end{array}$	$ \begin{array}{r} 161 \\ 62 \\ 63 \\ 64 \\ 65 \\ 66 \\ 67 \\ 68 \\ 69 \\ 70 \\ \end{array} $	$\begin{array}{c} 130.\ 3\\ 131.\ 1\\ 131.\ 9\\ 132.\ 7\\ 133.\ 5\\ 134.\ 3\\ 135.\ 1\\ 135.\ 9\\ 136.\ 7\\ 137.\ 5\end{array}$	$\begin{array}{c} 94.\ 6\\ 95.\ 2\\ 95.\ 8\\ 96.\ 4\\ 97.\ 0\\ 97.\ 6\\ 98.\ 2\\ 98.\ 7\\ 99.\ 3\\ 99.\ 9\end{array}$	$\begin{array}{r} 221 \\ 22 \\ 23 \\ 24 \\ 25 \\ 26 \\ 27 \\ 28 \\ 29 \\ 30 \end{array}$	$\begin{array}{c} 178.8\\ 179.6\\ 180.4\\ 181.2\\ 182.0\\ 182.8\\ 183.6\\ 184.5\\ 185.3\\ 186.1 \end{array}$	$\begin{array}{c} 129.\ 9\\ 130.\ 5\\ 131.\ 1\\ 131.\ 7\\ 132.\ 3\\ 132.\ 8\\ 133.\ 4\\ 134.\ 0\\ 134.\ 6\\ 135.\ 2 \end{array}$	$281 \\ 82 \\ 83 \\ 84 \\ 85 \\ 86 \\ 87 \\ 88 \\ 89 \\ 90$	$\begin{array}{c} 227.3\\ 228.1\\ 229.0\\ 229.8\\ 230.6\\ 231.4\\ 232.2\\ 233.0\\ 233.8\\ 234.6\\ \end{array}$	$\begin{array}{c} 165.\ 2\\ 165.\ 8\\ 166.\ 3\\ 166.\ 9\\ 167.\ 5\\ 168.\ 1\\ 168.\ 7\\ 169.\ 3\\ 169.\ 9\\ 170.\ 5\\ \end{array}$
51 52 53 54 55 56 57 58 59 60	$\begin{array}{c} 41.3\\ 42.1\\ 42.9\\ 43.7\\ 44.5\\ 45.3\\ 46.1\\ 46.9\\ 47.7\\ 48.5\end{array}$	$\begin{array}{c} 30.0\\ 30.6\\ 31.2\\ 31.7\\ 32.3\\ 32.9\\ 33.5\\ 34.1\\ 34.7\\ 35.3 \end{array}$	$ \begin{array}{c} 111\\ 12\\ 13\\ 14\\ 15\\ 16\\ 17\\ 18\\ 19\\ 20\\ \end{array} $	$\begin{array}{c} 89.8\\ 90.6\\ 91.4\\ 92.2\\ 93.0\\ 93.8\\ 94.7\\ 95.5\\ 96.3\\ 97.1 \end{array}$	$\begin{array}{c} 65.2\\ 65.8\\ 66.4\\ 67.0\\ 67.6\\ 68.2\\ 68.8\\ 69.4\\ 69.9\\ 70.5 \end{array}$	$ \begin{array}{r} 171 \\ 72 \\ 73 \\ 74 \\ 75 \\ 76 \\ 77 \\ 78 \\ 79 \\ 80 \\ \end{array} $	$\begin{array}{c} 138.3\\ 139.2\\ 140.0\\ 140.8\\ 141.6\\ 142.4\\ 143.2\\ 144.0\\ 144.8\\ 145.6 \end{array}$	$\begin{array}{c} 100.\ 5\\ 101.\ 1\\ 101.\ 7\\ 102.\ 3\\ 102.\ 9\\ 103.\ 5\\ 104.\ 0\\ 104.\ 6\\ 105.\ 2\\ 105.\ 8 \end{array}$	$\begin{array}{r} 231 \\ 32 \\ 33 \\ 34 \\ 35 \\ 36 \\ 37 \\ 38 \\ 39 \\ 40 \end{array}$	$\begin{array}{c} 186.9\\ 187.7\\ 188.5\\ 189.3\\ 190.1\\ 190.9\\ 191.7\\ 192.5\\ 193.4\\ 194.2 \end{array}$	$\begin{array}{c} 135.8\\ 136.4\\ 137.0\\ 137.5\\ 138.1\\ 138.7\\ 139.3\\ 139.9\\ 140.5\\ 141.1 \end{array}$	$\begin{array}{r} 291 \\ 92 \\ 93 \\ 94 \\ 95 \\ 96 \\ 97 \\ 98 \\ 99 \\ 300 \end{array}$	$\begin{array}{c} 235.4\\ 236.2\\ 237.0\\ 237.9\\ 238.7\\ 239.5\\ 240.3\\ 241.1\\ 241.9\\ 242.7\end{array}$	$\begin{array}{c} 171.0\\ 171.6\\ 172.2\\ 172.8\\ 173.4\\ 174.0\\ 174.6\\ 175.2\\ 175.7\\ 176.3 \end{array}$
Dist.	Dep.	Lat.	Dist.	Dep.	Lat.	Dist.	Dep,	Lat.	Dist.	Dep.	Lat.	Dist.	Dep.	Lat.
						$54^{\circ}(1$	$26^{\circ}, 234$	°, 306°).					

						Т	ABLE	E 2.					[Page	439
			Differe	ence of [Latitud	e and	Departu	are for	36° (1	.44°, 210	3°, 324°).		
Dist.	Lat.	Dep.	Dist.	Lat.	Dep.	Dist.	Lat.	Dep.	Dist.	Lat.	Dep.	Dist.	Lat.	Dep.
301	243.5	176.9	$\frac{361}{62}$	292.1	212.2	421	340.6	247.5	481	389.1	282.7	541	437.7	318.0
$02 \\ 03$	244.3 245.1	178.1	$62 \\ 63$	292.9 293.7	212.8 213.4	$\frac{22}{23}$	341.4 342.2	240.1 248.6	83	390.0 390.8	283.9	43	439.3	318.0 319.1
04	246.0	178.7	64 65	294.5 205.2	214.0	24	343.0	249.2	84	391.6	284.5	44	440.2	319.7
05	240.8 247.6	179.9	66	295.3	214.0 215.1	$\frac{20}{26}$	344.7	249.0	86	393.2	285.6	46	441.8	320.3 320.9
07	248.4	180.5	67	296.9	215.7	27	345.5	251.0 251.6	87	394.0	286.2	47	442.6	321.5
08	249.2 250.0	181.6	69	298.5	216.9	$\frac{20}{29}$	347.1	251.0 252.2	89	395.6	280.8	49	444.2	322.1 322.7
10	250.8	182.2	$\frac{70}{271}$	299.3	$\frac{217.5}{219.1}$	$\frac{30}{491}$	347.9	$\frac{252.8}{252.2}$	90	396.4	$\frac{288.0}{999.0}$	50	445.0	$\frac{323.3}{202.0}$
$\frac{311}{12}$	251.6 252.4	182.8 183.4	$\frac{571}{72}$	300.2 301.0	218.1 218.7	+31 32	349.5	253.3 253.9	491 92	397.3	288.0 289.2	$\frac{551}{52}$	446.6	323.8 324.4
13	253.2	184.0	73	301.8	219.3	33	350.3	254.5	93	398.9	289.8	53	447.4	325.0
$14 \\ 15$	254.0 254.9	184.0	$74 \\ 75$	302.0 303.4	219.8 220.4	35 - 35	351.1 351.9	255.1 255.7	94	400.5	290.5 290.9	55	448.2 449.0	326.2
16	255.7	185.8	$-\frac{76}{77}$	304.2	221.0	$\frac{36}{27}$	352.7	256.3	96	401.3	291.5	$\frac{56}{57}$	$\frac{449.8}{150.7}$	326.8
$17 \\ 18$	256.5 257.3	180.4 186.9	78	305.0	221.0 222.2	38	354.4	250.9 257.5	97	402.1 402.9	292.1 292.7	$\frac{57}{58}$	451.5	327.4 328.0
19	258.1	187.5	79	306.6	222.8	39	355.2	258.0	99	403.7	293.3	59 60	452.3	328.5
$\frac{20}{321}$	$\frac{258.9}{259.7}$	188.7	381	$\frac{307.4}{308.2}$	$\frac{223.4}{224.0}$	40	$\frac{356.0}{356.8}$	259.2	$\frac{500}{501}$	404.0	$\frac{293.9}{294.5}$	$\frac{60}{561}$	$\frac{+53.1}{453.9}$	$\frac{329.1}{329.7}$
22	260.5	189.3	82	309.1	224.5	42	357.6	259.8	02	406.1	295.0	62	454.7	330.3
$\frac{23}{24}$	261.3 262.1	189.9 190.5	83	309.9 310.7	225.1 225.7	43	358.4 359.2	260.4 261.0	03	407.0 407.8	295.6 296.2	$\frac{63}{64}$	$\frac{455,5}{456,3}$	330.9 331.5
$\tilde{25}$	262.9	191.0	85	311.5	226.3	45	360.0	261.6	05	408.6	296.8	65	457.1	332.1
$\frac{26}{27}$	263.7 264.6	191.6 192.2	$\frac{86}{87}$	312.3 313.1	226.9 227.5	$\frac{46}{47}$	360.8 361.6	262.2 262.8	06	409.4 410.2	297.4 298.0	$\frac{66}{67}$	457.9 458.7	$\begin{vmatrix} 332.7\\ 333 \end{vmatrix}$
$\tilde{28}$	265.4	192.8	88	313.9	228.1	48	362.4	263.3	08	411.0	298.6	68	459.5	333.8
$\frac{29}{30}$	$266.2 \\ 267.0$	193.4 194.0	- 89 - 90	314.7 315.5	228.7 229.2	$\frac{49}{50}$	363.3 364.1	263.9 264.5	09	411.8 412.6	299.2 299.8	$\frac{69}{70}$	460.3 461.1	334.4 335.0
331	267.8	194.6	391	316.3	229.8	451	364.9	$\frac{261.0}{265.1}$	511	413.4	$\frac{200.0}{300.3}$	571	462.0	335.6
$\frac{32}{33}$	268.6	195.2 195.7	92	317.1	230.4	$52 \\ 53$	365.7	265.7	$\frac{12}{13}$	414.2	300.9	$\frac{72}{73}$	462.8	336.2
34	270.2	196.3	94	318.8	231.0 231.6	$54 \\ 54$	367.3	266.9	14	415.9	302.1	74	464.4	337.4
$\frac{35}{36}$	271.0 271.8	196.9 197.5	95 96	319.6	232.2	55 56	368.1	267.5	15	416.7	$\begin{vmatrix} 302.7\\ 202 \end{vmatrix}$	$75 \\ 76$	465.2	338.0
37	271.8 272.6	197.0 198.1	90 97	320.4	232.8	57	369.7	-268.0 268.6	17	417.3	303.9	77	466.8	339.1
$\frac{38}{20}$	273.5	198.7	98	322.0	233.9	58	370.5	269.2	18	419.1	304.4	78	467.6	339.7
- 40	274.5 275.1	199.3	400	323.6	234.0 235.1	- 59 - 60	$371.3 \\ 372.2$	209.8 270.4	$\frac{19}{20}$	419.9	305.0	79 80	469.3	340.3
341	275.9	200.4	401	324.4	235.7	461	373.0	271.0	521	421.5	306.2	581	470.1	341.5
$\frac{42}{43}$	276.7 277.5	201.0 201.6	$02 \\ 03$	325.2 326.0	236.3 236.9	$\frac{62}{63}$	373.8 374.6	271.6 272.2	$\frac{22}{23}$	422.3 423.1	306.8 307.4	$\frac{82}{83}$	470.9 471.7	342.1 342.7
44	278.3	202.2	04	326.9	237.5	64	375.4	272.7	24	423.9	308.0	84	472.5	343.2
45 46	$279.1 \\ 279.9$	202.8 203.4	05 06	327.7 328.5	$238.1 \\ 238.7$	65 66	376.2 377.0	273.3 273.9	$\frac{25}{26}$	$\begin{array}{c} 424.7\\ 425.5\end{array}$	308.6 309.2	$\frac{85}{86}$	$\begin{array}{c} 473.3 \\ 474.1 \end{array}$	343.8 344.4
47	280.7	204.0	07	329.3	239.2	67	377.8	274.5	27	426.4	309.7	87	474.9	345.0
$\frac{48}{49}$	281.5 282.4	$\begin{bmatrix} 204.6\\ 205.1 \end{bmatrix}$	$08 \\ 09$	330.1 330.9	239.8 240.4	$\frac{68}{69}$	378.6 379.4	$ \frac{275.1}{275.7} $	$\frac{28}{29}$	427.2 428.0	310.3 310.9	88 89	$475.7 \\ 476.5$	345.6 346.2
$\overline{50}$	283.2	205.7	10	331.7	241.0	70	380.2	276.3	30	428.8	311.5	90	477.3	346.8
$\frac{351}{52}$	284.0 281 9	206.3 206.9	411	332.5	241.6	$\frac{471}{79}$	381.1 381.0	276.9	531	429.6 430.1	$\frac{312.1}{319}$	591 09	478.2 479.0	347.4 347.0
$\frac{52}{53}$	285.6	200.9 207.5	$12 \\ 13$	334.1	242.2	73^{12}	382.7	$\begin{bmatrix} 277.4\\ 278.0 \end{bmatrix}$	э <i>4</i> 33	431.2	313.3	92 93	479.8	347.9 348.5
54 55	286.4	208.1	14	334.9	243.4	74	383.5	278.6	34	432.0	313.9	94	480.6	349.1
$\frac{55}{56}$	287.2 288.0	203.7 209.3	$15 \\ 16$	336.6	240.9	-76 - 76	385.1	$\begin{bmatrix} 279.2\\279.8\end{bmatrix}$	- 35 - 36	432.9 433.7	315.0	95 96	482.2	350.3
57	288.8	209.8	17	337.4	245.1	77	385.9	280.4	37	434.5	315.6	97	483.0	350.9
59 59	289.6 290.4	210.4 211.0	$18 \\ 19$	558, 2 339, 0	240.7 246.3	$\frac{18}{79}$	380.7	281.0 281.6	$\frac{38}{39}$	430.3 436.1	316.2 316.8	- 98 - 99	483.8 484.6	351. ə 352. 1
60	291.3	211.6	20	339.8	246.9	80	388.3	282.1	40	436.9	317.4	600	485.4	352.7
Dist.	Dep.	Lat.	Dist.	Dep.	Lat.	Dist,	Dep.	Lat.	Dist,	Dep.	Lat.	Dist.	Dep.	Lat.
						54° (1	26°, 23-	4°, 306°).					

Pa	ge 440]				Т	ABLE	2 2.						
		1	Differe	nce of I	atitud	e and	Departu	re for 3	37° (1	43°, 217	°, 323°).		
Dist.	Lat.	Dep.	Dist.	Lat.	Dep.	Dist.	Lat.	Dep.	Dist.	Lat.	Dep.	Dist.	Lat.	Dep.
$ \begin{array}{c} 1 \\ 2 \\ 3 \\ 4 \\ 5 \\ 6 \\ 7 \\ 8 \\ 9 \\ 10 \\ \end{array} $	$\begin{array}{c} 0.8\\ 1.6\\ 2.4\\ 3.2\\ 4.0\\ 4.8\\ 5.6\\ 6.4\\ 7.2\\ 8.0 \end{array}$	$\begin{array}{c} 0.\ 6\\ 1.\ 2\\ 1.\ 8\\ 2.\ 4\\ 3.\ 0\\ 3.\ 6\\ 4.\ 2\\ 4.\ 8\\ 5.\ 4\\ 6.\ 0\end{array}$	61 62 63 64 65 66 67 68 69 70	$\begin{array}{r} 48.\ 7\\ 49.\ 5\\ 50.\ 3\\ 51.\ 1\\ 51.\ 9\\ 52.\ 7\\ 53.\ 5\\ 54.\ 3\\ 55.\ 1\\ 55.\ 9\end{array}$	$\begin{array}{c} 36.\ 7\\ 37.\ 3\\ 37.\ 9\\ 38.\ 5\\ 39.\ 1\\ 39.\ 7\\ 40.\ 3\\ 40.\ 9\\ 41.\ 5\\ 42.\ 1\end{array}$	$121 \\ 22 \\ 23 \\ 24 \\ 25 \\ 26 \\ 27 \\ 28 \\ 29 \\ 30$	96. 6 97. 4 98. 2 99. 0 99. 8 100. 6 101. 4 102. 2 103. 0 103. 8	$\begin{array}{c} 72.8\\ 73.4\\ 74.0\\ 74.6\\ 75.2\\ 75.8\\ 76.4\\ 77.0\\ 77.6\\ 78.2 \end{array}$	181 82 83 84 85 86 87 88 89 90	$\begin{array}{c} 144.\ 6\\ 145.\ 4\\ 146.\ 2\\ 146.\ 9\\ 147.\ 7\\ 148.\ 5\\ 149.\ 3\\ 150.\ 1\\ 150.\ 9\\ 151.\ 7\end{array}$	$\begin{array}{c} 108. \ 9\\ 109. \ 5\\ 110. \ 1\\ 110. \ 7\\ 111. \ 3\\ 111. \ 9\\ 112. \ 5\\ 113. \ 1\\ 113. \ 7\\ 114. \ 3 \end{array}$	$241 \\ 42 \\ 43 \\ 44 \\ 45 \\ 46 \\ 47 \\ 48 \\ 49 \\ 50$	$192.5 \\193.3 \\194.1 \\194.9 \\195.7 \\196.5 \\197.3 \\198.1 \\198.9 \\199.7 \\$	$\begin{array}{c} 145.\ 0\\ 145.\ 6\\ 146.\ 2\\ 146.\ 8\\ 147.\ 4\\ 148.\ 0\\ 148.\ 6\\ 149.\ 3\\ 149.\ 9\\ 150.\ 5\end{array}$
$ \begin{array}{r} 11 \\ 12 \\ 13 \\ 14 \\ 15 \\ 16 \\ 17 \\ 18 \\ 19 \\ 20 \\ \end{array} $	$\begin{array}{c} 8.8\\ 9.6\\ 10.4\\ 11.2\\ 12.0\\ 12.8\\ 13.6\\ 14.4\\ 15.2\\ 16.0\\ \end{array}$	$\begin{array}{c} 6. \ 6 \\ 7. \ 2 \\ 7. \ 8 \\ 8. \ 4 \\ 9. \ 0 \\ 9. \ 6 \\ 10. \ 2 \\ 10. \ 8 \\ 11. \ 4 \\ 12. \ 0 \end{array}$	$71 \\ 72 \\ 73 \\ 74 \\ 75 \\ 76 \\ 77 \\ 78 \\ 79 \\ 80$	$56.7 \\ 57.5 \\ 58.3 \\ 59.1 \\ 59.9 \\ 60.7 \\ 61.5 \\ 62.3 \\ 63.1 \\ 63.9 $	$\begin{array}{r} 42.7\\ 43.3\\ 43.9\\ 44.5\\ 45.1\\ 45.7\\ 46.3\\ 46.9\\ 47.5\\ 48.1 \end{array}$	$ \begin{array}{r} 131 \\ 32 \\ 33 \\ 34 \\ 35 \\ 36 \\ 37 \\ 38 \\ 39 \\ 40 \\ 40 \end{array} $	104. 6 105. 4 106. 2 107. 0 107. 8 108. 6 109. 4 110. 2 111. 0 111. 8	$\begin{array}{c} 78.8\\ 79.4\\ 80.0\\ 80.6\\ 81.2\\ 81.8\\ 82.4\\ 83.1\\ 83.7\\ 84.3 \end{array}$	$ \begin{array}{r} 191 \\ 92 \\ 93 \\ 94 \\ 95 \\ 96 \\ 97 \\ 98 \\ 99 \\ 200 \\ \end{array} $	$\begin{array}{c} 152.5\\ 153.3\\ 154.1\\ 154.9\\ 155.7\\ 156.5\\ 157.3\\ 158.1\\ 158.9\\ 159.7\end{array}$	$\begin{array}{c} 114.9\\ 115.5\\ 116.2\\ 116.8\\ 117.4\\ 118.0\\ 118.6\\ 119.2\\ 119.8\\ 120.4 \end{array}$	$251 \\ 52 \\ 53 \\ 54 \\ 55 \\ 56 \\ 57 \\ 58 \\ 59 \\ 60$	$\begin{array}{c} 200.\ 5\\ 201.\ 3\\ 202.\ 1\\ 202.\ 9\\ 203.\ 7\\ 204.\ 5\\ 205.\ 2\\ 206.\ 0\\ 206.\ 8\\ 207.\ 6\end{array}$	$\begin{array}{c} 151.1\\ 151.7\\ 152.3\\ 152.9\\ 153.5\\ 154.1\\ 154.7\\ 155.3\\ 155.9\\ 156.5 \end{array}$
$21 \\ 22 \\ 23 \\ 24 \\ 25 \\ 26 \\ 27 \\ 28 \\ 29 \\ 30$	$\begin{array}{c} 16.8\\ 17.6\\ 18.4\\ 19.2\\ 20.0\\ 20.8\\ 21.6\\ 22.4\\ 23.2\\ 24.0\\ \end{array}$	$\begin{array}{c} 12.6\\ 13.2\\ 13.8\\ 14.4\\ 15.0\\ 15.6\\ 16.2\\ 16.9\\ 17.5\\ 18.1 \end{array}$	81 82 83 84 85 86 87 88 89 90	$\begin{array}{c} 64.\ 7\\ 65.\ 5\\ 66.\ 3\\ 67.\ 1\\ 67.\ 9\\ 68.\ 7\\ 69.\ 5\\ 70.\ 3\\ 71.\ 1\\ 71.\ 9\end{array}$	$\begin{array}{c} 48.7\\ 49.3\\ 50.0\\ 50.6\\ 51.2\\ 51.8\\ 52.4\\ 53.0\\ 53.6\\ 54.2 \end{array}$	$ \begin{array}{r} 141 \\ 42 \\ 43 \\ 44 \\ 45 \\ 46 \\ 47 \\ 48 \\ 49 \\ 50 \\ 50 \end{array} $	$\begin{array}{c} 112.\ 6\\ 113.\ 4\\ 114.\ 2\\ 115.\ 0\\ 115.\ 8\\ 116.\ 6\\ 117.\ 4\\ 118.\ 2\\ 119.\ 0\\ 119.\ 8\end{array}$	84. 9 85. 5 86. 1 86. 7 87. 3 87. 9 88. 5 89. 1 89. 7 90. 3	$ \begin{array}{c} 201 \\ 02 \\ 03 \\ 04 \\ 05 \\ 06 \\ 07 \\ 08 \\ 09 \\ 10 \\ \end{array} $	$\begin{array}{c} 160.5\\ 161.3\\ 162.1\\ 162.9\\ 163.7\\ 164.5\\ 165.3\\ 166.1\\ 166.9\\ 167.7 \end{array}$	$\begin{array}{c} 121.0\\ 121.6\\ 122.2\\ 122.8\\ 123.4\\ 124.0\\ 124.6\\ 125.2\\ 125.8\\ 126.4 \end{array}$	$261 \\ 62 \\ 63 \\ 64 \\ 65 \\ 66 \\ 67 \\ 68 \\ 69 \\ 70$	$\begin{array}{c} 208.\ 4\\ 209.\ 2\\ 210.\ 0\\ 210.\ 8\\ 211.\ 6\\ 212.\ 4\\ 213.\ 2\\ 214.\ 0\\ 214.\ 8\\ 215.\ 6\end{array}$	$\begin{array}{c} 157. 1 \\ 157. 7 \\ 158. 3 \\ 158. 9 \\ 159. 5 \\ 160. 1 \\ 160. 7 \\ 161. 3 \\ 161. 9 \\ 162. 5 \end{array}$
$ \begin{array}{r} 31 \\ 32 \\ 33 \\ 34 \\ 35 \\ 36 \\ 37 \\ 38 \\ 39 \\ 40 \\ 40 \end{array} $	$\begin{array}{c} \hline 24.8 \\ 25.6 \\ 26.4 \\ 27.2 \\ 28.0 \\ 28.8 \\ 29.5 \\ 30.3 \\ 31.1 \\ 31.9 \end{array}$	$\begin{array}{c} 18.7\\ 19.3\\ 19.9\\ 20.5\\ 21.1\\ 21.7\\ 22.3\\ 22.9\\ 23.5\\ 24.1 \end{array}$	91 92 93 94 95 96 97 98 99 100	$\begin{array}{c} \hline 72.7\\ 73.5\\ 74.3\\ 75.1\\ 75.9\\ 76.7\\ 77.5\\ 78.3\\ 79.1\\ 79.9 \end{array}$	$54.8 \\ 55.4 \\ 56.0 \\ 56.6 \\ 57.2 \\ 57.8 \\ 58.4 \\ 59.0 \\ 59.6 \\ 60.2$	$ \begin{array}{r} 151 \\ 52 \\ 53 \\ 54 \\ 55 \\ 56 \\ 57 \\ 58 \\ 59 \\ 60 \\ \end{array} $	$\begin{array}{c} 120.\ 6\\ 121.\ 4\\ 122.\ 2\\ 123.\ 0\\ 123.\ 8\\ 124.\ 6\\ 125.\ 4\\ 126.\ 2\\ 127.\ 0\\ 127.\ 8\end{array}$	$\begin{array}{c} 90. \ 9\\ 91. \ 5\\ 92. \ 1\\ 92. \ 7\\ 93. \ 3\\ 93. \ 9\\ 94. \ 5\\ 95. \ 1\\ 95. \ 7\\ 96. \ 3\end{array}$	$\begin{array}{c} 211 \\ 12 \\ 13 \\ 14 \\ 15 \\ 16 \\ 17 \\ 18 \\ 19 \\ 20 \end{array}$	$\begin{array}{c} 168.5\\ 169.3\\ 170.1\\ 170.9\\ 171.7\\ 172.5\\ 173.3\\ 174.1\\ 174.9\\ 175.7 \end{array}$	$\begin{array}{c} 127.0\\ 127.6\\ 128.2\\ 128.8\\ 129.4\\ 130.0\\ 130.6\\ 131.2\\ 131.8\\ 132.4\\ \end{array}$	$\begin{array}{c} 271 \\ 72 \\ 73 \\ 74 \\ 75 \\ 76 \\ 77 \\ 78 \\ 79 \\ 80 \end{array}$	$\begin{array}{c} 216.4\\ 217.2\\ 218.0\\ 218.8\\ 219.6\\ 220.4\\ 221.2\\ 222.0\\ 222.8\\ 223.6\end{array}$	$\begin{array}{c} 163.1\\ 163.7\\ 164.3\\ 164.9\\ 165.5\\ 166.1\\ 166.7\\ 167.3\\ 167.9\\ 168.5 \end{array}$
$\begin{array}{c} 41 \\ 42 \\ 43 \\ 44 \\ 45 \\ 46 \\ 47 \\ 48 \\ 49 \\ 50 \end{array}$	$\begin{array}{c} 32.7\\ 33.5\\ 34.3\\ 35.1\\ 35.9\\ 36.7\\ 37.5\\ 38.3\\ 39.1\\ 39.9\end{array}$	$\begin{array}{c} 24.7\\ 25.3\\ 25.9\\ 26.5\\ 27.1\\ 27.7\\ 28.3\\ 28.9\\ 89.5\\ 30.1\\ \end{array}$	$ \begin{array}{r} 101 \\ 02 \\ 03 \\ 04 \\ 05 \\ 06 \\ 07 \\ 08 \\ 09 \\ 10 \\ \end{array} $	80.7 81.5 82.3 83.1 83.9 84.7 85.5 86.3 87.1 87.8	$\begin{array}{c} 60.8\\ 61.4\\ 62.0\\ 62.6\\ 63.2\\ 63.8\\ 64.4\\ 65.0\\ 65.6\\ 66.2 \end{array}$	$ \begin{array}{r} 33 \\ 161 \\ 62 \\ 63 \\ 64 \\ 65 \\ 66 \\ 67 \\ 68 \\ 69 \\ 70 \\ 70 \\ \end{array} $	$\begin{array}{c} 128.6\\ 129.4\\ 130.2\\ 131.0\\ 131.8\\ 132.6\\ 133.4\\ 134.2\\ 135.0\\ 135.8\\ \end{array}$	96. 9 97. 5 98. 1 98. 7 99. 3 99. 9 100. 5 101. 1 101. 7 102. 3	$ \begin{array}{r} 221 \\ 22 \\ 23 \\ 24 \\ 25 \\ 26 \\ 27 \\ 28 \\ 29 \\ 30 \\ \end{array} $	$\begin{array}{c} 176.5\\ 177.3\\ 178.1\\ 178.9\\ 179.7\\ 180.5\\ 181.3\\ 182.1\\ 182.9\\ 183.7\\ \end{array}$	$\begin{array}{c} 133.0\\ 133.6\\ 134.2\\ 134.8\\ 135.4\\ 136.0\\ 136.6\\ 137.2\\ 137.8\\ 138.4 \end{array}$	281 82 83 84 85 86 87 88 89 90	$\begin{array}{c} 224.\ 4\\ 225.\ 2\\ 226.\ 0\\ 226.\ 8\\ 227.\ 6\\ 228.\ 4\\ 229.\ 2\\ 230.\ 0\\ 230.\ 8\\ 231.\ 6\end{array}$	$\begin{array}{c} 169.1\\ 169.7\\ 170.3\\ 170.9\\ 171.5\\ 172.1\\ 172.7\\ 173.3\\ 173.9\\ 174.5\\ \end{array}$
51 52 53 54 55 56 57 58 59 60	$\begin{array}{r} 40.\ 7\\ 41.\ 5\\ 42.\ 3\\ 43.\ 1\\ 43.\ 9\\ 44.\ 7\\ 45.\ 5\\ 46.\ 3\\ 47.\ 1\\ 47.\ 9\end{array}$	$\begin{array}{c} 30.\ 7\\ 31.\ 3\\ 31.\ 9\\ 32.\ 5\\ 33.\ 1\\ 33.\ 7\\ 34.\ 3\\ 34.\ 9\\ 35.\ 5\\ 36.\ 1\end{array}$	$ \begin{array}{c} 111\\ 12\\ 13\\ 14\\ 15\\ 16\\ 17\\ 18\\ 19\\ 20\\ \end{array} $	$\begin{array}{c} 88.6\\ 89.4\\ 90.2\\ 91.0\\ 91.8\\ 92.6\\ 93.4\\ 94.2\\ 95.0\\ 95.8\end{array}$	$\begin{array}{c} 66.8\\ 67.4\\ 68.0\\ 68.6\\ 69.2\\ 69.8\\ 70.4\\ 71.0\\ 71.6\\ 72.2 \end{array}$	$ \begin{array}{r} 171 \\ 72 \\ 73 \\ 74 \\ 75 \\ 76 \\ 77 \\ 78 \\ 79 \\ 80 \\ \end{array} $	$\begin{array}{c} 136.\ 6\\ 137.\ 4\\ 138.\ 2\\ 139.\ 0\\ 139.\ 8\\ 140.\ 6\\ 141.\ 4\\ 142.\ 2\\ 143.\ 0\\ 143.\ 8\end{array}$	$\begin{array}{c} 102.\ 9\\ 103.\ 5\\ 104.\ 1\\ 104.\ 7\\ 105.\ 3\\ 105.\ 9\\ 106.\ 5\\ 107.\ 1\\ 107.\ 7\\ 108.\ 3 \end{array}$	$\begin{array}{c} 231 \\ 32 \\ 33 \\ 34 \\ 35 \\ 36 \\ 37 \\ 38 \\ 39 \\ 40 \end{array}$	$184.5 \\ 185.3 \\ 186.1 \\ 186.9 \\ 187.7 \\ 188.5 \\ 189.3 \\ 190.1 \\ 190.9 \\ 191.7 \\$	$\begin{array}{c} 139.\ 0\\ 139.\ 6\\ 140.\ 2\\ 140.\ 8\\ 141.\ 4\\ 142.\ 0\\ 142.\ 6\\ 143.\ 2\\ 143.\ 8\\ 144.\ 4\end{array}$	$291 \\ 92 \\ 93 \\ 94 \\ 95 \\ 96 \\ 97 \\ 98 \\ 99 \\ 300$	$\begin{array}{c} 232.\ 4\\ 233.\ 2\\ 234.\ 0\\ 234.\ 8\\ 235.\ 6\\ 236.\ 4\\ 237.\ 2\\ 238.\ 0\\ 238.\ 8\\ 239.\ 6\end{array}$	$\begin{array}{c} 175.1\\ 175.7\\ 176.3\\ 176.9\\ 177.5\\ 178.1\\ 178.7\\ 179.3\\ 179.9\\ 180.5 \end{array}$
Dist.	Dep.	Lat.	Dist.	Dep.	Lat.	Dist.	Dep:	Lat.	Dist.	Dep.	Lat.	Dist.	Dep.	Lat.
						53° (1	27°, 23	3°, 307°	°).					

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						Т	ABLF	E 2.					[Page	e 441
			Differ	ence of	Latitud	le and	Depart	ure for	37° (1	143°, 21	7°, 323°	°).		
Dist.	Lat.	Dep.	Dist.	Lat.	Dep.	Dist.	Lat.	Dep.	Dist.	Lat.	Dep.	Dist.	Lat.	Dep.
301	240.4	181.1	$\frac{361}{62}$	288.3	217.3	421	336.2	253.4	481	384.1	289.5	541	432.0	325.6
$ \begin{array}{c} 02 \\ 03 \end{array} $	241.2 942.0	181. /	$\frac{62}{63}$	289.1	217.5	$\frac{22}{23}$	337.0	204.0 254.6	84 83	$\frac{384.9}{385.7}$	290.01 290.6	42	$\frac{432.8}{133.6}$	- 326, 2 226 - 8
04	242.7	183.0	64	290.7	219.1	$\overline{24}$	338.6	255.2	84	386.5	291.2	44	434.4	327.3
05	243.5	183.6	65	291.5	219.7	25	339.4	255.8	85	387.3	291.8	45	435.2	327.9
06	244.3	184.2	$\frac{66}{27}$	292.3	220.3	$\frac{26}{97}$	340.2	256.4	86	388.1	292.41	46	436.0	328.5
01	245.1	184.0	07 68	293. 1 293. 9	220. 9 991 5	$\frac{27}{28}$	241.0	201.0	81	388.9 289-7	295.0	4/	430.8	329.1
09	246.7	186.0	69	294.7	222.1	$\frac{20}{29}$	342.6	251.0 258.2	89	390.5	294.2	49	438.4	525. i 330. 3
10	247.5	186.6	70	295.5	222.7	30	343.4	258.8	90	391.3	294.8	50	439.2	330.9
311	248.3	187.2	371	296.3	223.3	431	344.2	259.4	491	392.1	295.4	551	440.0	331.5
12	249.1	187.8	$\frac{72}{72}$	297.1	223.9	$\frac{32}{22}$	345.0	260.0	$\frac{92}{03}$	392.9	296.0	$52 \\ 52$	440.8	332.1
15 14	249.9 250.7	$180. \pm 189.0$	74	297.5	224.0 225.1	- 30 - 34	340.0	200.0 261.2	93 94	395. 1 394. 5	290.0	- 55 - 54	441.0	332. 1
$\hat{15}$	251.5	189.6	75	299.5	225.7	35	347.4	261.8	95	395.3	297.8	55	443. 2	333.9
16	252.3	190.2	76	300.3	226.3	36	348.2	262.4	96	396.1	298.5	56	444.0	334.6
17	253.1	190.8	77	301.1	226.9	37	349.0	263.0	97	396.9	299.1	57	444.8	235.2
18	205.9 954-7	191.4	$\frac{10}{79}$	301.8	227.0 998.1	- 30 - 39	349.8	205.0 964.2	99	397.1	399.7	- 50 - 59	440.0	330. o 226 4
20	255.5	192. č	80	303.4	228.7	40	351.4	264.8	500	399.3	300.9	60	447.2	337.0
321	256.3	193.2	381	304.2	229.3	441	352.2	265.4	501	400.1	301.5	561	448.0	337.6
22	257.1	193.8	82	305.0	229.9	42	353.0	266.0	02	400.9	302.1	62	448.8	338.2
23	257.9	194.4	83	305.8	230.5	43	353.8	266.6	03	401. 7	302.7	63	449.6	338.8
24 25	208. i 259. 5	195.0	85	300.0	231.1 231.7	45	354.0	207.2 967.8	05	402.0	303.0	04 65	400.4	339.4
$\frac{1}{26}$	260.3	196.2	86	308.2	232.3	46	356.2	268.4	06	404.1	303.5 304.5	66	452.0	340.6
27	261.1	196.8	87	309.0	232.9	47	357.0	269.0	07	404.9	305.1	67	452.8	341.2
28	261.9	197.4	88	309.8	233.5	48	357.8	269.6	08	405.7	305.7	68	453.6	341.8
29 20	262. (198.0	89	310.0	234.1	49 50	358.0	270. 2 270. 8	09 10	406. 5	306.3	$\frac{69}{70}$	454.4	342.4
221	205.5	$\frac{196.0}{199.2}$	391	312.2	204. 1	451	260 1	971 4	511	101.0	207 5	571	156 0	2.12 6
32^{-301}	265.1	199.8	92	313.0	235.9	52	360. 9	272.0	12	408.9	308.2	72	456.8	344.3
33	265.9	200.4	93	313.8	236.5	53	361.7	272.6	13	409.7	308.8	73	457.6	344.9
34	266.7	201.0	94	314.6	237.1	54	362.5	273.2	14	410.5	309.4	74	458.4	345.5
35 26	267.0	201.0	90 96	315. +	231.1	- 50 - 56	363. 5	213.8	10 16	411.0	310. 0 210. 6	10 76	459.2	346.1 246.7
37	263.5 269.1	202.2	97	317.0	238.9	57	364.9	275.0	17	412.9	310.0 311.2	77	460.8	347.3
38	269.9	203.4	98	317.8	239.5	58	365.7	275.6	18	413.7	311.8	78	461.6	347.9
39	270.7	204.0	99	318.6	240.1	59	366.5	276.2	19	414.5	312.4	79	462.4	348.5
40	271.5	204.6	400	319.4	240.7	60	367.3	$\frac{276.8}{377.1}$	20	415.3	313.0	80	463.2	349.1
341	272.5 972.1	205.2	401	320.2 291 0	241.3	461 69	368. 1 268. 9	277.4	$\frac{521}{92}$	416.1	313.0	581 99	464.0	349.7
43	273.9	206.4	03	321.0 321.8	241.0	63	369.7	278.6	23	417.7	314. 2	83	465.6	350.5
44	274.7	.207.0	(4)	322.6	243.1	64	370.5	279.2	24	418.5	315.4	84	466.4	351.5
45	275.5	207.6	05	323.4	243.7	65	371.3	279.8	$\frac{25}{22}$	419.3	316.0	85	467.2	352.1
46	276.3 977.1	208.2	06	324. 2 295 0	244.3	$\frac{66}{87}$	372.1	280.4	$\frac{26}{97}$	420.1	316.6	86	468.0	352.7
48	277.9	208.8	08	320.0 325.8	244. 5	68	312.9	281.0 281.6	$\frac{21}{28}$	420. 5	$\frac{317.2}{217.8}$	81	408.8	303. o 253. g
49	278.7	210.0	09	326.6	246.1	69	374.5	282.3	29	422.5	318.4	89	470.4	354, 5
50	279.5	210.6	10	327.4	246.7	70	375, 3	282.9	30	423.3	319, 0	-90	471.2	355.1
351	280.3	211.2	411	328.2	247.3	471	376.1	283.5	531	424.1	319.6	591	472.0	355.7
52	281.1	211.8	$\frac{12}{12}$	329.0	247.9	$\frac{72}{52}$	376.9	284.1	$\frac{32}{22}$	424.9	320.2	92	472.8	356.3
ээ 54	281.9 989 7	212. 4	10	329. 8 329. 8	248.0	73 74	311.1	284. 1	33	420.7	320.8 291 4	93 01	473.0	356.9 257 5
55	283.5	213.6	15	331.4	249.8	75	379.3	285.9	35	420.3 427.3	322.0	95	475.2	357.0
56	284.3	214.2	16	332.2	250.4	-76	380.1	286.5	36	428.1	322.6	96	476.0	358.7
57	285.1	214.8	17	333.0	251.0	77	380.9	287.1	37	428.9	323.2	97	476.8	359.3
58	285.9	215.4	18	333.8	251.0 259.9	78	381.7	287.7	38	429.7	323.8	98	477.6	359.9
60	280.7 287.5	210.1 216.7	$\frac{19}{20}$	335.4	252.2 252.8	80	383. 3	288.9	40	431.3	324.4 325.0	600	479.2	360.5 361.1
Dist,	Dep.	Lat,	Dist.	Den,	Lat,	Dist.			Dist.	Den,	Lat	Dist.	Den	Tat
Diet		I	Diat	Deb			7=0 966 Deb	- 9070	Disc	Dep.	Lar.	Dist.	pep.	Lat.
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Po	ma 119	1					ADTI	2.0						
Ia	ge 442		Differe	ence of 1	Latitud	ر e and	Depart	ure for	38° (142°, 213	8° 322'	٥١		
Dist.	Lat.	Dep.	Dist.	Lat.	Dep.	Dist,	Lat.	Dep.	Dist.	Lat.	Dep.	Dist.	Lat.	Dep.
1	0.8	0.6	61	48.1	37.6	121	95.3	74.5	181	142.6	111.4	241	189.9	148.4
2	1.6	1.2	62	48.9	38.2	22	96, 1	75.1	- 82	143.4	112.1	42	190.7	149.0
3	2.4	1.8	63	49.6	38.8	$\frac{23}{24}$	96.9	75.7	83	144.2	112.7	43	191.5	149.6
5	0.2 3.9	2.0	65	51 9	39.4	24	97.7	76.3	84	145.0	113.3	44	192.3	150.2
6	4.7	3.7	66	52.0	40.6	$\frac{26}{26}$	99.3	77.6	86	146.6	113.5	40	193.9	151.5
7	5.5	4.3	67	52.8	41.2	27	100.1	78.2	87	147.4	115.1	47	194.6	152.1
8	6.3	4.9	68	53.6	41.9	28	100.9	78.8	88	148.1	115.7	48	195.4	152.7
10	$\frac{1.1}{7.9}$	5. 5 6. 2	- 69 - 70	04.4 55.2	42.5	29	101.7	19.4	89	148.9	116.4 117.0	49	196.2	153.3
11	8.7	6.8	71	55.9	43.7	131	102.4 103.2	80.7	191	$\frac{149.7}{150.5}$	117.0	251	197.0	$\frac{100.9}{154.5}$
12	9,5	7.4	72	56.7	44.3	32	104.0	81.3	92	151.3	117.0 118.2	$\frac{201}{52}$	197.8	154.5 155.1
13	10.2	8.0	73	57.5	44.9	- 33	104.8	81.9	93	152.1	118.8	53	199.4	155.8
14	11.0	8.6	74	58.3	45.6	34	105.6	82.5	94	152.9	119.4	54	200.2	156.4
10	11.8	9.2	10	59.1 59.9	40.2	- 30 - 36	106.4	83.1	95	153.7	120.1 120.7	00 56	200.9 201.7	157.0 157.6
17	13.4	10.5	77	60.7	47.4	37	107.2	84.3	97	155.2	120.7 121.3	57	201.7 202.5	157.0
18	14.2	11.1	78	61.5	48.0	38	108.7	85.0	98	156.0	121.9	58	203.3	158.8
$19 \\ 20$	15.0	11.7	79	62.3	48.6	39	109.5	85.6	99	156.8	122.5	59	204.1	159.5
20	10.8	12.3	80	63.0	49.3	40	110.3	86.2	200	157.6	123.1	60	204.9	160.1
21	10.0 17.3	12.9 13.5	81	61 6	49.9	141	111.1	80.8	201	150.4	123.7 194-4	$\frac{261}{69}$	205.7	160.7
$\frac{22}{23}$	18.1	14.2	83	65.4	51.1	43	1112.7	88.0	03	160.0	124.4 125.0	63	200.0 207.2	161.9
24	18.9	14.8	84	66.2	51.7	44	113.5	88.7	04	160.8	125.6	64	208.0	162.5
25	19.7	15.4	85	67.0	52.3	45	114.3	89.3	05	161.5	126.2	65	208.8	163.2
$\frac{26}{27}$	20.5	16.0 16.6	86	67.8 69.6	52.9	46	115.0	89.9	06	162.3	126.8	66	209.6	163.8
$\frac{21}{28}$	$\frac{21.3}{22.1}$	10.0 17.2	88	69.3	54.2	48	116.6	90.5	08	103.1 163.9	127.4 128 1	68	210.4	165 0
$\overline{29}$	22.9	17.9	89	70.1	54.8	49	117.4	91.7	09	164.7	128.7	69	212.0	165.6
30	23.6	18.5	90	70.9	55.4	50	118.2	92.3	10	165.5	129.3	70	212.8	166.2
31	24.4	19.1	91	71.7	56.0	151	119.0	93.0	211	166.3	129.9	271	213.6	166.8
$\frac{32}{22}$	25.2 26.0	19.7	92	72.5	56.6	$\frac{52}{52}$	119.8	93.6	$12 \\ 12$	167.1	130.5	$\frac{72}{72}$	214.3	167.5
34	26.8	20.3 20.9	93	74.1	57.9	54	120.0 121.4	94.2	10	168 6	131.1	73	215.1 215.9	108.1 168.7
35	27.6	21.5	95	74.9	58.5	55	122.1	95.4	15	169.4	132.4	75	216.7	169.3
36	28.4	22.2	96	75.6	59.1	56	122.9	96.0	16	170.2	133.0	76	217.5	169.9
37	29.2	22.8	97	76.4	59.7	57	123.7	96.7	17	$ 171.0 \\ 171.0 $	133.6	77	218.3	170.5
39	$\frac{29.9}{30.7}$	23.4 24.0	98	78.0	61, 0	59	124.0 125.3	97.5	10	171.8	134.2	79	219.1	171.2 171.8
40	31.5	24.6	100	78.8	61.6	60	126.1	98.5	20	173.4	135.4	80	210.0 220.6	172.4
-41	32.3	25.2	101	79.6	62.2	161	126.9	99.1	221	174.2	136.1	281	221.4	173.0
42	33.1	25.9	02	80.4	62.8	62	127.7	99.7	22	174.9	136.7	82	222.2	173.6
43	33.9	26.5 27.1	03	81.2	63.4	63	128.4	100.4	23	175.7	137.3	83	223.0	174.2
45	35.5	27.7	04	82.7	64.6	65	129.2 130.0	101.0 101.6	24	170.0 177.3	137.9	85	225.8	174.8 175.5
46	36.2	28.3	06	83.5	65.3	66	130.8	102.2	26	178.1	139.1	86	225.4	176.1
47	37.0	28.9	07	84.3	65.9	67	131.6	102.8	27	178.9	139.8	87	226.2	176.7
48	37.8	29.6	$\begin{array}{c} 08\\ 00\end{array}$	85.1	66.5	68 60	132.4	103.4	- 28	179.7	140.4	88	226.9	177.3
49 50	39.4	30.2	10	86.7	67.1 67.7	- 69 - 70	133.2 131 0	104.0 104.7	29	180.5	141.0 141.6	- 89 90	227.7	177.9 178 5
51	40.2	31.4	111	87.5	68.3	171	$\frac{104.0}{134.7}$	$\frac{101.7}{105.3}$	231	$\frac{101.2}{182.0}$	141.0	- 291	220.0	179.2
52	41.0	32.0	12	88.3	69.0	72	135.5	105.9	32	182.8	142.8	92	230.1	179.8
53	41.8	32.6	13	89.0	69.6	73	136.3	106.5	-33	183.6	143.4	- 93	230.9	180.4
54	42.6	$\frac{33.2}{22}$	14	89.8	$[70.2]{70.2}$	74	137.1	107.1	· 34	184.4	144.1	94	231.7	181.0
- 00 - 56	43.3	33.9 34.5	10	90.6	70.8	10 76	137.9 138 7	107.7	30	185.2 186.0	144.7	95	232. 5	181.0 182.2
57	44.9	35.1	17	92.2	72.0	77	139.5	109.0	37	186.8	145.9	97	234.0	182.9
58	45.7	35.7	18	93.0	72.6	78	140.3	109.6	38	187.5	146.5	- 98	234.8	183.5
59	46.5	36.3	19	93, 8	73.3	79	141.1	110.2	39	188.3	147.1	99	235.6	184.1
60	41.3	36.9	20	94.6	73.9	80	141.8	110.8	40	189,1	147.8	300	236, 4	184.7
Dist.	Dep.	Lat.	Dist.	Dep.	Lat.	Dist,	Dep.	Lat.	Dist,	Dep.	Lat.	Dist.	Dep.	Lat.
					523	° (128	°, 232°,	308°).						

						Т	ABLE	2 2.					[Page	443
]	Differe	ence of l	Latitud	e and	Departu	ire for	38° (1	42°, 218	3°, 322°).		
Dist,	Lat.	Dep.	Dist.	Lat.	Dep.	Dist.	Lat.	Dep.	Dist.	Lat.	Dep.	Dist.	Lat.	Dep.
301	237.2	185.3	$\frac{361}{62}$	284.5	222.3	421	331.8	259.2	481	379.0 379.8	296.2	541 .19	426.3	$\frac{333.1}{222}$
02	238.0 238.8	186.6	63	286.0	223.5	$\frac{22}{23}$	333.3	260.4	83	380.6	297.4	$\frac{12}{43}$	427.9	334.3
04	239.6	187.2	64	286.8	224.1	24	334.1	261.0	84	381.4	298.0	44	428.7	335.0
05	240.3 241.1	187.8 188.4	66 66	287.0	224.7 225.3	$\frac{23}{26}$	334.9 335.7	261.7 262.3	$\frac{89}{86}$	382.2 383.0	298.0 299.2	40	429.5 430.3	336.2
07	241.9	189.0	67	289.2	226.0	27	336.5	262.9	87	383.8	299.8	47	431.0	336.8
08	242.7 242.5	189.6	68 69	290.0	226.6 227.2	$\frac{28}{29}$	337.3	263.5 264.1	- 88 89	384.5 385.3	300.4 301.1	48	431.8 132.6	337.4 338.0
10	243.3 244.3	190.2 190.9	70	290.8 291.6	227.8	$\frac{29}{30}$	338.8	264.7 264.7	90	386.1	301.7 301.7	50	433.4	338.6
311	245.1	191.5	371	292.4	228.4	431	339.6	265.4	491	386.9	302.3	551	434.2	339.3
$\frac{12}{12}$	245.9	192.1	$\frac{72}{72}$	293.1	229.0	$\frac{32}{22}$	340.4	266.0	$92 \\ 02$	387.7	302.9 303.5	$52 \\ 52$	435.0	339.9
$13 \\ 14$	240.0 247.4	192.7 193.3	$73 \\ 74$	293.9 294.7	230.3	$\frac{33}{34}$	341.2 342.0	260.0 267.2	94 94	389.3	303.3 304.2	54	436.6	341.1
15	248.2	193.9	75	295.5	230.9	35	342.8	267.8	95 95	390.1	304.8	55	437.4	341.7
$\frac{16}{17}$	249,0 249-8	194.6 195.2	76	296.3 297 1	231.5 232.1	$\frac{36}{37}$	343.6 344.4	268.4 269.1	$96 \\ 97$.	390.9 391.6	305.4 306.0	- 56 - 57	438.1	342.3 343.0
18	250.6	195.8	78	297.9	232.7	38	345.2	269.7	98	392.4	306.6	58	439.7	343.6
19	251.4	196.4	79	298.7	233.3	39	345.9	270.3	99 500	393.2	307.2	59 60	440.5	344.2
20	$\frac{252, 2}{253, 0}$	$\frac{197.0}{197.6}$	381	$\frac{299.4}{300.2}$	$\frac{234.0}{234.6}$	40	340.7	$\frac{270.9}{271.5}$	$\frac{500}{501}$	$\frac{394.0}{394.8}$	307.8	561	441.3	344.8
22	253.0 253.7	198.2	82	301.0	235.2	42	348.3	272.1	$001 \\ 02$	395.6	309.1	62	442.9	346.0
23	254.5	198.9 100.5	83	301.8	235.8	43	349.1	272.7	03	396.4	309.7	63	443.7	346.6
$\frac{24}{25}$	250.3 256.1	199.5 200.1	84 85	302.6 303.4	236.4 237.0	44	349.9 350.7	273.4 274.0	$ 04 \\ 05 $	397.2 397.9	310.3 310.9	$65 \\ 65$	$\frac{111}{445.2}$	347.2 347.8
26	256.9	200.7	86	304.2	237.7	46	351.5	274.6	06	398.7	311.6	66	446.0	348.5
27	257.7	201.3	87	305.0	238.3	47	352.2	275.2	07	399.5	312.2	67	446.8	349.1
$\frac{28}{29}$	258.5 259.3	201.9 202.6	89	306.5	239.5	$\frac{40}{49}$	353.8	275.8 276.4	08	400.3	312.8 313.4	$\frac{08}{69}$	448.4	350.3
30	260.0	203.2	.90	307.3	240.1	50	354.6	277.1	10	401.9	314.0	70	449.2	350.9
331	260.8	203.8	391	308.1	240.7	451	355.4	277.7	511	402.7	314.6	$571 \\ 79$	450.0	351.6
$\frac{32}{33}$	261.6 262.4	204.4 205.0	$\frac{92}{93}$	308.9	241.3 242.0	$\frac{52}{53}$	350.2 357.0	278.9 278.9	12	403.5	310.2 315.8	$\frac{72}{73}$	450.7	352.2 352.8
34	263.2	205.6	94	310.5	242.6	54	357.8	279.5	14	405.0	316.4	74	452.3	353.4
35	264.0	206.3	95	311.3	243.2	55 56	358.5	280.1	15 16	405.8	317.1	$75 \\ 76$	453.1	354.0
37	264.8 265.6	200.5 207.5	97	312.1	243.8 244.4	$50 \\ 57$	360.1	280.7 281.4	17	407.4	317.7 318.3	$\frac{70}{77}$	453. 9	354.0 355.2
38	266.3	208.1	98	313.6	245.0	58	360.9	282.0	18	408.2	318.9	78	455.5	355.8
- 39 - 40	267.1 267.9	208.7 209.3	400	314.4 315.2	245.7 246.3	- 59 - 60	361.7 362.5	282.6 283.2	$\frac{19}{20}$	409,0	319.5 320.2	- 79 - 80	456.3 457.1	356.4 357.1
341	268.7	200.0 209.9	401	316.0	$\frac{246.9}{246.9}$	461	363.3	283.8	$\frac{20}{521}$	410.6	$\frac{320.2}{320.8}$	581	457.8	$\frac{357.1}{357.7}$
42	269.5	210.6	02	316.8	247.5	62	364.1	284.4	22	411.3	321.4	82	458.6	358.3
$\frac{43}{44}$	270.3 271.1	211.2 211.8	$03 \\ 04$	317.6 318 4	248.1 248.7	$\frac{63}{64}$	364.9 365.6	$285.1 \\ 285.7$	$\frac{23}{24}$	412.1 412.9	322.0 322.6	$\frac{83}{84}$	459.4	358.9 359.5
45	271.9	212.4	05	319.1	249.3	65	366.4	286.3	$\frac{21}{25}$	413.7	323.2	85	461.0	360.2
46	272.7	213.0	06	319.9	250.0	$\frac{66}{27}$	367.2	286.9	26	414.5	323.8	86	461.8	360.8
47	273.4 274.2	213.0 214.3	- 08	320.7 321.5	250.0 251.2	- 67 - 68	368.0	$\frac{287.9}{288.1}$	$\frac{27}{28}$	415.5	324.0 325.1	87	$\frac{402.0}{463.3}$	301.4 362.0
49	275.0	214.9	09	322, 3	251.8	69	369.6	288.7	$\overline{29}$	416.9	325.7	89	464.1	362.6
$\frac{50}{951}$	275.8	215.5	$\frac{10}{111}$	$\frac{323.1}{202.0}$	$\frac{252.4}{252.0}$	$\frac{70}{171}$	$\frac{370.4}{971.9}$	$\frac{289.3}{200.0}$	30	$\frac{417.6}{419.4}$	$\frac{326.3}{226.0}$	90	464.9	363.2
$\frac{551}{52}$	270.0 277.4	210.1 216.7	+11 - 12	323.9 324.7	253.0 253.7	$\frac{471}{72}$	371.2 371.9	290.0 290.6	$\frac{331}{32}$	418.4	326.9 327.5	991 92	466.5	303.8
53	278.2	217.3	$\overline{13}$	325.5	254.3	$\overline{73}$	372.7	291.2	33	420.0	328.2	93	467.3	365.1
54 55	279.0 279.7	218.0	14	326.2	254.9 255.5	$\frac{74}{75}$	373.5 274.3	291.8	34 25	420.8	328.8	94	468.1	365.7
56	280.5	219.2	16	327.8	256.0 256.1	76	375.1	292.4 293.1	-36	422.4	330.0	96	469.7	366.9
57	281.3	219.8	17	328.6	256.7	77	375.9	293.7	37	423.2	330.6	97	470.5	367.5
- 58 - 59	282.1 282.9	$\begin{bmatrix} 220.4\\ 221.0 \end{bmatrix}$	18	329.4 330.2	257.4 258.0	78 79	376.7 377.5	294.3	$\frac{38}{39}$	424.0 424.7	331.2 331.8	98 99	471.2	368.1 368.7
60	283.7	221.6	$\frac{10}{20}$	331.0	258.6	80	378.2	295.5	40	425.5	332.5	600	472.8	369.4
Dist.	Dep.	Lat.	Dist.	Dep.	Lat.	Dist.	Dep.	Lat.	Dist.	Dep.	Lat.	Dist.	Dep.	Lat.
						52° (1	28°, 232	2°, 308°).					

Pa	ge 444]				Т	ABLE	2 2.						
		I	Differei	nce of L	atit: d	and i	Departu	re for 3	39° (1	41°, 219	°, 321°).		
Dist.	Lat.	Dep.	Dist.	Lat.	Dep.	Dist.	Lat.	Dep.	Dist.	Lat.	Dep.	Dist.	Lat.	Dep.
1	0.8	0.6	61	47.4	38.4	121	94.0	76.1	181	140.7	113.9	241	187.3	151.7
$\frac{2}{3}$	$\frac{1.0}{2.3}$	1.3 1.9	$\frac{62}{63}$	48.2	39.0 39.6	$\frac{22}{23}$	94.8 95.6	70.8 77.4	82	141.4 142.2	114.5 115.2	42	188.1	152.3 152.9
4	3.1	2.5	64	49.7	40.3	24	96.4	78. 0	84	143.0	115.8	44	189.6	153.6
5	3.9	$\frac{3.1}{2.9}$		50.5	40.9	25 26	97.1	78.7	85	143.8	116.4	45	190.4	154.2
7	5.4	4.4	67	51.5 52.1	42.2	27	98.7	79.9	87	145.3	117.7	40	191.2 192.0	154.8
8	6.2	5.0	68	52.8	42.8	28	99.5	80.6	88	146.1	118.3	48	192.7	156.1
10	$7.0 \\ 7.8$	0.7 6.3	$\frac{69}{70}$	53.6 54.4	43.4	29 30	100.3	81.2	- 89 - 90	146.9	118.9 119.6	$\frac{49}{50}$	193.5	156.7 157.3
11	8.5	$\frac{0.0}{6.9}$	71	$\frac{51.1}{55.2}$	44.7	131	101.8	82.4	191	148.4	$\frac{110.0}{120.2}$	251	195.1	158.0
12	9.3	7.6	$\frac{72}{72}$	56.0	45.3	32	102.6	83.1	92	149.2	120.8	52	195.8	158.6
13	10.1	8.2	$\frac{73}{74}$	56.7 57.5	45.9	33	103.4	83.7	93	150, 0 150, 8	121.5 199 1	53	196.6 197.4	159.2
15	11.7	9.4	75	58.3	47.2	35	104.9	85.0	95	151.5	122.7 122.7	55	198.2	160.5
16	12.4	10.1	76	59.1	47.8	36	105.7	85.6	96	152.3	123.3	56	198.9	161.1
18	13.2 14.0	10.7 11.3	$\frac{77}{78}$	59.8 60.6	49.1	38	106.5 107.2	86.2	97	153.1 153.9	124.0 124.6	- 57 - 58	199.7	161.7 162.4
19	14.8	12.0	79	61.4	49.7	39	108.0	87.5	99	154.7	125.2	59	201.3	163.0
20	$\frac{15.5}{16.9}$	$\frac{12.6}{12.9}$	$\frac{80}{91}$	$\frac{62.2}{c2.0}$	$\frac{50.3}{51.0}$	$\frac{40}{141}$	108.8	88.1	$\frac{200}{901}$	$\frac{155.4}{150.9}$	125.9	$\frac{60}{-901}$	202.1	163.6
$\frac{21}{22}$	10.3 17.1	13.2 13.8	$\frac{81}{82}$	62.9 63.7	51.0 51.6	42	109.0 110.4	89.4	$\frac{201}{02}$	150.2 157.0	120.5 127.1	$\frac{201}{62}$	202.8 203.6	164.9
23	17.9	14.5	83	64.5	52.2	43	111.1	90.0	03	157.8	127.8	63	204.4	165.5
24	18.7	15.1	84	65.3	52.9	44	111.9	90.6	04	158.5	128.4	64	205.2	166.1
$\frac{20}{26}$	19.4 20.2	16.4	86	66.8	54.1	46	112.7	91.9 91.9	06	160.1	129.0 129.6	66	205.9 206.7	167.4
27	21.0	17.0	87	67.6	54.8	47	114.2	92.5	07	160.9	130.3	67	207.5	168.0
28	$\frac{21.8}{22.5}$	17.6 18 3	88	68.4 69.2	55.4 56.0	48	115.0 115.8	93.1	08	$^{\circ}161.6$	130.9 131 5	68 69	208.3	168.7
30	23.3	18.9	90	69.9	56.6	50	116.6	94.4	10	162.4 163.2	131.0 132.2	70	209.8	169.9
31	24.1	19.5	91	70.7	57.3	151	117.3	95.0	211	164.0	132.8	271	210.6	170.5
$\frac{32}{33}$	24.9	$\begin{bmatrix} 20, 1\\ 20, 8 \end{bmatrix}$	92	71.5 72.3	57.9	$52 \\ 53$	118.1	95.7	12	164.8 165.5	133.4	$\frac{72}{73}$	211.4	171.2
34	$\frac{26.0}{26.4}$	21.4	94	73.1	59.2	54	110.5	96.9	14	166.3	134.7	74	212. 9	172.4
35	27.2	22.0	95	73.8	59.8	55	120.5	97.5	15	167.1	135.3	75	213.7	173.1
$\frac{36}{37}$	28.0 28.8	22.7 23.3	96 97	74.6	60.4	56 57	121.2 122.0	98.2 98.8	16 17	167.9	135.9	76	214.5 215.3	173.7 174.3
38	29.5	23.9	98	76.2	61.7	58	122.8	99.4	18	169.4	137.2	- 78	216.0	175.0
39	30.3	24.5	99	76.9	62.3	59 60	123.6	100.1	19	170.2 171.0	137.8	79	216.8	175.6
40	$\frac{31.1}{31.9}$	$\frac{20.2}{25.8}$	100	78.5	$\frac{62.9}{63.6}$	161	$\frac{124.3}{125.1}$	100.7 101.3	221	171.0 171.7	$\frac{138.9}{139.1}$	$\frac{80}{281}$	$\frac{217.0}{218.4}$	170.2 176.8
42	32.6	26.4	02	79.3	64.2	62	125.9	101.9	22	172.5	139.7	82	219.2	177.5
43	33.4	27.1	03	80.0	64.8	63	126.7	102.6	23	173.3 174.1	140.3	83	219.9 220.7	178.1
45	35.0	28.3	04	81.6	66.1	65	127.0 128.2	103.2	$\frac{24}{25}$	174.1	141.6	85	220.7 221.5	179.4
46	35.7	28.9	06	82.4	66.7	66	129.0	104.5	26	175.6	142.2	86	222.3	180.0
47 48	$\frac{36.5}{37.3}$	29.6 30.2	07	83.2 83.9	67.3	67 68	129.8 130.6	$105.1 \\ 105.7$	27 28	176.4	142.9 143.5	87 88	223.0 223.8	$ 180.6 \\ 181.9 $
49	38.1	30.8	09	84.7	68.6	69	131.3	106.4	29	178.0	144.1	89	224.6	181.9
_50	38.9	31.5	10	85.5	69.2	70	132.1	107.0	30	178.7	144.7	90	225.4	182.5
$\frac{51}{52}$	39.6 40.4	32.1 32.7	$\frac{111}{12}$	86.3 87 0	69.9 70.5	$\begin{array}{c} 171 \\ 79 \end{array}$	132.9 133.7	107.6 108.9	$\frac{231}{32}$	179.5	145.4 146.0	291	226.1 226.0	183.1
53	41.2	33.4	13	87.8	71.1	73^{-7}	134.4	108.9	33	181.1	146.6	93	227.7	184.4
54	42.0	34.0	14	88.6	71.7	74	135.2	109.5	34	181.9	147.3	94	228.5	185.0
00 56	42.7	34.6 35.2	$\frac{15}{16}$	89.4 90.1	72.4 73.0	$75 \\ 76$	136.0 136.8	110.1	35 36	182.6	147.9	90 96	229.3 230.0	180.6 186.3
57	44.3	35.9	17	90.9	73.6	77	137.6	111.4	37	184.2	149.1	97	230.8	186.9
58	45.1 45.0	36.5	18	91.7 92 5	74.3	78	138.3	112.0	$\frac{38}{20}$	185.0	149.8	98	231.6	187.5
60	46.6	37.8	$\frac{19}{20}$	92. 3 93. 3	75.5	80	139.1	112.0 113.3	40	185.7	150.4	300	232.4 233.1	188.8
Dist.	Dep.	Lat.	Dist.	Dep.	Lat.	Dist.	Dep.	Lat.	Dist.	Dep.	Lat.	Dist.	Dep.	Lat.
			-			51° (1290 22	1° 309	•)					
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						J	CABLI	E 2.					[Page	445
		Ì	Differe	ence of 1	Latitud	e and	Departu	are for :	39° (1	.41°, 219)°, 321°).		
Dist.	Lat.	Dep.	Dist.	Lat.	Dep.	Dist.	Lat.	Dep.	Dist.	Lat.	Dep.	Dist.	Lat.	Dep.
301	233.9	189.4	$\frac{361}{62}$	280.6 281.3	227.1 227.8	421	327.2	264.9 265.5	481 82	373.8 374.6	302.6	$541 \\ 42$	420.4 421.2	340.4
02	234. 7	190.0	$62 \\ 63$	281.0	227.0	$\frac{22}{23}$	328.0 328.7	266.0 266.2	83	375.4	303.9	43	422.0	341.7
04	236.3	191.3	64	282.9	229.0	24	329.5	266.8	84	376.1	304.5	44	422.7	342.3
05	237.0	191.9	65	283.7	229.7	25	330.3	267.4	85	376.9	305.2	45	423.5	342.9
06	237.8	192. 5	60 67	284.4	230. 3	$\frac{20}{27}$	331.1	268.01	80	377.7	305. o 206. 4	40	424. 5	343.0 244-2
08	239.4	193.8	68	286.0	230.5 231.5	28	332.6	269.3	88	379.3	307.1	48	425.9	344.8
09	240.1	194.4	69	286.8	232.2	29	333.4	269.9	89	380.0	307.7	49	426.6	345.5
10	240.9	195.0	70	287.6	232.8	30	334.2	270.6	90	380.8	308.3	50	427.4	346.1
311	241.7	195.7	$\frac{371}{72}$	288.3	233.4	431	335.0	271.2 971.8	491	381.0	308.9	551	428.2	$\frac{346.7}{247.4}$
$\frac{14}{13}$	242.0 243.3	196.9	$\frac{72}{73}$	289.9 289.9	234.7	33	336.5	272.5	93	383.1	310.2	53	429.7	348.0
14	244.0	197.6	74	290.7	235.3	34	337.3	273.1	94	383.9	310.8	54	430.5	348.6
15	244.8	198.2	75	291.4	236.0	35	338.1	273.7	95	384.7	311.5	55	431.3	349.2
10 17	240. 0 946 4	198.8	70	292. 4	230.0	30 37	338.0	274. 5	90	380.0	312.1	- 00 - 57	432.1	349.9
18	247.1	200.1	78	293.8	237.8	38	340.4	275.6	98	387.0	313.3	58	433.6	351.1
19	247.9	200.7	79	294.5	238.5	39	341.2	276.2	99	387.8	314.0	59	434.4	351.7
20	248.7	201.3	80	295.3	239.1	40	342.0	276.9	500	388.6	314.7	60	435.2	352.4
$\frac{321}{99}$	$\begin{array}{cccccccccccccccccccccccccccccccccccc$													
$\frac{24}{23}$	$\begin{array}{cccccccccccccccccccccccccccccccccccc$													
24	251.8	438.3	354.9											
25	252.6	439.1	355.5											
26	253.4	205.1	86	300.0	242.91	$\frac{46}{47}$	346.6	280.61	06	393.2	318.4	66	439.8	356.2
28	254.1	205.1 206.4	88	300.0	243.0	48	348.2	281.9	08	394.0	319.0	68	441.4	300.0
$\overline{29}$	255.7	207.0	89	302.3	244.8	49	349.0	282.5	09	395.6	320.3	69	442.2	358.1
30	256.5	207.6	90	303.1	245.4	50	349.7	283.2	10	396.3	320.9	70	443.0	358.7
$\frac{331}{22}$	257.2 258.0	208.3	$\frac{391}{02}$	303.9	246.0	$451 \\ 59$	350.5	283.8	$511 \\ 12$	397.1 207 q	321.6	571	443.7	359.3
33	258.0 258.8	208.5	93	304.1 305.4	240. 1	53	351.5 352.1	201.1 285.0	12^{12}	397.0	322.8	$\frac{12}{73}$	445.3	359.9 360.6
34	259.6	210.2	94	306.2	247.9	54	352.8	285.7	14	399.4	323.4	74	446.1	361.2
35	260.4	210.8	95	307.0	248.5	55	353.6	286.3	15	400.2	324.1	75	446.9	361.8
30 37	261. 1 961. 9	211.4	90	307.8	249.2	- 00 - 57	354.4	286.9	16	401.0	324. /	70	447.0	362.4
38	261.5 262.7	212. 7	98	309.3	250.4	58	355.9	281.0 288.2	18	401.0	325.9	78	449.2	363.7
39	263.5	213.3	99	310.1	251.1	59	356.7	288.8	19	403.3	326.6	79	450.0	364.3
40	264.2	213.9	400	310.9	251.7	60	357.5	289.4		404.1	327.2	80	450.7	365.0
$\frac{341}{49}$	265.0	214.6 915.9	401	311.6	252.3	461	358.3	290.1	521	404.9	327.8	581	451.5	365.6
43	266.6	215.2 215.8	$02 \\ 03$	312.7 313.2	252.9 253.6	63	399. 1 359. 8	290.7 291.3	$\frac{24}{23}$	406.4	$\frac{320.0}{329.1}$	$\frac{82}{83}$	452.0	300. 4 366. 9
44	267.3	216.4	04	314.0	254.2	64	360.6	292.0	$\tilde{24}$	407.2	329.7	84	453.9	367.5
45	268.1	217.1	05	314.8	254.8	65	361.4	292.6	25	408.0	330.4	85	454.6	368.1
40 47	268.9	217.7	00	315. 5 216 3	255.5 956 1	60 67	362. Z	293.2	$\frac{26}{97}$	408.8	331.0	86 87	455.4	368.8
48	270.5	219.0	08	310.0 317.1	256.7	68	363.7	293.0 294.5	$\frac{1}{28}$	410.3	332.3	88	457.0	309. 1 370. 0
49	271.2	219.6	09	317.9	257.3	69	364.5	295.1	29	411.1	332.9	89	457.8	370.6
50	272.0	220.2		318.6	258.0	70	365.3	295.7	30	411.9	333,5	90	458.5	371.3
351 59	272.8	220.8	411	319.4	258.6	$[\frac{471}{79}]$	366.0	296.4	$531 \\ 29$	412.6	334.1	591	459.3	371.9
53	273.0	221.0 222.1	$12 \\ 13$	320.2 321.0	259.2	$\begin{bmatrix} 12 \\ 73 \end{bmatrix}$	367.6	297.0 297.6	$\frac{32}{33}$	$\frac{413.4}{414.2}$	334. o 225. 4	92 93	460.1	$\frac{372.9}{273.2}$
54	$\tilde{2}75.1$	222.7	14	321.8	260.5	74	368.4	298.3	34	415.0	336.1	94	461.6	373.8
55,	275.9	223.4	15	322.5	261.1	75	369.2	298.9	35	415.8	336.7	95	462.4	374.4
50 57	276.7	224.0	$\frac{16}{17}$	323.3	261.8	$\begin{bmatrix} 76 \\ 77 \end{bmatrix}$	369.9	299.5	$\frac{36}{27}$	416.5	337.3	96	463.2	375.1
58	278.2	224.0 225.3	18	324. 1 324. 9	202.4 263.0	78	370.7 371.5	300.1	37	417.5	337.9 228.5	97	464.0	379.7 276.3
59	279.0	225.9	19	325.6	263.6	79	372.3	301.4	39	418.0	339.1	99	465.5	376.9
60	279.8	226.5	20	326.4	264.3	80	373.0	302.0	40	419.6	339.8	600	466.3	377.6
Dist.	Dep.	Lat.	Dist.	Dep.	Lat.	Dist.	Dep.	Lat.	Dist.	Dep.	Lat.	Dist.	Dep.	Lat.
			1		E	51° (1)		° 309°	1					-
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			Differe	ence of 1	Latitud	le and	Depart	ure for	40° (1	40°, 220)°, 320°).		
Dist.	Lat.	Dep.	Dist.	Lat.	Dep.	Dist.	Lat.	Dep.	Dist.	Lat.	Dep.	Dist.	Lat,	Dep.
1	0.8	0.6	61	46.7	39.2	121	92.7	77.8	181	138.7	116.3	241	184.6	154.9
2	1.0	1.3	$\frac{62}{63}$	41.0	39.9	22	93.5	78.4	82	139.4	$ 117.0 \\ 117.0 \\ 117.$	42	185.4	155.6
4	2.5	9 6	64	49.0	40.0	20	95.0	79.1	84	140.2	112 9	43	180.1	156.2
5	3.8	$\bar{3}.2$	65	49.8	41.8	$\overline{25}$	95.8	80.3	85	141.7	118.9	45	187.7	157.5
6	4.6	3.9	* 66	50.6	42.4	26	96.5	81.0	86	142.5	119.6	46	188.4	158.1
7	5.4	4.5	67	51.3	43.1	27	97.3	81.6	87	143.3	120.2	47	189.2	158.8
8	6.1	0.1	68 60	52.1	43.7	28	98.1	82.3	88	144.0	120.8	48	190.0	159.4
10	0.9	6.6	70	53 G	44.4	29	98.8	82.9	89	144.8	121.5 199.1	49	190.7	160.1
-11	8.4	7 1	71	54 4	45 6	131	100 4	81 2	101	146.9	122.1	251	191.0	$\frac{100.7}{161.9}$
11^{11}_{12}	9.2	7.7	72	55.2	46.3	$\frac{131}{32}$	100.4	84.8	$\frac{191}{92}$	140.0	122.0 123.4	$\frac{201}{52}$	192.5 193.0	101.5 162.0
13	10.0	8.4	73^{-1}	55.9	46.9	33	101.9	85.5	93	147.8	124.1	53	193.8	162.6
14	10.7	9.0	74	56.7	47.6	- 34	102.6	86.1	94	148.6	124.7	54	194.6	163.3
15	11.5	9.6	75	57.5	48.2	35	103.4	86.8	95	149.4	125.3	55	195.3	163.9
10	12.3	10.3	16		48.9	36	104.2	87.4	96	150.1	126.0	56	196.1	164.6
18	13.0	10.9	$\frac{7}{78}$	59.0	19.0 50.1	38	104.9	88.7	97	100.9 151 7	120.0 197.2	07 59	196.9	165.2
19	14.6	11.0 12.2	79	60.5	50.1	39	106.5	89.3	99	151.7 152.4	127.3	59	197.0	105.8 166.5
20	15.3	12.9	80	61.3	51.4	40	107.2	90.0	200	153.2	128.6	60	199.2	167.1
21	16.1	13.5	81	62.0	52.1	141	108.0	90.6	201	154.0	129.2	261	199.9	167.8
22	16.9	14.1	82	62.8	52.7	42	108.8	91.3	02	154.7	129.8	62	200.7	168.4
23	17.6	14.8	83	63.6	53.4	43	109.5	91.9	03	155.5	130.5	63	201.5	169.1
24	18.4	10.4	84	64.3	54.0	44	110.3	92.6	04	156.3	131.1	64	202.2	169.7
$\frac{20}{26}$	19.2	10.1 16.7	86	65 9	55 3	40	111.1	93.2	00	107.0 157.8	131.8	60	203.0	170.3
$\frac{1}{27}$	20.7	17.4	87	66.6	55.9	47	1112.6	94.5	07	158.6	132.4 133.1	67	203.8 204.5	171.0
28	21.4	18.0	88	67.4	56.6	48	113.4	95.1	08	159.3	133.7	68	205.3	172.3
29	22.2	18.6	89	68.2	57.2	49	114.1	95.8	- 09	160.1	134.3	69	206.1	172.9
	23.0	19.3	_90	68.9	57.9	50	114.9	96.4	10	160.9	135.0	70	206.8	173.6
31	23.7	19.9	91	69.7	58.5	151	115.7	97.1	211	161.6	135.6	271	207.6	174.2
32	24.0	20.6	92	70.5	50 0	52 52	116.4	97.7	12	162.4	136.3	$\frac{72}{72}$	208.4	174.8
34 1	$\frac{20.3}{26.0}$	21.2	93	71.2 72.0	60 4	54	117.2	98.5	13	105.2 163.9	130.9	73	209.1	170.0 176.1
35	26.8	22.5	95	72.8	61.1	55	118.7	99.6	15	164.7	137.0 138.2	75	210.7	176.8
36	27.6	23.1	96	73.5	61.7	56	119.5	100.3	16	165.5	138.8	76	211.4	177.4
37	28.3	23.8	97	74.3	62.4	57	120.3	100.9	17	166.2	139.5	77	212.2	178.1
" <u>38</u>	29.1	24.4	98	75.1	$\begin{bmatrix} 63.0\\ 09.0 \end{bmatrix}$	-58	121.0	101.6	18	167.0	140.1	$\frac{78}{20}$	213.0	178.7
- 39 - 40	29.9	20.1 95.7	100	76.8 76.6	64 2	- 39 - 80	121.8 192 6	102.2 102.8	19	167.8 168.5	140.8 141.4	79	213.7 214.5	179.3
-11	31 1	20.1	100	77.1	61.0	161	122.0	$\frac{102.8}{103.5}$	$\frac{20}{991}$	100.0 160.2	$\frac{141.4}{149.1}$	- 00	$\frac{214.0}{915.9}$	180.0
42	32.2	27.0	$101 \\ 02$	78.1	65.6	62	120.0 124.1	103.0	221	100.0 170.1	142.1 142.7	82	219.0 216.0	180.0
43	32.9	27.6	03	78.9	66.2	63	124.9	104.8	23	170.8	143.3	83	216.8	181.9
44	33.7	28.3	04	79.7	66.8	64	125.6	105.4	24	171.6	144.0	. 84	217.6	182.6
45	34.5	28.9	05	80.4	67.5	65	126.4	106.1	25	172.4	144.6	85	218.3	183.2
46	35.2	29.6	06	81.2	68.1	66	127.2 197.0	106.7 107.2	$\frac{26}{97}$	173.1 172.0	145.3	86	219.1	183.8
48	36.8	30.2	08	82.7	69.0	68	127.9 128 7	107.5	$\frac{27}{28}$	175.9 174.7	140.9	88	219.9 220 B	185.1
49	37.5	31.5	09	83.5	70.1	69	129.5	108.6	29	175.4	147.2	89	220.0 221.4	185.8
50	38.3	32.1	10	84.3	70.7	70	130.2	109.3	30	176.2	147.8	90	222.2	186.4
51	39.1	32.8	111	85.0	71.3	171	131.0	109.9	231	177.0	148.5	291	222.9	187.1
52	39.8	33.4	12	85.8	72.0	72	131.8	110.6	32	177.7	149.1	92	223.7	187.7
53	40.6	34.1	13	86.6	72.6	73	132.5	111.2	33	178.5 170.2	149.8	93	224.5	188.3
55	41.4	35 1	14	88 1	73.0	74	135.5	111.8 119.5	34	179.3	150.4 151.1	94 95	220. Z 226 0	189.0
56	42.9	36.0	16	88.9	74.6	76	134.8	112.0	36	180.8	151.7 151.7	- 96 - 96	226.0 226.7	190.3
57	43.7	36, 6	17	89.6	75.2	77	135.6	113.8	37	181.6	152.3	97	227.5	190.9
58	44.4	37.3	18	90.4	75.8	78	136.4	114.4	- 38	182.3	153.0	- 98	228.3	191.6
59	45.2	37.9	19	91.2	76.5	79	137.1	115.1	39	183.1	153.6	99	229.0	192.2
60	46, 0	38.6	20	91.9	11.1	80	137.9	115.7	-40	183.9	154.3	300	229.8	192.8
Dist.	Dep.	Lat.	Dist.	Dep.	Lat.	Dist.	Đep.	Lat.	Dist.	Dep.	Lat.	Dist.	Dep.	Lat.
					ŧ	50° (1	30°, 230	°, 310°]).					

						Т	ABLE	2 2.					[Page	447
]	Differe	ence of I	Latitud	e and	Departu	ire for	40° (1	.40°, 220)°, 320°).		
Dist.	Lat.	Dep.	Dist.	Lat.	Dep.	Dist.	Lat.	Dep.	Dist.	Lat.	Dep.	Dist.	Lat.	Dep.
301	230.6	193.5	361	276.5	232.1	421	322.5	270.6	481	368.5	309.2	541_{-12}	414.4	347.7
$ \begin{array}{c} 02 \\ 03 \end{array} $	231.5 232.1	194.1 194.8	63	277.3 278.1	232.7 233.3	$\frac{22}{23}$	323. 3	271.9 271.9	83	370.0	309.8 310.5	43	416.0	349.0
04	232.9	195.4	64	278.8	234.0	24	324.8	272.6	84	370.8	311.1	44	416.7	349.7
05	233.6 234.4	196.1 196.7	66 66	279.6 280.4	234.0 235.3	$\frac{25}{26}$	325.6 326.3	273.2 273.8	80	371.5 372.3	311.7 312.4	45 46	417.5	350.3
07	235.2	197.3	67	281.1	235.9	27	327.1	274.5	87	373.1	313.0	47	419.0	351.6
08	235.9 236.7	198.0 198.6	$\frac{68}{69}$	281.9 282.7	236.6 237.2	$\frac{28}{29}$	327.9 328.6	275.1 275.8	88	373.8	313.6 314.3	$\frac{48}{49}$	419.8 420.6	352.2 352.9
10	237.5	199.3	70	283.4	237.8	30	329.4	276.4	90	375.4	314.9	50 - 50	421.3	353.5
311	238.2	199.9	$\frac{371}{79}$	284.2	238.5	431	330.2	277.1	491	376.1	315.6	551	422.1	354.2
12 13	239.0 239.8	200.6 201.2	$\frac{72}{73}$	285.0 285.7	239.1 239.7	$\frac{32}{33}$	331.7	277.7 278.3	92	377.7	310.2 316.9	$\frac{52}{53}$	422.9	355.5
14	240.5	201.8	74	286.5	240.4	34	332.5	279.0	94	378.4	317.5	54	424.4	356.1
$15 \\ 16$	241.3 242.1	202.5 203.1	$\frac{75}{76}$	287.3 288.0	241.0 241.7	35 36	333.2 334.0	279.6 280.3	95 96	379.2	318.2 318.8	56 56	425.2 425.9	356.8 357.4
17	242.8	203.8	77	288.8	242.3	37	334.8	280.9	97	380.7	319.5	57	426.7	358.0
18	243.6 244.4	204.4 205.1	$\frac{78}{79}$	289.6 290.3	243.0 243.6	- 38 - 30	335.5	$281.6 \\ 282.2$	98	381.5 382.3	320.1 320.8	58 59	427.5	358.7 359.3
$\begin{array}{c ccccccccccccccccccccccccccccccccccc$													429.0	360.0
321	$\begin{array}{c ccccccccccccccccccccccccccccccccccc$													
$\frac{22}{23}$	$\begin{array}{cccccccccccccccccccccccccccccccccccc$													
24	248.2	208.3	84	294.2	246.8	44	340.1	285.4	04	386.1	324.0	64	432.1	362.5
$\frac{25}{26}$	249.0 249.7	208.9 209.6	85 86	294.9 295.7	247.5 248 1	45	340.9 341.7	$\frac{286.0}{286.7}$	05	386.8 387.6	324.6 325.9	65 66	432.8	363.2
$\frac{20}{27}$	249.7 250.5	203.0 210.2	87	296.5	248.8	47	342.4	280.7 287.3	07	388.4	325.9	67	434.3	364.5
28	251.3	210.8	88	297.2	249.4	48	343.2	288.0	08	389.2	326.5	68 60	435.1	365.1
$\frac{29}{30}$	252.0 252.8	211.5 212.1	- 89 - 90	298.0 298.8	250.1 250.7	$\frac{49}{50}$	344.7	289.3	10	390.7	$\frac{327.1}{327.8}$	70	436.6	366.4
331	253.6	212.8	391	299.5	251.3	451	345.5	289.9	511	391.5	328.4	571	437.4	367.0
$\frac{32}{33}$	254.3 255.1	213.4 214 1	92	300.3 301.1	252.0 252.6	52 53	346.3 347.0	290.5 291.2	$\frac{12}{13}$	392.2 393.0	$\frac{329.1}{329.7}$	$72 \\ 73$	438.2	367.7
34	255.9	214.7 214.7	94	301.8	252.0 253.3	54	347.8	291.8	14	393.8	330.4	74	439.7	369.0
$\frac{35}{26}$	256.6	215.3	95 96	302.6	253.9	55	348.6	292.5 202 1	$\frac{15}{16}$	394.5	331.0	$\frac{75}{76}$	440.5	369.6
$\frac{30}{37}$	257.4 258.2	210.0 216.6	90	303.4 304.1	254.0 255.2	57	350.1	293.1 293.8	17	396.1	332.3	77	441.2	370.2
38	258.9	217.3	98	304.9	255.8	58	350.8	294.4	18	396.8	332.9	78	442.8	371.5
$\frac{39}{40}$	259.7 260.5	217.9 218.6	$\frac{99}{400}$	305.7 306.4	256.5 257.1	59 60	351.6 352.4	295.0 295.7	$\frac{19}{20}$	397.6	333.6 334.2	- 79 - 80	443.5	372.2 372.8
341	261.2	219.2	401	307.2	257.8	461	353.1	296.3	521	399.1	334.9	581	445.1	373.5
42	262.0	219.8	02	308.0	258.4	62	353.9	297.0	22	399.9	335.5	82	445.8	374.1
40	262.8 263.5	220.5 221.1	03	309.5	259.1 259.7	64	355.4	297.0 298.3	$\frac{23}{24}$	400.0	336.8	84	440.0	375.4
45	264.3	221.8	05	310.2	260.3	65	356.2	298.9	25	402.2	337.4	85	448.1	376.0
46 47	265.1 265.8	$\begin{bmatrix} 222.4\\ 223.1 \end{bmatrix}$	06	311.0 311.8	261.0 261.6	$-60 \\ -67$	357.7	299.0 300.2	$\frac{26}{27}$	402.9	338.7	80	449.7	377.3
48	266.6	223.7	08	312.5	262.3	68	358.5	300.8	28	404.5	339.4	88	450.4	378.0
$\frac{49}{50}$	$267.4 \\ 268.1$	224.3 225.0	09	313.3 314 1	262.9 263.6	$\frac{69}{70}$	359.3	$\frac{301.5}{302}$	29 30	405.2 406.0	340.0 340.6	89 90	$\frac{451.2}{452.0}$	378.6 379.9
351	268.9	225.6	411	314.8	264.2	471	360.8	302.8	531	406.8	341.3	591	452.7	379.9
52	$\cdot 269.6$	226.3	12	315.6	264.8	72	361.6	303.4	32	407.5	341.9	92	453.5	380.5
$\frac{53}{54}$	270.4 271.2	226.9 227.6	13 14	310.4	260.0 266.1	$\frac{73}{74}$	362.3 363.1	304.0 304.7	33 34	408.3	342.6 343.2	93 94	455.0	381.2 381.8
55	271.9	228.2	15	317.9	266.8	75	363.9	305.3	35	409.8	343.9	95	455.8	382.4
$\frac{56}{57}$	272.7 273.5	228.8 229.5	$16 \\ 17$	318.7 319.4	$267.4 \\ 268.1$	$\frac{76}{77}$	364.6 365.4	306.0 306.6	$\frac{36}{37}$	410.6 411 1	344.5 345.9	96 97	457 3	$\frac{383.1}{383.7}$
58	274.2	230.1	18	320.2	268.7	78	366.2	307.3	38	412.1	345.8	98	458.1	384.4
59 60	275.0 275.9	230.8	19 20	321.0 321.7	269.3 270.0	79 80	366.9 367.7	307.9 308.5	39 10	412.9 413.7	346.4 347 1	99 600	458.9 159.6	385.0 385.7
	210.8	201.4		041.7	210.0			000, 0		419.1	011.1		403.0	000.1
Dist.	Dep.	Lat.	Dist.	Dep.	Lat.	Dist.	Dep.	Lat.	Dist.	Dep.	Lat.	Dist.	Dep.	Lat.
						50° (1	30°, 230	°, 310°).					

Pa	ge 448					Г	ABLF	C 2.						
		1	Differe	nce of L	atitude	e and	Departu	re for	41° (1	.39°, 221	°, 319°	').		
Dist.	Lat.	Dep.	Dist.	Lat.	Dep.	Dist.	Lat.	Dep.	Dist.	Lat.	Dep.	Dist.	Lat.	Dep.
$\frac{1}{2}$	$0.8 \\ 1.5$	$0.7 \\ 1.3$	$\begin{array}{c} 61 \\ 62 \\ \end{array}$	46.0 46.8	$ \begin{array}{c} 40.0 \\ 40.7 \\ \end{array} $	$121 \\ 22 \\ 22 \\ 22 \\ 22 \\ 22 \\ 22 \\ 22 $	91.3 92.1	79.4 80.0	181 82	$136.6 \\ 137.4 \\ 137.4$	$118.7 \\ 119.4 \\ 100.1$	$\begin{array}{c} 241 \\ 42 \\ \end{array}$	181.9 182.6	$158.1 \\ 158.8$
$\frac{3}{4}$	2.3 3.0	2.0 2.6 2.2		47.0 48.3	41.3 42.0 19.6	23 24 95	92.8 93.6	80.7 81.4	83 84 85	138.1 138.9 120.6	120.1 120.7 120.7	· 43 - 44 - 45	183.4 184.1 184.0	159.4 160.1
$\frac{5}{6}$	$\frac{3.0}{4.5}$	3.9 4.6	* 66 87	49.8	$\frac{42.0}{43.3}$	$\frac{26}{26}$	95.1 95.8	82.7	86 87	140.4	121.4 122.0 122.7	46	185.7	160.7 161.4 162.0
8	6.0 6.8	5.2	68 69	51.3 52.1	$\frac{11.0}{44.6}$	28 29	96.6 97.1	84.0 84.6	88 89	141.9 142.6	122.1 123.3 124.0	48	180.4 187.2 187.9	162.0 162.7 163.4
$\frac{10}{11}$	$\frac{7.5}{8.3}$	$\frac{6.6}{7.2}$	$\frac{70}{71}$	$\frac{52.8}{53.6}$	45.9	$\frac{30}{131}$	98.1	85.3	$\frac{90}{191}$	143.4 144 1	$\frac{124.7}{125.3}$	$\frac{50}{251}$	188.7	164.0 164.7
$11 \\ 12 \\ 13$	9.1 9.8	$7.9 \\ 8.5$	$72 \\ 73$	54.3 55.1	47.2 47.9	$\frac{32}{33}$	99,6 100,4	86.6 87.3	92 93	144.9 145.7	126.0 126.0 126.6	$52 \\ 53$	190. 2 190. 9	165.3 166.0
14 15	10.6 11.3	9.2 9.8	74 75	55.8 56.6	$\frac{48.5}{49.2}$	$\frac{34}{35}$	101.1 101.9	87.9 88.6	94 95	$146.4 \\ 147.2$	127.3 127.9	$ 54 \\ 55 $	191.7 192.5	166.6 167.3
$\frac{16}{17}$	$\begin{array}{c} 12.1\\ 12.8 \end{array}$	$10.5 \\ 11.2$	$\begin{array}{c} 76 \\ 77 \end{array}$	$57.4 \\ 58.1$	$49.9 \\ 50.5$	$\frac{36}{37}$	$102.6 \\ 103.4$	$89.2 \\ 89.9$	96 97	$147.9 \\ 148.7$	$128.6 \\ 129.2$	$\begin{array}{c} 56 \\ 57 \end{array}$	$193.2 \\ 194.0$	$ \begin{array}{r} 168.0 \\ 168.6 \end{array} $
$\frac{18}{19}$	$13.6 \\ 14.3$	$11.8 \\ 12.5$	78 79	58.9 59.6	$\begin{array}{c} 51.2\\51.8\end{array}$	38 39	$104.1 \\ 104.9$	$\begin{array}{c}90.5\\91.2\end{array}$	-98 99	$149.4 \\ 150.2$	$129.9 \\ 130.6$	$\begin{array}{c} 58 \\ 59 \end{array}$	$194.\ 7\\195.\ 5$	169.3 169.9
$\frac{20}{21}$	$\frac{15.1}{15.8}$	$\frac{13.1}{13.8}$	$\frac{80}{81}$	$\frac{60.4}{61.1}$	$\frac{52.5}{53.1}$	$\frac{40}{141}$	$\frac{105.7}{106.4}$	$\frac{91.8}{92.5}$	$\frac{200}{201}$	$\frac{150.9}{151.7}$	$\frac{131.2}{131.9}$	$\frac{60}{261}$	$\frac{196.2}{197.0}$	$ \begin{array}{r} 170.6 \\ 171.2 \end{array} $
$\begin{array}{c} 22\\ 23\\ \end{array}$	$16.6 \\ 17.4 \\ 10.1$	14.4 15.1	82 83	61.9 62.6	$53.8 \\ 54.5 \\ 74.5 \\ $	$\begin{array}{c} 42 \\ 43 \\ \end{array}$	$107.2 \\ 107.9 \\ 100.7 \\ 100.$	93. 2 93. 8	02 03	152.5 153.2	$\begin{vmatrix} 132.5\\ 133.2\\ 122 \end{vmatrix}$	62 63	$ \begin{array}{r} 197.7 \\ 198.5 \\ 100 \\ \end{array} $	$ \begin{array}{c c} 171.9\\ 172.5\\ \end{array} $
$\begin{array}{c} 24\\ 25\end{array}$	18.1 18.9 10.6	15.7 16.4	84 85 92	$63.4 \\ 64.2 \\ 64.0$	55.1 55.8	$ \frac{44}{45} $	108.7 109.4	94.5 95.1	04 05 07	154.0 154.7	133.8 134.5 105.1	$\begin{array}{c} 64 \\ 65 \\ a6 \end{array}$	199.2 200.0	173.2 173.9
$\frac{26}{27}$	19.6 20.4 21.1	17.1 17.7 18.1	80 87 99	64.9 65.7 66.4	50.4 57.1 57.7	40 47 48	110.2 110.9 111.7	95.8 96.4 97.1	06	150.0 156.2 157.0	130, 1 135, 8 136, 5	60 67 68	200.8 201.5 202.3	174.5 175.2 175.9
29 30	$ \begin{array}{c} 21.1 \\ 21.9 \\ 22.6 \end{array} $	10.4 19.0 19.7	89 90	67.2 67.9	$57.4 \\ 58.4 \\ 59.0$	49 50	111.7 112.5 113.2	97.8 98.4	09	157.0 157.7 158.5	130.5 137.1 137.8	69 70	202.3 203.0 203.8	175.8 176.5 177.1
$\frac{31}{32}$	23.4 24.2	20.3 21.0	$\frac{91}{92}$	68.7 69.4	59.7 60.4	$\frac{151}{52}$	114.0 114.7	99.1 99.7	$\frac{10}{211}$	159.2 160.0	138.4 139.1	$\frac{1}{271}$	204.5	177.8 178.4
$\frac{33}{34}$	$24.9 \\ 25.7$	$\frac{21.6}{22.3}$	93 94	$70.2 \\ 70.9$	$ \begin{array}{c} 61.0\\ 61.7 \end{array} $	$53 \\ 54$	115.5 116.2	100.4 101.0	$13 \\ 14$	$160.8 \\ 161.5$	139.7 140.4	73 74	206.0 206.8	179.1 179.8
$\frac{35}{36}$	$26.4 \\ 27.2$	$23.0 \\ 23.6$	$\begin{array}{c} 95 \\ 96 \end{array}$	$71.7 \\ 72.5$	$\begin{array}{c} 62.3 \\ 63.0 \end{array}$	$\begin{array}{c} 55 \\ 56 \end{array}$	$117.0 \\ 117.7$	$101.7 \\ 102.3$	$15 \\ 16$	$162.3 \\ 163.0$	$141.1 \\ 141.7$	$\frac{75}{76}$	$207.5 \\ 208.3$	$180.\ 4\\181.\ 1$
37 38	$\begin{array}{c} 27.9\\ 28.7 \end{array}$	$24.3 \\ 24.9 \\ 25.2 \\ 24.9 \\ 25.2 \\ 24.2 \\ $	97 98	$73.2 \\ 74.0$	$63.6 \\ 64.3$	57 58	$118.5 \\ 119.2$	103.0 103.7	17 18	$163.8 \\ 164.5$	$142.4 \\ 143.0$	77 78	$\begin{array}{c} 209.1 \\ 209.8 \end{array}$	$ \begin{array}{c c} 181.7\\ 182.4 \end{array} $
39 40	$29.4 \\ 30.2$	25.6 26.2	$\frac{99}{100}$	$\begin{array}{r} 74.7 \\ \overline{75.5} \end{array}$	$64.9 \\ 65.6$	$\frac{59}{60}$	120.0 120.8	$104.3 \\ 105.0$	$\frac{19}{20}$	$165.3 \\ 166.0$	$143.7 \\ 144.3$	$\frac{79}{80}$	210.6 211.3	$ \begin{array}{r} 183.0 \\ 183.7 \end{array} $
$\frac{41}{42}$	30.9 31.7	26.9 27.6	$\begin{array}{c}101\\02\\0\end{array}$	$76.2 \\ 77.0 \\ 77.7 \\ $	66.3 66.9 67.6	$\begin{array}{c} 161 \\ 62 \\ 69 \end{array}$	121.5 122.3 122.0	105.6 106.3	$221 \\ 22 \\ 00$	166.8 167.5	145.0 145.6 146.9	$\begin{array}{c} 281 \\ 82 \\ \circ \end{array}$	212.1 212.8	184.4 185.0
44	32.0 33.2 31.0	28, 2 28, 9 20, 5	05	78.5	67.6 68.2 68.0	03 64 65	123.0 123.8 124.5	100.9 107.6 108.2	$23 \\ 24 \\ 25$	108.3 169.1 160.8	140.3 147.0 147.6	85 - 84 - 85	213.0 214.3 215.1	185.7 186.3 187.0
$\frac{46}{47}$	$ 34.7 \\ 35.5 $	$ \begin{array}{c} 20.0 \\ 30.2 \\ 30.8 \end{array} $	06 07	80. 0 80. 8	69.5 70.2	66 67	124.0 125.3 126.0	108.9		105.6 170.6 171.3	147.0 148.3 148.9	86 87	215.8 216.6	187.6 187.6 188.3
48 49	$36.2 \\ 37.0$	31.5 32.1	08 09	81.5 82.3	70.9 71.5	$\begin{array}{c} 68\\69\end{array}$	126.8 127.5	110.2 110.9	$ \begin{array}{c} 28 \\ 29 \end{array} $	172.1 172.8	149.6 150.2	88 89	217.4 218.1	188.9 189.6
$\frac{50}{51}$	$\frac{37.7}{38.5}$	$\frac{32.8}{33.5}$	$\frac{10}{111}$	83.0	$\frac{72.2}{72.8}$	$\frac{70}{171}$	$\frac{128.3}{129.1}$	111.5 112.2	$\frac{30}{231}$	173.6 174.3	150.9 151.5	$\frac{90}{291}$	$\frac{218.9}{219.6}$	$\frac{190.3}{190.9}$
$52 \\ 53$	$39.2 \\ 40.0$	$34.1 \\ 34.8$	$\begin{array}{c} 12 \\ 13 \end{array}$	$84.5 \\ 85.3$	$73.5 \\ 74.1$	$\begin{array}{c} 72 \\ 73 \end{array}$	$129.8 \\ 130.6$	$112.8 \\ 113.5$	$\frac{32}{33}$	$175.1 \\ 175.8$	$152.2 \\ 152.9$	92 93	$220.4 \\ 221.1$	$191.6 \\ 192.2$
$\begin{array}{c} 54 \\ 55 \end{array}$	$40.8 \\ 41.5 \\ 100 \\ 10$	35.4 36.1	$\begin{array}{c} 14\\ 15\end{array}$	86.0 86.8	$74.8 \\ 75.4$	$\frac{74}{75}$	$131.3 \\ 132.1$	$114.\ 2\\114.\ 8$	$ 34 \\ 35 $	176.6 177.4	153.5 154.2	94 95	221.9 222.6	$192.9 \\ 193.5$
56 57 59	42.3 43.0	36.7 37.4	$\begin{array}{c} 16\\17\\19\end{array}$	87.5 88.3	$\begin{array}{c} 76.1 \\ 76.8 \\ 77.4 \end{array}$	76 77 70	132.8 133.6 121.2	115.5 116.1	$ 36 \\ 37 \\ 99 $	178.1 178.9 170.2	154.8 155.5 156.1	96 97	223.4 224.1	$194.2 \\ 194.8 \\ 105.5 \\$
58 59 60	40.8 44.5 45.3	38.1 38.7 39.1	18 19 20	89.1 89.8 90.6	77.4 78.1 78.7	78 79 80	134.3 135.1 135.8	116.8 117.4 118.1	38 39 40	179.6 180.4 181.1	156.1 156.8 157.5	98 99 300	224.9 225.7 226.4	195.5 196.2 196.9
Dist.	Dep.		Dist.	 		Dist	 	Lat	Dist	 	Lat	Dist	 	Lat.
	2.0p.		1	20191	JALL.	49° (1	.31°, 229	°, 311°).	a.c.p.		1 2 101.	2 cP:	and to

						Г	ABLE	Z 2.					[Page	449
		1	Differe	ence of I	Latitud	e and	Departu	ire for	41° (1	39°, 221	°, 319°).		
Dist.	Lat.	Dep.	Dist.	Lat.	Dep.	Dist.	Lat.	Dep.	Dist.	Lat.	Dep.	Dist.	Lat.	Dep.
$ \begin{array}{r} 301 \\ 02 \\ 03 \\ 04 \end{array} $	$227.2 \\ 227.9 \\ 228.7 \\ 220.4$	$197.5 \\198.1 \\198.8 \\109.4$	$ \begin{array}{r} 361 \\ 62 \\ 63 \\ 64 \end{array} $	272.5 273.2 274.0 274.7	236.9 237.5 238.2 238.9	$421 \\ 22 \\ 23 \\ 21$	317.7 318.5 319.2 320.0	276.2 276.9 277.5 278.2	481 82 83 81	363.0 363.8 364.5 365.2	315.6 316.2 316.9 217.5	$541 \\ 42 \\ 43 \\ 44$	408.3 409.0 409.8 -110.6	354.9 355.6 356.2 256.0
$ \begin{array}{c} 04 \\ 05 \\ 06 \\ 07 \\ 00 \end{array} $	230. 2 230. 9 231. 7	$ \begin{array}{c} 199.4 \\ 200.1 \\ 200.8 \\ 201.4 \\ 202.1 \end{array} $	65 66 67	$\begin{array}{c} 275.5\\ 276.2\\ 277.0\\ 977.7\end{array}$	239.5240.1240.8241.4	$ \begin{array}{c} 21 \\ 25 \\ 26 \\ 27 \\ 98 \end{array} $	320.8 321.5 322.3 322.0	278.8 279.5 280.1	85 86 87	366.0 366.8 367.5 268.2	318.2 318.8 319.5 290.1	45 46 47	$\begin{array}{c} 410.0 \\ 411.3 \\ 412.1 \\ 412.8 \\ 412.6 \end{array}$	350.9 357.5 358.2 358.8 250.5
$ \begin{array}{r} 08 \\ 09 \\ 10 \\ \overline{311} \end{array} $	$ \begin{array}{r} 232.5 \\ 233.2 \\ 234.0 \\ \hline 234.7 \\ \end{array} $	$ \begin{array}{r} 202.1 \\ 202.7 \\ 203.4 \\ \hline 204.0 \end{array} $	$\begin{array}{r} 68\\69\\70\\\overline{371}\end{array}$	$\begin{array}{r} 277.7\\ 278.5\\ 279.2\\ \hline 280.0 \end{array}$	$ \begin{array}{r} 241.4 \\ 242.1 \\ 242.7 \\ \hline 243.4 \end{array} $	$ \begin{array}{r} 28 \\ 29 \\ 30 \\ \overline{431} \end{array} $	$ \begin{array}{r} 323. \\ 323. \\ 324. \\ 325. \\ 325. \\ 3 \end{array} $	$ \begin{array}{r} 280.8 \\ 281.5 \\ 282.1 \\ \overline{} \\ 282.8 \\ \end{array} $		$ \begin{array}{r} 368.5 \\ 369.0 \\ 369.8 \\ \overline{370.6} \end{array} $	$ \begin{array}{r} 320.1 \\ 320.8 \\ 321.5 \\ 322.1 \end{array} $		$ \begin{array}{r} 413.6 \\ 414.3 \\ 415.1 \\ \overline{} \\ 415.8 \\ \end{array} $	$ \begin{array}{r} 359.5 \\ 360.2 \\ 360.8 \\ \overline{361.5} \end{array} $
$ \begin{array}{r} 12 \\ 13 \\ 14 \\ 15 \end{array} $	235.5236.2237.0237.7	$\begin{array}{c} 204.\ 7\\ 205.\ 4\\ 206.\ 0\\ 206.\ 7\end{array}$	$72 \\ 73 \\ 74 \\ 75$	$\begin{array}{c} 280.8 \\ 281.5 \\ 282.3 \\ 283.0 \end{array}$	$244.1 \\ 244.7 \\ 245.4 \\ 246.0$	$ \begin{array}{r} 32 \\ 33 \\ 34 \\ 35 \end{array} $	$\begin{array}{c} 326.\ 0\\ 326.\ 8\\ 327.\ 5\\ 328.\ 3\end{array}$	$283. 4 \\284. 1 \\284. 7 \\285. 4$	$92 \\ 93 \\ 94 \\ 95$	$\begin{array}{c} 371.3 \\ 372.1 \\ 372.8 \\ 373.6 \end{array}$	$\begin{array}{c} 322.8\\ 323.4\\ 324.1\\ 324.7\end{array}$	$52 \\ 53 \\ 54 \\ 55$	$\begin{array}{c} 416. 6\\ 417. 3\\ 418. 1\\ 418. 9\end{array}$	$\begin{array}{c c} 362.1 \\ 362.8 \\ 363.4 \\ 364.1 \end{array}$
$ \begin{array}{r} 16 \\ 17 \\ 18 \\ 19 \\ 20 \\ \end{array} $	238.5239.2240.0240.8241.5	$\begin{array}{c} 207.\ 3\\ 208.\ 0\\ 208.\ 6\\ 209.\ 3\\ 200.\ 0\\ \end{array}$	76 77 78 79	$\begin{array}{c} 283.8 \\ 284.5 \\ 285.3 \\ 286.0 \\ 286 \end{array}$	$\begin{array}{c} 246.7 \\ 247.3 \\ 248.0 \\ 248.7 \\ 240.2 \end{array}$	$ \begin{array}{r} 36 \\ 37 \\ 38 \\ 39 \\ 10 \end{array} $	329.1 329.8 330.6 331.3 229.1	$\begin{array}{c} 286.0 \\ 286.7 \\ 287.4 \\ 288.0 \\ 288.7 \end{array}$	96 97 98 99	$\begin{array}{c} 374.3 \\ 375.1 \\ 375.8 \\ 376.6 \\ 277.2 \end{array}$	$\begin{array}{c} 325.4 \\ 326.0 \\ 326.7 \\ 327.4 \\ 228.0 \end{array}$	$56 \\ 57 \\ 58 \\ 59 \\ 60$	$\begin{array}{c} 419.\ 6\\ 420.\ 4\\ 421.\ 1\\ 421.\ 9\\ 129.\ 6\end{array}$	364.8 365.4 366.1 366.7 267.1
$ \begin{array}{r} 20 \\ 321 \\ 22 \\ 23 \\ 21 \\ 23 \\ 21 \end{array} $	$\begin{array}{r} 241.5 \\ 242.3 \\ 243.0 \\ 243.8 \\ 211.5 \end{array}$	$ \begin{array}{r} 209.9 \\ \hline 210.6 \\ 211.3 \\ 211.9 \\ 212.6 \end{array} $		$ \begin{array}{r} 280.8 \\ \hline 287.5 \\ 288.3 \\ 289.1 \\ 280.8 \\ \end{array} $	249.3 250.0 250.6 251.3 251.9	$ \frac{40}{441} 42 43 11 $	$\begin{array}{r} 332.1 \\ 332.8 \\ 333.6 \\ 334.3 \\ 335.1 \end{array}$	$ \begin{array}{r} 289.7 \\ \overline{289.3} \\ 290.0 \\ 290.6 \\ 291.3 \end{array} $	$ \begin{array}{r} 500 \\ 501 \\ 02 \\ 03 \\ 04 \end{array} $	$\begin{array}{c} 377.3 \\ 378.1 \\ 378.9 \\ 379.6 \\ 380.4 \end{array}$	$\begin{array}{r} 328.0 \\ 328.7 \\ 329.3 \\ 330.0 \\ 230.6 \end{array}$		$\begin{array}{r} 422.0 \\ \hline 423.4 \\ 424.1 \\ 424.9 \\ 125.7 \end{array}$	$ \begin{array}{r} 367.4 \\ 368.0 \\ 368.7 \\ 369.4 \\ 370.0 \\ \end{array} $
$24 \\ 25 \\ 26 \\ 27 \\ 28 \\ 28 \\ 28 \\ 28 \\ 29 \\ 28 \\ 29 \\ 28 \\ 20 \\ 20 \\ 20 \\ 20 \\ 20 \\ 20 \\ 20$	244.0 245.3 246.0 246.8 247.5	$\begin{array}{c} 212.0\\ 213.2\\ 213.9\\ 214.5\\ 215.2 \end{array}$	85 86 87 88	$\begin{array}{c} 290.6\\ 291.3\\ 292.1\\ 292.8\end{array}$	251.9 252.6 253.2 253.9 254.6	$45 \\ 46 \\ 47 \\ 48$	$\begin{array}{c} 335.8\\ 336.6\\ 337.4\\ 338.1 \end{array}$	$\begin{array}{c} 291.9\\ 292.0\\ 292.6\\ 293.3\\ 293.9\end{array}$	$ \begin{array}{c} 05 \\ 06 \\ 07 \\ 08 \end{array} $	381.1 381.9 382.6 383.4	331.3 332.0 332.6 333.3		$\begin{array}{c} 426.4 \\ 426.4 \\ 427.2 \\ 427.9 \\ 428.7 \end{array}$	370.7 371.3 372.0 372.6
	$ \begin{array}{r} 248.3 \\ 249.1 \\ \overline{} \\ 249.8 \\ \end{array} $	$ \begin{array}{r} 215.9 \\ 216.5 \\ \overline{217.2} \end{array} $	89 90 391	$ \begin{array}{r} 293.6 \\ 294.3 \\ \overline{295.1} \\ \end{array} $	$ \begin{array}{r} 251.0 \\ 255.2 \\ 255.9 \\ 256.5 \end{array} $		$ 338.9 \\ 339.6 \\ \overline{340.4} $	$ \begin{array}{r} 294.6 \\ 295.2 \\ \overline{295.9} \end{array} $	$\begin{array}{r} 09\\10\\\overline{511}\end{array}$	$ 384.1 \\ 384.9 \\ 385.7 $	$ \begin{array}{r} 333.9 \\ 334.6 \\ \overline{335.2} \end{array} $	$\begin{array}{r} 69\\ 70\\ \overline{571} \end{array}$	$ \begin{array}{r} 120.1 \\ 429.4 \\ 430.2 \\ \overline{430.9} \end{array} $	$ \begin{array}{r} 373.3 \\ 374.0 \\ \overline{374.6} \end{array} $
$32 \\ 33 \\ 34 \\ 35 \\ 35 \\ 35 \\ 32 \\ 32 \\ 35 \\ 31 \\ 32 \\ 32 \\ 33 \\ 33 \\ 34 \\ 35 \\ 35 \\ 35 \\ 35 \\ 35$	$250.6 \\ 251.3 \\ 252.1 \\ 252.8 \\ 252.$	$217.8 \\ 218.5 \\ 219.1 \\ 219.8 \\ 219.8 \\ 219.8 \\ 219.8 \\ 219.8 \\ 219.8 \\ 219.8 \\ 219.8 \\ 210.$	$92 \\ 93 \\ 94 \\ 95 \\ 00$	$\begin{array}{c} 295.8 \\ 296.6 \\ 297.4 \\ 298.1 \\ \end{array}$	$\begin{array}{c} 257.2 \\ 257.8 \\ 258.5 \\ 259.2 \\ 259.2 \end{array}$	$52 \\ 53 \\ 54 \\ 55 \\ 55 \\ 55 \\ 55 \\ 51 \\ 55 \\ 51 \\$	$\begin{array}{c} 341. 1 \\ 341. 9 \\ 342. 6 \\ 343. 4 \end{array}$	$\begin{array}{c} 296.5 \\ 297.2 \\ 297.9 \\ 298.5 \\ \end{array}$		$\begin{array}{c} 386.4 \\ 387.2 \\ 387.9 \\ 388.7 \\ \end{array}$	335.9 336.5 337.2 337.9	$72 \\ 73 \\ 74 \\ 75 \\ 75 \\ 75 \\ 75 \\ 75 \\ 75 \\ 75$	$\begin{array}{c} 431.7 \\ 432.4 \\ 433.2 \\ 434.0 \end{array}$	$\begin{array}{c} 375. \ 3\\ 375. \ 9\\ 376. \ 6\\ 377. \ 2\end{array}$
$ \begin{array}{c} 36 \\ 37 \\ 38 \\ 39 \\ 40 \end{array} $	$\begin{array}{c} 253.6\\ 254.3\\ 255.1\\ 255.8\\ 256.6\end{array}$	$220. 4 \\ 221. 1 \\ 221. 8 \\ 222. 4 \\ 223. 1$	96 97 98 99 400	$\begin{array}{c} 298.9 \\ 299.6 \\ 300.4 \\ 301.1 \\ 301.9 \end{array}$	259.8 260.5 261.1 261.8 262.4	56 57 58 59 60	344.9 345.7 346.4 347.2	299.2 299.8 300.5 301.1 301.8	16 17 18 19 20	389.4 390.2 390.9 391.7 392.4	338.5 339.2 339.8 340.5 341.1	76 77 78 79 80	$\begin{array}{r} 434.7\\ 435.5\\ 436.2\\ 437.0\\ 437.7\end{array}$	377.9 378.5 379.2 379.8 380.5
$ \begin{array}{r} 341 \\ 42 \\ 43 \\ 44 \end{array} $	257.4 258.1 258.9 259.6	$ \begin{array}{r} \hline 223.7 \\ 224.4 \\ 225.0 \\ 225.7 \\ \end{array} $	$ \begin{array}{r} 401 \\ 02 \\ 03 \\ 04 \end{array} $	$ \begin{array}{r} 302.6 \\ 303.4 \\ 304.2 \\ 304.9 \end{array} $	$ \begin{array}{r} 263.1 \\ 263.7 \\ 264.4 \\ 265.1 \end{array} $	$ \begin{array}{r} 461 \\ 62 \\ 63 \\ 64 \end{array} $	$ \begin{array}{r} 347.9 \\ 348.7 \\ 349.4 \\ 350.2 \end{array} $	$ \begin{array}{r} 302.5 \\ 303.1 \\ 303.8 \\ 304.4 \end{array} $	521 22 23 24	393.2 394.0 394.7 395.5	341.8 342.5 343.1 343.8		$ \begin{array}{r} 438.5 \\ 439.2 \\ 440.0 \\ 440.7 \end{array} $	$ 381.2 \\ 381.8 \\ 382.5 \\ 383.2 $
45 46 47 48	$\begin{array}{c} 260.\ 4\\ 261.\ 1\\ 261.\ 9\\ 262.\ 6\end{array}$	$\begin{array}{c} 226.\ 3\\ 227.\ 0\\ 227.\ 7\\ 228.\ 3\end{array}$	05 06 07 08	305.7 306.4 307.2 307.9	$\begin{array}{c} 265.7\\ 266.4\\ 267.0\\ 267.7\end{array}$		350.9 351.7 352.5 353.2	305.1 305.7 306.4 307.0	$ \begin{array}{r} 25 \\ 26 \\ 27 \\ 28 \end{array} $	$\begin{array}{c} 396.2 \\ 397.0 \\ 397.7 \\ 398.5 \end{array}$	$ \begin{array}{r} 344.4 \\ 345.1 \\ 345.7 \\ 346.4 \end{array} $	85 86 87 88	$\begin{array}{r} 441.5 \\ 442.3 \\ 443.0 \\ 443.8 \end{array}$	$\begin{array}{c} 383.8\\ 384.5\\ 385.1\\ 385.8\end{array}$
$\begin{array}{r} 49\\ 50\\ \hline 351 \end{array}$	$\frac{263.4}{264.2}$	$229.\ 0\\229.\ 6\\230.\ 3$	$\begin{array}{r} 09\\10\\\overline{111} \end{array}$	$ \begin{array}{r} 308.7 \\ 309.4 \\ \overline{310.2} \end{array} $	$\frac{268.3}{269.0}\\ \hline 269.6$	$\begin{array}{r} 69\\70\\\overline{471}\end{array}$	354.0 354.7 355.5	307.7 308.4 309.0	$\begin{array}{r} 29\\ 30\\ \hline 531 \end{array}$	$ \begin{array}{r} 399.2 \\ 400.0 \\ \overline{400.7} \end{array} $	$\frac{347.0}{347.7}\\\overline{348.4}$	$\frac{89}{90}$ $\overline{591}$	$ \begin{array}{r} 444.5 \\ 445.3 \\ \overline{} \\ 446.0 \\ \end{array} $	$\frac{386.4}{387.1}$ $\overline{387.7}$
$52 \\ 53 \\ 54 \\ 55$	$265.7 \\ 266.4 \\ 267.2 \\ 267.9$	230.9 231.6 232.3 232.9	$ 12 \\ 13 \\ 14 \\ 15 $	$\begin{array}{c} 310. \ 9 \\ 311. \ 7 \\ 312. \ 5 \\ 313. \ 2 \end{array}$	270.3 271.0 271.6 272.3	$72 \\ 73 \\ 74 \\ 75$	356.2 357.0 357.7 358.5	$\begin{array}{c} 309.\ 7\\ 310.\ 3\\ 311.\ 0\\ 311.\ 6\end{array}$	$ \begin{array}{r} 32 \\ 33 \\ 34 \\ 35 \end{array} $	$\begin{array}{r} 401.5 \\ 402.2 \\ 403.0 \\ 403.8 \end{array}$	349.0 349.7 350.3 351.0	92 93 94 95	$\begin{array}{r} 446.8 \\ 447.5 \\ 448.3 \\ 449.1 \end{array}$	$\begin{array}{c} 388.4 \\ 389.1 \\ 389.7 \\ 390.4 \end{array}$
$56 \\ 57 \\ 58 \\ 59$	$268.7 \\ 269.4 \\ 270.2 \\ 270.9$	$\begin{array}{c} 233.\ 6\\ 234.\ 2\\ 234.\ 9\\ 235.\ 5\end{array}$	$ \begin{array}{c} 16 \\ 17 \\ 18 \\ 19 \end{array} $	314.0 314.7 315.5 316.2	272.9 273.6 274.2 274.9	$76 \\ 77 \\ 78 \\ 79$	359.2 360.0 360.8 361.5	312.3 312.9 313.6 314.3		$\begin{array}{r} 404.5 \\ 405.3 \\ 406.0 \\ 406.8 \end{array}$	$\begin{array}{c} 351.\ 6\\ 352.\ 3\\ 352.\ 9\\ 353.\ 6\end{array}$	96 97 98 99	$\begin{array}{r} 449.8 \\ 450.6 \\ 451.3 \\ 452.1 \end{array}$	391.0 391.7 392.3 393.0
60	271.7	236.2	20	317.0	275.6	80	362.3	314.9	-40	407.5	354.3	600	452.8	393.6
Dist.	Dep.	Lat.	Dist.	Dep.	Lat.	Dist.	Dep.	Lat.	Dist.	Dep.	Lat.	Dist.	Dep.	Lat.
						49° (1	or [*] , 229	-, 3110).					

22489-03----29

Difference of Latitude and Departure for 42° (138°, 222°, 318°). 18t Lat. Dep. Dist. Lat. Dist. Dist. Dist.<	Pa	ge 450]				Т	ABLE	2 2.						
]	Differe	ence of 1	Latitud	e and	Departu	ire for ·	42° (1	38°, 222	°, 318°).		
	Dist.	Lat.	Dep.	Dist.	Lat.	Dep.	Dist.	Lat.	Dep.	Dist.	Lat.	Dep.	Dist.	Lat.	Dep.
$ \begin{array}{ c c c c c c c c c c c c c c c c c c c$	$ \begin{array}{c} 1 \\ 2 \\ 3 \\ 4 \\ 5 \\ 6 \\ 7 \\ 8 \\ 9 \\ 10 \\ \end{array} $	$\begin{array}{c} 0.\ 7\\ 1.\ 5\\ 2.\ 2\\ 3.\ 0\\ 3.\ 7\\ 4.\ 5\\ 5.\ 2\\ 5.\ 9\\ 6.\ 7\\ 7.\ 4\end{array}$	$\begin{array}{c} 0.\ 7\\ 1.\ 3\\ 2.\ 0\\ 2.\ 7\\ 3.\ 3\\ 4.\ 0\\ 4.\ 7\\ 5.\ 4\\ 6.\ 0\\ 6.\ 7\end{array}$	$\begin{array}{c} 61 \\ 62 \\ 63 \\ 64 \\ 65 \\ \bullet 66 \\ 67 \\ 68 \\ 69 \\ 70 \end{array}$	$\begin{array}{c} 45.3\\ 46.1\\ 46.8\\ 47.6\\ 48.3\\ 49.0\\ 49.8\\ 50.5\\ 51.3\\ 52.0 \end{array}$	$\begin{array}{r} 40.8\\ 41.5\\ 42.2\\ 42.8\\ 43.5\\ 44.2\\ 44.8\\ 45.5\\ 46.2\\ 46.8\end{array}$	$ \begin{array}{r} 121 \\ 22 \\ 23 \\ 24 \\ 25 \\ 26 \\ 27 \\ 28 \\ 29 \\ 30 \\ \end{array} $	$\begin{array}{c} 89.\ 9\\ 90.\ 7\\ 91.\ 4\\ 92.\ 1\\ 92.\ 9\\ 93.\ 6\\ 94.\ 4\\ 95.\ 1\\ 95.\ 9\\ 96.\ 6\end{array}$	$\begin{array}{c} 81.\ 0\\ 81.\ 6\\ 82.\ 3\\ 83.\ 0\\ 83.\ 6\\ 84.\ 3\\ 85.\ 0\\ 85.\ 6\\ 86.\ 3\\ 87.\ 0\end{array}$	$ \begin{array}{r} 181 \\ 82 \\ 83 \\ 84 \\ 85 \\ 86 \\ 87 \\ 88 \\ 89 \\ 90 \\ 90 \end{array} $	$134.5 \\ 135.3 \\ 136.0 \\ 136.7 \\ 137.5 \\ 138.2 \\ 139.0 \\ 139.7 \\ 140.5 \\ 141.2$	$\begin{array}{c} 121. \ 1\\ 121. \ 8\\ 122. \ 5\\ 123. \ 1\\ 123. \ 8\\ 124. \ 5\\ 125. \ 1\\ 125. \ 8\\ 126. \ 5\\ 127. \ 1 \end{array}$	$241 \\ 42 \\ 43 \\ 44 \\ 45 \\ 46 \\ 47 \\ 48 \\ 49 \\ 50$	$179.1 \\ 179.8 \\ 180.6 \\ 181.3 \\ 182.1 \\ 182.8 \\ 183.6 \\ 184.3 \\ 185.0 \\ 185.8 \\ 185.$	$\begin{array}{c} 161.\ 3\\ 161.\ 9\\ 162.\ 6\\ 163.\ 3\\ 163.\ 9\\ 164.\ 6\\ 165.\ 3\\ 165.\ 9\\ 166.\ 6\\ 167.\ 3\end{array}$
$ \begin{array}{ c c c c c c c c c c c c c c c c c c c$	$ \begin{array}{r} 11 \\ 12 \\ 13 \\ 14 \\ 15 \\ 16 \\ 17 \\ 18 \\ 19 \\ 20 \\ \end{array} $	$\begin{array}{c} 8.2\\ 8.9\\ 9.7\\ 10.4\\ 11.1\\ 11.9\\ 12.6\\ 13.4\\ 14.1\\ 14.9 \end{array}$	$\begin{array}{c} 7.4 \\ 8.0 \\ 8.7 \\ 9.4 \\ 10.0 \\ 10.7 \\ 11.4 \\ 12.0 \\ 12.7 \\ 13.4 \end{array}$	$\begin{array}{c} 71 \\ 72 \\ 73 \\ 74 \\ 75 \\ 76 \\ 77 \\ 78 \\ 79 \\ 80 \end{array}$	$\begin{array}{c} 52.8\\ 53.5\\ 54.2\\ 55.0\\ 55.7\\ 56.5\\ 57.2\\ 58.0\\ 58.7\\ 59.5\end{array}$	$\begin{array}{r} 47.5\\ 48.2\\ 48.8\\ 49.5\\ 50.2\\ 50.9\\ 51.5\\ 52.2\\ 52.9\\ 53.5\end{array}$	$ \begin{array}{r} 131 \\ 32 \\ 33 \\ 34 \\ 35 \\ 36 \\ 37 \\ 38 \\ 39 \\ 40 \\ 40 \end{array} $	$\begin{array}{c} 97.4\\ 98.1\\ 98.8\\ 99.6\\ 100.3\\ 101.1\\ 101.8\\ 102.6\\ 103.3\\ 104.0\\ \end{array}$	87.7 88.3 89.0 89.7 90.3 91.0 91.7 92.3 93.0 93.7	$ \begin{array}{r} 191 \\ 92 \\ 93 \\ 94 \\ 95 \\ 96 \\ 97 \\ 98 \\ 99 \\ 200 \\ \end{array} $	$\begin{array}{r} 141.9\\ 142.7\\ 143.4\\ 144.2\\ 144.9\\ 145.7\\ 146.4\\ 147.1\\ 147.9\\ 148.6 \end{array}$	$\begin{array}{c} 127.8\\ 128.5\\ 129.1\\ 129.8\\ 130.5\\ 131.1\\ 131.8\\ 132.5\\ 133.2\\ 133.8 \end{array}$	$\begin{array}{c} 251 \\ 52 \\ 53 \\ 54 \\ 55 \\ 56 \\ 57 \\ 58 \\ 59 \\ 60 \end{array}$	$\begin{array}{c} 186.5\\ 187.3\\ 188.0\\ 188.8\\ 189.5\\ 190.2\\ 191.0\\ 191.7\\ 192.5\\ 193.2 \end{array}$	$\begin{array}{c} 168.\ 0\\ 168.\ 6\\ 169.\ 3\\ 170.\ 0\\ 170.\ 6\\ 171.\ 3\\ 172.\ 0\\ 172.\ 6\\ 173.\ 3\\ 174.\ 0\end{array}$
$ \begin{array}{ c c c c c c c c c c c c c c c c c c c$	$21 \\ 22 \\ 23 \\ 24 \\ 25 \\ 26 \\ 27 \\ 28 \\ 29 \\ 30$	$\begin{array}{c} 15.6\\ 16.3\\ 17.1\\ 17.8\\ 18.6\\ 19.3\\ 20.1\\ 20.8\\ 21.6\\ 22.3\\ \end{array}$	$\begin{array}{c} 14.1\\ 14.7\\ 15.4\\ 16.1\\ 16.7\\ 17.4\\ 18.1\\ 18.7\\ 19.4\\ 20.1\\ \end{array}$	81 82 83 84 85 86 87 88 89 90	$\begin{array}{c} 60.2\\ 60.9\\ 61.7\\ 62.4\\ 63.2\\ 63.9\\ 64.7\\ 65.4\\ 66.1\\ 66.9 \end{array}$	$\begin{array}{c} 54.\ 2\\ 54.\ 9\\ 55.\ 5\\ 56.\ 2\\ 56.\ 9\\ 57.\ 5\\ 58.\ 2\\ 58.\ 9\\ 59.\ 6\\ 60.\ 2\end{array}$	$ \begin{array}{r} 141 \\ 42 \\ 43 \\ 44 \\ 45 \\ 46 \\ 47 \\ 48 \\ 49 \\ 50 \\ 50 \end{array} $	$\begin{array}{c} 104.8\\ 105.5\\ 106.3\\ 107.0\\ 107.8\\ 108.5\\ 109.2\\ 110.0\\ 110.7\\ 111.5 \end{array}$	$\begin{array}{c} 94.3\\95.0\\95.7\\96.4\\97.0\\97.7\\98.4\\99.0\\99.7\\100.4\end{array}$	$ \begin{array}{r} 201 \\ 02 \\ 03 \\ 04 \\ 05 \\ 06 \\ 07 \\ 08 \\ 09 \\ 10 \end{array} $	$\begin{array}{c} 149.\ 4\\ 150.\ 1\\ 150.\ 9\\ 151.\ 6\\ 152.\ 3\\ 153.\ 1\\ 153.\ 8\\ 154.\ 6\\ 155.\ 3\\ 156.\ 1\end{array}$	$\begin{array}{c} 134.5\\ 135.2\\ 135.8\\ 136.5\\ 137.2\\ 137.8\\ 138.5\\ 139.2\\ 139.8\\ 140.5\\ \end{array}$	$\begin{array}{r} 261 \\ ^{\circ}62 \\ 63 \\ 64 \\ 65 \\ 66 \\ 67 \\ 68 \\ 69 \\ 70 \end{array}$	$\begin{array}{c} 194.\ 0\\ 194.\ 7\\ 195.\ 4\\ 196.\ 2\\ 196.\ 9\\ 197.\ 7\\ 198.\ 4\\ 199.\ 2\\ 199.\ 9\\ 200.\ 6 \end{array}$	174.6 175.3 176.0 176.7 177.3 178.0 178.7 179.3 180.0 180.7
$\begin{array}{ c c c c c c c c c c c c c c c c c c c$	$ \begin{array}{r} 31 \\ 32 \\ 33 \\ 34 \\ 35 \\ 36 \\ 37 \\ 38 \\ 39 \\ 40 \\ 40 \end{array} $	$\begin{array}{c} 23.0\\ 23.8\\ 24.5\\ 25.3\\ 26.0\\ 26.8\\ 27.5\\ 28.2\\ 29.0\\ 29.7\\ \end{array}$	$\begin{array}{c} 20.7\\ 21.4\\ 22.1\\ 22.8\\ 23.4\\ 24.1\\ 24.8\\ 25.4\\ 26.1\\ 26.8\\ \end{array}$	$\begin{array}{r} 91 \\ 92 \\ 93 \\ 94 \\ 95 \\ 96 \\ 97 \\ 98 \\ 99 \\ 100 \end{array}$	$\begin{array}{c} 67.\ 6\\ 68.\ 4\\ 69.\ 1\\ 69.\ 9\\ 70.\ 6\\ 71.\ 3\\ 72.\ 1\\ 72.\ 8\\ 73.\ 6\\ 74.\ 3\end{array}$	$\begin{array}{c} 60.\ 9\\ 61.\ 6\\ 62.\ 2\\ 62.\ 9\\ 63.\ 6\\ 64.\ 2\\ 64.\ 9\\ 65.\ 6\\ 66.\ 2\\ 66.\ 9\end{array}$	$ \begin{array}{r} 151 \\ 52 \\ 53 \\ 54 \\ 55 \\ 56 \\ 57 \\ 58 \\ 59 \\ 60 \\ \end{array} $	$\begin{array}{c} 112.2\\ 113.0\\ .113.7\\ 114.4\\ 115.2\\ 115.9\\ 116.7\\ 117.4\\ 118.2\\ 118.9 \end{array}$	$\begin{array}{c} 101.\ 0\\ 101.\ 7\\ 102.\ 4\\ 103.\ 0\\ 103.\ 7\\ 104.\ 4\\ 105.\ 1\\ 105.\ 7\\ 106.\ 4\\ 107.\ 1 \end{array}$	$\begin{array}{r} 211 \\ 12 \\ 13 \\ 14 \\ 15 \\ 16 \\ 17 \\ 18 \\ 19 \\ 20 \end{array}$	$\begin{array}{c} 156.\ 8\\ 157.\ 5\\ 158.\ 3\\ 159.\ 0\\ 159.\ 8\\ 160.\ 5\\ 161.\ 3\\ 162.\ 0\\ 162.\ 7\\ 163.\ 5\\ \end{array}$	$\begin{array}{r} 141.\ 2\\ 141.\ 9\\ 142.\ 5\\ 143.\ 2\\ 143.\ 9\\ 144.\ 5\\ 145.\ 2\\ 145.\ 9\\ 146.\ 5\\ 147.\ 2 \end{array}$	$\begin{array}{c} 271 \\ 72 \\ 73 \\ 74 \\ 75 \\ 76 \\ 77 \\ 78 \\ 79 \\ 80 \end{array}$	$\begin{array}{c} 201. \ 4\\ 202. \ 1\\ 202. \ 9\\ 203. \ 6\\ 204. \ 4\\ 205. \ 1\\ 205. \ 9\\ 206. \ 6\\ 207. \ 3\\ 208. \ 1 \end{array}$	$\begin{array}{c} 181.3\\ 182.0\\ 182.7\\ 183.3\\ 184.0\\ 184.7\\ 185.3\\ 186.0\\ 186.7\\ 187.4 \end{array}$
$ \begin{array}{ c c c c c c c c c c c c c c c c c c c$	$\begin{array}{r} 41 \\ 42 \\ 43 \\ 44 \\ 45 \\ 46 \\ 47 \\ 48 \\ 49 \\ 50 \end{array}$	$\begin{array}{c} 30.5\\ 31.2\\ 32.0\\ 32.7\\ 33.4\\ 34.2\\ 34.9\\ 35.7\\ 36.4\\ 37.2\\ \end{array}$	$\begin{array}{c} 27.4\\ 28.1\\ 28.8\\ 29.4\\ 30.1\\ 30.8\\ 31.4\\ 32.1\\ 32.8\\ 33.5 \end{array}$	$ \begin{array}{r} 101 \\ 02 \\ 03 \\ 04 \\ 05 \\ 06 \\ 07 \\ 08 \\ 09 \\ 10 \\ \end{array} $	$\begin{array}{c} 75.1\\ 75.8\\ 76.5\\ 77.3\\ 78.0\\ 78.8\\ 79.5\\ 80.3\\ 81.0\\ 81.7 \end{array}$	$\begin{array}{c} 67.\ 6\\ 68.\ 3\\ 68.\ 9\\ 69.\ 6\\ 70.\ 3\\ 70.\ 9\\ 71.\ 6\\ 72.\ 3\\ 72.\ 9\\ 73.\ 6\end{array}$	$ \begin{array}{r} 161 \\ 62 \\ 63 \\ 64 \\ 65 \\ 66 \\ 67 \\ 68 \\ 69 \\ 70 \\ \end{array} $	$\begin{array}{c} 119.\ 6\\ 120.\ 4\\ 121.\ 1\\ 121.\ 9\\ 122.\ 6\\ 123.\ 4\\ 124.\ 1\\ 124.\ 8\\ 125.\ 6\\ 126.\ 3\\ \end{array}$	$\begin{array}{c} 107.\ 7\\ 108.\ 4\\ 109.\ 1\\ 109.\ 7\\ 110.\ 4\\ 111.\ 1\\ 111.\ 7\\ 112.\ 4\\ 113.\ 1\\ 113.\ 8\end{array}$	$221 \\ 22 \\ 23 \\ 24 \\ 25 \\ 26 \\ 27 \\ 28 \\ 29 \\ 30$	$\begin{array}{c} 164.\ 2\\ 165.\ 0\\ 165.\ 7\\ 166.\ 5\\ 167.\ 2\\ 168.\ 0\\ 168.\ 7\\ 169.\ 4\\ 170.\ 2\\ 170.\ 9\end{array}$	$\begin{array}{c} 147.9\\ 148.5\\ 149.2\\ 149.9\\ 150.6\\ 151.2\\ 151.9\\ 152.6\\ 153.2\\ 153.9 \end{array}$	$281 \\ 82 \\ 83 \\ 84 \\ 85 \\ 86 \\ 87 \\ 88 \\ 89 \\ 90$	$\begin{array}{c} 208.8\\ 209.6\\ 210.3\\ 211.1\\ 211.8\\ 212.5\\ 213.3\\ 214.0\\ 214.8\\ 215.5\\ \end{array}$	$\begin{array}{c} 188.0\\ 188.7\\ 189.4\\ 190.0\\ 190.7\\ 191.4\\ 192.0\\ 192.7\\ 193.4\\ 194.0 \end{array}$
	$51 \\ 52 \\ 53 \\ 54 \\ 55 \\ 56 \\ 57 \\ 58 \\ 59 \\ 60$	$\begin{array}{c} 37. \ 9\\ 38. \ 6\\ 39. \ 4\\ 40. \ 1\\ 40. \ 9\\ 41. \ 6\\ 42. \ 4\\ 43. \ 1\\ 43. \ 8\\ 44. \ 6\end{array}$	$\begin{array}{r} 34.1\\ 34.8\\ 35.5\\ 36.1\\ 36.8\\ 37.5\\ 38.1\\ 38.8\\ 39.5\\ 40.1 \end{array}$	$ \begin{array}{c} 111\\12\\13\\14\\15\\16\\17\\18\\19\\20\\\end{array} $	$\begin{array}{c} 82.5\\ 83.2\\ 84.0\\ 84.7\\ 85.5\\ 86.2\\ 86.9\\ 87.7\\ 88.4\\ 89.2 \end{array}$	$\begin{array}{c} 74.3\\ 74.9\\ 75.6\\ 76.3\\ 77.0\\ 77.6\\ 78.3\\ 79.0\\ 79.6\\ 80.3 \end{array}$	$ \begin{array}{r} 171 \\ 72 \\ 73 \\ 74 \\ 75 \\ 76 \\ 77 \\ 78 \\ 79 \\ 80 \\ \end{array} $	$\begin{array}{c} 127.\ 1\\ 127.\ 8\\ 128.\ 6\\ 129.\ 3\\ 130.\ 1\\ 130.\ 8\\ 131.\ 5\\ 132.\ 3\\ 133.\ 0\\ 133.\ 8\end{array}$	$\begin{array}{c} 114.4\\115.1\\115.8\\116.4\\117.1\\117.8\\118.4\\119.1\\119.8\\120.4\end{array}$	$\begin{array}{c} 231 \\ 32 \\ 33 \\ 34 \\ 35 \\ 36 \\ 37 \\ 38 \\ 39 \\ 40 \end{array}$	$\begin{array}{c} 171.\ 7\\ 172.\ 4\\ 173.\ 2\\ 173.\ 9\\ 174.\ 6\\ 175.\ 4\\ 176.\ 1\\ 176.\ 9\\ 177.\ 6\\ 178.\ 4 \end{array}$	$\begin{array}{c} 154.\ 6\\ 155.\ 2\\ 155.\ 9\\ 156.\ 6\\ 157.\ 2\\ 157.\ 9\\ 158.\ 6\\ 159.\ 3\\ 159.\ 9\\ 160.\ 6\end{array}$	$\begin{array}{c} 291 \\ 92 \\ 93 \\ 94 \\ 95 \\ 96 \\ 97 \\ 98 \\ 99 \\ 300 \end{array}$	$\begin{array}{c} 216.\ 3\\ 217.\ 0\\ 217.\ 7\\ 218.\ 5\\ 219.\ 2\\ 220.\ 0\\ 220.\ 7\\ 221.\ 5\\ 222.\ 2\\ 222.\ 9\end{array}$	$194.7 \\ 195.4 \\ 196.1 \\ 196.7 \\ 197.4 \\ 198.1 \\ 198.7 \\ 199.4 \\ 200.1 \\ 200.7 \\$
Dist. Dep. Lat.	Dist.	Dep.	Lat.	Dist.	Dep.	Lat.	Dist.	Dep.	Lat.	Dist.	Dep.	Lat.	Dist.	Dep.	Lat.

						Г	ABLE	2 2.					Page	451
]	Differe	ence of I	Latitude	e and	Departu	re for ·	42° (1	38°, 222	°, 318°).		
Dist.	Lat.	Dep.	Dist.	Lat.	Dep.	Dist.	Lat.	Dep.	Dist.	Lat.	Dep.	Dist.	Lat.	Dep.
$301 \\ 02$	223.7 224.4	201.4 202.1	$\frac{361}{62}$	268.3 269.0	241.6 242.2	$\frac{421}{22}$	312.9 313.6	$\frac{281.7}{282.4}$	481 82	357.5 358.2	321.9 322.5	$541 \\ 42$	402.1 402.8	362.0 362.7
03	225.2	202.8	63	269.8 270.5	242.9 243.6	$\frac{23}{24}$	314.4 315.1	283.0 283.7	83 8.1	358.9 359.7	323.2 323.0	43	403.5 404.3	363.3
04	225. 5	203.4 204.1	65	270.3	243.0	$\frac{24}{25}$	315.8	284.4	85	360.4	324.6	45	405.0	364.7
$\begin{array}{c} 06\\ 07\end{array}$	$227.4 \\ 228.1$	204.8 205.4	$\frac{66}{67}$	272.0 272.7	244.9 245.6	$\frac{26}{27}$	316.6 317.3	$285.1 \\ 285.7$	86 87	$\begin{array}{c} 361.2\\ 361.9 \end{array}$	$325.2 \\ 325.9$	46 47	405.8 406.5	365.4 366.0
08 09	228.9 229.6	206.1 206.8	$\begin{array}{c} 68 \\ 69 \end{array}$	273.5 274.2	246.2 246.9	$\frac{48}{29}$	318.1 318.8	286.4 287.1	- 88 89	362.7 363.4	326.6 327.2	48 49	407.2 408.0	366.7 367.4
10	230.4	$\frac{207.4}{200.1}$	70	275.0	247.6	30	319.6	287.7	90	364.1	327.9	50	408.7	368.0
$ \begin{array}{c} 311 \\ 12 \end{array} $	$231.1 \\ 231.9$	208.1 208.8	$\frac{371}{72}$	275.7 276.5	$248.3 \\ 248.9$	$\frac{431}{32}$	320.3 321.0	$288.4 \\ 289.1$	$\frac{491}{92}$	364.9 365.6	328.6 329.2	$551 \\ 52$	409.5 410.2	368.7 369.4
13 14	232.6 233.3	209.4 210.1	$73 \\ 74$	$277.2 \\ 277.9$	249.6 250.3	$\frac{33}{34}$	$321.8 \\ 322.5$	289.7 290.4	$\frac{93}{94}$	366.4 367.1	329.9 330.6	$\frac{53}{54}$	411.0 411.7	$370.0 \\ 370.7$
15	234.1	210.8	75	278.7	250.9 251 6	35	323.3	291.1 201 7	95 96	367.9	331.3 331.0	55 56	412.4	371.4 372.0
17	235.6	211.5 212.1	77	280.2	251.0 252.3	37	324.8	292.4	97 97	369.3	332.6	57	413.9	372.7
$ 18 \\ 19 $	$\begin{array}{c}236.3\\237.1\end{array}$	$212.8 \\ 213.5$	$\frac{78}{79}$	$280.9 \\ 281.7$	252.9 253.6	$\frac{38}{39}$	325.5 326.2	293.1 293.8	98 99	370.1 370.8	333.3 333.9	$\frac{58}{59}$	414.7 415.4	373.4 374.1
$\frac{20}{291}$	237.8	$\frac{214.1}{214.9}$	80	282.4	$\frac{254.3}{254.9}$	40	$\frac{327.0}{297.7}$	$\frac{294.4}{205.1}$	500	371.6	$\frac{334.6}{335.3}$	$\frac{60}{561}$	416.2	$\frac{374.7}{375.4}$
$\frac{321}{22}$	239.3	214.8	82	283.9	255.6	42	328.5	295.1 295.8	02^{-}	373.1	335.9	62	417.6	376.1
$\frac{23}{24}$	240.0 240.8	216.1 216.8	$\frac{83}{84}$	284.6 285.4	256.3 257.0	43	329.2 330.0	$296.4 \\ 297.1$	$03 \\ 04$	$373.8 \\ 374.5$	336.6 337.2	$\begin{array}{c} 63 \\ 64 \end{array}$	418.4 419.1	376.7 377.4
$\frac{25}{26}$	$241.5 \\ 242.3$	217.5 218.1	85 86	286.1 286.9	$\begin{vmatrix} 257.6\\ 258.3 \end{vmatrix}$	$\frac{45}{46}$	330.7 331.4	297.8 298.4	$ 05 \\ 06 $	375.3 376.0	337.9 338.6	$\frac{65}{66}$	419.9	378.1 378.7
27	243.0	218.8	87	287.6	259.0	47	332.2	299.1	07	376.8	339.3	67 68	421.4	379.4
28 29	243.8	$\begin{vmatrix} 219.5\\220.1\\220.1 \end{vmatrix}$	89	280.3 289.1	259.0 260.3	40	333.7	300.4	08	378.3	340.6	69	422.8	380.7
$\frac{30}{331}$	$\frac{245.2}{246.0}$	$\frac{220.8}{221.5}$	$\frac{90}{391}$	$\frac{289.8}{290.6}$	$\frac{261.0}{261.6}$	$\frac{50}{451}$	$\frac{334.4}{335.2}$	$\frac{301.1}{301.8}$	$\frac{10}{511}$	$\frac{379.0}{379.7}$	$\frac{341.3}{341.9}$	$\frac{70}{571}$	$\frac{423.6}{424.3}$	$\frac{381.4}{382.1}$
$\frac{32}{22}$	246.7 247.5	222.2	92 03	291.3	262.3	52	335.9	302.5	12	380.5	342.6	$\frac{72}{73}$	425.1	382.8
34 34	248.2	223.5	94	292.8	263.6	54	337.4	303.8	14	382.0	343.9	74	426.6	384.1
$\frac{35}{36}$	$249.0 \\ 249.7$	224.2 224.8	$\frac{95}{96}$	293.5 294.3	$264.3 \\ 265.0$	$\frac{55}{56}$	338.1 338.9	$304.5 \\ 305.1$	$15 \\ 16$	$382.7 \\ 383.5$	344.6 345.3	$\frac{75}{76}$	427.3 428.0	384.8 385.4
$\frac{37}{38}$	250.4 251.2	225.5 226.2	97 98	295,0 295,8	265.7 266.3	$57 \\ 58$	339.6	305.8 306.5	17 18	384.2 384.9	346.0 346.6	$77 \\ 78$	428.8 429.5	386.1 386.8
39	251.9	226.8	99	296.5	$\begin{bmatrix} 267.0\\ 267.0\\ 267.7 \end{bmatrix}$	59 60	341.1	307.1	19	385.7	347.3	79	430.3	387.4
$\frac{40}{341}$	$\frac{252.7}{253.4}$	$\frac{227.5}{228.2}$	$\frac{400}{401}$	$\frac{297.5}{298.0}$	$\frac{267.7}{268.3}$	$\frac{60}{461}$	$\frac{341.8}{342.6}$	$\frac{307.8}{308.5}$	$\frac{20}{521}$	$\frac{380.4}{387.2}$	348.6	581	431.8	388.8
42 43	254.2 254.9	228.8 229.5	02	298.7 299.5	269.0 269.7	$\frac{62}{63}$	343.3 344.1	309.1 309.8	22 23	387.9 388.7	349.3 350.0	82 83	432.5 433.2	389.4 390.1
44	255.6	$\begin{bmatrix} 230.2\\ 220.0 \end{bmatrix}$	04	300.2	270.3	64 65	344.8	310.5	24	389.4	350.6	84	434.0	390.8
40 46	250.4 257.1	230.9 231.5	05	301.0 301.7	271.0 271.7	66 66	346.3	311.2 311.8	$\frac{23}{26}$	390. 1 390. 9	351.5 352.0	86 86	435.5	391.4 392.1
$\begin{array}{c} 47 \\ 48 \end{array}$	$257.9 \\ 258.6$	$\begin{vmatrix} 232.2\\232.9 \end{vmatrix}$	07 08	302.5 303.2	$\begin{vmatrix} 272.\ 3\\ 273.\ 0 \end{vmatrix}$	$\frac{67}{68}$	347.0 347.8	$ \begin{array}{c} 312.5\\ 313.2 \end{array} $	$\frac{27}{28}$	391.6 392.4	$\begin{vmatrix} 352. \ 6 \\ 353. \ 3 \end{vmatrix}$	87 88	$436.2 \\ 437.0$	392.8 393.4
$\frac{49}{50}$	259.4 260.1	233.5 234.2	09 10	303.9 304.7	273.7 274.3	$\frac{69}{70}$	348.5	313.8 314.5	29 30	393.1 393.9	354.0 354.6	89 90	$437.7 \\ 438.4$	394.1 394.8
351	260.8	$\frac{234.9}{234.9}$	411	305.4	275.0	471	350.0	$\frac{315.2}{315.2}$	531	394.6	355.3	591	439.2	395.4
$\frac{52}{53}$	$261.6 \\ 262.3$	235.5 236.2	$12 \\ 13$	306.2 306.9	$275.7 \\ 276.4$	$\begin{array}{c} 72 \\ 73 \end{array}$	350.8 351.5	315.8 316.5	$\frac{32}{33}$	395.3 396.1	356.0 356.6	$\frac{92}{93}$	440.0 440.7	396.1 396.8
54 55	263.1 263.8	236.9 237.5	14 15	307.7 308.4	277.0 277.7	74 75	352.3 353.0	$317.2 \\ 317.8$	$\frac{34}{35}$	396.8 397.6	357.3 358.0	94 95	441.4	397.5 398.1
56	264.6	238.2	16	309.1	278.4	76	353.7	318.5	36	398.3	358.6	96	442.9	398.8
57 58	260.3 266.0	238.9 239.6	17	309.9 310.6	279.0 279.7	78	354.5 355.2	$319.2 \\ 319.9$	37 38	399.1 399.8	359.3 360.0	97 98	444.4	599.5 400.1
$\begin{array}{c} 59 \\ 60 \end{array}$	$266.8 \\ 267.5$	$\begin{vmatrix} 240.\ 2\\ 240.\ 9 \end{vmatrix}$	$ \frac{19}{20} $	$311.4 \\ 312.1$	$ \begin{array}{c} 280.4\\ 281.0 \end{array} $	$\frac{79}{80}$	356.0 356.7	320.5 321.2	$\frac{39}{40}$	$\begin{array}{c} 400.\ 6\\ 401.\ 3\end{array}$	360.6 361.3	99 600	$\begin{array}{c c} 445.2 \\ 445.9 \end{array}$	400.8 401.5
Dist.	Dep.	Lat.	Dist.	Dep.	Lat.	Dist.	Dep.	Lat.	Dist.	Dep.	Lat.	Dist.	Dep.	Lat.
			۹			4 8° (1	.32°, 228	3°, 312°	·).		,	•		

Pa	ge 452					Т	ABLE	2.						
]	Differe	ence of 1	Latitud	e and	Departu	ire for	43° (1	37°, 223	3°, 317°).		
Dist.	Lat.	Dep.	Dist.	Lat.	Dep.	Dist.	Lat.	Dep.	Dist.	Lat.	Dep.	Dist.	Lat.	Dep.
$ \begin{array}{c} 1\\2\\3\\4\\5\\6\\7\\8\\9\\10\\\end{array} $	$\begin{array}{c} 0.7\\ 1.5\\ 2.2\\ 2.9\\ 3.7\\ 4.4\\ 5.1\\ 5.9\\ 6.6\\ 7.3\\ \end{array}$	$\begin{array}{c} 0.7\\ 1.4\\ 2.0\\ 2.7\\ 3.4\\ 4.1\\ 4.8\\ 5.5\\ 6.1\\ 6.8\\ \end{array}$	$\begin{array}{c} 61 \\ 62 \\ 63 \\ 64 \\ 65 \\ 66 \\ 67 \\ 68 \\ 69 \\ 70 \\ \hline \end{array}$	$\begin{array}{r} 44.\ 6\\ 45.\ 3\\ 46.\ 1\\ 46.\ 8\\ 47.\ 5\\ 48.\ 3\\ 49.\ 0\\ 49.\ 7\\ 50.\ 5\\ 51.\ 2\end{array}$	$\begin{array}{c} 41.6\\ 42.3\\ 43.0\\ 43.6\\ 44.3\\ 45.0\\ 45.7\\ 46.4\\ 47.1\\ 47.7\end{array}$	$ \begin{array}{c} 121 \\ 22 \\ 23 \\ 24 \\ 25 \\ 26 \\ 27 \\ 28 \\ 29 \\ 30 \\ 121 \end{array} $	$\begin{array}{c} 88.5\\ 89.2\\ 90.0\\ 90.7\\ 91.4\\ 92.2\\ 92.9\\ 93.6\\ 94.3\\ 95.1\\ \hline \end{array}$	$\begin{array}{c} 82.5\\ 83.2\\ 83.9\\ 84.6\\ 85.2\\ 85.9\\ 86.6\\ 87.3\\ 88.0\\ 88.7\end{array}$	$ \begin{array}{r} 181 \\ 82 \\ 83 \\ 84 \\ 85 \\ 86 \\ 87 \\ 88 \\ 89 \\ 90 \\ 191 \end{array} $	$\begin{array}{c} 132.\ 4\\ 133.\ 1\\ 133.\ 8\\ 134.\ 6\\ 135.\ 3\\ 136.\ 0\\ 136.\ 8\\ 137.\ 5\\ 138.\ 2\\ 139.\ 0\\ \end{array}$	$\begin{array}{c} 123.\ 4\\ 124.\ 1\\ 124.\ 8\\ 125.\ 5\\ 126.\ 2\\ 126.\ 9\\ 127.\ 5\\ 128.\ 2\\ 128.\ 9\\ 129.\ 6\\ 129.\ 6\end{array}$	$241 \\ 42 \\ 43 \\ 44 \\ 45 \\ 46 \\ 47 \\ 48 \\ 49 \\ 50 \\ 950 \\ 951 \\ 951 \\ 950 \\ 951 \\ 9$	$176.3 \\ 177.0 \\ 177.7 \\ 178.5 \\ 179.2 \\ 179.9 \\ 180.6 \\ 181.4 \\ 182.1 \\ 182.8 \\ 100000000000000000000000000000000000$	$\begin{array}{c} 164.\ 4\\ 165.\ 0\\ 165.\ 7\\ 166.\ 4\\ 167.\ 1\\ 167.\ 8\\ 168.\ 5\\ 169.\ 1\\ 169.\ 8\\ 170.\ 5\end{array}$
$ \begin{array}{r} 11 \\ 12 \\ 13 \\ 14 \\ 15 \\ 16 \\ 17 \\ 18 \\ 19 \\ 20 \\ \end{array} $	$\begin{array}{c} 8.0\\ 8.8\\ 9.5\\ 10.2\\ 11.0\\ 11.7\\ 12.4\\ 13.2\\ 13.9\\ 14.6\end{array}$	7.58.28.99.510.210.911.612.313.013.6	$71 \\ 72 \\ 73 \\ 74 \\ 75 \\ 76 \\ 77 \\ 78 \\ 79 \\ 80$	$51.9 \\ 52.7 \\ 53.4 \\ 54.1 \\ 54.9 \\ 55.6 \\ 56.3 \\ 57.0 \\ 57.8 \\ 58.5 $	$\begin{array}{r} 48.4\\ 49.1\\ 49.8\\ 50.5\\ 51.1\\ 51.8\\ 52.5\\ 53.2\\ 53.9\\ 54.6\end{array}$	$ \begin{array}{r} 131 \\ 32 \\ 33 \\ 34 \\ 35 \\ 36 \\ 37 \\ 38 \\ 39 \\ 40 \\ 40 \\ \end{array} $	95. 8 96. 5 97. 3 98. 0 98. 7 99. 5 100. 2 100. 9 101. 7 102. 4	$\begin{array}{c} 89.3\\ 90.0\\ 90.7\\ 91.4\\ 92.1\\ 92.8\\ 93.4\\ 94.1\\ 94.8\\ 95.5\end{array}$	$ \begin{array}{r} 191 \\ 92 \\ 93 \\ 94 \\ 95 \\ 96 \\ 97 \\ 98 \\ 99 \\ 200 \\ \end{array} $	$\begin{array}{c} 139.7\\ 140.4\\ 141.2\\ 141.9\\ 142.6\\ 143.3\\ 144.1\\ 144.8\\ 145.5\\ 146.3\\ \end{array}$	$\begin{array}{c} 130.\ 3\\ 130.\ 9\\ 131.\ 6\\ 132.\ 3\\ 133.\ 0\\ 133.\ 7\\ 134.\ 4\\ 135.\ 0\\ 135.\ 7\\ 136.\ 4\end{array}$	$251 \\ 52 \\ 53 \\ 54 \\ 55 \\ 56 \\ 57 \\ 58 \\ 59 \\ 60$	$183.6 \\ 184.3 \\ 185.0 \\ 185.8 \\ 186.5 \\ 187.2 \\ 188.0 \\ 188.7 \\ 189.4 \\ 190.2$	$\begin{array}{c} 171.2\\ 171.9\\ 172.5\\ 173.2\\ 173.9\\ 174.6\\ 175.3\\ 176.0\\ 176.6\\ 177.3 \end{array}$
$\begin{array}{c} 21 \\ 22 \\ 23 \\ 24 \\ 25 \\ 26 \\ 27 \\ 28 \\ 29 \\ 30 \end{array}$	15. 416. 116. 817. 618. 319. 019. 720. 521. 221. 9	$14.3 \\ 15.0 \\ 15.7 \\ 16.4 \\ 17.0 \\ 17.7 \\ 18.4 \\ 19.1 \\ 19.8 \\ 20.5$	81 82 83 84 85 86 87 88 89 90	$\begin{array}{c} 59.2\\ 60.0\\ 60.7\\ 61.4\\ 62.2\\ 62.9\\ 63.6\\ 64.4\\ 65.1\\ 65.8\end{array}$	$\begin{array}{c} 55.\ 2\\ 55.\ 9\\ 56.\ 6\\ 57.\ 3\\ 58.\ 0\\ 58.\ 7\\ 59.\ 3\\ 60.\ 0\\ 60.\ 7\\ 61.\ 4\end{array}$	$ \begin{array}{r} 141 \\ 42 \\ 43 \\ 44 \\ 45 \\ 46 \\ 47 \\ 48 \\ 49 \\ 50 \\ 50 \\ \end{array} $	$103.1 \\ 103.9 \\ 104.6 \\ 105.3 \\ 106.0 \\ 106.8 \\ 107.5 \\ 108.2 \\ 109.0 \\ 109.7 \\ 100.7 \\ 100.$	96. 2 96. 8 97. 5 . 98. 2 98. 9 99. 6 100. 3 100. 9 101. 6 102. 3	$201 \\ 02 \\ 03 \\ 04 \\ 05 \\ 06 \\ 07 \\ 08 \\ 09 \\ 10$	$\begin{array}{c} 147.\ 0\\ 147.\ 7\\ 148.\ 5\\ 149.\ 2\\ 149.\ 9\\ 150.\ 7\\ 151.\ 4\\ 152.\ 1\\ 152.\ 9\\ 153.\ 6\end{array}$	$\begin{array}{c} 137.1\\ 137.8\\ 138.4\\ 139.1\\ 139.8\\ 140.5\\ 141.2\\ 141.9\\ 142.5\\ 143.2 \end{array}$	$261 \\ 62 \\ 63 \\ 64 \\ 65 \\ 66 \\ 67 \\ 68 \\ 69 \\ 70$	$190. 9 \\191. 6 \\192. 3 \\193. 1 \\193. 8 \\194. 5 \\195. 3 \\196. 0 \\196. 7 \\197. 5$	$178.0 \\ 178.7 \\ 179.4 \\ 180.0 \\ 180.7 \\ 181.4 \\ 182.1 \\ 182.8 \\ 183.5 \\ 184.1 \\ 184.$
$ \begin{array}{r} 31 \\ 32 \\ 33 \\ 34 \\ 35 \\ 36 \\ 37 \\ 38 \\ 39 \\ 40 \\ 40 \end{array} $	$\begin{array}{c} 22.\ 7\\ 23.\ 4\\ 24.\ 1\\ 24.\ 9\\ 25.\ 6\\ 26.\ 3\\ 27.\ 1\\ 27.\ 8\\ 28.\ 5\\ 29.\ 3\end{array}$	$\begin{array}{c} 21.1\\ 21.8\\ 22.5\\ 23.2\\ 23.9\\ 24.6\\ 25.2\\ 25.9\\ 26.6\\ 27.3 \end{array}$	$91 \\ 92 \\ 93 \\ 94 \\ 95 \\ 96 \\ 97 \\ 98 \\ 99 \\ 100$	$\begin{array}{c} 66.\ 6\\ 67.\ 3\\ 68.\ 0\\ 68.\ 7\\ 69.\ 5\\ 70.\ 2\\ 70.\ 9\\ 71.\ 7\\ 72.\ 4\\ 73.\ 1\end{array}$	$\begin{array}{c} 62.1\\ 62.7\\ 63.4\\ 64.1\\ 64.8\\ 65.5\\ 66.2\\ 66.8\\ 67.5\\ 68.2 \end{array}$	$ \begin{array}{r} 151 \\ 52 \\ 53 \\ 54 \\ 55 \\ 56 \\ 57 \\ 58 \\ 59 \\ 60 \\ \end{array} $	$\begin{array}{c} 110.\ 4\\ 111.\ 2\\ 111.\ 9\\ 112.\ 6\\ 113.\ 4\\ 114.\ 1\\ 114.\ 8\\ 115.\ 6\\ 116.\ 3\\ 117.\ 0 \end{array}$	$\begin{array}{c} 103.\ 0\\ 103.\ 7\\ 104.\ 3\\ 105.\ 0\\ 105.\ 7\\ 106.\ 4\\ 107.\ 1\\ 107.\ 8\\ 108.\ 4\\ 109.\ 1 \end{array}$	$211 \\ 12 \\ 13 \\ 14 \\ 15 \\ 16 \\ 17 \\ 18 \\ 19 \\ 20$	$\begin{array}{c} 154.3\\ 155.0\\ 155.8\\ 156.5\\ 157.2\\ 158.0\\ 158.7\\ 159.4\\ 160.2\\ 160.9 \end{array}$	$\begin{array}{c} 143.9\\ 144.6\\ 145.3\\ 145.9\\ 146.6\\ 147.3\\ 148.0\\ 148.7\\ 149.4\\ 150.0 \end{array}$	$271 \\ 72 \\ 73 \\ 74 \\ 75 \\ 76 \\ 77 \\ 78 \\ 79 \\ 80$	$198. 2 \\198. 9 \\199. 7 \\200. 4 \\201. 1 \\202. 6 \\203. 3 \\204. 0 \\204. 8$	$\begin{array}{c} 184.8\\ 185.5\\ 186.2\\ 186.9\\ 187.5\\ 188.2\\ 188.9\\ 189.6\\ 190.3\\ 191.0 \end{array}$
$ \begin{array}{r} 41 \\ 42 \\ 43 \\ 44 \\ 45 \\ 46 \\ 47 \\ 48 \\ 49 \\ 50 \\ \end{array} $	$\begin{array}{c} 30.\ 0\\ 30.\ 7\\ 31.\ 4\\ 32.\ 2\\ 32.\ 9\\ 33.\ 6\\ 34.\ 4\\ 35.\ 1\\ 35.\ 8\\ 36.\ 6\end{array}$	$\begin{array}{c} 28.0\\ 28.6\\ 29.3\\ 30.0\\ 30.7\\ 31.4\\ 32.1\\ 32.7\\ 33.4\\ 34.1 \end{array}$	$ \begin{array}{r} 101 \\ 02 \\ 03 \\ 04 \\ 05 \\ 06 \\ 07 \\ 08 \\ 09 \\ 10 \end{array} $	$\begin{array}{c} 73.9\\74.6\\75.3\\76.1\\76.8\\77.5\\78.3\\79.0\\79.7\\80.4 \end{array}$	$\begin{array}{c} 68.9\\ 69.6\\ 70.2\\ 70.9\\ 71.6\\ 72.3\\ 73.0\\ 73.7\\ 74.3\\ 75.0\\ \end{array}$	$ \begin{array}{r} 161 \\ 62 \\ 63 \\ 64 \\ 65 \\ 66 \\ 67 \\ 68 \\ 69 \\ 70 \\ 70 \end{array} $	$\begin{array}{c} 117.7\\ 118.5\\ 119.2\\ 119.9\\ 120.7\\ 121.4\\ 122.1\\ 122.9\\ 123.6\\ 124.3 \end{array}$	$\begin{array}{c} 109.\ 8\\ 110.\ 5\\ 111.\ 2\\ 111.\ 8\\ 112.\ 5\\ 113.\ 2\\ 113.\ 9\\ 114.\ 6\\ 115.\ 3\\ 115.\ 9 \end{array}$	$\begin{array}{r} 221\\ 22\\ 23\\ 24\\ 25\\ 26\\ 27\\ 28\\ 29\\ 30\\ \end{array}$	$\begin{array}{c} 161.\ 6\\ 162.\ 4\\ 163.\ 1\\ 163.\ 8\\ 164.\ 6\\ 165.\ 3\\ 166.\ 0\\ 166.\ 7\\ 167.\ 5\\ 168.\ 2\\ \end{array}$	$\begin{array}{c} 150.\ 7\\ 151.\ 4\\ 152.\ 1\\ 152.\ 8\\ 153.\ 4\\ 154.\ 1\\ 154.\ 8\\ 155.\ 5\\ 156.\ 2\\ 156.\ 9\end{array}$	281 82 83 84 85 86 87 88 89 90	$\begin{array}{c} 205.5\\ 206.2\\ 207.0\\ 207.7\\ 208.4\\ 209.2\\ 209.9\\ 210.6\\ 211.4\\ 212.1 \end{array}$	191. 6 192. 3 193. 0 193. 7 194. 4 195. 1 195. 7 196. 4 197. 1 197. 8
$51 \\ 52 \\ 53 \\ 54 \\ 55 \\ 56 \\ 57 \\ 58 \\ 59 \\ 60$	$\begin{array}{c} 37.\ 3\\ 38.\ 0\\ 38.\ 8\\ 39.\ 5\\ 40.\ 2\\ 41.\ 0\\ 41.\ 7\\ 42.\ 4\\ 43.\ 1\\ 43.\ 9\end{array}$	$\begin{array}{c} 34.8\\ 35.5\\ 36.1\\ 36.8\\ 37.5\\ 38.2\\ 38.9\\ 39.6\\ 40.2\\ 40.9 \end{array}$	$ \begin{array}{c} 111\\12\\13\\14\\15\\16\\17\\18\\19\\20\\\end{array} $	$\begin{array}{c} 81.2\\ 81.9\\ 82.6\\ 83.4\\ 84.1\\ 84.8\\ 85.6\\ 86.3\\ 87.0\\ 87.8\\ \end{array}$	$\begin{array}{c} 75.\ 7\\ 76.\ 4\\ 77.\ 1\\ 77.\ 7\\ 78.\ 4\\ 79.\ 1\\ 79.\ 8\\ 80.\ 5\\ 81.\ 2\\ 81.\ 8\end{array}$	$171 \\ 72 \\ 73 \\ 74 \\ 75 \\ 76 \\ 77 \\ 78 \\ 79 \\ 80$	$\begin{array}{c} 125.1\\ 125.8\\ 126.5\\ 127.3\\ 128.0\\ 128.7\\ 129.4\\ 130.2\\ 130.9\\ 131.6 \end{array}$	$\begin{array}{c} 116.\ 6\\ 117.\ 3\\ 118.\ 0\\ 118.\ 7\\ 119.\ 3\\ 120.\ 0\\ 120.\ 7\\ 121.\ 4\\ 122.\ 1\\ 122.\ 8 \end{array}$	$\begin{array}{c} 231 \\ 32 \\ 33 \\ 34 \\ 35 \\ 36 \\ 37 \\ 38 \\ 39 \\ 40 \end{array}$	$\begin{array}{c} 168. \ 9\\ 169. \ 7\\ 170. \ 4\\ 171. \ 1\\ 171. \ 9\\ 172. \ 6\\ 173. \ 3\\ 174. \ 1\\ 174. \ 8\\ 175. \ 5 \end{array}$	$\begin{array}{c} 157.5\\ 158.2\\ 158.9\\ 159.6\\ 160.3\\ 161.0\\ 161.6\\ 162.3\\ 163.0\\ 163.7 \end{array}$	291 92 93 94 95 96 97 98 99 300	$\begin{array}{c} 212.8\\ 213.6\\ 214.3\\ 215.0\\ 215.7\\ 216.5\\ 217.2\\ 217.9\\ 218.7\\ 219.4 \end{array}$	$\begin{array}{c} 198.5\\ 199.1\\ 199.8\\ 200.5\\ 201.2\\ 201.9\\ 202.6\\ 203.2\\ 203.9\\ 204.6\end{array}$
Dist.	Dep.	Lat.	Dist.	Dep.	Lat.	Dist.	Dep.	Lat.	Dist.	Dep.	Lat.	Dist.	Dep.	Lat.
						+/- (I	55, 227	, 513°).					

						Т	ABLE	2 2.					[Page	453
		J	Differe	ence of I	Latitud	e and	Departu	re for 4	43° (1	37°, 223	3°, 317°).		
Dist.	Lat.	Dep.	Dist.	Lat.	Dep.	Dist.	Lat.	Dep.	Dist.	Lat.	Dep.	Dist.	Lat.	Dep.
$301 \\ 02 \\ 03$	220.1 220.9 221.6	205.3 206.0 206.7	$\begin{array}{c} 361\\ 62\\ 63\end{array}$	264.0 264.8 265.5	246.2 246.9 247.6	$ \begin{array}{r} 421 \\ 22 \\ 23 \end{array} $	307.9 308.6 309.4	287.1 287.8 288.5		351.8 352.5 353.2	328.1 328.7 329.4	$541 \\ 42 \\ 43$	395.7 396.4 397.1	369.0 369.7 370.3
04 05 06	222.3 223.1 223.8	207.3 208.0 208.7		266.2 267.0 267.7	$ \begin{array}{c} 248.3 \\ 248.9 \\ 249.6 \end{array} $	$ \begin{array}{r} 24 \\ 25 \\ 26 \end{array} $	310.1 310.8 311.6	289.2 289.9 290.5	84 85 86	354.0 354.7 355.4	330.1 330.8 331.4	$ 44 \\ 45 \\ 46 $	397.9 398.6 399.3	371.0 371.7 372.4
$ \begin{array}{c} 07 \\ 08 \\ 09 \end{array} $	224.5 225.3 226.0	$209.4 \\ 210.1 \\ 210.7$		268.4 269.1 269.9	$ \begin{array}{c} 250.3 \\ 251.0 \\ 251.7 \end{array} $	$\begin{array}{c} \overline{27} \\ 28 \\ 29 \end{array}$	312.3 313.0 313.8	$ \begin{array}{r} 291.2\\291.9\\292.6\end{array} $	87 88 89	356.2 356.9 357.7	332.1 332.8 333.5	47 48 49	$\begin{array}{c} 400.1 \\ 400.8 \\ 401.5 \end{array}$	373.1 373.7 374.4
$\frac{10}{311}$	$\frac{2267}{227.5}$	$\frac{211.4}{212.1}$	$\frac{70}{371}$	$\frac{270.6}{271.3}$	$\frac{252.3}{253.0}$	$\frac{30}{431}$	$\frac{314.5}{315.2}$	293.3 293.9	$\frac{90}{491}$	$\frac{358.4}{359.1}$	$\frac{334.2}{334.9}$	$\frac{50}{551}$	402.2 403.0	$\frac{375.1}{375.8}$
$12 \\ 13 \\ 14$	$ \begin{array}{r} 228.2 \\ 228.9 \\ 229.7 \\ \end{array} $	$212.8 \\ 213.5 \\ 214.2 \\ 214.2$	$\begin{array}{c} 72 \\ 73 \\ 74 \end{array}$	$\begin{array}{c} 272.1 \\ 272.8 \\ 273.5 \\ \end{array}$	$\begin{array}{c} 253.\ 7\\ 254.\ 4\\ 255.\ 1\\ 255.\ 1\end{array}$	32 33 34	$\begin{array}{c} 316.0\\ 316.7\\ 317.4\\ 210.1 \end{array}$	294.6 295.3 296.0 206.5	92 93 94	359.8 360.6 361.3	335.5 336.2 336.9	$52 \\ 53 \\ 54 \\ 54$	$\begin{array}{c} 403.7 \\ 404.4 \\ 405.2 \\ 405.2 \end{array}$	376.5 377.1 377.8 272.8
$ 15 \\ 16 \\ 17 \\ 18 $	230.4 231.1 231.8 232.6	214.8 215.5 216.2 216.9	$75 \\ 76 \\ 77 \\ 78 \\ 78 \\ 78 \\ 78 \\ 75 \\ 78 \\ 78$	274.3 275.0 275.7 276.5	255.8 256.4 257.1 257.8	$ \begin{array}{r} 35 \\ 36 \\ 37 \\ 38 \end{array} $	$\begin{array}{c} 318.1 \\ 318.9 \\ 319.6 \\ 320.3 \end{array}$	296.7 297.4 298.0 298.7	95 96 97 98	362.0 362.8 363.5 364.2	337.6 338.3 338.9 339.6	56 57 58	405.9 406.6 407.4 408.1	378.5 379.2 379.9 380.6
$10 \\ 19 \\ 20 \\ 321$	232.0 233.3 234.0 234.8	210.9 217.6 218.2 218.9	$ \frac{79}{80} 381 $	277.2 277.9 278.7	258.5 259.2 259.8		321.1 321.8 322.5	299.4 300.1 300.8	$99 \\ 500 \\ 501$	364.9 365.7 366.4	340.3 341.0 341.7		408.8 409.6 410.3	381.2 381.9 382.6
$ \begin{array}{c} 321 \\ 22 \\ 23 \\ 24 \end{array} $	235.5 236.2 237.0	210.9 219.6 220.3 221.0	82 83 84	279.4 280.1 280.8	260.5 261.2 261.9		$\begin{array}{c} 323. \ 3\\ 324. \ 0\\ 324. \ 7\end{array}$	301.4 302.1 302.8	$ \begin{array}{c} 001 \\ 02 \\ 03 \\ 04 \end{array} $	367.1 367.8 368.6	342.4 343.0 343.7	$\begin{array}{c} 62\\ 63\\ 64\end{array}$	$ \begin{array}{c} 411.0\\ 411.8\\ 412.5 \end{array} $	$ \begin{array}{c} 383.3\\ 384.0\\ 384.6 \end{array} $
$25 \\ 26 \\ 27$	237.7 238.4 239.2	$\begin{array}{c} 221.\ 7\\ 222.\ 3\\ 223.\ 0 \end{array}$	85 86 87	$\begin{array}{c} 281.\ 6\\ 282.\ 3\\ 283.\ 0\end{array}$	262.6 263.3 263.9	$ 45 \\ 46 \\ 47 $	$\begin{array}{c} 325.\ 5\\ 326.\ 2\\ 326.\ 9\end{array}$	$\begin{array}{c} 303.\ 5\\ 304.\ 2\\ 304.\ 9\end{array}$	$\begin{array}{c} 05\\ 06\\ 07\end{array}$	$369.3 \\ 370.0 \\ 370.8$	$344.4 \\ 345.1 \\ 345.8$	$ \begin{array}{r} 65 \\ 66 \\ 67 \end{array} $	$\begin{array}{c} 413.2 \\ 414.0 \\ 414.7 \end{array}$	$\begin{array}{c} 385.\ 3\\ 386.\ 0\\ 386.\ 7\end{array}$
$28 \\ 29 \\ 30$	$\begin{array}{c} 239.9\\ 240.6\\ 241.4\end{array}$	$\begin{array}{c} 223.\ 7\\ 224.\ 4\\ 225.\ 1\end{array}$	88 89 90	$\begin{array}{c} 283.\ 7\\ 284.\ 5\\ 285.\ 2\end{array}$	$\begin{array}{c} 264.\ 6\\ 265.\ 3\\ 266.\ 0 \end{array}$	48 49 50	327.7 328.4 329.1	305.5 306.2 306.9	$ \begin{array}{c} 08 \\ 09 \\ 10 \end{array} $	371.5 372.3 373.0	$346.5 \\ 347.1 \\ 347.8$	$ \begin{array}{r} 68 \\ 69 \\ 70 \end{array} $	$\begin{array}{c} 415.4\\ 416.2\\ 416.9\end{array}$	$387.4 \\ 388.1 \\ 388.7$
$\frac{331}{32}$	242.1 242.8	225.7 226.4	$\begin{array}{c} 391 \\ 92 \\ 0 \end{array}$	286.0 286.7	266.7 267.3	$451 \\ 52 \\ 52 \\ 59 \\ 59 \\ 50 \\ 50 \\ 50 \\ 50 \\ 50 \\ 50$	329.9 330.6	307.6 308.3	$511 \\ 12 \\ 10$	373.8 374.5	348.5 349.2	571 72	417.6 418.3	389.4 390.1
$ \begin{array}{r} 33 \\ 34 \\ 35 \\ 22 \end{array} $	243.5 244.3 245.0	227.1 227.8 228.5	93 94 95	287.4 288.2 288.9	268.0 268.7 269.4	53 54 55	331.3 332.1 332.8	309.0 309.6 310.3	13 14 15	375.2 376.0 376.6	349.9 350.5 351.2	73 74 75	419.1 419.8 420.5	390.8 391.5 392.2
36 37 38	245.7 246.5 247.2	229.2 229.8 230.5 221.2	96 97 98	289.6 290.4 291.1	270.1 270.8 271.4 272.1	56 57 58	333.5 334.3 335.0 225.7	311.0 311.7 312.4	$16 \\ 17 \\ 18 \\ 10$	$\begin{array}{c c} 377.4 \\ 378.2 \\ 378.9 \\ 270.6 \end{array}$	351.9 352.6 353.3 251.0	76 77 78	$\begin{array}{c} 421.3 \\ 422.0 \\ 422.7 \\ 422.7 \\ 422.5 \end{array}$	392.8 393.5 394.2
$\frac{39}{40}$ $\overline{341}$	$\frac{247.9}{248.7}$ $\frac{249.4}{249.4}$	$ \begin{array}{r} 231.2 \\ 231.9 \\ \overline{232.6} \end{array} $	$\frac{400}{401}$	$ \begin{array}{r} 291.8 \\ 292.6 \\ \overline{293.3} \end{array} $	272.1 272.8 273.5	$\frac{59}{60}$ $\overline{461}$	$ \begin{array}{r} 335.7 \\ 336.5 \\ \overline{337.2} \\ \end{array} $	$\frac{313.0}{313.7}$ $\frac{313.7}{314.4}$	$\frac{19}{20}$ $\overline{521}$	$ \frac{379.6}{380.3} \\ \overline{381.1} $	354.0 354.6 355.3	$\frac{\frac{79}{80}}{581}$	$ \begin{array}{r} 423.5 \\ 424.2 \\ \overline{424.9} \end{array} $	$ \begin{array}{r} 394.9 \\ 395.6 \\ \overline{396.2} \end{array} $
$\begin{array}{c} 42\\ 43\\ 44\\ \end{array}$	250.1 250.9 251.6	$\begin{array}{c} 233.2 \\ 233.9 \\ 234.6 \\ 235.9 \end{array}$	$ \begin{array}{c} 02 \\ 03 \\ 04 \\ 05 \end{array} $	$294.0 \\ 294.7 \\ 295.5$	274.2 274.9 275.5	62 63 64	337.9 338.7 339.4	$315.1 \\ 315.8 \\ 316.5 \\ 316.$	$ \begin{array}{c} 22 \\ 23 \\ 24 \\ 25 \end{array} $	$\begin{array}{c} 381.8 \\ 382.6 \\ 383.3 \\ \end{array}$	356.0 356.7 357.4	82 83 84	$\begin{array}{c} 425.7 \\ 426.4 \\ 427.1 \\ \end{array}$	396.9 397.6 398.3
45 46 47 40	252.3 253.1 253.8 254.5	$ \begin{array}{c} 235.3 \\ 236.0 \\ 236.7 \\ 297.9 \end{array} $	05 06 07	$\begin{array}{c} 296.2 \\ 296.9 \\ 297.7 \\ 297.4 \end{array}$	276.2 276.9 277.6 277.6	65 66 67	340.1 340.8 341.6	317.1 317.8 318.5 210.2	25 26 27	384.0 384.7 385.5 202.0	358.1 358.7 359.4 260.1	85 86 87	$\begin{array}{r} 427.9 \\ 428.6 \\ 429.3 \\ 429.1 \end{array}$	399.0 399.6 400.3
$\begin{array}{r} 48\\ 49\\ 50\end{array}$	254.5 255.3 256.0	$237.3 \\ 238.0 \\ 238.7$	$\begin{array}{r} 08\\09\\10\end{array}$	$298.4 \\ 299.1 \\ 299.9$	278.3 278.9 279.6	68 69 70	342, 3 343, 0 343, 7	319.2 319.9 320.5	$\begin{array}{r} 28\\29\\30\end{array}$	386.2 386.9 387.6	360.1 360.8 361.5	88 89 90	$ \begin{array}{r} 430.1 \\ 430.8 \\ 431.5 \\ \end{array} $	$\begin{array}{r} 401.0 \\ 401.7 \\ 402.4 \end{array}$
$351 \\ 52 \\ 53 \\ 53$	256.7 257.4 258.2	$239.4 \\ 240.1 \\ 240.8 \\ 300000000000000000000000000000000000$	$ \begin{array}{r} 411 \\ 12 \\ 13 \\ 14 \end{array} $	300.6 301.3 302.1	$280. \ 3 \\ 281. \ 0 \\ 281. \ 7 \\$	$471 \\ 72 \\ 73 \\ 73 \\ 73 \\ 73 \\ 73 \\ 73 \\ 73$	$344.5 \\ 345.2 \\ 345.9 \\ $	$321.2 \\ 321.9 \\ 322.6 \\ 322.$	$531 \\ 32 \\ 33 \\ 33$	$\begin{array}{c} 388.4 \\ 389.1 \\ 389.9 \end{array}$	$362.1 \\ 362.8 \\ 363.5 \\ 363.5$	$591 \\ 92 \\ 93 \\ 01$	$\begin{array}{c} 432.\ 3\\ 433.\ 0\\ 433.\ 7\end{array}$	$\begin{array}{c} 403.1 \\ 403.7 \\ 404.4 \end{array}$
$54 \\ 55 \\ 56 \\ 57$	258.9 259.6 260.4	241.4 242.1 242.8 242.8	14 15 16 17	302.8 303.5 304.3	$282.4 \\ 283.0 \\ 283.7 \\ 200.17 \\ 200.$	$\begin{array}{c} 74 \\ 75 \\ 76 \\ \end{array}$	346.7 347.4 348.1	323.3 324.0 324.6	$ 34 \\ 35 \\ 36 \\ 27 $	390.6 391.3 392.0	364.2 364.9 365.5	94 95 96	$\begin{array}{r} 434.5 \\ 435.2 \\ 435.9 \\ 120.5 \end{array}$	$\begin{array}{c} 405.1 \\ 405.8 \\ 406.5 \\ 107.6 \end{array}$
57 58 59 60	361.1 261.8 262.6 263.3	243.5 244.2 244.8 245.5	$17 \\ 18 \\ 19 \\ 20$	305.0 305.7 306.4 307.2	284.4 285.1 285.8 286.4	77 78 79 80	348.9 349.6 350.3 351.1	325.3 326.0 326.7 327.4	37 38 39 10	392.8 393.5 394.2 394.0	366.2 366.9 367.6 368.3	97 98 99 600	$\begin{array}{r} 436.7\\ 437.4\\ 438.1\\ 438.8\end{array}$	407.2 407.8 408.5 409.2
Dist.	 Dep.	Lat.	Dist.	 	Lat.	Dist.	Dep.	Lat.	Dist.	Dep.	Lat.	Dist.	Dep.	Lat.
		,			4	7° (1	33°, 227	°, 313°).				-	

Pa	ge 454]				Т	ABL	E 2.						
			Differe	ence of I	Latitud	le and	Departu	ire for	44° (1	136°, 22-	4°, 316°	°).		
Dist.	Lat.	Dep.	Dist.	Lat.	Dep.	Dist.	Lat.	Dep.	Dist.	Lat.	Dep.	Dist.	Lat.	Dep.
1	0.7	0.7	61	43.9	42.4	121	87.0	84.1	181	130.2	125.7	241	173.4	167.4
2	1.4	1.+	62 69	44.6	43.1	22	87.8	84.7	82	130.9 191 g	126.4 197.1	42	174.1	168.1
4	$\frac{2.2}{2.9}$	2.8	64	46.0	44.5	24	89.2	86.1	84	131.0 132.4	127.1 127.8	40	174.0	100.0 169.5
$\hat{5}$	3.6	3.5	65	46.8	45.2	25	89.9	86.8	85	133.1	128.5	45	176.2	170.2
6	4.3	4.2	¢66	47.5	45.8	26	90.6	87.5	86	133.8	129.2	46	177.0	170.9
7	5.0	4.9	67	48.2	46.5	27	91.4	88.2	87	134.5	129.9	47	177.7	171.6
0	0.8 6.5	0.0 6.3	60	48,9	47.2	28	92.1	80.9	80	130.2 136.0	130.0	48	178.4 170 1	172.3 172.0
10	7.2	6.9	70	50.4	48.6	30	93.5	90.3	90	136.0 136.7	131.0 132.0	50	179.8	173.0 173.7
11	7.9	7.6	71	51.1	49.3	·131	94.2	91.0	191	137.4	132.7	251	180.6	174.4
12	8.6	8.3	72	51.8	50.0	32	95.0	91.7	92	138.1	133.4	52	181.3	175.1
13	9.4	9.0	73	52.5	50.7	33	95.7	92.4	93	138.8	134.1	53	182.0	175.7
14	10.1	9.7	74	51 0	01.4 59 1	34	90.4	93.1	94	139.6	134.8 125.5	04 55	182.7	175.4
16	10.8 11.5	11.1	76	54.7	52.8	36	97.8	94.5	96	141.0	130.0 136.2	56	184.2	177.8
17	12.2	11.8	77	55.4	53.5	37	98.5	95.2	97	141.7	136.8	57	184.9	178.5
18	12.9	12.5	78	56.1	54.2	38	99.3	95.9	98	142.4	137.5	58	185.6	179.2
19	13.7	13.2	79	56.8	54.9	39	100.0	96.6	99	143.1	138.2	59	186.3	179.9
20	14.4	13.9	80	<u>- 31. 3</u>	$\frac{33.6}{50.9}$	+0	100.7	97.3	200	143.9	$\frac{138.9}{120.6}$	00	187.0	180.6
21 22	10.1 15.8	14.0 15.3	$\frac{61}{82}$	59.0	57.0	42	101.4 102.1	97.9	$\frac{201}{02}$	144.0 145.3	139.0	201 62	187.7	181.3
23	16.5	16.0	83	59.7	57.7	43	102.9	99.3	03	146.0	141.0	63	189.2	182.7
24	17.3	16.7	84	60.4	58.4	44	103.6	100.0	04	146.7	141.7	64	189.9	183.4
25	18.0	17.4	85	61.1	59.0	45	104.3	100.7	05	147.5	142.4	65	190.6	184.1
26	18.7	18.1	86	61.9	59.7 60.4	46	105.0 105.7	101.4	06	148.2	143.1	66	191.3	184.8
$\frac{21}{28}$	20.1	10.0 19.5	88	63.3	61.1	48	106.5	102.1 102.8	08	149.6	144.5	68	192.8	186.2
29	20.9	20.1	89	64.0	61.8	49	107.2	103.5	09	150.3	145.2	69	193.5	186.9
30	21.6	20.8	90	64.7	62.5	50	107.9	104.2	10	151.1	145.9	70	194.2	187.6
31	22.3	21.5	91	65.5	63.2	151	108.6	104.9	211	151.8	146.6	271	194.9	188.3
$\frac{32}{22}$	23.0	22.2	92	66.2	63.9	52	109.3	105.6	$\frac{12}{12}$	152.5 152.9	147.3	$\frac{72}{79}$	195.7	188.9
34	20.7	22.9	93	67 6	65 3	54	110.1	100.5 107.0	13	153.2 153.9	148.7	74	190.4	189.0
35	25.2	24.3	95	68.3	66.0	55	111.5	107.7	15	154.7	149.4	75	197.8	191.0
36	25.9	25.0	96	69.1	66.7	56	112.2	108.4	16	155.4	150.0	76	198.5	191.7
37	26.6	25.7	97	69.8	67.4	57	112.9	109.1	17	156.1	150.7		199.3	192.4
38	27.3	26.4	98	70.5	68.1	- 58 - 59	113.7	109.8	18	157.5	151.4	78	200.0	193.1
40	$\frac{20.1}{28.8}$	27.8	100	71.9	69.5	60	115.1	111.1	$\frac{10}{20}$	157.5	152.8	80	200.1	194.5
41	29.5	28.5	101	72.7	70.2	161	115.8	111.8	221	159.0	153.5	281	202.1	195.2
42	30.2	29.2	02	73.4	70.9	62	116.5	112.5	22	159.7	154.2	82	202.9	195.9
43	30.9	29.9	03	74.1	71.5	63	117.3	113.2	23	160.4	154.9	83	203.6	196.6
44	31.7	30.6	04	74.8	72.2	64	118.0	113.9	24	161.1 161.0	156 2	84	204.3 205.0	197.3
46	32.4 33.1	31.3 32.0	06	76.3	73.6	66	119.4	115.3	$\frac{20}{26}$	162.6	150.3 157.0	86	205.0 205.7	198.7
47	33.8	32.6	07	77.0	74.3	67	120.1	116.0	27	163.3	157.7	87	206.5	199.4
48	34.5	33.3	08	77.7	75.0	68	120.8	116.7	28	164.0	158.4	88	207.2	200.1
49	35.2	34.0	09	78.4	75.7	69 50	121.6	117.4	29	164.7	159.1	89	207.9	200.8
50	$\frac{36.0}{26.7}$	34.1	111	79.1	70.4	171	122.3	118.1	<u>- 30</u> - 991	100.4	109.8	90	208.0	201.0
01 52	30.7	30.4	111 12	79.8 80.6	77.8	$\frac{171}{72}$	123.0 123.7	118.8. 119.5	$\frac{231}{32}$	100.2 166 9	160.5 161.2	291	209.3	202.1 202.8
53	38.1	36.8	13	81.3	78.5	73	124.4	120.2	33	167.6	161.9	93	210.8	202.0 203.5
54	38.8	37.5	14	82.0	79.2	74	125.2	120.9	34	168.3	162.6	94	311.5	204.2
55	39.6	38.2	15	82.7	79.9	75	125.9	121.6	35	169.0	163.2	95	212.2	204.9
55	40.3	38.9 30 g	$16 \\ 17$	83.4	80.6	$\frac{76}{77}$	126.6 197.2	122.3 199 0	36	169.8 170.5	163.9	96 07	212.9	205.6
58	41.0	40.3	18	84 9	82 0	78	127.3	123.0 123.6	38	171.2	165.3	98	213.0	200.3
59	42.4	41.0	19	85.6	82.7	79	128.8	124.3	39	171.9	166.0	99	215.1	207.7
60	43.2	41.7	20	86.3	83.4	80	129.5	125.0	40	172.6	166.7	300	215.8	208.4
Dist.	Dep.	Lat.	Dist.	Dep.	Lat.	Dist.	Dep.	Lat.	Dist.	Dep.	Lat.	Dist.	Dep.	Lat.
	-	1			F	169 (1	2.10 000	0 9110)	1				1
						1) 01	or , 220	, 014-	<i>)</i> •					

						Г	ABLF	E 2.					[Page	e 455
]	Differe	ence of	Latitud	le and	Depart	ure for	44° (!	136°, 22	4°, 316°	°).		
Dist.	Lat.	Dep.	Dist.	Lat.	Dep.	Dist.	Lat.	Dep.	Dist.	Lat.	Dep.	Dist.	Lat.	Dep.
301	216.5	209.1	361	259.7	250.8	421	302.8	292.5	481	346.0	334.1	541	389.2	375.8
02 03	$217.2 \\ 218.0$	209.5 210.5	$\begin{array}{c} 62\\ 63\end{array}$	260.4 261.1	251.5 252.2	$\frac{22}{23}$	303. o 304. 3	293.2 293.8	82 83	346.7 347.4	334. o 335. 5	$\frac{42}{43}$	389. 9 390. 6	376.5 377.2
04	218.7	211.2	64	261.8	252.9	24	305.0	294.5	84	348.2	336.2	44	391.3	377.9
05 06	$\begin{array}{c} 219.4\\ 220.1 \end{array}$	211.9 212.6	60 66	262. o 263. 3	253.0 254.3	$\frac{25}{26}$	305.7 306.4	295.2 295.9	85 86	348.9 349.6	336. 9 337. 6	40 46	392.0 392.8	378. ө 379. 3
07	220.8	213.3	67	264.0	254.9	27	307.2	296.6	87	350.3	338.3	47	393.5	380.0
08	221.6 222.3°	214.01 214.7	$\begin{array}{c} 68\\ 69\end{array}$	264.7 265.4	255. b 256. 3	$\frac{28}{29}$	307.9	297.3 298.0	88 89	-351.0 -351.7	339.0 339.7	$\begin{array}{c} 48 \\ 49 \end{array}$	394.2 394.9	$\frac{380.7}{381.4}$
10	223.0	215.4	70	266.2	257.0	30	309.3	298.7	90	352.5	340.4	50	395.6	382.1
311	223.7	216.0	$\frac{371}{72}$	266.9	257.7	$\frac{431}{32}$	310.0	299.4 200.1	491 92	353.2	341.1	$551 \\ 52$	396.4	$\frac{382.7}{282.4}$
$12 \\ 13$	224.4 225.2	210.1 217.4	73	268.3	250.1 259.1	33	311.5	300. 1	93	354.6	342.5	53	397.8	384.1
14	225.9	218.1	74	269.0	259.8	$\frac{34}{25}$	312.2	301.5	94	355.3	343.2	54 55	398.5	384.8
15	220.0 227.3	218.0 219.5	76	209.8 270.5	260.5 261.2	$\frac{30}{36}$	312.5 313, 6	302.2 302.9	90 96	356. s	345. 5	$\frac{55}{56}$	399. 2 400. 0	385.5
17	228.0	220.2	77	271.2	261.9	37	314.4	303.6	97	357.5	345.2	57	400.7	386.9
$\frac{18}{19}$	228.8 229.5	220.9 221.6	$\frac{78}{79}$	271.9 272.6	262.0 263.3	$\frac{38}{39}$	$\begin{array}{c} 315.1\\315.8\end{array}$	304. o 305. 0	98 99	358.2 358.9	345.9	$\frac{58}{59}$	401.4 402.1	387.0
20	230.2	222.3	80	273.4	264.0	40	316.5	305.7	500	359.7	347.3	60	402.8	389.0
$321 \\ 22$	230.9	223.0	$\frac{381}{82}$	274.1 974.8	264.7 265.4	441	317.2 218 0	306.4	$501 \\ 02$	360.4 261 1	348.0	$\frac{561}{62}$	403.6	389.7
$\frac{22}{23}$	231.0 232.3	223. 224. 4	83	274.0	266.1	43	318.7	307.7	03	361. 8	349.4	63	404.0	390. - 391. 1
24	233.1	225.1	84	276.2	266.8	44	319.4	308.4	04	362.5	350.1	64 65	405.7	391.8
$\frac{20}{26}$	$233.6 \\ 234.5$	225.0 226.5	86	270. 5	267.0 268.1	$\frac{40}{46}$	320.1 320.8	309. 1 309. 8	00	363.0 364.0	350.0 351.5	66	400. 4 407. 2	392.0 393.2
27	235.2	227.2	87	278.4	268.8	47	321.5	310.5	07	364.7	352.2	67	407.9	393.9
$\frac{28}{29}$	235. 9 236. 7	$227.9 \\ 228.6$	$\frac{88}{89}$	279.1	$269.5 \\ 270.2$	$\begin{array}{c} 48 \\ 49 \end{array}$	322.5 323.0	311.2 311.9	08	365.4 366.1	352.9	68 69	408. o 409. 3	394.0
30	237.4	229.2	90	280.5	270.9	50	323.7	312.6	10	366.9	354.3	70	410.0	396.0
$\frac{331}{32}$	238.1 238.8	229.9 230.6	$\begin{array}{c} 391 \\ 92 \end{array}$	281.3 282.0	271.6 272.3	$\begin{array}{c} 451 \\ 52 \end{array}$	$\frac{324.4}{225.2}$	313.3	$511 \\ 12$	367.6 368.3	355.0 355.7	$571 \\ 72$	410.7	396.7 207 3
33	239.5	230.0 231.3	93	282.7	272.0 273.0	53	325.9	314.7	13	369.0	356.4	73^{-73}	411.0	398.0
$\frac{34}{25}$	240.3	232.0	94	283.4	273.7	54	326.6	315.4	14	369.7	357.1	74	412.9	398.7
36 36	241.0 241.7	232.233.4	96 96	284. 1 284. 9	274.4 275.1	56	321.0 328.0	316.1	$10 \\ 16$	370.0 371.2	357.5 358.4	$\frac{76}{76}$	413.0	399. 1 400. 1
37	242.4	234.1	97	285.6	275.8	57	328.7	317.5	17	371.9	359.1	77	415.1	400.8
$\frac{38}{39}$	$243.1 \\ 243.9$	234.0 335.5	98 99	280.0 287.0	270.0 277.2	$\frac{58}{59}$	$329.0 \\ 330.2$	$318.2 \\ 318.9$	18 19	372.0	359.0 360.5	79 79	415.5 416.5	401.5 402.2
40	244.6	236.2	400	287.7	277.9	60	330. 9	319.6	20	374.1	361.2	80	417.2	402.9
$\begin{bmatrix} 341 \\ 42 \end{bmatrix}$	245.3 246.0	236.9 237.6	$\begin{array}{c}401\\02\end{array}$	288.5	278.6 979.3	$\begin{bmatrix} 461 \\ 62 \end{bmatrix}$	331.6	320.2 320.9	$\begin{bmatrix} 521 \\ 22 \end{bmatrix}$	374.8 375.5	$\frac{361.9}{262.6}$	581 82	417.9 418.7	403.6
43	246.7	238.3	03	289.9	280.0	63	333.1	321.6	23	376.2	363.3	83	410.4	404.0
44	247.5	239.0	04	290.6 201_3	280.7	$64 \\ 65$	333.8	322.3 222.0	$\frac{24}{25}$	376.9 977.7	364.0	84	420.1	405.7
46	248.9	255.240.4	06	291.0 292.1	281.0 282.0	66	335.2	323.0 323.7	$\frac{26}{26}$	378.4	364.1 365.4	86 86	420.0 421.5	400.4
47	249.6	241.1	07	292.8	282.7	67	335.9	324.4	27	379.1	366.1	87	422.3	407.8
40 49	250.5 251.1	241.7 242.4	08	293.0 294.2	283.4 284.1	69 69	330.7 337.4	$320.1 \\ 325.8$	$\frac{28}{29}$	379.5 380.5	$366.0 \\ 367.5$	88 89	423.0 423.7	408.5 409.1
50	251.8	243.1	10	294.9	284.8	70	338.1	326.5	30	381.2	368.2	90	424.4	409.9
351 52	252.5	243.8 214.5	411	295.7 296.4	285.5	$\begin{bmatrix} 471 \\ 72 \end{bmatrix}$	338.8	$\frac{327.2}{227.9}$	531	$\frac{382.0}{282.7}$	368.9	591 92	425.1	410.5
53	253.9	245.2	11	290. 1	286.9	73	340.3	328.6	32	383.4	309.0	93	425.6	411. 2 411. 9
54 55	254.6	245.9	14	297.8	287.6	74	341.0	329.3	34	384.1	371.0 371.7	94	427.3	412.6
56	256.1	240.0 247.3	16	298.0	280.0 289.0	76	341. 342.4	330.0	$\frac{30}{36}$	385.6	371.7 372.4	95 96	428.0 428.7	413.5 414.0
57	256.8	248.0	17	300.0	289.7	77	343.1	331.4	37	386.3	373.1	97	429.5	414.7
$\frac{58}{59}$	$257.5 \\ 258.2$	248.4 249.4	$\begin{array}{c}18\\19\end{array}$	300.7 301.4	$290. \pm 291.1$	78	343.8	$\begin{smallmatrix} 332. \\ 332. 7 \end{smallmatrix}$	$\frac{38}{39}$	387.0 387.7	373.7 374.4	98	$\begin{array}{c c} 430.2 \\ 430.9 \end{array}$	415.4
60	259.0	250.1	20	302.1	291.8	80	345.3	333.4	40	388.4	375.1	600	431.6	416.8
Dist.	Dep.	Lat.	Dist.	Dep.	Lat.	Dist.	Dep.	Lat.	Dist.	Dep.	Lat.	Dist.	Dep.	Lat.
					4	6° (18	34°, 226°	°, 314°)).					

	Page 456] TABLE 2.													
Pa	ge 456	<u>ا</u> ا				Г	ABL	£ 2.						
			Differe	ence of I	Latitud	le and	Depart	ure for	45° (1	135°, 228	5°, 315°	°).		
Dist.	Lat.	Dep.	Dist.	Lat.	Dep.	Dist.	Lat.	Dep.	Dist.	Lat.	Dep.	Dist.	Lat.	Dep.
1	0.7	0.7	61	43.1	43.1	121	85.6	85.6	181	128.0	128.0	241	170.4	170.4
$\frac{2}{3}$	1.4	1.4	62	43.8	43.8	$\frac{22}{23}$	86.3	86.3	82	128.7	128.7	42	171.1	171.1
4	$2.1 \\ 2.8$	2.8	$\begin{array}{c} 05\\ 64\end{array}$	44.0	44.0 45.3	$\frac{20}{24}$	87.7	87.7	80 84	129.4 130.1	129.4 130.1	45 44	171.0 172.5	171.8
5	3.5	3.5	65	46.0	46.0	25	88.4	88.4	85	130.8	130.8	45	173.2	173.2
6	4.2	4.2	[@] 66	46.7	46.7	26	89.1	89.1	86	131.5	131.5	46	173.9	173.9
8	4.9	4.9	67	47.4	47.4	27	89.8	89.8	87	132.2	132.2	47	174.7	174.7
9	6.4	6.4	69	48.8	48.8	29	91.2	91.2	89	132.0 133.6	132.0 133.6	40 49	170.4 176.1	170.4 176.1
10	7.1	7.1	70	49.5	49.5	30	91.9	91.9	90	134.4	134.4	50	176.8	176.8
11	7.8	7.8	71	50.2	50.2	131	92.6	92.6	191	135.1	135.1	251	177.5	177.5
12 13	8.5	8.0	$\begin{bmatrix} 72\\73 \end{bmatrix}$	50.9 51.6	50.9	$\frac{32}{33}$	93.3	93.3	92 93	135.8 136.5	135.8 126.5	52 53	178.2	178.2
14	9.9	9.9	74	52.3	$51.0 \\ 52.3$	34	94.8	94.8	94	130.0 137.2	130.0 137.2	54	179.6	179.6
15	10.6	10.6	75	53.0	53.0	35	95.5	95.5	95	137.9	137.9	55	180.3	180.3
$16 \\ 17$	11.3	11.3	76	53.7	53.7	$\frac{36}{27}$	96.2	96.2	96	138.6	138.6	$56 \\ 57$	181.0	181.0
18	12.0 12.7	12.0 12.7	78	04.4 55.2	04.4 55.2	31	90.9	90.9	97	139.5 140.0	139.5	57 58	181.7	181.7
19	13.4	13.4	79	55.9	55.9	39	98.3	98.3	99	140.7	140.7	59	183.1	183.1
20	14.1	14.1	80	56.6	56.6	40	99.0	99.0	200	141.4	141.4	60	183.8	183.8
21	14.8	14.8	81	57.3	57.3	$141 \\ 49$	99.7	99.7	$201 \\ 02$	142.1	142.1	261	184.6	184.6
23	16.3	16.0 16.3	$\frac{82}{83}$	58.7	58.7	42 43	100.4 101.1	100.4 101.1	02	142.0 143.5	142.0 143.5		185. ə 186. 0	185.5
24	17.0	17.0	84	59.4	59.4	44	101.8	101.8	04	144.2	144.2	64	186.7	186.7
25	17.7	17.7	85	60.1	60.1	45	102.5	102.5	05	145.0	145.0	65	187.4	187.4
$\left \begin{array}{c} 26\\ 97 \end{array} \right $	18.4	18.4	86 87	60.8 61.5	60.8	$\frac{46}{47}$	103.2 103.9	103.2 102.9	06	145.7	145.7	66 67	188.1	188.1
28	19.8	19.8	88	62.2	62.2	48	103.0	103.0 104.7	08	140.4	140. 4	68	180.0	189.5
29	20.5	20.5	89	62.9	62.9	49	105.4	105.4	09	147.8	147.8	69	190.2	190.2
30	21.2	21.2	90	63.6	63.6	50	106.1	106.1	10	148.5	148.5	70	190.9	190.9
31	21.9 22.6	21.9 22.6	91 92	64.3 65.1	64.3	$151 \\ 52$	106.8 107.5	106.8 107.5	$211 \\ 12$	149.2	149. Z	$271 \\ 72$	191.6	191.6 102.3
33	23.3	23.3	93	65.8	65.8	53	107.0	108.2	$12 \\ 13$	140.0	149.0	73	192.0	192.0
34	24.0	24.0	94	66.5	66.5	54	108.9	108.9	14	151.3	151.3	74	193.7	193.7
35	24.7	24.7	95	67.2	67.2	55	109.6	109.6	15	152.0	152.0	75	194.5	194.5
30	25.0 26.2	25.5 26.2	90	68.6	67.9	50 57	111.0	110.5	10 17	152.7	152.7	70	195. 2 195. 9	195.2 105.9
38	26.9	26.9	98	69.3	69.3	58	111.7	111.7	18	154.1	154.1	78	196.6	196.6
39	27.6	27.6	99	70.0	70.0	59	112.4	112.4	19	154.9	154.9	79	197.3	197.3
40	28.3	28.3	100	70.7	70.7	60	113.1	113.1	20	150.0	155.6	80	198.0	198.0
$\frac{41}{42}$	29.0	29.0 29.7	$101 \\ 02$	71.4 72.1	$\frac{1.4}{72.1}$	$\begin{array}{c}101\\-62\end{array}$	113.8	113.0 114.6	$\frac{221}{22}$	150.5 157.0	150.5 157.0	$\frac{281}{82}$	198.7	198.7
43	30.4	30.4	03	72.8	72.8	63	115.3	115.3	23	157.7	157.7	83	200.1	200.1
44	31.1	31.1	04	73.5	73.5	64	116.0	116.0	24	158.4	158.4	84	200.8	200.8
45	31.8 29.5	31.8 29.5	05	74.2 75.0	74. Z	65 66	116.7 117.4	116.7 117.4	$\frac{25}{26}$	159.1	159.1	85 86	201.5	201. 5
47	33.2	33.2	07	75.7	75.7	67	118.1	118.1	27	160.5	160.5	87	202. 2	202. 2
48	33.9	33.9	08	76.4	76.4	68	118.8	118.8	28	161.2	161.2	88	203.6	203.6
49	34.6	34.6	09	77.1	77.1	69	119.5	119.5	29	161.9	161.9	89	204.4	204.4
51	35.4	35.4	10	79 5	11.0	10	120.2	120.2	30	162.0	162.0	90	205.1	205.1
52	36.8	36.1 36.8	12	79.2	79.2	72	120.5 121.6	120.5 121.6	$\frac{231}{32}$	163.0 164.0	105.5 164.0	291 92	205.8	200.0
53	37.5	37.5	13	79.9	79.9	73	122.3	122.3	33	164.8	164.8	93	207.2	207.2
54	38.2	38.2	14	80.6	80.6	74	123.0	123.0	34	165.5	165.5	94	207.9	207.9
56 56	38.9 39.6	38.9	10 16	81.5	81.3	10 76	123.7 194 5	123.7 194 5	30 36	166.2 166.9	166.2 166.9	90	208.0	208.0
57	40.3	40.3	17	82.7	82.7	77	125.2	125.2	37	167.6	167.6	97	210.0	210.0
58	41.0	41.0	18	83.4	83.4	78	125.9	125.9	38	168.3	168.3	98	210.7	210.7
59 60	41.7	41.7	19 20	84.1	84.1	79 90	126.6 197.3	126.6 197.3	39	169.0 160.7	169.0 169.7	99	211.4 212.1	211.4
	*14. 1	74. 1	40	01.0	01.0	00	147.0	121.0	40	105.7	105.1		212.1	212.1
Dist.	Dep.	Lat.	Dist.	Dep.	Lat.	Dist.	Dep.	Lat.	Dist.	Dep.	Lat.	Dist.	Dep.	La t.
					-1	5° (18	35°, 225°	°, 315°)).					



						Т	ABLE	2.					[Page	457
			Differ	ence of	Latitud	le and	l Depart	ure for	45° (135°, 22	5°, 315	°).		
Dist.	Lat.	Dep.	Dist.	Lat.	Dep.	Dist.	Lat.	Dep.	Dist.	Lat.	Dep.	Dist.	Lat.	Dep.
301	212.8	212.8	361	255.3	255.3	421	297.7	297.7	481	340.1	340.1	541	382.5	382.5
02	213.5 214.2	213.5 214.9	62 62	256.0 256.7	256.0 256.7	22 92	298, 4 299, 1	298.4 299-1	82 82	340.8	340.8 341 5	42	383 0	$\begin{smallmatrix} 583.2\\ 382.0 \end{smallmatrix}$
03	214.5 215.0	214.3	64	250.7 257.4	257.4	$\frac{23}{24}$	299.8	299.8	84	342.2	342.2	44	384.7	384.7
05	215.7	215.7	65	258.1	258.1	25	300.5	300.5	85	342.9	342.9	45	385.4	385.4
06	216.4	216.4	66	258.8	258.8	$\frac{26}{27}$	301.2	301.2	86	343.6	343.6	46	386.1	386.1
07	217.1	217.1 217.0	67 60	259.5	259.5	27	301.9	301.9	87	344.3	344. 3 345 1	47	386.8 387 =	386,8
08	217.8	217.8	- 68 - 60	260.2	260.2	$\frac{28}{20}$	302.0	302.0 303.4	80	345 8	345.8	40	388 9	388 9
10	219.2	219.2	70	261.6	261.6	30	304.1	304.1	90	346.5	346.5	50	388.9	388.9
311	219.9	219.9	371	262.3	262.3	431	304.8	304.8	491	347.2	347.2	551	389.6	389.6
12	220.6	220.6	72	263.0	263.0	32	305.5	305.5	92	347.9	347.9	52	390.3	390.3
13	221.3	221.3	73	263.8	263.8	33	306.2	306.2	93	348.6	348.6	53	391.0	391.0
14	222.0	222.0	74	264.5	204.5	34 9=	306.9 307 e	306.9 307-9	94 05	349.3	349.3	04 55	591.7 309 4	391.7 309 4
10 16	223 1	223 4	$\frac{70}{76}$	265.2 265.0	$\frac{200.2}{265}$ 0	50 36	308 3	308 3	98 98	350.0 350.7	350.7	56 56	393.1	393.1
17	224.2	224.2	77	266.6	266.6	37	309.0	309.0	97	351.4	351.4	57	393.9	393.9
18	224.9	224.9	. 78	267.3	267.3	38	309.7	309.7	98	352.1	352.1	58	394.6	394.6
19	225.6	225.6	79	268.0	268.0	39	310.4	310.4	99	352.8	352.8	59	395.3	395.3
20	226.3	226.3	80	268.7	268.7	40	311.1	<u>311.1</u>	500	303.5	303.5	60	396.0	396.0 200 -
321	227.0 227.7	$\frac{227.0}{997.7}$	381	269.4 970.1	$\frac{269.4}{270-1}$	441	311.8 319 #	511.8 319 #	001 09	355 0	355 0	001 69	396.7 307 -	396.7 397 4
$\frac{42}{23}$	228.4	228 4	83	270.1 270.8	270.8	$\frac{12}{43}$	313 3	313 3	$\frac{02}{03}$	355.0 355.7	350.0 355.7	63	398.1	398.1
24	229.1	229.1	84	271.5	271.5	44	314.0	314.0	04	356.4	356.4	64	398.8	398.8
25	229.8	229.8	85	272.2	272.2	45	314.7	314.7	05	357.1	357.1	65	399.5	399.5
26	230.5	230.5	86	272.9	272.9	46	315.4	315.4	06	357.8	357.8	66	400.2	400.2
27	231.2	231.2	87	273.7	273.7	47	316.1	316.1	07	358.5	358.5	67	400.9	400.9
28	231.9 229 e	231.9	88	274.4	274.4	48	316.8 317 5	316.8 317 E	08	359.2 350 0	359.2	68 60	401.6	401.6
29 30	232.0 233.3	232.0	90	270.1 275.8	275.1 275.8	49	318.9	318 9	10	360 B	360 B	70	403 0	403.0
331	$\frac{230.0}{234.1}$	$\frac{230.0}{234}$ 1	391	276 5	276 5	451	318 9	318.9	511	361.3	361.3	571	403.8	403.8
32	234.8	234.8	92	277.2	277.2	52	319.6	319.6	12	362.0	362.0	72	404.5	404.5
33	235.5	235.5	93	277.9	277.9	53	320.3	320.3	13	362.7	362.7	73	405.2	405.2
34	236.2	236.2	94	278.6	278.6	54	321.0	321.0	14	363.5	363.5	$\frac{74}{2}$	405.9	405.9
35	236.9	236.9	95	279.3	279.3	55	321.7	321.7	15	364.2	364.2	75	406.6	406.6
$\frac{36}{27}$	237.6	237.6	96	280.0	280.0	$\frac{56}{57}$	322.4	322.4	$16 \\ 17$	304.9 365 e	304.9 365 e	$\frac{16}{77}$	407.3	407.3
38	239 0	239 0	97	280.7	280.7	58	323 9	323.2 323.9	18	366 3	366 3	78	408.7	408.7
39	239.7	239.7	99	282.1	282.1	59	324.6	324.6	19	367.0	367.0	79	409.4	409.4
40	240.4	240.4	400	282.8	282.8	60	325.3	325.3	20	367.7	367.7	80	410.1	410.1
341	241.1	241.1	401	283.6	283.6	461	326.0	326.0	521	368.4	368.4	581	410.8	410.8
42	241.8	241.8	02	284.3	284.3	62	326.7	326.7	22	369.1	369.1	82	411.5	411.5
43	242.5	242.5	03	285.0	285.0	63	327.4	327.4	23	369.8	369.8	83	412.2	412.2
44 45	243.2	243.2	04	280.7	200.7	04 65	328.0	328.1	24 95	371 9	370.5	85	413.7	$\frac{+12.9}{413.7}$
46	244.7	244.7	06	287.1	287.1	66	329.5	329.5	26	371.9	371.9	86	414.4	414.4
47	245.4	245.4	07	287.8	287.8	67	330.2	330.2	27	372.6	372.6	87	415.1	415.1
48	246.1	246.1	08	288.5	288.5	68	330.9	330.9	28	373.4	373.4	88	415.8	415.8
49	246.8	246.8	09	289.2	289.2	69	331.6	331.6	29	374.1	374.1	89	416.5	416.5
50	247.5	247.5	10	289.9	289.9	-70	332.3	$\frac{332.3}{200}$	30	374.8	374.8	90	417.2	417.2
351	248.2	248.2	411	290.6	290.6	471	333.1	333.1 329 0	031 90	310.5	313.5	- 091 - 09	417.9	417.9
52 52	240.9 249 g	240.9 249 g	12	291.3	291.3 292 A	72	334 5	000. 8 334 - 5	02 22	376 0	376 0	92 93	419 2	419 2
54	250.3	250.3	14	292.7	292.7	74	335.2	335.2	34	377.6	377.6	94	420.0	420.0
55	251.0	251.0	15	293.5	293.5	75	335.9	335.9	35	378.3	378.3	95	420.7	420.7
56	251.7	251.7	16	294.2	294.2	76	336.6	336.6	36	379.0	379.0	96	421.4	421.4
57	252.4	252.4	17	294.9	294.9	77	337.3	337.3	37	379.7	379.7	97	422.1	422.1
- 28 50	$\begin{array}{c} 203.1\\ 253.0 \end{array}$	203.1 252.0	18	295.6 206 9	290, 6 206 0	18	338. U	338 -	38	380.4	381 1	98	422.8	422.8 493 e
- 60 - 60	200.9 254.6	255.9 254 B	20	290.3 297 0	290.3 297 0	80	339 1	339 4	- 39 - 40	381.8	381.8	600	424.3	424.3
							500.1						U 11 0	
Dist.	Dep.	Lat.	Dist.	Dep.	Lat.	Dist.	Dep.	Lat.	Dist.	Dep.	Lat.	Dist.	Dep.	Lat.
	J	-	·			45° (135°. 22	5°, 3159	· · · ·					

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TABLE 3.

Meridional Parts, or Increased Latitudes.

Comp. 1

						293,400					
М.	0 °	1°	20	5°	+ °	5 °	60	70	8°	90	М.
0	0.0	59.6	119.2	178.9	238.6	298.3	358. 2	418.2	478 3	538 6	0
1	1.0	60.6	20.2	79.9	39.6	99.3	59.2	19.2	79.3	39.6	1
$\hat{2}$	2.0	61.6	21.2	80.8	40.6	300.3	60.2	20.2	80.3	40.6	2
3	3.0	62.6	22.2	81.8	41.6	01.3	61.2	21.2	81.3	41.6	3
4	4.0	63.6	23.2	82.8	42.5	02.3	62.2	22.2	82.3	42.6	4
5	5.0	64.6	124.2	183.8	243.5	303.3	363.2	423.2	483.3	543.6	5
6	6.0	65.6	25.2	84.8	44.5	04.3	64.2	24.2	84.3	44.6	6
1	7.0	66. ð 67. 5	26.2	80.8	40.0	00.3	60.2 60.2	25.2	85.3	40.6	1
0	1.9	69.5	21.2	87.8	40.0	07.3	67.2	20.2 97.2	87.3	40.0	0
10	0.0	60.5	120.2	199 9	948 5	208 2	269 9	499 9	100 9	519 8	10
11	10.9	70.5	$\frac{129.1}{30.1}$	89.8	49.5	09.3	69 2	99.9	400.0	49.6	11
12	11.9	71.5	31.1	90.8	50.5	10.3	70.2	30.2	90.4	50.6	$\frac{11}{12}$
13	12.9	72.5	32.1	91.8	51.5	11.3	71.2	31.2	91.4	51.7	13
14	13.9	73.5	33.1	92.8	52.5	12.3	72.2	32.2	92.4	52.7	14
15	14.9	74.5	134.1	193.8	253.5	313.3	373.2	433.2	493.4	553.7	15
16	15.9	75.5	35.1	94.8	54.5	14.3	74.2	34.2	94.4	54.7	16
17	16.9	76.5	36.1	95.8	55.5	15.3	75.2	35.2	95.4	55.7	17
18	17.9	77.5	37.1	96.8	56.5	16.3	76.2	36.2	96.4	56.7	18
19	18.9	78.5	38.1	97.8	57.5	17.3	$_{-77.2}$	37.2	97.4	57.7	
20	19.9	79.5	139.1	198.8	258.5	318.3	378.2	438.2	498.4	558.7	20
21	20.9	80.5	40.1	99.7	59.5	19.3	79.2	39.2	99.4	59.7	21
22	21.9	81.0	41.1	200.7	60.5	20.3	80.2	40.2	500.4	60.7	22
23	22.8	82.4	42.1	01.7 02.7	01.0 69.5	21.3 99.3	81.2	41.2	01.4 02.4	69 7	23
	91.0	00.4	$\frac{10.1}{14.1}$		02.0	22.0	202.2	44.4	502.4	569 7	- 24
20	24.0	01.1 85.4	45 1	205.7	205.0	04.3	000. 4 81 9	440.4	01.1	84 7	20
27	26.8	86.4	46.0	05.7	65.5	25.3	85 2	45 2	05.4	65 7	20
28	27.8	87.4	47.0	06.7	66.5	$\frac{26.0}{26.3}$	$\frac{86.2}{2}$	46.2	06.4	66.8	28
29	28.8	88.4	48.0	07.7	67.4	27.3	87.2	47.2	07.4	67.8	29
30	29.8	89.4	149.0	208.7	268.4	328.3	388.2	448.2	508.4	568.8	30
31	30.8	90.4	50.0	09.7	69.4	29.3	89.2	49.2	09.4	69.8	31
32	31.8	91.4	51.0	10.7	70.4	30.3	90.2	50.2	10.4	70.8	32
33	32.8	92.4	52.0	11.7	71.4	31.3	91.2	51.2	11.4	71.8	33
34	33.8	93.4	53.0	12.7	72.4	32.3	92.2	52.2	12.4	72.8	34
35	34.8	94.4	154.0	213.7	273.4	333.3	393.2	453.2	513.4	573.8	35
36	35.8	95.4	55.0	14.7	74.4	34.3	94.2	54.3	14.5	74.8	36
38	30.7 37.7	90.4	57.0	10.7 16.7	76.4	30.3 36.9	95.2	00.0 56.2	10.0	10.8	30
39	38.7	98.3	58.0	10.7 17 7	77 4	30.2 37.2	97.2	57.3	17.5	77.8	39
40	39.7	99.3	159.0	218 7	278 4	338.9	398.2	458 3	518 5	578.8	-40
41	40.7	100.3	60.0	19.7	79.4	39.2	99.2	59.3	19.5	79.9	41
42	41.7	01.3	61.0	20.6	80.4	40.2	400.2	60.3	20.5	80.9	42
43	42.7	02.3	62.0	21.6	81.4	41.2	01.2	61.3	21.5	81.9	43
44	43.7	03.3	63.0	22.6	82.4	42.2	02.2	62.3	22.5	82.9	44
45	44.7	104.3	164.0	223.6	283.4	343.2	403.2	463.3	523.5	583.9	45
46	45.7	05.3	65.0	24.6	84.4	44.2	04.2	64.3	24.5	84.9	46
47	46.7	06.3	66.0	25.6	85.4	45.2	05.2	65.3	25.5	85.9	47
48	41.1	07.3	67.0	26.6	86.4	46.2	06.2	66.3	26.5	86.9	48
49	48.7	100.0	100.0	21.0	81.4	41.2	100.0	01.3	27.0	87.9	49
00 51	49.7	109.3	168.9	228.6	288.4	348.2	408.2	468.3	928, 5 90, 5	088.9	00 51
52	51.6	10.5	70 9	29.0	09.4 90.4	49.2	10.2	70.3	29.5	90 Q	52
53	52.6	12.3	71.9	31.6	91 4	51 2	11 2	71.3	31.5	91.9	53
54	53.6	13.2	72.9	32.6	92.4	52.2	12.2	72.3	32.5	93.0	54
55	54.6	114.2	173.9	233.6	293.4	353.2	413.2	473.3	533.5	594.0	55
56	55.6	15.2	74.9	34.6	94.4	54.2	14.2	74.3	34.6	95.0	56
57	56.6	16.2	75.9	35.6	95.4	55.2	15.2	75.3	35.6	96.0	57
58	57.6	17.2	76.9	36.6	96.3	56.2	16.2	76.3	36.6	97.0	58
59	58.6	18.2	77.9	37.6	97.3	. 57. 2	17.2	77.3	37.6	98.0	59
М.	00	10	20	30	4 °	50	60	70	80	90	М.

TABLE 3.

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Meridional Parts, or Increased Latitudes.

Comp. $\frac{1}{293.465}$

						200.100					
М.	10°	110	120	130	140	150	16°	170	180	19°	М.
0	599. 0	659.6	720.5	781.5	842.8	904.4	966.3	1028.5	1091.0	1153.9	0
1	600.0	60.6	21.5	82.5	43.9	05.4	67.3	29.5	92.0	54.9	ĩ
2	01.0	61.7	22.5	83.6	44.9	06.5	68.3	30.5	93.1	56.0	2
3	02.0	62.7	23.5	84.6	45.9	07.5	<u>69.4</u>	31.6	94.1	57.0.	3
4	03.0	63.7	24.5	85.6	46.9	08.5		32.6	95.2	08.1	4
5	604.1	664.7	725.5	786.6	847.9	909.6	971.4	1033.7	1096.2	1159.1	5
0	06.1	00.7 66 7	20.0 97 B	88 7	49.0 50.0	10.0	72.0	35 7	91.3	61 9	0
8	07.1	67.7	28.6	89.7	51.0	12.6	74.6	36.8	99.4	62.3	8
9	08.1	68.7	29.6	90.7	52.0	13.7	75.6	37.8	1100.4	63.3	9
10	609.1	669.8	730.6	791.7	853.1	914.7	976.6	1038.9	1101.4	1164.4	10
11	10.1	70.8	31.6	92.7	54.1	15.7	77.7	39.9	02.5	65.4	11
12	11.1	71.8	32.7	93.8	55.1	16.8	78.7	40.9	03.5	66.5	$\frac{12}{12}$
13	12.1 12.1	72.8	33. 7 24 7	94.8	$ \begin{array}{c} 00.1 \\ 57.9 \end{array} $	17.8	19.7	42.0	04.6	68 6	13
14	61.1 1	67.1 9	735 7	706 9	859 9	910 0	081 0	$\frac{\pm 0.0}{1044}$	1108 7	1160 7	14
16	15 2	75.8	36.7	97.8	59.2	20.9	82.8	45.1	07.7	70.7	16
17	16.2	76.8	37.7	98.9	60.2	21.9	83.9	46.1	08.8	71.8	17
18	17.2	77.9	38.8	99.9	61.3	22.9	84.9	47.2	09.8	72.8	18
19	18.2	78.9	39.8	800.9	62.3	24.0	85.9	48.2	10.9	73.9	19
20	. 619.2	679.9	740.8	801.9	863.3	925.0	987.0	1049.3	1111.9	1174.9	20
21	20.2	80.9	41.8	02.9	64.3	26.0	88.0	50.3	13.0	76.0	21
22 93	21.2 99.9	81.9 89 0	42.8	04.0	00.4 66.4	27.1 98-1	89.0 90.1	91.3 59.4	14.0 15.0	$\frac{11.0}{78.1}$	22 93
20 24	23. 2	83.9	44.9	06.0	67.4	20.1 29.1	91.1	53.4	16.1	79.1	$\frac{23}{24}$
25	624. 2	684.9	745.9	807.0	868.5	930.1	992.1	1054.5	1117.1	1180.2	-25
26	25.3	86.0	46.9	08.1	· 69.5	31.2	93.2	55.5	18.2	81.2	26
27	26.3	87.0	47.9	09.1	70.5	32.2	94.2	56.6	19.2	82.3	27
28	27.3	88.0	48.9	10.1	71.5	33.2	95.3	. 57.6	20.3	83.3	28
29	28.3	89.0	49.9		12.6	34.3	96.3	58.6	21.3	84.4	29
30	629.3	090.0 01_0	751.0	812.1 12.0	873.6 74.6	935.3	997.3	1059.7	1122.4	1185.5	30 21
32	31.3	92 0	53 0	10.2 14.2	75.6	$30.3 \\ 37.4$	99.4	61.8	20.4 24 5	87 B	32
33	32.3	93.1	54.0	15.2	76.7	38.4	1000.4	62.8	25.5	88.6	33
34	33.3	94.1	55.0	16.2	77.7	39.4	01.5	63.9	26.6	89.7	34
35	634.3	695.1	756.0	817.3	878.7	940.5	1002.5	1064.9	1127.6	1190.7	35
36	35.4	96,1	57.1	18.3	79.7	41.5	03.6	65.9	28.7	91.8	36
37	36.4	97.1	58.1	19.3	80.8	42.5	04.6	67.0	29.7	92.8	37
- 38 - 30	38.1	99.1	60 1	20.3 21.3	82.8	43.0 44 ß	00.0	69.1	31.8	95.9 95.0	30
	639 4	700 2	761 1	822 1	883 8	945 B	1007 7	1070 1	1139 0	1196 0	40
41	40.4	01.2	62.2	23.4	84.9	46.7	08.7	71.2	33.9	97.1	41
42	41.4	02.2	63.2	24.4	85.9	47.7	09.8	72.2	35.0	98.1	42
43	42.4	03.2	64.2	25.4	86.9	48.7	10.8	73.2	36.0	99.2	43
44	43.4	04.2	65.2	26.5	88.0	49.7	11.8	74.3	37.1	1200.2	44
45	644.5	705.2	766.2	827.5	889.0	950.8	1012.9	1075.3	1138.1	1201.3	45
46	45.5	06.2	07.3	28.5	90.0	01.8 59 0	13.9	76.4	39.2	02.3	40
48	40.0	08.3	69.3	29.0 30.5	92 1	52.8	16.0	78.5	40.2	04 5	48
49	48.5	09.3	70.3	31.6	93.1	54.9	17.0	79.5	42.3	05.5	49
50	649.5	710.3	771.3	832.6	894.1	955.9	1018.1	1080.5	1143.4	1206.6	50
51	50.5	11.3	72.3	33.6	95.2	57.0	19.1	81.6	44.4	07.6	51
52	51.5	12.3	73.4	34.6	96.2	58.0	20.2	82.6	45.5	08.7	52
53	52.5	13.4	$\frac{74.4}{75.4}$	35.7	97.2	59.0 60.1	21.2	83.7	46.5	09.7	5.1
55	651 0	715 4	776 1	20.1	800 2	061 1	1022 2	1085 0	11.19 0	1911 0	- 55
56 56	55 6	16 1	77 1	38 7	900 3	62 1	24 3	86.8	49 7	1211.8	56
57	56.6	17.4	78.5	39.8	01.3	63.2	25.3	87.9	50.7	14.0	57
58	57.6	18.4	79.5	40.8	02.3	64.2	26.4	88.9	51.8	15.0	58
59	58.6	19.4	80.5	41.8	03.4	65.2	27.4	89.9	52.8	16.1	59
М.	10°	11°	120	130	140	150	16°	170	1%°	150	М.

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TABLE 3.

Meridional Parts, or Increased Latitudes.

Comp. $\frac{1}{202.465}$

						293,400					
М.	20°	21°	220	230	240	25°	260	270	28°	290	М.
0	1217.1	1280.8	1344.9	1409.5	1474.5	1540.1	1606.2	1672.9	1740.2	1808.1	0
1	18.2	81.9	46.0	10.6	75.6	41.2	07.3	74.0	41.3	09.2	1
2	19.3	82.9	47.1	11.6	76.7	42.3	08.4	75.1	42.4	10.4	2
3	20.3	84.0	48.1	12.7	77.8	43.4	09.5	76.2	43.6	11.5	3
4	21.4	85.1	49.2	13.8	78.9	44.0	10.6	1070 5	44.7	12.6	4
5	1222.4	1286.1	1350.3	1414.9	1480.0	1545.6	1611.7	1678.5	1745.8	1813.8	5
67	23.5	87.2	01.4 59.4	16.0 17.1	81.1	40.7	12.9	19.0	40.9	14.9	07
8	24. 0 25. 6	89.3	52.4 53.5	18 1	83.3	48.9	15.1	81.8	49 2	17.2	8
9	26.0 26.7	90.4	54.6	19.2	84.3	50.0	16.2	82.9	50.3	18.3	9
10	1227.7	1291.5	1355.7	1420.3	1485.4	1551.1	1617.3	1684.1	1751.5	1819.5	10
11	28.8	92.5	56.7	21.4	86.5	52.2	18.4	85.2	52.6	20.6	11
12	29.8	93.6	57.8	22.5	87.6	53.3	19.5	86.3	53.7	21.8	12
13	30.9	94.7	58.9	23.5	88.7	54.4	20.6	87.4	56 0	22.9	13
14	32.0	90.7	1961 0	1495 7	1400 0	1556 6	1699 0	1680 7	1757 1	1995 9	19
10	1255.0	1290.8 07 0	1301. U 69 1	26.2	92 0	57 7	23 9	90.8	58.9	26.3	16
10	35 1	98.9	63.2	27.9	93.1	58.8	25.0	91.9	59.4	27.5	17
18	36.2	1300.0	64.2	29.0	94.2	59.9	26.2	93.0	60.5	28.6	18
19	37.3	01.1	65.3	30.0	95.2	61.0	27.3	94.1	61.6	29.7	19
20	1238.3	1302.1	1366.4	1431.1	1496.3	1562.1	1628.4	1695.3	1762.7	1830. 9	20
21	39.4	03.2	67.5	32.2	97.4	63.2	29.5	96.4	63.9	32.0	21
22	40.4	04.3	68.5	33.3	98.5	64.3	30.6	97.5	65.0	33.2	22
23	41.5	05.3	69.6 70.7	34.4	99.6	00.4	31.7	98.6	67 9	34.3	23 9.1
24	12.0	1207 5	1971 0	1498 5	1501 0	1567 6	1622 0	1700 0	1769 4	1836 6	
20	41 7	1307.3	79.8	1400. 0 37 B	02.9	68 7	35.0	02.0	69.5	37.7	$\frac{20}{26}$
27	45.7	09.6	73.9	38.7	04.0	69.8	36.1	03.1	70.7	38.9	27
28	46.8	10.7	75.0	39.8	05.1	70.9	37.3	04.2	71.8	40.0	$\overline{28}$
29	47.9	11.7	76.1	40.9	06.2	72.0	38.4	05.3	72.9	41.2	29
30	1248.9	1312.8	1377.1	1442.0	1507.3	1573.1	1639.5	1706.5	1774.1	1842.3	30
31	50.0	13.9	78.2	43.0	08.4	74.2	40.6	07.6	75.2	43.4	31
32	51.0	14.9	79.3	44.1	09.4	75.3	41.7	08.7	76.3	44.6	32
33	02. 1 52. 0	16.0 17.1	80.4	40.2	10.5	77 5	42.8	10.0	78.6	40.7	00 31
- 04	1954 9	1210 0	1289 5	1447 4	1519 7	1579 8	1645 0	1719 1	1770 7	1848 0	35
30	55 3	19 2	1002.0 83 R	48 5	13.8	79 7	46.2	13.2	80.8	49.2	36
37	56.4	20.3	84.7	49.5	14.9	80.8	47.3	14.3	82.0	50.3	37
38	57.4	21.4	85.8	50.6	16.0	81.9	48.4	15.4	83.1	51.4	38
39	58.5	22.4	86.8	51.7	17.1	83.0	49.5	16.6	84.2	52.6	39
40	1259.5	1323.5	1387.9	1452.8	1518.2	1584.1	1650.6	1717.7	1785.4	1853.7	40
41	60.6	24.6	89.0	53.9	19.3	85.2	51.7	18.8	86.5	54.9	41
42	61.7	25.6	90.1	00.0 56 1	20.4	80.3	52.8 52.0	19.9 91 1	81.0	00.0 57.9	42
43	63.8	20.7	92.2	57.1	22.6	88.5	55.1	22.2	89.9	58.3	44
45	1264 9	1328 9	1393 3	1458 2	1523 7	1589 6	1656.2	1723.3	1791.1	1859.5	45
46	65.9	29.9	94.4	59.3	24.8	90.7	57.3	24.4	92.2	60.6	46
47	67.0	31.0	95.5	60.4	25.9	91.8	58.4	25.5	93.3	61.8	47
48	68.0	32.1	96.5	61.5	27.0	92.9	59.5	26.7	94.5	62.9	48
49	69.1	33.1	97.6	62.6	28.0	94.1	60.6	27.8	95.6	64.0	
50	1270.2	1334.2	1398.7	1463.7	1529.1	1595.2	1661.7	1728.9	1796.7	1865.2	50
51	71.2	35.3	99.8	64.8	30.2	96.3	62.9	30.0	97.9	60.3 67 5	01 59
52 52	72.3	30.3	1400.9	00.8 66 0	31.3	97.4 09.5	65 1	31. Z 39. 2	1800 1	68 R	53
54	74 4	38.5	03.0	68.0	33.5	99.6	66.2	33.4	01.3	69.8	54
55	1275.5	1339.6	1404.1	1469.1	1534.6	1600.7	1667.3	1734.5	1802.4	1870.9	. 55
56	76.6	40.6	05.2	70.2	35.7	01.8	68.4	35.7	03.5	72.1	56
57	77.6	41.7	06.2	71.3	36.8	02.9	69.5	36.8	04.7	73.2	57
58	78.7	42.8	07.3	72.4	37.9	04.0	70.7	37.9	05.8	74.4	58
59	79.7	43.8	08.4	73.5	39.0	. 05.1	71.8	39.1	07.0	75.5	59
М.	20°	21°	220	23°	240	250	260	270	28°	290	М.

TABLE 3.

Meridional Parts, or Increased Latitudes.

Comp. $\frac{1}{293.465}$

						200.100					
М.	30°	310	320	330	34°	350	360	37°	38°	39°	М.
0	1876.7	1946.0	2016.0	2086.8	2158.4	2230.9	2304.2	2378.5	2453.8	2530.2	0
1	77.8	47.1	17.2	88.0	59.6	32.1	05.5	79.8	55.1	31.5	ĭ
2	79.0	48.3	18.3	89.2	60.8	33.3	06.7	81.0	56.4	32.8	2
3	80.1	49.4	19.5	90.3	62.0	34.5	07.9	82.3	57.6	34.0	3
4	81.3	50.6	20.7	91.5	63.2	35.7	09.2	83.5	58.9	35.3	4
5	1882.4	1951.8	2021.9	2092.7	2164.4	2236.9	2310.4	2384.8	2460.2	2036.6	5
0 7	83.6	54 1	23.0 91.9	93.9	05.6	38. 2 30 4	11.6	80.0	69 7	30.9	
8	85.9	55.3	25.4	96.3	68.0	40.6	14.1	88.5	64.0	40.5	8
9	87.0	56.4	26.6	97.5	69.2	41.8	15.3	89.8	65.2	41.7	9
10	1888.2	1957.6	2027.7	2098.7	2170.4	2243.0	2316.5	2391.0	2466.5	2543.0	10
11	89.3	58.7	28.9	99.8	71.6	44.2	17.8	92.3	67.8	44.3	11
12	90.5	59.9	30.1	2101.0	72.8	45.5	19.0	93.5	69.0	45.6	12
13	91.6	61.1	31.3	02.2	74.0	46.7	20.3	94.8	70.3	46.9	13
14	92.8	02.2	32.4	03.4	10.2	47.9	21.0	90.0	11.6	48.2	14
15 16	1593.9	1903. 1 64 6	2033.6	2104.6	2176.4	2249.1 50.2	2322.7	4391.3 02 5	24/2.8	2049.0	10 16
17	96.2	65 7	36.0	05.8	78.8	50.3	25 2	90.0 99 8	75 4	52.0	17
18	97.4	66.9	37.1	08.2	80.0	52.8	26.4	2401.0	76.6	53.3	18
19	98.5	68.1	38.3	09.4	81.2	54.0	27.7	02.3	77.9	54.6	19
20	1899.7	1969.2	2039.5	2110.6	2182.5	2255.2	2328.9	2403.5	2479.2	2555.9	20
21	1900.8	70.4	40.7	11.8	83.7	56.4	30.1	04.8	80.4	57.2	21
22	02.0	71.5	41.8	12.9	84.9	57.7	31.4	06.0	81.7	58.5	22
23	03.1	72.7	43.0	14.1	86.1	58.9	32.6	07.3	83.0	59.8 61 0	23
24	1005 5	1075 0	20.15 1	10.3	01.3	9961 9	9225 1	2100 0	01.3	2569 9	- 24
20	1909.9	76.9	2040.4 16.6	$ \begin{array}{r} 2110. \\ 17 7 \end{array} $	2108.0 80.7	4201.3 69 5	4000.1	2409.8	2400.0	2002.3 62.6	20 26
27	07.8	77.4	47.7	18.9	90.9	63.8	37.6	12.3	88.1	64.9	27
28	08.9	78.5	48.9	20.1	92.1	65.0	38.8	13.6	89.3	66.2	28
29	10.1	79.7	50.1	21.3	93.3	66.2	40.0	14.8	90.6	67.5	29
30	1911.2	1980.9	2051.3	2122.5	2194.5	2267.4	2341.3	2416.1	2491.9	2568.8	30
31	12.4	82.0	52.5	23.7	95.7	68.7	42.5	17.3	≁ 93.2	70.1	31
32	13.5	83.2	53.6	24.9	96.9	69.9	43.7	18.6	94.4	71.4	32
33	14.7	84.4 85 5	04.8 56.0	26.1 97.9	98.1	(1.1)	40.0	19.8	95.7	72.7	21
25	1917 0	1986 7	2057 9	21.0	2200 4	9979 E	92.17 5	21.1	2100 9	2575 9	- 25
36	18 2	87.9	58 4	29.6	01.8	74 8	48 7	23 B	2490.0 99.5	76.5	36
37	19.3	89.1	59.5	30.8	03.0	76.0	49.9	24.9	2500.8	77.8	37
38	20.5	90.2	60.7	32.0	04.2	77.2	51.2	26.1	02.1	79.1	38
39	21.6	91.4	61.9	33.2	05.4	78.4	52.4	27.4	03.4	80.4	39
40	1922.8	1992.6	2063.1	2134.4	2206.6	2279.7	2353.7	2428.6	2504.6	2581.7	40
41	23.9	93.7	64.3	35.6	07.8	80.9	54.9	29.9	05.9	83.0	41
42	25.1	94.9	65.5	36.8	09.0	82.1	56.1	31.2	07.2	84.3	42
4.1	20.3 27.4	97.9	67.8	30.0	10.2	81 R	58 6	32.4	08.0	80, 6 86, 0	43
45	1928 R	1998 4	2060 0	2140 1	9219 7	9985 0	2350 0	9121 0	2511 0	2589 9	45
46	29.7	99.6	70.2	41 6	13.9	87 0	61 1	2104.9	12 3	89.5	46
47	30.9	2000.7	71.4	42.8	15.1	88.3	62.4	37.4	13.6	90.8	47
48	32.0	01.9	72.6	44.0	16.3	89.5	63.6	38.7	14.8	92.1	48
49	33.2	03.1	73.7	45.2	17.5	90.7	64.8	40.0	16.1	93.4	49
50	1934.4	2004.3	2074.9	2146.4	2218.7	2291.9	2366.1	2441.2	2517.4	2594.7	50
51	35.5	05.4	76.1	47.6	19.9	93.2	67.3	42.5	18.7	96.0	51
52 59	30. / 27 e	00.6	70 5	48.8	21.1	94.4	68.6	43.7	20.0	97.3	52
54	39.0	08.9	79.7	51.9	22.4 93.6	96 Q	71 1	46.2	21.2	90.0	54
55	1940.2	2010 1	2080 8	2152 4	2294 8	2298 1	2372 2	2447 5	2523 8	2601 1	55
56	41.3	11.3	82.0	53.6	26.0	99.3	-73.6	48.8	25.1	02.4	56
57	42.5	12.5	83.2	54.8	27.2	2300.5	74.8	50.1	26.4	03.7	57
58	43.6	13.6	84.4	56.0	28.4	01.8	76.1	51.3	27.6	05.0	58
59	44.8	. 14.8	85.6	57.2	29.6	03.0	, 77.3	52.6	28.9	06.3	59
26	802	010	800	000							
м.	300	31°	320	330	34°	35°	36°	370	38°	39°	M.

• 293.465

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TABLE 3.

Meridional Parts, or Increased Latitudes.

Comp. 1

			1		T	293.465					
М.	400	410	420	430	440	450	46°	470	480	49°	М.
0	2607.6	2686.2	2766.0	2847.1	2929.5	3013.4	3098.7	3185.6	3274.1	3364.4	0
1	08.9	87.6	67.4	48.5	30.9	14.8	3100.1	87.1	75.6	65.9	1
2	10.2	88,9	68.7	49.9	32.3	16.2	01.6	88.5	77.1	67.4	2
3	11.5	90.2	70.1	51.2	33.7	17.6	03.0	90.0	78.6	69.0	3
4	12.8	91.5	71.4	52.6	35.1	19.0	04.4	91.4	80.1	70.5	4
5	2614.1	2692.8	2772.8	2853.9	2936.5	3020.4	3105.9	3192.9	3281.6	3372.0	5
6	15.4	94.2	74.1	55.3	37.9	21.8	07.3	94.4	83.1	73.5	6
7	16.8	95.5	10.4	50.7	39.3 40.9	23.3	10.9	99.8	84.6	70.1 76.0	6
8	18.1	90.8	78.1	59.1	40.0	24.7	10.2	98.8	87 B	70.0	0
	2690 7	9600 5	2770 5	2860 9	2943 4	3027 5	3113 1	3200 2	3289 0	3370 B	10
10	2020. / 99 n	2700 8	80.8	62.1	44.8	28.9	14.5	01.7	90.5	81.9	11
19	23.2	021	82.2	63.5	46.2	30.3	16.0	03.2	92.0	82.7	12
13	24.6	03.4	83.5	64.9	47.6	31.7	17.4	04.6	93.5	84.2	13
14	25.9	04.8	84.8	66.2	49.0	33. 2	18.8	06.1	95.0	85.7	14
15	2627.2	2706.1	2786.2	2867.6	2950.4	3034.6	3120.3	3207.6	3296.5	3387.3	15
16	28.5	07.4	87.5	69.0	51.8	36.0	21.7	09.0	98.0	88.8	16
17	29.8	08.7	88.9	70.3	53.2	37.4	23.2	10.5	99.5	90.3	17
18	31.1	10.1	90.2	71.7	54.5	38.8	24.6	12.0	3301.0	91.8	18
19	32.4	11.4	91.6	/3.1	55.9	40.2	26.0	13.4	02.5	93.4	19
20	2633.7	2712.7	2792.9	2874.4	2957.3	3041.7	3127.5	3214.9	3304.0	3394.9	20
21	35.0	14.0	94.3	(5.8	58.7 60.7	43.1	28.9	16.4	05.5	96.4	21
22	36.3	10.4	90.6	79.0	00. I 61 #	44.0	30.4 21 0	17.9	07.0	98.0 98.0	22
23	31.6	10.7	97.0	70.0	62 0	40.9	32.2	20 0	10.0	3401 0	20
- 24	9840 9	2710.0	2700 7	9881 9	2961 9	3019 7	3194 7	3999 9	3311 5	3409 0	
20 96	2040. 2 A1 @	2119.3	2801 0	89 7	65 7	50 9	36.9	23 7	12 0	04 1	20 26
20	41.0	20.7	02.1	84 0	67.1	51.6	37.6	25. 2	14.5	05.6	27
28	44 9	23.3	03.7	85.4	68.5	53.0	39.0	26.7	16.0	07.2	28
29	45.5	24.7	05.1	86.8	69.9	54.4	40.5	28.2	17.5	08.7	29
30	2646.8	2726.0	2806.4	2888.2	2971.3	3055.9	3141.9	3229.6	3319.0	3410.2	30
31	48.1	27.3	07.8	89.5	72.7	57.3	43.4	31.1	20.5	11.8	31
32	49.4	28.6	09.1	90.9	74.1	58.7	44.8	32.6	22.1	13.3	32
33	50.7	30.0	10.5	92.3	75.5	60.1	46.3	34.1	23.6	14.8	33
34	52.0	31.3	11.8	93.7	76.9	61.5	47.7	35.6	25.1	16.4	34
35	2653.3	2732.6	2813.2	2895.0	2978.3	3063.0	3149.2	3237.0	3326.6	3417.9	35
36	54.7	34.0	14.5	96.4	79.7	64.4	50.6	38.5	28.1	19.5	36
37	56.0	35.3	15.9	97.8	81.1	65.8	52.1 59.5	40.0	29.6	21.0	31
38	50 e	30.0	17.2	2900 5	82. 0 82. 0	68 7	55 0	41.0	31. I 32 R	22.0	30
	9650 0	2720.2	2820 0	2000.0	9985 9	3070 1	3156 4	39.14 4	3324 1	3195 @	.10
40	2009.9	4109.3	2020.0	03.9	86 7	71 5	57 0	45 0	35 R	97.9	41
41	62 5	42 0	22.7	04.7	88.1	72.9	59.4	47.4	37.1	28.7	42
43	63.9	43.3	24.0	06.1	89.5	74.4	60.8	48.9	38.6	30.2	43
44	65.2	44.6	25.4	07.4	90.9	75.8	62.3	50.3	40.2	31.8	44
45	2666.5	2746.0	2826.7	2908.8	2992.3	3077.2	3163.7	3251.8	3341.7	3433.3	45
46	67.8	47.3	28.1	10.2	93.7	78.7	65.2	53. 3	43.2	34.9	46
47	69.1	48.6	29.4	11.6	95.1	80.1	66.6	54.8	44.7	36.4	47
48	70.4	50.0	30.8	13.0	96.5	81.5	68.1	56.3	46.2	38.0	48
49	71.7	51.3	32.2	14.3	97.9	82.9	69.5	57.8	47.7	39.5	49
50	2673.1	2752.7	2833.5	2915.7	2999.3	3084.4	3171.0	3259.3	3349.2	3441.0	50
51	14.4	54.0	34.9	17.1	000.7 09.1	80.8	12.0	69.9	00.8 59.9	42.0	01 59
	10.1	00.3 58 7	30. Z 27. g	10.0	02.1	88 7	75.4	63 7	53.8	45 7	53
54	78.3	58.0	39.0	21. 2	04.9	90.1	76.8	65.2	55.3	47.2	54
55	2679 6	2759 3	2840 3	2922 6	3006 3	3091.5	3178.3	3266.7	3356.8	3448.8	55
56	81.0	60 7	41.7	24.0	07.7	93.0	79.7	68.2	58.3	50.3	56
57	82.3	62.0	43.0	25.4	09.2	94.4	81.2	69.7	59.9	51.9	57
58	83.6	63.4	44.4	26.8	10.6	95.8	82.7	71.1	61.4	53.4	58
59	84.9	64.7	45.8	28.2	12.0	. 97.3	84.1	72.6	62.9	55.0	59
М.	400	41°	420	43°	44°	45°	46°	47°	48°	49°	М.

TABLE 3.

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Meridional Parts, or Increased Latitudes.

Comp. $\frac{1}{293,465}$

					- 1	293.465					
М.	50°	510	52°	53°	540	55°	56°	570	58°	59°	М.
0	3456.5	3550.6	3646.7	3745.1	3845.7	3948.8	4054.5	4163.0	4274.4	4389.1	0
1	58.1	52.2	48.4	46.7	47.4	50.5	56.3	64.8	76.3	91.0	1
2	59.6	53.8	50.0	48.4	49.1	52.3	58.1	66.6	78.2	92.9	2
3	61.2	55.4	51.6	50.0	50.8	54.0	59.8	68.5	80.1	94.9	3
4	62.7	56.9	53.2	51.7	52.5	55.7	61.6	70.3	82.0	96.8	-4
5	3464.3	3558.5	3654.8	3753.4	3854.2	3957.5	4063.4	4172.1	4283.9	4398.8	5
6	65.9	60.1	56.5	55.0	55.9	59.2	65.2	74.0	85.7	4400.7	6
7	67.4	61.7	58.1	56.7	57.6	61.0	67.0	75.8	87.6	02.6	7
8	69.0	63.3	59.7	58.3	59.3	62.7	68.8	77.7	89.5	04.6	8
9	70.5	64.9	61.3	60.0	61.0	64.5	70.6	79.5	91.4	06.5	9
10	3472.1	3566.5	3663.0	3761.7	3862.7	3966.2	4072.4	4181.3	4293.3	4408.5	10
11	73.6	68.1	64.6	63.3	64.4	68.0	74.2	83.2	95.2	10.4	11
12	75.2	69.7	66.2	65.0	66.1	69.7	76.0	85.0	97.1	12.4	12
13	76.7	71.3	67.9	66.7	67.8	71.5	77.7	86.9	99.0	14.3	13
14	78.3	72.8	69.5	68.3	69.5	-73.2	79.5	88.7	4300.9	16.3	14
15	3479.9	3574.4	3671.1	3770.0	3871.2	3975.0	4081.3	4190.6	4302.8	4418.2	15
16	81.4	76.0	72.7	71.7	72.9	76.7	83.1	92.4	04.7	20.2	16
17	83.0	77.6	74.4	73.3	74.6	78.5	84.9	94.2	06.6	22.1	17
18	84.5	79.2	76.0	75.0	76.3	80.2	86.7	96.1	08.5	24.1	18
19	86.1	80.8	11.6	16.7	78.1	82.0	88. 5	97.9	10.4	26.1	19.
20	3487.7	3582.4	3679.3	3778.3	3879.8	3983.7	4090.3	4199.8	4312.3	4428.0	20
21	89.2	84.0	80.9	80.0	81.5	85.5	92.1	4201.6	14.2	30.0	21
22	90.8	85.6	82.5	81.7	83.2	87.2	93.9	03.5	16.1	31.9	22
23	92.4	81.2	84.2	83.3	84.9	89.0	95.7	05.3	18.0	33.9	23
24	93.9	00.0	00.0	0700.7	80.0	90.7	97.0	07.2	19.9	35.8	24
25	3495.5	3590.4	3687.4	3786.7	3888.3	3992.5	4099.3	4209.0	4321.8	4437.8	25
20	97.1	92.0	89.1	88.4	90.0	94.3	4101.1	10.9	23.7	39.8	26
21	98.0	95.0	90.7	90.0	91.8		02.9	12.8	25.6	41.7	21
20	01.8	96.8	94.0	02 1	95.0	97.0	04.0	14.0	27.0	45.7	20
20	01.0	2509 4	2005 0	9705 1	2000 0	1001 9	1100.1	4010.0	4991 0	40.7	20
30	01 0	3600 0	07 3	06.8	08 6	4001.5	10.9	4218.5	4001.0	4447.0	30
39	06.5	01.6	91.9	98.1	3000 1	01.8	12.0	20.2	35.2	51.6	39
33	08.0	03.2	3700 5	3800 1	02 1	06.6	12.0 13.8	23.9	37 1	53.5	33
34	09.6	04.8	02.2	01.8	03.8	08.3	15.6	25.8	39.0	55 5	34
35	3511 2	3606 4	3703 8	3803 5	3905 5	4010 1	4117 4	4227 6	4340 9	1457 5	35
36	12 7	08.0	05.5	05.1	07.2	11 9	19.2	29.5	42.8	59.4	36
37	14.3	09.6	07.1	06.8	09.0	13.6	21 0	31.3	44.7	61.4	37
38	15.9	11.2	08.7	08.5	10.7	15.4	22.9	33.2	46.6	63.4	38
- 39	17.5	12.8	10.4	10.2	12.4	17.2	24.7	35.1	48.6	65.4	39
40	3519.0	3614.5	3712.0	3811.9	3914.1	4018.9	4126.5	4236.9	4350.5	4467.3	40
41	20.6	16.1	13.7	13.6	15.9	20.7	28.3	38.8	52.4	69.3	41
42	22.2	17.7	15.3	15.2	17.6	22.5	30.1	40.7	54.3	71.3	42
43	23.7	19.3	17.0	17.0	19.3	24.3	31.9	42.5	56.2	73.3	43
44	25.3	20, 9	18.6	18.6	21.0	26.0	33.8	44.4	58.2	75.3	44
45	3526.9	3622.5	3720.3	3820.3	3922.8	4027.8	4135.6	4246.3	4360.1	4477.2	45
46	28.5	24.1	21.9	22.0	24.5	29.6	37.4	48.1	62.0	79.2	46
47	30.1	25.7	23.6	23.7	26.2	31.4	39.2	50.0	63.9	81.2	47
48	31.6	27.3	25.2	25.4	28.0	33.1	41.0	51.9	65.9	83.2	48
49	33.2	29.0	26.9	27.1	29.7	34.9	42.9	53.8	67.8	85.2	49
50	3534.8	3630.6	3728.5	3828.7	3931.4	4036.7	4144.7	4255.6	4369.7	4487.2	50
51	36.4	32.2	30.2	30.4	33.2	38.5	46.5	57.5	71.7	89.1	51
52	37.9	33.8	31.8	32.1	34.9	40.2	48.3	59.4	73.6	91.1	52
53	39.5	35.4	33.5	33.8	36.6	42.0	50.2	61.3	75.5	93.1	53
- 04	41.1	37.0	35.1	30.5	38.4	43.8	52.0	63.1	17.4	95.1	- 54
55	3542.7	3638.6	3736.8	3837.2	3940.1	4045.6	4153.8	4265.0	4379.4	4497.1	55
56	44.3	40.3	38.4	38.9	41.8	47.4	55.7	66.9	81.3	99.1	50
57	45.9	41.9	40.1	40.6	43.6	49.1	07.0	08.8	83.2	4001.1	01
	47.4	43.0	41.7	42.3	40.3	50.9	09.3 61.1	10.1 70 E	80.2	05.1	50
- 09	49.0	40.1	40.4	40.0	41.0	04.1	01.1	12.0	01.1	00.1	00
М.	500	510	520	530	540	55°	560	570	580	590	M.
			04	00	UT I						

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TABLE 3.

Meridional Parts, or Increased Latitudes.

Comp. 1

						200.100					
М.	60°	61°	620	6:3°	640	650	66°	67°	68°	69°	М.
0	4507 1	4628 7	4754 3	4884_1	5018.4	5157.6	5302.1	5452.4	5609.1	5772.7	0
1	09.1	30.8	56.4	86.3	20.6	59.9	04.6	55.0	11.8	75.5	1
2	11.1	329	58.6	88.5	22.9	62.3	07.0	57.6	14.4	78.3	2
3	13.1	34.9	60.7	90.7	25.2	64.7	09.5	60.1	17.1	81.1	3
4	15.1	37.0	62.8	92.9	27.5	67.0	11.9	62.7	19.8	83.8	- +
5	4517.1	4639.0	4764.9	4895.1	5029.8	5169.4 71 o	0314.4	0400.2 67.9	$ \begin{array}{r} 5622.4 \\ 95.1 \end{array} $	9786.6 80.4	5 6
67	19.1	41.1	60 9	91.3	34.1	74.9	10.9	70.4	20.1 27.8	92.4	7
8	23.1	45.2	71.3	4901.7	36.6	76.5	21.8	72.9	30.5	95.1	8
9	25.1	47.3	73.5	03.9	38.9	78.9	24.3	75.5	33.2	95.9	9
10	4527.1	4649.4	4775.6	4906.1	5041.2	5181.3	5326.7	5477.1	5635.9	5800.7	10
11	29.1	51.5	77.8	08.3	43.5	83.7	29.2	80.7	38.5	03.5	11
12	31.1	53.5	79.9	10.5	45.8	86.0	31.7	83.2	41.2	06.3	12
13	55, 1 25, 1	50.6 57 7	81 9	12.8	50 4	90.8	36.6	88.4	46.6	11.9	14
14	4537 1	4659 7	4786 3	4917 2	5052 7	5193 2	5339 1	5491.0	5649.3	5814.7	15
10	39.2	61.8	88.5	19.4	55.0	95.6	41.6	93.6	52.0	17.6	16
17	41.2	63.9	90.6	21.6	57.3	98.0	44.1	96.2	54.7	20.4	17
18	43.2	66.0	92.8	23.9	59.6	5200.4	46.6	98.7	57.4	23.2	18
19	45.2	68.1	94.9	26.1	61.9	02.7	49.1	5501.3	60.1	26.0	19
20	4547.2	4670.1	4797.1	4928.3	5064.2	5205.1	5351.5	5503.9	5662.8	3828.9	20
21	49.2	71.2	99.2	30.5	69.0	07.5	04.0 56.5	00.5	62.9	31.7	21
22	01. 3 53 2	74.3	1001.4	35.0	71 1	12.3	59.0	11.7	70.9	37.4	23
23	55.3	78.5	05.7	37.2	73.4	14.7	61.5	14.3	73.7	40.2	24
25	4557.3	4680.6	4807.8	4939.4	5075.7	5217.1	5364.0	5516.9	5676.4	5843.0	25
26	59.3	82.6	10.0	41.7	78.1	19.5	66.5	19.5	79.1	45.9	26
27	61.4	84.7	12.1	43.9	80.4	21.9	69.0	22.1	81.8	48.7	27
28	63.4	86.8	14.3	46.1	82.7	24.3	71.5	24.7	84.5	51.6	28
29	65.4	88.9	16.5	48.4	85.0	26.7	14.0	5500 0	81.3	5057 0	- 29
30	4567.4	4691.0	4818.6	4950.6	5087.3	0229.1 .91 e	03/6.5	ээ29. 9 39 к	090.0	60 1	30
31	09.5 71.5	95.1	20.8	55 1	92.0	34 0	81.5	32.0 35.2	95.4	63.0	32
32	73.5	97.3	25.1	57.3	94.3	36.4	84.0	37.8	98.2	65.9	33
34	75.6	99.4	27.3	59.6	96.6	38.8	86.5	40.4	5700.9	68.7	34
35	4577.6	4701.5	4829.5	4961.8	5098.9	5241.2	5389.1	5543.0	5703.6	5871.6	35
36	79.6	03.6	31.6	64.1	5101.3	43.6	91.6	45.6	06.4	74.4	36
37	81.7	05.7	33.8	66.3	03.6	46.0	94.1	48.3	09.1	77.3	37
38	83.7	07.8	36.0	68.6 70.8	00.9	48.0	96.6	50.9 52 5	11.9 14 g	80.2 83 1	38
	4597 0	4719 0	1940 9	4972 1	5110 6	5252 2	5401 8	5556 1	5717.2	5885 0	40
40	89.8	14 1	42.5	75.3	12.9	55.7	04.2	58.8	20.1	88.8	41
42	91.8	16.2	44.7	77.6	15.3	58.2	06.7	61.4	22.8	91.7	42
43	93.9	18.3	46.8	79.8	17.6	60.6	09.2	64.0	25.6	94.6	43
44	95.9	20.4	49.0	82.1	19.9	63.0	11.8	66.7	28.3	97.4	44
45	4598.0	4722.5	4851.2	4984.3	5122.3	5265.4	5414.3	5569.3	5731.1	5900.3	45
46	4600.0	24.6	53.4	86.6	24.6	67.9	16.8	71.9	33.9	03.2	40
47	02.1	20.7	00.6 57 9	01 1	27.0	70.3	19.3	77.9	30.0 39.1	09.0	47
40	04.1 06.1	31.0	59.9	93.4	31.7	75.2	24.4	79.9	42.1	11.9	49
50	4608 2	4733.1	4862.1	4995.6	5134.0	5277.6	5427.0	5582.5	5744.9	5914.8	50
- 51	10.2	35.2	64.3	97.9	36.4	80.1	29.5	85.2	47.7	17.7	51
52	12.3	37.3	66.5	5000.2	38.7	82.5	32.0	87.8	50.4	20.6	52
53	14.3	39.4	68.7	02.4	41.1	85.0	34.6	90.5	53.2	23.5	53
54	16.4	41.6	70.9	04.7	43.4	87.4	37.1	93.1	5750.0	20.4	- 04
55	4618.5	4743.7	4873.1	5007.0	0145.8	0289.8	0 1 39.7	00 4	0758.8 61 5	0929.3 29 9	00 56
00 57	20. 5 92. 6	40.8	77 5	09.3	48.1 50.5	92.3	42.2	$5601 \ 1$	64 3	32.2 35.1	57
58	24.6	50.0	79.7	13.8	52.8	97.2	47.3	03.8	67.1	38.1	58
59	26.7	52.2	81.9	16.1	55.2	. 99.7	49.9	06.4	69.9	41.0	59
М.	60°	61°	62°	630	640	65°	66°	670	68°	690	М.
TABLE 3.

[Page 465

Meridional Parts, or Increased Latitudes.

Comp. <u>1</u> 293.465

M. 700 719 729 739 740							230.400					
$ 0 5943.9 6123.5 6312.5 6512.0 6723.2 6947.7 7187.3 7444.4 7721.6 8022.7 0 \\ 1 46.8 20.6 15.8 15.4 20.8 51.6 91.5 48.8 26.4 772.7 18 \\ 249.7 29.7 13.0 18.8 15.4 20.8 51.4 90.6 53.3 31.3 33.2 2 \\ 352.6 32.8 22.5 22.7 34.1 59.3 90.7 774.5 8049.0 5 \\ 61.6 33.8 52.8 22.5 37.7 60.2 7406.7 7745.8 8049.0 5 \\ 61.6 61.6 42.0 32.9 32.4 44.7 70.9 12.2 71.1 50.6 54.3 5 \\ 61.6 42.0 32.9 32.0 44.0 70.9 12.2 71.1 50.6 54.3 5 \\ 61.7 64.7 34.8 32.9 32.0 54.6 57.7 51.6 51.2 70.6 54.3 5 \\ 61.7 64.7 34.8 32.9 32.0 54.6 57.7 57.7 50.6 54.3 5 \\ 61.7 64.7 34.8 33.9 54.5 54.2 77.8 71.6 57.7 50.6 54.3 5 \\ 91.0 5073.2 6154.4 6345.0 6546.4 6759.7 6986.5 7228.9 7480.1 7770.1 8075.5 10 \\ 11 5703.2 6154.4 6345.0 6546.4 6759.7 6986.5 7228.9 7480.1 7770.1 8075.5 10 \\ 12 70.6 68.8 58.1 60.2 74.3 7002.2 45.7 70.7 18.6 698.8 11 \\ 15 5086.0 6169.9 668.1 6667.7 677.6 70.06.1 7249.9 7511.7 77.4 58.102.2 15 \\ 14 85.0 66.8 58.1 60.2 74.3 7002.2 45.7 70.1 80.6 68.8 11 \\ 15 5086.0 6109.9 630.1 667.9 67.7 6728.0 61.7 724.9 7511.7 77.4 58.102.2 15 \\ 17 90.9 76.1 67.9 70.7 6728.0 705.6 724.8 30.7 71.8 80.8 12.2 23.7 70.4 33.5 27.7 80.4 31.9 22 \\ 6002.8 6185.5 6377.8 658.1 0 6786.5 7005.8 720.7 758.4 7819.1 31.8 $	М.	70°	710	720	73°	74°	75°	76°	770	78°	79°	М.
0 0 0 0 0 0 0 0 1 0	0	5012 0	6192 5	6219 5	6519 0	6793-9	60.17 7	7197 2	71.11 1	7791 6	8099 7	0
$ \begin{array}{c c c c c c c c c c c c c c c c c c c $	1	46.8	26.6	15.8	15.4	26.8	51.6	91.5	48.8	26.4	27.9	1
3 52.7 32.8 22.3 34.1 59.3 90.7 57.7 36.1 38.5 3 4 55.5 635.8 632.5 25.5 25.7 37.7 77.7 30.1 20.9 90.2 20.9 90.0 53.6 54.3 66 61.5 54.3 66 61.5 54.3 66 61.6 54.3 66 66.3 54.3 66 66.6 55.5 55.3 78.7 20.5 80.1 60.3 64.9 8 9 -70.3 51.3 41.8 42.9 56.0 82.6 24.7 84.6 65.7 70.1 90.75 10 90.5 91.6 170.1 90.75 10 90.5 10 93.6 74.9 90.8 81.1 12 12 79.1 60.6 53.1 60.2 74.3 70.7 98.3 41.5 750.2 68.4 14 13 82.0 66.69 83.1 66 70.2 70.7 98.3 41.1 15.5 70.7 79.8.3 11.1 774.4 80.1 <td>2</td> <td>49.7</td> <td>29.7</td> <td>19.0</td> <td>18.9</td> <td>30.5</td> <td>55.4</td> <td>95.6</td> <td>53.3</td> <td>31.3</td> <td>$\frac{21.0}{33.2}$</td> <td>2</td>	2	49.7	29.7	19.0	18.9	30.5	55.4	95.6	53.3	31.3	$\frac{21.0}{33.2}$	2
4 55.6 35.8 25.7 37.7 63.2 7203.9 922.2 40.0 43.7 4 5 5058.5 6138.9 6232.8 622.9 1674.1 6067.1 712.9 711.1 50.6 54.3 6 5.7 78.8 67.3 448.2 33.3 30.6 48.7 74.8 16.4 75.6 55.5 59.6 6 7.7 8 6 55.5 59.6 6 7.7 8 6 6.5 72.8 78.7 20.5 80.1 605.2 70.2 9 10 597.2 57.5 48.8 63.3 90.4 33.1 95.6 74.8 70.7 98.3 41.5 705.2 88.11 11 80.5 160.6 51.6 50.8 70.7 98.3 41.5 776.0 8.8 11.5 778.4 80.1 12.9 97.5 18.3 90.9 73.0 66.7 70.5 18.4 77.6 28.8 66.7	3	52.7	32.8	22.3	22.3	34.1	59.3	99.7	57.7	36.1	38.5	3
5 5958.5 6138.9 6328.8 6529.1 6741.4 6067.1 7208.0 7466.7 7745.8 745.8 8049.0 5 6 61.5 42.0 32.0 32.0 32.0 32.0 32.0 32.0 35.5 52.3 78.7 72.0 5 80.7 64.4 45.1 55.0 82.6 24.7 84.6 65.2 70.2 9 9 -70.3 51.3 41.8 42.9 56.0 82.6 24.7 84.6 65.5 70.5 10 10 507.3 48.3 49.8 63.3 90.4 73.3 78.1 77.0 80.8 11 12 79.1 79.6 88.1 12 13.8 80.9 610.9 636.1 665.7 677.8.0 700.2 45.7 70.1 80.6 81.1 14.5 598.6 617.2 79.6 81.4 79.5 10.0 64.1 16.2 99.4 07.5 16 17.7 18.9 99.4 07.5 16 17.9 79.5 10.3 18.1 18.9 99.4 11.3	4	55.6	. 35. 8	25.5	25.7	37.7	63.2	7203.9	62.2	40.9	43.7	4
6 6 6 7 64.4 45.1 33.3 36.0 48.7 74.8 16.4 75.6 55.5 59.6 77 8 67.3 48.2 38.5 39.5 52.3 78.7 20.5 80.1 60.6 55.5 59.6 77 29.7 10 597.3 2 18.4 42.9 56.0 82.6 722.4 7.84.6 65.2 70.2 9 10 597.3 2 61.6 53.3 67.0 94.3 37.3 98.1 77.9 80.6 81.1 12 79.1 60.6 51.6 53.3 67.7 97.9 83.3 11.5 598.6 67.1 81.7 77.0 83.3 11.5 77.6 83.8 11.7 79.9 75.1 80.6 9.6 80.1 11.3 81.1 17.9 62.5 25.0 70.0 83.4 14.0 93.8 13.9 96.8 90.2 71.2 74.4 88.1 14.9 93.9 14.1 81.9 14.1 81.9 14.1 81.9 <td>5</td> <td>5958.5</td> <td>6138.9</td> <td>6328.8</td> <td>6529.1</td> <td>6741.4</td> <td>6967.1</td> <td>7208.0</td> <td>7466.7</td> <td>7745.8</td> <td>8049.0</td> <td>5</td>	5	5958.5	6138.9	6328.8	6529.1	6741.4	6967.1	7208.0	7466.7	7745.8	8049.0	5
i 64.4 45.1 33.5 30.0 48.7 74.8 10.4 75.0 50.0 30.6 77.0 10.6 30.3 61.3 41.8 42.9 56.0 82.6 24.7 84.6 60.3 60.3 64.9 8 10 597.2 615.4 635.5 636.4 675.9 78.7 29.8 748.0 77.0 18.07.5 10 11 76.2 57.5 48.3 49.8 633.3 90.4 33.1 79.8 86.1 12 12 79.1 60.6 53.6 70.7 98.3 41.5 7502.6 84.7 91.5 13 13 85.0 666.8 58.1 60.2 74.3 700.2 45.7 70.1 89.6 80.8 11 18.5 86.7 97.1.2 77.4 18.0 17.0 65.4 11.0 65.3 11.7 79.4 43.5 29.2 25.5 20.6 10.3 10.3 10.3	6	61.5	42.0	32.0	32.6	45.0	70.9	12.2	71.1	50.6	54.3	6
a a <	6	64.4	45.1	30.3	30.0	48.7	79.7	10.4	10.0	00.0 20.9	59.6 61.0	1
$ \begin{array}{ c c c c c c c c c c c c c c c c c c c$	0	07.5	40.2	41 8	19 9	56.0	82 6	20.0	81 B	65 2	04.9 70.9	0
$ \begin{array}{ c c c c c c c c c c c c c c c c c c c$	10	5973 2	6154 4	6345 0	6546 4	6759 7	6986 5	7998 0	7.189 1	7770 1	8075 5	10
$ \begin{array}{cccccccccccccccccccccccccccccccccccc$	11	76.2	57.5	48.3	49.8	63.3	90.4	33.1	93.6	74.9	80.8	11
13 82.1 63.7 54.8 56.7 70.7 98.3 41.5 7502.6 84.7 91.5 13 15 5998.0 6169.9 6361.4 6563.7 677.8 0 7006.1 7249.9 7511.7 7794.5 8102.2 15 16 90.9 73.0 64.7 677.1 81.7 10.0 54.1 16.2 90.4 07.5 180.2 15 17 93.6 77.2 71.2 74.1 80.1 17.9 62.5 25.3 09.3 09.4 12.2 17 18 18.2 18.3 18 18 12.2 10.5 88.8 68.1 18.4.5 6800.2 29.7 75.2 38.9 24.1 34.5 21.0 13.4 48.5 6800.2 29.7 75.2 38.9 24.1 34.5 21.0 35.7 78.1 74.4 35.9 22.1 13.4 44.6 29.0 29.0 23.5 49.6 69.2 757	12	79.1	60.6	51.6	53.3	67.0	94.3	37.3	98.1	79.8	86.1	12
$\begin{array}{c ccccccccccccccccccccccccccccccccccc$	13	82.1	63.7	54.8	56.7	70.7	98.3	41.5	7502.6	84.7	91.5	13
15 5988.0 6169.9 6361.4 6503.7 677.8 7006.1 7249.9 7511.7 7749.5 8102.2 15 16 90.9 73.0 64.7 67.1 81.7 10.0 554.1 14.0 558.3 20.7 7904.3 12.9 17 18 966.9 79.2 71.2 74.1 89.1 17.9 62.5 25.3 90.3 18.3 18 19 990.8 82.3 74.5 77.6 92.8 71.2 759.4 731.4 719.1 812.9 17 20 6602.8 6185.5 6377.8 658.1 18.4 860.2 29.7 75.2 38.9 24.1 34.5 21.3 34.5 21.3 34.5 21.3 35.6 29.0 30.9 22.3 21.1 6394.3 6598.5 6815.0 7045.6 7292.2 7557.3 784.4 8166.2 25 27.2 255.3 760.7 37.4 41.8 48.9 61.6 26 27.7 23.6 607.4 6402.0 91.5 22.5 53.	14	85.0	66.8	58.1	60.2	74.3	7002.2	45.7	07.1	89.6	96.8	14
$ \begin{array}{ccccccccccccccccccccccccccccc$	15	5988.0	6169.9	6361.4	6563.7	6778.0	7006.1	7249.9	7511.7	7794.5	8102.2	15
$ \begin{array}{ccccccccccccccccccccccccccccc$	$16 \\ 17$	90.9	73.0	64.7	67.1	81.7	10.0	54.1	16.2	99.4	07.5	16
	17	93.9	76.1	67.9	70.6	80.4	14.0	58.3	20.7	7804.3	12.9	17 10
	10	90.9	19.2 89.3	71.2	77 6	99.1	21.8	66 7	20.5	11 9	18.5	18
$ \begin{array}{c ccccccccccccccccccccccccccccccccccc$		6002 8	6185 5	6377 8	6581 0	8706 5	7025 8	7970.0	7591.4	7810 1	<u>20.7</u> 9190 1	- 10
$\begin{array}{c ccccccccccccccccccccccccccccccccccc$	20	05.8	88.6	81.1	84.5	6800.2	29.7	75.2	38.9	24.1	34.5	$\frac{20}{21}$
$\begin{array}{c c c c c c c c c c c c c c c c c c c $	22	08.7	91.7	84.4	88.0	03.9	33.7	79.4	43.5	29.0	39.9	22
24 14,7 98,0 91.0 95.0 11.3 41.6 87.9 757.3 7844.0 8156.2 25 26 20.7 04.2 97.6 6602.0 18.8 49.6 96.4 61.8 84.0 96.4 61.8 84.9 96.4 61.8 84.9 96.4 61.8 84.9 96.4 61.8 84.9 96.4 61.8 84.9 96.4 61.8 84.9 96.4 61.5 06.3 97.6 66.2 27.5 50.5 71.0 58.9 72.6 28 26.6 10.5 04.3 09.0 26.5 7313.5 7580.3 7868.9 8183.5 30 31 35.6 20.0 14.2 19.6 37.4 469.5 7313.5 7580.3 7868.9 8183.5 30 32 38.6 23.1 17.6 32.1 41.2 73.5 22.1 89.5 79.0 94.5 32 33 41.6 26.3 20.9 </td <td>23</td> <td>11.7</td> <td>94.8</td> <td>87.7</td> <td>91.5</td> <td>07.6</td> <td>37.7</td> <td>83.7</td> <td>48.1</td> <td>34.0</td> <td>45.3</td> <td>23</td>	23	11.7	94.8	87.7	91.5	07.6	37.7	83.7	48.1	34.0	45.3	23
256017.76201.16394.36588.56815.07045.67292.27557.37844.08156.2252620.704.297.66602.018.849.696.461.848.961.6262723.607.46400.905.522.553.57300.766.445.997.662929.6613.707.612.530.0615.509.275.763.978.029306032.66216.86410.96616.16833.77065.57313.57580.37868.98183.5303135.620.014.219.637.469.517.884.974.089.0313238.623.117.623.141.273.522.189.579.094.5323341.626.320.926.644.977.526.494.284.0820.0333444.629.424.230.248.781.530.7708.4789.115.53650.635.830.937.256.289.539.308.199.216.6363753.638.934.240.860.093.543.612.87904.222.11373856.642.137.6641.3637.7710.652.322.114.433.33959.745.340.947.9	24	14.7	98.0	91.0	95.0	11.3	41.6	87.9	52.7	39.0	50.8	24
$ \begin{array}{c ccccccccccccccccccccccccccccccccccc$	25	6017.7	6201.1	6394.3	6598.5	6815.0	7045.6	7292.2	7557.3	7844.0	8156.2	25
$\begin{array}{c ccccccccccccccccccccccccccccccccccc$	26	20.7	04.2	97.6	6602.0	18.8	49.6	96.4	61.8	48.9	61.6	26
$\begin{array}{cccccccccccccccccccccccccccccccccccc$	27	23.6	07.4	6400.9	05.5	22.5	53.5	7300.7	66.4	53.9	67.1	27
$\begin{array}{c ccccccccccccccccccccccccccccccccccc$	28 20	20.0 20.6	10.0	04.3	19.0	26.2	07.0 61.5	00.0			72.0	28
3135.620.014.219.637.4605.5717.884.974.089.0313238.623.117.623.141.273.522.189.579.094.5323341.626.320.926.644.977.526.494.284.08200.0333444.629.424.230.248.781.530.798.889.105.534356047.66232.66427.66633.76852.47085.57335.07603.47894.18211.1353650.635.830.937.256.289.539.308.199.216.6363755.638.934.240.860.093.543.612.87904.222.1373856.642.137.644.363.797.647.917.409.327.7383959.745.340.947.967.57101.652.322.114.433.339406062.76248.46444.36651.46871.37105.67356.67626.87919.48238.8404165.751.647.6655.075.109.760.640.834.755.663.0424371.758.054.462.182.617.869.640.834.755.664.14445.6677.8 <td>30</td> <td>6032 6</td> <td>6216 8</td> <td>6410.9</td> <td>6616 1</td> <td>6833 7</td> <td>7065.5</td> <td>7313 5</td> <td>7580 3</td> <td>7868 0</td> <td>8183 5</td> <td>- 20</td>	30	6032 6	6216 8	6410.9	6616 1	6833 7	7065.5	7313 5	7580 3	7868 0	8183 5	- 20
3238.623.117.623.141.273.522.189.579.094.5323341.626.320.926.644.977.526.494.284.08200.0333444.629.424.230.248.781.530.798.889.105.534356047.66232.66427.66633.76852.47085.57335.07603.47894.18211.1353650.635.830.937.256.289.539.308.199.216.6363753.638.934.240.860.093.543.612.87904.222.1373856.642.137.644.3663.797.647.917.409.327.7383959.745.340.947.967.57101.652.322.114.433.339406062.76248.46444.36651.46871.37105.6736.67626.87919.48238.8404165.751.647.655.075.109.760.931.424.544.4414268.754.851.058.578.913.765.336.129.650.0424371.758.054.462.182.617.869.640.834.755.6434474.881.257.76	31	35.6	20.0	14.2	19.6	37.4	69.5	17.8	84.9	74.0	89.0	31
$\begin{array}{c ccccccccccccccccccccccccccccccccccc$	32	38.6	23.1	17.6	23.1	41.2	73.5	22.1	89.5	79.0	94.5	32
3444.629.424.230.248.781.530.798.889.105.534356047.66232.66427.66633.76852.47085.57335.07603.47894.18211.1353650.635.830.937.256.289.539.308.199.216.6363753.638.934.240.860.093.543.612.87904.222.1373856.642.137.644.363.797.647.917.409.327.7383959.745.340.947.967.57101.652.322.114.433.339406062.76248.46444.36651.46871.37105.67356.67626.87919.48238.8404165.751.647.655.075.109.760.931.424.544.4414268.754.851.058.578.913.765.336.129.650.0424371.758.054.462.182.617.869.640.834.755.6434474.8612.257.765.786.421.874.045.539.961.244456077.86264.46461.16669.26890.27125.97378.37650.27945.08266.8454680.867.6 <td>- 33</td> <td>41.6</td> <td>26.3</td> <td>20.9</td> <td>26.6</td> <td>44.9</td> <td>77.5</td> <td>26.4</td> <td>94.2</td> <td>84.0</td> <td>8200.0</td> <td>- 33</td>	- 33	41.6	26.3	20.9	26.6	44.9	77.5	26.4	94.2	84.0	8200.0	- 33
$\begin{array}{c ccccccccccccccccccccccccccccccccccc$	34	44.6	29.4	24.2	30, 2	48.7	81.5	30.7	98.8	89.1	05.5	34
3650.635.830.937.256.289.539.308.199.216.6363753.638.934.240.860.093.543.612.87904.222.1373855.642.137.644.366.797.647.917.409.327.7383959.745.340.947.967.57101.652.322.114.433.339406062.76248.46444.36651.46871.37105.67356.67626.87919.48238.8404165.751.647.655.075.109.760.931.424.544.4414268.754.851.058.578.913.765.336.129.650.0424371.758.054.462.182.617.869.640.834.755.6434474.861.257.765.786.421.874.045.539.961.244456077.86264.46461.16669.26890.27125.9737.8.37650.27945.08266.8454680.867.664.572.894.029.982.755.050.172.4464788.974.071.280.06901.738.191.464.460.483.7484989.977.274.6	35	6047.6	6232.6	6427.6	6633.7	6852.4	7085.5	7335.0	7603.4	7894.1	8211.1	35
$\begin{array}{c ccccccccccccccccccccccccccccccccccc$	36	50.6	35.8	30.9	37.2	56.2	89.5	39.3	08.1	99.2	16.6	36
$\begin{array}{c ccccccccccccccccccccccccccccccccccc$	37	56 C	38.9	34.2	40.8	60.0	93.0	43.6	12.8	7904.2	22.1	37
30 30.7 30.8 10.6 11.6 10.76 110.76 7356.6 722.1 $11.7.4$ 336.8 30 40 6062.7 6248.4 6444.3 6651.4 6871.3 7105.6 7356.6 7626.8 7919.4 8238.8 40 41 65.7 51.6 47.6 55.0 75.1 99.7 60.9 31.4 24.5 44.4 41 42 68.7 54.8 51.0 58.5 78.9 13.7 65.3 36.1 29.6 50.0 42 43 71.7 58.0 54.4 62.1 82.6 17.8 69.6 40.8 34.7 55.6 43 44 74.8 61.2 57.7 65.7 66.7 80.6 40.8 34.7 55.6 43 44 74.8 612.2 57.7 65.7 86.4 21.8 74.0 45.5 39.9 61.2 44 45 6077.8 6264.4 6461.1 6669.2 6890.2 7125.9 7378.3 7650.2 7945.0 8266.8 45 46 80.8 67.6 64.5 72.8 94.0 29.9 82.7 55.0 50.1 72.4 46 47 83.9 70.8 67.8 76.4 97.8 34.0 87.1 59.7 55.2 78.1 47 48 86.9 74.0 71.2 80.0 6901.7 38.1 91.4 64.4 60.4 <td>39</td> <td>59.7</td> <td>42.1</td> <td>40.9</td> <td>44.5</td> <td>67.5</td> <td>7101 6</td> <td>47.9</td> <td>99 1</td> <td>14 4</td> <td>21.1</td> <td>20</td>	39	59.7	42.1	40.9	44.5	67.5	7101 6	47.9	99 1	14 4	21.1	20
4165.751.647.655.078.913.760.070.0.070.0.170.1.4200.8414268.751.647.655.078.913.765.336.129.650.0424371.758.054.462.182.617.869.640.834.755.6434474.861.257.765.786.421.874.045.539.961.244456077.86264.46461.16669.26890.27125.97378.37650.27945.08266.8454680.867.664.572.894.029.982.755.050.172.4464783.970.867.876.497.834.087.159.755.278.1474886.974.071.280.06901.738.191.464.460.483.7484989.977.274.683.505.542.295.869.165.589.349506093.06280.46478.06687.16909.37146.27400.27673.97970.78295.0505199.186.884.894.316.954.409.083.481.006.452536102.190.083.297.920.858.513.488.186.212.0535405.293.2	40	6062 7	6248 4	6444 2	6651 J	6871 2	7105 6	7356 6	7626.8	7919 4	8238 8	-40
4268.754.851.058.578.913.765.336.124.650.0424371.758.054.462.182.617.869.640.834.755.6434474.861.257.765.786.421.874.045.539.961.244456077.86264.46461.16669.26890.27125.97378.37650.27945.08266.8454680.867.664.572.894.029.982.755.050.172.4464783.974.071.280.06901.738.191.464.460.483.7484989.977.274.683.505.542.295.869.165.589.349506093.06280.46478.06687.16909.37146.27400.27673.97970.78295.0505196.083.681.490.713.150.304.678.675.98300.7515299.186.884.894.316.954.409.083.481.006.452536102.190.083.297.990.858.513.488.186.212.0535405.293.291.66701.524.662.617.892.991.417.754556108.26296.46495.0 </td <td>41</td> <td>65.7</td> <td>51.6</td> <td>47.6</td> <td>55.0</td> <td>75.1</td> <td>09.7</td> <td>60.9</td> <td>31.4</td> <td>24.5</td> <td>44.4</td> <td>41</td>	41	65.7	51.6	47.6	55.0	75.1	09.7	60.9	31.4	24.5	44.4	41
$\begin{array}{c ccccccccccccccccccccccccccccccccccc$	$\overline{42}$	68.7	54.8	51.0	58.5	78.9	13.7	65.3	36.1	29.6	50.0	42
$ \begin{array}{c c c c c c c c c c c c c c c c c c c $	43	71.7	58.0	54.4	62.1	82.6	17.8	69.6	40.8	34.7	55.6	43
$ \begin{array}{c ccccccccccccccccccccccccccccccccccc$	44	74.8	61.2	57.7	65.7	86.4	21.8	74.0	45.5	39.9	61.2	44
$ \begin{array}{c ccccccccccccccccccccccccccccccccccc$	45	6077.8	6264.4	6461.1	6669.2	6890.2	7125.9	7378.3	7650.2	7945.0	8266.8	45
$\begin{array}{c ccccccccccccccccccccccccccccccccccc$	46	80.8	67.6	64.5	72.8	94.0	29.9	82.7	55.0	50.1	72.4	46
$ \begin{array}{c ccccccccccccccccccccccccccccccccccc$	47	83.9	70.8	67.8	76.4	97.8	34.0	87.1	59.7	55.2	78.1	47
$ \begin{array}{c ccccccccccccccccccccccccccccccccccc$	40	89.9	77.9		83.5	05 5	49 9	91.4	69 1	65 5	80.3	40
$ \begin{array}{c ccccccccccccccccccccccccccccccccccc$		6093.0	6280 4	6178 0	6687 1	6000 3	7146 2	7400.2	7673 9	7970 7	8205 0	- 50
$ \begin{array}{c ccccccccccccccccccccccccccccccccccc$	51	96.0	83.6	81.4	90.7	13.1	50.3	04.6	78.6	75.9	8300.7	51
$ \begin{array}{c ccccccccccccccccccccccccccccccccccc$	$5\overline{2}$	99.1	86.8	84.8	94.3	16.9	54.4	09.0	83.4	81.0	06.4	52
$ \begin{array}{c ccccccccccccccccccccccccccccccccccc$	53	6102.1	90.0	88.2	97.9	20.8	58.5	13.4	88.1	86.2	12.0	53
$ \begin{array}{c ccccccccccccccccccccccccccccccccccc$	54	05.2	93.2	91.6	6701.5	24.6	62.6	17.8	92.9	91.4	17.7	54
$ \begin{array}{c ccccccccccccccccccccccccccccccccccc$	55	6108.2	6296.4	6495.0	6705.1	6928.4	7166.7	7422.2	7697.7	7996.6	8323.4	55
$ \begin{array}{c ccccccccccccccccccccccccccccccccccc$	56	11.3	99.6	98.4	08.7	32.3	70.8	26.6	7702.5	8001.8	29.2	56
$ \begin{array}{c ccccccccccccccccccccccccccccccccccc$	07 58	14.3 17.4	0302,9	05 9	12.4	1.06 10.0	70.0	31.1	12 0	19.9	34.9 40 e	07 50
M. 70° 71° 72° 73° 74° 75° 76° 77° 78° 79° M.	59	20.5	09.3	05.2	19.6	43.8	83.2	39.9	16.8	12.2 17.5	46.4	59
M. 70° 71° 72° 73° 74° 75° 76° 77° 78° 79° M.		-0.0			1010	10.0	00.2	50.0	10.0	1110	51.2	
	М.	70°	710	720	73°	7.40	750	760	770	780	790	М.

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TABLE 4.

Length	of	a Des	gree in	ı L	atitude	e and	Longitude.
TOUR OIL	· • •				ce ca c ca ca ca	C	ano an matter of

		Degree of Long.			Degree of Lat.		Tet
Lat.	Naut. miles.	Statute miles.	Meters.	Naut. miles.	Statute miles.	Meters.	Lat.
0							0
0	60,068	69.172	$111 \ 321$	59.661	68.704	110 567	0
1	0.059	9.162	1 304	. 661	. 704	568	1
2	0.031	9.130	1 253	. 662	. 705	569	2
3	59,986	9.078	1 169	. 663	. 706	570	3
4	9,922	9.005	$1 \ 051$. 664	. 708	573	4
5	59,840	68,911	110 900	59,666	68,710	110 576	5
Ğ	9, 741	8, 795	0 715	. 668	. 712	580	6
7	9,622	8,660	0 497	. 670	. 715	584	7
8	9,487	8, 504	0 245	. 673	. 718	589	8
ğ	9, 333	8.326	109 959	. 676	. 721	595	ğ
10	59.161	68, 129	109 641	59,680	68.725	110 601	10
11	8 971	7,910	9 289	. 684	730	608	11
$\hat{12}$	8.764	7.670	8 904	687	. 734	616	12
13	8, 538	7,410	8 486	692	. 739	624	13
14	8.295	7.131	8 036	. 697	. 744	633	14
15	58,034	66, 830	107 553	59, 702	68, 751	110 643	15
16	7,756	6,510	7 036	. 707	. 757	653	$1\tilde{6}$
17	7,459	6,169	6 487	. 713	. 764	663	17
18	7.146	5,808	5 906	. 719	. 771	675	18
19	6.816	5.427	5 294	.725	. 778	686	19
20	56,468	65,026	104 649	59,732	68.786	110 699	20
21	6,102	4,606	3 972	. 739	. 794	712	21
22	5.720	4.166	3 264	. 746	. 802	725	22
23	5.321	3,706	2524	. 754	. 811	739	23
24	4.905	3.228	1 754	. 761	. 820	753	24
25	54,473	62.729	100 952	59.769	68.829	110 768	25
26	4.024	2.212	0 119	· .777	. 839	783	26
27	3.558	1.676	$99 \ 257$. 786	. 848	799	27
28	3.076	1.122	$8 \ 364$. 795	. 858	815	28
29	2.578	0.548	7 441	. 804	. 869	832	29
30	52.064	59.956	96 488	59.813	68.879	110 849	30
31	1.534	9.345	5 506	. 822	. 890	866	31
32	0.989	8.716	4 495	. 831	. 901	883	32
33	0.428	8.071	3 455	. 841	. 912	901	- 33
34	49.851	7.407	$2 \ 387$. 851	. 923	919	34
35	49, 259	56.725	91 290	59.861	68.935	110 938	35
36	8.653	6.027	$0 \ 166$. 871	. 946	956	36
37	8.031	5.311	89 014	. 881	. 958	975	37
38	7.395	4:579	7 835	. 891	. 969	994	38
39	6.744	3, 829	6 629	. 902	. 981	111 013	39
40	46.079	53.063	85 396	59.912	68.993	$111 \ 033$	40
41	5.399	2.281	$4 \ 137$. 923	69.006	052	41
42	4.706	1.483	2 853	. 933	. 018	072	42
43	4.000	0.669	1 543	. 944	. 030	091	43
44	3.280	49.840	0.208	. 954	. 042	111	44

TABLE 4.

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Length of a Degree in Latitude and Longitude.

		Degree of Long.			Degree of Lat.		
Lat.	Naut. miles.	Statute miles.	Meters.	Naut. miles.	Statute miles.	Meters.	Lat.
0							0
45	42,546	48.995	78 849	. 59.965	69.054	111 131	45
46	1.801	8.136	7 466	. 976	. 066	151	46
47	1.041	7.261	$6 \ 058$. 987	. 079	170	47
48	0.268	6.372	4628	.997	. 091	190	48
49	39, 484	5,469	3 174	60.008	. 103	210	49
50	38 688	44.552	71 698	60.019	69,115	111 229	50
51	7 880	3 621	0 200	. 029	. 127	249	51
52	7 060	2 676	68 680	039	139	268	52
52	6 229	1 719	7 140	050	151	287	53
54	5 386	0 749	5 578	. 060	163	306	54
55	24 599	20.766	63 006	60.070	69 175	111 395	55
50	04.004	9 771	9 305	00.070	03.170	3/13	56
50	5.000	7 764		. 000	107	260	57
01.	2.794	6 745	50 125	. 090	. 197	200	59
58	1.909	5 716	09 100	.100	. 209		50
- 99	1.015	0.710	1 410	. 109	. 220	007	- 09
60	30.110	34.674	55 802	60.118	69, 230	111 415	60
61	29.197	3.623	4 110	. 128	. 241	432	61
62	8.275	2.560	2 400	. 137	. 251	448	62
63	7.344	1.488	0 675	.145	. 261	464	63
64	6.404	0.406	48 934	. 154	. 271	480	64
65	25.456	29.315	47 177	60.162	69.281	$111 \ 496$	65
66	4.501	8.215	5 407	. 170	. 290	511	66
67	3. 538	7.106	3 622	.178	. 299	525	67
68	2.567	5.988	1 823	. 186	. 308	539	68
69	1.590	4.862	$0 \ 012$. 193	. 316	553	69
70	20,606	23.729	38 188	60.200	69.324	111 566	70
71	19.616	2.589	6 353	. 207	. 332	578	71
72	8,619	1.441	4 506	. 213	. 340	590	72
73	7.617	0.287	2648	. 220	. 347	602	73
74	6,609	19.127	0 781	. 225	. 354	613	74
75	15.596	17.960	28 903	60, 231	69.360	111 623	75
76	4 578	6.788	7 017	. 236	. 366	633	76
77	3 556	5.611	5 123	. 241	372	642	77
78	2529	4,428	3 220	. 246	377	650	78
79	1 499	3 242	1 311	. 250	. 382	658	79
	10 465	12 051	10 304	60.254	60 386	111 665	80
00 91	0 400	10.857	7 479	957	300	671	81
60	0.420	0.650	5 5.15	- 207	304	677	82
02	0,000	8 459	0 0±0 2 610	. 200	- 004	629	82
80	6 200	7 955	0 012 1 675	. 203	. 397	697	84
	0.300	1.200	1 0/0	, 200	. 400	111 007	04
85	5.253	6.049	9 735	60.268	69.402	111 691	80
86	4.205	4.842	1 192	. 269	.404	694	80
87	3.154	3.632	5 846	. 270	. 405	696	87
88	2.103	2.422	3 898	. 271	. 407	698	88
89	1.052	1.211	1 949	. 272	. 407	699	89
00	0	0	0	. 272`	407	699	- 90

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TABLE 5A.

Distance of an Object by Two Bearings.

Difference between the course and second				Dif	erence	betweer	the cou	irse and	first bea	ring, in	points,			
points.	3	2	21	1/4	2	1/2	2	74	;	3	3	1/4	3	1/2
$\begin{array}{c} 3 \\ 3 \\ 3 \\ 3 \\ 4 \\ 4 \\ 4 \\ 5 \\ 5 \\ 5 \\ 5 \\ 5 \\ 6 \\ 6 \\ 6 \\ 6 \\ 6$	$\begin{array}{c} 1.96\\ 1.57\\ 1.32\\ 1.14\\ 1.00\\ 0.81\\ 1.00\\ 0.81\\ 0.64\\ 0.57\\ 0.50\\ 0.48\\ 0.42\\ 0.442\\ 0.442\\ 0.442\\ 0.442\\ 0.39\\ 0.38\\ 0$	$\begin{array}{c} 1.09\\ 0.94\\ 0.761\\ 0.663\\ 0.553\\ 0.0552\\ 0.0552\\ 0.047\\ 0.0663\\ 0.555\\ 0.0552\\ 0.047\\ 0.0445\\ 0.00\\ 0.0444\\ 0.00\\ 0.038\\ 0.0355\\ 0.0335\\ 0.0332\\ 0.0335\\ 0.0332\\ 0.0332\\ 0.0332\\ 0.0332\\ 0.0332\\ 0.0332\\ 0.00\\ 0.0228\\ 0.00\\ 0.0228\\ 0.00$	$\begin{array}{c} 2\\ 2,19\\ 1,76\\ 1,47\\ 1,12\\ 1,00\\ 0,913\\ 0,72\\ 0,684\\ 0,055\\ 3,55\\ 0,5531\\ 0,0445\\ 0,443\\ 0,433\\ 0,433\\ 0,433\\ 0,443\\ 0,443\\ 0,443\\ 0,443\\ 0,443\\ 0,443\\ 0,443\\ 0,443\\ 0,443\\ 0,443\\ 0,443\\ 0,443\\ 0,443\\ 0,443\\ 0,443\\ 0,443\\ 0,443\\ 0,443\\ 0,445\\ 0,551\\ 0,555\\ 0,55$	$\begin{smallmatrix} & & \\ & & \\ 1.31 \\ 1.12 \\ 0.990 \\ 0.83 \\ 0.77 \\ 0.769 \\ 0.661 \\ 0.557 \\ 0.554 \\ 0.551 \\ 0.554 \\ 0.551 \\ 0.550 \\ 0.443 \\ 0.443 \\ 0.440 \\ 0.388 \\ 0.354 \\ 0.331 \\ 0.332 \\ 0.331 \\ 0.329 \\ 0.226 \\ 0.244 \\ 0.40 \\ 0.384 \\ 0.331 \\ 0.228 \\ 0.224 \\ 0.41 \\ 0.40 \\ 0.384 \\ 0.331 \\ 0.329 \\ 0.226 \\ 0.224 \\ 0.41 \\ 0.420 \\ 0.331 \\ 0.329 \\ 0.226 \\ 0.224 \\ 0.41 \\ 0.41 \\ 0.41 \\ 0.41 \\ 0.420 \\ 0.331 \\ 0.320 \\ 0.224 \\ 0.41 \\ 0.41 \\ 0.420 \\ 0.331 \\ 0.320 \\ 0.224 \\ 0.41 \\ 0.41 \\ 0.420 \\ 0.320 \\ 0.224 \\ 0.41 \\ 0.41 \\ 0.41 \\ 0.41 \\ 0.41 \\ 0.420 \\ 0.320 \\ 0.224 \\ 0.41 \\ 0.41 \\ 0.41 \\ 0.420 \\ 0.224 \\ 0.41 \\ 0.41 \\ 0.420 \\ 0.224 \\ 0.41 \\ 0.41 \\ 0.41 \\ 0.420 \\ 0.224 \\ 0.41 \\ 0.41 \\ 0.420 \\ 0.224 \\ 0.41 \\ 0.41 \\ 0.41 \\ 0.420 \\ 0.224 \\ 0.41 \\ 0.41 \\ 0.420 \\ 0.224 \\ 0.41 \\ 0.420 \\ 0.224 \\ 0.41 \\ 0.420 \\ 0.224 \\ 0.41 \\ 0.420 \\ 0.224 \\ 0.420 \\ 0.224 \\ 0.41 \\ 0.420 \\ 0.224 \\ 0.420 \\ 0.224 \\ 0.41 \\ 0.420 \\ 0.224 \\ 0.420 \\ 0.224 \\ 0.41 \\ 0.420 \\ 0.224 \\ 0.420 \\ 0.224 \\ 0.420 \\ 0.224 \\ 0.420 \\ 0.224 \\ 0.420 \\ 0.224 \\ 0.420 \\ 0.224 \\ 0.420 \\ 0.224 \\ 0.420 \\ 0.224 \\ 0.420 \\ 0.420 \\ 0.224 \\ 0.420 \\ 0.224 \\ 0.420 \\ 0.224 \\ 0.420 \\ $	$\begin{array}{c} 2.\ 42\\ 1.\ 94\\ 1.\ 62\\ 1.\ 92\\ 0.\ 74\\ 0.\ 85\\ 0.\ 79\\ 0.\ 67\\ 0.\ 664\\ 0.\ 57\\ 0.\ 55\\ 0.\ 55\\ 0.\ 55\\ 0.\ 55\\ 0.\ 55\\ 0.\ 56\\ 0.\ 48\\ 0.\ 48\\ 0.\ 48\\ 0.\ 48\\ 0.\ 48\\ 0.\ 48\\ 0.\ 48\\ 0.\ 48\\ 0.\ 48\\ 0.\ 48\\ 0.\ 48\\ 0.\ 55$	$\begin{array}{c} & & & \\ & & & & \\ & & & \\ & & & & \\ & & & & \\ & & & & \\ & & & & \\ & & & & \\ & & & & \\ & & & & \\ & & & & \\ & & & & \\ & & & & \\ & & & & \\ & & & & \\ & & & & \\ & & & & \\ & & & & \\ & & & & \\ & & & & \\ & & & & \\ & & & & \\$	$\begin{array}{c} 2.\ 64\\ 2.\ 12\\ 1.\ 77\\ 1.\ 53\\ 1.\ 34\\ 1.\ 209\\ 1.\ 009\\ 0.\ 93\\ 6\\ 0.\ 93\\ 0.\ 93\\ 0.\ 93\\ 0.\ 93\\ 0.\ 93\\ 0.\ 93\\ 0.\ 93\\ 0.\ 93\\ 0.\ 93\\ 0.\ 93\\ 0.\ 93\\ 0.\ 93\\ 0.\ 93\\ 0.\ 93\\ 0.\ 662\\ 0.\ 55\\ 0$	$\begin{array}{c} & & \\ 1.\ 77 \\ 1.\ 50 \\ 1.\ 31 \\ 1.\ 18 \\ 1.\ 08 \\ 0.\ 94 \\ 0.\ 88 \\ 0.\ 84 \\ 0.\ 94 \\ 0.\ 88 \\ 0.\ 86 \\ 0.\ 66 \\ 0.\ 62 \\ 0.\ 67 \\ 0.\ 55 \\ 0.\ 33 \\ 0.\ 32 \\ 0.\ 30 \\ 0.\ 26 \\ 0.\ 26 \\ 0.\ 55 \ 0.\ 55 \\ 0.\ 55 \ 0.\ 55 \$	$\begin{array}{c} 2.85\\ 2.29\\ 1.91\\ 1.65\\ 1.30\\ 1.18\\ 1.08\\ 0.93\\ 0.75\\ 0.663\\ 0.661\\ 0.669\\ 0.57\\ 0.566\\ 0.56\\ 0.56\\ 0.566\\ $	$\begin{array}{c} 2.01\\ 1.69\\ 1.48\\ 1.321\\ 1.11\\ 1.04\\ 0.98\\ 0.88\\ 0.80\\ 0.74\\ 0.72\\ 0.69\\ 0.665\\ 0.63\\ 0.61\\ 0.597\\ 0.56\\ 0.54\\ 0.52\\ 0.56\\ 0.54\\ 0.52\\ 0.51\\ 0.448\\ 0.446\\ 0.453\\ 0.33\\ 0.32\\ 0.33\\ 0.332\\ 0.32\\ 0.28\\ \end{array}$	$\begin{array}{c} 3.05\\ 2.45\\ 2.057\\ 1.56\\ 1.39\\ 1.26\\ 1.07\\ 1.00\\ 0.94\\ 0.89\\ 0.80\\ 0.77\\ 0.74\\ 0.69\\ 0.68\\ 0.66\\ 0.64\\ 0.63\\ 0.62\\ 0.61\\ 0.60$	$\begin{array}{c} \overset{\times}{} \\ 2.26\\ 1.90\\ 1.65\\ 1.47\\ 1.34\\ 1.23\\ 1.14\\ 1.01\\ 0.96\\ 0.91\\ 0.83\\ 0.80\\ 0.77\\ 0.742\\ 0.69\\ 0.67\\ 0.653\\ 0.61\\ 0.59\\ 0.57\\ 0.553\\ 0.51\\ 0.50\\ 0.48\\ 0.44\\ 0.43\\ 0.41\\ 0.37\\ 0.35\\ 0.33\\ 0.31\\ 0.29\end{array}$	3.25 2.61 1.88 1.666 1.485 1.23 1.14 1.06 0.90 0.866 0.829 0.764 0.720 0.699 0.670 0.665 0.644 0.644 0.644 0.644 0.645 0.665 0.665 0.665 0.664 0.644 0.644 0.645 0.665 0.665 0.665 0.665 0.665 0.665 0.664 0.644 0.645 0.667 0.665 0.670 0.670 0.700 0.700	$\begin{array}{c} 2.51\\ 2.51\\ 2.10\\ 1.82\\ 1.62\\ 1.46\\ 1.34\\ 1.16\\ 1.09\\ 1.03\\ 0.93\\ 0.89\\ 0.86\\ 0.93\\ 0.89\\ 0.86\\ 0.61\\ 0.73\\ 0.76\\ 0.73\\ 0.76\\ 0.73\\ 0.76\\ 0.66\\ 0.63\\ 0.61\\ 0.57\\ 0.55\\ 0.53\\ 0.53\\ 0.55\\ 0.53\\ 0.53\\ 0.49\\ 0.47\\ 0.45\\ 0.42\\ 0.41\\ 0.39\\ 0.37\\ 0.35\\ 0.30\\$
$13\frac{1}{2}$ $13\frac{1}{4}$ 14	0.50 0.52 0.54	$\begin{array}{c} 0.\ 23 \\ 0.\ 22 \\ 0.\ 21 \end{array}$	0.53 0.55 0.58	$\begin{array}{c} 0.25 \\ 0.24 \\ 0.22 \end{array}$	0.57 0.59 0.61	$\begin{array}{c} 0.\ 27 \\ 0.\ 25 \\ 0.\ 23 \end{array}$	$\begin{array}{c} 0.\ 60\\ 0.\ 62\\ 0.\ 64 \end{array}$	$\begin{array}{c} 0.\ 28 \\ 0.\ 26 \\ 0.\ 24 \end{array}$	$\begin{array}{c} 0.\ 63 \\ 0.\ 65 \\ 0.\ 67 \end{array}$	$\begin{array}{c} 0.\ 30 \\ 0.\ 28 \\ 0.\ 26 \end{array}$	$\begin{array}{c} 0.\ 66\\ 0.\ 68\\ 0.\ 69\end{array}$	$\begin{array}{c} 0.\ 31 \\ 0.\ 29 \\ 0.\ 27 \end{array}$	0.69 0.70 0.72	0. 3 0. 3 0. 2

			\mathbf{T}_{A}	ABLE 5A.			[Page 469
		Di	istance of an	Object by Tw	o Bearings.		
Difference between the course and second		D	ifference betwe	een the course an	d first bearing, i	n points.	
points.	3¾	4	4 1/4	41/2	43⁄4	ā	51/4
$\begin{array}{c} 4\\5\\5\\5\\5\\5\\6\\6\\6\\6\\6\\6\\7\\7\\7\\7\\7\\8\\8\\8\\8\\8\\8\\9\\9\\9\\9\\9\\9\\9\\9\\9$	$\begin{array}{cccccccccccccccccccccccccccccccccccc$	$\begin{array}{cccccccccccccccccccccccccccccccccccc$	$\begin{array}{cccccccccccccccccccccccccccccccccccc$	$\begin{array}{cccccccccccccccccccccccccccccccccccc$	$\begin{array}{cccccccccccccccccccccccccccccccccccc$	$\begin{array}{cccccccccccccccccccccccccccccccccccc$	$\begin{array}{cccccccccccccccccccccccccccccccccccc$
	5½	53/4	6	6¼	6½	634	7
$\begin{array}{c} 6\frac{1}{2} \\ 67 \\ 7 \\ 7 \\ 7 \\ 7 \\ 7 \\ 8 \\ 8\frac{1}{4} \\ -\frac{1}{2} \\ 28 \\ 8 \\ 8 \\ 9 \\ 9 \\ 9 \\ 9 \\ 9 \\ 9 \\ 9 \\ $	$\begin{array}{cccccccccccccccccccccccccccccccccccc$	$\begin{array}{cccccccccccccccccccccccccccccccccccc$	$\begin{array}{c ccccccccccccccccccccccccccccccccccc$	$\begin{array}{c ccccccccccccccccccccccccccccccccccc$	$\begin{array}{c ccccccccccccccccccccccccccccccccccc$	$\begin{array}{c ccccccccccccccccccccccccccccccccccc$	$ \begin{array}{c ccccccccccccccccccccccccccccccccccc$

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TABLE 5A.

Distance of an Object by Two Bearings.

Difference between the course					Differe	nce bet	ween t	he cour	se and	first be	earing, i	in poin	ts.			
bearing, in points.	7	1/4	7	1/2	7	3/4		8	8	1/4	8	1/2	s	3/4		9
$\begin{array}{c} 8\frac{1}{4}\\ 8\frac{1}{2}\\ 8\frac{1}{2}\\ 8\frac{1}{2}\\ 9\\ 9\frac{1}{2}\\ 9\frac{1}{2}\\ 9\frac{1}{2}\\ 9\frac{1}{2}\\ 9\frac{1}{2}\\ 9\frac{1}{2}\\ 9\frac{1}{2}\\ 10\frac{1}{2}\\ 1$	5.07 4.07 3.41 2.94 2.58 2.31 2.10 1.92 1.78 1.66 1.56 1.47 1.40 1.34 1.23 1.19 1.12 1.09 1.07 1.05 1.03 1.02	$\begin{array}{c} 5.06\\ 4.05\\ 3.37\\ 2.88\\ 2.51\\ 1.98\\ 1.78\\ 1.61\\ 1.46\\ 1.34\\ 1.22\\ 1.12\\ 1.035\\ 0.87\\ 0.80\\ 0.73\\ 0.61\\ 0.55\\ 0.50\\ 0.44\\ 0.39\\ \end{array}$	$\begin{array}{c}\bullet\\5.10\\4.10\\3.43\\2.95\\2.60\\2.33\\2.11\\1.93\\1.79\\1.67\\1.57\\1.48\\1.41\\1.29\\1.24\\1.20\\1.16\\1.13\\1.10\\1.08\\1.06\\1.04\end{array}$	5.08 4.06 3.367 2.19 1.95 1.758 1.43 1.30 1.19 1.00 0.91 0.83 0.769 0.63 0.571 0.45 0.40	$\begin{array}{c} 5.12\\ 4.11\\ 3.44\\ 2.96\\ 2.61\\ 2.34\\ 2.12\\ 1.94\\ 1.80\\ 1.68\\ 1.57\\ 1.49\\ 1.41\\ 1.35\\ 1.29\\ 1.24\\ 1.20\\ 1.16\\ 1.13\\ 1.10\\ 1.08\\ 1.06\\ \end{array}$	$\begin{array}{c} 5.06\\ 4.03\\ 3.34\\ 2.84\\ 2.46\\ 2.16\\ 1.92\\ 1.71\\ 1.54\\ 1.39\\ 1.26\\ 1.15\\ 0.95\\ 0.87\\ 0.79\\ 0.72\\ 0.65\\ 0.58\\ 0.52\\ 0.46\\ 0.41\\ \end{array}$	5.13 4.12 3.44 2.97 2.61 2.34 2.12 1.95 1.80 1.68 1.58 1.49 1.41 1.35 1.29 1.20 1.17 1.13 1.11 1.08	$\begin{array}{c} 5.03\\ 3.39\\ 3.30\\ 2.79\\ 2.41\\ 2.11\\ 1.87\\ 1.67\\ 1.50\\ 1.35\\ 1.22\\ 1.10\\ 1.00\\ 0.91\\ 0.82\\ 0.74\\ 0.67\\ 0.60\\ 0.53\\ 0.47\\ 0.41\\ \end{array}$	$5.12 \\ 4.11 \\ 3.44 \\ 2.96 \\ 2.61 \\ 2.34 \\ 2.12 \\ 1.94 \\ 1.80 \\ 1.68 \\ 1.57 \\ 1.49 \\ 1.41 \\ 1.357 \\ 1.29 \\ 1.24 \\ 1.20 \\ 1.16 \\ 1.13 \\ 1.10 \\$	$\begin{array}{r} 4.97\\ 3.93\\ 3.24\\ 2.74\\ 2.36\\ 1.82\\ 1.62\\ 1.42\\ 1.30\\ 1.17\\ 1.05\\ 0.95\\ 0.95\\ 0.95\\ 0.62\\ 0.55\\ 0.48\\ 0.42\\ \end{array}$	$5.10 \\ 4.10 \\ 3.43 \\ 2.95 \\ 2.60 \\ 2.33 \\ 2.11 \\ 1.93 \\ 1.79 \\ 1.67 \\ 1.57 \\ 1.48 \\ 1.41 \\ 1.29 \\ 1.24 \\ 1.20 \\ 1.16 \\ 1.13 \\ 1.13 \\ 1.13 \\ 1.13 \\ 1.13 \\ 1.13 \\ 1.14 \\ 1.13 \\ 1.14 \\ $	$\begin{array}{c} 4.88\\ 3.86\\ 3.17\\ 2.67\\ 2.29\\ 2.00\\ 1.76\\ 1.55\\ 1.38\\ 1.24\\ 1.11\\ 1.00\\ 0.89\\ 0.72\\ 0.64\\ 0.56\\ 0.50\\ 0.43\\ \end{array}$	5.07 4.07 3.41 2.58 2.31 2.102 1.78 1.666 1.47 1.40 1.34 1.28 1.23 1.19 1.15	$\begin{array}{r} 4.77\\ 3.76\\ 3.08\\ 2.59\\ 2.22\\ 1.92\\ 1.49\\ 1.32\\ 1.17\\ 1.05\\ 0.93\\ 0.74\\ 0.66\\ 0.58\\ 0.51\\ 0.44 \end{array}$	5.03 4.04 3.38 2.91 2.56 2.29 2.08 1.91 1.77 1.65 1.55 1.46 1.39 1.32 1.27 1.22 1.18	$\begin{array}{c} 4.64\\ 3.65\\ 2.98\\ 2.50\\ 2.13\\ 1.84\\ 1.61\\ 1.41\\ 1.25\\ 1.11\\ 0.98\\ 0.87\\ 0.77\\ 0.68\\ 0.60\\ 0.52\\ 0.45\\ \end{array}$
	91	1/4	9	1/2	9	3⁄4	1	0	10	1/4	10	1/2	10	3⁄4		11
$\begin{array}{c} 10\frac{1}{10}\\ 10\frac{1}{2}\\ 10\frac{1}{2}\\ 111\\ 11\frac{1}{11}\\ 11\frac{1}{2}\\ 12\frac{1}{2}\\ 12\frac{1}{2}\\ 12\frac{1}{2}\\ 12\frac{1}{2}\\ 12\frac{1}{2}\\ 12\frac{1}{2}\\ 12\frac{1}{2}\\ 13\frac{1}{2}\\ 13\frac{1}{2}\\ 13\frac{1}{2}\\ 13\frac{1}{2}\\ 14\end{array}$	$\begin{array}{c} 4.97\\ 3.99\\ 3.34\\ 2.88\\ 2.53\\ 2.27\\ 2.06\\ 1.89\\ 1.75\\ 1.62\\ 1.53\\ 1.44\\ 1.37\\ 1.31\\ 1.25\\ 1.21\\ \end{array}$	$\begin{array}{c} 4.50\\ 3.52\\ 2.87\\ 2.39\\ 2.04\\ 1.75\\ 1.52\\ 1.33\\ 1.18\\ 1.03\\ 0.91\\ 0.80\\ 0.71\\ 0.62\\ 0.54\\ 0.46\end{array}$	$\begin{array}{c} 4.91\\ 3.94\\ 3.30\\ 2.84\\ 2.50\\ 2.24\\ 2.03\\ 1.86\\ 1.72\\ 1.61\\ 1.51\\ 1.42\\ 1.35\\ 1.29\\ 1.24 \end{array}$	$\begin{array}{r} 4.33\\ 3.38\\ 2.74\\ 2.28\\ 1.93\\ 1.66\\ 1.44\\ 1.25\\ 1.09\\ 0.96\\ 0.84\\ 0.73\\ 0.64\\ 0.55\\ 0.47\\ \end{array}$	$\begin{array}{r} 4.83\\ 3.87\\ 3.24\\ 2.79\\ 2.46\\ 2.20\\ 2.00\\ 1.83\\ 1.69\\ 1.58\\ 1.48\\ 1.40\\ 1.33\\ 1.27\end{array}$	$\begin{array}{r} 4.14\\ 3.22\\ 2.61\\ 2.16\\ 1.82\\ 1.56\\ 1.34\\ 1.16\\ 1.01\\ 0.88\\ 0.76\\ 0.66\\ 0.57\\ 0.49\\ \end{array}$	$\begin{array}{r} 4.74\\ 3.80\\ 3.18\\ 2.74\\ 2.41\\ 2.16\\ 1.96\\ 1.66\\ 1.55\\ 1.46\\ 1.38\\ 1.31\end{array}$	3.94 3.05 2.46 2.03 1.71 1.45 1.24 1.07 0.92 0.80 0.69 0.59 0.50	$\begin{array}{r} 4.63\\ 3.72\\ 3.11\\ 2.68\\ 2.36\\ 2.11\\ 1.92\\ 1.76\\ 1.63\\ 1.52\\ 1.42\\ 1.35\end{array}$	3.72 2.88 2.31 1.90 1.59 1.34 1.14 0.98 0.84 0.72 0.61 0.52	$\begin{array}{r} 4.52\\ 3.63\\ 3.04\\ 2.62\\ 2.30\\ 2.06\\ 1.87\\ 1.72\\ 1.59\\ 1.48\\ 1.39\end{array}$	3.49 2.69 2.15 1.76 1.46 1.23 1.04 0.88 0.75 0.63 0.53	$\begin{array}{c} 4.40\\ 3.53\\ 2.95\\ 2.55\\ 2.24\\ 2.01\\ 1.82\\ 1.67\\ 1.54\\ 1.44 \end{array}$	$\begin{array}{c} 3.20\\ 2.50\\ 1.98\\ 1.62\\ 1.34\\ 1.11\\ 0.94\\ 0.79\\ 0.66\\ 0.55 \end{array}$	$\begin{array}{r} 4.26\\ 3.42\\ 2.86\\ 2.47\\ 2.17\\ 1.94\\ 1.76\\ 1.62\\ 1.50\end{array}$	3.01 2.30 1.82 1.47 1.21 1.00 0.83 0.69 0.57
	11	1/4	11	1/2	11	3⁄4	1	2	12	1/4	12	1/2	15	3/4	1	18
$12\frac{1}{12}\frac{1}{2}\frac{1}{2}\frac{1}{2}\frac{1}{4}$ $13\frac{1}{13}\frac{1}{2}\frac{1}{2}$ $13\frac{1}{4}$ 14	$\begin{array}{r} 4.12\\ 3.31\\ 2.77\\ 2.38\\ 2.10\\ 1.88\\ 1.70\\ 1.56\end{array}$	$\begin{array}{c} 2.77\\ 2.10\\ 1.65\\ 1.32\\ 1.08\\ 0.89\\ 0.73\\ 0.60 \end{array}$	3.96 3.18 2.66 2.29 2.02 1.81 1.64	$2.51 \\ 1.90 \\ 1.48 \\ 1.18 \\ 0.95 \\ 0.77 \\ 0.63$	3.80 3.05 2.55 2.20 1.94 1.73	$2.26 \\ 1.69 \\ 1.31 \\ 1.04 \\ 0.83 \\ 0.66$	3.62 2.91 2.44 2.10 1.85	2.01 1.50 1.15 0.90 0.71	$3.44 \\ 2.76 \\ 2.31 \\ 1.99$	$1.77 \\ 1.30 \\ 0.99 \\ 0.76$	$3.25 \\ 2.61 \\ 2.19$	1.53 1.12 0.84	$3.05 \\ 2.45$	$\begin{array}{c} 1.31\\ 0.94 \end{array}$	2.85	1.09

TABLE 5B. Distance of an Object by Two Bearings.

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Difference between					Diffe	rence be	etween t	he cours	e and fi	rst bearin	ng.			
the course and second bearing.	20	0°	2	20	2	4 °	20	6 0	2	80	30	00	3	20
bearing. 30° 32 34 36 38 40 42 44 46 48 50 52 54 56 58 60 62 64 66 68 70 72 74 76 78 80 82 84 86 88 90 92 94 96 98 100 102 104 106 108 100 102 104 106 108 110 112 124 126 128 130 132 134 136 138 140 142 144 146 158 130 132 134 136 138 140 142 144 146 158 150 152 154 156 158 100 102 104 106 108 110 112 124 126 128 130 132 134 136 138 140 142 154 156 158 160	$\begin{array}{c} 1\\ 1.97\\ 1.41\\ 1.10\\ 1.091\\ 1.424\\ 1.10\\ 0.0.768\\ 655\\ 655\\ 519\\ 0.0.0\\ 0.0.655\\ 655\\ 519\\ 0.0.0\\ 0.0$	$\begin{array}{c} 0.987793 \\ 0.0644 \\ 0.0554 \\ 0.0554 \\ 1.000 \\ 0$	$\begin{array}{c} 2.16\\ 80556\\ 1.11\\ 1.556\\ 1.11\\ 1.00\\ 2.580\\ 0.0.0\\ 0.0\\ 0.0\\ 0.0\\ 0.0\\ 0.0\\ 0.0\\$	$\begin{array}{c} 1.14\\ 1.01\\ 0.91\\ 0.73\\ 0.666\\ 0.0\\ 0.557\\ 0.0\\ 0.554\\ 0.0\\ 0.551\\ 0.0\\ 0.554\\ 0.0\\ 0.0\\ 0.551\\ 0.0\\ 0.551\\ 0.0\\ 0.0\\ 0.0\\ 0.0\\ 0.0\\ 0.0\\ 0.0\\ 0.$	$\begin{array}{c} 2.346\\ 1.482\\ 1.968\\ 1.482\\ 1.900\\ 0.937\\ 1.093\\ 0.0666\\ 3.19\\ 0.06663\\ 1.10\\ 0.00\\ 0.06663\\ 1.10\\ 0.00\\ 0.$	$\begin{array}{c} 1.31\\ 1.095\\ 8.38\\ 7.4\\ 1.095\\ 8.38\\ 7.4\\ 1.095\\ 8.38\\ 7.4\\ 1.095\\ 8.38\\ 7.4\\ 1.095\\ 8.38\\ 7.4\\ 1.095\\ 8.38\\ 7.4\\ 1.095\\ 8.38\\ 7.4\\ 1.05\\ 8.38\\ 7.4\\ 1.05\\ 8.38\\ 7.4\\ 1.05\\ 1$	$\begin{array}{c} 2.521\\ 1.592\\ 2.181\\ 1.928\\ 1.1592\\ 2.181\\ 1.928\\ 1.1592\\ 2.181\\ 1.928\\ 1.1592\\ 2.181\\ 1.928\\ 1.1592\\ 2.181\\ 1.928\\ 1.1592\\ 2.181\\ 1.928\\ 1.92$	$\begin{array}{c} 1.48\\ 1.30\\ 0.98\\ 2.70\\ 0.98\\ 3.99\\ 0.98\\ 3.99\\ 0.98\\ 3.99\\ 0.98\\ 3.99\\ 0.98\\ 3.99\\ 0.98\\ 0.$	$\begin{array}{c} 2.70\\ 2.26\\ 1.94\\ 1.70\\ 2.25\\ 1.125\\ $	$\begin{array}{c} 1.\ 66\\ 1.\ 45\\ 1.\ 30\\ 1.\ 18\\ 1.\ 092\\ 0.\ 96\\ 0.\ 91\\ 1.\ 02\\ 0.\ 96\\ 0.\ 91\\ 1.\ 02\\ 0.\ 96\\ 0.\ 91\\ 0.\ 91\\ 0.\ 96\\ 0.\ 91\\ 0.\ 96\\ 0.\ 91\\ 0.\ 96\\ 0.\ 91\\ 0.\ 96\\ 0.\ 91\\ 0.\ 96\\ 0.\ 91\\ 0.\ 96\\ 0.\ 91\\ 0.\ 96\\ 0.\ 91\\ 0.\ 96\\ 0.\ 91\\ 0.\ 96\\ 0.\ 91\\ 0.\ 96\\ 0.\ 91\\ 0.\ 96\\ 0.\ 91\\ 0.\ 96\\ 0.\ 91\\ 0.\ 96\\ 0.\ 91\\ 0.\ 96\\ 0.\ 91\\ 0.\ 96\\ 0.\ 91\\ 0.\ 96\\ 0.\ 91\ 0.\ 91\\ 0.\ 91\ 0.\ 0.\ 91\ 0.\ 0.\ 91\ 0.\ 0.\ 0.\ 0.\ 0.\ 0.\ 0.\ 0.\ 0.\ 0.$	$\begin{array}{c} 2.88\\ 2.40\\ 7.1.646\\ 3.33\\ 1.1.646\\ 3.324\\ 1.00\\ 0.94\\ 0.895\\ 1.1.00\\ 0.0752\\ 0.00\\ 0.655\\ 0.556\\ 0.555\\ 0.552\\ 2.11\\ 1.00\\ 0.94\\ 0.895\\ 1.1.00\\ 0.94\\ 0.895\\ 0.752\\ 0.00\\ 0.555\\$	$\begin{array}{c} 1.85\\ 1.61\\ 1.44\\ 1.30\\ 1.12\\ 1.05\\ 9.90\\ 0.97\\ 0.83\\ 0.75\\ 0.90\\ 0.87\\ 0.73\\ 0.71\\ 0.667\\ 0.666\\ 0.63\\ 0.75\\ 0.554\\ 0.552\\ 0.554\\ 0.552\\ 0.551\\ 0.550\\ 0.554\\ 0.442\\ 0.442\\ 0.442\\ 0.442\\ 0.442\\ 0.442\\ 0.442\\ 0.442\\ 0.442\\ 0.442\\ 0.442\\ 0.39\\ 0.335\\ 0.32\\ 0.22\\ 0.$	$\begin{array}{c} 3.05\\ 3.05\\ 2.192\\ 1.75\\ 1.41\\ 0.990\\ 6.25\\ 5.5\\ 1.1\\ 1.55\\ 1.41\\ 0.990\\ 6.282\\ 9.2\\ 0.76\\ 4.1\\ 0.90\\ 0.86\\ 2.9\\ 0.76\\ 4.1\\ 0.90\\ 0.86\\ 2.9\\ 0.76\\ 4.1\\ 0.90\\ 0.667\\ 0.666\\ 4.2\\ 0.55\\ 5.55\\ 4.4\\ 4.5\\ 5.3\\ 3.3\\ 3.3\\ 3.4\\ 4.5\\ 5.5\\ 5.5\\ 5.5\\ 5.5\\ 5.5\\ 5.5\\ 5$	$\begin{array}{c} 2.\ 04\\ 1.\ 77\\ 1.\ 58\\ 1.\ 43\\ 1.\ 1.\ 22\\ 1.\ 14\\ 1.\ 03\\ 0.\ 98\\ 0.\ 94\\ 0.\ 98\\ 0.\ 96\\ 0.\ 94\\ 0.\ 98\\ 0.\ 96\\ 0.\ 96\\ 0.\ 66\\ 0.\ 66\\ 0.\ 66\\ 0.\ 66\\ 0.\ 66\\ 0.\ 66\\ 0.\ 66\\ 0.\ 66\\ 0.\ 66\\ 0.\ 55\ 0.\ 55\\ 0.\ 55\ 0.\ 55\ 0.\ 55\ 0.\ 55\ 0.\ 55\ 0.\ 55\ 0.\ 55\ 0.\ 55\ 0.\ 55\ 0.\ 55\ 0.\ 55\ 0.\ 55\ 0.\ 0.\ 55\ 0.\ 0.\ 0.\ 0.\ 0.\ 0.\$

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TABLE 5B.

Distance of an Object by Two Bearings.

Difference between			Difference b	etween the cours	se and first beari	ng.	
and second bearing.	310	€6°	C8°	40°	420	44 °	46°
the course is and second bearing. -44° to be the course is and second bearing. -44° to be the course is a second bearing is a second bearing. -44° to be the course is a second bearing is a s	$\begin{array}{c} 3 \stackrel{\circ}{\scriptstyle 2}^{\circ} \\ \hline \\ 3 \stackrel{\circ}{\scriptstyle 2} 2 \stackrel{\circ}{\scriptstyle 2} \stackrel{2}{\scriptstyle 2} \stackrel{4}{\scriptstyle 2} \stackrel{6}{\scriptstyle 6} 9 \stackrel{1}{\scriptstyle 1} \stackrel{93}{\scriptstyle 3} \\ 2 \stackrel{\circ}{\scriptstyle 3} 1 \stackrel{1}{\scriptstyle 1} \stackrel{72}{\scriptstyle 2} \\ 2 \stackrel{\circ}{\scriptstyle 0} 3 \stackrel{1}{\scriptstyle 1} \stackrel{5}{\scriptstyle 3} \\ 1 \stackrel{6}{\scriptstyle 1} \stackrel{1}{\scriptstyle 3} \stackrel{1}{\scriptstyle 1} \stackrel{1}{\scriptstyle 1} \stackrel{1}{\scriptstyle 3} \\ 1 \stackrel{63}{\scriptstyle 1} \stackrel{1}{\scriptstyle 3} \stackrel{29}{\scriptstyle 1} \stackrel{1}{\scriptstyle 1} \stackrel{1}{\scriptstyle 4} \\ 1 \stackrel{37}{\scriptstyle 1} \stackrel{1}{\scriptstyle 1} \stackrel{1}{\scriptstyle 1} \stackrel{1}{\scriptstyle 1} \\ 1 \stackrel{1}{\scriptstyle 2} 1 \stackrel{1}{\scriptstyle 1} \stackrel{1}{\scriptstyle 1} \\ 1 \stackrel{1}{\scriptstyle 2} 1 \stackrel{1}{\scriptstyle 1} \stackrel{1}{\scriptstyle 1} \\ 1 \stackrel{1}{\scriptstyle 2} 1 \stackrel{1}{\scriptstyle 1} \stackrel{1}{\scriptstyle 1} \\ 1 \stackrel{1}{\scriptstyle 2} 1 \stackrel{1}{\scriptstyle 1} \stackrel{1}{\scriptstyle 1} \\ 1 \stackrel{1}{\scriptstyle 2} 1 \stackrel{1}{\scriptstyle 1} \stackrel{1}{\scriptstyle 1} \\ 1 \stackrel{1}{\scriptstyle 2} 1 \stackrel{1}{\scriptstyle 1} \stackrel{1}{\scriptstyle 1} \\ 1 \stackrel{1}{\scriptstyle 2} 1 \stackrel{1}{\scriptstyle 1} \stackrel{1}{\scriptstyle 1} \\ 1 \stackrel{1}{\scriptstyle 2} 1 \stackrel{1}{\scriptstyle 1} \stackrel{1}{\scriptstyle 1} \\ 1 \stackrel{1}{\scriptstyle 2} 1 \stackrel{1}{\scriptstyle 1} \stackrel{1}{\scriptstyle 1} \\ 1 \stackrel{1}{\scriptstyle 2} 1 \stackrel{1}{\scriptstyle 1} \stackrel{1}{\scriptstyle 1} \\ 1 \stackrel{1}{\scriptstyle 2} 1 \stackrel{1}{\scriptstyle 1} \stackrel{1}{\scriptstyle 1} \\ 1 \stackrel{1}{\scriptstyle 2} 1 \stackrel{1}{\scriptstyle 1} \stackrel{1}{\scriptstyle 1} \\ 1 \stackrel{1}{\scriptstyle 2} 1 \stackrel{1}{\scriptstyle 1} \stackrel{1}{\scriptstyle 1} \\ 1 \stackrel{1}{\scriptstyle 2} 1 \stackrel{1}{\scriptstyle 1} \stackrel{1}{\scriptstyle 1} \\ 1 \stackrel{1}{\scriptstyle 2} 1 \stackrel{1}{\scriptstyle 1} \stackrel{1}{\scriptstyle 1} \\ 1 \stackrel{1}{\scriptstyle 2} 1 \stackrel{1}{\scriptstyle 1} \stackrel{1}{\scriptstyle 1} \\ 1 \stackrel{1}{\scriptstyle 2} 1 \stackrel{1}{\scriptstyle 1} \stackrel{1}{\scriptstyle 1} \stackrel{1}{\scriptstyle 1} \\ 1 \stackrel{1}{\scriptstyle 2} 1 \stackrel{1}{\scriptstyle 1} \stackrel{1}$	$\begin{array}{c} 56^{\circ} \\ \hline \\ $	$\begin{array}{c} 28^{\circ} \\ 3.55 & 2.63 \\ 2.96 & 2.27 \\ 2.54 & 2.01 \\ 2.23 & 1.81 \\ 1.99 & 1.65 \\ 1.80 & 1.53 \\ 1.64 & 1.42 \\ 1.51 & 1.34 \\ 1.40 & 1.26 \\ 1.31 & 1.20 \\ 1.23 & 1.14 \\ 1.40 & 1.26 \\ 1.31 & 1.20 \\ 1.23 & 1.14 \\ 1.16 & 1.09 \\ 1.10 & 1.05 \\ 1.05 & 1.01 \\ 1.00 & 0.97 \\ 0.96 & 0.94 \\ 0.92 & 0.91 \\ 0.89 & 0.88 \\ 0.86 & 0.85 \\ 0.83 & 0.83 \\ 0.80 & 0.80 \\ 0.78 & 0.78 \\ 0.76 & 0.76 \\ 0.74 & 0.74 \\ 0.73 & 0.72 \\ 0.71 & 0.70 \\ 0.67 & 0.65 \\ 0.66 & 0.64 \\ 0.66 & 0.62 \\ 0.65 & 0.61 \\ 0.64 & 0.59 \\ 0.63 & 0.55 \\ 0.62 & 0.43 \\ 0.63 & 0.42 \\ 0.62 & 0.45 \\ 0.62 & 0.45 \\ 0.62 & 0.45 \\ 0.62 & 0.45 \\ 0.62 & 0.45 \\ 0.62 & 0.45 \\ 0.62 & 0.45 \\ 0.62 & 0.45 \\ 0.62 & 0.45 \\ 0.63 & 0.42 \\ 0.63 & 0.40 \\ 0.63 & 0.39 \\ 0.64 & 0.38 \\ 0.66 & 0.35 \\ 0.66 & 0.33 \\ 0.66 & 0.35 \\ $	$\begin{array}{c ccccccccccccccccccccccccccccccccccc$	$\begin{array}{c ccccccccccccccccccccccccccccccccccc$	$\begin{array}{c ccccccccccccccccccccccccccccccccccc$	$\begin{array}{c ccccccccccccccccccccccccccccccccccc$

				Di	stance	TA of an	ABLE	5B. by Two	o Beari	ngs			[Page	e 473
Difference between					Diffe	erence b	etween t	he cours	e and fi	rst bearing	ng.			
the course and second bearing.	4	80 .	5	00	õ	20	5	1 0	5	60	ő	80	(6 0 0
, 58° 60 62 64 66 68 70 72 74 76 80 82 84 86 80 92 94 96 98 100 102 104 106 108 110 112 124 126 128 130 132 134 136 138 140 142 144 146 152 154 156 158 160	$\begin{array}{c} 4.357700000000000000000000000000000000000$	$\begin{array}{c} 3.\ 63\\ 3.\ 10\\ 2.\ 71\\ 2.\ 42\\ 2.\ 20\\ 2.\ 01\\ 1.\ 86\\ 1.\ 74\\ 1.\ 63\\ 1.\ 54\\ 1.\ 38\\ 1.\ 32\\ 1.\ 20\\ 1.\ 16\\ 1.\ 11\\ 1.\ 07\\ 1.\ 03\\ 0.\ 99\\ 0.\ 96\\ 0.\ 93\\ 0.\ 90\\ 0.\ 87\\ 0.\ 84\\ 0.\ 99\\ 0.\ 96\\ 0.\ 93\\ 0.\ 90\\ 0.\ 87\\ 0.\ 84\\ 0.\ 82\\ 0.\ 77\\ 0.\ 74\\ 0.\ 72\\ 0.\ 74\\ 0.\ 72\\ 0.\ 74\\ 0.\ 72\\ 0.\ 68\\ 0.\ 66\\ 0.\ 63\\ 0.\ 61\\ 0.\ 59\\ 0.\ 57\\ 0.\ 56\\ 0.\ 54\\ 0.\ 52\\ 0.\ 50\\ 0.\ 54\\ 0.\ 52\\ 0.\ 50\\ 0.\ 54\\ 0.\ 32\\ 0.\ 30\\ 0.\ 27\\ \end{array}$	$\begin{array}{c} 4.41\\ 3.68\\ 3.17\\ 2.78\\ 2.24\\ 2.04\\ 1.88\\ 2.24\\ 2.04\\ 1.53\\ 1.45\\ 1.53\\ 1.45\\ 1.30\\ 1.24\\ 1.19\\ 1.14\\ 1.10\\ 1.06\\ 1.03\\ 1.097\\ 0.95\\ 0.92\\ 0.98\\ 0.85\\ 0.85\\ 0.85\\ 0.88\\ 0.85\\ 0.88\\ 0.85\\ 0.88\\ 0.85\\ 0.77\\ 0.77\\ 0.77\\ 0.77\\ 0.77\\ 0.77\\ 0.77\\ 0.77\\ 0.77\\ 0.77\\ 0.77\\ 0.77\\ 0.77\\ 0.77\\ 0.78\\ 0.81\\ 0.82\\ 0.82\\ 0.81\\ 0.82\\ 0.82\\ 0.81\\ 0.82\\ 0.82\\ 0.81\\ 0.82\\ 0.82\\ 0.81\\ 0.82\\ 0.82\\ 0.81\\ 0.82\\ 0.82\\ 0.81\\ 0.82\\ 0.82\\ 0.81\\ 0.82\\ 0.82\\ 0.81\\ 0.82$	$\begin{array}{c} 3.82\\ 3.25\\ 2.85\\ 2.530\\ 2.10\\ 1.94\\ 1.81\\ 1.70\\ 1.60\\ 1.51\\ 1.43\\ 1.360\\ 1.24\\ 1.19\\ 1.143\\ 1.30\\ 1.24\\ 1.19\\ 1.10\\ 1.06\\ 1.02\\ 0.95\\ 0.92\\ 0.89\\ 0.92\\ 0.89\\ 0.92\\ 0.89\\ 0.92\\ 0.89\\ 0.92\\ 0.89\\ 0.92\\ 0.89\\ 0.92\\ 0.89\\ 0.92\\ 0.$	$\begin{array}{c} 4.54\\ 3.79\\ 3.286\\ 2.55\\ 2.300\\ 1.491\\ 1.88\\ 1.58\\ 1.491\\ 1.34\\ 1.28\\ 1.13\\ 1.10\\ 1.063\\ 1.00\\ 0.97\\ 0.993\\ 0.886\\ 0.882\\ 0.881\\ 0.880\\$	$\begin{array}{c} 4.\ 01\\ 3.\ 41\\ 2.\ 965\\ 2.\ 39\\ 2.\ 19\\ 2.\ 028\\ 1.\ 76\\ 5.\ 1.\ 56\\ 1.\ 56\\ 1.\ 56\\ 1.\ 1.\ 34\\ 1.\ 28\\ 1.\ 17\\ 1.\ 13\\ 1.\ 08\\ 1.\ 041\\ 1.\ 097\\ 0.\ 94\\ 0.\ 907\\ 0.\ 94\\ 0.\ 907\\ 0.\ 94\\ 0.\ 907\\ 0.\ 66\\ 0.\ 64\\ 0.\ 62\\ 0.\ 55\\ $	$\begin{array}{c} 4.66\\ 3.894\\ 2.94\\ 2.62\\ 2.376\\ 1.99\\ 1.85\\ 1.72\\ 1.63\\ 1.38\\ 1.316\\ 1.21\\ 1.16\\ 1.129\\ 1.06\\ 1.03\\ 1.008\\ 0.95\\ 0.93\\ 0.920\\ 0.89\\ 0.85\\ 0.83\\ 0.88\\ 0.83\\ 0.81\\ 0.81\\ 0.81\\ 0.81\\ 0.81\\ 0.81\\ 0.81\\ 0.81\\ 0.83\\$	$\begin{array}{c} 4. \ 19\\ 3. \ 55\\ 3. \ 10\\ 2. \ 49\\ 2. \ 270\\ 1. \ 95\\ 1. \ 82\\ 1. \ 76\\ 1. \ 95\\ 1. \ 82\\ 1. \ 76\\ 1. \ 95\\ 1. \ 82\\ 1. \ 76\\ 1. \ 95\\ 1. \ 82\\ 1. \ 76\\ 1. \ 95\\ 1. \ 82\\ 1. \ 76\\ 1. \ 95\\ 1. \ 82\\ 1. \ 76\\ 1. \ 95\\ 1. \ 82\\ 1. \ 76\\ 1. \ 95\\ 1. \ 82\\ 1. \ 76\\ 1. \ 95\\ 1. \ 82\\ 1. \ 76\\ 1. \ 95\\ 1. \ 95\\ 1. \ 95\\ 0. \ 99\\ 0. \ 95\\ 0. \ 95\\ 0. \ 95\\ 0. \ 95\\ 0. \ 95\\ 0. \ 95\\ 0. \ 95\\ 0. \ 95\\ 0. \ 95\\ 0. \ 66\\ 0. \ 61\\ 0. \ 57\\ 0. \ 54\\ 0. \ 43\\ 0. \ 43\\ 0. \ 36\\ 0. \ 34\\ 0. \ 31\\ 0. \ 29\\ \end{array}$	$\begin{array}{c} 4.779\\ 3.43\\ 01\\ 2.24\\ 1.56\\ 1.56\\ 1.14\\ 1.12\\ 24\\ 1.12\\ 1.12\\ 1.09\\ 0.94\\ 0.91\\ 0.990\\ 0.90\\ 0.90\\ 0.85\\ 0.85\\ 0.83\\ 0.83\\ 0.83\\ 0.83\\ 0.83\\ 0.83\\ 0.85\\ 0.$	$\begin{array}{c} 4.36\\ 3.71\\ 3.22\\ 2.86\\ 2.58\\ 2.316\\ 2.01\\ 1.87\\ 1.765\\ 1.56\\ 1.48\\ 1.41\\ 1.28\\ 1.13\\ 1.08\\ 1.04\\ 1.096\\ 0.93\\ 0.89\\ 0.853\\ 0.077\\ 1.65\\ 0.56\\ $	$\begin{array}{c} 4.88\\ 8.851\\ 3.2246\\ 8.22208\\ 1.812222\\ 2.981\\ 1.700\\ 1.524\\ 1.32222\\ 2.981\\ 1.100\\ 1.008\\ 0.965\\ 0.931\\ 0.990\\ 0.885\\ 0.885\\ 0.855\\ 0.$	$\begin{array}{c} 4.53\\ 3.83\\ 3.33\\ 2.96\\ 2.43\\ 2.23\\ 2.06\\ 2.43\\ 2.23\\ 2.06\\ 1.70\\ 1.60\\ 1.524\\ 1.37\\ 1.31\\ 1.259\\ 1.14\\ 1.051\\ 0.97\\ 0.93\\ 0.96\\ 0.83\\ 0.80\\ 0.77\\ 1.0\\ 6.8\\ 0.66\\ 0.68\\ 0.55\\ 0.55\\ 0.66\\ 0.66\\ 0.68\\ 0.55\\ 0.55\\ 0.47\\ 0.45\\ 0.32\\ 0.30$	$\begin{array}{c} 4.99\\ 4.17\\ 3.58\\ 4.25\\ 3.140\\ 2.53\\ 2.53\\ 2.53\\ 1.55\\ 1.47\\ 1.41\\ 1.359\\ 1.25\\ 1.20\\ 1.17\\ 1.10\\ 1.07\\ 1.042\\ 1.00\\ 0.98\\ 0.99\\ 0.99\\ 0.99\\ 0.99\\ 0.99\\ 0.99\\ 0.88\\ 7\\ 0.87\\ 0.$	$\begin{array}{c} 4.\ 69\\ 3.\ 96\\ 4.\ 3.\ 96\\ 4.\ 3.\ 96\\ 4.\ 3.\ 96\\ 4.\ 3.\ 96\\ 4.\ 4.\ 5.\ 1.\ 4.\ 1.\ 3.\ 9\\ 2.\ 12\\ 1.\ 2.\ 49\\ 2.\ 29\\ 2.\ 12\\ 1.\ 21\\ 1.\ 16\\ 1.\ 12\\ 1.\ 13\\ 1.\ 27\\ 1.\ 21\\ 1.\ 16\\ 1.\ 12\\ 1.\ 16\\ 1.\ 12\\ 1.\ 16\\ 1.\ 12\\ 1.\ 16\\ 1.\ 12\\ 1.\ 16\\ 1.\ 12\\ 1.\ 16\\ 1.\ 12\\ 1.\ 16\\ 1.\ 12\\ 1.\ 16\\ 1.\ 12\\ 1.\ 16\\ 1.\ 12\\ 1.\ 16\\ 1.\ 12\\ 1.\ 16\\ 1.\ 12\\ 1.\ 16\\ 1.\ 12\\ 1.\ 16\\ 1.\ 12\\ 1.\ 16\\ 1.\ 12\\ 1.\ 16\\ 1.\ 12\\ 1.\ 16\\ 1.\ 16\\ 1.\ 12\\ 1.\ 16\ 1.\ 16\\ 1.\ 16\ 1.\ $

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rage.	3131

TABLE 5B.

Distance of an Object by Two Bearings.

Difference between					Dif	ference	e betw	een the	e course	e and fi	rst bea	ring.				
the course and second bearing.	6	20	6-	t o	66	j o	6	<u>8</u> 0	70	90	7:	0	7.	1 0	7	6°
72° 74 76 78 80 82 84 86 88 90 92 94 98 100 102 104 106 108 110 112 114 116 118 120 122 124 126 138 130 132 134 136 138 140 142 144 150 152 154 158 160	$\begin{array}{c} 5.4.255\\ 4.3.2225\\ 2.2.367\\ 1.1.550\\ 1.437\\ 1.1.223\\ 1.1.11\\ 1.123\\ 1.12$	$\begin{array}{c} 4.84\\ 4.08\\ 3.54\\ 3.13\\ 2.56\\ 2.34\\ 2.17\\ 2.01\\ 1.38\\ 1.76\\ 1.66\\ 1.57\\ 1.12\\ 2.117\\ 1.12\\ 2.117\\ 1.02\\ 1.07\\ 1.02\\ 8.094\\ 0.90\\ 0.083\\ 0.79\\ 0.76\\ 0.61\\ 0.55\\ 0.52\\ 0.50\\ 0.61\\ 0.55\\ 0.52\\ 0.50\\ 0.64\\ 0.61\\ 0.55\\ 0.52\\ 0.50\\ 0.64\\ 0.61\\ 0.55\\ 0.52\\ 0.50\\ 0.64\\ 0.61\\ 0.55\\ 0.52\\ 0.50\\ 0.52\\ 0.52\\ 0.50\\ 0.52\\ 0.52\\ 0.50\\ 0.52\\ 0$	$\begin{array}{c} 5.18\\ 4.32\\ 3.726\\ 2.91\\ 2.63\\ 0.22\\ 0.5\\ 1.91\\ 1.53\\ 1.46\\ 1.25\\ 1.21\\ 1.14\\ 1.00\\ 0.98\\ 0.95\\ 0.94\\ 0.95\\ 0.991\\ 0.90$	$\begin{array}{c} 4.98\\ 4.19\\ 3.63\\ 2.88\\ 2.61\\ 2.39\\ 2.205\\ 1.91\\ 1.79\\ 1.69\\ 1.51\\ 1.43\\ 1.36\\ 1.23\\ 1.17\\ 1.02\\ 1.98\\ 0.98\\ 0.94\\ 0.986\\ 0.82\\ 0.79\\ 0.72\\ 0.666\\ 0.660\\ 0.57\\ 0.666\\ 0.651\\ 0.42\\ 0.39\\ 0.34\\ 0.31\\ \end{array}$	$\begin{array}{c} 5.\ 396\\ 4.\ 378\\ 3.\ 31\\ 2.\ 96\\ 2.\ 245\\ 2.\ 95\\ 1.\ 832\\ 1.\ 55\\ 1.\ 832\\ 1.\ 55\\ 1.\ 482\\ 1.\ 37\\ 1.\ 132\\ 1.\ 19\\ 1.\ 16\\ 1.\ 13\\ 1.\ 00\\ 0.\ 997\\ 0.\ 94\\ 0.\ 93\\ 0.\ 92\\ 0.\ 92\\ 0.\ 91\\$	$\begin{array}{c} 5.100\\ 5.302\\ 2.246\\ 4.302\\ 2.2.246\\ 4.252\\ 2.946\\ 4.222\\ 2.946\\ 1.522\\ 1.71\\ 1.61\\ 1.524\\ 1.107\\ 1.983\\ 0.898\\ 0.852\\ 0.664\\ 1.071\\ 0.684\\ 0.661\\ 0.552\\ 0.552\\ 0.641\\ 0.684\\ 0.661\\ 0.555\\ 0.549\\ 0.430\\ 0.31\\ $	$\begin{array}{c} -\\ 5.34\\ 4.46\\ 3.83\\ 3.36\\ 3.001\\ 2.248\\ 2.12\\ 1.95\\ 1.75\\ 1.66\\ 1.58\\ 1.14\\ 1.39\\ 1.25\\ 1.21\\ 1.18\\ 1.15\\ 1.12\\ 1.09\\ 1.07\\ 1.05\\ 1.01\\ 1.00\\ 0.99\\ 0.96\\ 0.94\\ 0.93\\ $	$\begin{array}{c} 5.22\\ 4.39\\ 3.80\\ 3.35\\ 2.99\\ 2.71\\ 1.96\\ 1.84\\ 1.72\\ 1.62\\ 1.84\\ 1.72\\ 1.62\\ 1.84\\ 1.72\\ 1.62\\ 1.84\\ 1.72\\ 1.07\\ 1.02\\ 0.93\\ 0.88\\ 0.84\\ 0.80\\ 0.77\\ 0.93\\ 0.88\\ 0.84\\ 0.80\\ 0.77\\ 0.73\\ 0.69\\ 0.56\\ 0.55\\$	$\begin{array}{c} 5.42\\ 5.452\\ 3.88\\ 3.04\\ 1.25\\ 2.51\\ 2.31\\ 2.00\\ 1.88\\ 1.66\\ 1.23\\ 1.16\\ 1.31\\ 1.26\\ 1.31\\ 1.16\\ 1.31\\ 1.16\\ 1.03\\ 1.01\\ 1.00\\ 0.99\\ 0.95\\ 0.95\\ 0.94$	$\begin{array}{c} 5.33\\ 4.48\\ 3.860\\ 2.75\\ 2.51\\ 2.302\\ 1.98\\ 1.855\\ 1.73\\ 1.634\\ 1.45\\ 1.37\\ 1.24\\ 1.17\\ 1.12\\ 1.061\\ 0.92\\ 0.87\\ 0.75\\ 0.684\\ 0.61\\ 0.57\\ 0.541\\ 0.48\\ 0.45\\ 0.45\\ 0.45\\ 0.32\\ 0.32\\ \end{array}$	$\begin{array}{c} 5.\ 48\\ 5.\ 48\\ 5.\ 3.\ 93\\ 5.\ 3.\ 93\\ 5.\ 3.\ 93\\ 5.\ 5.\ 48\\ 2.\ 51\\ 1.\ 93\\ 2.\ 54\\ 2.\ 51\\ 1.\ 52\\ 1.\ 54\\ 1.\ 52\\ 1.\ 52\\ 1.\ 120\\ 1.\ 54\\ 1.\ 122\\ 1.\ 120\\ 1.\ 120\\ 1.\ 120\\ 1.\ 100\\ 1.\ 00\\ 0.\ 99\\ 0.\ 97\\ 0.\ 96\\ 0.\ 95\\ 0$	$\begin{array}{c} 5.425\\ 4.55\\ 3.925\\ 3.308\\ 2.783\\ 2.15\\ 2.00\\ 1.743\\ 1.54\\ 1.37\\ 1.10\\ 0.95\\ 0.90\\ 0.82\\ 0.77\\ 4.070\\ 0.55\\ 0.49\\ 0.33\\$	$\begin{array}{c} 5.54\\ 4.62\\ 3.349\\ 3.11\\ 2.576\\ 2.19\\ 2.05\\ 1.92\\ 1.56\\ 1.5$	$\begin{array}{c} 5.51\\ 4.61\\ 3.97\\ 3.49\\ 3.11\\ 2.80\\ 2.55\\ 2.34\\ 2.16\\ 2.00\\ 1.87\\ 1.54\\ 1.63\\ 1.54\\ 1.63\\ 1.54\\ 1.63\\ 1.54\\ 1.63\\ 1.54\\ 1.63\\ 1.54\\ 1.63\\ 1.54\\ 1.63\\ 1.54\\ 1.63\\ 1.54\\ 1.63\\ 1.54\\ 1.63\\ 1.54\\ 1.63\\ 1.54\\ 1.63\\ 1.54\\ 1.63\\ 1.54\\ 1.63\\ 1.54\\ 1.63\\ 1.54\\ 1.63\\ 1.54\\ 1.63\\ 1.54\\ 1.63\\ 1.54\\ 1.63\\ 1.54\\ 1.54\\ 1.63\\ 1.54\\ 1.54\\ 1.54\\ 1.54\\ 1.54\\ 1.54\\ 1.54\\ 1.54\\ 1.54\\ 1.54\\ 1.54\\ 1.54\\ 1.54\\ 1.55\\$	$\begin{array}{c} 5.597\\ 4.611\\ 3.524\\ 2.39\\ 2.29\\ 2.39\\ 2.207\\ 1.83\\ 1.51\\ 1.45\\ 1.51\\ 1.45\\ 1.51\\ 1.27\\ 1.23\\ 1.127\\ 1.12\\ 1.108\\ 1.06\\ 1.05\\ 1.02\\ 1.01\\ 1.00\\ 0.999\\ 0.98\\ 0.98\\ \end{array}$	$\begin{array}{c} 5.566\\ 4.01\\ 3.52\\ 2.35\\ 2.16\\ 1.74\\ 1.63\\ 1.28\\ 1.21\\ 1.08\\ 1.22\\ 1.74\\ 1.63\\ 1.28\\ 1.21\\ 1.108\\ 1.027\\ 0.97\\ 0.97\\ 0.822\\ 0.78\\ 0.74\\ 0.65\\ 0.584\\ 0.50\\ 0.47\\ 0.430\\ 0.37\\ 0.33\end{array}$

TABLE 5B.

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Difference			Differenc	e between the	course and fi	rst bearing.		
the course and second bearing.	78°	80°	82°	84°	86°	88°	90°	920
$\begin{array}{c} 88^\circ\\ 90\\ 92\\ 94\\ 98\\ 100\\ 102\\ 104\\ 106\\ 108\\ 110\\ 112\\ 114\\ 116\\ 118\\ 120\\ 122\\ 124\\ 126\\ 128\\ 130\\ 132\\ 134\\ 136\\ 138\\ 140\\ 142\\ 144\\ 146\\ 148\\ 150\\ 152\\ 154\\ 156\\ 158\\ 160\\ \end{array}$	$\begin{array}{cccccccccccccccccccccccccccccccccccc$							
	94°	96°	98°	100°	1020	104°	106°	108°
$\begin{array}{c} 104^{\circ} \\ 106 \\ 108 \\ 110 \\ 1112 \\ 114 \\ 116 \\ 118 \\ 120 \\ 122 \\ 124 \\ 126 \\ 122 \\ 124 \\ 126 \\ 128 \\ 130 \\ 132 \\ 134 \\ 136 \\ 138 \\ 140 \\ 142 \\ 144 \\ 146 \\ 148 \\ 150 \\ 152 \\ 154 \\ 156 \\ 158 \\ 160 \end{array}$	$\begin{array}{cccccccccccccccccccccccccccccccccccc$	$\begin{array}{cccccccccccccccccccccccccccccccccccc$	$\begin{array}{cccccccccccccccccccccccccccccccccccc$	$\begin{array}{cccccccccccccccccccccccccccccccccccc$	$\begin{array}{cccccccccccccccccccccccccccccccccccc$			

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TABLE 5B.

Distance of an Object by Two Bearings.

						•								
Difference between the course					Diffe	rence be	etween t	he cours	e and fir	st bearii	ng.			
and second bearing.	110	0	11	20	11	140	11	16°	11	IS ^o	15	0°	1	220
$\begin{array}{c} 120^\circ \\ 122 \\ 124 \\ 126 \\ 128 \\ 130 \\ 132 \\ 134 \\ 136 \\ 138 \\ 140 \\ 142 \\ 144 \\ 146 \\ 148 \\ 150 \\ 152 \\ 154 \\ 156 \\ 158 \\ 160 \end{array}$	$\begin{array}{c} 5. \ 41 \\ 4. \ 52 \\ 3. \ 88 \\ 3. \ 41 \\ 2. \ 75 \\ 2. \ 51 \\ 2. \ 51 \\ 2. \ 51 \\ 2. \ 51 \\ 2. \ 51 \\ 2. \ 51 \\ 2. \ 51 \\ 2. \ 51 \\ 1. \ 68 \\ 1. \ 60 \\ 1. \ 53 \\ 1. \ 66 \\ 1. \ 53 \\ 1. \ 46 \\ 1. \ 35 \\ 1. \ 46 \\ 1. \ 35 \\ 1. \ 46 \\ 1. \ 23 \\ 1. \ 1. \ 1. \ 1. \ 1. \ 1. \ 1. \ 1.$	$\begin{array}{c} 4.\ 69\\ 3.\ 83\\ 3.\ 322\\ 2.\ 76\\ 2.\ 40\\ 2.\ 10\\ 1.\ 86\\ 1.\ 66\\ 1.\ 49\\ 1.\ 34\\ 1.\ 21\\ 1.\ 99\\ 0.\ 89\\ 0.\ 89\\ 0.\ 81\\ 0.\ 73\\ 0.\ 66\\ 0.\ 59\\ 0.\ 59\\ 0.\ 57\\ 0.\ 42\\ \end{array}$	$\begin{array}{c} 5. \ 34\\ 4. \ 46\\ 3. \ 83\\ 3. \ 36\\ 3. \ 00\\ 2. \ 71\\ 2. \ 48\\ 2. \ 28\\ 2. \ 12\\ 1. \ 95\\ 1. \ 75\\ 1. \ 66\\ 1. \ 58\\ 1. \ 58\\ 1. \ 58\\ 1. \ 58\\ 1. \ 58\\ 1. \ 58\\ 1. \ 39\\ 1. \ 33\\ 1. \ 29\\ 1. \ 25\\ \end{array}$	$\begin{array}{c} 4.53\\ 3.70\\ 3.10\\ 2.65\\ 2.30\\ 2.01\\ 1.78\\ 1.58\\ 1.42\\ 1.27\\ 1.14\\ 1.03\\ 0.93\\ 0.93\\ 0.93\\ 0.93\\ 0.61\\ 0.54\\ 0.48\\ 0.43\\ \end{array}$	$5.26 \\ 4.39 \\ 3.78 \\ 3.31 \\ 2.96 \\ 2.67 \\ 2.44 \\ 2.25 \\ 2.08 \\ 1.95 \\ 1.83 \\ 1.72 \\ 1.63 \\ 1.55 \\ 1.48 \\ 1.42 \\ 1.37 \\ 1.32 \\ 1.27 \\ $	$\begin{array}{c} 4.36\\ 3.55\\ 2.98\\ 2.54\\ 2.20\\ 1.92\\ 1.69\\ 1.30\\ 1.30\\ 1.30\\ 1.30\\ 0.96\\ 0.87\\ 0.70\\ 0.62\\ 0.56\\ 0.49\\ 0.43\\ \end{array}$	$5.18 \\ 4.32 \\ 3.26 \\ 2.91 \\ 2.63 \\ 2.40 \\ 2.21 \\ 1.80 \\ 1.61 \\ 1.53 \\ 1.46 \\ 1.40 \\ 1.34 \\ 1.29 \\ $	$\begin{array}{c} 4.\ 19\\ 3.\ 41\\ 2.\ 85\\ 2.\ 42\\ 2.\ 09\\ 1.\ 83\\ 1.\ 61\\ 1.\ 42\\ 1.\ 26\\ 1.\ 13\\ 1.\ 01\\ 0.\ 80\\ 0.\ 72\\ 0.\ 64\\ 0.\ 57\\ 0.\ 50\\ 0.\ 44\\ \end{array}$	$\begin{array}{c} 5.\ 08\\ 4.\ 25\\ 3.\ 65\\ 3.\ 20\\ 2.\ 86\\ 2.\ 36\\ 2.\ 36\\ 2.\ 17\\ 2.\ 01\\ 1.\ 88\\ 1.\ 77\\ 1.\ 58\\ 1.\ 50\\ 1.\ 43\\ 1.\ 37\\ 1.\ 32\\ \end{array}$	$\begin{array}{c} 4.\ 01\\ 3.\ 25\\ 2.\ 71\\ 2.\ 30\\ 1.\ 98\\ 1.\ 73\\ 1.\ 52\\ 1.\ 34\\ 1.\ 18\\ 1.\ 05\\ 0.\ 94\\ 0.\ 66\\ 0.\ 58\\ 0.\ 51\\ 0.\ 45\\ \end{array}$	$\begin{array}{c} 4.99\\ 4.17\\ 3.58\\ 3.14\\ 2.80\\ 2.53\\ 2.31\\ 2.13\\ 1.98\\ 1.84\\ 1.73\\ 1.63\\ 1.55\\ 1.47\\ 1.41\\ 1.35\\ \end{array}$	$\begin{array}{c} 3.82\\ 3.10\\ 2.57\\ 2.18\\ 1.88\\ 1.42\\ 1.25\\ 1.10\\ 0.98\\ 0.87\\ 0.77\\ 0.68\\ 0.60\\ 0.53\\ 0.46 \end{array}$	$\begin{array}{c} 4.88\\ 4.08\\ 3.51\\ 3.08\\ 2.74\\ 2.48\\ 2.26\\ 2.08\\ 1.93\\ 1.81\\ 1.70\\ 1.60\\ 1.52\\ 1.44\\ 1.38\end{array}$	$\begin{array}{c} 3.\ 63\\ 2.\ 93\\ 2.\ 44\\ 2.\ 06\\ 1.\ 53\\ 1.\ 33\\ 1.\ 17\\ 1.\ 03\\ 0.\ 80\\ 0.\ 70\\ 0.\ 62\\ 0.\ 54\\ 0.\ 47\\ \end{array}$
	124	o	12	6°	1:	8°	18	80°	13	20	13	4 °	1	36°
$134^{\circ} \\ 136 \\ 138 \\ 140 \\ 142 \\ 144 \\ 146 \\ 148 \\ 150 \\ 152 \\ 154 \\ 156 \\ 158 \\ 160 \\ 160 \\ 158 \\ 160 \\ 150 \\ 158 \\ 160 \\ 150 \\ 150 \\ 160 \\ 100 \\ $	$\begin{array}{c} 4.77 \\ 3.99 \\ 2.38 \\ 2.68 \\ 2.22 \\ 1.20 \\ 1.89 \\ 1.77 \\ 1.66 \\ 1.48 \\ 1.41 \\ 0 \end{array}$	3. 43 2. 77 2. 29 1. 93 1. 65 1. 42 1. 24 1. 08 0. 95 0. 83 0. 64 0. 73 0. 64 0. 56 0. 48	$\begin{array}{c} 4.\ 66\\ 3.\ 89\\ 2.\ 94\\ 2.\ 62\\ 2.\ 37\\ 2.\ 16\\ 1.\ 99\\ 1.\ 85\\ 1.\ 72\\ 1.\ 62\\ 1.\ 53\\ 1.\ 45 \end{array}$	$\begin{array}{c} 3.\ 23\\ 2.\ 60\\ 2.\ 15\\ 1.\ 81\\ 1.\ 54\\ 1.\ 32\\ 1.\ 14\\ 0.\ 99\\ 0.\ 87\\ 0.\ 76\\ 0.\ 66\\ 0.\ 57\\ 0.\ 49\\ \end{array}$	$\begin{array}{r} 4.54\\ 3.79\\ 3.26\\ 2.86\\ 2.55\\ 2.30\\ 2.10\\ 1.94\\ 1.80\\ 1.68\\ 1.58\\ 1.49\end{array}$	$\begin{array}{c} 3.04\\ 2.44\\ 2.01\\ 1.68\\ 1.43\\ 1.22\\ 1.05\\ 0.91\\ 0.79\\ 0.68\\ 0.59\\ 0.51\\ \end{array}$	$\begin{array}{c} 4.\ 41\\ 3.\ 68\\ 3.\ 17\\ 2.\ 78\\ 2.\ 24\\ 2.\ 04\\ 1.\ 88\\ 1.\ 75\\ 1.\ 63\\ 1.\ 53\end{array}$	$\begin{array}{c} 2.84\\ 2.27\\ 1.86\\ 1.55\\ 1.31\\ 1.12\\ 0.96\\ 0.83\\ 0.71\\ 0.61\\ 0.52\end{array}$	$\begin{array}{c} 4.28\\ 3.57\\ 3.07\\ 2.70\\ 2.40\\ 2.17\\ 1.98\\ 1.83\\ 1.70\\ 1.58\end{array}$	$\begin{array}{c} 2.\ 63\\ 2.\ 10\\ 1.\ 72\\ 1.\ 43\\ 1.\ 20\\ 1.\ 02\\ 0.\ 87\\ 0.\ 64\\ 0.\ 54\\ \end{array}$	$\begin{array}{c} 4.\ 14\\ 3.\ 46\\ 2.\ 97\\ 2.\ 61\\ 2.\ 33\\ 2.\ 10\\ 1.\ 92\\ 1.\ 77\\ 1.\ 64 \end{array}$	$\begin{array}{c} 2.43\\ 1.93\\ 1.58\\ 1.30\\ 1.09\\ 0.92\\ 0.78\\ 0.66\\ 0.56\end{array}$	$\begin{array}{c} 4.\ 00\\ 3.\ 34\\ 2.\ 87\\ 2.\ 52\\ 2.\ 25\\ 2.\ 03\\ 1.\ 85\\ 1.\ 71 \end{array}$	$\begin{array}{c} 2.\ 24\\ 1.\ 77\\ 1.\ 44\\ 1.\ 18\\ 0.\ 99\\ 0.\ 83\\ 0.\ 69\\ 0.\ 58\end{array}$
	1389		14	0°	14	20	14	4 °	14	6°	14	8°	1	50°
148° 150 152 154 156 158 160	3.85 2 3.22 1 2.77 1 2.43 1 2.17 (1.96 (1.79 (2. 04 1. 61 1. 30 1. 06 0. 88 0. 73 0. 61	3.70 3.09 2.66 2.33 2.08 1.88	$\begin{array}{c} 1.85\\ 1.45\\ 1.16\\ 0.95\\ 0.78\\ 0.64 \end{array}$	3.55 2.96 2.54 2.23 1.99	1.66 1.30 1.04 0.84 0.68	3. 38 2. 83 2. 43 2. 13	1.48 1.15 0.91 0.73	3.22 2.69 2.31	1.31 1.01 0.79	3. 05 2. 55	1. 14 0. 87	2.88	0. 98

TABLE 6.

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Distance of Visibility of Objects at Sea.

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Height, feet.	Nautieal miles.	Statute miles.	Height, feet.	Nautical miles.	Statute miles.	Height, feet.	Nautical miles.	Statute miles.
1	1.1	1.3	100	11.5	13.2	760	31.6	36.4
$\hat{2}$	1.7	1.9	105	11.7	13.5	780	32.0	36.9
3	2.0	2.3	110	12.0	13.8	800	32.4	37.3
4	2.0	2.0	115	12.0	10.0	820	32.4	37.8
5	2.5	2.0	120	12.0	14.5	810	22.0	20 2
0	2.0	2.9	120	12.0	14.0	840	00. 4 00. 0	00.0 90.7
0	2.8	3.2	120	12.9	14.8	860	33.0	38.7
7	2.9	3.5	130	13.1	15.1	880	34.0	39.2
8	3.1	3.7	135	13.3	15.3	900	34.4	39.6
9	3.5	4.0	140	13.6	15.6	920	34.7	40.0
10	3,6	4.2	145	13.8	15.9	940	35.2	40.5
11	3.8	4.4	150	14.1	16.2	960	35.5	40.9
12	4.0	4.6	160	14.5	16.7	980	35.9	41.3
13	4.2	4.8	170	14.9	17.2	1.000	36.2	41.7
14	4.3	4.9	180	15.4	17.7	1,100	38 0	43.8
15	4 4	5 1	190	15.8	18 2	1 200	39.6	45 6
16	1.1	5 3	200	16.0	18.7	1,200	41 3	47.6
17	1.0	5.0	210	16.2	10.1	1,000	71,0 40 0	40.4
10	4.6	0.4 5 0	210	10.0	10.0	1,400	42.9	10.4
18	4.9	5.0	220	17.0	19.0	1,000	44.4	<u>91.1</u>
19	5.0	5.8	230	17.4	20.0	1,600	45.8	52.8
20	5.1	5.9	240	17.7	20.4	1,700	47.2	54.4
21	5.3	6.1	250	18.2	20.9	1,800	48.6	56.0
22	5.4	6.2	260	18.5	21.3	1,900	49.9	57.5
23	5.5	6.3	270	18.9	21.7	2,000	51.2	59.0
24	5.6	6.5	280	19.2	22.1	2,100	52.5	60.5
25	5.7	6.6	290	19.6	22.5	2,200	53.8	61.9
26	5.8	6.7	300	19.9	22.9	2.300	55.0	63.3
27	6.0	6.9	310	20.1	23.2	2,400	56.2	64.7
28	61	7 0	320	20.5	23 6	2 500	57 3	66.0
20	6.2	7 1	330	20.8	24 0	2 600	58 5	67.3
20	63	7 9	340	20.0	21.0	2,000	59.6	68.6
21	6.1	$\frac{1.2}{7.2}$	350	91 5	21.0	2,100	60.6	60.8
	0.4	7.5	260	21.0 91.7	25.0	2,800	61 0	71 1
04	0.0	1.0	300	21.7	20.0	2,900	01.0	71.1
33	6.6	7.6	370	22.1	20.4	3,000	62.8	12.3
34	6.7	1.7	380	22.3	25.7	3,100	63.8	73.5
35	6.8	7.8	390	22.7	26.1	3,200	64.9	74.7
36	6.9	7.9	400	22.9	26.4	3,300	65.9	75.9
37	6.9	8.0	410	23.2	26.7	3,400	66.9	77.0
38	7.0	8.1	420	23.5	27.1	3,500	67.8	78.1
39	7.1	8.2	430	23.8	27.4	3,600	; 68.8	79.2
40	7.2	8.3	440	24.1	27.7	3,700	69.7	80.3
41	7.3	8,4	450	24.3	28.0	3,800	70.7	81.4
42	7.4	8.5	460	24.6	28.3	3,900	71.6	82.4
43	7.5	8 7	470	24 8	28.6	4,000	72.5	83.5
4.1	7.6	8.8	480	25.1	28.0	4 100	73.1	84 5
15	7.0	8.0	.100	25.1	20. 8	1,100	7.1 9	85 R
40	$\frac{1}{7}$	0.9	490	20.4	49.2 20 E	4,200	74.0	00.0
40	1.8	9.0	800	20.0	29.0	4,300	10.2	80.0
47	7.9	9.0	520	26.1	30.1	4,400	70.1	87.6
48	7.9	9.1	540	26.7	30.7	4,500	76.9	88.5
49	8.0	9.2	560	27.1	31.2	4,600	77.7	89.5
50	8.1	9.3	580	27.6	31.8	4,700	78.6	90.5
55	8.5	9.8	600	28.0	32.3	4,800	79.4	91.4
60	8.9	10.2	620	28.6	32.9	4,900	80.2	92.4
65	9.2	10.6	640	29.0	33.4	5,000	81.0	93.3
70	9.6	11.0	660	29.4	33.9	6,000	88.8	102.2
75	9.9	11.4	680	29.9	34.4	7,000	96.0	110.5
80	10.3	11 8	700	30.3	34 9	8 000	102.6	118.1
85	10.5	19.9	790	20.7	25 1	9,000	102.0	195.9
- 60	10.0	19.5	7.10	21 1	25 0	10,000	114 6	132 0
05	10.0	12.0	140	01.1	00.0	10,000	114.0	102.0
90	11.2	12.9						

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TABLE 7.

For converting Arc into Time, and the reverse

			For c	onvertii	ig Are in	to Time,	, and the	reverse.			
0	Н. М.	0	H. M.	0	Н. М.	0	Н. М.	0	Н. М.	0	Н. М.
'	M. S.	'	M. S.	1	M. S.	'	M. S.	'	M. S.	'	M. S.
"	S. 50	"	S. 1 60	"	S. 100	"	S. do	"	S. a	"	S. 50
$ \begin{array}{c} 1 \\ 2 \\ 3 \\ 4 \\ 5 \\ 6 \\ 7 \\ 8 \\ 9 \\ 10 \\ \end{array} $	$\begin{array}{cccc} 0 & 4 \\ 0 & 8 \\ 0 & 12 \\ 0 & 16 \\ 0 & 20 \\ 0 & 24 \\ 0 & 28 \\ 0 & 32 \\ 0 & 36 \\ 0 & 40 \end{array}$	$\begin{array}{c} 61 \\ 62 \\ 63 \\ 64 \\ 65 \\ 66 \\ 67 \\ 68 \\ 69 \\ 70 \end{array}$	$\begin{array}{r} 4 & 4 \\ 4 & 8 \\ 4 & 12 \\ 4 & 16 \\ 4 & 20 \\ 4 & 24 \\ 4 & 24 \\ 4 & 28 \\ 4 & 32 \\ 4 & 36 \\ 4 & 40 \end{array}$	$121 \\ 122 \\ 123 \\ 124 \\ 125 \\ 126 \\ 127 \\ 128 \\ 129 \\ 130$	$\begin{array}{rrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrr$	$181 \\ 182 \\ 183 \\ 184 \\ 185 \\ 186 \\ 187 \\ 188 \\ 189 \\ 190$	$\begin{array}{cccccccccccccccccccccccccccccccccccc$	$\begin{array}{c} 241 \\ 242 \\ 243 \\ 244 \\ 245 \\ 246 \\ 247 \\ 248 \\ 249 \\ 250 \end{array}$	$\begin{array}{cccccccccccccccccccccccccccccccccccc$	$\begin{array}{r} 301 \\ 302 \\ 303 \\ 304 \\ 305 \\ 306 \\ 307 \\ 308 \\ 309 \\ 310 \end{array}$	$\begin{array}{cccccccccccccccccccccccccccccccccccc$
$ \begin{array}{c} 11\\ 12\\ 13\\ 14\\ 15\\ 16\\ 17\\ 18\\ 19\\ 20\\ \end{array} $	$\begin{array}{c} 0 & 44 \\ 0 & 48 \\ 0 & 52 \\ 0 & 56 \\ 1 & 0 \\ 1 & 4 \\ 1 & 8 \\ 1 & 12 \\ 1 & 16 \\ 1 & 20 \end{array}$	$71 \\ 72 \\ 73 \\ 74 \\ 75 \\ 76 \\ 77 \\ 78 \\ 79 \\ 80$	$\begin{array}{r} 4 & 44 \\ 4 & 48 \\ 4 & 52 \\ 4 & 56 \\ 5 & 0 \\ 5 & 4 \\ 5 & 8 \\ 5 & 12 \\ 5 & 16 \\ 5 & 20 \end{array}$	$\begin{array}{c} 131 \\ 132 \\ 133 \\ 134 \\ 135 \\ 136 \\ 137 \\ 138 \\ 139 \\ 140 \end{array}$	$\begin{array}{c} 8 & 44 \\ 8 & 48 \\ 8 & 52 \\ 8 & 56 \\ 9 & 0 \\ 9 & 4 \\ 9 & 8 \\ 9 & 12 \\ 9 & 16 \\ 9 & 20 \end{array}$	$\begin{array}{r} 191 \\ 192 \\ 193 \\ 194 \\ 195 \\ 196 \\ 197 \\ 198 \\ 199 \\ 200 \end{array}$	$\begin{array}{c} 12 \ 44 \\ 12 \ 48 \\ 12 \ 52 \\ 12 \ 56 \\ 13 \ 0 \\ 13 \ 4 \\ 13 \ 8 \\ 13 \ 12 \\ 13 \ 16 \\ 13 \ 20 \end{array}$	$\begin{array}{r} 251 \\ 252 \\ 253 \\ 254 \\ 255 \\ 256 \\ 257 \\ 258 \\ 259 \\ 260 \end{array}$	$\begin{array}{c} 16 \ 44 \\ 16 \ 48 \\ 16 \ 52 \\ 16 \ 56 \\ 17 \ 0 \\ 17 \ 4 \\ 17 \ 8 \\ 17 \ 12 \\ 17 \ 16 \\ 17 \ 20 \end{array}$	$\begin{array}{c} 311\\ 312\\ 313\\ 314\\ 315\\ 316\\ 317\\ 318\\ 319\\ 320\\ \end{array}$	$\begin{array}{cccccccccccccccccccccccccccccccccccc$
$ \begin{array}{r} 21\\ 22\\ 23\\ 24\\ 25\\ 26\\ 27\\ 28\\ 29\\ 30\\ \end{array} $	$ \begin{array}{r} 1 24 \\ 1 28 \\ 1 32 \\ 1 36 \\ 1 40 \\ 1 44 \\ 1 48 \\ 1 52 \\ 1 56 \\ 2 0 \end{array} $	81 82 83 84 85 86 87 88 89 90	$\begin{array}{cccccccccccccccccccccccccccccccccccc$	$ \begin{array}{r} 141\\ 142\\ 143\\ 144\\ 145\\ 146\\ 147\\ 148\\ 149\\ 150\\ \end{array} $	$\begin{array}{c} 9 \ 24 \\ 9 \ 28 \\ 9 \ 32 \\ 9 \ 36 \\ 9 \ 40 \\ 9 \ 44 \\ 9 \ 48 \\ 9 \ 52 \\ 9 \ 56 \\ 10 \ 0 \end{array}$	$\begin{array}{c} 201 \\ 202 \\ 203 \\ 204 \\ 205 \\ 206 \\ 207 \\ 208 \\ 209 \\ 210 \end{array}$	$\begin{array}{cccccccccccccccccccccccccccccccccccc$	$\begin{array}{c} 261 \\ 262 \\ 263 \\ 264 \\ 265 \\ 266 \\ 267 \\ 268 \\ 269 \\ 270 \end{array}$	$\begin{array}{cccccccccccccccccccccccccccccccccccc$	$\begin{array}{c} 321 \\ 322 \\ 323 \\ 324 \\ 325 \\ 326 \\ 327 \\ 328 \\ 329 \\ 330 \end{array}$	$\begin{array}{cccccccccccccccccccccccccccccccccccc$
31 32 33 34 35 36 37 38 39 40	$ \begin{array}{cccccccccccccccccccccccccccccccccccc$	$91 \\ 92 \\ 93 \\ 94 \\ 95 \\ 96 \\ 97 \\ 98 \\ 99 \\ 100$	$\begin{array}{cccccccccccccccccccccccccccccccccccc$	$ \begin{array}{r} 151 \\ 152 \\ 153 \\ 154 \\ 155 \\ 156 \\ 157 \\ 158 \\ 159 \\ 160 \\ \end{array} $	$\begin{array}{cccccccccccccccccccccccccccccccccccc$	$\begin{array}{c} 211 \\ 212 \\ 213 \\ 214 \\ 215 \\ 216 \\ 217 \\ 218 \\ 219 \\ 220 \end{array}$	$\begin{array}{cccccccccccccccccccccccccccccccccccc$	$\begin{array}{r} 271 \\ 272 \\ 273 \\ 274 \\ 275 \\ 276 \\ 277 \\ 278 \\ 279 \\ 280 \end{array}$	$\begin{array}{cccccccccccccccccccccccccccccccccccc$	$\begin{array}{c} 331 \\ 332 \\ 333 \\ 334 \\ 335 \\ 336 \\ 337 \\ 338 \\ 339 \\ 340 \end{array}$	$\begin{array}{r} 22 & 4 \\ 22 & 8 \\ 22 & 12 \\ 22 & 16 \\ 22 & 20 \\ 22 & 24 \\ 22 & 24 \\ 22 & 32 \\ 22 & 32 \\ 22 & 36 \\ 22 & 40 \end{array}$
$\begin{array}{r} 41 \\ 42 \\ 43 \\ 44 \\ 45 \\ 46 \\ 47 \\ 48 \\ 49 \\ 50 \end{array}$	$\begin{array}{cccccccccccccccccccccccccccccccccccc$	$ \begin{array}{r}101\\102\\103\\104\\105\\106\\107\\108\\109\\110\end{array} $	$\begin{array}{c} 6 & 44 \\ 6 & 48 \\ 6 & 52 \\ 6 & 56 \\ 7 & 0 \\ 7 & 4 \\ 7 & 8 \\ 7 & 12 \\ 7 & 16 \\ 7 & 20 \end{array}$	$161 \\ 162 \\ 163 \\ 164 \\ 165 \\ 166 \\ 167 \\ 168 \\ 169 \\ 170$	$\begin{array}{cccccccccccccccccccccccccccccccccccc$	221 222 223 224 225 226 227 228 229 230	$\begin{array}{cccccccccccccccccccccccccccccccccccc$	281 282 283 284 285 286 287 288 289 290	$\begin{array}{c} 18 \ 44 \\ 18 \ 48 \\ 18 \ 52 \\ 18 \ 56 \\ 19 \ 0 \\ 19 \ 4 \\ 19 \ 8 \\ 19 \ 12 \\ 19 \ 16 \\ 19 \ 20 \end{array}$	$\begin{array}{r} 341 \\ 342 \\ 343 \\ 344 \\ 345 \\ 346 \\ 347 \\ 348 \\ 349 \\ 350 \end{array}$	$\begin{array}{cccccccccccccccccccccccccccccccccccc$
$51 \\ 52 \\ 53 \\ 54 \\ 55 \\ 56 \\ 57 \\ 58 \\ 59 \\ 60$	$\begin{array}{c} 3 & 24 \\ 3 & 28 \\ 3 & 32 \\ 3 & 36 \\ 3 & 40 \\ 3 & 44 \\ 3 & 48 \\ 3 & 52 \\ 3 & 56 \\ 4 & 0 \end{array}$	$111 \\ 112 \\ 113 \\ 114 \\ 115 \\ 116 \\ 117 \\ 118 \\ 119 \\ 120$	$\begin{array}{cccccccccccccccccccccccccccccccccccc$	$ \begin{array}{r} 171 \\ 172 \\ 173 \\ 174 \\ 175 \\ 176 \\ 177 \\ 178 \\ 179 \\ 180 \\ \end{array} $	$\begin{array}{cccccccccccccccccccccccccccccccccccc$	$\begin{array}{c} 231 \\ 232 \\ 233 \\ 234 \\ 235 \\ 236 \\ 237 \\ 238 \\ 239 \\ 240 \end{array}$	$\begin{array}{cccccccccccccccccccccccccccccccccccc$	$\begin{array}{c} 291 \\ 292 \\ 293 \\ 294 \\ 295 \\ 296 \\ 297 \\ 298 \\ 299 \\ 300 \end{array}$	$\begin{array}{cccccccccccccccccccccccccccccccccccc$	$\begin{array}{r} 351 \\ 352 \\ 353 \\ 354 \\ 355 \\ 356 \\ 357 \\ 358 \\ 359 \\ 360 \end{array}$	$\begin{array}{cccccccccccccccccccccccccccccccccccc$

Note.—When turning seconds of arc into time, and vice versa, it should be remembered that the fractions are sixtieths; thus, the value in time of 42" is not 2°.48, but 2°.48 = 2°.8.

	TABLE 8. [Pag									479
			ŝ	Sidereal int	o Mean Sol	ar Time.				
eal.			То	be subtracted	l from a sidere	eal time inter	val.			
Sider	0 h	1h	2h	3 h	4h	5 h	6h	7 h	For	seconds.
$m. \\ 0 \\ 1 \\ 2 \\ 3 \\ 4 \\ 5$	$\begin{array}{cccccccccccccccccccccccccccccccccccc$	$\begin{array}{cccccccccccccccccccccccccccccccccccc$	$\begin{array}{cccccccccccccccccccccccccccccccccccc$	$\begin{array}{cccccccccccccccccccccccccccccccccccc$	$\begin{array}{cccccccccccccccccccccccccccccccccccc$	$\begin{array}{cccccccccccccccccccccccccccccccccccc$	$\begin{array}{cccccccccccccccccccccccccccccccccccc$	$\begin{array}{cccccccccccccccccccccccccccccccccccc$		8. 0.003 .005 .008 .011 .014
6 7 8 9 10	$\begin{array}{c} 0 & 0.983 \\ 0 & 1.147 \\ 0 & 1.311 \\ 0 & 1.474 \\ \hline 0 & 1.638 \\ 0 & 1.028 \end{array}$	0 10. 813 0 10. 976 0 11. 140 0 11. 304 0 11. 468	0 20.642 0 20.806 0 20.970 0 21.134 0 21.297	$\begin{array}{c} 0 & 30. 472 \\ 0 & 30. 635 \\ 0 & 30. 799 \\ 0 & 30. 963 \\ \hline 0 & 31. 127 \\ 0 & 31. 001 \end{array}$	0 40.301 0 40.465 0 40.629 0 40.793 0 40.956	$\begin{array}{c} 0 \ 50. \ 131 \\ 0 \ 50. \ 295 \\ 0 \ 50. \ 458 \\ 0 \ 50. \ 622 \\ \hline 0 \ 50. \ 786 \\ 0 \ 50. \ 786 \\ \end{array}$	$\begin{array}{cccccccccccccccccccccccccccccccccccc$	$\begin{array}{rrrr} 1 & 9.790 \\ 1 & 9.954 \\ 1 & 10.118 \\ 1 & 10.281 \\ \hline 1 & 10.445 \\ 1 & 10.200 \end{array}$	$ \begin{array}{r} 6 \\ 7 \\ 8 \\ 9 \\ 10 \\ 11 $	$\begin{array}{r} . \ 016 \\ . \ 019 \\ . \ 022 \\ . \ 025 \\ \hline . \ 027 \\ 020 \end{array}$
$ \begin{array}{r} 11 \\ 12 \\ 13 \\ 14 \\ 15 \\ 16 \\ 16 \\ \end{array} $	$\begin{array}{c} 0 & 1.802 \\ 0 & 1.966 \\ 0 & 2.130 \\ 0 & 2.294 \\ \hline 0 & 2.457 \\ 0 & 2.621 \end{array}$	$\begin{array}{c} 0 & 11. 632 \\ 0 & 11. 795 \\ 0 & 11. 959 \\ 0 & 12. 123 \\ \hline 0 & 12. 287 \\ 0 & 12. 451 \end{array}$	$\begin{array}{c} 0 & 21.461 \\ 0 & 21.625 \\ 0 & 21.789 \\ 0 & 21.953 \\ \hline 0 & 22.117 \\ 0 & 22.280 \\ \end{array}$	$\begin{array}{c} 0 & 31. 291 \\ 0 & 31. 455 \\ 0 & 31. 618 \\ 0 & 31. 782 \\ \hline 0 & 31. 946 \\ 0 & 32. 110 \end{array}$	$\begin{array}{c} 0 \ 41.120 \\ 0 \ 41.284 \\ 0 \ 41.448 \\ 0 \ 41.612 \\ \hline 0 \ 41.776 \\ 0 \ 41.939 \end{array}$	$\begin{array}{c} 0 \ 50.950\\ 0 \ 51.114\\ 0 \ 51.278\\ 0 \ 51.441\\ \hline 0 \ 51.605\\ 0 \ 51.769\\ \end{array}$	$ \begin{array}{r} 1 & 0.779 \\ 1 & 0.943 \\ 1 & 1.107 \\ 1 & 1.271 \\ \hline 1 & 1.435 \\ 1 & 1 & 599 \\ \end{array} $	$ \begin{array}{cccccccccccccccccccccccccccccccccccc$	$ \begin{array}{r} 11 \\ 12 \\ 13 \\ 14 \\ 15 \\ 16 \\ 16 \\ 16 \\ 11 \\ 11 \\ 12 \\ 12 \\ 13 \\ 14 \\ 15 \\ 16 \\ 16 \\ 16 \\ 16 \\ 11 \\ 11 \\ 12 \\ 12 \\ 13 \\ 14 \\ 15 \\ 16 \\ 16 \\ 16 \\ 16 \\ 16 \\ 16 \\ 16 \\ 11 \\ 11 \\ 12 \\ 12 \\ 13 \\ 14 \\ 15 \\ 16 \\$.030 .033 .035 .038 .041 .041
$ \begin{array}{r} 17 \\ 18 \\ 19 \\ 20 \\ 21 \end{array} $	$\begin{array}{r} 0 & 2.785 \\ 0 & 2.949 \\ 0 & 3.113 \\ \hline 0 & 3.277 \\ 0 & 3.440 \end{array}$	0 12. 615 0 12. 778 0 12. 942 0 13. 106 0 13. 270	$\begin{array}{c} 0 & 22.444 \\ 0 & 22.608 \\ 0 & 22.772 \\ \hline 0 & 22.936 \\ 0 & 23.099 \end{array}$	$\begin{array}{c} 0 & 32.\ 274 \\ 0 & 32.\ 438 \\ 0 & 32.\ 601 \\ \hline 0 & 32.\ 765 \\ 0 & 32.\ 929 \end{array}$	$\begin{array}{c} 0 & 42.103 \\ 0 & 42.267 \\ 0 & 42.431 \\ \hline 0 & 42.595 \\ 0 & 42.759 \\ \end{array}$	$\begin{array}{c} 0 & 51.933 \\ 0 & 52.097 \\ 0 & 52.260 \\ \hline 0 & 52.424 \\ 0 & 52.588 \end{array}$	$ \begin{array}{cccccccccccccccccccccccccccccccccccc$	$\begin{array}{c}1&11.592\\1&11.756\\1&11.920\\\hline1&12.083\\1&12.247\end{array}$	$ \begin{array}{r} 17 \\ 18 \\ 19 \\ \hline 20 \\ 21 \end{array} $.046 .049 .052 .055 .057
$ \begin{array}{r} 22 \\ 23 \\ 24 \\ \overline{25} \\ 26 \end{array} $	$\begin{array}{c} 0 & 3. & 604 \\ 0 & 3. & 768 \\ 0 & 3. & 932 \\ \hline 0 & 4. & 096 \\ 0 & 4. & 259 \end{array}$	$\begin{array}{c} 0 \ 13.\ 434 \\ 0 \ 13.\ 598 \\ 0 \ 13.\ 761 \\ \hline 0 \ 13.\ 925 \\ 0 \ 14.\ 089 \end{array}$	$\begin{array}{c} 0 \ 23. \ 263 \\ 0 \ 23. \ 427 \\ 0 \ 23. \ 591 \\ \hline 0 \ 23. \ 755 \\ 0 \ 23. \ 919 \end{array}$	$\begin{array}{c} 0 & 33. \ 093 \\ 0 & 33. \ 257 \\ 0 & 33. \ 420 \\ \hline 0 & 33. \ 584 \\ 0 & 33. \ 748 \end{array}$	$\begin{array}{c} 0 \ 42.\ 922 \\ 0 \ 43.\ 086 \\ 0 \ 43.\ 250 \\ \hline 0 \ 43.\ 414 \\ 0 \ 43.\ 578 \end{array}$	$\begin{array}{c} 0 \ 52.\ 752 \\ 0 \ 52.\ 916 \\ 0 \ 53.\ 080 \\ \hline 0 \ 53.\ 243 \\ 0 \ 53.\ 407 \end{array}$	$ \begin{array}{rrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrr$	$\begin{array}{c}1&12.411\\1&12.575\\1&12.739\\\hline1&12.903\\1&13.066\end{array}$	$ \begin{array}{r} 22 \\ 23 \\ 24 \\ \overline{25} \\ 26 \end{array} $.060 .063 .066 .068 .071
$ \begin{array}{r} 27 \\ 28 \\ 29 \\ \overline{30} \\ 31 \end{array} $	$\begin{array}{r} 0 \ 4. \ 423 \\ 0 \ 4. \ 587 \\ 0 \ 4. \ 751 \\ \hline 0 \ 4. \ 915 \\ 0 \ 5. \ 079 \end{array}$	$\begin{array}{c} 0 \ 14. 253 \\ 0 \ 14. 417 \\ 0 \ 14. 581 \\ \hline 0 \ 14. 744 \\ 0 \ 14. 908 \end{array}$	$\begin{array}{c} 0 \ 24.\ 082 \\ 0 \ 24.\ 246 \\ 0 \ 24.\ 410 \\ \hline 0 \ 24.\ 574 \\ 0 \ 24.\ 738 \end{array}$	$\begin{array}{c} 0 & 33. 912 \\ 0 & 34. 076 \\ 0 & 34. 240 \\ \hline 0 & 34. 403 \\ 0 & 34. 567 \end{array}$	$\begin{array}{c} 0 \ 43. \ 742 \\ 0 \ 43. \ 905 \\ 0 \ 44. \ 069 \\ \hline 0 \ 44. \ 233 \\ 0 \ 44. \ 397 \end{array}$	$\begin{array}{c} 0 \ 53. 571 \\ 0 \ 53. 735 \\ 0 \ 53. 899 \\ \hline 0 \ 54. 063 \\ 0 \ 54. 226 \end{array}$	$ \begin{array}{rrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrr$	$ \begin{array}{r} 1 & 13. 230 \\ 1 & 13. 394 \\ 1 & 13. 558 \\ \hline 1 & 13. 722 \\ 1 & 13. 886 \\ \end{array} $	$ \begin{array}{r} 27 \\ 28 \\ 29 \\ \overline{30} \\ 31 \end{array} $	0.074 0.076 0.079 0.082 0.085
32 33 34 35 36	$\begin{array}{c} 0 & 5.242 \\ 0 & 5.406 \\ 0 & 5.570 \\ \hline 0 & 5.734 \\ 0 & 5 & 898 \end{array}$	$\begin{array}{c} 0 & 15.072 \\ 0 & 15.236 \\ 0 & 15.400 \\ \hline 0 & 15.563 \\ 0 & 15.727 \\ \end{array}$	$\begin{array}{c} 0 & 24.902 \\ 0 & 25.065 \\ 0 & 25.229 \\ \hline 0 & 25.393 \\ 0 & 25.557 \end{array}$	$\begin{array}{c} 0 & 34.731 \\ 0 & 34.895 \\ 0 & 35.059 \\ \hline 0 & 35.223 \\ 0 & 35 & 386 \\ \end{array}$	$\begin{array}{c} 0 & 44.561 \\ 0 & 44.724 \\ 0 & 44.888 \\ \hline 0 & 45.052 \\ 0 & 45.216 \end{array}$	$\begin{array}{c} 0 & 54.390 \\ 0 & 54.554 \\ 0 & 54.718 \\ \hline 0 & 54.882 \\ 0 & 55 & 046 \\ \end{array}$	$ \begin{array}{r} 1 & 4.220 \\ 1 & 4.384 \\ 1 & 4.547 \\ \hline 1 & 4.711 \\ 1 & 4.875 \\ \end{array} $	$ \begin{array}{r} 1 & 14.049 \\ 1 & 14.213 \\ 1 & 14.377 \\ \hline 1 & 14.541 \\ 1 & 14.705 \\ \end{array} $	$ \begin{array}{r} 32 \\ 33 \\ 34 \\ \overline{35} \\ 36 \end{array} $.087 .090 .093 .096 .098
$ \begin{array}{r} 37 \\ 38 \\ 39 \\ \overline{40} \\ 41 \\ 41 \end{array} $	$\begin{array}{c} 0 & 6.062 \\ 0 & 6.225 \\ 0 & 6.389 \\ \hline 0 & 6.553 \\ 0 & 6.717 \\ \end{array}$	$\begin{array}{c} 0 & 15.891 \\ 0 & 16.055 \\ 0 & 16.219 \\ \hline 0 & 16.383 \\ 0 & 16.546 \end{array}$	$\begin{array}{c} 0 & 25.721 \\ 0 & 25.885 \\ 0 & 26.048 \\ \hline 0 & 26.212 \\ 0 & 26&376 \\ \end{array}$	$\begin{array}{c} 0 & 35.550 \\ 0 & 35.714 \\ 0 & 35.878 \\ \hline 0 & 36.042 \\ 0 & 36 & 206 \end{array}$	$\begin{array}{c} 0 & 45.380 \\ 0 & 45.544 \\ 0 & 45.707 \\ \hline 0 & 45.871 \\ 0 & 46.025 \end{array}$	$\begin{array}{c} 0 & 55. & 209 \\ 0 & 55. & 373 \\ 0 & 55. & 537 \\ \hline 0 & 55. & 701 \\ 0 & 55 & 865 \\ \end{array}$	$\begin{array}{cccccccccccccccccccccccccccccccccccc$	$\begin{array}{c}1&14.868\\1&15.032\\1&15.196\\\hline1&15.360\\1&15.521\end{array}$	$ \begin{array}{r} 37 \\ 38 \\ 39 \\ \overline{40} \\ 41 \end{array} $	$ \begin{array}{r} .101 \\ .104 \\ .106 \\ .109 \\ .119 \end{array} $
42 43 44 45	$\begin{array}{r} 0 & 0.717 \\ 0 & 6.881 \\ 0 & 7.045 \\ \hline 0 & 7.208 \\ \hline 0 & 7.372 \\ \hline 0 & 7.372 \\ \hline \end{array}$	$\begin{array}{c} 0 & 10.540 \\ 0 & 16.710 \\ 0 & 16.874 \\ 0 & 17.038 \\ \hline 0 & 17.202 \\ 0 & 17.202 \end{array}$	$\begin{array}{c} 0 & 20.370 \\ 0 & 26.540 \\ 0 & 26.704 \\ 0 & 26.867 \\ \hline 0 & 27.031 \\ \hline \end{array}$	$\begin{array}{c} 0 & 36. \ 200 \\ 0 & 36. \ 369 \\ 0 & 36. \ 533 \\ 0 & 36. \ 697 \\ \hline 0 & 36. \ 861 \end{array}$	$\begin{array}{c} 0 & 40.033 \\ 0 & 46.199 \\ 0 & 46.363 \\ 0 & 46.527 \\ \hline 0 & 46.690 \end{array}$	$\begin{array}{c} 0 & 55.865 \\ 0 & 56.028 \\ 0 & 56.192 \\ 0 & 56.356 \\ \hline 0 & 56.520 \end{array}$	$ \begin{array}{r} 1 & 5.054 \\ 1 & 5.858 \\ 1 & 6.022 \\ 1 & 6.186 \\ \hline 1 & 6.350 \\ \end{array} $	$\begin{array}{c}1&15.524\\1&15.688\\1&15.851\\1&16.015\\\hline1&16.179\end{array}$	41 42 43 44 44 45 45	$ \begin{array}{r} .112\\.115\\.117\\.120\\\hline .123\\\hline \end{array} $
$ \begin{array}{r} 46 \\ 47 \\ 48 \\ 49 \\ \overline{50} \end{array} $	$\begin{array}{c} 0 & 7.536 \\ 0 & 7.700 \\ 0 & 7.864 \\ 0 & 8.027 \\ \hline 0 & 8.191 \end{array}$	$\begin{array}{c} 0 & 17.366 \\ 0 & 17.529 \\ 0 & 17.693 \\ 0 & 17.857 \\ \hline 0 & 18.021 \end{array}$	$\begin{array}{c} 0 \ 27. \ 195 \\ 0 \ 27. \ 359 \\ 0 \ 27. \ 523 \\ 0 \ 27. \ 687 \\ \hline 0 \ 27. \ 850 \end{array}$	$\begin{array}{c} 0 & 37. \ 025 \\ 0 & 37. \ 188 \\ 0 & 37. \ 352 \\ 0 & 37. \ 516 \\ \hline 0 & 37. \ 680 \end{array}$	$\begin{array}{c} 0 \ 46.\ 854 \\ 0 \ 47.\ 018 \\ 0 \ 47.\ 182 \\ \hline 0 \ 47.\ 346 \\ \hline 0 \ 47.\ 510 \end{array}$	$\begin{array}{c} 0 \ 56.\ 684 \\ 0 \ 56.\ 848 \\ 0 \ 57.\ 011 \\ 0 \ 57.\ 175 \\ \hline 0 \ 57.\ 339 \end{array}$	$ \begin{array}{rrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrr$	$\begin{array}{r}1 & 16. 343\\1 & 16. 507\\1 & 16. 671\\1 & 16. 834\\\hline1 & 16. 998\end{array}$	$ \begin{array}{r} 46 \\ 47 \\ 48 \\ 49 \\ \overline{50} \end{array} $	$ \begin{array}{r} .126\\.128\\.131\\.134\\\hline .137\\\end{array} $
$51 \\ 52 \\ 53 \\ 54 \\ \overline{55}$	$ \begin{array}{r} 0 & 8.355 \\ 0 & 8.519 \\ 0 & 8.683 \\ 0 & 8.847 \\ \hline 0 & 9.010 \end{array} $	$\begin{array}{c} 0 \ 18. \ 185 \\ 0 \ 18. \ 349 \\ 0 \ 18. \ 512 \\ 0 \ 18. \ 676 \\ \hline 0 \ 18. \ 840 \end{array}$	$\begin{array}{c} 0 & 28.014 \\ 0 & 28.178 \\ 0 & 28.342 \\ 0 & 28.506 \\ \hline 0 & 28.670 \end{array}$	$\begin{array}{c} 0 & 37.844 \\ 0 & 38.008 \\ 0 & 38.171 \\ 0 & 38.335 \\ \hline 0 & 38 & 499 \end{array}$	$\begin{array}{c} 0 \ 47.\ 673 \\ 0 \ 47.\ 837 \\ 0 \ 48.\ 001 \\ 0 \ 48.\ 165 \\ \hline 0 \ 48.\ 329 \end{array}$	$\begin{array}{r} 0 & 57.503 \\ 0 & 57.667 \\ 0 & 57.831 \\ 0 & 57.994 \\ \hline 0 & 58 & 158 \end{array}$	$ \begin{array}{rrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrr$	$ \begin{array}{r} 1 & 17. 162 \\ 1 & 17. 326 \\ 1 & 17. 490 \\ 1 & 17. 654 \\ \hline 1 & 17. 817 \\ \end{array} $	$51 \\ 52 \\ 53 \\ 54 \\ 55$.139 .142 .145 .147 .150
$56 \\ 57 \\ 58 \\ 59$	$\begin{array}{c} 0 & 9.174 \\ 0 & 9.338 \\ 0 & 9.502 \\ 0 & 9.666 \end{array}$	0 19.004 0 19.168 0 19.331 0 19.495	$\begin{array}{c} 0 & 28.833 \\ 0 & 28.997 \\ 0 & 29.161 \\ 0 & 29.325 \end{array}$	$ \begin{smallmatrix} 0 & 38. & 663 \\ 0 & 38. & 827 \\ 0 & 38. & 991 \\ 0 & 39. & 154 \\ \end{smallmatrix} $	0 48. 492 0 48. 656 0 48. 820 0 48. 984	$\begin{array}{c} 0 & 58. 322 \\ 0 & 58. 486 \\ 0 & 58. 650 \\ 0 & 58. 814 \end{array}$	$\begin{array}{cccc} 1 & 8.152 \\ 1 & 8.315 \\ 1 & 8.479 \\ 1 & 8.643 \end{array}$	$\begin{array}{c}1&17.\ 981\\1&18.\ 145\\1&18.\ 309\\1&18.\ 473\end{array}$	56 57 58 59	$ \begin{array}{c} .153\\.156\\.156\\0.161\end{array} $

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TABLE 8.

			ŝ	Sidereal int	o Mean Sol	ar Time.				
eal.			То	be subtracted	l from a sider	eal time inter	val,			
Sider	Sh	9h	10 ^h	11 ^h	12 ^h	13 ^h	14h	15 ^h	For	seconds.
m.	m. s. 1 18.636	m. s. 1 28.466	m. s. 1 38, 296	m. 8. 1 48.125	$m. \ s. \ 1 \ 57.955$	$ \begin{array}{ccc} m. & s. \\ 2 & 7.784 \end{array} $	$m. \frac{s}{2}$	m. 8. 2 27.443	8.	8.
$\frac{1}{2}$	1 18.800 1 18.964	1 28.630 1 28.794	$\begin{array}{cccccccccccccccccccccccccccccccccccc$	1 48.289 1 48.453	$1 58.119 \\ 1 58.282$	$ \begin{array}{cccc} 2 & 7.948 \\ 2 & 8.112 \end{array} $	$\begin{array}{c}2 & 17.778\\2 & 17.941\end{array}$	$\begin{array}{ c c c c c c c c c c c c c c c c c c c$	$\frac{1}{2}$	0.003 .005
3	1 19.128	1 28.958	1 38.787	1 48.617	1 58.446	2 8.276	2 18.105	2 27.935	3	.008
4	1 19.292 1 19.456	1 29.121 1 29.285	1 38.951 1 39 115	1 48.780 1 48 944	158.610 158.774		2 18.269 2 18 433	228.099 228.263	$\frac{4}{5}$	011 014
$\begin{bmatrix} 0\\6\end{bmatrix}$	1 19.450 1 19.619	$1 29.200 \\ 1 29.449$	$1 \ 39.279$	1 49.108	1 58.938		$\frac{2}{2}$ 18.597	$\begin{array}{c} 2 & 26.203 \\ 2 & 28.426 \end{array}$	6	.014
7	1 19.783	$\begin{array}{cccccccccccccccccccccccccccccccccccc$	$\begin{array}{cccccccccccccccccccccccccccccccccccc$	1 49.272 1 49 436	159.101 159.265	$\begin{bmatrix} 2 & 8.931 \\ 2 & 9.095 \end{bmatrix}$	$\begin{array}{c} 2 & 18.761 \\ 2 & 18 & 924 \end{array}$	$\begin{array}{cccccccccccccccccccccccccccccccccccc$	7	.019 022
9	1 20.111	1 29.940	1 39.000 1 39.770	1 49.600	1 59.429	$ \frac{2}{2} $ 9.259	$ \frac{2}{2} $ 10.021 $ \frac{2}{19} $ 088	$ \frac{2}{2} $ 28.918	9	. 025
10	1 20.275	1 30.104 1 20 969	1 39.934 1 40.008	1 49.763 1 40.027	159.593 150.757	$ \begin{array}{cccccccccccccccccccccccccccccccccccc$	$\begin{array}{cccccccccccccccccccccccccccccccccccc$	$\begin{array}{cccccccccccccccccccccccccccccccccccc$	$10 \\ 11$.027
$11 \\ 12$	1 20.439	$1 \ 30.\ 208$ $1 \ 30.\ 432$	1 40.098 1 40.261	1 49.927 1 50.091	1 59.921	$ \begin{array}{cccc} 2 & 9.580 \\ 2 & 9.750 \end{array} $	$ \begin{array}{c} 2 & 19.410 \\ 2 & 19.580 \end{array} $	2 29.249 2 29.409	$11 \\ 12$. 030
13	1 20.766	1 30.596 1 20 760	1 40.425 1 40 580	1 50.255 1 50.419	$\begin{array}{cccc} 2 & 0.084 \\ 2 & 0.248 \end{array}$	$ \begin{array}{ccccccccccccccccccccccccccccccccccc$	2 19.744	$\begin{array}{c} 2 & 29.573 \\ 2 & 29 & 737 \end{array}$	13	. 035
15	120.000 121.094	$\frac{1}{1}$ 30.923	140.000 140.753	1 50.583	2 0.210 2 0.412	2 10.010 2 10.242	$\frac{2}{2}$ 20.071	2 29.901	$\frac{11}{15}$.041
16	1 21.258	$\begin{array}{cccccccccccccccccccccccccccccccccccc$	1 40.917	1 50.746 1 50.910	$\begin{array}{cccc} 2 & 0.576 \\ 2 & 0.740 \end{array}$	$\begin{array}{c} 2 & 10.405 \\ 2 & 10.569 \end{array}$	$\begin{array}{cccccccccccccccccccccccccccccccccccc$	$\begin{array}{cccccccccccccccccccccccccccccccccccc$	$16 \\ 17$. 044
18	1 21.422 1 21.585	$1 \ 31.251$ $1 \ 31.415$	1 41.031 1 41.244	1 50.510 1 51.074	$ \frac{2}{2} $ 0.904	$\begin{array}{c} 2 & 10.503 \\ 2 & 10.733 \end{array}$	2 20.593 2 20.563	2 30.228 2 30.392	18	.040
19	1 21.749	1 31.579	1 41.408	1 51.238	2 1.067	2 10.897	2 20.727	2 30.556	$\frac{19}{20}$. 052
$\frac{20}{21}$	$1 21.913 \\ 1 22.077$	$1 \ 31.743 \\ 1 \ 31.906$	$1 41.572 \\ 1 41.736$	$1 \ 51.402$ $1 \ 51.565$	$\begin{array}{cccccccccccccccccccccccccccccccccccc$	$\begin{array}{c} 2 & 11.061 \\ 2 & 11.225 \end{array}$	$\begin{array}{cccccccccccccccccccccccccccccccccccc$	$\begin{array}{c} 2 & 30.720 \\ 2 & 30.884 \end{array}$	$\frac{20}{21}$. 055
$\frac{22}{22}$	1 22.241	1 32.070	1 41.900	1 51.729	$\begin{array}{cccccccccccccccccccccccccccccccccccc$	$\begin{array}{c} 2 & 11.388 \\ 2 & 11 & 552 \end{array}$	$\begin{array}{cccccccccccccccccccccccccccccccccccc$	2 31.048	22	. 060
$\frac{23}{24}$	$1 22.404 \\ 1 22.568$	$1 \ 32.234 \\ 1 \ 32.398$	$1 42.004 \\ 1 42.227$	1 51.895 1 52.057	$\begin{array}{cccccccccccccccccccccccccccccccccccc$	$\begin{array}{c} 2 & 11.352 \\ 2 & 11.716 \end{array}$	$\begin{array}{cccccccccccccccccccccccccccccccccccc$	$\begin{array}{c}2 & 31.211\\2 & 31.375\end{array}$	23 24	. 066
25	1 22.732	$1 \ 32.562$	1 42.391	1 52.221	2 2.050	2 11.880	2 21.709	2 31.539	$\overline{25}$. 068
$\frac{26}{27}$	1 22.896 1 23.060	$\begin{array}{cccccccccccccccccccccccccccccccccccc$	$1 42.555 \\ 1 42.719$	$\begin{array}{c}1 & 52.385\\1 & 52.548\end{array}$	$\begin{array}{cccccccccccccccccccccccccccccccccccc$	$\begin{array}{c} 2 & 12.044 \\ 2 & 12.208 \end{array}$	$\begin{array}{cccccccccccccccccccccccccccccccccccc$	$\begin{array}{c}2 & 31.703\\2 & 31.867\end{array}$	$\frac{26}{27}$.071 .074
28	1 23.224	$1 \ 33.053$	1 42.883	1 52.712 1 59.976	$\begin{array}{cccccccccccccccccccccccccccccccccccc$	$\begin{array}{c} 2 & 12.371 \\ 2 & 12 & 525 \end{array}$	$\begin{array}{cccccccccccccccccccccccccccccccccccc$	$\begin{array}{c} 2 & 32.031 \\ 2 & 22 & 101 \end{array}$	28	. 076
$\frac{29}{30}$	1 23.387 1 23.551	$\frac{1}{1}$ $\frac{33.217}{33.381}$	1 43.047 1 43.210	$\frac{1}{1}$ $\frac{52.870}{53.040}$	$\begin{array}{cccccccccccccccccccccccccccccccccccc$	$\frac{2}{2}$ 12.555 2 12.699	$\frac{2}{2}$ 22. 505 2 22. 529	$\frac{2}{2}$ $\frac{32}{32}$ $\frac{194}{358}$	$\frac{29}{30}$. 079
31	1 23.715	1 33.545	1 43.374	1 53.204	$\begin{array}{cccccccccccccccccccccccccccccccccccc$	2 12.863	2 22.692	2 32.522	31	. 085
$\frac{32}{33}$	$1 23.879 \\ 1 24.043$	$\begin{array}{c}1 & 33.\ 708\\1 & 33.\ 872\end{array}$	$1 43.538 \\ 1 43.702$	$\begin{array}{c}1 & 53.368\\1 & 53.531\end{array}$	$\begin{array}{cccccccccccccccccccccccccccccccccccc$	$\begin{array}{c} 2 & 13.027 \\ 2 & 13.191 \end{array}$	$\begin{array}{cccccccccccccccccccccccccccccccccccc$	2 32.686 2 32.850	$\frac{32}{33}$. 087
34	1 24.207	1 34.036	1 43.866	1 53.695	2 3.525	2 13.354	2 23.184	2 33.013	34	. 093
$\frac{35}{36}$	$1 24.370 \\ 1 24.534$	$\begin{array}{cccccccccccccccccccccccccccccccccccc$	$1 44.029 \\ 1 44.193$	$1 53.859 \\ 1 54.023$	$\begin{array}{cccccccccccccccccccccccccccccccccccc$	$\begin{array}{cccccccccccccccccccccccccccccccccccc$	$\begin{array}{cccccccccccccccccccccccccccccccccccc$	$\begin{array}{cccccccccccccccccccccccccccccccccccc$	$\frac{35}{36}$. 096
37	1 24.698	$1 \ 34.528$	1 44.357	1 54.187	$ \begin{array}{cccccccccccccccccccccccccccccccccccc$	2 13.846	2 23.675	2 33.505	37	. 101
$\frac{38}{39}$	$1 24.862 \\ 1 25.026$	$1 \ 34.691 \\ 1 \ 34.855$	$1 \ 44.521 \\1 \ 44.685$	$1 54.351 \\ 1 54.514$	$\begin{array}{cccccccccccccccccccccccccccccccccccc$	$\begin{array}{c} 2 & 14.010 \\ 2 & 14.173 \end{array}$	$\begin{array}{cccccccccccccccccccccccccccccccccccc$	$\begin{array}{c} 2 & 33.669 \\ 2 & 33.833 \end{array}$	$\frac{38}{39}$. 104
40	1 25.190	1 35.019	1 44.849	1 54.678	2 4.508	2 14.337	2 24.167	2 33, 996	40	.109
$\frac{41}{42}$	$\begin{array}{c} 1 & 25.353 \\ 1 & 25.517 \end{array}$	$\begin{array}{c}1 & 35.183\\1 & 35.347\end{array}$	$1 45.012 \\ 1 45.176$	$1 54.842 \\ 1 55.006$	$ \begin{array}{cccc} 2 & 4.672 \\ 2 & 4.835 \end{array} $	$\begin{array}{cccccccccccccccccccccccccccccccccccc$	$\begin{array}{cccccccccccccccccccccccccccccccccccc$	$\begin{array}{cccccccccccccccccccccccccccccccccccc$	41 42	.112 .115
43	1 25.681	$1 \ 35.511$	1 45.340	1 55.170	$\begin{array}{cccccccccccccccccccccccccccccccccccc$	2 14.829	2 24.658	2 34.488	43	. 117
$\frac{44}{45}$	$\frac{1}{1}$ 25.845 $\frac{1}{26}$ 009	$\frac{1}{1}$ $\frac{35.074}{35.838}$	$\frac{1}{1}$ $\frac{45}{45}$ $\frac{668}{668}$	$\frac{1}{1}$ $\frac{55}{5}$ $\frac{497}{55}$	$\frac{2}{2}$ $\frac{5,165}{5,327}$	$\frac{2}{2}$ 14.993 $\frac{2}{2}$ 15.156	$\frac{2}{2}$ 24.822 2 24.986	$\frac{2}{2}$ 34. 652 $\frac{34}{34}$ 816	$\frac{44}{45}$. 120
46	1 26.172	1 36.002	1 45.832	1 55.661	$ \frac{1}{2} $ 5.491	2 15.320	2 25.150	2 34.979	46	. 126
$\frac{47}{48}$	$1 26.336 \\ 1 26.500$	$\begin{array}{c}1 & 36.166\\1 & 36.330\end{array}$	$1 45.995 \\ 1 46.159$	$\begin{array}{cccccccccccccccccccccccccccccccccccc$	$\begin{array}{cccccccccccccccccccccccccccccccccccc$	$\begin{array}{c} 2 & 15.484 \\ 2 & 15.648 \end{array}$	$\begin{array}{cccccccccccccccccccccccccccccccccccc$	$\begin{array}{c} 2 & 35.143 \\ 2 & 35.307 \end{array}$	$\frac{47}{48}$. 128
49	1 26,664	1 36.493	1 46.323	1 56.153	2 5.982	2 15.812	2 25.641	2 35.471	49	. 134
$\begin{bmatrix} 50 \\ 51 \end{bmatrix}$	$1 26.828 \\ 1 26.992$	$\begin{array}{cccccccccccccccccccccccccccccccccccc$	$1 46.487 \\ 1 46.651$	$\begin{array}{cccccccccccccccccccccccccccccccccccc$	$\begin{array}{cccccccccccccccccccccccccccccccccccc$	$\begin{array}{cccccccccccccccccccccccccccccccccccc$	$\begin{array}{cccccccccccccccccccccccccccccccccccc$	$\begin{array}{cccccccccccccccccccccccccccccccccccc$	50 51	.137
52	1 27.155	$1 \ 36.985$	1 46.815	1 56.644	$ \begin{array}{cccccccccccccccccccccccccccccccccccc$	2 16.303	2 26.133	2 35.962	52	. 142
$\frac{53}{54}$	$1 \ 27.319 \\ 1 \ 27.483$	$\begin{array}{cccccccccccccccccccccccccccccccccccc$	1 46.978 1 47.142	$1 56.808 \\ 1 56.972$	$\begin{array}{cccccccccccccccccccccccccccccccccccc$	$\begin{array}{c} 2 & 16.467 \\ 2 & 16.631 \end{array}$	2 26.297 2 26.460	$\begin{array}{cccccccccccccccccccccccccccccccccccc$	53 54	. 145
55	1 27.647	1 37.476	1 47.306	1 57.136	2 6.965	2 16.795	2 26.624	2 36.454	55	. 150
$\frac{56}{57}$	$1 \ 27.811 \\ 1 \ 27.975$	$\begin{array}{cccccccccccccccccccccccccccccccccccc$	$1 47.470 \\ 1 47.634$	$\begin{array}{cccccccccccccccccccccccccccccccccccc$	$\begin{array}{cccccccccccccccccccccccccccccccccccc$	$\begin{bmatrix} 2 & 16,959 \\ 2 & 17,122 \end{bmatrix}$	$\begin{array}{cccccccccccccccccccccccccccccccccccc$	$\begin{array}{cccccccccccccccccccccccccccccccccccc$	56 57	.153 .156
58	1 28.138	$1 \ 37.968$	1 47.797	1 57.627	2 7.457	2 17.286	2 27.116	2 36.945	58	. 158
59	1 28.302	1 38.132	1 47,961	1 57.791	2 7.620	2 17.450	2 27.280	2 37.109	99	0.161

TABLE 8.

Sidereal into Mean Solar Time.

	1					-				
eal.			Tol	be subtracted	from a sidere	al time inter	val.			
Sider	16 ^h	17h	18 ^h	19 ^h	20h	21h	22h	23 ^h	For	seeonds.
m.	m. s.	<i>m.</i> 8.	<i>m.</i> 8.	m. s.	<i>m.</i> 8.	m. s.	<i>m. s</i> .	<i>m. s</i> .	8.	8.
0	2 37.273	2 47.102	256.932	$3 \ 6.762$	3 16.591	$3\ 26.421$	$3 \ 36.250$	3 46.080		
1	$2 \ 37.437$	2 47.266	2 57.096	3 6.925	3 16.755	3 26.585	3 36.414	$3 \ 46.244$	1	0.003
2	$2 \ 37.601$	2 47.430	2 57.260	3 7.089	3 16.919	3 26.748	$3 \ 36.578$	3 46. 407	2	.005
3	2 37.764	2 47.594	2 57.424	3 7.253	3 17.083	$3\ 26.\ 912$	$3 \ 36.742$	3 46.571	3	.008
4	2 37.928	2 47.758	2 57.587	3 7.417	3 17.246	$3 \ 27.076$	3 36.906	3 46.735	4	.011
5	2 38, 092	2 47.992	2 57.751	3 7.581	3 17.410	3 27. 240	3 37.069	3 46. 899	5	. 014
6	2 38 256	2 48 085	2 57 915	3 7 745	3 17.574	3 27.404	3 37 233	3 47.063	6	. 016
7	2 38 420	2 48 219	$\frac{1}{2}$ 58 079	3 7 908	3 17 738	3 27 568	3 37 397	3 47 227	7	. 019
8	2 38 581	2 48 413	2 58 213	3 8 079	3 17 902	3 27 731	3 37 561	3 47 390	8	. 022
g	2 38 747	2 48 577	2 58 406	3 8 236	3 18.066	3 27 895	3 37 725	3 47 554	9	. 025
10	9 20 011	9 40 741	2 50 570	3 2 100	3 12 990	3 99 050	3 37 200	3 47 710	10	097
10	2 00.911	2 40.741	2 00.010	3 0.400	3 10 209	0 40.009 2 90 999	3 30 020	3 47 200	11	. 027
11	2 39.073	2 40,900	2 00. 104	3 0.004	0 10.090	3 90 907	0 00.00Z 2 22 010	3 40 010	11	. 030
12	2 39.239	2 49,008	2 50.098	9 0.128	0 10.00/	3 90 550	3 20 200	9 40 040 9 40 010	$12 \\ 19$. 000
15	2 09.403 9 20 500	2 49.232	2 59,002	3 0.021	3 10 00	3 90 711	3 20 511	9 40.210 9 40 979	10	. 030
14	2 39. 300	2 49. 590	2 09.220	0 9.000	0 10.000	0 40.714	0 00.044	0 40.013	14	. 038
15	2 39.730	2 49.560	2 59.389	$\begin{array}{cccc} 3 & 9.219 \\ 2 & 2.229 \\ \end{array}$	3 19.049	3 28.878	3 38.708	3 48.537	15	.041
16	2 39.894	2 49.724	2 59.553	3 9.383	3 19.212	3 29.042	3 38.871	3 48.701	$16 \\ 16$.044
17	2 40.058	2 49.888	2 59.717	3 9.547	3 19.376	3 29.206	3 39.035	3 48.865	17	. 046
18	2 40.222	2 50.051	2 59.881	3 9.710	3 19.540	3 29.370	3 39, 199	3 49.029	18	.049
19	2 40.386	2 50.215	3 0.045	3 9.874	3 19, 704	3 29.533	3 39, 363	3 49.193	19	052
20	2 40.549	2 50.379	3 0.209	3 10.038	3 19.868	3 29.697	3 39.527	3 49.356	20	. 055
21	2 40.713	2 50.543	3 0.372	3 10.202	3 20.032	3 29.861	$3 \ 39.691$	3 49.520	21	. 057
22	2 40.877	2 50.707	3 0.536	3 10.366	3 20. 195	3 30.025	3 39.854	3 49.684	22	. 060
23	2 41.041	2 50.870	3 0.700	3 10.530	3 20.359	3 30.189	3 40.018	3 49.848	23	. 063
24	2 41.205	2 51.034	3 0.864	$3\ 10.693$	$3\ 20.523$	3 30.353	3 40.182	3 50.012	24	. 066
$\overline{25}$	2 41.369	2 51.198	3 1.028	3 10.857	3 20.687	3 30.516	3 40.346	3 50.175	25	. 068
26	2 41.532	2 51.362	3 1.192	3 11.021	3 20.851	3 30.680	3 40.510	3 50.339	26	.071
27	2 41.696	2 51.526	3 1.355	3 11.185	3 21.014	3 30.844	3 40.674	3 50, 503	27	.074
28	2 41.860	2 51.690	3 1.519	3 11.349	$3\ 21.178$	3 31.008	3 40, 837	3 50.667	28	.076
29	2 42.024	2 51.853	3 1.683	3 11.513	$3\ 21.342$	3 31.172	3 41.001	3 50.831	29	.079
30	2 42.188	2 52.017	3 1.847	3 11,676	3 21, 506	3 31, 336	3 41, 165	3 50, 995	30	. 082
31	2 42 352	2 52 181	3 2.011	3 11.840	321.670	3 31.499	3 41. 329	3 51.158	31	. 085
32	2 42.515	2 52.345	3 2.174	3 12.004	3 21.834	3 31, 663	3 41. 493	3 51.322	32	. 087
33	2 42 679	2 52 509	3 2 338	3 12 168	3 21 997	3 31 827	3 41.657	3 51 486	33	. 090
34	2 42 843	252.673	3 2.502	3 12 332	3 22 161	3 31 991	3 41 820	3 51 650	34	. 093
35	2 13 007	2 59 998	3 9 888	3 19 408	3 99 205	3 39 155	3 41 09.1	3 51 814	25	008
38	2 43 171	2 52 000	3 9 220	3 19 850	3 22. 020	3 20 210	3 49 1.10	3 51 070	28	. 080
37	2 43 224	253.000 253.164	3 9 00.1	3 19 892	3 22 652	3 32 129	3 49 219	3 59 1.11	37	101
38	2 43 100	2 53 292	3 3 157	3 12 927	3 99 817	3 32 616	3 49 176	3 52 305	38	104
30	2 43 669	2 53 109	3 3 291	3 13 151	3 22 080	3 32 810	3 42 620	3 52 180	30	.106
10	9 19 000	9 59 050	3 9 105	3 19 015	2 99 144	3 29 0"1	3 19 000	3 50 200	10	100
10	2 10.020	2 00.000	3 2 6 10	0 10.010	0 20, 144	0 02.9/4	3 49 007	9 59 707	11	110
10	2 40.990	2 52 009	3 2 019	3 12 649	2 92 170	9 99 901	3 12 191	3 59 001	11	115
12	2 44. 104 9 11 917	2 00.985	0 0.010	3 12 000	3 99 890	0 00,001	9 19 00 ²	2 52 101	44	110
10	2 11.01/	2 04. 14/	0 0.911	3 13.800	0 20.000	0 00, 1 00 2 22 200	3 12 450	3 52 000	40	190
11	2 44.481	9 54.011 9 54 485	9 4 004	9 14 104	9 00 000	0 00.029	9 49 000	9 50 450	17	- 120
40	2 44.645	2 04. 4/0	3 4.304	0 14.134	3 23.963	3 33.793	3 43.622	3 33. 432	40	. 123
40	2 44.809	2 04.638	3 4.468	3 14,298	3 24. 127	3 33.957	3 43, 786	3 33,616	40	. 126
11	2 44.973	2 54.802	ə 4.632 9 4.700	a 14, 461	3 24, 291	3 34. 121	ə 43, 950	0 03.780	41	. 128
48	2 45.137	2 54.966	3 4.796	3 14.625	3 24, 455	3 34.284	3 44.114	3 53.943	48	. 131
49	2 45.300	2 55.130	3 4.960	3 14.789	3 24,619	3 34.448	3 44.278	3 34. 107	49	. 134
50	2 45.464	2 55.294	3 5.123	3 14.953	3 24.782	3 34.612	3 44. 442	354.271	50	.137
51	2 45.628	2 55.458	3 5.287	3 15.117	3 24.946	3 34.776	3 44.605	3 54.435	51	.139
22	2 45.792	255.621	3 5.451	3 15.281	3 25.110	3 34.940	3 44.769	3 54.599	52	.142
93	2 45.956	2 55.785	3 5.615	3 15.444	3 25.274	3 35.104	3 44.933	3 54.763	$\overline{53}$.145
04	2 46.120	2 55.949	3 5.779	3 15.608	3 25.438	3 35.267	3 45.097	3 54.926	54	. 147
55	2 46.283	2 56.113	3 5.942	3 15.772	3 25,602	3 35.431	3 45.261	3 55.090	55	. 150
56	2 46.447	2 56.277	3 6.106	3 15,936	3 25.765	3 35, 595	3 45.425	3 55.254	56	. 153
57	2 46.611	2 56.441	3 6.270	3 16, 100	3 25, 929	3 35.759	3 45.588	3 55.418	57	.156
58	2 46.755	2 56.604	3 6.434	3 16.264	3 26.093	3 35.923	3 45.752	3 55.582	58	. 158
59	2 46 939	2 56 768	3 6 598	3 16 197	3 96 957	1 3 36 086	2 45 016	1 2 55 746	1.50	0 161

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TABLE 9.

Mean Solar into Sidereal Time.

$ \begin{array}{ c c c c c c c c c c c c c c c c c c c$	
$ \begin{array}{ c c c c c c c c c c c c c c c c c c c$	onds.
$ \begin{array}{c ccccccccccccccccccccccccccccccccccc$	s.
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$\begin{array}{c ccccccccccccccccccccccccccccccccccc$	$008 \\ 011$
$ \begin{array}{c ccccccccccccccccccccccccccccccccccc$	$\frac{011}{014}$
$ \begin{array}{cccccccccccccccccccccccccccccccccccc$	016
$ \begin{array}{c ccccccccccccccccccccccccccccccccccc$	$019 \\ 022$
$ \begin{array}{c ccccccccccccccccccccccccccccccccccc$	$022 \\ 025$
$\begin{array}{c ccccccccccccccccccccccccccccccccccc$	027
$\begin{array}{cccccccccccccccccccccccccccccccccccc$	$030 \\ 022$
$ \begin{array}{c ccccccccccccccccccccccccccccccccccc$	036
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$\begin{array}{cccccccccccccccccccccccccccccccccccc$	041
$1710 - 2.793 \pm 0.12.649 \pm 0.22.506 \pm 0.32.362 \pm 0.42.219 \pm 0.52.075 \pm 1.1.932 \pm 1.11.788 117 \pm 1.1710$	044
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$\begin{array}{c ccccccccccccccccccccccccccccccccccc$	068
$\begin{array}{cccccccccccccccccccccccccccccccccccc$	071
$\begin{array}{cccccccccccccccccccccccccccccccccccc$	074
$\begin{array}{cccccccccccccccccccccccccccccccccccc$	077
$\frac{25}{30} \bigcirc \frac{4}{0} \stackrel{.04}{.} \stackrel{.04}{.} \stackrel{.04}{.} \stackrel{.01}{.} \stackrel{.02}{.} \stackrel{.02}{.} \stackrel{.02}{.} \stackrel{.01}{.} \stackrel{.03}{.} .0$	$\frac{010}{082}$
$ \begin{array}{c ccccccccccccccccccccccccccccccccccc$	085
$\begin{array}{c ccccccccccccccccccccccccccccccccccc$	088
$\begin{array}{cccccccccccccccccccccccccccccccccccc$	093
$\overline{35} \ \overline{0} \ 5.\ 750 \ \overline{0} \ 15.\ 606 \ \overline{0} \ 25.\ 463 \ \overline{0} \ 35.\ 319 \ \overline{0} \ 45.\ 176 \ \overline{0} \ 55.\ 032 \ \overline{1} \ 4.\ 888 \ \overline{1} \ 14.\ 745 \ 35 \ \overline{1} \ 35 \ \overline{1} \ \overline{1} \ 4.\ 888 \ \overline{1} \ 14.\ 745 \ \overline{1} \ \overline$	096
$\begin{array}{c ccccccccccccccccccccccccccccccccccc$	099
$\begin{array}{cccccccccccccccccccccccccccccccccccc$	104
39 0 6.407 0 16.263 0 26.120 0 35.976 0 45.833 0 55.689 1 5.546 1 15.402 39	107
$\begin{array}{cccccccccccccccccccccccccccccccccccc$	$110 \\ 119$
$\begin{array}{cccccccccccccccccccccccccccccccccccc$	$112 \\ 115$
43 0 7.064 0 16.920 0 26.777 0 36.633 0 46.490 0 56.346 1 6.203 1 16.059 43	118
$\frac{44}{17} \underbrace{0 7.228}_{0 7.200} \underbrace{0 17.085}_{0 17.010} \underbrace{0 26.941}_{0 27.105} \underbrace{0 36.798}_{0 29.069} \underbrace{0 46.654}_{0 16.010} \underbrace{0 56.510}_{0 56.510} \underbrace{1 6.367}_{1 6.591} \underbrace{1 16.223}_{1 16.000} \underbrace{44}_{1 16.000} \underbrace{44}_{1 16.000} \underbrace{1 16.223}_{1 16.000} \underbrace{16.200}_{1 16$	$\frac{120}{199}$
$\begin{array}{cccccccccccccccccccccccccccccccccccc$	$\frac{123}{126}$
47 0 7.721 0 17.137 0 37.290 0 47.147 0 57.003 1 6.860 1 16.716 47	129
48 0 7.885 0 17.742 0 27.598 0 37.455 0 47.311 0 57.168 1 7.024 1 16.881 48	131
$\frac{43}{50} \begin{array}{c} 0 & 6.043 \\ \hline 0 & 18 & 070 \\ \hline 0 & 18 & 070 \\ \hline 0 & 27 & 927 \\ \hline 0 & 37 & 783 \\ \hline 0 & 47 & 440 \\ \hline 0 & 57 & 496 \\ \hline 1 & 7 & 353 \\ \hline 1 & 7 & 353 \\ \hline 1 & 17 & 909 \\ \hline 50 \\ \hline \end{array}$	$\frac{10+}{137}$
51 0 8.378 0 18.234 0 28.091 0 37.947 0 47.804 0 57.660 1 7.517 1 17.373 51	140
$\begin{bmatrix} 52 \\ 0 \\ 8.542 \\ 0 \\ 18.399 \\ 0 \\ 18.399 \\ 0 \\ 28.255 \\ 0 \\ 38.112 \\ 0 \\ 47.968 \\ 0 \\ 17.980 \\ 1 \\ 7.980 \\ 1 \\ 7.980 \\ 1 \\ 7.945 \\ 1 \\ 17.538 \\ 52 \\ 1 \\ 7.980 \\ 1 \\ 7.945 \\ 1 \\ 17.798 \\ 52 \\ 1 \\ 7.980 \\ 1 \\ 7.945 \\ 1 \\ 17.798 \\ 52 \\ 1 \\ 7.980 \\ 1 \\ 7.945 \\ 1 \\ 17.798 \\ 52 \\ 1 \\ 7.980 \\ 1 \\ 7.945 \\ 1 \\ 17.798 \\ 1 \\ 1 \\ 7.98 \\ 1 \\ 1 \\ 1 \\ 7.98 \\ 1 \\ 1 \\ 1 \\ 7.98 \\ 1 \\ 1 \\ 1 \\ 7.98 \\ 1 \\ 1 \\ 1 \\ 7.98 \\ 1 \\ 1 \\ 1 \\ 1 \\ 1 \\ 1 \\ 1 \\ 1 \\ 1 \\ $	142
53 0 8.707 0 18.503 0 28.420 0 58.270 0 48.152 0 57.989 1 7.845 1 17.702 53 54 0 8.871 0 18.727 0 28.584 0 38.440 0 48.297 0 58.153 1 8.010 1 17.866 54 54 54 54 54 54 54 54 54 54 54 54 54	140
55 0 9.035 0 18.892 0 28.748 0 38.605 0 48.461 0 58.317 1 8.174 1 18.030 55	151
56 0 9.199 0 19.056 0 28.912 0 38.769 0 48.625 0 58.482 1 8.338 1 18.195 56 56 0 9.199 0 10 900 0 92 0 48.625 0 58.482 1 8.338 1 18.195 56	153
$\begin{array}{cccccccccccccccccccccccccccccccccccc$	$150 \\ 159$
59 0 9.692 0 19.549 0 29.405 0 39.262 0 49.118 0 58.975 1 8.831 1 18.688 59 0	162

TABLE 9.

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Mean	Solar	into	Sidereal	Time.
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'n.				To be added	l to a mean ti	me interval.				
Mea	Sh	9h	10h	11h	12 ^h	13 ^h	14h	15 ^h	For	seconds.
$\overset{m.}{\overset{0}{0}}$	m. s. 1 18.852	m. s. 1 28.708	m. s. 1 38.565 1 20.790	m. s. 1 48.421	m. s. 1 58.278	m. s. 2 8.134	m. s. 2 17.991	m. s. 2 27.847	8.	8.
$\frac{1}{2}$	$1 19.016 \\ 1 19.180$	$1 28.873 \\ 1 29.037$	$1 \ 38.729 \\ 1 \ 38.893$	1 48.585 1 48.750	1 58.442 1 58.606	$ \begin{array}{ccccccccccccccccccccccccccccccccc$	$\begin{bmatrix} 2 & 18.155 \\ 2 & 18.319 \end{bmatrix}$	$\begin{array}{cccccccccccccccccccccccccccccccccccc$	$\frac{1}{2}$	0.003
$\frac{3}{4}$	$\begin{array}{cccccccccccccccccccccccccccccccccccc$	$\begin{array}{cccccccccccccccccccccccccccccccccccc$	$1 39.058 \\ 1 39.222$	$\begin{array}{c}1 & 48.914\\1 & 49.078\end{array}$	$\begin{array}{cccccccccccccccccccccccccccccccccccc$	$egin{array}{cccccccccccccccccccccccccccccccccccc$	$ \begin{array}{cccccccccccccccccccccccccccccccccccc$	$\begin{array}{cccccccccccccccccccccccccccccccccccc$	$\frac{3}{4}$.008
5	1 19.673	1 29.530	1 39.386	1 49.243	1 59.099	2 8.956	2 18.812	2 28.668	$\overline{5}$.014
$\frac{6}{7}$	$\begin{array}{cccccccccccccccccccccccccccccccccccc$	$\begin{array}{cccccccccccccccccccccccccccccccccccc$	$\begin{array}{c} 1 & 39.550 \\ 1 & 39.715 \end{array}$	$1 49.407 \\ 1 49.571$	$1 59.263 \\ 1 59.428$	$ \begin{array}{cccc} 2 & 9.120 \\ 2 & 9.284 \end{array} $	$\begin{array}{cccccccccccccccccccccccccccccccccccc$	$\begin{array}{cccccccccccccccccccccccccccccccccccc$	$\frac{6}{7}$.016 .019
8	$\begin{array}{cccccccccccccccccccccccccccccccccccc$	$\begin{array}{cccccccccccccccccccccccccccccccccccc$	1 39.879 1 40 043	1 49.735 1 49 900	$1 59.592 \\ 1 59.756$	$ \begin{array}{cccccccccccccccccccccccccccccccccccc$	$\begin{array}{cccccccccccccccccccccccccccccccccccc$	2 29.161	8	$.022 \\ 025$
$\frac{\partial}{10}$	120.390 120.495	1 30.351	140.043 140.207	$1 \ 50.064$	1 59.920 1 59.920	$\frac{2}{2}$ 9.777	2 19.633	2 29. 320	$\frac{\partial}{10}$. 025
$\frac{11}{12}$	$\begin{array}{cccccccccccccccccccccccccccccccccccc$	$\begin{array}{c} 1 & 30, 515 \\ 1 & 30, 680 \end{array}$	$\begin{bmatrix} 1 & 40.372 \\ 1 & 40.536 \end{bmatrix}$	$\begin{array}{cccccccccccccccccccccccccccccccccccc$	$\begin{array}{cccc} 2 & 0.085 \\ 2 & 0.249 \end{array}$	$\begin{array}{cccc} 2 & 9.941 \\ 2 & 10.105 \end{array}$	$\begin{array}{cccccccccccccccccccccccccccccccccccc$	$\begin{array}{cccccccccccccccccccccccccccccccccccc$	$\frac{11}{12}$	$.030 \\ 033$
13	1 20.987	1 30.844	1 40.700	1 50.557 1 50.701	$\begin{array}{cccccccccccccccccccccccccccccccccccc$	2 10.270	2 20.126	2 29.983	13	. 036
$\frac{14}{15}$	1 21.132 1 21.316	1 31.008 1 31.172	$\frac{1}{1}$ 40.865 1 41.029	$\frac{1}{1}$ 50.721 1 50.885	$\frac{2}{2}$ 0.378 $\frac{1}{2}$ 0.742	$\frac{2}{2}$ 10. 434 2 10. 598	$\frac{2}{2} \frac{20.290}{20.455}$	$\frac{2}{2} \frac{30.147}{30.311}$	$\frac{14}{15}$.038
$\frac{16}{17}$	$1 \ 21.480 \\ 1 \ 21 \ 644$	$\begin{array}{cccccccccccccccccccccccccccccccccccc$	$1 \ 41.193$ $1 \ 41 \ 357$	$\begin{array}{cccccccccccccccccccccccccccccccccccc$	$\begin{array}{ccc} 2 & 0.906 \\ 2 & 1.070 \end{array}$	$\begin{array}{cccccccccccccccccccccccccccccccccccc$	$\begin{array}{cccccccccccccccccccccccccccccccccccc$	2 30.476	$\frac{16}{17}$.044
18	$1 21.044 \\ 1 21.809$	1 31.665 1 31.665	1 41.507 1 41.522	1 51.378 1 51.378		$ \frac{2}{2} 11.091 $	$ \frac{2}{2} $ 20. 183 $ \frac{2}{2} $ 20. 948		18	.047
$\frac{19}{20}$	$\frac{1}{1}$ $\frac{21}{22}$ $\frac{973}{137}$	1 31.829 1 31 994	$\frac{1}{1}$ $\frac{41,686}{41,850}$	$\frac{1}{1}$ $\frac{51}{51}$ $\frac{542}{707}$	$\frac{2}{2}$ $\frac{1.399}{1.563}$	$\frac{2}{2}$ 11.255 $\frac{2}{2}$ 11.420	$\frac{2}{2} \frac{21.112}{2.21}$	2 30.968 2 31 133	$\frac{19}{20}$	$\frac{.052}{055}$
21	1 22.302	1 32.158	1 42.015	1 51.871	$ \frac{1}{2} $ 1.727	2 11.584	2 21.440	$ \frac{2}{2} \frac{31}{31} \frac{297}{491} $	21	.057
$\frac{22}{23}$	$1 22.466 \\ 1 22.630$	$ \begin{array}{c} 1 & 32.322 \\ 1 & 32.487 \end{array} $	$1 \ 42.179 \ 1 \ 42.343$	$\begin{array}{cccccccccccccccccccccccccccccccccccc$	$\begin{array}{cccccccccccccccccccccccccccccccccccc$	$\begin{array}{cccccccccccccccccccccccccccccccccccc$	$\begin{array}{cccccccccccccccccccccccccccccccccccc$	$\begin{array}{cccccccccccccccccccccccccccccccccccc$	$\frac{22}{23}$.060
$\frac{24}{25}$	1 22.794 1 22.794	1 32.651	1 42.507 1 42.679	152.364	$\frac{2}{2}$ 2.220	2 12.077	2 21.933	2 31.790	$\frac{24}{25}$.066
$\frac{20}{26}$	$1 22.959 \\ 1 23.123$	$1 \ 32.813 \\ 1 \ 32.979$	1 42.072 1 42.836	$1 \ 52.528 \\ 1 \ 52.692$	$\begin{array}{cccccccccccccccccccccccccccccccccccc$	$ \begin{array}{ccccccccccccccccccccccccccccccccc$	$\begin{array}{cccccccccccccccccccccccccccccccccccc$	$\begin{array}{c} 2 & 51.954 \\ 2 & 32.118 \end{array}$	$\frac{25}{26}$.008
$\frac{27}{28}$	$\begin{array}{cccccccccccccccccccccccccccccccccccc$	$\begin{array}{cccccccccccccccccccccccccccccccccccc$	$\begin{array}{cccccccccccccccccccccccccccccccccccc$	$\begin{array}{cccccccccccccccccccccccccccccccccccc$	$\begin{array}{cccccccccccccccccccccccccccccccccccc$	$\begin{array}{cccccccccccccccccccccccccccccccccccc$	$\begin{array}{cccccccccccccccccccccccccccccccccccc$	$\begin{array}{cccccccccccccccccccccccccccccccccccc$	$\frac{27}{28}$	$.074 \\ 077$
29	1 23.616	1 33.472	1 43.329	1 53, 185	2 3.042	2 12.898	2 22.755	2 32.611	$\frac{20}{29}$.079
$\frac{30}{31}$	$\begin{array}{cccccccccccccccccccccccccccccccccccc$	$egin{array}{cccccccccccccccccccccccccccccccccccc$	$\begin{array}{cccccccccccccccccccccccccccccccccccc$	$\begin{array}{cccccccccccccccccccccccccccccccccccc$	$egin{array}{cccccccccccccccccccccccccccccccccccc$	$\begin{array}{cccccccccccccccccccccccccccccccccccc$	$\begin{array}{cccccccccccccccccccccccccccccccccccc$	$\begin{array}{cccccccccccccccccccccccccccccccccccc$	$\left \begin{array}{c} 30 \\ 31 \end{array} \right $.082 .085
$\frac{32}{22}$	$1 24.109 \\ 1 24 273$	$ \begin{array}{ccccccccccccccccccccccccccccccccccc$	$1 \ 43.\ 822$ 1 43 986	$\begin{array}{cccccccccccccccccccccccccccccccccccc$	$\begin{array}{cccccccccccccccccccccccccccccccccccc$	$\begin{array}{cccccccccccccccccccccccccccccccccccc$	$\begin{array}{cccccccccccccccccccccccccccccccccccc$	$\begin{array}{cccccccccccccccccccccccccccccccccccc$	$\frac{32}{32}$. 088
34	$1 24.273 \\ 1 24.437$	1 34.125 1 34.294	1 44.150	1 53.042 1 54.007	$\begin{array}{cccccccccccccccccccccccccccccccccccc$		$ \frac{2}{2} $ 23. 412 $ \frac{2}{2} $ 23. 576	$\begin{array}{c} 2 & 33.208 \\ 2 & 33.432 \end{array}$	34	. 093
35 36	$1 24.601 \\ 1 24 766$	$1 \ 34.458 \\ 1 \ 34 \ 622$	$1 44.314 \\ 1 44 479$	$1 54.171 \\ 1 54 335$	$ \begin{array}{rrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrr$	$\begin{array}{cccccccccccccccccccccccccccccccccccc$	$\begin{array}{cccccccccccccccccccccccccccccccccccc$	$\begin{array}{cccccccccccccccccccccccccccccccccccc$	$\frac{35}{36}$. 096
37	1 24.930	1 34.786	1 44.643	1 54.499	2 4.356	2 14.212	2 24.069	$\frac{2}{2}$ 33.925	37	. 101
$\frac{38}{39}$	$1 25.094 \\ 1 25.259$	$1 \ 34.951$ $1 \ 35.115$	1 44.807 1 44.971	$1 54.664 \\ 1 54.828$	$ \begin{array}{ccccccccccccccccccccccccccccccccc$	$\begin{array}{cccccccccccccccccccccccccccccccccccc$	$\begin{array}{cccccccccccccccccccccccccccccccccccc$	$\begin{array}{cccccccccccccccccccccccccccccccccccc$	$\frac{38}{39}$. 104
40	$1 25.423 \\ 1 25.587$	$1 \ 35.\ 279$ $1 \ 35.\ 144$	$1 45.136 \\ 1 45.300$	$1 54.992 \\ 1 55 156$	$ \begin{array}{cccccccccccccccccccccccccccccccccccc$	$\begin{array}{cccccccccccccccccccccccccccccccccccc$	$\begin{array}{cccccccccccccccccccccccccccccccccccc$	$\begin{array}{cccccccccccccccccccccccccccccccccccc$	40	. 110
42	1 25.751	$1 \ 35.608$	1 45.464	1 55.321	$ \frac{2}{2} 5.177 $	$ \frac{2}{2} \frac{14.005}{15.034} $	2 24. 890	2 34.002 2 34.747	42	. 115
43 44	$1 25.916 \\ 1 26.080$	$\begin{array}{c} 1 & 35.772 \\ 1 & 35.936 \end{array}$	$1 45.629 \\ 1 45.793$	$\begin{array}{cccccccccccccccccccccccccccccccccccc$	$\begin{array}{cccccccccccccccccccccccccccccccccccc$	$\begin{array}{cccccccccccccccccccccccccccccccccccc$	$\begin{array}{cccccccccccccccccccccccccccccccccccc$	$\begin{array}{cccccccccccccccccccccccccccccccccccc$	$\frac{43}{44}$.118 .120
45	1 26.244	1 36.101	1 45.957 1 46 191	1 55.814	$ \begin{array}{cccccccccccccccccccccccccccccccccccc$	2 15.527	$\begin{array}{cccccccccccccccccccccccccccccccccccc$	2 35.239	45	. 123
40	$1 20.408 \\ 1 26.573$	1 36.205 1 36.429	1 40.121 1 46.286	$1 55.978 \\ 1 56.142$	$\begin{array}{cccccccccccccccccccccccccccccccccccc$	$\frac{2}{2}$ 15.091 2 15.855	$\begin{array}{cccccccccccccccccccccccccccccccccccc$	$\begin{array}{cccccccccccccccccccccccccccccccccccc$	40 47	.120 .129
$\frac{48}{49}$	$\begin{array}{c ccccccccccccccccccccccccccccccccccc$	$egin{array}{cccccccccccccccccccccccccccccccccccc$	$\begin{array}{cccccccccccccccccccccccccccccccccccc$	$egin{array}{cccccccccccccccccccccccccccccccccccc$	$\begin{array}{cccccccccccccccccccccccccccccccccccc$	$\begin{array}{cccccccccccccccccccccccccccccccccccc$	$\begin{array}{cccccccccccccccccccccccccccccccccccc$	$\begin{array}{cccccccccccccccccccccccccccccccccccc$	48 49	.131 .134
$\overline{50}$	1 27.066	1 36.922	1 46.778	1 56.635	2 6.491	2 16.348	2 26.204	2 36.061	50	. 137
$\frac{51}{52}$	$\begin{array}{c ccccccccccccccccccccccccccccccccccc$	$1 \ 37.086 \\ 1 \ 37.251$	$1 46.943 \\ 1 47.107$	$1 56.799 \\ 1 56.964$	$ 2 6.656 \\ 2 6.820 $	$\begin{array}{cccccccccccccccccccccccccccccccccccc$	$\begin{array}{cccccccccccccccccccccccccccccccccccc$	$\begin{array}{cccccccccccccccccccccccccccccccccccc$	$51 \\ 52$.140 .142
$\frac{53}{54}$	$\begin{array}{cccccccccccccccccccccccccccccccccccc$	$1 \ 37.415 \\ 1 \ 37.579$	$1 \ 47.\ 271$ $1 \ 47.\ 436$	$\begin{array}{cccccccccccccccccccccccccccccccccccc$	$\begin{array}{cccccccccccccccccccccccccccccccccccc$	$\begin{array}{cccccccccccccccccccccccccccccccccccc$	$\begin{array}{cccccccccccccccccccccccccccccccccccc$	$\begin{array}{cccccccccccccccccccccccccccccccccccc$	$53 \\ 54$	$.145 \\ .148$
55	1 27.887	1 37.743	1 47.600	1 57.456	2 7.313	2 17.169	2 27.026	2 36.882	55	.151
$\frac{56}{57}$	1 28.051 1 28.215	$\begin{array}{c}1 & 37.908\\1 & 38.072\end{array}$	$\frac{1}{1} \frac{47.764}{47.928}$	$\begin{array}{cccccccccccccccccccccccccccccccccccc$	$\begin{array}{cccccccccccccccccccccccccccccccccccc$	$\begin{array}{cccccccccccccccccccccccccccccccccccc$	$\begin{array}{cccccccccccccccccccccccccccccccccccc$	$\begin{array}{cccccccccccccccccccccccccccccccccccc$	$\left \begin{array}{c} 56 \\ 57 \end{array} \right $.153 .156
58 59	$1 28.380 \\ 1 28.544$	$1 \ 38.236$ 1 38.400	1 48.093 1 18 257	$1 57.949 \\ 1 58 119$	$ \begin{array}{ccc} 2 & 7.806 \\ 2 & 7.970 \end{array} $	$\frac{2}{2}$ 17.662	$2 \ 27.519$ $2 \ 27.689$	$\begin{array}{c} 2 & 37.375 \\ 2 & 27 & 520 \end{array}$	58 50	.159
99	1 48.044	1 99.400	1 48.207	1 99, 119	2 1.970	∴ 17.820	2 21,083	2 31. 039	99	0.102

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 $\begin{array}{c} 2 & 16.871 \\ \hline 2 & 46.739 \\ 2 & 46.903 \\ 2 & 47.067 \\ 2 & 47.232 \\ 2 & 47.396 \end{array}$

2 56.595

3 6.452

ž 6.616

3 6.780 $6.944 \\ 7.109$

3

3

3 16.308

 $3 16.472 \\ 3 16.637$

TABLE 9.

	Mean Solar into Sidereal time.									
				To be addee	l to a mean ti	ime interval,				
Mean	16 ^h	17h	1Sh	1Sh	204	21h	22 ^h	23h	For	seconds.
m. 0 1 2 3 4	$\begin{array}{cccccccccccccccccccccccccccccccccccc$	$\begin{array}{cccccccccccccccccccccccccccccccccccc$	$\begin{array}{cccccccccccccccccccccccccccccccccccc$	$\begin{array}{cccccccccccccccccccccccccccccccccccc$	$\begin{array}{cccccccccccccccccccccccccccccccccccc$	$\begin{array}{cccccccccccccccccccccccccccccccccccc$	$\begin{array}{cccccccccccccccccccccccccccccccccccc$	$\begin{array}{cccccccccccccccccccccccccccccccccccc$	${s. \ 1 \ 2 \ 3 \ 4}$	8. 0.003 .005 .008 .011
	$\begin{array}{c} 2 & 38.525 \\ 2 & 38.689 \\ 2 & 38.854 \\ 2 & 39.018 \\ 2 & 39.182 \end{array}$	$\begin{array}{c} 2 \ 48.\ 381 \\ 2 \ 48.\ 546 \\ 2^{\circ} \ 48.\ 710 \\ 2 \ 48.\ 874 \\ 2 \ 49.\ 039 \end{array}$	$\begin{array}{c} 2 \ 58.\ 238 \\ 2 \ 58.\ 402 \\ 2 \ 58.\ 566 \\ 2 \ 58.\ 731 \\ 2 \ 58.\ 895 \end{array}$	$\begin{array}{cccccccccccccccccccccccccccccccccccc$	$\begin{array}{c} 3 & 17.951 \\ 3 & 18.115 \\ 3 & 18.279 \\ 3 & 18.444 \\ 3 & 18.608 \end{array}$	$\begin{array}{c} 3 & 27.\ 807 \\ 3 & 27.\ 972 \\ 3 & 28.\ 136 \\ 3 & 28.\ 300 \\ 3 & 28.\ 464 \end{array}$	$\begin{array}{c} 3 & 37.\ 664 \\ 3 & 37.\ 828 \\ 3 & 37.\ 992 \\ 3 & 38.\ 157 \\ 3 & 38.\ 321 \end{array}$	$\begin{array}{r} 3 & 47.520 \\ 3 & 47.685 \\ 3 & 47.849 \\ 3 & 48.013 \\ 3 & 48.177 \end{array}$	5 6 7 8 9	.014 .016 .019 .022 .025
$10 \\ 11 \\ 12 \\ 13 \\ 14$	$\begin{array}{c}2&39.\ 346\\2&39.\ 511\\2&39.\ 675\\2&39.\ 839\\2&40.\ 003\end{array}$	$\begin{array}{c}2 & 49.\ 203\\2 & 49.\ 367\\2 & 49.\ 531\\2 & 49.\ 696\\2 & 49.\ 860\end{array}$	$\begin{array}{cccccccccccccccccccccccccccccccccccc$	$\begin{array}{cccccccccccccccccccccccccccccccccccc$	$\begin{array}{c} 3 \ 18.\ 772 \\ 3 \ 18.\ 937 \\ 3 \ 19.\ 101 \\ 3 \ 19.\ 265 \\ 3 \ 19.\ 429 \end{array}$	$\begin{array}{c} 3 & 28.\ 629 \\ 3 & 28.\ 793 \\ 3 & 28.\ 957 \\ 3 & 29.\ 122 \\ 3 & 29.\ 286 \end{array}$	$\begin{array}{c} 3 & 38.\ 485 \\ 3 & 38.\ 649 \\ 3 & 38.\ 814 \\ 3 & 38.\ 978 \\ 3 & 39.\ 142 \end{array}$	$\begin{array}{c} 3 & 48. 342 \\ 3 & 48. 506 \\ 3 & 48. 670 \\ 3 & 48. 834 \\ 3 & 48. 999 \end{array}$	$10 \\ 11 \\ 12 \\ 13 \\ 14$.027 .030 .033 .036 .038
$ \begin{array}{r} 15 \\ 16 \\ 17 \\ 18 \\ 19 \\ \end{array} $	$\begin{array}{c}2 \ 40. \ 168\\2 \ 40. \ 332\\2 \ 40. \ 496\\2 \ 40. \ 661\\2 \ 40. \ 825\end{array}$	$\begin{array}{c} 2 \ 50.\ 024 \\ 2 \ 50.\ 188 \\ 2 \ 50.\ 353 \\ 2 \ 50.\ 517 \\ 2 \ 50.\ 681 \end{array}$	$\begin{array}{cccccccccccccccccccccccccccccccccccc$	$\begin{array}{cccccccccccccccccccccccccccccccccccc$	$\begin{array}{c} 3 & 19.594 \\ 3 & 19.758 \\ 3 & 19.922 \\ 3 & 20.086 \\ 3 & 20.251 \end{array}$	$\begin{array}{r} 3 & 29. 450 \\ 3 & 29. 614 \\ 3 & 29. 779 \\ 3 & 29. 943 \\ 3 & 30. 107 \end{array}$	$\begin{array}{c} 3 & 39. \ 307 \\ 3 & 39. \ 471 \\ 3 & 39. \ 635 \\ 3 & 39. \ 799 \\ 3 & 39. \ 964 \end{array}$	$\begin{array}{c} 3 & 49. 163 \\ 3 & 49. 327 \\ 3 & 49. 492 \\ 3 & 49. 656 \\ 3 & 49. 820 \end{array}$	$ \begin{array}{r} 15 \\ 16 \\ 17 \\ 18 \\ 19 \\ \end{array} $.041 .044 .047 .049 .052
$20 \\ 21 \\ 22 \\ 23 \\ 24$	$\begin{array}{c}2 \ 40.\ 989\\2 \ 41.\ 153\\2 \ 41.\ 318\\2 \ 41.\ 482\\2 \ 41.\ 646\end{array}$	$\begin{array}{c}2 & 50.846\\2 & 51.010\\2 & 51.174\\2 & 51.338\\2 & 51.503\end{array}$	$\begin{array}{cccccccccccccccccccccccccccccccccccc$	$\begin{array}{c} 3 & 10.559 \\ 3 & 10.723 \\ 3 & 10.887 \\ 3 & 11.051 \\ 3 & 11.216 \end{array}$	$\begin{array}{c} 3 & 20. 415 \\ 3 & 20. 579 \\ 3 & 20. 744 \\ 3 & 20. 908 \\ 3 & 21. 072 \end{array}$	$\begin{array}{c} 3 & 30. \ 271 \\ 3 & 30. \ 436 \\ 3 & 30. \ 600 \\ 3 & 30. \ 764 \\ 3 & 30. \ 929 \end{array}$	$\begin{array}{c} 3 \ 40.\ 128 \\ 3 \ 40.\ 292 \\ 3 \ 40.\ 456 \\ 3 \ 40.\ 621 \\ 3 \ 40.\ 785 \end{array}$	$\begin{array}{r} 3 & 49.984 \\ 3 & 50.149 \\ 3 & 50.313 \\ 3 & 50.477 \\ 3 & 50.642 \end{array}$	$20 \\ 21 \\ 22 \\ 23 \\ 24$	055 057 060 063 066
$25 \\ 26 \\ 27 \\ 28 \\ 29$	$\begin{array}{c}2 \ 41.\ 810\\2 \ 41.\ 975\\2 \ 42.\ 139\\2 \ 42.\ 303\\2 \ 42.\ 468\end{array}$	$\begin{array}{c}2 51.667\\2 51.831\\2 51.995\\2 52.160\\2 52.324\end{array}$	$\begin{array}{cccccccccccccccccccccccccccccccccccc$	$\begin{array}{c} 3 \ 11. \ 380 \\ 3 \ 11. \ 544 \\ 3 \ 11. \ 708 \\ 3 \ 11. \ 873 \\ 3 \ 12. \ 037 \end{array}$	$\begin{array}{c} 3 \ 21. 236 \\ 3 \ 21. 401 \\ 3 \ 21. 565 \\ 3 \ 21. 729 \\ 3 \ 21. 893 \end{array}$	$\begin{array}{c} 3 \ 31. \ 093 \\ 3 \ 31. \ 257 \\ 3 \ 31. \ 421 \\ 3 \ 31. \ 586 \\ 3 \ 31. \ 750 \end{array}$	$\begin{array}{r} 3 \ 40. \ 949 \\ 3 \ 41. \ 114 \\ 3 \ 41. \ 278 \\ 3 \ 41. \ 442 \\ 3 \ 41. \ 606 \end{array}$	$\begin{array}{c} 3 \ 50, 806 \\ 3 \ 50, 970 \\ 3 \ 51, 134 \\ 3 \ 51, 299 \\ 3 \ 51, 463 \end{array}$	$25 \\ 26 \\ 27 \\ 28 \\ 29$.068 .071 .074 .077 .079
$ \begin{array}{r} 30 \\ 31 \\ 32 \\ 33 \\ 34 \end{array} $	$\begin{array}{c}2 & 42.\ 632\\2 & 42.\ 796\\2 & 42.\ 960\\2 & 43.\ 125\\2 & 43.\ 289\end{array}$	$\begin{array}{cccccccccccccccccccccccccccccccccccc$	$\begin{array}{cccccccccccccccccccccccccccccccccccc$	$\begin{array}{c} 3 & 12.\ 201 \\ 3 & 12.\ 366 \\ 3 & 12.\ 530 \\ 3 & 12.\ 694 \\ 3 & 12.\ 858 \end{array}$	$\begin{array}{c} 3 & 22.058 \\ 3 & 22.222 \\ 3 & 22.386 \\ 3 & 22.551 \\ 3 & 22.715 \end{array}$	$\begin{array}{c} 3 & 31.914 \\ 3 & 32.078 \\ 3 & 32.243 \\ 3 & 32.407 \\ 3 & 32.571 \end{array}$	$\begin{array}{r} 3 \ 41.\ 771 \\ 3 \ 41.\ 935 \\ 3 \ 42.\ 099 \\ 3 \ 42.\ 264 \\ 3 \ 42.\ 428 \end{array}$	$\begin{array}{c} 3 \ 51.\ 627 \\ 3 \ 51.\ 791 \\ 3 \ 51.\ 956 \\ 3 \ 52.\ 120 \\ 3 \ 52.\ 284 \end{array}$	$ \begin{array}{c} 30 \\ 31 \\ 32 \\ 33 \\ 34 \end{array} $. 082 . 085 . 088 . 090 . 093
35 36 37 38 39	$\begin{array}{c}2 & 43.453\\2 & 43.617\\2 & 43.782\\2 & 43.946\\2 & 44.110\end{array}$	$\begin{array}{r} 2 \ 53.\ 310 \\ 2 \ 53.\ 474 \\ 2 \ 53.\ 638 \\ 2 \ 53.\ 803 \\ 2 \ 53.\ 967 \end{array}$	$\begin{array}{cccccccccccccccccccccccccccccccccccc$	$\begin{array}{c} 3 & 13.\ 023 \\ 3 & 13.\ 187 \\ 3 & 13.\ 351 \\ 3 & 13.\ 515 \\ 3 & 13.\ 680 \end{array}$	$\begin{array}{cccccccccccccccccccccccccccccccccccc$	$\begin{array}{c} 3 & 32.\ 736 \\ 3 & 32.\ 900 \\ 3 & 33.\ 064 \\ 3 & 33.\ 228 \\ 3 & 33.\ 393 \end{array}$	$\begin{array}{c} 3 & 42.\ 592 \\ 3 & 42.\ 756 \\ 3 & 42.\ 921 \\ 3 & 43.\ 085 \\ 3 & 43.\ 249 \end{array}$	$\begin{array}{cccccccccccccccccccccccccccccccccccc$	35 36 37 38 39	.096 .099 .101 .104 .107
$ \begin{array}{r} 40 \\ 41 \\ 42 \\ 43 \\ 44 \\ \end{array} $	$\begin{array}{cccccccccccccccccccccccccccccccccccc$	$\begin{array}{cccccccccccccccccccccccccccccccccccc$	$\begin{array}{cccccccccccccccccccccccccccccccccccc$	$\begin{array}{c} 3 \ 13.\ 844 \\ 3 \ 14.\ 008 \\ 3 \ 14.\ 173 \\ 3 \ 14.\ 337 \\ 3 \ 14.\ 501 \end{array}$	$\begin{array}{c} 3 \ 23.\ 700 \\ 3 \ 23.\ 865 \\ 3 \ 24.\ 029 \\ 3 \ 24.\ 193 \\ 3 \ 24.\ 358 \end{array}$	$\begin{array}{c} 3 & 33.\ 557 \\ 3 & 33.\ 721 \\ 3 & 33.\ 886 \\ 3 & 34.\ 050 \\ 3 & 34.\ 214 \end{array}$	$\begin{array}{c} 3 & 43.413 \\ 3 & 43.578 \\ 3 & 43.742 \\ 3 & 43.906 \\ 3 & 44.071 \end{array}$	$\begin{array}{c} 3 & 53.\ 270 \\ 3 & 53.\ 434 \\ 3 & 53.\ 598 \\ 3 & 53.\ 763 \\ 3 & 53.\ 927 \end{array}$	$ \begin{array}{r} 40 \\ 41 \\ 42 \\ 43 \\ 44 \\ \end{array} $.110 .112 .115 .118 .120
$ \begin{array}{r} 45 \\ 46 \\ 47 \\ 48 \\ 49 \\ \end{array} $	$\begin{array}{r} 2 \ 45, 096 \\ 2 \ 45, 260 \\ 2 \ 45, 425 \\ 2 \ 45, 589 \\ 2 \ 45, 753 \end{array}$	$\begin{array}{c} 2 & 54, 952 \\ 2 & 55, 117 \\ 2 & 55, 281 \\ 2 & 55, 445 \\ 2 & 55, 610 \end{array}$	$\begin{array}{rrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrr$	$\begin{array}{c} 3 & 14.\ 665\\ 3 & 14.\ 830\\ 3 & 14.\ 994\\ 3 & 15.\ 158\\ 3 & 15.\ 322 \end{array}$	$\begin{array}{c} 3 & 24.522 \\ 3 & 24.686 \\ 3 & 24.850 \\ 3 & 25.015 \\ 3 & 25.179 \end{array}$	$\begin{array}{c} 3 & 34.\ 378 \\ 3 & 34.\ 543 \\ 3 & 34.\ 707 \\ 3 & 34.\ 871 \\ 3 & 35.\ 035 \end{array}$	$\begin{array}{c} 3 & 44.\ 235\\ 3 & 44.\ 399\\ 3 & 44.\ 563\\ 3 & 44.\ 728\\ 3 & 44.\ 892 \end{array}$	$\begin{array}{c} 3 & 54.\ 091.\\ 3 & 54.\ 256\\ 3 & 54.\ 420\\ 3 & 54.\ 584\\ 3 & 54.\ 748 \end{array}$	$ \begin{array}{r} 45 \\ 46 \\ 47 \\ 48 \\ 49 \end{array} $.123 .126 .129 .131 .134
$50 \\ 51 \\ 52 \\ 53 \\ 54$	$\begin{array}{cccccccccccccccccccccccccccccccccccc$	$\begin{array}{cccccccccccccccccccccccccccccccccccc$	$\begin{array}{cccccccccccccccccccccccccccccccccccc$	$\begin{array}{c} 3 \ 15.\ 487 \\ 3 \ 15.\ 651 \\ 3 \ 15.\ 815 \\ 3 \ 15.\ 980 \\ 3 \ 16.\ 144 \end{array}$	$\begin{array}{c} 3 & 25. & 343 \\ 3 & 25. & 508 \\ 3 & 25. & 672 \\ 3 & 25. & 836 \\ 3 & 26. & 000 \end{array}$	$\begin{array}{c} 3 & 35.\ 200 \\ 3 & 35.\ 364 \\ 3 & 35.\ 528 \\ 3 & 35.\ 693 \\ 3 & 35.\ 857 \end{array}$	$\begin{array}{c} 3 & 45.\ 056 \\ 3 & 45.\ 220 \\ 3 & 45.\ 385 \\ 3 & 45.\ 549 \\ 3 & 45.\ 713 \end{array}$	$\begin{array}{c} 3 & 54. 913 \\ 3 & 55. 077 \\ 3 & 55. 241 \\ 3 & 55. 405 \\ 3 & 55. 570 \end{array}$	$50 \\ 51 \\ 52 \\ 53 \\ 54$.137 .140 .142 .142 .145 .148

 $\begin{array}{c} 3 & 36.021 \\ 3 & 36.185 \\ 3 & 36.350 \\ 3 & 36.514 \\ \end{array}$

3 36.678

 $\begin{array}{c} 3 \\ 3 \\ 45.878 \\ 3 \\ 46.042 \\ 3 \\ 46.206 \\ 3 \\ 46.370 \\ \end{array}$

3 46.535

 $\begin{array}{c} 3 & 55.076 \\ \hline 3 & 55.734 \\ 3 & 55.898 \\ 3 & 56.063 \end{array}$

3 56.227

3 56.391

 $\begin{array}{c} 3 & 26, \, 600 \\ \hline 3 & 26, \, 165 \\ 3 & 26, \, 329 \\ 3 & 26, \, 493 \\ 3 & 26, \, 657 \\ 3 & 26, \, 822 \end{array}$

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.153 $\begin{array}{c|c} 50 & .155 \\ 57 & .156 \\ 58 & .159 \\ 59 & 0.162 \end{array}$

55

56

				Mean Time of S	Sun's Visible Ris	ing and Setting.	
		Lat. N.		0 0 I N 0 7		2 II	17 18 19
	rox.	вр ddV	Dee. N.	ස්ත්ස්ත්ස්ත්ස්ත්ස්ත්	ಚಿಹಜೆಹಜೆಹೆಹೆ ಹೆ ಹೆ ಹೆ ಹೆ	ಜೆಹೆದೆಹೆದ್ದ ಸದೆಹ ದೆಹೆದ	න්ත්ත්ත්ත්ත්ත්ත්
		31	23° 27'	h. m. h. m. 557 57 557 557 557 557 557 557 557 557	65065655 6515 6515 6515 6515 6515 6515 6	, , , , , , , , , , , , , , , , , , ,	٥ 6
	JUNE	10	530	6 21 6 22 6 22 22 22 22 22 22 22 22 22 22 22	6 19 19 19 19 19 19 19 19 19 19 19 19 19	៴៸៰៴៸៰៴៸៰៴៰៴៰៴៰៴៰ ៵៹៵៵៵៵៵៵៵៵៵៵៵៵៵៵៵	6 2 6 2 6 2 8 2 8 2 8 2 8 2 8 2 8 2 8 2
		1	°1 81	$ \begin{array}{c} h \\ h \\ 5 \\ 5 \\ 5 \\ 5 \\ 6 \\ 0 \\ 5 \\ 0 \\ 0 \\ 0 \\ 0 \\ 0 \\ 0 \\ 0 \\ 0$	5 46 5 45 6 09 6 11 5 13 5 13 5 13 5 13 5 13 5 13 5 13 5	8698 8558858888888888	6 2 6 2 8 2 8 2 8 2 8 2 8 2 8 2 8 2 8 2
		96	0 21	6 07 0 00 6 05 6 05 7 8 8 8 8 8 8 8 8 8 8 8 8 8	6 9 8 9 1 9 1 9 1 9 1 9 1 9 1 9 1 9 1 9 1	88289 8331233152888888 88289 8331233153288888 88289 8331233153	65655655555 82232828288 82232828288
		5	50°	6 9 6 9 8 8 9 8 9 8 9 8 9 8 9 8 9 8 9 8	6 2 6 9 6 9 8 9 8 9 8 9 8 9 8 9 8 9 8 9 8 9	5 5 5 5 5 5 5 5 5 5 5 5 5 5 5 5 5 5 5	$\begin{smallmatrix} 6 & 22 \\ 6 & 22 \\ 6 & 22 \\ 6 & 22 \\ 6 & 22 \\ 2 & 22 \\ 2 & 22 \\ 2 & 22 \\ 2 & 22 \\ 2 & 22 \\ 2 & 22 \\ 2 & 2 \\$
ing.]		16	180	6 9 4 4 8 8 9 9 1 9 1 9 1 9 1 9 1 9 1 9 1 9 1 9	$\begin{smallmatrix} 5 & 45 \\ 6 & 07 \\ 6 & 6 & 08 \\ 6 & 11 \\ 6 & 11 \\ 6 & 12 \\ 6 & 13 \\ 6 & 11 \\ 13 \\ 13 \\ 13 \\ 10 \\ 10 \\ 10 \\ 10 \\$	5 5 5 5 5 5 5 5 5 5 5 5 5 5 5 5 5 5 5	6 5 5 5 5 5 6 6 7 6 5 7 6 5 7 6 5 7 6 5 7 6 5 7 6 5 7 6 5 7 6 5 7 6 5 7 6 5 7 7 7 7
le setti	WAY.		180	6 5 5 5 5 5 5 5 5 5 5 5 5 5 5 5 5 5 5 5	6 5 6 9 8 8 9 9 9 9 9 9 9 9 9 9 9 9 9 9 9 9	5 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2	6 5 5 5 5 5 5 5 5 5 5 5 5 5 5 5 5 5 5 5
s visib		x	17°	6 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0	6 5 6 9 6 9 6 9 6 9 6 9 6 9 6 9 6 9 6 9	5 5	6 5 2 2 2 8 3 3 2 3 3 3 2 3
ne 22 of sun'		10	16°	6 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0	6 5 6 9 6 9 6 9 6 9 6 9 6 9 6 9 6 9 6 9	5 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2	65 23 22 23 13 3 6 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2
to Ju time c		1	150	6 5 5 5 5 5 5 5 5 5 5 5 5 5 5 5 5 5 5 5	6 5 6 5 6 5 6 5 6 8 4 8 6 9 6 8 4 8 6 9 6 9 6 9 6 9 6 9 6 9 6 9 6 9 6 9 6	ッ - - - - - - - - - - - - -	6 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2
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 TABLE 10.

 Mean Time of Sun's Visible Rising and Setting.

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TABLE 10.

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North Latitude: 41° to 60°—March 21 to June 22.

TABLE 10.

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TABLE 10.

Mean Time of Sun's Visible Rising and Setting.

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North Latitude: 0° to 20° —September 23 to December 22.

TABLE 10.

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TABLE 10.

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TABLE 10. Mean Time of Sun's Visible Rising and Setting.

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North Latitude: 41° to 60°—September 23 to December 22.

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TABLE 10.

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Mean Time of Sun's	Visible	Rising and	Setting.
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North Latitude: 21° to 40° —December 22 to March 21.

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TABLE 10.

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TABLE 10.

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South latitude: 0° to 20°—March 21 to June 22.

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TABLE 10.

	Lat. S.		0	1 1		1	24	25	26	27	28	29	30	31	32	33		35	36	37	38	39	40	2
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TABLE	10.

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TABLE 10.

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TABLE 10.

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TABLE 10.

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South Latitude: 41° to 60° —June 22 to September 23.

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TABLE 10.

Mean Time of Sun's Visible Rising and Setting.

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South latitude: 0° to 20° —September 23 to December 22.

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South latitude: 21° to 40° —September 23 to December 22.

TABLE 10.

Mean Time of Sun's Visible Rising and Setting.

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TABLE 10.

Mean Time of Sun's Visible Rising and Setting.

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TABLE 10.

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Mean Time of Sun's Visible Rising and Setting.

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South Latitude: 21° to 40°—December 22 to March 21.

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	Lat. S.		0	51	52	53	24	52	26	52	58	53	30	31	32	8	34	35	36	37	38	39	
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	18	01	h.m.	6 03 6 14	6 03 6 14	6 03 6 14	6 03 6 14	6 02 6 14	6 02 6 14	6 02 6 14	$602 \\ 142 $	6 02 6 14	6 02 6 15	6 02 6 15	6 01 6 15	6 01 6 15	$6 01 \\ 6 15$	$6 01 \\ 6 15$	6 01 6 15	6 01	89	6 00 16 00	6 00 6 16
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	9	° 9	h. m.	5 59 6 25	828 928	e 28 9	5 57 6 26	6 27 6 27	5 56 6 27	5 56 28 28	5 55 28	5 54 6 29	26 27 0 27 0 27	5 53 6 30	5 53 6 31	5 52 6 32	0 21 0 21 0 21	5 30 8 33 9	5 50 6 34	992 992	999 999	5 47 6 36	5 47
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	٦	ŝ	h. m.	5 56 6 29	2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2	5 35 6 30	5 55 6 31	5 54 6 32	5 53 6 32	9 55 9 55 9 55	5 51 6 34	5 50 6 35	5 50 6 36	5 49 6 37	5 48 6 37		5 47 6 39	5 46 6 40	5 45	5 44	1 1 2 1 2 1 3 1 3 1 3 1 3 1 3 1 3 1 3 1	5 42 44	179 9
	56	o 6	h. m.	5 55 6 31	5 57 8 57	38 8 9	33 9 9	6 34 6 34	5 51 6 35	550	5 49 6 37	5 1 8 6 38 88	$5 \frac{18}{39}$	5 47 6 40	546 641	5 45 6 42	6 45 4 55 4 55	5 43 6 44	5 45 6 45	5 41	5 6 6	5 39 6 48	5 38 6 49
	8	10°	h.m.	۵. ۳. ۲. ۳	6 23 6 23	5 53 6 35	5 52 6 36	5 51 6 37	5 50 6 38 38	6 5 49 6 39	5 48 6 40	5 47 6 41	5 46 6 42	5 45 6 43	5 41 6 41	5 54 6 45	5 1 5 6 1 5	5 41 6 47	5 40 6 48	200 200 200 200 200 200 200 200 200 200	5 37	5 36 5 36	00 22 22 22 22 22
	05	110	h. m.	6 93 6 93 6 93	5 52 6 36	5 51 6 37	2 20 8 80 9 80	6 39	5 48 6 40	6 41 6 41	9 12 12 12 12 12 12 12 12 12 12 12 12 12	5 5 5 5 5 5 5 5 5 5 5 5 5 5 5 5 5 5 5	17 9 17 9	5 1 5 6 15	6 41 6 41	5 40 6 47	5 39 6 49	6 50 6 50	5 37 6 51	5 35	12.0	5.32	5 31 6 57
IX.	18	120	h. m.	5 51 6 37	9 8 9 9	5 49 6 39	5 1 5 6 1 5	5 41 6 41	5 46 6 42	5 4 5 4 5	5 44 6 44	5 1 3 6 1 5	242 9 9	5 40 6 48	5 39 6 49	6 30 5 38 5 0	5 37 6 52	5 35 6 53	5 34	222 223		5 29	5 28 7 01
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	6	150	h.m.	5 47 6 42	5 1 6 6 1 3	5 44 6 44	5 43 6 46	6 41 9	5 40 6 48	5 39 6 50	6 51	5 36 6 53	5 34 6 54	5 33 5 35	$5 31 \\ 6 57$	5 30 6 59	5 28 7 00	$\frac{5}{2}$	5 25	883 1 0 1	2 2 2 2	5 19	5 17 7 11
	10	16°	h. m.	5 1 4 1	5 11 6 15	5 1 6 9	5 41 6 48	6 49	5 38 6 51	5 36 5 36	88	6 25 25 23	6 57	5 30 6 58	$^{2}_{2}$	5 27 7 02	5 25 7 03	5 23 7 25 2	5 21	2 19	5 12	5 15	7 15 13
	51	170	h. m.	5 5 5 5 5	5 41 6 46	5 40 6 48	5 38	5 37 6 51		5 34 6 54	6 55 55 55	5 30 6 57	659	5 27 7 01	88 97	5 23 7 01	5 21 7 06	$\frac{5}{10}$ 19	5 17	122	113	11 2 2 11	5 09 7 18
	55	180	h. m.	5 41 6 46	5 39 6 47	5 37 6 49	5 36 5 36	6 23	5 32 6 54	5 31 6 56	5 23 6 23	5 27 6 59	5 26 7 01	524 703	5 22 5,22	5 20 7 07	$\frac{5}{18}$	5 16 7 11	5 14	2 1 1 1 1 1 1	5 09	5 07	582
	10 10	19°	h. m.	5 38 6 47	0 48 9 48 9	6 20 20 20	88 99	6 27 3	5 29 6 55	5 28 57	6 26 59	5 24 7 01	2 5 2 5 5 5	$\frac{5}{7}$ 20	5 18	5 16	5 14	$\frac{5}{12}$	5 09	202	2.8° 2.8°	888 191	182
ARY.	ភ	007	h. m.	5 35 6 1 8	5 33 6 49	5 31 6 51	0 30 9 30 9 30	6 5 5 5 5 5 5 5 5	5 26 6 56	5 24 6 58	858	$\frac{5}{2}$ 20	$\frac{5}{18}$	$\frac{5}{7}$ 16	5 14 7 08	5 12	5 10	5 07 7 15	5 05 7 18	222	388 1 0 1	405	318.8
INVE	16	°12	h. m.	5 32 6 48	5 30 6 50	6 55 55 55 55	5 26	5 24 6 55	5 22 6 57	5 20 6 59	5 18 7 01	5 16 7 03	5 14 7 05	$\frac{5}{7}$ 12	5 10	5 07	5 05 7 15	5 02 7 17	2 00 2 00	128	- - - 1/2 %	- 4 r - 2 2 - 2 3	1 49
	10	550	h. m.	5 28 6 48	6 50 5 26	524 652	22	6 20 9 20 9 20	$ \begin{array}{c} 5 \\ 6 \\ 58 \end{array} $	5 16 7 00	5 14	5 11 7 04	5 09 7 06	5 07 7 09	2 04	202	$\frac{4}{7}$ 59	4 57	4 54	122	646	146	348
	31	081	h.m.	5 5 6 46 22	520 648	5 18 6 50	5 16	575 900		5 09 6 58	202	5 05 7 03	5 02 7 05	$\frac{5}{1}$ 00	4 57 7 10	4 55	4 52	7 18	4 47	4	545	-71 888	- -
DECEM- BER.	31	230 27/	h. m.	5 15 6 41	5 13 6 43	5 11 6 45	5 09	202	5 05 6 52	5 05 2 7	000	4 58 59 8	4 55 7 01	4 53 7 04	4 20	4 48	4 45	41	4 39	- 71	- 41	88	4 27
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	Lat. S.		0	21	22	12	24	25	26	27	28	29	30	31	32	ŝŝ	34	35	38	37	ž	39	40

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TABLE 10.

Mean Time of Sun's Visible Rising and Setting.

	Lat S.		0	} 41	} 42	43	44	45	46	47		<u>≁</u> 48	49	20	51	\$ 52	-23		÷	22	26	57			FO -	09
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	18	10	h, m.	6 00 6 17	6 00 6 17	5 59 6 17	5 59	5 59 2 59	5 59	5 59	6 18 5 58	9 9 9 9	6 19 6 19	5 58 6 19	5 57	5 57	2 22	5 57	6 20	5 56 6 20	5 56 6 21	5 55 8 91	5 55	22	6 22	500
	16	81 61	h. m.	5 57 6 21	5 57 6 21	5 56	188	28	222	2 29	6 23 5 5 4	83	0 04 6 24	5 54 6 24	5 53	122 122 122 122 122 122 122 122 122 122	122	222	6 26	5551 626	5 51 6 27	5 50 6 50	2 1 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2	5 53 8 23	6 29	2 1 2
	13	30	ħ. m.	5 55 6 25	5 54	5 54	122	8 82 J	5 52	5 52	6 28 5 51	6 28	0 29 6 29	5 30 6 30	5 49	5 49 649	2 48	5 47	6 32	5 46 6 33	546 634	5 45 6 25	544	5 43	6 37	0 42
ARCH.	Ξ	•	h. m.	0 23 6 29	5 51 6 29	5 51	202	5 49 5 49	0 32 5 48 9 90	5 48	6 33 5 47	6.33		5 46 6 35	5 45 6 26	14 0	5 43	5 42 5 42	6 39	5 41 6 40	5 40 6 41	5 39	188	6 43 5 37	944	5 5 5 5
W	x	0°0	h. m.	5 49 6 34	5 48 6 34	5 48 8 5	5 47	5 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2	5 45	5 44	6 38 43 8	6 33	0 9 7 9 9 9 9 9	5 42 6 41	5 41 6 40	199 999	288	5 37 37	6 45	5 36 6 46	5 35 6 48	5 34 6 40	222	5 20	6 52	67 C
	9	° 9	h. m.	5 46 6 38 88	5 45 6 38	5 44 6 39	5 2 7 7 7 7 7 7 7 7 7 7 7 7 7 7 7 7 7 7	9 2 2 2 2 3 3 3 3	5 41 5 41	5 40	$6 \frac{43}{29}$	6 44	0 88 6 45	5 37 6 46	5 36	2.02 20.02	2 33	5 32	6 51	5 31 6 53	$529 \\ 654$	5 28 5 28	200	6 57 5 24	6 59	22.0
	**	0	h. m.	6 43 6 42	5 42 6 42	5 41 6 43	999 999	5 39	5 38 1	5 37	6 8 8 8 8 8 8	649	0 24 6 50	5 33 6 52	5 31	2230	5 28	5 25	6 58	5 25 6 59	$524 \\ 701$	253	200	5 18 0	2 02	916
	1	ŝ	h. m.	5 40 6 46	5 39 6 47	5 38	2 32	55.55 255	5 34 0	58	6 53 31	5.5	6 26 0 30	5 28 6 57	5 27	888	222	5 22	7 04	5 20 7 06	$\frac{5}{7}$ 08	5 16	212	5 11	11	60 0
	26	o 6	h. m.	5 37 6 50	5 36 6 51	5 34	383	225 255	2 30	5 29	5 28	629	35	5 24 7 03	5 22	122	5 18	5 16	7 10	5 14 7 12	5 12 7 14	5 10	2 01	5 05	22	9 07
	8	100	ħ. m.	9 27 9 9 27 9	5 32 5 55	5 31	5 23	88 6 7 6 0	228	5 24	7 03	88	2 27 06	$\frac{5}{7}$ 08	5 17	102	5 13	5 11	7 16	5 09 7 19	$\frac{5}{7}$ 21	5 03	207	4 58	7 30	4 23
	05	11°	h. m.	0 20 6 58 6 58	5 28 5 28	5 27	222	5 24	5 23	20	5 07	60 2	2 11 2	5 14 7 13	5 12	202	2 08 2	22	7 22	5 03 7 25	$\frac{5}{2}$	4 57	4 54	7 34 4 50	7 37	4 47
Υ.	18	120	h. m.	7 02 0 0 20	2 22	5 23	225	200	5 18	5 16	7 12	114	212	5 09 7 19	5 07	192	102	4 59	7 29	$ \frac{4}{1} $ $ \frac{57}{32} $	4 54 7 35	4 50	447	4 4 4 4 4 4 7 4 7 4 7 4 7 4 7 4 7 4 7 4	145	4 40
RUAR	15	130	h. m.	88	5 21 2 08	5 19	311	5 15 H	5 13	2 II 2	5 00	119	222	5 04	5 02	4 59	4 56	4 532	7 35	$ \frac{4}{2} $ $ \frac{50}{38} $	4 47 7 42	43	4 40	7 49 4 36	1 53	4 32
FEB	10	140	h. m.	0 19 7 10	5 17	5 15	2 13	2 11 2	200 200 200	208	225	1 22	0 01 7 27	4 59 7 30	4 56	4 229	32	4 47	7 41	4 44 7 45	4 40 7 49	4 36	4 8 8 7 8	4 28	3 II 8 8	4
	6	15°	h. m.	$\frac{5}{7}$ 13	$\frac{5}{7}$ 13	5 11 2	2 60 2	2 88	2 67	287	1 27	2 30	7 32	4 53 7 35	4 50	64: 64:	4 44	7 44	7 48	$\frac{4}{7}$ $\frac{37}{51}$	4 33	4 53	4 24	8 04 19	66	4 15
	•0	16°	h. m.	5 11 7 17	5 09	202	17	24	4 2 2	4 57	1 32	1 33	4 01 7 38	4 48 7 41	4 44	4	4 38	7 51 4 34	7 54	$ \begin{array}{c} 4 \\ 7 \\ 58 \\ 58 \end{array} $	8 77 8 75 8 75 8 75 8 75 8 75 8 75 8 75	4 21	4 16	8 15 8 15	8 17	4 06
	61	170	h. m.	5 07 7 21	5 05 7 23	202	328	8 12 2 12 2 12	4 64	4 51	1 36	7 39	4 45 7 43	4 42 7 46	4 38	4 35	4 31	4 97	8	* * 8 33	4 18 8 10	4 13	4 08	ନ୍ଦ୍ର ୭ ୩	8 25	3 57
	58	180	h. m.	$\frac{5}{24}$	5 00 7 27	4 57	- 41	$\frac{7}{61}$	4 48 30	4 45	7 41	144	$\frac{4}{1}$ $\frac{39}{48}$	$\frac{4}{7}$ 35	4 32	383	4 24	8 03 19	8 07	4 8 12 8	4 10 8 17	4 04	3 29	8 27 3 23	88	3 47
	25	061	h. m.	4 57 7 27	4 55 7 30	4 52	49	4 46	4 42	4 39 42	7 45 4 36	7 49	$1 \frac{4}{52}$	4 29	4 25	6 4 9	4 16	8 09 11	8 13	4 06 8 18	4 01 8 23	128	3 49 8 49	x 8 2 2 2 2 3 2 3 3 3 3 3 3 3 3 3 3 3 3 3	9 9 9 9	336
ARY.	15	500	h. m.	$\frac{4}{7}$ 31	4 49	4 46	43	4 40	4 36	4 33,	2 20	122	4 26 7 57	8 57 8 01 9 12	4 17	0 1 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0	4 08 8 08	8 15 8 03	8 20	3 57 8 25	3 52 8 30	8 4 2 4 2 4	339	20 00 27 00 27 00	8 50	3 3
JANU	16	510	h. m.	4 46 7 33	$\frac{4}{2}$	440	4 37	4 33	1 46	4 26	28	1 22	4 18 8 01	8 14 8 06	4 09	4 04	3 59 U	8 20 5 1 0 20	8 26	3 48 8 31 8 31	3 42 8 37		68 78 78	8 8 8 8	20 20 20 20	3 13
	10	0101	h. m.	4 40 7 36	4 37 7 39	***	4 29	1 46 4 26	1 22	4 18	1 57	8 01	4 10 8 06	8 10 8 10	4 01	212 S	8 08 0 18 0 18	8 26 3 44	8 32	80 80 80 80 80 80	3 31 8 44	324	3 16	8 20 8 20 8 20	80 6	5 23
	51	53°	h. m.	1 32	4 29	313 2	4 21	4 17	4 13	68 4	1 59	8 83 8 83 8 83	4 x 8 8	56 S	3 50	978 878	3 88 0 00	8 50 8 50 8 50	3.6 3.6	8 8 8 2 7	3 18 8 40	11	3 65	90 6 6 6	9 15	2 42 7
DECEM- BER.	61 61	230 27/	h. m.	4 24 33 4	4 20	412	4 13	7 44 4 09	4 05	4 002	7 56	8 01 8 01	8 51 8 05	3 46	3 41	£1833 ∞ cro c	3 29	8 51 8 52	8 34	3 16 8 41	3 08 8 48	8	2 51 2 51	9 09 9 49	9 15 9 15	2 31
70X. 16.	вр d d y	Dec. S.		ഷ്ഗ്	щ.	irio	n'≍i	vi rei	5 2 22	xi≃i	σiρ	i vi	eri vi	i ei o	i zi o	n et a	é zi	vi≃	i vi	ri vi	щa	i ei o	ó≃i	vi≃	i vi	ä
	S.		0	41	1 2	43	11	12	4	1	Ť	48	49	20	51	52	69	3	Ť	25	56	22	20	5	69	500

TABLE 11.

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i.

For reducing the Time of the Moon's passage over the Meridian of Greenwich to the Time of its passage over any other Meridian. The numbers taken from this Table are to be added to the Time at Greenwich in West Longitude, subtracted in East Longitude.

Longi-					Daily v	ariatio	n of the	moon's j	passing t	the meri	dian.				Longi-
tude.	40m	42m	44mª	46m	48m	50 m	52 ^m	54m	56m	5 8m	60 ^m	62 ^m	64 ^m	66 ^m	tude.
0	<i>m</i> .	<i>m</i> .	<i>m</i> .	<i>m</i> .	<i>m</i> .	<i>m</i> .	<i>m</i> .	<i>m</i> .	<i>m</i> .	<i>m</i> .	<i>m</i> .	<i>m</i> .	m.	<i>m</i> .	0
0	0	0	0	1	1	1	1	1	1	1	1	1	1	1	5
0 10	1	1	1	1	1	1	1	1		9	9	9	9	9	10
10	1	1	1	2	9			$\frac{1}{2}$	2	2	2	3	3	2	15
10	2	20	2	- 0 - 0	2	2	2	3	3	3	3	3	1	1	20
20	2	2	2	2	2	3	1	4	4	4	4	4	1	5	$\frac{20}{25}$
30	3	3	1	4	4	4	4	4	5	5	ŝ	5	5	5	30
- 25			1			5	5	5	5	6	6	6	6		35
40	4	5	5	5	5	6	6	6	6	6	7	7	7	7	40
45	5	5	5	6	6	6	6	7	7	7	7	8	8	8	45
50	6	6	6	6	7	7	7	$\dot{7}$	8	8	8	9	9	ğ	$\hat{50}$
55	ő	6	7	7	7	8	8	8	9	9	9	9	10	10	55
60	7	7	7	8	8	8	9	9	9	10	10	10	11	11	60
65	7	8	8	8	9	9	9	10	10	10	11	11	12	12	65
70	8	8	9	9	9	10	10	10	11	11	12	12	12	13	70
75	8	9	9	10	10	10	11	11	12	12	12	13	13	14	75
80	9	9_	10			11	12	12	12	13	13	14	14	15	80
85	9	10	10	11	11	12	12	13	13	14	14	15	15	16	85
90	10	10	11	11	12	12	13	13	14	14	15	15	16	16	90
95	11	11	12	12	13	13	14	14	15	15	16	16	17	17	95
100	11	12	12	13	13	14	14	15	16	16	17	17	18	18	100
105	$\frac{12}{12}$	12	$-\frac{13}{13}$			15	15	16	10	17	11	18			105
110	12	13	13	14	15	15	16	16	11	18	18	19	20	20	110
115	13	13	14	15	10	10	17	1/	10	19	19	20	20	21	110
120	$\frac{13}{14}$	14	10	10	10	17	10	10	10	19	20	21	21 99	22	120
120	1.1	10	10	10	$\frac{17}{17}$	18	10	19	20	20	21	22	22	23	120
100	15	-10	$\frac{10}{10}$	$\frac{17}{17}$	-10	$\frac{10}{10}$	10								195
130	10	10	10	10	10	19	- 19	20	21	22	22	20	24	20	140
140	10	10	11	10	19	19 20	20	21 99	22 93	20	20	25	26	20	140
140	10	17	10	10	20	20	21 99	- <u>44</u> 99	20	20	25	26	$\frac{20}{97}$	27	150
155	17	18	19	20	20	22	22	$\frac{22}{23}$	20	25	26	27	28	28	155
160	-19	-10		-20	-21		- 22	- 21	- 25						160
165	18	10	20	20	29	22	20	25	20	20	27	28	29	30	165
170	10	20	21	22	23	24	25	25	26	27	28	29	30	31	170
175	19	20-	21	22	23	24	25	26	27	28	29	30	31	32	175
180	$\frac{10}{20}$	21	22	23	24	25	$\frac{26}{26}$	27	28	29	30	31	32	33	180
· · ·	40m	1.9.0	1.fm	16m	48m		5.9m	5.4m	5.6m	59m		Rom	6.4m	A.G.m.	
	40m	420	444	4014	430	90m	02m	0+m	90m	0.9m	0.0	02"	04	001	

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TABLE 12.

									Но	rary r	notior	1.								
М.	1″	2''	3''	0 ⁴ "	5"	6''	7''	s"	9''	10''	11"	12"	13"	14″	15″	16″	17"	18″	19″	М.
1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1
$\frac{2}{3}$	0	0	0	0	0	0	0	0	0	1		1		1		$\begin{vmatrix} 1\\1 \end{vmatrix}$	1	1	1	$\frac{2}{3}$
4 5	0	0	0	0	$\begin{vmatrix} 0\\ 0 \end{vmatrix}$	$\begin{vmatrix} 0\\ 1 \end{vmatrix}$	$\begin{array}{c} 0\\ 1\end{array}$	1	1	$\frac{1}{1}$		1	$\begin{vmatrix} 1\\1 \end{vmatrix}$	1	1	$ 1 \\ 1$	1	$\frac{1}{2}$	$\frac{1}{2}$	$\frac{4}{5}$
6	0	0	0	0	1	1	1	1	1	1	1	1	1	1	$\frac{1}{2}$	$\frac{1}{2}$	2	2	2	$\frac{6}{6}$
78	$\begin{array}{c} 0\\ 0\end{array}$	$\begin{array}{c} 0\\ 0\end{array}$	0	$\begin{array}{c} 0\\ 1\end{array}$	1 1		1 1	$\frac{1}{1}$	1	1 1	$\begin{vmatrix} 1\\ 1 \end{vmatrix}$	$\begin{vmatrix} 1\\2 \end{vmatrix}$	$\frac{2}{2}$	$\frac{2}{2}$	$\frac{2}{2}$	$\begin{vmatrix} 2\\ 2 \end{vmatrix}$	$\frac{2}{2}$	$\frac{2}{2}$	$\frac{2}{3}$	$\frac{7}{8}$
$\frac{9}{10}$	0	0	0	1	1	1	1	1	$\frac{1}{2}$	$\frac{2}{2}$	$\frac{2}{2}$	$\frac{2}{2}$	$\begin{vmatrix} 2\\ 9 \end{vmatrix}$	$\frac{2}{2}$	$\frac{2}{3}$	$\frac{2}{3}$	3	3 9	3	9 10
11	0	0	1	1	1	1	1	1	2	2	2	$\frac{2}{2}$	2	3	3	3	3	3	3	11
$12 \\ 13$	$\begin{bmatrix} 0\\ 0 \end{bmatrix}$	0	1		1 1	1	$\frac{1}{2}$	$\frac{2}{2}$	$\frac{2}{2}$	$\frac{2}{2}$	$\frac{2}{2}$	$\frac{2}{3}$	3	3	3	$\frac{3}{3}$	$\frac{3}{4}$	+	4	$12 \\ 13$
14 15	0	0	1	$\frac{1}{1}$	1	$\frac{1}{2}$	$\frac{2}{2}$	$\frac{2}{2}$	$\frac{2}{9}$	$\frac{2}{3}$	3	3	3	$\frac{3}{4}$	4	4	4	45	45	14 15
16	$\frac{0}{0}$	1	1	1	1	$\frac{2}{2}$	$\frac{2}{2}$	$\frac{2}{2}$	2	3	$\frac{0}{3}$	$\frac{0}{3}$	3	4	4	4	5	5	5	$\frac{10}{16}$
$17 \\ 18$	$\begin{bmatrix} 0\\ 0 \end{bmatrix}$	$\frac{1}{1}$	1 1	1 1	$\begin{vmatrix} 1\\ 2 \end{vmatrix}$	$\frac{2}{2}$	$\frac{2}{2}$	$\frac{2}{2}$	$\frac{3}{3}$	$\frac{3}{3}$	$\frac{3}{3}$	$\frac{3}{4}$	$\frac{4}{4}$	4	$\frac{4}{5}$	$\begin{vmatrix} 5\\5 \end{vmatrix}$	5 5	$\frac{5}{5}$	$\frac{5}{6}$	17 18
$\frac{19}{20}$	$\begin{bmatrix} 0\\ 0 \end{bmatrix}$	$\frac{1}{1}$	$\frac{1}{1}$	1	$\begin{vmatrix} 2\\ 2 \end{vmatrix}$	$\frac{2}{2}$	$\frac{2}{2}$	3	3	$\frac{3}{3}$	3	4	4 4	$\frac{4}{5}$	55	5 5	$\frac{5}{6}$	6 6	$\frac{6}{6}$	$\frac{19}{20}$
$\frac{-21}{22}$	$\frac{0}{0}$	1	1	1	$\frac{1}{2}$	$\frac{-}{2}$	$\frac{-}{2}$	3	3	4	4	+	5	• 5	5	$\frac{6}{6}$	6	<u> </u>	7	$\frac{20}{21}$
$\frac{22}{23}$	0	1	1	$\frac{1}{2}$	$\frac{2}{2}$	$\frac{2}{2}$	3	3	3	4	4	$\frac{1}{5}$	5	$\frac{9}{5}$	6	6	0 7	$\frac{1}{7}$	$\frac{1}{7}$	$\frac{22}{23}$
$\frac{24}{25}$	$\begin{bmatrix} 0\\ 0 \end{bmatrix}$	$\frac{1}{1}$	$\frac{1}{1}$	$\begin{vmatrix} 2\\ 2 \end{vmatrix}$	$\begin{vmatrix} 2\\ 2 \end{vmatrix}$	$\begin{bmatrix} 2\\ 3 \end{bmatrix}$	$\frac{3}{3}$	3	$\frac{4}{4}$	$\frac{1}{4}$	$\frac{4}{5}$	$\frac{5}{5}$	$\frac{5}{5}$	$\begin{array}{c} 6\\ 6\end{array}$	$\begin{array}{c} 6\\ 6\end{array}$	$\begin{vmatrix} 6\\7 \end{vmatrix}$	$\frac{7}{7}$	78	8	$\frac{24}{25}$
$\frac{26}{27}$	$\overline{0}$	1	1	2	$\frac{2}{2}$	3	3	3	4	4	5	5	6	6	77	7	7	8	8	26
28	0	1	1	2	$\frac{2}{2}$	3	3	4	4	5	5	6	6	7	7	7.	8	8	9	$\frac{27}{28}$
$\frac{29}{30}$	$\begin{array}{c} 0 \\ 1 \end{array}$	1	$\frac{1}{2}$	$\frac{2}{2}$	$\frac{2}{3}$	$\frac{3}{3}$	$\frac{3}{4}$	+ 4	$\frac{4}{5}$	$\frac{5}{5}$	$\begin{array}{c} 5 \\ 6 \end{array}$	$\frac{6}{6}$	$\frac{6}{7}$	7	8	8	$\frac{8}{9}$	9 9	$\frac{9}{10}$	$\frac{29}{30}$
31 32	$\frac{1}{1}$	1	$\frac{2}{2}$	$\frac{2}{2}$	3	3	4	4	5	5	6	6	777	7	8	8	9	9	10	31
33	1	1	$\frac{2}{2}$	$\frac{2}{2}$	3	3	4	4	5	6	6	$\frac{1}{2}$	7	8	8	9	9	10	10	32 33
$\frac{34}{35}$	1	1	$\frac{2}{2}$	$\frac{2}{2}$	3	$\frac{3}{4}$	4 4	$\frac{5}{5}$	$\frac{5}{5}$	6 6	$\begin{array}{c} 6\\ 6\end{array}$	7	8	8 8	9	9	10 10	10	11	$\frac{34}{35}$
$\frac{36}{37}$	$\frac{1}{1}$	1	2	$\frac{2}{2}$	3	4	4	55	5	6	$\frac{7}{7}$	$\frac{7}{7}$	8	8	9	$\frac{10}{10}$	$\frac{10}{10}$	11	$11 \\ 12$	$\frac{36}{37}$
38	1	1	2	3	3	4	4	5_{i}	6	6	7	8	8	9	10	10	11	11	$12 \\ 12 \\ 12$	38
39 40	1	$1 \\ 1$	$\frac{2}{2}$	$\frac{3}{3}$	3 3	4	$\frac{9}{5}$	$\frac{5}{5}$	6 6	7	$\frac{7}{7}$	8	$\frac{8}{9}$	9	$10 \\ 10$	$10 \\ 11$	11	$12 \\ 12$	$\frac{12}{13}$	$\frac{39}{40}$
$\frac{41}{42}$	1	1	$\frac{2}{2}$	$\frac{3}{3}$	3	+	$\frac{5}{5}$	$\frac{5}{6}$	$\frac{6}{6}$	$\frac{7}{7}$	8	8	9	$\frac{10}{10}$	$\frac{10}{11}$	$\frac{11}{11}$	$\frac{12}{12}$	$\frac{12}{13}$	$\frac{13}{13}$	$\frac{41}{42}$
43	,1	Î	2	3	4	4	5	6	$\frac{6}{7}$	7	8	9	9	10	11	11	12	13	14	43
$44 \\ 45$	1	$\frac{1}{2}$	$\frac{2}{2}$	3	4	$\frac{1}{5}$	$\frac{5}{5}$	6	$\frac{7}{7}$	8	8	9	$10 \\ 10$	10	11 11	$\frac{12}{12}$	12 13	13 14	14	$\frac{44}{45}$
$\frac{46}{47}$	1	$\frac{2}{2}$	$\frac{2}{2}$	3	4	$\frac{5}{5}$	5	$\frac{6}{6}$	$\frac{7}{7}$	8	8	9	10 10	$\frac{11}{11}$	$\frac{12}{12}$	$\frac{12}{13}$	$\frac{13}{13}$	$\frac{14}{14}$	$\frac{15}{15}$	$\frac{46}{47}$
48 49 -	1	$\begin{bmatrix} \tilde{2}\\ 2 \end{bmatrix}$	2	3	4	5 5	6	$\frac{6}{7}$	7	8	9	10	10	11	$\frac{12}{12}$	13 12	14	14	15	48
50	1	2	3	3	4	5	6	7	8	8	9	10	11	$11 \\ 12$	$12 \\ 13$	$13 \\ 13$	14	$15 \\ 15$	16	49 50
$51 \\ 52$	1 1	$\left \begin{array}{c} 2\\ 2 \end{array} \right $	3 3	3 3	4		$\begin{array}{c} 6 \\ 6 \end{array}$	$\begin{bmatrix} 7\\7 \end{bmatrix}$	8	$\frac{9}{9}$	$\frac{9}{10}$	$\begin{array}{c}10\\10\end{array}$	11 11	$\frac{12}{12}$	$\frac{13}{13}$	$\frac{14}{14}$	$\frac{14}{15}$	$\frac{15}{16}$	$\begin{array}{c} 16 \\ 16 \end{array}$	$51 \\ 52$
$53 \\ 54$	1	$\frac{2}{2}$	3	4	45	$\frac{5}{5}$	6	7	8	9	$10 \\ 10$	11 11	11 19	$\frac{12}{13}$	$\frac{13}{14}$	14	$15 \\ 15$	16 16	$\frac{17}{17}$	53 54
55	1	2	3	4	5	6	_6	7	8	9	10	11	$\frac{12}{12}$	13	14	15	16	17	17	55
$\frac{56}{57}$	1 1	$\frac{2}{2}$	$\frac{3}{3}$	4	5 5	$\begin{array}{c} 6 \\ 6 \end{array}$	$\frac{7}{7}$	$\begin{bmatrix} 7\\ 8 \end{bmatrix}$	$\frac{8}{9}$	$\frac{9}{10}$	$\frac{10}{10}$	$\frac{11}{11}$	$\begin{array}{c} 12 \\ 12 \end{array}$	$\frac{13}{13}$	$\frac{14}{14}$	$\begin{array}{c} 15\\ 15\end{array}$	$\begin{array}{c}16\\16\end{array}$	$\frac{17}{17}$	$\frac{18}{18}$	$\frac{56}{57}$
$\frac{58}{59}$	1	$\frac{2}{2}$	3	4	5 5	$\begin{array}{c} 6 \\ 6 \end{array}$	$\frac{7}{7}$	8	9	$\frac{10}{10}$	11 11	$\frac{12}{12}$	$\frac{13}{13}$	14 14	$\frac{15}{15}$	$\begin{array}{c} 15\\ 16\end{array}$	$\frac{16}{17}$	17 18	18 19	$\frac{58}{59}$
60	ĩ	$\tilde{2}$	3	4	5	ĕ	7	8	9	10	11	12	13	$1\overline{4}$	15	16	17	18	19	60

TABLE 12.

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								I	Iorary	motion								
М.	20″	21″	22"	23"	24″	25″	26"	27″	28″	29"	30″	31″	32″	33″	34″	35″	36″	M.
1	0	0	0	0	0	0	0	0	0	0	1	1	1	1	1	1	1	1
$\frac{2}{3}$	1	1	1			1	1	1	1	1	$\frac{1}{2}$	$\frac{1}{2}$	$\frac{1}{2}$	$\frac{1}{2}$	$\frac{1}{2}$	$\frac{1}{2}$	$\begin{bmatrix} 1\\ 2 \end{bmatrix}$	$\frac{2}{3}$
4	î	i	1	2	$\hat{2}$	$\tilde{2}$	2	2	$\overline{2}$	$\frac{1}{2}$	$\overline{2}$	$\frac{1}{2}$	$\overline{2}$	2	$\overline{2}$	$\tilde{2}$	2	4
$\frac{5}{6}$	$\frac{2}{2}$	2	$\frac{2}{2}$	$-\frac{2}{2}$	-2-	$\frac{2}{2}$	$-\frac{2}{3}$		$\frac{2}{3}$	$\frac{2}{2}$	$\frac{3}{2}$	$\frac{3}{2}$	$\frac{3}{2}$		- 3	1	3	$\frac{5}{6}$
7	$\frac{1}{2}$	$\frac{2}{2}$	3	$\frac{2}{3}$	3	3	3	3	3	3	4	4	4	4	4	4	4	7
8	$\frac{3}{2}$	3	3	3	3	3	3	4	4	4	4	4 5	4 5	4	5	5	5	8
10	- 3	4	4	4	4	4	4	5	5	$\overline{5}$	$\frac{5}{5}$	5	5	6	6	6		10^{-5}
$\frac{11}{19}$	4	4	4	4 5	+	5	5	5	5	5	6	6	6	$\frac{6}{7}$	$\frac{6}{7}$	$\frac{6}{7}$	77	11
$12 \\ 13$	4	5	5	5	5	5	$\begin{bmatrix} 0\\6\end{bmatrix}$	6	6	6	7	7	7	7	7	8	8	$12 \\ 13$
14	5	5	5	5	6	6	$\frac{6}{7}$	67	$\frac{7}{7}$	7	7	7	7	8	8	8	8	14
$\frac{10}{16}$	$\frac{-5}{5}$	$\frac{-5}{6}$	$\frac{0}{6}$	$\frac{-6}{-6}$	$\frac{-6}{-6}$	- 7	$\frac{7}{7}$	$-\frac{1}{7}$	$\frac{1}{7}$	$-\frac{i}{8}$	$-\frac{\circ}{8}$	$\frac{0}{8}$	$\frac{\circ}{9}$	$\frac{-6}{9}$	$\frac{\vartheta}{9}$	$\frac{-\sigma}{9}$	$\frac{3}{10}$	$\frac{10}{16}$
17	6	6	6	7	7	7	7	8	8	8	9	9	9	9	10	10	10	17
18	6	7	7	$\frac{i}{7}$	8	8	8	$\frac{8}{9}$	$\frac{8}{9}$	9	10	10^{-9}	$10 \\ 10$	10	10	11	11	18
20		_7	7	8	8	8	9	9	9	10	10	10			11	12	12	20
$\frac{21}{22}$	$\frac{7}{7}$	8	8	8	8	9 9	$\frac{9}{10}$	$\frac{9}{10}$	10	10 11	11	11	$\frac{11}{12}$	$\frac{12}{12}$	$\frac{12}{12}$	$12 \\ 13$	$13 \\ 13$	$\frac{21}{22}$
23	8	8	8	9	9	10	10	10	11	11	12	12	12	13	13	13	14	23
$\frac{24}{25}$	8	$\frac{8}{9}$	9	10^{-9}	10 10	10 10	10 11	11	11 12	$\frac{12}{12}$	$\frac{12}{13}$	$\frac{12}{13}$	$\frac{13}{13}$	$13 \\ 14$	14	$14 \\ 15$	14	$\frac{24}{25}$
$\frac{-3}{26}$	9	9	10	10	10	11	11	$\frac{12}{12}$	12	13	13	13	14	14	15	15	16	26
$\frac{27}{28}$	9	10	$10 \\ 10$	$ 10 \\ 11 $	11	$\frac{11}{12}$	$\frac{12}{12}$	12 13	13	13	14	$\frac{14}{14}$	14	$15 \\ 15$	15	$16 \\ 16$	16	27
$\frac{20}{29}$	10	10	11	11	12	12^{12}	$1\overline{3}$	13	14	14	15	$15 \\ 15$	15	16	$10 \\ 16$	17	17	29
$\frac{30}{21}$	$\frac{10}{10}$	$\frac{11}{11}$	$\frac{11}{11}$	$\frac{12}{12}$	$\frac{12}{12}$	$\frac{13}{12}$	$\frac{13}{12}$	$\frac{14}{14}$	$\frac{14}{11}$	$\frac{15}{15}$	$\frac{15}{16}$	$\frac{16}{16}$	$\frac{16}{17}$	$\frac{17}{17}$	$\frac{17}{18}$	$\frac{18}{18}$	$\frac{18}{10}$	$\frac{30}{31}$
$\frac{31}{32}$	11	11	$11 \\ 12$	$12 \\ 12$	$12 \\ 13$	$13 \\ 13$	14	14	15	$15 \\ 15$	16	17	$\frac{17}{17}$	18	18	19	19	32
33	11	12	12	13	13	14	14	15	15	16	17	17	18	18	19	19	20	33
35	$11 \\ 12$	$12 \\ 12$	$12 \\ 13$	13	14	15	10	$16 \\ 16$	$10 \\ 16$	17	18	18	$13 \\ 19$	19	$\frac{19}{20}$	$\frac{20}{20}$	$\frac{20}{21}$	35
36	12	13	13	14	14	15	16	16	17	17	18	19	19	$\frac{20}{20}$	20	21	22	36
$-37 \\ -38$	$\frac{12}{13}$	$\frac{13}{13}$	14	$14 \\ 15$	$15 \\ 15$	$\frac{15}{16}$	$\frac{16}{16}$	$\frac{17}{17}$	17	18	$\frac{19}{19}$	$\frac{19}{20}$	$\frac{20}{20}$	$\frac{20}{21}$	$\frac{21}{22}$	$\frac{22}{22}$	$\frac{22}{23}$	37 38
39	13	14	14	15	16	16	17	18	18	19	20	20	21	21	22	23	23	39
$\frac{40}{41}$	$\frac{13}{14}$	$\frac{14}{14}$	$\frac{10}{15}$	$\frac{10}{16}$	$\frac{16}{16}$	$\frac{17}{17}$	$\frac{17}{18}$	$\frac{18}{18}$	$\frac{19}{19}$	$\frac{19}{20}$	$\frac{20}{91}$	$\frac{21}{21}$	$\frac{21}{22}$	$\frac{22}{23}$	$\frac{23}{23}$	$\frac{23}{24}$	$\frac{24}{25}$	40
42	14	$\hat{15}$	15	16	17	18	18	$10 \\ 19$	20	20	$\overline{21}$	22	22	23	24	25	25	42
$\frac{43}{44}$	$14 \\ 15$	$15 \\ 15$	$16 \\ 16$	$ 16 \\ 17 $	$17 \\ 18$	18 18	$\frac{19}{19}$	$\frac{19}{20}$	$\frac{20}{21}$	$\frac{21}{21}$	$\frac{22}{22}$	$\frac{22}{23}$	$\frac{23}{23}$	$\frac{24}{24}$	$\frac{24}{25}$	$\frac{25}{26}$	$\frac{26}{26}$	$\frac{43}{44}$
45	15	$1\ddot{6}$	17	17	18	19	$\frac{10}{20}$	$\overline{20}$	$\tilde{21}$	-22	23	$-\bar{23}$	$\overline{24}$	25	$\overline{26}$	26	27	45
46	$15 \\ 16$	16 16	17	18	18	$\frac{19}{20}$	$\frac{20}{20}$	21 91	21	22 93	23 94	$\frac{24}{91}$	$\frac{25}{25}$	$\frac{25}{26}$	$\frac{26}{27}$	$\frac{27}{97}$	28 28	$\frac{46}{47}$
48	$10 \\ 16$	17	18	18	$10 \\ 19$	$\frac{20}{20}$	$\frac{20}{21}$	$\frac{1}{22}$	$\frac{12}{22}$	$\frac{23}{23}$	$\overline{24}$	25	$\frac{10}{26}$	$\frac{26}{26}$	27	28	29	48
$\frac{49}{50}$	$16 \\ 17$	17	18	19	$\frac{20}{20}$	20 21	$\frac{21}{22}$	22 23	23	24 24	$\frac{25}{25}$	$\frac{25}{26}$	$\frac{26}{27}$	27	$\frac{28}{28}$	29	29 30	49 50
$\frac{50}{51}$	17	18	$\frac{10}{19}$	20	$\frac{20}{20}$	$\frac{21}{21}$	$\frac{-22}{22}$	$\frac{23}{23}$	$-\frac{10}{24}$	25	$\frac{26}{26}$	26	$\frac{-27}{27}$	28	$\frac{-20}{29}$	$-\frac{20}{30}$	31	51
52 52	17	18	19	$\frac{20}{20}$	21	22	$\frac{23}{22}$	23	24 25	$\frac{25}{26}$	$\frac{26}{27}$	27	$\frac{28}{28}$	29	29 30	30	$\frac{31}{32}$	52
54	18	19	20	$\frac{20}{21}$	$\frac{21}{22}$	$\frac{22}{23}$	$\frac{25}{23}$	$\frac{24}{24}$	$^{20}_{-25}$	$\frac{20}{26}$	$\frac{27}{27}$	$\frac{21}{28}$	$\frac{28}{29}$	$\frac{29}{30}$	31	32	32	54
55	18	19	20	21	22	23	24		$\frac{26}{26}$	27	28	28	29	30	31	$\frac{32}{22}$	33	55
эб 57	19	$\frac{20}{20}$	$\frac{21}{21}$	$\frac{21}{22}$	$\frac{22}{23}$	$\frac{23}{24}$	$\frac{24}{25}$	$\frac{29}{26}$	$\frac{26}{27}$	$\frac{27}{28}$	$\frac{28}{29}$	29	30 30	31	$\frac{32}{32}$	33 33	34 34	50 57
58 50	19	20	21	22	23	24	25	26	27	28	29	30	31	32	33	34	35	58 50
$\frac{59}{60}$	$\frac{20}{20}$	$\frac{21}{21}$	$\frac{22}{22}$	$\begin{vmatrix} 23 \\ 23 \end{vmatrix}$	$\frac{24}{24}$	$\frac{25}{25}$	$\frac{26}{26}$	$\frac{27}{27}$	$\frac{28}{28}$	$\frac{29}{29}$	30 30	30 31	$\frac{31}{32}$	$\frac{32}{33}$	33 34	3 4 35	30 36	60
		1		1	1													

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TABLE 12.

									Horary	motion	ι.							
M.	37″	38″	39″	40 ″	41"	42''	43''	44"	45"	46''	47"	48″	49''	50″	51''	52''	53''	м.
1	1	1	1	1	1	$\frac{1}{1}$	1	1	$\frac{1}{2}$	1	1	1	1	1	1	1	1	1
$\frac{2}{3}$	$\frac{1}{2}$	$\frac{1}{2}$	$\frac{1}{2}$	$\frac{1}{2}$	$\frac{1}{2}$	$\frac{1}{2}$	$\frac{1}{2}$	$\frac{1}{2}$	$\frac{2}{2}$	$\frac{4}{2}$	$\frac{1}{2}$	$\frac{2}{2}$	$\frac{2}{2}$	$\frac{2}{3}$	$\frac{2}{3}$	$\frac{2}{3}$	$\frac{2}{3}$	$\frac{2}{3}$
4	2	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	4	4
<u> </u>	$\frac{3}{4}$	$\frac{3}{4}$	$-\frac{3}{4}$	$\frac{3}{4}$	- 3		4		- 4 5	4			$-\frac{4}{5}$	- 4 5				5
7	4	4	5	5	5	5	5	5	5	5	5	6	6	6	6	6	6	7
8	5	$\frac{5}{6}$	$\frac{5}{6}$	5 6	$\frac{5}{6}$	$6\\6$	6 6	$\frac{6}{7}$	$\begin{array}{c} 6\\ 7\end{array}$	$\begin{array}{c} 6\\ 7\end{array}$	$\begin{array}{c} 6\\7\end{array}$	$\frac{6}{7}$	$\frac{7}{7}$	7	7	7	7	8
_10	_6	6	7	7	7	7	7	7	8	8	8	8	8	8	9	9	9	10
11	$\frac{7}{7}$	7	7	7	8	8	8	8	8	8	9	9 10	9	9 10	9	10	10	11
$12 \\ 13$	8	8	8	9	9	9	9	10^{3}	10	10	10	10	11	11	11	11	11	$12 \\ 13$
14	9	9 10	9 10	9 10	$10 \\ 10$	10	10	10	11	11 19	11 19	11 19	11 19	12	$12 \\ 13$	$\frac{12}{13}$	$\frac{12}{13}$	14
16	$\frac{3}{10}$	10	10	11	11	11	11	12	$\frac{11}{12}$	$\frac{12}{12}$	13	$\frac{12}{13}$	$-\frac{12}{13}$	$-\frac{13}{13}$	$\frac{10}{14}$	$\frac{13}{14}$	$\frac{10}{14}$	$\frac{10}{16}$
17	10	11	11 19	11	$12 \\ 12$	12	12	$12 \\ 12$	$13 \\ 14$	$13 \\ 14$	13	. 14	14	$\frac{14}{15}$	14	15	15	17
18 19	$11 \\ 12$	$11 \\ 12$	$12 \\ 12$	12	$12 \\ 13$	$13 \\ 13$	14	13	14	14	14	$14 \\ 15$	$10 \\ 16$	$10 \\ 16$	$10 \\ 16$	10 16	10	$18 \\ 19$
20	12	13	13	13	14	14	14	15	15	15	16	16	16	17	17	17	18	20
$\frac{21}{22}$	$\frac{13}{14}$	$13 \\ 14$	14	$14 \\ 15$	$14 \\ 15$	$15 \\ 15$	15 16	$15 \\ 16$	$16 \\ 17$	$16 \\ 17$	$\frac{16}{17}$	$17 \\ 18$	$17 \\ 18$	$\frac{18}{18}$	$18 \\ 19$	$\begin{array}{c}18\\19\end{array}$	$\frac{19}{19}$	$\frac{21}{22}$
23	14	15	15	15	16	16	16	17	17	18	18	18	19	19	20	20	20	23
$\frac{24}{25}$	15 15	15 16	16 16	16	$16 \\ 17$	17	17 18	$18 \\ 18$	$18 \\ 19$	18 19	19 20	$\frac{19}{20}$	$\frac{20}{20}$	$\frac{20}{21}$	$\frac{20}{21}$	$\frac{21}{22}$	$\frac{21}{22}$	$\frac{24}{25}$
26	16	16	17	17	18	18	19	19	20	20	20	$\frac{20}{21}$	21	22	22	23	23	26
27 98	$\frac{17}{17}$	17	18	$\begin{array}{c}18\\19\end{array}$	18 19	19 20	19 20	$20 \\ 21$	$20 \\ 21$	$21 \\ 21$	$\frac{21}{22}$	$\frac{22}{99}$	22 93	$23 \\ 23$	$\frac{23}{24}$	$\frac{23}{94}$	24 25	27
29	18	18	19	19	20	20	21.	$\frac{21}{21}$	22	22	$\frac{22}{23}$	23	23	23	25	25	$\frac{23}{26}$	$\frac{28}{29}$
$\frac{30}{21}$	$\frac{19}{10}$	19	$\frac{20}{20}$	$\frac{20}{91}$	$\frac{21}{91}$	$\frac{21}{22}$	$\frac{22}{22}$	$\frac{22}{22}$	23	23	$\frac{24}{94}$	24	25	25	26	26	27	30
$\frac{31}{32}$	$\frac{19}{20}$	$\frac{20}{20}$	20	$\frac{21}{21}$	21 22	$\frac{22}{22}$	$\begin{array}{c} 22\\23\end{array}$	$\frac{23}{23}$	$\frac{23}{24}$	$\frac{24}{25}$	$\frac{24}{25}$	$\frac{20}{26}$	$\frac{29}{26}$	26 27	$\frac{26}{27}$	$\frac{27}{28}$	21 28	$\frac{31}{32}$
33	20	21	21	22	23	23	24	24	25	25	26	26	27	28	28	29	29	33
$\frac{34}{35}$	$\frac{21}{22}$	$\frac{22}{22}$	$\frac{22}{23}$	$\frac{23}{23}$	23	24	24 25	$\frac{25}{26}$	$\frac{20}{26}$	$\frac{20}{27}$	$\frac{27}{27}$	28	$\frac{28}{29}$	$\frac{28}{29}$	$\frac{29}{30}$	$\frac{29}{30}$	$\frac{30}{31}$	$\frac{34}{35}$
36	22	23	23	24	25	25	26	26	27	28	28	29	29	30	31	31	32	36
37 38	$\frac{23}{23}$	$\frac{23}{24}$	$\frac{24}{25}$	$\frac{20}{25}$	$\begin{vmatrix} 25\\26 \end{vmatrix}$	$\frac{26}{27}$	27	$\frac{27}{28}$	$\frac{28}{29}$	$\frac{28}{29}$	$\frac{29}{30}$	30 30	$\frac{30}{31}$	$\frac{31}{32}$	$\frac{31}{32}$	$\frac{32}{33}$	33	$\frac{37}{38}$
39 40	24	25	25	26	27	27	28	29	29	30	31	31	32	33	33	34	34	39
$-\frac{40}{41}$	$\frac{25}{25}$	$\frac{29}{26}$	$\frac{26}{27}$	$\frac{21}{27}$	$\frac{21}{28}$	$\frac{28}{29}$	$\frac{29}{29}$	$\frac{29}{30}$	$\frac{-30}{-31}$	$\frac{31}{31}$	$\frac{31}{32}$	$\frac{32}{32}$	33	33	34	35	35	40
\cdot 42	26	27	27	28	29	29	30	31	32	32	33	34	34	35	36	36	37	41 42
$43 \\ 44$	$\frac{27}{27}$	$\frac{27}{28}$	$\frac{28}{29}$	$\begin{vmatrix} 29 \\ 29 \end{vmatrix}$	$\begin{vmatrix} 29 \\ 30 \end{vmatrix}$	30	$\frac{31}{32}$	32	32	33	34 24	34	35 36	36	37	37	38	43
45	28	29	29	30	31	32	32	33	34	35	35	36	37	38	38	39	40	44 45
46	28	29	30	31	31	$\frac{32}{22}$	33	34	35	35	36	37	38	38	39	40	41	46
48	$\frac{29}{30}$	30	31	$\frac{31}{32}$	$\begin{vmatrix} 32 \\ 33 \end{vmatrix}$	33	34	35	30 36	36 37	38	$\frac{38}{38}$	38 39	39 40	40	41 42	42 42	47
49 50	30 21	31	$\frac{32}{29}$	33	33	34	35	36	37	38	38	39	40	41	42	42	43	49
$\frac{50}{51}$	$\frac{31}{31}$	$\frac{32}{32}$	33	$\frac{35}{34}$	35	$\frac{-30}{-36}$	$\frac{30}{37}$	$\frac{-37}{37}$	$\frac{-38}{-38}$	$\frac{-38}{-39}$		40	$\frac{41}{42}$	$\frac{42}{43}$	$\frac{43}{43}$	43	44	<u>50</u>
52	32	33	34	35	36	36	37	38	39	40	41	42	42	43	44	45	46	52
$\frac{53}{54}$	33 33	$\frac{34}{34}$	$\frac{54}{35}$	30 36	36	37	$\frac{38}{39}$	39 40	40	41	$\frac{42}{42}$	42 43	$\frac{43}{44}$	44 45	45	46	$\frac{47}{48}$	$53 \\ 54$
55	34	35	36	37	38	39	39	40	41	42	43	44	45	46	47	48	49	55
$\frac{56}{57}$	$\frac{35}{35}$	$\begin{vmatrix} 35 \\ 36 \end{vmatrix}$	$\frac{36}{37}$	$\begin{vmatrix} 37 \\ 38 \end{vmatrix}$	$\frac{38}{39}$	39	40	41	42	43	44	45	46	47	48	49	49	56
58	36	37	38	39	40	41	42	43	44	44	45	46	47	48	40	50	51	58
59 60	$\frac{36}{37}$	37	38	39	40	41	42	43	44	45	46	47	48	49	50	51	52	59
00	37	00	09	1 40	1+1	42	40	44	40	40	41	48	49	90	51	52	53	60

TABLE 12.

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For finding the Variation of the Sun's Right Ascension or Declination, or of the Equation of Time, in any number of minutes of time, the Horary Motion being given at the top of the page in seconds, and the number of minutes of time in the side column. Also for finding the Variation of the Moon's Declination or Right Ascension in seconds of time, the motion in one minute being given at the top, and the numbers in the side column being taken for seconds.

								I	Iorary	motion								N
м. 	54″	55''	56″	57″	55″	59″	60''	61''	62''	63''	64''	65''	66″	67"	68''	69″	70''	м,
1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
$\frac{2}{3}$	$\frac{2}{3}$	$\frac{2}{3}$	$\frac{4}{3}$	$\frac{4}{3}$	$\frac{2}{3}$	$\frac{2}{3}$	$\frac{2}{3}$	$\frac{2}{3}$	$\frac{2}{3}$	$\frac{2}{3}$	$\frac{2}{3}$	- 2 3	$\frac{2}{3}$	$\frac{2}{3}$	3	$\frac{2}{3}$	4	- 3
4	4	4	4	4	4	4	4	4	4	4	4	- 4	4	4	5	5	5	4
$\frac{b}{6}$	$\frac{5}{5}$	$\frac{\partial}{\partial \theta}$	$\frac{6}{6}$	$\frac{-3}{7}$	$\frac{6}{7}$		$\frac{6}{7}$	$\frac{-6}{7}$		$\frac{\partial}{\partial \theta}$								
7	$\ddot{6}$	6	7	7	$\ddot{7}$	7	7	7	$\ddot{7}$	7	$\ddot{7}$	8	8	8	8	8	8	7
8	7	7	7	8	8	8	8	8	8	8	9 10	9	9	9	9	9	9 11	8
10	9	9	- ğ	10	10	10	10	10	10	_11	11	11	11	11	11	12	11	10
$\frac{11}{12}$	$10 \\ 11$	$10 \\ 11$	$10 \\ 11$	$10 \\ 11$	$\frac{11}{12}$	$\frac{11}{12}$	11 12	11	11 12	$\frac{12}{13}$	12	12	$\frac{12}{13}$	$12 \\ 13$	$\frac{12}{14}$	13	13	11
$12 \\ 13$	$11 \\ 12$	$11 \\ 12$	12^{11}	$11 \\ 12$	13^{12}	13	13^{12}	13	$1\tilde{3}$	14	14	14	14	15	15	15	15	$12 \\ 13$
14 15	13 14	13	$\frac{13}{14}$	13	14	14	14 15	14	$14 \\ 16$	$15 \\ 16$	$15 \\ 16$	15	$15 \\ 17$	$16 \\ 17$	$16 \\ 17$	16	16	14
$\frac{10}{16}$	$\frac{11}{14}$	$\frac{11}{15}$	$\frac{11}{15}$	$\frac{11}{15}$	$\frac{10}{15}$	$\frac{10}{16}$	$\frac{10}{16}$	$\frac{10}{16}$	$\frac{10}{17}$	$\frac{10}{17}$	10	17	$\frac{17}{18}$	$\frac{11}{18}$	$\frac{17}{18}$	$\frac{17}{18}$	$\frac{10}{19}$	$\frac{10}{16}$
17	15	16	$16 \\ 17$	16	16	17_{18}	17	17	18	18	18	18	19	19	19	20	20	17
18	17	17	$17 \\ 18$	$117 \\ 18$	$11'_{18}$	$10 \\ 19$	18	18	$\frac{19}{20}$	$\frac{19}{20}$	$\frac{19}{20}$	$\frac{20}{21}$	20	$\frac{20}{21}$	$\frac{20}{22}$	$\frac{21}{22}$	$\frac{21}{22}$	$18 \\ 19$
20	18	18	19	19	19	20	20	20	21	21	21	22	22	22	23	23		20
$\frac{21}{22}$	$\frac{19}{20}$	$\frac{19}{20}$	$\frac{20}{21}$	$\frac{20}{21}$	$\frac{20}{21}$	$\frac{21}{22}$	$\frac{21}{22}$	$\frac{21}{22}$	$\frac{22}{23}$	$\frac{22}{23}$	$\frac{22}{23}$	$\frac{23}{24}$	$\frac{23}{24}$	$\frac{23}{25}$	$\frac{24}{25}$	$\frac{24}{25}$	$\frac{25}{26}$	$\frac{21}{22}$
23	21	21	21	22	22	23	23	23	24	24	25	25	25	26	26	26	27	23
$\frac{24}{25}$	$\frac{22}{23}$	$\frac{22}{23}$	$\frac{22}{23}$	$\frac{23}{24}$	$\frac{23}{24}$	$\frac{24}{25}$	$\frac{24}{25}$	$\frac{24}{25}$	$\frac{25}{26}$	$\frac{25}{26}$	$\frac{26}{27}$	$\frac{26}{27}$	$-26 \\ -28$	$\frac{27}{28}$	$\frac{27}{28}$	$\frac{28}{29}$	$\frac{28}{29}$	$\frac{24}{25}$
26	23	24	24	25	25	26	26	26	27	27	28	28	29	29	29	30	$\frac{-20}{30}$	26
27	$\frac{24}{25}$	$\frac{25}{26}$	$25 \\ 26$	$26 \\ 97$	$\frac{26}{27}$	27	27	27	28	28	29 30	29 30	$\frac{30}{21}$	30	31	31	$\frac{32}{22}$	27
$\frac{20}{29}$	$\frac{26}{26}$	$\frac{20}{27}$	$\frac{20}{27}$	$\frac{1}{28}$	28	29	29	29	30	30	31	31	32	32	33	33	34	$\frac{20}{29}$
$\frac{30}{21}$	27	$\frac{28}{99}$	$\frac{28}{20}$	$\frac{29}{90}$	$\frac{29}{20}$	30	$\frac{30}{21}$	$\frac{31}{22}$	31	$\frac{32}{22}$	32	33	33	34	34	35	35	$\frac{30}{91}$
$\frac{31}{32}$	$\frac{28}{29}$	$\frac{28}{29}$	$\frac{29}{30}$	$\frac{29}{30}$	$\frac{30}{31}$	30 31	$\frac{31}{32}$	$\frac{32}{33}$	$\frac{32}{33}$	$\frac{33}{34}$	33 34	34	35 35	- 30 - 36	36	30 37	30 37	$\frac{31}{32}$
33	$\frac{30}{21}$	30	31	31	32	32	33	34	34	35	35	$\frac{36}{27}$	36	37	37	38	39	33
$\frac{34}{35}$	$31 \\ 32$	32	33	33	30 34	33 34	35 35	- 39 - 36	- 35 - 36	$\frac{50}{37}$	$\frac{30}{37}$	$\frac{37}{38}$	39	39		-39 -40	40	$\frac{34}{35}$
36	$\frac{32}{22}$	33	34	34	35	35	36	37	37	38	38	39	40	40	41	41	42	36
37 38	$\frac{33}{34}$	35	$\frac{30}{35}$	30	$\frac{30}{37}$	- 36 - 37	37	$\frac{38}{39}$	$\frac{38}{39}$	39 40	39 41	40	41 42	41	42	44	43	$\frac{37}{38}$
39	35	36	36	37	38	38	39	40	40	41	42	42	43	44	44	45	46	39
40	$\frac{30}{37}$	$\frac{37}{38}$	$\frac{37}{38}$	30	$\frac{-39}{-40}$		$\frac{40}{41}$	41	-41	42	43	43	44	40	40	40	-11	40
42	38	39	39	40	41	41	42	43	43	44	45	46	46	47	48	48	49	42
43 44	$\frac{39}{40}$	$\frac{39}{40}$	40	$ 41 \\ 42 $	$ \frac{42}{43} $	42	$\frac{43}{44}$	44 45	44	45	$\frac{46}{47}$	47	47	$\frac{48}{49}$	$-49 \\ -50$	49 51	$50 \\ 51$	43
45	41	41	42	43	44	44	45	46	47	47	48	49	50	50	51	52	53	45
46	41	42	43	44	44	45	46	47	48	48	49	50 51	51	51 59	$52 \\ 52$	53	54	$\frac{46}{47}$
48	43	44	45	40	40	47	48	48	49 50	49 50	$\frac{50}{51}$	$51 \\ 52$	- 52 - 53	$\frac{52}{54}$	$\frac{53}{54}$	04 55	$\begin{array}{c} 55\\56\end{array}$	48
49	44	45	46	47	47	48	49	50	51	51	52	53	54	55	56	56	57	49
$\frac{-50}{51}$	$\frac{40}{46}$	$\frac{40}{47}$	48	40	40	$\frac{49}{50}$	51	$-\frac{51}{52}$	$\frac{\partial 2}{53}$		$\frac{33}{54}$	04 55	 56	$\frac{30}{57}$	$-\frac{57}{58}$	$\frac{-38}{59}$	$\frac{-98}{60}$	$\frac{50}{51}$
52	47	48	49	49	50	51	52	53	54	55	55	56	57	58	59	60	61	52
53 54	48	$ \frac{49}{50} $	$\frac{49}{50}$	50	$51 \\ 52$	$52 \\ 53$	53 54	54 55	55	$\frac{56}{57}$	$57 \\ 58$	57 59	$58 \\ 59$	59 60	60 61		$62 \\ 63$	$\frac{53}{54}$
55	50	50	51	52	53	54	55	56	57	58	59	60	61	61	62	63	64	55
$56 \\ 57$	50 51	$51 \\ 59$	52	53	54	55 56	56	57	58	59 60	60	61	62	63	63 65	64 20	65 67	56 57
58	52	53	54	55	$56 \\ 56$	57	58	59	- 60	61	$61 \\ 62$	$63 \\ 63$	64	65	66	67	68	58
59 60	53 54	54	55	56	57	58	59	60	61	62	63	64	65	66	67	68	69 70	59 60
	04	00	00	01	- 58	- 99	00	61	62	63	04	69	06	67	08	09	10	00

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TABLE 12.

								I	lora r y	motion	•							
М.	71″	72"	73″	74″	75″	76″	77″	78″	79″	80″	81″	82"	83″	84″	85″	86″	87″	м.
1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
23	2	$\frac{2}{4}$	2	$\frac{2}{4}$	$\frac{3}{4}$	3	3	3	3 4	3 4	3 4	3 4	3 4	3 4	3 4	3 4	3	$\frac{2}{3}$
4	5	5	5	5	5	5	$\hat{5}$	$\overline{5}$	$\hat{5}$	$\hat{5}$	$\overline{5}$	$\hat{5}$	6	6	$\hat{6}$	$\hat{6}$	$\hat{6}$	4
5	6	6	6		6		<u>-6</u>					$\frac{7}{2}$	$\frac{7}{2}$		$\frac{7}{0}$	$\frac{7}{2}$		5
67	8	8	- 6	9	$\begin{vmatrix} 8\\9 \end{vmatrix}$	$\begin{vmatrix} 8\\9 \end{vmatrix}$	$\begin{vmatrix} 8\\9 \end{vmatrix}$	$\frac{8}{9}$	$\begin{vmatrix} 8\\9 \end{vmatrix}$	$\frac{8}{9}$	$\frac{8}{9}$	10^{8}	10^{8}	10^{8}	10	9 10	9 10	7
8	9	10	10	10	10	10	10	10	11	11	11	11	11	11	11	11	12	8
- 9 - 10	$11 \\ 12$	11 12	$\frac{11}{12}$	$\frac{11}{12}$	$\begin{bmatrix} 11\\ 13 \end{bmatrix}$	$11 \\ 13$	$\frac{12}{13}$	$\frac{12}{13}$	$\begin{bmatrix} 12\\ 13 \end{bmatrix}$	$\begin{array}{c} 12\\ 13\end{array}$	$\frac{12}{14}$	$\frac{12}{14}$	$\frac{12}{14}$	13	13	13	$\frac{13}{15}$	9 10
11	13	13	13	14	14	14	14	14	14	15	15	15	15	15	16	16	16	11
$\frac{12}{13}$	14	14 16	$\frac{15}{16}$	$15 \\ 16$	$15 \\ 16$	15	$\frac{15}{17}$	$\frac{16}{17}$	$16 \\ 17$	$16 \\ 17$	$\frac{16}{18}$	$\frac{16}{18}$	$\frac{17}{18}$	17 18	17	$17 \\ 19$	$17 \\ 19$	$\frac{12}{13}$
14	17	17	17^{10}	17	18	18	18	18	18	19	10	19	19	$\tilde{20}$	20	20	$\tilde{20}$	14
$\frac{15}{16}$	$\frac{18}{10}$	$\frac{18}{10}$	$\frac{18}{10}$	$\frac{19}{20}$	$\frac{19}{90}$	$\frac{19}{20}$	$\frac{19}{-91}$	$\frac{20}{21}$	$\frac{20}{21}$	$\frac{20}{21}$	$\frac{20}{99}$	$\frac{21}{22}$	$\frac{21}{22}$	$\frac{21}{-99}$	$\frac{21}{22}$	$\frac{22}{23}$	$\frac{22}{22}$	$\frac{15}{16}$
10	$\frac{19}{20}$	$\frac{19}{20}$	21	$\frac{20}{21}$	$\frac{20}{21}$	$\frac{20}{22}$	$\frac{21}{22}$	$\frac{21}{22}$	$\frac{21}{22}$	$\frac{21}{23}$	$\frac{22}{23}$	$\frac{12}{23}$	24	24^{22}	$\frac{23}{24}$	$\frac{23}{24}$	$\frac{25}{25}$	17
18	21	22	22	22	23	23	23	23	24	24	24	$\frac{25}{26}$	$\frac{25}{26}$	25	26	26	26	18
$\frac{19}{20}$	$\frac{22}{24}$	$\frac{23}{24}$	$\frac{23}{24}$	$\frac{23}{25}$	$\frac{24}{25}$	$\frac{24}{25}$	$\frac{24}{26}$	$\frac{25}{26}$	$\frac{25}{26}$	$\frac{25}{27}$	$\frac{26}{27}$	$\frac{26}{27}$	$\frac{20}{28}$	$\frac{27}{28}$	$\frac{27}{28}$	$\frac{27}{29}$	$\frac{28}{29}$	20
21	25	25	26	26	26	27	27	27	28	28	28	29	29	29	30	30	30	21
$\frac{22}{23}$	$\frac{26}{27}$	$\frac{26}{28}$	$\frac{27}{28}$	$\frac{27}{28}$	$\frac{28}{29}$	$\frac{28}{29}$	$\frac{28}{30}$	$\frac{29}{30}$	$\frac{29}{30}$	$\frac{29}{31}$	30 31	$\frac{30}{31}$	$-\frac{30}{32}$	$\frac{31}{32}$	31	$\frac{32}{33}$	32 33	$\frac{22}{23}$
24	$\overline{28}$	$\overline{29}$	29	30	30	30	31	31	32	32	32	33	33	34	34	34	34	24
$\frac{25}{-26}$	$\frac{30}{31}$	$\frac{30}{31}$	$\frac{30}{32}$	$\frac{31}{32}$	$\frac{31}{33}$	$\frac{32}{33}$	$\frac{32}{33}$	33	$\frac{33}{34}$	$\frac{33}{35}$	$\frac{34}{35}$	$\frac{34}{36}$	$\frac{35}{36}$	$\frac{35}{36}$	$\frac{35}{37}$	$\frac{-36}{-37}$	$\frac{36}{38}$	25
27	32	$\frac{31}{32}$	33	$\frac{32}{33}$	34	34	35	35	36	36	36	37	37	38	38	39	39	$\frac{20}{27}$
28	33	34	34	35	35	$\frac{35}{27}$	36	36	$\frac{37}{20}$	37	38	38	39	39	40	40	41	28
$\frac{29}{30}$	36	$\frac{30}{36}$	30 37	$\frac{30}{37}$	$\frac{30}{38}$	$\frac{37}{38}$	39	$\frac{38}{39}$	40	40	39 41	40	$\frac{40}{42}$	41 42	43	43	44	$\frac{29}{30}$
31	37	37	38	38	39	39	40	40	41	41	42	42	43	43	44	44	45	31
$\frac{32}{33}$	$\frac{38}{39}$	$\frac{38}{40}$	$\frac{39}{40}$	39 41	$\begin{array}{c} 40\\ 41 \end{array}$	$\frac{41}{42}$	$\frac{41}{42}$	$\frac{42}{43}$	42 43	$\frac{43}{44}$	43 45	44	44 46	45 46	40	40	46	$\frac{32}{33}$
34	40	41	41	42	43	$\tilde{43}$	44	44	45	45	46	46	47	48	48	49	49	34
$\frac{35}{26}$	$\frac{41}{42}$	$\frac{42}{42}$	$\frac{43}{44}$	$\frac{43}{41}$	44	44	$\frac{45}{46}$	$\frac{46}{47}$	46	47	$\frac{47}{10}$	$\frac{48}{49}$	$\frac{48}{50}$	$\frac{49}{50}$	$\frac{50}{51}$	$\frac{50}{52}$	$\frac{51}{52}$	$\frac{35}{26}$
30 37	43 44	43 44	$\frac{44}{45}$	44 46	$\frac{40}{46}$	40 47	40 47	48	49	48 49	49 50	49 51	51	$\frac{50}{52}$	52	53	$52 \\ 54$	$\frac{30}{37}$
38	45	46	46	47	48	48	49	49	50	51	51_{52}	52	53	53	54	54	55	38 20
39 40	46 47	47 48	$\frac{47}{49}$	$\frac{48}{49}$	49 •50	$\frac{49}{51}$	$\frac{50}{51}$	$\frac{51}{52}$	53	$\frac{52}{53}$	$\frac{53}{54}$	- 55 - 55	- 5 5	ээ 56	50 57	50 57	- 57 - 58 -	39 40
41	49	49	50	51	$\overline{51}$	52	53	53	54	55	55	56	57	57	58	59	59	41
42	50 51	50	51 52	$\frac{52}{53}$	53	53 54	$\frac{54}{55}$	55 56	$55 \\ 57$	$\frac{56}{57}$	57 58	57 59	$\frac{58}{59}$	59 60	60	$60 \\ 62$	$61 \\ 62$	42
43	$51 \\ 52$	$52 \\ 53$	$52 \\ 54$	54	$55 \\ 55$	56	$50 \\ 56$	$57 \\ 57$	58	59	$59 \\ 59$	60	$61 \\ 61$	62	62	63	64	44
45	53	54	55	56	56					60	61	62	$\frac{62}{24}$	63	64	65	65	45
$\frac{46}{47}$	$\frac{54}{56}$	55 56	$56 \\ 57$	$57 \\ 58$	$\frac{58}{59}$	- 58 - 60	59 60	60 61	$\frac{61}{62}$	$61 \\ 63$	62 63	$63 \\ 64$	64 65	64 66	65 67	66 67	67 68	46 47
48	57	58	58	59	60	61	62	62	63	64	65	66	66	67	68	69	70	48
49 50	58 59	59 60	$60 \\ 61$	60 62	$\begin{array}{c} 61 \\ 63 \end{array}$	$\frac{62}{63}$	$63 \\ 64$	$64 \\ 65$	65 66	$65 \\ 67$	66 68	67 68	68 69	$\frac{69}{70}$	69 71	$\begin{array}{c} 70\\72\end{array}$	$\frac{71}{73}$	49 50
51	60	61	62	63	64	65	65	66	67	68	69	70	$\frac{30}{71}$	71	72	73	74	51
52	62	62	63	64	65 60	66	67	68	68 70	69 71	$\frac{70}{79}$	$71 \\ 72$	$\frac{72}{72}$	$73 \\ 74$	74	$\frac{75}{76}$	$\frac{75}{77}$	52 53
53 54	64	65	66	67	68	68	69	70	70	$71 \\ 72$	73^{-2}	74	75	76	77	77	78	54
55	65	66	67	68	69	70	71	72	72	73		75	76	77	78	79	80	55
56 57	$\frac{66}{67}$	67	$68 \\ 69$	69 70	70	$\frac{71}{72}$	$\frac{72}{73}$	73 74	$\frac{74}{75}$	$\frac{75}{76}$	76 77	78	79	80	81	80 82	81 83	50 57
58	69	70	71	72	73	73	74	75	76	77	78	79	80	81	82	83	84	58
59 60	70	$\frac{71}{72}$	72	73	$\frac{74}{75}$	75 76	$\frac{76}{77}$	77 78	78 79	79 80	80 81	81 82	82 83	83 84	84 85	80 86	80 87	59 60
00		1.2					•••	10		50	01							, Ť

TABLE 12.

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								H	Iorary	motion					1			3.5
М.	88″	89″	90″	91″	92″	93″	94″	95″	96″	97″	98″	99″	100″	101″	102″	103″	104″	м.
1	1	1	$\frac{2}{2}$	2	$\frac{2}{2}$	$\frac{2}{2}$	$\frac{2}{3}$	$\frac{2}{2}$	$\frac{2}{2}$	$\frac{2}{3}$	$\frac{2}{3}$	$\frac{2}{3}$	2	$\frac{2}{2}$	$\frac{2}{2}$	$\frac{2}{2}$	$\frac{2}{3}$	1
$\frac{2}{3}$	3 4	3 4	3 5	3 5	5 5	3 5	э 5	5 5	5 5	5 5	5	5	5	5	5 5	5	5 5	$\frac{4}{3}$
4 5	$\frac{6}{7}$	$\frac{6}{7}$	6	6	6 8	$\frac{6}{8}$	$\frac{6}{8}$	$\frac{6}{8}$	$\frac{6}{8}$	$\begin{array}{c} 6\\ 8\end{array}$	7	7	7	7	7 9	7	7 9	$\frac{4}{5}$
6	9	-9	-9	$\frac{-9}{9}$	9		- 9	10	$\frac{0}{10}$	10	10	10	10	10	10	10	10	6
7	$\frac{10}{12}$	$\frac{10}{12}$	$\frac{11}{12}$	$\frac{11}{12}$	11 12	$\frac{11}{12}$	$\frac{11}{13}$	$\frac{11}{13}$	$\begin{array}{c} 11 \\ 13 \end{array}$	11 13	$\frac{11}{13}$	$\begin{array}{c} 12\\ 13\end{array}$	$\begin{array}{c} 12 \\ 13 \end{array}$	$\begin{array}{c} 12\\ 13\end{array}$	$\begin{array}{c} 12 \\ 14 \end{array}$	$\begin{array}{c} 12 \\ 14 \end{array}$	$\frac{12}{14}$	7 8
9	13	13	14	14	14	14	14	14	14	15	15	15	15	15	15	15	16	9
$\frac{10}{11}$	$\frac{15}{16}$	$\frac{10}{16}$	$\frac{15}{17}$	$\frac{15}{17}$	$\frac{13}{17}$	$\frac{16}{17}$	$\frac{16}{17}$	$\frac{16}{17}$	$\frac{10}{18}$	$\frac{10}{18}$	$\frac{10}{18}$	$\frac{17}{18}$	$\frac{17}{18}$	$\frac{17}{19}$	$\frac{11}{19}$	$\frac{17}{19}$	$\frac{17.}{19}$	10
12 12	18 19	18 19	$\frac{18}{20}$	18 20	$18 \\ 20$	$\frac{19}{20}$	$\frac{19}{20}$	19 21	$\frac{19}{21}$	19 21	$\frac{20}{21}$	$\begin{array}{c} 20\\ 21 \end{array}$	$\frac{20}{22}$	$\frac{20}{22}$	$\frac{20}{22}$	$21 \\ 22$	$\frac{21}{23}$	$\frac{12}{13}$
13	21	21	$\frac{20}{21}$	21	$\begin{vmatrix} 20\\21 \end{vmatrix}$	22	22	$\frac{21}{22}$	22	23	23	23	23	24	24	24	24	14
$\frac{15}{16}$	$\frac{22}{23}$	$\frac{22}{24}$	$\frac{23}{24}$	$\frac{23}{24}$	$\frac{23}{25}$	$\frac{23}{25}$	$\frac{24}{25}$	$\frac{24}{25}$	$\frac{24}{26}$	$\frac{24}{26}$	$\frac{25}{26}$	$\frac{25}{26}$	$\frac{25}{27}$	$\frac{25}{27}$	$\frac{26}{27}$	$\frac{26}{27}$	$\frac{26}{28}$	$\frac{15}{16}$
17	25	25	26	26	$ \frac{26}{26} $	26	27	27	27	27	28	28	28	29	29	29	29 21	17
18 19	$\frac{26}{28}$	$\frac{27}{28}$	$\frac{27}{29}$	$\frac{27}{29}$	$\begin{vmatrix} 28\\29 \end{vmatrix}$	$\frac{28}{29}$	$\frac{28}{30}$	$\frac{29}{30}$	29 30	29 31	$\frac{29}{31}$	$\frac{50}{31}$	30 32	$\frac{30}{32}$	$\frac{31}{32}$	$\frac{51}{33}$	$\frac{51}{33}$	18
$\frac{20}{21}$	29	30	30	30	31	$\frac{31}{22}$	$\frac{31}{22}$	$\frac{32}{22}$	$\frac{32}{24}$	$\frac{32}{24}$	$\frac{33}{24}$	33	33	34	34	34	$\frac{35}{26}$	$\frac{20}{21}$
$\frac{21}{22}$	$31 \\ 32$	$\frac{31}{33}$	$\frac{32}{33}$	$\frac{32}{33}$	$\frac{32}{34}$	33 34	33 34	35 35	34 35	36	36	36	37	37	37	38	38	$\frac{21}{22}$
$\begin{array}{c} 23 \\ 24 \end{array}$	$\frac{34}{35}$	$\frac{34}{36}$	$\frac{35}{36}$	$\frac{35}{36}$	$\frac{35}{37}$	$\frac{36}{37}$	$\frac{36}{38}$	$\frac{36}{38}$	$\frac{37}{38}$	$\frac{37}{39}$	$\frac{38}{39}$	38 40	$\frac{38}{40}$	$ \frac{39}{40} $	39 41	$ \begin{array}{c} 39 \\ 41 \end{array} $	$\begin{array}{c} 40 \\ 42 \end{array}$	$\frac{23}{24}$
25	37	37	38	38	38	39	39	40	40	40	41	41	42	42	43	43	43	25
$\frac{26}{27}$	$\frac{38}{40}$	$\frac{39}{40}$	$\frac{39}{41}$	39 41	$\begin{array}{c} 40\\ 41 \end{array}$	$ 40 \\ 42 $	$\begin{array}{c} 41 \\ 42 \end{array}$	$\frac{41}{43}$	$\frac{42}{43}$	$\begin{array}{c} 42 \\ 44 \end{array}$	$\frac{42}{44}$	$ 43 \\ 45 $	$ \frac{43}{45} $	44 45	44 46	$ \frac{45}{46} $	$\frac{45}{47}$	$\frac{26}{27}$
28	41	42	42	42	43	43	44	44	45	45	46	46	47	47	48	48	49	28 20
$\frac{29}{30}$	43 44	$\frac{43}{45}$	44 45	$\frac{44}{46}$	44 46	45 47	40 47	46 48	46 48	$\frac{47}{49}$	$^{+41}_{-49}$	48 50	$-48 \\ 50$	-49 51	51	$50 \\ 52$	$50 \\ 52$	$\frac{29}{30}$
$\frac{31}{22}$	$\frac{45}{47}$	$\frac{46}{47}$	47	47	48	48	49 50	49 51	50 51	$\frac{50}{52}$	$51 \\ 52$	51 52	$\frac{52}{53}$	52 54	53 54	53 55	54 55	$\frac{31}{32}$
33	48	49	50	50	51	51	50	52	53	53	54	54	55	56	56	57	57	33
$\frac{34}{35}$	$50 \\ 51$	$50 \\ 52$	$51 \\ 53$	$52 \\ 53$	$\begin{vmatrix} 52\\54 \end{vmatrix}$	$53 \\ 54$	$53 \\ 55$	$54 \\ 55$	$\frac{54}{56}$	$55 \\ 57$	56 57	56 58	57 58	57 59	$\begin{array}{c} 58\\ 60 \end{array}$	58 60	59 61	$\frac{34}{35}$
36	53	53	54	55	55	56	56	57	58	58	59	59	60	61	61	62	62	36
37 38	$\frac{54}{56}$	$\frac{55}{56}$	56 57	$56 \\ 58$	58	37 59	- 60 - 60	- 59 - 60	$ \frac{59}{61} $	$60 \\ 61$	60	63	63	62 64	$65 \\ 65$	64 65	66	38
39 40	57 59	58 59	59 60	59 61	60 61	60 62	61 63	62 63	62 64	$63 \\ 65$	$64 \\ 65$	64 66	65 67			67 69	$\frac{68}{69}$	$\frac{39}{40}$
41	60	61	62	62	63	64	64	65	66	66	67	68	68	69	70	70	71	41
$\frac{42}{43}$	$\begin{array}{c} 62 \\ 63 \end{array}$	$\begin{bmatrix} 62 \\ 64 \end{bmatrix}$	$\begin{array}{c} 63 \\ 65 \end{array}$	$\begin{array}{c c} 64 \\ 65 \end{array}$	$\begin{array}{ c c }64\\66\end{array}$	$\begin{vmatrix} 65\\ 67 \end{vmatrix}$	$\begin{array}{c} 66 \\ 67 \end{array}$		$\begin{array}{c c} 67\\ 69\end{array}$	$\begin{array}{c} 68 \\ 70 \end{array}$	$\begin{array}{c} 69 \\ 70 \end{array}$	$ \begin{array}{c} 69 \\ 71 \end{array} $	$\begin{vmatrix} 70 \\ 72 \end{vmatrix}$	$\begin{bmatrix} 71 \\ 72 \end{bmatrix}$	$\begin{vmatrix} 71\\73 \end{vmatrix}$	$\begin{array}{ c c } 72 \\ 74 \end{array}$	73 75	$\begin{array}{c} 42 \\ 43 \end{array}$
44	65	65	66	67	67	68	69	70	70	71	72	73	73	74	75	76	76	44
$\frac{45}{46}$	$\frac{00}{67}$	$\frac{07}{68}$	$\frac{08}{69}$	$\frac{08}{70}$	$\frac{09}{71}$	$\frac{70}{71}$	$\frac{71}{72}$	$\frac{71}{73}$	74	$\frac{73}{74}$	$\frac{74}{75}$	$\frac{74}{76}$	$\frac{10}{77}$	$\frac{70}{77}$	78	79	80	46
47	69 70	70	71	71	72	73	74	74	75	76	77	78	78	79 81	80	81	81 82	47 48
48	$70 \\ 72$	$\frac{71}{73}$	74	74	74	76	77	78	78	79	80	81	80	82	83	84	85	49
50	73	74	75	76	77	78	78	79	80	81	82	83	83	84	85	86	87	$\frac{50}{51}$
52	76	77	78	79	80	81	81	82	83	84	85	86	87	88	88	89	90	52
$53 \\ 54$	$\frac{78}{79}$	79 80	80 81	80 82		$ \begin{array}{c} 82 \\ 84 \end{array} $	83 85	84 86	85 86	86 87	87 88	87	88	89 91	$ 90 \\ 92 $	91 93	92 94	53 54
55	81	82	83	83	84	85	86	87	88	89	90	91	92	93	94	94	95	55
56 57	$\frac{82}{84}$	83 85	$ \frac{84}{86} $	85 86	$\left \begin{array}{c} 86\\ 87 \end{array} \right $	87 88	88 89	8 <i>3</i> 90	90 91	91 92	91 93	92 94	93 95	94 96	95 97	96 98	97	$\frac{50}{57}$
58 50	85	86	87	88	89	90	91	92	93	94	95	96	97	98	99	100	101	$\frac{58}{59}$
60	88	89	90	91	92	93	94	95	96	97	98	99	100	101	102	103	104	60
_	1	1	1	1	ſ	1	1	1	1	1	1	1	5	1		1	1	

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TABLE 12.

							Hora	ry motio	n.						
М.	105″	106″	107″	108″	109″	110″	111″	112″	113″	114″	115″	116″	117″	118″	М.
1	2	2	2	• 2	2	2	2	2	2	2	2	2	2	2	1
$\frac{2}{2}$	4	4	4	+ 5	+ 5	4	4	4	+	+	4	4	4	4	$\frac{2}{2}$
5	$\frac{9}{7}$		$\frac{3}{7}$	$\frac{\partial}{7}$	5 7	7	7		8	8	8	8	8	8	4
$\hat{5}$	9	9	9	9	9	9	9	9	9	10	10	10	10	10	5
6	11	11	11	11	11	11	11	11	11	11	12	$\frac{12}{14}$	12	12	6
8	12	12	12	$13 \\ 14$	$10 \\ 15$	$15 \\ 15$	15 15	15	15	15	15	14	14	14	8
9	16	16	16	16	16	17	17	17	17	17	17	17	18	18	- ğ
10	18	18	18	18	18	18	19	19	19	19	19	19	20	20	10
11	19 21	$\frac{19}{21}$	20	20	$\frac{20}{22}$	$\frac{20}{22}$	$\frac{20}{22}$	$\frac{21}{22}$	21	$\frac{21}{23}$	$\frac{21}{23}$	$\frac{21}{23}$	21	22	11
$12 \\ 13$	$\frac{21}{23}$	$\frac{21}{23}$	23	23	24	$\frac{22}{24}$	24	24	24	25	25	25	$\frac{20}{25}$	26	12^{12}
14	25	25	25	25	25	26	26	26	26	27	27	27	27	28	14
$\frac{15}{10}$	26	$\frac{27}{99}$	$\frac{27}{90}$	27	$\frac{27}{20}$	$\frac{28}{20}$	$\frac{28}{20}$	$\frac{28}{20}$	28	$\frac{29}{20}$	$\frac{29}{21}$	29	$\frac{29}{21}$	$\frac{30}{21}$	$\frac{15}{16}$
$16 \\ 17$	$\frac{28}{30}$	$\frac{28}{30}$	29 30	$\frac{29}{31}$	$\frac{29}{31}$	$\frac{29}{31}$	30 31	30	30 32	30	$\frac{31}{33}$	31	31	31	$10 \\ 17$
18	32	32	32	$3\hat{2}$	33	33	33	34	34	34	35	35	35	35	18
19	33	34	34	34	35	35	- 35	35	36	36	36	37	37	37	19
$\frac{20}{-21}$	$\frac{30}{97}$	$\frac{30}{27}$	30	30	30	- 37	31	37			- 38		- 39		$\frac{20}{91}$
$\frac{21}{22}$	39	39	39	40	40	40	41	41	41	42	42	43	43	43	$\frac{21}{22}$
23	40	41	41	41	42	42	43	43	43	44	44	44	45	45	23
24 95	42	$\frac{42}{44}$	43	43	44	44 46	44	45	45	46	46	46	47	47	24
$\frac{20}{26}$	46	46	46	40	47	40	48	49	49	40	50				$\frac{20}{26}$
27	47	48	48	49	49	$\tilde{50}$	$\tilde{50}$	50	$\tilde{51}$	51	52	52	$5\hat{3}$	53	$\bar{27}$
28	49	49	50	50	51	51	52	52	53	53	54	54	55	55	28
$\frac{29}{30}$	53 51	$\frac{51}{53}$	- 52 54	$\frac{52}{54}$	оз 55			- 56	- 55 - 57	00 57	58	58	59	59	$\frac{29}{30}$
31	$\frac{-50}{54}$	55	55	$\frac{51}{56}$	56	57	57	58	58	$\frac{-51}{59}$	59	60	60	61	31
32	56	57	57	58	58	59	59	60	60	61	61	62	62	63	32
33	- 58 60	- 58 60	59 61	59 61	60 62	$61 \\ 62$	$61 \\ 62$	62 63	62 6.1	63	63	64 66	64 66	65	33
35	61	62	62	63	64	64	65	65	66	67	67	68	68	69	35
36	63	64	64	65	65	66	67	67	68	68	69	70	70	71	36
$\frac{37}{20}$	$65 \\ 67$	$65 \\ 67$	66	67	67 60	$\frac{68}{70}$	68 70	$\frac{69}{71}$	$70 \\ 72$	$70 \\ 79$	71	$\frac{72}{72}$	$\frac{72}{74}$	73	37
$\frac{30}{39}$	68	69	70	70	$\frac{09}{71}$	$\frac{70}{72}$	72^{10}	$\frac{71}{73}$	$\frac{72}{73}$	74	75	$\frac{75}{75}$	76	77	$\frac{39}{39}$
40	70	71	71	72	73	73	74	75	75	76	77	77	78	79	40
41	$\frac{72}{74}$	72	73	74	74	$\frac{75}{75}$	$\frac{76}{70}$	77	77	78	79	79	80	81	41
42 43	74	$\frac{74}{76}$	$\frac{75}{77}$	76	$\frac{76}{78}$	79	78 80	78 80	79 81	80	81	81	82 84	83	42
44	77	78	78	79	80	81	81	82	83	84	84	85	86	87	44
45		80	80	81	82	83	83	84	85	86	86	87	88	89	45
$\frac{46}{47}$	81 82	81 83	82 8.1	83	84 85	84 86	85 87	86	87 89	87	88	89 01	90	90	46
48	84	85	86	86	87	88	89	90	90	91	92	93	94	94	48
49	86	87	87	88	89	90	91	91	92	93	94	95	96	96	49
$\frac{50}{51}$	88	88		90	$\frac{91}{02}$	$-\frac{92}{01}$	93	93	94	95	96	$\frac{97}{00}$	$\frac{-98}{-00}$	98	50
$51 \\ 52$	91	92	93	92 94	93 94	94 95	94	95 97	90	97	100	101	101 = 101	100	51.52
53	93	94	95	95	96	97	98	99	100	101	102	102	103	104	53
54	95	95 97	96	97	98	99 101	$100 \\ 102$	101	102	103	$104 \\ 105$	$104 \\ 106$	$105 \\ 107$	106	54 55
- 56	- 98	- 99	100	101	100	101	104	$\frac{105}{105}$	104	-105 -106	107	108	107	110	56
57	100	101	102	103	104	105	105	106	107	108	109	110	111	112	57
58	102	102	103	104	105	106	107	108	109	110	111	112	113	114	58
- 60	$103 \\ 105$	104	$105 \\ 107$	106	107 109	108	109	110	111	112	113	$114 \\ 116$	115	110	- 60
50		100	201	1.00	100	-10	***		.10		110	110			00

TABLE 12.

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							Horan	y motio	n.						
М.	119″	120″	121″	122″	123″	124″	125″	126″	127″	128″	129″	130″	131″	132//	М.
1	2	2	2	2	2	2	2	2	2	2	2	2	2	2	1
2	4	4	4	4	4	4	4	4	4	4	4	4	4	4	2
3	6	6	6	6	6	6	6	6	6	6	6	7	7	7	3
5	10	10	10	10	10	10	10	11	11	11	11	11	11	11	- 5
$-\frac{\circ}{6}$	$\frac{10}{12}$	$\frac{10}{12}$	12	-12	12	$\frac{12}{12}$	$\frac{10}{13}$	13	13	13	13	13	13	-13	6
7	14	14	14	14	14	14	15	15	15	15	15	15	15	15	7
8	$16 \\ 10$	16	$16 \\ 10$	$16 \\ 10$	16	17	17	17	17	17	17	17	17	18	8
10	18 20	$\frac{18}{20}$	18	18	18 91	19 21	19 	19 21	19 21	19 	19 99	$\frac{20}{22}$	$\frac{20}{22}$	20 22	10
$\frac{10}{11}$	$\frac{20}{22}$	22	- 22	22	23	23	$\frac{21}{23}$	$\frac{21}{23}$	23	23	24		- 24	24	11
$\overline{12}$	24	24	24	24	25	25	25	25	25	26	26	26	26	26	12
13	26	26	26	26	27	27	27	27	28	28	28	28	28	29	13
14	28 30	$\frac{28}{30}$	28 30	$\frac{28}{31}$	29 31	29 31	29 31	29 32	30	30	30	30	31	31	14
$\frac{10}{16}$	$\frac{30}{32}$	$-\frac{30}{32}$	$\frac{30}{32}$	- 33	33	33	33	$\frac{-02}{-34}$	34	34	34	35	$\frac{-35}{35}$	35	$\frac{10}{16}$
17	34	34	34	35	35	35	35	36	36	36	37	37	37	37	17
18	36	36	36	37	37	37	38	38	38	38	39	39	39	40	18
19	38 40	38	38	39 41	39	39 41	$\frac{40}{12}$	40	40	41	-11 	41	41	42	$\frac{19}{20}$
$\frac{20}{21}$	$\frac{10}{42}$	$-\frac{10}{42}$	42	43	- 43	43		44		45	45	46			$\frac{20}{21}$
22	44	44	44	45	45	45	46	46	$\hat{47}$	47	47	48	48	$\frac{10}{48}$	22
23	46	46	46	47	47	48	48	48	49	49	49	50	50	51	23
24 95	48	$\frac{48}{50}$	48	49 51	49	50 52	50 52	50 53	01 53	51 53	52 54	52	52 55	53	24 25
$-\frac{20}{26}$	$\frac{-50}{52}$	$\frac{50}{52}$	$\frac{50}{52}$	- 53	53	54	51	55		55	56	56	57	57	$\frac{20}{26}$
$\frac{20}{27}$	54	$52 \\ 54$	54	55	55	56	56	57	57	58	58	59	59	59	27
28	56	56	56	57	57	58	58	59	59	60	60	61	61	62	28
29	58 60	- 58 - 60	58	59 61	59 69	60	60 62	$61 \\ 62$	61	62	62	63	63 66	64 66	29
- 30	$\frac{60}{61}$	$\frac{-60}{-62}$	<u>- 61</u> 63	$\frac{-01}{63}$	64	64	65	- 65	66	66	67	$\frac{-65}{-67}$	68	68	30
$\frac{31}{32}$	63	64	65	65	66	66	67	67	68	68	69	69	70	70	32
33	65	66	67	67	68	68	69	69	70	70	71	72	72	73	33
34	67	68	69	69 71	70	70	$71 \\ 79$	71	72	73	73	74	74	75	34
$\frac{30}{26}$	$\frac{-09}{71}$	-79	$\frac{11}{79}$	$\frac{11}{72}$	$\frac{72}{74}$	74	75	74	78	- 75		70	$\frac{70}{70}$	$\frac{11}{70}$	26
$\frac{30}{37}$	$\frac{71}{73}$	74	75 75	$\frac{75}{75}$	76	76	77	78	78	79	80	80	81	81	37
38	75	76	77	77	78	79	79	80	80	81	82	82	83	84	38
39	77		79	79	80	81	81	82	83	83	84	85	85	86	39
$\frac{40}{41}$	-19 	80	- 82	- 61	8.1	85	- 85	86	- 80	87	- 88				40
42	83	84	85	85	86	87	88	88	89	90	90	91	92^{-50}	92^{-90}	42
43	85	86	87	87	88	89	90	90	91	92	92	93	94	95	43
44	87	88	89	89	90	91	92	92 05	93	94	95 07	95	96	97	44
$-\frac{40}{46}$	-09	- 90	- 91	- 92	92	95	94	95	- 97	90			$\frac{98}{100}$	$\frac{99}{101}$	40
47	93	94	95	96	96	97	98	99	99	100	101	102	103	101	47
48	95	96	97	98	98	99	100	101	102	102	103	104	105	106	48
49	97	98	99	100	100	101	102	$103 \\ 105$	104	105	105	$106 \\ 108$	107	$108 \\ 110$	49
$\frac{-90}{51}$	$\frac{99}{101}$	$\frac{100}{102}$	$\frac{101}{102}$	$\frac{102}{101}$	105	$\frac{103}{105}$	$\frac{104}{106}$	$-\frac{105}{107}$	100	$\frac{107}{109}$	$\frac{108}{110}$	$\frac{108}{111}$	$\frac{109}{111}$	$\frac{110}{112}$	51
$51 \\ 52$	103	102	$103 \\ 105$	104	105	105	108	109	110	111	112	113	114	114	$51 \\ 52$
53	105	106	107	108	109	110	110	111	112	113	114	115	116	117	53
54	107	108	109	110	111	112	113	113	114	115	116	117	118	119	54
$\frac{-99}{-56}$	109	$\frac{110}{112}$	111	$\frac{112}{111}$	115	114	$\frac{110}{117}$	110	110	110	$\frac{118}{120}$	119	$\frac{120}{122}$	$\frac{121}{192}$	56
57	113	114	115	114	117	118	119	120	121	122	$120 \\ 123$	121	124	$125 \\ 125$	57
58	115	116	117	118	119	120	121	122	123	124	125	126	127	128	58
59	117	118	119	120	121	122	123	124	125	126	127	128	129	130	59
60	119	120	121	122	123	124	120	126	127	128	129	130	121	132	00

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TABLE 12.

							Hora	ry motic	m.						
M.	133″	134″	135″	136"	137"	138''	139''	140"	141″	142"	143''	144″	145"	146''	м.
1	2	2	2	2	2	2	2	2	2	2	2	2	2	2	1
$\frac{2}{3}$	7	47				7			7		7	3 7		7	$\frac{4}{3}$
4	9	9	9	9	9	9	9	9	9	9	10	10	10	10	4
5	11	11			11	12	$\frac{12}{14}$	12	$-\frac{12}{14}$	$\frac{12}{14}$	12	12	$\frac{12}{15}$	$\frac{12}{15}$	$\frac{5}{c}$
	13	$13 \\ 16$	14	$14 \\ 16$	14	14	$14 \\ 16$	14	14	14	14	17	13	$13 \\ 17$	7
8	18	18	18	18	18	18	19	19	19	19	19	19	19	19	8
9	20	$\begin{vmatrix} 20 \\ 22 \end{vmatrix}$	$\begin{vmatrix} 20 \\ 22 \end{vmatrix}$	$20 \\ 23$	$21 \\ 23$	21	$\frac{21}{23}$	$21 \\ 23$	$\frac{21}{94}$	$21 \\ 94$	$21 \\ 24$	22	22	$\frac{22}{24}$	9
11	$\frac{22}{24}$	25	$\frac{25}{25}$	$\frac{20}{25}$	25	$\frac{20}{25}$	$\frac{20}{25}$	$\frac{26}{26}$	$\frac{21}{26}$	26	26	26	27	$\frac{21}{27}$	11
12	27	27	27	27	27	28	28	28	28	28	29	29	29	29	12
$13 \\ 14$	29	29	29	$\frac{29}{32}$	$\frac{30}{32}$	30 32	30 32	30	31	31	31	31	31	32	13
15	33	34	34	34	34	35	35	35	35	- 36	36	36	36	37	15
16	35	36	36	36	37	37	37	37	38	38	38	38	39	39	16
17	$\frac{38}{40}$	$\frac{38}{40}$	38	39 41	39 41	39 41	39 42	40	40 42	40	41	41	41	41	17
19	42	42	43	43	43	44	44	44	45	45	45	46	46	46	19
	44	45	45	45	46	46	46	47	47	47	48	48	48	49	20
$\frac{21}{22}$	47	47	47	48 50	48 50	$\frac{48}{51}$	49	49	$\frac{49}{52}$	50 52	$. 50 \\ . 52 $	50	51	51	$\frac{21}{22}$
$\frac{22}{23}$	51	51	52	52	53	53	53	54	54	54	55	55	56	56	23
24	53	54	54	54	55	55	56	56	56 50	57	57	58	58	58	24
$\frac{25}{26}$	$\frac{-99}{-58}$	$\frac{50}{58}$	59	$\frac{-57}{59}$	<u> </u>	$\frac{-38}{-60}$	<u> </u>	$\frac{-98}{-61}$		$\frac{-39}{62}$	62	$\frac{60}{62}$	63	63	20
27	60	60	61	61	62	62	63	63	63	64	64	05	65	66	27
28	62	63	63	63	64 ce	64 67	$65 \\ 67$	$65 \\ 69$	66 68	66	67 60	67	68	68	28
29 30	64 67	67 67	68 68		69	69	70	70	$ \frac{08}{71} $	71	69 72	$\frac{70}{72}$	70	$71 \\ 73$	$\frac{29}{30}$
31	69	69	70	70	71	71	72	72	73	73	74	74	75	75	31
32	71	71	72	73	73	74	74	75	$\frac{75}{79}$	76	76	77	77	78	32
33	73	74	74	70 77	78 78	78	70	79	80	80	- 79 - 81	79 82	80 82	80	33 34
$3\overline{5}$	78	78	79	79	80	81	81	82	82	83	83	84	85	85	35
36	80	80	81	82	82	83	83	84	85	85	86	86	87	88	36
37	82 84	85 85	86 86	84 86	87 87	87	88	89	89	90	91	- 89 - 91	89 92	90 92	38
39	86	87	88	88	89	90	90	91	92	92	93	94	94	95	39
$\frac{40}{41}$		$\frac{-89}{-02}$	$\frac{90}{02}$	$\frac{-91}{-92}$	$-\frac{91}{94}$	$-\frac{92}{04}$	93	93	$-\frac{94}{96}$	$-\frac{95}{07}$	95	96	97	97	40
$\frac{41}{42}$	91 93	92 94	92 95	95 95	94 96	97	97	90 98	90 99	99	100	101	102	100	42
43	95	96	97	97	98	99	100	100	101	102	102	103	104	105	43
44 45	98	$\frac{98}{101}$	99	$100 \\ 102$	$100 \\ 103$	101	$102 \\ 104$	$103 \\ 105$	103	104	$105 \\ 107$	$106 \\ 108$	$106 \\ 109$	107	44
46	102	103	101	104	$\frac{100}{105}$	$\frac{101}{106}$	107	107	108	109	110	$\frac{100}{110}$	111	112	46
47	104	105	106	107	107	108	109	110	110	111	112	113	114	114	47
48	106	107	108	$109 \\ 111$	110	110	$\frac{111}{114}$	$112 \\ 114$	113	114	$114 \\ 117$	115	$ 116 \\ 118 $	117	48
50	111	112	113	113	114	115	116	117	118	118	119	120	121	122	50
51	113	114	115	116	116	117	118	119	120	121	122	122	123	124	51
$\frac{52}{53}$	$115 \\ 117$	116	117	$118 \\ 120$	$\begin{array}{c}119\\121\end{array}$	$\frac{120}{122}$	$\frac{120}{123}$	$\frac{121}{124}$	$\frac{122}{125}$	$123 \\ 125$	$\frac{124}{126}$	$\frac{125}{127}$	$126 \\ 128$	$\frac{127}{129}$	$52 \\ 53$
54	120	121	122	122	$121 \\ 123$	124	$125 \\ 125$	$124 \\ 126$	$120 \\ 127$	128	$129 \\ 129$	130	131	131	54
55	122	123	124	125	126	127	127	128	129	130	131	132	133	134	55
56 57	$124 \\ 126$	$125 \\ 127$	$\frac{126}{128}$	$\frac{127}{129}$	$\frac{128}{130}$	$\frac{129}{131}$	$\frac{130}{132}$	$\frac{131}{133}$	$132 \\ 134$	$133 \\ 135$	$133 \\ 136$	$\frac{134}{137}$	$135 \\ 138$	$136 \\ 139$	56 57
58	129	130	131	131	132	133	134	135	136	137	138	139	140	141	58
59	131	132	133	134	135	136	137	138	139	140	141	142	143	144	59 60
00	133	134	139	130	137	138	139	140	141	142	143	144	140	140	00

TABLE 12.

For finding the Variation of the Sun's Right Ascension, or Declination, or of the Equation of Time in any number of minutes of time, the Horary Motion being given at the top of the page in seconds, and the number of minutes of time in the side column. Also for finding the Variation of the Moon's Declination or Right Ascension in seconds of time, the motion in one minute being given at the top, and the numbers in the side column being taken for seconds.

							Hora	y motio	n.					1	
М.	147"	148″	149″	150″	151″	152″	153″	154″	155″	156″	157″	158″	159″	160″	м.
1	2	2	2	3	3	3	3	3	3	3	3	3	3	3	1
$\frac{2}{2}$	$\frac{5}{7}$	$\frac{5}{7}$	$\frac{5}{7}$	5	5	5	5	5	5	5	5	5	5	5	$\frac{2}{3}$
4	10	10	10	10	10	10	10	10	10	10	10	11	11	11	4
5	12	12	12	13	13	13	13	13	13	13	13	13	13	13	5
$\frac{6}{7}$	$15 \\ 17$	$15 \\ 17$	$15 \\ 17$	15	15 18	$15 \\ 18$	15 18	$15 \\ 18$	$\frac{16}{18}$	16 18	16 18	$16 \\ 18$	16	16 10	$\frac{6}{7}$
8	$\frac{17}{20}$	$\frac{17}{20}$	$\frac{17}{20}$	$\frac{10}{20}$	$\frac{18}{20}$	$\frac{13}{20}$	20	21	$\frac{10}{21}$	21^{10}	$\frac{10}{21}$	$\frac{13}{21}$	21	13 21	8
. 9	22	22	22	23	23	23	23	23	23	23	24	24	24	24	9
$\frac{10}{11}$	$\frac{25}{97}$	$\frac{25}{97}$	$\frac{25}{97}$	$\frac{25}{98}$	$\frac{25}{-98}$	$\frac{25}{-98}$	- 20		- 26	$\frac{26}{20}$	$\frac{26}{20}$	$-\frac{26}{20}$	$\frac{27}{20}$	$\frac{27}{20}$	$\frac{10}{11}$
$11 \\ 12$	$\frac{27}{29}$	$\frac{27}{30}$	$\frac{27}{30}$	$\frac{20}{30}$	$\frac{20}{30}$	$\frac{28}{30}$	$\frac{20}{31}$	$\frac{20}{31}$	$\frac{20}{31}$	$\frac{23}{31}$	$\frac{29}{31}$	$\frac{23}{32}$	$\frac{23}{32}$	$\frac{25}{32}$	$11 \\ 12$
13	32	32	32	33	33	33	33	33	34	34	34	34	34	35	13
14	34 37	$\frac{35}{37}$	$\frac{35}{37}$	35	30 38	30	36	36 39	36 39	36 39	37	37 40	37	37 40	$14 \\ 15$
$\frac{10}{16}$	39	39	$\frac{-01}{40}$	40	40	. 41	41	41	41	42	42	$\frac{10}{42}$	$\frac{10}{42}$	43	16
17	42	42	42	43	43	43	43	44	44	44	44	45	45	45	17
18	44	44	$\frac{45}{47}$	$\frac{45}{48}$	$\begin{array}{c} 45\\ 48\end{array}$	$\frac{46}{48}$	46	$\frac{46}{49}$	47	47	47 50	47	48	48 51	18
20	49	49	50	50	50	51	51	51	52	52	52	53	53	53	20
21	51	52	52	53	53	53	54	54	. 54	55	55	55	56	56	21
$\frac{22}{23}$	54 56	$\frac{54}{57}$	$\frac{55}{57}$	$\frac{50}{58}$	58 58	56 58		26 59	57 59	57 60	- 58 - 60	58 61	58 61	59 61	$\frac{22}{23}$
24	59	59	60	60	60	61	61	62	62	62	63	63	64	64	24
25	61	62	62	63	63	63	64	64	65	65	65	66	66	67	$\frac{25}{20}$
$\frac{26}{27}$	64 66	64 67	65 67	65 68	65 68	66 68	66 69	67 69	67 70	$ \frac{68}{70} $	$\frac{68}{71}$	68 71	$\frac{69}{72}$	69 72	26 27
28	69	69	70	70	70	71	71	72	72	73	$\overline{73}$	74	74	75	28
29	71	72	72	73	$73 \\ 76$	73	$\frac{74}{77}$	$\frac{74}{77}$	$\frac{75}{79}$	$75 \\ 78$	· 76	76	77	77	29
$\frac{30}{31}$	$\frac{74}{76}$	$\frac{74}{76}$	70	$\frac{70}{78}$	$\frac{70}{78}$	$\frac{70}{79}$	$\frac{11}{79}$		80	- 10		- 19	82	83	$\frac{30}{31}$
32	78	79	79	80	81	81	82	82	83	83	84	84	85	85	32
33	81	81	82	83	83	84	84	85	85	86	86	87	87	88	33
34	83 86	84 86	87	89 88	80	89	89	90	90	$\frac{88}{91}$	- 89 92	90 92	90	91	35
36	88		89	- 90	- 91	91	92	92	93	94	94		95	96	36
37	91	91	92	93	93	94	94	95	96	96	97	97	98	99	37
- 38 - 39	93 96	94 96	94	95 98	90 98	90	97	100	101	101	102	$100 \\ 103$	101	101	- 30 - 39
40	98	99	- 99	100	101	101	102	103	103	104	105	105	106	107	40
41	$100 \\ 100$	101	102	$103 \\ 105$	$103 \\ 100$	104	105	105	106	$107 \\ 100$	107	108	109	109	41
42 43	$103 \\ 105$	$104 \\ 106$	104	105	108	100	107 110	1108	109	$109 \\ 112$	110	$111 \\ 113$	111	$112 \\ 115$	$\frac{42}{43}$
44	108	109	109	110	111	111	112	113	114	114	115	116	117	117	44
$\frac{45}{48}$	110	$\frac{111}{110}$	112	113	$\frac{113}{116}$	$\frac{114}{117}$	115	$-\frac{116}{110}$	$\frac{116}{110}$	117	$\frac{118}{190}$	$\frac{119}{191}$	$\frac{119}{100}$	$\frac{120}{199}$	45
40	113	113	114	115	118	$117 \\ 119$	$117 \\ 120$	$118 \\ 121$	$119 \\ 121$	$120 \\ 122$	120	$121 \\ 124$	$122 \\ 125$	$125 \\ 125$	40
48	118	118	119	120	121	122	122	123	124	125	126	126	127	128	48
49 50	$\frac{120}{122}$	$121 \\ 192$	$122 \\ 124$	$123 \\ 195$	$123 \\ 126$	$124 \\ 197$	$125 \\ 128$	$126 \\ 128$	$127 \\ 120$	$127 \\ 130$	$\frac{128}{131}$	$129 \\ 132$	$130 \\ 133$	131	49 50
$\frac{50}{51}$	$\frac{123}{125}$	$\frac{120}{126}$	127	$\frac{120}{128}$	$\frac{120}{128}$	$\frac{127}{129}$	$\frac{120}{130}$	$\frac{123}{131}$	$\frac{129}{132}$	$\frac{130}{133}$	$\frac{101}{133}$	$\frac{132}{134}$	$\frac{135}{135}$	$\frac{100}{136}$	51
$5\overline{2}$	127	128	129	130	131	132	133	133	134	135	136	137	138	139	52
53	130	131	132	$133 \\ 125$	$133 \\ 126$	134	135	$136 \\ 120$	$137 \\ 140$	$138 \\ 140$	139	$140 \\ 142$	$140 \\ 142$	141	53 54
55	$132 \\ 135$	135	134	138	130	139	140	141	140	143	144	145	146	147	55
56	137	138	139	140	141	142	143	144	145	146	147	147	148	149	56
57	$140 \\ 149$	$ 141 \\ 1.12 $	$142 \\ 144$	143	143	144	145	146	147	$148 \\ 151$	$\frac{149}{152}$	$150 \\ 153$	$151 \\ 151$	$152 \\ 155$	57 58
$58 \\ 59$	142	140	144	143	140	149	140	151	$150 \\ 152$	151	154	$155 \\ 155$	156	157	59
60	147	148	149	150	151	152	153	154	155	156	157	158	159	160	60

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TABLE 13.

For finding the Sun's change of Right Ascension for any given number of hours.

	ror	munig	the su	n s cha	uge of .	inght A	scensio	n ior a	ny give	n nunn	ber of L	iours.	•
Hourly varia-						Number	of hours	•					Hourly varia-
tion.	1		3	4		6	7	8	0	10	11	12	tion.
8.	8.	8.	8.	8.	8.	8.	8.	8.	8.	8.	8.	8.	8.
8.50	8.5	17.0	25.5 25.7	34.0	42.5	51.0 51.2	59.5 50.0	68.0	76.5	85.0	93.5 91 1	102.0 102.6	8.50
8, 60 8, 60	8.6	17.1 17.2	25.7 25.8	$\frac{54.2}{34.4}$	43.0	51.5 51.6	60.2	68.8	77.4	86.0	94.6	102.0 103.2	8.99 8.60
8.65	8.7	17.3	26.0	34.6	43.3	51.9	60.6	69.2	77.9	86.5	95.2	103.8	8.65
8.70	8.7	17.4	26.1	34.8	43.5	52.2	60.9	_69.6	78.3	87.0	95.7	104.4	8.70
8.75	8.8	17.5 17.6	$\frac{26.3}{26.1}$	35.0	43.8	52.5	61.3 61.6	70.0	78.8	87.5	96.3	105.0 105.6	8.75
8.85	8.9	17.7	26.4 26.6	35.4	44.3	53.1	62.0	70.8	79.7	88.5	97.4	105.0 106.2	8.85
8.90	8.9	17.8	26.7	35.6	44.5	53.4	62.3	71.2	80.1	89.0	97.9	106.8	8.90
8.95	-9.0	17.9	26.9	35.8	44.8	53.7	-62.7	71.6	80.6	89.5	98.5	107.4	8.95
9.00	9.0	18.0	$\frac{27.0}{27.2}$	$\frac{30.0}{36.2}$	40. 0 45. 3	54.0 54.3	63.0	72.0 72.4	81.0	90.0 90.5	99.0	108.0 108.6	9.00 9.05
9.10	9.1	18.2	$27.\tilde{3}$	36.4	45.5	54.6	63.7	72.8	81.9	91.0	100.1	109.2	9.10
9.15	9.2	18.3	27.5	36.6	45.8	54.9	64.1	73.2	82.4	91.5	100.7	109.8	9,15
9.20	$-\frac{9.2}{0.9}$	18.4	27.6	30.8	40.0	00.2 55.5	61 9	71.0	82.8	92.0	101.2	110.4	9.20
9.20	9.3	18.6	27.8 27.9	37.0 37.2	46.5	55.8	65.1	74.4	83.7	93.0	101.8	111.0 111.6	9.30
9.35	9.4	18.7	28.1	37.4	46.8	56.1	65.5	74.8	84.2	93.5	102.9	112.2	9.35
9.40	9.4	18.8	28.2	37.6	47.0	56.4	65.8	75.2	84.6	94.0	103.4	112.8	9.40
9.40	$\frac{9.0}{9.5}$	10.9	$\frac{28.4}{28.5}$	38.0	47.5	-57.0	$\frac{-00.2}{-66.5}$	$\frac{73.6}{76.0}$	$\frac{-60.1}{85.5}$	94.0	104.0	113.4	9.40
9.55	9.6	19.1	$\frac{20.0}{28.7}$	38.2	47.8	57.3	66.9	76.4	86.0	95.5	105.1	114.6	9.55
9.60	9.6	19.2	28.8	38.4	48.0	57.6	67.2	76.8	86.4	96.0	105.6	115.2	9.60
9.65	9.7	19.3	29.0 20.1	38.6	48.3	57.9 58-9	67.6	77.2	86.9	96.5	106.2 106.7	115.8	9.65
9.70	9.1	19.4	29.1	39 0	40.0	58.5	68 3	78.0	87.8	97.5	100.7	117.0	9.75
9.80	9.8	19.6	29.4	39.2	49.0	58.8	68.6	78.4	88.2	98.0	107.8	117.6	9.80
9.85	9.9	19.7	29.6	39.4	49.3	59.1	69. 0 69. 0	78.8	88.7	98.5	108.4	118.2	9.85
9,90 9,95	9,9 10.0	19.8	29.7 29.9	39.6 39.8	49.5. 49.8	59.4 59.7	69, 3 69, 7	79.2 79.6	89.1	99.0 99.5	108.9 109.5	118.8 119.4	9,90 9,95
10.00	10.0	20.0	30.0	40.0	50.0	60.0	70.0	80.0	90.0	100.0	110.0	120.0	10.00
10.05	10.1	20.1	30.2	40.2	50.3	60.3	70.4	80.4	90.5	100.5	110.6	120.6	10.05
10.10 10.15	10.1 10.2	20.2 20.3	30.3	40.4 40.6	50.5 50.8	60.6 60.9	70.7	80.8	90.9	101.0 101.5	111.1 111.7	121.2 121.9	10.10 10.15
10.13	10.2 10.2	20.3 20.4	30.6	40.8	50.8 51.0	61.2	71.4	81.6	91.4	101.0	112.2	121.8	10.10
10.25	10.3	20.5	30.8	41.0	51.3	61.5	71.8	82.0	92.3	102.5	112.8	123.0	10.25
10.30	10.3	20.6	30.9	41.2	51.5	61.8	72.1	82.4	92.7	103.0	113.3	123.6	10.30
10.35	10.4 10.4	20.7	$\frac{31.1}{31.2}$	$41.4 \\ 41.6$	51.8 52.0	62.1 62.4	72.0 72.8	82.8	93.2	103.5	113.9 114.4	124.2 124.8	10.35
10.45	10.5	20.9	31.4	41.8	52.3	62.7	73.2	83.6	94.1	104.5	115.0	125.4	10.45
10.50	10.5	21.0	31.5	42.0	52.5	63.0	73.5	84.0	94.5	105.0	115.5	126.0	10.50
10.55 10.60	10.6	21.1 21.2	31.7	42.2	52.8	63.3	73.9 74.9	84.4	95.0	105.5	116.1	126.6 127.2	10.55 10.60
10.60	10.0 10.7	21.2 21.3	31.8 32.0	42.6	53.3	63.9	74.6	85.2	95.9	106.5	117.2	127.8	10.00 10.65
10.70	10.7	21.4	32.1	42.8	53, 5	64.2	74.9	85.6	96.3	107.0	117.7	128.4	10.70
10.75	10.8	21.5	32.3	43.0	53.8	64.5	75.3	86.0	96.8	107.5	118.3	129.0	10.75
10.80	10.8 10.9	21.6 21.7	32.4	43.2	54.0 54.3	64.8 65.1	78.0	86.4	97.2	108.0	118.8	129.6 130.2	10.80 10.85
10.90	10.9	21.8	32.7	43.6	54.5	65.4	76.3	87.2	98.1	109.0	119.9	130.8	10.90
10.95	11.0	21.9	32.9	43.8	54.8	65.7	76.7	87.6	98.6	109.5	120.5	131.4	10.95
11.00	11.0	22.0	33.0	44.0	55.0	66.0	77.0	88.0	99.0	110.0	121.0 121.6	132.0	11.00 11.05
11.10	11.1	22.1 22.2	33.3	44.4	55.5	66.6	77.7	88.8	99.9	111.0	121.0	133.2	11.05
11.15	11.2	22.3	33.5	44.6	55.8	66.9	78.1	89.2	100.4	111.5	122.7	133.8	11.15
11.20	11.2	22.4	33.6	44.8	56.0	67.2	78.4	89.6	100.8	112.0	123.2	134.4	$\frac{11.20}{11.25}$
11.25 11.30	$11.3 \\ 11 2$	22.5	33.8	45.0 45.2	56.3	67.5	78.8	90.0	101.3	112.5	123.8 191 2	135.0 135.6	11.25 11.30
11.35	11.4	22.7	34.1	45.4	56.8	68.1	79.5	90.8	102.2	113.5	124.9	136.2	11.35 11.35
11.40	11.4	22.8	34.2	45.6	57.0	68.4	79.8	91.2	102.6	114.0	125.4	136.8	11.40
11.45	11.5	22.9	34.4	45.8	57.3	68.7	80,2	91.6	103.1	114.5	126.0	137.4	11.45

TABLE 13.

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For finding the Sun's change of Right Ascension for any given number of hours.

	1					Number	of hours						1
Hourly varia			1	1 10		Number	or nours	-				1	Hourly varia-
tion.	13	14	15	16	17	18	19	20	21	22	23	24	tion.
8.	8.	8.	8.	8.	8.	8.	8.	8.	8.	8.	8,	8.	8.
8.50	110.5	119.0	127.5	136.0	144.5	153.0	161.5	170.0	178.5	187.0	195.5	204.0	8.50
8.55	111.2	119.7	128.3	136.8 127.6	140.4 1.16.2	153.9	162.5 163.1	171.0 172.0	179.6	188.1	196.7	205.2	8,55
8.00 8.65	111.0 112.5	120.4 121.1	129.0 129.8	137.0	147.1	155.7	164.4	172.0	180.0	189.2	197.8	200.4 207.6	8.65
8.70	113.1	121.8	130.5	139.2	147.9	156.6	165.3	174.0	182.7	191.4	200.1	208.8	8.70
8.75	113.8	122.5	131.3	140.0	148.8	157.5	166.3	175.0	183.8	192.5	201.3	210.0	8.75
8,80	114.4 115.1	123.2	132.0	140.8	149.6 150.5	158.4 150.2	167.2	176.0	184.8	193.6	202.4	211.2	8.80
8.90	115.1 115.7	123. 9	132.8 133.5	141.0	150.5 151.3	160.2	169.2 169.1	178.0	180.9 186.9	194.7	203.0 204.7	212.4 213.6	8.80
8.95	116.4	125.3	134.3	143.2	152.2	161.1	170.1	179.0	188.0	196.9	205.9	214.8	8.95
9.00	117.0	126.0	135.0	144.0	153.0	162.0	171.0	180.0	189.0	198.0	207.0	216.0	9.00
9.05	117.7	126.7	135.8	144.8	153.9	162.9	172.0	181.0	190.1	199.1	208.2	217.2	9.05
9.10	118.3	127.4 128 1	136.0	140.6 146.4	154.7 155.6	163.8 164.7	172.9 173.9	182.0	191.1	200.2	209.3 210.5	218.4	9.10 0.15
9.20	119.6	128.8	138.0	140.4 147.2	156.4	165.6	174.8	184.0	192.2 193.2	201.3 202.4	211.6	219.0 220.8	9.10 9.20
9.25	120.3	129.5	138.8	148.0	157.3	166.5	175.8	185.0	194.3	203.5	212.8	222.0	$\frac{0.20}{9.25}$
9.30	120.9	130.2	139.5	148.8	158.1	167.4	176.7	186.0	195.3	204.6	213.9	223.2	9.30
9.35	121.6	130.9	140.3	$ 149.6 \\ 150 $	159.0	168.3	177.7	187.0	196.4	205.7	215.1	224.4	9.35
9.40	122.2 122.9	131.0 132.3	141.0	150.4 151.2	159.8 160.7	109.2 170.1	178.0 179.6	188.0	197.4	200.8	210.2 217.4	225.6	9.40
9,50	$\frac{122.6}{123.5}$	133.0	$\frac{111.0}{142.5}$	152.0	$\frac{100.1}{161.5}$	171.0	180.5	190.0	199.5	$\frac{201.0}{209.0}$	218.5	228.0	9.50
9.55	124.2	133.7	143.3	152.8	162.4	171.9	181.5	191.0	200.6	210.1	219.7	229.2	9.55
9.60	124.8	134.4	144.0	153.6	163.2	172.8	182.4	192.0	201.6	211.2	220.8	230.4	9.60
9.60	120.0 196.1	135.1	144.8	104.4	164.1 164.0	173.7	183.4	193.0	202.7	212.3	222.0	231.6	9.65
9.75	$\frac{120.1}{126.8}$	$\frac{130.8}{136.5}$	146.3	156.0	165.8	$\frac{174.0}{175.5}$	185.3	195.0	$\frac{205.7}{204.8}$	213.4	991 3	931 0	9.70
9.80	127.4	137.2	147.0	156.8	166.6	176.4	186.2	196.0	205.8	215.6	225.4	235.2	9.80
9.85	128.1	137.9	147.8	157.6	167.5	177.3	187.2	197.0	206.9	216.7	226.6	236.4	9.85
9.90	128.7	138.6	148.5	158.4	168.3	178.2	188.1	198.0	207.9	217.8	227.7	237.6	9,90
10.00	$\frac{129.4}{130.0}$	$\frac{139.3}{140.0}$	149.0	109.2 160.0	$\frac{109.2}{170.0}$	$\frac{179.1}{180.0}$	109.1	200 0	$\frac{209.0}{210.0}$	$\frac{210.9}{220.0}$	220.9	$\frac{230.8}{210.0}$	9.95
10.05	130.7	140.7	150.8	160.8	170.9	180.9	191.0	201.0	211.1	221.1	231.2	240.0 241.2	10.00
10.10	131.3	141.4	151.5	161.6	171.7	181.8	191.9	202.0	212.1	222.2	232.3	242.4	10.10
10.15	132.0	142.1	152.3	162.4	172.6	182.7	192.9	203.0	213.2	223.3	233.5	243.6	10.15
10.20 10.25	$\frac{132.0}{123.2}$	$\frac{142.8}{143.5}$	$\frac{100.0}{152.8}$	$\frac{105.2}{164.0}$	$\frac{170.4}{174.3}$	$\frac{185.0}{184.5}$	195.8	$\frac{204.0}{205.0}$	$\frac{214.2}{915.3}$	224.4	234.0	244.8	10.20 10.25
10.20 10.30	133.9	143.3	153.8 154.5	164.8	174.5 175.1	185.4	194.0	205.0	210.3 216.3	226.6	236.9	240.0	10.20 10.30
10.35	134.6	144.9	155.3	165.6	176.0	186.3	196.7	207.0	217.4	227.7	238.1	248.4	10.35
10.40	135.2	145.6	156.0	166.4	176.8	187.2	197.6	208.0	218.4	228.8	239.2	249.6	10.40
10.40 10.50	$\frac{130.9}{126.5}$	140.3 147.0	150.8	107.2	177. 5	188.1	198.6	$\frac{209.0}{910.0}$	219.5	229.9	240.4	250.8	$\frac{10.45}{10.50}$
10.50 10.55	130.0 137.2	147.7	157.5	168.0 168.8	179.4	189.9	200.5	210.0 211.0	220.5 221.6	231.0 232.1	241.0 242.7	252.0 253.2	10.50 10.55
10.60	137.8	148.4	159.0	169.6	180.2	190.8	201.4	212.0	222.6	233.2	243.8	254.4	10.60
10.65	138.5	149.1	159.8	170.4	181.1	191.7	202.4	213.0	223.7	234.3	245.0	255.6	10.65
10.70	139.1	149.8	160.5	171.2	181.9	192.6	203.3	$\frac{214.0}{215.0}$	224.7	235.4	$\frac{246.1}{246.1}$	256.8	10.70
10.75 10.80	139.8 140 4	150.5	161.3 162 0	172.0 172.8	182.8	193.5	204.3	215.0 216.0	225.8	236.5	247.3	258.0 259.2	10.75
10.85	141.1	151.9	162.0 162.8	173.6	184.5	195.3	206.2 206.2	217.0	227.9	238.7	249.6	260.2 260.4	10.80 10.85
10.90	141.7	152.6	163.5	174.4	185.3	196.2	207.1	218.0	228.9	239.8	250.7	261.6	10.90
10.95	142.4	153.3	164.3	175.2	186.2	197.1	208.1	219.0	230.0	240.9	251.9	262.8	10.95
11.00	143.0	154.0	165.0	176.0	187.0	198.0	209.0	220.0	231.0	242.0	253.0	264.0	11.00 11.05
11.05	144.3	155.4	166.5	177.6	187.9	199.8	210.0 210.9	222.0	232.1 233.1	244.2	255.3	266.4	11.05
11.15	145.0	156.1	167.3	178.4	189.6	200.7	211.9	223.0	234.2	245.3	256.5	267.6	11.15
11.20	145.6	156.8	168.0	179.2	190.4	201.6	212.8	224.0	235.2	246.4	257.6	268.8	11.20
11.25 11.20	146.3	157.5	168.8	180.0	191.3	202.5	213.8	225.0	$ \frac{236.3}{227.2} $	247.5	258.8	270.0	11.25 11.20
11.30 11.35	140.9	158.2 158.9	109.0 170.3	180.8	192.1 193.0	205.4 204.3	214.7	220.0 227.0	238.4	249.7	259.9 261.1	271.2 272.4	11.30 11.35
11.40	148.2	159.6	171.0	182.4	193.8	205.2	216.6	228.0	239.4	250.8	262.2	273.6	11.40
11.45	148.9	160.3	171.8	183.2	194.7	206.1	217.6	229.0	240.5	251.9	263.4	274.8	11.45

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Page	522]				TAB.	LES	14, 1	5, 1	υ.			
TAB Dip of Hor	LE 14. the Sea izon.			Dip o	f the S	ea at	T. differe	ABLI nt Di	E 15. istances fro	m the O	bserver.	
Height of	Dip of the		Dist. of			Не	ight of t	he Ey	e above the s	Sea in Fee	t.	
the Eye.	Horizon.		Sea Miles.	õ	10	15	5	20	25	30	35	40
Feet. 1 2 3 4 5 6 7 8 9	$\begin{array}{c} & & \\ 0 & 59 \\ 1 & 23 \\ 1 & 42 \\ 1 & 58 \\ 2 & 11 \\ 2 & 24 \\ 2 & 36 \\ 2 & 46 \\ 2 & 56 \end{array}$	•		$\begin{array}{r} & 11 \\ 6 \\ 4 \\ 3 \\ \hline 3 \\ 2 \\ 2 \\ \end{array}$			+ 2) 	$\begin{array}{c} ' \\ 45 \\ 23 \\ 15 \\ 12 \\ 10 \\ 8 \\ 7 \\ 6 \end{array}$	$ \begin{array}{r} , \\ 57 \\ 28 \\ 19 \\ 15 \\ \hline 12 \\ 10 \\ 8 \\ 7 \\ \end{array} $	$ \begin{array}{r} 68 \\ 34 \\ 23 \\ 17 \\ 14 \\ 12 \\ 9 \\ 8 \end{array} $	$ \begin{array}{r} 79 \\ 40 \\ 27 \\ 20 \\ \hline 16 \\ 14 \\ 11 \\ 9 \end{array} $	$ \begin{array}{r} 91 \\ 45 \\ 30 \\ 23 \\ \overline{19} \\ 16 \\ 12 \\ 10 \\ \end{array} $
$10 \\ 11 \\ 12 \\ 13$	$ \begin{array}{r} 2 & 00 \\ 3 & 06 \\ 3 & 15 \\ 3 & 24 \\ 3 & 32 \end{array} $		$ \begin{array}{r} 3 \\ 3 \\ 4 \\ 5 \end{array} $	2 2 2 2	3 3 3	444		$5 \\ 5 \\ 5 \\ 4$		$\begin{array}{c} 7\\6\\6\\6\\6\end{array}$	8 7 7 6	9 8 7 7
14	3 40		6	2	3	4	1	4	5	5	6	6
$\begin{array}{c} 18\\19\\20\\21\\22\\23\\24\\25\\26\\27\\28\\30\\31\\32\\33\\34\\35\\36\\37\\38\\39\\40\\55\\60\\55\\60\\57\\0\end{array}$	$\begin{array}{c} 4 \ 09 \\ 4 \ 16 \\ 4 \ 23 \\ 4 \ 29 \\ 4 \ 36 \\ 4 \ 29 \\ 4 \ 36 \\ 4 \ 42 \\ 4 \ 48 \\ 4 \ 54 \\ 5 \ 00 \\ 5 \ 06 \\ 5 \ 11 \\ 5 \ 22 \\ 5 \ 27 \\ 5 \ 33 \\ 5 \ 43 \\ 5 \ 53 \\ 5 \ 43 \\ 5 \ 53 \\ 5 \ 43 \\ 5 \ 53 \ 53$		to those	heigh	ts not 1	being	so far T The in Altitu 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0	dista ABL Sun's 1 Alt ide.	E 16. Parallax itude. Parallax. "9 9 8 8 7 6 5 4			
$75 \\ 80 \\ 85 \\ 90 \\ 95 \\ 100$	$\begin{array}{c ccccc} 8 & 29 \\ 8 & 46 \\ 9 & 02 \\ 9 & 18 \\ 9 & 33 \\ 9 & 48 \end{array}$						65 70 75 80 85 90		$\begin{array}{c} 4\\ 3\\ 2\\ 2\\ 1\\ 0\end{array}$			

		TABLE 17.	
		Parallax in Altitude of a Planet.	
'əpt	ntitla	0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0	
	35"	011245°6 - 28 00112453719222222222333333	
	30″	0 - 1 × 2 × 2 × 2 × 2 × 2 × 2 × 2 × 2 × 2 ×	
	58 ″	0-123456428901124564289013346888	
	"15 "	0183456414891153455428555555	
	26"	016334536438401345164385666	
	25"	0-0.022222223	
	24"	2222222 2422 2010 2010 2010 2010 2010 20	
	28″	0-18233434666478990112314516478908333	
	166	018234556428900123445567389222	
	21"	0112234450667890112345555480112	
	20/1	011233455667899011123345556748	
	19″	0	
net.	18″	01-12334490664890001123334596488	
of pla	17″	01-122254499967788900122225556544	
allax	16″	5564255551505000000000000000000000000000000	
ıl parı	15″	юй423111000000/голет44220001100	
izonts	14″	4489110000000000000000000000000000000000	
Ног	13″	xxxx11000000000004448xx00011000	
	12″	2211000000000004400000011000	
	11″	11000000000004400000011000	
	10″	002000000044000000000000000000000000000	
	<i>"</i> 6	001111220000000000000000000000000000000	
	8"	8 8 8 7 7 9 9 9 9 9 4 4 4 9 8 9 9 9 9 9 9 9 9 9 9	
	"2	> > > > > > > > > > > > > > > > > > >	
	6″	∞∞∞ [™] [™] [™] 444 [™]	
	5"	どうび 4 4 4 4 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 	
	4"	444000000000000000000000000000000000000	
	3"	***************************************	
	ŝ	NNNNNHHHHHHHHHO0000000	
	"1		
·əpı	aitHA	9888888883351236525252560°°	

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TABLES 18, 19.

TABLE 18.

Augmentation of the Moon's Semidiameter.

TABLE 19.

Augmentation of the Moon's Horizontal Parallax.

nt de))'s Semid	iameter.			e of va-	۵٬۵	, Hor. Paral	lax.
bare Litu	14'	• 15	·	1	6′	17′	tud ser on.	2		
Ap1 In lo	80″	0"	30″	0"	30″	0″	Lati of tic	ŏ 3′	57/	61'
0	"	"	"	"	"	"	0	"	"	"
0	0.1	0.1	0.1	0.1	0.2	0.2	0	0.0	0.0	0.0
2	0.6	0.6	0.7	0.7	_0.8	0.8	2	0.0	0.0	0.0
4	1.0	1.1	1.2	1.3	1.4	1.5	4	0.1	0.1	0.1
6	1.5	1.6	1.7	1.9	-2.0	2.1	6	0.1	0.1	0.1
- 10	2.0	2,1	2.3	2.4	2.0	2.1		0.2	0.2	0.2
10	2.4	2.0	2.8	3.0	$-\frac{3}{2},\frac{2}{2}$	3. 1 1 0	10	0.3	0.3	0.4
14	2.9	3.6	3.9	4.1	4.4	4.0	14	0.5	$0.5 \\ 0.7$	0.5
16	3.8	4.1	4.4	4.7	5.0	5.3	16	0.8	0.9	0.9
18	4.3	4.6	4.9	5.2	5.6	5.9	18	1.0	1.1	1.1
20	4.7	5.1	5.4	5.8	6.1	6.5	20	1.2	1.3	1.4
22	5.2	5.5	5.9	6.3	6.7	7.1	22	1.5	1.6	1.7
24	5.6	6.0	6.4	6.8	7.3	7.7	24	1.7	1.9	2.0
26	6.0	6.5	6.9	7.4	7.8	8.3	$\frac{26}{20}$	2.0	2.2	2.3
28	6.5	6.9	7.0	7.9	8.4	8.9	28	2.3	2, 0	2.0
30	6.9	$\frac{1.3}{7.8}$	1.9	8.4	8.9	9.5	30	2.6	2.8	3.0
04 3.1 :	$\frac{1.3}{7.7}$	1.0	0.0	0.9	9.4	10.0		2.9	2.1	3.4
36	81	8.6	9.2	9.8	10.0	10.0	36	3.6	3.9	4.1
38	8.4	9.0	9.7	10.3	10.9	11.6	38	4.0	4.3	4.6
	8.8	9.4	10.1	10.7	11.4	12.1		4.3	4.6	5.0
42	9.2	9.8	10.5	11.2	11.9	12.6	42	4.7	5.0	5.4
44	9.5	10.2	10.9	11.6	12.3	13.1	44	5.0	5.4	5.8
46	9.8	10.5	11.3	12.0	12.8	13.6	46	5.4	5.8	6.2
-48	10.2	10.9	11.0	12.4	<u>13. 2</u>	14.0	48	0.8	$\frac{0.2}{0.2}$	
50	10.5	11.2	12.0	12.8	13.6 14.0	14.4		6. 1 6 5	6.6 7.0	7.5
54	10.8	11.0	12.3	13.1	14.0 14.4	14.9	02 54	6.5	$7.0 \\ 7.4$	7.9
56	11.1 11.3	12.1	13.0	13.8	14.7	15.6	56	7.2	7.7	8.3
58°	11.6	12.4	13.3	14.1	15.1	16.0	58	7.5	8.1	8.6
60	11.8	12.7	13.5	14.4	15.4	16.3	60	7.8	8.4	9.0
62	12.1	12.9	13.8	14.7	15.7	16.6	62	8.1	8.8	9.4
64	12.3	13.2	14.1	15.0	16.0	16.9	64	8.4	9.1	9.7
66	12.5	13.4	14.3	15.2	16.2	17.2	66	8.7	9.4	10.0
68	12.7	13.6	14.5	15.5	16.5	17.5	68	9.0	9.7	10.3
70	12.9	13.8	14.7	15.7	16.7	17.7	70	9.2	9.9	10.6
74	13.0	13.9	14.9	10.9	10.9 17 1	17.9	72	9.5	10.2 10.1	10.9
74	10.1	14.1 14.9	10.0 15.2	10.0 16.2	$\begin{array}{c} 17.1 \\ 17.9 \end{array}$	10.1	76	9.7	10.4 10.6	11.1 11.3
78	13.4	14.3	15.3	16.2 16.3	17.4	18.4	78	10.0	10.8	11.5
80	13.5	14.4	15.4	16.4	17.5	18.6	80	10.1	10.9	11.7
82	13, 5	14.5	15.5	16.5	17.6	18.7	82	10.3	11.0	11.8
84	13.6	14.6	15.6	16.6	17.6	18.7	84	10.3	11.1	11.9
86	13.6	14.6	15.6	16.6	17.7	18.8	86	10.4	11.2	12.0
88	13.7	14.6	15.6	16.7	17.7	18.8	88	10.4	11.2	12.0
90	13.7	14.6	15.6	16.7	17.7	18.8	90	10.5	11.3	12.0

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TABLE 20A.

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Mean Refraction.

[Barometer, 30 inches. Fahrenheit's Thermometer, 50°.]

		[.54							
Apparent Altitude.	Mean Re- fraction.	Apparent Altitude.	Mean Re- fraction.	Apparent Altitude.	Mean Re- fraction.	Apparent Altitude.	Mean Re- fraction.	Apparent Altitude.	Mean Re- fraction.
0 /	1 11	0 /	1 11	0 /	/ //	0 /	/ //	0 /	1 11
0.00	00.00.4	9 30	5 35.1	15 00	$\begin{array}{c} 3 & 34.1 \\ 2 & 21 & 7 \end{array}$	25 00	2 4.4	42 00	1 04.7
0 00	36 29.4 94 59 6	30 40	0 32.4 5 90 6	10	3 31.7	10	2 5.4 9 9 5	20	1 03.9
2.00	18 25 5	40	5 27.0	20	3 27.1	30		43 00	1 00.2 1 02.4
3 00	14 25.0 14 25.1	50	$5\ 24.3$	40	3 24.8	40	$\frac{1}{2}$ 0.7	20	1 01.7
4 00	11 44.4	55	$5\ 21.7$	50	3 22.6	50	1 59.8	40	1 01.0
5 00	9 52.0	10 00	5 19.2	16 00	3 20.5	26 00	1 58.9	44 00	1 00.3
05	9 44.0	05	$5\ 16.7$	10	3 18.4	$10 \\ 10$	158.1	20	0 59.6
10	9 36.2	10	5 14.2 5 11 7	20	3 16.3	20 20	157.2 158.1	40	0 58.9
10	9 28.0	20	5 11.7 5 9 3	40	3 14.2 3 12 2	$\frac{30}{40}$	150.4 155.5	40 00	050.2 057.6
$\frac{20}{25}$	9 14.0	$\frac{20}{25}$	5 6.9	50	3 10.3	50	1 54.7	40	0 56.9
5 30	9 7.0	10 30	5 4.6	17 00	3 8.3	27 00	1 53.9	46 00	0 56.2
35	9 0.1	35	5 2.3	10	$\frac{3}{2}$ 6.4	10	153.1	20	0 55.6
40	8 53.4	40	$ \begin{array}{ccc} 5 & 0.0 \\ 4 & 57 & 9 \end{array} $	20 20	3 4.6	20 20	$1 \ 52.3$ $1 \ 51 \ 5$	40	0 50.0
40 50	8 40 4	40 50	4 55.6	30 40	3 1.0	40	1 51.5 1 50.7	20	0 53.7
55	8 34.2	55	4 53.4	50	2 59.2	50	1 50.0	40	0 53.1
6 00	8 28.0	11 00	4 51.2	18 00	2 57.5	28 00	1 49.2	48 00	0 52.5
05	8 22.1	05	4 49.1	10	2 55.8	20	1 47.7	49 00	0 50.6
10	8 16.2	10	4 47.0	20	254.1	40	1 46.2	50 00	0 48.9
15	8 10.5	15	4 44.9	$\frac{30}{40}$	2 52.4	29 00	1 44.8	52 00	0 47.2 0 45 5
$\frac{20}{25}$	$ \begin{array}{r} 6 & 4.8 \\ 7 & 59.3 \end{array} $	$\frac{20}{25}$	4 40.9	40 50	2 49.2	$\frac{20}{40}$	143.4 142.0	53 00	0 43.9
6.30	$-\frac{1}{7}$ 53.9	11 30	4 38.9	19 00	2 47.7	30 00	$\frac{1}{140.6}$	54 00	0 42.3
35	7 48.7	35	4 36.9	10	2 46.1	20	1 39.3	55 00	0 40.8
40	7 43.5	40	4 35.0	20	2 44.6	40	1 38.0	56 00	$0\ 39.3$
45_{50}	7 38.4	45	4 33.1	30	2 43.1 2 41 9	$\frac{31}{90}$	1 36.7 1 25 5	58 00	0 37.8
· 50 55	7 28 6	50 55	4 29 4	40 50	2 41.0 2 40.2	$\frac{20}{40}$	$1 30.0 \\ 1 34.2$	59 00	0 35.0
7 00	7 23 8	12 00	4 27.5	20.00	2 38.8	32 00	1 33.0	60 00	0 33.6
05	7 19.2	05	$\hat{4}$ 25.7	10	$\frac{1}{2}$ 37.4	20	1 31.8	61 00	0 32.3
10	7 14.6	10	4 23.9	20	2 36.0	40	1 30.7	62 00	0 31.0
15	$\frac{7}{7}$ 10.1	15	4 22.2	30	2 34.6	33 00	129.5	63 00	0 29.7
$\frac{20}{25}$	7 0.7 7 1 4	20 25	4 20.4	40 50	$\begin{array}{c} 2 & 33.3 \\ 2 & 32.0 \end{array}$	20 40	$1 28.4 \\ 1 27.3$	65 00	$0\ 20.4$ $0\ 27.2$
7 30	$\frac{1.1}{6.57.1}$	12 30	4 17.0	21 00	2 30.7	34 00	1 26.2	66 00	0 25.9
35	6 53.0	35	4 15.3	10	2 29.4	20	1 25.1	67 00	0 24.7
40	6 48.9	40	4 13.6	20	$2\ 28.1$	40	1 24.1	68 00	0 23.6
45	6 44.9	45	4 12.0	30	2 26.9	35 00	1 23.1	69 00 70 00	022.4
50 55	6 41.0 6 27 1	50 55	4 10.4	40 50	2 20.7	20 40	1 22.0 1 21 0	70 00	$0\ 21.2$ $0\ 20.1$
8 00	6 33 3	13.00	4 7.2	22.00	2 23.3	36 00	$\frac{121.0}{120.1}$	72 00	0 18.9
05	6 29.6	10 00	$\frac{1}{4}$ 5.6	10	2 22.1	20	1 19.1	73 00	0 17.8
10	6 25.9	10	4 4.1	20	2 20.9	40	$1 \ 18.2$	74 00	0 16.7
15	$6\ 22.3$	15	4 2.6	30	2 19.8	37 00	1 17.2	75 00	0 15.6
20 25	$6\ 18.8$ $6\ 15\ 2$	20 25	$\begin{array}{c} 4 & 1.0 \\ 2 & 50 & 6 \end{array}$	40	2 18.7 2 17 5	20 40	1 16.3 1 15 4	70 00 77 00	014.5 013.5
8 30	6 11 0	13 30	3 58 1	- 23 00	2 16.4	38 00	1 14 5	78 00	0 12.4
35	6 8.5	35	356.6	10	$ \frac{10.4}{2} $	20	1 13.6	79 00	0 11.3
40	6 5.2	40	3 55.2	20	2 14.3	40	$1 \ 12.7$	80 00	0 10.3
45	6 2.0	45	3 53.7	30	2 13.3	39 00	1 11.9	81 00	0 9.2
50 55	5 55 7	50 55	3 52.3	40 50	$2 12.2 \\ 2 11 9$	20 40	$1 11.0 \\ 1 10.9$	82 00	$0 \ 8.2 \ 0 \ 7.2$
9.00	5 59 6	14 00	3 49 5	24 00	$-\frac{2}{2}$ 10.2	40 00	$\frac{1}{19.4}$	84 00	$\frac{0}{0}$ 6.1
05	5 49.6	11 00	3 46.8	10	$\frac{10.2}{29.2}$	20	1 8.6	85 00	0 5.1
10	5 46.6	20	3 44.2	20	2 8.2	40	1 7.8	86 00	0 4.1
15	5 43.6	30	3 41.6	30	$\begin{array}{ccc} 2 & 7.2 \\ 0 & 2.2 \end{array}$	41 00	1 7.0	87 00	
20 25	5 40.7	$\frac{40}{50}$	3 39.0	40 50	$2 \ 6.2$ 2 5 2	20 40	$1 \ 6.2$ $1 \ 5.4$	89 00	0 2.0 0 1 0
0.30	5 25 1	15 00	3 2.1 1	25.00	2 0.0	40	$\frac{1}{1}$ $\frac{0.4}{1}$	90.00	0 0.0
0.00	0.00.1	10.00	0 04.1	20 00	4 T. T	74 00	T I I	00 00	0 0.0

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TABLE 20B.

Correction of the Sun's Apparent Altitude for Refraction and Parallax.

[Barometer, 30 inches. Fahrenheit's Thermometer, 50°.]

Apparent Altitude.	Mean Re- fraction and Parallax ⊙.	Apparent Altitude.	Mean Re- fraction and Parallax⊙.	Apparent Altitude.	Mean Re- fraction and Parallax ⊙.	Apparent Altitude.	Mean Re- fraction and Parallax ⊙.	App a rent Altitude.	Mean Re- fraction and Parallax ⊙.
0 /	, , ,	0 /	, ,	0 /	1 11	0 /	, , ,	0 /	, ,
		9 30	5 26	15 00	3 25	25 00	1 56	42 00	0 58
0 00	36 20	35	5 23	10	3 24	10	1 55	20	0 57
1 00	$24 \ 45$	40	5 21	20	3 21	20	1 55	40	0 56
2 00	18 17	45	5 18	30	3 19	30	154	$43 \ 00$	0.55
3 00	$14 \ 16$	50	5 15	40	3 17	40	1 53	20	0 55
4 00	11 35	55	5 13	50	3 15		152	40	0 54
5 00	9 43	10 00	5 10	16 00		26 00	151	44 00	053
05	9 35	05		10		10	1 50	20	0 53
10	9 27	10	53	20	36	20	1 49	40	0.52 0.52
$\frac{10}{20}$	9 12	20	5 0	40	3 4	40	1 48	20	0.52 0.52
$\tilde{25}$	9 5	$\overline{25}$	4 58	50	$3 \hat{2}$	50	1 47	40	0 $5\overline{1}$
5 30	8 58	10 30	4 56	17 00	3 0	27 00	146	46 00	0 50
35	8 51	35	4 53	10	258	10	1 45	20	0 50
40	8 44	40	4 51	20	257	20	1 44	40	0 49
45	8 38	45	4 49	30	255	30	1 44	47 00	0 48
50	8 31	00 55	4 47	40	2 53	40	1 43	20	0 48
00	8 20	11 00	4 44	12.00	2 51	00	1 42	40	0.47
0 00	8 13	11 00	4 42 4 40	10 10	2 48	28 00	$1 41 \\ 1 40$	49 00	0 47
10	8 7	10	4 38	20	2 46	40	1 38	50 00	0 43
15	8 2	15	4 36	30	2 44	29 00	1 37	$51 \ 00$	0 41
20	7 56	20	4 34	40	2 43	20	$1 \ 35$	$52 \ 00$	0 40
25	7 50	25	4 32	50	241	40	1 34	53 00	0 39
6 30	7 45	$11 \ 30$	4 30	19 00	240	30 00	1 33	54 00	0 37
35	7 40 7 25	35	4 28	10	$238 \\ 0.27$, 20	$1 31 \\ 1 20$	55 00	0 36
40	7 30	40	4 20	20	2 37	31 00	1 30	57 00	0.33
50	7 25 725	-10 50	424	40	234	20	$120 \\ 128$	58 00	0 32
55	$\frac{1}{7}$ $\frac{1}{20}$	55	$\hat{4} \ \bar{20}$	$\tilde{50}$	$\frac{1}{2}$ 32	40	1 26	59 00	0 31
7 00	7 15	12 00	4 19	20 00	2 31	32 00	1 25	60 00	0 30
05	7 10	05	4 17	10	2 29	20	1 24	$61 \ 00$	0 28
10	76	10	4 15	20	2 28	40	1 23	62 00	0 27
15	7 1	- 15	4 13	30	227	33 00	1 22	63 00	0 26
20	0 07 6 59	20 25	4 11	40 50	2 20	20 40	1 20	65 00	0 24
7 20	6 48	12 20	4 10			34.00	1 18	66 00	0 23
35	6 40 6 44	14 30	4 6	21 00	$ \begin{array}{c} 2 \\ 2 \\ $	20	1 10	67 00	$022 \\ 021$
40	6 40	40	4 5	20	$\frac{1}{2}$ $\frac{1}{20}$	40	1 16	68 00	0 21
45	6 36	45	4 3	$\overline{30}$	2 19	35 00	1 15	69 00	0 19
50	6 32	50	4 1	40	2 18	20	1 15	70 00	0 18
55	6_28	55	4 0	50	2 17	40	1 14	71 00	0 17
8 00	$\begin{array}{c} 6 & 24 \\ 0 & 21 \end{array}$	$13 \ 00$	358	22 00	2 15	36 00		72 00	0 16 0 16
05	$621 \\ 617$	05 10	3 57	10	2 14	20	$1 12 \\ 1 11$	73 00	0 16
10	$6 17 \\ 6 13$	10	3 55	30	$213 \\ 212$	37 00	1 10	75 00	0 13
20	610	$\frac{10}{20}$	3 52	40	$ \frac{1}{2} $ $ \frac{1}{11} $	20	1 9	76 00	0 13
25	6 6	25	3 51	50	2 10	40	1 8	77 00	0 12
8 30	6 3	13 30	3 49	· 23 00	2 8	38 00	1 8	78 00	0 10
35	6 0	35	3 48	10	2 7	20	1 7	79 00	09
40	556	40	346	20	2 6	40		80 00	0 8
40 50	0 03 5 50	40 50	3 45 2 19	30	2 0	39 00	1 0	82 00	
55	5 47	55	3 42	50	2^{4} 3^{4}	40	$1 \frac{1}{3}$	83 00	0 6
9.00	5 44	14 00	3 41	24 00	2 2	40 00	$\frac{1}{1}$	84 00	0 5
05	5 41	10	3 38	10	$\tilde{2}$ $\tilde{1}$	20	$\hat{1}$ $\tilde{2}$	85 00	0 4
10	5 38	20	3 35	20	$2 \ 0$	40	1 1	86 00	0 3
15	5 35	30	3 33	30	1 59	41 00	1 0	87 00	$ \begin{array}{ccc} 0 & 2 \\ 0 & 2 \end{array} $
20	5 32	40	3 30	40	158	20	0 59	88 00	0 2
20	<u> </u>		3 28	05 00	1 57	40	0.58	-00 00	0 1
9-30	5 26	15 00	3 25	25 00	1 56	42 00	0 58	90.00	0 0

TABLE 21.

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Correction of the Mean Refraction for the Height of the Barometer.

Baror									2	fean	refra	etion							-			Rarom
Darom.	0	,	1	'	2		3	'	4	Y I	ŝ	6'	6	<i>י</i>	7	,	8	81	9	,	10′	Daroni.
Subtract.	0''	30''	0''	30''	0''	30''	0''	30''	0''	30''	0''	30′′	0″	80"	0″	30′′	0''	80''	0''	30''	0''	Add.
	"	,,	"	,,	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	
27.50	0	2	5	7	10	$\frac{12}{12}$	15	17	20	23	25	28	30	33	35	38	40	43	45	48	51	
27.55 27.60	0	$\frac{2}{2}$	0 5	$\frac{1}{7}$	$10 \\ 10$	$\frac{12}{12}$	$\frac{10}{14}$	$\frac{17}{17}$	20	22	$\frac{20}{24}$	27	$\frac{50}{29}$	32 31	30	эт 36	40 39	41 41	40	46	- 2 0 - 49	
27.60 27.65	0	$\frac{2}{2}$	5	7	9	12^{12}	14	16	19	21	24	$\frac{1}{26}$	$\frac{1}{28}$	31	33	36	38	40	43	45	48	
27.70	0	$\overline{2}$	5	7	9	11	14	16	18	21	23	25	28	30	32	35	37	39	42	44	47	
27.75	0	2	4	7	9	11	13	16	18	20	23	25	27	29	32	34	36	39	41	43	46	
27.80	0	2	4	7	9	11	13	15	18	20	22	24	27	29	31	33	35	38	40	42	45	
27.85	0	20	4	6	9	10	13	10	17	19	22	24	20 25	28	30	32	30	36	39	41	44	
27.90	0	$\frac{4}{2}$	4	6	8	$10 \\ 10$	$\frac{10}{12}$	14	16^{17}	18	$\frac{21}{21}$	$\frac{23}{23}$	$\frac{20}{25}$	$\frac{21}{27}$	29	31	33	35	$\frac{33}{37}$	39	42	
28.00	$\frac{0}{0}$		4	-6	-8	$\frac{10}{10}$	$\frac{14}{12}$	14	16	18	$\frac{21}{20}$	22	24	26	28	30	$\frac{30}{32}$	34	36	38	41	
28.00 28.05	Ŏ	$\overline{2}$	4	6	8	10	$1\overline{2}$	$1\overline{4}$	$\hat{16}$	18	20	22	24	25	27	29	31	33	35	37	39	
28.10	0	2	4	6	8	9	11	13	15	17	19	21	23	25	27	29	31	33	34	36	38	
28.15	0	2	4	6	7	9	11	13	15	17	19	20	22	24	26	28	30	32	34	36	37	
28.20	0	2_{-2}	4	_5	_7		11	13	14	16	18	20	22	24	25	27	$\frac{29}{22}$	31	33	35	36	
28.25	0	2	3	5	7	9	10	12_{10}	14	16	18	19	21	23	25	26	28	30	$\begin{vmatrix} 32 \\ 21 \end{vmatrix}$	$\frac{34}{99}$	35	
28.30	0	2	3	05	7	8	10	12	14	10	$ \frac{1}{17} $	19	21	22	24	20	21	29	30	39	34	
28.30	0	2	3	5	ĥ	8	10	11	13	14	16^{17}	18	19	21	$\frac{20}{23}$	$\frac{20}{24}$	$\frac{2}{26}$	27	$ \frac{30}{29} $	31	$\frac{33}{32}$	
28.45	0	$\overline{2}$	3	5	6	8	-9	11	12	14	16	17	19	$\overline{20}$	22	23	25	27	28	30	31	
28.50	$\overline{0}$	1	3	4	6	7	9	10	12	14	15	17	18	20	21	23	24	26	27	29	30	31.50
28.55	0	1	3	4	6	7	9	10	12	13	15	16	17	19	20	22	23	25	26	28	29	31.45
28.60	0	1	3	4	6	7	8	10	11	13	14	15	17	18	20	21	23	24	25	27	28	31.40
28.65	0	1	3	4	5	7	8	9	11	12	14	15	16	18	19	20	22	23	25	26	27	31.35 21.90
28.70	0	<u> </u>	3	+	0	6	8	-9	10	$\frac{12}{11}$	13	14	10	$\frac{1}{10}$	18	20	$\frac{21}{90}$	22	24	20	20	31. 30 31. 9 [±]
28.75	0	1	29	+	5	6 6	$\frac{1}{7}$	9	10		13	14	10	10	18	19	20	21	$\frac{23}{22}$	24	20	$ \begin{array}{c} 31, 20 \\ 31, 20 \end{array} $
28,80	0	1	$\frac{2}{2}$	1 3	5	6	$\frac{1}{7}$	8	10		$12 \\ 12$	13	14	15	16	17	19	$\frac{1}{20}$	$\frac{1}{21}$	22	23	31.15
28.90	Ő	1	$\frac{1}{2}$	3	4	5	7	8	9	10	11	12	13	14	16	17	18	19	$\overline{20}$	$ \overline{21} $	22	31.10
28.95	0	1	$\overline{2}$	3	4	5	6	7	8	9	11	12	13	14	15	_16	17	18	19	20	21	31.05
29.00	0	1	$\overline{2}$	3	4	5	6	7	8	9	10	11	$\overline{12}$	13	14	15	16	17	18	19	$\overline{20}$	31.00
29.05	0	1	2	3	4	5	6	7	8	9	10	11	11	12	13	14	15	16	17	18	19	30.95
29.10	0	1	$\frac{2}{2}$	3	4	4	5	6	7	8	9		11	12	13	14	15	15	16	17	18	30.90
29.15	0		2	3	3	4	5	6	6	87	9	9	10	11	12	13	14	10	10	10	16	30.80
29.20		1	4	-4-0	$\frac{\partial}{\partial}$	+		- 5	- 0	7	-0	-0	0	10	11	11	19	13	14	11	15	30 75
29.20		1	1	2	3	4	4	5	6	6		8	8	10	10	11	11	$10 \\ 12$	13	13	14	30,70
29.35	0	1	î	$\overline{2}$	3	3	4	5	5	6	7	7	8	9	9	10	10	11	12	13	13	30.65
29.40	Ő	1	1	$\overline{2}$	2	3	4	4	5	5	6	7	7	8	8	9	10	10	11	12	12	30.60
29.45	0	_1	1	2	2	3	3	4	4	5	6	6	7	7	8	8	9	9	10	11	11	30.55
29.50	0	0	1	1	2	2	3	3	4	5	5	6	6	7		8	8	9	9	10	10	30.50
29.55	0	0	1	1	$\begin{vmatrix} 2 \\ \circ \end{vmatrix}$	2	3	3	4	4	5	5	5	6	6	1	Ĩ	87	87	9	9	30.45
29.60			1	1	$ _{\frac{2}{1}}$	2		3	3	4	4	4		05	0 5	05	6	ß	6	7	7	30.40
29.00	0		1	1	1		$\frac{4}{2}$	2	2	3	3	3	4	4	4	5	5	5	5	6	6	30.30
20.70	0	-0	0	1	1	1	$\frac{2}{1}$	- 2	2	2	3	3	3	3	4	4	4	4	5	5	5	30.25
29,80	ŏ	0	0	1	1	i	1	ī	$ $ $\frac{1}{2}$	$\overline{2}$	2	2	$\begin{vmatrix} 2 \end{vmatrix}$	3	3	3	3	3	4	4	4	30.20
29.85	ŏ	0	0	Ō	Î	1	1	1	1	1	2	2	2	2	2	2	2	3	3	3	3	30.15
29.90	0	0	0	0	0	0	1	1	1	1	1	1	1	1	1	2	2	2			2	30.10
29.95	0	0	0	0	0	0	0	0	0	0	1	1	1		1	1	1	1		1		30.00
30.00	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	30,00
Subtract.	0''	30''	0''	30''	0''	30''	0''	30''	0''	30''	0''	307	0''	30''	6″	30''	0"	30"	0''	30"	0''	Aḍd,
Barom.		0'		1′		2'		3′		4'		5'		6'		7'		8'		9′	10/	Barom
									1	Mean	refra	action										1

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TABLE 22.

Correction of the Mean Refraction for the Height of the Thermometer.

Ther										Mear	ı refi	ractio	n.									
Add		0′	_	1′		27		8′		4'		5'		6′		7'	8)'	10'	Ther.
Add.	0''	30''	0''	30''	0''	30''	0''	30''	0''	30"	0''	30"	0'	30"	0''	80''	0''	30''	0''	30"	0''	
0	"	"	"		"	"	"	"	"	"	"	"	"	"	"	"	"	"	//	"	//	0
-10	0	+	8	12	16	20	24	28	33	37	41	46	00 48	00 53	60 59	60	10	10 79	$\frac{80}{77}$	85 89	90 87	-10
$-\frac{3}{6}$	0	4	7	11	15	19	22	26	30	34	38	42	47	51	55	60	64	69	74	79	84	$-\frac{3}{6}$
- 4	0	4	7	11	14	18	22	25	29	33	37	41	45	49	53	57	62	66	71	76	80	- 4
- 2	0	3	7	10	14	17	21	24	28	31	35	39	$\frac{43}{41}$	47	$\frac{51}{10}$	55	59	64	68	72	77	-2
0	0	3	7	10	13	$\frac{16}{16}$	20	$\frac{23}{99}$	27	30	34	37	41	40	49	53 50	51	61 58	65	69 66	$\frac{74}{70}$	0
4	0	3	6	9	$12 \\ 12$	15	18	$\frac{1}{21}$	$\frac{20}{24}$	$\frac{1}{28}$	31	34	37	41	44	48	52	55	59	63	67	$\tilde{4}$
6	0	3	6	8	11	14	17	20	23	$\overline{26}$	29	32	36	39	42	46	49	53	56	60	64	6
8	0	3	5	8	11	14	16	19	22	25	28	31	34	37	40	43	47	50	54	57	61	8
10	0	3	5	87	$10 \\ 10$	13	15	18	$\frac{21}{20}$	24	26	29	32	35	38	$\frac{41}{40}$	44	48	51	04 53	58 56	10
$11 \\ 12$	0	$\frac{2}{2}$	5	7	10	$13 \\ 12$	$10 \\ 15$	17	$\frac{20}{20}$	$\frac{23}{22}$	$\frac{20}{25}$	28	30	33	36	39	$\frac{13}{42}$	45	48	51	54	$11 \\ 12$
13	0	$\overline{2}$	5	7	9	12	14	17	19	22	24	27	30	32	35	38	41	44	47	50	53	13
14	0	2	5	7	9	11	14	16	19	21	24	26	$\frac{29}{32}$	31	34	37	40	42	45	48	51	14
$15 \\ 16$	0	$\frac{2}{2}$	4	7	9		13	$16 \\ 15$	18	$\frac{20}{20}$	$\frac{23}{22}$	$\frac{25}{25}$	$\frac{28}{27}$	30	33	36	$\frac{38}{37}$	$\frac{41}{40}$	44	$\frac{47}{45}$	$\frac{50}{48}$	15 16
10	0	$\frac{2}{2}$	4	6	8	10	13	15	17	19	$\frac{22}{21}$	24	$\frac{2}{26}$	29	31	33	36	39	41	44	47	17
18	Ő	2	4	6	8	10	12	14	16	19	21	23	25	28	30	32	35	37	40	43	45	18
19	0		4	6	8	10	12	14	16	18_	20	22	24	27	29	31	34	36	39	41	44	19
20	0	$\frac{2}{2}$	4	$\frac{6}{5}$	87	9	11	13	15	$17 \\ 17$	19	$22 \\ 91$	24	26	28	30	33	35	37	40	$\frac{42}{41}$	$\frac{20}{21}$
$\frac{21}{22}$	0	$\frac{2}{2}$	3	5	7	9	11	$13 \\ 12$	14	16^{17}	18	$\frac{21}{20}$	$\frac{23}{22}$	24	23	$\frac{29}{28}$	30	32	35	37	39	22
23	0	$\overline{2}$	3	5	7	8	10	12	14	15	17	19	21	23	25	27	29	31	33	36	38	23
24	0	2	3	5	6	8	10	11	13	15	17	18	$\frac{20}{10}$	22	24	26	28	30	32	34	36	24
25 26	0	$\frac{2}{1}$	3	5	6	8	9	11	13	14	16	18	19	21	23	25	27	29 28	31	33	30	25 26
$\frac{20}{27}$	0	1	3	4	6	7	9	10	$12 \\ 12$	13^{11}	15	16	18	19	$\frac{22}{21}$	23	$\frac{20}{25}$	$\frac{10}{26}$	28	30	32	27
28	0	1	3	4	5	7	8	10	11	12	14	15	17	19	20	22	23	25	27	29	30	28
	0	_1	3	4	5	6	8	9	$\frac{11}{12}$	12	$\frac{13}{12}$	15	16	18	$\frac{19}{10}$	$\frac{21}{82}$	22	24	$\frac{26}{24}$	$\frac{27}{27}$	$\frac{29}{29}$	29
30 21	0	1	2	1 2	5	6	$\frac{7}{7}$	9		11	13	14	15	17	$18 \\ 17$	20	21	23	24	$\frac{26}{25}$	$\frac{28}{26}$	30 31
32^{-31}	0	1	$\tilde{2}$	3	4	6	7	8	9	10	11	13	14	15	16	18	19	$\tilde{20}$	$\frac{20}{22}$	23	$\frac{20}{25}$	32
- 33	0	1	2	3	4	5	6	7	8	10	11	12	13	14	15	17	18	19	21	22	23	33
34	0	1	2	3	4	5	6	7	8	9	10	11	12	13	14	16	17	18	19	$\frac{21}{10}$	$\frac{22}{22}$	34
35 36	0	1	2	3	4	5	6	6	7	8	9	$10 \\ 10$		13	14	15	16	17	18	19	20	35 36
$\frac{50}{37}$	0	1	$\frac{4}{2}$	2	0 3	4	5	6	6	7	8	9	10	11^{12}	$13 \\ 12$	13	14	$10 \\ 15$	16^{17}	17	18	37
38	0	1	1	2	3	4	4	5	6	7	7	8	9	10	11	12	13	13	14	15	16	38
39	0		1	2	3	3	4	5	5	6	$\frac{7}{2}$	8	8	9	10	11	11	12	13	14	$\frac{15}{10}$	$\frac{39}{10}$
40	0	1	1	$\frac{2}{2}$	$\frac{2}{2}$	3	4	-1	5	65	6	7	8	87	9	10	$10 \\ 0$	$11 \\ 10$	$ 12 \\ 11$	13	13	40
42	0	0	1	1	$\frac{4}{2}$	2	3	3	4	4	5	5	6	7	7	8	8	10	11 9	10	11	42
43	0	Ő	1	1	$\overline{2}$	2	3	3	3	4	4	5	5	6	6	7	7	8	8	9	9	43
44	0	0	1	1	1	2	2	3	3	3	4	_4	4	5	5	6	6	7	7	8	8	44
45 16	0	0	1	1	1	1	2	2	$\frac{2}{2}$	3	3	3	4	4	4	5	5	6	65	6 5	7	45
40	0	0	0	1	1	1	1	1	$\tilde{1}$	$\frac{2}{2}$	$\frac{2}{2}$	$\frac{2}{2}$	2	2	4	43	4	4	4	4	- 4	40
48	Ő	0	0	Ō	0	1	1	i	1	ĩ	1	ĩ	1	$ $ $\tilde{2}$	2	2	2	2	$\frac{1}{2}$	2	3	48
49	0	0	0	0	0	0	0	0	0	1	1	1	1	1	1	1	1	1	1	1		_49
50	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	50
Add.	0''	30"	0"	30''	0''	30′′	0''	30''	0''	30″	0''	30″	0''	30′′	0''	30"	0''	30″	0''	30″	0''	Add.
There	- 0)'		1′		2'		3′		1 ′		5'		6′		7'	8	'	9		10′	There
Iner.										Mean	n ref	ractio	n.									Ther.

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			Co	rrect	ion	of th	le M	ean	Ref	ractio	on fe	or th	е Н	eight	t of	the '.	Ther	mom	eter.			
Ther.	$ \begin{array}{c c c c c c c c c c c c c c c c c c c $														Ther.							
Subt.		0′		1′		2′		3'		1 ′		5′		6′		7'		8′	9	'	10′	Subt.
	0″	30″	0″	30″	0″	30″	0″	30″	0″	30″	0″	30″	0″	30″	0"	30″	0″	30″	0″	30″	0″	
0	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	0
$50 \\ 51$	0	0	0		$\begin{vmatrix} 0\\0 \end{vmatrix}$				$\begin{bmatrix} 0\\0 \end{bmatrix}$	$\begin{array}{c} 0\\ 1\end{array}$	$\begin{vmatrix} 0\\ 1 \end{vmatrix}$		$\begin{vmatrix} 0\\1 \end{vmatrix}$	$\begin{vmatrix} 0\\1 \end{vmatrix}$	$\begin{vmatrix} 0\\1 \end{vmatrix}$	$\begin{array}{c} 0\\ 1\end{array}$	$\begin{array}{c} 0\\ 1\end{array}$	$\begin{vmatrix} 0\\1 \end{vmatrix}$	$\begin{array}{c} 0\\ 1\end{array}$	$\begin{array}{c} 0\\ 1\end{array}$	$\begin{array}{c} 0\\ 1\end{array}$	$\frac{50}{51}$
52	0	Ő	Ő	Ő	Ŏ	1	1	1	1	1	î	1	ī	$\hat{2}$	$\frac{1}{2}$	$\hat{2}$	$\hat{2}$	$\hat{2}$	$ \hat{2} $	$\hat{2}$	3	52
53 54	0	0	0		1		$1 \\ 1$	$\frac{1}{2}$	$\frac{1}{2}$	$\frac{2}{2}$	$\frac{2}{2}$	$\frac{2}{3}$	$\begin{vmatrix} 2 \\ 3 \end{vmatrix}$	$\frac{2}{3}$	$\frac{2}{3}$	$\frac{3}{4}$	$\frac{3}{4}$		35	4 5	$\frac{4}{5}$	$\frac{53}{54}$
55	$\frac{0}{0}$	-0	$\frac{1}{1}$	1	$\frac{1}{1}$	1	$\frac{1}{2}$	$\overline{2}$	$\frac{-}{2}$	$\frac{-}{3}$	3	3	4	4	4	$\overline{5}$	$\overline{5}$	$\frac{-}{5}$	6	6	6	55
56	0	0	1	1	$\frac{1}{2}$	$\frac{2}{2}$	$\frac{2}{2}$	$\frac{2}{2}$	$\frac{3}{2}$	3	4	4 5	4 5	5	5	6	$\frac{6}{7}$		7	7	8	$\frac{56}{57}$
$\frac{97}{58}$	0	0	1	1	$\frac{2}{2}$	$\frac{1}{2}$	$\frac{2}{3}$	3	4	4	5	5	6	6		7	8	9	9	10	10	58
59	0	1	1	2	$\frac{2}{2}$	3	3	4	4	5	$\frac{5}{c}$	6	6	7	8	8	9	10	10	11	12	59
$\frac{60}{61}$	$\begin{array}{c} 0\\ 0\end{array}$	$\frac{1}{1}$	1	$\frac{2}{2}$	$\frac{2}{3}$	3	$\frac{3}{4}$	4	5 5	5 6	67	7	8	$\frac{8}{9}$	9	9 10	10	$11 \\ 12$	$11 \\ 12$	$\frac{12}{13}$	$13 \\ 14$	60 61
62	ŏ	1	1	2	3	3	4	$\frac{5}{2}$	6	6	7	8	9	9	10	11	12	13	14	15	15	62
$63 \\ 64$	$\begin{bmatrix} 0\\ 0 \end{bmatrix}$	1	$\frac{1}{2}$	$\frac{2}{2}$	3	4) 5	5 6	$\frac{6}{7}$	7	8	$\frac{8}{9}$	9 10	$10 \\ 11$	$\frac{11}{12}$	$\frac{12}{13}$	13 14	$14 \\ 15$	15 16	$16 \\ 17$	$\frac{17}{18}$	$\frac{63}{64}$
65	$\overline{0}$	1	$\frac{2}{2}$	$\frac{-}{3}$	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	65
66 67	0	1	$\frac{2}{2}$	3	$\begin{vmatrix} 4 \\ 4 \end{vmatrix}$	5	6	$\frac{6}{7}$	7	8	9	10	$\frac{11}{12}$	$\frac{12}{13}$	14	$15 \\ 16$	$\frac{16}{17}$	17	18	$\frac{19}{20}$	$\frac{20}{22}$	$\frac{66}{67}$
68	0	1	$\frac{2}{2}$	3	4	5	6	7	8	9	11	11	13^{12}	14	15^{14}	$16 \\ 16$	18	19	$\frac{10}{20}$	22	$\frac{22}{23}$	68
69	0	1	2	3	4	5	7	8	9	10	11	12	13	15	16	17	19	20	21	23	24	69
70 71	$\begin{array}{c} 0\\ 0\end{array}$	$\frac{1}{1}$	$\frac{2}{2}$	$\frac{3}{4}$	0 5	6	7	8	10	10	$\frac{12}{12}$	$\frac{12}{13}$	14	$10 \\ 16$	$\frac{17}{18}$	$18 \\ 19$	$\frac{20}{20}$	$\frac{21}{22}$	$\frac{22}{23}$	$\frac{24}{25}$	$\frac{25}{27}$	70
72	Ŏ	1	$\overline{2}$	4	5	6	8	9	10	11	13	14	16	17	18	20	21	23	25	26	28	72
$73 \\ 74$	$\begin{bmatrix} 0\\ 0 \end{bmatrix}$	1	$\frac{3}{3}$	4	5	7	8	10	11 11	$\frac{12}{12}$	$\frac{13}{14}$	$\frac{14}{15}$	$\frac{16}{17}$	18 18	$\frac{19}{20}$	$\frac{21}{22}$	$\frac{22}{23}$	$\frac{24}{25}$	$\frac{26}{27}$	$\frac{27}{28}$	$\frac{29}{30}$	$73 \\ 74$
75	0	$\frac{1}{1}$	3	4	6	7	8	10	11	13	14	16	18	19	$\overline{21}$	22	24	26	28	29	31	75
$\frac{76}{77}$	0	1	3	45	6	7	9	10	$ \frac{12}{12} $	$13 \\ 14$	$15 \\ 16$	$\frac{16}{17}$	18 19	$\frac{20}{21}$	$\frac{22}{22}$	$\frac{23}{24}$	$\frac{25}{26}$	$ \frac{27}{28} $	29 30	$\frac{31}{32}$	$\frac{32}{34}$	$\frac{76}{77}$
78	0	$\frac{1}{2}$	3	5	6	8	9	11	$12 \\ 13$	14	16	18	20	$\frac{21}{21}$	23	25	27	29	31	33	35	78
79	0	$\frac{2}{2}$	3	5	6	8	10	11	13	15	17	18	20	22	24	26	28	30	32	34	36	79
80 81	0	$\frac{2}{2}$	$\frac{3}{3}$) 5	7	8	10	$12 \\ 12$	14	$15 \\ 16$	$\frac{17}{18}$	$\frac{19}{20}$	$ \frac{21}{21} $	$\frac{23}{24}$	$\frac{29}{26}$	$\frac{27}{28}$	$\frac{29}{30}$	$\frac{31}{32}$	$\frac{33}{34}$	$\frac{39}{36}$	$\frac{37}{38}$	80 81
82	0	2	4	5	7	9	11	13	14	16	18	20	22	24	26	28	31	33	35	37	40	82
83 84	0	$\frac{2}{2}$	44	э 6	8	9	11	$13 \\ 13$	$15 \\ 15$	$17 \\ 17$	19 19	$\frac{21}{21}$	$\frac{23}{23}$	$\frac{29}{26}$	$\frac{27}{28}$	$\frac{29}{30}$	$\frac{31}{32}$	34 35	30 37	$\frac{38}{39}$	$\frac{41}{42}$	83 84
85	0	2	4	6	8	10	12	14	16	18	20	22	24	26	29	31	33	36	38	40	43	85
86 87	0	$\frac{2}{2}$	4	6	8	10	12	14	$16 \\ 17$	18	$\frac{20}{21}$	$\frac{23}{23}$	$\frac{25}{25}$	27	29	$\frac{32}{32}$	$\frac{34}{35}$	37	$\frac{39}{40}$	42	44	86 87
88	0	$\frac{1}{2}$	4	6	8	10	13	15	17	19	$\frac{21}{21}$	24	$\frac{26}{26}$	28	31	33	$\frac{36}{36}$	38	41	44	46	88
89	0	2	4	6	9	11	13	15	17	$\frac{20}{20}$	22	24	27	29	32	.34	37	39	42	45	48	89
90 91	0	$\frac{2}{2}$	4	7	9	11	13	$16 \\ 16$	18	$\frac{20}{21}$	$\frac{23}{23}$	$\frac{20}{25}$	$\frac{27}{28}$	30	$\frac{32}{33}$	35 36	$\frac{38}{39}$	40	43 44	40 47	$\frac{49}{50}$	90 91
92	0	2	5	7	9	11	14	16	19	21	24	26	29	31	34	37	39	42	45	48	51	92
93 94	0	$\frac{2}{2}$	5 5	7	9 10	$\frac{12}{12}$	14	$17 \\ 17$	19	$\begin{vmatrix} 22 \\ 22 \end{vmatrix}$	$\frac{24}{25}$	$\frac{27}{27}$	$\frac{29}{30}$	$\frac{32}{33}$	35 35	37 38	40	43	40	$\frac{49}{50}$	$\frac{52}{53}$	93 94
- 95	0	$\overline{2}$	5	7	$\frac{1}{10}$	12	15	17	20	22	25	28	30	33	36	39	42	45	48	51	54	95
96 97	0	$\begin{array}{c ccccccccccccccccccccccccccccccccccc$						18	20	23	26	28	31	34	37	40	43	46	49 50	52 53	55	96 97
98	0	3	$\begin{array}{c ccccccccccccccccccccccccccccccccccc$							24	$\frac{20}{27}$	$\frac{29}{29}$	$32 \\ 32$	35	38	41	44	48	51	54	58	98
99	0	3	5	$\begin{array}{cccccccccccccccccccccccccccccccccccc$									42	45	49	52	55	59	99			
100	0	3	5	.8	11	13	16	19	22	25	28	31	34	37	40	43	46	50	53	56	60	100
Subt	0"	30"	0″	30″	0"	30″	0"	30″	0″	30″	0"	30"	0"	30″	0″	30″	0"	30″	0″	30"	0″	Subt
, Subt.		0'		1'	-	2'		3'		4'		5′		6'		7'		8')')'	10'	Subt.
Ther.			1		1					Mea	n ref	fractio	on.		1				1			Ther.

TABLE 22.

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TABLES 23, 24.

			TABI	CE 23.			
Correc fract zont	tion of ion co al para	f the Mo rrespond llax, 57'	oon's A ling to ' 30″.	ltitude a mear	for par 1 value	allax an 9 of the	d re- hori-
Moon's alt.	Corr.	Moon's alt.	Corr.	Moon's alt.	Corr.	Moon's alt.	Corr.
P 0	,	0	,	0	,	0	,
10	51	31	48	51	35	71	18
11	52	32	47	52	-35	72	17
12	52	- 33	47	53	34	73	17
13	52	- 34	-46	54	- 33	74	16
14	52	- 35	46	55	32	75	15
15	52	36	45	56	32	76	14
16	52	- 37	45	57	31	- 77	13
17	52	- 38	44	58	- 30	78	12
18	52	- 39	44	59	29	79	11
19	52	40	43	60	28	80	10
20	51						
21	51	41	42	61	27	81	9
22	51	42	42	62	26	82	8
23	51	43	41	63	26	83	7
24	50	44	40	64	25	84	6
25	50	45	40	65	24	85	5
26	50	46	. 39	66	23	86	4
27	49	47	38	67	22	87	3
- 28	49	48	· 38	68	21	88	2
29	49	49	37	69	20	89	1
30	48	50	36	70	19	90	0

TABLE 24.

Correction of the Moon's Apparent Altitude for Parallax and Refraction.

[Barometer, 30 inches.—Fahrenheit's Thermometer, 50°.]

Moon's			н	orizontal	parallax	ι.			nds of illax.	Cor	rectio para	n for a	secon -Add.	ds of	Corr. for
app. alt.	54/	55′	56'	57/	58′	59'	60′	61′	Secol para	0″	2″	4″	6″	8″	of alt.
$ \begin{array}{c} \circ & \prime \\ 5 & 0 \\ 10 \\ 20 \\ 30 \\ 40 \\ 50 \\ \hline \\ 6 & 0 \\ 10 \\ 20 \\ 30 \\ 40 \\ 50 \\ \hline \\ 7 & 0 \\ 10 \\ 20 \\ 30 \\ 40 \\ 50 \\ \hline \\ 8 & 0 \\ 10 \\ 20 \\ 30 \\ 40 \\ 50 \\ \hline \\ 9 & 0 \\ 10 \\ 20 \\ 30 \\ 40 \\ 50 \\ \hline \\ 50 \\ \hline \end{array} $	$\begin{array}{c} & & "\\ 43 & 56\\ 44 & 11\\ & 25\\ & 39\\ 45 & 4\\ 45 & 15\\ & 26\\ & 36\\ & 46\\ & 46\\ & 46\\ & 12\\ & 29\\ & 36\\ & 46\\ & 46\\ & 42\\ & 21\\ & 29\\ & 36\\ & 46\\ & 46\\ & 46\\ & 12\\ & 29\\ & 36\\ & 46\\ & 56\\ & 47\\ & 2\\ & 8\\ & 13\\ & 50\\ & 46\\ & 56\\ & 47\\ & 2\\ & 8\\ & 13\\ & 30\\ & 7\\ & 41\\ & 45\\ & 49\\ \end{array}$	$\begin{array}{c} & & '' & '' \\ 44 & 56 \\ 45 & 11 \\ & 25 \\ & 39 \\ 51 \\ 46 & 15 \\ & 26 \\ & 36 \\ 46 \\ 15 \\ & 26 \\ & 36 \\ & 46 \\ & 47 \\ & 3 \\ & 47 \\ & 12 \\ & 20 \\ & 28 \\ & 36 \\ & 447 \\ & 32 \\ & 36 \\ & 411 \\ & 48 \\ & 23 \\ & 48 \\ & 27 \\ & 32 \\ & 36 \\ & 411 \\ & 44 \\ & 48 \\ \end{array}$	$\begin{array}{c} , & "\\ 45 & 56\\ 46 & 11\\ 25\\ 38\\ 38\\ 47 & 14\\ 25\\ 36\\ 45\\ 5\\ 5\\ 48\\ 3\\ 48 & 12\\ 20\\ 28\\ 35\\ 48\\ 12\\ 20\\ 28\\ 35\\ 48\\ 12\\ 20\\ 28\\ 35\\ 49\\ 1\\ 1^{7}\\ 1^{2}\\ 22\\ 49\\ 26\\ 31\\ 35\\ 40\\ 43\\ 47\\ \end{array}$	$\begin{array}{c} & & & \\$	$\begin{array}{c} & & \\ & 47 & 56 \\ 48 & 11 \\ & 25 \\ & 38 \\ 49 & 3 \\ 49 & 14 \\ & 25 \\ & 35 \\ & 45 \\ & 35 \\ & 45 \\ & 53 \\ & 50 \\ & 3 \\ & 50 \\ & 12 \\ & 19 \\ & 27 \\ & 35 \\ & 45 \\ & 51 \\ & 0 \\ & 11 \\ & 48 \\ & 50 \\ & 54 \\ & 51 \\ & 0 \\ & 6 \\ & 11 \\ & 11 \\ & 48 \\ & 50 \\ & 54 \\ & 51 \\ & 0 \\ & 6 \\ & 11 \\ & 11 \\ & 51 \\ & 25 \\ & 30 \\ & 34 \\ & 38 \\ & 42 \\ & 46 \\ \end{array}$	$\begin{array}{c} & & \\$	$\begin{array}{c} & & & & & \\ & & & \\$	$\begin{array}{c} & & & \\ & & & \\ & 50 & 551 & 100 \\ & & 24 \\ & & 37 \\ & 51 \\ & 52 & 33 \\ & 52 & 13 \\ & & 25 \\ & & 34 \\ & 44 \\ & 44 \\ & 44 \\ & 53 & 53 \\ & 53 & 10 \\ & & 18 \\ & 255 \\ & & 33 \\ & 33 \\ & 400 \\ & & 46 \\ & 53 & 53 \\ & 54 \\ & 44 \\ & & 9 \\ & & 14 \\ & & 19 \\ & 54 & 23 \\ & & 36 \\ & & 39 \\ & & 44 \end{array}$	$\begin{array}{c c} & " & 0 \\ 0 & 10 \\ 20 \\ 30 \\ 40 \\ 50 \\ 0 \\ 10 \\ 20 \\ 30 \\ 40 \\ 50 \\ 0 \\ 10 \\ 20 \\ 30 \\ 40 \\ 50 \\ 0 \\ 10 \\ 20 \\ 30 \\ 40 \\ 50 \\ 0 \\ 10 \\ 20 \\ 30 \\ 40 \\ 50 \\ 50 \\ 0 \\ 50 \\ 50 \\ 50 \\ 50$	$\begin{array}{c} " \\ 0 \\ 10 \\ 20 \\ 30 \\ 40 \\ 50 \\ \hline 0 \\ 10 \\ 20 \\ 30 \\ 40 \\ 50 \\ \hline 0 \\ 10 \\ 20 \\ 30 \\ 40 \\ 50 \\ \hline 0 \\ 10 \\ 20 \\ 30 \\ 40 \\ 40 \\ 49 \\ \end{array}$	$\begin{array}{ c c c c c c c c } & & & & & \\ & & & & & \\ & & & & & \\ & & & & & \\ & & & & & & & \\ & & & & & & \\ & & & & & & \\ & & & & & & \\ & & & & & & \\$	$\begin{array}{c} " & 4 \\ 14 \\ 24 \\ 34 \\ 44 \\ 44 \\ 44 \\ 44 \\ 44 \\ 4$	$\begin{array}{ c c c c c } & & & & & & & & & & & & & & & & & & &$	"	Add. 1' 1'' 2 1 3 2 2 5 3 6 4 7 4 8 5 5 9 5

TABLE 24.

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Correction of the Moon's Apparent Altitude for Parallax and Refraction, [Barometer 30 inches.—Fahrenheit's Thermometer 50°.]

	1								5.	Com	notio	n for		du of	Com
Moon's app. alt.			. E	Iorizonta	l paralla:	Χ.	*		onds ralla:		para	llax	-Add.		for minutes
	54/	55'	56'	57'	58'	59/	60′	61′	Sec	0″	2"	4″	6″	8''	of alt.
$ \begin{smallmatrix} \circ & , \\ 10 & 0 \\ 10 \\ 20 \\ 30 \\ 40 \\ 50 \end{smallmatrix} $	$\begin{array}{c}, & ''\\ 47 & 53 \\ 56 \\ 59 \\ 48 & 2 \\ 5 \\ 7 \end{array}$	$\begin{array}{c} ' & '' \\ 48 & 52 \\ 55 \\ 58 \\ 49 & 1 \\ 4 \\ 6 \end{array}$	$' " \\ 49 51 \\ 54 \\ 57 \\ 50 0 \\ 2 \\ 5$	$\begin{array}{c} & ' & '' \\ 50 & 50 \\ & 53 \\ & 56 \\ & 59 \\ 51 & 2 \\ & 4 \end{array}$	$\begin{array}{c} & & \\ & 51 & 50 \\ & 52 \\ & 55 \\ & 58 \\ 52 & 1 \\ & 4 \end{array}$	$ \begin{array}{c} ' & "\\ 52 & 48 \\ 51 \\ 55 \\ 57 \\ 53 & 0 \\ 2 \\ \end{array} $	$\begin{smallmatrix} & & & \\ & 53 & 48 \\ & 50 \\ & 54 \\ & 56 \\ & 59 \\ 54 & 1 \\ \end{smallmatrix}$	$\begin{smallmatrix} & & & \\ & 54 & 47 \\ & 50 \\ & 53 \\ & 55 \\ & 58 \\ 55 & 0 \end{smallmatrix}$			$\begin{array}{c} '' \\ 2 \\ 12 \\ 22 \\ 31 \\ 41 \\ 51 \end{array}$		'' 6 16 26 35 45 55	" 8 18 28 37 47 57	$\begin{array}{c} \text{Add.} \\ 1' \ 0'' \\ 2 \ 1 \\ 3 \ 1 \\ 4 \ 1 \\ 5 \ 2 \\ 6 \ 2 \end{array}$
$ \begin{array}{r} & 0 \\ \hline 11 & 0 \\ 10 \\ 20 \\ 30 \\ 40 \\ 50 \end{array} $	$ \begin{array}{r} 48 \ 10 \\ 12 \\ 15 \\ 17 \\ 19 \\ 21 \end{array} $	$ \begin{array}{r} 49 & 9 \\ 11 \\ 14 \\ 16 \\ 18 \\ 20 \\ \end{array} $	$ \begin{array}{r} 50 & 8 \\ 10 \\ 12 \\ 14 \\ 17 \\ 18 \end{array} $	$ \begin{array}{r} 51 & 7 \\ 9 \\ 12 \\ 13 \\ 15 \\ 17 \end{array} $	$ \begin{array}{r} 52 & 7 \\ 9 \\ 11 \\ 13 \\ 15 \\ 17 \end{array} $		$egin{array}{cccccccccccccccccccccccccccccccccccc$	$ \begin{array}{cccc} 55 & 3 \\ 5 \\ 7 \\ 9 \\ 11 \\ 13 \\ \end{array} $	$ \begin{array}{r} 0 \\ 10 \\ 20 \\ 30 \\ 40 \\ 50 \end{array} $	$ \begin{array}{r} 0 \\ 10 \\ 20 \\ 29 \\ 39 \\ 49 \\ 49 \end{array} $	$ \begin{array}{r} 2 \\ 12 \\ 22 \\ 31 \\ 41 \\ 51 \end{array} $	$ \begin{array}{r} 4 \\ 14 \\ 24 \\ 33 \\ 43 \\ 53 \end{array} $	$ \begin{array}{r} 6 \\ 16 \\ 26 \\ 35 \\ 45 \\ 55 \\ \end{array} $	8 18 28 37 47 57	$\begin{array}{ccc} 7 & 2 \\ 8 & 2 \\ 9 & 3 \end{array}$
$12 0 \\ 10 \\ 20 \\ 30 \\ 40 \\ 50 \\ 12$	$\begin{array}{r} 48 \ 22 \\ 24 \\ 26 \\ 27 \\ 28 \\ 29 \end{array}$	$\begin{array}{r} 49 \ 21 \\ 23 \\ 25 \\ 26 \\ 27 \\ 28 \end{array}$	$50 \ 19 \\ 21 \\ 23 \\ 24 \\ 25 \\ 26$	$51 \ 18 \\ 20 \\ 22 \\ 23 \\ 24 \\ 25$	$52 \ 17 \\ 19 \\ 21 \\ 22 \\ 23 \\ 24$	$53 \ 17 \\ 18 \\ 20 \\ 20 \\ 21 \\ 22$	$54 \ 15 \\ 16 \\ 18 \\ 19 \\ 20 \\ 21$	$55 \ 14 \ 15 \ 17 \ 18 \ 19 \ 20$	$\begin{array}{c} 0 \\ 10 \\ 20 \\ 30 \\ 40 \\ 50 \end{array}$	$\begin{array}{c} 0 \\ 10 \\ 20 \\ 29 \\ 39 \\ 49 \end{array}$	$2 \\ 12 \\ 22 \\ 31 \\ 41 \\ 51$	$\begin{array}{c} 4\\ 14\\ 24\\ 33\\ 43\\ 53\end{array}$	$\begin{array}{c} 6 \\ 16 \\ 25 \\ 35 \\ 45 \\ 55 \end{array}$	8 18 27 37 47 57	
$\begin{array}{ccc} 13 & 0 \\ & 10 \\ & 20 \\ & 30 \\ & 40 \\ & 50 \end{array}$	$\begin{array}{r} 48 & 30 \\ & 31 \\ & 32 \\ & 33 \\ & 34 \\ & 35 \end{array}$	$\begin{array}{ccc} 49 & 29 \\ & 30 \\ & 31 \\ & 32 \\ & 32 \\ & 33 \end{array}$	$50 \ 27 \ 28 \ 29 \ 30 \ 30 \ 31$	$51 \ 26 \\ 27 \\ 27 \\ 28 \\ 29 \\ 30$	$52 \ 25 \\ 26 \\ 26 \\ 27 \\ 28 \\ 28 \\ 28 \\ 28 \\ 28 \\ 28 \\ 28$	$53 \ 23 \ 24 \ 24 \ 25 \ 26 \ 26 \ 26$	$ \begin{array}{cccccccccccccccccccccccccccccccccccc$	$55 \ 20 \ 21 \ 21 \ 22 \ 22 \ 23 \ 23$	$\begin{array}{c} 0 \\ 10 \\ 20 \\ 30 \\ 40 \\ 50 \end{array}$	$\begin{array}{c} 0\\ 10\\ 19\\ 29\\ 39\\ 49\end{array}$	$2 \\ 12 \\ 21 \\ 31 \\ 41 \\ 51$	$ \begin{array}{r} 4 \\ 14 \\ 23 \\ 33 \\ 43 \\ 53 \end{array} $	$\begin{array}{c} 6 \\ 16 \\ 25 \\ 35 \\ 45 \\ 55 \end{array}$		$ \begin{array}{cccccccccccccccccccccccccccccccccccc$
$\begin{array}{ccc} 14 & 0 \\ & 10 \\ & 20 \\ & 30 \\ & 40 \\ & 50 \end{array}$	$\begin{array}{ccc} 48 & 35 \\ & 35 \\ & 36 \\ & 36 \\ & 36 \\ & 36 \\ & 36 \end{array}$	$\begin{array}{rrrr} 49 & 33 \\ & 34 \\ & 34 \\ & 34 \\ & 34 \\ & 34 \\ & 34 \end{array}$	$50 \ 31 \\ 32 \\ 32 \\ 32 \\ 32 \\ 32 \\ 32 \\ 32 \\$	$51 \ \ 30 \\ \ \ 30 \\ \ \ 30 \\ \ \ 30 \\ \ \ 30 \\ \ \ 30 \\ \ \ 30 \\ \ \ 30 \\ \ \ 30 \\ \ \ 30 \\ \ \ 30 \\ \ \ 30 \\ \ \ 30 \\ \ \ \ 30 \\ \ \ \ \ \ \ \ \ \ \ \ \ \ \ \ \ \ \ $	$52 \ 28 \\ 29 \\ 29 \\ 29 \\ 29 \\ 29 \\ 29 \\ 29 \\$	$53 \ 26 \\ 26 \\ 27 \\ 27 \\ 27 \\ 27 \\ 27 \\ 27 \\$	$54 \ 25 \ 25 \ 25 \ 25 \ 25 \ 25 \ 25 \ $	$\begin{bmatrix} 55 & 23 \\ & 23 \\ & 24 \\ & 23 \\ & 23 \\ & 23 \\ & 23 \end{bmatrix}$	$\begin{array}{c} 0\\ 10\\ 20\\ 30\\ 40\\ 50 \end{array}$	$\begin{array}{c} 0\\ 10\\ 19\\ 29\\ 39\\ 49\end{array}$	$2 \\ 12 \\ 21 \\ 31 \\ 41 \\ 51$	$ \begin{array}{r} 4 \\ 14 \\ 23 \\ 33 \\ 43 \\ 53 \end{array} $	$\begin{array}{c} 6 \\ 16 \\ 25 \\ 35 \\ 45 \\ 55 \end{array}$		$ \begin{array}{ccc} 7 & 0 \\ 8 & 0 \\ 9 & 0 \end{array} $
$ \begin{array}{r} 15 & 0 \\ 10 \\ 20 \\ 30 \\ 40 \\ 50 \end{array} $	$\begin{array}{r} 48 & 36 \\ & 36 \\ & 36 \\ & 36 \\ & 36 \\ & 35 \end{array}$	$\begin{array}{r} 49 & 35 \\ & 35 \\ & 35 \\ & 34 \\ & 34 \\ & 33 \end{array}$	$50 \ 33 \ 32 \ 32 \ 31 \ 31 \ 30$	$51 \ 31 \ 30 \ 30 \ 29 \ 29 \ 28$	$\begin{array}{r} 52 & 29 \\ 28 \\ 28 \\ 28 \\ 28 \\ 27 \\ 26 \end{array}$	$53 \ 27 \ 26 \ 26 \ 25 \ 25 \ 25 \ 24$	$54 \ 25 \ 24 \ 24 \ 23 \ 23 \ 21$	$55 \ 23 \\ 22 \\ 22 \\ 21 \\ 21 \\ 19$	$\begin{array}{c} 0 \\ 10 \\ 20 \\ 30 \\ 40 \\ 50 \end{array}$	0 10 19 29 39 49	$2 \\ 12 \\ 21 \\ 31 \\ 41 \\ 51$	$ \begin{array}{r} 4 \\ 14 \\ 23 \\ 38 \\ 43 \\ 53 \\ \end{array} $	$\begin{array}{c} 6 \\ 16 \\ 25 \\ 35 \\ 45 \\ 55 \end{array}$	8 18 27 37 47 57	
$ \begin{array}{ccc} 16 & 0 \\ 10 \\ 20 \\ 30 \\ 40 \\ 50 \end{array} $	$\begin{array}{r} 48 & 35 \\ & 34 \\ & 34 \\ & 33 \\ & 33 \\ & 32 \end{array}$	$\begin{array}{ccc} 49 & 32 \\ & 32 \\ & 32 \\ & 31 \\ & 31 \\ & 30 \end{array}$	$50 \ 29 \\ 29 \\ 29 \\ 28 \\ 28 \\ 27 \\ 27$	$51 \ 27 \\ 27 \\ 26 \\ 25 \\ 24$	$52 \ 25 \\ 25 \\ 25 \\ 24 \\ 23 \\ 22$	$53 \ 23 \\ 23 \\ 22 \\ 21 \\ 21 \\ 20$	$54 \ 20 \ 20 \ 20 \ 19 \ 18 \ 17$	$55 \ 18 \ 18 \ 17 \ 16 \ 16 \ 15$	$\begin{array}{c} 0 \\ 10 \\ 20 \\ 30 \\ 40 \\ 50 \end{array}$	$\begin{array}{c} 0 \\ 10 \\ 19 \\ 29 \\ 38 \\ 48 \end{array}$	$2 \\ 12 \\ 21 \\ 31 \\ 40 \\ 50$	$ \begin{array}{r} 4 \\ 13 \\ 23 \\ 33 \\ 42 \\ 52 \\ \end{array} $	$\begin{array}{c} 6 \\ 15 \\ 25 \\ 35 \\ 44 \\ 54 \end{array}$		Sub.
$ \begin{array}{rrrr} 17 & 0 \\ 10 \\ 20 \\ 30 \\ 40 \\ 50 \\ \end{array} $	$\begin{array}{r} 48 \ \ 31 \\ \ \ 30 \\ \ \ 28 \\ \ \ 27 \\ \ \ 26 \\ \ \ 26 \end{array}$	$\begin{array}{r} 49 \ 29 \\ 28 \\ 26 \\ 25 \\ 24 \\ 23 \end{array}$	$50 \ 26 \\ 25 \\ 23 \\ 22 \\ 21 \\ 20$	$51 \ 23 \\ 22 \\ 20 \\ 19 \\ 18 \\ 17$	$52 \ 21 \\ 20 \\ 18 \\ 17 \\ 16 \\ 15$	$53 \ 18 \ 17 \ 15 \ 14 \ 13 \ 12$	$54 \ 16 \ 14 \ 12 \ 11 \ 10 \ 9$	$55 \ 13 \ 12 \ 10 \ 9 \ 7 \ 6$	$\begin{array}{c} 0 \\ 10 \\ 20 \\ 30 \\ 40 \\ 50 \end{array}$	$\begin{array}{c} 0 \\ 10 \\ 19 \\ 29 \\ 38 \\ 48 \end{array}$	$2 \\ 12 \\ 21 \\ 31 \\ 40 \\ 50$	$ \begin{array}{r} 4 \\ 13 \\ 23 \\ 33 \\ 42 \\ 52 \end{array} $	$\begin{array}{c} 6 \\ 15 \\ 25 \\ 34 \\ 44 \\ 53 \end{array}$		$ \begin{array}{cccccccccccccccccccccccccccccccccccc$
$ \begin{array}{cccc} 18 & 0 \\ 10 \\ 20 \\ 30 \\ 40 \\ 50 \\ \end{array} $	$\begin{array}{ccc} 48 & 24 \\ & 23 \\ & 22 \\ & 21 \\ & 20 \\ & 18 \end{array}$	$\begin{array}{r} 49 \ 21 \\ 20 \\ 19 \\ 18 \\ 17 \\ 15 \end{array}$	$50 \ 18 \\ 17 \\ 16 \\ 15 \\ 14 \\ 12$	$51 \ 15 \\ 14 \\ 13 \\ 12 \\ 10 \\ 9$	$52 \ 13 \ 12 \ 11 \ 10 \ 8 \ 6$	$53 \ 10 \ 9 \ 8 \ 6 \ 4 \ 2$	$54 \ 7 \ 6 \ 5 \ 3 \ 1 \ 53 \ 59$	$55 \ 4 \ 3 \ 2 \ 0 \ 54 \ 58 \ 56$	$\begin{array}{c} 0 \\ 10 \\ 20 \\ 30 \\ 40 \\ 50 \end{array}$	$egin{array}{c} 0 \\ 10 \\ 19 \\ 29 \\ 38 \\ 48 \end{array}$	$2 \\ 11 \\ 21 \\ 30 \\ 40 \\ 50$	$ \begin{array}{r} 4 \\ 13 \\ 23 \\ 32 \\ 42 \\ 51 \end{array} $	$\begin{array}{c} 6\\ 15\\ 25\\ 34\\ 44\\ 53\end{array}$		$egin{array}{cccc} 7 & 1 \ 8 & 1 \ 9 & 1 \ \end{array}$
$ \begin{array}{rrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrr$	$\begin{array}{r} 48 \ 16 \\ 15 \\ 13 \\ 12 \\ 10 \\ 9 \end{array}$	$ \begin{array}{r} 49 \ 13 \\ 12 \\ 10 \\ 8 \\ 6 \\ 5 \end{array} $	$50 \ 10 \ 8 \ 6 \ 5 \ 3 \ 2$	$51 7 \\ 5 \\ 3 \\ 2 \\ 0 \\ 50 58$		$53 ext{ } 0 \\ 52 ext{ } 59 \\ 57 \\ 55 \\ 53 \\ 51 \\ 1 \\ 1 \\ 1 \\ 1 \\ 1 \\ 1 \\ 1 \\ 1 \\ $	53 57 55 53 51 49 48	54 55 53 51 49 47 45	$\begin{array}{c} 0 \\ 10 \\ 20 \\ 30 \\ 40 \\ 50 \end{array}$	$ \begin{array}{c} 0 \\ 10 \\ 19 \\ 29 \\ 38 \\ 48 \end{array} $	$2 \\ 11 \\ 21 \\ 30 \\ 40 \\ 50$				

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TABLE 24.

Correction of the Moon's Apparent Altitude for Parallax and Refraction.

[Barometer 30 inches.--Fahrenheit's Thermometer 50°.]

Moon's			н	lorizontal	parallax	τ.			onds of allax.	Corr	ection paral	for a	secone -Add,	ls of	Corr. for minutes
	54'	55'	56'	57'	58′	59'	60′	61'	Seco	0″	2″	4″	6″	8″	of alt.
$ \begin{smallmatrix} \circ & ' \\ 20 & 0 \\ 10 \\ 20 \\ 30 \\ 40 \\ 50 \end{smallmatrix} $	${\begin{array}{*{20}c} {}' & {}'' \\ 48 & 6 \\ 5 \\ 3 \\ 1 \\ 59 \\ 57 \end{array}}$	$ \begin{array}{c} ' & " \\ 49 & 3 \\ 2 \\ 0 \\ $	$\begin{array}{c} & "\\ 49 & 59\\ 58\\ 56\\ 53\\ 52\\ 50\end{array}$	$\begin{array}{c} ' & '' \\ 50 & 56 \\ 55 \\ 52 \\ 50 \\ 48 \\ 46 \end{array}$	$\begin{array}{c} , & "\\ 51 & 52 \\ 51 \\ 49 \\ 46 \\ 44 \\ 42 \end{array}$	$ \begin{array}{c} ' & " \\ 52 & 49 \\ 47 \\ 45 \\ 42 \\ 40. \\ 38 \\ 38 $	$ \begin{array}{cccc} $	$54 \ 42 \\ 40 \\ 37 \\ 35 \\ 33 \\ 30 \\$	" 10 20 30 40 50	" 9 19 28 38 47	${"}{2}{11}{21}{30}{39}{49}$		${}''_{6} \\ 15 \\ 24 \\ 34 \\ 43 \\ 53$	"81726364554	$\begin{array}{c} \text{Sub.} \\ 1' \ 0'' \\ 2 \ 0 \\ 3 \ 1 \\ 4 \ 1 \\ 5 \ 1 \\ 6 \ 1 \end{array}$
$\begin{array}{ccc} 21 & 0 \\ 10 \\ 20 \\ 30 \\ 40 \\ 50 \end{array}$	$\begin{array}{r} 47 & 55 \\ 53 \\ 51 \\ 48 \\ 46 \\ 43 \end{array}$	$ \begin{array}{r} 48 51 \\ 49 \\ 47 \\ 44 \\ 42 \\ 39 \\ \end{array} $	$ \begin{array}{r} 49 & 47 \\ & 45 \\ & 43 \\ & 40 \\ & 38 \\ & 35 \\ \end{array} $	$ \begin{array}{r} 50 & 43 \\ 41 \\ 39 \\ 36 \\ 33 \\ 31 \end{array} $	$51 \ 39 \\ 37 \\ 35 \\ 32 \\ 29 \\ 27 \\ 27$	$52 \ 35 \ 33 \ 31 \ 28 \ 25 \ 22$	$53 \ 31 \\ 29 \\ 27 \\ 24 \\ 21 \\ 18$	54 28 26 23 20 17 14	$ \begin{array}{r} 0 \\ 10 \\ 20 \\ 30 \\ 40 \\ 50 \end{array} $	$0 \\ 9 \\ 19 \\ 28 \\ 37 \\ 47$	$ \begin{array}{r} 2 \\ 11 \\ 21 \\ 30 \\ 39 \\ 49 \\ 49 \end{array} $	$\begin{array}{r} 4 \\ 13 \\ 22 \\ 32 \\ 41 \\ 50 \end{array}$	$\begin{array}{r} 6 \\ 15 \\ 24 \\ 34 \\ 43 \\ 52 \end{array}$	$7 \\ 17 \\ 26 \\ 35 \\ 45 \\ 54$	$egin{array}{cccc} 7 & 1 \ 8 & 1 \ 9 & 2 \ \end{array}$
$22 0 \\ 10 \\ 20 \\ 30 \\ 40 \\ 50 \\ 10 \\ 10 \\ 10 \\ 10 \\ 10 \\ 10 \\ 1$	$ \begin{array}{r} 47 & 42 \\ & 40 \\ & 37 \\ & 34 \\ & 32 \\ & 29 \\ \end{array} $	$\begin{array}{cccc} 48 & 37 \\ & 35 \\ & 32 \\ & 30 \\ & 27 \\ & 25 \end{array}$	$\begin{array}{r} 49 \ 33 \\ 30 \\ 27 \\ 25 \\ 22 \\ 20 \end{array}$	$50 \ 29 \\ 26 \\ 23 \\ 20 \\ 18 \\ 15 \\ 15 \\ 15 \\ 15 \\ 15 \\ 15 \\ 15$	$51 \ 25 \\ 22 \\ 19 \\ 16 \\ 13 \\ 11$	$ \begin{array}{r} 52 & 20 \\ 17 \\ 14 \\ 11 \\ 9 \\ 6 \\ \hline 10 \\ 10 \\ 10 \\ 10 \\ 10 \\ 10 \\ 10 \\ 10 \\$	$ \begin{bmatrix} 53 & 16 \\ 13 \\ 10 \\ 7 \\ 4 \\ 1 \end{bmatrix} $	$54\ 11\ 8\ 5\ 3\ 0\ 53\ 57$	$ \begin{array}{c} 0 \\ 10 \\ 20 \\ 30 \\ 40 \\ 50 \\ \end{array} $	$ \begin{array}{r} 0 \\ 9 \\ 19 \\ 28 \\ 37 \\ 46 \\ \end{array} $	$ \begin{array}{c} 2 \\ 11 \\ 20 \\ 30 \\ 39 \\ 48 \\ \end{array} $	$\begin{array}{r} 4\\ 13\\ 22\\ 31\\ 41\\ 50\end{array}$	$ \begin{array}{r} 6 \\ 15 \\ 24 \\ 33 \\ 43 \\ 52 \\ \end{array} $	$7 \\ 17 \\ 26 \\ 35 \\ 45 \\ 54 $	
23 0 10 20 30 40 50	$ \begin{array}{r} 47 & 27 \\ & 25 \\ & 22 \\ & 19 \\ & 16 \\ & 13 \\ \end{array} $	$ \begin{array}{r} 48 & 22 \\ & 20 \\ & 17 \\ & 14 \\ & 11 \\ & 8 \\ \end{array} $	$\begin{array}{r} 49 \ 17 \\ 15 \\ 12 \\ 9 \\ 6 \\ 3 \end{array}$	$ \begin{array}{r} 50 & 13 \\ & 10 \\ & 7 \\ & 4 \\ & 1 \\ & 49 & 58 \\ \end{array} $	$51 ext{ } 8 ext{ } 5 ext{ } 2 ext{ } 0 ext{ } 50 ext{ } 57 ext{ } 54 ext{ } $	$52 \ 3 \ 0 \ 51 \ 57 \ 54 \ 51 \ 48 \ 48 \ 68 \ 51 \ 51 \ 51 \ 51 \ 51 \ 51 \ 51 \ 5$	52 58 55 52 49 46 43	5354 51 48 45 42 38	$ \begin{array}{c} 0 \\ 10 \\ 20 \\ 30 \\ 40 \\ 50 \end{array} $	$0 \\ 9 \\ 18 \\ 28 \\ 37 \\ 46$	$ \begin{array}{c} 2 \\ 11 \\ 20 \\ 29 \\ 39 \\ 48 \end{array} $	$ \begin{array}{r} 4 \\ 13 \\ 22 \\ 31 \\ 40 \\ 50 \end{array} $	$ \begin{array}{r} 6 \\ 15 \\ 24 \\ 33 \\ 42 \\ 51 \\ \end{array} $	$7 \\ 17 \\ 26 \\ 35 \\ 44 \\ 53$	-
24 0 10 20 30 40 50	$ \begin{array}{r} 47 & 10 \\ & 8 \\ & 5 \\ & 2 \\ 46 & 59 \\ & 56 \\ \end{array} $	$ \begin{array}{r} 48 & 5 \\ 3 \\ 0 \\ 47 & 57 \\ 54 \\ 51 \\ \end{array} $	$\begin{array}{rrrr} 49 & 0 \\ 48 & 57 \\ & 54 \\ & 51 \\ & 48 \\ & 45 \end{array}$	$ \begin{array}{r} 49 55 \\ 52 \\ 49 \\ 46 \\ 43 \\ 40 \\ \end{array} $	50 50 47 44 41 38 35	$51 \ 45 \ 42 \ 39 \ 35 \ 32 \ 29$	$52 \ 40 \\ 37 \\ 33 \\ 30 \\ 27 \\ 23$	53 35 32 28 24 21 18	$\begin{array}{c} 0 \\ 10 \\ 20 \\ 30 \\ 40 \\ 50 \end{array}$	$0 \\ 9 \\ 18 \\ 27 \\ 36 \\ 46$	$ \begin{array}{c} 2 \\ 11 \\ 20 \\ 29 \\ 38 \\ 47 \end{array} $	$ \begin{array}{r} 4 \\ 13 \\ 22 \\ 30 \\ 40 \\ 49 \end{array} $	$5 \\ 15 \\ 24 \\ 32 \\ 42 \\ 51$	$7\\16\\26\\34\\44\\53$	$ \begin{array}{cccccccccccccccccccccccccccccccccccc$
$egin{array}{ccc} 25 & 0 \ 10 \ 20 \ 30 \ 40 \ 50 \end{array}$	$\begin{array}{cccc} 46 & 53 \\ & 50 \\ & 46 \\ & 43 \\ & 40 \\ & 37 \end{array}$	$\begin{array}{r} 47 \ 48 \\ 45 \\ 41 \\ 38 \\ 34 \\ 31 \end{array}$	$\begin{array}{ccc} 48 & 42 \\ & 39 \\ & 35 \\ & 32 \\ & 28 \\ & 25 \end{array}$	$\begin{array}{ccc} 49 & 37 \\ & 33 \\ & 29 \\ & 26 \\ & 23 \\ & 19 \end{array}$	$50 \ 31 \\ 28 \\ 24 \\ 20 \\ 17 \\ 14$	$51 \ 26 \ 22 \ 18 \ 14 \ 11 \ 7$	$52 \ 20 \ 16 \ 12 \ 8 \ 5 \ 1$	$53\ 14\ 10\ 6\ 3\ 52\ 59\ 56$	$\begin{array}{c} 0\\ 10\\ 20\\ 30\\ 40\\ 50 \end{array}$	0 9 18 27 36 45	$ \begin{array}{r} 2 \\ 11 \\ 20 \\ 29 \\ 38 \\ 47 \end{array} $	$\begin{array}{c} 4 \\ 13 \\ 22 \\ 31 \\ 40 \\ 49 \end{array}$	$5 \\ 14 \\ 24 \\ 33 \\ 42 \\ 51$	$7 \\ 16 \\ 25 \\ 34 \\ 43 \\ 52$	$ \begin{array}{ccc} 7 & 2 \\ 8 & 2 \\ 9 & 3 \end{array} $
$26 & 0 \\ 10 \\ 20 \\ 30 \\ 40 \\ 50 \\ \hline$	$\begin{array}{r} 46 & 34 \\ & 31 \\ & 27 \\ & 24 \\ & 20 \\ & 17 \end{array}$	$\begin{array}{r} 47 \ 28 \\ 25 \\ 21 \\ 18 \\ 14 \\ 11 \end{array}$	$\begin{array}{r} 48 \ 22 \\ 19 \\ 15 \\ 12 \\ 8 \\ 4 \end{array}$	$ \begin{array}{r} 49 & 16 \\ 13 \\ 9 \\ 6 \\ 2 \\ 48 & 58 \end{array} $	$50 \ 10 \ 7 \ 3 \ 49 \ 59 \ 55 \ 51$	$51 4 \\ 1 \\ 50 57 \\ 53 \\ 49 \\ 45 \\ 1 \\ 1 \\ 1 \\ 1 \\ 1 \\ 1 \\ 1 \\ 1 \\ 1 \\ $	51 58 54 50 46 42 38	$5252 \\ 48 \\ 44 \\ 40 \\ 36 \\ 32$	$ \begin{array}{r} 0 \\ 10 \\ 20 \\ 30 \\ 40 \\ 50 \\ \end{array} $	$ \begin{array}{c} 0 \\ 9 \\ 18 \\ 27 \\ 36 \\ 45 \end{array} $	$2 \\ 11 \\ 20 \\ 29 \\ 38 \\ 47$	$\begin{array}{c} 4\\ 13\\ 22\\ 31\\ 39\\ 48\end{array}$	$5 \\ 14 \\ 23 \\ 32 \\ 41 \\ 50$	$7 \\ 16 \\ 25 \\ 34 \\ 43 \\ 52$	
27 0 10 20 30 40 50	$egin{array}{cccc} 46 & 14 & & \ 11 & & 7 & \ 3 & 45 & 59 & \ 56 & & 56 \end{array}$	$egin{array}{ccc} 47 & 7 & & & \ & 4 & & \ & 1 & \ 46 & 57 & & \ & 53 & \ & 49 & \ \end{array}$	$ \begin{array}{r} 48 & 1 \\ 47 & 58 \\ 54 \\ 50 \\ 46 \\ 42 \\ \end{array} $	$ \begin{array}{r} 48 54 \\ 51 \\ 47 \\ 43 \\ 39 \\ 35 \\ \end{array} $	$ \begin{array}{r} 49 \ 48 \\ 44 \\ 40 \\ 36 \\ 32 \\ 28 \\ \end{array} $	$50 \ 41 \\ 37 \\ 33 \\ 29 \\ 25 \\ 21 \\$	$51 \ 35 \ 31 \ 27 \ 23 \ 19 \ 15$	5228 24 20 16 12 8	$ \begin{array}{r} 0 \\ 10 \\ 20 \\ 30 \\ 40 \\ 50 \\ \end{array} $	$0 \\ 9 \\ 18 \\ 27 \\ 36 \\ 44$	$2 \\ 11 \\ 20 \\ 28 \\ 37 \\ 46$	$ \begin{array}{r} 4 \\ 12 \\ 21 \\ 30 \\ 39 \\ 48 \\ \end{array} $	$5 \\ 14 \\ 23 \\ 32 \\ 41 \\ 50$	$7 \\ 16 \\ 25 \\ 34 \\ 43 \\ 52$	$ \begin{array}{cccccccccccccccccccccccccccccccccccc$
$ \begin{array}{r} 28 & 0 \\ 10 \\ 20 \\ 30 \\ 40 \\ 50 \end{array} $	$ \begin{array}{r} 45 53 \\ 49 \\ 45 \\ 41 \\ 37 \\ 34 \end{array} $	$\begin{array}{c} 46 & 46 \\ & 42 \\ & 38 \\ & 34 \\ & 30 \\ & 26 \end{array}$	$\begin{array}{r} 47 & 38 \\ & 34 \\ & 30 \\ & 26 \\ & 23 \\ & 19 \end{array}$	$\begin{array}{r} 48 \ \ 31 \\ 27 \\ 23 \\ 19 \\ 15 \\ 11 \end{array}$	$\begin{array}{c} 49 \ 24 \\ 20 \\ 16 \\ 12 \\ 8 \\ 4 \end{array}$	$50 \ 17 \ 13 \ 9 \ 5 \ 1 \ 1 \ 49 \ 57$	$51 \ 11 \\ 6 \\ 2 \\ 50 \ 57 \\ 54 \\ 49$	$52 \ 4$ $51 \ 59$ 55 50 46 42	$\begin{array}{c} 0 \\ 10 \\ 20 \\ 30 \\ 40 \\ 50 \end{array}$	$0\\9\\18\\26\\35\\44$	$2 \\ 11 \\ 19 \\ 28 \\ 37 \\ 46$	$4 \\ 12 \\ 21 \\ 30 \\ 39 \\ 48$	$5 \\ 14 \\ 23 \\ 32 \\ 41 \\ 49$	$7 \\ 16 \\ 25 \\ 33 \\ 42 \\ 51$	7 3 8 3 9 3
$29 0 \\ 10 \\ 20 \\ 30 \\ 40 \\ 50$	$\begin{array}{r} 45 \ \ 30 \\ 26 \\ 22 \\ 18 \\ 14 \\ 11 \end{array}$	$\begin{array}{c} 46 \ 22 \\ 18 \\ 14 \\ 10 \\ 6 \\ 3 \end{array}$	$\begin{array}{r} 47 \ 15 \\ 11 \\ 7 \\ 2 \\ 46 \ 58 \\ 55 \end{array}$	$\begin{array}{r} 48 & 7 \\ & 3 \\ 47 & 59 \\ & 55 \\ & 51 \\ & 47 \end{array}$	$\begin{array}{r} 49 & 0 \\ 48 & 56 \\ 52 \\ 47 \\ 43 \\ 39 \end{array}$	$ \begin{array}{r} 49 \ 53 \\ 49 \\ 49 \\ 44 \\ 39 \\ 35 \\ 31 \\ \end{array} $	$50 \ 45 \ 40 \ 36 \ 31 \ 27 \ 23$	$51 \ 38 \ 34 \ 29 \ 24 \ 20 \ 15$	$ \begin{array}{r} 0 \\ 10 \\ 20 \\ 30 \\ 40 \\ 50 \\ \end{array} $	$ \begin{array}{r} 0 \\ 9 \\ 17 \\ 26 \\ 35 \\ 44 \end{array} $	$ \begin{array}{r} 2 \\ 10 \\ 19 \\ 28 \\ 37 \\ 45 \end{array} $	$ \begin{array}{r} 4 \\ 12 \\ 21 \\ $	$5 \\ 14 \\ 23 \\ 31 \\ 40 \\ 49$	$7 \\ 16 \\ 24 \\ 33 \\ 42 \\ 51$	

TABLE 24.

Correction of the Moon's Apparent Altitude for Parallax and Refraction. [Barometer 30 inches.—Fahrenheit's Thermometer 50°.]

									1 -	1				1	1
Moon's app. alt			н	orizontal	parallax				conds o rallax.	Cori	paral	n for s lax.—	econd Add,	lsof	Corr. for minutes
-P.P. OIL	54'	55'	56'	57'	58/	59'	60′	61'	Sec	0″	2″	4 ″	6″	8″	of alt.
	$\begin{smallmatrix} ' & '' \\ 45 & 6 \\ 2 \\ 44 & 58 \\ 54 \\ 50 \\ 45 \\ \end{smallmatrix}$	$\begin{array}{c} & ' & '' \\ 45 & 57 \\ & 54 \\ & 50 \\ & 46 \\ & 42 \\ & 38 \end{array}$	$\begin{array}{c} & & \\ & 46 \\ & 46 \\ & 42 \\ & 37 \\ & 33 \\ & 29 \end{array}$	$\begin{array}{c} & ' & '' \\ 47 & 42 \\ & 38 \\ & 34 \\ & 29 \\ & 25 \\ & 21 \end{array}$	$, "\\48 34\\30\\26\\21\\17\\12$	$ \begin{array}{c} ' & " \\ 49 & 26 \\ 22 \\ 18 \\ 13 \\ 8 \\ 4 $	$ \begin{array}{c} ' & '' \\ 50 & 18 \\ 13 \\ 9 \\ 4 \\ 0 \\ 49 & 55 \\ \end{array} $	$51 \ 10 \\ 6 \\ 1 \\ 50 \ 56 \\ 52 \\ 47$	${ { $			${ { 3 \\ 12 \\ 21 \\ 29 \\ 38 \\ 47 } }$			$\begin{array}{c} \text{Sub.} \\ 1' \ 0'' \\ 2 \ 1 \\ 3 \ 1 \\ 4 \ 2 \\ 5 \ 2 \\ 6 \ 3 \end{array}$
$ \begin{array}{r} 31 & 0 \\ 10 \\ 20 \\ 30 \\ 40 \\ 50 \end{array} $	$ \begin{array}{r} 41 \\ 44 \\ 41 \\ 37 \\ 33 \\ 28 \\ 24 \\ 20 \end{array} $	$ \begin{array}{r} 33 \\ 45 33 \\ 29 \\ 24 \\ 20 \\ 16 \\ . 11 \end{array} $	$ \begin{array}{r} 23 \\ \overline{46 \ 24} \\ 20 \\ 15 \\ 11 \\ 7 \\ 2 \end{array} $	$ \begin{array}{r} 21 \\ 47 & 16 \\ 12 \\ 7 \\ 2 \\ 46 & 58 \\ 53 \\ \end{array} $	$ \begin{array}{r} 12 \\ 48 & 7 \\ 2 \\ 47 & 58 \\ 54 \\ 49 \\ 44 \end{array} $	$ \begin{array}{r} 48 59 \\ 54 \\ 49 \\ 45 \\ 40 \\ 35 \end{array} $	$ \begin{array}{r} 49 50 \\ 45 \\ 40 \\ 36 \\ 31 \\ 26 \\ \hline \end{array} $	$50 \ 42 \ 37 \ 32 \ 27 \ 22 \ 17$	$ \begin{array}{r} 0 \\ 10 \\ 20 \\ 30 \\ 40 \\ 50 \end{array} $	$ \begin{array}{c} 0 \\ 9 \\ 17 \\ 26 \\ 34 \\ 43 \end{array} $	$ \begin{array}{r} 2 \\ 10 \\ 19 \\ 27 \\ 36 \\ 44 \end{array} $	$ \begin{array}{r} 3 \\ 12 \\ 21 \\ 29 \\ 38 \\ 46 \end{array} $	$5 \\ 14 \\ 22 \\ 31 \\ 39 \\ 48$	$7 \\ 15 \\ 24 \\ 32 \\ 41 \\ 50$	$ \begin{array}{c} 7 & 3 \\ 8 & 4 \\ 9 & 4 \end{array} $
$\begin{array}{cccc} 32 & 0 \\ 10 \\ 20 \\ 30 \\ 40 \\ 50 \end{array}$	${ \begin{array}{c} 44 & 15 \\ & 11 \\ & 7 \\ & 3 \\ 43 & 58 \\ & 54 \end{array} } }$	$\begin{array}{rrrr} 45 & 7 \\ & 3 \\ 44 & 58 \\ & 53 \\ & 48 \\ & 44 \\ \end{array}$	$\begin{array}{r} 45 \ 58 \\ 53 \\ 48 \\ 44 \\ 39 \\ 34 \end{array}$	$\begin{array}{r} 46 \ \overline{49} \\ 44 \\ 39 \\ 34 \\ 29 \\ 24 \end{array}$	$\begin{array}{r} 47 \ 40 \\ 35 \\ 30 \\ 25 \\ 20 \\ 15 \end{array}$	$\begin{array}{r} 48 \ 31 \\ 26 \\ 21 \\ 16 \\ 11 \\ 6 \\ \hline \end{array}$	$\begin{array}{r} 49 \ 22 \\ 17 \\ 11 \\ 6 \\ 1 \\ 48 \ 56 \end{array}$	$50 \ 13 \\ 8 \\ 2 \\ 49 \ 57 \\ 52 \\ 47 \\ 47 \\ 10 \\ 10 \\ 10 \\ 10 \\ 10 \\ 10 \\ 10 \\ 1$	$\begin{array}{c} 0\\ 10\\ 20\\ 30\\ 40\\ 50\end{array}$	$ \begin{array}{c} 0 \\ 8 \\ 17 \\ 25 \\ 34 \\ 42 \\ \hline 2 \\ \hline 2 \\ 3 \\ 4 \\ \hline 2 \\ \hline 2 \\ 3 \\ 4 \\ \hline 2 \\ \hline 2 \\ 3 \\ 4 \\ \hline 2 \\ \hline 2 \\ 3 \\ 4 \\ 2 \\ \hline 2 \\ 3 \\ 3 \\ 4 \\ 2 \\ \hline 2 \\ 3 \\ 3 \\ 4 \\ 2 \\ \hline 3 \\ 3 $	$ \begin{array}{c} 2 \\ 10 \\ 19 \\ 27 \\ 35 \\ 44 \end{array} $	$ \begin{array}{r} 3 \\ 12 \\ 20 \\ 29 \\ 37 \\ 46 \\ \hline 26 \\ 37 \\ 46 \\ \hline 37 \\ 46 \\ 37 \\ 46 \\ 37 \\ 46 \\ 37 \\ 46 \\ 37 \\ 46 \\ 37 \\ 46 \\ 37 \\ 37 \\ 46 \\ 37 \\ 37 \\ 46 \\ 37 \\ 37 \\ 37 \\ 37 \\ 46 \\ 37 \\ 3$	$5 \\ 14 \\ 22 \\ 30 \\ 39 \\ 47$	$7 \\ 15 \\ 24 \\ 32 \\ 41 \\ 49 $	
$egin{array}{cccc} 33 & 0 & 10 & \ 20 & 30 & \ 40 & \ 50 & \ \end{array}$	$\begin{array}{r} 43 \ 48 \\ 44 \\ 40 \\ 35 \\ 30 \\ 25 \end{array}$	$\begin{array}{r} 44 & 39 \\ & 34 \\ & 30 \\ & 25 \\ & 20 \\ & 15 \end{array}$	$\begin{array}{r} 45 & 29 \\ & 25 \\ & 20 \\ & 15 \\ & 10 \\ & 5 \end{array}$	$\begin{array}{r} 46 \ 19 \\ 15 \\ 10 \\ 5 \\ 0 \\ 45 \ 55 \end{array}$	$\begin{array}{r} 47 \ 10 \\ 5 \\ 0 \\ 46 \ 55 \\ 50 \\ 45 \end{array}$	$\begin{array}{rrrr} 48 & 0 \\ 47 & 55 \\ & 50 \\ & 45 \\ & 40 \\ & 35 \end{array}$	$\begin{array}{rrrr} 48 & 50 \\ & 45 \\ & 40 \\ & 35 \\ & 30 \\ & 24 \end{array}$	$\begin{array}{r} 49 \ 41 \\ 36 \\ 31 \\ 25 \\ 20 \\ 14 \end{array}$	$\begin{array}{c} 0\\ 10\\ 20\\ 30\\ 40\\ 50\end{array}$	$ \begin{array}{c} 0 \\ 8 \\ 17 \\ 25 \\ 33 \\ 42 \end{array} $	$ \begin{array}{c} 2 \\ 10 \\ 18 \\ 27 \\ 35 \\ 43 \end{array} $	$ \begin{array}{r} 3 \\ 12 \\ 20 \\ 28 \\ 37 \\ 45 \end{array} $	$5 \\ 13 \\ 22 \\ 30 \\ 38 \\ 47$	$ \begin{array}{r} 7 \\ 15 \\ 23 \\ 32 \\ 40 \\ 48 \\ 48 \end{array} $	$ \begin{array}{cccccccccccccccccccccccccccccccccccc$
$egin{array}{cccc} 34 & 0 & \ 10 & \ 20 & \ 30 & \ 40 & \ 50 & \ \end{array}$	$\begin{array}{c} 43 \ 21 \\ 16 \\ 11 \\ 6 \\ 1 \\ 42 \ 56 \end{array}$	$\begin{array}{c} 44 \ 11 \\ 6 \\ 1 \\ 43 \ 56 \\ 51 \\ 46 \end{array}$	$\begin{array}{rrrr} 45 & 0 \\ 44 & 55 \\ & 50 \\ & 45 \\ & 40 \\ & 35 \end{array}$	$\begin{array}{r} 45 \ 50 \\ 45 \\ 40 \\ 35 \\ 30 \\ 24 \end{array}$	$\begin{array}{r} 46 \ 40 \\ 34 \\ 29 \\ 24 \\ 19 \\ 14 \end{array}$	$\begin{array}{c} 47 \ 30 \\ 24 \\ 19 \\ 13 \\ 8 \\ 3 \end{array}$	$\begin{array}{r} 48 \ 19 \\ 14 \\ 9 \\ 3 \\ 47 \ 58 \\ 52 \end{array}$	$\begin{array}{rrrr} 49 & 9 \\ & 3 \\ 48 & 58 \\ & 52 \\ & 47 \\ & 42 \end{array}$	$\begin{array}{c} 0 \\ 10 \\ 20 \\ 30 \\ 40 \\ 50 \end{array}$	$ \begin{array}{r} 0 \\ 8 \\ 17 \\ 25 \\ 33 \\ 41 \end{array} $	$ \begin{array}{c} 2 \\ 10 \\ 18 \\ 26 \\ 35 \\ 43 \end{array} $	$ \begin{array}{r} 3 \\ 12 \\ 20 \\ 28 \\ 36 \\ 44 \end{array} $	$5 \\ 13 \\ 21 \\ 30 \\ 38 \\ 46$	$ \begin{array}{r} 7 \\ 15 \\ 23 \\ 31 \\ 40 \\ 48 \\ 48 \end{array} $	$ \begin{array}{r} 7 & 3 \\ 8 & 4 \\ 9 & 4 \end{array} $
$35 ext{ 0} \\ 10 \\ 20 \\ 30 \\ 40 \\ 50 \\ \hline$	$\begin{array}{r} 42 \ 52 \\ 47 \\ 42 \\ 37 \\ 32 \\ 27 \end{array}$	$\begin{array}{r} 43 \ 41 \\ 36 \\ 31 \\ 26 \\ 21 \\ 16 \end{array}$	$\begin{array}{r} 44 \ 30 \\ 25 \\ 20 \\ 15 \\ 10 \\ 4 \end{array}$	$\begin{array}{r} 45 \ 19 \\ 14 \\ 9 \\ 3 \\ 44 \ 58 \\ 53 \\ \end{array}$	$\begin{array}{r} 46 & 9 \\ & 3 \\ 45 & 58 \\ & 52 \\ & 47 \\ & 42 \end{array}$	$\begin{array}{r} 46 \ 58 \\ 52 \\ 47 \\ 41 \\ 36 \\ 30 \end{array}$	$\begin{array}{r} 47 & 47 \\ & 41 \\ & 36 \\ & 30 \\ & 25 \\ & 19 \end{array}$	$ \begin{array}{r} 48 & 36 \\ & 30 \\ & 25 \\ & 19 \\ & 14 \\ & 8 \\ \end{array} $	$ \begin{array}{c} 0 \\ 10 \\ 20 \\ 30 \\ 40 \\ 50 \\ \end{array} $	$ \begin{array}{c} 0 \\ 8 \\ 16 \\ 24 \\ 33 \\ 41 \\ \hline $	$ \begin{array}{c} 2 \\ 10 \\ 18 \\ 26 \\ 34 \\ 42 \\ \hline 2 \overline{} $	$ \begin{array}{r} 3 \\ 11 \\ 20 \\ 28 \\ 36 \\ 44 \\ \hline 24 \\ 36 \\ 44 \\ \hline 20 \\ 36 \\ 44 \\ \hline 36 \\ 36 \\ 44 \\ \hline 36 \\ 44 \\ 36 \\ 36 \\ 44 \\ 36 \\ 36 \\ 44 \\ 36 \\ 36 \\ 36 \\ 44 \\ 36$	$5 \\ 13 \\ 21 \\ 29 \\ 38 \\ 46 \\$	$ \begin{array}{r} 7 \\ 15 \\ 23 \\ 31 \\ 39 \\ 47 \\ \hline 7 \end{array} $	
$ \begin{array}{r} 36 & 0 \\ 10 \\ 20 \\ 30 \\ 40 \\ 50 \\ \hline \end{array} $	$\begin{array}{r} 42 \ 22 \\ 17 \\ 12 \\ 7 \\ 1 \\ 41 \ 56 \end{array}$	$\begin{array}{c} 43 \ 11 \\ 5 \\ 0 \\ 42 \ 55 \\ 50 \\ 44 \\ \hline \end{array}$	$ \begin{array}{r} 43 59 \\ 54 \\ 48 \\ 43 \\ 38 \\ 32 \\ \hline 1000 $	$ \begin{array}{r} 44 \ 48 \\ 42 \\ 37 \\ 31 \\ 26 \\ 20 \\ \end{array} $	$ \begin{array}{r} 45 & 37 \\ & 31 \\ & 25 \\ & 20 \\ & 14 \\ & 8 \\ \end{array} $	$ \begin{array}{r} 46 & 25 \\ & 19 \\ 14 \\ 8 \\ 2 \\ 45 & 56 \\ \end{array} $	$ \begin{array}{r} 47 & 14 \\ $	$ \begin{array}{r} 48 & 2 \\ 47 & 56 \\ 50 \\ 44 \\ 39 \\ 33 \\ 47 \\ 47 \\ 47 \\ 47 \\ 47 \\ 47 \\ 47 \\ 47$	$ \begin{array}{c} 0 \\ 10 \\ 20 \\ 30 \\ 40 \\ 50 \\ \hline \end{array} $	$ \begin{array}{r} 0 \\ 8 \\ 16 \\ 24 \\ 32 \\ 40 \\ \hline $	$ \begin{array}{c c} 2 \\ 10 \\ 18 \\ 26 \\ 34 \\ 42 \\ \hline 2 \\ \hline 2 \\ 3 \\ 4 \\ 2 \\ \hline 2 \\ 3 \\ 4 \\ 2 \\ \hline 2 \\ 3 \\ 4 \\ 2 \\ \hline 2 \\ 3 \\ 4 \\ 2 \\ \hline 2 \\ 3 \\ 4 \\ 2 \\ \hline 2 \\ 3 \\ 4 \\ 2 \\ \hline 2 \\ 3 \\ 4 \\ 2 \\ \hline 2 \\ 3 \\ 4 \\ 2 \\ \hline 2 \\ 3 \\ 3 \\ 4 \\ 2 \\ \hline 2 \\ 3 \\ 3 \\ 4 \\ 2 \\ \hline 2 \\ 3 \\ 4 \\ 3 \\ $	$ \begin{array}{r} 3 \\ 11 \\ 19 \\ 27 \\ 35 \\ 43 \\ \hline 2 7 35 43 \hline 3 3 3 3 3 $	$5 \\ 13 \\ 21 \\ 29 \\ 37 \\ 45$	$ \begin{array}{r} 6 \\ 14 \\ 23 \\ 31 \\ 39 \\ 47 \\ \hline 23 \\ 31 \\ 39 \\ 47 \\ \hline 23 \\ 31 \\ 39 \\ 47 \\ \hline 31 \\ 39 \\ 47 \\ \hline 32 \\ 31 \\ 39 \\ 47 \\ 31 \\ 31 \\ 31 \\ 39 \\ 47 \\ 31 \\ $	$ \begin{array}{cccccccccccccccccccccccccccccccccccc$
$\begin{array}{ccc} 37 & 0 \\ 10 \\ 20 \\ 30 \\ 40 \\ 50 \end{array}$	$\begin{array}{c} 41 \ 51 \\ 46 \\ 41 \\ 35 \\ 30 \\ 25 \end{array}$	$\begin{array}{r} 42 & 39 \\ & 34 \\ & 29 \\ & 23 \\ & 18 \\ & 12 \end{array}$	$\begin{array}{r} 43 \ 27 \\ 21 \\ 16 \\ 11 \\ 5 \\ 42 \ 59 \end{array}$	$\begin{array}{r} 44 \ 15 \\ 9 \\ 43 \ 58 \\ 53 \\ 47 \end{array}$	$ \begin{array}{r} 45 & 3 \\ 44 & 57 \\ 52 \\ 46 \\ 40 \\ 34 \end{array} $	$\begin{array}{cccc} 45 & 51 \\ & 45 \\ & 40 \\ & 34 \\ & 28 \\ & 22 \end{array}$	$\begin{array}{c} 46 & 39 \\ & 33 \\ & 27 \\ & 21 \\ & 15 \\ & 9 \end{array}$	$\begin{array}{r} 47 & 27 \\ & 21 \\ & 15 \\ & 9 \\ & 3 \\ 46 & 57 \end{array}$	$ \begin{array}{c} 0 \\ 10 \\ 20 \\ 30 \\ 40 \\ 50 \end{array} $	$ \begin{array}{c} 0 \\ 8 \\ 16 \\ 24 \\ 32 \\ 40 \end{array} $	$ \begin{array}{c} 2 \\ 10 \\ 17 \\ 25 \\ 33 \\ 41 \end{array} $	$ \begin{array}{r} 3 \\ 11 \\ 19 \\ 27 \\ 35 \\ 43 \end{array} $	$5 \\ 13 \\ 21 \\ 29 \\ 37 \\ 45$	$ \begin{array}{r} 6 \\ 14 \\ 22 \\ 30 \\ 38 \\ 46 \\ \end{array} $	$ \begin{array}{r} 6 & 3 \\ 7 & 4 \\ 8 & 4 \\ 9 & 5 \\ \end{array} $
$ \begin{array}{r} 38 & 0 \\ 10 \\ 20 \\ 30 \\ 40 \\ 50 \end{array} $	$\begin{array}{ccc} 41 & 19 \\ & 14 \\ & 8 \\ & 3 \\ 40 & 58 \\ & 52 \end{array}$	$\begin{array}{cccc} 42 & 7 \\ & 2 \\ 41 & 56 \\ & 51 \\ & 45 \\ & 39 \end{array}$	$\begin{array}{r} 42 \ 54 \\ 49 \\ 43 \\ 38 \\ 32 \\ 26 \end{array}$	$\begin{array}{ccc} 43 & 41 \\ & 36 \\ & 30 \\ & 24 \\ & 18 \\ & 13 \end{array}$	$\begin{array}{c} 44 & 29 \\ & 23 \\ & 17 \\ & 12 \\ & 6 \\ & 0 \end{array}$	$\begin{array}{c} 45 & 16 \\ & 10 \\ & 4 \\ 44 & 58 \\ & 52 \\ & 46 \end{array}$	$\begin{array}{rrrr} 46 & 3 \\ 45 & 57 \\ & 51 \\ & 45 \\ & 39 \\ & 33 \end{array}$	$\begin{array}{c} 46 & 51 \\ & 45 \\ & 38 \\ & 32 \\ & 26 \\ & 20 \end{array}$	$ \begin{array}{c} 0 \\ 10 \\ 20 \\ 30 \\ 40 \\ 50 \end{array} $	$egin{array}{c} 0 \\ 8 \\ 16 \\ 23 \\ 31 \\ 39 \end{array}$	$ \begin{array}{c} 2 \\ 9 \\ 17 \\ 25 \\ 33 \\ 41 \end{array} $	$\begin{array}{c} 3\\11\\19\\27\\35\\42\end{array}$	$5 \\ 13 \\ 20 \\ 28 \\ 36 \\ 44$	$egin{array}{c} 6 \\ 14 \\ 22 \\ 30 \\ 38 \\ 46 \end{array}$	
$ \begin{array}{r} 39 & 0 \\ 10 \\ 20 \\ 30 \\ 40 \\ 50 \end{array} $	$\begin{array}{ccc} 40 & 47 \\ & 42 \\ & 36 \\ & 30 \\ & 25 \\ & 19 \end{array}$	$\begin{array}{c} 41 \ \ 33 \\ 28 \\ 23 \\ 17 \\ 11 \\ 5 \end{array}$	$\begin{array}{rrrr} 42 & 20 \\ & 15 \\ & 9 \\ & 3 \\ 41 & 57 \\ & 51 \end{array}$	$\begin{array}{rrrr} 43 & 7 \\ & 1 \\ 42 & 55 \\ & 49 \\ & 43 \\ & 37 \end{array}$	$\begin{array}{rrrr} 43 & 54 \\ & 48 \\ & 42 \\ & 36 \\ & 30 \\ & 23 \end{array}$	$\begin{array}{c} 44 \ \ 40 \\ 34 \\ 28 \\ 22 \\ 16 \\ 9 \end{array}$	$\begin{array}{c} 45 & 27 \\ & 21 \\ & 15 \\ & 8 \\ & 2 \\ 44 & 55 \end{array}$	$\begin{array}{r} 46 \ 13 \\ 7 \\ 1 \\ 45 \ 54 \\ 48 \\ 42 \end{array}$	$ \begin{array}{c} 0 \\ 10 \\ 20 \\ 30 \\ 40 \\ 50 \end{array} $	$egin{array}{c} 0 \\ 8 \\ 15 \\ 23 \\ 31 \\ 39 \end{array}$	$ \begin{array}{c} 2 \\ 9 \\ 17 \\ 25 \\ 32 \\ 40 \end{array} $	$ \begin{array}{r} 3 \\ 11 \\ 19 \\ 26 \\ 34 \\ 42 \end{array} $	$5 \\ 12 \\ 20 \\ 28 \\ 36 \\ 43$	$egin{array}{c} 6 \\ 14 \\ 22 \\ 29 \\ 37 \\ 45 \end{array}$	$\begin{array}{cccc} 1 & 1 \\ 2 & 1 \\ 3 & 2 \\ 4 & 2 \\ 5 & 3 \end{array}$

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TABLE 24.

Correction of the Moon's Apparent Altitude for Parallax and Refraction.

[Barometer 30 inches.—Fahrenheit's Thermometer 50°.]

Moon's	Horizontal parallax.									Correction for seconds of parallaxAdd.					Corr. for
app.alt.	54'	55'	56′	57'	58′	59′	60′	61′	Secon	0″	2″	4″	6″	8″	minutes of alt.
$ \begin{array}{c} \circ & ' \\ 40 & 0 \\ 10 \\ 20 \\ 30 \\ 40 \\ 50 \end{array} $	$\begin{array}{c} & ' & '' \\ 40 & 14 \\ & 8 \\ 2 \\ 39 & 56 \\ & 50 \\ 45 \end{array}$	$\begin{array}{c} & & \\ & 41 & 0 \\ 40 & 54 \\ & 48 \\ & 42 \\ & 36 \\ & 30 \end{array}$	$\begin{array}{c} & ' & '' \\ 41 & 46 \\ & 39 \\ & 33 \\ & 28 \\ & 22 \\ & 16 \end{array}$	$\begin{array}{c} ' & '' \\ 42 & 32 \\ & 25 \\ 19 \\ 13 \\ & 7 \\ & 1 \end{array}$	$\begin{array}{c} & ' & '' \\ 43 & 18 \\ & 11 \\ & 5 \\ 42 & 59 \\ & 53 \\ & 47 \end{array}$	$ \begin{array}{c} ' & '' \\ 44 & 4 \\ 43 & 57 \\ 50 \\ 44 \\ 38 \\ 32 \\ \end{array} $	$' " \\ 44 50 \\ 43 \\ 36 \\ 30 \\ 24 \\ 18 \\ 18 \\ $								Sub. 6' 3'' 7 4 8 5 9 5
$ \begin{array}{r} \frac{80}{41} \\ \frac{41}{10} \\ 20 \\ 30 \\ 40 \\ 50 \end{array} $	$ \begin{array}{r} 39 \ 39 \ $	$ \begin{array}{r} 30 \\ 40 24 \\ 18 \\ 12 \\ 6 \\ 0 \\ 39 54 \end{array} $	$ \begin{array}{r} 10 \\ 41 \\ 10 \\ 40 \\ 58 \\ 51 \\ 45 \\ 39 \\ \end{array} $	$ \begin{array}{r} 1 \\ 41 \\ 55 \\ 49 \\ 43 \\ 36 \\ 30 \\ 24 \end{array} $	$ \begin{array}{r} 11 \\ 42 41 \\ 34 \\ 28 \\ 22 \\ $	$\begin{array}{r} 52 \\ 43 \ 26 \\ 19 \\ 13 \\ 7 \\ 0 \\ 42 \ 53 \end{array}$	$ \begin{array}{r} 10 \\ 44 11 \\ 43 58 \\ 51 \\ 45 \\ 38 \end{array} $	$ \begin{array}{r} 3 \\ 44 56 \\ 49 \\ 43 \\ 37 \\ 30 \\ 23 \end{array} $	$ \begin{array}{r} 0 \\ 10 \\ $	$ \begin{array}{r} 0 \\ 8 \\ 15 \\ 23 \\ 30 \\ 38 \end{array} $	$ \begin{array}{r} 10 \\ 2 \\ 9 \\ 17 \\ 24 \\ 32 \\ 39 \end{array} $	$ \begin{array}{r} 11 \\ 3 \\ $	$ \begin{array}{r} 5 \\ 12 \\ 20 \\ 27 \\ 35 \\ 42 \end{array} $	$ \begin{array}{r} $	
${\begin{array}{ccc} 42 & 0 \\ 10 \\ 20 \\ 30 \\ 40 \\ 50 \end{array}}$	$ \begin{array}{r} 39 & 4 \\ 38 & 58 \\ 52 \\ 46 \\ 40 \\ 34 \end{array} $	$ \begin{array}{r} 39 \ 48 \\ 42 \\ 36 \\ 30 \\ 24 \\ 18 \\ \end{array} $	$ \begin{array}{r} 40 & 33 \\ & 27 \\ & 21 \\ & 14 \\ & 8 \\ & 2 \end{array} $	$\begin{array}{c} 41 \ 17 \\ 11 \\ 5 \\ 40 \ 58 \\ 52 \\ 46 \\ \end{array}$	$\begin{array}{cccc} 42 & 2 \\ 41 & 56 \\ & 50 \\ & 43 \\ & 36 \\ & 30 \end{array}$	$\begin{array}{r} 42 \ 47 \\ 41 \\ 34 \\ 27 \\ 21 \\ 14 \end{array}$	$\begin{array}{r} 43 \ 31 \\ 25 \\ 18 \\ 11 \\ 5 \\ 42 \ 58 \end{array}$	$\begin{array}{c} 44 \ 16 \\ 10 \\ 3 \\ 43 \ 56 \\ 49 \\ 42 \end{array}$	$ \begin{array}{r} 0 \\ 10 \\ 20 \\ 30 \\ 40 \\ 50 \\ \end{array} $	$\begin{array}{c} 0 \\ 7 \\ 15 \\ 22 \\ 30 \\ 37 \end{array}$	$ \begin{array}{r} 1 \\ 9 \\ 16 \\ 24 \\ 31 \\ 38 \\ \end{array} $	$ \begin{array}{r} 3 \\ 10 \\ 18 \\ 25 \\ 33 \\ 40 \end{array} $	$\begin{array}{r} 4\\ 12\\ 19\\ 27\\ 34\\ 41\end{array}$	$ \begin{array}{r} 6 \\ 13 \\ 21 \\ 28 \\ 36 \\ 43 \\ \end{array} $	$ \begin{array}{cccccccccccccccccccccccccccccccccccc$
$\begin{array}{r} 43 & 0 \\ 10 \\ 20 \\ 30 \\ 40 \\ 50 \end{array}$	$ \begin{array}{r} 38 & 28 \\ 22 \\ 16 \\ 10 \\ 4 \\ 37 & 57 \\ \end{array} $	$ \begin{array}{r} 39 \ 12 \\ 6 \\ 38 \ 59 \\ 53 \\ 47 \\ 41 \\ \end{array} $	$ \begin{array}{r} 39 56 \\ 50 \\ 43 \\ 37 \\ 30 \\ 24 \end{array} $	$ \begin{array}{r} 40 & 40 \\ & 34 \\ & 27 \\ & 20 \\ & 14 \\ & 7 \\ \end{array} $	$\begin{array}{c} 41 & 24 \\ & 18 \\ & 11 \\ & 5 \\ 40 & 58 \\ & 51 \end{array}$	$\begin{array}{cccc} 42 & 8 \\ & 1 \\ 41 & 54 \\ & 48 \\ & 41 \\ & 34 \end{array}$	$ \begin{array}{r} 42 & 52 \\ & 45 \\ & 38 \\ & 31 \\ & 24 \\ & 17 \\ \end{array} $	$\begin{array}{c c} 43 & 36 \\ & 29 \\ & 22 \\ & 15 \\ & 8 \\ & 1 \end{array}$	$ \begin{array}{c} 0 \\ 10 \\ 20 \\ 30 \\ 40 \\ 50 \\ \end{array} $	$ \begin{array}{r} 0 \\ 7 \\ 15 \\ 22 \\ 29 \\ 37 \\ \end{array} $	$ \begin{array}{c} 1 \\ 9 \\ 16 \\ 23 \\ 31 \\ 38 \end{array} $	$ \begin{array}{r} 3 \\ 10 \\ 18 \\ 25 \\ 32 \\ 39 \\ \hline \end{array} $	$ \begin{array}{r} 4 \\ 12 \\ 19 \\ 26 \\ 34 \\ 41 \\ \end{array} $	$ \begin{array}{r} 6 \\ 13 \\ 20 \\ 28 \\ 35 \\ 42 \end{array} $	$ \begin{array}{r} 6 & 4 \\ 7 & 4 \\ 8 & 5 \\ 9 & 5 \\ 9 & 5 \\ \end{array} $
$\begin{array}{rrr} 44 & 0 \\ & 10 \\ & 20 \\ & 30 \\ & 40 \\ & 50 \end{array}$	$ \begin{array}{r} 37 & 51 \\ 45 \\ 38 \\ 32 \\ 26 \\ 20 \\ \end{array} $	$ \begin{array}{r} 38 & 35 \\ 28 \\ 21 \\ 15 \\ 9 \\ 2 \end{array} $	$ \begin{array}{r} 39 & 18 \\ 11 \\ 4 \\ 38 & 58 \\ 51 \\ 44 \end{array} $	$\begin{array}{cccc} 40 & 1 \\ 39 & 54 \\ & 47 \\ & 41 \\ & 34 \\ & 27 \end{array}$	$ \begin{array}{r} 40 & 44 \\ & 37 \\ & 30 \\ & 24 \\ & 17 \\ & 10 \end{array} $	$\begin{array}{ccc} 41 & 27 \\ & 20 \\ & 13 \\ & 7 \\ & 0 \\ 40 & 53 \end{array}$	$\begin{array}{c} 42 & 10 \\ & 3 \\ 41 & 56 \\ & 49 \\ & 42 \\ & 35 \end{array}$	$\begin{array}{c cccc} 42 & 54 \\ & 46 \\ & 39 \\ & 32 \\ & 25 \\ & 18 \end{array}$	$\begin{array}{c} 0 \\ 10 \\ 20 \\ 30 \\ 40 \\ 50 \end{array}$	$ \begin{array}{r} 0 \\ 7 \\ 14 \\ 21 \\ 29 \\ 36 \\ \end{array} $	$ \begin{array}{c} 1 \\ 9 \\ 16 \\ 23 \\ 30 \\ 37 \end{array} $	$ \begin{array}{r} 3 \\ 10 \\ 17 \\ 24 \\ 31 \\ 39 \end{array} $	$ \begin{array}{r} 4 \\ 11 \\ 19 \\ 26 \\ 33 \\ 40 \\ \end{array} $	$ \begin{array}{r} 6 \\ 13 \\ 20 \\ 27 \\ 34 \\ 41 \end{array} $	
$\begin{array}{ccc} 45 & 0 \\ & 10 \\ & 20 \\ & 30 \\ & 40 \\ & 50 \end{array}$	$ \begin{array}{r} 37 & 14 \\ 7 \\ 0 \\ 36 & 54 \\ 48 \\ 41 \end{array} $	$egin{array}{cccc} 37 & 56 \\ 49 \\ 43 \\ 37 \\ 30 \\ 23 \end{array}$	$ \begin{array}{r} 38 & 38 \\ 31 \\ 25 \\ 18 \\ 11 \\ 4 \end{array} $	$ \begin{array}{r} 39 \ 21 \\ 14 \\ 7 \\ 1 \\ 38 \ 54 \\ 47 \end{array} $		$ \begin{array}{r} 40 & 46 \\ & 39 \\ & 32 \\ & 25 \\ & 18 \\ & 11 \end{array} $	$\begin{array}{c} 41 \ 28 \\ 21 \\ 14 \\ 7 \\ 0 \\ 40 \ 52 \end{array}$	$\begin{array}{cccc} 42 & 11 \\ & 3 \\ 41 & 56 \\ & 49 \\ & 42 \\ & 34 \end{array}$	$\begin{array}{c} 0 \\ 10 \\ 20 \\ 30 \\ 40 \\ 50 \end{array}$	$\begin{array}{c} 0 \\ 7 \\ 14 \\ 21 \\ 28 \\ 35 \end{array}$	$ \begin{array}{c} 1 \\ 8 \\ 15 \\ 23 \\ 30 \\ 37 \end{array} $	$ \begin{array}{r} 3 \\ 10 \\ 17 \\ 24 \\ 31 \\ 38 \end{array} $	$ \begin{array}{r} 4 \\ 11 \\ 18 \\ 25 \\ 32 \\ 39 \\ \end{array} $	$\begin{array}{c} 6\\ 13\\ 20\\ 27\\ 34\\ 41 \end{array}$	$ \begin{array}{cccccccccccccccccccccccccccccccccccc$
$ \begin{array}{r} 46 & 0 \\ 10 \\ 20 \\ 30 \\ 40 \\ 50 \end{array} $	$egin{array}{cccc} 36 & 35 \\ & 29 \\ & 22 \\ & 16 \\ & 9 \\ & 2 \end{array}$	$\begin{array}{c} 37 \ 17 \\ 10 \\ 3 \\ 36 \ 57 \\ 50 \\ 43 \end{array}$	$egin{array}{cccc} 37 & 58 \ 51 \ 44 \ 38 \ 32 \ 25 \ \end{array}$	$ \begin{array}{r} 38 \ 40 \\ 33 \\ 26 \\ 20 \\ 13 \\ 6 \end{array} $	$egin{array}{cccc} 39 & 22 & & \ 15 & & \ 8 & & \ 1 & \ 38 & 54 & \ 47 & \ \end{array}$	$ \begin{array}{r} 40 & 4 \\ 39 & 57 \\ & 49 \\ & 42 \\ & 35 \\ & 28 \end{array} $	$ \begin{array}{r} 40 & 45 \\ & 38 \\ & 31 \\ & 24 \\ & 17 \\ & 9 \\ \end{array} $	$\begin{array}{ccc} 41 & 27 \\ & 20 \\ 12 \\ & 5 \\ 40 & 58 \\ & 50 \end{array}$	$\begin{array}{c} 0\\ 10\\ 20\\ 30\\ 40\\ 50\end{array}$	$\begin{array}{c} 0 \\ 7 \\ 14 \\ 21 \\ 28 \\ 35 \end{array}$	$ \begin{array}{c} 1 \\ 8 \\ 15 \\ 22 \\ 29 \\ 36 \end{array} $	$ \begin{array}{r} 3 \\ 10 \\ 17 \\ 23 \\ 30 \\ 37 \end{array} $	$ \begin{array}{r} 4 \\ 11 \\ 18 \\ 25 \\ 32 \\ 39 \end{array} $	$ \begin{array}{r} 6 \\ 12 \\ 19 \\ 26 \\ 33 \\ 40 \\ \end{array} $	$ \begin{array}{ccc} 7 & 5 \\ 8 & 5 \\ 9 & 6 \\ \end{array} $
$\begin{array}{r} 47 & 0 \\ 10 \\ 20 \\ 30 \\ 40 \\ 50 \end{array}$	$ \begin{array}{r} 35 & 56 \\ 49 \\ 42 \\ 36 \\ 30 \\ 23 \end{array} $	$egin{array}{cccc} 36 & 37 \\ & 30 \\ 23 \\ 17 \\ 10 \\ & 3 \end{array}$	$ \begin{array}{r} 37 & 18 \\ 11 \\ 4 \\ 36 & 57 \\ 50 \\ 43 \end{array} $	$egin{array}{cccc} 37 & 59 \ 52 \ 45 \ 38 \ 31 \ 24 \ \end{array}$	$ \begin{array}{r} 38 40 \\ 34 \\ 26 \\ 19 \\ 12 \\ 5 \end{array} $	$ \begin{array}{r} 39 & 21 \\ 14 \\ 6 \\ 38 & 59 \\ 52 \\ 45 \\ 45 \end{array} $	$\begin{array}{cccc} 40 & 2 \\ 39 & 55 \\ & 47 \\ & 40 \\ & 32 \\ & 25 \end{array}$	$ \begin{array}{r} 40 & 43 \\ & 36 \\ & 28 \\ & 21 \\ & 13 \\ & 5 \end{array} $	$ \begin{array}{r} 0 \\ 10 \\ 20 \\ 30 \\ 40 \\ 50 \\ \end{array} $	$\begin{array}{c} 0 \\ 7 \\ 14 \\ 20 \\ 27 \\ 34 \end{array}$	$ \begin{array}{c} 1 \\ 8 \\ 15 \\ 22 \\ 29 \\ 35 \end{array} $	$ \begin{array}{r} 3 \\ 10 \\ 16 \\ 23 \\ 30 \\ 37 \\ \end{array} $	$ \begin{array}{r} 4 \\ 11 \\ 18 \\ 24 \\ 31 \\ 38 \end{array} $	$5 \\ 12 \\ 19 \\ 26 \\ 33 \\ 39$	
$\begin{array}{rrrr} 48 & 0 \\ & 10 \\ & 20 \\ & 30 \\ & 40 \\ & 50 \end{array}$	$35 \ 16 \ 10 \ 3 \ 34 \ 56 \ 49 \ 42$	$egin{array}{cccc} 35 & 56 \ 50 \ 43 \ 36 \ 29 \ 22 \ \end{array}$	$egin{array}{cccc} 36 & 36 \ & 30 \ & 23 \ & 16 \ & 9 \ & 1 \end{array}$	$\begin{array}{c} 37 \ 17 \\ 10 \\ 2 \\ 36 \ 55 \\ 48 \\ 41 \end{array}$	$egin{array}{cccc} 37 & 57 \ 50 \ 43 \ 35 \ 28 \ 21 \end{array}$		$ \begin{array}{r} 39 \ 17 \\ 10 \\ 2 \\ 38 \ 55 \\ 48 \\ 40 \end{array} $	$ \begin{array}{r} 39 & 58 \\ 50 \\ 42 \\ 34 \\ 27 \\ 19 \\ \end{array} $	$\begin{array}{c} 0\\ 10\\ 20\\ 30\\ 40\\ 50 \end{array}$	$\begin{array}{c} 0 \\ 7 \\ 13 \\ 20 \\ 27 \\ 33 \end{array}$	$ \begin{array}{c} 1 \\ 8 \\ 15 \\ 21 \\ 28 \\ 35 \end{array} $	$ \begin{array}{r} 3 \\ 9 \\ 16 \\ 23 \\ 29 \\ 36 \end{array} $	$ \begin{array}{r} 4 \\ 11 \\ 17 \\ 24 \\ 31 \\ 37 \\ \end{array} $	$5 \\ 12 \\ 19 \\ 25 \\ 32 \\ 39$	$ \begin{array}{cccccccccccccccccccccccccccccccccccc$
$\begin{array}{rrrr} 49 & 0 \\ 10 \\ 20 \\ 30 \\ 40 \\ 50 \end{array}$	$egin{array}{c} 34 & 35 \\ 29 \\ 22 \\ 15 \\ 8 \\ 1 \end{array}$	$35 15 \\ 8 \\ 1 \\ 34 54 \\ 47 \\ 40$	$ \begin{array}{r} 35 54 \\ 47 \\ 40 \\ 33 \\ 26 \\ 19 \end{array} $	$\begin{array}{r} 36 & 34 \\ & 27 \\ 20 \\ 12 \\ & 5 \\ 35 & 58 \end{array}$	$ \begin{array}{r} 37 & 13 \\ 6 \\ 36 & 59 \\ 51 \\ 44 \\ 36 \end{array} $	$ \begin{array}{r} 37 & 53 \\ 46 \\ 38 \\ 30 \\ 23 \\ 15 \end{array} $	$ \begin{array}{r} 38 & 32 \\ 25 \\ 17 \\ 9 \\ 2 \\ 37 & 54 \end{array} $	$ \begin{array}{r} 39 \ 11 \\ 4 \\ 38 \ 56 \\ 48 \\ 41 \\ 33 \end{array} $	$egin{array}{c} 0 \\ 10 \\ 20 \\ 30 \\ 40 \\ 50 \end{array}$	$\begin{array}{c} 0 \\ 7 \\ 13 \\ 20 \\ 26 \\ 33 \end{array}$	$ \begin{array}{c} 1 \\ 8 \\ 14 \\ 21 \\ 27 \\ 34 \end{array} $	$ \begin{array}{r} 3 \\ 9 \\ 16 \\ 22 \\ 29 \\ 35 \end{array} $	$ \begin{array}{r} 4 \\ 10 \\ 17 \\ 23 \\ 30 \\ 36 \end{array} $	$5 \\ 12 \\ 18 \\ 25 \\ 31 \\ 38$	$ \begin{array}{ccc} 7 & 5 \\ 8 & 5 \\ 9 & 6 \\ \end{array} $

TABLE 24.

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Correction of the Moon's Apparent Altitude for Parallax and Refraction.

[Barometer 30 inches.—Fahrenheit's Thermometer 50°.]

	1										5.: Correction for seconds of						
Moon's	Horizontal parallax.								parallaxAdd.				as of	Corr. for			
app. alt.	54'	55'	56'	57'	58′	59'	60′	61'	Secol	0″	2″	4″	6″	8″	of alt.		
	$ \begin{array}{c} , & "\\ 33 & 54 \\ 47 \\ 40 \\ 33 \\ 26 \end{array} $	$\begin{array}{c} & "\\ 34 & 33\\ & 26\\ & 19\\ & 11\\ & 4\end{array}$	$ \begin{array}{r} ' & '' \\ 35 & 11 \\ 4 \\ 34 & 57 \\ 49 \\ 42 \\ \end{array} $	$ \begin{array}{c} ' & " \\ 35 & 50 \\ 43 \\ 36 \\ 28 \\ 20 \\ \end{array} $	$\begin{array}{c} & ' & '' \\ 36 & 29 \\ & 21 \\ & 14 \\ & 6 \\ 35 & 58 \end{array}$	$\begin{array}{c} & & \\ & & \\ & 37 & 8 \\ & & 0 \\ 36 & 53 \\ & & 45 \\ & & 37 \end{array}$	$ \begin{array}{c} $	$ \begin{array}{c} ' & '' \\ 38 & 25 \\ 17 \\ 9 \\ 1 \\ 37 & 53 \end{array} $				$ \begin{array}{c} '' \\ 3 \\ 9 \\ 15 \\ 22 \\ 28 \\ \end{array} $	" 4 10 17 23 29	$ $			
$ \begin{array}{r} 50 \\ 51 & 0 \\ 10 \\ 20 \\ 30 \\ 40 \\ 50 \\ 50 \end{array} $	$ \begin{array}{r} 19 \\ 33 12 \\ 5 \\ 32 58 \\ 51 \\ 44 \\ 37 \end{array} $	$ \begin{array}{r} 33 57 \\ 33 50 \\ 43 \\ 36 \\ 29 \\ 22 \\ 14 \end{array} $	$\begin{array}{r} 35 \\ 34 \ 28 \\ 21 \\ 13 \\ 6 \\ 33 \ 59 \\ 51 \end{array}$	$ \begin{array}{r} 13 \\ 35 & 6 \\ 34 & 58 \\ 50 \\ 43 \\ 36 \\ 28 \\ \end{array} $	$ \begin{array}{r} 51 \\ 35 44 \\ 36 \\ 28 \\ 21 \\ 14 \\ 6 \end{array} $	$ \begin{array}{r} 29 \\ 36 22 \\ 14 \\ 6 \\ 35 58 \\ 50 \\ 42 \end{array} $	$ \begin{bmatrix} 7 \\ 36 59 \\ 51 \\ 43 \\ 36 \\ 28 \\ 20 \end{bmatrix} $	$ \begin{array}{r} 45 \\ \overline{37\ 37} \\ 29 \\ 21 \\ 13 \\ 5 \\ 36\ 57 \\ \end{array} $	$ \begin{array}{r} 50 \\ 0 \\ 10 \\ 20 \\ 30 \\ 40 \\ 50 \\ 50 \end{array} $	$ \begin{array}{r} 32 \\ 0 \\ 6 \\ 13 \\ 19 \\ 25 \\ 31 \end{array} $	$ \begin{array}{r} 33 \\ 1 \\ 8 \\ 14 \\ 20 \\ 26 \\ 33 \end{array} $	$ \begin{array}{r} 35 \\ 3 \\ 9 \\ 15 \\ 21 \\ 28 \\ 34 \end{array} $	$ \begin{array}{r} 36 \\ 4 \\ 10 \\ 16 \\ 23 \\ 29 \\ 35 \end{array} $	$ \begin{array}{r} 37 \\ 5 \\ 11 \\ 18 \\ 24 \\ 30 \\ 36 \end{array} $	$\begin{array}{c} \text{Sub.} \\ 1' & 1'' \\ 2 & 1 \\ 3 & 2 \\ 4 & 3 \\ 5 & 4 \\ 6 & 4 \end{array}$		
$52 ext{ } 0 ext{ } 10 ext{ } 20 ext{ } 30 ext{ } 40 ext{ } 50 ext{ } $	$egin{array}{cccc} 32 & 30 \\ & 23 \\ & 15 \\ & 8 \\ & 1 \\ 31 & 54 \end{array}$	$egin{array}{cccc} 33 & 7 & 0 \ 32 & 52 & \ 45 & \ 38 & \ 31 & \ \end{array}$	$\begin{array}{cccc} 33 & 44 \\ & 36 \\ & 29 \\ & 21 \\ & 14 \\ & 7 \end{array}$	$egin{array}{cccc} 34 & 21 \\ & 13 \\ & 6 \\ 33 & 58 \\ & 50 \\ & 43 \end{array}$	$egin{array}{cccc} 34 & 58 \\ & 50 \\ & 43 \\ & 35 \\ & 27 \\ & 19 \end{array}$	$35 \ 35 \ 27 \ 19 \ 11 \ 3 \ 34 \ 55$	$ \begin{array}{r} 36 \ 12 \\ 4 \\ 35 \ 56 \\ 48 \\ 40 \\ 32 \end{array} $	$36 \ 49 \ 41 \ 33 \ 24 \ 16 \ 8$	$\begin{array}{c} 0 \\ 10 \\ 20 \\ 30 \\ 40 \\ 50 \end{array}$	$ \begin{array}{c} 0 \\ 6 \\ 12 \\ 18 \\ 24 \\ 31 \end{array} $	$ \begin{array}{c} 1 \\ 7 \\ 13 \\ 20 \\ 26 \\ 32 \end{array} $	$2 \\ 9 \\ 15 \\ 21 \\ 27 \\ 33$	$ \begin{array}{r} 4 \\ 10 \\ 16 \\ 22 \\ 28 \\ 34 \end{array} $	$5 \\ 11 \\ 17 \\ 23 \\ 29 \\ 35$	$ \begin{array}{ccc} 7 & 5 \\ 8 & 6 \\ 9 & 6 \end{array} $		
$53 ext{ } 0 ext{ } 10 ext{ } 20 ext{ } 30 ext{ } 40 ext{ } 50 ext{ } $	$ \begin{array}{r} 31 & 47 \\ 39 \\ 32 \\ 25 \\ 17 \\ 10 \\ \end{array} $	$egin{array}{cccc} 32 & 23 & 15 & \ & 8 & 0 & \ 31 & 53 & \ & 46 & \ \end{array}$	32 59 51 44 36 28 21	$egin{array}{cccc} 33 & 35 & & 27 & & \ 20 & 12 & & \ 4 & 32 & 57 & \ \end{array}$	$egin{array}{cccc} 34 & 11 & & & \ & 3 & 33 & 56 & \ & 48 & & \ & 40 & & \ & 32 & \ \end{array}$	$egin{array}{cccc} 34 & 47 \\ & 39 \\ & 31 \\ & 23 \\ & 15 \\ & 7 \end{array}$	$35 \ 24 \ 15 \ 7 \ 34 \ 59 \ 51 \ 43$	$ \begin{array}{r} 36 & 0 \\ 35 & 51 \\ 43 \\ 35 \\ 27 \\ 19 \end{array} $	$ \begin{array}{c} 0 \\ 10 \\ 20 \\ 30 \\ 40 \\ 50 \end{array} $	$egin{array}{c} 0 \\ 6 \\ 12 \\ 18 \\ 24 \\ 30 \end{array}$	$ \begin{array}{c} 1 \\ 7 \\ 13 \\ 19 \\ 25 \\ 31 \end{array} $	$ \begin{array}{r} 2 \\ 8 \\ 14 \\ 20 \\ 26 \\ 32 \end{array} $	$ \begin{array}{r} 4 \\ 10 \\ 16 \\ 22 \\ 28 \\ 34 \end{array} $	$5 \\ 11 \\ 17 \\ 23 \\ 29 \\ 35$			
54 0 10 20 30 40 50	$ \begin{array}{r} 31 & 3 \\ 30 & 55 \\ 48 \\ 40 \\ 33 \\ 26 \end{array} $	$\begin{array}{c} 31 & 38 \\ & 30 \\ & 22 \\ & 15 \\ & 8 \\ & 0 \end{array}$	$ \begin{array}{r} 32 & 13 \\ 5 \\ 31 & 57 \\ 49 \\ 42 \\ 35 \end{array} $	$\begin{array}{cccc} 32 & 49 \\ & 41 \\ & 33 \\ & 25 \\ & 17 \\ & 9 \end{array}$	$ \begin{array}{c} 33 & 24 \\ 16 \\ 8 \\ 0 \\ 32 & 52 \\ 44 \end{array} $	$\begin{array}{cccc} 33 & 59 \\ & 51 \\ & 43 \\ & 35 \\ & 27 \\ & 19 \end{array}$	$ \begin{vmatrix} 34 & 35 \\ & 26 \\ & 18 \\ & 10 \\ & 1 \\ 33 & 53 \end{vmatrix} $	$\begin{vmatrix} 35 & 10 \\ 1 \\ 34 & 53 \\ 45 \\ 37 \\ 28 \end{vmatrix}$	$\begin{array}{c} 0\\ 10\\ 20\\ 30\\ 40\\ 50 \end{array}$	$egin{array}{c} 0 \\ 6 \\ 12 \\ 18 \\ 23 \\ 29 \end{array}$	$ \begin{array}{c c} 1 \\ 7 \\ 13 \\ 19 \\ 25 \\ 30 \end{array} $	$ \begin{array}{c} 2 \\ 8 \\ 14 \\ 20 \\ 26 \\ 32 \end{array} $	$ \begin{array}{r} 4 \\ 9 \\ 15 \\ 21 \\ 27 \\ 33 \end{array} $	$5 \\ 11 \\ 16 \\ 22 \\ 28 \\ 34$			
$55 ext{ 0} \\ 10 \\ 20 \\ 30 \\ 40 \\ 50 \\ \end{array}$	$30 \ 18 \ 10 \ 3 \ 29 \ 55 \ 48 \ 40$	$\begin{array}{r} 30 \ 52 \\ 45 \\ 38 \\ 30 \\ 22 \\ 14 \end{array}$	$\begin{array}{r} 31 \ 27 \\ 19 \\ 12 \\ 4 \\ 30 \ 56 \\ 48 \end{array}$	$\begin{array}{cccccccccccccccccccccccccccccccccccc$	$egin{array}{cccc} 32 & 36 \\ & 28 \\ & 20 \\ & 12 \\ & 4 \\ 31 & 55 \end{array}$	$\begin{array}{r} 33 \ 10 \\ 2 \\ 32 \ 54 \\ 46 \\ 37 \\ 29 \end{array}$	$\begin{array}{ccc} 33 & 45 \\ & 36 \\ & 28 \\ & 20 \\ & 11 \\ & 3 \end{array}$	$ \begin{array}{r} 34 & 19 \\ 11 \\ 3 \\ 33 & 54 \\ 45 \\ 37 \\ \end{array} $	$ \begin{array}{r} 0 \\ 10 \\ 20 \\ 30 \\ 40 \\ 50 \end{array} $	$egin{array}{c} 0 \\ 6 \\ 11 \\ 17 \\ 23 \\ 28 \end{array}$	$ \begin{array}{r} 1 \\ 7 \\ 13 \\ 18 \\ 24 \\ 30 \end{array} $	$ \begin{array}{r} 2 \\ 8 \\ 14 \\ 19 \\ 25 \\ 31 \end{array} $	$ \begin{array}{r} 3 \\ 9 \\ 15 \\ 20 \\ 26 \\ 32 \end{array} $	$5 \\ 10 \\ 16 \\ 22 \\ 27 \\ 33$			
56 0 10 20 30 40 50 50 50 50 50 50 5	$ \begin{array}{r} 29 & 33 \\ & 25 \\ & 18 \\ & 10 \\ & 3 \\ & 28 & 55 \\ \hline & 20 & 45 \\ \end{array} $	$ \begin{array}{r} 30 & 7 \\ 29 & 59 \\ 51 \\ 43 \\ 36 \\ 28 \\ \hline 20 & 20 \\ \end{array} $	$ \begin{array}{r} 30 40 \\ 32 \\ 24 \\ 16 \\ 9 \\ 1 \\ 20 50 \\ \end{array} $	$ \begin{array}{cccccccccccccccccccccccccccccccccccc$	$ \begin{array}{r} 31 & 47 \\ & 39 \\ & 31 \\ & 23 \\ & 15 \\ & 7 \\ \hline & 20 & 50 \\ \end{array} $	$ \begin{array}{r} 32 & 21 \\ 13 \\ 4 \\ 31 & 56 \\ 48 \\ 40 \\ \hline 21 & 21 \\ \end{array} $	$ \begin{array}{r} 32 55 \\ 46 \\ 37 \\ 29 \\ 21 \\ 12 \\ \hline 32 \\ 21 \\ 12 \\ \hline 32 \\ 37 \\ 29 \\ 21 \\ 12 \\ \hline 32 \\ 37 \\ 29 \\ 21 \\ 12 \\ \hline 37 \\ 20 \\ 20 \\ 20 \\ 20 \\ 20 \\ 20 \\ 20 \\ 20$	$ \begin{array}{r} 33 28 \\ 20 \\ 11 \\ 2 \\ 32 54 \\ 45 \\ \hline 22 23 26 \\ \hline 22 26 \\ $	$ \begin{array}{c} 0 \\ 10 \\ 20 \\ 30 \\ 40 \\ 50 \\ \hline \end{array} $	$ \begin{array}{c} 0 \\ 6 \\ 11 \\ 17 \\ 22 \\ 28 \\ \hline 0 $	$ \begin{array}{c} 1 \\ 7 \\ 12 \\ 18 \\ 23 \\ 29 \\ \hline 1 1 1 1 3 2 1 1 1 3 2 1 1 1 1 1 $	$ \begin{array}{c} 2 \\ 8 \\ 13 \\ 19 \\ 24 \\ 30 \\ \hline \end{array} $	$ \begin{array}{r} 3 \\ 9 \\ 14 \\ 20 \\ 25 \\ 31 \\ \hline 21 \\ 31 \\ \hline 31 \\ 3$	$ \begin{array}{r} 4 \\ 10 \\ 16 \\ 21 \\ 27 \\ 32 \\ \hline 16 \\ 21 \\ 27 \\ 32 \\ \hline 10 \\ 21 \\ 27 \\ 32 \\ \hline 10 \\ 21 \\ 27 \\ 32 \\ \hline 10 \\ 21 \\ 27 \\ 32 \\ \hline 10 \\ 21 \\ 27 \\ 32 \\ \hline 10 \\ 21 \\ 27 \\ 32 \\ \hline 10 \\ 21 \\ 27 \\ 32 \\ \hline 10 \\ 21 \\ 27 \\ 32 \\ \hline 10 \\ 21 \\ 27 \\ 32 \\ \hline 10 \\ 21 \\ 27 \\ 32 \\ \hline 10 \\ 21 \\ 27 \\ 32 \\ \hline 10 \\ 21 \\ 27 \\ 32 \\ \hline 10 \\ 21 \\ 27 \\ 32 \\ 10 \\ 21 \\ 27 \\ 32 \\ 10 \\ 21 \\ 27 \\ 32 \\ 10 \\ 21 \\ 27 \\ 32 \\ 10 \\ 21 \\ 27 \\ 32 \\ 10 \\ 1$	$\begin{array}{ccc}1&1\\2&2\\3&2\\4&2\end{array}$		
$ \begin{array}{r} 57 & 0 \\ 10 \\ 20 \\ 30 \\ 40 \\ 50 \\ \hline \end{array} $	$ \begin{array}{r} 28 \ 47 \\ 39 \\ 32 \\ 24 \\ 17 \\ 9 \\ \hline \hline 24 \\ 17 \\ 9 \end{array} $	$ \begin{array}{r} 29 \ 20 \\ 12 \\ 5 \\ 28 \ 57 \\ 49 \\ 41 \end{array} $	$ \begin{array}{r} 29 53 \\ 45 \\ 37 \\ 29 \\ 21 \\ 13 \\ 13 \end{array} $	$ \begin{array}{r} 30 & 25 \\ 17 \\ 9 \\ 1 \\ 29 & 53 \\ 45 \\ 45 \end{array} $	$ \begin{array}{r} 30 & 58 \\ 50 \\ 42 \\ 33 \\ 25 \\ 17 \end{array} $	$ \begin{array}{r} 31 & 31 \\ & 22 \\ & 14 \\ & 6 \\ 30 & 57 \\ & 49 \\ \end{array} $	$ \begin{array}{r} 32 & 3 \\ 31 & 55 \\ 47 \\ 38 \\ 29 \\ 21 \end{array} $	$ \begin{array}{r} 32 \ 36 \\ 27 \\ 19 \\ 10 \\ 1 \\ 31 \ 52 \end{array} $	$ \begin{array}{r} 0 \\ 10 \\ 20 \\ 30 \\ 40 \\ 50 \\ \end{array} $	$ \begin{array}{c} 0 \\ 5 \\ 11 \\ 16 \\ 22 \\ 27 \\ \end{array} $	$ \begin{array}{c} 1 \\ 6 \\ 12 \\ 17 \\ 23 \\ 28 \end{array} $	$2 \\ 7 \\ 13 \\ 18 \\ 24 \\ 29$	$ \begin{array}{r} 3 \\ 9 \\ 14 \\ 19 \\ 25 \\ 30 \\ \end{array} $	$ \begin{array}{r} 4 \\ 10 \\ 15 \\ 21 \\ 26 \\ 31 \end{array} $	$ \begin{array}{cccccccccccccccccccccccccccccccccccc$		
$ \begin{array}{r} 38 & 0 \\ 10 \\ 20 \\ 30 \\ 40 \\ 50 \end{array} $	$ \begin{array}{r} 28 & 1 \\ 27 & 53 \\ 45 \\ 38 \\ 30 \\ 22 \end{array} $	$28 \ 33 \ 25 \ 17 \ 9 \ 1 \ 27 \ 53$	$29 \ 5$ $28 \ 57$ 49 41 33 24	$29 \ 37 \\ 28 \\ .20 \\ 12 \\ 4 \\ 28 \ 55$	$\begin{array}{ccc} 30 & 9 \\ & 0 \\ 29 & 52 \\ & 44 \\ & 35 \\ & 27 \end{array}$	$ \begin{array}{r} 30 & 41 \\ 32 \\ 23 \\ 15 \\ 6 \\ 29 & 58 \end{array} $	$ \begin{array}{r} 31 & 12 \\ 4 \\ 30 & 55 \\ 46 \\ 38 \\ 29 \end{array} $	$31 \ 44 \ 35 \ 26 \ 17 \ 9 \ 0$	$\begin{array}{c} 0 \\ 10 \\ 20 \\ 30 \\ 40 \\ 50 \end{array}$	$\begin{array}{c} 0 \\ 5 \\ 10 \\ 16 \\ 21 \\ 26 \end{array}$	$ \begin{array}{c} 1 \\ 6 \\ 12 \\ 17 \\ 22 \\ 27 \\ \end{array} $	27 7 13 18 23 28	$ \begin{array}{r} 3 \\ 8 \\ 14 \\ 19 \\ 24 \\ 29 \\ \end{array} $	$ \begin{array}{r} 4 \\ 9 \\ 15 \\ 20 \\ 25 \\ 30 \\ \end{array} $			
59 0 10 20 30 40 50	$\begin{array}{cccc} 27 & 14 \\ & 6 \\ 26 & 58 \\ & 51 \\ & 43 \\ & 35 \end{array}$	$27 \ 45 \ 37 \ 29 \ 21 \ 13 \ 5$	$28 \ 16 \ 7 \ 27 \ 59 \ 51 \ 43 \ 35$	$28 \ 47 \\ 38 \\ 30 \\ 22 \\ 14 \\ 5$	$ \begin{array}{r} 29 \ 18 \\ $	$29 \ 49 \\ 40 \\ 31 \\ 23 \\ 14 \\ 6$	$\begin{array}{cccc} 30 & 20 \\ & 11 \\ & 2 \\ 29 & 54 \\ & 45 \\ & 36 \end{array}$	$30\ 51\ 42\ 33\ 24\ 15\ 6$	$\begin{array}{c} 0 \\ 10 \\ 20 \\ 30 \\ 40 \\ 50 \end{array}$	$\begin{array}{c} 0 \\ 5 \\ 10 \\ 15 \\ 20 \\ 25 \end{array}$	$ \begin{array}{r} 1 \\ 6 \\ 11 \\ 16 \\ 21 \\ 26 \end{array} $	$\begin{array}{c} 2 \\ 7 \\ 12 \\ 17 \\ 22 \\ 27 \end{array}$		$ \begin{array}{r} 4 \\ 9 \\ 14 \\ 19 \\ 24 \\ 30 \end{array} $			

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TABLE 24.

Correction of the Moon's Apparent Altitude for Parallax and Refraction.

[Barometer 30 inches.—Fahrenheit's Thermometer 50°.]

	•		•												
Moon's	Horizontal parallax.										Correction for seconds parallax.—Add.				
app.alt.	54'	55'	56'	57'	58'	59'	60′	61'	Secon	0″	2″	4″	6″	8″	of alt.
	$\begin{smallmatrix} ' & '' \\ 26 & 26 \\ 19 \\ 11 \\ 3 \\ 25 & 55 \\ 47 \end{smallmatrix}$	$ \begin{smallmatrix} & & & \\ & & & 26 & 57 \\ & & & 49 \\ & & 41 \\ & & 32 \\ & & 24 \\ & & 16 \\ \end{smallmatrix} $	27 27 27 19 11 2 26 53 45 45 19	$\begin{smallmatrix} & & & \\ & & 27 & 57 \\ & & 49 \\ & & 40 \\ & & 31 \\ & & 23 \\ & & 14 \\ \end{smallmatrix}$		$\begin{array}{c} & ' & '' \\ 28 & 57 \\ & 49 \\ & 40 \\ & 31 \\ & 22 \\ & 13 \end{array}$	$ \begin{smallmatrix} & & & \\ & & & 29 & 27 \\ & & & 18 \\ & & & 9 \\ & & & 0 \\ 28 & 51 \\ & & & 42 \\ \end{smallmatrix} $	$ \begin{array}{c} ' & "\\ 29 & 57\\ 48\\ 39\\ 30\\ 21\\ 12 \end{array} $	${" \\ 0 \\ 10 \\ 20 \\ 30 \\ 40 \\ 50 }$		$ \begin{bmatrix} '' & 1 \\ 1 & 6 \\ 11 & 16 \\ 21 & 26 26 $	$\begin{matrix} '' & 2 \\ 7 & 12 \\ 17 & 22 \\ 27 & 27 \end{matrix}$			
$\begin{array}{ccc} 61 & 0 \\ 10 \\ 20 \\ 30 \\ 40 \\ 50 \end{array}$	$\begin{array}{r} 25 & 39 \\ & 31 \\ & 23 \\ & 15 \\ & 7 \\ 24 & 59 \end{array}$	$ \begin{bmatrix} 26 & 8 \\ 0 \\ 25 & 52 \\ 43 \\ 35 \\ 27 \end{bmatrix} $	$\begin{array}{r} 26 & 37 \\ & 29 \\ & 20 \\ & 12 \\ & 4 \\ 25 & 55 \end{array}$	$ \begin{array}{r} 27 & 6 \\ 26 & 58 \\ 49 \\ 40 \\ 32 \\ 24 \end{array} $	$\begin{array}{r} 27 & 36 \\ & 27 \\ & 18 \\ & 10 \\ & 1 \\ 26 & 52 \end{array}$	$ \begin{array}{r} 28 & 5 \\ 27 & 56 \\ 47 \\ 38 \\ 29 \\ 20 \end{array} $	$\begin{array}{r} 28 & 34 \\ & 25 \\ 16 \\ & 7 \\ 27 & 58 \\ & 49 \end{array}$	$ \begin{array}{r} 29 & 3 \\ 28 & 54 \\ 45 \\ 35 \\ 26 \\ 17 \end{array} $	$ \begin{array}{r} 0 \\ 10 \\ 20 \\ 30 \\ 40 \\ 50 \end{array} $	$ \begin{array}{r} 0 \\ 5 \\ 10 \\ 14 \\ 19 \\ 24 \end{array} $	$ \begin{array}{c} 1 \\ 6 \\ 11 \\ 15 \\ 20 \\ 25 \end{array} $	$ \begin{array}{r} 2 \\ 7 \\ 12 \\ 16 \\ 21 \\ 26 \end{array} $	$ \begin{array}{r} 3 \\ 8 \\ 12 \\ 17 \\ 22 \\ 27 \end{array} $	$ \begin{array}{r} 4 \\ 9 \\ 13 \\ 18 \\ 23 \\ 28 \end{array} $	
$\begin{array}{ccc} 62 & 0 \\ 10 \\ 20 \\ 30 \\ 40 \\ 50 \end{array}$	$24 \ 50 \\ 42 \\ 34 \\ 26 \\ 18 \\ 10$	$25 \ 19 \\ 10 \\ 2 \\ 24 \ 54 \\ 46 \\ 37 \\ 37 \\ 37 \\ 37 \\ 37 \\ 37 \\ 37 \\ 3$	$25 \ 47 \\ 38 \\ 29 \\ 21 \\ 13 \\ 4$	$26 \ 15 \\ 6 \\ 25 \ 57 \\ 49 \\ 41 \\ 32$	$26 \ 43 \\ 34 \\ 25 \\ 17 \\ 8 \\ 25 \ 59$	$27 \ 11 \\ 2 \\ 26 \ 53 \\ 45 \\ 36 \\ 27$	$\begin{array}{cccc} 27 & 40 \\ & 30 \\ & 21 \\ & 12 \\ & 3 \\ 26 & 54 \end{array}$	$28 & 8 \\ 27 & 58 \\ 49 \\ 40 \\ 31 \\ 21$	$\begin{array}{c} 0\\ 10\\ 20\\ 30\\ 40\\ 50 \end{array}$	$\begin{array}{c} 0 \\ 5 \\ 9 \\ 14 \\ 19 \\ 23 \end{array}$	$ \begin{array}{c} 1 \\ 6 \\ 10 \\ 15 \\ 19 \\ 24 \end{array} $	$2 \\ 6 \\ 11 \\ 16 \\ 20 \\ 25$	$3 \\ 7 \\ 12 \\ 17 \\ 21 \\ 26$	$ \begin{array}{r} 4 \\ 8 \\ 12 \\ 18 \\ 22 \\ 27 \\ \end{array} $	
$egin{array}{ccc} 63 & 0 & \ 10 & \ 20 & \ 30 & \ 40 & \ 50 & \ \end{array}$	$24 \ 2$ $23 \ 54 \ 46 \ 37 \ 29 \ 20$	$24 \ 29 \\ 21 \\ 13 \\ 4 \\ 23 \ 55 \\ 47 \\ 47 \\ 13 \\ 13 \\ 13 \\ 13 \\ 13 \\ 13 \\ 13 \\ 1$	$24 56 \\ 48 \\ 39 \\ 31 \\ 22 \\ 13$	$25 \ 23 \ 15 \ 6 \ 24 \ 58 \ 49 \ 40$	$25 \ 51 \\ 42 \\ 33 \\ 24 \\ 15 \\ 6$	$26 \ 18 \\ 9 \\ 0 \\ 25 \ 51 \\ 42 \\ 33$	$26 \ 45 \\ 36 \\ 27 \\ 18 \\ 8 \\ 25 \ 59$	$ \begin{array}{r} 27 & 12 \\ 3 \\ 26 & 54 \\ 45 \\ 35 \\ 26 \\ \end{array} $	$\begin{array}{c} 0 \\ 10 \\ 20 \\ 30 \\ 40 \\ 50 \end{array}$	$\begin{array}{c} 0 \\ 4 \\ 9 \\ 13 \\ 18 \\ 22 \end{array}$	$ \begin{array}{c} 1 \\ 5 \\ 10 \\ 14 \\ 19 \\ 23 \end{array} $	$2 \\ 6 \\ 11 \\ 15 \\ 20 \\ 24$	$ \begin{array}{r} 3 \\ 7 \\ 12 \\ 16 \\ 21 \\ 25 \end{array} $	$egin{array}{c} 4 \\ 8 \\ 13 \\ 17 \\ 22 \\ 26 \end{array}$	
${ \begin{array}{c} 64 & 0 \\ 10 \\ 20 \\ 30 \\ 40 \\ 50 \end{array} }$	$23 \ 12 \\ 4 \\ 22 \ 56 \\ 47 \\ 39 \\ 31$	$23 \ 39 \\ 31 \\ 22 \\ 13 \\ 5 \\ 22 \ 57$	$24 5 \\ 23 57 \\ 48 \\ 39 \\ 30 \\ 22$	$24 \ 32 \\ 23 \\ 14 \\ 5 \\ 23 \ 56 \\ 48$	$24 \ 58 \\ 49 \\ 40 \\ 31 \\ 22 \\ 13$	$25 \ 24 \\ 15 \\ 6 \\ 24 \ 57 \\ 48 \\ 39$	$\begin{array}{c ccccc} 25 & 50 \\ & 41 \\ & 32 \\ & 22 \\ & 13 \\ & 4 \end{array}$	$26 \ 17 \\ 8 \\ 25 \ 58 \\ 48 \\ 39 \\ 30$	$\begin{array}{c} 0\\ 10\\ 20\\ 30\\ 40\\ 50 \end{array}$	$egin{array}{c} 0 \\ 4 \\ 9 \\ 13 \\ 17 \\ 22 \end{array}$	$ \begin{array}{c} 1 \\ 5 \\ 10 \\ 14 \\ 18 \\ 23 \end{array} $	$2 \\ 6 \\ 10 \\ 15 \\ 19 \\ 23$	$ \begin{array}{r} 3 \\ 7 \\ 11 \\ 16 \\ 20 \\ 24 \end{array} $	$ \begin{array}{r} 3 \\ 8 \\ 12 \\ 16 \\ 21 \\ 25 \end{array} $	
$egin{array}{ccc} 65 & 0 \ 10 \ 20 \ 30 \ 40 \ 50 \end{array}$	$22 \ 23 \ 14 \ 6 \ 21 \ 58 \ 49 \ 41$	$ \begin{array}{c ccccccccccccccccccccccccccccccccccc$	$23 \ 13 \\ 5 \\ 22 \ 56 \\ 48 \\ 39 \\ 30$	$23 \ 39 \\ 30 \\ 21 \\ 13 \\ 4 \\ 22 \ 55$	$24 \ 4 \\ 23 \ 55 \\ 46 \\ 37 \\ 28 \\ 19$	$24 \ \ 30 \\ 20 \\ 11 \\ 23 \ \ 53 \\ 44$	$24 \ 55 \\ 46 \\ 36 \\ 27 \\ 18 \\ 8 \\ 8$	$25 \ 21 \\ 11 \\ 1 \\ 24 \ 52 \\ 43 \\ 33$	$ \begin{array}{r} 0\\10\\20\\30\\40\\50\end{array} $	$0\\ 4\\ 8\\ 13\\ 17\\ 21$	$ \begin{array}{c} 1 \\ 5 \\ 9 \\ 13 \\ 18 \\ 22 \end{array} $	$2 \\ 6 \\ 10 \\ 14 \\ 18 \\ 23$	$2 \\ 7 \\ 11 \\ 15 \\ 19 \\ 23$	$ \begin{array}{r} 3 \\ 7 \\ 12 \\ 16 \\ 20 \\ 24 \end{array} $	$\begin{array}{c} \text{Sub.} \\ 1' & 1'' \\ 2 & 2 \\ 3 & 3 \\ 4 & 4 \\ 5 & 5 \end{array}$
$ \begin{array}{cccc} 66 & 0 \\ 10 \\ 20 \\ 30 \\ 40 \\ 50 \\ \end{array} $	$21 \ 32 \\ 24 \\ 15 \\ 7 \\ 20 \ 59 \\ 50 \\ \hline$	$ \begin{array}{cccccccccccccccccccccccccccccccccccc$	$\begin{array}{cccccccccccccccccccccccccccccccccccc$	$22 \ 46 \\ 37 \\ 28 \\ 19 \\ 10 \\ 1 \\ 1 \\ 1 \\ 1 \\ 1 \\ 1 \\ 1 \\ 1 \\ $	$23 \ 10 \\ 1 \\ 22 \ 52 \\ 43 \\ 34 \\ 25$	$23 \ 35 \\ 25 \\ 15 \\ 6 \\ 22 \ 57 \\ 48$	$23 \ 59 \\ 49 \\ 40 \\ 31 \\ 21 \\ 12 \\ 12 \\ 12 \\ 12 \\ 12 \\ 12$	$24 \ 23 \\ 14 \\ 4 \\ 23 \ 55 \\ 45 \\ 36 \\ 36$	$\begin{array}{c} 0 \\ 10 \\ 20 \\ 30 \\ 40 \\ 50 \end{array}$	$egin{array}{c} 0 \\ 4 \\ 8 \\ 12 \\ 16 \\ 20 \end{array}$	$ \begin{array}{c} 1 \\ 5 \\ 9 \\ 13 \\ 17 \\ 21 \end{array} $	$2 \\ 6 \\ 10 \\ 14 \\ 18 \\ 22$	$2 \\ 7 \\ 11 \\ 15 \\ 19 \\ 23$	$ \begin{array}{r} 3 \\ 7 \\ 11 \\ 16 \\ 20 \\ 24 \\ \end{array} $	$ \begin{array}{r} 6 & 5 \\ 7 & 6 \\ 8 & 7 \\ 9 & 8 \end{array} $
$ \begin{array}{r} 67 & 0 \\ 10 \\ 20 \\ 30 \\ 40 \\ 50 \\ \end{array} $	$ \begin{array}{r} 20 \ 41 \\ 33 \\ 25 \\ 16 \\ 8 \\ 19 \ 59 \\ \end{array} $	$21 5 \\ 20 \ 56 \\ 48 \\ 39 \\ 30 \\ 21$	$21 \ 28 \\ 19 \\ 11 \\ 2 \\ 20 \ 53 \\ 44$	$21 \ 52 \\ 43 \\ 34 \\ 25 \\ 16 \\ 7$	$22 \ 15 \\ 6 \\ 21 \ 57 \\ 48 \\ 39 \\ 30$	$22 \ 39 \\ 29 \\ 20 \\ 11 \\ 2 \\ 21 \ 52$	$23 \ 22 \ 52 \ 43 \ 34 \ 24 \ 15$	$23 \ 26 \ 16 \ 7 \ 22 \ 57 \ 47 \ 37 \ 37 \ 37 \ 37 \ 37 \ 37 \ 3$	$\begin{array}{c} 0 \\ 10 \\ 20 \\ 30 \\ 40 \\ 50 \end{array}$	$ \begin{array}{c} 0 \\ 4 \\ 8 \\ 12 \\ 15 \\ 19 \\ \end{array} $	$ \begin{array}{c} 1 \\ 5 \\ 8 \\ 12 \\ 16 \\ 20 \\ \end{array} $	$ \begin{array}{c} 2 \\ 5 \\ 9 \\ 13 \\ 17 \\ 21 \end{array} $	$2 \\ 6 \\ 10 \\ 14 \\ 18 \\ 22$	$ \begin{array}{r} 3 \\ 7 \\ 11 \\ 15 \\ 18 \\ 22 \end{array} $	
$ \begin{array}{r} 68 & 0 \\ 10 \\ 20 \\ 30 \\ 40 \\ 50 \\ \end{array} $	$ \begin{array}{r} 19 50 \\ 42 \\ 33 \\ 25 \\ 16 \\ 7 \end{array} $	$20 \ 13 \\ 4 \\ 19 \ 56 \\ 47 \\ 38 \\ 29$	$20 \ 35 \\ 27 \\ 18 \\ 9 \\ 0 \\ 19 \ 51$	$ \begin{array}{r} 20 58 \\ 49 \\ 40 \\ 31 \\ 22 \\ 13 \end{array} $	$21 \ 21 \ 12 \ 2 \ 20 \ 53 \ 44 \ 34$	$21 \ 43 \\ 34 \\ 24 \\ 15 \\ 5 \\ 20 \ 56$	22 5 21 56 47 37 27 17	$\begin{array}{cccccccccccccccccccccccccccccccccccc$	$\begin{array}{c} 0\\ 10\\ 20\\ 30\\ 40\\ 50 \end{array}$	$ \begin{array}{c} 0 \\ 4 \\ 7 \\ 11 \\ 15 \\ 18 \\ \end{array} $	$ \begin{array}{c} 1 \\ 4 \\ 8 \\ 12 \\ 16 \\ 19 \end{array} $	$ \begin{array}{c} 1 \\ 5 \\ 9 \\ 13 \\ 16 \\ 20 \end{array} $	$2 \\ 6 \\ 9 \\ 13 \\ 17 \\ 21$	$ \begin{array}{r} 3 \\ 7 \\ 10 \\ 14 \\ 18 \\ 21 \end{array} $	
$\begin{array}{ccc} 69 & 0 \\ 10 \\ 20 \\ 30 \\ 40 \\ 50 \end{array}$	$\begin{array}{ccc} 18 & 59 \\ & 50 \\ & 42 \\ & 33 \\ & 24 \\ & 16 \end{array}$	$ \begin{array}{r} 19 \ 21 \\ 12 \\ 3 \\ 18 \ 54 \\ 45 \\ 37 \end{array} $	$ \begin{array}{r} 19 & 42 \\ 33 \\ 24 \\ 15 \\ 6 \\ 18 & 57 \end{array} $	$ \begin{array}{r} 20 & 4 \\ 19 & 55 \\ 45 \\ 36 \\ 27 \\ 18 \end{array} $	$20\ 25 \\ 16 \\ 7 \\ 19\ 57 \\ 48 \\ 39$	$20 \ 47 \ 37 \ 28 \ 18 \ 9 \ 0$	$ \begin{array}{r} 21 & 8 \\ 20 & 59 \\ 49 \\ \cdot & 39 \\ 29 \\ 20 \end{array} $	$21 \ 30 \ 20 \ 10 \ 0 \ 20 \ 50 \ 41$	$ \begin{array}{c} 0 \\ 10 \\ 20 \\ 30 \\ 40 \\ 50 \end{array} $	$ \begin{array}{r} 0 \\ 4 \\ 7 \\ 11 \\ 14 \\ 18 \\ \end{array} $	$ \begin{array}{c} 1 \\ 4 \\ 8 \\ 11 \\ 15 \\ 18 \\ \end{array} $	$ \begin{array}{c} 1 \\ 5 \\ 8 \\ 12 \\ 15 \\ 19 \end{array} $	$ \begin{array}{c} 2 \\ 6 \\ 9 \\ 13 \\ 16 \\ 20 \end{array} $	$ \begin{array}{r} 3 \\ 6 \\ 10 \\ 13 \\ 17 \\ 20 \end{array} $	
TABLE 24.

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Correction of the Moon's Apparent Altitude for Parallax and Refraction. [Barometer 30 inches.—Fahrenheit's Thermometer 50°.]

Moon's			н	orizontal	parallax	κ.			onds of allax.	Cori	ection paral	1 for s lax.—	econd Add,	ls of	Corr. for
app. art.	54'	55'	56'	57'	58′	59'	60′	61'	Sec	0″	2"	4 ″	6″	8″	of alt.
	$\begin{array}{c} & ' & '' \\ 18 & 7 \\ 17 & 58 \\ & 50 \\ & 41 \\ & 32 \\ & 24 \end{array}$	$\begin{array}{c} & & \\ & & \\ & & 18 & 28 \\ & & 19 \\ & & 10 \\ & & 1 \\ 117 & 53 \\ & & 44 \end{array}$	$ \begin{smallmatrix} & & & \\ &$	${ \begin{smallmatrix} & ' & '' \\ 19 & 9 \\ & 0 \\ 18 & 50 \\ & 41 \\ & 32 \\ & 23 \\ \hline \end{array} }$	${ \begin{smallmatrix} & & & \\ & & & & \\ & & & \\ & & & \\ & & & \\ & & & \\ & & & \\ & & & \\ & & & \\ & & & $	$ \begin{smallmatrix} & & & \\ & & & 19 & 50 \\ & & & 41 \\ & & 31 \\ & & 21 \\ & & 12 \\ & & 3 \end{smallmatrix} $	$\begin{array}{c} , & "\\ 20 & 11\\ & 1\\ 19 & 51\\ & 41\\ & 32\\ & 22 \end{array}$	$\begin{array}{c} , & '' \\ 20 & 31 \\ & 21 \\ & 11 \\ & 11 \\ 19 & 52 \\ & 42 \end{array}$	${" \\ 0 \\ 10 \\ 20 \\ 30 \\ 40 \\ 50 }$	$ $					
$ \begin{array}{r} $	$ \begin{array}{r} 17 & 15 \\ 6 \\ 16 & 57 \\ 48 \\ 40 \\ 31 \end{array} $	$ \begin{array}{r} 17 & 35 \\ 26 \\ 17 \\ 8 \\ 16 & 59 \\ 50 \\ 50 \end{array} $	$ \begin{array}{r} 17 54 \\ 45 \\ 36 \\ 27 \\ 18 \\ 9 \end{array} $	$ \begin{array}{r} 18 & 14 \\ 5 \\ 17 & 55 \\ 46 \\ 37 \\ 28 \\ \end{array} $	$18 \ 34 \\ 24 \\ 14 \\ 5 \\ 17 \ 56 \\ 47$	$ \begin{array}{r} 18 53 \\ 43 \\ 33 \\ 24 \\ 15 \\ 5 \end{array} $	$ \begin{array}{r} 19 & 12 \\ 3 \\ 18 & 53 \\ 43 \\ 34 \\ 24 \end{array} $	$\begin{array}{cccc} 19 & 32 \\ & 22 \\ & 12 \\ & 2 \\ 18 & 52 \\ & 42 \end{array}$	$\begin{array}{c} 0 \\ 10 \\ 20 \\ 30 \\ 40 \\ 50 \end{array}$	$ \begin{array}{r} 0 \\ 3 \\ 6 \\ 10 \\ 13 \\ 16 \end{array} $	$ \begin{array}{r} 1 \\ 4 \\ 7 \\ 10 \\ 13 \\ 17 \end{array} $	$ \begin{array}{c} 1 \\ 4 \\ 8 \\ 11 \\ 14 \\ 17 \end{array} $	$ \begin{array}{r} 2 \\ 5 \\ 8 \\ 12 \\ 15 \\ 18 \end{array} $	$ \begin{array}{r} 3 \\ 6 \\ 9 \\ 12 \\ 15 \\ 19 \end{array} $	
$72 \ 0 \\ 10 \\ 20 \\ 30 \\ 40 \\ 50$	$16 \ 22 \\ 13 \\ 5 \\ 15 \ 57 \\ 48 \\ 39$	$\begin{array}{cccc} 16 & 41 \\ & 32 \\ & 23 \\ & 14 \\ & 5 \\ 15 & 56 \end{array}$	$ \begin{array}{cccccccccccccccccccccccccccccccccccc$	$ \begin{array}{r} 17 & 18 \\ 9 \\ 16 & 59 \\ 50 \\ 41 \\ 32 \\ \hline \end{array} $	$ \begin{array}{r} 17 & 37 \\ 27 \\ 18 \\ 9 \\ 16 & 59 \\ 50 \\ \underline{50} \\ 16 & 10 \end{array} $	$ \begin{array}{r} 17 55 \\ 46 \\ 36 \\ 27 \\ 17 \\ 7 \\ 10 50 \end{array} $	$ \begin{array}{r} 18 & 14 \\ 4 \\ 17 & 54 \\ 45 \\ 35 \\ 25 \\ \hline 17 & 15 \\ \hline 17 & 15 \\ 1$	$ \begin{array}{r} 18 & 32 \\ 22 \\ 12 \\ 3 \\ 17 & 53 \\ 43 \\ 17 & 52 \end{array} $	$ \begin{array}{r} 0 \\ 10 \\ 20 \\ 30 \\ 40 \\ 50 \\ \hline 0 \end{array} $	$ \begin{array}{c} 0 \\ 3 \\ 6 \\ 9 \\ 12 \\ 15 \\ \hline $	$ \begin{array}{c} 1 \\ 4 \\ 7 \\ 10 \\ 13 \\ 16 \\ \hline 16 \\ \hline 1 1 1 1 1 $	$ \begin{array}{c} 1 \\ 4 \\ 7 \\ 10 \\ 13 \\ 16 \\ \hline 16 \end{array} $	$2 \\ 5 \\ 8 \\ 11 \\ 14 \\ 17$	$2 \\ 5 \\ 8 \\ 11 \\ 14 \\ 18$	
$73 \ 0 \\ 10 \\ 20 \\ 30 \\ 40 \\ 50 \\ \hline$	$ \begin{array}{r} 15 & 30 \\ 21 \\ 12 \\ 3 \\ 14 & 54 \\ 45 \\ \hline 14 & 54 \\ 45 \\ \hline 14 & 54 \\ 45 \\ \hline 12 \\ 3 \\ 14 & 54 \\ 45 \\ \hline 12 \\ 3 \\ 14 & 54 \\ 45 \\ \hline 12 \\ 3 \\ 14 & 54 \\ 45 \\ \hline 12 \\ 3 \\ 14 & 54 \\ 45 \\ 12 \\ 3 \\ 14 & 54 \\ 45 \\ 12 \\ 3 \\ 14 & 54 \\ 45 \\ 12 \\ 3 \\ 14 & 54 \\ 45 \\ 12 \\ 3 \\ 14 & 54 \\ 45 \\ 12 \\ 12 \\ 3 \\ 14 & 54 \\ 45 \\ 12 \\ 1$	$ \begin{array}{c} 15 \ 47 \\ 38 \\ 29 \\ 20 \\ 11 \\ 2 \\ \hline 14 \\ 52 \\ \hline 14 \\ \hline 15 \\ 16 \\ \hline 15 \\ 16 \\ \hline 16 \\ \hline 16 \\ 16 \\ \hline 16 \\ 16 \\ \hline 16 $	$ \begin{array}{cccccccccccccccccccccccccccccccccccc$	$ \begin{array}{r} 16 & 22 \\ & 13 \\ & 4 \\ 15 & 55 \\ & 45 \\ & 35 \\ \end{array} $	$ \begin{array}{r} 16 \ 40 \\ 30 \\ 21 \\ 12 \\ 2 \\ 15 \ 52 \\ \hline 15 \ 40 \\ 15 \ 40 \\ \hline 15 \ 40 \ 40 \\ \hline 15 \ 40 \ 40 \\ \hline 15 \ 40 \ 40 \ 40 \ 40 \ 40 \ 40 \ 40 \ 4$	$ \begin{array}{c} 16 58 \\ 48 \\ 39 \\ 29 \\ 19 \\ 9 \\ 15 50 \\ \end{array} $	$ \begin{array}{c ccccccccccccccccccccccccccccccccccc$	$ \begin{array}{r} 17 & 33 \\ 23 \\ 13 \\ 3 \\ 16 & 53 \\ 42 \\ 16 & 9 \\ \hline 16 & 9 \\ \hline 16 & 9 \\ 42 \\ 16 & 9 \\ 42 \\ 16 & 9 \\ 42 \\ 16 & 9 \\ 42 \\ 16 & 9 \\ 42 \\ 16 & 9 \\ 42 \\ 16 & 9 \\ 42 \\ 16 & 9 \\ 42 \\ 16 & 9 \\ 42 \\ 16 & 9 \\ 42 \\ 16 & 9 \\ 42 \\ 16 & 9 \\ 42 \\ 16 & 9 \\ 42 \\ 16 & 9 \\ 42 \\ 16 & 9 \\ 42 \\ 16 & 9 \\ 42 \\ 16 & 9 \\ 1$	$ \begin{array}{c} 0 \\ 10 \\ 20 \\ 30 \\ 40 \\ 50 \\ \hline 0 \end{array} $	$ \begin{array}{c} 0 \\ 3 \\ 6 \\ 9 \\ 11 \\ 14 \\ \hline 0 \end{array} $	$ \begin{array}{c} 1 \\ 3 \\ 6 \\ 9 \\ 12 \\ 15 \\ \hline 1 1 \end{array} $	$ \begin{array}{c} 1 \\ 4 \\ 7 \\ 10 \\ 13 \\ 15 \\ \hline 15 \\ \hline 1 \end{array} $	$ \begin{array}{c} 2 \\ 5 \\ 7 \\ 10 \\ 13 \\ 16 \\ \hline 2 7 7 7 7 7 $	$2 \\ 5 \\ 8 \\ 11 \\ 14 \\ 17 $	
$74 \ 0 \\ 10 \\ 20 \\ 30 \\ 40 \\ 50$	$ \begin{array}{r} 14 & 36 \\ & 28 \\ & 19 \\ & 10 \\ & 1 \\ 13 & 52 \end{array} $	$ \begin{array}{r} 14 53 \\ 44 \\ 35 \\ 26 \\ 17 \\ 8 \end{array} $	$ \begin{array}{cccccccccccccccccccccccccccccccccccc$	15 26 17 8 14 58 49 39 3 $ 39 $	$ \begin{array}{r} 15 \ 42 \\ 33 \\ 24 \\ 14 \\ 5 \\ 14 \ 55 \\ \end{array} $	$ \begin{array}{r} 15 & 59 \\ 49 \\ 40 \\ 30 \\ 20 \\ 10 \\ \end{array} $	$ \begin{array}{r} 16 & 16 \\ 6 \\ 15 & 56 \\ 46 \\ 36 \\ 26 \end{array} $	$ \begin{array}{r} 16 & 32 \\ 22 \\ 12 \\ 2 \\ 15 & 52 \\ 42 \\ 42 \end{array} $	$ \begin{array}{c} 0 \\ 10 \\ 20 \\ 30 \\ 40 \\ 50 \\ \end{array} $	$ \begin{array}{c} 0 \\ 3 \\ 5 \\ 8 \\ 11 \\ 13 \end{array} $	$ \begin{array}{c} 1 \\ 3 \\ 6 \\ 9 \\ 11 \\ 14 \end{array} $	$ \begin{array}{c} 1 \\ 4 \\ 6 \\ 9 \\ 12 \\ 14 \\ \end{array} $	$2 \\ 4 \\ 7 \\ 10 \\ 12 \\ 15 \\ 15 \\ 15 \\ 12 \\ 15 \\ 15 \\ 10 \\ 10 \\ 10 \\ 10 \\ 10 \\ 10$		$ \begin{array}{c} \text{Sub.} \\ 1' 1'' \\ 2 2 \\ 3 3 \\ 4 4 \\ 5 5 \end{array} $
$75 \ 0 \ 10 \ 20 \ 30 \ 40 \ 50$	$13.43 \\ 34 \\ 25 \\ 16 \\ 7 \\ 12 58$	$ \begin{array}{r} 13 & 59 \\ 50 \\ 41 \\ 32 \\ 22 \\ $	$ \begin{array}{r} 14 & 14 \\ & 5 \\ 13 & 56 \\ & 46 \\ & 37 \\ & 28 \\ \end{array} $	$ \begin{array}{r} 14 & 29 \\ & 20 \\ & 11 \\ & 1 \\ 13 & 52 \\ & 42 \end{array} $	$ \begin{array}{r} 14 \\ 36 \\ 27 \\ 17 \\ 7 \\ 13 \\ 57 \end{array} $	$ \begin{array}{cccccccccccccccccccccccccccccccccccc$	$ \begin{array}{cccccccccccccccccccccccccccccccccccc$	$ \begin{array}{r} 15 & 32 \\ 22 \\ 12 \\ 2 \\ 14 & 51 \\ 41 \\ \end{array} $	$ \begin{array}{c} 0 \\ 10 \\ 20 \\ 30 \\ 40 \\ 50 \end{array} $	$ \begin{array}{c} 0 \\ 3 \\ 5 \\ 8 \\ 10 \\ 13 \end{array} $	$ \begin{array}{c} 1 \\ 3 \\ 6 \\ 8 \\ 11 \\ 13 \end{array} $	$ \begin{array}{c} 1 \\ 4 \\ 6 \\ 9 \\ 11 \\ 14 \end{array} $	$2 \\ 4 \\ 7 \\ 9 \\ 12 \\ 14$	$ \begin{array}{r} 2 \\ 5 \\ 7 \\ 10 \\ 12 \\ 15 \\ \end{array} $	$ \begin{array}{r} 6 & 6 \\ 7 & 7 \\ 8 & 8 \\ 9 & 9 \\ 9 \end{array} $
$76 \ 0 \\ 10 \\ 20 \\ 30 \\ 40 \\ 50$	$12 \ 49 \ 41 \ 32 \ 23 \ 14 \ 5$	$ \begin{array}{r} 13 & 4 \\ 12 & 55 \\ 46 \\ 37 \\ 27 \\ 18 \end{array} $	$ \begin{array}{cccccccccccccccccccccccccccccccccccc$	$ \begin{array}{r} 13 \ \ 33 \\ 24 \\ 14 \\ 5 \\ 12 \ 55 \\ 45 \\ \end{array} $	$ \begin{array}{r} 13 \ 47 \\ 38 \\ 28 \\ 19 \\ 9 \\ 12 \ 59 \end{array} $	$ \begin{array}{r} 14 & 2 \\ 13 & 53 \\ 43 \\ 33 \\ 23 \\ 13 \end{array} $	$ \begin{array}{r} 14 & 17 \\ & 7 \\ 13 & 57 \\ & 47 \\ & 36 \\ & 26 \\ \end{array} $	$ \begin{bmatrix} 14 & 31 \\ 21 \\ 11 \\ 11 \\ 13 & 50 \\ 40 \end{bmatrix} $	$ \begin{array}{c} 0 \\ 10 \\ 20 \\ 30 \\ 40 \\ 50 \\ \end{array} $	$ \begin{array}{c} 0 \\ 2 \\ 5 \\ 7 \\ 9 \\ 12 \end{array} $	$ \begin{array}{c} 0 \\ 3 \\ 5 \\ 8 \\ 10 \\ 12 \end{array} $	$ \begin{array}{c} 1 \\ 3 \\ 6 \\ 8 \\ 10 \\ 13 \end{array} $	$ \begin{array}{c} 1 \\ 4 \\ 6 \\ 8 \\ 11 \\ 13 \end{array} $	$2 \\ 4 \\ 7 \\ 9 \\ 11 \\ 14$	
$77 \ 0 \\ 10 \\ 20 \\ 30 \\ 40 \\ 50$	$11 \ 56 \\ 47 \\ 38 \\ 29 \\ 19 \\ 10$	$ \begin{array}{rrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrr$	$ \begin{array}{r} 12 & 22 \\ & 13 \\ & 4 \\ 11 & 55 \\ & 45 \\ & 35 \\ \end{array} $	$ \begin{array}{r} 12 & 36 \\ & 27 \\ & 17 \\ & 8 \\ 11 & 58 \\ & 48 \\ \end{array} $	$12 \ 49 \\ 40 \\ 30 \\ 21 \\ 11 \\ 1 \\ 1$	$ \begin{array}{rrrr} 13 & 3 \\ 12 & 53 \\ 43 \\ 33 \\ 23 \\ 13 \end{array} $	$ \begin{array}{cccccccccccccccccccccccccccccccccccc$	$ \begin{array}{r} 13 & 30 \\ 20 \\ 10 \\ 0 \\ 12 & 49 \\ 39 \\ 39 \end{array} $	$ \begin{array}{c} 0 \\ 10 \\ 20 \\ 30 \\ 40 \\ 50 \end{array} $	$ \begin{array}{c} 0 \\ 2 \\ 4 \\ 7 \\ 9 \\ 11 \end{array} $	$ \begin{array}{c} 0 \\ 3 \\ 5 \\ 7 \\ 9 \\ 11 \end{array} $	$ \begin{array}{c} 1 \\ 3 \\ 5 \\ 7 \\ 9 \\ 12 \end{array} $	$ \begin{array}{c} 1 \\ 4 \\ 6 \\ 8 \\ 10 \\ 12 \end{array} $	$ \begin{array}{c} 2 \\ 4 \\ 6 \\ 8 \\ 10 \\ 13 \end{array} $	
$ \begin{array}{r} 78 & 0 \\ 10 \\ 20 \\ 30 \\ 40 \\ 50 \end{array} $	$11 \ 1 \\ 10 \ 52 \\ 43 \\ 34 \\ 25 \\ 16$	$ \begin{array}{c ccccccccccccccccccccccccccccccccccc$	$11 \ 26 \\ 17 \\ 8 \\ 10 \ 58 \\ 48 \\ 39$	$11 \ 39 \\ 30 \\ 20 \\ 10 \\ 0 \\ 10 \ 51$	$ \begin{array}{c ccccccccccccccccccccccccccccccccccc$	$12 \ 4 \\ 11 \ 54 \\ 44 \\ 34 \\ 24 \\ 15$	$12 \ 16 \\ 6 \\ 11 \ 56 \\ 46 \\ 36 \\ 26$	$ \begin{array}{r} 12 & 29 \\ 19 \\ 8 \\ 11 & 58 \\ 48 \\ 38 \\ 38 \end{array} $	$\begin{array}{c} 0\\ 10\\ 20\\ 30\\ 40\\ 50 \end{array}$	$egin{array}{c} 0 \\ 2 \\ 4 \\ 6 \\ 8 \\ 10 \end{array}$	$egin{array}{c c} 0 \\ 2 \\ 4 \\ 6 \\ 8 \\ 10 \end{array}$	$ \begin{array}{c} 1 \\ 3 \\ 5 \\ 7 \\ 9 \\ 11 \end{array} $	$ \begin{array}{c} 1 \\ 3 \\ 5 \\ 7 \\ 9 \\ 11 \end{array} $	$egin{array}{c c} 2 \\ 4 \\ 6 \\ 8 \\ 10 \\ 12 \end{array}$	
$79 \ 0 \\ 10 \\ 20 \\ 30 \\ 40 \\ 50$	$ \begin{array}{r} 10 & 7 \\ 9 & 58 \\ 49 \\ 40 \\ 31 \\ 22 \end{array} $	$ \begin{array}{cccccccccccccccccccccccccccccccccccc$	$ \begin{array}{c} 10 & 30 \\ & 21 \\ & 11 \\ & 1 \\ 9 & 52 \\ & 43 \end{array} $	$ \begin{array}{c ccccccccccccccccccccccccccccccccccc$	$ \begin{array}{r} 10 53 \\ 43 \\ 33 \\ 23 \\ 13 \\ 4 \end{array} $	$ \begin{array}{cccccccccccccccccccccccccccccccccccc$	$ \begin{array}{c} 11 & 16 \\ & 6 \\ 10 & 56 \\ & 45 \\ & 35 \\ & 25 \end{array} $	$ \begin{array}{r} 11 & 28 \\ 17 \\ 7 \\ 10 & 56 \\ 46 \\ 36 \\ 36 \end{array} $	$ \begin{array}{c} 0 \\ 10 \\ 20 \\ 30 \\ 40 \\ 50 \end{array} $	$\begin{bmatrix} 0\\ 2\\ 4\\ 6\\ 7\\ 9 \end{bmatrix}$	$ \begin{array}{c c} 0 \\ 2 \\ 4 \\ 6 \\ 8 \\ 10 \end{array} $	$ \begin{array}{c} 1 \\ 3 \\ 4 \\ 6 \\ 8 \\ 10 \end{array} $	$ \begin{array}{c} 1 \\ 3 \\ 5 \\ 7 \\ 8 \\ 10 \end{array} $	$ \begin{array}{c} 1 \\ 3 \\ 5 \\ 7 \\ 9 \\ 11 \end{array} $	

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TABLE 24.

Correction of the Moon's Apparent Altitude for Parallax and Refraction.

[Barometer 30 inches.—Fahrenheit's Thermometer 50°.]

Moon's			Н	orizontal	parallax		ads of llax.	Corr	ectior paral	for slax.	econd	ls of	Corr.		
app. alt.	54'	55'	56'	57/	58′	59'	60′	61′	Secon	0″	2"	4″	6″	8″	minutes of alt.
	${ \begin{array}{c} & ' & '' \\ 9 & 13 \\ & 3 \\ 8 & 54 \\ & 45 \\ & 36 \\ & 27 \end{array} }$	${ \begin{array}{c} & & & \\ 9 & 23 \\ & & 14 \\ & 4 \\ 8 & 55 \\ & 46 \\ & 37 \end{array} }$	$ \begin{smallmatrix} & & & \\ & 9 & 34 \\ & 24 \\ & 14 \\ & 5 \\ 8 & 55 \\ & 46 \\ \end{smallmatrix} $	${ \begin{array}{c} & & \\ 9 & 44 \\ & 34 \\ & 24 \\ & 15 \\ & 5 \\ 8 & 56 \end{array} }$	${\begin{array}{*{20}c} & & & \\ & 9 & 55 \\ & 45 \\ & 35 \\ & 25 \\ & 15 \\ & 6 \end{array}}$	$ \begin{smallmatrix} & & & \\ & 10 & 5 \\ & 9 & 55 \\ & 45 \\ & 35 \\ & 25 \\ & 15 \end{smallmatrix} $	$ \begin{smallmatrix} & & & \\ & 10 & 15 \\ & 5 \\ 9 & 55 \\ & 45 \\ & 35 \\ & 25 \end{smallmatrix} $	$' " \\10 26 \\15 \\5 \\9 54 \\44 \\34$	$" \\ 0 \\ 10 \\ 20 \\ 30 \\ 40 \\ 50$	" 0 2 3 5 7 8					
$\begin{array}{ccc} 81 & 0 \\ & 10 \\ & 20 \\ & 30 \\ & 40 \\ & 50 \end{array}$	$ \begin{array}{r} 8 \ 18 \\ 9 \\ 7 \ 59 \\ 50 \\ 41 \\ 32 \end{array} $	$ \begin{bmatrix} 8 & 27 \\ 18 \\ 8 \\ 7 & 59 \\ 50 \\ 41 \end{bmatrix} $	$8 \ 37 \\ 27 \\ 17 \\ 8 \\ 7 \ 59 \\ 49 \\ 49$	$ \begin{array}{r} 8 \ \ 46 \\ 36 \\ 26 \\ 17 \\ 8 \\ 7 \ 58 \\ \end{array} $	$egin{array}{cccc} 8 & 56 & \ 46 & \ 36 & \ 26 & \ 17 & \ 7 & \ \end{array}$	$ \begin{array}{r} 9 & 5 \\ 8 & 55 \\ 45 \\ 35 \\ 25 \\ 15 \end{array} $	$9 14 \\ 4 \\ 8 54 \\ 44 \\ 34 \\ 24$	$ \begin{array}{r} 9 & 24 \\ 13 \\ 3 \\ 8 & 52 \\ 42 \\ 32 \end{array} $	$\begin{array}{c} 0 \\ 10 \\ 20 \\ 30 \\ 40 \\ 50 \end{array}$	$ \begin{array}{c} 0 \\ 1 \\ 3 \\ 4 \\ 6 \\ 7 \end{array} $	0 2 3 5 6 8	$\begin{array}{c}1\\2\\4\\5\\6\\8\end{array}$	$\begin{array}{c}1\\2\\4\\5\\7\\8\end{array}$	$ \begin{array}{c} 1 \\ 3 \\ 4 \\ 6 \\ 7 \\ 9 \end{array} $	
$\begin{array}{rrrr} 82 & 0 \\ 10 \\ 20 \\ 30 \\ 40 \\ 50 \end{array}$	$7 \ 23 \\ 14 \\ 4 \\ 6 \ 55 \\ 46 \\ 37 \\ \hline$	$7 \ 31 \ 22 \ 12 \ 3 \ 6 \ 54 \ 45 \ 22 \ 3 \ 7 \ 54 \ 54 \ 54 \ 54 \ 54 \ 54 \ 54 $	$ \begin{array}{r} 7 & 40 \\ 30 \\ 20 \\ 11 \\ 2 \\ 6 & 52 \\ \hline 6 & 52 \\ \hline \end{array} $	$7 \ 48 \\ 38 \\ 28 \\ 19 \\ 10 \\ 0 \\ \hline 0 \\ \hline 10 \\ 0 \\ 0 \\ \hline 10 \\ 0 \\ 0 \\ \hline 10 \\ 0 \\ 0 \\ 0 \\ 0 \\ 0 \\ 0 \\ 0 \\ 0 \\ 0 $	$7 57 \\ 47 \\ 37 \\ 27 \\ 17 \\ 7 \\ 7 \\ 7 \\ 7 \\ 7 \\ 7 \\ 7 \\ 7 \\ 7 \\ $	$ \begin{array}{r} 8 & 5 \\ 7 & 55 \\ 45 \\ 35 \\ 25 \\ 15 \\ \end{array} $	$ \begin{array}{r} 8 13 \\ 3 \\ 7 52 \\ 42 \\ 32 \\ 22 \\ \hline \end{array} $	$ \begin{array}{r} 8 22 \\ 11 \\ 0 \\ 7 50 \\ 40 \\ 30 \\ \hline \end{array} $	$ \begin{array}{r} 0 \\ 10 \\ 20 \\ 30 \\ 40 \\ 50 \\ \hline \end{array} $	$ \begin{array}{c} 0 \\ 1 \\ 3 \\ 4 \\ 5 \\ 7 \\ \hline 7 \end{array} $	$\begin{array}{c}0\\2\\3\\4\\6\\7\end{array}$	$\begin{array}{c}1\\2\\3\\5\\6\\7\end{array}$	$\begin{array}{c}1\\2\\3\\5\\6\\7\end{array}$	$\begin{array}{c}1\\2\\4\\5\\6\\8\end{array}$	
$ \begin{array}{r} 83 & 0 \\ 10 \\ 20 \\ 30 \\ 40 \\ 50 \end{array} $	$egin{array}{ccc} 6 & 28 \\ & 19 \\ & 9 \\ & 0 \\ 5 & 51 \\ & 42 \end{array}$	$ \begin{array}{r} 6 & 35 \\ 26 \\ 16 \\ 7 \\ 5 & 58 \\ 49 \\ \end{array} $	$ \begin{array}{r} 6 & 43 \\ 33 \\ 23 \\ 13 \\ 4 \\ 5 & 55 \\ \hline \end{array} $		$ \begin{array}{r} 6 57 \\ 47 \\ 37 \\ 27 \\ 18 \\ 8 \\ \end{array} $	$ \begin{array}{cccccccccccccccccccccccccccccccccccc$	$ \begin{array}{c} 7 & 12 \\ 2 \\ 6 & 51 \\ 41 \\ 31 \\ 21 \\ \end{array} $	$ \begin{array}{r} 7 & 20 \\ 9 \\ 6 & 58 \\ 48 \\ 38 \\ 27 \\ \end{array} $	$ \begin{array}{r} 0 \\ 10 \\ 20 \\ .30 \\ 40 \\ 50 \\ \end{array} $	$\begin{array}{c}0\\1\\2\\3\\5\\6\end{array}$	$\begin{array}{c}0\\1\\3\\4\\5\\6\end{array}$	$\begin{array}{c} 0\\ 2\\ 3\\ 4\\ 5\\ 6\end{array}$	$\begin{array}{c}1\\2\\3\\4\\5\\6\end{array}$	$\begin{array}{c}1\\2\\3\\4\\6\\7\end{array}$	Sub. 1' 1'' 2 2 3 3 4 4 5 5 2
$\begin{array}{rrr} 84 & 0 \\ 10 \\ 20 \\ 30 \\ 40 \\ 50 \end{array}$	$5 \ 33 \ 23 \ 14 \ 5 \ 4 \ 56 \ 47$	$5 \ 39 \ 30 \ 20 \ 10 \ 1 \ 4 \ 52$	$5 45 \\ 36 \\ 26 \\ 16 \\ 7 \\ 4 58$	$5 52 \\ 42 \\ 32 \\ 22 \\ 13 \\ 3$	$558 \\ 48 \\ 38 \\ 28 \\ 18 \\ 8 \\ 8 \\ 8 \\ 8 \\ 8 \\ 8 \\ 8 \\ 8 \\$	$ \begin{array}{r} 6 & 4 \\ 5 & 54 \\ 44 \\ 34 \\ 24 \\ 14 \end{array} $	$ \begin{array}{c} 6 & 10 \\ 0 \\ 5 & 50 \\ 39 \\ 29 \\ 19 \\ \end{array} $	$ \begin{array}{r} 6 \ 17 \\ $	$ \begin{array}{c} 0 \\ 10 \\ 20 \\ 30 \\ 40 \\ 50 \end{array} $	$\begin{array}{c}0\\1\\2\\3\\4\\5\end{array}$	$\begin{array}{c}0\\1\\2\\3\\4\\5\end{array}$	$ \begin{array}{c} 0 \\ 1 \\ 2 \\ 3 \\ 4 \\ 5 \end{array} $	$\begin{array}{c}1\\2\\3\\4\\5\end{array}$	$egin{array}{c} 1\\ 2\\ 3\\ 4\\ 5\\ 6\end{array}$	6 6 7 7 8 8 9 9
$egin{array}{cccc} 85 & 0 & 10 & \ 20 & 30 & \ 40 & 50 & \ \end{array}$	$egin{array}{ccc} 4 & 37 \\ & 28 \\ & 18 \\ & 9 \\ & 0 \\ 3 & 51 \end{array}$	$egin{array}{c} 4 & 43 \\ & 33 \\ & 24 \\ & 14 \\ & 5 \\ 3 & 56 \end{array}$	$ \begin{array}{r} 4 & 48 \\ & 38 \\ & 28 \\ & 19 \\ & 10 \\ & 0 \\ \end{array} $	$egin{array}{c} 4 & 53 \\ 43 \\ 33 \\ 23 \\ 14 \\ 5 \end{array}$	$ \begin{array}{r} 4 58 \\ 48 \\ 38 \\ 28 \\ 19 \\ 9 \end{array} $	$5 \ 4 \ 53 \ 43 \ 33 \ 23 \ 13$	$5 9 \\ 4 58 \\ 48 \\ 38 \\ 28 \\ 18 \\ 18 \\ \end{array}$	$ \begin{array}{c cccc} 5 & 14 \\ & 3 \\ 4 & 53 \\ & 43 \\ & 33 \\ & 22 \\ \end{array} $	$\begin{array}{c} 0\\ 10\\ 20\\ 30\\ 40\\ 50 \end{array}$	$ \begin{array}{c} 0 \\ 1 \\ 2 \\ 2 \\ 3 \\ 4 \end{array} $	$ \begin{array}{c} 0 \\ 1 \\ 2 \\ 3 \\ 3 \\ 4 \end{array} $	$\begin{array}{c}0\\1\\2\\3\\4\\4\end{array}$	$ \begin{array}{c} 0 \\ 1 \\ 2 \\ 3 \\ 4 \\ 5 \end{array} $	$\begin{array}{c}1\\1\\2\\3\\4\\5\end{array}$	
	$ \begin{array}{r} 3 & 42 \\ 33 \\ 23 \\ 14 \\ 5 \\ 2 & 56 \end{array} $	$ \begin{array}{r} 3 & 46 \\ 37 \\ 27 \\ 18 \\ 9 \\ 2 & 59 \\ \end{array} $	$ \begin{array}{r} 3 50 \\ 41 \\ 31 \\ 21 \\ 12 \\ 3 \end{array} $	$egin{array}{cccc} 3 & 55 \\ 45 \\ 35 \\ 25 \\ 16 \\ 6 \end{array}$	$egin{array}{cccc} 3 & 59 \\ 49 \\ 39 \\ 29 \\ 19 \\ 9 \end{array}$	$ \begin{array}{r} 4 & 3 \\ 3 & 53 \\ 43 \\ 33 \\ 23 \\ 13 \end{array} $	$ \begin{array}{r} 4 & 7 \\ 3 & 57 \\ 46 \\ 36 \\ 26 \\ 16 \end{array} $	$ \begin{array}{r} 4 & 11 \\ 1 \\ 3 & 50 \\ 40 \\ 30 \\ 19 \\ \end{array} $	$\begin{array}{c} 0 \\ 10 \\ ,20 \\ 30 \\ 40 \\ 50 \end{array}$	$egin{array}{c} 0 \\ 1 \\ 1 \\ 2 \\ 3 \\ 3 \\ 3 \end{array}$	$\begin{smallmatrix} 0\\1\\1\\2\\3\\3\\3\end{smallmatrix}$	$ \begin{array}{c} 0 \\ 1 \\ 2 \\ 2 \\ 3 \\ 3 \end{array} $	$\begin{array}{c}0\\1\\2\\2\\3\\4\end{array}$	$\begin{array}{c}1\\1\\2\\2\\3\\4\end{array}$	
$\begin{array}{r} 87 & 0 \\ 10 \\ 20 \\ 30 \\ 40 \\ 50 \end{array}$	$2 \ 47 \ 37 \ 28 \ 19 \ 10 \ 1$	$egin{array}{ccc} 2 & 50 \\ 40 \\ 31 \\ 21 \\ 12 \\ 3 \end{array}$	$ \begin{array}{r} 2 53 \\ 43 \\ 33 \\ 24 \\ 15 \\ 5 \end{array} $	$256 \\ 46 \\ 36 \\ 26 \\ 17 \\ 7$	$2 59 \\ 49 \\ 39 \\ 29 \\ 19 \\ 9$	$ \begin{array}{r} 3 & 2 \\ 2 & 52 \\ 42 \\ 32 \\ 22 \\ 12 \end{array} $	$ \begin{array}{r} 3 & 5 \\ 2 & 55 \\ 45 \\ 34 \\ 24 \\ 14 \end{array} $	$ \begin{array}{r} 3 & 9 \\ 2 & 58 \\ 47 \\ 37 \\ 27 \\ 16 \end{array} $	$\begin{array}{c} 0 \\ 10 \\ 20 \\ 30 \\ 40 \\ 50 \end{array}$	$\begin{array}{c}0\\0\\1\\1\\2\\2\end{array}$	$\begin{array}{c}0\\1\\1\\1\\2\\2\end{array}$	$\begin{array}{c}0\\1\\2\\2\\2\\2\end{array}$	$\begin{array}{c}0\\1\\1\\2\\2\\3\end{array}$	$\begin{array}{c}0\\1\\2\\2\\3\end{array}$	
$\begin{array}{rrrr} 88 & 0 \\ 10 \\ 20 \\ 30 \\ 40 \\ 50 \end{array}$	$ \begin{array}{r} 1 & 51 \\ 42 \\ 32 \\ 23 \\ 14 \\ 5 \end{array} $	$egin{array}{cccc} 1 & 53 \\ & 43 \\ & 34 \\ & 25 \\ & 15 \\ & 6 \end{array}$	$ \begin{array}{r} 1 55 \\ 45 \\ 36 \\ 26 \\ 16 \\ 7 \end{array} $	$ \begin{array}{r} 1 & 57 \\ 47 \\ 38 \\ 28 \\ 19 \\ 9 \end{array} $	$ \begin{array}{r} 1 59 \\ 49 \\ 39 \\ 29 \\ 20 \\ 10 \end{array} $	$ \begin{array}{cccc} 2 & 2 \\ 1 & 51 \\ 41 \\ 31 \\ 21 \\ 11 \end{array} $	$ \begin{array}{cccc} 2 & 4 \\ 1 & 53 \\ 43 \\ 32 \\ 22 \\ 12 \end{array} $	$ \begin{array}{cccc} 2 & 6 \\ 1 & 55 \\ 44 \\ 34 \\ 24 \\ 13 \end{array} $	$\begin{array}{c} 0 \\ 10 \\ 20 \\ 30 \\ 40 \\ 50 \end{array}$	$ \begin{array}{c} 0 \\ 0 \\ 1 \\ 1 \\ 1 \\ 1 \end{array} $	$ \begin{array}{c} 0 \\ 0 \\ 1 \\ 1 \\ 1 \\ 1 \end{array} $	$ \begin{array}{c} 0 \\ 0 \\ 1 \\ 1 \\ 1 \\ 1 \end{array} $	$ \begin{array}{c} 0 \\ 0 \\ 1 \\ 1 \\ 1 \\ 2 \end{array} $	$ \begin{array}{c} 0 \\ 0 \\ 1 \\ 1 \\ 1 \\ 2 \end{array} $	
$\begin{array}{rrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrr$	$ \begin{array}{r} 0 & 56 \\ 46 \\ 37 \\ 28 \\ 19 \\ 9 \end{array} $	$\begin{array}{c} 0 & 57 \\ & 47 \\ & 37 \\ & 28 \\ & 19 \\ & 10 \end{array}$	$ \begin{array}{r} 0 \ 58 \\ 48 \\ 38 \\ 28 \\ 19 \\ 10 \end{array} $	$\begin{array}{c} 0 & 59 \\ 49 \\ 39 \\ 29 \\ 19 \\ 10 \end{array}$	$ \begin{array}{cccc} 1 & 0 \\ 0 & 50 \\ 40 \\ 30 \\ 20 \\ 10 \end{array} $	$ \begin{array}{c} 1 & 1 \\ 0 & 51 \\ 40 \\ 30 \\ 20 \\ 10 \end{array} $	$ \begin{array}{r} 1 & 2 \\ 0 & 51 \\ 41 \\ 31 \\ 21 \\ 10 \end{array} $	$ \begin{array}{r} 1 & 3 \\ 0 & 52 \\ 42 \\ 31 \\ 21 \\ 10 \end{array} $	$\begin{array}{c} 0\\ 10\\ 20\\ 30\\ 40\\ 50 \end{array}$	$ \begin{array}{c} 0 \\ 0 \\ 0 \\ 0 \\ 0 \\ 1 \end{array} $	$ \begin{array}{c} 0 \\ 0 \\ 0 \\ 0 \\ 0 \\ 1 \end{array} $	$ \begin{array}{c} 0 \\ 0 \\ 0 \\ 0 \\ 0 \\ 1 \end{array} $	$ \begin{array}{c} 0 \\ 0 \\ 0 \\ 0 \\ 1 \end{array} $	$egin{array}{c} 0 \\ 0 \\ 0 \\ 0 \\ 0 \\ 1 \end{array}$	

TABLE 25.

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Table showing the variation of the altitude of an object arising from a change of 100 seconds in the declination. Unmarked quantities in the Table are positive. If the change move the body toward the elevated pole, apply the correction to the altitude with the signs in the Table; otherwise, change the signs.

nation.	ıde.	Latitude of same name as declination. Latitude of different name from declination.													ade.	nation.		
Deelir	Altitu	70°	60°	50°	40°	30°	20°	10°	0°	10°	20°	30°	40 °	50°	60°	70°	Altitu	Deeli
。 0	$^{\circ}$ 0 10 20 30 40 50 60 70	" 94 95 100	" 87 88 92 100		$ \begin{array}{c} '' & 64 \\ 65 & 68 \\ 74 & 84 \\ 100 \\ 100 \\ $		$" \\ 34 \\ 35 \\ 36 \\ 39 \\ 45 \\ 53 \\ 68 \\ 100$	$ $		${ { 17 \\ 18 \\ 20 \\ 22 \\ 27 \\ 35 \\ 51 } }$		$50 \\ 51 \\ 53 \\ 57 \\ 65 \\ 78 \\ 100$	${{}^{\prime\prime}_{64}}{{}^{65}}{}_{68}{}_{74}{}_{84}{}_{100}$	" 76 78 82 88 100	" 87 88 92 100	" 94 95 100	${ \begin{smallmatrix} \circ \\ 0 \\ 10 \\ 20 \\ 30 \\ 40 \\ 50 \\ 60 \\ 70 \\ \end{smallmatrix} }$	。 0
2	$\begin{array}{c} 0 \\ 10 \\ 20 \\ 30 \\ 40 \\ 50 \\ 60 \\ 70 \end{array}$	$94 \\ 95 \\ 99 \\ 107$	87 87 91 98 111	$77 \\ 77 \\ 81 \\ 87 \\ 98 \\ 116$	$ \begin{array}{r} 64 \\ 65 \\ 67 \\ 73 \\ 82 \\ 97 \\ 124 \end{array} $	$50 \\ 50 \\ 52 \\ 56 \\ 63 \\ 74 \\ 95 \\ 139$	$34 \\ 34 \\ 35 \\ 38 \\ 42 \\ 50 \\ 64 \\ 92$	$17 \\ 17 \\ 17 \\ 18 \\ 20 \\ 24 \\ 30 \\ 43$	$\begin{array}{c} 0 \\ -1 \\ -2 \\ -2 \\ -3 \\ -5 \\ -8 \end{array}$	$ \begin{array}{r} 17 \\ 18 \\ 19 \\ 22 \\ 25 \\ 30 \\ 40 \\ 59 \\ 59 \\ \end{array} $	$34 \\ 35 \\ 37 \\ 41 \\ 47 \\ 57 \\ 73 \\ 108$	$50 \\ 51 \\ 54 \\ 59 \\ 68 \\ 81 \\ 103$	$ \begin{array}{r} 64 \\ 66 \\ 69 \\ 76 \\ 86 \\ 103 \end{array} $	$77 \\ 78 \\ 83 \\ 90 \\ 102$	87 88 93 102	94 96 101	$\begin{array}{c} 0 \\ 10 \\ 20 \\ 30 \\ 40 \\ 50 \\ 60 \\ 70 \end{array}$	2
4	$\begin{array}{c} 0 \\ 10 \\ 20 \\ 30 \\ 40 \\ 50 \\ 60 \\ 70 \end{array}$	$94 \\ 94 \\ 98 \\ 105$	87 87 90 96 107	$77 \\ 77 \\ 79 \\ 85 \\ 94 \\ 111$	$ \begin{array}{r} 64\\ 64\\ 66\\ 70\\ 78\\ 92\\ 117 \end{array} $	$50 \\ 50 \\ 51 \\ 54 \\ 59 \\ 70 \\ 88 \\ 127$	$34 \\ 34 \\ 34 \\ 36 \\ 39 \\ 45 \\ 56 \\ 81$	$17 \\ 16 \\ 16 \\ 16 \\ 17 \\ 19 \\ 23 \\ 32$	$\begin{array}{r} 0 \\ -1 \\ -3 \\ -4 \\ -6 \\ -8 \\ -12 \\ -19 \end{array}$	$17 \\ 19 \\ 21 \\ 24' \\ 29 \\ 35 \\ 47 \\ 70$	$34 \\ 36 \\ 39 \\ 44 \\ 51 \\ 62 \\ 81 \\ 119$	$50 \\ 52 \\ 56 \\ 62 \\ 71 \\ 86 \\ 112$	$ \begin{array}{r} 64 \\ 67 \\ 71 \\ 78 \\ 90 \\ 109 \end{array} $	$77 \\ 79 \\ 84 \\ 93 \\ 106$	87 89 95 104	94 97 103	$\begin{array}{c} 0\\ 10\\ 20\\ 30\\ 40\\ 50\\ 60\\ 70 \end{array}$	4
6	$\begin{array}{c} 0 \\ 10 \\ 20 \\ 30 \\ 40 \\ 50 \\ 60 \\ 70 \end{array}$	$94 \\ 94 \\ 97 \\ 103$	$87 \\ 87 \\ 89 \\ 94 \\ 105$	7776788392107	$65 \\ 64 \\ 65 \\ 69 \\ 76 \\ 88 \\ 111$	$50 \\ 49 \\ 50 \\ 52 \\ 57 \\ 66 \\ 82 \\ 118$	$34 \\ 33 \\ 33 \\ 34 \\ 36 \\ 41 \\ 51 \\ 72$	17 16 15 14 14 14 15 17 22	$\begin{array}{r} 0 \\ -2 \\ -4 \\ -6 \\ -9 \\ -13 \\ -18 \\ -29 \end{array}$	$17 \\ 20 \\ 22 \\ 26 \\ 32 \\ 40 \\ 53 \\ 80$	$34 \\ 37 \\ 40 \\ 46 \\ 54 \\ 66 \\ 87 \\ 129$	$50 \\ 53 \\ 57 \\ 64 \\ 74 \\ 91 \\ 119$	$ \begin{array}{r} 65 \\ 67 \\ 73 \\ 81 \\ 93 \\ 113 \end{array} $	$77 \\ 80 \\ 86 \\ 95 \\ 109$	87 90 96 107	94 98 104	$\begin{array}{c} 0\\ 10\\ 20\\ 30\\ 40\\ 50\\ 60\\ 70 \end{array}$	6
8	$\begin{array}{c} 0 \\ 10 \\ 20 \\ 30 \\ 40 \\ 50 \\ 60 \\ 70 \end{array}$	$95 \\ 94 \\ 96 \\ 101$	87 86 88 93 102	$77 \\ 76 \\ 77 \\ 81 \\ 89 \\ 104$	65 63 64 67 73 84 105	$ \begin{array}{r} 50 \\ 49 \\ 49 \\ 50 \\ 54 \\ 62 \\ 77 \\ 109 \end{array} $	$35 \\ 33 \\ 32 \\ 32 \\ 33 \\ 37 \\ 45 \\ 62$	18 15 14 12 11 11 11 13 1	$\begin{array}{r} 0 \\ -3 \\ -5 \\ -8 \\ -12 \\ -17 \\ -24 \\ -39 \end{array}$	18 20 24 28 35 44 59 90	$35 \\ 38 \\ 40 \\ 48 \\ 57 \\ 70 \\ 93 \\ 140$	$50 \\ 54 \\ 59 \\ 66 \\ 78 \\ 95 \\ 125$	$65 \\ 68 \\ 74 \\ 83 \\ 97 \\ 118$	$ \begin{array}{r} 77 \\ 81 \\ 87 \\ 97 \\ 113 \end{array} $	87 91 98 109	95 99 106	$\begin{array}{c} 0 \\ 10 \\ 20 \\ 30 \\ 40 \\ 50 \\ 60 \\ 70 \end{array}$	8
10	$\begin{array}{c} 0 \\ 10 \\ 20 \\ 30 \\ 40 \\ 50 \\ 60 \\ 70 \end{array}$	$95 \\ 94 \\ 95 \\ 100$	88 86 87 91 100	$78 \\ 75 \\ 76 \\ 80 \\ 87 \\ 100$		51 48 49 51 58 71 100	$\begin{array}{c} 35\\ 32\\ 31\\ 30\\ 31\\ 33\\ 39\\ 53 \end{array}$	$ \begin{array}{r} 18 \\ 15 \\ 12 \\ 10 \\ 8 \\ 6 \\ 5 \\ 3 \end{array} $	$\begin{array}{r} 0 \\ -3 \\ -6 \\ -10 \\ -15 \\ -21 \\ -31 \\ -48 \end{array}$	$ \begin{array}{r} 18 \\ 21 \\ 25 \\ 30 \\ 38 \\ 48 \\ 66 \\ 100 \\ \end{array} $	$35 \\ 38 \\ 43 \\ 50 \\ 60 \\ 75 \\ 100$	$51 \\ 55 \\ 60 \\ 69 \\ 81 \\ 100$	$ \begin{array}{r} 65 \\ 69 \\ 76 \\ 86 \\ 100 \end{array} $	78 82 89 100	88 92 100	95 100	$\begin{array}{c} 0 \\ 10 \\ 20 \\ 30 \\ 40 \\ 50 \\ 60 \\ 70 \end{array}$	10
12	$\begin{array}{c} 0 \\ 10 \\ 20 \\ 30 \\ 40 \\ 50 \\ 60 \\ 70 \end{array}$	$96 \\ 94 \\ 94 \\ 99 \\ 108$	$ \begin{array}{r} 89 \\ 86 \\ 86 \\ 90 \\ 98 \\ 112 \end{array} $	$78 \\ 76 \\ 76 \\ 78 \\ 84 \\ 97 \\ 120$	$ \begin{array}{r} 66\\63\\62\\64\\68\\77\\95\\134 \end{array} $	$51 \\ 48 \\ 47 \\ 47 \\ 49 \\ 54 \\ 65 \\ 91$	$ \begin{array}{r} 35 \\ 32 \\ 29 \\ 28 \\ 28 \\ 29 \\ 33 \\ 44 \end{array} $	$ \begin{array}{r} 18 \\ 14 \\ 11 \\ 8 \\ 5 \\ 2 \\ -1 \\ -6 \\ \end{array} $	$\begin{array}{r} 0 \\ - 4 \\ - 8 \\ -12 \\ -18 \\ -25 \\ -37 \\ -58 \end{array}$	$ \begin{array}{r} 18 \\ 22 \\ 27 \\ 33 \\ 41 \\ 53 \\ 72 \\ 110 \end{array} $	$35 \\ 39 \\ 45 \\ 53 \\ 63 \\ 80 \\ 107$	$51 \\ 56 \\ 62 \\ 71 \\ 85 \\ 105$	$ \begin{array}{r} 66 \\ 70 \\ 78 \\ 88 \\ 104 \end{array} $	$78 \\ 83 \\ 91 \\ 103$	89 94 102	96 101	$ \begin{array}{c} 0 \\ 10 \\ 20 \\ 30 \\ 40 \\ 50 \\ 60 \\ 70 \\ \end{array} $	12
ation.	le.	70°	60°	50°	40 °	30 °	200	10°	0°	10°	20°	30°	40°	50°	60°	70°	le.	ation.
Declin.	Altitud	1	Latitud	e of sar	ne nan	ie as d	leclina	tion.		Latitu	ide of (lifferer	nt nam	e from	declina	tion.	Altitue	Declin

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TABLE 25.

Table showing the variation of the altitude of an object arising from a change of 100 seconds in the declination. Unmarked quantities in the Table are positive. If the change move the body toward the elevated pole, apply the correction to the altitude with the signs in the Table; otherwise, change the signs.

ation.	ide.		Latituć	le of sa	me nar	ne as	declina	ation.	1	Latitud	le of d	ifferen	t name	from d	leclina	tion.	de.	lation.
Declin	Altitu	70°	60°	50°	40°	30°	200	10°	00	10°	200	80°	40 °	50°	60°	70°	Altitu	Deelin
。 14	${ { 0 \\ 10 \\ 20 \\ 30 \\ 40 \\ 50 \\ 60 \\ 70 } }$	" 97 94 94 97 106	" 89 86 86 89 96 109	" 79 76 75 77 82 93 115 $ 115 $	${}^{''}_{66}\\{}^{63}_{61}\\{}^{62}_{66}\\{}^{66}_{73}\\{}^{89}_{125}$	${"52 \\ 48 \\ 46 \\ 45 \\ 46 \\ 50 \\ 60 \\ 82 }$	" 35 31 27 26 25 25 27 35	${ { 18 \\ 14 \\ 10 \\ 6 \\ 2 \\ -2 \\ -7 \\ -16 } }$	$ \begin{array}{c} '' \\ 0 \\ - 4 \\ - 9 \\ - 14 \\ - 21 \\ - 30 \\ - 43 \\ - 69 \\ \end{array} $	${"18 \\ 23 \\ 28 \\ 35 \\ 44 \\ 58 \\ 79 \\ 121$	${" \\ 35 \\ 40 \\ 45 \\ 55 \\ 67 \\ 85 \\ 114 }$	" 52 57 64 74 88 110	" 66 72 80 91 107	" 79 85 93 106	" 95 104	" 97 103	${ { } { } { } { } { } { } { } { } { } {$	。 14
16 [°]	$\begin{array}{c} 0\\ 10\\ 20\\ 30\\ 40\\ 50\\ 60\\ 70 \end{array}$	$98 \\ 94 \\ 94 \\ 96 \\ 104$	90 86 85 87 94 106	$ \begin{array}{r} 80 \\ 76 \\ 74 \\ 75 \\ 80 \\ 90 \\ 110 \\ \end{array} $	$67 \\ 63 \\ 61 \\ 61 \\ 63 \\ 70 \\ 84 \\ 117$	$52 \\ 48 \\ 45 \\ 44 \\ 44 \\ 47 \\ 54 \\ 73$	$36 \\ 31 \\ 27 \\ 25 \\ 22 \\ 21 \\ 21 \\ 25 \\ 25 \\ 25 \\ 25$	$ \begin{array}{r} 18 \\ 13 \\ 9 \\ 4 \\ 0 \\ -6 \\ -14 \\ -26 \\ \end{array} $	$\begin{array}{r} 0 \\ - 5 \\ - 10 \\ - 17 \\ - 24 \\ - 34 \\ - 50 \\ - 79 \end{array}$	$ 18 \\ 23 \\ 30 \\ 37 \\ 48 \\ 62 \\ 86 \\ 132 $	$36 \\ 41 \\ 48 \\ 58 \\ 70 \\ 90 \\ 121$	$52 \\ 58 \\ 66 \\ 77 \\ 92 \\ 115$	$67 \\ 73 \\ 82 \\ 94 \\ 111$	80 86 95 109	90 97 106	98 104	$\begin{array}{c} 0\\ 10\\ 20\\ 30\\ 40\\ 50\\ 60\\ 70 \end{array}$	16
18	$\begin{array}{c} 0\\ 10\\ 20\\ 30\\ 40\\ 50\\ 60\\ 70 \end{array}$	$99 \\ 95 \\ 93 \\ 95 \\ 102$	$91 \\ 87 \\ 85 \\ 86 \\ 92 \\ 103$	$81 \\ 76 \\ 74 \\ 78 \\ 87 \\ 105$		$53 \\ 48 \\ 44 \\ 42 \\ 41 \\ 43 \\ 49 \\ 64$	$36 \\ 31 \\ 26 \\ 23 \\ 20 \\ 17 \\ 16 \\ 16 \\ 16$	$ \begin{array}{r} 18 \\ 13 \\ 8 \\ 2 \\ -3 \\ -10 \\ -20 \\ -36 \\ \end{array} $	$\begin{array}{r} 0 \\ - & 6 \\ - & 12 \\ - & 19 \\ - & 27 \\ - & 39 \\ - & 56 \\ - & 89 \end{array}$	$18 \\ 24 \\ 31 \\ 40 \\ 51 \\ 67 \\ 93 \\ 143$	$36 \\ 42 \\ 50 \\ 60 \\ 74 \\ 95 \\ 128$	$53 \\ 59 \\ 68 \\ 79 \\ 96 \\ 121$	$ \begin{array}{r} 68 \\ 74 \\ 84 \\ 97 \\ 116 \end{array} $	81 88 98 112	91 98 109	99 106	$\begin{array}{c} 0\\ 10\\ 20\\ 30\\ 40\\ 50\\ 60\\ 70 \end{array}$	18
20	$\begin{array}{c} 0\\ 10\\ 20\\ 30\\ 40\\ 50\\ 60\\ 70 \end{array}$	$100 \\ 95 \\ 93 \\ 94 \\ 100$	92 87 85 85 90 100	82 76 74 73 76 83 100	$ \begin{array}{r} 68 \\ 63 \\ 60 \\ 58 \\ 59 \\ 63 \\ 74 \\ 100 \\ \end{array} $	$53 \\ 48 \\ 43 \\ 40 \\ 39 \\ 39 \\ 43 \\ 56$	$36 \\ 31 \\ 25 \\ 21 \\ 17 \\ 13 \\ 10 \\ 6$	$ \begin{array}{r} 18\\12\\6\\-6\\-15\\-26\\-46\end{array} $	$\begin{array}{c} 0 \\ - & 6 \\ - & 13 \\ - & 21 \\ - & 31 \\ - & 43 \\ - & 63 \\ -100 \end{array}$	$ 18 \\ 25 \\ 33 \\ 42 \\ 55 \\ 72 \\ 100 $	$36 \\ 43 \\ 52 \\ 63 \\ 78 \\ 100$	$53 \\ 60 \\ 70 \\ 82 \\ 100$	68 76 86 100	82 89 100	92 100	100	$\begin{array}{c} 0\\ 10\\ 20\\ 30\\ 40\\ 50\\ 60\\ 70 \end{array}$	20
22	$\begin{array}{c} 0 \\ 10 \\ 20 \\ 30 \\ 40 \\ 50 \\ 60 \\ 70 \end{array}$	$96 \\ 93 \\ 94 \\ 98 \\ 110$	$93 \\ 88 \\ 85 \\ 85 \\ 88 \\ 97 \\ 117$	$83 \\ 77 \\ 73 \\ 72 \\ 74 \\ 80 \\ 95 \\ 131$	$ \begin{array}{r} $	$^{\circ}54$ 48 43 39 36 36 36 38 47	37 30 25 19 14 9 4 -3	$ \begin{array}{r} 19\\12\\5\\-2\\-9\\-19\\-33\\-56\end{array} $	$\begin{array}{r} 0 \\ - & 7 \\ - & 15 \\ - & 23 \\ - & 34 \\ - & 48 \\ - & 70 \\ -111 \end{array}$	$ \begin{array}{r} 19 \\ 26 \\ 35 \\ 45 \\ 58 \\ 77 \\ 107 \end{array} $	$37 \\ 45 \\ 54 \\ 66 \\ 82 \\ 106$	$54 \\ 62 \\ 72 \\ 86 \\ 104 $	69 78 88 103	83 91 103	93 102	101	$\begin{array}{c} 0\\ 10\\ 20\\ 30\\ 40\\ 50\\ 60\\ 70 \end{array}$	22
24	$\begin{array}{r} 0 \\ 10 \\ 20 \\ 30 \\ 40 \\ 50 \\ 60 \\ 70 \end{array}$	97 93 93 97 107	$95 \\ 88 \\ 85 \\ 84 \\ 86 \\ 93 \\ 112$	84 77 73 71 72 77 91 123	$70 \\ 64 \\ 59 \\ 56 \\ 54 \\ 56 \\ 64 \\ 83$	$55 \\ 48 \\ 42 \\ 38 \\ 34 \\ .32 \\ 32 \\ 38 \\ 38 \\ 38 \\ 38 \\ 38 \\ 38 \\ $	$ \begin{array}{r} 37 \\ 30 \\ 24 \\ 18 \\ 12 \\ 5 \\ -2 \\ -13 \end{array} $	$ \begin{array}{r} 19 \\ 11 \\ 4 \\ -4 \\ -12 \\ -23 \\ -39 \\ -67 \\ \end{array} $	$\begin{array}{c} 0 \\ - 8 \\ - 16 \\ - 26 \\ - 37 \\ - 53 \\ - 77 \\ - 122 \end{array}$	$ \begin{array}{r} 19 \\ 27 \\ 36 \\ 48 \\ 62 \\ 83 \\ 115 \end{array} $	$37 \\ 46 \\ 56 \\ 69 \\ 86 \\ 111$	$55 \\ 63 \\ 74 \\ 89 \\ 109$	70 79 91 107	84 93 105	95 104	103	$\begin{array}{c} 0 \\ 10 \\ 20 \\ 30 \\ 40 \\ 50 \\ 60 \\ 70 \end{array}$	24
26	$\begin{array}{c} 0 \\ 10 \\ 20 \\ 30 \\ 40 \\ 50 \\ 60 \\ 70 \end{array}$	$98 \\ 95 \\ 93 \\ 96 \\ 105$	96 89 85 83 85 92 108	$ \begin{array}{r} 85 \\ 78 \\ 73 \\ 70 \\ 70 \\ 74 \\ 86 \\ 115 \\ \end{array} $	$72 \\ 64 \\ 59 \\ 54 \\ 52 \\ 53 \\ 58 \\ 75$	$56 \\ 48 \\ 41 \\ 36 \\ 32 \\ 28 \\ 27 \\ 29$	$38 \\ 30 \\ 23 \\ 16 \\ 9 \\ 1 \\ -8 \\ -23$	$ \begin{array}{r} 19 \\ 11 \\ 3 \\ -6 \\ -16 \\ -28 \\ -46 \\ -78 \\ \end{array} $	$\begin{array}{r} 0 \\ - 9 \\ - 18 \\ - 28 \\ - 41 \\ - 58 \\ - 84 \\ - 134 \end{array}$	$ \begin{array}{r} 19 \\ 28 \\ {}^{'}38 \\ 50 \\ 66 \\ 88 \\ 123 \end{array} $	$ \begin{array}{r} 38 \\ 47 \\ 58 \\ 72 \\ 91 \\ 117 \end{array} $	$56 \\ 65 \\ 77 \\ 92 \\ 114$	$72 \\ 81 \\ 94 \\ 111$	85 95 108	96 106	105	$\begin{array}{c} 0 \\ 10 \\ 20 \\ 30 \\ 40 \\ 50 \\ 60 \\ 70 \end{array}$	26
ation.	le.	70°	60°	50°	40°	30°	200	10°	0°	10°	200	30°	40°	50°	60°	70°	le.	ation.
Declin	Altitud		Latitud	le of sa	те паг	ne as e	declina	ttion.	I	atitud	e of d	ifferen	t name	from d	leclinat	ion.	Altitue	Declin

						TAI	BLE 2	6.				[Page	541		
			Varia	tion of	Altitud	e in on	e minute	from m	eridian	passage.					
Lati-		De	clination	n of the	same nam	ne as the	latitude;	upper trai	nsit; redn	ction add	Itive.		Lati-		
	00	10		<u> </u>	4°	50	6°			<u> </u>	10°	110			
° 0	"	"	"	"	28.1	22.4	18.7	16.0	14.0	12.4	″ 11.1	10.1	° 0		
$\frac{1}{2}$						28.0	$\begin{array}{c} 22.4\\ 28.0 \end{array}$	$ \begin{array}{c} 18.6 \\ 22.3 \end{array} $	$\begin{array}{c} 16.0\\ 18.6 \end{array}$	$13.9 \\ 15.9$	$\begin{array}{c c} 12.4 \\ 13.9 \end{array}$	$11.1 \\ 12.3$	$\frac{1}{2}$		
$\frac{1}{3}$	28 1							27.9	22.3 27.8	18.5 22.2	15.8 18.5	$13.8 \\ 15.8$	3		
- 4 5	20.1 22.4	28.0								$\frac{22.2}{27.7}$	$\frac{10.0}{22.1}$	18.4	5		
$\frac{6}{7}$	$18.7 \\ 16.0$	$22.4 \\ 18.6$	$28.0 \\ 22.3$	27.9							27.6	$22.0 \\ 27.4$	$\begin{bmatrix} 6\\7 \end{bmatrix}$		
8 9	14.0 12.4	$16.0 \\ 13.9$	$18.6 \\ 15.9$	$22.3 \\ 18.5$	$27.8 \\ 22.2$	27.7							$\frac{8}{9}$		
10	11.1	12.4	13.9 12.2	15.8	18.5	22.1	27.6	97.4	·····				10		
11 12	9.2	10.1	12.5 11.1	13.8 12.3	13.8	15.4 15.7	18.3	21.4 21.9	27.3				12		
$\frac{13}{14}$	$8.5 \\ 7.9$	$9.2 \\ 8.5$	10.0 9.2	11.0 10.0	$12.2 \\ 10.9$	13.7 12.1	15.6 13.6	$18.2 \\ 15.5$	18.0	$\frac{27.1}{21.6}$	26.9		13 14		
$\frac{15}{16}$	7.3 6.8	$7.8 \\ 7.3$	8.4	9.1	9.9	10.9 9.8	12.1 10.8	13.5 12.0	15.4 13.4	$17.9 \\ 15.3$	$21.4 \\ 17.8$	26.7 21.3	$\frac{15}{16}$		
17	6.4	6.8	7.2	7.8	8.3	9.0	9.8	10.7	11.9	13.3	15.2	17.6	17		
$18 \\ 19$	$ \begin{array}{c ccccccccccccccccccccccccccccccccccc$														
$\frac{20}{21}$	$ \begin{array}{c ccccccccccccccccccccccccccccccccccc$														
22	$ \begin{array}{c ccccccccccccccccccccccccccccccccccc$														
$\frac{23}{24}$	$ \begin{array}{cccccccccccccccccccccccccccccccccccc$														
$\begin{array}{c} 25\\ 26\end{array}$	$4.2 \\ 4.0$	$\frac{4.4}{4.2}$	$\frac{4.6}{4.3}$	$\frac{4.7}{4.5}$	$5.0 \\ 4.7$	$5.2 \\ 4.9$	$5.4 \\ 5.1$	$5.7 \\ 5.4$	$\begin{array}{c} 6.0 \\ 5.7 \end{array}$	$6.4 \\ 6.0$	$\begin{array}{c} 6.8\\ 6.3\end{array}$	$7.2 \\ 6.7$	$ 25 \\ 26 $		
$\frac{27}{28}$	$\frac{3.9}{3.7}$	$\frac{4.0}{3.8}$	4.1 4.0	$\frac{4.3}{4.1}$	$\frac{4.5}{4.3}$	4.7	4.9 4.6	$5.1 \\ 4.8$	$5.3 \\ 5.0$	$5.6 \\ 5.3$	$5.9 \\ 5.5$	$6.2 \\ 5.8$	$\frac{27}{28}$		
29	3.5	3.7	3.8	3.9	4.1	4.2	4.4	4.6	4.7	5.0	5.2	5.5	29		
$\frac{30}{31}$	3.4 3.3	$3.0 \\ 3.4$	$3.6 \\ 3.5$	3.7 3.6	$3.9 \\ 3.7$	$\frac{4.0}{3.8}$	$4.2 \\ 4.0$	4.3 4.1	4. 5 4. 3	4.4	4.9 4.6	$5.1 \\ 4.8$	$\frac{30}{31}$		
$\frac{32}{33}$	$3.1 \\ 3.0$	3.2 3.1	$\frac{3.3}{3.2}$	3.4 3.3	3.5 3.4	$3.7 \\ 3.5$	$3.8 \\ 3.6$	$\begin{array}{c c} 3.9 \\ 3.7 \end{array}$	$4.1 \\ 3.9$	$4.2 \\ 4.0$	$\begin{array}{c} 4.4\\ 4.2 \end{array}$	4.6 4.3	$\frac{32}{33}$		
$\frac{34}{25}$	$\frac{2.9}{2.8}$	$\frac{3.0}{2.0}$	$\frac{3.1}{2.0}$	$\frac{3.2}{2.0}$	$\frac{3.2}{2.1}$	3.3	$\frac{3.4}{222}$	$\frac{3.6}{2.1}$	3.7	$\frac{3.8}{2.6}$	$\frac{3.9}{2.7}$	$\frac{4.1}{2.0}$	$\frac{34}{25}$		
36 36	$2.8 \\ 2.7 \\ 2.7$	2.9 2.8	2.8	$\frac{3.0}{2.9}$	3.1 3.0	3.2 3.1	3.3	ə. 4 3. 3	3. 4 3. 4	5. 0 3. 5	3.6	3.9 3.7	36		
$\frac{37}{38}$	$2.6 \\ 2.5$	$2.7 \\ 2.6$	$\begin{array}{c c} 2.7\\ 2.6 \end{array}$	$\frac{2.8}{2.7}$	$\begin{array}{c c} 2.9\\ 2.8 \end{array}$	$\frac{2.9}{2.8}$	$\begin{array}{c} 3.0\\ 2.9 \end{array}$	$\begin{array}{c} 3.1 \\ 3.0 \end{array}$	3.2 3.0	$3.3 \\ 3.2$	$3.4 \\ 3.2$	$3.5 \\ 3.3$	$\frac{37}{38}$		
$\frac{39}{10}$	$\frac{2.4}{2.2}$	$\frac{2.5}{2.1}$	$\frac{2.5}{2.1}$	$\frac{2.6}{2.5}$	$\frac{2.7}{2.6}$	$\frac{2.7}{2.6}$	$\frac{2.8}{2.7}$	$\frac{2.9}{2.7}$	$\frac{2.9}{2.9}$	$\frac{3.0}{2.0}$	$\frac{3.1}{2.0}$	$\frac{3.2}{3.0}$	$-\frac{39}{40}$		
41	$\frac{2.3}{2.3}$	$\frac{2.3}{2.3}$	$\frac{2.4}{2.4}$	2.9 2.4	$\begin{bmatrix} 2.0\\ 2.5\\ 0.4 \end{bmatrix}$	$2.0 \\ 2.5 \\ 0.1$	2.6	2.6	$2.8 \\ 2.7 \\ 2.7 \\ 0.0 $	2.8	2.8	2.9	41		
$\frac{42}{43}$	$\begin{array}{c} 2.2\\ 2.1\end{array}$	$2.2 \\ 2.1$	$\begin{array}{c} 2.3\\ 2.2 \end{array}$	$\begin{array}{c} 2.3\\ 2.2 \end{array}$	$\begin{array}{c c} 2.4\\ 2.3 \end{array}$	$\frac{2.4}{2.3}$	$2.5 \\ 2.4$	$\begin{array}{c c} 2.5\\ 2.4 \end{array}$	$2.6 \\ 2.5$	$2.6 \\ 2.5$	$\begin{bmatrix} 2.7\\ 2.6 \end{bmatrix}$	$2.8 \\ 2.7$	$42 \\ 43$		
$\frac{44}{45}$	$\frac{2.0}{2.0}$	$\frac{2.1}{2.0}$	$\frac{2.1}{2.0}$	$\frac{2.1}{2.1}$	$\frac{2.2}{2.1}$	$\frac{2.2}{2.2}$	$\frac{2.3}{2.2}$	$\frac{2.3}{2.2}$	$\frac{2.4}{2.3}$	$\frac{2.4}{2.3}$	$\frac{2.5}{2.4}$	$\frac{2.5}{2.4}$	44		
46	1.9	1.9	$\frac{1}{2}, \frac{1}{2}$	2.0	$\frac{2.0}{2.0}$	2.1	$\begin{bmatrix} 2, 1 \\ 2, 1 \\ 0 \end{bmatrix}$	$\begin{bmatrix} 2.2\\ 2.2\\ 0.1 \end{bmatrix}$	2.2	2.2	2.3	2.3	46		
48	$1.8 \\ 1.8$	1.9	$1.9 \\ 1.8$	$1.9 \\ 1.9$	$\frac{2.0}{1.9}$	$\frac{2.0}{1.9}$	2.0 2.0	$2.1 \\ 2.0$	2.1 2.0	2.1 2.1	2.2 2.1	$2.2 \\ 2.1$	47 48		
$\frac{-49}{-50}$	$\frac{1.7}{1.6}$	$-\frac{1.7}{1.7}$	$\frac{1.8}{1.7}$	$\frac{1.8}{1.7}$	$\frac{1.8}{1.8}$	$\frac{1.8}{1.8}$	$\frac{1.9}{1.8}$	$\frac{1.9}{1.8}$	$\frac{1.9}{1.9}$	$\frac{2.0}{1.9}$	$\frac{2.0}{1.9}$	$\frac{2.1}{2.0}$	$\frac{49}{50}$		
$51 \\ 52$	1.6 1.5	1.6	$1.6 \\ 1.6$	1.7	1.7	1.7	1.7	1.8	1.8	1.8	1.9	1.9	$51 \\ 59$		
53.	1.5	1.5	1.5	1.5 1.5	1.6	1.6	1.6	1.6	1.7	1.7	1. 7	1.7	53 53		
$\frac{-54}{-55}$	$\frac{1.4}{1.4}$	$\frac{1.4}{1.4}$	$\frac{1.5}{1.4}$	$\frac{1.5}{1.4}$	$\frac{1.5}{1.5}$	$-\frac{1.5}{1.5}$	1.5	$\frac{1.6}{1.5}$	$\frac{1.6}{1.5}$	$\frac{1.6}{1.6}$	$\frac{1.6}{1.6}$	$\frac{1.7}{1.6}$	$\frac{54}{55}$		
$\frac{56}{57}$	$1.3 \\ 1.3$	$1.3 \\ 1.3$	$1.4 \\ 1.3$	$1.4 \\ 1.3$	$1.4 \\ 1.3$	1.4	1.4	1.4	1.5	1.5 1.1	$1.5 \\ 1.4$	$1.5 \\ 1.5$	$\frac{56}{57}$		
58 50	1.2	1.2	1.3	1.3	1.3	1.3	1.3	1.3	1.3	1.4	1.4	1.4	58 50		
59 60	$1.2 \\ 1.1$	1.2	$1.2 \\ 1.2$	$1.2 \\ 1.2$	1.2 1.2	$1.3 \\ 1.2$	$1.3 \\ 1.2$	$1.3 \\ 1.2$	$1.3 \\ 1.2$	$1.3 \\ 1.2$	$1.3 \\ 1.3$	1.3 1.3	60 60		
	00	1°	20	30	4 °	5 ⁰	6°	70	80	9°	10°	11°			
		De	clination	1 of the	same nam	ie as the	latitude;	apper trai	ısit; redu	ction add	itive.	-			

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TABLE 26.

Variation of Altitude in one minute from meridian passage.

	1	De	alinatio	n of the	Declination of the same name as the latitude; upper transit; reduction additive.													
Lati- tude.	1.00	1 190	1.10	1 01 110 -	same ma	1 1 70	1 100	10; upper	r transa	; reunce	1011 8000	tive.	1 010	Lati- tude,				
		10		10	10-		10	19	20-	21-	22-	230	24~					
°	9.2	8.5	7.9	7.3	6.8	6.4	6.0	57	5.4	51	19	1.6	1.4	°				
1	10.1	9.2	8.5	7.8	7.3	6.8	6.4	6.0	5.7	5.4	5.1	4.8	4.6	1				
$\frac{2}{2}$	11.1	10.0	9.2	8.4	7.8	7.2	6.8	6.3	6.0	5.6	5.3	5.0	4.8	2				
3 4	12.5 13.8	11.0 12.2	10.0	9.1	8.4	8.3	7.7	$\begin{array}{c} 6.7\\ 7.2 \end{array}$	6.3	5.9 6.3	5.0	$ \begin{array}{c} 5.3 \\ 5.5 \end{array} $	5.0	$\frac{3}{4}$				
5	15.7	13.7	12.1	10.9	9.8	9.0	8.3	7.6	7.1	6.6	6.2	5.8	5.5	5				
$\frac{6}{7}$	18.3	15.6	13.6	12.1	10.8	9.8	8.9	8.2	7.6	7.0	6.6	6.1	5.8	6				
8	$21.9 \\ 27.3$	$18.2 \\ 21.7$	10.0	15.0	12.0 13.4	10.7	9.7	8.9 9.6	8.1	1.0	7.0	6. ð 6. 9	6.1 6.4	8				
9		27.1	21.6	17.9	15.3	13.3	11.8	10.6	9.5	8.7	8.0	7.4	6.8	9				
10			26.9	21.4	17.8	15.2	13.2 15.0	11.7 12 1	10.5	9.5	8.6	7.9	7.3	10				
11 12				20. 1	$21.5 \\ 26.5$	$\frac{17.0}{21.1}$	15.0 17.5	13.1 14.9	13.0	10.4	9.4	8.0 9.3	8.4	11 12				
13						26.2	20.9	17.3	14.8	12.8	11.3	10.1	9.2	13				
$\frac{14}{15}$							26.0	20.7	17.1 90.4	14.0	12.7 14.4	11.2	10.0	$\frac{14}{15}$				
16	26.5							20.1	20.4 25.4	$10.5 \\ 20.2$	16.7	14.3	11.1 12.4	$16 \\ 16$				
17	21.1	26.2	00.0			1				25, 1	20.0	16.5	14.1	17				
18 19	$17.5 \\ 14.9$	$20.9 \\ 17.3$	20.0 20.7	25.7							24.8	19.7 24.5	16.3 19.5	18 19				
20	13.0	14.8	17.1	20.4	25.4					-			24.2	$\frac{10}{20}$				
$21 \\ 99$	11.5	12.8	14.6 197	16.9 14.4	20.2	25.1	91 8			ļ				21				
$\frac{22}{23}$	10.3 9.3	$11.5 \\ 10.1$	12.1 11.2	14.4	10. 7	16.5	24.0	24.5						$\frac{22}{23}$				
24	8.4	9.2	10.0	11.1	12.4	14.1	16.3	19.5	24.2					24				
25	7.7	8.3	9.0	9.9	10.9	12.2	13.9 12.1	16.1	19.2 15.9	23.8	02.5			25				
$\frac{20}{27}$	6.6	7.0	$7.5^{0.2}$	8.1	8.8	9.6	12.1 10.6	13.7	13.5 13.5	15.6	25.0	23.1		$\frac{20}{27}$				
28	6.2	6.5	7.0	7.4	8.0	8.7	9.5	10.5	11.7	13.3	15.4	18.3	22.7	28				
29	5.4	6.1	6.4	6.9	7.3	7.9	8.0	9.4	$\frac{10.3}{9.2}$	$\frac{11.5}{10.1}$	$\frac{13.1}{11.3}$	15.1	18.0	29				
31	5.1	5.3	5.6	5.9	6.3	6.7	7.1	7.7	8.3	9.0	10.0	11.1	12.6	31				
$\frac{32}{22}$	4.8	5.0	5.2	5.5	5.8	6.2	6.5	7.0	7.5	8.1	8.9	9.8	10.9	32				
$\frac{33}{34}$	$4.0 \\ 4.3$	4.4	4.9	$\frac{5.1}{4.8}$	$5.4 \\ 5.1$	$5.1 \\ 5.3$	5.6	0.4 5.9	6.9 6.3	6.8	$\frac{8.0}{7.3}$	7.8	9.0 8.6	$\frac{33}{34}$				
35	4.0	4.2	4.4	4.5	4.7	5.0	5.2	5.5	5.8	6.2	6.6	7.1	7.7	35				
36	3.8	4.0	4.1	4.3	4.5	4.7	4.9	5.1	5.4	5.7	6.1	6.5	7.0	$\frac{36}{97}$				
$\frac{37}{38}$	$3.0 \\ 3.4'$	3.6 3.6	$3.5 \\ 3.7$	4.0	4.0	4.4	4.0	4.0	$\frac{5.0}{4.7}$	$\frac{5.5}{4.9}$	$5.0 \\ 5.2$	5.5	5.8	38				
39	3.3	3.4	3.5	3.6	3.8	3.9	4.0	4.2	4.4	4.6	4.8	5.1	5.4	39				
40 41	$\frac{3.1}{2.0}$	$\frac{3.2}{2.1}$	$\frac{3.3}{2.2}$	$\frac{3.4}{2.3}$	$\frac{3.6}{2.4}$	$\frac{3.7}{3.5}$	3.8	$\frac{4.0}{2.7}$	$\frac{4.1}{2.9}$	4.3	4.5 4.2	4.7	$5.0 \\ 4.6$	40 41				
41 42	2.9	$2.9^{3.1}$	$3.2 \\ 3.0$	3.1	3.2	3.3	$3.0 \\ 3.4$	3.5	$3.0 \\ 3.7$	3.8	4.0	4.1	4.3	42				
43	2.7	2.8	2.9	3.0	3.0	3.1	3.2	3.3	3.5	3.6	3.7	3.9	4.0	43				
44	2.0	$\frac{2.1}{2.6}$	$\frac{2.1}{2.6}$	$\frac{2.8}{9.7}$	$\frac{2.9}{2.8}$	$\frac{3.0}{2.8}$	$\frac{3.1}{9.9}$	$\frac{3.2}{3.0}$	$\frac{3.3}{3.1}$	3.4	3.0	$\frac{3.0}{3.4}$	$\frac{3.0}{3.5}$	44 45				
46	2.4	2.4	2.5	2.6	2.6	2.7	2.8	2.8	2.9	3.0	3.1	3.2	3.3	46				
47	2.3	2.3	2.4	2.4	2.5	2.6	2.6	2.7	2.8	2.9	2.9	3.0	$\frac{3.1}{2.0}$	47				
40 49	2.2 2.1	$2.2 \\ 2.1$	$2.3 \\ 2.2$	$2.3 \\ 2.2$	$2.4 \\ 2.3$	$2.4 \\ 2.3$	$2.0 \\ 2.4$	$2.0 \\ 2.4$	$2.0 \\ 2.5$	2.6 2.6	$2.8 \\ 2.6$	$2.5 \\ 2.7$	2.8	48				
50	2.0	2.0	2.1	2.1	2.2	2.2	2.3	2.3	2.4	2.4	2.5	2.6	2.6	50				
$51 \\ 59$	$1.9 \\ 1.8$	$2.0 \\ 1.9$	2.0 1 9	$2.0 \\ 1.9$	2.1 2.0	2.1 2.0	$2.2 \\ 2.1$	2.2 2 1	2.3 2.1	$2.3 \\ 2.2$	$2.4 \\ 2.9$	$2.4 \\ 2.3$	2.5 2.4	$\frac{51}{52}$				
$\frac{52}{53}$	1.8	1.8	$1.0 \\ 1.8$	$1.0 \\ 1.9$	1.9	$1.9^{2.0}$	$2.1 \\ 2.0$	$2.1 \\ 2.0$	$2.0^{2.1}$	$\frac{2.2}{2.1}$	2.1	2.2	2.2	.53				
54_	1.7	1.7	1.7	1.8	1.8	1.8	1.9	1.9	1.9	2.0	2.0	2.1	2.1	$^{-54}_{-55}$				
55 56	$\begin{array}{c} 1.6\\ 1.5\end{array}$	$1.6 \\ 1.6$	$1.7 \\ 1.6$	1.7 1.6	$1.7 \\ 1.6$	1.8 1.7	1.8 1.7	$1.8 \\ 1.7$	$1.9 \\ 1.8$	$1.9 \\ 1.8$	$1.9 \\ 1.8$	$2.0 \\ 1.9$	$\frac{2.0}{1.9}$	$\frac{55}{56}$				
57	1.5	1.5	1.5	1.5	1.6	1.6	1.6	1.6	1.7	1.7	1.7	1.8	1.8	57				
58 50	1.4	1.4	1.5	1.5	1.5	1.5	1.5	1.6	1.6	1.6	1.6	1.7	1.7	58 50				
- 59 - 60	$1.4 \\ 1.3$	$1.4 \\ 1.3$	$1.4 \\ 1.3$	1.4 1.3	1.4	$1.0 \\ 1.4$	1.0	1.0	$1.0 \\ 1.4$	$1.0 \\ 1.5$	$1.0 \\ 1.5$	$1.0 \\ 1.5$	$1.0 \\ 1.5$	60 60				
	120	130	140	150	16°	17°	18°	190	20°	21°	220	23°	240					
		Dee	clination	1 of the	same na	me as the	e latitud	e; upper	r transit;	reducti	ion addit	tive.						

	TABLE 26. [Page 54] Variation of Altitude in one minute from meridian passage.														
			Varia	tion of	Altitu	de in o	ne min	ute fro	m me r	idian p	assage.				
Lati-		Dec	lination	of the	same nai	ne as th	e latitud	e; upper	r transit	; reducti	ion addi	live.		Lati-	
	25°	260	270	280	<u></u>	30°	<u>31</u> °	320	<u></u>	340	350	36°	37°		
°	4.2	4.0	3.9	$\overset{''}{3.7}$	3.5	3.4	" 3.3	3.1	" 3. 0	2.9	2.8	2.7	$\overset{''}{2.6}$	$\overset{\circ}{0}$	
$\frac{1}{2}$	$\frac{4.4}{4.6}$	$\frac{4.2}{4.3}$	4.0 4.1	$3.8 \\ 4.0$	$3.7 \\ 3.8$	$3.5 \\ 3.6$	$\frac{3.4}{3.5}$	$\frac{3.2}{3.3}$	$\frac{3.1}{3.2}$	$3.0 \\ 3.1$	$2.9 \\ 3.0$	$2.8 \\ 2.8$	$2.7 \\ 2.7$	$\frac{1}{2}$	
3	4.7	4.5	4.3	$\frac{4.1}{4.2}$	3.9	3.7	$\frac{3.6}{3.7}$	3.4	$\frac{3.3}{3.4}$	$\frac{3.2}{2.2}$	3.0	2.9	$\frac{1}{2.8}$	3	
	$\frac{5.0}{5.2}$	4.9	4.7	4.4	4.2	4.0	3.8	3.7	3.5	3.3	$\frac{3.1}{3.2}$	$\frac{3.0}{3.1}$	$\frac{2.9}{3.0}$	$\frac{\pi}{5}$	
$\frac{6}{7}$	$5.4 \\ 5.7$	$5.1 \\ 5.4$	4.9 5.1	$\frac{4.6}{4.8}$	4.4 4.6	$\frac{4.2}{4.3}$	$4.0 \\ 4.1$	$\frac{3.8}{3.9}$	$3.6 \\ 3.7$	$3.5 \\ 3.6$	$3.3 \\ 3.4$	3.2	$\frac{3.0}{3.1}$	$\frac{6}{7}$	
8 9	$6.0 \\ 6.4$	$5.7 \\ 6.0$	$5.3 \\ 5.6$	5.0 5.3	$\frac{4.8}{5.0}$	$\frac{4.5}{4.7}$	$4.3 \\ 4.4$	$\frac{4.1}{4.2}$	$3.9 \\ 4.0$	3.7 3.8	$3.5 \\ 3.6$	$3.4 \\ 3.5$	$\frac{3.2}{3.3}$	$\frac{8}{9}$	
10	$\frac{6.8}{7.2}$	6.3	5.9	5.5	5.2 5.5	4.9	4.6	4.4	4.2	3.9	$\frac{3.8}{2.0}$	$\frac{3.6}{3.7}$	$\frac{3.4}{2.5}$	10	
11 12	7.2 7.7	7.1	6.2 6.6	6.2	5.8	5.4	5.1	4.8	4.5	4.3	4.0	3.8	3.6 3.6	$11 \\ 12 \\ 12$	
$\begin{array}{c} 13\\14\end{array}$	$\begin{array}{c} 8.3\\ 9.1 \end{array}$	$\begin{array}{c} 7.6 \\ 8.2 \end{array}$	$7.1 \\ 7.6$	6.5 7.0	6.1 6.4	5.7 6.0	$\begin{array}{c} 5.3\\ 5.6\end{array}$	$5.0 \\ 5.2$	4.1	4.4	4.2 4.4	4.0	$3.8 \\ 3.9$	$13 \\ 14$	
$\frac{15}{16}$	9.9 10.9	8.9 9.8	8.1	$7.4 \\ 8.0$	$\frac{6.9}{7.3}$	$6.4 \\ 6.8$	$5.9 \\ 6.3$	5.5 5.8	$5.2 \\ 5.4$	$\frac{4.8}{5.1}$	$4.5 \\ 4.8$	$\frac{4.3}{4.5}$	$\frac{4.0}{4.2}$	$ 15 \\ 16 $	
17	12.2	10.8	9.6	8.7	7.9	7.2	6.7	6.2	5.7	5.3	5.0	4.7	4.4	17	
$18 \\ 19$	$13.9 \\ 16.1$	$12.1 \\ 13.7$	10.6	9.5 10.5	9.4	8.4	$\frac{7.1}{7.7}$	$\frac{0.0}{7.0}$	6.1	$\frac{5.6}{6.0}$	$5.2 \\ -5.5$	$\frac{4.9}{5.1}$	4.0	$18 \\ 19$	
$\frac{20}{21}$	$ \begin{array}{c ccccccccccccccccccccccccccccccccccc$														
$\frac{22}{23}$	$\begin{array}{c ccccccccccccccccccccccccccccccccccc$														
24	$\begin{array}{c ccccccccccccccccccccccccccccccccccc$														
$\frac{25}{26}$	$\begin{array}{c ccccccccccccccccccccccccccccccccccc$														
$\frac{27}{28}$	1						21.5	$\frac{17.0}{21.1}$	14.0 16.7	11.9 13.8	10.3 11.7	$\begin{array}{c} 9.1 \\ 10.1 \end{array}$	$\frac{8.1}{8.9}$	$\frac{27}{28}$	
$\frac{-29}{-30}$ -	$\frac{22.3}{17.7}$	21.9							20.6	$\frac{16.3}{20.2}$	13.5 16.0	$\frac{11.4}{13.2}$	$\frac{9.9}{11.1}$	$\frac{29}{30}$	
31	14.6	17.4	21.5	01 1						20.2	19.8	15.6 10.2	12.9	31	
32 33	12.4 10.7	14.5 12.1	17.0 14.0	16.7	20.6							19. 5	15.5 18.9	32 33	
$\frac{34}{35}$	$\frac{9.4}{8.4}$	$\frac{10.5}{9.2}$	$\frac{11.9}{10.3}$	$\frac{13.8}{11.7}$	$\frac{16.3}{13.5}$	$\frac{20.2}{16.0}$	19.8							$\frac{34}{35}$	
$\frac{36}{37}$	$7.5 \\ 6.8$	$\frac{8.2}{7.4}$	$9.1 \\ 8.1$	$10.1 \\ 8.9$	$\begin{array}{c} 11.4 \\ 9.9 \end{array}$	13.2 11.1	$15.6 \\ 12.9$	$19.3 \\ 15.3$	18.9					$\frac{36}{37}$	
38 30	$\begin{array}{c} 6.2 \\ 5.7 \end{array}$	6.7	7.2	$\frac{7.9}{7.1}$	$\frac{8.7}{7.7}$	9.6	10.9	12.6 10.6	14.9 12.2	18.4 14.5	17.9			38 30	
40	5.3	5.6	6.0	6.4	6.9	7.5	8.2	9.2	10.4	11.9	14.1	17.4		40	
$\begin{array}{c} 41 \\ 42 \end{array}$	$\frac{4.9}{4.5}$	$5.2 \\ 4.8$	$5.5 \\ 5.0$	$5.8 \\ 5.3$	$\begin{array}{c} 6.2\\ 5.7\end{array}$	$6.7 \\ 6.1$	$7.3 \\ 6.6$	$\begin{array}{c} 8.0\\ 7.1 \end{array}$	$\begin{array}{c} 8.9 \\ 7.8 \end{array}$	$\begin{array}{c} 10.1\\ 8.7\end{array}$	$\begin{array}{c}11.6\\9.8\end{array}$	$\begin{array}{c}13.8\\11.3\end{array}$	$17.0\\13.4$	$41 \\ 42$	
$\begin{array}{c} 43\\ 44\end{array}$	$\frac{4.2}{3.9}$	4.4	$\frac{4.6}{4.3}$	$\frac{4.9}{4.5}$	$\begin{array}{c} 5.2\\ 4.8 \end{array}$	$5.5 \\ 5.1$	$5.9 \\ 5.4$	$6.4 \\ 5.8$	$6.9 \\ 6.2$	$7.6 \\ 6.7$	$8.5 \\ 7.4$	$9.5 \\ 8.2$	$\begin{array}{c} 11.0\\ 9.3 \end{array}$	43 44	
45	3.7	3.8	4.0	4.2	4.4	4.7	4.9	5.2	5.6	6.0	6.6	7.2	8.0	45	
46 47	5. 5 3. 3	$3.6 \\ 3.4$	5.7 3.5	3.9 3.6	$\frac{4.1}{3.8}$	4.3	4.0 4.2	4.8	$ \frac{5.1}{4.6} $	$ \frac{0.4}{4.9} $	5.9 5.3	$0.4 \\ 5.7$	6.2	40 47	
48 49	$\frac{3.1}{2.9}$	3.2 3.0	$\begin{array}{c} 3.3\\ 3.1 \end{array}$	$3.4 \\ 3.2$	$3.5 \\ 3.3$	$3.7 \\ 3.4$	$3.9 \\ 3.6$	$\frac{4.0}{3.7}$	$4.3 \\ 3.9$	$\frac{4.5}{4.1}$	$\frac{4.8}{4.4}$	5.1 4.6	5.5 5.0	48 49	
50 51	$\frac{2.7}{2.6}$	$\frac{2.8}{2.6}$	$\frac{2.9}{2.7}$	$\frac{3.0}{2.8}$	$\frac{3.1}{2.9}$	$\frac{3.2}{3.0}$	$\frac{3,3}{3,1}$	$\frac{3.5}{3.2}$	$\frac{3.6}{3.4}$	$\frac{3.8}{3.5}$	$\frac{4.0}{3.7}$	$\frac{4.2}{3.9}$	$\frac{4.5}{4.1}$	$50 \\ 51$	
52	$\begin{bmatrix} 2.4\\ 2.4\\ 2.2 \end{bmatrix}$	2.5	$\tilde{2}.6$	2.6	2.7	2.8	2.9	3.0	3.1	3.2	3.4 2 1	3.6	3.7	52	
$\frac{53}{54}$	$2.3 \\ 2.2$	$\frac{2.3}{2.2}$	$2.4 \\ 2.3$	$2.0 \\ 2.3$	$2.5 \\ 2.4$	$\frac{2.0}{2.5}$	2.7 2.5	$2.8 \\ 2.6$	$2.9 \\ 2.7$	$\frac{5.0}{2.8}$	$\frac{3.1}{2.9}$	3. 0	3, 4 3, 2	$\frac{55}{54}$	
$ 55 \\ 56 $	$\begin{array}{c} 2.0\\ 1.9 \end{array}$	2.1 2.0	$2.1 \\ 2.0$	$2.2 \\ 2.1$	2.3 2.1	$2.3 \\ 2.2$	$2.4 \\ 2.2$	$2.4 \\ 2.3$	$2.5 \\ 2.4$	$\begin{array}{c} 2.6\\ 2.4 \end{array}$	$2.7 \\ 2.5$	$2.8 \\ 2.6$	$2.9 \\ 2.7$	55 56	
57 58	$1.8 \\ 1.7$	1.9 1.8	$1.9 \\ 1.8$	2.0 1.8	$2.0 \\ 1.9$	$2.0 \\ 1.9$	2.1 2.0	$2.2 \\ 2.0$	$\begin{array}{c} 2.2\\ 2.1 \end{array}$	$\begin{array}{c} 2.3 \\ 2.1 \end{array}$	$\begin{array}{c} 2.3\\ 2.2 \end{array}$	$\frac{2.4}{2.3}$	$\frac{2.5}{2.3}$	$57 \\ 58$	
59 60	1.6	1.7 1.7	1.7	1.7 1.7	1.8	1.8 1.7	1.9	1.9	1.9	2.0	2.0 1.0	$2.0 \\ 2.1 \\ 2.0$	2.2	59 60	
	1.0	1.0	1.0	1,0~	1. (1.7	1.1	1.0	1.0	1.9	1.9	2.0			
	250	26°	27°	28°	29°	30°	31° e latituć	32°	33°	34°	35°	36° tive,	37°		

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TABLE 26.

Variation of Altitude in one minute from meridian passage.

	Declination of the same name as the latitude; upper transit; reduction additive. ati- de. 380 390 400 410 420 430 460 470 480 500													
Lati-		De	clination	1 of the P	same nar	ne as th	e latituu	te; upper	transit;	; reducu	ion adam	tive.		Lati-
	380	39 °	40°	410	420	430	440	450	460	47°	48°	490	50°	thue.
0			"		."				1.0	10	"			0
1	$2.5 \\ 2.6$	$2.4 \\ 2.5$	$\frac{2.5}{2.4}$	$\begin{array}{c} 2.3\\ 2.3\end{array}$	$\begin{array}{c} 2.2\\ 2.2 \end{array}$	$\begin{array}{c} 2.1\\ 2.2 \end{array}$	$2.0 \\ 2.1$	$2.0 \\ 2.0$	$1.9 \\ 1.9$	$1.8 \\ 1.9$	$1.8 \\ 1.8$	1.7 1.7	1.7 1.7	1 0
2	2.6	2.5	2.4	2.4	2.3	2.2	2.1	2.0	2.0	1.9	1.8	1.8	1.7	2
$\frac{3}{4}$	$\frac{2.7}{2.8}$	$2.6 \\ 2.7$	$2.5 \\ -9.6$	$2.4 \\ 2.5$	$2.3 \\ 2.4$	$2.2 \\ 2.3$	$2.2 \\ 2.2$	2.1 2.1	2.0 2.0	1.9	$1.9 \\ 1.9$	$1.8 \\ 1.8$	1.7 1.8	$\frac{3}{4}$
	$\frac{2.0}{2.8}$	$\frac{2.1}{2.7}$	$\frac{2.6}{2.6}$	2.5	2.4	$\frac{2.3}{2.3}$	$\frac{2.2}{2.2}$	$\frac{2.1}{2.2}$	$\frac{2.0}{2.1}$	2.0	$\frac{1.0}{1.9}$	1.9	1.8	
6	2.9	2.8	2.7	2.6	2.5	2.4	2.3	2.2	2.1	2.0	2.0	1.9	1.8	ě
7	$\frac{3.0}{2.1}$	$2.9 \\ 9.9$	2.7 2.7 2.8	$2.6 \\ 2.7$	$2.5 \\ 2.6$	$2.4 \\ 2.5$	$2.3 \\ 2.4$	2.2 2.3	2.2 2.2	$\begin{array}{c} 2.1 \\ 2.1 \end{array}$	2.0 2.0	1.9	$1.8 \\ 1.9$	7
9	3.2	3.0	2.9	2.8	2.7	2.5	2.4	2.3	2.2	2.2	2.1	2.0	1.9	9
10	3.3	3.1	3.0	2.8	2.7	$\frac{2.6}{2.7}$	2.5	2.4	2.3	2.2	2.1	2.0	1.9	10
$11 \\ 12$	3.4 3.5	$3.2 \\ 3.3$	3.1 3.1	$2.9 \\ 3.0$	$2.8 \\ 2.9$	$\frac{2.7}{2.7}$	$\frac{2.6}{2.6}$	2.4 2.5	2.3 2.4	$2.2 \\ 2.3$	$2.1 \\ 2.2$	2.1 2.1	$2.0 \\ 2.0$	$\frac{11}{12}$
13	3.6	3.4	3.2	3.1	2.9	2.8	2.7	2.6	2.4	2.3	2.2	2.1	2.0	13
14	3.7	3.5	3.3	$\frac{3.2}{2.2}$	3.0	2.9	2.7	2.6	2.5	2.4	2,3	2.2	$\frac{2.1}{2.1}$	14
15 16	$\frac{3.8}{4.0}$	$3.0 \\ 3.8$	3. 1 3. 6	$3.3 \\ 3.4$	$3.1 \\ 3.2$	3.0	$2.8 \\ 2.9$	$\frac{2.1}{2.8}$	2.0 2.6	$2.4 \\ 2.5$	$2.5 \\ 2.4$	$2.2 \\ 2.3$	$2.1 \\ 2.2$	15 16
17	4.1	3.9	3.7	3.5	3.3	3.1	3.0	2.8	2.7	2.6	2.4	2.3	2.2	17
18 19	$\frac{4.3}{4.5}$	$\frac{4.1}{4.2}$	$3.8 \\ \pm 0$	$\frac{3.6}{3.7}$	3.4	$\frac{3.2}{3.3}$	3.1	2.9	2.8 2.8	$2.6 \\ 9.7$	$2.5 \\ 2.6$	2.4 2 4	2.3 2.3	$18 \\ 19$
$\frac{10}{20}$	4.7	4.4	4.1	3.9	$-\frac{3.5}{3.7}$	3.5	$\frac{3.2}{3.3}$	$\frac{3.0}{3.1}$	$\frac{2.0}{2.9}$	2.8	$\frac{2.6}{2.6}$	$\frac{2.3}{2.5}$	$\frac{2.0}{2.4}$	20
21	4.9	4.6	4.3	4.0	3.8	3.6	3.4	3.2	3.0	2.9	2.7	2.6	2.4	21
$\frac{22}{23}$	$5.2 \\ 5.5$	$\frac{4.8}{5.1}$	$\begin{array}{c} 4.5 \\ 4.7 \end{array}$	4.2 4.4	4.0	3.7 3.9	$3.5 \\ 3.6$	3.3	$3.1 \\ 3.2$	2.9	$2.8 \\ 2.9$	$2.6 \\ 2.7$	$2.5 \\ 2.6$	$\frac{22}{23}$
24	5.8	5.4	5.0	4.6	4.3	4.0	3.8	3.5	3.3.	3.1	3.0	2.8	2.6	24
25	6.2	5.7	5.3	4.9	4.5	4.2	3.9	3.7	3.5	3.3	3.1	2.9	2.7	25
20 27	$\begin{array}{c} 6.1\\ 7.2 \end{array}$	$6.1 \\ 6.5$	$5.0 \\ 6.0$	$5.2 \\ 5.5$	$4.8 \\ 5.0$	$4.4 \\ 4.6$	$\begin{array}{c} 4.1 \\ 4.3 \end{array}$	$\frac{3.8}{4.0}$	$3.0 \\ 3.7$	$3.4 \\ 3.5$	$3.2 \\ 3.3$	$3.0 \\ 3.1$	$2.8 \\ 2.9$	$\frac{26}{27}$
28	7.9	7.1	6.4	5.8	5.3	4.9	4.5	4.2	3.9	3.6	3.4	3.2	3.0	28
$\frac{29}{20}$	8.7	7.7	6.9	6.2	5.7	5.2	4.8	4.4	4.1	3.8	3.5	3.3	$\frac{3.1}{2.2}$	29
$\frac{30}{31}$	9.0 10.9	$8.0 \\ 9.4$	$\frac{1.0}{8.2}$	$\frac{6.7}{7.3}$	$ \begin{array}{c} 6.1 \\ 6.6 \end{array} $	$5.0 \\ 5.9$	$5.1 \\ 5.4$	$\frac{4.1}{4.9}$	4.5	4.0	3.7 3.9	$3.4 \\ 3.6$	$3.2 \\ 3.3$	$\frac{30}{31}$
32	12.6	10.6	9.2	8.0	7.1	6.4	5.8	5.2	4.8	4.4	4.0	3.7	3.5	32
33 34	14.9 18.4	$12.2 \\ 14.5$	$10.4 \\ 11.9$	8.9 10.1	7.8	$\begin{array}{c} 6.9 \\ 7.6 \end{array}$	$\begin{array}{c} 6.2 \\ 6.7 \end{array}$	5.6 6.0	5.1 5.4	4.6	4.3 - 4.5	$3.9 \\ 4.1$	3.6 3.8	33 34
35		17.9	14.1	11.6	9.8	8.5	7.4	6.6	5.9	5.3	4.8	4.4	4.0	35
36			17.4	13.8	11.3	9.5	8.2	7.2	6.4	5.7	5.1	4.6	4.2	36
37 38				17.0	$13.4 \\ 16.5$	11.0 13.0	9.3 10.7	8.0 9.0	7.7	6.2 6.8	$5.5 \\ 6.0$	$5.0 \\ 5.3$	4.0 4.8	$\frac{37}{38}$
39					10.0	16.0	12.6	10.3	8.7	7.5	6.5	5.8	5.1	39
40							15.5	12.2	10.0	8.4	7.2	$\begin{array}{c c} 6.3 \\ 7.0 \end{array}$	5.6	40
41 42	16.5							10.0	$11.0 \\ 14.5$	9.1	9.3	7.9	6.7	41 42
43	13.0	16.0								14.0	11.0	9.0	7.6	43
44	$\frac{10.7}{0.0}$	$\frac{12.0}{10.3}$	$\frac{15.5}{19.2}$	15.0							13.6	10.0	8.7	44
46	7.7	8.7	10.0	11.8	14.5							10.1	12.6	46
47	6.8	7.5	$\frac{8.4}{7.2}$	9.7	11.4	14.0	19.6						Í.	47
48	5.0	5.8	6.3	7.0	9.5	9.0	13.0 10.6	13.1						48 49
50	4.8	5.1	5.6	6.1	6.7	7.6	8.7	10.2	12.6					50
$\frac{51}{52}$	$\frac{4.3}{2.9}$	$\frac{4.6}{1.2}$	$5.0 \\ 4.5$	5.4	$5.9 \\ 5.2$	$\begin{array}{c} 6.5 \\ 5.7 \end{array}$	$\begin{array}{c} 7.3 \\ 6.3 \end{array}$	$\begin{bmatrix} 8.4 \\ 7.0 \end{bmatrix}$	9.9	12.1 9.5	11.6			$\frac{51}{52}$
53	3.6	3.8	4.0	4.3	4.6	5.0	5.4	6.0	6.7	7.7	9.1	11.1	1	53
54	3.3	3.5	3.7	3.9	4.1	4.4	4.8	5.2	5.8	6.5	7.4	8.7	10.6	54
$\frac{55}{56}$	$\frac{3.0}{2.8}$	$\frac{3.2}{2.9}$	$\frac{3.3}{3.1}$	$\frac{3.5}{3.2}$	3.7 3.4	$\frac{4.0}{3.6}$	$\frac{4.3}{3.8}$	4.6 4.1	5.0 4.4	5.5 4.8	$\begin{array}{c} 6.2 \\ 5.3 \end{array}$	$\begin{array}{c} 7.1 \\ 5.9 \end{array}$	$8.3 \\ 6.8$	55 56
57 - 57	2.6	2.7	2.8	2.9	3.1	3.2	3.4	3.6	3.9	4.2	4.6	5.0	5.6	57
$58 \\ 59$	2.4	2.5 9.3	$\frac{2.6}{9.4}$	2.7	2.8	$2.9 \\ 2.7$	$\frac{3.1}{2.8}$	3.3	$\frac{3.5}{2.1}$	$\frac{3.7}{2.3}$	4.0	4.4	4.8	58 50
60	2.1	$2.0 \\ 2.1$	$2.4 \\ 2.2$	$2.3 \\ 2.3$	$2.0 \\ 2.4$	$2.1 \\ 2.5$	$2.6 \\ 2.6$	2.7	$2.8^{-5.1}$	3.0	$3.0 \\ 3.2$	3.4	3.6	60
	380	390	400	41°	420	43°	440	45°	46°	47°	48°	490	50°	
	1	Dee	elinatior	1 of the s	same nar	me as th	e latitud	le; upper	r transit:	; reducti	on addit	dve.		1

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						ТА	BLE	26.					[Page	545
			Varia	ation of	i Altitu	de in o	ne min	ute fro	m meri	idian p	assage.			
Lati-		Der	elination	n of the	same nar	me as the	e latitud	e; upper	transit;	, redueti	on addit	lve.		Lati-
tude.	51°	520	550	540	55°	56°	57°	58°	59°	60°	610	620	63°	tude.
°	$\overset{''}{1.6}$	1.5	1.5	1.4	″ 1.4	1.3	1.3	$\overset{''}{1.2}$	$\overset{''}{1.2}$	″ 1.1	1.1	″ 1. 0	1.0''	。 0
1	$1.6 \\ 1.6$	1.6 1.6	$1.5 \\ 1.5$	$1.4 \\ 1.5$	$1.4 \\ 1.4$	$1.3 \\ 1.4$	$1.3 \\ 1.3$	$1.2 \\ 1.3$	$1.2 \\ 1.2$	$\begin{array}{c c} 1.2 \\ 1.2 \end{array}$	$1.1 \\ 1.1$	$1.1 \\ 1.1$	1.0 1.0	$\frac{1}{2}$
3	1.7 1.7	1.6	1.5	1.5	1.4	1.4	1.3	1.3	1.2	1.2	1.1	1.1	1.0	3
	$\frac{1.7}{1.7}$	1.0	1.0	$\frac{1.5}{1.5}$	$\frac{1.5}{1.5}$	1.4	$\frac{1.0}{1.4}$	1.3	$\frac{1.2}{1.3}$	1.2	1.1	$\frac{1.1}{1.1}$	1.0	$-\frac{4}{5}$
$\frac{6}{7}$	$1.7 \\ 1.8$	$1.7 \\ 1.7$	$1.6 \\ 1.6$	$1.5 \\ 1.6$	$egin{array}{c c} 1.5 \\ 1.5 \end{array}$	$\begin{array}{c} 1.4 \\ 1.4 \end{array}$	$\begin{array}{c} 1.4 \\ 1.4 \end{array}$	$\begin{array}{c}1.3\\1.3\end{array}$	$\begin{array}{c}1.3\\1.3\end{array}$	$\begin{array}{c c} 1.2\\ 1.2 \end{array}$	$\begin{array}{c c} 1.2\\ 1.2\end{array}$	$1.1 \\ 1.1$	$1.1 \\ 1.1$	$\frac{6}{7}$
8	$1.8 \\ 1.8$	$1.7 \\ 1.8$	1.7 1.7	$1.6 \\ 1.6$	$1.5 \\ 1.6$	$1.5 \\ 1.5$	$1.4 \\ 1.4$	$1.4 \\ 1.4$	$1.3 \\ 1.3$	$1.2 \\ 1.3$	$\begin{array}{c c} 1.2\\ 1.2 \end{array}$	1.1	1.1	8
10	1.9	1.8	1.7	1.6	1.6	1.5	1.4	1.4	1.3	1.3	1.2	1.2	1.1	10
$11 \\ 12$	$\begin{array}{c}1.9\\1.9\end{array}$	$1.8 \\ 1.8$	$1.7 \\ 1.8$	$1.7 \\ 1.7$	$1.6 \\ 1.6$	$1.5 \\ 1.6$	$1.5 \\ 1.5$	$1.4 \\ 1.4$	$1.3 \\ 1.4$	$\begin{array}{c} 1.3\\ 1.3\end{array}$	$1.2 \\ 1.2$	$1.2 \\ 1.2$	1.1	$11 \\ 12$
13 14	$2.0 \\ 2.0$	$1.9 \\ 1.9$	$1.8 \\ 1.8$	$1.7 \\ 1.7$	$\begin{array}{c c} 1.6\\ 1.7\end{array}$	$1.6 \\ 1.6$	$1.5 \\ 1.5$	$1.4 \\ 1.5$	$\begin{array}{c} 1.4 \\ 1.4 \end{array}$	$1.3 \\ 1.3$	$egin{array}{c} 1.3 \ 1.3 \end{array}$	$1.2 \\ 1.2$	$1.1 \\ 1.2$	$13 \\ 14$
15	2.0	1.9	1.9	1.8	1.7	1.6	1.5	1.5	1.4	1.3	1.3	$\frac{1.2}{1.2}$	1.2	15
16 17	$2.1 \\ 2.1$	$2.0 \\ 2.0$	$1.9 \\ 1.9$	$1.8 \\ 1.8$	1.1 1.8	1.0	1.0	$1.0 \\ 1.5$	$1.4 \\ 1.5$	1.4	1.3 1.3	$1.2 \\ 1.3$	$1.2 \\ 1.2$	$16 \\ 17$
$\frac{18}{19}$	$2.2 \\ 2.2$	$\begin{array}{c} 2.1 \\ 2.1 \end{array}$	$2.0 \\ 2.0$	$\begin{array}{c} 1.9\\ 1.9\end{array}$	$\begin{array}{c}1.8\\1.8\end{array}$	$\begin{array}{c} 1.7\\ 1.7\end{array}$	$\begin{array}{c}1.6\\1.6\end{array}$	$\begin{array}{c} 1.5 \\ 1.6 \end{array}$	$1.5 \\ 1.5$	$1.4 \\ 1.4$	$1.3 \\ 1.4$	$1.3 \\ 1.3$	$\begin{array}{c} 1.2\\ 1.2\end{array}$	$\begin{array}{c}18\\19\end{array}$
20	$\frac{2.3}{2.3}$	$\frac{2.1}{2.9}$	2.0 2 1	1.9 2.0	1.9	1.8	1.7	1.6	1.5	1.4	1.4	1.3	1.2	20
$\frac{21}{22}$	$2.5 \\ 2.4$	$\begin{bmatrix} 2.2\\ 2.2\\ 2.2 \end{bmatrix}$	2.1 2.1	2.0 2.0	1.9	1.8	1.7	1.6 1.6	$1.0 \\ 1.6$	$1.5 \\ 1.5$	1.4	1.3	1.2	$\frac{21}{22}$
$\frac{23}{24}$	$\begin{array}{c} 2.4 \\ 2.5 \end{array}$	$2.3 \\ 2.4$	$\begin{array}{c} 2.2 \\ 2.2 \end{array}$	$2.1 \\ 2.1$	$2.0 \\ 2.0$	$\begin{array}{c}1.9\\1.9\end{array}$	$1.8 \\ 1.8$	$\begin{array}{c c}1.7\\1.7\end{array}$	$egin{array}{c} 1.6 \\ 1.6 \end{array}$	$1.5 \\ 1.5$	$\begin{array}{c} 1.4 \\ 1.5 \end{array}$	$1.4 \\ 1.4$	$1.3 \\ 1.3$	$\frac{23}{24}$
$\frac{25}{26}$	$\frac{2.6}{2.6}$	2.4 2.5	$\frac{2.3}{2.3}$	$\frac{2.2}{2.2}$	$\frac{2.0}{2.1}$	1.9 2.0	$1.8 \\ 1.9$	1.7 1.8	$1.6 \\ 1.7$	$1.6 \\ 1.6$	$1.5 \\ 1.5$	$1.4 \\ 1.4$	1.3 1.3	$\frac{25}{26}$
27	$2.0 \\ 2.7 \\ 0.8$	2.6	2.4	2.3	2.1	2.0	1.9	1.8	1.7	1.6	1.5	1.4	1.4	27
$\frac{28}{29}$	$2.8 \\ 2.9$	$2.0 \\ 2.7$	$2.5 \\ 2.5$	2.5 2.4	2.2 2.3	2.1 2.1	2.0 2.0	1.8 1.9	1.7 1.8	$1.0 \\ 1.7$	$1.0 \\ 1.6$	$1.5 \\ 1.5$	1.4	$\frac{28}{29}$
$\frac{30}{31}$	3.0 3.1	$\begin{array}{c} 2.8 \\ 2.9 \end{array}$	$\begin{array}{c} 2.6 \\ 2.7 \end{array}$	$2.5 \\ 2.5$	$\begin{array}{c} 2.3\\ 2.4 \end{array}$	$egin{array}{c} 2.2\ 2.2 \end{array}$	$\begin{array}{c} 2.0\\ 2.1 \end{array}$	1.9 2.0	$\begin{array}{c}1.8\\1.9\end{array}$	$\begin{array}{c} 1.7\\ 1.7\end{array}$	$\begin{array}{c}1.6\\1.6\end{array}$	$\begin{array}{c}1.5\\1.5\end{array}$	$1.4 \\ 1.4$	$\frac{30}{31}$
$\frac{32}{33}$	$\frac{3.2}{3.4}$	3.0	2.8	$\frac{2.6}{2.7}$	$\frac{2.4}{2.5}$	$\frac{2.3}{2.4}$	2.2	2.0	1.9	1.8	1.7	1.6	1.5	32
34	3.5	3.2	3.0	2.8	2.6	2.4	$\frac{2.2}{2.3}$	$\frac{2.1}{2.1}$	$\frac{1.0}{2.0}$	1.9	1.7	1.6	1.5	34
$\frac{35}{36}$	$3.7 \\ 3.9$	$\begin{array}{c} 3.4\\ 3.6\end{array}$	3.1 3.3	$2.9 \\ 3.0$	$\begin{array}{c} 2.7\\ 2.8 \end{array}$	$\begin{array}{c} 2.5\\ 2.6\end{array}$	$\begin{array}{c} 2.3\\ 2.4 \end{array}$	$\begin{array}{c} 2.2\\ 2.3 \end{array}$	$egin{array}{c} 2.0\ 2.1 \end{array}$	$egin{array}{c} 1.9 \\ 2.0 \end{array}$	$\begin{array}{c}1.8\\1.8\end{array}$	$\left \begin{array}{c}1.7\\1.7\end{array}\right $	$\begin{array}{c} 1.6\\ 1.6\end{array}$	$\frac{35}{36}$
$\frac{37}{38}$	4.1 4.3	$3.7 \\ 3.9$	3.4 3.6	$3.2 \\ 3.3$	2.9 .3.0	2.7 2.8	$2.5 \\ 2.6$	2.3 2.4	$2.2 \\ 2.2$	$2.0 \\ 2.1$	$1.9 \\ 1.9$	$1.7 \\ 1.8$	1.6 1.7	37 38
39	4.6	4.2	3.8	3.5	3.2	2.9	2.7	2.5	2.3	$\frac{2.1}{2.1}$	$\frac{2.0}{2.0}$	1.8	1.7	39
$\begin{array}{c} 40\\ 41 \end{array}$	$5.0 \\ 5.4$	4.0 4.8	$\frac{4.0}{4.3}$	$3.7 \\ 3.9$	$3.3 \\ 3.5$	3.1 3.2	$\begin{array}{c} 2.8\\ 2.9\end{array}$	$2.6 \\ 2.7$	$2.4 \\ 2.5$	$2.2 \\ 2.3$	$2.0 \\ 2.1$	$\begin{array}{c}1.9\\1.9\end{array}$	$1.8 \\ 1.8$	40 41
$\begin{array}{c} 42\\ 43 \end{array}$	$\begin{array}{c}5.9\\6.5\end{array}$	$\begin{array}{c} 5.2\\ 5.7\end{array}$	$\begin{array}{c} 4.6 \\ 5.0 \end{array}$	$4.1 \\ 4.4$	$\begin{array}{c} 3.7\\ 4.0\end{array}$	$\begin{array}{c} 3.4\\ 3.6 \end{array}$	$\begin{array}{c} 3.1 \\ 3.2 \end{array}$	$\begin{array}{c} 2.8 \\ 2.9 \end{array}$	$egin{array}{c} 2.6 \\ 2.7 \end{array}$	$\begin{array}{c} 2.4 \\ 2.5 \end{array}$	$\begin{array}{c} 2.2 \\ 2.3 \end{array}$	$egin{array}{c} 2.0\ 2.1 \end{array}$	$\begin{array}{c} 1.9\\ 1.9\end{array}$	$\begin{array}{c} 42 \\ 43 \end{array}$
44	7.3	$\frac{6.3}{7.0}$	5.4	4.8	4.3	3.8	$\frac{3.4}{2.6}$	$\frac{3.1}{2.2}$	2.8	$\frac{2.6}{2.7}$	2.3	$\frac{2.2}{2.2}$	$\frac{2.0}{2.0}$	44
45 46	8. 1 9. 9	8.0	$6.0 \\ 6.7$	$5.2 \\ 5.8$	$\frac{4.0}{5.0}$	4.1	3. 0 3. 9	$\frac{3.3}{3.5}$	3.0 3.1	2.6 2.8	$2.4 \\ 2.6$	$2.2 \\ 2.3$	2.0 2.1	40 46
$\frac{47}{48}$	12.1	$\begin{array}{c}9.5\\11.6\end{array}$	$\left \begin{array}{c} 7.7 \\ 9.1 \end{array} \right $	$\begin{array}{c} 6.5 \\ 7.4 \end{array}$	$\begin{array}{c} 5.5\\ 6.2 \end{array}$	$\begin{array}{c}4.8\\5.3\end{array}$	$\begin{array}{c} 4.2\\ 4.6\end{array}$	$\begin{array}{c c} 3.7 \\ 4.0 \end{array}$	3.3 3.6	$\begin{array}{c} 3.0\\ 3.2 \end{array}$	$\begin{array}{c} 2.7 \\ 2.8 \end{array}$	$\begin{array}{c c} 2.4\\ 2.6 \end{array}$	$\begin{array}{c} 2.2\\ 2.3 \end{array}$	47 48
49			11.1	8.7	7.1	5.9	$\frac{5.0}{5.6}$	4.4	3.8	$\frac{3.4}{2.6}$	$\frac{3.0}{2.2}$	$\frac{2.7}{2.9}$	$\frac{2.4}{2.6}$	49
51				10.0	10.2	7.9	6.4	4.0 5.4	4.6	4.0	3.2 3.5	2. 9 3. 0	2.0 2.7	50 51
$\frac{52}{53}$						9.7	$\begin{array}{c} 7.6 \\ 9.2 \end{array}$	$\begin{array}{c} 6.1 \\ 7.2 \end{array}$	5.1 5.9	$\begin{array}{c} 4.3 \\ 4.9 \end{array}$	$\begin{array}{c} 3.8\\ 4.1\end{array}$	$\begin{array}{c} 3.3\\ 3.6\end{array}$	2.9 3.1	$\frac{52}{53}$
54 55	10.2							8.8	6.8	5.5	$\frac{4.6}{5.3}$	$\frac{3.9}{4.3}$	$\frac{3.4}{2.7}$	54
56	7.9	9.7	0.9						0.0	7.9	6.1	5.0	4.1	56
57 58	5.4	6.1	$\frac{9.2}{7.2}$	8.8							1.4	$\begin{array}{c} 5.8 \\ 7.0 \end{array}$	4. 1 5. 4	57 58
$\begin{array}{c} 59 \\ 60 \end{array}$	$\begin{array}{c} 4.6\\ 4.0\end{array}$	$\begin{array}{c} 5.1\\ 4.3\end{array}$	$\begin{array}{c} 5.9\\ 4.9\end{array}$	$\begin{array}{c} 6.8 \\ 5.5 \end{array}$	$\begin{array}{c} 8.3\\ 6.5\end{array}$	7.9							6.6	$\begin{array}{c} 59 \\ 60 \end{array}$
	51°	52°	53°	54°	55°	56°	570	58°	59°		610	620	630	
		Der	elination	n of the	same nar	ne as th	e latitud	e: upper	transit	: redueti	ion addlt	tive.		

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TABLE 26.

Variation of Altitude in one minute from meridian passage.

	Declination of a different name from the latitude; upper transit; reduction additive.												
Lati-		Decli	nation o	f a differ	rent name	e from th	e latitude	; upper ti	ansit; rec	luction ad	iditive.		Lati-
tnde.	0°	1°	20	30	t ⁰	5°	60	70	8°	90	10°	11°	tude.
്റ	"			"	28.1	22.4	18.7	16.0	14.0	12.4	11 1	10 1	ů
ů 1				28.1	22.4	18.7	16.0	14.0	12.4	11.2	10.1	9.3	1 ĭ
2			28.1	22.4	18.7	16.0	14.0	12.5	11.2	10.2	9.3	8.6	2
3	00.1	28.1	22.4	18.7	16.0	14.0	12.5	11.2	10.2	9.3	8.6	8.0	3
	$\frac{28.1}{28.4}$	10.7	18.1	$\frac{10.0}{14.0}$	14.0	12.0	11.2	$\frac{10.2}{0.2}$	$\frac{9.3}{0.6}$	8.0	8.0	7.4	4
0 6	18 7	18.7	10.0 14 0	14.0	12.0	11.2 10.2	9.3	9.5	8.0	8.0 7.5	$\frac{7.4}{7.0}$	7.0 6.6	0 6
7	16.0	14.0	12.4	11.2	10.2	9.3	8.6	8.0	7.5	7.0	6,6	6.2	7
8	14.0	12.4	11.2	10.2	9.3	8.6	8.0	7.5	7.0	6.6	6.2	5.9	8
9	12.4	11.2	10.2	9.3	8.6	8.0	7.5	7.0	6.6	6.2	5.9	5.6	9
10	11.1	10.1	9.3	8.6		7.4		6.6	6.2	5.9	5.6	5.3	10
11	9.2	9.5	8.0	8.0		6.5	0.0 6.2	0.2 5.9	5.9	5.0	0.3 5.0	$\begin{array}{c} 0.1\\ 4.8\end{array}$	11
12^{12}	8.5	7.9	7.4	6.9	6.5	6.2	5.8	5.6	5.3	5.0	4.8	4.6	$112 \\ 113$
14	7.9	7.4	6.9	6.5	6.2	5.8	5.5	5.3	5.0	4.8	4.6	4.4	14
15	7.3	6.9	6.5	6.1	5.8	5.5	5.3	5.0	4.8	4.6	4.4	4.2	15
$16 \\ 17$	6.8	6.5	6.1	5.8	5.5	5.2	5.0	4.8	4.6	4.4	4.2	$\frac{4.1}{2.0}$	16
17	6.0	5.7	5.5	$5.0 \\ 5.2$	5.0	4.8	4.6	4.4	4.4	4.2	$\frac{4.1}{3.9}$	3.9 3.8	$\frac{17}{18}$
10	5.7	5.4	5.2	4.9	4.7	4.5	4.4	4.2	4.0	3.9	3.8	3.6	19
20	5.4	5.1	4.9	4.7	4.5	4.3	4.2	4.0	3.9	3.8	3.6	3.5	20
21	5.1	4.9	4.7	4.5	4.3	4.2	4.0	3. 9	3.7	3.6	3.5	3.4	21
22	4.9	4.7	4.5	4.3	4.1	4.0	3.9	3.7	3.6	3.5	3.4	3.3	22
$\frac{25}{24}$	4.0	4.4	4.0	$\frac{4.1}{3.9}$	3.8	3.7	3.6	5. 0 3. 5	3.4	3.3	3. 3 3. 2	3. 1 3. 1	23
$\frac{21}{25}$	4.2	4.1	3.9	3.8	$\frac{3.8}{3.7}$	3.5	$\frac{-3.3}{3.4}$	3.3	3.2	$\frac{3.3}{3.1}$	$\frac{3.2}{3.1}$	3.0	25
$\overline{26}$	4.0	3.9	3.8	3.6	3.5	3.4	3.3	3.2	3.1	3.0	3.0	2.9	26
27	3.9	3.7	3.6	3.5	3.4	3.3	3.2	3.1	3.0	2.9	2.9	2.8	27
$\frac{28}{20}$	3.7	3.6	3.0	3.4	3.3	3.2	$\frac{3.1}{3.0}$	3.0	2.9	2.8 2.8	$2.8 \\ 2.7$	2.7	28
	$\frac{3.0}{3.4}$	33	$\frac{3.0}{3.2}$	$\frac{0.2}{3.1}$	$\frac{3.1}{3.0}$	$\frac{0.1}{3.0}$	$\frac{0.0}{2.9}$	$\frac{2.3}{2.8}$	$\frac{2.0}{2.7}$	$\frac{2.0}{2.7}$	$\frac{2.7}{2.6}$	$\frac{2.0}{2.5}$	30
31	3.3	$3.0 \\ 3.2$	3.1	3.0	2.9	2.9	2.8	$2.0 \\ 2.7$	2.6	$\frac{2.6}{2.6}$	$2.0 \\ 2.5$	2.5	31
32	3.2	3.1	3.0	2.9	2.8	2.8	2.7	2.6	2.6	2.5	2.5	2.4	32
33	3.0	2.9	2.9	2.8	2.7	2.7	2.6	2.5	2.5	2.4	2.4	2.3	33
	$\frac{2.9}{9.9}$	$\frac{2.8}{9.7}$	$\frac{2.8}{9.7}$	$\frac{2.7}{9.6}$	2.0	$\frac{2.0}{2.5}$	$\frac{2.0}{9.4}$	2.0	$\frac{2.4}{9.2}$	$\frac{2.4}{9.2}$	2.0	$\frac{4.3}{9.9}$	25
- 30 - 36	$\frac{2.8}{2.7}$	$\frac{2.7}{2.6}$	$\frac{2.7}{2.6}$	$2.0 \\ 2.5$	2.5 2.5	$2.0 \\ 2.4$	2.4 2.4	$\frac{2.4}{2.3}$	2.3	$\frac{4.3}{2.2}$	$-\frac{2.2}{2.2}$	2.2 2.1	36
37	2.6	2.5	2.5	2.4	2.4	2.3	2.3	$\bar{2}.2$	2.2	2.2	2.1	$\bar{2}, \bar{1}$	37
38	2.5	2.5	2.4	2.4	2.3	2.3	2.2	2.2	2.1	2.1	2.1	2.0	38
39	2.4	2.4	2.3	2.3	2.2	2.2	2.1	$\frac{2.1}{2.1}$	$\frac{2.1}{2.1}$	2.0	2.0	$\frac{2.0}{1.0}$	39
$40 \\ 41$	$\frac{2.3}{2.2}$	2.3	$\frac{2.2}{2.2}$	2.2 2 1	2.2 2 1	2.1	2.1	$\frac{2.0}{2.0}$	2.0 1-9	2.0	1.9	1.9	40
41 42	$2.3 \\ 2.2$	2.1	2.1	2.1 2.1	$2.1 \\ 2.0$	$2.1 \\ 2.0$	$2.0 \\ 2.0$	1.9	1.9	1.9	1.8	1.8	42
43	$\tilde{2}.1$	$\bar{2}.1$	$\bar{2}.0$	$\bar{2}.\bar{0}$	2.0	1.9	1.9	1.9	1.8	1.8	1.8	1.7	43
44	2.0	2.0	2.0	1.9	1.9	1.9	1.8	1.8	1.8	1.7	1.7	1.7	44
45	2.0	1.9	1.9	1.9	1.8	1.8	1.8	1.7	1.7	1.7	1.7	1.6	45
46	1.9	1.9	1.8 1.8	$1.8 \\ 1.7$	$1.8 \\ 1.7$	1.7 1.7	1.7 1.7	1.7	1.7	1.0	1.0	1.0	40 47
48	1.8	1.7	1.7	1.7	1.7	1.6	1.6	$1.0 \\ 1.6$	$1.0 \\ 1.6$	1.6	1.5	1.5	48
49	1.7	1.7	1.7	1.6	1.6	1.6	1.6	1.5	1.5	1.5	1.5	1.5	49
50	1.6	1.6	1.6	1.6	1.6	1.5	1.5	1.5	1.5	1.5	1.4	1.4	50
51	1.6	1.6	1.6	1.5	1.5	1.5	1.5	1.5	1.4	1.4	1.4	1.4	51
53 52	$1.0 \\ 1.5$	1.0	$1.0 \\ 1.4$	$1.0 \\ 1.4$	$1.0 \\ 1.4$	1.4	$1.4 \\ 1.4$	1.4	$1.4 \\ 1.3$	1.4	1.4	1.3	53
54	1.4	1.4	1.4	1.4	1.4	, 1.3	1.3	1.3	1.3	1.3	1.3	1.3	54
55	1.4	1.4	1.3	1.3	1.3	1.3	1.3	1.3	1.3	1.2	1.2	1.2	55
56	1.3	1.3	1.3	1.3	1.3	1.3	1.2	1.2	1.2	1.2	1.2	1.2	$\frac{56}{57}$
57	1.3	1.3	1.3	$\frac{1.2}{1.9}$	1.2	1.2	$\frac{1.2}{1.9}$	1.2	1.2	1.2	1.1	1.1 1 1	07 58
59	$1.2 \\ 1.2$	$1.2 \\ 1.2$	$1.2 \\ 1.2$	$1.2 \\ 1.2$	1.1	1.2 1.1	$1.2 \\ 1.1$	1.1	1.1	1.1	1.1	1.1	59
50	1.1	1.1	1.1	1.1	1.1	1.1	1.1	1.1	1.0	10	1.0	1.0	60
	0°	1°	20	30	4 °	5 °	6°	70	80	90	10°	11°	
		Decli	iation of	a differ	ent name	from the	e latitude	upper tr	ansit; red	luction ad	ditive.		

Variational of Alfiteneric number of all sectors and all se							TA	BLE	26.					[Page	547	
Desire unitable with the serie with the se				Varia	ution of	Altitu	de in o	ne min	ute fro	m meri	idian p	assage.				
inde ige ige <td>Lati-</td> <td></td> <td>Decli</td> <td>ination o</td> <td>of a diffe</td> <td>rent nan</td> <td>ne from</td> <td>the latit</td> <td>ude; upj</td> <td>per trans</td> <td>sit; redu</td> <td>ction ad</td> <td>litive.</td> <td></td> <td>Lati-</td>	Lati-		Decli	ination o	of a diffe	rent nan	ne from	the latit	ude; upj	per trans	sit; redu	ction ad	litive.		Lati-	
$ \begin{array}{c c c c c c c c c c c c c c c c c c c $	tude.	120	13°	140	150	16°	170	180	19°	200	210	220	230	240	tude.	
$\begin{array}{c c c c c c c c c c c c c c c c c c c $	0	"	"	"	"	"	"	"	"	"	"	"	"	"	0	
$ \begin{array}{c c c c c c c c c c c c c c c c c c c $	0	9.2	8.5	7.9	7.3	6.8	6.4	6.0	5.7	5.4	5.1	$\frac{4.9}{1.7}$	4.6	4.4	0	
3 7.4 6.6 6.5 6.2 5.8 5.5 5.2 5.0 4.7 4.5 4.3 4.1 4.0 3.8 4 5 6 6.5 6.2 5.8 5.5 5.2 5.0 4.7 4.5 4.3 4.2 4.0 3.8 8.4 5 6 6.5 5.3 5.0 4.8 4.6 4.4 4.2 4.0 3.9 3.7 3.6 3.5 3.4 8.8 3.6 3.5 3.4 3.8 3.6 3.5 3.4 3.8 3.6 3.5 3.4 3.3 3.2 3.1 3.0 12 11 4.4 4.3 4.4 4.3 4.4 4.3 3.8 3.7 3.5 3.4 3.3 3.2 3.1 3.0 2.9 1.3 1.4 4.4 4.3 3.3 3.2 3.1 3.0 2.9 2.8 2.7 2.6 2.6 2.5 2.4 2.9 1.3	$\frac{1}{2}$	$\frac{8.9}{7.9}$	7.4	.6.9	0.9 6.5	0.0 6.1	5.8	$ \begin{array}{c} 0.7 \\ 5.5 \end{array} $	$ \begin{array}{c} 5.4 \\ 5.2 \end{array} $	$\frac{0.1}{4.9}$	4.9	4.1	4.4	4.2 4 1	$\frac{1}{2}$	
$ \begin{array}{c c c c c c c c c c c c c c c c c c c $	3	7.4	6.9	6.5	6.1	5.8	5.5	5.2	4.9	4.7	4.5	4.3	4.1	3.9	3	
5 6.5 6.5 7 5.8 5.5 5.0 4.8 4.6 4.4 4.2 4.0 3.9 3.7 3.6 6 7 5.6 5.6 5.3 5.0 4.8 4.6 4.4 4.2 4.0 3.9 3.7 3.6 6.5 3.4 8 3.6 5.5 3.4 3.8 3.6 3.5 3.4 3.3 3.2 10 10 5.0 4.8 4.6 4.4 4.2 4.1 3.9 3.8 3.6 3.5 3.4 3.3 3.2 11 11 4.8 4.6 4.4 4.2 4.1 3.9 3.8 3.6 3.5 3.4 3.3 3.2 3.1 3.0 2.9 1.8 3.7 3.5 3.4 3.3 3.2 3.1 3.0 2.9 2.8 2.8 2.7 2.6 2.6 2.5 2.4 2.0 2.8 2.7 2.6 2.6 2.5 2.4 2.0 2.8 2.7 2.6 2.6 2.5 2.4 2.4	4	7.0	6.5	6.2	5.8	5.5	5.2	5.0	4.7	4.5	4.3	4.1	$\frac{4.0}{2.0}$	3.8	4	
$\begin{array}{c} 3 & 5.6 & 5.6 & 5.3 & 5.0 & 4.8 & 4.6 & 4.4 & 4.2 & 4.2 & 4.0 & 3.9 & 3.7 & 3.6 & 3.5 & 3.4 & 8.8 \\ 9 & 5.3 & 5.0 & 4.8 & 4.6 & 4.4 & 4.2 & 4.1 & 3.9 & 3.8 & 3.6 & 3.5 & 3.4 & 3.3 & 9. \\ 10 & 5.0 & 4.8 & 4.6 & 4.4 & 4.2 & 4.1 & 3.9 & 3.8 & 3.6 & 3.5 & 3.4 & 3.3 & 3.2 & 3.1 & 1.1 \\ 12 & 4.6 & 4.4 & 4.4 & 4.1 & 4.1 & 3.9 & 3.8 & 3.6 & 3.5 & 3.4 & 3.3 & 3.2 & 3.2 & 1.1 \\ 12 & 4.6 & 4.4 & 4.4 & 4.1 & 4.1 & 3.9 & 3.8 & 3.7 & 3.5 & 3.4 & 3.3 & 3.2 & 3.2 & 3.1 & 3.0 & 1.2 \\ 13 & 4.4 & 4.3 & 4.1 & 3.9 & 3.8 & 3.7 & 3.5 & 3.4 & 3.3 & 3.2 & 3.2 & 3.1 & 3.0 & 2.9 & 2.8 \\ 14 & 4.2 & 4.1 & 3.9 & 3.8 & 3.7 & 3.5 & 3.4 & 3.3 & 3.2 & 3.1 & 3.0 & 2.9 & 2.8 \\ 15 & 4.1 & 3.9 & 3.8 & 3.7 & 3.5 & 3.4 & 3.3 & 3.2 & 3.1 & 3.0 & 2.9 & 2.8 \\ 16 & 3.9 & 3.7 & 3.5 & 3.4 & 3.3 & 3.2 & 3.1 & 3.0 & 2.9 & 2.8 & 2.7 & 2.6 & 2.6 & 2.5 & 1.6 \\ 18 & 3.8 & 3.7 & 3.5 & 3.4 & 3.3 & 3.2 & 3.1 & 3.0 & 2.9 & 2.8 & 2.7 & 2.6 & 2.6 & 2.5 & 1.6 \\ 19 & 3.5 & 3.4 & 3.3 & 3.2 & 3.1 & 3.0 & 2.9 & 2.8 & 2.7 & 2.6 & 2.6 & 2.5 & 1.6 \\ 19 & 3.5 & 3.4 & 3.3 & 3.2 & 3.1 & 3.0 & 2.9 & 2.8 & 2.7 & 2.6 & 2.6 & 2.5 & 1.6 \\ 19 & 3.5 & 3.4 & 3.3 & 3.2 & 3.1 & 3.0 & 2.9 & 2.8 & 2.7 & 2.6 & 2.6 & 2.5 & 1.4 & 2.4 \\ 21 & 3.3 & 3.2 & 3.1 & 3.0 & 2.9 & 2.8 & 2.7 & 2.6 & 2.6 & 2.5 & 2.4 & 2.4 \\ 22 & 3.3 & 3.1 & 3.0 & 2.9 & 2.8 & 2.2 & 2.2 & 2.2 & 2.5 & 2.4 & 2.4 & 2.3 \\ 22 & 2.8 & 2.7 & 2.7 & 2.6 & 2.5 & 2.5 & 2.4 & 2.4 & 2.3 & 2.3 & 2.3 & 2.3 & 2.3 \\ 24 & 3.0 & 2.9 & 2.8 & 2.8 & 2.7 & 2.6 & 2.6 & 2.6 & 2.5 & 2.4 & 2.4 & 2.3 \\ 2.9 & 2.8 & 2.7 & 2.7 & 2.6 & 2.5 & 2.5 & 2.4 & 2.4 & 2.3 & 2.3 & 2.3 & 2.3 & 2.3 \\ 24 & 3.0 & 2.9 & 2.8 & 2.8 & 2.7 & 2.6 & 2.6 & 2.5 & 2.4 & 2.4 & 2.3 \\ 2.9 & 2.8 & 2.7 & 2.7 & 2.6 & 2.5 & 2.4 & 2.4 & 2.3 & 2.3 & 2.2 & 2.2 & 2.4 & 2.4 & 2.3 \\ 2.0 & 2.9 & 2.8 & 2.8 & 2.8 & 2.7 & 2.6 & 2.6 & 2.5 & 2.4 & 2.4 & 2.3 \\ 2.2 & 2.9 & 2.8 & 2.7 & 2.7 & 2.6 & 2.5 & 2.4 & 2.4 & 2.3 & 2.$	5 6	6.5 6.2	$\begin{array}{c} 6.2 \\ 5.8 \end{array}$	$ \begin{array}{c} 5.8 \\ 5.5 \end{array} $	$5.5 \\ 5.3$	$5.2 \\ 5.0$	$\frac{5.0}{4.8}$	$4.8 \\ 4.6$	$4.0 \\ 4.4$	4.3 4.2	$\frac{4.2}{4.0}$	$\frac{4.0}{3.9}$	$\frac{3.8}{3.7}$	3.7 3.6	5 6	
s 5 5 5 5 0 4.8 4.6 4.4 4.2 4.0 3.9 3.7 3.6 3.5 3.4 3.8 9 5.0 4.8 4.6 4.4 4.2 4.1 3.9 3.8 3.6 3.5 3.4 3.3 3.2 3.1 11 12 4.6 4.4 4.2 4.1 3.9 3.8 3.7 3.5 3.4 3.3 3.2 3.1 3.0 2.9 2.8 2.8 13 14 4.2 4.1 3.9 3.8 3.7 3.5 3.4 3.3 3.2 3.1 3.0 2.9 2.8 2.8 2.8 15 14 4.2 4.1 3.9 3.8 3.7 3.5 3.4 3.3 3.2 3.1 3.0 2.9 2.8 2.8 2.7 2.6 2.6 2.5 16 17 3.8 3.7 3.5 3.4 3.3 3.2 3.1 3.0 2.9 2.8 2.7 2.6 2.6 2.5 2.6 2.5 2.6	7	5.9	5.6	5.3	5.0	4.8	4.6	4.4	4.2	4.0	3.9	3.7	3.6	3.5	$\ddot{7}$	
$ \begin{array}{c c c c c c c c c c c c c c c c c c c $	8	5.6	5.3	5.0	4.8	4.6	4.4	$\frac{4.2}{1.1}$	$\frac{4.0}{2.0}$	3.9	$\frac{3.7}{2.6}$	$\frac{3.6}{2.5}$	$\frac{3.5}{2.1}$	3.4	8	
$\begin{array}{ c c c c c c c c c c c c c c c c c c c$		$\frac{0.5}{5.0}$	$\frac{0.0}{4.8}$	4.6	4.0	4.4	4.1	$\frac{4.1}{3.9}$	$\frac{3.9}{3.8}$	3.6	$\frac{5.0}{3.5}$	$\frac{3.0}{3.4}$	3.3	3.2	10	
$\begin{array}{c ccccccccccccccccccccccccccccccccccc$	11	4.8	4.6	4.4	4.2	4.1	3.9	3.8	3.6	3.5	3.4	3.3	3.2	3.1	11	
13 4.4 4.3 4.4 4.3 9 3.8 3.7 3.5 3.4 3.3 3.2 3.1 3.0 2.9 2.8 14 15 4.1 3.9 3.8 3.7 3.5 3.4 3.3 3.2 3.1 3.0 2.9 2.8 2.8 2.8 15 16 3.9 3.8 3.7 3.5 3.4 3.3 3.2 3.1 3.0 2.9 2.8 2.8 2.7 2.6 16 17 18 3.7 3.5 3.4 3.3 2.9 2.9 2.8 2.7 2.6 2.6 2.5 2.4 20 23.2 3.1 3.0 2.9 2.8 2.7 2.6 2.6 2.5 2.4 2.3 2.3 2.3 2.3 2.3 2.3 2.3 2.3 2.3 2.3 2.3 2.3 2.2 2.4 2.3 2.3 2.4 2.3 2.3 2.2 2.2 2.4 2.3 2.3 2.2 2.2 2.2 2.2 2.2	12	4.6	4.4	4.3	4.1	3.9	3.8	3.7	3.5	3.4	3.3	3.2	$\frac{3.1}{2.0}$	3.0	12_{10}	
$\begin{array}{ c c c c c c c c c c c c c c c c c c c$	13 14	4.4	$\frac{4.3}{4.1}$	$\frac{4.1}{3.9}$	3.9 3.8	$3.8 \\ 3.7$	$\frac{3.7}{3.5}$	$3.0 \\ 3.4$	3.4	$\frac{3.3}{3.2}$	$3.2 \\ 3.1$	3.1 3.0	$\frac{3.0}{2.9}$	$\frac{2.9}{2.8}$	13	
16 3.9 3.8 3.7 3.5 3.4 3.3 3.2 3.1 3.0 2.9 2.8 2.8 2.7 2.6 17 18 3.7 3.5 3.4 3.3 3.2 3.1 3.0 2.9 2.8 2.8 2.7 2.6 2.6 2.5 18 20 3.4 3.3 3.2 3.1 3.0 2.9 2.8 2.7 2.6 2.6 2.5 2.4 2.4 2.4 2.2 23 3.3 3.2 3.1 3.0 2.9 2.8 2.7 2.6 2.6 2.5 2.4 2.4 2.3 2.3 2.3 2.3 2.3 2.3 2.3 2.3 2.3 2.3 2.3 2.3 2.3 2.2 2.4 2.4 2.3 2.3 2.3 2.2 2.4 2.4 2.3 2.3 2.3 2.2 2.2 2.4 2.4 2.3 2.3 2.2 2.2 2.4 2.4 2.3 2.3 2.2 2.2 2.4 <th2.4< th=""> <th2.3< th=""> 2.3</th2.3<></th2.4<>	15	4.1	3.9	3.8	3.7	3.5	3.4	3.3	3.2	3.1	3.0	2.9	2.8	2.8	15	
17 3.8 3.7 3.5 3.4 3.3 3.2 3.1 3.0 2.9 2.8 2.7 2.6 2.6 2.5 18 19 3.5 3.4 3.3 3.2 3.1 3.0 2.9 2.8 2.7 2.6 2.6 2.5 2.4 20 20 3.4 3.3 3.2 3.1 3.0 2.9 2.8 2.7 2.6 2.6 2.5 2.4 2.4 2.3 2.3 2.3 3.1 3.0 2.9 2.8 2.7 2.6 2.6 2.5 2.4 2.4 2.3 2.3 2.3 3.1 3.0 2.9 2.8 2.7 2.6 2.5 2.4 2.4 2.3 2.3 2.3 2.2 2.2 25 2.9 2.8 2.7 2.6 2.5 2.4 2.4 2.3 2.3 2.2 2.1 2.1 2.1 2.1 2.1 2.1 2.1 2.1 2.1 2.1 2.1 2.1 2.1 2.0 2.2 2.1 2.1 2.1 <td>16</td> <td>3.9</td> <td>3.8</td> <td>3.7</td> <td>3.5</td> <td>3.4</td> <td>3.3</td> <td>3.2</td> <td>3.1</td> <td>3.0</td> <td>2.9</td> <td>2.8</td> <td>2.8</td> <td>2.7</td> <td>16</td>	16	3.9	3.8	3.7	3.5	3.4	3.3	3.2	3.1	3.0	2.9	2.8	2.8	2.7	16	
19 3.5 3.4 3.3 3.1 3.0 2.9 2.8 2.7 2.6 2.6 2.5 2.4 2.0 20 3.4 3.3 3.2 3.1 3.0 2.9 2.8 2.7 2.6 2.6 2.5 2.4 2.3 2.3 2.2 2.2 2.4 2.4 2.3 2.3 2.2 2.2 2.4 2.4 2.3 2.2 2.2 2.1 2.1 2.1 2.1 2.0 2.6 2.5 2.5 2.4 2.4 2.3 2.2 2.2 2.1 2.1 2.1 2.1 2.0 2.0 2.0 2.0 2.0 2.0 2.0 2.0 2.0 2.0 2.0 2.0 2.	$\frac{17}{18}$	$\begin{array}{c} 3.8\\ 3.7\end{array}$	$\frac{3.7}{3.5}$	3.0 3.4	$\frac{3.4}{3.3}$	$\frac{3.3}{3.2}$	$\frac{3.2}{3.1}$	$\frac{3.1}{3.0}$	$\frac{3.0}{2.9}$	2.9 2.9	$\frac{2.8}{2.8}$	2.8 2.7	$\frac{2.7}{2.6}$	$\frac{2.6}{2.5}$	17	
$\begin{array}{c c c c c c c c c c c c c c c c c c c $	19	3.5	3.4	3.3	3.2	3.1	3.0	2.9	$\tilde{2}.9$	2.8	2.7	2.6	2.6	2.5	19	
$\begin{array}{c c c c c c c c c c c c c c c c c c c $	20	$ \begin{array}{ c c c c c c c c c c c c c c c c c c c$														
$\begin{array}{c ccccccccccccccccccccccccccccccccccc$	$\frac{21}{22}$	$ \begin{array}{c ccccccccccccccccccccccccccccccccccc$														
24 3.0 2.9 2.8 2.7 2.6 2.5 2.5 2.4 2.4 2.3 2.3 2.2 2.4 25 2.9 2.8 2.7 2.6 2.5 2.5 2.4 2.4 2.3 2.3 2.2 2.1 2.0 2.8 2.6 2.5 2.5 2.4 2.3 2.3 2.2 2.2 2.1 2.1 2.1 2.0 2.0 2.0 2.0 2.0 2.0 2.0 2.0 2.0 2.0 2.0 2.0 2.0 1.9 1.9 1.8 1.	23	$ \begin{array}{c ccccccccccccccccccccccccccccccccccc$														
$\begin{array}{c ccccccccccccccccccccccccccccccccccc$	24	$\begin{array}{c ccccccccccccccccccccccccccccccccccc$														
$\begin{array}{c ccccccccccccccccccccccccccccccccccc$	$\frac{25}{26}$	$ \begin{array}{c ccccccccccccccccccccccccccccccccccc$														
$\begin{array}{c ccccccccccccccccccccccccccccccccccc$	$\frac{20}{27}$	$2.0 \\ 2.7$	2.7	2.6	$2.0 \\ 2.5$	$2.5 \\ 2.5$	$2.0 \\ 2.4$	2.4	$2.3^{2.4}$	$\frac{2.0}{2.2}$	$\frac{2.3}{2.2}$	2.1	2.1	$\frac{2.1}{2.1}$	27	
29 2.6 2.5 2.4 2.4 2.4 2.3 2.3 2.2 2.1 2.1 2.0 2.0 2.0 2.9 30 2.5 2.4 2.4 2.4 2.4 2.4 2.3 2.2 2.2 2.1 2.1 2.0 2.0 2.0 1.9 1.9 30 31 2.4 2.4 2.4 2.2 2.2 2.1 2.1 2.0 2.0 2.0 1.9 1.9 1.9 1.8 33 33 2.3 2.2 2.2 2.1 2.1 2.0 2.0 1.9 1.9 1.9 1.8 1.8 33 33 2.3 2.2 2.1 2.1 2.0 2.0 1.9 1.9 1.9 1.8 1.8 1.8 1.8 1.8 1.8 1.8 1.8 1.8 1.8 1.8 1.7 1.7 1.6 1.6 1.6 1.6 1.6 1.6 1.6 1.6 1.6 1.6 1.6 1.6 1.6 1.6 1.6 1.6 1.6	28	2.6	2.6	2.5	2.5	2.4	2.3	2.3	2.2	2.2	2.1	2.1	2.1	2.0	28	
$\begin{array}{c ccccccccccccccccccccccccccccccccccc$	$\frac{29}{20}$	2.0	$\frac{2.5}{9.4}$	2.4	2.4	$\frac{2.3}{9.3}$	$\frac{2.3}{9.9}$	2.2	$\frac{2.2}{2.1}$	$\frac{2.1}{2.1}$	$\frac{2.1}{2.0}$	$\frac{2.0}{2.0}$	$\frac{2.0}{2.0}$	$\frac{2.0}{1.9}$	29	
$\begin{array}{c ccccccccccccccccccccccccccccccccccc$	31	2. 0	2.4	2.4 2.3	$\frac{2.3}{2.3}$	$2.0 \\ 2.2$	2.2	$\frac{2}{2.1}$	$2.1 \\ 2.1$	$\frac{2.1}{2.0}$	$\frac{2.0}{2.0}$	$\frac{2.0}{2.0}$	1.9	1.9	31	
$\begin{array}{c ccccccccccccccccccccccccccccccccccc$	32	2.3	2.3	2.2	2.2	2.2	2.1	2.1	2.0	2.0	1.9	1.9	1.9	1.8	32	
$\begin{array}{c ccccccccccccccccccccccccccccccccccc$	33 34	$\begin{array}{c} 2.3\\ 2.2 \end{array}$	$\begin{array}{c} 2.2\\ 2.2\end{array}$	$2.2 \\ 2.1$	$\frac{2.1}{2.1}$	$\frac{2.1}{2.0}$	$\frac{2.1}{2.0}$	$2.0 \\ 2.0$	$\frac{2.0}{1.9}$	1.9 1.9	1.9 1.9	1.9 1.8	$\frac{1.8}{1.8}$	1.8 1.8	$\frac{33}{34}$	
$\begin{array}{c ccccccccccccccccccccccccccccccccccc$	35	2.2	$\frac{2.2}{2.1}$	$\frac{2.1}{2.1}$	$\frac{2.1}{2.0}$	$\frac{2.0}{2.0}$	$\frac{2.0}{2.0}$	$\frac{2.0}{1.9}$	$\frac{1.0}{1.9}$	1.8	1.8	1.8	$\frac{1.0}{1.7}$	1.7	35	
$\begin{array}{c ccccccccccccccccccccccccccccccccccc$	36	2.1	2.1	2.0	2.0	1.9	1.9	1.9	1.8	1.8	1.8	1.7	1.7	1.7	36	
$\begin{array}{c ccccccccccccccccccccccccccccccccccc$	37	2.0 2.0	2.0 1 9	$\frac{2.0}{1.9}$	$1.9 \\ 1.9$	1.9	$1.9 \\ 1.8$	$1.8 \\ 1.8$	1.8.18	$1.8 \\ 1.7$	$\frac{1.7}{1.7}$	1.7 17	$1.7 \\ 1.6$	$1.6 \\ 1.6$	37 38	
$\begin{array}{ c c c c c c c c c c c c c c c c c c c$	39	1.9	1.9	1.9	1.8	1.8	1.8	1.7	$1.0 \\ 1.7$	1.7	1.6	1.6	1.6	1.6	39	
$\begin{array}{c ccccccccccccccccccccccccccccccccccc$	40	1.9	1.8	1.8	1.8	1.7	1.7	1.7	1.7	1.6	1.6	-1.6	-1.6	1.5	40	
42 1.8 1.7 1.7 1.7 1.6 1.6 1.6 1.6 1.5 1.5 1.5 1.6 1.6 1.4 43 43 1.7 1.6 1.6 1.6 1.6 1.5 1.5 1.5 1.5 1.4 1.4 1.4 43 44 1.7 1.6 1.6 1.6 1.5 1.5 1.5 1.5 1.4 1.4 1.4 44 45 1.6 1.6 1.5 1.5 1.5 1.5 1.4 1.4 1.4 44 46 1.6 1.5 1.5 1.5 1.5 1.4	41 49	1.8	1.8	1.8	1.7	$\frac{1.7}{1.7}$	1.7	1.6	1.6	1.6	1.6	1.5	1.5	1.5	41	
$\begin{array}{c ccccccccccccccccccccccccccccccccccc$	42	$1.0 \\ 1.7$	1.7	1.7	$1.4 \\ 1.6$	1.7 1.6	$1.0 \\ 1.6$	1.6	$1.0 \\ 1.5$	1.5	$1.5 \\ 1.5$	$1.5 \\ 1.5$	1.0	1.0	42 43	
$\begin{array}{c ccccccccccccccccccccccccccccccccccc$	44	1.7	1.6	1.6	1.6	1.6	1.5	1.5	1.5	1.5	1.5	1.4	1.4	1.4	44	
$\begin{array}{c ccccccccccccccccccccccccccccccccccc$	45 46	1.6	1.6	1.6	1.5	1.5	1.5	1.5	1.5	1.4	1.4	1.4	$1.4 \\ 1.3$	1.4	$\frac{45}{46}$	
$\begin{array}{c ccccccccccccccccccccccccccccccccccc$	40	$1.0 \\ 1.5$	$1.0 \\ 1.5$	1.5	$1.5 \\ 1.5$	1.4	$1.0 \\ 1.4$	1.4	1.4	1.4	1.4	1.4	$1.3 \\ 1.3$	$1.3 \\ 1.3$	40	
$\begin{array}{c c c c c c c c c c c c c c c c c c c $	48	1.5	1.5	1.4	1.4	1.4	1.4	1.4	1.4	1.3	1.3	1.3	1.3	1.3	48	
$\begin{array}{c ccccccccccccccccccccccccccccccccccc$	49	$\frac{1.4}{1.4}$	1.4	1.4	1.4	$\frac{1.4}{1.9}$	$\frac{1.3}{1.9}$	$\frac{1.3}{1.9}$	$\frac{1.3}{1.9}$	1.3	1.3	$\frac{1.3}{1.9}$	$\frac{1.2}{1.9}$	$\frac{1.2}{1.9}$	49	
$\begin{array}{c ccccccccccccccccccccccccccccccccccc$	50	1.4	$1.4 \\ 1.3$	$1.4 \\ 1.3$	$1.3 \\ 1.3$	$1.5 \\ 1.3$	$1.0 \\ 1.3$	$1.5 \\ 1.3$	$1.5 \\ 1.2$	$1.5 \\ 1.2$	$1.3 \\ 1.2$	$1.2 \\ 1.2$	$1.2 \\ 1.2$	$1.2 \\ 1.2$	$\frac{50}{51}$	
$ \begin{array}{c ccccccccccccccccccccccccccccccccccc$	52	1.3	1.3	1.3	1.3	1.3	1.3	1.2	1.2	1.2	1.2	1.2	1.1	1.1	52	
$\begin{array}{c ccccccccccccccccccccccccccccccccccc$	53 54	$\begin{array}{c} 1.3\\ 1.2 \end{array}$	$\frac{1.3}{1.2}$	$\frac{1.3}{1.2}$	$\frac{1.2}{1.2}$	$\frac{1.2}{1.9}$	$\frac{1.2}{1.2}$	$1.2 \\ 1.2$	1.2	$1.2 \\ 1.1$	$1.2 \\ 1.1$	1.1	$1.1 \\ 1.1$	1.1	53 54	
$ \begin{array}{c ccccccccccccccccccccccccccccccccccc$	55	$\frac{1.2}{1.2}$	$\frac{1.2}{1.2}$	$\frac{1.2}{1.2}$	$\frac{1.2}{1.2}$	$\frac{1.2}{1.1}$	$\frac{1.2}{1.1}$	$\frac{1.2}{1.1}$	1.1	1.1	$\frac{1.1}{1.1}$	1.1	$\frac{1.1}{1.1}$	$\frac{1.1}{1.1}$	55	
$ \begin{array}{c ccccccccccccccccccccccccccccccccccc$	56	1.2	1.1	1.1	1.1	1.1	1.1	1.1	1.1	1.1	1.1	1.0	1.0	1.0	56	
$ \begin{array}{c ccccccccccccccccccccccccccccccccccc$	$57 \\ 58$	1.1	1.1	$\begin{array}{c} 1.1 \\ 1 1 \end{array}$	1.1	1.1	1.1	1.1	1.0	1.0	1.0	1.0	1.0	1.0 1.0	57 58	
$ \begin{array}{c c c c c c c c c c c c c c c c c c c $	$50 \\ 59$	1.1 1.1	1.1 1.0	1.1 1.0	1.1 1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	0.9	$0.9^{1.0}$	$50 \\ 59$	
$\begin{array}{c c c c c c c c c c c c c c c c c c c $	60	1.0	1.0	1.0	1.0	1.0	1.0	1.0	0.9	0.9	0.9	0.9	0.9	0.9	60	
Declination of a different name from the latitude: unner transit: reduction additive		120	130	140	150	160	170	180	190		210	9.90	230	240		
Decimation of a unicient name mont one natione. Inper matist, requerior autores			Decl	ination	of a diffe	rent nar	me from	the latit	tude: un	per tran	sit: redu	etion ad	ditive.			

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TABLE 26.

Variation of Altitude in one minute from meridian passage.

	Declination of a different name from the latitude; upper transit; reduction additive.													
Lati-		Declin	nation of	a differ	ent nam	e irom t	ne latitu	icie; upp	er transi	n; reduc	uon add	attive.		Lati-
tuae.	250	260	270	280	290	30°	31 °	320	33°	340	350	36°	37°	e.
0	"	"	"	"	"	"	"	"		"				0
0	4.2	$\frac{4.0}{3.0}$	3.9 3.7	3.7 3.6	3.5	$\frac{3.4}{3.2}$	3.3	$\frac{3.1}{3.1}$	$\frac{3.0}{2.9}$	$\begin{bmatrix} 2.9\\ 2.8 \end{bmatrix}$	$2.8 \\ 2.7$	$\begin{array}{c c} 2.7 \\ 2.6 \end{array}$	$\frac{2.6}{2.6}$	0
$\frac{1}{2}$	3.9	3.8	3.6	3.5	3.3	3.2	3.1	3.0	2.9	2.8	2.7	2.6	2.5	2
3	3.8	3.6	3.5	3.4	$\frac{3.2}{2.2}$	3.1	3.0	2.9	2.8	2.7	2.6	2.5	$\frac{2.4}{2.4}$	3
4	3.7	3.0	3.4	3.3	3.1	3.0	2.9	2.8	$\frac{4.1}{2.7}$	$\frac{2.0}{2.6}$	$\frac{4.0}{2.5}$	2.4	2.3	
$\frac{9}{6}$	3.4	3.3	3.2	3.1	3.0	2.9	2.8	2.7	2.6	2.5	2.4	2.4	2.3	6
7	3.3	$\frac{3.2}{2.1}$	3.1	3.0	2.9	$2.8 \\ 2.7$	2.7 2.7	2.6	2.5 2.5	2.5	2.4	2.3	2.2	7
8 9	$3.2 \\ 3.1$	$3.1 \\ 3.0$	$\frac{3.0}{2.9}$	$2.9 \\ 2.9$	2.8 2.8	2.7	$2.6^{2.6}$	$2.0 \\ 2.5$	$2.0 \\ 2.4$	$2.4 \\ 2.4$	2.3 2.3	$2.3 \\ 2.2$	2.2	9
10	3.1	3.0	2.9	2.8	2.7	2.6	2.5	2.5	2.4	2.3	2.2	2.2	2.1	10
11	3.0	2.9	$2.8 \\ 2.7$	2.7	2.6 2.6	$\frac{2.5}{2.5}$	2.5 2.1	$\frac{2.4}{22}$	2.3 2.2	$\frac{2.3}{2.2}$	$2.2 \\ 2.9$	$\begin{array}{c c} 2.1\\ 2.1 \end{array}$	$\frac{2.1}{2.0}$	11 19
$12 \\ 13$	$2.9 \\ 2.8$	$2.0 \\ 2.7$	2.7	2.6 2.6	2.5 2.5	2.4	2.4	2.3	2.2	$\tilde{2}.\tilde{2}$	$\tilde{2}.1$	$\tilde{2}.1$	$\frac{2.0}{2.0}$	$12 \\ 13$
14	2.7	2.7	2.6	2.5	2.4	2.4	2.3	2.3	2.2	2.1	2.1	2.0	2.0	14
15 16	2.7 2.6	$\frac{2.6}{2.5}$	$\frac{2.5}{2.5}$	2.5 2.4	$\frac{2.4}{2.2}$	$\begin{array}{c} 2.3\\ 2.3\end{array}$	$\frac{2.3}{2.2}$	$\begin{array}{c} 2.2\\ 2.9\end{array}$	$\begin{array}{c} 2.1 \\ 2.1 \end{array}$	$\begin{array}{c} 2.1 \\ 2.0 \end{array}$	$2.0 \\ 2.0$	$\frac{2.0}{1.9}$	$1.9 \\ 1.9$	15 16
$10 \\ 17$	$2.0 \\ 2.5$	2.5 2.5	$2.3 \\ 2.4$	2.3	2.3 2.3	2.2	$\tilde{2}.\tilde{2}$	$\tilde{2}.\tilde{1}$	$\tilde{2.1}$	2.0	$\bar{2}.0$	1.9	1.9	17
18	2.5	2.4	2.4	2.3	2.2	2.2	2.1	2.1	2.0	2.0	1.9 1.0	1.9	1.8	18
<u></u>	$\frac{2.4}{2.4}$	$\frac{2.4}{2.3}$	2.3	$\frac{2.2}{2.2}$	$\frac{2.2}{2.1}$	$\frac{4.1}{2.1}$	$\frac{4.1}{2.0}$	$\frac{2.0}{2.0}$	1.9	$\frac{1.9}{1.9}$	$\frac{1.9}{1.9}$	1.8	1.8	$\frac{19}{20}$
21^{-10}	2.3	2.3	2.2	2.1	2.1	2.0	2.0	2.0	1.9	1.9	1.8	1.8	1.7	21
22	2.3	2.2	$\begin{array}{c} 2.2\\ 9.1 \end{array}$	2.1 2 1	2.1	2.0 2.0	2.0 1.0	1.9 1.0	$1.9 \\ 1.9$	$1.8 \\ 1.8$	1.8	$\begin{array}{c} 1.7\\ 1.7\end{array}$	1.7 1.7	$\frac{22}{22}$
$\frac{23}{24}$	$2.2 \\ 2.2$	2.2 2.1	$2.1 \\ 2.1$	$2.1 \\ 2.0$	$2.0 \\ 2.0$	1.9	$1.9 \\ 1.9$	1.8	1.8	.1.8	1.7	1.7	1.6	24
25	2.1	2.1	2.0	2.0	1.9	1.9	1.8	1.8	1.8	1.7	1.7	1.6	1.6	25
$\frac{26}{97}$	$\frac{2.1}{2.0}$	2.0 2.0	$\frac{2.0}{1.9}$	1.9 1 9	1.9 1 0	1.9 1.8	$1.8 \\ 1.8$	$\begin{array}{c} 1.8\\ 1.7\end{array}$	1.7	$1.7 \\ 1.7$	1.7 1.6	1.6 1.6	$1.6 \\ 1.6$	$\frac{26}{27}$
28	2.0	1.9	1.9	1.9	1.8	1.8	1.7	1.7	1.7	1.6	1.6	1.6	1.5	28
29	1.9	1.9	1.9	1.8	1.8	1.7	$\frac{1.7}{1.7}$	$\frac{1.7}{1.9}$	$\frac{1.6}{1.6}$	1.6	$\frac{1.6}{1}$	$\frac{1.5}{1.5}$	1.5	$\frac{29}{20}$
30 31	$1.9 \\ 1.8$	$1.8 \\ 1.8$	$1.8 \\ 1.8$	$1.8 \\ 1.7$	1.7 1.7	$1.7 \\ 1.7$	$1.7 \\ 1.6$	1.6	$1.6 \\ 1.6$	$1.6 \\ 1.5$	$1.5 \\ 1.5$	$1.0 \\ 1.5$	$1.0 \\ 1.5$	30 31
32	1.8	1.8	1.7	1.7	1.7	1.6	1.6	1.6	1.5	1.5	1.5	1.5	1.4	32
33 34	1.8 1.7	$1.7 \\ 1.7$	$1.7 \\ 1.7$	1.7 1.6	1.6 1.6	1.6 1.6	1.6 1.5	$1.5 \\ 1.5$	$1.5 \\ 1.5$	$1.5 \\ 1.5$	$1.5 \\ 1.4$	1.4 1.4	$1.4 \\ 1.4$	33 34
35	1.7	1.7	1.6	1.6	1.6	1.5	1.5	1.5	1.5	1.4	1.4	1.4	1.4	35
36	1.6	1.6	1.6	1.6	1.5	1.5	1.5	1.5	1.4	1.4	1.4	1.4	1.3	36
37 38	$1.6 \\ 1.6$	$1.6 \\ 1.5$	$1.6 \\ 1.5$	$1.5 \\ 1.5$	$1.5 \\ 1.5$	$1.5 \\ 1.5$	1.5	1.4	$1.4 \\ 1.4$	1.4	$1.4 \\ 1.3$	1.3	1.3	38
39	1.5	1.5	1.5	1.5	1.4	1.4	1.4	1.4	1.4	1.3	1.3	1.3	1.3	39
40	1.5	1.5	1.5	1.4	1.4	1.4	1.4	1.3	1.3	1.3 1 2	$1.3 \\ 1.2$	$\begin{array}{c} 1.3\\1.9\end{array}$	$\begin{array}{c} 1.2\\ 1.9\end{array}$	40 11
$41 \\ 42$	1.0	1.4	1.4	1.4	1.4	1.4	1.3	1.3	1.3	1.3	1.3	1.2 1.2	$1.2 \\ 1.2$	42
43	1.4	1.4	1.4	1.3	1.3	1.3	1.3	1.3	1.2	1.2	1.2	1.2	1.2	43
44	$\frac{1.4}{1.2}$	$\frac{1.4}{1.2}$	$\frac{1.3}{1.2}$	$\frac{1.3}{1.2}$	$\frac{1.3}{1.2}$	$\frac{1.3}{1.9}$	$\frac{1.3}{1.9}$	$\frac{1.2}{1.9}$	$\frac{1.2}{1.9}$	$\frac{1.2}{1.9}$	$\frac{1.2}{1.9}$	$\frac{1.2}{1.1}$	$\frac{1.2}{1.1}$	44 45
46	1.3	1.3	1.3	1.3	$1.0 \\ 1.2$	1.2	1.2	1.2	1.2	1.2	1.1	1.1	1.1	46
47	1.3	1.3	1.2	1.2	1.2	1.2	1.2	1.2	1.1	1.1	1.1	1.1	1.1	47 49
$\frac{48}{49}$	$1.2 \\ 1.2$	$1.2 \\ 1.2$	$1.2 \\ 1.2$	$1.2 \\ 1.2$	$1.2 \\ 1.2$	$1.2 \\ 1.1$	1.1	1.1	1.1	1.1	1.1	1.1	•	49
50	1.2	1.2	1.2	1.1	1.1	1.1	1.1	1.1	1.1	1.1				50
51 59	1.2	1.1 1 1	1.1	1.1	1.1	1.1	$1.1 \\ 1.0$	$ 1.1 \\ 1.0$	1.0					51 59
53	1.1	1.1	1.1	1.1	1.0	1.0	1.0	1.0						53
54	1.1	1.0	1.0	1.0	1.0	1.0								54
55 56	$1.0 \\ 1.0$	1.0 1.0	1.0	1.0 1.0	1.0									ээ 56
57	1.0	1.0	1.0											57
58 50	1.0	0.9											0.8	58 59
60	0.9											0.8	0.8	60
								0.74	000	0.12	0.00	800		
	250	260	270	280	290	300	310	320	330	340	800	300	010	
		Deel	lination	of the sa	ame nan	re as the	latitud	e; lower	transit;	reductio	on subtr	active.		

	TABLE 26. [Page 549 Variation of Altitude in one minute from meridian passage.													
			Varia	tion of	Altitue	le in or	ne min	ite froi	n me ri	dian pa	ussage.			
Lati- tude.	380	Deeli 39°	40°	f a differ 41°	42°	43°	44°	tae; upp 45°	er trans	47°	45°	49°	50°	Lati- tude
0		"	"	"	"	"	"	"	"	"	"	//	//	0
0	2.5	2.4	$\frac{2.3}{9.9}$	2.3	$\frac{2.2}{9.1}$	$\frac{2.1}{2.1}$	$\frac{2.0}{2.0}$	2.0	1.9	1.8	1.8	$\frac{1.7}{1.7}$	1.7	$\begin{bmatrix} 0\\ 1 \end{bmatrix}$
$\frac{1}{2}$	$2.0 \\ 2.4$	$\frac{2.4}{2.3}$	$\frac{2.3}{2.3}$	$\frac{2}{2}, \frac{2}{2}$	$\frac{2.1}{2.1}$	$\frac{2.1}{2.0}$	$\frac{2.0}{2.0}$	1.9	1.8	1.8	1.7	1.7	1.6	$\frac{1}{2}$
3	2.4	$\frac{2.3}{2.3}$	2.2	2.1	$\frac{2.1}{2.0}$	$\frac{2.0}{2.0}$	1.9	1.9	1.8	$\frac{1.8}{1.7}$	$\frac{1.7}{1.7}$	1.6	1.6	3
- 1 5	$\frac{2.3}{2.3}$	$\frac{2.2}{2.2}$	$-\frac{2.2}{2.1}$	$-\frac{2.1}{2.1}$	$\frac{2.0}{2.0}$	$\frac{2.0}{1.9}$	$\frac{1.9}{1.9}$	$\frac{1.8}{1.8}$	$\frac{1.8}{1.8}$	$\frac{1.7}{1.7}$	$\frac{1.7}{1.6}$	$\frac{1.0}{1.6}$	$\frac{1.0}{1.5}$	$-\frac{+}{5}$
6	2.2	2.2	2.1	2.0	2.0	1.9	1.8	1.8	1.7	1.7	1.6	1.6	1.5	6
7	$2.2 \\ 2.1$	$\frac{2.1}{2.1}$	$\begin{bmatrix} 2.0\\ 2.0 \end{bmatrix}$	$\frac{2.0}{1.9}$	$1.9 \\ 1.9$	$1.9 \\ 1.8$	$1.8 \\ 1.8$	1.8	$\frac{1.7}{1.7}$	$1.6 \\ 1.6$	1.6	$1.0 \\ 1.5$	$1.5 \\ 1.5$	ŝ
9	2.1	2.0	2.0	1.9	1.9	1.8	1.8	1.7	1.6	1.6	1.6	1.5	1.5	9
$10 \\ 11$	$\frac{2.1}{2.0}$	$\frac{2.0}{2.0}$	$1.9 \\ 1.9$	$1.9 \\ 1.8$	$1.8 \\ 1.8$	$1.8 \\ 1.7$	$1.7 \\ 1.7$	$\frac{1.7}{1.6}$	$\frac{1.6}{1.6}$	1.6 1.6	1.5 1.5	$1.5 \\ 1.5$	1.4 1.4	$10 \\ 11$
12	$\frac{2.0}{2.0}$	1.9	1.9	1.8	1.8	1.7	1.7	1.6	1.6	1.5	1.5	1.4	1.4	12
$\frac{13}{14}$	1.9 1.9	$\frac{1.9}{1.9}$	$1.8 \\ 1.8$	$1.8 \\ 1.8$	$1.7 \\ 1.7$	$1.7 \\ 1.7$	$1.6 \\ 1.6$	$1.6 \\ 1.6$	1.6 1.5	$1.0 \\ 1.5$	$1.0 \\ 1.4$	$1.4 \\ 1.4$	1.4	13
15	$\frac{1.0}{1.9}$	1.8	1.8	1.7	1.7	1.6	1.6	1.6	1.5	1.5	1.4	1.4	1.4	15
16 17	1.8	$\frac{1.8}{1.8}$	1.7	1.7	1.7 1.6	$1.6 \\ 1.6$	$1.6 \\ 1.5$	$1.5 \\ 1.5$	$1.5 \\ 1.5$	$1.4 \\ 1.4$	$1.4 \\ 1.4$	1.4	1.3	$16 \\ 17$
18	1.8	1.7	1.7	1.6	1.6	1.6	1.5	1.5	1.4	1.4	1.4	1.3	1.3	18
19	$\frac{1.7}{1.7}$	$\frac{1.7}{1.7}$	$\frac{1.7}{1.6}$	$\frac{1.6}{1.6}$	$\frac{1.6}{1.6}$	$\frac{1.5}{1.5}$	$\frac{1.5}{1.5}$	$\frac{1.5}{1.1}$	$\frac{1.4}{1.1}$	$\frac{1.4}{1.1}$	$\frac{1.4}{1.3}$	$\frac{1.3}{1.3}$	$\frac{1.3}{1.2}$	$-\frac{19}{20}$
$\frac{20}{21}$	1.7 1.7	1.7 1.6	$1.0 \\ 1.6$	1.6	$1.0 \\ 1.5$	$1.5 \\ 1.5$	1.5	1.4	1.4 1.4	1.4	1.3	1.3	1, 3	$\frac{20}{21}$
22	1.7	1.6	1.6	1.5	1.5	1.5	1.4	1.4	1.4	$\frac{1.3}{1.3}$	1.3	1.3	1.2 1.2	$-\frac{22}{23}$
$\frac{23}{24}$	$1.0 \\ 1.6$	1.6	1.5	1.5	$1.5 \\ 1.5$	1.4	1.4	1.4	1.3	1.3	1.0 1.3	1.0	1.2 1.2	24
25	1.6	1.5	1.5	1.5	1.4	1.4	1.4	1.3	$\frac{1.3}{1.2}$	1.3	$\frac{1.2}{1.2}$	1.2	1.2	25 96
$\frac{26}{27}$	$1.6 \\ 1.5$	$1.5 \\ 1.5$	1.0 1.5	$1.0 \\ 1.4$	1.4	1.4	$1.4 \\ 1.3$	$1.3 \\ 1.3$	$\frac{1.3}{1.3}$	$1.5 \\ 1.2$	$1.2 \\ 1.2$	$1.2 \\ 1.2$	$1.2 \\ 1.2$	20
28	1.5	1.5	1.4	1.4	1.4	1.3	1.3	1.3	1.3	1.2	1.2	1.2	1.1	28
$\frac{29}{30}$	$\frac{1.5}{1.5}$	1.4	$\frac{1.4}{1.4}$	$\frac{1.4}{1.4}$	$\frac{1.4}{1.3}$	$\frac{1.3}{1.3}$	$\frac{1.5}{1.3}$	$\frac{1.3}{1.2}$	$\frac{1.2}{1.2}$	$\frac{1.2}{1.2}$	$\frac{1.2}{1.2}$	$\frac{1.2}{1.1}$	$\frac{1.1}{1.1}$	$\frac{-29}{-30}$
31	1.4	1.4	1.4	1.3	1.3	1.3	1.3	1.2	1.2	1.2	1.2	1.1	1.1	31
32 33	1.4	$1.4 \\ 1.4$	1.3 1.3	$1.3 \\ 1.3$	$1.3 \\ 1.3$	$1.3 \\ 1.2$	1.2 1.2	$\begin{array}{c} 1.2\\ 1.2 \end{array}$	1.2 1.2	$1.2 \\ 1.1$	1.1	1.1	1.1	$\frac{32}{33}$
34	1.4	1.3	1.3	1.3	1.3	1.2	1.2	1.2	1.2	1.1	1.1	1.1	1.1	34
$\frac{35}{36}$	$1.3 \\ 1.3$	$\frac{1.3}{1.3}$	$\frac{1.3}{1.3}$	$\frac{1.3}{1.2}$	$1.2 \\ 1.2$	$1.2 \\ 1.2$	$\begin{array}{c} 1.2\\ 1.2\end{array}$	$\frac{1.2}{1.1}$	1.1 1.1	1.1 1.1	1.1 1.1	1.1		35 36
37	1.3	1.3	$1.0 \\ 1.2$	$\tilde{1}.\tilde{2}$	1.2	1.2	1.2	1.1	1.1	1.1				37
$\frac{38}{39}$	$\begin{array}{c} 1.3\\ 1.2 \end{array}$	$\frac{1.2}{1.2}$	$egin{array}{c} 1,2\\ 1,2 \end{array}$	$1.2 \\ 1.2$	1.2 1.2	1.2 1.1	1.1 1.1	1.1 1.1	1.1					$\frac{38}{39}$
40	1.2	1.2	1.2	1.2	1.1	1.1	1.1							40
41 49	$1.2 \\ 1.2$	$\frac{1.2}{1.2}$	1.2	1.1	1.1	1.1						-		$\frac{41}{12}$
43	1.2 1.2	1.1	1.1	1.1	, 1. 1									43
44	$\frac{1.1}{1.1}$	$\frac{1.1}{1.1}$	1.1											44
46	1.1	1.1											0.9	46
47											0.0	0.9	0.9	47
49										0.9	0.9	0.9	0.8	49
50 51								0.0	0.9	0.9	0.9	0.8	0.8	50 51
$51 \\ 52$							0.9	0.9	0.9	0.9	0.8	0.8	0.8	52
53 54					0.0	0.9	0.9	0.8	0.8	0.8	0.8	$\begin{bmatrix} 0.8\\ 0.8 \end{bmatrix}$	0.8	53 54
55				0.9	$\frac{0.9}{0.8}$	$\frac{0.9}{0.8}$	0.8	0.8	$\frac{0.8}{0.8}$	$\frac{0.8}{0.8}$	0.8	$-\frac{0.8}{0.8}$	0.8	55
$56 \\ 57$		0.0	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.7	0.7	56
$\frac{57}{58}$	0.8	0.8	0.8	0.8	0.8	0.8	0.8	$0.8 \\ 0.8$	0.8	0.8	0.7	0.7	0.7	58
59	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.7	0.7	0.7	0.7	0.7	0.7	59 80
60	0.8	0.8	0.8	0.8	0.8	0.7	0.7	0.7	0.7.	0.7	0.7	0.7	0.7	
	38°	390	40°	41°	420	430	440	45°	46 °	470	48°	490	50°	

Declination of the same name as the latitude; lower transit; reduction subtractive.

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TABLE 26.

Variation of Altitude in one minute from meridian passage.

	Declination of a different name from the latitude; upper transit; reduction additive.													
Lati- tude.	51°	52°	53°	540.	55°	56°	570	58°	59°	60°	61°	620	63°	Lati- tude.
0	"	"	"		"	1.0	"		"			1		0
0	$1.6 \\ 1.6$	$1.5 \\ 1.5$	1.5 1.5	1.4 1.4	$1.4 \\ 1.4$	$1.3 \\ 1.3$	$1.3 \\ 1.3$	1.2	$1.2 \\ 1.2$	1.1 1.1	1.1 1.1	1.0 1.0	$1.0 \\ 1.0$	0
2	1.5	1.5	1.4	1.4	1.3	1.3	1.3	1.2	1.2	1.1	1.1	1.0	1.0	2
$\frac{3}{4}$	$1.5 \\ 1.5$	$1.5 \\ 1.5$	1.4 1.4	1.4	$\frac{1.3}{1.3}$	$1.3 \\ 1.3$	$\frac{1.2}{1.2}$	$\begin{array}{c} 1.2\\ 1.2 \end{array}$	1.1 1.1	1.1 1.1	1.1 1.1	1.0 1.0	1.0. 1.0	$\frac{3}{4}$
5	1.5	1.4	1.4	1.3	1.3	1.3	1.2	1.2	1.1	1.1	1.0	1.0	1.0	5
6	1.5	1.4	1.4	1.3	1.3	1.2	1.2	1.2	1.1	1.1	1.0	1.0	1.0	6 7
8	1.4	1.4	1.4	1.3	1.3	$1.2 \\ 1.2$	$1.2 \\ 1.2$	1.1 1.1	1.1	1.1 1.1	$1.0 \\ 1.0$	1.0	0.9	8
9	1.4	1.4	1.3	1.3	1.2	1.2	1.2	1.1	1.1	1.0	1.0	1.0	0.9	9
10 11	$1.4 \\ 1.4$	$1.4 \\ 1.3$	$1.3 \\ 1.3$	$1.3 \\ 1.3$	$\begin{array}{c c} 1.2 \\ 1.2 \end{array}$	$1.2 \\ 1.2$	1.1	1.1 1.1	1.1	$1.0 \\ 1.0$	1.0 1.0	$1.0 \\ 1.0$	0.9	10 11
12	1.4	1.3	1.3	1.2	1.2	1.2	1.1	$\hat{1}.\hat{1}$	1.1	1.0	1.0	0.9	0.9	12
$\frac{13}{14}$	$1.3 \\ 1.3$	$\frac{1.3}{1.3}$	$1.3 \\ 1.3$	$\begin{array}{c} 1.2 \\ 1.2 \end{array}$	$\begin{array}{c c} 1.2 \\ 1.2 \end{array}$	1.2 1.1	1.1 1.1	1.1 1.1	$1.0 \\ 1.0$	$1.0 \\ 1.0$	$1.0 \\ 1.0$	$0.9 \\ 0.9$	0.9 0.9	$13 \\ 14$
15	1.3	1.3	1.2	1.2	1.2	1.1	1.1	1.1	1.0	1.0	1.0	0.9	0.9	15
$16 \\ 17$	1.3	$\frac{1.3}{1.9}$	1.2	$1.2 \\ 1.2$	1.1	1.1	$1.1 \\ 1 1$	$1.0 \\ 1.0$	$1.0 \\ 1.0$	1.0 1.0	0.9	0.9	0.9	$16 \\ 17$
18	$1.3 \\ 1.3$	$1.2 \\ 1.2$	$1.2 \\ 1.2$	$1.2 \\ 1.2$	1.1	1.1	1.1	1.0	1.0	1.0	0.9	0.9	0.9	18
19	1.2	$\frac{1.2}{1.9}$	1.2	1.1	1.1	1.1	$\frac{1.0}{1.0}$	1.0	$\frac{1.0}{1.0}$	$\frac{1.0}{0.0}$	$\frac{0.9}{0.9}$	0.9	$\frac{0.9}{0.8}$	19
$\frac{20}{21}$	$1.2 \\ 1.2$	$1.2 \\ 1.2$	$1.2 \\ 1.2$	1.1	$1.1 \\ 1.1$	1.1 1.1	$1.0 \\ 1.0$	1.0	1.0	0.9	0.9	0.9	0.8	$\frac{20}{21}$
22	1.2	1.2	1.1	1.1	1.1	1.0	1.0	1.0	1.0	0.9	0.9	0.9		22
$\frac{23}{24}$	$1.2 \\ 1.2$	$1.2 \\ 1.1$	1.1 1.1	1.1 1.1	1.1 1.1	$1.0 \\ 1.0$	$1.0 \\ 1.0$	1.0 1.0	0.9	0.9	0.9			$\frac{23}{24}$
25	1.2	1.1	1.1	1.1	1.0	1.0	1.0	1.0	0.9					25
$\frac{26}{27}$	1.1	$1.1 \\ 1 1$	1.1	$1.1 \\ 1.0$	$1.0 \\ 1.0$	$1.0 \\ 1.0$	$1.0 \\ 1.0$	0.9						$\frac{26}{27}$
28	1.1	1.1	1.1	1.0	1.0	1.0	110							28
$\frac{29}{20}$	$\frac{1.1}{1.1}$	$\frac{1.1}{1.1}$	$\frac{1.0}{1.0}$	$\frac{1.0}{1.0}$	1.0									$\frac{29}{30}$
30 31	1.1 1.1	$1.1 \\ 1.0$	$1.0 \\ 1.0$	1.0		•								31
$\frac{32}{22}$	1.1	1.0											0.8	$\frac{32}{33}$
$\frac{55}{34}$	1.1											0.8	0.8	$\frac{33}{34}$
35										0.0	0.8	0.8	0.7	35
36									0.8	0.8	$0.8 \\ 0.8$	$0.8 \\ 0.7$	0.7	$\frac{30}{37}$
38							- 0.0	0.8	0.8	0.8	0.8	0.7	0.7	38
$\frac{39}{40}$						0.8	$\frac{0.8}{0.8}$	$\frac{0.8}{0.8}$	$\frac{0.8}{0.8}$	$\frac{0.8}{0.8}$	$\frac{0.8}{0.8}$	-0.7	$\frac{0.7}{0.7}$	$-\frac{39}{40}$
41					0.9	0.8	0.8	0.8	0.8	0.8	0.7	0.7	0.7	41
$\frac{42}{43}$			0.9	0.9	0.8	$\begin{bmatrix} 0.8\\0.8\end{bmatrix}$	0.8	$0.8 \\ 0.8$	$0.8 \\ 0.8$	$0.8 \\ 0.7$	$0.7 \\ 0.7$	0.7 0.7	$0.7 \\ 0.7$	$\frac{42}{43}$
44	12.5	0.9	0.9	0.8	0.8	0.8	0.8	0.8	0.8	0.7	0.7	0.7	0.7	44
45	0.9	0.9	0.8	0.8	0.8	0.8	0.8	0.8	0.7	0.7	0.7	0.7	0.7	45
40 47	0.9	0.9	0.8	0.8	0.8	0.8	0.8	0.8	0.7	0.7	0.7	0.7	0.6	47
48	0.8	0.8	0.8	0.8	0.8	0.8	0.7	0.7	0.7	0.7	0.7	0.7	0.6	48
$\frac{49}{50}$	0.8	0.8	0.8	0.8	$-\frac{0.8}{0.7}$	-0.7 0.7	$-\frac{0.7}{0.7}$	-0.7	0.7	0.7	$\frac{0.7}{0.7}$	0.6	0.6	50
51	0.8	0.8	0.8	0.8	0.7	0.7	0.7	0.7	0.7	0.7	0.7	0.6	0.6	51
$52 \\ 53$	0.8	0.8	$0.8 \\ 0.7$	0.7	0.7	0.7	0.7	0.7	0.7	0.7	0.6	0.6	0.6	$\frac{52}{53}$
54	0.8	0.7	0.7	0.7	0.7	0.7	0.7	0.7	0.6	0.6	0.6	0.6	0.6	54
55 56	$0.7 \\ 0.7$	$\begin{bmatrix} 0.7\\ 0.7 \end{bmatrix}$	$\begin{bmatrix} 0.7\\ 0.7 \end{bmatrix}$	$ \begin{array}{c} 0.7 \\ 0.7 \end{array} $	$\begin{array}{c c} 0.7\\ 0.7\end{array}$	0.7 0.7	$0.7 \\ 0.7$	$ \begin{array}{c c} 0.7 \\ 0.6 \end{array} $	0, 6 0, 6	0.6	0, 6 0, 6	$0.6 \\ 0.6$	0.6	$ 55 \\ 56 $
57	0.7	0.7	0.7	0.7	0.7	0.7	0.6	0.6	0.6	0.6	0.6	0.6	0.6	57
58 59	$0.7 \\ 0.7$	$\begin{bmatrix} 0.7\\ 0.7 \end{bmatrix}$	$0.7 \\ 0.7$	$\begin{bmatrix} 0.7\\ 0.6 \end{bmatrix}$	0.7	0.6	0.6	0.6	$0.6 \\ 0.6$	$0.6 \\ 0.6$	$0.6 \\ 0.6$	0.6	$0.6 \\ 0.5$	$\frac{58}{59}$
60	0.7	0.7	0.6	0.6	0.6	0.6	0.6	0.6	0.6	0.6	0.6	0.6	0.5	60
	510	520	53°	540	55°	56°	570	580	59°	60°	61°	62°	63°	
		D	eclinatio	on of the	same na	ame as tl	he latitu	de; lowe	r transit	t; reduct	ion subt	ractive.		

TABLE 27. [Page 55] Delection to be explicitly a Mainley near the Marilling														551
			Red	luction	to be a	pplied	to Alti	tudes 1	near th	e Meric	lian.			
Var.					Ti	ime fron	n meridi	an passa	.ge.					Var.
1 min. (Table 26.)	m. s. 0 30	m. s. 10	m. s. 1 30	m. s. 2 0	m. 8. 2 30	m. s. 3 0	m. 8. 3 30	m. s. 4 0	m. s. 4 30	m. s. 5 0	m. s. 5 30	m. s. 6 0	m. s. 6 30	1 min. (Table 26.)
$\begin{array}{c} ({\rm Table} \\ 26.) \\ \hline \\ \\ \\ \\ \\ \\ \\ \\ \\ \\ \\ \\ \\ \\ \\ \\ \\ $	$\begin{array}{c} \overset{m.\ s.}{0\ 30}\\ &, & & \\ &, & \\ &, & $	$\begin{array}{c} \overset{n.}{10}, \overset{s.}{10}\\ & \overset{n}{10}\\ &$	$\begin{array}{c} \begin{array}{c} \text{m. s.} \\ 1 \ 30 \\ \\ 0 \\ \\ 0 \\ 0 \\ 0 \\ 0 \\ 1 \\ 0 \\ 0$	$\begin{array}{c} \overset{m. \ s. \ s. \ }{20} \\ & \overset{m. \ s. \ }{2} $	$\begin{array}{c} \overset{m. \ s.}{2} \begin{array}{c} \overset{g}{30} \\ \overset{g}{2} \begin{array}{c} \overset{g}{30} \\ & & \\$	$\begin{array}{c} \overset{\texttt{m.s.s.}}{30} \\ & \overset{\texttt{m.s.s.}}{30} \\ & \overset{\texttt{m.s.s.}}{30} \\ & \overset{\texttt{m.s.s.}}{300} \\ & \overset{\texttt{m.s.s.}}{300} \\ & \overset{\texttt{m.s.s.s.}}{300} \\ & \texttt{m.s.s.s.s.s.s.s.s.s.s.s.s.s.s.s.s.s.s.s$	$\begin{array}{c} \overset{\text{ML}}{3} \overset{\text{g}}{3} \overset{\text{M}}{3} \\ & \overset{\text{M}}{3} \overset{\text{g}}{3} \\ & \overset{\text{M}}{0} \overset{\text{M}}{1} \\ & \overset{\text{M}}{0} \\ & \overset{\text{M}}{1} \\ & \overset{\text{M}}{0} \\ & \overset{\text{M}}{1} \\ & \overset{\text{M}}{0} \\ & \overset{\text{M}}{1} \\ & \overset{\text{M}}{$	$\begin{array}{c ccccccccccccccccccccccccccccccccccc$	$\begin{array}{c} \overset{\text{\tiny W.}}{4} \overset{\text{\tiny S}}{30} \\ & \overset{\text{\tiny W}}{4} \overset{\text{\tiny S}}{30} \\ & \overset{\text{\tiny W}}{0} \overset{\text{\tiny Z}}{2} \\ & 0 & 4 \\ & 0 & 6 \\ & 0 & 8 \\ \hline & 0 & 10 \\ & 0 & 12 \\ & 0 & 14 \\ & 0 & 16 \\ & 0 & 20 \\ & 0 & 14 \\ & 0 & 16 \\ & 0 & 20 \\ & 0 & 11 \\ & 1 & 1 \\ & 1 & 1 \\ & 1 & 1 \\ & 1 & 1$	$\begin{array}{c} \overset{\texttt{m.s. s.}}{50} \\ \begin{array}{c} \overset{\texttt{m.s. s.}}{50} \\ & \texttt{m.s. s.$	$\begin{array}{c} \overset{\text{ml. $s.}}{5} \\ \overset{\text{s.}}{5} \\ \overset{\text{s.}}{0} \\ \overset{\text{ml. $s.}}{0}	$\begin{array}{c} \overset{m.\ s.\ o}{6} \\ \hline & & & & \\ \hline & & & & \\ \hline & & & & \\ \hline & & & &$	$\begin{array}{c} \overset{\text{m.s. s.}}{6} & \overset{\text{m.s. s.}}{6} \\ \overset{\text{m.s. s.}}{6} & \overset{\text{m.s. s.}}{6} \\ \overset{\text{m.s. s.}}{0} & \overset{\text{m.s. s.}}{10} \\ \overset{\text{m.s. s.}}{11} \\ \overset{\text{m.s. s.}}{10} \\ \overset{\text{m.s. s.}}{11} \\ \text{m$	$\begin{array}{c} (1able \\ 26.) \\ \hline \\ \\ \\ \\ \\ \\ \\ \\ \\ \\ \\ \\ \\ \\ \\ \\ \\ $
$26.0 \\ 27.0 \\ 28.0$	$\begin{smallmatrix}&0&6\\&0&7\\&0&7\end{smallmatrix}$	${\begin{array}{c} 0 & 26 \\ 0 & 27 \\ 0 & 28 \end{array}}$	$egin{array}{ccc} 0 & 58 \ 1 & 1 \ 1 & 3 \end{array}$	$ \begin{array}{r} 1 & 44 \\ 1 & 48 \\ 1 & 52 \end{array} $	$ \begin{array}{r} 2 & 42 \\ 2 & 49 \\ 2 & 55 \end{array} $	$ \begin{array}{r} 3 54 \\ 4 3 \\ 4 12 \end{array} $	5 18 5 30 5 43	$\begin{array}{c} 6 & 56 \\ 7 & 12 \\ 7 & 28 \end{array}$		$\begin{array}{ccc} 10 & 50 \\ 11 & 15 \\ 11 & 40 \end{array}$	13 6			$26.0 \\ 27.0 \\ 28.0$

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Lago	000

TABLE 27.

Reduction to be applied to Altitudes near the Meridian.														
Var.	Time from meridian passage.													Var.
1 min. (Table 26.)	m. s. 70	m. s. 7 30	m. s. S 0	m. 8. 8 30	m. s. 9 0	m. s. 9 30	<i>m. s.</i> 10 0	m. 8. 10 30	m. s. 11 0	m. s. 11 30	<i>m. s.</i> 12 0	m. s. 12 30	m. 8. 13 0	1 min. (Table 26.)
$\begin{array}{c} 26. \\ \end{array} \\ \hline \\ 0.1 \\ 0.2 \\ 0.3 \\ 0.4 \\ 0.5 \\ 0.6 \\ 0.7 \\ 0.8 \\ 0.9 \\ 0.0 \\ 1.0 \\ 2.0 \\ 3.0 \\ 4.0 \\ 1.0 \\ 2.0 \\ 3.0 \\ 4.0 \\ 1.0$	$\begin{array}{c} & 0 \\ & 7 \\ & 0 \\ & 5 \\ & 0 \\ & 10 \\ & $	$\begin{array}{c} 7 \ 30 \\ 7 \ 30 \\ 7 \ 30 \\ 7 \ 30 \\ 7 \ 30 \\ 7 \ 30 \\ 7 \ 30 \\ 7 \ 30 \\ 8 \ 26 \\ 9 \ 22 \\ 10 \ 19 \\ 11 \ 15 \\ 12 \ 11 \\ 13 \ 7 \\ 14 \ 41 \\ 7 \ 30 \\ 15 \\ 12 \ 11 \\ 13 \ 7 \\ 14 \ 41 \\ 7 \ 30 \\ 15 \\ 12 \ 11 \\ 13 \ 7 \\ 14 \ 41 \\ 14 \ 7 \\ 14 \ 41 \\ 15 \\ 12 \ 11 \\ 13 \ 7 \\ 14 \ 41 \\ 14 \ 7 \\ 14 \ 41 \\ 15 \\ 12 \ 11 \\ 13 \ 7 \\ 14 \ 41 \\ 14 \ 7 \\ 14 \ 41 \\ 15 \\ 12 \ 11 \\ 13 \ 7 \\ 14 \ 41 \\ 15 \\ 12 \ 11 \\ 13 \ 7 \\ 14 \ 41 \\ 14 \ 7 \\ 14 \ 41 \\ 15 \ 7 \\ 14 \ 41 \\ 15 \\ 12 \ 11 \\ 13 \ 7 \\ 14 \ 41 \\ 15 \ 12 \ 11 \\ 13 \ 7 \\ 14 \ 41 \\ 15 \ 12 \ 11 \\ 13 \ 7 \\ 14 \ 41 \\ 14 \ 7 \\ 14 \ 41 \\ 15 \ 12 \ 11 \\ 15 \ 12 \ 11 \\ 15 \ 12 \ 11 \\ 15 \ 12 \ 11 \\ 15 \ 12 \ 11 \\ 15 \ 12 \ 11 \\ 13 \ 7 \\ 14 \ 41 \\ 14 \ 41 \\ 15 \ 12 \ 11 \\ 14 \ 14 \ 14 \\ 14 \ 14 \ 14 \\ 14 \ 14 \$	$\begin{array}{c} 8 \ 0 \\ \hline \\ 8 \ 0 \\ \hline \\ 9 \\ \hline \\ 0 \\ 0 \\ 13 \\ 0 \\ 10 \\ 0 \\ 10 \\ 0 \\ 10 \\ 1$	$ \begin{array}{c} 8 \ 30 \\ \hline \\ 8 \ 30 \\ \hline \\ 0 \ 7 \\ 0 \ 14 \\ 0 \ 22 \\ 0 \ 29 \\ \hline \\ 0 \ 36 \\ 0 \ 43 \\ 0 \ 51 \\ 1 \ 52 \\ 1 \ 22 \\ 2 \ 44 \\ 3 \ 37 \\ 4 \ 49 \\ 6 \ 1 \\ 7 \ 14 \\ 8 \ 26 \\ 9 \ 38 \\ 10 \ 50 \\ 12 \ 2 \\ 13 \ 15 \\ 14 \ 27 \\ 15 \ 39 \\ 16 \ 51 \\ 18 \ 14 \\ 8 \end{array} $	$\begin{array}{c} 9 \ 0 \\ 0 \\ 0 \\ 0 \\ 0 \\ 0 \\ 0 \\ 0 \\ 0 \\ 0$	$\begin{array}{c} 9 \ 30 \\ \hline \\ 9 \ 30 \\ \hline \\ 0 \ 9 \\ 0 \ 18 \\ 0 \ 27 \\ 0 \ 36 \\ \hline \\ 0 \ 45 \\ 0 \ 54 \\ 1 \ 3 \\ 1 \ 21 \\ 1 \ 21 \\ 1 \ 21 \\ 1 \ 21 \\ 1 \ 30 \\ 3 \ 0 \\ 4 \ 30 \\ 6 \ 1 \\ 7 \ 31 \\ \hline \\ 10 \ 32 \\ 12 \ 2 \\ 13 \ 32 \\ 15 \ 2 \ 2 \\ 16 \ 33 \\ 18 \ 3 \\ 19 \ 33 \\ 21 \ 3 \\ 22 \ 31 \\ 32 \\ 13 \\ 32 \\ 13 \\ 32 \\ 32 \\ 31 \\ 32 \\ 31 \\ 32 \\ 31 \\ 32 \\ 31 \\ 32 \\ 31 \\ 32 \\ 31 \\ 32 \\ 31 \\ 32 \\ 31 \\ 32 \\ 31 \\ 32 \\ 31 \\ 32 \\ 31 \\ 32 \\ 31 \\ 31$	$\begin{array}{c} 10 \ 0 \\ 10 \ 0 \\ 10 \ 0 \\ 20 \\ 0 \\ 30 \\ 0 \\ 40 \\ 1 \\ 10 \\ 1 \\ 20 \\ 1 \\ 30 \\ 1 \\ 10 \\ 1 \\ 20 \\ 1 \\ 30 \\ 1 \\ 40 \\ 13 \\ 20 \\ 10 \\ 0 \\ 11 \\ 40 \\ 13 \\ 20 \\ 10 \\ 10 \\ 0 \\ 11 \\ 40 \\ 13 \\ 20 \\ 10 \\ 10 \\ 0 \\ 21 \\ 40 \\ 22 \\ 0 \\ 21 \\ 40 \\ 23 \\ 20 \\ 25 \\ 0 \\ 25 \\ 0 \\ 25 \\ 0 \\ 25 \\ 0 \\ 25 \\ 0 \\ 25 \\ 0 \\ 25 \\ 0 \\ 25 \\ 0 \\ 25 \\ 0 \\ 25 \\ 0 \\ 25 \\ 0 \\ 25 \\ 0 \\ 25 \\ 0 \\ 25 \\ 0 \\ 25 \\ 0 \\ 25 \\ 0 \\ 25 \\ 0 \\ 0 \\ 25 \\ 0 \\ 0 \\ 25 \\ 0 \\ 0 \\ 25 \\ 0 \\ 0 \\ 25 \\ 0 \\ 0 \\ 0 \\ 25 \\ 0 \\ 0 \\ 0 \\ 0 \\ 0 \\ 0 \\ 0 \\ 0 \\ 0 \\ $	$\begin{array}{c} 10\ 30\\ 10\ 30\\ 10\ 30\\ 10\ 22\\ 0\ 33\\ 0\ 44\\ 0\ 55\\ 1\ 6\\ 1\ 17\\ 1\ 28\\ 1\ 39\\ 1\ 50\\ 3\ 40\\ 5\ 31\\ 7\ 21\\ 9\ 11\\ 11\\ 12\ 52\\ 14\ 42\\ 16\ 32\\ 18\ 22\\ 20\ 13\\ 22\ 3\\ 23\ 53\\ 25\ 43\\ 27\ 34\\ \end{array}$	$\begin{array}{c} 11 \ 0 \\ 11 \ 0 \\ 12 \\ 0 \ 24 \\ 0 \ 36 \\ 0 \ 48 \\ 1 \ 0 \\ 1 \ 13 \\ 1 \ 25 \\ 1 \ 37 \\ 1 \ 49 \\ 2 \ 1 \\ 4 \ 2 \\ 6 \ 3 \\ 8 \ 4 \\ 10 \ 5 \\ 12 \ 6 \\ 14 \ 7 \\ 16 \ 8 \\ 18 \ 9 \\ 20 \ 10 \\ 22 \ 11 \\ 24 \ 12 \\ 26 \ 13 \\ 28 \ 14 \\ \end{array}$	$\begin{array}{c} 11 \ 30 \\ 11 \ 30 \\ \hline \\ \\ 1 \ 30 \\ 1 \ 30 \\ 1 \ 6 \\ 1 \ 50 \\ 1 \ 50 \\ 1 \ 50 \\ 1 \ 50 \\ 2 \ 12 \\ 1 \ 21 \\ 2 \\ 1 \ 21 \\ 2 \\ 1 \ 21 \\ 2 \\ 1 \ 21 \\ 2 \\ 1 \ 21 \\ 2 \\ 1 \ 21 \\ 2 \\ 1 \ 21 \\ 2 \\ 1 \ 21 \\ 2 \\ 1 \ 21 \\ 2 \\ 1 \ 21 \\ 2 \\ 1 \ 21 \\ 2 \\ 1 \ 21 \\ 2 \\ 2 \\ 2 \\ 2 \\ 2 \\ 2 \\ 2 \\ 2 \\ 2 $	$\begin{array}{c} 12\ 0\\ \hline \\ 12\ 0\\ \hline \\ 12\ 0\\ \hline \\ 12\ 0\\ 14\\ 0\ 29\\ 0\ 43\\ 0\ 58\\ \hline \\ 11\ 2\\ 1\ 26\\ 1\ 41\\ 1\ 55\\ 2\ 100\\ \hline \\ 2\ 24\\ 4\ 48\\ 7\ 12\\ 2\ 9\ 36\\ \hline \\ 12\ 0\\ 14\ 24\\ 16\ 48\\ 19\ 12\\ 21\ 36\\ 24\ 0\\ \hline \\ 28\ 48\\ \hline \end{array}$	$\begin{array}{c} 12 \ 30 \\ \hline \\ 12 \ 30 \\ \hline \\ \\ \\ \\ \\ \\ \\ \\ \\ \\ \\ \\ \\ \\ \\ \\ \\ $	$\begin{array}{c} \textbf{13 0} \\ \hline & & \\$	$\begin{array}{c} 26.)\\ \hline \\ & \\ & \\ & \\ 0.1\\ 0.2\\ 0.3\\ 0.4\\ 0.5\\ 0.6\\ 0.7\\ 0.8\\ 0.9\\ 0.0\\ 0.0\\ 0.0\\ 0.0\\ 0.0\\ 0.0\\ 0.0$
$ \begin{array}{r} 16.0 \\ 17.0 \\ 18.0 \\ 19.0 \\ 20.0 \\ \hline \end{array} $	$ \begin{array}{r} 13 & 4 \\ 13 & 53 \\ 14 & 42 \\ 15 & 31 \\ 16 & 20 \\ 17 & 0 \end{array} $	$ \begin{array}{r} 15 & 0 \\ 15 & 56 \\ 16 & 52 \\ 17 & 49 \\ 18 & 45 \end{array} $	$ \begin{array}{r} 10 & 0 \\ 17 & 4 \\ 18 & 8 \\ 19 & 12 \\ 20 & 16 \\ \hline \end{array} $	$ \begin{array}{r} 10 & 11 \\ 19 & 16 \\ 20 & 28 \\ 21 & 40 \\ \end{array} $	$ \begin{array}{c} 21 & 36 \\ 22 & 57 \\ 24 & 18 \end{array} $	$ \begin{array}{c} 22 & 0 \\ 24 & 4 \\ 25 & 34 \end{array} $	26 40							$ \begin{array}{r} 18.0 \\ 16.0 \\ 17.0 \\ 18.0 \\ 19.0 \\ 20.0 \\ \end{array} $
21.0	11 8							1	1					21.0

	TABLE 27. [Page 55] Reduction to be applied to Altitudes user the Meridian														
			Rec	luction	to be a	applied	to Alt	itudes	near th	e Meri	dian				
Var.					Т	'ime fror	n me r idi	an passa	ge.					Var.	
(Table 26.)	$m. \ s. 13 \ 30$	m. s. 14 0	<i>m. s.</i> 14 30	m. s. 15 0	${m. \ 8. \ 15 \ 80}$	m. s. 16 0	<i>m. s.</i> 16 30	m. s. 17 0	${m. \ s. \ 17 \ 30}$	m. s. 18 0	<i>m. s.</i> 18 30	m. s. 19 0	<i>m. s.</i> 19 3 0	(Table 26.)	
$ \begin{array}{r} " \\ 0.1 \\ 0.2 \\ 0.3 \\ 0.4 \\ \hline 0.5 \\ 0.6 \\ \end{array} $	$\begin{array}{c} & & \\ & & \\ 0 & 18 \\ 0 & 36 \\ 0 & 55 \\ 1 & 13 \\ \hline 1 & 31 \\ 1 & 49 \\ 2 & 9 \end{array}$	$ \begin{array}{r} ' \; '' \\ 0 \; 20 \\ 0 \; 39 \\ 0 \; 59 \\ 1 \; 18 \\ 1 \; 38 \\ 1 \; 38 \\ 1 \; 58 \\ 2 \; 15 \\ $	$ \begin{array}{c} ' & " \\ 0 & 21 \\ 0 & 42 \\ 1 & 3 \\ 1 & 24 \\ 1 & 45 \\ 2 & 6 \\ 2 & 87 \\ \end{array} $	$ \begin{array}{r} ' & "\\ 0 & 22\\ 0 & 45\\ 1 & 7\\ 1 & 30\\ \hline 1 & 52\\ 2 & 15\\ 2 & 27\\ \end{array} $	$ \begin{array}{c} ' & " \\ 0 & 24 \\ 0 & 48 \\ 1 & 12 \\ 1 & 36 \\ \hline 2 & 0 \\ 2 & 24 \\ 0 & 48 \\ \end{array} $	$ \begin{array}{c} ' & " \\ 0 & 26 \\ 0 & 51 \\ 1 & 17 \\ 1 & 42 \\ \hline 2 & 8 \\ 2 & 34 \\ 2 & 50 \\ \end{array} $	$\begin{array}{c} & ' & '' \\ 0 & 27 \\ 0 & 54 \\ 1 & 22 \\ 1 & 49 \\ \hline 2 & 16 \\ 2 & 43 \\ 2 & 11 \\ \end{array}$	$\begin{array}{c} & '' \\ 0 & 29 \\ 0 & 58 \\ 1 & 27 \\ 1 & 56 \\ \hline 2 & 24 \\ 2 & 53 \\ 2 & 92 \\ \end{array}$	$\begin{array}{c} & ' & '' \\ 0 & 31 \\ 1 & 1 \\ 1 & 32 \\ 2 & 2 \\ \hline 2 & 33 \\ 3 & 4 \\ 2 & 24 \\ \end{array}$	$\begin{array}{c} & ' & '' \\ 0 & 32 \\ 1 & 5 \\ 1 & 37 \\ 2 & 10 \\ \hline 2 & 42 \\ 3 & 14 \\ 2 & 47 \end{array}$	$\begin{array}{c} & ' & '' \\ 0 & 34 \\ 1 & 8 \\ 1 & 43 \\ 2 & 17 \\ \hline 2 & 51 \\ 3 & 25 \\ 1 & 0 \\ \end{array}$	$\begin{array}{c} & ' & '' \\ 0 & 36 \\ 1 & 12 \\ 1 & 48 \\ 2 & 24 \\ \hline & 3 & 1 \\ 3 & 37 \\ 4 & 12 \\ \end{array}$	$\begin{array}{c} & & \\ & 0 & 38 \\ 1 & 16 \\ 1 & 54 \\ 2 & 32 \\ \hline & 3 & 10 \\ 3 & 48 \\ 1 & 96 \\ \end{array}$	$ \begin{array}{c} '' \\ 0.1 \\ 0.2 \\ 0.3 \\ 0.4 \\ 0.5 \\ 0.6 \\ 0.7 \\ \end{array} $	
$0.7 \\ 0.8 \\ 0.9$	$ \begin{array}{r} 2 & 8 \\ 2 & 26 \\ 2 & 44 \end{array} $	$ \begin{array}{r} 2 & 17 \\ 2 & 37 \\ 2 & 56 \end{array} $	$ \begin{array}{r} 2 & 27 \\ 2 & 48 \\ 3 & 9 \end{array} $	$ \begin{array}{c} 2 & 37 \\ 3 & 0 \\ 3 & 22 \end{array} $	$ \begin{array}{r} 2 48 \\ 3 12 \\ 3 36 \end{array} $	$ \begin{array}{r} 2 59 \\ 3 25 \\ 3 50 \end{array} $	$ \begin{array}{r} 3 & 11 \\ 3 & 38 \\ 4 & 5 \end{array} $	$ \begin{array}{r} 3 & 22 \\ 3 & 51 \\ 4 & 20 \end{array} $	$ \begin{array}{r} 3 & 34 \\ 4 & 5 \\ 4 & 36 \end{array} $	$ \begin{array}{r} 3 47 \\ 4 19 \\ 4 52 \end{array} $	$\begin{array}{ccc} 4 & 0 \\ 4 & 34 \\ 5 & 8 \end{array}$	$ \begin{array}{r} 4 13 \\ 4 49 \\ 5 25 \end{array} $	$ \begin{array}{r} 4 & 26 \\ 5 & 4 \\ 5 & 42 \end{array} $	0.7 0.8 0.9	
$ \begin{array}{r} 1.0 \\ 2.0 \\ 3.0 \\ 4.0 \\ 5.0 \end{array} $	$ \begin{array}{r} 3 & 2 \\ 6 & 4 \\ 9 & 7 \\ 12 & 9 \\ 15 & 11 \end{array} $	$\begin{array}{r} 3 \ 16 \\ 6 \ 32 \\ 9 \ 48 \\ 13 \ 14 \\ 16 \ 20 \end{array}$	$\begin{array}{r} 3 \ 30 \\ 7 \ 0 \\ 10 \ 30 \\ 14 \ 1 \\ 17 \ 31 \end{array}$	$\begin{array}{r} 3 \ 45 \\ 7 \ 30 \\ 11 \ 15 \\ 15 \ 0 \\ 18 \ 45 \end{array}$	$\begin{array}{rrrr} 4 & 0 \\ 8 & 0 \\ 12 & 1 \\ 16 & 1 \\ 20 & 1 \end{array}$	$\begin{array}{r} 4 \ 16 \\ 8 \ 32 \\ 12 \ 48 \\ 17 \ 4 \\ 21 \ 20 \end{array}$	$\begin{array}{r} 4 \ 32 \\ 9 \ 4 \\ 13 \ 38 \\ 18 \ 9 \\ 22 \ 41 \end{array}$	$\begin{array}{r} 4 & 49 \\ 9 & 38 \\ 14 & 27 \\ 19 & 16 \\ 24 & 5 \end{array}$	$\begin{array}{rrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrr$	$\begin{array}{r} 5 \ 24 \\ 10 \ 48 \\ 16 \ 12 \\ 21 \ 36 \\ 27 \ 0 \end{array}$	$\begin{array}{r} 5 \ 42 \\ 11 \ 24 \\ 17 \ 7 \\ 22 \ 49 \\ 28 \ 31 \end{array}$	$egin{array}{cccc} 6 & 1 \\ 12 & 2 \\ 18 & 3 \\ 24 & 4 \end{array}$	$\begin{array}{r} 6 \ 20 \\ 12 \ 40 \\ 19 \ 1 \\ 25 \ 21 \end{array}$	$ \begin{array}{c} 1.0\\ 2.0\\ 3.0\\ 4.0\\ 5.0 \end{array} $	
6.0 7.0 8.0 9.0	$\begin{array}{c} 18 \ 13 \\ 21 \ 16 \\ 24 \ 18 \\ 27 \ 20 \end{array}$	$ \begin{array}{r} 19 \ 36 \\ 22 \ 52 \\ 26 \ 8 \end{array} $	$\begin{array}{ccc} 21 & 2\\ 24 & 32\\ 28 & 2 \end{array}$	$\begin{array}{c} 22 \ 30 \\ 26 \ 15 \end{array}$	$\begin{array}{ccc} 24 & 1 \\ 28 & 1 \end{array}$	25 36	27 13							$ \begin{array}{c} 6.0\\ 7.0\\ 8.0\\ 9.0 \end{array} $	
Var.					Т	'ime froi	n meridi	ian passa	age.	•				Var.	
1 min. (Table 26.)	m. s. 20 0	m. s. 20 30	m. s. 21 0	m. s. 21 30	m. s. 22 0	m, 8, 22 30	m. s. 23 0	$m. \ s. 23 \ 30$	m. s. 24 0	m. s. 24 30	$m. \ s. 25 \ 0$	m. s. 25 30	$m. \ s. 26 \ 0$	(Table 26.)	
$\begin{array}{c} & "\\ 0.1\\ 0.2\\ 0.3\\ 0.4\\ \hline 0.5\\ 0.6\\ 0.7\\ 0.8\\ 0.9\\ \hline 1.0\\ 2.0\\ 3.0\\ 4.0\\ \end{array}$	$\begin{array}{c} & & ' & '' \\ 0 & 40 \\ 1 & 20 \\ 2 & 0 \\ 2 & 40 \\ \hline 3 & 200 \\ 4 & 0 \\ 4 & 40 \\ 5 & 200 \\ 6 & 0 \\ \hline 6 & 400 \\ 13 & 200 \\ 20 & 0 \\ 26 & 40 \\ \end{array}$	$\begin{array}{c} & & & \\$	$\begin{array}{c} & & & \\$	$\begin{array}{c} & & ' & '' \\ 0 & 46 \\ 1 & 32 \\ 2 & 199 \\ 3 & 5 \\ \hline & 3 & 51 \\ 4 & 37 \\ 5 & 24 \\ 6 & 10 \\ 6 & 56 \\ \hline & 7 & 42 \\ 15 & 24 \\ 23 & 7 \\ \end{array}$	$\begin{array}{c} & & ' & '' \\ 0 & 48 \\ 1 & 37 \\ 2 & 25 \\ 3 & 14 \\ \hline 4 & 2 \\ 4 & 50 \\ 5 & 39 \\ 6 & 27 \\ \hline 7 & 16 \\ 8 \\ 4 \\ 16 \\ 8 \\ 24 \\ 12 \\ \end{array}$	$\begin{array}{c} & & ' & '' \\ 0 & 51 \\ 1 & 41 \\ 2 & 32 \\ 3 & 22 \\ \hline 4 & 13 \\ 5 & 4 \\ 5 & 54 \\ 6 & 45 \\ 7 & 36 \\ 8 & 26 \\ 16 & 52 \\ 25 & 19 \\ \end{array}$	$\begin{array}{c} & & ' & '' \\ 0 & 53 \\ 1 & 46 \\ 2 & 39 \\ 3 & 32 \\ \hline 4 & 24 \\ 5 & 17 \\ 6 & 10 \\ 7 & 3 \\ 7 & 56 \\ \hline 8 & 49 \\ 17 & 38 \\ 26 & 27 \\ \end{array}$	$\begin{array}{c} & & ' & '' \\ 0 & 55 \\ 1 & 50 \\ 2 & 46 \\ 3 & 41 \\ \hline 4 & 36 \\ 5 & 31 \\ 6 & 27 \\ 7 & 22 \\ 8 & 17 \\ \hline 9 & 12 \\ 18 & 24 \\ 27 & 37 \\ \end{array}$	$\begin{array}{c} & & ' & '' \\ 0 & 58 \\ 1 & 55 \\ 2 & 53 \\ 3 & 50 \\ \hline \\ 4 & 48 \\ 5 & 46 \\ 6 & 43 \\ 7 & 41 \\ 8 & 38 \\ \hline \\ 9 & 36 \\ 19 & 12 \\ 28 & 48 \\ \end{array}$	$\begin{array}{c} & & & \\ & & 1 & 0 \\ 2 & 0 \\ 3 & 0 \\ 4 & 0 \\ \hline 5 & 0 \\ 6 & 0 \\ 7 & 0 \\ 8 & 0 \\ 9 & 0 \\ \hline 10 & 0 \\ 20 & 0 \\ 30 & 0 \\ \end{array}$	$\begin{array}{c} & & & \\$	$\begin{array}{c} & & & \\ & 1 & 6 \\ 2 & 10 \\ 3 & 15 \\ 4 & 20 \\ \hline & 5 & 25 \\ 6 & 30 \\ 7 & 35 \\ 8 & 40 \\ 9 & 45 \\ \hline & 10 & 50 \\ 21 & 40 \\ \end{array}$	$\begin{array}{c} & & & \\$	$\begin{matrix} " \\ 0.1 \\ 0.2 \\ 0.3 \\ 0.4 \\ \hline 0.5 \\ 0.6 \\ 0.7 \\ 0.8 \\ 0.9 \\ \hline 1.0 \\ 2.0 \\ 3.0 \\ 4.0 \end{matrix}$	

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TABLE 28A.

For finding the Latitude of a place by Altitudes of Polaris.

[A=1st correction. Argument, the star's hour angle (or 24^b-the star's hour angle).]

	0 h	1 h		2 ^h		3 ^h		4 h		5 ^h		
<i>m</i> .	0 / //	" 0 / /		0 / //	"	0 7 77	"	0 / //	"	0 1 0 00 0	"	m.
0	-1.1200.0	-10932.	$^{8}_{-4.9}$	-10221.4	9.5	-0.50.54.9	13.3	-0.3600.0	16.3	-0.1838.2	18.2	50
1	11 59.9	.1 09 27.	9 5.0	02 11.9	9.5	50 41.6	13.4	30 43.7	16.4	18 20.0	18.2	- 59
2	11 59.8	.1 09 22.	9 5.0	02 02.4	9.6	50 28.2	13.5	30 27.3	16.4	18 01.8	18.3	- 28
3	11 59.6	.3 09 17.	$\frac{9}{5.2}$	01 52.8	9.7	50 14.7	13.5	35 10.9	16.4	17 43.0	18.3	01
4	$11\ 59.3$	09 12.	1 53	$01 \ 43.1$	9.7	50 01.2	13.6	34 94.9	16.4	17 25.2	18.3	90
5	$-1\ 11\ 58.9$	$-\frac{3}{4}-1\ 09\ 07.$	4 53	-1 01 33.4	0.9	-0.4947.6	13.7	-0.34 38.1	16.5	-0.1706.9	18.3	-55
6	$11\ 58.5$	$\frac{14}{5} = 09.02.$	1 54	$01 \ 23.6$	0.0	$49 \ 33.9$	19.7	$34 \ 21.6$	16.6	$16 \ 48.6$	18.3	54
7	$11\ 58.0$	$^{.9}_{-6} = 08.56.$	7 5.1	$01 \ 13.7$	10.0	$49\ 20.2$	13.7	$34\ 05.0$	16.6	$16 \ 30.3$	18.4	53
8	$11\ 57.4$	$^{.0}_{-}$ 08 51.	3 55	$01 \ 03.7$	10.0	49 06.5	13.8	$33 \ 48.4$	16.7	$16\ 11.9$	18.1	52
9	$11\ 56.7$	·' 08 45.	8	$00\ 53.7$	10.0	48 52.7	10.0	$33 \ 31.7$	10.7	15 53.5	10.1	51
10	-1 11 55.9	$\frac{.8}{.0}$ 1 08 40.	2 5.0	-1 00 43.6	10.1	-0.4838.8	110	-0 33 15.0	16 0	-0.15 35.1	10.4	50
11	- 11 55.0	$^{.9}$ 08 34.	4 50	00 33.4	10.2	48 24.8	14.0	$32\ 58.2$	10.0	$15\ 16.7$	10.4	49
12	$11\ 54.1$	08 28.	6 5.0	00 23.2	10.2	48 10.8	14.0	$32 \ 41.4$	10.0	1458.3	10.4	48
13	11 53.1	$1.0 \\ 1.1 08 22.$	7 5.0	00 12.9	10.0	47 56.8	14.0	32 24.6	10.8	$14 \ 39.9$	10.4	47
14	$11\ 52.0$	1.1 08 16.	89	00 02.6	10.3	47 42.7	14.1	$32\ 07.8$	10.8	$14\ 21.5$	18.4	46
15	-1 11 50 8	$^{1.2}$ -1 08 10.	8 6.0	-0.5952.1	10.5	-0.4728.6	14.1	-0.3150.9	16.9	-0.1403.0	18.5	45
16	11 49.5	1.3 08.04	7 6.1	59 41.6	10.5	47 14.4	14.2	$31 \ 34.0$	16.9	13 44.5	18.5	44
17	11 48.1	1.4 07.58	5 6.2	59 31.0	10.6	47 00.2	14.2	$31 \ 27.1$	16.9	$13\ 26.0$	18.5	43
18	11 46.7	1.4 07 52	$3^{-6.2}$	59 20.4	10.6	46 45.9	14.3	31 10.1	17.0	13 07.5	18.5	42
19	11 45 2	1.5 07 46.	0 6.3	59 09.7	10.7	46 31.5	14.4	3053.0	17.1	12 48.9	18.6	41
	1 11 12 6	1.6 - 1.07.39	6.4	-0.58.58.9	-10.8	-0.46.17.1	-14.4	-0.30.36.0	- 17.0	-0.12303	-18.6	-10
20	-1 11 40.0	1.7 - 107 33	1 6.5	58 18 0	10.9	16 02 6	14.5	30 18 9	17.1	12 00.0 19 11 7	18.6	39
21	11 41.5	1.8 07 26	5 6.6	58 37 1	10.9	45 48 1	14.5	30 01 7	17.2	11531	18.6	38
44 09	11 90.1	1.8 07 19	G 6.6	58 96 9	10.9	15 33 5	14.6	29 44 5	17.2	11 34 5	18.6	37
20	11 96 9	2.0 07 13	1 6.8	58 15 1	11.1	45 18 9	14.6	29 17 3	17.2	11 15 9	18.6	36
24	1 11 04 0	2.0 1 07 00	6.8	0 50 10.1	11.1	0 45 0 10.0	14.7	0.20.00.1	17.2	0 10 57 9	18.7	95
25	-11134.3	2.1 - 10700.	5 6.8	-0 38 04.0	11.2	-0 40 04.2	14.8	-0 29 00.1	17.3	-0 10 37.2	18.6	21
26	11 32.2	2.2 00 59.	5 7.0	57 52.8	11.2	44 49.4	14.8	20 42.0	17.3	10 38.0	18.6	99
27	11 30.0	2.2 00 52	9 5 7.0	57 20 2	11.3	44 04.0	14.8	28 20.0	17.3	10 20.0	18.6	20
28	11 27.8	2.3 00 40	3 7.1	57 10.5	11.4	44 19.8	14.9	20 00.2	17.4	10 01.4	18.7	21
	11 20.0	-2.4 - 1.00.01	± 7.2	07 10.9	- 11.4	44 04.9	-14.9	27 00.8	- 17.4	0.00.21.0	- 18.7	- 01
30	-1 11 23.1	-10631	2 7.2	-05707.5	11.5	-0 43 50.0	15.0	-0.2733.4	17.4	-0.0924.0	18.7	30
31	11 20.6	2.6 06 24	0 7.3	56 56.0	11.6	43 30.0	15.0		17.5	09 00.3	18.7	- 29
32	11 18.0	2.7 00 10	6 7.4	00 44.4	11.6	43 20.0	15.0	20 30.3	17.5	00 40.0	18.7	20
33	11 10.3	2.7 06 09	3 7.5	00 32.8 50 91 1	11.7	43 00.0	15.1	20 41.0	17.5	08 27.9	18.7	26
34	11 12.0	2.9 00 01	8 7.6	30 21.1	11.8	42 49.9	15.2	20 25.5	17.6	00 09.1	18.7	20
35	$-1\ 11\ 09.7$	$\frac{-1}{2.9}$ -1 05 54	2 7.6	-0.56.09.3	11.8	-0.4234.7	15.2	0 26 05.9	17.6	-0.0750.4	18.7	20
36	$11\ 06.8$	3.0 05 46.	6 7.7	55 57.5	11.9	42 19.5	15.3	25 48.3	17.6	07 31.7	18.7	24
37	$11\ 03.8$	05 38	9 7.8	55 45.6	12.0	42 04.2	15.3	25 30.7	17.6	07 12.9	18.8	23
38	11 00.8	3.2 05 31	1 7.8	55 33.6	12.0	41 48.9	15.3	25 13.1	17.7	06 54.1	18.8	22
39	10 57.6	00 23	3 80	55 21.6	-12.1	41 33.6	- 15 4	24 00.4	- 17.7	00 35.3	- 18.7	21
40	$-1\ 10\ 54.4$	$\frac{0.2}{3.3} - 1\ 05\ 15$	3 8.0	-0.5509.5	12.1	-0.41 18.2	15.5	-0.24 37.7	17.7	-0.0616.6	18.8	20
41	$10\ 51.1$	3.4 05 07	3 8.0	5457.4	12.2	41 02.7	15.5	24 20.0	17.8	05 57.8	18.8	19
42	10 47.7	35 0459	3 8.2	$54 \ 45.2$	12.3	40 47.2	15.6	24 02.2	17.8	05 39.0	18.8	18
43	$10 \ 44.2$	3.5 04 51	1 8.2	54 32.9	12.3	40 31.6	15.6	23 44.4	17.8	05 20.2	18.8	10
44	$10 \ 40.7$	04 42	9 83	$54\ 20.6$	19.1	40 16.0	15.7	23 26.6	17.8	05 01.4	18.8	10
45	$-1 \ 10 \ 37.0$	$^{3.4}_{3.7}$ -1 04 34	$6 \frac{0.0}{8.4}$	$-0.54\ 08.2$	12.5	$-0\ 40\ 00.3$	15.7	$-0.23\ 08.8$	17.9	-0.0442.6	18.8	15
46	$10 \ 33.3$	$\frac{0.1}{2.8}$ 04 26	2 84	$53\ 55.7$	12.5	39 44.6	15.7	22 50.9	17.9	$04\ 23.8$	18.8	14
47	$10\ 29.5$	3.0 04 17	8 8.5	$53 \ 43.2$	12.6	$39\ 28.9$	15.8	$22\ 33.0$	17.9	04 05.0	18.8	13
48	$10\ 25.6$	3.9 04 09	3 8.6	$53 \ 30.6$	12.6	$39\ 13.1$	15.8	$22\ 15.1$	17.9	03 46.2	18.8	12
49	$10\ 21.7$	04 00	7	$53\ 18.0$	- 19.7	3857.3	- 15.0	21 57.2	- 18 0	03 27.4	- 18 0	
50	-1 10 17.6	$^{4.1}_{11} - 1\ 03\ 52$	0 87	$-0.53\ 05.3$	12.7	-0.3841.4	15.0	-0.21 39.2	18.0	-0.03.08.5	18.8	10
51	$10\ 13.5$	4.1 03 43	3	$52\ 52.5$	10.0	$38\ 25.5$	16.0	$21\ 21.2$	18.0	$02 \ 49.7$	18.8	9
52	$10\ 09.3$	$\frac{4.2}{1.2}$ 03.34	5 80	52 39.7	12.0	38 09.5	16.0	$21 \ 03.2$	18.0	$02 \ 30.9$	18.9	8
53	$10\ 05.0$	$\frac{1.0}{4.3}$ 03 25	6 9.0	52 26.8	13.0	37 53.5	16.1	$20 \ 45.2$	18.1	$02\ 12.0$	18.8	7
54	$10\ 00.7$	^{4.5} 03 16	.6	52 13.8	10.0	$37 \ 37.4$	10.1	$20\ 27.1$	10.1	$01\ 53.2$	10.0	6
55	-1 09 56.2	$^{4.5}_{4.7}$ -1 03 07	6 9.0	-0.5200.8	13.0	-03721.3	10.1	-0.2009.0	10.1	-0 01 34.4	18.0	5
56	09 51.7	4.0 02 58	.6 9.0	51 47.8	13.0	37 05.1	10.2	19 50.9	10.1	$01 \ 15.5$	18.9	4
57	09 47.1	4.0 02 49	4 9.2	51 34.7	10.1	36 48.9	16.9	$19\ 32.8$	10.1	00 56.7	18.0	3
58	09 42.4	4.7 02 40	2 9.2	51 21.5	10.2	36 32.6	16.9	19 14.6	18.9	00 37.8	18.9	2
59	09 37.7	10 02 30	8 9.4	$51\ 08.2$	10.0	36 16.3	10.0	18 56.4	18.0	00 18.9	18.9	1
60	$-1 \ 09 \ 32.8$	-1 02 21	4 9.4	-0.50.54.9	10.0	$-0.36\ 00.0$	10.0	-0.18 38.2	10.2	-0.00.00.0	10.0	0
										L		
m.	11h	10 ^h		9h		Sh		7 h		6 h		<i>m</i> .

Change the sign to + when the argument is found at the bottom.

TABLE 28B.

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For finding the Latitude of a place by Altitudes of Polaris. [B=the 2d correction. This correction is always additive.]

B = the 2d correction. This correction is always additional terms of the second sec	1V
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Star's					Star's a	altitude.					Star's
hour angle.	10°	150	16°	17°	18°	, 19°	20°	210	220	230	nour angle.
$\begin{array}{c} \begin{array}{c} \text{hour}\\ \text{angle.}\\ \\ \begin{array}{c} \text{hour}\\ \text{angle.}\\ \end{array}\\ \hline \\ \begin{array}{c} \text{hour}\\ \text{angle.}\\ \end{array}\\ \hline \\ \begin{array}{c} \text{hour}\\ 0\\ 0\\ 0\\ 0\\ 0\\ 0\\ 0\\ 0\\ 0\\ 0\\ 0\\ 0\\ 0\\$	$\begin{array}{c} 10^{\circ} \\ \hline \\ \\ \\ \\ \\ \\ \\ \\ \\ \\ \\ \\ \\ \\ \\ \\ \\ $	$\begin{array}{c} 15^{\circ} \\ \hline \\ 0.0 & 0.0 \\ 0.1 & 0.1 \\ 0.2 & 1.1 \\ 0.3 & 2 \\ 0.5 & 3.3 \\ 0.8 & 3.1 \\ 1.4 & 3.4 \\ 2.2 & 6.4 \\ 1.8 & .4 \\ 2.2 & 6.4 \\ 3.5 & 5.5 \\ 5$	$\begin{array}{c} 16^{\circ} \\ \hline \\ 0.0.0.0 \\ 0.0.1. \\ 0.1.2.2 \\ 0.4.2 \\ 0.9.3 \\ 1.5.3 \\ 1.5.3 \\ 1.5.3 \\ 1.5.3 \\ 1.5.3 \\ 1.5.3 \\ 1.5.3 \\ 1.5.3 \\ 1.5.3 \\ 1.5.5 \\ 2.8.4 \\ 5.5.9 \\ 1.5.5 \\ 1.6.6 \\ 5.5.9 \\ 6.5 \\ 5.9.6 \\ 6.5 \\ 5.9.6 \\ 6.5 \\ 5.9.6 \\ 6.5 \\ 5.9.6 \\ 6.5 \\ 5.9.2 \\ 5.5 \\ 9.2.5 \\ 9.2.5 \\ 9.7.5 \\ 10.7 \\ 5.5 \\ 10.7 $	$\begin{array}{c} 17^{\circ} \\ \hline \\ \\ \\ \\ \\ \\ \\ \\ \\ \\ \\ \\ \\ \\ \\ \\ \\ $	$\begin{array}{c} 18^{\circ} \\ \hline \\ & \\ & \\ & \\ & \\ & \\ & \\ & \\ & \\ &$	$\begin{array}{c} 19^{\circ} \\ \hline \\ \\ \\ \\ \\ \\ \\ \\ \\ \\ \\ \\ \\ \\ \\ \\ \\ $	$\begin{array}{c} \textbf{20^{\circ}} \\ \hline \\ \textbf{0}, 0, 0, 0 \\ 0, 0, 1, 1 \\ 0, 3, 2 \\ 0, 5, 3 \\ 0, 8, 3 \\ 1, 1, 3 \\ 1, 4, 3 \\ 1, 9, 5 \\ 2, 4, 5 \\ 2, 9, 5 \\ 2, 9, 5 \\ 3, 5, 6 \\ 3, 5, 6 \\ 3, 5, 6 \\ 3, 6 \\ 5, 4, 7 \\ 6, 8, 7 \\ 7, 5, 7 \\ 8, 3 \\ 8, 9, 7 \\ 9, 6 \\ 8, 9, 7 \\ 9, 6 \\ 8, 9, 7 \\ 10, 4, 8 \\ 11, 0, 7 \\ 11, 7, 6 \\ 11, 7, 7 \\ 12, 3 \\ 0, 7 \\ 13, 6 \\ 6 \end{array}$	$\begin{array}{c} 21^{\circ} \\ \hline \\ & \\ & \\ & \\ & \\ & \\ & \\ & \\ & \\ &$	$\begin{array}{c} 22^{\circ} \\ \hline \\ & \\ & \\ & \\ & \\ & \\ & \\ & \\ & \\ &$	$\begin{array}{c} \textbf{23^{\circ}} \\ \textbf{7} \\ \textbf{0}, \textbf{0}, \textbf{0} \\ \textbf{0}, \textbf{0} \\ \textbf{0}, \textbf{1} \\ \textbf{0}, \textbf{3}, \textbf{2} \\ \textbf{0}, \textbf{6}, \textbf{3} \\ \textbf{0}, \textbf{9}, \textbf{4} \\ \textbf{1}, \textbf{7}, \textbf{5} \\ \textbf{2}, \textbf{2}, \textbf{6} \\ \textbf{3}, \textbf{4} \\ \textbf{1}, \textbf{7}, \textbf{5} \\ \textbf{5}, \textbf{5}, \textbf{8} \\ \textbf{6}, \textbf{3}, \textbf{6} \\ \textbf{4}, \textbf{0}, \textbf{7} \\ \textbf{5}, \textbf{5}, \textbf{8} \\ \textbf{7}, \textbf{1}, \textbf{8} \\ \textbf{7}, \textbf{7}, \textbf{8} \\ \textbf{1}, \textbf{7}, \textbf{7} \\ \textbf{1}, \textbf{8} \\ \textbf{12}, \textbf{9}, \textbf{8} \\ \textbf{12}, \textbf{1}, \textbf{8} \\ \textbf{12}, \textbf{9}, \textbf{8} \\ \textbf{13}, \textbf{7}, \textbf{7} \\ \textbf{15}, \textbf{7}, \textbf{7} \end{array}$	$\begin{array}{c} \text{hour}\\ \text{angle.}\\ \text{angle.}\\ 12 \ 00\\ 11 \ 50\\ 40\\ 20\\ 10\\ 00\\ 10 \ 50\\ 40\\ 30\\ 20\\ 10\\ 00\\ 00\\ 10 \ 50\\ 40\\ 30\\ 20\\ 10\\ 00\\ 00\\ 8 \ 50\\ 40\\ 30\\ 20\\ 10\\ 00\\ 00\\ 10\\ 00\\ 7 \ 50\\ 40\\ 30\\ 20\\ 10\\ 00\\ 10\\ 00\\ 10\\ 00\\ 10\\ 00\\ 10\\ 00\\ 10\\ 00\\ 10\\ 00\\ 10\\ 00\\ 10\\ 00\\ 10\\ 00\\ 10\\ 00\\ 10\\ 00\\ 10\\ 00\\ 10\\ 00\\ 10\\ 00\\ 10\\ 00\\ 10\\ 00\\ 10\\ 1$
$20 \\ 30 \\ 40 \\ 50 \\ 5 00 \\ 10 \\ 20 \\ 30 \\ 40 \\ 50 \\ 6 00 \\ 10 \\ 10 \\ 10 \\ 10 \\ 10 \\ 10 \\$	$\begin{array}{c} 6.6 & .3 \\ 6.8 & .2 \\ 7.0 & .2 \\ 7.3 & .3 \\ 7.5 & .2 \\ \hline 7.6 & .1 \\ 7.8 & .2 \\ 7.9 & .1 \\ 7.9 & .0 \\ 7.9 & .0 \\ 7.9 & .0 \\ 7.9 & .0 \end{array}$	$\begin{array}{c} 10.0 & \overset{4}{\cdot} \\ 10.4 & \overset{4}{\cdot} \\ 10.8 & \overset{4}{\cdot} \\ 11.1 & \overset{3}{\cdot} \\ 11.4 & \overset{3}{\cdot} \\ 11.6 & \overset{2}{\cdot} \\ 11.7 & \overset{1}{\cdot} \\ 11.9 & \overset{2}{\cdot} \\ 12.0 & \overset{1}{\cdot} \\ 12.1 & \overset{1}{\cdot} \\ 12.2 & \overset{1}{\cdot} \end{array}$	$\begin{array}{c} 10.7 \cdot 5 \\ 11.1 \cdot 4 \\ 11.4 \cdot 3 \\ 11.8 \cdot 4 \\ 12.1 \cdot 3 \\ 12.4 \cdot 3 \\ 12.6 \cdot 2 \\ 12.7 \cdot 1 \\ 12.7 \cdot 1 \\ 12.9 \cdot 2 \\ 13.0 \cdot 0 \\ 13.0 \cdot 0 \end{array}$	$\begin{array}{c} 11.3 & .4 \\ 11.7 & .4 \\ 12.1 & .4 \\ 12.5 & .4 \\ 12.9 & .4 \\ 13.2 & .3 \\ 13.4 & .2 \\ 13.6 & .2 \\ 13.6 & .1 \\ 13.8 & .1 \\ 13.9 & .1 \\ 13.9 & .1 \end{array}$	$\begin{array}{c} 12.1 & \cdot ^{5} \\ 12.5 & \cdot ^{4} \\ 13.0 & \cdot ^{5} \\ 13.4 & \cdot ^{4} \\ 13.7 & \cdot ^{3} \\ \overline{14.0} & \cdot ^{3} \\ 14.2 & \cdot ^{2} \\ 14.4 & \cdot ^{2} \\ 14.6 & \cdot ^{2} \\ 14.7 & \cdot ^{1} \\ 14.7 & \cdot ^{0} \end{array}$	$\begin{array}{c} 12.8 & \overset{6}{\cdot} \\ 13.3 & \overset{5}{\cdot} \\ 13.8 & \overset{5}{\cdot} \\ 14.2 & \overset{4}{\cdot} \\ 14.5 & \overset{3}{\cdot} \\ 14.8 & \overset{3}{\cdot} \\ 15.1 & \overset{3}{\cdot} \\ 15.3 & \overset{2}{\cdot} \\ 15.5 & \overset{2}{\cdot} \\ 15.6 & \overset{1}{\cdot} \\ 15.6 & \overset{1}{\cdot} \end{array}$	$\begin{array}{c} 13.6 & \cdot 6 \\ 14.0 & \cdot 4 \\ 14.5 & \cdot 5 \\ 15.0 & \cdot 5 \\ 15.4 & \cdot 4 \\ \hline 15.7 & \cdot 3 \\ 16.0 & \cdot 3 \\ 16.2 & \cdot 2 \\ 16.4 & \cdot 2 \\ 16.5 & \cdot 1 \\ 16.5 & \cdot 0 \end{array}$	$\begin{array}{c} 14.3 \cdot ^{7} \\ 14.8 \cdot ^{5} \\ 15.3 \cdot ^{5} \\ 15.8 \cdot ^{5} \\ 16.2 \cdot ^{4} \\ 16.5 \cdot ^{3} \\ 16.8 \cdot ^{3} \\ 17.1 \cdot ^{3} \\ 17.3 \cdot ^{2} \\ 17.3 \cdot ^{0} \\ 17.3 \cdot ^{0} \end{array}$	$\begin{array}{c} 14.9 \cdot 6\\ 15.6 \cdot 7\\ 16.1 \cdot 5\\ 16.6 \cdot 5\\ 17.1 \cdot 5\\ \overline{17.4} \cdot 3\\ 17.7 \cdot 3\\ 18.0 \cdot 3\\ 18.1 \cdot 1\\ 18.2 \cdot 1\\ 18.3 \cdot 1\end{array}$	$\begin{array}{c} 15.7 \cdot 7 \\ 16.3 \cdot 6 \\ 16.9 \cdot 6 \\ 17.5 \cdot 6 \\ 17.9 \cdot 4 \\ 18.3 \cdot 4 \\ 18.6 \cdot 3 \\ 18.9 \cdot 3 \\ 19.0 \cdot 1 \\ 19.1 \cdot 1 \\ 19.2 \cdot 1 \end{array}$	$\begin{array}{r} 40\\ 30\\ 20\\ 10\\ 00\\ \hline 650\\ 40\\ 30\\ 20\\ 10\\ 6\ 00\\ \end{array}$

TABLE 28C.

[C=the 3d correction. Hor. Arg., the star's declination. Vert. Arg., B=the 2d correction.]

		88°	47′		1		88° 49'						
В.	20"	30″	40″	50″	0″	10″	20″	30″	40″	50″	0″	10″	20″
"	"	"	"	"	"	"	"	"	"	"	"	"	"
0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
10	+0.2	+0.1	+0.1	+0.0	0.0	0.0	-0.1	-0.1	-0.2	-0.2	-0.3	-0.4	-0.4
20	0.4	0.3	0.2	0.1	0.0	0.1	0.2	0.3	0.4	0.5	0.6	0.7	0.8
- 30	0.6	0.5	0.3	0.1	0.0	0.1	0.3	0.5	0.6	0.7	0.8	1.1	1.2
40	0.8	0.6	0.4	0.2	0.0	0.2	0.4	0.6	0.8	1.0	1.2	1.5	1.6
50	+1.0	+0.7	+0.5	+0.2	0.0	-0.2	-0.5	-0.9	-1.0	-1.2	-1.5	-1.7	-2.1

NOTE.-Below 15° B is nearly proportional to the altitude.

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TABLE 28B.

For finding the Latitude of a place by Altitudes of Polaris.

[B=the 2d correction. This correction is always additive.]

					Ct. 1	1.2					
Star's					Star's a	initude.					Star's
angle.	240	250	260	270	280	29°	30 °	310	320	33 °	angle.
$h. m. \\ 0 00 \\ 10 \\ 20 \\ 30 \\ 40$	$\begin{array}{c} & " \\ 0.0 & .0 \\ 0.0 & .1 \\ 0.1 & .2 \\ 0.3 & .3 \\ 0.6 & .4 \end{array}$	$\begin{array}{c} '' \\ 0. & 0 \\ 0. & 0 \\ 0. & 1 \\ 0. & 1 \\ 0. & 3 \\ 0. & 3 \\ 0. & 6 \end{array}$	$\begin{array}{c} "\\ 0. & 0\\ 0. & 0\\ 0. & 2\\ 0. & 2\\ 0. & 4\\ 0. & 7\\ 0. & 7\\ \end{array}$	$\begin{array}{c} '' \\ 0, 0 \\ 0, 0 \\ 0, 2 \\ 0, 2 \\ 0, 4 \\ 0, 7 \\ 0, 7 \\ 0 \end{array}$	$\begin{matrix} " \\ 0.0 & .0 \\ 0.0 & .2 \\ 0.2 & .2 \\ 0.4 & .3 \\ 0.7 & .4 \end{matrix}$	$\begin{array}{c} '' \\ 0. \ 0 \\ 0. \ 0 \\ 0. \ 2 \\ 0. \ 2 \\ 0. \ 4 \\ 0. \ 7 \end{array}$	$\begin{array}{c} '' \\ 0. \ 0 \\ 0. \ 0 \\ 0. \ 2 \\ 0. \ 2 \\ 0. \ 4 \\ 0. \ 8 \\ 4 \end{array}$	$\begin{array}{c} '' \\ 0.0 \\ 0.0 \\ 0.2 \\ 0.2 \\ 0.5 \\ 0.5 \\ 0.8 \\ 5 \end{array}$	$\begin{array}{c} "\\ 0.0\\ 0.0\\ 0.2\\ .2\\ 0.5\\ .3\\ 0.8\\ .8\\ \end{array}$	$\begin{array}{c} "\\ 0.0\\ 0.0\\ 0.2\\ .2\\ 0.5\\ .3\\ 0.5\\ .4\\ 0.9\\ 5\end{array}$	$\begin{array}{cccc} h. & m. \\ 12 & 00 \\ 11 & 50 \\ & 40 \\ & 30 \\ & 20 \end{array}$
$\begin{array}{c} 50 \\ 1 \ 00 \end{array}$	$\begin{array}{ccc} 1.0 & .4 \\ 1.4 & .4 \end{array}$	1.0 $.4$ 1.4	$\begin{array}{ccc} 1.1 & \cdot^{\star} \\ 1.5 & \cdot^{4} \end{array}$	1.1 \cdot \cdot 1.5 \cdot	$\begin{array}{ccc} 1.1 & \cdot & \cdot \\ 1.6 & \cdot & \cdot \end{array}$	$\begin{array}{ccc} 1.1 & .4 \\ 1.7 & .6 \end{array}$	$\begin{array}{ccc} 1.2 & \overset{\mathbf{\cdot}\mathbf{x}}{.5} \\ 1.7 & \overset{\mathbf{\cdot}\mathbf{x}}{.5} \end{array}$	$\begin{array}{ccc} 1.3 & .5 \\ 1.8 & .5 \end{array}$	$\begin{array}{c}1.3\\1.9\end{array}^{.6}$	$\begin{array}{ccc} 1.4 & .5 \\ 1.9 & .5 \end{array}$	10 00
$ \begin{array}{r} 10 \\ 20 \\ 30 \\ 40 \end{array} $	$\begin{array}{cccccccccccccccccccccccccccccccccccc$	$\begin{array}{cccccccccccccccccccccccccccccccccccc$	$\begin{array}{c} 2.0 & .5 \\ 2.5 & .5 \\ 3.2 & .7 \\ 4.0 & .7 \end{array}$	$\begin{array}{c} 2.1 & .6 \\ 2.7 & .6 \\ 3.4 & .7 \\ 4.1 & .7 \end{array}$	$\begin{array}{c} 2.2 & .6 \\ 2.8 & .6 \\ 3.5 & .7 \\ 4.3 & .8 \\ \end{array}$	$\begin{array}{c} 2.3 & .6 \\ 2.9 & .6 \\ 3.6 & .7 \\ 4.5 & .9 \\ \end{array}$	$\begin{array}{c} 2.3 & .6 \\ 3.0 & .7 \\ 3.8 & .8 \\ 4.7 & .9 \\ 4.7 & .9 \end{array}$	$\begin{array}{c} \hline 2.4 & .6 \\ 3.2 & .8 \\ 4.0 & .8 \\ 4.9 & .9 \\ \end{array}$	$\begin{array}{r} 2.5 & .6 \\ 3.3 & .8 \\ 4.1 & .8 \\ 5.0 & .9 \\ \end{array}$	$\begin{array}{c} 2.6 & .7 \\ 3.4 & .8 \\ 4.3 & .9 \\ 5.3 & .0 \end{array}$	$ \begin{array}{r} 10 50 \\ 40 \\ 30 \\ 20 \end{array} $
$\begin{array}{c}50\\2&00\end{array}$	$\begin{array}{c} 4.3 & .7 \\ 5.0 & .7 \end{array}$	$\begin{array}{c}4.5\\5.3\end{array}$	$4.7 \\ 5.5 \\ .8$	4.9^{8} 5.8 ⁹	$5.1.9 \\ 6.0$	$5.3.9 \\ 6.2.9 \\ 10$	5.6.9 6.5.9	$5.8 \\ 6.8 \\ 1.0 $	$\begin{array}{c} 6.0 \\ 7.0 \\ 1.0 \\ 1.0 \\ 1.0 \end{array}$	$\begin{array}{c} 6.2 \\ 7.3 \\ 1.1 \\ 1.1 \end{array}$	$\begin{array}{c} 10 \\ 00 \end{array}$
$\begin{array}{r}10\\20\\30\\40\end{array}$	5.8.8 6.6.8 7.5.9 8.3.8	$\begin{array}{cccccccccccccccccccccccccccccccccccc$	$\begin{array}{c} 6.4 & .9 \\ 7.3 & .9 \\ 8.2 & .9 \\ 9.1 & .9 \end{array}$	$\begin{array}{r} 6.7 & .9 \\ 7.6 & .9 \\ 8.5 & .9 \\ 9.5 & 1.0 \\ \end{array}$	$\begin{array}{r} 7.0 \\ 7.9 \\ 9.9 \\ 8.9 \\ 10.0 \\ 10.0 \\ 10 \end{array}$	$\begin{array}{r} 7.2 \\ 8.3 \\ 9.3 \\ 10.4 \\ 10.4 \\ 10 \end{array}$	7.51.08.61.19.61.010.81.2	$\begin{array}{r} 7.9 \\ 8.9 \\ 10.0 \\ 11.2 \\ 11.2 \\ 10.0 \\ 12.1 \\ 11.2 \\ 10.0$	$\begin{array}{r} 8.2 \\ 9.3 \\ 1.1 \\ 10.4 \\ 11.6 \\ 12 \\ 11.6 \\ 12 \\ 12 \\ 11.6 \\ 12 \\ 11.6 \\ 12 \\ 12 \\ 12 \\ 10.4 $	$ \begin{array}{r} $	$9 50 \\ 40 \\ 30 \\ 20$
$\begin{array}{c} 50\\ 3 \ 00 \end{array}$	9.2^{9} 10.0	$\begin{array}{c}9.6\\10.5\end{array}^{.9}$	10.0^{9} $11.0^{1.0}$	$10.5 ext{ 1.0} \\ 11.5 ext{$	$11.0 \\ 12.0 \\ 10 \\ 10 \\ 10 \\ 10 \\ 10 \\ 10 \\ 10 \\ $	$11.4^{1.0}_{12.5}$	$11.9^{1.1}$ $13.0^{1.1}$	$\frac{12.4}{13.6}^{1.2}_{1.2}$	$\frac{12.9}{14.1}^{1.3}_{1.2}$	$13.3_{-1.3}^{-1.3}$ 14.6	$\begin{array}{c} 10 \\ 00 \end{array}$
$ \begin{array}{r} 10 \\ 20 \\ 30 \\ 40 \\ 50 \\ 4 00 \end{array} $	$\begin{array}{cccccccccccccccccccccccccccccccccccc$	$\begin{array}{c} 11.4 & .9 \\ 12.4 & 1.0 \\ 13.3 & .9 \\ 14.2 & .9 \\ 15.0 & .8 \\ 15.8 & .8 \end{array}$	$\begin{array}{c} 12.0 \\ 1.0 \\ 13.0 \\ 1.0 \\ 13.9 \\ .9 \\ 14.8 \\ .9 \\ 15.7 \\ .9 \\ 16.5 \\ .8 \end{array}$	$\begin{array}{c} 12.5 \\ 1.0 \\ 13.5 \\ 1.0 \\ 14.5 \\ 10 \\ 15.5 \\ 10 \\ 15.4 \\ 9 \\ 17.3 \\ 9 \end{array}$	$\begin{array}{c} 13.0 \\ 1.0 \\ 14.1 \\ 15.1 \\ 10 \\ 16.1 \\ 10 \\ 17.1 \\ 10 \\ 18.1 \\ \end{array}$	$\begin{array}{c} 13.6 \\ 1.1 \\ 14.7 \\ 1.1 \\ 15.8 \\ 1.0 \\ 16.8 \\ 1.0 \\ 17.8 \\ 1.0 \\ 18.8 \\ 1.0 \end{array}$	$\begin{array}{c} 14.2 \\ 1.2 \\ 15.3 \\ 1.1 \\ 16.4 \\ 1.1 \\ 17.5 \\ 1.0 \\ 18.5 \\ 1.0 \\ 19.6 \\ 1.1 \end{array}$	$\begin{array}{r} \hline 14.7 \\ 1.1 \\ 15.9 \\ 1.2 \\ 17.1 \\ 18.2 \\ 1.1 \\ 18.2 \\ 1.2 \\ 19.4 \\ 1.0 \\ 20.4 \\ 1.0 \\ \end{array}$	$\begin{array}{c} 15.\ 4\ 1.3\\ 16.\ 6\ 1.2\\ 17.\ 8\ 1.2\\ 19.\ 0\ 1.2\\ 20.\ 1\ 1.1\\ 21.\ 2\ 1.1\end{array}$	$\begin{array}{c} 16.0 \\ 1.4 \\ 17.3 \\ 1.3 \\ 18.5 \\ 19.7 \\ 1.2 \\ 20.9 \\ 1.2 \\ 22.0 \\ 1.1 \end{array}$	
$ \begin{array}{r} 10 \\ 20 \\ 30 \\ 40 \\ 50 \\ 5 00 \\ 5 00 \\ \end{array} $	$\begin{array}{cccccccccccccccccccccccccccccccccccc$	$\begin{array}{cccccccccccccccccccccccccccccccccccc$	$\begin{array}{cccccccccccccccccccccccccccccccccccc$	$\begin{array}{cccccccccccccccccccccccccccccccccccc$	$\begin{array}{cccccccccccccccccccccccccccccccccccc$	$\begin{array}{cccccccccccccccccccccccccccccccccccc$	$\begin{array}{c} 20.6 & 1.0 \\ 21.5 & .9 \\ 22.3 & .8 \\ 23.0 & .7 \\ 23.7 & .7 \\ 24.4 & .7 \end{array}$	$\begin{array}{c} 21. \ 4 \ 1.0 \\ 22. \ 4 \ 1.0 \\ 23. \ 2 \ .8 \\ 24. \ 0 \ .8 \\ 24. \ 6 \ .6 \\ 25. \ 3 \ .7 \end{array}$	$\begin{array}{c} 22.3 \\ 23.2 \\ 9 \\ 24.1 \\ 9 \\ 24.9 \\ 8 \\ 25.7 \\ 26.4 \\ 6 \end{array}$	$\begin{array}{c} 23.1 \\ 24.1 \\ 25.1 \\ 25.9 \\ 25.9 \\ 26.7 \\ 27.4 \\ .7 \\ 6 \end{array}$	7 50 40 30 20 10 00
$ \begin{array}{r} 10 \\ 20 \\ 30 \\ 40 \\ 50 \\ 6 00 \\ \end{array} $	$\begin{array}{cccccccccccccccccccccccccccccccccccc$	$\begin{array}{cccccccccccccccccccccccccccccccccccc$	$\begin{array}{cccccccccccccccccccccccccccccccccccc$	$\begin{array}{cccccccccccccccccccccccccccccccccccc$	$\begin{array}{c} 22.9 & .3 \\ 23.3 & .4 \\ 23.6 & .3 \\ 23.9 & .3 \\ 24.0 & .1 \\ 24.1 & .1 \end{array}$	$\begin{array}{cccccccccccccccccccccccccccccccccccc$	$\begin{array}{cccccccccccccccccccccccccccccccccccc$	$\begin{array}{c} 25.8 & .5\\ 26.2 & .4\\ 26.6 & .4\\ 26.9 & .3\\ 27.0 & .1\\ 27.1 & .1\end{array}$	$\begin{array}{cccccccccccccccccccccccccccccccccccc$	$\begin{array}{cccccccccccccccccccccccccccccccccccc$	$egin{array}{ccc} 6 & 50 \\ & 40 \\ & 30 \\ & 20 \\ & 10 \\ 6 & 00 \end{array}$

	[C	=the 3d	correction	n. Hor.	Arg., t	TABL	E 28C leclinatio	n. Vert.	Arg., B=	the 2d co	rrection.	.]	
1		88°	47′		1		88	• 48'			*	883 49'	
в.	20"	30″	40″	50″	0″	10″	20″	30″	40″	50″	0"	10″	20"
"	"	"	"	"	"	"	"	"	"	"	"	"	"
0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
10	+0.2	+0.1	+0.1	+0.0	0.0	-0.0	-0.1	-0.1	-0.2	-0.2	-0.3	-0.4	-0.4
20	0.4	0.3	0.2	0.1	0.0	0.1	0.2	0.3	0.4	0.5	0.6	0.7	0.8
30	0.6	0.5	0.3	0.1	0.0	0.1	0.3	0.5	0.6	0.7	0.8	1.1	1.2
40	0.8	0.6	0.4	0.2	0.0	0.2	0.4	0.6	0.8	1.0	1.2	1.5	1.6
50	+1.0	+0.7	+0.5	+0.2	0.0	-0.2	-0.5	-0.7	-1.0	-1.2	-1.5	-1.7	-2.1

TABLE 28B.

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For finding the Latitude of a place by Altitudes of Polaris. [B = the 2d correction. This correction is always additive.]

Star's					Star's a	altitude.	-					Star's
angle.	340	350	360	370	380	390	40°	41°	420		430	hour angle.
$\begin{array}{c} \text{angre.} \\	$\begin{array}{c} 3.\\ & & \\ &$	$\begin{array}{c} 33\\ & \\ & \\ & \\ & \\ & \\ & \\ & \\ & \\ & \\$	$\begin{array}{c} & , & , & , \\ & , & , & , \\ & & , & , \\ & & , & ,$	$\begin{array}{c} & , \\ & , \\ & , \\ & 0, 0, 1, 1\\ 0, 1, 2\\ 0, 3, 3\\ 0, 6, 4\\ 1, 0, 6, 6\\ 1, 6, 7\\ 2, 3, 8\\ 3, 1, 9\\ 4, 0, 10\\ 5$	$\begin{array}{c}\\\\ 0.0\\\\ 0.1\\\\ 0.3\\\\ 0.6\\\\$	$\begin{array}{c} & & & \\ & & & & \\ & & & \\ & & & \\ & & & \\ & & & \\ & & & \\ & & & \\ & & & \\ & & &$	$\begin{array}{c} 13\\ 10,0&1&.1\\ 0,1&.2\\ 0,3&.3\\ 0,6&.5\\ 1,1&.7\\ 1,8&.7\\ 2.5&.9\\ 3.4&.5&1.1\\ 5.6&1.2\\ 6.8&1.3\\ 8.1&1.4\\ 9.5&1.4\\ 9.5&1.4\\ 10.9&1.6\\ 12.5&1.6\\ 12.5&1.6\\ 12.5&1.6\\ 17.3&1.7\\ 19.0&1.7\\ 20.7&1.6\\ 22.3&1.6\\ 23.9&1.5\\ 25.4&1.6\\ 23.9&1.5\\ 25.4&1.6\\ 23.9&1.5\\ 25.4&1.6\\ 23.9&1.5\\ 25.4&1.6\\ 23.9&1.5\\ 31.2&1.2\\ 32.4&1.1\\ 33.5&.9\\ 34.4&.9\\ 35.3&.8\\ 36.1&.7\\ 36.8&.5\\ 37.8&.5\\ 37.6&.2\\ 3$	$\begin{array}{c} \begin{array}{c} & & & \\ & $	$\begin{array}{c} & & \\$	$\begin{array}{c} .1\\ .2\\ .4\\ .5\\ .7\\ .9\\ .9\\ .9\\ .11\\ 1.2\\ 1.3\\ 1.4\\ 1.5\\ 1.7\\ 1.7\\ 1.7\\ 1.7\\ 1.7\\ 1.7\\ 1.7\\ 1.7$	$\begin{array}{c} & & & & & \\ & & & & \\ & & & & \\ & & & & \\ & & & & \\ & & & & \\ & & & & \\ & & & & \\ & & & & \\ & & & & \\ & & & & \\ & & & & \\ & & & & \\ & & & & \\ & & & & \\ & & & \\ & & & & \\ & & &$	$\begin{array}{c} \text{h. m.} \\ 12 \ 00 \\ 11 \ 50 \\ 40 \\ 00 \\ 10 \ 50 \\ 40 \\ 30 \\ 20 \\ 10 \\ 50 \\ 40 \\ 30 \\ 20 \\ 10 \\ 50 \\ 40 \\ 30 \\ 20 \\ 10 \\ 00 \\ 9 \ 50 \\ 40 \\ 30 \\ 20 \\ 10 \\ 00 \\ 7 \ 50 \\ 40 \\ 30 \\ 20 \\ 10 \\ 00 \\ 6 \ 50 \\ 40 \\ 30 \\ 20 \\ 10 \\ 00 \\ 20 \\ 20 \\ 20 \\ 20 \\ 2$
$\begin{smallmatrix}&50\\6&00\end{smallmatrix}$	30.5 .0 30.5 .0	31.6 .1 31.7	$\begin{array}{c} 32.8 \\ 32.9 \end{array}$.1	$\left \begin{array}{c} 34.0 \\ 34.1 \\ 34.1 \end{array}\right ^{1}$	$\begin{array}{c c} 35.2 & .1 \\ 35.3 & .1 \end{array}$	$ \begin{array}{c} 36.5 \\ 36.6 \end{array} $	$\begin{bmatrix} 37.8 & .2 \\ 37.9 & .1 \end{bmatrix}$	$\begin{array}{c} 39.3 \\ 39.4 \end{array}$	$ \begin{array}{c c} 40.7 \\ 40.8 \end{array} $.1 4 4	$\begin{array}{c} 2.1 & .2 \\ 2.2 & .1 \\ 2.2 \end{array}$	$\begin{smallmatrix}&10\\6&00\end{smallmatrix}$
	[C	= the 3d c	orrection.	Hor. Arg.	TABI , the star's	LE 28C	• n. Vert. A	rg.; B = th	ne 2d corr	rection	1.]	
	-	88° 4	7'			88	° 48′		1		88° 49	,
В.	20"	30''	40''	50'' 0'	· 10··	20"	30''	40''	50''	0''	10"	20''
" 0 10 20 30 40 50	$ \begin{smallmatrix} & , & \\ & 0.0 \\ + 0.2 \\ & 0.4 \\ & 0.6 \\ & 0.8 \\ + 1.0 \end{smallmatrix} $	$\begin{matrix}\\ 0.0\\ +0.1\\ 0.3\\ 0.5\\ 0.6\\ +0.7 \end{matrix}$	$\begin{array}{c} ,'' \\ 0.0 \\ +0.1 \\ 0.2 \\ 0.3 \\ 0.4 \\ +0.5 \\ +\end{array}$	$\begin{array}{c} \begin{array}{c} \\ \\ 0.0 \\ -0.0 \\ 0.1 \\ 0.1 \\ 0.2 \\ 0.2 \\ 0.0 \end{array}$	$\begin{array}{c ccccc} & & & & & & \\ 0 & & 0 & 0 & 0 \\ 0 & & -0 & 0 & 0 \\ 0 & & 0 & 1 & 0 \\ 0 & & 0 & 1 & 0 \\ 0 & & 0 & 2 & 0 \\ 0 & & -0 & 2 \end{array}$	$\begin{matrix} "\\ 0.0\\ -0.1\\ 0.2\\ 0.3\\ 0.4\\ -0.5 \end{matrix}$	$\begin{array}{c} & & \\ & & \\ & 0.0 \\ -0.1 \\ & 0.3 \\ & 0.5 \\ & 0.6 \\ -0.7 \end{array}$	$\begin{array}{c} & & \\ & & \\ 0.0 \\ -0.2 \\ 0.4 \\ 0.6 \\ 0.8 \\ -1.0 \end{array}$	$\begin{array}{c} & & \\ & 0. & 0 \\ -0. & 2 \\ 0. & 5 \\ 0. & 7 \\ 1. & 0 \\ -1. & 2 \end{array}$	$\begin{matrix} . & 0 \\ 0 & 0 \\ -0 & 3 \\ 0 & 6 \\ 0 & 8 \\ 1 & 2 \\ -1 & 5 \end{matrix}$	$\begin{matrix} "\\ 0.0\\ -0.4\\ 0.7\\ 1.1\\ 1.5\\ -1.7 \end{matrix}$	$ \begin{array}{c c} $

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TABLE 28B.

For finding the Latitude of a place by Altitudes of Polaris.

[B=the 2d correction. This correction is always additive.]

Star's					Star's altitu	de.				Star's
hour angle.	44 °	45°	46 °	47°	4 8°	49°	50°	51°	520	hour angle.
h. m.	,,	"	"	,,	,,	"	"	"	"	h. m.
0 00	0.0 .1	0.0 .1	0.0 .1	0.0 .1	0.0 .1	0.0 .1	0.0 .1	0.0 .1	0.0 .1	$12 \ 00$
10	$\begin{bmatrix} 0.1 \\ 0.2 \end{bmatrix} .2$	0.1	0.1 .2	0.1 .2	0.1 .3	0.1 .3	0.1 .3	0.1 .3	0.1 $.3$	11 50
20	$\begin{bmatrix} 0.3 \\ 0.7 \end{bmatrix} .4$	0.3 .4	0.3.5	0.3.5	0.4.5	0.4 .5	0.4.5	0.4 .6	0.4 .6	1 40
	$\begin{bmatrix} 0.7\\1.3\end{bmatrix}$.6	1 4 .7	14.6	1.5 .7	1.5	16.7	1.6.7	1.0 .7	1.8 .8	
50	$\frac{1.0}{2.0}$.7	2.1 .7	2.2.8	2.3 .8	2.3.8	2.4.8	2.5.9	2.6.9	$2.8^{1.0}$	10
1 00	$\frac{2.0}{2.9}$.9	3.0^{9}	$\begin{bmatrix} 2.2 \\ 3.2 \end{bmatrix}^{1.0}$	3.2^{9}	$\frac{1}{3}, 4$	$3.5^{1.1}$	$3.6^{1.1}$	$3.7^{1.1}$	$3.9^{1.1}$	00
10	$\frac{1}{4}$ 0 1.1	4 1 1.1	$\frac{-1.0}{4.2}$	4 4 1.2	4 5 1.1	$\frac{-1.2}{4.7}$	$\frac{1.3}{4.9}$	$-\frac{1.3}{5.0}$	$\frac{-5}{5}3$ 1.4	10.50
20	$5.1^{1.1}$	5.31.2	5, 5, 1.3	$5.7^{1.3}_{1.4}$	$5.9^{1.4}_{15}$	$6.1^{1.4}_{1.5}$	$\hat{6}, \hat{3}, \hat{1}, \hat{4}$	$6.6^{1.6}_{1.6}$	$6.8^{1.5}$	40
30	$6.4^{1.3}_{1.4}$	$6.6^{1.3}_{1.5}$	$6.9^{1.4}_{1.4}$	$7.1_{1.6}^{1.4}$	$7.4_{1.6}^{1.5}$	$7.6_{1.7}^{1.3}$	$7.9^{1.0}_{1.7}$	8.218	$8.5^{1.7}_{1.0}$	30
40	$7.8^{1.4}_{1.5}$	$8.1_{15}^{1.5}$	$8.3_{1.7}^{1.4}$	8.71.7	9.0 $\frac{1.0}{1.7}$	$9.3^{1.1}_{1.8}$	$9.6_{1.9}^{1.7}$	$10.0^{1.0}_{1.9}$	$10.3^{1.8}_{0.0}$	20
50	9.3 $^{1.0}_{1.6}$	9.6 $\frac{1.0}{1.7}$	$10.0_{1.7}$	$10.4_{1.8}$	10.7 $_{1.9}$	11.11.9	$11.5_{2.0}$	$11.9_{2.0}$	12.3 $^{2.0}_{2.2}$	10
2 00	$10.9^{1.0}_{1.7}$	11.3_{17}	11.7	12.2_{18}	12.6_{19}	13.0_{20}	13.5_{21}	13.9 22	14.5 ^{2.2}	- 00
10	$12.6_{1.7}$	$13.0_{1.9}$	$13.5_{1.9}$	14.0 20	$14.5_{2.0}$	15.0 2.1	15.6_{21}	16.1 2.3	16.7 $^{2.2}_{0.9}$	9 50
20	14.3 $\frac{11}{19}$	14.91.9	$15.4_{1.9}$	$16.0\frac{2.0}{2.0}$	$16.5\frac{2.0}{2.1}$	$17.1_{2.2}$	$17.7\frac{2.1}{2.3}$	$18.4_{2.3}$	$19.0\frac{2.3}{2.5}$	40
- 30	16.2 $\frac{10}{1.9}$	16.8 1.9	$17.3_{2.1}$	$18.0_{2.0}$	$18.6_{2.1}$	$19.3_{2.2}$	$20.0_{2.3}$	$20.7\frac{-10}{2.4}$	21.5 $\frac{2.5}{2.4}$	30
40	$18.1_{1.8}$	18.7 $_{2.0}$	$19.4_{2.0}$	$20.0_{2.1}$	$20.7_{2.2}$	$21.5_{2.2}$	22.3 $_{2.3}$	$23.1_{2.4}$	$23.9\frac{2.4}{2.5}$	20
50	$19.9_{2.0}$	$20.7_{1.9}$	$21.4_{2.0}$	$22.1_{2.1}$	$22.9_{2.2}$	$23.7_{2.3}$	$24.6_{2.4}$	$25.5_{2.4}$	$26.4^{0}_{2.5}$	10
3 00	$\frac{21.9}{1.8}$	$\frac{22.6}{2.0}$	$\frac{23.4}{2.0}$	$\frac{24.2}{2.2}$	$\frac{25.1}{2.2}$	26.0	$\frac{27.0}{2.3}$	$\frac{27.9}{2.5}$	$\frac{28.9}{26}$	00
10	23.7 $_{1.9}$	$24.6_{2.0}$	$25.4_{2.1}$	$26.4_{2.1}$	$27.3_{2.2}$	$28.3_{2.2}$	29.3 $_{2,4}$	$30.4_{2.4}$	$31.5 \frac{2.0}{2.5}$	8 50
20	$25.6_{1.9}$	$26.6_{1.9}$	$27.5_{2.0}$	$28.5_{2.0}$	$29.5_{2.1}$	$30.5_{2.2}$	$31.7_{2.2}$	$32.8_{2.4}$	34.0 2.5	40
30	$27.5_{1.8}$	28. 5 1.9	$29.5_{1.9}$	$30.5_{2.1}$	$\frac{31.6}{22}$	$32.7_{2.2}$	$33.9_{2.3}$	$\frac{35.2}{2.3}$	36.5	30
40	$29.3 \\ 1.8$	$\frac{30.4}{20.9}$ 1.8	$\frac{31.4}{99}$	$\frac{32.0}{94.5}$ 1.9	$\frac{33.}{25}$ $\frac{1}{7}$ 2.0	$34.9_{2.1}$	$\frac{30.2}{202}$ 2.1	$\frac{31.0}{20}$	38.9 41 9 2.3	20
1 00	$\frac{51.1}{29}$ $\frac{1}{7}$ 1.6	$\frac{32.2}{29}$ 0 1.7	20.01.9	$\frac{34.0}{96.4}$ 1.9	$\frac{30.7}{97.7}$ 2.0	$\frac{37.0}{20}$	$\frac{35.3}{40.4}$	$\begin{bmatrix} 39.0 \\ 41 \\ 0 \end{bmatrix}$	41, 2 2.2	10
4 00	$\frac{32.7}{04.9}$ 1.6	$\frac{33.9}{95.6}$ 1.7	$\frac{30.2}{92.0}$ 1.7	$\frac{30.4}{20.0}$ 1.8	$-\frac{37.7}{20.5}$ 1.8	$-\frac{35.0}{41.0}2.0$	$\frac{40.4}{49.5}$ 2.1	$-\frac{41.8}{44.0}2.1$	45.5 2.1	7 50
10	$\frac{34}{25}$ $\frac{3}{0}$ 1.6	$30.0 \\ 97.0 \\ 1.6$	$\frac{30.9}{99}$ 1.6	$\frac{38.2}{200}$ 1.7	$39.0 \\ 41.2 \\ 1.8$	$\frac{41.0}{19}$ 1.8	$\frac{42.0}{44.9}$ 1.8	44.0 _{1.9}	40.0	1 30
20	$\frac{50.9}{27}$ $\frac{91.4}{2}$	37.21.4	$\frac{36.0}{40.0}$ 1.5	$39.9 \\ 1.5 \\ 41.4$	49.8	42.01.6	46.0	40.91.8 47.7	47.5	30
30	$\frac{37.3}{38.6}$ $\frac{1.3}{1.3}$	39.01.3	41.0 1.4	$428^{11.1}_{1.4}$	44 4 1.6	45 9	$47.6^{1.6}_{1.6}$	$49.3^{1.6}$	51 1 1.7	20
50	$39.8^{1.2}$	41.1	$42.6^{11.2}_{1.2}$	44.1	45.71.3	47.31.4	49.01.4	50.81.5	$52.7^{1.6}$	10
5 00	40.7^{9}	$42.2^{1.1}$	$43.7^{1.1}$	$45.3^{1.2}$	$46.9^{1.2}$	48.6	$50.3^{1.3}$	$52.1^{1.3}$	54.0 $^{1.3}$	ÕÕ
10	41.6^{9}	43.1 .9	44.6 .9	$\frac{46.3}{1.0}$	$-47.9^{1.0}$	$\frac{49.7}{1.1}$	$-\frac{1.2}{51.5}$	$-\frac{1.1}{53.21}$	$55.2^{1.2}$	6 50
20	42.4^{-8}	43.9 .8	45.4 -8	$47.1^{.8}$	$48.7^{.8}$	50.5^{-8}	52.4^{-9}	$54.2^{1.0}$	56.1^{9}	40
30	42.9^{-5}	44.5	46.1	47.7^{-6}	49.4 5	51.2 5	53.1 5	54.9 6	56.9 ^{.8}	30
40	43.3^{+4}_{-2}	44.9^{4}	46.5^{4}	48.1^{4}	49.9^{-3}	$51.7^{+0.0}$	53.6 3	55.5 .0	57.5^{-6}	20
50	43.6 $^{,5}_{1}$	45.1^{2}	46.7 $\frac{1}{1}$	$48.4^{.3}$	50.1^{+2}_{-1}	51.9 2	53.9	55.7 2	57.8 .3	10
6 00	43.7	45.3 .2	46.8	48.5	50.2	52.1	54.0	55.9	57.9 .1	6 00

TABLE 28C.

,

[C=the 3d correction. Hor. Arg., the star's declination. Vert. Arg., B=the 2d correction.]

		88°	47'				88	8° 48′				88° 49'	
в.	20''	30''	40''	50″	0″	10''	20''	30′′	40"	50''	0''	10''	20''
"	"	"	"	"	"	"	"	"	"	"	"	"	"
- 30	+0.6	+0.5	+0.3	+0.1	0.0	-0.1	-0.3	-0.5	-0.6	-0.7	-0.8	-1.1	-1.2
40	0.9	0.6	0.4	0.2	0.0	0.2	0.4	0.6	0.9	1.0	1.2	1.4	1.6
50	1.0	0.7	0.5	0.2	0.0	0.2	0.5	0.7	1.0	1.2	1.5	1.7	2.0
60	1.2	0.9	0.6	0.2	0.0	0.2	0.6	0.9	1.2	1.5	1.8	$2.1 \cdot$	2.5
70	1.5	1.1	0.7	0.4	0.0	0.4	0.7	1.1	1.5	1.8	2.1	2.5	2.8
80	+1.6	+1.2	+0.8	+0.4	0.0	0.4	-0.8	-1.2	-1.6	-2.1	-2.5	-2.8	-3.3

TABLE 28B.

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For finding the Latitude of a place by Altitudes of Polaris. [B = the 2d correction. This correction is always additive.]

Star's				Star's a	ltitude.				Star's
hour angle.	53°	54°	55°	56°	570	5 8°	59°	60°	hour angle.
$h. m. \\ 0 00 \\ 10 \\ 20 \\ 20$	$\begin{array}{c} & "\\ 0 & 0.0 \\ 0.1 \\ 0.1 \\ 0.5 \\ 0.5 \end{array}$	$ \begin{smallmatrix} & & & \\ 0 & & 0.0 & _{0.1} \\ & & 0.1 & _{0.4} \\ & & 0.5 & _{0.5} \end{smallmatrix} $	$ \begin{smallmatrix} & & & \\ 0 & & 0.0 & _{0.1} \\ & & 0.1 & _{0.4} \\ & & 0.5 & _{0.6} \\ \end{smallmatrix} $	$ \begin{smallmatrix} & & & \\ 0 & & 0.0 & _{0.2} \\ & & 0.2 & _{0.3} \\ & & 0.5 & _{0.6} \\ \end{smallmatrix} $	$ \begin{smallmatrix} & & & \\ 0 & & 0.0 & _{0.2} \\ & & 0.2 & _{0.3} \\ & & 0.5 & _{0.7} \\ \end{smallmatrix} $	$ \begin{smallmatrix} & '' \\ 0 & 0.0 \\ 0.2 \\ 0.4 \\ 0.6 \\ 0.6 \end{smallmatrix} $	$ \begin{smallmatrix} & & \\ 0 & & 0.0 \\ & 0.2 \\ 0.2 \\ 0.4 \\ 0.6 \\ 0.7 \end{smallmatrix} $	$ \begin{smallmatrix} & & \\ 0 & & 0.0 & _{0.2} \\ & 0.2 & _{0.4} \\ & 0.6 & _{0.7} \end{smallmatrix} $	$egin{array}{cccc} h. & m. \\ 12 & 00 \\ 11 & 50 \\ & 40 \\ \hline \end{array}$
$ \begin{array}{r} 30 \\ 40 \\ 50 \\ 1 00 \\ 10 \end{array} $	$ \begin{array}{r} 1.0_{0.8}\\ 1.8_{1.0}\\ 2.8_{1.2}\\ 4.0\\ 1.4\\ 0 5.4_{1.6}\\ \end{array} $	$ \begin{array}{r} 1.0_{0.8} \\ 1.8_{1.1} \\ 2.9_{1.3} \\ 4.2_{1.4} \\ \hline 0 5.6_{1.7} \end{array} $	$ \begin{array}{r} 1.10.8\\ 1.91.1\\ 3.01.3\\ -4.31.5\\ \hline 0 5.817 \end{array} $	$ \begin{array}{r} 1.1 & 0.9 \\ 2.0 & 1.1 \\ 3.1 & 1.4 \\ - & 4.5 \\ \hline 0 & 6.1 \\ 1.8 \\ \end{array} $	$\begin{array}{r} 1.2 \\ 0.9 \\ 2.1 \\ 1.1 \\ 3.2 \\ 1.5 \\ 4.7 \\ 1.6 \\ \hline 0 \\ \hline 0 \\ 6.3 \\ 1.9 \end{array}$	$ \begin{array}{r} 1.2 \\ 2.2 \\ 1.2 \\ 3.4 \\ 1.5 \\ -4.9 \\ 1.7 \\ 0 \\ 6.6 \\ 1.8 \\ \end{array} $	$ \begin{array}{r} 1.3 \\ 0.9 \\ 2.2 \\ 1.3 \\ 3.5 \\ 1.5 \\ 5.0 \\ 1.8 \\ 0 \\ 6.8 \\ 2.0 \\ 1.8 \\ 0 \\ 0 \\ 1.8 \\ 0 \\ 0 \\ 1.8 \\ 0 \\ 0 \\ 0 \\ 0 \\ 0 \\ 0 \\ 0 \\ 0 \\ 0 \\ 0$	$ \begin{array}{r} 1.3 \\ 2.3 \\ 1.3 \\ 3.6 \\ 1.7 \\ 5.3 \\ 1.8 \\ 0 \\ 7.1 \\ 1.8 \\ 0 \end{array} $	$ \begin{array}{r} 30 \\ 20 \\ 10 \\ 00 \\ 10 50 \end{array} $
$20 \\ 30 \\ 40 \\ 50 \\ 2 00$	$\begin{array}{c} 7.0 \\ 1.8 \\ 8.8 \\ 1.9 \\ 10.7 \\ 2.1 \\ 12.8 \\ 2.2 \\ 15.0 \end{array}$	$\begin{array}{c} 7.3 \\ 9.1 \\ 2.0 \\ 11.1 \\ 2.2 \\ 13.3 \\ 2.3 \\ 15.6 \end{array}$	$\begin{array}{c} 7.5_{2.0} \\ 9.5_{2.0} \\ 11.5_{2.3} \\ 13.8_{2.3} \\ 16.1 \end{array}$	$\begin{array}{r} 7.9 \\ 1.9 \\ 9.8 \\ 2.1 \\ 11.9 \\ 2.4 \\ 14.3 \\ 2.5 \\ 16.8 \end{array}$	$\begin{array}{c} 8.2 \\ 2.0 \\ 10.2 \\ 2.3 \\ 12.5 \\ 2.3 \\ 14.8 \\ 2.6 \\ 17.4 \end{array}$	$\begin{array}{c} 8.4 \\ 2.2 \\ 10.6 \\ 2.4 \\ 13.0 \\ 2.5 \\ 15.5 \\ 2.6 \\ 18.1 \end{array}$	$\begin{array}{c} 8.8 \begin{array}{c} 2.0 \\ 2.2 \\ 11.0 \\ 2.4 \\ 13.4 \\ 2.6 \\ 16.0 \\ 2.8 \\ 18.8 \end{array}$	$\begin{array}{r} 9.1 \begin{array}{c} 2.0 \\ 11.5 \begin{array}{c} 2.5 \\ 14.0 \begin{array}{c} 2.7 \\ 16.7 \end{array} \end{array}$	
	$\begin{array}{c} \begin{array}{c} 131 & 2.3 \\ \hline 0 & 17.3 & 2.4 \\ 19.7 & 2.5 \\ 22.2 & 2.6 \\ 24.8 & 2.6 \\ 97.4 & 2.6 \end{array}$	$\begin{array}{c} \hline & 2.4 \\ \hline 0 & 18.0 & 2.5 \\ 20.5 & 2.6 \\ 23.1 & 2.6 \\ 25.7 & 2.7 \\ \hline \\ 28.4 & 2.7 \\ \hline \end{array}$	$\begin{array}{c} \hline 0 & 18.6 & 2.5 \\ \hline 0 & 18.6 & 2.7 \\ & 21.3 & 2.7 \\ & 24.0 & 2.7 \\ & 26.7 & 2.8 \\ & 20.5 & 2.8 \end{array}$	$\begin{array}{c} \hline 0 & 19.3 \\ 22.1 \\ 22.1 \\ 24.9 \\ 27.7 \\ 20.6 \\ 29.9 \\ 20.6 \\ 29.9 \\ 20.6 \\ 29.9 \\ 20.6 \\ 29.9 \\ 20.6 \\ 29.9 \\ 20.6 \\ 29.9 \\ 20.6 \\ 29.9 \\ 20.6 \\ 29.9 \\ 20.6 \\ 29.9 \\ 20.6 \\ 29.9 \\ 20.6 \\ 29.9 \\ 20.6 \\ 29.9 \\ 20.6 \\ 20.$	$\begin{array}{c} \hline 0 & 20.1 & 2.7 \\ \hline 0 & 20.1 & 2.8 \\ & 22.9 & 2.9 \\ & 25.8 & 3.0 \\ & 28.8 & 3.0 \\ & 21.8 & 3.0 \\ \hline \end{array}$	$\begin{array}{c ccccccccccccccccccccccccccccccccccc$	$\begin{array}{r} \hline 10,0,0,2,9\\ \hline 0,21,7,3,1\\ 24,8,3,1\\ 27,9,3,2\\ 31,1,3,2\\ 21,2,3,2\\ \end{array}$	$\begin{array}{r} 10.0 & 3.0 \\ \hline 0 & 22.6 & 3.2 \\ 25.8 & 3.3 \\ 29.1 & 3.3 \\ 32.4 & 3.4 \\ 95.6 & 3.4 \end{array}$	
	$\begin{array}{r} 27.42.7\\ 30.1\\ 2.5\\ \hline 0 \ 32.62.6\\ 35.22.6\\ 37.82.5\end{array}$	$\begin{array}{r} 28.42.7\\ \underline{31.1}\\ 2.7\\ 0 33.82.7\\ 36.52.7\\ 39.22.6\end{array}$	$\begin{array}{r} 29.5 \\ 32.3 \\ 32.3 \\ 2.8 \\ 35.1 \\ 2.8 \\ 37.9 \\ 2.8 \\ 40.7 \\ 2.6 \end{array}$	$\begin{array}{r} 30.022.9\\ 33.52.9\\ \hline 0 36.52.9\\ 39.42.9\\ 42.22.8\\ 42.22.8\end{array}$	$\begin{array}{r} 31.8 & 3.0 \\ 34.8 & 3.1 \\ \hline 0 & 37.9 & 3.0 \\ 40.9 & 2.9 \\ 43.8 & 2.9 \end{array}$	$\begin{array}{r} 53.0 \\ 36.2 \\ 36.2 \\ 3.2 \\ \hline 0 \\ 39.4 \\ 3.1 \\ 42.5 \\ 3.1 \\ 45.6 \\ 3.0 \end{array}$	$\begin{array}{r} 54.5 \\ 37.6 \\ 3.3 \\ \hline 0 40.9 \\ 3.3 \\ 44.2 \\ 3.2 \\ 47.4 \\ 3.1 \end{array}$	$\begin{array}{r} 55.8 \\ 39.2 \\ 3.4 \\ \hline 0 \\ 42.6 \\ 3.4 \\ 46.0 \\ 3.3 \\ 49.3 \\ 3.3 \end{array}$	
$ \begin{array}{r} 40 \\ 50 \\ 4 00 \\ 10 \end{array} $	$\begin{array}{r} 40.3 \\ 42.7 \\ 2.3 \\ 45.0 \\ \hline 0 \\ 47.2 \\ 2.1 \end{array}$	$\begin{array}{r} 41.8 \\ 2.5 \\ 44.3 \\ 2.4 \\ 46.7 \\ \hline 0 \\ 49.0 \\ 2.3 \\ \hline 0 \\ 49.0 \\ 2.1 \end{array}$	$\begin{array}{r} 43.3 \\ 45.9 \\ 2.5 \\ 48.4 \\ \hline 0 50.8 \\ 2.3 \end{array}$	$\begin{array}{r} 45.0 \\ 47.7 \\ 2.7 \\ 47.7 \\ 2.6 \\ 50.3 \\ \hline 0 52.8 \\ 2.5 \\ 2.8 \\ 2.8 \end{array}$	$\begin{array}{r} 46.7 \\ 49.6 \\ 2.9 \\ \underline{49.6} \\ 2.6 \\ \underline{52.2} \\ 0 \\ 54.8 \\ 2.4 \end{array}$	$\begin{array}{r} 48.6_{2.9} \\ 51.5_{2.8} \\ 54.3 \\ \hline 0 56.9_{2.5}^{2.6} \end{array}$	$ \begin{array}{r} 50.5 \\ 53.5 \\ 2.9 \\ 56.4 \\ \hline 0 59.2 \\ 2.8 \\ 7.7 \\ \hline \end{array} $	$ \begin{array}{r} 52.63.1\\ 55.73.1\\ 58.8\\ \hline 1 & 1.62.8\\ \end{array} $	$ \begin{array}{r} 20 \\ 10 \\ 00 \\ \overline{7 \ 50} \end{array} $
$20 \\ 30 \\ 40 \\ 50 \\ 5 00$	$\begin{array}{c} 49.3 \\ 51.3 \\ 53.1 \\ 53.1 \\ 54.6 \\ 56.1 \\ 1.2 \\ \end{array}$	$51.12.0 \\ 53.12.0 \\ 55.01.6 \\ 56.61.5 \\ 58.12.2 \\ 1.2 \\ 58.12.2 \\ 1.2 $	53.12.055.21.957.11.758.81.510.312	55.12.957.32.257.31.959.21.81.01.61.2.61.8	57.22.359.52.11 1.61.81 3.41.61 5.014	$\begin{array}{c} 59.4 \\ 2.4 \\ 1 \\ 1.8 \\ 2.1 \\ 1 \\ 3.9 \\ 2.0 \\ 1 \\ 5.9 \\ 1.7 \\ 1 \\ 7.6 \\ 1.4 \end{array}$	$\begin{array}{cccccccccccccccccccccccccccccccccccc$	$\begin{array}{c}1&4.4 \\ 2.5\\1&6.9 \\ 2.3\\1&9.2 \\ 2.1\\1&11.3 \\ 1.8\\1&13.1 \\ \end{array}$	$ \begin{array}{r} 40 \\ 30 \\ 20 \\ 10 \\ 00 \end{array} $
$ \begin{array}{r} 10 \\ 20 \\ 30 \\ 40 \\ 50 \\ 6 \ 00 \end{array} $	$\begin{array}{c} 0 & 57.3 & 0.9 \\ 58.2 & 0.8 \\ 59.0 & 0.6 \\ 59.6 & 0.3 \\ 59.9 & 0.1 \\ 1 & 0.0 \end{array}$	$\begin{array}{c} 0 & 59.4 \\ 1 & 0.4 \\ 1 & 0.4 \\ 1 & 1.2 \\ 0.6 \\ 1 & 1.8 \\ 0.3 \\ 1 & 2.1 \\ 0.2 \\ 1 & 2.3 \end{array}$	$\begin{array}{c}1&1.6&1.3\\1&2.7&0.8\\1&3.5&0.7\\1&4.2&0.3\\1&4.5&0.2\\1&4.7\end{array}$	$\begin{array}{c}1&3.9&1.1\\1&5.0&0.9\\1&5.9&0.7\\1&6.6&0.4\\1&7.0&0.1\\1&7.1\end{array}$	$\begin{array}{c}1 & 6.4 & 1.4 \\1 & 7.6 & 0.9 \\1 & 8.5 & 0.7 \\1 & 9.2 & 0.4 \\1 & 9.6 & 0.1 \\1 & 9.7 \end{array}$	$\begin{array}{c} 1 & 9.0 \\ 1.2 \\ 1 & 10.2 \\ 1.2 \\ 1.0 \\ 1 & 11.2 \\ 0.6 \\ 1 & 11.8 \\ 0.4 \\ 1 & 12.2 \\ 0.2 \\ 1 & 12.4 \end{array}$	$\begin{array}{c}1&11.8&1.3\\1&13.1&0.9\\1&14.0&0.8\\1&14.8&0.4\\1&15.2&0.2\\1&15.4\end{array}$	$\begin{array}{c}1&14.\ 7&1.6\\1&16.\ 1&0.9\\1&17.\ 0&0.8\\1&17.\ 8&0.4\\1&18.\ 2&0.2\\1&18.\ 4\end{array}$	$ \begin{array}{r} 6 50 \\ 40 \\ 30 \\ 20 \\ 10 \\ 6 00 \end{array} $

TABLE 28C.

[C = the 3d correction. Hor. Arg., the star's declination. Vert. Arg., B = the 2d correction.]

		88°	47′				88	° 48′				88° 49'	
в.	20''	30''	40″	50''	0''	10''	20''	30′′	40''	50''	0''	10″	20''
"	"		"	,,	. 11	11	"		,,	11	"	"	"
- 30	+0.6	+0.5	+0.3	+0.1	0.0	-0.1	-0.3	-0.5	-0.6	-0.7	-0.8	-1.1	-1.2
40	0.9	0.6	0.4	0.2	0.0	0.2	0.4	0.6	0.9	1.0	1.2	1.4	1.6
50	1.0	0.7	0.5	0.2	0.0	0.2	0.5	0.7	1.0	1.2	1.5	1.7	2.0
60	1.2	0.9	0.6	0.2	0.0	0.2	0.6	0.9	1.2	1.5	1.8	2.1	2.5
70	1.5	1.1	0.7	0.4	0.0	0.4	0.7	1.1	1.5	1.8	2.1	2.5	2.8
80	+1.6	+1.2	+0.8	+0.4	0.0	-0.4	-0.8	-1.2	-1.6	-2.1	-2.5	-2.8	-3.3
											-		

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TABLE 28D.

For finding the Latitude of a place by Altitudes of Polaris.

[D=the 4th correction. (D has the same sign as A when the Dec. <88° 43′, the opposite sign when the Dec. >88° 48′.)] [Vertical Argument, A = the 1st correction. Horizontal Argument, the star's declination.]

						-/					00	0.404		1	D			
A.			Dec	imatio	1, 889 4	F#'						~ 48'			Pro	portic	onal p	arts.
	20''	25"	30"	85″	40''	45"	50''	55"	0''	5''	10"	15″	20''	25''	1″	2''	3"	4''
,	"	,,	,,	,,	,,	,,	"	"		,,	"	,,	,,	,,	"	"	,,	"
0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
2	1.1	1.0	0.8	0.7	0.6	0.4	0.2	0.1	0.0	$[0, 1]{0, 2}$	$\begin{bmatrix} 0.2 \\ 0.2 \end{bmatrix}$	0.4	0.6	0.7	0.0	0.0	0.1	0.1
4	2.2	1.9	1.7	1.4	1.1 1.7	0.8	0.0	0.3	0.0	0.3	0.0	0.8	$\frac{1}{1}, \frac{1}{7}$	1.4	0.1	$\begin{bmatrix} 0, 1 \\ 0, 2 \end{bmatrix}$	$\begin{bmatrix} 0.2\\ 0.9 \end{bmatrix}$	0.2
8	0.0 4.4	$\frac{2.9}{3.9}$	2.0	$\frac{2.1}{2.8}$	$\frac{1}{2.2}$	1.7	1.1	0. 6	0.0	$0.4 \\ 0.6$	1.1	1.7	$\frac{1}{2}, \frac{1}{2}$	$2.1 \\ 2.8$	0.1 0.1	0.2 0.2	$0.2 \\ 0.3$	0.3 0.4
$\frac{10}{10}$	5.6	4.9	4.2	$\frac{-3.4}{3.4}$	2.8	$\frac{1}{2.1}$	$\frac{1.4}{1.4}$	$\frac{0.7}{0.7}$	$\overline{0,0}$	$\frac{0.7}{0.7}$	1.4	$\frac{-2.1}{2.1}$	$\frac{-1}{2.8}$	3.4	$\frac{0.1}{0.1}$	$\frac{0.2}{0.3}$	$\frac{0.4}{0.4}$	$\frac{0.1}{0.6}$
$\tilde{12}$	6.7	5.8	5.0	4.2	3.3	2.5	1.7	0.8	0.0	0.8	1.7	2.5	3.3	4.1	0.2	0.3	0.5	0.6
14	7.8	6.8	5.8	4.9	3.9	2.9	1.9	1.0	0.0	1.0	1.9	2.9	3.9	4.9	0.2	0.4	0.6	0.8
16	8.9	7.8	6.7	$\frac{5.5}{2}$	4.4	3.3	2.2	$\frac{1.1}{1.0}$	$\frac{0.0}{0.0}$	$\frac{1.1}{1.0}$	2.2	3.3	4.4	5.5	0.2	$\frac{0.4}{0.4}$	$\frac{0.7}{0.7}$	0.9
18	10.0	8.8	7.5	6.2	$\frac{5.0}{5.5}$	3.8	2.5	1.2	0.0	$1.2 \\ 1.4$	2.5	3.8	5.0	6.2	0.2	0.5	0.7	1.0
$\frac{20}{22}$	11.1 12.2	10.7	0.0	$\frac{0.5}{7.7}$	6.1	4.6	$\frac{2.8}{3.0}$	$1.4 \\ 1.6$	0.0	$1.4 \\ 1.6$	$\frac{2.8}{3.0}$	4.2	$\begin{bmatrix} 0.0\\ 6.1 \end{bmatrix}$	77	0.3	0.0	0.0	1.1 1.3
24	12.2 13.3	11.7	10.0	8.3	6.7	5.0	3.3	1.7	0.0	1.7	3, 3	5.0	6.7	8.3	0.3	0.7	1.0	1.4
26	14.4	12.7	10.8	9.0	7.2	5.4	3.6	1.8	$\overline{0.0}$	1.8	3.6	5.4	7.2	9.0	0.4	0.7	1.1	1.4
28	15.6	13.6	11.7	9.7	7.8	5.8	3.9	1.9	0.0	1.9	3.9	5.8	7.8	9.7	0.4	0.8	1.1	1.5
30	16.7	14.6	12.5	10.4	8.3	$\begin{bmatrix} 6.2\\ 7\end{bmatrix}$	4.2	2.1	0.0	2.1	4.2	6.2	8.3	10.4	0.4	$[0.8]{0.8}$	1.3	1.7
-32	$\frac{17.8}{19.0}$	$\frac{10.0}{10.0}$	13.3	$\frac{11.1}{11.0}$	$\frac{8.9}{0.4}$	$\frac{0.1}{7.1}$	4.4	2.4	$\frac{0.0}{0.0}$	$\frac{4.4}{9.9}$	4.4	$\frac{0.1}{7.1}$	$\frac{0.9}{0.1}$	11.1	$\frac{0.4}{0.5}$	$\frac{0.9}{0.0}$	$\frac{1.0}{1.1}$	$\frac{1.8}{1.0}$
- 34 - 36	18.9	10.0 17 5	$14.2 \\ 15.0$	11.0 12.5	9.4	$\frac{7.1}{7.5}$	4.7	2.5	0.0	$\frac{2.5}{2.5}$	5.0	$\frac{7.1}{7.5}$	9.4	11.0 12.5	$0.5 \\ 0.5$	1.0	$1.4 \\ 1.5$	$\frac{1.9}{2.0}$
38	$\frac{20.0}{21.1}$	18.4	15.8	13.2	10.6	7.9	5.3	$2.0 \\ 2.7$	0.0	$\frac{2.0}{2.7}$	5.3	7.9	10.0 10.6	13.2	0.5	1.1	1.6	2.0 2.1
40	22.2	19.4	16.7	13.9	11.1	8.3	5.6	2.8	0.0	2.8	5.6	8.3	11.1	13.9	0.6	1.1	1.7	2.2
42	23.3	20.4	17.6	14.6	11.7	8.8	5.8	2.9	0.0	2.9	5.8	8.8	11.7	14.6	0.6	1.2	1.7	2.3
44	24.4	21.4	18.3	15.3	12.2	9.2	6.1	3.0	0.0	$\frac{3.0}{2.0}$	6.1	9.2	12.2	15.3	0.6	1.2	1.8	2.4
40	20.0 26.7	22.3	19.2 20.0	10.0 16.7	12.0 13.3	9.0	67	0.4 3.3	0.0	3.4	$ \begin{array}{c} 0.4 \\ 6 7 \end{array} $	9.0	12.0 13.3	10.0 16.7	0.0 0.7	1.0	1.9	2.0 2.6
-50	$\frac{20.1}{97.8}$	20.0	$\frac{20.0}{20.8}$	$\frac{10.1}{17.3}$	$\frac{10.0}{13.9}$	$\frac{10.0}{10.4}$	6.9	$\frac{0.0}{3.4}$	$\frac{0.0}{0.0}$	3 4	6.9	$\frac{10.0}{10.4}$	$\frac{10.0}{13.9}$	17.3	$\frac{0.7}{0.7}$	14	$\frac{2.0}{2.1}$	$\frac{2.0}{2.8}$
52	28.9	25.3	21.7	18.0	14.4	10.8	7.2	3.6	0.0	3.6	7.2	10.8	14.4	18.0	0.7	1.4	2.2	2.9
54	30.0	26.2	22.5	18.8	15.0	11.2	7.5	3.8	0.0	3.8	7.5	11.2	15.0	18.8	0.7	1.5	2.2	3.0
56	31.1	27.2	23.3	19.4	15.6	11.7	7.8	3.9	$\left \underline{0,0} \right $	3.9	7.8	11.7	15.6	19.4	0.8	1.6	2.3	$\frac{3.1}{}$
58	$\frac{32.2}{22}$	28.2	24.2	20.1	16.1	12.1	8.0	$ \frac{4.0}{4.0} $	0.0	$\frac{4.0}{1.0}$	8.0	12.1	16.1	20.1	0.8	1.6	2.4	$ \frac{3.2}{2.2} $
60	33.3	29.2	25.0 25.8	20.8 91.5	10.7 17.9	12.0	8.5	4.2	0.0	4.2	8.5	12.0	10.7	20.8	0.8	1.7	2.0	3.3
$61 \\ 64$	35.6	31.1	$\begin{bmatrix} 20.0\\ 26.7 \end{bmatrix}$	$21.0 \\ 22.2$	17.2 17.8	12.0 13.3	8.9	4.4	0.0	4.4	8.9	12.0 13.3	17.8	22.2	0.9	1.8	$\frac{2.0}{2.7}$	3.6
66	$\overline{36.7}$	$\overline{32.1}$	$\overline{27.5}$	22.9	18.3	13.8	9.2	4.6	0.0	4.6	9.2	13.8	18.3	22.9	0.9	1.8	2.8	3.7
68	37.8	33.0	28.3	23.6	18.9	14.2	9.4	4.7	0.0	4.7	9.4	14.2	18.9	23.6	0.9	1.9	2.8	3.8
70	38.9	34.0	29.2	24.3	19.4	14.6	9.7	4.9	0.0	4.9	9.7	14.6	19.4	24.3	1.0	1.9	2.9	3.9
72	40.0	35.0	30.0	25.0	20.0	15.0	10.0	5.0	0.0	5.0	10.0	15.0	20.0	25.0	1.0	2.0	3.0	4.0
						Des		a)	1	1					1	1		1
						Prop	ortion	ai pai	us.	1			1					
1 11	"	"	"	"	"	"	"	"	"	"	"	"	"	"	1			
0 20	0.2	0.2	0.1	0.1	0.1	0.1	0.0	$[0.0]{0.0}$	0.0	$[0.0]{0.0}$	$\begin{bmatrix} 0.0\\ 0.0 \end{bmatrix}$	0.1	$\begin{bmatrix} 0.1\\ 0.2 \end{bmatrix}$	$\begin{bmatrix} 0.1\\ 0.2 \end{bmatrix}$				
0 40	0.4	0.3	0.3	0.2	0.2	0.1	0.0	$\begin{bmatrix} 0.0\\ 0.1 \end{bmatrix}$	0.0	0.0	0.0	0.1	0.2	$\begin{bmatrix} 0.2\\ 0.4 \end{bmatrix}$				
1 20	$0.0 \\ 0.7$	$0.5 \\ 0.7$	0.4	0.4	0.3	$0.2 \\ 0.2$	0.1	0.1	0.0	0.1	0.1	$0.2 \\ 0.2$	0.3	0.4				
1 40	0.9	0.8	0.7	0.6	0.5	0.3	0.2	0.1	0.0	0.1	0.2	0.3	0.5	0.6				
$2 \ 00$	1.1	1.0	0.8	0.7	0.6	0.4	0.2	0.1	0.0	0.1	0.2	0.4	0.6	0.7				
					f				1		1	1			1			

TABLE 28D.

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For finding the Latitude of a place by Altitudes of Polaris.

[D=the 4th correction. (D has the same sign as A when the Dec. <88° 48', the opposite sign when the Dec. >88° 48'.)] [Vertical Argument A=the 1st correction. Horizontal Argument, the star's declination.]

		De	eclinatio	n, 88° 4	8'				88° 49'			Pr	oportio	nal par	ts.
А.	30"	35″	40"	45"	50″	55''	0"	5''	10''	15″	20″	1"	2''	3''	4''
,	"	,,	,,	,,	"	"	"	"	"	"	"	"	,,	,,	"
0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
$\frac{2}{4}$	$0.8 \\ 1.7$	$1.0 \\ 1.9$	$\frac{1.1}{2.2}$	$\frac{1.2}{2.5}$	$1.4 \\ 2.8$	$\frac{1.0}{3.1}$	$\frac{1.7}{3.3}$	$\frac{1.8}{3.6}$	$\frac{1.9}{3.9}$	$\begin{bmatrix} 2.1\\ 4.2 \end{bmatrix}$	$\frac{2.2}{4.4}$	0.0 0.1	$0.1 \\ 0.1$	$0.1 \\ 0.1$	$0.1 \\ 0.2$
6	2.5	2.9	3.3	3.8	4.2	4.6	5.0	5.3	5.8	6.2	6.7	0.1	0.2	0.2	0.3
- 10	$\frac{3.3}{4.9}$	$\frac{3.9}{4.9}$	$\frac{4.4}{5.6}$	$\frac{5.0}{6.2}$	$\frac{5.6}{6.9}$	$\frac{6.1}{7.6}$	<u> </u>	$\frac{7.2}{9.0}$	9.7	$\frac{8.3}{10.4}$	8.9	$\frac{0.1}{0.1}$	$\frac{0.2}{0.3}$	$\frac{0.3}{0.4}$	$\frac{0.4}{0.6}$
12	5.0	5.8	6.7	7.5	8.3	9.2	10.0	10.8	11.7	12.5	13.3	$0.1 \\ 0.2$	0.3	$0.4 \\ 0.5$	0.0 0.7
14	5.8	6.8	7.8	8.8	9.8	10.8	11.8	12.7	13.7	14.6 16.7	15.6	0.2	0.4	0.6	0.8
$\frac{10}{18}$	$\frac{0.7}{7.5}$	8.8	$\frac{0.9}{10.0}$	$\frac{10.0}{11.2}$	$\frac{11.1}{12.5}$	$\frac{12.2}{13.8}$	$\frac{10.0}{15.0}$	$\frac{14.4}{16.2}$	$\frac{10.0}{17.5}$	18.8	$\frac{17.8}{20.0}$	$\frac{0.2}{0.2}$	$\frac{0.4}{0.5}$	$\frac{0.7}{0.7}$	$\frac{0.9}{1.0}$
$\tilde{20}$	8.3	9.7	11.1	12.5	13.9	15.3	16.7	18.1	19.4	20.9	22.2	0.3	0.6	0.8	1.1
$\frac{22}{24}$	9.2 10.0	10.7 11.7	$12.2 \\ 13.3$	$\frac{13.8}{15.0}$	$15.3 \\ 16.7$	16.8 18.4	18.3 20.0	$19.8 \\ 21.7$	$21.4 \\ 23.3$	$22.9 \\ 25.0$	$24.4 \\ 26.7$	$0.3 \\ 0.3$	$0.6 \\ 0.7$	1.0 1.0	$1.3 \\ 1.4$
26	10.8	12.7	14.4	16.2	18.0	19.9	21.7	23.5	25.3	27.1	28.9	0.4	0.7	1.1	1.4
28	11.7	13.6	15.6 16.7	17.5	19.4	21.4	23.3 25.0	25.3 27.1	27.2	29.2 31.2	$\frac{31.1}{22}$	0.4	0.8	1.2	1.6
$\frac{30}{32}$	$12.0 \\ 13.3$	$14.0 \\ 15.6$	17.8	20.0	20.8 22.2	24.4	26.0 26.7	27.1 28.9	31.1	33.3	35.5 35.5	0.4	0.9	$1.2 \\ 1.3$	$1.0 \\ 1.8$
34	14.2	16.6	18.9	21.2	23.6	26.0	28.4	30.7	33.1	35.4	37.8	0.5	0.9	1.4	1.9
- 36 - 38	15.0 15.8	$17.5 \\ 18.4$	20.0 21.1	$\frac{22.5}{23.8}$	25.0 26.4	$\frac{27.5}{29.0}$	30.0 31.6	$32.5 \\ 34.2$	35.0 37.0	37.5	$40.0 \\ 42.2$	$0.5 \\ 0.5$	$1.0 \\ 1.1$	$1.0 \\ 1.6$	$2.0 \\ 2.2$
40	16.7	19.4	22, 2	25.0	27.8	30.6	33.3	36.1	38.9	41.7	44.4	0.6	1.1	1.7	2.2
42	17.6	20.4	23.3	26.2 27.5	29.2 30.6	32.1	35.0	37.9	40.8	43.8	46.7	0.6	1.2	1.8	2.4
46	$10.3 \\ 19.2$	21.4 22.3	24.4 25.6	28.8	32.0	35.1	38.3	41.5	44.8	47.9	51.1	0.6	1.2 1.3	1.9	$2.4 \\ 2.6$
	20.0	23.3	26.7	30.0	33.3	36.7	40.0	43.3	46.7	50.0	53.3	0.7	1.3	2.0	2.7
$\frac{50}{52}$	$20.8 \\ 21.7$	24.3 25.3	27.8 28.9	$\frac{31.2}{32.5}$	34.7 36.1	38.2 39.7	41.7 43.3	45.1	48.6	52.1 54.2	55.5 57.8	0.7 0.7	1.4	$\frac{2.1}{2.2}$	$2.8 \\ 2.9$
$5\overline{4}$	22.5	26.2	30.0	33.8	37.5	41.2	45.0	48.7	52.5	56.2	60.0	0.7	1.5	2.2	$\bar{3}.0$
56	$\frac{23.3}{94.9}$	$\frac{27.2}{99.9}$	$\frac{31.1}{20.0}$	$\frac{35.0}{26.9}$	$\frac{38.9}{40.2}$	42.8	46.7	50.5	54.4	$\frac{58.3}{60.1}$	$\frac{62.2}{64.4}$	$\frac{0.8}{0.8}$	$\frac{1.6}{1.6}$	$\frac{2.3}{9.4}$	$\frac{3.1}{2.9}$
- 58 - 60	$24.2 \\ 25.0$	$\begin{array}{c} 28.2\\29.2\end{array}$	34.4 33.3	30.2 37.5	40.5	44.5	40. 5 50. 0	54.2	58.3	62.5	66.7	0.8	$1.0 \\ 1.7$	$2.4 \\ 2.5$	3.4 3.3
62	25.8	30.1	34.4	38.8	43.0	47.3	51.7	56.0	60.3	64.6	68.9	0.9	1.7	2.6	[3, 4]
$\frac{-64}{-66}$	$\frac{26.7}{27.5}$	$\frac{31.1}{32.1}$	$\frac{30.0}{36.7}$	$\frac{40.0}{41.2}$	$\frac{44.4}{45.8}$	$\frac{48.9}{50.4}$	$\frac{33.3}{55.0}$	$\frac{57.8}{59.6}$	$\frac{62.2}{64.2}$	68.8	$\frac{71.1}{73.3}$	$\frac{0.9}{0.9}$	$\frac{1.8}{1.8}$	$\frac{2.7}{2.7}$	$\frac{3.0}{3.6}$
68	28.3	33.0	37.8	42.5	47.2	52.0	56.7	61.3	66.1	70.9	75.5	0.9	1.9	2.8	3.8
$\frac{70}{72}$	29.2	34.0	38.9	43.8	48.6	53.5 55.0	58.3	63.1	$\begin{bmatrix} 68.0 \\ 70.0 \end{bmatrix}$	72.9	80.0	1.0	1.9	2.9	$\begin{bmatrix} 3.9\\ 4 & 0 \end{bmatrix}$
14	50.0	55.0	10.0	10.0	00.0	00.0	00.0	00.0	10.0	10.0	00.0	1.0	2.0	0.0	1.0
					Prop	rtional	parts.								
, ,,		"	"	"	"	"	"	"	"	"	"				
020	0.1	0.1	0.1	$0.2 \\ 0.4$	$0.2 \\ 0.5$	0.3	0.3	0.3	0.3	$\begin{bmatrix} 0.3\\ 0.7 \end{bmatrix}$	$0.4 \\ 0.7$				
1.00	$0.2 \\ 0.4$	0.5	0.4	0.4	0.5	0.8	0.8	0.9	0.9	1.0	1.1				
1 20	0.5	0.7	0.7	0.8	0.9	1.1	1.1	1.2	1.3	1.4	1.5				
$140 \\ 200$	0.8	1.0	0.9	$1.0 \\ 1.2$	1.1	1.3	$1.4 \\ 1.7$	$1.0 \\ 1.8$	1.0	$\frac{1.7}{2.1}$	$1.8 \\ 2.2$				

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TABLE 29.

Conversion Tables for Nautical and Statute Miles.

						1					
	Nau	tical miles	into statute	miles.			Statut	te miles int	lo nauticat r	niles.	
	1 naut 1 statu	ical mile o te mile	or knot $= 6,$ = 5,	080 feet. 280 feet.			1 statut 1 nautie	e mile cal mile o	=5,2 r knot = 6,0	80 feet. 80 feet.	
Nautical miles. 1.00 1.25 1.50 1.75 2.00 2.25 2.50 2.75 3.00 3.25 3.50 3.75 4.00 4.25	1 statu Statute miles. 1, 151 1, 439 1, 727 2, 015 2, 303 2, 590 2, 878 3, 166 3, 454 3, 742 4, 030 4, 318 4, 606 4, 893	Nautical miles. 8,75 9,00 9,25 9,50 9,75 10,00 10,25 10,50 10,50 10,75 11,00 11,25 11,50 11,75 12,00	=5, Statute miles. 10. 075 10. 363 10. 651 10. 939 11. 227 11. 515 11. 803 12. 090 12. 378 12. 666 12. 954 13. 242 13. 530 13. 818	Nautical miles. 16.50 16.75 17.00 17.25 17.50 18.00 18.50 18.75 19.00 19.25 19.50 19.75	Statute miles. 18.999 19.287 19.575 19.863 20.151 20.439 20.727 21.015 21.303 21.878 22.166 22.454 22.742	Statute miles. 1.00 1.25 1.50 1.75 2.00 2.25 2.50 2.75 3.00 3.25 3.50 3.75 4.00 4.25	I nauti Nautical miles. 0. 868 1. 085 1. 302 1. 519 1. 736 1. 953 2. 170 2. 387 2. 604 2. 821 3. 038 3. 256 3. 473 3. 690	Statute miles. 7.00 9.25 9.50 9.50 10.00 10.25 10.00 10.75 11.00 11.25 11.50 12.00 12.25	$ r \text{ knot} = 6,0 \\ \hline \text{Nautical miles.} \\ \hline 7.815 \\ 8.032 \\ 8.249 \\ 8.467 \\ 8.684 \\ 8.901 \\ 9.118 \\ 9.335 \\ 9.552 \\ 9.769 \\ 9.986 \\ 10.203 \\ 10.420 \\ 10.638 \\ \hline \end{cases} $	Statute miles. 17.00 17.55 17.50 17.51 18.00 18.25 18.50 19.00 19.25 19.50 19.75 20.00 20.25	Nautical miles. 14, 763 14, 980 15, 197 15, 414 15, 632 15, 849 16, 066 16, 283 16, 500 16, 717 16, 934 17, 151 17, 369 17, 586
$\begin{array}{c} 4.25\\ 4.50\\ 4.75\\ 5.00\\ 5.25\\ 5.50\\ 5.50\\ 5.50\\ 6.25\\ 6.50\\ 6.75\\ 7.00\\ 7.25\\ 7.50\\ 7.75\\ 8.00\\ 8.25\\ 8.50\\ \end{array}$	$\begin{array}{c} \textbf{1}, \textbf{093}\\ \textbf{5}, \textbf{181}\\ \textbf{5}, \textbf{469}\\ \textbf{5}, \textbf{757}\\ \textbf{6}, \textbf{045}\\ \textbf{6}, \textbf{333}\\ \textbf{6}, \textbf{621}\\ \textbf{6}, \textbf{909}\\ \textbf{7}, \textbf{196}\\ \textbf{7}, \textbf{484}\\ \textbf{7}, \textbf{772}\\ \textbf{8}, \textbf{060}\\ \textbf{8}, \textbf{348}\\ \textbf{8}, \textbf{636}\\ \textbf{8}, \textbf{924}\\ \textbf{9}, \textbf{212}\\ \textbf{9}, \textbf{500}\\ \textbf{9}, \textbf{787} \end{array}$	$\begin{array}{c} 12, 25\\ 12, 50\\ 12, 75\\ 13, 00\\ 13, 25\\ 13, 50\\ 13, 75\\ 14, 00\\ 14, 25\\ 14, 50\\ 14, 50\\ 14, 75\\ 15, 00\\ 15, 25\\ 15, 50\\ 15, 75\\ 16, 00\\ 16, 25\\ \end{array}$	$\begin{array}{c} 14.\ 106\\ 14.\ 393\\ 14.\ 681\\ 14.\ 969\\ 15.\ 257\\ 15.\ 545\\ 15.\ 833\\ 16.\ 121\\ 16.\ 409\\ 16.\ 696\\ 16.\ 984\\ 17.\ 272\\ 17.\ 560\\ 17.\ 848\\ 18.\ 136\\ 18.\ 424\\ 18.\ 712\\ \end{array}$	$\begin{array}{c} 10, 10\\ 20, 00\\ 20, 25\\ 20, 50\\ 20, 75\\ 21, 00\\ 21, 25\\ 21, 50\\ 21, 75\\ 22, 00\\ 22, 25\\ 22, 50\\ 22, 75\\ 23, 50\\ 24, 00\\ 24, 50\\ 25, 00\\ \end{array}$	$\begin{array}{c} 23,030\\ 23,318\\ 23,606\\ 23,893\\ 24,181\\ 24,469\\ 24,757\\ 25,045\\ 25,333\\ 25,621\\ 25,909\\ 26,196\\ 26,484\\ 27,060\\ 27,636\\ 28,212\\ 28,787\\ \end{array}$	$\begin{array}{c} \textbf{4.250} \\ \textbf{4.75} \\ \textbf{5.005} \\ \textbf{5.250} \\ \textbf{5.75} \\ \textbf{5.575} \\ \textbf{6.250} \\ \textbf{6.550} \\ \textbf{6.550} \\ \textbf{6.575} \\ \textbf{7.000} \\ \textbf{7.550} \\ \textbf{7.550} \\ \textbf{7.550} \\ \textbf{8.255} \\ \textbf{8.550} \\ \textbf{8.75} \\ \textbf{8.850} \\ \textbf{8.75} \\ 8.$	$\begin{array}{c} 3.907\\ 4.124\\ 4.341\\ 4.559\\ 4.776\\ 4.994\\ 5.211\\ 5.428\\ 5.645\\ 5.862\\ 6.079\\ 6.296\\ 6.513\\ 6.730\\ 6.947\\ 7.164\\ 7.381\\ 7.598\\ \end{array}$	$\begin{array}{c} 12, 20\\ 12, 75\\ 13, 00\\ 13, 25\\ 13, 50\\ 13, 75\\ 14, 00\\ 14, 25\\ 14, 50\\ 14, 75\\ 15, 00\\ 15, 25\\ 15, 50\\ 15, 75\\ 16, 00\\ 16, 25\\ 16, 50\\ 16, 75\\ \end{array}$	$\begin{array}{c} 10.855\\ 11.072\\ 11.289\\ 11.507\\ 11.724\\ 11.941\\ 12.158\\ 12.376\\ 12.593\\ 12.810\\ 13.027\\ 13.244\\ 13.461\\ 13.678\\ 13.895\\ 14.112\\ 14.329\\ 14.546\end{array}$	$\begin{array}{c} 20, 50\\ 20, 50\\ 21, 25\\ 21, 00\\ 21, 25\\ 21, 50\\ 22, 25\\ 22, 50\\ 22, 75\\ 23, 00\\ 23, 25\\ 23, 55\\ 24, 00\\ 24, 25\\ 24, 50\\ 25, 00\\ \end{array}$	$\begin{array}{c} 17,803\\ 17,803\\ 18,020\\ 18,237\\ 18,454\\ 18,671\\ 18,888\\ 19,105\\ 19,322\\ 19,539\\ 19,756\\ 19,973\\ 20,191\\ 20,408\\ 20,625\\ 20,842\\ 21,060\\ 21,277\\ 21,711 \end{array}$

and strated .

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TABLE 30.

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Conversion Tables for Metric and English Linear Measure. Metric to English.

Meters.	Feet.	Yards.	Statute miles.	Nautical miles.
$ \begin{array}{r} 1 \\ 2 \\ 3 \\ 4 \\ 5 \\ 6 \\ 7 \\ 8 \\ 9 \\ 9 \\ 5 5 5 5 5 $	$\begin{array}{cccccccccccccccccccccccccccccccccccc$	$\begin{array}{cccccccccccccccccccccccccccccccccccc$	$\begin{array}{cccccccccccccccccccccccccccccccccccc$	$\begin{array}{cccccccccccccccccccccccccccccccccccc$
		English to metr	ic.	
No.	Feet to meters.	Yards to meters.	Statute miles to meters.	Nautical miles to meters.
$ \begin{array}{r} 1 \\ 2 \\ 3 \\ 4 \\ 5 \\ 6 \\ 7 \\ 8 \\ 9 \\ 9 \end{array} $	$\begin{array}{cccccccccccccccccccccccccccccccccccc$	$\begin{array}{cccccccccccccccccccccccccccccccccccc$	$\begin{array}{c} 1, 609. 35\\ 3, 218. 70\\ 4, 828. 05\\ 6, 437. 40\\ \hline 8, 046. 75\\ 9, 656. 10\\ 11, 265. 45\\ 12, 874. 80\\ 14, 484. 15\\ \end{array}$	$\begin{array}{c} 1,853.25\\ 3,706.50\\ 5,559.75\\ 7,413.00\\ 9,266.25\\ 11,119.50\\ 12,972.75\\ 14,826.00\\ 16,679.25\\ \end{array}$

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TABLE 31.

Conversion Tables for Thermometer Scales.

[F°=Fahrenheit temperature; C°=Centigrade temperature; R°=Réaumur temperature.]

Eq	uivalent te	Réau													
	R C	$c^{\circ} = \frac{4}{5} C^{\circ} = \frac{5}{4} R^{\circ} =$	4 (F ^o - 5 (F ^o -	$-32^{\circ}).$ $-32^{\circ}).$											
F°.	C°.	R°.	F°.	C°.	R°.										
$\frac{1}{2}$	$-17.2 \\ 16.7$	$-13.8 \\ 13.3$	$51 \\ 52$	+10.6 11.1	$+ \frac{8.4}{8.9}$		Equiv	valent	temperat	ures—	Centigra	de an	d Fahre	nheit.	1
3	16.1 15.6	12.9 12.4	53 54	11.7	9.3				:	$F^{\circ} = \frac{n}{8}$	℃+32°.				
5	15.0	12. 4	55	12.8	10.2	C°.	F°.	C°.	F°.	C°.	F ^o .	C°.	F°.	C°.	Fo.
$\frac{6}{7}$	14.4 13.9	$11.6 \\ 11.1$	56 57	13.3	10.7 11.1										
8	13.3	10.7	58	14.4	11.6	-10_{0}	14.0	0	32.0	$10 \\ 11$	50.0	20	68,0	$\frac{30}{21}$	86.0
9	12.8 12.2	10.2	59 60	15.0 15.6	12.0 12.4	$- \frac{3}{8}$	10.8 17.6	$\frac{1}{2}$	35.6	$11 \\ 12$	51.6 53.6	$\frac{21}{22}$	71.6	$\frac{31}{32}$	89.6
11	11.7	9.3	61	16.1	12.9	-7	19.4	3	37.4	13	55.4	23	73.4	33	91.4
12	11.1	8.9	62	16.7	13.3	-6 - 5	$\begin{array}{c} 21.2 \\ 23.0 \end{array}$	$\frac{4}{5}$	39.2 41 0	14	57.2 59.0	$\frac{24}{25}$	$\begin{array}{c c} 75.2\\ 77.0 \end{array}$	$\frac{34}{35}$	93.2 95.0
13	10.6 10.0	8.4	63	17.2 17.8	13.8 14.2	-4	24.8	6	42.8	$16 \\ 16$	60.8	26	78.8	36	96.8
15	9.4	7.6	65	18.3	14.7	- 3	26.6	7	44.6	17	62.6	27	80.6	37	98.6
16	8.9	7.1	66	18.9	15.1	-2 -1	$\frac{28.4}{30.2}$	8	46.4	18	64.4 66.2	$\frac{28}{29}$	82,4	$\frac{38}{39}$	100.4 102.2
17	$\frac{8.3}{7.8}$	6.7	67	19.4	15.6	1	00.2	ľ	10.4	10	00.2	20	01.2	00	102.2
19	7.2	5.8	69	20.6	16.4										
20	6.7	5.3	70	21.1	16.9										
21		4.9	$\frac{71}{72}$	21.7	17.3 17.8										
23	5.0	4.0	$7\overline{3}$	22.8	18.2										
24	4.4	3.6	74	23.3	18.7										
25	3.9	3.1 97	75	23.9	19,1										
27	2.8	2.2	77	25.0	20.0		Equ	ivalen	t tempero	tures-	-Réaum	ur and	t Fahre	nheit.	
28	2.2	1.8	78	25.6	20.4					$F^{o}=\frac{9}{4}$	R°+32°				
29 30	1.7	1.3	79 80	26.1	20.9 21.3			. 1	700		1	1 -			
31	-0.6	-0.4	81	27.2	21.8	R0.	F	°.	R ⁰ .	F ⁰ .	R°.	ŀ		Rº.	F°.
32	0.0	0.0	82	27.8	22.2	1(9.5	0	32.0	10	5	64.5	20	.77.0
$\frac{33}{34}$	+ 0.6	$+ 0.4 \\ 0.9$	83 84	28.3	22.7 23.1	{) 1	1.8	1	34.2	11	10	6.8	$\overline{21}$	79.2
35	1.7	1.3	85	29.4	23.6	- 8	$\begin{array}{c ccccccccccccccccccccccccccccccccccc$	$\frac{4.0}{2}$	$\frac{2}{2}$	36.5	$12 \\ 12$	5	9.0	22	81.5
36	2.2	1.8	86	30.0	24.0	- 6	3 18	$3.2 \\ 8.5$	4	41.0	13	l é	33.5	24	86.0
37	2.8	2.2	87	30.6	24.4	- 8	5 20	0.8	5	43.2	15	6	5.8	25	88.2
39	3.9	3.1	89	31.7	25.3		$\frac{1}{2}$	3.0	$\frac{6}{7}$	45.5	16		8.0	26	90.5
40	4.4	3.6	90	32.2	25.8		$\frac{2}{2}$	5. 2 7. 5	8	50.0	18	1	$2.5^{0.2}$	$\frac{27}{28}$	95.0
$\frac{41}{42}$	5.0	4.0	91 92	32.8	26.2 26.7		1 29	9.8	9	52.2	19	7	4.8	29	97.2
43	6.1	4.9	93	33.9	27.1						1				
44	6.7	5.3	94	34.4	27.6										
45 46	7.8	$\begin{bmatrix} 5.8 \\ 6.2 \end{bmatrix}$	96	35. 6	28.0 28.4										
47	8.3	, 6.7	97	36.1	28.9										
48	8.9		98	36.7	29.3										
50	+10.0	+ 8.0	100	+37.8	+30.2										
			1												

			TABLE 32.		Page 565
Т	o ol	btain the True Force and Dir	rection of the Wind from Moving Vessel.	its Apparent Force and	l Direction on a
	9	True force, Beaufort scale.	0180084040000000000000	72888888888888888888888888888888888888	HINNAN
		True direction, points off the bow.	222222222222222222222222222222222222222	16 16 16 16 16 16 16 16 16 16 16 16 16 1	1661666166
		True force, Beaufort scale.	01000404000000000000	rxxxxxxxxxx2051511	1122222222
	1	True direction, points off the bow.	16 16 15 15 15 15 15 15 15 15 15 15 15 15 15	255555555555555555555555555555555555555	55555555555
	-	True force, Beaufort scale.	0,000,00,00,00,00,00,00,00,00,00,00,00,	<u>∽∞∞∞∞∞∞∞000000000000000000000000000000</u>	1222222222
	÷	True direction, points off the bow.		244554455455555555555555555555555555555	**************************************
		True force, Beaufort scale.	01000040040000000000	~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~	1222222222
	1	True direction, points off the bow.	59999999999999999999999999999999999999		
	21	True force, Beaufort scale,	010040040040000000000	rr*r**********************************	111222222222
	-	True direction, points off the bow.	9697667767777777	***********************	assesses assesses
	_	Ттие force, Beaufort seale.	0,0404040000000	91-21-222222222222000	11111222222
	-	True direction, points off the bow.	SUCTION STREET	988998899989998998	2222222222
		True force, Beaufort scale.	0,0040040040400000	922209999888999999999999999999999999999	
bow	-	True direction, points off the bow.	22222222222222222222222222222222222222	22222222222222222	=======
ff the	-	Ттие force, Beaufort scale.	0,0,40,040,40,40,90,60	992222888444466	8111138333
nts o	0.0	True direction, points off the bow.	85582255525555555		991999999
(poi	~	Ттие force, Beaufort scale.	01 00 4 01 00 4 00 4 10 4 10 4 10 10 10	000000000000000000000000000000000000000	2221111000 22211111000
wind	30	True direction, points off the bow.	5198813884 4 88999	10 3 10 3 11 3 3 11 10 11 10 11 10 10 10 10 10 10 10 10	6601 6601 6601 6601
the		Ттие force, Beaufort scale.	01 00 4 01 00 4 00 00 4 00 7 10 4 10 10	10100001-1-1-xxxx000	866111353
on of		True direction, points off the bow.	5195112351232222 519511235222	011008008666666666666666666666666666666	x x & x x & x x & x x x
recti		Ттие force, Beaufort seale.	01 00 7 01 00 7 01 00 7 00 00 7 7 7 7		10110 ⁹
ent di	Ť	True direction, points off the bow.	55553346556655555	x a g x a g r x a r x a r x x	xx
ppare		Ттие force, Beaufort scale.	H 01 7 H 01 00 01 01 00 01 00 00 07 4	448000000000000000000000000000000000000	9 9 10 110 112 111
A	10	True direction, points off the bow.	5°°°51242518°°51°°°5	- x 0 - x 0 x 0 x 0 x 0 x 0 x 0 x 0 x 0	0001001000
		Ттие force, Beaufort scale.		400004400000000000	9 10 110 110 110 111 111
	-7	True direction, points off the bow.	0×120×22941255555	©0000014001044004400	0000000400
		Тгие fórce, Beaufort scale.	-04-00000-0000	000044000041-00001-1-	988010 10 10 10 10 10 10 10 10 10 10 10 10
	**	True direction, points off the bow.	04°59°63588358555	10 0 0 4 10 1- 4 10 0 4 4 10 4 4 10	यां या या या या या 00 या या
	•	True force, Beaufort scale.	-0000000000000000	000140010441-000ro	$ \begin{array}{c} 8 & 8 & 9 \\ 9 & 9 & 9 & 11 \\ 11 & 9 & 9 & 11 \\ 11 & 10 & 10 & 10 \\ $
		True direction, points off the bow.	5555547-5120×54.00	00 CO 45 45 CO 00 45 CO 00 45 CO 40 CO 00	01 00 00 01 00 00 01 01 00
		True force, Beaufort scale.	-00000000000000	∞√1∞∞∞∞∞∞∞∞∞∞∞∞∞∞∞∞∞∞∞	$\begin{smallmatrix}&&&&\\&&&&\\&&&&&\\&&&&&\\&&&&&\\&&&&&\\&&&&&\\&&&&$
	-	True direction, points off the bow.	888445585588858886946	0.00.00.00.00.00.00.00.00.00.00	
		Ттие force, Beaufort scale.	01/000100001000/10	00040010400040010400100	$ \begin{array}{c} 10 \\ 9 \\ 11 \\ $
	-	True direction, points off the bow.	000000000000000000000000000000000000000	••••••••••••	000000000
		Speed of vessel, knots.	2021502150215021502150215021502150215021	25555555555555555555555555555555555555	2021202220210 202120222020
		Appar- ent force of the Wend (Beau- fort scale).	<u></u>	<u>, , , , , , , , , , , , , , , , , , , </u>	10

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TABLE 33.

Distance by Vertical Angle.

													_			_																		_		_
	150	1 0	13 52	7 02	4 42	3 32	2 49	727	1 46	1 34	1 25	1 17		80	0 67	0 23	0.00	0 47 0 45	0 42	0 40	0 39	0 35	0 34	800	0 30	0 29	0 28	0 25	0 24	0 21	0 20	6T 0	0 18	0 17		
	140	. 0	19.58	6 34	4 23	3 18	2 38	2 12	1 20	1 28	1 19	1 12	1.06	1 01	0 20	0 49	0 47	0 44 0 42	0 40	0 38	2200	5 C	0 32	06.0	0.58	0 27	0.28	030	0 22	0 20	0 19	0 18	0 16	0 16		
-	130	0	19 04	90 9	4 05	3 04	2 27	505		1 22	1 14	1 07	10 1	0 53	0.0	0 46	0 43	0 41	0 37	0 35	0 22	0 31	0 29	220	0 26	0 25	380	0.22	0 20	0 18	0 17	11 0	0 15	0 15	-	
	120	. 0	11 10	1 200	3 46	2 49	2 16	1 23	1 37	1 15	1 08	1 02	0 57	0 52	24 0	0 45	0 40	880	0 34	0 32	0 31	88	0 27	0.20	0 24	0 23	0 8 0 0	0 20	0 19	0 12	0 16	0 15	0 14	0 14		
	110		10.15	2 10	3 27	2 35	2 04	1 44	67 T	100	1 02	0 57	052	0 48		0 39	0 37	88	0 31	0 30	818	0 26	0 25	F7 0	38	0 21	0 21	0 18	0 17	0 10	0 15	0 14	0 13	0 12	-	
	100	0	0.90	4 49	80	2 21	1 53	134	127	18	0 57	0 51	0 47	0 44	0 40	0 35	0 33	0.31	0 28	0 27	0 26	0 24	0 23		0 20	0 20	0 19	0 17	0 16	0 14	0 14	0 13	0 12	0 11		
	95	\ 0	8 53	4 28	2 59	2 14	1 47	1 30	11 1	1 00	0 54	0 49	0 45	0 41	000	880	0 32	0.00	0 27	0 26	0 24	32	0 21	120	0 19	0 19	0 18.	0 16	0 15	0 13	0 13	0 12	0 11 0	0 11	-	
-	90	. 0	8 95	414	2 49	2 07	1 42	1.25	1 12	1 04	0.51	0 46	0 42	0 30	000	0 32	0 30	0 28	0 25	0 24	0.23	0 21	0.20	020	0 18	0 18	0 17	0 15	. 0 14	0 13	0 12	0 12		0 10	_	
-	83	. 0	7 58	4 00	2 40	2 00	1 36	$\frac{1}{20}$	68	380	0 48	0 44	0 40	0 37	1000	080	0 28	0 27	0 24	0 23	22 0 0	82	0 19	0 10	0 17	0 17	0 16	0 14	0 13	0 12	0 11	0 11	010	0 10	_	
, .	80	0	7 30	3 46	2 31	1 53	1 30	1 15	81	020	0 45	0 41	0 38	88	70 0	0 28	0 27	0 25	0 23	0 22	0 21	0 19	0 18	11 0	0 16	0 16	0 15	0 13	0 13	0 11					-	
	25	0	7 00	100	2 21	1 46	1 25	1 11	101	0 47	0 42	0 39	0 35		0000	0.22	0 25	0 24	0 21	0 20	0 19	0 18	0 17	0 TC	0 15	0 15	0 14		110	11 0						
	20	0	6 2.4	181 8	2 12	1 39	1 19	1 06	0.97	0 49 0	0 40	0 36	0 33	080	0 20 0 20 0 20	38	0 23	85 00	0.20	0 19	$0 \frac{18}{18}$	0 17	0 16	0 10	0 14	0 14	0 13-	110	100	0 10						
	65	. 0	6 00	33	5 05	1 32	111	1 01	0 23	0 40	0 37	0 33	0 31	0 28	0.70	នន	0 22	0 20	0 18	0 18	0 17	0 15	0 15	0 14	0 13	0 13	0 12								-	
	60	0	5 90 Y	0000	1.53	1 25	1 08	0 57	0 48	0 42	0.34	0.31	0 28	0 26	1 24	220	0 20	0 19	0 17	0 16	0 15	0 14 0	0 13	0 13	0 12	0 11	0 10			1.					_	
	22	. 0	R 10	100	141	1 18	1 02	0 52	0 44	0 35	0.31	0 28	0 26	0 24	77.0	0 21	0 18	0 17	910	0 15	0 14	0 14 0	0 12	0 12	110	0 10	0 10								-	
	50		4 40	- 1	12	111	0 57	0 47	0 40	2 C C	- 86 0	0 26	0 24	0 53	0.20	0 18	0 17	0 16	0 14	0 14	0 13	0 12 0 12	0 11	11 0	010	0 10	6 0									
	45	0	1 1 1	4 F4	1 95	102	0 51	0 42	880	0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0	0.05	0.23	0 21	0 20	0 19	0 16	0 15	0 14	0 13	0 13	0 12	0 12 0 12	0 11	0 10	0 6 0	6 0	6 0									
	40	0	0 40	0 1 2 2 2 2 2	112	0 57	0 45	0 38	0 33	0 0 2 2 2 2	0.93	0.25	0 19	0 17	0 10	0 15 0	0 13	0 13	0 11	0 11	0 10	0 10	6 0	6 0 0	0 0 0	0 8	0 8									
Diet	cnots.		10	10	1 00		0.5	9.		×.0	20	.1.	÷.	°, -	+ ;	1.5		x, c	0.6	:-:	67	0, 4	2.5	91	- 00	6.	3.0	14	. 90	4.0		4.	e «	5.0	-	

				TABLE 33.	[Page 567
				Distance by Vertical Angle.	
	2,000	• •	22 22 25 10 20 25 10 15 20 15 20 21 20 22 21 22 20 22 21 22 20 22 21 22 20 22 21 22 20 22 21 22 22 21 22 22 21 22 22 21 22 22 22 21 22 22 22 22 22 22 22 22 22 22 22 22 22	2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2	
	1,800	0	2012 2013 2013 2013 2013 2013 2013 2013	8 8 2 2 2 2 2 2 3 2 3 2 2 3 2 3 2 3 2 3	
	1,600	0	22 22 22 22 22 22 22 22 22 22 22 22 22	9 9 7 7 8 8 8 8 8 8 8 8 8 8 8 8 8 8 8 8	
	1,400	/ 0 / 0	10222 1022 10 10 10 10 10 10 10 10 10 10 10 10 10	2 414128 88848 884848 84848 848848 8888888888	
	1,200	, o , h	822 11 12 22 22 22 22 22 22 22 22 22 22 2	9 858858 889854 44448 888869 000000 9 85868 889854 88152 88588 8448223	
	1,000	0 28 44 29 31	21111111111111111111111111111111111111	2 19 28 28 28 28 28 28 28 28 28 28 28 28 28	
	906	0 / 26 16 26 16 20 18	9 20 20 20 20 20 20 20 20 20 20 20 20 20	8 8 8 8 8 8 8 7 8 8 7 8 8 7 8 8 8 8 8 8	
	800	0 / 23 41 / 18 13	11244 11244 11244 11244 124444 124444 124444 124444 124444 124444 1244444 124444	0 04440 00000 00000 00000 00000 00000 0 23818 488258 22448 22588 844828	
cs in feet.	200	29 56 ^	$\begin{array}{c} 12258\\ 12258\\ 5556\\ 5556\\ 5259\\ 5229$ 5229\\ 5229\\ 5229\\ 5229\\ 5229 5229\\ 5229 5229\\ 5229\\ 5229 5229\\ 5229 5229\\ 5229	4 4 4 8 8 8 8 8 8 9 9 9 9 9 9 9 9 9 9 9	
Height	600	0 / 26 16 18 13 13 59	110 110 110 110 110 110 110 110	4 2022 2022 2022 1 1 1 1 1 2 2 2 2 2 2 2	
	200	22 21 15 20 11 27	8355 337 337 337 337 337 337 337 337 337	2280808011108888 24999888888888888888888888888888888	
	400	0 / 18 13 12 22 0 30	828331198885	2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2	
	300	26 16 13 52 13 52 00 00	22222 832228 842228 842228	0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0	
	200	0 / 18 13 / 18 / 18	22228286 2222828 2232828 2232828 2232828 2232828 223282 223282 223282 223282 22328 22357 2	00000000000000000000000000000000000000	
	190	0 / 17 21 8 53 8 53 1 0 0 1 0 0 1 0 0 0 0 0 0 0 0 0 0 0 0	1 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2		
	180	16 29 5 25 1 29 1 29	1 25 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2	1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1	
	170	0 0 15 37 5 19 5 19	1 20 1 27 1 20 1 27 1 20 1 20 1 20 1 20 1 20 1 20 1 20 1 20		
	160	0 / 14 45 7 30 7 30 01 00 10 00 00 00 00 00 00 00 00 00 00		00000 000000	
	Dist., knots.	0.1		4	

TABLE 34.

t.,	Height of the Eye Above the Level of the Sea, in Feet.												
1s.	20	30	40	50	60	70	80	90	100	110	120	yards.	
	0 /	0 /	0 1	。 ,	o /'	o /	0 /	0 /	0 /	o /	0 /		
100	3 44	5 37	7 29	9 21	11 11	13 00	$14 \ 47 \ 7 \ 97$	16 34	$18 16 \\ 0 10$	19 58	$\begin{bmatrix} 21 & 37 \\ 11 & 02 \end{bmatrix}$	100	
200	$1 50 \\ 1 19$	2 46	3 43	4 39	0 30 2 11	6 31 4 10	1 56	$\frac{8}{5}\frac{23}{32}$	9 18	10 13	$\begin{bmatrix} 11 & 08 \\ 7 & 95 \end{bmatrix}$	200	
100	$112 \\ 52$	1 21	$1 \frac{2}{1} \frac{20}{48}$	2 16	244	$\frac{1}{3}$ 12	$\frac{4}{3}$ 40	4 08	4 36	5 04	$5 \frac{40}{32}$	400	
500	41	1 03	1 25	1 48	2 10	$2 \ 32$	254	3 17	3 39	4 01	4 24	50	
300	34	52	1 10	129	1 47	2 05	2 24	$2 \ 42$	3 01	3 20	3 38	60	
700	28	44	1 01	1 15	1 31	1 46	2 01	218	234	250	3 05	70	
500 000	24	38	01 15	$1 00 \\ 57$	1 18	1.32 1.99	1 40	2 00	$\begin{array}{ccc} 2 & 13 \\ 1 & 57 \end{array}$	2 27 2 10	2 41	80	
000	$\frac{21}{18}$	29	40	50	1 01	1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1	1 23	1 + 3 + 3 + 3 + 3 + 3 + 3 + 3 + 3 + 3 +	1 45	1 56	$\frac{2}{2}$ $\frac{22}{07}$	1.00	
100	$\frac{10}{16}$	26	35	45	55	1 05	$\frac{1}{1}$ 15	1 24	$\frac{1}{1}\frac{34}{34}$	1 44	$\frac{-51}{154}$	1,10	
200	15	23	32	41	50	59	1 08	1 17	1 26	1 35	1 44	1, 20	
300	13	21	29	37	45	53	$1 \ 02$	1 10	1 18	1 27	1 35	1,30	
400	12	19	21	34	41	49	07 59	1 04	1 12 1 07	1 20	$\begin{bmatrix} 1 & 27 \\ 1 & 91 \end{bmatrix}$	1,40	
600	$-\frac{11}{10}$	$\frac{10}{16}$	- 24		- 35			55	$\frac{107}{102}$	$\frac{1}{108}$	$\frac{1}{1}\frac{21}{15}$	$\frac{1,50}{1.60}$	
700	10	15	$\frac{22}{21}$	$\tilde{27}^{0}$	33	39	$\frac{10}{45}$	51	58	1 04	1 10 1 10	1,70	
800		14	19	25	31	36	42	48	54	1 00	1 06	1,80	
900		13	18	23	29	34	39	45	50	56	1 02	1,90	
000		12	17	22	27	32	37	$\frac{42}{10}$	47	53		$\frac{2,00}{2,00}$	
100		10	16	20	20	30	30	40	40	50	00 59	2, 10	
300		10	10	18	24	$\frac{23}{27}$	31	36	40	45	49	2, 20 2, 30	
400			13	$\tilde{1}\tilde{7}$	21	25	29	34	38	42	47	2, 40	
500			12	16	20	24	28	32 -	36	40	44	2,50	
600			11	15	19	23	26	30	34	38	42	2,60	
700			11	14	18	22	25	29	33	36	40	2,70	
900			10	14	16	19	24	28	30	33	37	2, 80	
000				10 12	15	19	22	25	28	32	35	3,00	
100				12	15	18	21	24	27	30	34	3, 10	
200				11	14	17	20	23	26	29	32	-3, 20	
300				10	13	16	19	22	25	28	31	3,30	
400 500					13	15	10	$\frac{21}{20}$	23	26	29	3.50	
600					12	14	17	19	22	25	$\frac{-2}{27}$	3,60	
700					11	13	16	19	21	24	26	3,70	
800					11	13	15	18	20	23	25	3,80	
900					10		15	17	20	22	25	3,90	
100						11	1.1	10	18			4 10	
200						11	13	15	17	20	20	4, 20	
300						10	13	15	17	19	21	4, 30	
400							12	14	16	18	21	4,40	
500							12	14	16	18	20	4,50	
600							11	13	15	17	19	4,60	
700							10	13	10	16	19	4, 80	
900							10	12	14	15	17	4,90	
000								11	12	15	17	5 00	

TABLE 35.

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Speed in knots per hour developed by a vessel traversing a measured nautical mile in any given number of minutes and seconds.

	1	Number of minutes.													
Sec.	1	2	3	4	5	6	7	8	9	10	11	12	Sec.		
0	Knots.	Knots. 30, 000	Knots. 20. 000	Knots. 15, 000	Knots. 12.000	Knots. 10.000	Knots. 8. 571	Knots. 7.500	Knots. 6. 666	Knots. 6.000	Knots. 5. 455	Knots. 5. 000	0		
ĭ	59.016	29.752	19.890	14.938	11.960	9.972	8.551	7.484	6.654	5.990	5.446	4.993	1		
2	58.065	29.508	19.780	14.876	11.920	9.944	8.530	7.468	6.642	5.980	5.438	4.986	2		
3	57.143	29.268	19.672	14.815	11.880	9.917	8.510	7.453	6.629	5.970	5 429	4.979	3		
	$\frac{50.200}{55.385}$	28,800	19.000	14. 694	11.011	9.863	8 470	7 492	6 605	5 950	5 413	4 965			
6	54.545	28.571	19.355	14.634	11.764	9.836	8.450	7.407	6.593	5.940	5.405	4.958	6		
7	53.731	28.346	19.251	14.575	11.726	9.809	8.430	7.392	6.581	5.930	5.397	4.951	7		
8	52.941	28.125	19.149	14.516	11.688	9.783	8.411	7.377	6.569	5.921	5.389	4.945	8		
$\frac{9}{10}$	$\frac{52.174}{51-190}$	27.907	19.048	14.408	$\frac{11.000}{11.812}$	9.700	8.392	7.946	6.515	5 009	5 979	4.938	9		
10	51.429 50.704	27. 692	18.947	14.400	11.013 11.575	9.729	8.353	7.331	6. 533	5.902 5.892	5.365	4.932	10		
12	50.000	27.273	18.750	14.286	11.538	9.677	8.334	7.317	6.521	5.882	5.357	4.918	12		
13	49.315	27.068	18,652	14.229	11.501	9.651	8.315	7.302	6.509	5.872	5.349	4.911	13		
14	48.649	26.866	18.556	14.173	11.465	9.625	8.295	7.287	6.498	5.863	5.341	4.904	14		
15	48.000	26.667	18.461	14.118	11.428 11.209	9.600	8.276	7 958	6.486	5,853	5 295	4.897	15		
17	46.753	26. 277	18. 274	14.003 14.008	11.352 11.356	9.549	8.238	7.243	6.463	5.834	5.325 5.317	4.884	17		
18	46.154	26, 087	18.182	13.953	11.321	9.524	8.219	7.229	6.451	5.825	5.309	4.878	18		
19	45.570	25.899	18.090	13.900	11.285	9.499	8.200	7.214	6.440	5.815	5.301	4.871	19		
20	45.000	25.714	18.000	13.846	11.250	9.473	8.181	7.200	6.428	5.806	5.294	4.865	20		
21	44, 444	25.532	17.910	13.793	11.214 11.180	9.448	8.163	7.185	6.417	5 787	5.286	4.858	21		
$\frac{22}{23}$	43.373	25.352 25.175	17.734	13, 688	11, 146	9.399	8.126	7.157	6.394	5.778	5.270 5.270	4.845	$\frac{22}{23}$		
24	42.857	25.000	17.647	13.636	11.111	9.375	8.108	7.142	6.383	5.769	5.263	4.838	24		
25	42.353	24.828	17.560	13.584	11.077	9.350	8.090	7.128	6.371	5.760	5.255	4.832	25		
26	41.860	24.658	17.475	13.533	11.043	9.326	8.071	7.114	6.360	5.750	5.247	4.825	26		
27	41.379	24.490	17.391 17.307	13.483	11.009 10.975	9.302	8,003	7.100	6.349	5.741 5.739	5.240 5.939	4.819	27		
$\frac{20}{29}$	40.449	24.161	17.225	13.383	10.973 10.942	9.278 9.254	8.017	7.072	6.327	5.723	5.232 5.224	4.806	29		
30	40.000	24.000	17.143	13.333	10.909	9.230	8.000	7.059	6.315	5.714	5.217	4.800	$\overline{30}$		
31	39.560	23.841	17.061	13.284	10.876	9.207	7.982	7.045	6.304	5.705	5.210	4.793	31		
32	39.130 28 710	23.684	16.981	13.235 19 196	10.843	9.183 0.160	7.964	7.031	6.293	5.696	5.202	4.787	$\frac{32}{99}$		
34	38,710 38,298	23.329 23.377	16.901 16.822	13.130 13.138	10.810 10.778	9.100 9.137	7.929	7.0017	6.282 6.271	5.678	5.195 5.187	4.780	ээ 34		
35	$\frac{337.895}{37.895}$	$\frac{23.311}{23.226}$	16.744	$\frac{10.100}{13.091}$	$\frac{10.746}{10.746}$	9, 113	7.912	6.990	6.260	$\overline{5.669}$	$\frac{5.131}{5.179}$	4.768	35		
36	37.500	23.077	16.667	13.043	10.714	9.090	7.895	6.977	6.250	5.660	5.172	4.761	36		
37	37.113	22.930	16.590	12.996	10.682	9.068	7.877	6.963	6.239	5.651	5.164	4.755	37		
38	36.735	22.785	16.514	12.950 12.002	10.651 10.610	9.045	7.860	6.950 6.926	$\begin{array}{c} 6.228 \\ 6.217 \end{array}$	5.642 5.633	5, 157	$\frac{4.749}{4.742}$	38		
$\frac{30}{40}$	36,000	$\frac{22.042}{22.500}$	10.430 16 363	$\frac{12.000}{12.857}$	10.019 10.588	9,000	7 826	6 923	$\frac{0.217}{6.207}$	$\frac{0.000}{5.625}$	5 143	4.745	$\frac{39}{40}$		
41	35.644	22.360	16.289	12.801	10.557	8.977	7.809	6.909	6.196	5.616	5.135	4.731	41		
42	35.294	22.222	16.216	12.766	10.526	8.955	7.792	6.896	6.185	5.607	5.128	4.724	42		
43	34.951	22.086	16.143	12.721	10.495	8.933	7.775	6,883	6.174	5.598	5.121	4.718	43		
44	$\frac{34.013}{21.986}$	$\frac{21.901}{91.910}$	$\frac{10.071}{16.000}$	$\frac{12.076}{12.021}$	10.400	8.911	7.711	6.870	$\frac{0.104}{0.152}$	5.590	$\frac{0.114}{5.106}$	4.712	44		
46	33.962	21.818 21.687	15,000 15,929	12.031 12.587	10.434 10.404	8.869	$7.741 \\ 7.725$	6.844	6.133 6.143	5.581 5.572	5.106 5.099	4.700	40 46		
47	33. 645	21.557	15.859	12.543	10.375	8.845	7.708	6.831	6.132	5.564	5.091	4.693	47		
48	33, 333	21.429	15.789	12.500	10.345	8.823	7.692	6.818	6.122	5.555	5.084	4.687	48		
49	33.028	$\frac{21.302}{21.302}$	15.721	12.456	10.315	8.801	7.675	6.805	6.112	5.547	5.077	4.681	49		
50 51	32.727 32.129	21.176 21.052	15.652 15.581	12.413 19.271	10.286	8.780	7.659 7.642	6.792	6.101 6.001	5.538	5.070	4.675	50		
$\frac{51}{52}$	32.432 32.143	21.035 20.930	15.584 15.517	12.329 12.329	10.230 10.227	8.737	7.627	6.779 6.766	6.091 6.081	5. 521	5.003 5.056	4,663	$\frac{51}{52}$		
53	31.858	20.809	15.450	12.287	10.198	8.716	7.611	6.754	6.071	5.513	5.049	4.657	53		
54	31.579	20.690	15.384	12.245	10.169	8.695	7.595	6.741	6.060	5.504	5.042	4.651	54		
55	31.304	20.571	15.319	12.203	10.140	8.675	7.579	6.739	6.050	5.496	5.035	4.645	55		
00 57	31.034	20.455	15, 254	12.162 12 191	10.112 10.081	8,654	7 517	6.716 6.701	6.040	5.487 5.470	5.028 5.020	4.639	57 57		
58	30.508	20.339 20.225	15.190 15.126	12.121 12.080	10.054 10.055	8,612	7.531	6, 691	6.020	5.471	5.020 5.013	4.627	58 - 58		
59	30.252	20.112	15.062	12.040	10.027	8.591	7.515	6.679	6.010	5.463	5.006	4.621	59		
Sec.	1	2	3	4	5	6	7	8	9	10	11	12	See.		

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TABLE 36.

Reduction of Local Mean Time to Standard Meridian Time, and the reverse.

[If local meridian is east of standard meridian, subtract from local mean time, or add to standard meridian time. If local meridian is west of standard meridian, add to local mean time, or subtract from standard meridian time.]

Difference of longitude be- tween local meridian and standard meridian.	Reduction to be applied to local mean time.	Difference of longitude be- tween local meridian and standard meridian.	Reduction to be applied to local mean time.
0 / 0 /	Minutes.	0 / 0 /	Minutes.
0 00 to 0 07	0	7 23 to 7 37	30
0 08 to 0 22	1	7 38 to 7 52	31
0 23 to 0 37	2	7 53 to 8 07	32
0 38 to 0 52	3	8 08 to 8 22	33
0 53 to 1 07	- 4	8 23 to 8 37	34
1 08 to 1 22	5	8 38 to 8 52	35
1 23 to 1 37	6	8 53 to 9 07	36
1 38 to 1 52	7	9 08 to 9 22	37
153 to 207	8	9 23 to 9 37	38
2 08 to 2 22	9	9 38 to 9 52	39
$\frac{1}{2}$ 23 to 2 37	10	9 53 to 10 07	40
2 38 to 2 52	11	10 08 to 10 22	41
$\frac{1}{2}$ 53 to $\frac{3}{2}$ 07	12	10 23 to 10 37	42
3 08 to 3 22	13	10 38 to 10 52	43
3 23 to 3 37	14	10 53 to 11 07	44
3 38 to 3 52	15	11 08 to 11 22	45
3 53 to 4 07	16	11 23 to 11 37	46
4 08 to 4 22	17	11 38 to 11 52	47
4 23 to 4 37	18	11 53 to 12 07	48
4 38 to 4 52	19	12 08 to 12 22	49
4 53 to 5 07	20	12 23 to 12 37	50
5 08 to 5 22	21	12 38 to 12 52	51
5 23 to 5 37	22	12 53 to 13 07	52
5 38 to 5 52	23	13 08 to 13 22	53
5 53 to 6 07	24	13 23 to 13 37	54
6 08 to 6 22	25	13 38 to 13 52	55
6 23 to 6 37	26	13 53 to 14 07	56
6 38 to 6 52	27	14 08 to 14 22	57
6 53 to 7 07	28	14 23 to 14 37	58
7 08 to 7 22	29	14 38 to 14 52	59

TABLE 37.

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Log. A and Log. B.

[For Computing the Equation of Equal Altitudes. For Noon, A-; for Midnight, A+; for Noon or Midnight, B+. Argument=Elapsed Time.]

ed.	G	h	1	h	2	h	:	3 ^h	4	h	1	h		
Elaps time	Log. A.	Log. B.	Log. A.	Log. B.	Log. A.	Log. B.	Log. A.	Log. B.	Log. A.	Log. B.	Log. A.	Log. B.		
${}^{m.}_{0}$	9. 4059 . 4059	9.4059 .4059	9.4072 .4072	9. 4034 . 4034	9. 4109 . 4110	9.3959 .3957	$9.4172 \\ .4173$	$9.3828 \\ .3825$	9. 4260 . 4261	9.3635 .3631	$9.4374 \\ .4376$	9.3369 .3364		
$\frac{2}{3}$.4059 .4059 .4050	.4059 .4059 1050	.4073 .4073 4074	.4033 .4032	.4111 .4112	. 3955 . 3953	.4174 .4175	.3822 .3820 .3817	.4263 .4265 .4265	.3627 .3624 .3624	.4378 .4380 .4282	. 3358		
$\frac{-4}{5}$	$\frac{.4059}{9.4059}$	9.4059	$\frac{.4074}{9.4074}$	$\frac{.4031}{9.4030}$	$\frac{.4113}{9.4113}$	$\frac{.3352}{9.3950}$	$\frac{.4177}{9.4178}$	$\frac{.3017}{9.3814}$	$\frac{.4200}{9.4268}$	$\frac{.3020}{9.3616}$	9.4385	9.3343		
$\frac{6}{7}$.4060 .4060	.4059 .4059	.4074 .4075	.4029 .4028	.4114 .4115	.3948 .3946	.4179 .4181	.3811 .3809	.4270 .4272	.3612 .3608	.4387 .4389	. 3337		
8	.4060	.4059	.4075 4076	.4027 4026	$.4116 \\ 4117$.3944 3943	$.4182 \\ .4183$. 3806	$.4273 \\ .4275$. 3604	$.4391 \\ 4393$.3327 3221		
$\frac{0}{10}$	9.4060	9.4059	9.4076	9.4025	$\frac{.4117}{9.4118}$	9.3941	9.4184	9.3800	9.4277	9.3596	9.4396	9.3316		
$\frac{11}{12}$.4060 .4060	.4059 .4058	.4077 .4077	.4024 .4023	.4119 .4120	. 3939 . 3937	.4186 .4187	.3797 .3794	.4279 .4280	.3592 .3588	.4398 .4400	.3311 .3305		
$\frac{13}{14}$.4060	$.4058 \\ 4058$	$.4078 \\ 4078$	$.4022 \\ 4021$	$.4121 \\ 4121$. 3935	.4188 4190	.3792 3789	$.4282 \\ 4284$.3584 .3580	$.4402 \\ 4405$. 3300		
$\frac{11}{15}$	9.4060	9.4058	9.4079	9.4020	9.4122	9.3931	9.4191	9.3786	9.4286	9.3576	9.4407	9. 3289		
$\frac{16}{17}$.4060 .4060	.4058 .4057	. 4079	.4019 .4018	.4123 .4124	.3929 .3927	. 4193	.3783 .3780	.4288 .4289	.3572 .3568	.4409 .4411	.3283 .3278		
18 19	.4061	.4057 .4057	.4080 .4081	.4017 .4016	$\begin{array}{c} .4125 \\ .4126 \end{array}$.3925 .3923	.4195 .4197	.3777 .3774	.4291 .4293	.3564 .3559	.4414 .4416	.3272 .3266		
20	9.4061	9.4057	9.4081	9.4015	9.4127	9.3921	9.4198	9.3771	9.4295	9.3555	9.4418	9. 3261		
$\frac{21}{22}$.4061 .4061	. 4056	. 4082	. 4014	.4128 .4129	.3919 .3917	.4199 .4201	.3768 .3765	.4297 .4299	.3551 .3547	.4420 .4423	.3255 .3249		
$\frac{23}{24}$.4061 .4061	.4056 .4055	.4083 .4084	.4012 .4010	$\begin{array}{c}.4130\\.4131\end{array}$.3915 .3913	.4202 .4204	.3762 .3759	.4300 .4302	.3542 .3538	$ \frac{.4425}{.4427}$.3244 .3238		
25	9.4062	9.4055	9.4084	9.4009	9.4132	9.3911	9.4205	9.3756	9.4304	9.3534	9.4430	9.3232		
$\frac{20}{27}$. 4062	. 4055	. 4085	. 4008	. 4133	. 3905	. 4207	. 3732	. 4308	. 3525	. 4434	.3220 .3220		
$\frac{28}{29}$.4062 .4062	.4054 .4054	.4086 .4087	.4006 .4004	.4135 .4136	. 3905	.4209 .4211	$.3746 \\ .3743$.4310 .4312	.3521 .3516	.4437 .4439	.3214 .3208		
$\frac{30}{21}$	9.4062	9.4053	9.4087	9.4003	9.4137	9.3900	9.4212	9.3740	9.4314	9.3512	9.4441	9.3203		
$\frac{31}{32}$.4003 .4063	.4053 .4052	. 4088	. 4002	. 4138	. 3896	.4214	. 3733	. 4315	. 3508	.4444.4446	. 3197		
$\frac{33}{34}$.4063 .4063	.4052 .4051	. 4089	. 3999	.4140	. 3894	.4217 .4218	3730. 3727	.4319 .4321	.3499 .3494	.4448 .4451	.3185 .3178		
$\frac{35}{36}$	9.4064	9.4051	9.4091	9.3997	9.4142	9.3889	9.4220	9.3723	9,4323	9.3490	9.4453	9.3172		
37	. 4064	. 4050	. 4091	. 3994	. 4145	. 3885	.4221 .4223	.3717	. 4325	. 3485	. 4458	.3160		
$\frac{38}{39}$. 4064 . 4065	. 4049	. 4093	. 3993	.4146	. 3882	.4224 .4226	.3713 .3710	.4329 .4331	3476. 3471	.4460 .4463	.3154 .3148		
40	9.4065	9.4048	9.4094	9.3990	$\overline{9.4148}_{4149}$	9.3878	9.4227	9.3707	9,4333	9.3467	9.4465	9.3142 2125		
42	. 4065	. 4047	. 4095	. 3987	. 4150	. 3873	. 4231	. 3703	. 4337	. 3452	. 4470	. 3129		
43 44	. 4066	. 4047	. 4096	. 3985	. 4151	.3871 .3868	.4232 .4234	. 3696	.4339 .4341	.3453 .3448	$.4473 \\ .4475$.3123 .3116		
$\frac{45}{46}$	9.4066	9.4045	9.4097 4098	9.3982	9.4154	9.3866	9.4235 4237	9.3690	9.4343	9.3443	9.4477	9.3110		
47	. 4067	. 4044	. 4099	. 3979	. 4156	. 3861	. 4238	.3683	. 4347	. 3433	. 4482	. 3097		
48 49	. 4067	.4043 .4043	. 4100	. 3978 . 3976	. 4157	. 3859	.4240 .4242	. 3679	.4349 .4351	.3429 .3424	.4485 .4487	.3091 .3084		
$\frac{50}{51}$	9.4068	9.4042 .4041	9.4101	9.3975 .3973	9.4159 .4161	9.3854 3851	$9.4243 \\ 4245$	9.3672 3668	$9.4353 \\ 4355$	9.3419 3414	9,4490	9.3078 3071		
52 52	. 4069	. 4041	. 4103	. 3972	.4162	. 3849	. 4246	.3665	. 4357	. 3409	. 4494	. 3064		
$\frac{55}{54}$. 4069	. 4040	. 4103	. 3969	. 4163	. 3843	.4248 .4250	.3651. $.3657$. 4359	. 3404 . 3399	. 4497 . 4500	.3058 .3051		
$\frac{55}{56}$	9.4070 .4070	9.4038 .4038	9.4105	9.3967 .3965	$9.4165 \\ .4167$	$9.3841 \\ .3838$	9.4251 .4253	9.3654 .3650	9.4363 .4366	9.3394 .3389	$9.4503 \\ 4505$	9.3044 . 3038		
57 58	.4071	. 4037	.4107	. 3964	. 4168	. 3836	. 4255	. 3646	.4368	. 3384	. 4508	. 3031		
59	. 4071	. 4035	. 4107	. 3960	. 4109	. 3830	.4250 .4258	. 3639	.4370 .4372	. 3374	. 4510	. 3024		
60	9.4072	9.4034	9.4109	9.3959	9.4172	9.3828	9.4260	9.3635	9.4374	9. 3369	9.4515	9. 3010		

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TABLE 37.

Log. A and Log. B. [For Computing the Equation of Equal Altitudes. For Noon, A-; for Midnight, A+; for Noon or Midnight, B+. Argument=Elapsed Time.]

						intente=1									
ed .	6	h	-	h	8	h	£	h	1	0 ^h	1	h			
Elaps	Log. A.	Log. B.	Log. A.	Log. B.	Log. A.	Log. B.	Log. A.	Log. B.	Log. A.	Log. B.	Log. A.	Log. B.			
$\stackrel{m.}{0}$	9.4515	9. 3010	9.4685	9.2530	9.4884	9. 1874	9.5115	9.0943	9.5379	8.9509	9. 5680	8. 6837			
1	. 4518	. 3003	. 4688	. 2520	. 4888	. 1861	. 5119	. 0925	. 5384	. 9478	. 5685	. 6770			
	. 4021	. 2996	. 4691	22011 2502	$.4892 \\ .4895$	1835	.0123 5127	.0900	. 0389 5303	. 9447	. 0091	.0701			
4	. 4526	.2983	. 4697	.2492	. 4899	.1830	.5127 .5132	. 0867	.5398	. 9384	.5000	. 6560			
5	9.4528	9.2975	9.4701	9.2483	9.4902	9.1809	$\overline{9.5136}$	9.0848	9.5403	8.9352	9.5707	8.6488			
6	.4531	. 2968	. 4704	. 2473	. 4906	.1796	.5140	. 0828	.5408	. 9320	.5712	.6414			
7	. 4534	. 2961	. 4707	. 2463	. 4910	.1782	. 5144	. 0809	. 5412	. 9287	. 5718	. 6339			
8	. 4536	.2954	. 4710	. 2454	. 4913	.1769 1756	.5148 5159	.0789	.5417 5499	.9254	.5723	. 6262			
$\frac{9}{10}$. 4009	. 2947	0.1716	0.9121	. 4917	$\frac{.1700}{0.1749}$	$\frac{.0100}{0.5157}$	0.0710	0.5497	9221	0.5724	· 0105			
10	9.4544	9. 2940	4719	2404	4924	.1742	5.5167	0729	5432	9153	5739	6021			
12	. 4547	.2925	. 4723	. 2415	. 4928	. 1715	. 5165	.0708	. 5436	. 9118	.5745	. 5937			
13	. 4550	.2918	.4726	. 2405	. 4932	.1701	.5169	.0688	.5441	. 9083	.5750	.5852			
14	. 4552	. 2911	. 4729	. 2395	. 4935	. 1687	.5174	. 0667	. 5446	. 9048	. 5756	. 5764			
15	9.4555	9.2903	9.4732	9.2385	9.4939	9.1673	9.5178	9.0646	9.5451	8. 9013	9.5761	8.5674			
16	.4561	. 2896	.4730	. 2375	. 4943	.1009 1645	.5182 5186	.0625	.0400 5461	. 8977	. 0/0/	· . 0083 5488			
18	. 4563	.2881	. 4742	.2355	. 4950	. 1630	.5100	. 0583	. 5466	. 8903	.5778	.5392			
19	.4566	.2873	.4745	. 2344	.4954	.1616	.5195	.0561	. 5470	. 8866	. 5783	.5293			
$\overline{20}$	9.4569	9.2866	9.4748	9.2334	9.4958	9.1602	9.5199	9.0540	9.5475	8.8829	9.5789	8.5192			
21	.4572	. 2858	. 4751	. 2324	. 4961	. 1587	. 5204	.0518	. 5480	.8791	.5794	. 5088			
22	. 4574	. 2850	. 4755	. 2313	. 4965	. 1573	. 5208	. 0496	. 5485	. 8752	. 5800	. 4981			
$\frac{20}{94}$	4580	2835	4761	. 2303	4909	1530	5212 5217	0452	. 5490	. 8715	. 5811	4758			
$\frac{2\pi}{25}$	9.4583	$\frac{12000}{9.2827}$	9.4764	9.2282	9,4977	$\frac{1010}{9.1528}$	$\frac{.0211}{9.5221}$	9.0429	9. 5500	8.8634	9.5817	8,4641			
$\frac{1}{26}$. 4585	. 2819	. 4768	. 2271	. 4980	. 1513	. 5225	. 0406	. 5505	. 8594	. 5822	. 4521			
27	.4588	.2812	.4771	. 2261	. 4984	. 1498	.5230	. 0383	.5510	. 8553	.5828	.4397			
28	:4591	. 2804	. 4774	. 2250	. 4988	. 1483	. 5234	. 0360	. 5515	. 8512	. 5834	. 4270			
29	. 4094	. 2796	.4/18	. 2239	. 4992	. 1408	. 5238	.0337	. 0020	. 8470	. 3839	. 41.58			
30	9.4597	9.2788 2780	9.4781	9.2228	9.4990	9, 1403	$9.0243 \\ 5917$	9.0314	9.0020	8.8427	9.0840	3860			
$\frac{31}{32}$. 4602	.2772	.4788	.2206	. 5003	. 1422	.5252	. 0266	. 5535	. 8341	. 5856	. 3713			
-33	. 4605	.2764	. 4791	. 2195	. 5007	. 1406	.5256	. 0242	.5540	. 8297	. 5862	. 3561			
34	. 4608	.2756	. 4794	. 2184	. 5011	. 1390	5261	. 0218	. 5545	. 8253	. 5868	. 3403			
35	9.4611	9.2747	9.4798	9.2173	9.5015	9.1375	9.5265	9.0194	9. 5550	8.8208	9.5874	8.3239			
$\frac{36}{27}$.4614	. 2739	. 4801	. 2162	. 5019	. 1359	. 5269	.0169	. 0000	.8162	. 0879	. 3007			
38	. 4620	.2701	. 4808	. 2140	.5023	. 1327	. 5278	.0119	.5565	. 8068	.5891	.2701			
39	. 4622	. 2714	. 4811	. 2128	. 5031	. 1310	. 5283	. 0094	.5570	. 8020	.5897	.2505			
40	9.4625	9.2706	9.4815	9.2117	9.5035	9.1294	9.5287	9.0069	9.5576	8.7972	9.5902	8.2299			
41	. 4628	. 2698	. 4818	. 2105	. 5038	. 1278	. 5292	. 0043	.5581	. 7923	. 5908	. 2082			
42	. 4631	. 2689	. 4821	. 2094	. 5042	1261	. 5296	. 0017 9 0001	. 5586	. 1813	. 0914 5020	. 1893			
44	. 4637	.2001 .2672	. 4828	. 2070	. 5050	.1211	.5301	. 9965	.5596	.7772	.5926	.1354			
$\overline{45}$	9.4640	9.2664	$\overline{9.4832}$	9.2059	$\overline{9.5054}$	$\overline{9.1211}$	9.5310	8.9938	9.5601	8,7720	9.5931	8.1080			
46	. 4643	.2655	.4835	. 2047	. 5058	.1194	.5315	. 9911	. 5606	. 7668	.5937	.0786			
47	. 4646	. 2646	. 4839	. 2035	. 5062	. 1177	. 5319	. 9884	.5612	. 7614	. 5943	. 0470			
48	. 4649	. 2638	. 4842	. 2023	. 5066	. 1159	. 5324	. 9857	. 5617	. 7560	. 0949	.0128			
49	. 4002	. 2029	0 1910	0.1000	0.5071	0 1195	0.5929	. 9000	$\frac{.0022}{0.5697}$	8 74.10	9 5961	7 9248			
51	. 4658	9.2020	4853	9. 1999	5074	9.1123 1107	5337	9774	5632	. 7392	. 5967	. 8897			
$5\overline{2}$. 4661	. 2602	. 4856	. 1974	. 5082	. 1089	. 5342	. 9745	. 5638	. 7335	.5973	. 8391			
53	. 4664	. 2593	. 4860	.1962	. 5086	. 1072	. 5347	.9717	. 5643	. 7276	. 5979	. 7817			
54	. 4667	. 2584	. 4863	. 1950	. 5091	. 1054	. 5351	. 9688	. 5648	. 7217	. 5985	. /154			
50	9.4670	9.2575	9.4867	9.1937	9.5095	9.1036	9.5356	8.9659	9.5654	8.7156	9. 5991	7.0308			
$\frac{50}{57}$. 4073	. 2006	4870	1920	. 5099	. 1017	.5361	. 9030	. 5664	. 7094	. 6003	. 4162			
58	.4679	. 2548	. 4877	1900	.5107	. 0981	.5370	.9570	. 5669	. 6968	. 6009	. 2407			
59	. 4682	. 2539	. 4881	. 1887	.5111	.0962	. 5375	. 9540	. 5675	. 6903	. 6015	6.9591			
60	9.4685	9.2530	9.4884	9.1874	9.5115	9.0943	9.5379	8.9509	9.5680	8.6837	9.6021	Inf.			
					1										


TABLE 37.

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Log. A and Log. B.

[For Computing the Equation of Equal Altitudes. For Noon, A --: for Midnight, A +: for Noon or Midnight, B -. Argument = Elapsed Time.]

sed le.	1	2h	1:	}h	14	h.	1	5 h	1	6 ^h	1	7h
Elap	Log. A,	Log. B.	Log. A.	Log. B.	Log. A.	Log. B.	Log. A.	Log. B.	Log. A.	Log. B.	Log. A.	Log. B.
m. 0 1 2	$9.6021 \\ .6027 \\ .6033$	<i>Inf.</i> 6. 9603 7. 2431	, 9. 6406 . 6412 . 6419	8.7563 .7641 .7718	$9.6841 \\ .6848 \\ .6856$	$9.0971 \\ .1014 \\ .1057$	9.7333 .7342 .7351	$9.3162 \\ .3194 \\ .3225$	9.7895 .7905 .7915	$9.4884 \\ .4911 \\ .4937$	$9.8539 \\ .8550 \\ .8562$	9. 6383 . 6407 . 6431
3	.6039 .6045	$.4198 \\ .5453$.6426 .6433	.7794 .7868	$.6864 \\ .6872$.1099 .1141	.7360 .7369	.3256 .3287	. 7925 . 7935	. 4963 . 4990	.8573 .8585	.6455 .6478
5	9.6051 .6057	$\overline{7.6428}_{.7226}$	9.6440	8.7942 .8015	$\overline{9.6879}_{.6887}$	9.1183 . 1224	9.7378 .7386	9.3319 .3350	$9.7945 \\ .7955$	9.5016 . 5042	9.8597 .8608	$9.6502 \\ .6526$
7	. 6063	. 7902	$.6454 \\ 6461$.8087 .8158	.6895 .6903	.1265 .1306	.7395 .7404	.3380 .3411	.7965 7975	.5068 .5094	$.8620 \\ 8632$.6550 .6573
9	6075	. 9005	. 6467	. 8227	$\frac{.6911}{0.6912}$. 1347	. 7413	. 3442	. 7986	. 5120	. 8644	. 6597
$10 \\ 11 \\ 12$	$9.6082 \\ .6088 \\ .6094$	$7.9469 \\ .9889 \\ 8.0273$	$9.6474 \\ . 6481 \\ . 6488 \\ . 6488$	$\begin{array}{c} 8.8296 \\ .8364 \\ .8432 \\ \end{array}$	9.6919 .6926 .6934	$9.1387 \\ .1428 \\ .1468 \\ .1567$	$9.7422 \\ .7431 \\ .7440$	$9.3472 \\ .3503 \\ .3533 \\ .55$	9.7996 .8006 .8016	$9.5146 \\ .5171 \\ .5197$	$9.8655 \\ .8667 \\ .8679 \\ .8079$	$9.6621 \\ .6644 \\ .6668 \\ .6668$
$\frac{13}{14}$.6100 .6106	.0627 .0955	.6495 .6502	.8498 .8564	.6942 .6950	.1507 .1547	.7449 .7458	.3563 .3593	.8027 .8037	.5223 .5248	. 8691 . 8703	$.6691 \\ .6715$
15 16 17	9.6112 .6119 .6125	8.1260 .1547 .1816	9.6509 .6516 .6523	8.8628 .8692 .8756	9.6958 .6966 .6974	$9.1586 \\ .1625 \\ .1664$	9.7467 .7476 .7485	$9.3623 \\ .3653 \\ .3683$	9.8047 .8058 .8068	9.5274 .5300 .5325	9.8715 .8727 .8739	$9.6738 \\ .6762 \\ .6785$
18 19	.6131 .6137	.2071 .2312	. 6530 . 6538	. 8818	.6982 .6990	.1703	. 7494 . 7503	.3713 .3742	. 8078	.5351 .5376	.8751	. 6809 . 6832
$20 \\ 21 \\ 22$	$9.6144 \\ .6150 \\ .6156$	$8.2541 \\ .2759 \\ .2967$	$9.6545 \\ .6552 \\ .6559$	8.8941 .9002 .9062	9.6998 .7006 .7014	9.1779 .1817 .1855	9.7512 .7522 .7531	9.3772 .3801 .3831	9.8099 .8110 .8120	$9.5401 \\ .5427 \\ .5452$	9.8775 .8787 .8799	9.6856 .6879 .6903
$\frac{23}{24}$.6163 .6169	$.3166 \\ .3357$.6566 .6573	.9121 .9180	.7022 .7030	.1893 .1930	.7540 .7549	.3860 .3889	. 8131 . 8141	.5477 .5502	.8812 .8824	.6926 .6949
$\frac{25}{26}$	9.6175 . 6182	$\frac{8.3540}{.3717}$	9.6580 .6588	8.9238 .9295	9.7038 .7047 7055	9.1967 .2004	$9.7558 \\ .7568 \\ .7577$	9.3918 .3947	9.8152 .8162 .8172	9.5528 .5553	9.8836 .8848	9.6973 .6996 .7010
$\frac{27}{28}$ 29	. 6188 . 6194 . 6201	. 3887 . 4051 . 4210	. 6595 . 6602 . 6609	. 9352 . 9408 . 9464	.7055 .7063 .7071	.2041 .2078 .2114	. 7517 . 7586 . 7595	. 4005	. 8173 . 8184 . 8194	.5578 .5603 .5628	.8873 .8885	. 7043 . 7066
$ \begin{array}{r} 30 \\ 31 \\ 32 \end{array} $	9.6207 .6214 .6220	$8.4363 \\ .4512 \\ .4657$	9.6616 . 6624 . 6631	8.9519 .9573 9627	9.7079 .7088 7096	9.2150 .2186 .2999	9.7605 .7614 .7624	9.4062 .4090 .4119	$9.8205 \\ .8216 \\ 8227$	$9.5653 \\ .5677 \\ 5702$	9,8898 .8910 8923	9.7089 .7112 .7136
$\frac{32}{33}\\34$.6226 .6233	. 4796	.6638 .6645	. 9681 . 9734	. 7104	.2258 .2293	.7633 .7642	.4147 .4175	. 8237 . 8248	.5727 .5752	. 8935 . 8948	.7159 .7182
$\frac{35}{36}$	9.6239 .6246 .6252	$8.5064 \\ .5192 \\ 5318$	9.6653 .6660 6667	8.9787 .9839 .9891	$9.7121 \\ .7129 \\ 7137$	9.2329 .2364 .2399	9.7652 .7661 7671	9.4204 .4232 .4260	9.8259 .8270 .8281	9.5777 .5801 .5826	9.8961 .8973 .8986	9.7205 .7228 .7251
$\frac{38}{39}$.6259 .6265	.5440 .5559	.6675 .6682	. 9942	.7146 .7154	.2434 .2468	.7680 .7690	.4288 .4316	.8292 .8303	.5850 .5875	. 8999 . 9011	.7275 .7298
$ \begin{array}{c} 40 \\ 41 \\ 42 \end{array} $	9.6272 .6279 .6285	8.5675 .5788 .5899	9.6690 .6697 .6704	9.0043 .0093 .0142	$9.7162 \\ .7171 \\ .7179$	9.2503 .2537 .2571	9.7699 .7709 .7718	9.4343 .4371 .4399	9.8314 .8325 .8336	9.5900 .5924 .5948	9.9024 .9037 .9050	$9.7321 \\ .7344 \\ .7367$
$\begin{array}{c} 12\\ 43\\ 44\end{array}$.6292 .6298	.6008 .6114	$.6712 \\ .6719$.0191 .0240	.7187 .7196	.2605 .2639	.7728 .7738	. 4426 . 4454	.8347 .8358	.5973 .5997	. 9063 . 9075	.7390 .7413
$\frac{45}{46}$	9.6305 .6311 .6318	$8.6218 \\ .6320 \\ 6410$	9.6727 .6734 .6742	9.0288 .0336 .0381	9.7204 .7213 7221	9.2673 .2706 .2740	9.7747 .7757 .7767	$9.4481 \\ .4509 \\ .4536$	9.8369 .8380 8301	9.6022 .6046 .6070	9.9088 .9101 9111	9.7436 .7459 7189
48 49	.6325 .6331	.6517 .6613	.6742 .6749 .6757	.0384 .0431 .0478	.7221 .7230 .7238	.2740 .2773 .2806	.7776 .7786	.4563 .4590	. 8402	.6070 .6094 .6119	.9127 .9140	.7505
$ 50 \\ 51 \\ 52 $	$9.6338 \\ .6345 \\ .6351$	8.6707 .6799 .6890	9.6764 .6772 .6770	9.0524 .0570 .0616	9.7247 .7256 .7961	9.2839 .2872 2005	9.7796 .7806 7815	9.4617 .4644 .4671	9.8425 .8436 .8117	9.6143 .6167 .6191	9.9154 .9167 .9180	$9.7552 \\ .7575 \\ .7598$
52 53 54	.6351 .6365	. 6979 . 7067	. 6787 . 6795	.0616 .0662 .0707	.7204 .7273 .7281	.2905 .2937 .2970	. 7815 . 7825 . 7835	.4671 .4698 .4725	. 8459 . 8470	.6215 .6239	.9193 .9206	.7621 .7644
$55 \\ 56 \\ 57$	9.6372 .6378	8.7153 .7237	9.6802	9.0752	9.7290 .7299 .7299	9.3002	9.7845 .7855 .7865	9.4752 .4778	9.8481 .8493	9.6263 .6287	9.9220 .9233	9.7667 .7690 7719
57 58 59	. 6392 . 6399	. 7321 . 7402 . 7483	.6818 .6825 .6833	.0840 .0884 .0928	. 7307 . 7316 . 7324	. 3098 . 3130	. 7800 . 7875 . 7885	.4800 .4831 .4858	.8504 .8516 .8527	.6335 .6359	.9240 .9260 .9273	.7736
60	9.6406	8.7563	9.6841	9.0971	9.7333	9.3162	9.7895	9.4884	9.8539	9.6383	9.9287	9.7782

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TABLE 37.

Log. A and Log. B.

[For Computing the Equation of Equal Altitudes. For Noon, A -; for Midnight, A +; for Noon or Midnight, B -. Argument = Elapsed Time.]

					0		•					
sed e.	1	Sh	1	9h	2	0 h	2	Ib	9	2 ^h	2	3h
Elaps tim	Log. A.	Log. B.	Log. A.	Log. B.	Log. A.	Log. B.	Log. A.	Log. B.	Log. A.	Log. B.	Log. A.	Log. B.
${\stackrel{m.}{\stackrel{0}{\scriptstyle 0}}}$	9. 9287 . 9300	9. 7782 . 7804	0.0172 .0188	9.9167 .9190	$0.1249 \\ .1269$	0.0625 .0650	0.2623 .2649	0.2279 .2309	$0.4523 \\ .4562$	0.4372 .4414	0.7689.7765	0.7652 .7729
$\frac{2}{3}$.9314 .9327	.7827 .7850	.0204 .0221	.9213 .9237	.1290 .1310	. 0676	.2676 .2702	.2339 .2370	.4601 .4640	. 4455	$.7842 \\ .7920$. 7807
4	. 9341	. 7873	$\frac{.0237}{0.0252}$. 9260	.1330	$\frac{.0727}{0.0752}$. 2729	. 2401	. 4680	. 4540	. 8000	. 7967
$\frac{9}{6}$	9.9368	9.7890	0.0255	9.9284	0.1351 .1371	0.0755	0.2756 .2783	0.2431 . 2462	0.4720 .4761	0.4582 .4625	0.8081	0.8049
$\frac{7}{8}$.9382 .9396	.7942 .7965	.0286 .0303	.9331 .9355	.1392 .1412	. 0805	.2810 .2838	.2493 .2524	.4801 .4842	.4668 .4711	.8247 .8333	.8218 .8305
$\frac{9}{10}$. 9410	. 7988	. 0319	. 9378	. 1433	. 0856	. 2865	. 2556	. 4884	. 4755	. 8420	. 8393
11	9.9424 .9437	. 8034	. 0353	9.9402	. 1454	. 0909	0.2895 .2921	. 2619	0.4920 .4968	. 4844	0.8508	0.8483
$\frac{12}{13}$.9451 .9465	. 8057 . 8080	.0370 .0386	.9449 .9473	.1496 .1517	0.0935 0.0961	.2949 .2977	.2650 .2682	.5010 .5053	.4889 .4934	.8691 .8786	. 8667
14	.9479	. 8103	. 0403	. 9497	.1538	. 0987	. 3005	. 2714	. 5097	. 4980	. 8882	. 8860
$10 \\ 16$	9.9493 .9508	9.8120 .8149	. 0437	9.9520	. 1581	. 1013	0, 3034 , 3063	. 2778	. 5184	0. 5026	0.8980	0.8959
$17 \\ 18$.9522 .9536	.8172 .8195	.0454 .0472	.9568 .9592	.1602 .1623	.1066 .1093	.3091 .3120	.2811 .2843	.5229 .5274	.5118 .5165	.9183 .9288	.9164 .9270
19	. 9550	. 8218	. 0489	. 9616	$\frac{.1645}{0.1667}$. 1119	. 3150	. 2876	. 5319	. 5213	. 9396	. 9378
$\frac{20}{21}$	9.9564	9.8241	0.0506. 0523	9.9640	. 1689	0.1146	0.3179 . 3208	0. 2909	0.5365	0. 5261	0.9506	0.9489
$\frac{22}{23}$.9593 .9607	.8287 .8310	$.0541 \\ .0558$. 9687	.1711 .1733	.1200 .1226	.3238 .3268	. 2975	.5458 .5505	.5358 .5407	.9734 .9853	.9719 .9839
24	. 9622	.8333	. 0576	. 9735	. 1755	. 1253	. 3298	. 3041	. 5553	. 5457	. 9975	. 9961
$\frac{25}{26}$	9.9650	9.8356	0.0593.0611	9.9760	0.1777	. 1308	0. 3328	0.3075	0. 5601	0. 5507	1.0100 .0228	. 0216
$\frac{27}{28}$.9665 .9680	.8402 .8425	.0628 .0646	. 9808	. 1821	1335. 1362	.3389 .3420	.3143 .3177	.5698 .5748	.5608 .5660	.0361 .0497	. 0350
29	. 9695	.8448	. 0664	. 9856	. 1867	. 1389	. 3451	. 3211	. 5798	. 5712	. 0638	. 0628
30 31	9.9709. 9724	9.8471	0.0682	9.9880	0. 1889 . 1912	0. 1417	0.3482 . 3514	0.3245 . 3280	0.5848.5899	0.5764	1.0783 .0934	1.0774
$\frac{32}{33}$.9739 .9754	.8517 .8540	.0718 .0736	. 9929	.1935 .1958	.1472 .1499	.3545 .3577	3315. 3350	.5951 .6003	.5871 .5925	.1089 .1250	.1081 .1242
34	. 9769	.8563	.0754	. 9977	. 1981	. 1527	. 3609	. 3385	. 6056	. 5979	. 1416	. 1409
35 36	9.9784.9798	9.8586	0.0772	0.0002	0.2004	0. 1555	0.3641	0. 3420	0.6110	0.6034	1.1590. 1770	1.1583
$\frac{37}{38}$.9813 .9829	.8632 .8655	.0809 .0827	.0051 .0075	.2051 .2075	.1610 .1638	.3706 .3739	.3491 .3527	.6218 .6273	.6147 .6204	.1958 .2154	.1952 .2149
39	. 9844	. 8678	. 0845	. 0100	. 2098	. 1667	. 3772	. 3563	. 6329	. 6261	. 2359	. 2354
40 41	9.9859 .9874	9.8701	0.0864	. 0124	0.2122	0.1695	0.3805	0.3599	0.6386	. 6378	1.2573	1.2569 .2795
$\frac{42}{43}$.9889 .9904	.8748 .8771	.0901 .0920	.0173 .0198	.2170 .2194	.1751 .1780	.3873 .3907	3673 . 3710	.6501 .6560	.6438 .6498	.3037 .3288	3033. 3285
44	. 9920	. 8794	. 0939	. 0223	. 2218	. 1808	. 3941	. 3747	. 6619	. 6559	. 3554	. 3552
$\frac{45}{46}$	9.9935 .9951	9.8817	0.0958	0.0248 .0272	0.2243.2267	. 1837	0. 3975	0.3784	0.6679	. 6684	1. 3837	1.3835. 4138
$\frac{47}{48}$.9966 .9982	.8863 .8887	.0995 .1015	0.0297 0.0322	.2292 .2316	.1895 .1924	.4045 .4080	3859. 3897	.6802 .6865	.6747 .6811	.4465 .4815	.4463 .4814
49	. 9998	. 8910	. 1034	. 0347	. 2341	. 1953	. 4115	. 3936	. 6928	. 6876	. 5196	. 5195
$\frac{50}{51}$. 0013	9.8933	0.1053 .1072	0.0372	0.2366. 2391	. 2011	. 4151	. 4013	0.6993	0.6942	1.5013 .6074	1.5612 . 6073
$52 \\ 53$.0044	. 8980 . 9003	.1092 .1111	.0422 .0447	$\begin{array}{c} .2416 \\ .2442 \end{array}$.2040 .2070	.4223 .4260	.4052 .4091	.7124 .7191	.7076 .7144	.6588 .7171	.6587 .7171
54	. 0076	. 9026	. 1131	. 0473	. 2467	. 2099	. 4297	. 4130	. 7259	. 7214	. 7844	. 7843
ээ 56	. 0108	9.9050 .9073	. 1150	0.0498	0.2493 . 2518	. 2129	0.4334 :4371	. 4210	0. 7328	. 7355	. 9610	. 9610
$57 \\ 58$.0124 .0140	.9096 .9120	$.1190 \\ .1209$.0548 .0574	$.2544 \\ .2570$.2189 .2219	.4408 .4446	.4250 .4291	.7469 .7541	$.7428 \\ .7501$	2.0863 .2627	2.0863 .2627
59	.0156	. 9143	. 1229	. 0599	. 2596	. 2249	. 4485	. 4331	. 7615	. 7576	2.5640	2.5640
60	0.0172	9.9167	0.1249	0.0625	0.2623	0.2279	0.4523	0.4372	0.7689	0.7652	Inj.	inj.

							r -	ГАВ	LE	38.							[Pa	ge 57	75
				Erro	r in I	ongitu	ude di	ue to	one i	ninu	te Ei	ror o	of La	titud	e.				
alti- le.	dis- ce.							Lat	itude	. •								dis- ce.	salti- le.
Sun's [tuð	Polar tan	0 °	5 °	10°	15°	20°	250	30°	35°	40°	450	50°	55°	60°	65°	700	75°	Polar tan	Sun's tuc
\circ 10 20 30 40 50 60	。 110	$, \frac{1}{.4}$	' .4 .4 .5 .6 .9	$' .4 \\ .5 \\ .6 \\ .8 \\ 1.2$,5 .6 .7 1.0	, 5, 7, .9, 1.3	, 6 .8 1.1	, 7 1.0 1.5	, .8 1.2 2.3	, 1.0 1.6	, 1.3 2.6	, 1. 8	2.9	1	1	1	,	° 110	$^{\circ}$ 10 20 30 40 50 60
$ \begin{array}{r} 10 \\ 20 \\ 30 \\ 40 \\ 50 \\ 60 \end{array} $	105	$ \begin{array}{r} 3 \\ 3 \\ 3 \\ 4 \\ 4 \\ 6 \end{array} $	$ \begin{array}{r} 3 \\ 3 \\ 4 \\ 5 \\ 6 \\ 9 \end{array} $	$ \begin{array}{r} .3 \\ .4 \\ .5 \\ .6 \\ .8 \\ \end{array} $	$ \begin{array}{r} .3 \\ .4 \\ .6 \\ .7 \\ 1.2 \end{array} $.4 .5 .7 1.0	.4 .6 .8 1.3	.5 .7 1.1	$\frac{.6}{.9}$ 1.5	.8 1.2 2.4	.9 1.6	$1.2 \\ 2.7$	1.8	3.0				105	$ \begin{array}{r} 10 \\ 20 \\ 30 \\ 40 \\ 50 \\ 60 \end{array} $
$ \begin{array}{r} 15 \\ 20 \\ 30 \\ 40 \\ 50 \\ 60 \end{array} $	100	$ \begin{array}{r} .2 \\ .2 \\ $	$ \begin{array}{c} .2 \\ .2 \\ $	$ \begin{array}{c} .2 \\ .3 \\ .4 \\ .6 \\ .9 \\ .9 $	$ \begin{array}{r} .3 \\ .4 \\ .6 \\ .8 \end{array} $	$ \begin{array}{r} .3 \\ .4 \\ .5 \\ .7 \\ 1.2 \end{array} $.4 .5 .6 .9	.4 .5 .8 1.3	$\overline{\begin{array}{c} .5 \\ .7 \\ 1.1 \\ 2.1 \end{array}}$	$ \begin{array}{r} .6 \\ .9 \\ 1.5 \end{array} $.8 1.1 2.4	$\frac{1.1}{1.6}$	1.6 2.7	2.9				100	$ \begin{array}{r} 15 \\ 20 \\ 30 \\ 40 \\ 50 \\ 60 \end{array} $
$ \begin{array}{r} 15 \\ 20 \\ 30 \\ 40 \\ 50 \\ 60 \end{array} $	95	.1 .1 .1 .1 .1 .2	$ \begin{array}{c} .1 \\ .1 \\ $	$ \begin{array}{c} .1 \\ .2 \\ .2 \\ $	$ \begin{array}{c} 2 \\ 2 \\ $	$ \begin{array}{r} 2 \\ .3 \\ .4 \\ .5 \\ .8 \\ \end{array} $	$ \begin{array}{r} .3 \\ .5 \\ .7 \\ 1.1 $	$ \begin{array}{r} .3 \\ .4 \\ .6 \\ .9 \\ \end{array} $	$ \begin{array}{r} .4 \\ .5 \\ .8 \\ 1.3 \end{array} $	$\overline{\begin{array}{c} .5 \\ .6 \\ 1.0 \\ 2.1 \end{array}}$	$\frac{.6}{.8}$ 1.5	$ \frac{.8}{1.1} 2.5 $	1.1 1.6	$1.7 \\ 2.8$	3.0			95	$ \begin{array}{r} 15 \\ 20 \\ 30 \\ 40 \\ 50 \\ 60 \end{array} $
$ \begin{array}{r} 20 \\ 30 \\ 40 \\ 50 \\ 60 \\ 70 \end{array} $	90	0. 0. 0. 0. 0. 0.	0.1 .1 .1 .1 .2 .2	$ \begin{array}{c} .1 \\ .2 \\ .2 \\ $	$ \begin{array}{c} .1 \\ .2 \\ .3 \\ .4 \\ .5 \\ 1.1 \end{array} $	$ \begin{array}{r} .1 \\ .2 \\ .3 \\ .5 \\ .9 \\ .9 \end{array} $	21 3 15 8	$ \begin{array}{r} .2 \\ .4 \\ .6 \\ 1.1 \end{array} $.3 .5 .9	.4 .7 1.3	$\overline{\begin{array}{c} .6\\ 1.0\\ 2.2 \end{array}}$.7 1.5	1.1 2.7	1.6	3.0			90	$ \begin{array}{r} 20 \\ 30 \\ 40 \\ 50 \\ 60 \\ 70 \end{array} $
$20 \\ 30 \\ 40 \\ 50 \\ 60 \\ 70$	85	1^* .1* .1* .1* .2* .3*	$ \begin{array}{c} .1^{*} \\ .0 \\ .0 \\ $	0.0 .0 .1 .1 .2	.0 .1 .1 .2 .3 .6	$ \begin{array}{r} 0 \\ .1 \\ .2 \\ .3 \\ .5 \\ 1.1 \end{array} $.1 .2 .3 .5 .9	$ \begin{array}{c} .1 \\ .2 \\ .4 \\ .7 \\ .7 $	$ \begin{array}{r} .2 \\ .4 \\ .6 \\ 1.1 \end{array} $.3 .5 .9	$\overline{\begin{array}{c} .3 \\ .7 \\ 1.3 \end{array}}$	$\overline{\begin{array}{c} .5\\ 1.0\\ 2.3 \end{array}}$.7 1.5	1.0 2.7	1.6	3.1		85	$ \begin{array}{r} 20 \\ 30 \\ 40 \\ 50 \\ 60 \\ 70 \end{array} $
$\begin{array}{c} 20 \\ 30 \\ 40 \\ 50 \\ 60 \\ 70 \end{array}$	80	2^* .2* .2* .2* .3* .4* .6*	·2* ·2* ·2* ·2* ·2* ·2* ·2* ·3*	$ \begin{array}{c} .1^{*} \\ .1^{*} \\ .1^{*} \\ .0 \\ .0 \end{array} $	$.1^*$.0 .0 .1 .1 .1 .2	$.1^*$.0 .1 .2 .3 .6	$ \begin{array}{c} .0 \\ .1 \\ .2 \\ .3 \\ .5 \\ 1.2 \end{array} $	$ \begin{array}{r} .0 \\ .1 \\ .3 \\ .5 \\ .9 \\ \end{array} $	$ \begin{array}{r} 0 \\ 2 \\ 4 \\ 7 \end{array} $	$ \begin{array}{r} 1 \\ .3 \\ .6 \\ 1.1 \end{array} $	$\begin{array}{ c c }\hline .1\\ .4\\ .9\\ \hline \end{array}$	$ \begin{array}{r} .2 \\ .6 \\ 1.3 \end{array} $.4 .9 2.4	.5 1.5	.9 2.8	1.5	3.1	80	$ \begin{array}{r} 20 \\ 30 \\ 40 \\ 50 \\ 60 \\ 70 \end{array} $
$ \begin{array}{r} 20 \\ 30 \\ 40 \\ 50 \\ 60 \\ 70 \end{array} $	75	3^* 3^* 4^* 4^* 6^* 1.2^*	3^* 3^* 3^* 3^* 4^* 6^*	$ \begin{array}{r} .2^{*}\\ .2^{*}\\ .2^{*}\\ .2^{*}\\ .2^{*}\\ .3^{*} \end{array} $	2^* .2* .1* .1* .1* .0	2^* .1* .1* .0 .1 .2	$.1^*$.1* .0 .1 .3 .6	$.1^*$.0 .1 .3 .5 1.2	$.1^*$.1 .2 .5 .9	.1* .1 .4 .7	$ \begin{array}{r} 0 \\ .2 \\ .5 \\ 1.1 $.0 .4 .8	$\overline{.1}$.6 1.3	$\frac{.2}{.9}$ 2.5	.3 1.5	.6 3.0	1.2	75	$ \begin{array}{r} 20 \\ 30 \\ 40 \\ 50 \\ 60 \\ 70 \end{array} $
$20 \\ 30 \\ 40 \\ 50 \\ 60 \\ 70$	70	.4* .4* .5* .6* .9*	$.4^*$.4* .5* .6* 1.2*	.3* .3* .3* .3* .4* .6*	.3* .3* .2* .3* .3*	$\begin{array}{c} & .3^{*} \\ .2^{*} \\ .2^{*} \\ .2^{*} \\ .1^{*} \\ .1^{*} \end{array}$	$.3^*$ $.2^*$ $.1^*$.0 .1 .2	$ \begin{array}{c} .2^{*}\\.1^{*}\\.0\\.1\\.2\\.6\end{array} $	2^* .1* .1 .3 .5 1.2	2^* .0 .2 .4 .9	· 2* .0 .3 .7	$\overline{)}, 2^*$.1 .5 1.1	.2* .2 .8	.6 1.3	.2* .8 2.6	. 2* 1. 5	.2* 3.1	70	$20 \\ 30 \\ 40 \\ 50 \\ 60 \\ 70$
Sun's alti- tude.	Polar dis- tance.	0°	50	10°	150	20°	250	30° Lat	35°	40°	45°	50°	550	60°	65°	700	75°	Polar dis- tance.	Sun's alti- tude.

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TABLE 39.

						Aı	mplitud	les.				•		
Lati						De	eelinatio	n.						Lati
tude.	0°.0	0°.5	1°.0	1°.5	2°.0	2°.5	3°.0	3°. 5	4°.0	4°.5	5°.0	5°.5	6°.0	tuđe.
0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
0	0.0	0.5	1.0	1.5	2.0	2.5	3.0	3.5	4.0	4.5	5.0	5.5	6.0	0
10	0.0	0.5	1.0	1.5	2.0	2.5	$\frac{3.0}{2.1}$	3.5	4.1	4.6	5.1	5.6	6.1	10
10	0.0	$0.5 \\ 0.5$	$1.0 \\ 1.1$	1.0	$\frac{2.1}{2.1}$	2.6	$\frac{5.1}{3.2}$	$\frac{3.0}{3.7}$	4.2	4.7	$5.2 \\ 5.3$	0.7 5.8	6.2 6.4	10
25	0.0	0.5	1.1	1.6	$\frac{2.2}{2.2}$	2.8	3.3	3.8	4.4	5.0	5.5	6.0	6.6	$\frac{20}{25}$
30	0.0	0.6	1.2	1.7	2.3	2.9	3.4	4.0	4.6	5.2	5.8	6.3	6.9	30
$\frac{32}{24}$	0.0	0.6	1.2	1.8	$\frac{2.4}{2.4}$	2.9	3.5	$\frac{4.1}{4.9}$	4.7	5.3	5.9	6.5	$7.0 \\ 7.9$	32
36	0.0	0.6	$1.2 \\ 1.2$	1.8	$\frac{2.4}{2.5}$	$3.0 \\ 3.1$	3.7	4.3	4.9	5.6	6.1	6.8	$7.4^{1.2}$	36
38	0.0	0.6	1.3	1.9	2.5	3.2	3.8	4.4	5.1	5.7	6.3	7.0	7.6	38
40	0.0	0.7	1.3	2.0	2.6	3.3	3.9	4.6	5.2	5.9	6.5	7.2	7.8	40
42	0.0	0.7	$1.3 \\ 1.4$	2.0 2.1	$\frac{2.7}{2.8}$	$3.4 \\ 3.5$	4.0	4.7	0.4 5.6	6.3	6.9	7.6	8.0	42
46	0.0	0.7	1.4	2.2	$2.0 \\ 2.9$	3.6	4.3	5.0	5.8	6.5	7.2	7.9	8.6	46
48	0.0	0.7	1.5	2.2	3.0	3.7	4.5	5.2	6.0	6.7	7.5	8.2	9.0	48
50	0.0	0.8	1.5	2.3	$\frac{3.1}{2.0}$	3.9	4.7	5.4	6.2	$\begin{bmatrix} 7.0\\7.9\end{bmatrix}$	7.8	8.6	9.3	50
$\frac{51}{52}$	0.0	0.8 0.8	$1.0 \\ 1.6$	2.4	3.3	4.1	4.9	5.0 5.7	6.5	$7.2 \\ 7.3$	8.1	9.0	9.5 9.7	$\frac{51}{52}$
53	0.0	0.8	$\tilde{1.6}$	2.5	3.3	4.2	5.0	5.8	6.7	7.5	8.3	9.2	10.0	$5\overline{3}$
54	0.0	0.9	1.7	2.5	3.4	4.3	5.1	6.0	6.8	7.7	8.5	9.4	0.2	54
55 56	0.0	0.9	1.7	2.6	3.5	4.4	$5.2 \\ 5.4$	6.1	$\begin{array}{c c} 7.0 \\ 7.2 \end{array}$	7.9	8.7	9.6	10.5	55 56
50 57	0.0	0.9	1.8 1.8	2.7	3.7	4.6	5.5	6.4	7.4	8.3	9.0	10.1	1.1	57
58	0.0	0.9	1.9	2.8	3.8	4.7	5.7	6.6	7.6	.8.5	9.5	0.4	1.4	58
59	0.0	$\frac{1.0}{1.0}$	$\frac{1.9}{2.0}$	$\frac{2.9}{2.9}$	3.9	$\frac{4.9}{5.0}$	$\frac{5.8}{0.0}$	6.8	7.8	8.8	9.7	0.7	$\frac{1.7}{10.1}$	
60 61	0.0	$1.0 \\ 1.0$	$\frac{2.0}{2.1}$	3.0	4.0	$5.0 \\ 5.2$	6.0 6.2	$7.0 \\ 7.2$	8.0	9.0	10.0 0.3	11.0	$\frac{12.1}{2.5}$	60 61
62	0.0	1.1	$\frac{2.1}{2.1}$	3.2	4.3	5.3	6.4	7.5	8.5	9.6	0.7	1.8	2.9	62
63	0.0	1.1	2.2	3.3	4.5	5.5	6.6	7.7	8.8	9.9	1.1	2.2	3.4	63
64	0.0	$\frac{1.1}{1.9}$	$\frac{2.3}{9.1}$	3.4	4.6	$\frac{5.7}{5.0}$	$\frac{6.9}{71}$	8.0	$-\frac{9.2}{0.5}$	$\frac{10.3}{10.7}$	$\frac{1.0}{11.0}$	$\frac{2.6}{19.1}$	$\frac{3.9}{11.1}$	64
5.5	0.0	$\frac{1.2}{1.2}$	2.4	3.6	4.8	6.0	$7.1 \\ 7.2$	8.5	9.5 9.7	10.7 0.9	11.9 2.1	13.1 3.4	4.6	5.5
6.0	0.0	$\overline{1}.\overline{2}$	2.5	3.7	4.9	6.1	7.4	8.6	9.9	1.1	2.4	3.6	4.9	6.0
6.5	0.0	1.2	2.5	3.8	5.0	6.3	7.5	8.8	10.1	1.3	2.6	3,9	5.2	6.5
$\frac{7.0}{67.5}$	0.0	$\frac{1.0}{1.2}$	$\frac{2.0}{2.6}$	3.0	$\frac{0.1}{5.9}$	6.5	$\frac{1,1}{7,9}$	9.0	$\frac{0.5}{10.5}$	$\frac{1.0}{11.8}$	$\frac{2.9}{13.9}$	4.4	$\frac{0.0}{15.9}$	$\frac{7.0}{67.5}$
8.0	0.0	$1.3 \\ 1.3$	$2.0 \\ 2.7$	4.0	5.2 5.3	6.7	8.0	9.4	0.7	$11.0 \\ 2.1$	3.5	4.8	6.2	8.0
8.5	0.0	1.4	2.7	4.1	5.4	6.8	8.2	9.6	1.0	2.4	3.8	5.2	6.6	8.5
9.0	0.0	1.4	2.8	4.2	5.5 5.7	$\begin{array}{ c c c } 7.0 \\ 7.2 \end{array}$	8.4	9.8	$ 1.2 \\ 1.5$	$\begin{bmatrix} 2.6\\ 2.9 \end{bmatrix}$	4.1	5.5	7.0 7.4	9.0
$\frac{3.3}{70.0}$	$\frac{0.0}{0.0}$	$\frac{1.4}{1.5}$	$\frac{2.9}{2.9}$	4.4	5.8	$\frac{7.2}{7.3}$	8.8	10.0 10.3	$\frac{1.0}{11.8}$	$\frac{2.3}{13.3}$	$\frac{1.1}{14.8}$	$\frac{0.3}{16.3}$	17.8	$\frac{0.0}{70.0}$
0.5	0.0	1.5	3.0	4.5	6.0	7.5	9.0	0.5	2.1	3.6	5.1	6.7	8.2	0.5
1.0	0.0	1.5	3.1	4.6	6.2	7.7	9.3	0.8	2.4	3.9	5.5	7.1	8.7	1.0
1.5 2.0	0.0	$1.6 \\ 1.6$	$3.2 \\ 3.2$	4.7	0.3 6.5	8.1	9.0	1.1 1.4	$\begin{bmatrix} 2.7\\ 3.0 \end{bmatrix}$	4.3	5.9 6.4	8.1	$9.2 \\ 9.8$	$1.5 \\ 2.0$
72.5	0.0	1.7	3.3	$\frac{10}{5.0}$	6.7	8.3	10.0	11.7	13.4	15.1	16.9	18.6	$\frac{0.0}{20.3}$	72.5
3.0	0.0	1.7	3.4	5.1	6.9	8.6	0.3	2.0	3.8	5.5	7.4	9.1	0.9	3.0
3.5	0.0	1.8	3.5	5.2	7.1	8.8	0.6	2.4	$4.2 \\ 4.6$	6.0	7.9	9.7	1.6	3.5
4.5	0.0	1.0	3.7	5.6	7.5	9.4	1.3	3.2	5.1	7.1	9.0	1.0	$\frac{2.3}{3.0}$	4.5
75.0	0.0	1.9	3.8	5.8	7.7	9.7	11.7	13.6	15.6	17.7	19.7	21.7	23.8	75.0
5.5	0.0	2.0	3.9	6.0	8.0	10.0	2.1	4.1	6, 2	8.3	20.4	2.5	4.7	5.5
6.5	0.0	$\frac{2.1}{2.1}$	4.0	$\begin{array}{c} 0.2 \\ 6.4 \end{array}$	8.3	$0.4 \\ 0.8$	$\begin{bmatrix} 2.0\\ 3.0 \end{bmatrix}$	4.0	0.8	9.6	1.1	3.3	5.6 6.6	0.0 6.5
7.0	0.0	$\tilde{2}.2$	4.4	6.6	8.9	1.2	3.5	5.8	8.1	20.4	2.8	5.2	7.7	7.0
	1		1								1			

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TABLE 39.

						An	nplitud	es.						
						De	clinatio	n.					1	
Lati- tude.	6°.0	6°.5	7°.0	7°.5	8°.0	8°.5	9°.0	9°.5	10°.0	10°.5	11°.0	110.5	120.0	Lati- tude.
$^{\circ}_{10}$ 10 15 20 25	${ { 6.0 \atop { 6.1 \atop { 6.2 \atop { 6.4 \atop { 6.6 \atop } } } } } } $	$\overset{\circ}{6.5} \\ \begin{array}{c} 6.6 \\ 6.7 \\ 6.9 \\ 7.1 \end{array}$	${ \begin{array}{c} \circ \\ 7.0 \\ 7.1 \\ 7.2 \\ 7.4 \\ 7.7 \end{array} }$			8.5 8.6 8.8 9.1 9.4	9.0 9.1 9.3 9.6 9.9	${ \begin{array}{c} \circ \\ 9.5 \\ 9.7 \\ 9.8 \\ 10.1 \\ 0.5 \end{array} } }$	${ \begin{smallmatrix} \circ \\ 10.0 \\ 0.1 \\ 0.4 \\ 0.7 \\ 1.1 \end{smallmatrix} }$		$^{\circ}_{11.0}\\ 1.2\\ 1.4\\ 1.7\\ 2.2$	${ { 11.5 \atop { 1.7 \atop { 1.9 \atop { 2.3 \atop { 2.8 \atop { 2.8 \\ } } } } } } } $	${ \begin{smallmatrix} \circ \\ 12.0 \\ 2.2 \\ 2.5 \\ 2.8 \\ 3.3 \end{smallmatrix} }$	$^{\circ}_{10}$ 10 15 20 25
$ \begin{array}{r} 30 \\ 32 \\ 34 \\ 36 \\ 38 \\ 40 \\ \end{array} $	$ \begin{array}{r} 6.9\\ 7.0\\ 7.2\\ 7.4\\ 7.6\\ \hline 7.8 \end{array} $	$ \begin{array}{r} 7.5 \\ 7.7 \\ 7.8 \\ 8.0 \\ 8.2 \\ \hline 8.5 \\ \end{array} $	$ \begin{array}{r} 8.1 \\ 8.3 \\ 8.5 \\ 8.7 \\ 8.9 \\ 9.1 \end{array} $	8.7 8.8 9.0 9.3 9.5 9.8	$ \begin{array}{r} 9.3 \\ 9.5 \\ 9.7 \\ 9.9 \\ 10.2 \\ \end{array} $	$\begin{array}{r} 9.8 \\ 10.0 \\ 0.3 \\ 0.5 \\ 0.8 \\ \hline 11.1 \end{array}$	$ \begin{array}{r} 10.4 \\ 0.6 \\ 0.8 \\ 1.1 \\ 1.4 \\ \end{array} $	$ \begin{array}{c} 11.0\\ 1.2\\ 1.5\\ 1.8\\ 2.1\\ 12.4 \end{array} $	$ \begin{array}{r} 11.5\\ 1.8\\ 2.1\\ 2.4\\ 2.7\\ 13.1\\ \end{array} $	$ \begin{array}{r} 12.1 \\ 2.4 \\ 2.7 \\ 3.0 \\ 3.4 \\ 13.8 \\ \end{array} $	$ \begin{array}{r} 12.7\\ 3.0\\ 3.3\\ 3.6\\ 4.0\\ \hline 14.4 \end{array} $	$ \begin{array}{r} 13.3 \\ 3.6 \\ 3.9 \\ 4.3 \\ 4.7 \\ 15.1 \end{array} $	$ \begin{array}{r} 13.9\\ 4.2\\ 4.5\\ 4.9\\ 5.3\\ 15.7 \end{array} $	$ \begin{array}{r} 30 \\ 32 \\ 34 \\ 36 \\ 38 \\ 40 \end{array} $
42 44 46 48 50	8.0 8.3 8.6 9.0 9.3	$ \begin{array}{r} 8.8 \\ 9.1 \\ 9.4 \\ 9.7 \\ \hline 10.1 \end{array} $	9.49.710.10.510.9	$ \begin{array}{c} 10.1 \\ 0.5 \\ 0.8 \\ 1.2 \\ \hline 11.7 \end{array} $	$ \begin{array}{r} 0.8 \\ 1.1 \\ 1.5 \\ 2.0 \\ \hline 12.5 \\ \end{array} $	$ \begin{array}{r} 1.5 \\ 1.9 \\ 2.3 \\ 2.8 \\ \overline{13.3} \end{array} $	$ \begin{array}{r} 2.1 \\ 2.5 \\ 3.0 \\ 3.5 \\ \hline 14.1 \end{array} $	$ \begin{array}{r} 2.8 \\ 3.3 \\ 3.8 \\ 4.3 \\ \overline{14.9} \end{array} $	$ \begin{array}{r} 3.5 \\ 4.0 \\ 4.5 \\ 5.0 \\ 15.7 \end{array} $	$ \begin{array}{r} 13.2 \\ 4.2 \\ 4.7 \\ 5.2 \\ 5.8 \\ \overline{16.5} \end{array} $	$ \begin{array}{r} 4.8 \\ 5.3 \\ 5.9 \\ 6.6 \\ \hline 17.3 \end{array} $		$ \begin{array}{r} 6.2\\ 6.8\\ 7.4\\ 8.1\\ \hline 18.9 \end{array} $	$ \begin{array}{r} 10 \\ 42 \\ 44 \\ 46 \\ 48 \\ \overline{50} \end{array} $
51 52 53 54 55	9.59.710.00.210.5	$0.4 \\ 0.6 \\ 0.8 \\ 1.1 \\ \overline{11.4}$	$ \begin{array}{r} 1.2 \\ 1.4 \\ 1.7 \\ 2.0 \\ \hline 12.3 \end{array} $	$ \begin{array}{r} 2.0\\ 2.2\\ 2.5\\ 2.8\\ \hline 13.1 \end{array} $	$ \begin{array}{r} 2.8 \\ 3.1 \\ 3.4 \\ 3.7 \\ \overline{14.0} \end{array} $	3.63.94.24.614.9	$ \begin{array}{r} 4.4 \\ 4.7 \\ 5.1 \\ 5.4 \\ \overline{15.8} \end{array} $	5.2 5.6 5.9 6.3 16.7	$ \begin{array}{r} 6.0\\ 6.4\\ 6.8\\ 7.2\\ \overline{17.6} \end{array} $	$ \begin{array}{r} 6.8\\ 7.2\\ 7.6\\ 8.1\\ \overline{18.5}\\ \end{array} $	7.78.18.58.919.4	8.58.99.49.820.3	9.39.720.20.721.2	$51 \\ 52 \\ 53 \\ 54 \\ 55 $
$56 \\ 57 \\ 58 \\ 59 \\ 60$	$0.8 \\ 1.1 \\ 1.4 \\ 1.7 \\ 12.1$	$ \begin{array}{r} 1.7 \\ 2.0 \\ 2.3 \\ 2.7 \\ \overline{13.1} \end{array} $	$ \begin{array}{r} 2.6 \\ 2.9 \\ 3.3 \\ 3.7 \\ \overline{14.1} \end{array} $	3.53.94.34.715.1	$ \begin{array}{r} 4.4 \\ 4.8 \\ 5.2 \\ 5.7 \\ \hline 16.2 \end{array} $	5.3 5.8 6.2 6.7 17.2	$ \begin{array}{r} 6.2 \\ 6.7 \\ 7.2 \\ \overline{7.7} \\ \overline{18.2} \end{array} $	7.27.78.28.719.3	$ \begin{array}{r} 8.1 \\ 8.6 \\ 9.1 \\ 9.7 \\ \hline 20.3 \end{array} $	$ \begin{array}{r} 9.0\\ 9.6\\ 20.1\\ 0.7\\ \hline 21.4 \end{array} $	9.920.51.11.722.4	$ \begin{array}{r} 0.9\\ 1.5\\ 2.1\\ 2.8\\ \hline 23.5\\ \end{array} $	$ \begin{array}{r} 1.8 \\ 2.4 \\ 3.1 \\ 3.8 \\ \hline 24.6 \end{array} $	56 57 58 59 60
	2.52.93.43.914.4	3.53.94.45.015.5	$ \begin{array}{r} 4.6 \\ 5.1 \\ 5.6 \\ 6.2 \\ \hline 16.8 \end{array} $	5.66.16.77.318.0	$ \begin{array}{r} 6.7\\ 7.3\\ 7.9\\ 8.5\\ \hline 19.3 \end{array} $	7.88.49.09.720.5	8.89.420.10.921.7	9.920.61.32.123.0	$ \begin{array}{r} 1.0 \\ 1.7 \\ 2.5 \\ 3.3 \\ \hline 24.2 \end{array} $	$ \begin{array}{r} 2.1 \\ 2.9 \\ 3.7 \\ 4.6 \\ \hline 25.6 \end{array} $	$ \begin{array}{r} 3.1 \\ 3.9 \\ 4.8 \\ 5.7 \\ \hline 26.8 \end{array} $	$ \begin{array}{r} 4.3 \\ 5.2 \\ 6.1 \\ 7.1 \\ 28.2 \end{array} $	5.4 6.3 7.2 8.3 29.5	$ \begin{array}{r} 61 \\ 62 \\ 63 \\ 64 \\ \hline 65, 0 \end{array} $
5.5 6.0 6.5 7.0	$ \begin{array}{r} 4.6 \\ 4.9 \\ 5.2 \\ 5.5 \\ 15.9 \\ \end{array} $	$ \begin{array}{r} 5.8\\ 6.2\\ 6.5\\ 6.8\\ \hline 17.9 \end{array} $	$ \begin{array}{r} 7.1 \\ 7.4 \\ 7.8 \\ 8.2 \\ \overline{19.6} \end{array} $		9.620.00.40.9	$ \begin{array}{r} 0.9\\ 1.3\\ 1.8\\ 2.2\\ \hline 92.7 \end{array} $	$ \begin{array}{r} 2.2 \\ 2.6 \\ 3.1 \\ 3.6 \\ \hline 21.1 \end{array} $	$ \begin{array}{r} 3.5 \\ 3.9 \\ 4.4 \\ 5.0 \\ \hline 25 5 \end{array} $	$ \begin{array}{r} 4.7 \\ 5.3 \\ 5.8 \\ 6.4 \\ \hline 27.0 \\ \end{array} $	$ \begin{array}{r} 6.1 \\ 6.6 \\ 7.2 \\ 7.8 \\ \overline{} \\ 9.4 \\ \end{array} $	$ \begin{array}{c} 7.4 \\ 8.0 \\ 8.6 \\ 9.2 \\ \end{array} $	$ \begin{bmatrix} 3.7 \\ 9.3 \\ 30.0 \\ 0.7 \\ 21.4 $	$ \begin{array}{r} 30.1 \\ 0.7 \\ 1.4 \\ 2.1 \\ \hline 22.0 \end{array} $	5.5 6.0 6.5 7.0 67.5
8.0 8.5 9.0 9.5	$ \begin{array}{r} 13.9 \\ 6.2 \\ 6.6 \\ 7.0 \\ \overline{7.4} \\ \overline{12.9} \end{array} $	$ \begin{array}{r} 17.2 \\ 7.6 \\ 8.0 \\ 8.4 \\ 8.9 \\ \hline 10.2 \end{array} $	$ \begin{array}{r} 18.6 \\ 9.0 \\ 9.4 \\ 9.9 \\ 20.4 \\ \hline \end{array} $	$ \begin{array}{r} 19.9 \\ 20.4 \\ 0.9 \\ 1.4 \\ 1.9 \\ \hline \end{array} $	$ \begin{array}{c} 21.3 \\ 1.8 \\ 2.3 \\ 2.8 \\ 3.4 \\ \hline 21.0 \\ \hline 2.8 \\ 3.4 \\ \hline 21.0 \\ \hline 2.8 \\ 3.4 \\ \hline 21.0 \\ \hline 2.8 \\ $	$ \begin{array}{c} 22.7 \\ 3.2 \\ 3.8 \\ 4.4 \\ 5.0 \\ \hline 95.6 \end{array} $	$ \begin{array}{c} 24.1 \\ 4.7 \\ 5.3 \\ 5.9 \\ 6.5 \\ \hline 97-9 \end{array} $	$ \begin{array}{c} 23.5 \\ 6.1 \\ 6.8 \\ 7.4 \\ 8.1 \\ \hline 22.2 \\ 22.2 \\ \hline $	$ \begin{array}{c} 27.0 \\ 7.6 \\ 8.3 \\ 9.0 \\ 9.7 \\ \hline 20.5 \\ \end{array} $	$ \begin{array}{r} 28.4 \\ 9.1 \\ 9.8 \\ 30.6 \\ 1.4 \\ \hline 29.9 \\ \hline 20.0 \\ \hline 1.4 \\ \hline 20.0 \\ \hline 20.0 \\ \hline 1.4 \\ \hline 20.0 \\ \hline 20.0 \\ \hline 1.4 \\ \hline 20.0 \\ \hline $	$ \begin{array}{c} 29.9 \\ 30.6 \\ 1.4 \\ 2.2 \\ 3.0 \\ \end{array} $	$ \begin{array}{c} 31.4\\ 2.2\\ 3.0\\ 3.8\\ 4.7\\ \hline 25.7\\ \hline 75.7\\ \hline 75.7 \hline 75$	$ \begin{array}{r} 3.2.9 \\ 3.7 \\ 4.6 \\ 5.5 \\ 6.4 \\ \hline 77 \\ 4.6 \\ 75 \\ 74 \\ 75 \\ 4 \end{array} $	67.5 8.0 8.5 9.0 9.5
$\begin{array}{c} 70.0 \\ 0.5 \\ 1.0 \\ 1.5 \\ 2.0 \end{array}$	17.8 8.2 8.7 9.2 9.8	$ \begin{array}{r} 19.3 \\ 9.8 \\ 20.3 \\ 0.9 \\ 1.5 \\ \end{array} $	$ \begin{array}{c} 20.9 \\ 1.4 \\ 2.0 \\ 2.6 \\ 3.2 \\ \hline \end{array} $	$ \begin{array}{r} 22.4 \\ 3.0 \\ 3.6 \\ 4.3 \\ 5.0 \\ \end{array} $	$ \begin{array}{r} 24.0 \\ 4.6 \\ 5.3 \\ 6.0 \\ 6.8 \\ \end{array} $	$ \begin{array}{r} 25.6 \\ 6.3 \\ 7.0 \\ 7.8 \\ 8.6 \\ \hline \end{array} $	$ \begin{array}{r} 27.2 \\ 7.9 \\ 8.7 \\ 9.5 \\ 30.4 \end{array} $	$28.8 \\ 9.6 \\ 30.5 \\ 1.4 \\ 2.3$	$ \begin{array}{r} 30.5 \\ 1.3 \\ 2.2 \\ 3.2 \\ 4.2 \end{array} $	$ \begin{array}{r} 32.2\\ 3.1\\ 4.0\\ 5.0\\ 6.1 \end{array} $	$ \begin{array}{r} 33.9 \\ 4.9 \\ 5.9 \\ 7.0 \\ 8.1 \end{array} $	$ \begin{array}{c} 35.7 \\ 6.7 \\ 7.8 \\ 8.9 \\ 40.2 \\ \end{array} $	$ \begin{array}{r} 37.4 \\ 8.5 \\ 9.7 \\ 40.9 \\ 2.3 \\ \end{array} $	$ \begin{array}{c} 70.0 \\ 0.5 \\ 1.0 \\ 1.5 \\ 2.0 \\ \end{array} $
72.53.03.54.04.5	$20.3 \\ 0.9 \\ 1.6 \\ 2.3 \\ 3.0 \\ \hline$	$22.1 \\ 2.8 \\ 3.5 \\ 4.3 \\ 5.1 \\ \hline$	$23.9 \\ 4.6 \\ 5.4 \\ 6.2 \\ 7.1$	$25.7 \\ 6.5 \\ 7.4 \\ 8.3 \\ 9.3$	$27.6 \\ 8.4 \\ 9.3 \\ 30.3 \\ 1.4$	29.530.41.42.53.6	$31.4 \\ 2.4 \\ 3.4 \\ 4.6 \\ 5.8$	$\begin{array}{c} 33.\ 3\\ 4.\ 4\\ 5.\ 5\\ 6.\ 8\\ 8.\ 2\end{array}$	35.3 6.5 7.7 9.1 40.5	$\begin{array}{c} 37.3 \\ 8.6 \\ 9.9 \\ 41.4 \\ 3.0 \end{array}$	$\begin{array}{c} 39.4 \\ 40.8 \\ 2.2 \\ 3.8 \\ 5.6 \end{array}$	$\begin{array}{c} 41.5 \\ 3.0 \\ 4.6 \\ 6.3 \\ 8.2 \end{array}$	$\begin{array}{c} 43.7\\ 5.3\\ 7.0\\ 8.9\\ 51.1\end{array}$	72.53.03.54.04.5
$75.0 \\ 5.5 \\ 6.0 \\ 6.5 \\ 7.0$	$23.8 \\ 4.7 \\ 5.6 \\ 6.6 \\ 7.7$	$26.0 \\ 6.9 \\ 7.9 \\ 9.0 \\ 30.2$	$28.1 \\ 9.1 \\ 30.2 \\ 1.4 \\ 2.8$	$ \begin{array}{c} 30.3\\ 1.4\\ 2.6\\ 4.0\\ 5.5 \end{array} $	$\begin{array}{c} 32.5\\ 3.8\\ 5.1\\ 6.6\\ 8.2 \end{array}$	$\begin{array}{c c} 34.8 \\ 6.2 \\ 7.7 \\ 9.3 \\ 41.1 \end{array}$	37.2 8.7 40.3 2.1 4.1	$ \begin{array}{c} 39.6 \\ 41.2 \\ 3.0 \\ 5.0 \\ 7.2 \end{array} $	$\begin{array}{c} 42.1 \\ 3.9 \\ 5.9 \\ 8.1 \\ 50.5 \end{array}$	$\begin{array}{c} 44.8 \\ 6.7 \\ 8.9 \\ 51.3 \\ 4.1 \end{array}$	$\begin{array}{c} 47.5 \\ 9.6 \\ 52.1 \\ 4.8 \\ 8.0 \end{array}$	$50.4 \\ 2.8 \\ 5.5 \\ 8.7 \\ 62.4$	53.56.29.3 $63.07.6$	$\begin{array}{c} 75.0 \\ 5.5 \\ 6.0 \\ 6.5 \\ 7.0 \end{array}$

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TABLE 39.

						Ar	nplitud	les.						1
Lati-	Declination. 100 0 170 0													
tude.	120.0	120.5	18°.0	130.5	140.0	14°.5	15°.0	150.5	16°.0	169.5	17°.0	17°.5	18°.0	tude.
0	0	с	0	0	0	0	0	0	0	0	0	0	0	0
0	12.0	12.5	13.0	13.5	14.0	14.5	15.0	15.5	16.0	16.5	17.0	17.5	18.0	10
10	2.2	2.7	3.2	3.7	4.2	4.7	0.0 5.6	0.8 6 1	0.3	0.8 7 1	1.3	1.9	8.3	10
$\frac{10}{20}$	$\frac{2.0}{2.8}$	2.9	3.8	4.0	4.9	5.5	6.0	6.5	7.1	7.6	8.1	8.7	9.2	20
$\frac{10}{25}$	3.3	3.8	4.4	4.9	5.5	6.1	6.6	7.1	7.7	8.3	8.8	9.4	9.9	$\overline{25}$
30	13.9	14.5	15.0	15.6	16.2	16.8	17.4	18.0	18.6	19.2	19.7	20.3	20.9	30
32	4.2	4.8	5.3	6.0	6.6	7.2	7.8	8.4	9.0	9.6	20.2	0.8	1.4	32
34	4.5	5.1	5.7	6.4	$\frac{7.0}{1}$	7.6	8.2	8.8	9.5	20.0	0.7	1.3	1.9	34
36	4.9	0.0	6.1	$\begin{array}{c} 6.8 \\ 7.9 \end{array}$	$\frac{7.4}{7.0}$	8.0	8.7	9.3	20.0	0.0	1.2	1.8	$\begin{array}{c} 2.0\\ 2.1 \end{array}$	30 20
38	0.0	$\frac{0.0}{10.1}$	0.0	17.9	19 1	$\frac{0.0}{10.1}$	$\frac{3.2}{10.7}$	90.1	91 1	91.8	99.1	2. 4	92 8	
40	15.7	$ \begin{array}{c} 10.4 \\ 6.7 \end{array} $	$\frac{17.1}{7.3}$	8.0	8.7	9.4	$\frac{19.7}{20.0}$	0.8	1.4	$\frac{21.8}{2.1}$	2.8	$\frac{20.1}{3.5}$	$\frac{40.8}{4.2}$	40
42	6.2	6.9	7.6	8, 3	9.0	9.7	0.4	1.1	1.8	2.5	3.2	3.9	4.6	42
43	6.5	7.2	7.9	8.6	9.3	20.0	0.7	1.4	2.2	2.9	3.6	4.3	5.0	43
44	6.8	7.5	8.2	8.9	9.6	0.4	1.1	1.8	2.6	3.3	4.0	4.7	5.4	44
45	17.1	17.8	18.5	19.3	20.0	20.7	21.5	22.2	23.0	23.7	24.4	25.2	25.9	45
46	7.4	8.2	8.9	9.6	0.4	1.1	1.9	$\begin{bmatrix} 2.6\\ 2.1 \end{bmatrix}$	3.4	4.1	4.9	5.7	6.4	$\frac{46}{47}$
47	0.1	8.0	9.3	20.0	0.8	1.0	2.3 2.8	3.1	0.0	4.0	5.4	$\begin{array}{c} 0.2\\ 6.7\end{array}$	0.9	41
40	8.5	9.3	20.1	0.8	1.2 1.6	2.4	$\frac{2.8}{3.2}$	4.1	4.9	5.7	6.5	7.3	8.1	49
50	18.9	19.7	$\frac{20.1}{20.5}$	21.3	22.1	22.9	$\frac{3.7}{23.7}$	24.6	25.4	26.2	$\overline{27.0}$	27.9	28.7	$\frac{10}{50}$
51	9.3	20.1	0.9	1.8	2.6	3.5	4.3	5.1	6.0	6.8	7.6	8.5	9.4	51
52	9.7	0.6	1.4	2.3	3,1	4.0	4.9	5.7	6.6	7.5	8.3	9.2	30.1	52
53	20.2	1.1	1.9	2.8	3.7	4.6	5.5	6.4	7.3	8.2	9.0	30.0	0.9	53
54	0.7	1.6	2.5	3.4	4.3	5.2	$\frac{6.1}{2000}$	$\frac{7.1}{07.0}$	8.0	8.9	9.8	0.8	1.7	- 54
55	21.2	22.2	23.1	24.0	$24.9 \\ 5.6$	25.9	26.8	27.8	28.7	29.7	30.6	31.6	32.6	50 50
50 57	1.8	2.8	3.1	4.7	$\begin{array}{c} 0.0\\ 6.4 \end{array}$	0.0	8.1	9.0	30.4	30.3	1.0 2.5	2.0	3.0	$\frac{30}{57}$
58	3 1	4.1	5.1	6.1	7.2	8.2	9.2	30.3	1.3	2.4	3.5	4.6	5.7	58
59	3.8	4.8	5.9	6.9	8.0	9.1	30.2	1.3	2.3	3.5	4.6	5.7	6.9	59
60	24.6	25.6	26.7	27,8	28.9	30.1	31.2	32.3	33.4	34.6	35.8	36.9	38.2	60
61	5.4	6.5	7.6	8.8	9.9	1.1	2.2	3.5	4.6	5.8	7.1	8.3	9.6	61
62	6.3	7.5	8.6	9.8	31.0	2.2	3.4	4.7	5.9		8.5	9.8	41.2	$62 \\ c_{2}$
63	7.2	8.0	9.7	31.0	2.2	3.0	4.1	$\begin{bmatrix} 0.1 \\ 7.6 \end{bmatrix}$	0.4	8.1 40.4	1 8	41.0	2.9	03 64
85 0	0.0	20.9	29.9	22.5	31.0	26.3	37.8	20.9	40.7	42.2	13.8	45.4	47.0	65 0
5.5	29.0	1 5	29	4 3	5 7	7.1	8.6	40.1	1.6	3.2	4.8	6.5	8.2	5.5
6.0	0.7	2.2	3.6	5.0	6.5	8.0	9.5	1.1	2.7	4.3	5.9	7.7	9.4	6.0
6.5	1.4	2.9	4.3	5.8	7.3	8.9	40.5	2.1	3.8	5.4	7.1	8.9	50.8	6.5
7.0	2.1	3.6	5.1	6.7	8.2	9.8	1.5	3.2	4.9	6.6	8.4	50.3	2.3	7.0
67.5	32.9	34.4	36.0	37.6	39.2	40.8	42.6	44.3	46.1	47.9	49.8	51.8	53.9	67.5
8.0	3.7	5.3	6.9	8.6	40.2	1.9	3.7	0.0	0.4	9.3	51.3	3.4	0.6	8.0
8.0	4.0	0.2	8.0	40.7	1.0	$\frac{5.1}{4.3}$	6.9	8.9	50.3	2.4	$\begin{bmatrix} 2.9\\4.6\end{bmatrix}$		9.6	9.0
9.5	6.4	8.2	40.0	1.8	3.7	5.6	7.6	9.7	1.9	4.2	6.5	9.1	61.9	9.5
70.0	37.4	39.3	41.1	43.0	45.0	47.0	49.2	51.4	53.7	56.1	58.7	61.5	64.6	70.0
0.5	8.5	40.4	2.4	4.4	6.4	8.6	50.8	3.2	5.7	8.3	61.1	4.3	7.8	0.5
1.0	9.7	1.7	3.7	5.8	8.0	50.3	2.6	5.2	7.9	60.7	3.9	7.5	71.7	1.0
1.5	40.9	3.0	5.1	7.4	9.7	$\begin{bmatrix} 2.1\\ 4.1 \end{bmatrix}$	4.6	7.4	60.3	3.5	$\begin{array}{c} 7.1. \\ 71.1 \end{array}$	11.4	6.9	1.5
-2.0	2.3	4.4	0.7	9.1	59 0	4.1	0.9	9.9	0.1 Re 4	70.0	76 5	0.7	90.0	79.5
12.0	45.7	40.0	48.4	3.0	5 0	8 0	69.4	6 1	70.6	6.3	90.0	50.0		3.0
3.5	7.0	9.6	2.3	5.3	8.4	61.8	5.6	70.3	6.1	90.0	00.0			3.5
4.0	8.9	51.7	4.7	7.9	61.4	5.3	9.8	75.9	90.0					4.0
4.5	51.1	4.1	7.3	60.9	4.9	9.5	75.5	90.0						4.5
	1	1	1			1							1	

TABLE 39.

Amplitudes.

						D	eclinatio	n.					· · · ·	
Lati- tude.	18°.0	18°.5	19°.0	19°.5	20°.0	20°. 5	21°.0	21°. 5	22°.0	220.5	23°.0	23°. õ	24°.0	tude,
$^{\circ}_{0}$ 10 15 20 25 20	° 18.0 8.3 8.7 9.2 9.9	° 18.5 8.8 9.2 9.7 20.5	\circ 19.0 9.3 9.7 20.3 1.1 22.1	$ \begin{array}{c} \circ \\ 19.5 \\ 9.8 \\ 20.2 \\ 0.8 \\ 1.6 \\ \hline 22.7 \end{array} $	$ \begin{array}{c} \circ \\ 20.0 \\ 0.3 \\ 0.7 \\ 1.4 \\ 2.2 \\ \hline 23.3 \\ \end{array} $	$ \begin{array}{r} \circ \\ 20.5 \\ 0.8 \\ 1.3 \\ 1.9 \\ 2.7 \\ \hline 23.8 \\ \end{array} $	$ \begin{array}{r} \circ \\ 21.0 \\ 1.3 \\ 1.8 \\ 2.4 \\ 3.3 \\ \hline 24.4 \end{array} $	$ \begin{array}{c} \circ \\ 21.5 \\ 1.8 \\ 2.3 \\ 3.0 \\ 3.9 \\ \hline 25.0 \end{array} $	$^{\circ}$ 22. 0 2. 3 2. 8 3. 5 4. 4 25. 6	$\begin{array}{c} \circ \\ 22.5 \\ 2.9 \\ 3.3 \\ 4.0 \\ 5.0 \\ \hline 26.2 \end{array}$	$ \overset{\circ}{23.0} \\ 3.4 \\ 3.9 \\ 4.6 \\ 5.5 \\ \hline 26.8 \\ \hline $	\circ 23.5 3.9 4.4 5.1 6.1 27.4	$\begin{array}{r} \circ \\ 24.0 \\ 4.4 \\ 4.9 \\ 5.7 \\ 6.7 \\ \hline 28.0 \end{array}$	$^{\circ}$ 10 15 20 25 30
$ \begin{array}{r} 30 \\ 32 \\ 34 \\ 36 \\ 38 \\ 40 \\ 41 \\ 42 \end{array} $	$ \begin{array}{c} 20.3 \\ 1.4 \\ 1.9 \\ 2.5 \\ 3.1 \\ \hline 23.9 \\ 4.2 \\ 4.6 \\ \end{array} $	$ \begin{array}{r} 21.0 \\ 2.0 \\ 2.5 \\ 3.1 \\ 3.8 \\ \hline 24.4 \\ 4.8 \\ 5.8 \\ \hline \end{array} $	$\begin{array}{r} 22.1\\ 2.6\\ 3.1\\ 3.7\\ 4.4\\ \hline 25.1\\ 5.5\\ 6.0\\ \end{array}$	$ \begin{array}{r} 3.2\\ 3.8\\ 4.4\\ 5.1\\ \hline 25.8\\ 6.2\\ 6.7\\ \end{array} $	$ \begin{array}{r} 3.8 \\ 4.4 \\ 5.0 \\ 5.7 \\ 26.5 \\ 6.9 \\ 7.4 \\ \end{array} $	$ \begin{array}{r} 4.4 \\ 5.0 \\ 5.7 \\ 6.4 \\ \hline 27.2 \\ 7.7 \\ 8 \\ 1 \end{array} $	$ \begin{array}{r} 5.0 \\ 5.6 \\ 6.3 \\ 7.0 \\ \hline 27.9 \\ 8.3 \\ 8 \\ 8 \end{array} $	$ \begin{array}{r} 25.6 \\ 5.6 \\ 6.2 \\ 6.9 \\ 7.7 \\ \hline 28.6 \\ 9.1 \\ 9.6 \\ \hline 9.6 \end{array} $	$ \begin{array}{c} 20.0 \\ 6.2 \\ 6.9 \\ 7.6 \\ 8.4 \\ \hline 29.3 \\ 9.8 \\ 30.3 \\ \end{array} $	$ \begin{array}{r} 6.8 \\ 7.5 \\ 8.2 \\ 9.1 \\ \overline{30.0} \\ 0.5 \\ 1 0 \end{array} $	$ \begin{array}{r} 7.4 \\ 8.1 \\ 8.9 \\ 9.7 \\ \hline 30.7 \\ 1.2 \\ 1.7 \\ \end{array} $	$ \begin{array}{r} 8.0 \\ 8.7 \\ 9.5 \\ 30.4 \\ \overline{31.3} \\ 1.8 \\ 2.4 \\ \end{array} $	$ \begin{array}{r} 8.7 \\ 9.4 \\ 30.2 \\ 1.1 \\ 32.1 \\ 2.6 \\ 3.2 \\ 3.2 \end{array} $	$ \begin{array}{r} 30 \\ 32 \\ 34 \\ 36 \\ 38 \\ 40 \\ 41 \\ 42 \end{array} $
$ \begin{array}{r} 42 \\ 43 \\ 44 \\ 45 \\ 46 \\ 47 \\ 48 \\ 40 \\ \end{array} $	$ \begin{array}{r} 4.0 \\ 5.0 \\ 5.4 \\ \hline 25.9 \\ 6.4 \\ 6.9 \\ 7.5 \\ 8 1 \end{array} $	$5.3 \\ 5.7 \\ 6.2 \\ 26.7 \\ 7.2 \\ 7.7 \\ 8.3 \\ 8.9 \\ 9$	$ \begin{array}{r} 6.4\\ 6.9\\ \hline 27.4\\ 7.9\\ 8.5\\ 9.1\\ 9.7\\ \end{array} $	$ \begin{array}{r} 7.2 \\ 7.7 \\ \hline 28.2 \\ 8.7 \\ 9.3 \\ 9.9 \\ 30.6 \\ \end{array} $	$ \begin{array}{r} 7.9 \\ 8.4 \\ 28.9 \\ 9.5 \\ 30.1 \\ 0.7 \\ 14 \end{array} $	$ \begin{array}{r} 8.6\\ 9.1\\ \hline 29.7\\ 30.3\\ 0.9\\ 1.6\\ 2.3\\ \end{array} $	$\begin{array}{r} 3.3 \\ 9.3 \\ 9.8 \\ \hline 30.4 \\ 1.0 \\ 1.7 \\ 2.4 \\ 3.1 \end{array}$	$ \begin{array}{r} 30.1 \\ 0.6 \\ \hline 31.2 \\ 1.8 \\ 2.5 \\ 3.2 \\ 4.0 \end{array} $	$ \begin{array}{r} 30.3 \\ 0.8 \\ 1.4 \\ \overline{32.0} \\ 2.6 \\ 3.3 \\ 4.0 \\ 4.8 \\ \end{array} $	$ \begin{array}{r} 1.6 \\ 2.2 \\ \overline{32.8} \\ 3.4 \\ 4.1 \\ 4.9 \\ 5.7 \\ \end{array} $	$ \begin{array}{r} 1.1 \\ 2.3 \\ 2.9 \\ 33.5 \\ 4.2 \\ 4.9 \\ 5.7 \\ 6.5 \\ \end{array} $	$ \begin{array}{r} 2.1\\ 3.0\\ 3.6\\ \hline 34.3\\ 5.0\\ 5.7\\ 6.5\\ 7.4 \end{array} $	$ 3.8 \\ 4.4 \\ 35.1 \\ 5.8 \\ 6.6 \\ 7.4 \\ 8 3 $	
$ \begin{array}{r} 49 \\ 50 \\ 51 \\ 52 \\ 53 \\ 54 \\ 55 \\ \end{array} $	$ \begin{array}{r} 8.1 \\ 28.7 \\ 9.4 \\ 30.1 \\ 0.9 \\ 1.7 \\ \overline{32.6} \end{array} $	$ \begin{array}{r} 8.9\\ \overline{29.6}\\ 30.3\\ 1.0\\ 1.8\\ 2.7\\ \overline{33.6} \end{array} $	$ \begin{array}{r} 9.7 \\ 30.4 \\ 1.1 \\ 1.9 \\ 2.7 \\ 3.6 \\ 34.6 \\ \hline 34.6 $	$ \begin{array}{r} 30.6 \\ 31.3 \\ 2.0 \\ 2.8 \\ 3.7 \\ 4.6 \\ \overline{35.6} \end{array} $	$ \begin{array}{r} 1.4\\ 32.1\\ 2.9\\ 3.7\\ 4.6\\ 5.6\\ 36.6 \end{array} $	$ \begin{array}{r} 2.3 \\ 33.0 \\ 3.8 \\ 4.7 \\ 5.6 \\ 6.6 \\ \overline{37.6} \end{array} $	$ \begin{array}{r} 33.9 \\ 4.7 \\ 5.6 \\ 6.6 \\ 7.6 \\ \overline{38.7} \end{array} $	$ \begin{array}{r} 4.0 \\ 34.8 \\ 5.6 \\ 6.5 \\ 7.5 \\ 8.6 \\ 39.7 \end{array} $	$ \begin{array}{r} 4.8 \\ \overline{35.6} \\ 6.5 \\ 7.5 \\ 8.5 \\ 9.6 \\ \overline{40.8} \end{array} $	$ \begin{array}{r} 36.5 \\ 7.4 \\ 8.4 \\ 9.5 \\ 40.6 \\ \overline{41.9} \end{array} $	$ \begin{array}{r} 0.5 \\ 37.4 \\ 8.4 \\ 9.4 \\ 40.5 \\ 1.7 \\ \overline{42.9} \end{array} $	$ \begin{array}{r} 7.4 \\ \overline{38.3} \\ 9.3 \\ 40.3 \\ 1.4 \\ 2.6 \\ \overline{44.0} \end{array} $	$ \begin{array}{r} 8.3 \\ 39.2 \\ 40.2 \\ 1.3 \\ 2.5 \\ 3.8 \\ 45.2 \end{array} $	
$56 \\ 57 \\ 58 \\ 59 \\ 60.0 \\ 0.5 $	3.6 4.6 5.7 6.9 $38.28.9$	$ \begin{array}{r} 4.6 \\ 5.6 \\ 6.8 \\ 8.0 \\ \overline{39.4} \\ 40.1 \end{array} $	$5.6 \\ 6.7 \\ 7.9 \\ 9.2 \\ 40.6 \\ 1.4$	$\begin{array}{r} 6.7 \\ 7.8 \\ 9.1 \\ 40.4 \\ \hline 41.9 \\ 2.7 \end{array}$	$7.7 \\ 8.9 \\ 40.2 \\ 1.6 \\ 43.2 \\ 4.0 \\ 1.6 \\ 1.6 \\ 1.0 \\ 1.6 \\ 1.0 \\ 1.$	8.8 40.0 1.4 2.8 44.5 5.1	9.8 41.1 2.5 4.1 45.8 6 7	$ \begin{array}{r} 41.0\\ 2.3\\ 3.8\\ 5.4\\ 47.2\\ 8.1 \end{array} $	$ \begin{array}{r} 10.0 \\ 2.1 \\ 3.5 \\ 5.0 \\ 6.7 \\ -48.6 \\ 9.6 \\ \end{array} $	$ \begin{array}{r} 3.2 \\ 4.6 \\ 6.2 \\ 8.0 \\ \overline{49.9} \\ 51 0 \end{array} $	$ \begin{array}{r} 4.3 \\ 5.8 \\ 7.5 \\ 9.3 \\ \overline{51.4} \\ 2 5 \end{array} $	5.4 7.0 8.8 50.7 52.9 4 1	$ \begin{array}{r} 6.7 \\ 8.3 \\ 50.1 \\ 2.2 \\ \overline{54.4} \\ 5.7 \\ \end{array} $	56 57 58 59 60.0
$ \begin{array}{r} 1.0\\ 1.5\\ 2.0\\ \hline 62.5\\ 3.0\\ 2.5\\ \end{array} $	9.6 40.4 1.2 42.0 2.9 2.9	$ \begin{array}{r} 10.9 \\ 1.7 \\ 2.5 \\ \overline{43.4} \\ 4.3 \\ 5 \\ \end{array} $	$ \begin{array}{r} 1.4 \\ 2.2 \\ 3.0 \\ 3.9 \\ \overline{44.9} \\ 5.9 \\ 6 \\ 0 \end{array} $	$ \begin{array}{r} 3.5 \\ 4.4 \\ 5.3 \\ \hline 46.3 \\ 7.4 \\ \circ 5 \end{array} $	$ \begin{array}{r} 4.9 \\ 5.8 \\ 6.8 \\ \overline{47.8} \\ 8.9 \\ 50 \\ \end{array} $	$ \begin{array}{r} 6.3 \\ 7.3 \\ 8.3 \\ \overline{49.4} \\ 50.5 \\ 1.7 \end{array} $	$ \begin{array}{r} 0.1 \\ 7.7 \\ 8.7 \\ 9.8 \\ \overline{51.0} \\ 2.2 \\ 2.5 \\ \end{array} $	9.1 50.2 1.3 52.6 3.9 5.2 52.6 5.2 5.2 5.2 5.2 5.2 5.2 5.2 5.2	$50.6 \\ 1.7 \\ 2.9 \\ 54.2 \\ 5.6 \\ 7.1 \\ 1$	$ \begin{array}{r} 2.1 \\ 3.3 \\ 4.6 \\ \overline{56.0} \\ 7.5 \\ 0.1 \\ \end{array} $	$ \begin{array}{r} 2.0 \\ 3.7 \\ 5.0 \\ 6.3 \\ \overline{57.8} \\ 9.4 \\ 61 \\ 1 \end{array} $	$5.3 6.7 8.1 \overline{59.7}61.4$	$ \begin{array}{r} 7.0 \\ 8.5 \\ 60.0 \\ \overline{61.7} \\ 3.6 \\ 5 \\ \overline{7} \end{array} $	$ \begin{array}{r} 0.0 \\ 1.0 \\ 1.5 \\ 2.0 \\ \overline{62.5} \\ 3.0 \\ 2 5 \end{array} $
$ \begin{array}{r} 3.5\\ 4.0\\ 4.5\\ 65.0\\ 5.5\\ 6.0\\ 6.0\\ 6.5\\ \end{array} $	$ \begin{array}{r} 3.8 \\ 4.8 \\ 5.9 \\ \overline{47.0} \\ 8.2 \\ 9.4 \\ 5.9 \\ \hline 47.0 \\ 8.2 \\ 9.4 \\ 5.9 \\ $	$ \begin{array}{r} 5.3 \\ 6.4 \\ 7.5 \\ \overline{48.7} \\ 50.0 \\ 1.3 \\ 7.5 \\ \end{array} $	$ \begin{array}{r} 6.9 \\ 8.0 \\ 9.2 \\ \overline{50.4} \\ 1.8 \\ 3.2 \\ 4.7 \\ \hline 7 7 7 7 7 $	$ \begin{array}{r} 8.5 \\ 9.7 \\ 50.9 \\ \overline{52.2} \\ 3.6 \\ 5.1 \\ 0 \end{array} $	$ \begin{array}{r} 50.1 \\ 1.3 \\ 2.6 \\ \overline{54.0} \\ 5.6 \\ 7.3 \\ 7.3 \\ \end{array} $	$ \begin{array}{r} 1.7\\ 3.0\\ 4.5\\ \hline 56.0\\ 7.6\\ 9.4\\ \end{array} $	$ \begin{array}{r} 3.5 \\ 4.9 \\ 6.4 \\ \overline{58.0} \\ 9.8 \\ 61.8 \\ 61.8 \\ \end{array} $	$ \begin{array}{r} 3.3 \\ 6.7 \\ 8.4 \\ \overline{60.2} \\ 2.2 \\ 4.4 \\ 0 \end{array} $	$ \begin{array}{r} 7.1\\ 8.7\\ 60.5\\ \hline 62.5\\ 4.7\\ \hline 7.1\\ \hline 0 \end{array} $	$ \begin{array}{r} 9.1\\ 60.7\\ 2.8\\ \hline 64.9\\ 7.3\\ 70.2\\ 9.7\\ \hline $	$\begin{array}{r} 61.1\\ 3.0\\ 5.2\\ \hline 67.6\\ 70.4\\ 3.8\\ \end{array}$	$ \begin{array}{r} 3.4 \\ 5.5 \\ 7.8 \\ \overline{70.6} \\ 4.1 \\ 8.6 \\ 0.0 \\ \end{array} $	$ \begin{array}{r} 3.1 \\ 8.1 \\ 70.9 \\ \overline{74.4} \\ 8.9 \\ 90.0 \\ \end{array} $	$ \begin{array}{r} 3.5 \\ 4.0 \\ 4.5 \\ \overline{65.0} \\ 5.5 \\ 6.0 \\ 6.5 \\ 6.0 \\ 5.5 \\ 5.5 \\ 6.0 \\ 5.5 \\ $
$ \begin{array}{r} 6.5 \\ 7.0 \\ \overline{67.5} \\ 8.0 \\ 8.5 \\ 9.0 \\ 9.5 \\ \end{array} $	$ \begin{array}{r} 50.8 \\ 2.3 \\ \overline{53.9} \\ 5.6 \\ 7.5 \\ 9.6 \\ 61.9 \\ \end{array} $	$ \begin{array}{r} 2.7 \\ 4.3 \\ \overline{56.0} \\ 7.9 \\ 60.0 \\ 2.3 \\ 5.0 \\ \end{array} $	$\begin{array}{r} 4.7\\ 6.4\\ \overline{58.3}\\ 60.3\\ 2.6\\ \overline{5.3}\\ 8.4\end{array}$	$ \begin{array}{r} 6.8 \\ 8.7 \\ \overline{60.7} \\ 3.0 \\ 5.6 \\ 8.7 \\ 72.4 \\ \end{array} $	$ \begin{array}{r} 9.1\\ 61.1\\ \overline{63.4}\\ 5.9\\ 8.9\\ 72.7\\ 7.6 \end{array} $	$ \begin{array}{r} 61.4 \\ 3.7 \\ \overline{66.2} \\ 9.2 \\ 72.8 \\ 7.7 \\ 90.0 \\ \end{array} $	$ \begin{array}{r} 4.0 \\ 6.5 \\ \overline{69.5} \\ 73.0 \\ 7.9 \\ 90.0 \\ \end{array} $	$ \begin{array}{r} 6.8 \\ 9.8 \\ \overline{73.3} \\ 8.1 \\ 90.0 \\ \end{array} $	$ \begin{array}{r} 70.0 \\ 3.5 \\ \overline{78.2} \\ 90.0 \\ \end{array} $	$ \frac{3.7}{8.3} \frac{90.0}{90.0} $	8.4 90.0	90.0		$ \begin{array}{r} 6.5 \\ 7.0 \\ 67.5 \\ 8.0 \\ 8.5 \\ 9.0 \\ 9.5 \\ \end{array} $
$70.0 \\ 0.5 \\ 1.0 \\ 1.5 \\ 2.0$	$\begin{array}{c} 64.\ 6\\ 7.\ 8\\ 71.\ 7\\ 6.\ 9\\ 90.\ 0\end{array}$	$\begin{array}{c} 69.1 \\ 71.9 \\ 7.1 \\ 90.0 \end{array}$	72.2 7.2 90.0	77.4 90.0	90.0		•							$70.0 \\ 0.5 \\ 1.0 \\ 1.5 \\ 2.0$

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TABLE 39.

Amplitudes.

Lati-		1				De	eelinatio	n.						Lati
tude.	24°.0	24°.5	25°.0	25°.5	26°.0	26°.5	27°.0	27°.5	28°.0	28°.5	29°.0	29°.5	30°.0	tude.
0	0	01.7	0	0	0	0 00 T	0	0	0000	00 5	0	° -	0	0
0	24.0	24.5	25.0 5 1	20.0	26.0 6 1	26.0	$\frac{27.0}{7.1}$	21.5	28.0	28.5	29.0	29.5	30.0	0
8	4.3	4.8	5.3	5.8	6.3	6.8	7.3	7.8	8.3	8.8	9.1	9.0	0.1 0.3	8
12	4.6	5.1	5.6	6.1	6.6	7.1	7.6	8.1	8.7	9.2	9.7	30.2	0.7	12
16	5.0	5.6	6.1	6.6	7.1	7.6	8.2	8.7	9.2	9.8	30.3	0.8	1.3	16
20	25.7	26.2	26.7	27.3	27.8	28.3	28.9	29.4	30.0	30.5	31.1	31.6	32.1	20
22	6.0	6.6	$\frac{7.1}{7.6}$	7.7	8.2	8.8	/9.3	9.9	0.4	1.0	1.5	2.1	2.6	.22
24 26	6.9	7.0 7.5	8.1	8.6	9.2	$9.2 \\ 9.7$	30.3	0.4	1.5	2.0	2.0	2.0	3.2	24 26
28	7.4	8.0	8.6	9.2	9.8	30.3	0.9	1.5	2.1	2.7	3.3	3.9	4.5	$\frac{1}{28}$
30	28.0	28.6	29.2	29.8	30.4	31.0	31.6	32.2	32.8	33.4	34.0	34.7	35.3	- 30
31	8.3	8.9	9.5	30.1	0.8	1.4	2.0	2.6	3.2	3.8	4.5	5.1	5.7	31
32	8.7	9.3	9.9	0.5	1.1	1.7	2.4	$\frac{3.0}{2.4}$	3.6	4.2	4.9	5.5	$\frac{6.1}{6.6}$	32
33 34	9.0	30.0	0.2	31.3	1.9	$\frac{2.1}{2.6}$	$\frac{2.8}{3.2}$	3.8	4.0	5.1	5.8	6.4	$\frac{0.0}{7.1}$	- 35 - 34
35	29.8	$\frac{30.3}{30.4}$	31.1	31.7	32.3	33.0	33.6	34.3	35.0	$\frac{5.1}{35.6}$	36.3	36.9	$\frac{1.1}{37.6}$	35
36	30.2	0.8	1.5	2.1	2.8	3.5	4.1	4.8	5.5	6.1	6.8	7.5	8.2	36
37	0.6	1.3	1.9	2.6	3.3	4.0	4.6	5.3	6.0	6.7	7.4	8.1	8.8	37
$\frac{38}{20}$	1.1	1.7	2.4	$\frac{3.1}{2.6}$	$\frac{3.8}{1.2}$	4.5	$5.2 \\ 5.7$	5.9	$\frac{6.6}{7.9}$	7.3	8.0	8.7	9.4	38
- 10	39 1	29.8	33.5	3.0	34.0	35.6	36.3	87.1	37.8	38 5	30 3	40.0	40.0	- 39
41	$\frac{52.1}{2.6}$	3.3	4.1	4.8	5.5	6.2	7.0	7.7	8.5	9.2	40.0	0.7	1.5	41
42	3.2	3.9	4.7	5.4	6.1	6.9	7.7	8.4	9.2	9.9	0.7	1.5	2.3	$\overline{42}$
43	3.8	4.5	5.3	6.1	6.8	7.6	8.4	9.2	9.9	40.7	1.5	2.3	3.1	43
44	$\frac{4.4}{05.1}$	$\frac{5.2}{25.2}$	6.0	6.8	$\frac{7.5}{2000}$	8.3	9.1	40.0	40.7	1.6	2.4	3.2	4.0	44
40	30.1	35.9	$\frac{36.7}{7.5}$	31.5	38.3	39.1	39.9	40.8	41.6	42.5	43.3	44.1	45.0	40
47	6.6	7.4	8.3	9.1	40.0	0.9	1.7	2.6	$\frac{2.5}{3.5}$	4.4	5.3	6.2	7.1	40
48	7.4	8.3	9.2	40.0	0.9	1.8	2.7	3.6	4.6	5.5	6.4	7.4	8.3	48
49	8.3	9.2	40.1	1.0	1.9	2.8	3.8	4.7	5.7	6.7	7.6	8.6	9.6	
50	39.2	40.2	41.1	42.0	43.0	43.9	44.9	45.9	46.9	47.9	48.9	50.0	51.1	$\frac{50}{51}$.
52	40.2	1.2	2.2	3.2	4.1	5.1	6. Z	7.2	8.2	9.3	2 0	1.0	2.6	01 59
53	2.5	$\frac{2.5}{3.5}$	4.6	5.7	6.7	7.8	9.0	50.1	51.3	2.5	3.7	4.9	6.2	53^{-1}
54	3.8	4.9	6.0	7.1	8.2	9.4	50.6	1.8	3.0	4.3	5.6	6.9	8.3	54
55.0	45.2	46.3	47.5	48.6	49.8	51.1	52.3	53.6	54.9	56.3	57.7	59.1	60.7	55.0
5.5	5.9	7.1	8.3	.9.5	50.7	2.0	3.3	4.6	6.0	7.4	8.9	60.4	2.0	5.5
6.0	0.7	1.9	9.1	00.4	1.0	2.9	4.3	5. 7	1.1	8.0	00.1	1.1	$\frac{3.4}{5.0}$	0.0 6.5
7.0	8.3	9.6	0.9	$\frac{1.0}{2.2}$	3.6	5.0	6.5	8.0	9.5	61.2	2.9	4.7	6.6	7.0
57.5	49.2	50.5	51.9	53.2	54.7	56.2	57.7	59.3	60.9	62.6	64.5	66.4	68.5	57.5
8.0	50.1	1.5	2.9	4.3	5.8	7.4	8.9	60.6	2.4	4.2	6.2	8.3	70.7	8.0
8.5	1.1	2.5	4.0	5.5	7.0	8.6	60.3	2.1	3.9	6.0	8.1	70.4	3.1	8.5
9.0	2.2	3.6	$\begin{bmatrix} 0,1\\6,4 \end{bmatrix}$	6.7	8.3	60.0	1.8	3.7	$\begin{bmatrix} 5.7\\7.7 \end{bmatrix}$	7.9	10.3	3.0	6. Z 80 1	9.0
60 0	54 4	56.0	57 7	59 4	61 9	63 2	65 9	67 4	69 9	72.6	75.8	80.0	90.0	60 0
0.5	5.7	7.4	9.1	61.0	2.9	5.0	7.2	9.6	72.4	5.8	9.9	90.0	00.0	0.5
1.0	7.0	8.8	60.7	2.6	4.7	7.0	9.5	72.3	5.5	9.8	90.0			1.0
1.5	8.5	60.3	2.3	4.4	6.7	9.2	72.0	5.4	9.7	90.0				1.5
2.0	$\frac{60.0}{61.7}$	$\frac{2.0}{2.0}$	$\frac{4.2}{66.2}$	6.5	9.0	71.9	$\frac{5.2}{2}$	9.6	90.0					2.0
02.0	01.7	6.0	8.6	08.8	4 9	10.1	9.5	90.0						02.5
3.5	5.7	8.3	71.3	4.8	9.3	90.0	00.0							3.5
4.0	8.1	71.1	4.6	9.2	90.0						-			4.0
4.5	70.9	4.4	9.0	90.0										4.5
									l	1				

						ТА	BLE	40.	•				[Page	581
		Co	rrection	n of the	e Ampl	itude a	s obser	rved on	the A	pparen	t Horiz	on.		
Lati						De	clinatio	on						Lati
tude.	0 °	5 °	10°	120	14°	16°	18°	200	220	240	26°	280	80°	tude.
o	· o	o	0	o	o	0	o	0	o	0	0	0	0	0
0	0.0	$\begin{array}{c ccccccccccccccccccccccccccccccccccc$												
5	.1	.1	.1	$\frac{1}{1}$	$\frac{1}{1}$	• 1	• 1	· 1 1	• • 1	• L 1	· · 1	.1	$\cdot 1$	
10	1.12	, <u>1</u> 9	$^{,1}_{,2}$	• 1	• 1	.1	. 1	$^{,1}_{9}$.1	. 1	. 1	• 1	$^{-1}_{-9}$	10
$\frac{10}{20}$	$\frac{1}{2}$	$\frac{1}{2}$	$\frac{1}{2}$	$\dot{2}$	$\ddot{2}$	$\frac{1}{2}$.3	.3	.3	.3	.3	. 3	. 3	$\frac{10}{20}$
24	0.3	0.3	0.3	0.3	0.3	0.3	0.3	0.3	0.3	0.3	0.3	0.4	0.4	24
28	.3	. 4	. 4	.4	.4	.4	.4	.4	.4	.4	. 4	. 4	. 4	28
$\frac{32}{96}$.4	.4	. +	.4	. 4	.4	. 4	.5	.5	.5	.5	.5	.5	$\frac{32}{2c}$
36	.05	.0	. 0	. Ə 5	. ð 6	. 5	. Ə 6	.ə 8	.0 8	.0	.0	.07	.07	- 30 - 38
	0.6		0.6	$-\frac{10}{0.6}$	0.6	0.6	$\frac{10}{0.6}$	$-\frac{.0}{0.6}$	$-\frac{.0}{0.6}$	$\frac{.0}{0.7}$	0.7	0.7	0.7	- 10
42	.6	. 6	. 6	. 6	. 6	. 7	.7	.7	.7	. 7		.8	.8	42
44	. 6	$\dot{6}$.7	.7	.7	.7	.7	.7	.8	.8	. 8	. 9	.9	44
46	.7	. 7	. 7	.7	.7	. 8	. 8	.8	.8	. 9	. 9	. 9	1.0	46
48	.7		. 8	. 8	. 8	.8	. 8	.9	. 9	1.0	1.0	1.0	1	48
50	0.8	0.8	0.8	0.8	0.9	0.9	0.9	0.9	1.0	1.1	1.1	1.1	1.3	50 50
52 54	.8	.9	.9	.9	.9	1.0	1.0	1.0	.1	. 2	.2	.3	.5	52 51
- 54 - 56	.9	10	1.0	1.0	1.0	$\frac{1}{2}$	$^{-1}_{2}$	•1	. 4	. ə 5	.4		22	56
58	.1	.1	$\frac{1}{2}$	$\cdot \cdot \cdot 2$	$\cdot \hat{2}$.3	. 3	.4	.5	.7	.9	2.3	3.2	58
60	1.2	1.2	1.3	1.3	1.3	1.4	1.5	1.6	1.7	2.0	2.4	3.4		60
62	. 3	. 3	. 4	. 4	.4	. 6	.7	.8	2.1	. 5	3.5			62
64 66	. 1	. 1	.5	.5	.6	.8	. 9	2.2	.6	3.7				64 ee
- 00 - 68	.ə 6	$\frac{1}{7}$	•7	2.0	.9	2.0	$\frac{2.3}{0}$.8	3.8					68
	$\frac{.0}{1.8}$	10	$-\frac{.9}{2.1}$	2.0	2.2	3 1	1 2	4.0						$-\frac{00}{70}$
$\frac{70}{72}$	$\frac{1.0}{2.0}$	$\frac{1.3}{2.1}$.5		3.3	4.6	т. 9	•						72
74	.2	.5	3.0	3.5	4.8									74
76	.6	3.0	.8	5.2										76
78	3.1	.6	5.7											78
80	3.8	4.4												80
				1					1					1

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TABLE 41.

Natural Sines and Cosines.

		1											<u></u>
Prop. parts		0	o .	1	0	2	0	3	0	4	0		Prop. parts
29	М.	N. sine.	N. cos.	N. sine.	N, cos.	N. sine.	N. cos.	N. sine.	N. cos.	N. sine	N.,cos.		2
0	0	00000	100000	01745	99985	03490 02510	99939	05234	99863	06976	99756	60	$\begin{vmatrix} 2 \\ 0 \end{vmatrix}$
1	1	00029	100000	01/14	99984	03519	99938	05203	99861 00860	07000	99704	59	
1	43	00058	100000	01805	99984	03548 03577	99936	05292 05321	99800	07063	99752 99750	- 3 8 - 57	
2	4	00116	100000	01862	99983	03606	99935	05350	99857	07092	99748	56	2
$\overline{2}$	5	00145	100000	01891	99982	03635	99934	05379	99855	07121	99746	55	$\overline{2}$
3	6	00175	100000	01920	99982	03664	99933	05408	99854	07150	99744	54	2
3	7	00204	100000	01949	99981	03693	99932	05437	99852	07179	99742	53	2
4	8	00233	100000	01978	99980	03723	99931	05466	99851	07208	99740	52	2
4	9	00262	100000	02007	99980	03752	99930	05495	99849	07237	99738	51	$\begin{vmatrix} 2 \\ - \end{vmatrix}$
0 5	10	00291	100000	02030	99979	03781	99929	05552	99847	07266	99736	50	2
6	12	00349	999999	02003	99978	03839	99926	05582	99844	07293	99731	48	2
	13	00378	00000	02001	99977	03868	99925	05611	99812	07353	99729	47	- 2
7	14	00407	999999	02152	99977	03897	99924	05640	99841	07382	99727	46	2
7	15	00436	99999	02181	99976	03926	99923	05669	99839	07411	99725	45	$\tilde{2}$
8	16	00465	99999	02211	99976	03955	99922	05698	99838	07440	99723	44	1
8	17	00495	99999	02240	99975	03984	99921	05727	99836	07469	99721	43	1
9	_18_	00524	99999	02269	99974	04013	99919	05756	99834	07498	99719	42	1.
9	19	00553	99998	02298	99974	04042	99918	05785	99833	07527	99716	41	1
10	20	00582	99998	02327	99973	04071	99917	05814	99831	07506	99714	40	
10	$\frac{21}{99}$	00011	99998	02330	99972	04100	99910	05873	99829	07585	99712	39	1
11	23	00669	99998	02335	99971	04129	99913	05902	99826	07643	99708	37	1
12	24	00698	99998	02443	99970	04188	99912	05931	99824	07672	99705	36	î
12	25	00727	99997	02472	99969	04217	99911	05960	99822	07701	99703	35	1
13	26	00756	99997	02501	99969	04246	99910	05989	99821	07730	99701	34	1
13	27	00785	99997	02530	99968	04275	99909	06018	99819	07759	99699	33	1
14	28	00814	99997	02560	99967	04304	99907	06047	99817	07788	99696	32	1
14	$\frac{29}{20}$	00844	99996	02589	99966	04333	99906	06076	99815	07817	99694	31	1
-10	$\frac{-90}{-91}$	00875	99990	02018	99900	04302	99905	00105	99813	07840	99092	- 00	1
10	01 20	00902	00006 99990	02047	99969	04391	99904	06162	99812	07875	99089	29	1
16	33	00951	99995	02070	99963	04449	99901	06192	99808	07933	99685	$\frac{20}{27}$	1
16	34	00989	99995	02734	99963	04478	99900	06221	99806	07962	99683	26	Î
17	35	01018	99995	02763	99962	04507	99898	06250	99804	07991	99680	25	1
17	36	01047	99995	02792	99961	04536	99897	06279	99803	08020	99678	24	1
18	37	01076	99994	02821	99960	04565	99896	06308	99801	08049	99676	23	1
18	38	01105	99994	02850	99959	04594	99894	06337	99799	08078	99673	22	1
19	39	01134	99994	02879	99959	04623	99893	06366	99797	08107	99671	21	1
$\frac{19}{20}$	40	01104	99993	02908	99957	04055	99892	06355	99793	08165	99666	19	1
$\frac{1}{20}$	$\frac{11}{42}$	01222	99993	02963 02967	99956	04711	99889	06453	99792	08194	99664	18	î
21	43	01251	99992	02996	99955	04740	99888	06482	99790	08223	99661	17	1
21	44	01280	99992	03025	99954	04769	99886	06511	99788	08252	99659	16	1
22	45	01309	99991	03054	99953	04798	99885	06540	99786	08281	99657	15	1
$\frac{22}{22}$	46	01338	99991	03083	99952	04827	99883	06569	99784	08310	99654	14	0
23	47	01367	99991	03112	99952	04856	99882	06598	99782	08339	99652	13	0
- 25	+8	01396	- 99990	03141	99991	04885	99881	00021	99780	08308	99049	$\frac{12}{11}$	-0-
24	49 50	01420	99980	03170	99990	04914	99879	06695	99778 00776	08397	99647	11	0
25	51	01434	99989	03199	99949	04943	99876	06714	99774	08455	99642	10	0
$\overline{25}$	52	01513	99989	03257	99947	05001	99875	06743	99772	08484	99639	8	0
26	53	01542	99988	03286	99946	05030	99873	06773	99770	08513	99637	7	0
26	54	01571	99988	03316	99945	05059	99872	06802	99768	08542	99635	6	0
27	55	01600	99987	03345	99944	05088	99870	06831	99766	08571	99632	5	0
27	56	01629	99987	03374	99943	05117	99869	06860	99764	08600	99630	4	0
28	07 50	01658	99986	03403	99942	05146	99867	06889	99762	08629	99627	3	0
28	50 50	01087	99986	03432	0001U 99941	05205	99800	06918	99760	08698	99620	1	0
29	60	01745	99985	03490	99939	05200 05234	99863	06976	99756	08716	99619		0
20	00	01110	00000	00100	00000	00401		2	00100	00110	00010		0
		N. cos.	N. sine.	N. cos.	N. sine.	N. cos.	N. sine.	N. cos.	N. sine.	N. cos.	N. sine.	М.	
			00								-0		
		8	90	86	~	8	1	8	0~	8	0		

TABLE 41.

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Natural Sines and Cosines.

													1
Prop. parts		5	0	6		7	0		0	· 9	0		Prop. parts
29	М.	N. sine.	N.cos.	N. sine.	N. eos.	N. sine.	N.eos.	N. sine.	N. eos.	N. sine.	N. cos.		4
0	0	08716	99619	10453	99452	12187	99255	13917	99027	15643	98769	60	.1
ŏ	1	08745	99617	10482	99449	12216	99251	13946	99023	15672	98764	59	4
1	2	08774	99614	10511	99446	12245	99248	13975	99019	15701	98760	58	4
1	- 3	08803	99612	10540	99443	12274	99244	14004	99015	15730	98755	57	4
2	4	08831	99609	10569	99440	12302	99240	14033	99011	15758	98751	56	-1
2	5	08860	99607	10597	99437	12331	99237	14061	99006	15787	98746	55	4
3	6	08889	99604	10626	99434	12360	99233	14090	99002	15816	98741	54	
3	7	08918	99602	10655	99431	12389	99230	14119	98998	15845	98737	53	4
4	8	08947	99599	10684	99428	12418	99226	14148	98994	15009	98732	52	3
4	9	08976	99596	10713	99424	12447	99222	14177	98990	15902	98728	50	3
5	10	09000	99094	10742	99421	12470	00215	14200	08089	15951	98718	.10	0
6	12^{11}	09063	99588	10800	99415	12533	99211	14263	98978	15988	98714	48	3
- 6	13	09092	99586	10829	99412	12562	99208	14292	98973	16017	98709	47	
7	14	09121	99583	10858	99409	12591	99204	14320	98969	16046	98704	46	. 3
7	15	09150	99580	10887	99406	12620	99200	14349	98965	16074	98700	45	3
8	16	09179	99578	10916	99402	12649	99197	14378	98961	16103	98695	44	3
8	17	09208	99575	10945	99399	12678	99193	14407	98957	16132	98690	43	3
9	18	09237	99572	10973	99396	12706	99189	14436	98953	16160	98686	42	- 3
9	19	09266	99570	11002	99393	12735	99186	14464	98948	16189	98681	41	3
10	20	09295	99567	11031	99390	12764	99182	14493	98944	16218	98676	40	3
10	21	09324	99564	11060	99386	12793	99178	14522	98940	16246	98671	39	3
11	22	09393	999552	11119	99383	12822 19851	99175	14001	98930	16270	98007	38	3
19	20	09382	99556	11110	99377	12880	99167	14608	98931	16333	98657	36	2
$\frac{12}{19}$	25	09440	99553	11176	99371	12000	99163	14637	98923	16361	98652	$\frac{30}{35}$	
13	$\frac{10}{26}$	09469	99551	11205	99370	12937	99160	14666	98919	16390	98648	34	$\tilde{2}$
13	-27	09498	99548	11234	99367	12966	99156	14695	98914	16419	98643	33	$\overline{2}$
14	-28	09527	99545	11263	99364	12995	99152	14723	98910	16447	98638	32	2
14	29	09556	99542	11291	99360	13024	99148	14752	98906	16476	98633	31	2
15	30	09585	99540	11320	99357	13053	99144	14781	98902	16505	98629	30	2
15	- 31	09614	99537	11349	99354	13081	99141	14810	98897	16533	98624	29	2
10	32	09642	99534	11378	99351	13110	99137	14838	98893	16562 16501	98619	28	2
10	- 00 - 2.1	09071	99531	11407	99547	10109	99133	14807	98889	16690	98014	24	20
17	35	09700	99526	11465	99344	13103	99129	14090	98880	16618	98601	$\frac{20}{25}$	3
17	36	09758	99523	11494	99337	13226	99122	14954	98876	16677	98600	24	2
18	37	09787	99520	11523	99334	13254	99118	14982	98871	16706	98595	23	2
18	38	09816	99517	11552	99331	13283	99114	15011	98867	16734	98590	$\frac{1}{22}$	ĩ
19	-39	09845	99514	11580	99327	13312	99110	15040	98863	-16763	98585	21	1
19	40	09874	99511	11609	99324	13341	99106	15069	98858	16792	98580	20	1
20	41	09903	99508	11638	99320	13370	99102	15097	98854	16820	98575	19	1
20	42	09932	99506	11667	99317	13399	99098	15126	98849	16849	98570	_18	1
21	43	09961	99503	11696	99314	13427	99094	15155	98845	16878	98565	17	1
21	44	09990	99500	11725	99310	13456	99091	15184	98841	16906	98561	16	1
22	40 46	10019	99497	11782	003U5 99201	13480	99085	$10212 \\ 15941$	92830	16955	98000	10	' 1 1
23	47	10077	99491	11812	99300	13543	99079	15270	98827	16992	98546	13	1
23	48	10106	99488	11840	99297	13572	99075	15299	98823	17021	98541	12	1
-24	49	10135	99485	11869	99293	13600	99071	15327	98818	17050	98536	11	1
24	50	10164	99482	11898	99290	13629	99067	15356	98814	17078	98531	10	î
-25	51	10192	99479	11927	99286	13658	99063	15385	98809	17107	98526	- 9	1
25	52	10221	99476	11956	99283	13687	99059	15414	98805	17136	98521	8	1
$\frac{26}{26}$	53	10250	99473	11985	99279	13716	99055	15442	98800	17164	98516	7	· 0
26	<u></u>	10279	99470	12014	99276	13744	99051	15471	98796	17193	98511	6	0
27	00 50	10308	99467	12043	99272	13773	99047	15500	98791	17222	98506	5	0
27	00 57	10337	99464	120/1	99269	13802	99043	15557	98/8/	17250	98501	4	0
20	58	10300	99401	12100	99200	13860	99032	10007	98779	17279	98496	3	0
29	59	10424	99455	12129	99258	13880	99033	15615	98773	17336	98186		0
29	60	10453	99452	12187	99255	13917	99027	15643	98769	17365	98481	0	0
1		N. eos.	N. sine.	N. cos.	N. sine.	N. cos.	N. sine.	N. cos.	N. sine.	N. cos.	N. sine.	М.	
		9.	10	24	0	•			10	e	00		
F		0.	•			• °	-	, °		°	v		

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TABLE 41.

Natural Sines and Cosines.

P			10	1	0	1	10	1	10		10		D-
parts		10				1:		1:		1.	*	·	parts
28	М.	N. sine.	N. cos.	N. sine.	N. cos.	N. sine.	N. cos.	N. sine.	N. cos.	N. sine.	N. cos.		6
0	0	17365	98481	19081	98163	20791	97815	22495	97437	24192	97030	60	6
ŏ	1	17393	98476	19109	98157	20820	97809	22523	97430	24220	97023	59	6
1	2	17422	98471	19138	98152	20848	97803	22552	97424	24249	97015	58	6
1	3	17451	98466	19167	98146	20877	97797	22580	97417	24277	97008	57	6
2	4 5	17479	98461	1020+	98140	20905	97791	22608	97411	24305	96004	96 5=	6
$\frac{2}{2}$	0 6	17508 17537	98400 98450	19224 19959	98190 98190	20953	97779	22665	97398	24369	96987	50 51	5
	-7	17565	98115	19281	98120	20990	97779	22602	97301	24300	96980	53	5
4	8	17594	98440	19309	98118	21019	97766	22722	97384	24418	96973	$50 \\ 52$	5
4	9	17623	98435	19338	98112	21047	97760	22750	97378	24446	96966	51	5
5	10	17651	98430	19366	98107	21076	97754	22778	97371	24474	96959	50	5
5	11	17680	98425	19395	98101	21104	97748	22807	97365	24503	96952	49	5
6	$\frac{12}{10}$	17708	98420	19423	98096	21132	97742	22835	9/358	24531	90945	48	5
6	$\frac{13}{14}$	17737	98414	19452	98090	$21161 \\ 21100$	97735	22863	97351	24559	96937	47	5
4	$\frac{14}{15}$	17704	98409 98404	19481	98070	212189	97799	22990	97339	24087	96922	40 45	0 5
7	16	17823	98399	19538	98073	21246	97717	22948	97331	24644	96916	44	4
8	17	17852	98394	19566	98067	21275	97711	22977	97325	24672	96909	43	4
8	18	17880	98389	19595	98061	21303	97705	23005	97318	24700	96902	42	4
9	19	17909	98383	19623	98056	21331	97698	23033	97311	24728	96894	41	4
9	20	17937	98378	19652	98050	21360	97692	23062	97304	24756	96887	40	4
10	21	17966	98373	19680	98044	21388	97686	23090	97298	24784	96880	39	4
10	22 99	17995	98368	19709	98039	21417	97680	23118 92140	97291	24813	96866	$\frac{38}{27}$	4
11	$\frac{23}{24}$	18023	98352 98357	19780	98097	21440	97667	20146 23175	97979	24841	96858	36 36	t J
19	-95	18092	00001	10700	98021	21509	97661	22909	97971	21009	96851	35	+
12	$\tilde{26}$	18100	98347	19892	98016	21530	97655	23231	97264	24925	96844	31	4
13	$\bar{27}$	18138	98341	19851	98010	21559	97648	23260	97257	24954	96837	33	3
13	28	18166	98336	19880	98004	21587	97642	23288	97251	24982	96829	32	3
14	29	18195	98331	19908	97998	21616	97636	23316	97244	25010	96822	31	3
14	30	18224	98325	19937	97992	21644	97630	23345	97237	25038	96815	30	3
14	31	18252	98320	19965	97987	21672	97623	23373	97230	25066	96807	29	3
15	$\frac{32}{22}$	18281	98315	19994	97981	21701	97617	23401	97223	25094	96800	28	3
10 16	33 34	18309	98310	20022	97975	21729	97611	23429	97910	20122 25151	96793	21	0 2
10	35	18367	98200	20051	97969	21798.	97502	23498	97203	25170	96778	$\frac{20}{25}$	3
17	36	18395	98294	20108	97958	21814	97592	23514	97196	25207	96771	24	2
17	37	18424	98288	20136	97952	21843	97585	23542	97189	25235	96764	23	2
18	38	18452	98283	20165	97946	21871	97579	23571	97182	25263	96756	22	2
18	39	18481	98277	20193	97940	21899	97573	23599	97176	25291	96749	21	2
19	40	18509	98272	20222	97934	21928	97566	23627	97169	25320	96742	$\frac{20}{10}$	2
19	41	18538	98267	20250	97928	21956	97560	23656	97155	$25348 \\ 25976$	90734	19 10	2
-20	42	1000/	00000	20279	07010	21980	07545	20084	07140	20010	08710	10	4
20 91	4.1	10090	98250	20307	97916	22013	97511	23740	971.41	25499	96719	16	29
21	45	18652	98245	20364	97905	22041	97534	23760	97134	25460	96705	15	2
21	46	18681	98240	20393	97899	22098	97528	23797	97127	25488	96697	14	Ĩ
22	47	18710	98234	20421	97893	22126	97521	23825	97120	25516	96690	13	1
22	.48	18738	98229	20450	97887	22155	97515	23853	97113	25545	96682	12	1
23	49	18767	98223	20478	97881	22183	97508	23882	97106	25573	96675	11	1
23	50	18795	98218	20507	97875	22212	97502	23910	97100	25601	96667	10	1
24	01	18824	98212	20535	97869	22240	97496	25938	97093	20029	90000	9	1
24 95	52	18881	98207 98201	20003	97857	22208	97489	23905	97070	25685	96645		1
25	54	18910	98196	20620	97851	22325	97476	24023	97072	25713	96638	6	1
26	55	18938	98190	20649	97845	22353	97470	24051	97065	25741	96630	5	1
26	56	18967	98185	20677	97839	22382	97463	24079	97058	25769	96623	4	Ō
27	57	18995	98179	20706	97833	22410	97457	24108	97051	25798	96615	3	0
27	58	19024	98174	20734	97827	22438	97450	24136	97044	25826	96608	2	0
28	59	19052	98168	20763	97821	22467	97444	24164	97037	25854	96500		
28	60	19081	98163	20791	97815	22495	97437	24192	ə1030	20882	90993		0
		N. cos.	N. sine.	N. cos.	N. sine.	N. cos.	N. sine.	N, cos.	N. sine.	N. cos.	N. sine.	M.	
	1	1	190	1 7.	8~	1 ;		1	0~	<u> </u>	19 [~]	-	

TABLE 41.

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Natural Sines and Cosines

					Natura	1 Sines a	ana Cosi	nes.					
Prop.		1	50	16	0	1	7°	1	8°	1	9°		Prop.
27	М.	N.sine.	N. cos.	N. sine.	N. ccs.	N.sine.	N. cos.	N. sine.	N. cos.	N. sine.	N. cos.		9
0	0	25882	96593	27564	96126	29237	95630	30902	95106	32557	94552	60	9
ŏ	ĭ	25910	96585	27592	96118	29265	95622	30929	95097	32584	94542	59	9
1	2	25938	96578	27620	96110	29293	95613	30957	95088	32612	94533	58	9
1	3	25966	96570	27648	96102	29321	95605	30985	95079	32639	94523	57	9
2	4	25994	96562	27676	96094	29348	95596	31012	95070	32667	94514	56	8
2	5	26022	96555	27704	96086	29376	95588	31040	95061	32694	94504	55	8
3_	6	26050	96547	27731	96078	29404	95579	31068	95052	32722	94495	54	8
3	7	26079	96540	27759	96070	29432	95571	31095	95043	32749	94485	53	8
4	8	26107	96532	27787	96062	29460	95562	31123	95033	32777	94476	52	8
4	10	26135	96524	- 27810	90004	29487	90004	31151 91170	95024	32804	94466	51	8
0 5	10	20105	90017	27840	96040	29010	95536	31206	95015	32850	94407	- 40	87
5	$\frac{11}{12}$	262191	96502	27899	96029	29571	95528	31233	94997	32887	94438	48	7
	12	26217	06404	27000	96020	20511	95519	31961	0.1088	32001	94498	47	7
6	14	26275	96486	27955	96013	29626	95511	31289	94979	32942	94418	46	7
7	15	26303	96479	27983	96005	29654	95502	31316	94970	32969	94409	45	7
7	16	26331	96471	28011	95997	29682	95493	31344	94961	32997	94399	44	7
8	17	26359	96463	28039	95989	29710	95485	31372	94952	33024	94390	43	6
8	18	26387	96456	28067	95981	29737	95476	31399	94943	33051	94380	42	6
9	19	26415	96448	28095	95972	29765	95467	31427	94933	33079	94370	41	6
9	20	26443	96440	28123	95964	29793	95459	31454	94924	33106	94361	40	6
9	21	26471	96433	28150	95956	29821	95450	31482	94915	33134	94351	39	6
10	22	26500	96425	28178	95948	29849	95441	31510	94906	33161	94342	38	6
10	23	26528	96417	28206	95940	29876	95433	31537	94897	33189	94332	37	6
	24	20000	90410	28234	93931	29904	93424	31000	94888	33210	94322	30	<u> </u>
11	20	26584	96402 06204	28262	95923	29932	95415	31593	94878	$33244 \\ 99071$	94313	30	5
12	20	20012	90394	28290	95915	29900	99407	31020	94809	33271	94303	34	05
12	28	26668	96379	28316	95898	29907	95389	31675	94800	33396	94293	39	5
13	29	26696	96371	28374	95890	30043	95380	31703	94842	33353	94274	31	5
14	30	26724	96363	28402	95882	30071	95372	31730	94832	33381	94264	30	5
14	31	26752	96355	28429	95874	30098	95363	31758	94823	33408	94254	29	4
14	32	26780	96347	28457	95865	30126	95354	31786	94814	33436	94245	28	4
15	33	26808	96340	28485	95857	30154	95345	31813	94805	33463	94235	27	4
15	34	26836	96332	28513	95849	30182	95337	31841	94795	33490	94225	26	4
16	35	26864	96324	28541	95841	30209	95328	31868	94786	33518	94215	25	4
_16	30	26892	96316	28569	95832	30237	95319	31896	94777	33545	94206	24	4
17	37	26920	96308	28597	95824	30265	95310	31923	94768	33573	94196	23	3
10	38	20948	90301	28020	95816	30292	95301	31951	94758	33600	94186	22	3
18	40	20970	90295	28002	95007	30320	95295	32006	94749	32655	94170	$\frac{21}{20}$	3
18	41	27032	96277	28708	95791	30376	95275	32034	94730	33682	94157	19	3
19	$\hat{42}$	27060	96269	28736	95782	30403	95266	32061	94721	33710	94147	18	3
19	43	27088	96261	28764	95774	30431	95257	32089	94712	33737	94137	17	3
20	44	27116	96253	28792	95766	30459	95248	32116	94702	33764	94127	16	2
20	45	27144	96246	28820	95757	30486	95240	32144	94693	33792	94118	15	2
21	46	27172	96238	28847	95749	30514	95231	32171	94684	33819	94108	14	2
21	47	27200	96230	28875	95740	30542	95222	32199	94674	33846	94098	13	2
22	_48	27228	96222	28903	95732	30570	95213	32227	94665	33874	94088	12	2
22	49	27256	96214	28931	95724	30597	95204	32254	94656	33901	94078	11	2
23	50	27284	96206	28959	95715	30625	95195	32282	94646	33929	94068	10	2
23	51	27312	96198	28987	95707	30653	95186	32309	94637	33956	94058	9	1
20	52	27340	90190	29010	90098	20708	99177	32337	94027	33983	94049	87	1
24	54	27396	96174	29042	95681	30736	95159	32304	94018	34011	94039	ĥ	1
-25	55	27.19.1	96166		05679	20782	05150	29,110	01500	31065	0.1010	-5	1
25	56	27459	96158	29098	9566J	30705	95119	32419	94599	34000	94019	0	1
26	57	27480	96150	29154	95656	30819	95133	32474	94580	34120	93999	3	0
$\frac{10}{26}$	58	27508	96142	29182	95647	30846	95124	32502	94571	34147	93989	2	ő
27	59	27536	96134	29209	95639	30874	95115	32529	94561	34175	93979	1	Ő
27	60	27564	96126	29237	95630	30902	95106	32557	94552	34202	93969	0	0
		N. cos.	N. sine.	N. cos.	N. sine.	N. cos.	N.sine.	N. cos.	N. sine.	N. cos.	N. sine.	M.	
		7-	1°	7:	3°	7	20	7	10	7	0°		

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TABLE 41.

Natural Sines and Cosines

					natura	i sines a	ing Cosi	nes.	····				
Prop. parts		20)°	21	0	2:	0	2	30	2.	1 °		Prop. parts
27	М.	N. sine.	N. cos.	N. sine.	N. cos.	N. sine.	N. cos.	N. sine.	N. cos.	N. sine.	N. cos.		11
0	0	34202	93969	35837	93358	37461	92718	39073	92050	40674	91355	60	11
ŏ	1	34229	93959	35864	93348	37488	92707	39100	92039	40700	91343	59	11
1	2	34257	93949	35891	93337	37515	92697	39127	92028	40727	91331	58	11
1	3	34284	93939	35918	93327	37542	92686	39153	92016	40753	91319	57	10
$\frac{2}{2}$	4	34311	93929	30940 25072	93316	37505	92675	39180	92000	40780	91307	55 55	10
2 2	Ð R	34339 34366	93000	36000	93295	37622	92653	39234	91994	40800	91290	00 54	10
- 2		34202	93800	36027	93285	37619	92619	39260	91971	40860	91279	53	10
0 4	8	34421	93889	36054	93274	37676	92631	39287	91959	40886	91260	52	10 .
4	9	34448	93879	36081	93264	37703	92620	39314	91948	40913	91248	51	9
5	10	34475	93869	36108	93253	37730	92609	39341	91936	40939	91236	50	9
5	11	34503	93859	36135	93243	37757	92598	39367	91925	40966	91224	49	9
5	12	34530	93849	36162	93232	37784	92587	39394	91914	40992	91212	48	9
6	13	34557	93839	36190	93222	37811	92576	39421	91902	41019	91200	47	9
6 7	14	34084	95829	36217	93211	37865	92000	39448	91891	41040	91188	40	8
47	10	34639	93809	36271	93190	37892	92543	39501	91868	41098	91164	44	8
8	17	34666	93799	36298	93180	37919	92532	39528	91856	41125	91152	43	8
8	18	34694	93789	36325	93169	37946	92521	39555	91845	41151	91140	42	8
- 9	19	34721	93779	36352	93159	37973	92510	39581	91833	41178	91128	41	8
9	20	34748	93769	36379	93148	37999	92499	39608	91822	41204	91116	40	7
9	21	34775	93759	36406	93137	38026	92488	39635	91810	41231	91104	39	7
10	22	34803	93748	36434	93127	38003	92477	39661	91799	41257 41984	91092	38 37	4
10	40 24	34857	93798	36488	93106	38107	92455	39715	91775	41310	91068	36	4
-11	25	34884	93718	36515	93095	38134	92444	39741	-91764	41337	91056	35	6
12	$\frac{1}{26}$	34912	93708	36542	93084	38161	92432	39768	91752	41363	91044	34	6
$\overline{12}$	27	34939	93698	36569	93074	38188	92421	39795	91741	41390	91032	33	6
13	28	34966	93688	36596	93063	38215	92410	39822	91729	41416	91020	32	6
13	29	34993	93677	36623	93052	38241	92399	39848	91718	41443	91008	31	6
	30	35021	93667	36650	93042	38268	92388	39875	91706	41469	90996	30	6
14	$\frac{31}{39}$	35075	93657 93617	365077	93031	38290	92377	39902	91694	41496	90984	29	0 5
15	33	35102	93637	36731	93010	38349	92355	39955	91671	41549	90960	$\frac{10}{27}$	5
15	34	35130	93626	36758	92999	38376	92343	39982	91660	41575	90948	26	5
16	35	35157	93616	36785	92988	38403	92332	40008	91648	41602	90936	25	5
16	36	35184	93606	36812	92978	38430	92321	40035	91636	41628	90924	24	4
17	37	35211	93596	36839	92967	38456	92310	40062	91625	41655	90911	23	4
17	38	35239	93585	36867	92956	38483	92299	40088	91613	41681	90899	22	4
18	39	35266	93575	36894	92945	38510	92287	40115	91601	41707	90887	21	+
18	41	35320	93555	36919	92930	38564	92265	40168	91578	41760	90863	19	3
19	42	35347	93544	36975	92913	38591	92254	40195	91566	41787	90851	18	3
19	43	35375	93534	37002	92902	38617	92243	40221	91555	41813	90839	17	3
20	44	35402	93524	37029	92892	38644	92231	40248	91543	41840	90826	16	3
20	45	35429	93514	37056	92881	38671	92220	40275	91531	41866	90814	15	3
21	46	35456	93503	37083	92870	38698	92209	40301	91519	41892	90802	14	3
21	41	35484	93493	37110	92859	38725	92198	40328	91508	41919	90790	13	
- 22	10	00011	99483	97104	92849	20770	02175	40300	01404	11079	00760	$\frac{12}{11}$	
22	49 50	35565 35565	93472 93469	37104	92838	38805	92175 9216J	40381	91484	41972	90753	10	2
$\frac{23}{23}$	51	35592	93452	37218	92816	38832	92152	40434	91461	42024	90741	9	2
23	52	35619	93441	37245	92805	38859	92141	40461	91449	42051	90729	8	1
24	53	35647	93431	37272	92794	38886	92130	40488	91437	42077	90717	7	1
24	54	$_{35674}$	93420	37299	92784	38912	92119	40514	91425	42104	90704	6	1
25	55	35701	93410	37326	92773	38939	92107	40541	91414	42130	90692	5	1
25	56	35728	93400	37353	92762	38966	92096	40567	91402	42156	90680	4	1
20	59	00700 35789	93389	37380	92701	30090	92080	40694	91390	42183	90655	9	0
27	59	35810	93368	37434	92720	39046	92062	40647	91366	42235	90643	ĩ	0
27	60	35837	93358	37461	92718	39073	92050	40674	91355	42262	90631	Ô	ŏ
		N. cos.	N. sine.	N. cos.	N. sine.	N. cos.	N. sine.	N. cos.	N. sine.	N. cos.	N. sine.	м.	
		6	90	6	30	6	70	6	6°	6	5°		
	E							•					1

TABLE 41.

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Natural Sines and Cosines.

	1				Natura	i Sines a		nes.			0.0		
Prop. parts			250			2		2	8°	<u>2</u>	90		parts
26	М.	N. sine.	N, cos.	N. sine.	N, cos.	N. sine.	• N. cos.	N. sine.	N. cos.	N. sine.	N. cos.		14
0	0	49262	90631	43837	89879	45399	89101	46947	88295	48481	87462	60	14
ŏ	ĭ	42288	90618	43863	89867	45425	89087	46973	88281	48506	87448	59	14
1	$\hat{2}$	42315	90606	43889	89854	45451	89074	46999	88267	48532	87434	58	14
1	- 3	42341	90594	43916	89841	45477	89061	47024	88254	48557	87420	57	13
2	4	42367	90582	43942	89828	45503	89048	47050	88240	48583	87406	56	13
2	5	42394	90569	43968	89816	45529	89035	47076	88226	48608	87391	55	13
3	6	42420	90557	43994	89803	45554	89021	47101	88213	48634	87377	54	13
3	7	42446	90545	44020	89790	45580	89008	47127	88199	48659	87363	53	12
3	8	42473	90532	44046	89777	45606	88995	47153	88185	48684	87349	52	12
-1	. 9	42499	90520	44072	89764	45632	88981	47178	88172	48710	87335	51	12
4	10	42020	90507	44098	89792	40000	89055	47204	00111	48730	87206	- 10	12
9 5	11	42002	90495	44124	89796	45004	88919	47229	88130	48786	87202	18	11
	<u>-10</u>	10001	00170	11177		15726	80000	17001	00100	10011	07202	$\frac{10}{17}$	11
6	10	42004	90470	11203	89700	45762	88915	47201	88103	48811	87261	46	11
7	15	42051	90446	44229	89687	45787	88902	47332	88089	48862	87250	45	11
	16	42683	90433	44255	89674	45813	88888	47358	88075	48888	87235	44	10
7	17	42709	90421	44281	89662	45839	88875	47383	88062	48913	87221	43	10
8	18	42736	90408	44307	89649	45865	88862	47409	88048	48938	87207	42	10
8	19	42762	90396	44333	89636	45891	88848	47434	88034	48964	87193	41	10
9	20	42788	90383	44359	89623	45917	88835	47460	88020	48989	87178	40	9
9	21	42815	90371	44385	89610	45942	88822	47486	88006	49014	87164	- 39	9
10	22	42841	90358	44411	89597	45968	88808	47511	87993	49040	87150	38	9
10	23	42867	90346	44437	89584	45994	88795	47537	87979	49065	87136	37	9
10	24	42894	90334	44464	89571	46020	88782	47562	87965	49090	87121	36	8
11	25	42920	90321.	44490	89558	46046	88768	47588	87951	49116	87107	35	8
11	26	42946	90309	44516	89545	46072	88755	47614	87937	49141	87093	34	8
12	21	42972	90296	44042	89532	40097	88/41	47639	87923	49166	87079	- 33 - 90	8
12	28	42999	90284	44008	89506	40125	88715	47000	87909	49192	87050	04 - 21	4
13	30	43051	90259	44620	89493	46175	88701	47716	87889	49217	87036	30	7
10	21	13077	00208	11646		46201	88688	177.11	87989	10268	87021	- 20	-7-
10	01 39	13101	90233	44679	89467	46226	88674	17767	87851	49208	87021	28	47
14	33	43130	90221	44698	89454	46252	88661	47793	87840	49318	86993	$\frac{1}{27}$	6
15	34	43156	90208	44724	89441	46278	88647	47818	87826	49344	86978	$\overline{26}$	ĕ
15	35	43182	90196	44750	89428	46304	88634	47844	87812	49369	86964	25	Ğ
16	36	43209	90183	44776	89415	46330	88620	47869	87798	49394	86949	24	6
16	37	43235	90171	44802	89402	46355	88607	47895	87784	49419	86935	23	5
16	38	43261	90158	44828	89389	46381	88593	47920	87770	49445	86921	22	5
17	39	43287	90146	44854	89376	46407	88580	47946	87756	49470	86906	21	5
17	40	43313	90133	44880	89363	46433	88566	47971	87743	49495	86892	20	5
18	41	43340	90120	44906	89350	46458	88553	47997	87729	49521	86878	19	4
18	42	43366	90108	44932	89337	40484	88539	48022	81115	49546	80803	18	-+
19	43	43392	90095	44958	89324	46510	88526	48048	87701	49571	86849	17	-1
19	44	43418	90082	44984	89311	40000	88012	48073	87087	49990	80804	$10 \\ 15$	-±
20	-40 -16	40440	90070	45010	89298	40001	88185	48099	87659	49022	86805	11	3
20	47	43497	90045	45062	89272	46613	88472	48150	87645	49672	86791	13	3
$\frac{1}{21}$	48	43523	90032	45088	89259	46639	88458	48175	87631	49697	86777	12	3
21	49	43549	90019	45114	89245	46664	88445	48201	87617	49723	86762	TI	3
22	50	43575	90007	45140	89232	46690	88431	48226	87603	49748	86748	10	2
22	51	43602	89994	45166	89219	46716	88417	48252	87589	49773	86733	-9	2
23	52	43628	89981	45192	89206	46742	88404	48277	87575	49798	86719	- 8	2
23	53	43654	89968	45218	89193	46767	88390	48303	87561	49824	86704	- 7	2
23	54	43680	89956	45243	89180	46793	88377	48328	87546	49849	86690	6_	1
24	55	43706	89943	45269	89167	46819	88363	48354	87532	49874	86675	5	1
24	56	43733	89930	45295	89153	46844	88349	48379	87518	49899	86661	4	1
25	57	43759	89918	45321	89140	46870	88336	48405	87504	49924	80646	3	1
40 96	-08 -50	40/80	80609 99809	40347	89127	40890	88900	48430	87.170	49900	86617	1	0
- <u>20</u> - <u>26</u>	60	43837	89870	40070	89101	40921	88905	18481	87.169	50000	86603	Ô	0
20	00	10007	00019	10000	00101	10041	00290	10101	01402	00000	00000		0
		N. cos.	N. sine.	N. cos.	N. sine.	N. cos.	N. sine.	N. cos.	N. sine.	N. cos.	N. sine.	М.	
			10		30			R	10		00		
		0.		0	.,	0	-	0	•		~		

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TABLE 41.

Natural Sines and Cosines.

Prop		90)0	21	0	1 2.	2001	90	30	94	to I	1	Prop
parts.			N	٥١ ۲	· ·		N		Y				parts.
25	M.	A, sine.	N. COS.	N. sine.	N, COS.	N.sine.	N. COS.	N. sinc.	N. COS.	N. sine.	N. COS.		16
0	0	50000	86603	51504	85717	52992	84805	54464	83867	55919	82904	60	16
0	1	50025	86588	51529	85702	53017	84789	54488	83851	55943	82887	59	16
1	2	50050	86573	51554	85687	53041	84774	54513	83835	55968	82871	58	15
1	3	50076	86559	51579	85672	53066	84759	54537	83819	55992	82855	57	15
$\frac{2}{2}$	4	50101	86544	51604	85657	53091	84743	54561	83804	56016	82839	56	15
$\frac{2}{2}$	0 8	50126 50151	80530 88515	51659	00042 85607	03115 52140	84728	04086 5.1010	82770	560040 56004	82822	00 54	15
3		50170	- 00010	51870	85010	59104	84607	51025	82750	56000	82700	04	14
3	8	50176 50201	00001 86188	51702	85597	53180	84681	04030 54650	837.10	56119	82779 82772	00 59	14
$\frac{3}{4}$	9	50227	86471	51728	85582	53214	84666	54683	83724	56136	82757	51	14
4	10	50252	86457	51753	85567	53238	84650	54708	83708	56160	82741	50	13
5	11	50277	86442	51778	85551	53263	84635	54732	83692	56184	82724	49	13
5	12	$_{50302}$	86427	51803	85536	53288	84619	54756	83676	56208	82708	48	13
5	13	50327	86413	51828	85521	53312	84604	54781	83660	56232	82692	47	13
6	14	50352	86398	51852	85506	53337	84588	54805	83645	56256	82675	46	12
$\frac{6}{7}$	15 16	- 20377 - 50402	86960	01877 51000	85450	03361 52900	84557	04829 5.105.4	83629	56205	82659	45	$\frac{12}{19}$
4	10 17	50403	8635.1	51902	85461	53411	84549	54879	83507	00000 56290	8269g	42	12
8	18	50453	86340	51952	85446	53435	84526	54902	83581	56353	82610	42	11
	19	50478	86325	51977	85431	53460	84511	54927	83565	56377	82593	41	11
8	20	50503	86310	52002	85416	53484	84495	54951	83549	56401	82577	40	11
9	21	50528	86295	52026	85401	53509	84480	54975	83533	56425	82561	39	10
9	22	50553	86281	52051	85385	53534	84464	54999	83517	56449	82544	38	10
10	23	50578	86266	52076	85370	53558	84448	55024	83501	56473	82528	37	10
10	24	50603	86251	50100	85010	50005	84433	00048	83485	56497	82511	36	10
10	25 90	50628	86237	52126 52151	85995	53607 52690	84417	00072 55007	83469	56521 56547	82495	35	9
	$\frac{26}{97}$	50670	86207	52151 52175	00320 85310	00032 53658	01102 84386	00097 55191	00403	56560	82169	04 32	9
11	$\frac{21}{28}$	50704	86192	52200	85294	53681	84370	55121 55145	83491	56593	82446	32	9
12	$\frac{1}{29}$	50729	86178	52225	85279	53705	84355	55169	83405	56617	82429	31	8
13	30	50754	86163	52250	85264	53730	84339	55194	83389	56641	82413	30	8
13	31	50779.	86148	52275	85249	53754	84324	55218	83373	56665	82396	29	8
13	32	50804	86133	52299	85234	53779	84308	55242	83356	56689	82380	28	7
14	33	50829	86119	52324	85218	53804	84292	55266	83340	56713	82363	$\frac{27}{27}$	7
14	34 97	00854 50070	86000	522749	85100	03828 4 59050	81961	00291 55917	82200	00736 58720	82347 82220	26 95	4
15 15	30 36	50904	86074	52300	85172	00003 53877	04201 842.15	00010 55330	00008 83909	56784	02000 8231.1	$\frac{20}{24}$	ß
10	37	50004	86050	52.192	85157	53909	81920	55362	83978	56809	82247	22	ß
10 16	38	50929	86045	52448	85142	53926	84214	55388	83260	56832	82281	$\frac{20}{22}$	6
16	39	50979	86030	52473	85127	53951	84198	55412	83244	56856	82264	21	6
17	40	51004	86015	52498	85112	53975	84182	55436	83228	56880	82248	20	5
17	41	51029	86000	52522	85096	54000	84167	55460	83212	56904	82231	19	5
18	42	51054	85985	52547	85081	54024	84151	55484	83195	56928	82214	18	_5
18	43	51079	85970	52572	85066	54049	84135	55509	83179	56952	82198	$17 \\ 10$	5
18	44	51104	85956	02097 59991	850951	04073 54007	84120	00033 55557	03163	00976 57000	02181 89165	$16 \\ 15$	+
19	40 40	51129	00941 8500e	5261g	85090	511997	84099	55581	83131	57094	82149	10 11	4
20	47	51179	85911	52670 52671	85005	54146	84072	55605	83115	57047	82132	13	3
20	48	51204	85896	52696	84989	54171	84057	55630	83098	57071	82115	12	3
20	49	51229	85881	52720	84974	54195	84041	55654	83082	57095	82098	11	3
21	50	51254	85866	52745	84959	54220	84025	55678	83066	57119	82082	10	3
21	51	51279	85851	52770	84943	54244	84009	55702	83050	57143	82065	9	2
22	52	51304	85836	52794	84928	54260	83994	55726	83034	57101	82048	8	20
22	03 5.1	01329 51954	8580e	52819 52844	84913 84807	04293 51217	03978	55775	830017	57915	82032	ß	5
-23	55	51270	85700	59000	81900	512.19	830.10	55700	82025	57939	81990	-5	1
23	00 56	51404	85777	52802	04082 84866	54366	83030	55892	82960	57262	81989	4	1
24	57	51429	85762	52918	84851	54391	83915	55847	82953	57286	81965	3	1
24	58	51454	85747	52943	84836	54415	83899	55871	82936	57310	81949	2	1
25	.59	51479	85732	52967	84820	54440	83883	55895	82920	57334	81932	1	0
25	60	51504	85717	52992	84805	54464	. 83867	55919	82904	57358	81915	0	0
		N	N	N	Nat	N	N al	N. ar	N et-	N or	N eine	M	
		. COS,	N. sine.	. cos.	o sine.	IN, COS.	7°	av. cos.	6°		5°		
1		5.	<i></i>	ð:		- ő		l õ	0	0		1	1

TABLE 41.

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Natural Sines and Cosines.

Prop. parts		32	5°	36	0	3	70	35	90 .	31	90		Prop. parts
23	м.	N. sine.	N. cos.	N. sine.	N. cos.	N. sine.	N. cos.	N, sine.	N. cos.	N. sine.	N. cos.		18
0	0	57358	81915	58779	80902	60182	79864	61566	78801	62932	77715	60	18
ŏ	ĭ	57381	81899	58802	80885	60205	79846	61589	78783	62955	77696	59	18
1	2	57405	81882	58826	80867	60228	79829	61612	78765	62977	77678	58	17
1	3	57429	81865	58849	80850	60251	79811	61635	78747	63000	77660	57	17
2	4	57453	81848	58873	80833	60274	79793	61658	78729	63022	77641	56	17
29	0 6	07477 57501	81832	08896 58090	80816	60298	79776	6170.1	78601	63045	77605	00 54	17
		57591	<u>- 01010</u> - <u>01700</u>	580.12	80799	60211	70711	61796	79670	62000	77590	59	$\frac{10}{16}$
3	8	57548	81782	58967	80765	60367	79723	61749	78658	63113	77568	53 52	10 16
3	9	57572	81765	58990	80748	60390	79706	61772	78640	63135	77550	51^{-51}	15
4	10	57596	81748	59014	80730	60414	79688	61795	78622	-63158	77531	50	15
4	11	57619	81731	59037	80713	60437	79671	61818	78604	63180	77513	49	15
5	12	57643	81714	59061	80696	60460	79653	61841	78586	63203	77494	48	14
$\frac{5}{2}$	13	57667	81698	59084	80679	60483	79635	61864	78568	63225	77476	47	14
5	14	57691	81681	59108	80662	60506	79618	61887	78550	63248	77458	46	14
6	10	07710 57729	81664	59131	80644	60529	79600	61909	78532	63271	77439	+5	14
7	$10 \\ 17$	57762	81631	59154	80610	60576	79565	61954	78106	63293	77421	44	13
7	18	57786	81614	59201	80593	60599	79547	61978	78478	63338	77384	42.	13
7	19	57810	81597	59225	80576	60622	79530	62001	78460	63361	77366	41	12
8	20	57833	81580	59248	80558	60645	79512	62024	78442	63383	77347	40	12^{12}
8	21	57857	81563	59272	80541	60668	79494	62046	78424	63406	77329	39	$\tilde{12}$
8	22	57881	81546	59295	80524	60691	79477	62069	78405	63428	77310	38	11
9	23	57904	81530	59318	80507	60714	79459	62092	78387	63451	77292	37	11
	24	57928	81513	59342	80489	60738	79441	62115	78369	63473	77273	36	11
10	$\frac{25}{26}$	57952	81496	59365	80472	60761	79424	62138	78351	63496	77255	35	11
10	26	57976	81479	59389	80455	60784	79406	62160	78333	63518	77236	34	$10 \\ 10$
11	21	58023	81402	59412	80438	60830	79388	62165	78907	63562	77100	33	10
11	29	58047	81428	59459	80403	60853	79353	62220	78279	63585	77181	31	10
$\hat{12}$	30	58070	81412	59482	80386	60876	79335	62251	78261	63608	77162	30	9
-12	31	58094	81395	59506	80368	60899	79318	62274	78243	63630	77144	$\frac{1}{29}$	9
12	32	58118	81378	59529	80351	60922	79300	62297	78225	63653	77125	28	8
13	-33	58141	81361	59552	80334	60945	79282	62320	78206	63675	77107	27	8
13	34	58165	81344	59576	80316	60968	79264	62342	78188	63698	77088	26	8
13	35	58189	81327	59599	80299	60991	79247	62365	78170	63720	77070	$\frac{25}{2}$	8
-14	- 30	500212	81310		80282	01015	79229	62388	78152	63/42	77001	24	1
14	31	08230 58960	81293	50660	80264	61038	79211	62411	78134	63765	77033	23	4
15	30	58283	81259	59609	80247	61081	79195	62400	78110	03/8/	76006	22	i de
15	40	58307	81242	59716	80212	61107	79158	62479	78079	63832	76977	20	6
16	41	58330	81225	59739	80195	61130	79140	62502	78061	63854	76959	19	Ğ
16	42	58354	81208	59763	80178	61153	79122	62524	78043	63877	76940	18	5
16	43	58378	81191	59786	80160	61176	79105	62547	78025	63899	76921	17	5
17	44	58401	81174	59809	80143	61199	79087	62570	78007	63922	76903	16	5
17	45	58425	81157	59832	80125	61222	79069	62592	77988	63944	76884	15	5
18	+0 17	$\frac{38449}{58479}$	81140	50870	80108	61245	79051	62615	77970	63966	76866	14	4
18	48	58196	81106	50000	80072	61208	79033	02038	77021	64011	76290	10	-t .1
10	10	58510	81080	50096	80056	61914	78000	62600	77010	<u>61099</u>	76910	14	
19	50	58543	81079	59940	80038	61337	78998	62706	77807	61056	76791	10	3
$\tilde{20}$	51	58567	81055	59972	80021	61360	78962	62728	77879	64078	76772	ĝ	3
20	52	58590	81038	59995	80003	61383	78944	62751	77861	64100	76754	8	2
20	53	58614	81021	60019	79986	61406	78926	62774	77843	64123	76735	7	2
	54	58637	81004	60042	79968	61429	78908	62796	77824	64145	76717	6	_2
21	55	58661	80987	60065	79951	61451	78891	62819	77806	64167	76698	5	2
21	00 57	08684 58700	80970	60089	79934	61474	78873	62842	77788	64190	76679	4	
22	58	58731	80035	60125	79916	61590	18855	62864	77751	64212	7661	3	
23	59	58755	80919	60155	79881	61542	78810	62000	77792	61956	76622	1	Δ.
23	60	58779	80902	60182	79864	61566	78801	62932	77715	64279	76604	ō	ŏ
		N. cos.	N. sine.	N. cos.	N. sine.	N. cos.	N. sine.	N. cos.	N. sine.	N. cos.	N. sine.	М.	
		5	10		0	-			10		00		
	1	 0	•		•	9	"	l 9	1.) ð	0-		I

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TABLE 41.

Natural Sines and Cosines.

Prop.	1	40)0	41	0	4:	20	43	0	+4	10		Prop.
parts	M	N. sine	N. cos	N. sine	N. cos	N. sine	N. cos	N. sine	N. cos	N. sine	N. 008	-	parts
				stronge.									
0	0	64279	76604	65606	75471	66913	74314	68200	73135	69466	71934	60	19
0	1	64301	76586	65628	75452	66935	74295	68221	73116	69487	71914	59	19
1	2	64323	76567	65650	75433	66956	74276	68242	73096	69508	71894	58	18
1	3	64346	76548	65672	75414	66978	74256	68264	73076	69529	71873	57	18
$\frac{1}{2}$	4 5	04368 6.1200	76530	00094	75975 75975	00999 67091	74237	08285 6820e	73036 73026	69570	$\frac{11853}{71999}$	96 55	18
2	0 6	64412	76492	65738	75356	67043	74198	68327	73016	69591	71813	00 51	17
	-7	64435	76473	65759	75337	67064	74178	68349	72996	69612	71792	53	17
3	8	64457	76455	65781	75318	67086	74159	68370	72976	69633	71772	52	16
3	9	64479	76436	65803	75299	67107	74139	68391	72957	69654	71752	51	16
4	10	64501	76417	65825	75280	67129	74120	68412	72937	69675	71732	50	16
4	11	64524	76398	05847	75941	67151	74000	08434	72917	09696 60717	71601	49	16 12
	$\frac{12}{10}$	04046	76901	00009 85901	75999	67104	74080	66400	79077	60797	71091	48	10
0 5	13 11	04008 64500	76349	65912	75222	67915	74041	68407	72857	69759	71650	11	10 15
6	15	64612	76323	65935	75184	67237	74022	68518	72837	69779	71630	45	14
6	16	64635	76304	65956	75165	67258	74002	68539	72817	69800	71610	44	14
6	17	64657	76286	65978	75146	67280	73983	68561	72797	69821	71590	43	14
7	_18_	64679	76267	66000	75126	67301	73963	68582	72777	69842	71569	42	13
7	19	64701	76248	66022	75107	67323	73944	68603	72757	69862	71549	41	13
0	20	04723 64740	76229	00044 6606e	75060	07344 67966	73924	00024 686.15	72737	69001	71529	-40 -40	13
8	$\frac{21}{22}$	64768	76192	66088	75050	67387	73885	68666	72697	69925	71488	38	12
8	$\tilde{23}$	64790	76173	66109	75030	67409	73865	68688	72677	69946	71468	37	12
9	24	64812	76154	66131	75011	67430	73846	68709	72657	69966	71447	36	11
9	25	64834	76135	66153	74992	67452	73826	68730	72637	69987	71427	35	11
10	26	64856	76116	66175	74973	67473	73806	68751	72617	70008	71407	34	11
10	27	64878	76097	66197	74024	67495	73787	68772	72597	70029	(1386)	33	10
10	$\frac{28}{20}$	04901 64099	76078	66240	74934	07016 67599	73747	68814	72557	70049	71345	32 91	10
11	30	64945	76041	66262	74896	67559	73728	68835	72537	70091	71325	30	10
11	31	64967	76022	66284	74876	67580	73708	68857	72517	70112	71305	29	9
12	32	64989	76003	66306	74857	67602	73688	68878	72497	70132	71284	28	9
12	33	65011	75984	66327	74838	67623	73669	68899	72477	70153	71264	27	9
12	34	65033	75965	66349	74818	67645	73649	68920	72457	70174	71999	26	8
13	30	00055	75097	00371 66209	74799	07066 67690	73610	08941 68069	72437	70195	71223	20	8
10	37	65100	75000	66114	74760	67700	73500	68982	72307	70226	71189	$\frac{24}{92}$	7
14	38	65199	75889	66436	74741	67730	73570	69004	72377	70257	71162	$\frac{29}{22}$	7
14	39	65144	75870	66458	74722	67752	73551	69025	72357	70277	71141	21	7
15	40	65166	75851	66480	74703	67773	73531	69046	72337	70298	71121	20	6
15	41	65188	75832	66501	74683	67795	73511	69067	72317	70319	71100	19	6
$-\frac{15}{10}$	42	65210	10813	66523	74664	67816	13491	09088	12297	70339	71080	18	6
16 10	43	65232	10794	00545 66560	74644	07837	73472	09109 60120	72277	70360	71059	17	0 5
10 17	45	65976	75756	66588	74608	67880	73432	69151	72936	70401	71019	10	- 5
17	46	65298	75738	66610	74586	67901	73413	69172	72216	70422	70998	14	4
17	47	65320	75719	66632	74567	67923	73393	69193	72196	70443	70978	13	4
	48	65342	75700	66653	74548	67944	73373	69214	72176	70463	70957	_12	4
18	49	65364	75680	66675	74528	67965	73353	69235	72156	70484	70937	11	3
18	50	65386	75661	66697	74509	67987	73333	69256	72136	70505	70916	10	3
19 10	01 59	00408	75699	00718	74470	08008 68090	73904	69217	72116	7054e	70896	9	3
19	52	65459	75604	66762	74451	68051	73274	69319	72075	70567	70855	7	2
20	54	65474	75585	66783	74431	68072	73254	69340	72055	70587	70834	6	2
20	55	65496	75566	66805	74412	68093	73234	69361	72035	70608	70813	5	2
21	56	65518	75547	66827	74392	68115	73215	69382	72015	70628	70793	4	1
21	57	65540	75528	66848	74373	68136	73195	69403	71995	70649	70772	3	1
21	58	65562	75400	66870	74353	68157	79155	69424 60445	71974	70670	70721	1	
22 99	60	00084 65606	75471	00891 66919	74334	68200	73135	69466	71934	70711	70711		Ő
				00010	. 1014	0	.0100						
		N. cos.	N.sine.	N. cos.	N.sine.	N. cos.	N. sine.	N. cos.	N.sine.	N.cos.	N. sine.	М.	
			90	·	80		170		60		150		-
		1 +	0~	1 4	10-	1	±1~	1 1	TU .	1		1	1

TABLE 42.

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Logarithms of Numbers.

								0.0000	
No. 1-	100.						L	og. 0.00000	2.00000.
No.	Log.	No.	Log.	No.	Log.	No.	Log.	No.	Log.
1	0.00000	21	1.32222	41	1.61278	61	1.78533	81	1.90849
2	0.30103	22	1.34242	42	1.62325	62	1.79239	82	1.91381
3	0.47712	23	1.36173	43	1.63347	63	1.79934	83	1.91908
4	0.60206	24	1.38021	-11	1.64345	64	1.80618	84	1.92428
5	0.69897	25	1.39794	45	1.65321	65	1.81291	85	1.92942
6	0.77815	26	1.41497	46	1.66276	66	1.81954	86	1.93450
7	0.84510	27	1.43136	47	1.67210	67	1.82607	87	1.93952
8	0.90309	28	1.44716	48	1.68124	68	1.83251	88	1.94448
9	0.95424	29	1.46240	49	1.69020	69	1.83885	89	1.94939
10	1.00000	30	1.47712	50	1.69897	70	1.84510	90	1.95424
11	1.04139	31	1.49136	51	1.70757	71	1.85126	91	1.95904
12	1.07918	32	1.50515	52°	1.71600	72	1.85733	92	1.96379
13	1.11394	33	1.51851	53	1.72428	73	1.86332	93	1.96848
14	1.14613	34	1.53148	54	1.73239	74	1.86923	94	1.97313
15	1.17609	35	1.54407	55	1.74036	75	1.87506	95	1.97772
16	1.20412	36	1.55630	56	1.74819	76	1.88081	96	1.98227
17	1.23045	37	1.56820	57	1.75587	77	1.88649	97	1.98677
18	1.25527	38	1.57978	58	1.76343	78	1.89209	98	1.99123
19	1.27875	39	1.59106	59	1.77085	79	1.89763	99	1.99564
20	1.30103	40	1.60206	60	1.77815	80	1.90309	100	2.00000

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TABLE 42.

Logarithms of Numbers.

No.	100									Log. 00	000-	-204	12.
No.	0	1	2	3	4	5	6	7	8	9			
100	00000	00043	00087	00130	00173	00217	00260	00303	00346	00389		49	4.0
101	00432	00475	00518	00561	00604	00647	00689	00732	00775	00817	-1-	1	
$102 \\ 102$	00860	00903	00945	00988	01030	01072 01.10.1	01115	01157	01199	01242	2	9	8
103	01284	01520	01508	01828	01452	01494	01953	01978	02036	02078	3	13	13
105	02119	$-\frac{01140}{02160}$	02202	02243	02281	02325	02366	02407	02449	02490	4	17	17
106	02531	02572	02612	02653	02694	02735	02776	02816	02857	02898	5	22	21
107	02938	02979	03019	03060	03100	03141	03181	03222	03262	03302	6 7	26 20	25
108	03342	03383	03423	03463	03503	03543	03583	03623	03663	03703	8	34	29
109	03743	03782	03822	03862	03902	03941	03981	04021	04060	04100	9	39	38
110	04139 04599	04179 04571	04218	04258	04297	$04336 \\ 04797$	04376	04415	04404	04493		41	40
112	04922	04961	04999	05038	05077	05115	05154	05192	05231	05269	1		4
113	05308	05346	05385	05423	05461	05500	05538	05576	05614	05652	2	8	8
114	05690	05729	05767	05805	05843	05881	05918	05956	05994	06032	3	12	12
115	06070	06108	06145	06183	06221	06258	06296	06333	06371	06408	4	16	16
116	06446	06483	06521	06558	06067	06633	06670	05707	06744	07151	0 6	$\frac{21}{25}$	20
117	07188	00000	07262	07298	07335	07372	07408	07445	07110	07518	7	29	28
119	07555	07591	07628	07664	07700	07737	07773	07809	07846	07882	8	33	32
120	07918	07954	07990	08027	08063	08099	08135	08171	08207	08243	9	37	36
121	08279	08314	08350	08386	08422	08458	08493	08529	08565	08600		39	38
122	08636	08672	08707	08743	08778	08814	08849	08884	08920	08955	1	4	4
123	08991	09026	09061	09096	09132	09167	09202	09237	09272	09307	2	8	8
124	09542	09311	00780	00705	009102	09911	09992	00024	09021	10009	3	$12 \\ 10$	11
$120 \\ 126$	10037	10072	10106	10140	10175	10209	10243	10278	10312-	10003	4 5	16	10
127	10380	10415	10449	10483	10517	10551	10585	10619	10653	10687	6	$\frac{20}{23}$	$\frac{19}{23}$
128	10721	10755.	10789	10823	10857	10890	10924	10958	10992	11025	7	27	27
129	11059	11093	11126	11160	11193	11227	11261	11294	11327	11361	8	31	30
130	11394	11428	11461	11494	11528	11561	11594	11628	11661	11694	9	35	34
$131 \\ 139$	12057	12090	11793	12156	12180	12993	11920 12251	12287	12320	12024		37	36
132	12385	12418	12450	12483	12516	12548	12581	12613	12646	12678	1	4	4
134	12710	12743	12775	12808	12840	12872	12905	12937	12969	13001	2	7	7
135	13033	13066	13098	13130	13162	13194	13226	13258	13290	13322	5	11	11
136	13354	13386	13418	13450	13481	13513	13545	13577	13609	13640	5	19	18
137	13672	13704	13/35	13767	13799	$13830 \\ 14145$	13862	13893	13920	13956	6	22	22
130	14301	14333	14364	14395	14426	14457	14489	14520	14551	14582	7	26	25
140	14613	14644	14675	14706	14737	14768	14799	14829	14860	14891	8	30	29
141	14922	14953	14983	15014	15045	15076	15106	15137	15168	15198		00	02
142	15229	15259	15290	15320	15351	15381	15412	15442	15473	15503		35	34
143	15534	15564	15594	15625	15655	15685	15715	15746	15776	15806	-1	4	3
144	10836	10866	10897	10927	10907	1098/	10017	16940	16970	16107	23	11	10
140 146	16137	16465	16197	16524	10200 16554	16584	16613	10540 16643	16673	16702	4	14	14
147	16732	16761	16791	16820	16850	16879	16909	16938	16967	16997	5	18	17
148	17026	17056	17085	17114	17143	17173	17202	17231	17260	17289	6	21	20
149	17319	17348	17377	17406	17435	17464	17493	17522	17551	17580	7	25	24
150	17609	17638	17667	17696	17725	17754	17782	17811	17840	17869	0	28	31
151	17898	17926	17955	17984	18013	18041	18070	18099	18127	18156		1 22	30
$152 \\ 153$	18469	18498	18526	18554	18583	18611	18639	18667	18696	18724	1	3	3
154	18752	18780	18808	18837	18865	18893	18921	18949	18977	19005	$\hat{2}$	7	6
155	19033	19061	19089	19117	19145	19173	19201	19229	19257	19285	3	10	10
156	19312	19340	19368	19396	19424	19451	19479	19507	19535	19562	4	13	13
157	19590	19618	19645	19673	19700	19728	19756	19783	19811	19838	0.6	20	16
158	19866	19893	19921	19948	19976	20003	20030	20058	20085	20112	7	$\frac{20}{23}$	$\frac{10}{22}$
109	20140	20107	20194	20222	20249	20270	2000a,	20000	20000	20000	8	26	26
No.	0	1	2	3	4	5	6	7	8	9	9	30	29

TABLE 42.

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Logarithms of Numbers.

Ne	. 1600	-2200,								Log. 20412		-34242	2.
No.	0	1	2	3	4	ð	6	7	8	9	1		
$160 \\ 161$	20412 20683	$20439 \\ 20710$	$20466 \\ 20737$	20493 20763	20520 20790	20548 20817	20575 20844	$20602 \\ 20871$	20629 20898	20656	-	31	30
$161 \\ 162$	20035 20952	20978	21005	21032	21059	21085	21112	21139	21165	21192	1	- 3	3
163	21219	21245	21272	21299	21325	21352	21378	21405	21431	21458	2	6	6
164	_21484	21511	21537	21564	21590	21617	21643	21669	21696	21722	3	9	19
165	21748	21775	21801	21827	21854 22115	21880	21906	21932	21958	21985	$\frac{1}{5}$	$12 \\ 16$	15
$100 \\ 167$	22011	22037	$\frac{22005}{22324}$	22089	$22110 \\ 22376$	22141	22107	22194	22220	22240	6	19	18
168	22531	22557	22583	22608	22634	22660	22686	22712	22737	22763	7	22	21
169	22789	22814	22840	22866	22891	22917	22943	22968	22994	23019	8	2ð	24
170	23045	23070	23096	23121	23147	23172	23198	23223	23249	23274	<u> </u>		- 21
$\frac{171}{172}$	23300	23325	23350	23376	23401 22654	$23426 \\ 22670$	23452	23477	23502 92754	23528	-	29	
$172 \\ 173$	23805	23830	23855	23880	23905	23930	23955	23980	24005	24030	$\frac{1}{2}$	- 3 - 6	3
174	24055	24080	24105	24130	24155	24180	24204	24229	24254	24279	3	9	8
175	24304	24329	24353	24378	24403	24428	24452	24477	24502	24527	4	12	11
176	24551	24576	24601	24625	24650	24674	24699	24724	24748	24773	5	15	14
177	24797	24822 25066	24846 25001	24871 95115	24890	24920	24944	24969	24993	25018	$\frac{6}{7}$	17	11
$170 \\ 179$	25285	25000 25310	25334	25358	25100 25382	25406	25100 25431	25455	25479	25201 25503	s	$\frac{1}{23}$	$\frac{1}{22}$
180	25527	25551	25575	25600	25624	25648	25672	25696	25720	25744	9	26	25
181	25768	25792	25816	25840	25864	25888	25912	25935	25959	25983		27	26
182	26007	26031	26055	26079	26102	26126	26150	26174	26198	26221	1	3	3
183	26240	26269	26293	$20310 \\ 26553$	26340	26600	26387	26411 26617	26430	20408 26691	2	5	5
185	26717	26741	26764	26788	26811	26834	26858	26881	26905	26928	3	8	8
186	26951	26975	26998	27021	27045	27068	27091	27114	27138	27161	$\begin{bmatrix} 1\\ 5\end{bmatrix}$	11	10
187	27184	27207	27231	27254	27277	27300	27323	27346	27370	27393	6	16	$16 \\ 16$
188	27416	27439	27462	27485	27508	27531	27554	27577	27600	27623	7	19	18
$\frac{189}{100}$	27040	27009	27092	27710	21108	27701	21184	21801	21800	27802	8	22	21
190	27875	21898	$\frac{27921}{28149}$	27944	27907	27989	28012	28262	28285	28081	9	24	23
192	28330	28353	28375	28398	28421	28443	28466	28488	28511	28533		25	24
193	28556	28578	28601	28623	28646	28668	28691	28713	28735	28758	$\frac{1}{2}$	3	2
194	28780	28803	28825	28847	28870	28892	28914	28937	28959	28981	$\frac{2}{3}$	- 0 - 8	$\frac{9}{7}$
195 196	29003	29020	29048	29070	29092	29115	29137 29358	29159	29181	29203	4	10	10
197	29220 29447	29469	29491	29513	29535	29557	29579	29601	29623	29645	5	13	12
198	29667	29688	29710	29732	29754	29776	29798	29820	29842	29863	$\frac{6}{7}$	15	14
199	29885	29907	29929	29951	29973	29994	30016	30038	30060	30081	ś	$\frac{18}{20}$	19
200	$\frac{30103}{20200}$	30125	30146	30168	-30190	30211	30233	30255	30276	30298	9	$\overline{23}$	22
$\frac{201}{202}$	30535	30557	30503 30578	30600	30621	30428 30643	30664	30685	30492	30514		23	
203	30750	30771	30792	30814	30835	30856	30878	30899	30920	30942	1	$\overline{2}$	$\overline{2}$
204	30963	30984	31006	31027	31048	31069	31091	31112	31133	31154	2	5	+
205	31175	31197	31218	31239	31260	31281	31302	31323	31345	31366	3	7	7
$206 \\ 207$	$\frac{31387}{21507}$	21619	31429	31450	31471	$\frac{31492}{21702}$	31513	31534	31555	31576	+	9	9
$-\frac{207}{208}$	31806	31827	31848	31869	31890	31911	31931	31952	31705	31769 31994	6	14	$11 \\ 13$
$\frac{200}{209}$	32015	32035	32056	32077	32098	32118	32139	32160	32181	32201	7	$\hat{16}$	15
210	32222	32243	32263	32284	32305	32325	32346	32366	32387	32408	8	18	18
211	32428	32449	32469	32490	32510	32531	32552	32572	32593	32613	9	21	20
$\frac{212}{212}$	32634 32839	$32654 \\ 32858$	32675 32870	32695 32800	$32715 \\ 32010$	32736	32756 39080	32777	32797	32818 33091	-	21	20
214	33041	33062	33082	33102	33122	33143	33163	33183	33203	33224	1	2	2
215	33244	33264	33284	33304	33325	33345	33365	33385	33405	33425	$\frac{4}{3}$	6	$\frac{1}{6}$
216	33445	33465	33486	33506	33526	33546	33566	33586	33606	33626	4	8	8
217	33646	33666	33686	33706	33726	33746	33766	33786	33806	33826	5	11	10
218 219	34044 34044	3300 34064	34084	34104	55925 34194	- 33940 - 34143	34163	55985 34183	34903	34020	$\frac{6}{7}$	13	12
	0.011	0.001	0.001	UTIOL	O A A M A	01110	01100	01100	01200	() []]]	8	17	16
No.	0	1	2	3	4	5	6	7	8	9	9	19	18

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TABLE 42.

Logarithms of Numbers.

No. 2	2200-2800).							L	og. 34242-	-447	16.
No.	0	1	2	3	4	5	6	7	8	9		
$220 \\ 221$	$\frac{34242}{2.1430}$	$\frac{34262}{34459}$	$\frac{34282}{34479}$	34301	34321	$\frac{34341}{34537}$	$34361 \\ 34557$	$\frac{34380}{34577}$	$\frac{34400}{34596}$	$\frac{34420}{34616}$	1	20
$\frac{221}{222}$	34635	34655	34674	34694	34713	34733	34753	34772	34792	34811	1	2
223	34830	34850	34869	34889	34908	34928	34947	34967	34986	35005	$\frac{2}{2}$	4
224	35025	35044	35064	35083	35102	35122	35141	35160	35180	35199	3	6
$-225 \\ -226$	$\frac{35218}{35411}$	35238	35257 35440	35168	35488	35507	35334 35526	30303 35515	35372	35392	$\frac{1}{5}$	10
$\frac{120}{227}$	35603	35622	35641	35660	35679	35698	35717	35736	35755	35774	6	12
228	35793	35813	35832	35851	35870	35889	35908	35927	35946	35965	7	14
229	35984		36021	36040	36059	36078	36097	36116	36135	$\frac{36154}{26049}$	9	18
$\frac{230}{231}$	36173	36192 36380	36399	$36229 \\ 36418$	36436	36455	36280 36474	36305	$36324 \\ 36511$	$36342 \\ 36530$		19
232	36549	36568	36586	36605	36624	36642	36661	36680	36698	36717		
233	36736	36754	36773	36791	36810	36829	36847	36866	36884	36903	$\hat{2}$	4
	36922	36940	36959	36977	36996	37014	37033	37051	37070	37088	3	6
230	37291	$\frac{57125}{37310}$	37328	$\frac{37102}{37346}$	37365	37383	37401	37420	37438	37457	5	10
237	37475	37493	37511	37530	37548	37566	37585	37603	37621	37639	6	11
238	37658	37676	37694	37712	37731	37749	37767	37785	37803	37822	7	13
239	37840	37858	3/8/6	3/894	37912	3/931	37949	3/96/	37985	38003	8	$15 \\ 17$
$\frac{240}{241}$	$\frac{38021}{38202}$	38220	38238	$\frac{38079}{38256}$	$38095 \\ 38274$	$\frac{38112}{38292}$	38310	38328	38346	38364		10
242	38382	38399	38417	38435	38453	38471	38489	38507	38525	38543	1	
243	38561	38578	38596	38614	38632	38650.	38668	38686	38703	38721	$\frac{1}{2}$	$\frac{2}{4}$
244	38739	38/07	38775	38792	38810	38828	38846	38863	38881	38899	3	5
$\frac{240}{246}$	39094	39111	3952 39129	39146	39164	39182	39023	39217	39038 39235	39252	4	7
247	39270	39287	39305	39322	39340	39358	39375	39393	39410	39428		11
248	39445	39463	39480	39498	39515	39533	39550	39568	39585	$\frac{39602}{20777}$	7	13
249	39620	39637	39655	39672	39690	39707.	39724	39742	39739	39777	8	14
$\frac{250}{251}$	39967	39985	40002	40019	40037	40054	40071	40088	40106	40123	9	10
252	40140	40157	40175	40192	40209	40226	40243	40261	40278	40295		17
253	40312	40329	40346	+10364	40381	40398	40415	40432	40449	40466 40627	$\frac{1}{2}$	$\frac{2}{3}$
204	40485	40671	40518	40555	40552	40739	40000	10773	40020	40037	3	5
$\frac{255}{256}$	40824	40841	40858	40875	40892	40909	40926	40943	40960	40976	4	7
257	40993	41010	41027	41044	41061	41078	41095	41111	41128	41145	5 6	10
$258 \\ 250$	41162 41220	$41179 \\ 41217$	41196 41362	41212	41229 41307	41246 41414	41263 41430	41280 414.17	41296 41464	$41313 \\ 41481$	7	12
$\frac{209}{260}$	41330	41514	41505	41547	41564	41581	41597	41614	41631	$\frac{41401}{41647}$	8	14
$\frac{260}{261}$	41664	41681	41697	41714	41731	41747	41764	41780	41797	41814		15
262	41830	41847	41863	41880	41896	41913	41929	41946	41963	41979		16
$263 \\ 264$	41996 42160	42012 42177	42029	$42045 \\ 42210$	$42062 \\ 42226$	42078	42095 49259	42111 42275	42127	$42144 \\ 42308$	1	$\begin{vmatrix} 2\\ 2 \end{vmatrix}$
265	42325	42341	42357	42374	42390	42406	42423	42439	42455	42472	$\frac{2}{3}$	5
266	42488	42504	42521	42537	42553	42570	42586	42602	42619	42635	4	6
267	42651	42667	42684	42700	42716	42732	42749	42765	42781	42797	5	8
$268 \\ 269$	$42813 \\ 42975$	$\frac{42830}{42991}$	42840	43024	42878	42894	42911	42927	42945	42939	7	11
270	43136	43152	$\frac{13000}{43169}$	43185	43201	43217	43233	43249	43265	43281	8	13
271	43297	43313	43329	43345	43361	43377	43393	43409	43425	43441	9	14
272	43457	43473	43489	43505	43521	43537 43606	43553	43569	43584	$\frac{43600}{43750}$		15
273	43010	43032	43807	43823	43838	43854	43870	43886	43902	43917	$\frac{1}{2}$	$\frac{2}{3}$
275	43933	43949	43965	43981	43996	44012	44028	44044	44059	44075	3	5
276	44091	44107	44122	44138	44154	44170	44185	44201	44217	44232	4	6
277	44248	44264	$\frac{44279}{11436}$	44295 44451	44311 4467	$44326 \\ 44489$	44342	44358	44373	44545	0 6	9
279	44560	44576	44592	44607	44623	44638	44654	44669	44685	44700	7	11
											8	12
No.	0	1	2	3	4	ð	6	7	8	9	9	14

TABLE 42.

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Logarithms of Numbers.

No. 5	2800-3400).							L	og. 44716-		48.
No.	0	1	2	3	4	5	6	7	8	9		
												16
280	44716	44731	44747	44762	44778	44793	44809	$\frac{14824}{14070}$	44840	44855		
281	44871	44886	15056	44917	44952	41948	44900	44979	44994	45010	1	2
282	45170	40040	40000	45071	45080	45255	45271	45286	45301	45317	2	3
$-285 \\ -281$	45175	45347	45260 45362	45378	45393	45408	45423	45439	45454	45469	3	5
- 204	15.19.1	15500	45515	45530	45545	45561	45576	45591	45606	45621	4	6
- 200 - 286	15637	45652	45667	45682	45697	45712	45728	45743	45758	45773	0	8
287	45788	45803	45818	45834	45849	45864	45879	45894	45909	45924	7	10
288	45939	45954	45969	45984	46000	46015	46030	46045	46060	46075	8	11
289	46090	46105	46120	46135	46150	46165	46180	46195	46210	46225	9	14
-290	46240	46255	46270	46285	46300	46315	46330	56345	46359	46374		
291	46389	46404	46419	46434	46449	46464	46479	46494	46509	46523		
292	46538	46553	46568	46583	46598	46613	46627	46642	46657	46672		15
293	46687	46702	46716	46731	46746	46761	46776	40790	40800	40820		
294	46835	46850	46864	40879	. 40894	40909	40923	40958	40900	40907	1	2
295	46982	46997	47012	47026	47041	47000	47070	47080	47100	17961	2	- 3
296	47129	47144	47109	4/1/0	47100	47202	47262	47202	17299	47201	3	5
297	47270	47290	47303	47315	47304	47494	47509	47524	47538	47553	1	6
295	47422	47582	47596	47611	47625	47640	47654	47669	47683	47698	a e	8
-200	17719	17797	17741	47756	47770	47784	47799	47813	47828	47842	07	11
301	17857	47871	47885	47900	47914	47929	47943	47958	47972	47986	8	12
-302	48001	48015	48029	48044	48058	48073	48087	48101	48116	48130	9	14
303	48144	48159	48173	48187	48202	48216	48230	48244	48259	48273		
304	48287	48302	48316	48330	48344	48359	48373	48387	48401	48416		
305	48430	48444	48458	48473	48487	48501	48515	48530	48544	48558		14
306	48572	48586	48601	48615	48629	48643	48657	48671	48686	48700		
307	48714	48728	48742	48756	48770	48785	48799	48813	48827	48841	1	1
308	48855	48869	48883	48897	48911	48926	48940	48954	48968	48982	2	3
309	48996	49010	49024	49038	49052	49000	49080	49094	49108	49122	3	4
310	49136	49150	49164	49178	49192	49206	49220	49234	49248	49262	4	67
311	49270	49290	49304	49518	49552	10.195	49500	40513	49000	49402	6 0	6
- 312 - 313	49410	49429	19582	19596	49471	19621	49638	49651	49665	49679	$\frac{0}{7}$	10
314	49693	49707	49721	49734	49748	49762	49776	49790	49803	49817	8	11
315	19831	19845	49859	49872	49886	49900	49914	49927	49941	49955	<u>9</u>	13
316	49969	49982	49996	50010	50024	50037	50051	50065	50079	50092		
317	50106	50120	50133	50147	50161	50174	50188	50202	50215	50229		
318	50243	50256	50270	50284	50297	50311	50325	50338	50352	50365		13
319	50379	50393	50406	$_{50420}$	50433	50447	50461	50474	50488	50501		
320	50515	50529	50542	50556	50569	50583	50596	50610	50623	50637	1	1
321	50651	50664	50678	50691	50705	50718	50732	50745	50759	50772	2	3
322	50786	50799	50813	50826	50074	50007	51001	51014	51090	51041	3	4
323	51055	51069	00947 51091	00961 51005	00974 51100	00987 51191	51125	511.49	51169	51041 51175	- 1 5	07
- 024	51100	51008	51051	51000	51949	51955	51920	51909	51905	51200	â	8
- 525 296	01188 51200	01202 51225	01210 51249	51228	51242	51200	51409	51415	51499	51441	7	$\tilde{9}$
320	51455	51468	51481	51495	51508	51521	51534	51548	51561	51574	8	10
328	51587	51601	51614	51627	51640	51654	51667	51680	51693	51706	9	12
329	51720	51733	51746	51759	51772	51786	51799	51812	51825	51838		
330	51851	51865	51878	51891	51904	51917	51930	51943	51957	51970		1
331	51983	51996	52009	52022	52035	52048	52061	52075	52088	52101		12
-332	52114	52127	52140	52153	52166	52179	52192	52205	52218	52231		_
333	52244	52257	52270	52284	52297	52310	52323	52336	52349	52362		
334	52375	52388	52401	52414	52427	52440	52453	52466	52479	52492		
335	52504	52517	52530	52543	52556	52569	52582	52595	52608	52621	6 1	5
336	52634	52647	52660	52673	52686	52699	52711	52724	52737	52750	5	6
337	52763	5200=	02789 59017	52802	52815 52042	02827 5905e	52840 52060	52082	02800 52004	02879	6	7
330	52092	53033	53046	53058	53071	53081	53097	53110	53199	53135	7	8
000	00020	00000	00000	00000	00011	00004	55001	00110	00122	00100	8	10
No.	0	1	2	3	4	ō	6	7	8	9	9	11
	l í	-									1	1

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TABLE 42.

Logarithms of Numbers.

No. 8	3400).							L	og. 53148-	602	06.
No.	0	1	2	3	4	5	6	7	8	9		
340	53148	53161	53173	53186	53199	53212	53224	53237	53250	53263		13
341	53275	53288	53301	53314	53326	53339	53352	53364	53377	53390		
342	53403	53415	53428	53441	53453	53466	53479	53491	53504	53517	$\frac{1}{2}$	1
343	53529	53542	53555	53567	53580	53593	53605	53618	53631	53643	$\frac{2}{3}$	0 4
344	03656	53668	- 53681	52094	59099	33719	5905-	59970	03/07	52005	4	5
345 246	03782 52000	52090	03807 53022	03820 53945	53958	53970	53982	53905	54009	00890 54090	5	7
347 347	54033	54045	54058	54070	54083	54095	54108	54120	54133	54145	6	8
348	54158	54170	54183	54195	54208	54220	54233	54245	54258	54270	0	9
349	54283	54295	54307	54320	54332	54345	54357	54370	54382	54394	9	$10 \\ 12$
350	. 54407	54419	54432	54444	54456	54469	54481	54494	54506	54518		
351	54531	54543	54555	54568	54580	54593	54505	54617	54630 54750	54765	1	
352	54654	ə4667 5.1700	04679 54609	04691 54914	04704 54897	04/16 54820	04/28 51851	54861	04753 51876	04765 54899	1	
əəə 35.1	54900	54913	54925	54937	54949	54962	54974	54986	54998	55011	1	
355	55023	55035	55047	55060	55072	55084	55096	55108	55121	55133		
356	, 55145	55157	55169	55182	55194	55206	55218	55230	55242	55255		12
357	55267	55279	55291	55303	55315	55328	55340	55352	55364	55376		
358	55388	55400	55413	55425	55437	55449	55461	55473	55485	55497	1	1
359	55509	55342	00034	55000	55070		55700	00094	55707	00018	2	2
360 961	55751	55769	55775	55787	00678 55700	00691 55811	00703 55899	00/15 55895	00727 55817	00739 55850	3	4
501 369	55871	00703 55883	55895	55907	55919	55931	55943	55955	55967	55979	$\frac{1}{5}$	Э В
363	55991	56003	56015	56027	56038	56050	56062	56074	56086	56098	6	7
364	56110	56122	56134	56146	56158	56170	56182	56194	56205	56217	7	8
365	56229^{-1}	56241	56253	56265	56277	56289	56301	56312	56324	56336	8	10
366	56348	56360	56372	56384	56396	56407	56419	56431	56443	56455	9	11
367	56467	56478	56490	56502	56514	56526	56538	56667	56561	56573 56601		1
$\frac{368}{260}$	56585 56502	56597 56714	26608 56726	56720 56720	56750	56761 56761	56779	00067 56785	00079 56797	568091 56809		
270	56990	56290	56811	56855	56867	56870	56801	56902	5691.1	56926		
370	56937	56949	56961	56972	56984	56996	57008	57019	57031	57043	1	
372	57054	57066	57078	57089	57101	57113	57124	57136	57148	57159		
373	57171	57183	57194	57206	57217	57229	57241	57252	57264	57276		11
374	57287	57299	57310	57322	57334	57345	57357	57368	57380	57392		1
375	57403	57415	57426	57438	57449	57461	57473	57600	57496	57699	$\frac{1}{2}$	2
376	5769.4	57610	07042 57657	07003 57660	07000 57690	07076 57609	07088 57702	57715	57796	57738	$\tilde{3}$	3
378	57749	57761	57772	57784	57795	57807	57818	57830	57841	57852	4	4
379	57864	57875	57887	57898	57910	57921	57933	57944	57955	57967	5	6
380	57978	57990	58001	58013	58024	58035	58047	58058	58070	58081	$\frac{6}{7}$	1
381	58092	58104	58115	58127	58138	58149	58161	58172	58184	58195	8	9
382	58206	58218	58229	58240	58252 E0007	58263	58274	58286	58410	58 100	9	10
383	58420 58422	58111	5815e	58167	08300 59.179	08317 58100	00388 58501	58519	58594	58535	-	1
106	585.10	59555	58560	58580	58501	58809	58611	58695	58620	586.17		
386 386	58650	58670	58681	58692	58704	58715	58726	58737	58749	58760	1	
387	58771	58782	58794	58805	58816	58827	58838	58850	58861	58872		
388	58883	58894	58906	58917	58928	58939	58950	58961	58973	58984		1
389	58995	59006	59017	59028	59040	59051	59062	59073	59084	59095		10
390	59106	59118	59129	59140	59151	59162	59173	59184	59195 50200	59207 59212		
391	59218	59229	59240 50251	59251 50262	59262 50279	50201	50205	09295 50.100	59417	59199 59199	1	1
- 392 - 302	09329 59120	09340 59150	09501 59181	59479	59182	59494	59506	59517	59528	59539	2	2
394	59550	59561	59572	59583	59594	59605	59616	59627	59638	59649	4	4
395	59660	59671	59682	59693	59704	59715	59726	59737	59748	59759	5	5
396	59770	59780	59791	59802	59813	59824	59835	59846	59857	59868	6	6
397	59879	59890	59901	59912	59923	59934	59945	59956	59966	59977	7	7
398	59988	59999	60010	60021	60032	60043	60054	60065	60194	00086 60105	8	8
399	00097	00108	00119	00130	00141	00152	00103	001/3	00184	00199	9	i)
No.	0	1	2	3	4	5	6	7	8	9		

TABLE 42.

Logarithms of Numbers.

No.	1000-4600).							L	.og. 60206-		276.
No.	0	1	2	3	4	5	6	7	8	9		
400	60206	60217	60228	60239	60249	60260	60271	60282	60293	60304	-	11
401	60314	60325	60336	60347	60358	60369	60379	60390	60401	60412		
402	60423	60433	60444	60455	60466	60477	60487	60498	60509	60520	1	1
403	60531	60541	60552	60563	60574	60584	60595	60606	60617	60627	2	2
404	60638	60649	60660	60670	60681	60692	60703	60713	60724	60735	್ 1	3
405	60746	60756	60767	60778	60788	60799	60810	60821	60831	60842	- 1	+ R
406	60853	60863	60874	60885	60895	60906	60917	60927	60938	60949	6	7
407	60959	60970	60981	60991	61002	61013	61023	61034	61045	61055	7	8
408	61066	61077	61087	61098	61109	61119	61130	61140	61151	61162	8	9
409	61172	61183	61194	61204	61215	61225	61236	61247	61257	61268	9	10
410	61278	61289	61300	61310	61321	61331	61342	61352	61363	61374		
411	61384	61395	61405	61416	61426	61437	61448	01408	61469	014/9		
412	61490	61500	61511	61021	01032	01042	01000	61660	01074	61600		
413	61595	61606	61616	01027	61749	61759	-01008	61773	61784	61704		•
414	01700	01/11	01721	01701 01090	01742	21057	-21020	61070	61000	61000		
415	61805	01810	01820 61020	61041	61051	61069	61079	61982	61992	62003		
410	62014	62024	62024	62045	62055	62066	62076	62086	62097	62107		
410	62118	62128	62138	62149	62159	62170	62180	62190	62201	62211		
410	62221	62232	62242	62252	62263	62273	62284	62294	62304	62315		
190	62325	62335	62346	62356	62366	62377	62387	62397	62408	62418		
420	62428	62439	62449	62459	62469	62480	62490	62500	62511	62521		
422	62531	62542	62552	62562	62572	62583	62593	62603	62613	62624		
423	62634	62644	62655	62665	62675	62685	62696	62706	62716	62726		
424	62737	62747	62757	62767	62778	62788	62798	62808	62818	62829		10
425	62839	62849	62859	62870	62880	62890	62900	62910	62921	62931		
426	62941	62951	62961	62972	62982	62992	63002	63012	63022	63033	1	1
427	63043	63053	63063	63073	63083	63094	63104	63114	63124	63134	2	2
428	63144	63155	63165	63175	63185	63195	63205	63215	63225	63236	3	3
429	63246	63256	63266	63276	63286	63296	63306	63317	63327	63337	4	4
430	63347	63357	63367	63377	63387	63397	63407	63417	63428	63438	5	5
431	63448	63458	63468	63478	63488	63498	63508	63518	63528	63538	6	6
432	63548	63558	63568	63579 69070	63589	63599	63609	03019	03029	63720		7
433	63649	63659	03669	03079	03089	63700	63600	63910	63890	63830	8	8
434	09/49	00/09	00109	00119	60100	69000	62000	62010	62000	63030	9	9
435	63849	03899	03869	63020	63065	63005	61006	61019	64029	61038		1
430	610.19	05959 61059	61066	61078	64088	61008	64108	64118	64128	64137		
437	64147	64157	64167	64177	64187	64197	64207	64217	64227	64237		
439	64246	64256	64266	64276	64286	64296	64306	64316	64326	64335		
110	64345	64355	64365	64375	64385	64395	64404	64414	64424	64434		
441	64444	64454	64464	64473	64483	64493	64503	64513	64523	64532		
442	64542	64552	64562	64572	64582	64591	64601	64611	64621	64631		
443	64640	64650	64660	64670	64680	64689	64699	64709	64719	64729		
444	64738	64748	64758	64768	64777	64787	64797	64807	64816	64826		
445	64836	64846	64856	-64865	64875	64885	6+895	6+904	64914	64924		
446	64933	64943	64953	64963	64972	64982	64992	65002	65011	65021		
447	65031	65040	65050	65060	65070	65079	65089	65099	65108	65118		
448	65128	65137	65147	65157	65167	65176	65186	65196	65205	65215		
449	65225	65234	65244	65254	65263	65273	65283	65292	65302	65312		9
450	65321	65331	65341	65350	65360	65369	65379	65389	65398	65408	·	
451	65418	65427	65437	65447	65456	65466	65475	65485	65495	65504	1	1
452	65514	65523	65533	65543	65552	65562	65571	65581	65591	65600	2	2
453	65610	65619	65629	65639	65648	65658	65667	65677	65686	65500	3	3
454	65706	65715	65725	65734	65744	65753	65763	09/12	00/82	05/92	4	4
455	65801	65811	65820	65830	65839	65849	65858	65868	65877	65887	0	6
456	65896	65906	65916	65925	60935	62944	66040	60963	60973	66077	0	0 R
457	66097	66001	00011 66106	66115	86194	66194	66149	66152	66169	66179	ŝ	7
408 .	66191	66101	66200	00110 66910	66910	66990	66938	66947	66257	66266	- 9	8
409	00101	00191	00200	00210	00210	00220	00200	00211	00201	00200	Ū	
No.	0	1	2	3	+	5	6	7	8	9		
								I	i			

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TABLE 42.

Logarithms of Numbers.

No.	4600-520	0.							I	.og. 66276-	716	00.
No.	0	1	2	3	4	5	6	7	8	9		
460	66276 66270	66285 66380	66295 66389	66304 66398	66314 66408	66323 66417	$66332 \\ 66497$	66342	66351 86115	66361		• 10
461	66464	66474	66483	66492	66502	66511	66521	66530	66539	66549	1	1
463	66558	66567	66577	66586	66596	66605	66614	66624	66633	66642	2	2
464	66652	66661	66671	66680	66689	66699	66708	66717	66727	66736	3	3
465	66745	66755	66764	66773	66783	66792	66801	66811	66820	66829	5	5
466	66839	66045	66950	66960	00870	66978	669894	66904	66913	66922	6	6
468	67025	67034	67043	67052	67062	67071	67080	67089	67000	67108	7	7
469	67117	67127	67136	67145	67154	67164	67173	67182	67191	67201	8	8
470	67210	67219	67228	67237	67247	67256	67265	67274	67284	67293	9	9
471	67302	67311	67321	67330	67339	67348	67357	67367	67376	67385		
472	67394	67403	67501	67514	67431 87593	67539	67449	67459	67468	67477		
473	67578	67587	67596	67605	67614	67624	67633	67642	67651	67660		
475	67669	67679	67688	67697	67706	67715	67724	67733	67742	67752		
476	67761	67770	67779	67788	67797	67806	67815	67825	67834	67843		
477	67852	67861	67870	67879	67888	67897	67906	67916	67925	67934		
478	67943	67952	67961	67970	67979	67988	67997	68006	68015	68024		
479	08034	60199	69149	68151	68160	- 68160	89179	89197	08100	68205		
480	08124 68215	68924	68233	68242	68251	68260	68269	68278	68287	68205		1
482	68305	68314	68323	68332	68341	68350	68359	68368	68377	68386		
483	68395	68404	68413	68422	68431	68440	68449	68458	68467	68476		
484	68485	68494	68502	68511	68520	68529	68538	68547	68556	68565		9
485	68574	68583	68592	68601	68610	. 68619	68628	68637	68646	68655		
486	68664	68673	68681	68780	68789	68707	68806	68915	68735	68744	1	1
487	68842	68851	68860	68869	68878	68886	68895	68904	68913	68922	$\frac{2}{2}$	$\frac{2}{2}$
489	68931	68940	68949	68958	68966	68975	68984	68993	69002	69011	4	- 4
490	69020	69028	69037	69046	69055	69064	69073	69082	69090	69099	5	5
491	69108	69117	69126	69135	69144	69152.	69161	69170	69179	69188	6	5
492	69197	69205	69214	69223 60311	69232	69241	69249	69258	69267	69276	7	6
495	69280 69373	69381	69390	69399	69408	69417	69425	69434	69443	69452	9	8
495	69461	69469	69478	69487	69496	69504	69513	69522	69531	69539	, v	Ŭ
496	69548	69557	69566	69574	69583	69592	69601	69609	69618	69627		
497	69636	69644	69653	69662	69671	69679	69688	69697	69705	69714		
498	69723	69732	69740	69749	69758	69767	69775	69784	69793	69801		
499	60907	60006	60014	60023	60032	600.10	600.10	69058	60066	60075		
500	69984	69992	70001	70010	70018	70027	70036	70044	70053	70062		
502	70070	70079	70088	70096	70105	70114	70122	70131	70140	70148		
-503	70157	70165	70174	70183	70191	70200	70209	70217	70226	70234		
504	70243	70252	70260	70269	70278	70286	70295	70303	70312	70321		
505 500	70329	70338	$70346 \\ 70499$	70355 70441	70364	70372	70381	70389 70175	70398	70406		
506 507	70410 70501	70424	70518	70526	70535	70544	70407	70475	70569	70578		
508	70586	70595	70603	70612	70621	70629	70638	70646	70655	70663		
509	70672	70680	70689	70697	70706	70714	70723	70731	70740	70749		8
510	70757	70766	70774	70783	70791	70800	70808	70817	70825	70834		
511	70842	70851	70859	70868	70876	70885	70893	70902	70910	70919	1	1
$\frac{512}{512}$	70927	70935	70944 71090	70992 71037	70961	70909	710978	70986	70999	71003	2	2
514	71096	71105	71113	71122	71130	71139	71147	71155	71164	71172	0 4	23
515	71181	71189	71198	71206	71214	71223	71231	71240	71248	71257	5	4
516	71265	71273	71282	71290	71299	71307	71315	71324	71332	71341	6	5
517	71349	71357	71366	71374	71383	71391	71399	71408	71416	71425	7	6
$518 \\ 519$	$71433 \\71517$	$71441 \\ 71525$	$71450 \\ 71533$	$71458 \\ 71542$	71466 71550	$71475 \\ 71559$	$71483 \\71567$	$71492 \\ 71575$	71500	71508 71592	9	$\frac{6}{7}$
No.	0	1	2	3	4	5	6	7	8	9		

TABLE 42.

Logarithms of Numbers.

No. 0 1 2 3 4 5 6 7 8 9 500 71600 71607 71675 71675 71675 71757 71757 71757 71757 71757 71757 71757 71757 71757 71757 71757 71757 71757 71757 71857 71857 71857 71857 71857 71857 71857 71857 71857 71857 71857 71985 71990 71997 71998 71997 71997 71997 71997 71997 71997 71997 71997 72157 72137 72239 72247 72239 72247 72239 72347 72239 72347 72239 72347 72357 7	No	. 5200-58	:00.					· · · · · ·		L	og. 71600-	7634	3.
520 71600 71607 71677 71025 71634 71625 71650 71650 71675 71675 521 77164 71177 71725 71777 71725 71734 71742 71736 71735 71843 71842 11843 72016 72017 72085 72016 72017 72018 72017 72018 72017 72018 72017 72018 72017 72018 72017 7201	No.	0	1	2	3	4	5	6	. 7	s	9		
321 71684 71692 71700 7177 7172 71730 71780 71890 7181 522 71767 71775 71883 71890 71817 71825 71883 71891 71917 71995 71935 71936 71917 71995 71936 71917 71995 71936 71910 7170 71770 71770 71770 71770 72777 72770 72737 72861 72881 72881 72881 72880 72871 72861 72875 72881 72880 72876 72861 72875 72881 72880 72876 72876 72876 72876 72876 72876 72876 72876 72876 72876 72876	520	71600	71609	71617	71625	71634	71642	71650	71659	71667	71675		9
522 71767 71775 71784 711800 71800 71800 71800 71800 71900 71903 33 523 71580 71188 711985 71996 71997 71997 71917 71925 33 34 524 72016 72002 72002 72002 72002 72006 72007 72008 72016 72008 72017 72016 72008 72017 72018 72115 72137 72337 72337 72337 72337 72337 72337 72338 7211 72117 72145 72147 72455 76 76 76 75 7533 72337 72337 72338 72441 72419 9 8 7333 72437 72345 72440 72448 72455 72403 72357 7238 7244 7338 72447 73457 72438 72446 72455 72567 72585 72587 72587 72587 72587 72587 72587 72587 72587 72587 72587 72587 72587 72587	521	71684	71692	71700	71709	71717	71725	71734	71742	71750	71759		1
223 71850 71857 71857 71957 71987 71997 72977 72977 72977 72977 72977 72978 72978 72978 72978 72978 72987 7	522	71767	71775	71784	71792	71800	71809	71817	71825	71834	71842	1	4
224 (1933) (1944) (1950) (1950) (1955) <td>523</td> <td>71850</td> <td>71858</td> <td>71867</td> <td>71875</td> <td>71883</td> <td>71892</td> <td>71900</td> <td>71908</td> <td>71917</td> <td>71925</td> <td>$\frac{4}{3}$</td> <td>2</td>	523	71850	71858	71867	71875	71883	71892	71900	71908	71917	71925	$\frac{4}{3}$	2
325 72016 72024 72041 72047 72046 72047 72046 72047 72046 72047 72046 72148 72488 72488 72488 72488 72488 72488 72488 72488 72488 72488 72488 72888 7	$_{-524}$	71933	71941	71950	71958	71966	11975	71983	71991	71999	72008	4	4
226 22100 72100 72103 72133 72133 72213 72213 72237 72337 75 6 527 72184 72238 72238 72237 72337 72337 7336 7 6 529 72346 72337 72377 72378 72337 72377 72378 72337 72378 72357<	525	72016	72024	72032	72041	72049	72057	72066	72074	72082	72090	5	5
224 12233 12139 12433 12234 12234 12235 12233 12333 12333 12333 12333 12333 12333 12333 12333 12333 12333 12333 123333 123333 123333 123333 <	526	72099	72107	72110	72123	72152	72140	72148	72100	72100	722173	6	5
Lab Lab <thlab< th=""> <thlab< th=""> <thlab< th=""></thlab<></thlab<></thlab<>	599	72181 79962	79979	72198	72200	72214	72264	79213	79391	79390	79227	7	6
530 72438 72438 72438 72438 72437 72485 72437 72485 72437 72457 7257 72583 72501 9 8 531 72509 72518 72538 72537 72585 72567 72575 72583 72567 72575 72585 72567 72575 72583 7216 72217 72777 72787 72787 72787 72787 72965 72973 72981 72989 7355 72981 72989 73006 73006 730102 73111 73119 73127 73125 73133 73131 73313 733131 73323 73324 73312 73323 73323 73323 73324	520	72346	72354	72362	72370	72378	72387	72395	72403	72411	72419	8	7
531 72500 72518 72561 72557 72557 72557 72557 72557 72557 72557 72557 72557 72557 72557 72557 72557 72557 72557 72557 72557 72557 72575 72581 72581 72819 72900 72905 72575 72581 72817 72907 72767 72757 72581 72817 72907 72906 72906 72906 72905 72916 72907 72007 72777 72777 72757 72817 73117 73117 73117 73117 73118 73119 73117 73117 73118 73119 73117 73118 73111 73119 73207 73217 73287 73087 7	530	79498	72136	72444	72452	72460	72469	72477	72485	72493	72501	9	8
552 725101 725260 72616 72616 72617 72618 72746 553 72637 72838 72740 72757 72725 72722 72738 72788 72788 72788 72788 72788 72786 72788 72788 72788 72788 72787 72965 72918 72989 72817 72965 72918 72989 72917 72905 72917 72965 72918 72989 72317 72918 72989 73167 73187 73010 73117 73119 73127 73125 73132 73323 73231 73311 540 732929 73247 73286 73363 73348 73364 73368 73364 73344 73312 7344 7349 7344 7344 7349 7344 7349 7344 7349 7344 7347 7376 73784 73761 73763 73761 73761 73761 737761 737777 73782 73761 <	531	72509	72518	72526	72534	72542	72550	72558	72567	72575	$\cdot 72583$		
533 72973 72981 72987 72713 72723 72730 72738 72887 534 7274 72779 72779 72777 72787 72780 72811 72819 72887 535 72843 72852 72940 72803 72811 72819 72887 536 72916 72925 72933 72941 72817 72957 72957 72957 72957 72951 72923 73231 73115 73119 73117 73113 73119 73117 73113 73119 73117 73113 73117 73113 73117 73113 73112 73287 73287 73287 73287 73287 73387 <	532	72591	72599	72607	72616	72624	72632	72640	72648	72656	72665		
535 7254 72700 72770 72777 72785 72803 72810 72810 72829 535 72837 72937 72980 72949 72357 72965 72973 72981 72981 72981 72981 72981 72981 72981 72981 72981 72981 72981 72981 72981 72981 72981 72981 72981 72981 73111 73111 73113 73143 73143 73143 73143 73143 73143 73143 73143 73143 73141 73121 73223 73231 73223 73231 73223 73231 73223 73231 73323 73343 73342 73444 73432 73440 73445 73450 73667 73667 7364 7362 73670 73671 73763 73763 73711 1 </td <td>533</td> <td>72673</td> <td>72681</td> <td>72689</td> <td>72697</td> <td>72705</td> <td>72713</td> <td>72722</td> <td>72730</td> <td>72738</td> <td>72746</td> <td></td> <td></td>	533	72673	72681	72689	72697	72705	72713	72722	72730	72738	72746		
555 72835 72843 72852 72800 72808 72876 72884 72890 72900 73000 73000 73000 73010 73010 73010 73010 73010 73010 73010 73010 73010 73010 7	534	72754	72762	72770	72779	72787	72795	72803	72811	72819	72827		
536 72916 72925 72940 72947 72965 72973 72981 72981 72981 72981 72981 72981 72981 72981 72981 72981 72981 72981 72981 72981 72981 73070 73070 73070 73070 73070 73070 73070 73070 73070 73070 73070 73070 73070 73070 73070 73070 73070 73021 73223 73324 73324 73324 73324 73324 73324 73344 73312 73260 73388 73394 73394 73392 73384 73394 73392 73383 73941 73512 73520 73385 73846 73640 73640 73646 73675 73753 73753 73753 73753 73753 73753 73753 73753 73753 73753 73751 73559 73960 73949 73907 73963 73941 1 1 1 1 1 <t< td=""><td>535</td><td>72835</td><td>72843</td><td>72852</td><td>72860</td><td>72868</td><td>72876</td><td>72884</td><td>72892</td><td>72900</td><td>72908</td><td>1</td><td></td></t<>	535	72835	72843	72852	72860	72868	72876	72884	72892	72900	72908	1	
537 72997 73006 73014 73022 73030 73048 73046 73047 73070 538 73057 73066 73047 73125 73111 73111 73119 73127 73235 73237 73237 73237 73237 73238 73334 73327 732360 73368 73376 73384 73392 73327 73236 73368 73364 73327 73237 73447 73312 73447 73425 73447 73452 73447 73452 73447 73452 73447 73452 73468 73446 73448 73446 73448 73447 73512 73520 73528 73535 73547 73568 73547 73660 73668 735714 73575 73686 735719 7367 73677 73676 73787 73832 73830 73838 73848 73897 74005 74077 74076 73677 73677 73677 73677 73677 73677 73677 73677 73767 73767 73767 737677 737677 737677	536	72916	72925	72933	72941	72949	72957	72965	72973	72981	72989		
538 73078 73086 73094 73191 73111 73119 73121 73215 73223 73311 540 73329 73225 73255 73263 7327 73280 73288 73284 73312 73215 73223 73312 73312 541 73320 73328 73336 73344 73342 73440 73448 73484 73352 73566 73564 73544 73525 73528 73566 73640 73544 73592 73528 73567 73707 737375 73757 73767 73757 73757 73757 73767 73757 73767 73757 73767 73757 73767 73767 73767 73767 73841 73440 73449 73492 73441 73449 73494 32 2 2 2 2 </td <td>537</td> <td>72997</td> <td>73006</td> <td>73014</td> <td>73022</td> <td>73030</td> <td>73038</td> <td>73046</td> <td>73054</td> <td>73062</td> <td>73070</td> <td></td> <td></td>	537	72997	73006	73014	73022	73030	73038	73046	73054	73062	73070		
540 7329 73416 7316 7316 7327 73227 73280 73280 73312 7327 73280 73388 73384 73389 73312 73328 73388 73386 73386 73386 73386 73366 73368 73366 73368 73367 73384 73389 73312 73440 73448 73496 73616 73624 73623 73668 73616 73624 73637 73624 73638 737677	538	73078	73086	73094	73102	73111	73119	73127	73135	73143	73151		
b40 73239 73244 73205 73205 73224 73360 73360 73368 73376 73384 73392 542 73400 73408 73416 73424 73422 73440 73448 73456 73366 73366 73366 73366 73366 73366 73366 73366 73366 73666 73667 73757 73753 73757 </td <td></td> <td>73159</td> <td>73107</td> <td>10110</td> <td>10100</td> <td>70191</td> <td>73199</td> <td>79207</td> <td>75210</td> <td>13223</td> <td>73231</td> <td></td> <td></td>		73159	73107	10110	10100	70191	73199	79207	75210	13223	73231		
3+1 73320 73320 73340 73440 73444 73474 73432 73440 73444 73472 543 73480 73488 73486 73496 73504 73512 73520 73528 73536 73544 73552 73553 73647 73763 73711 \$	540	73239	73247	73255	73263	73272	73280	73288	73296	73304	73312	ł –	
3-34 7.3400 7.3488 7.3448 7.3448 7.3512 7.3520 7.3520 7.3528 7.3534 7.3522 544 7.3560 7.3564 7.3576 7.3576 7.3576 7.3695 7.3695 7.3695 7.3753 7.3751 7.3753 7.3751 7.3753 7.3751 7.3753 7.3751 7.3753 7.3751 7.3753 7.3751 7.3753 7.3751 7.3753 7.3751 7.3753 7.3751 7.3753 7.3751 7.3753 7.3751 7.3753 7.3751 7.3753 7.3751 7.3753 7.3751 7.3753 7.3751 7.3753 7.3911 7.3911 7.3911 7.3913 7.3131 7.4132 7.4132 7.4132 7.4132 7.4132 7.4132 7.4132 7.4132	541	72100	79100	70000	72191	73439	73.140	72119	73.156	72161	72479		
544 73500 73506 73506 73504 73504 73600 73608 73616 73624 73624 73623 73624 73624 73624 73624 73625 73769 73695 73783 73711 1	- 044 5.13 -	73400	73408	73410	73504	73512	73520	73528	73536	73511	73552		
545 73640 73648 73656 73667 73679 73687 73095 73703 73711 1 1 546 73719 73727 73735 73743 73751 73757 73783 73775 73783 73775 73783 73775 73783 738775 73846 73857 73857 73826 73877 73857 73826 73877 73857 73826 73877 73857 73827 73837 7391 74007 74037 74037 74037 74037 74037 74037 74037 74097 74177 74177 7427 74297 74217 74217 74337 74337 74437 744327	544	73560	73568	73576	73584	73592	73600	73608	73616	73624	73632		E E
346 73719 73727 73735 73743 73751 73750 73767 73775 73783 73791 1 1 547 73799 73807 73815 73823 73830 73838 73846 73802 74003 74000 74007 7402 74036 74036 74017 74170 74170 74177 74177 74257	545	73640	73648	73656	73664	73672	73679	73687	73695	73703	73711		
547 73709 73807 73815 73823 73830 73838 73846 73862 73870 1 2 1 548 73876 73886 73884 73902 73910 73918 73924 73941 73941 73941 73941 73941 73941 73941 73941 73941 73941 73941 73941 73941 73941 73941 73428 74005 74005 74005 74002 74228 74228 74265 74076 74084 74092 74210 74170 74178 74176 74486 6 5 5 74273 74280 74265 7466 74374 74327 74335 74335 74335 74335 74353 74353 74437 74424 74429 74427 74455 74567 7456 7457 74567 74567 74567 74567 74567 74567 74567 74567 74567 74567 74567 74567 74567 74567	546	73719	73727	73735	73743	73751	73759	73767	73775	73783	73791		1
548 73878 73886 73894 73902 73910 73918 73926 73933 73941 73949 3 2 550 74036 74044 74052 74060 74068 74070 74020 74020 74028 4 3 550 74036 74044 74052 74060 74068 74076 74020 74020 74020 74218 74217 74233 7421 74257 74233 74327 74257 74280 74288 74266 74332 74337 74247 74257 74287 74287 74287 74287 74287 74257 74257 74257 74257 74357 74358 74577 74457 74457 74457 74457 74457 74457 74457 74457 74457 74457 7457 7456 74578 74577 74576 74578 74577 74576 74762 74717 74776 74776 74776 74776 747764 747779 </td <td>547</td> <td>73799</td> <td>73807</td> <td>73815</td> <td>73823</td> <td>73830</td> <td>73838</td> <td>73846</td> <td>73854</td> <td>73862</td> <td>73870</td> <td>$\frac{1}{2}$</td> <td>1</td>	547	73799	73807	73815	73823	73830	73838	73846	73854	73862	73870	$\frac{1}{2}$	1
549 73957 73965 73973 73981 73989 73997 74005 74013 74028 74028 74028 74028 74028 74028 74028 74028 74028 74028 74028 74028 74028 74029 74028 74028 74029 74027 74107 74178 74187 74186 7423 74241 74243 74243 74243 74243 74243 74335 74335 74335 74335 74335 74335 74335 74337 74357 74343 8 6 554 74357 74435 74437 74382 74304 74437 74335 74335 74335 74335 74337 74837 74837 74837 74848 74452 74570 74576 74576 74576 74576 74576 74576 74576 74576 74733 74881 74881 74881 74881 74881 74881 74881 74881 74881 74881 74834	548	73878	73886	73894	73902	73910	73918	73926	73933	73941	73949	$\frac{2}{3}$	9
550 74036 74044 74052 74060 74068 74076 74084 74092 74099 74107 5 4 551 74115 74123 74131 74137 74137 74155 74162 74194 74227 74233 74273 74287 74287 74287 74287 74237 74280 74287 74327 74335 74343 8 6 555 74129 74437 74537 74554 74554 74562 74570 7457 7457 74564 74737 74547 74554 74562 74570 74883 74883 74883 74883 74883 74883 74883 74883 <td>549</td> <td>73957</td> <td>73965</td> <td>73973</td> <td>73981</td> <td>73989</td> <td>73997</td> <td>74005</td> <td>74013</td> <td>74020</td> <td>74028</td> <td>4</td> <td>3</td>	549	73957	73965	73973	73981	73989	73997	74005	74013	74020	74028	4	3
551 74115 74123 74131 74139 74147 74162 74162 74178 74265 7 6 552 74194 74202 74210 74218 74225 74231 74249 74249 74267 74265 7 6 553 74273 74280 74287 74367 74437 74382 74300 74327 74355 74343 8 6 554 74351 74457 74457 74457 74457 74567 74570 74578 556 74507 74515 74531 74531 74537 74643 74622 74632 74640 74648 74456 74733 556 74633 74671 74677 74764 74772 74780 74788 74967 74881 74880 7481 559 74741 74794 74757 74764 74772 74780 74783 74963 74963 74963 74963 74963 74963 74963 74963 74963 74964 74811 74889 74811 <td>550</td> <td>74036</td> <td>74044</td> <td>74052</td> <td>74060</td> <td>74068</td> <td>74076</td> <td>74084</td> <td>74092</td> <td>74099</td> <td>74107</td> <td>$\hat{5}$</td> <td>4</td>	550	74036	74044	74052	74060	74068	74076	74084	74092	74099	74107	$\hat{5}$	4
552 74194 74202 74210 74218 74225 74233 74241 74241 74241 74257 74255 7 6 553 74273 74280 74387 74367 74374 74382 74390 74387 74385 74357 74441 74441 9 7 555 74429 74137 74445 74453 74461 74468 74467 74487 74429 74570 74570 74576 74568 74567 74573 74633 74671 74672 74632 74640 74648 74656 74576 7457 7456 74567 74577 74764 74767 74788 74783 74783 74803 74811 74837 74858 74963 74811 74837 74937 74937 74937<	551	74115	74123	74131	74139	74147	74155	74162	74170	74178	74186	6	5
553 74273 74280 74287 74351 74350 74351 74351 74350 74351 74351 74351 74351 74351 74437 74382 74390 74320 74327 74351 74439 74414 74429 9 7 555 74429 74437 74453 74461 74468 74477 74570 74570 74570 74570 74575 74586 74633 74617 74669 74702 74710 74718 74764 74772 74780 74788 74603 74811 74757 74764 74772 74780 74788 74967 74803 74811 74865 74873 74881 74889 74881 74889 74881 74889 74814 74907 7505 75012 75027 75035 75043 75043 75043 75051 75057 75113 75120 75246 75243 75250 75113 75120 75247 75266 75274 75365 75312 75320 75328 75331 753531 755361 75567 75567	552	74194	74202	74210	74218	74225	74233	74241	74249	74257	74265	7	6
354 (433) (433) (433) (433) (443) (4414) (4414) (4421) 9 7 555 74429 74437 74445 74453 74461 74468 74462 74484 74492 74500 74570 74500 556 74567 74533 74601 74609 74617 74624 74632 74640 74648 746456 74570 74570 74576 74733 74710 74717 74717 74717 74716 74717 74788 74796 74881 74881 74889 74881 74889 74964 74977 74706 74706 74707 74706 74707 74706 74873 74881 74889 74986 74904 74912 74920 74927 74935 74943 74950 74958 74956 74958 74966 74904 74912 74920 74927 75097 75007 75105 75113 75135 75059 75043 75059 75043 75057 75136 75136 75047 75087 75259 75266	553	74273	74280	74288	74296	74304	74312	74320	74327	74335	74343	8	6
555 74429 74451 74451 74451 74457 74454 74492 74900 1 556 74507 74515 74523 74530 74547 74554 74554 74562 74576 74575 74576 74576 74575 74576 74578 74575 74640 74648 74656 74578 74576 74733 7555 74660 74617 74772 74780 74718 74726 74333 74811 74803 74811 74803 74811 74803 74811 74807 74803 74811 74807 74967 74978 74978 74978 74978 74978 74978 74978 74978 74978 75117 75107		74501	74009	74007	74074	74082	74090	74098	74400	74414	74421	9	7
557 74586 74593 74601 74607 74637 74632 74640 74648 74656 558 74663 74671 74679 74687 74695 74702 74710 74718 74726 74733 559 74741 74749 74577 74764 74772 74788 74796 74803 74811 560 74819 74827 74834 74822 74850 74858 74857 74881 74889 561 74896 74904 74912 74920 74927 74935 74943 74950 74958 74966 562 74974 74981 74987 75005 75012 75020 75028 75035 75113 75120 563 75051 75289 75297 75285 75313 75287 75335 75343 75351 75343 75354 75343 75343 75354 75343 75354 75577 75566 75572 75586 75574 75587 75586 75732 7544 75732 7574 75752<	000 556	74429	74437	7 1592	74400 74591	74401	74408	71551	71569	74492	74000		
558 74663 74671 74673 74674 74772 74702 74710 74718 74726 74733 559 74741 74749 74757 74764 74772 74780 74788 74796 74803 74811 560 74819 74827 74834 74842 74850 74858 74865 74873 74881 74881 74881 74881 74881 74881 74881 74881 74881 74881 74881 74881 74881 74881 74881 74958 74966 74974 74974 74974 74975 75005 75012 75028 75035 75043 5563 75051 75059 75066 75074 75082 75287 75287 75286 75274 5585 75285 75335 75343 75313 75177 75466 75177 75466 75274 75385 75365 755343 75374 75385 75467 75473 75491 75420 75427 7568 75572 75585 75572 75586 75572 75586 75574	557	74507	71503	74020	74609	74000	74694	74004	74640	74618	74656		
559 74741 74749 74757 74764 74772 74780 74788 74796 74803 74813 560 74819 74827 74834 74842 74850 74858 74865 74873 74811 74899 74920 74927 74935 74943 74950 74958 74966 561 74896 74904 74912 74920 74927 74935 74943 74950 74958 74966 561 74896 74904 74912 74920 74927 74935 74943 74950 74958 74966 74974 74989 74997 75005 75012 75020 7528 75135 75131 75120 75197 75197 75197 75197 75197 75197 75197 75266 75274 75381 75381 75381 75387 75441 75487 75496 75547 75567 75572 75580 7572 75580 75732 75580 75732 <t< td=""><td>558</td><td>74663</td><td>74671</td><td>74679</td><td>74687</td><td>74695</td><td>74702</td><td>74710</td><td>74718</td><td>74726</td><td>74733</td><td></td><td></td></t<>	558	74663	74671	74679	74687	74695	74702	74710	74718	74726	74733		
560 74819 74827 74834 74842 74850 74858 74865 74873 74831 74889 561 74896 74904 74912 74920 74927 74935 74943 74950 74958 74966 562 74974 74981 74989 74997 75005 75012 75020 75028 75035 75043 563 75051 75559 75066 75174 75185 75186 75113 75120 564 75205 75213 75220 75228 75236 75243 75251 75259 75266 75274 565 75205 75213 75220 7528 75305 75312 75320 75328 75335 75343 75551 567 7538 73866 7374 75381 75481 75488 75407 75564 75542 75543 75441 75648 75656 7572 75732 1 1 572 <td>559</td> <td>74741</td> <td>74749</td> <td>74757</td> <td>74764</td> <td>74772</td> <td>74780</td> <td>74788</td> <td>74796</td> <td>74803</td> <td>74811</td> <td></td> <td></td>	559	74741	74749	74757	74764	74772	74780	74788	74796	74803	74811		
561 74896 74904 74912 74920 74927 74935 74943 74950 74953 74966 562 74974 74981 74989 74997 75005 75012 75020 75028 75035 75043 563 75051 75059 75066 75074 75082 75089 75097 75113 75120 564 75128 75136 75143 75151 75159 75166 75174 75287 75233 75274 565 75205 75213 75220 75228 75236 75325 75335 75343 75351 567 75358 75366 75374 75381 75389 75397 75404 75412 75420 75427 568 75435 75460 75645 75473 75481 75488 75496 75504 75504 75565 75572 75756 75762 75700 75777 75777 75773 75848 75893	560	74819	74827	74834	74842	74850	74858	74865	74873	74881	74889		
562 74974 74981 74989 74997 75005 75012 75020 75028 75035 75043 563 75051 75059 75066 75074 75082 75089 75097 75105 75113 75120 564 75128 75136 75143 75151 75159 75166 75174 75182 75189 75197 565 75205 75213 75220 75228 75243 75251 75259 75666 75274 566 75282 75287 75305 75312 75320 75328 75335 75343 75351 567 75358 75442 75450 75481 75481 75481 7548 7557 75565 75572 75580 7 569 75511 75595 75603 75610 75618 75626 75633 75641 75648 75586 75770 75770 75777 75785 75780 75806 75884 <	561	74896	74904	74912	74920	74927	74935	74943	74950	74958	74966		
563 75051 75059 75066 75074 75082 75089 75097 75105 75113 75120 564 75128 75136 75143 75151 75159 75166 75174 75182 75197 565 75205 75213 75220 75228 75236 75243 75251 75259 75266 75274 566 75282 75289 75305 75312 75320 75328 75335 75343 75351 567 75358 75445 75442 75450 75458 75455 75565 75572 75580 7 569 75511 75519 75526 75534 75542 75543 75641 75648 75572 75580 7 570 75587 75595 75603 75610 75618 75626 75833 75800 75800 75808 2 1 1 573 75740 75747 75755 7562	562	74974	74981	74989	74997	75005	75012	75020	75028	75035	75043		
564 75128 75136 75143 75151 75166 75174 75182 75189 75197 565 75205 75213 75220 75228 75236 75243 75251 75259 75266 75274 566 75282 75289 75297 75305 75312 75320 75328 75335 75343 75351 567 75358 75445 75442 75450 75458 75465 75473 75481 75488 75504 75504 569 75511 75519 75526 75534 75542 75549 75557 75655 75572 75580 7 570 75587 75595 75603 75610 75618 75626 75733 75800 75800 75802 75732 1 1 572 75740 75747 75755 75762 75770 75785 75937 75800 75883 2 1 1 575 75967 75987	563	75051	75059	75066	75074	75082	75089	75097	75105	75113	75120		
565 75205 75213 75220 75228 75236 75243 75251 75259 75266 75274 566 75282 75289 75297 75305 75312 75320 75328 75335 75343 75351 567 75358 75442 75450 75445 75455 75447 75485 75577 75565 75572 75580 7 7 7 7 7572 75785 75793 75800 75888 2 1	564	75128		75143	75151	75159	75166	75174	75182	75189	75197		
obc <i>i</i> 2582 <i>i</i> 0289 <i>i</i> 259 <i>i i</i> 0300 <i>i</i> 0312 <i>i</i> 0320 <t< td=""><td>565</td><td>75205</td><td>75213</td><td>75220</td><td>75228</td><td>75236</td><td>75243</td><td>75251</td><td>75259</td><td>75266</td><td>75274</td><td></td><td></td></t<>	565	75205	75213	75220	75228	75236	75243	75251	75259	75266	75274		
307 7300 7314 7301 73031 7301 7304 7312 73421 73531 73531 73531 73531 73531 73531 73531 73531 73532 75556 75572 75565 75572 755732 1 </td <td>566</td> <td>75282</td> <td>75289</td> <td>75297</td> <td>75305</td> <td>75312</td> <td>75320</td> <td>75328</td> <td>75335</td> <td>75343</td> <td>75351</td> <td></td> <td></td>	566	75282	75289	75297	75305	75312	75320	75328	75335	75343	75351		
569 75511 75512 75542 75542 75542 75543 75542 75543 75545 75572 75565 75572 75566 75572 75566 75572 75566 75572 75566 75572 75566 75572 75566 757572 75566 75572 75566 75732 1		75.125	75119	75150	75459	75.165	10397	75404	75.199	75106	75504		
557 75587 75595 75603 75610 75616 75626 75626 75633 75641 75648 75656 571 75664 75674 75757 75755 75762 75770 75778 75783 75801 75722 75709 75717 75724 75732 1 1 572 75740 75747 75755 75762 75770 75778 75783 75800 75808 2 1 573 75815 75823 75831 75838 75846 75853 75861 75868 75876 75884 3 2 574 75891 75899 75906 75914 75921 75929 75937 75944 75952 75599 4 3 575 75967 75974 75982 75989 75997 76005 76012 76020 76027 76035 5 4 575 76967 76957 760657 76072 76080 </td <td>569</td> <td>75511</td> <td>75510</td> <td>75596</td> <td>75581</td> <td>75549</td> <td>75510</td> <td>75557</td> <td>75565</td> <td>75579</td> <td>75580</td> <td></td> <td>-</td>	569	75511	75510	75596	75581	75549	75510	75557	75565	75579	75580		-
571 75664 75671 75679 75686 75694 75702 75709 75717 75724 75732 1 1 572 75740 75747 75755 75762 75709 75783 75800 75808 2 1 573 75815 75823 75831 75838 75846 75853 75861 75868 75843 2 1 573 75815 75823 75831 75838 75846 75853 75861 75868 75876 75884 3 2 574 75891 75899 75906 75914 75921 75929 75937 75944 75952 75959 4 3 575 75967 75974 75982 75989 75997 76005 76012 76020 76027 76035 5 4 575 75967 75982 75989 75997 76005 76012 76020 76035 5 4	-570	75597	75505	75602	75610	75819	75898	75622	758.11	756.19	75656		
$\begin{array}{c ccccccccccccccccccccccccccccccccccc$	571	75664	75671	75679	75686	75694	75702	75709	75717	75724	75732	1	1
$\begin{array}{c ccccccccccccccccccccccccccccccccccc$	572	75740	75747	75755	75762	75770	75778	75785	75793	75800	75808	1	1
574 75891 75899 75906 75914 75921 75929 75937 75944 75952 75959 4 3 575 75967 75974 75982 75989 75997 76005 76012 76020 76027 76035 5 4 576 76042 76050 76057 76065 76072 76080 76087 76095 76103 76110 6 4 577 76118 76125 76133 76140 76145 76155 76163 76170 76178 76185 7 5 578 76193 76200 76208 76215 76233 76203 76268 6 5 76305 76485 7 5 5 5 6 7 8 6 6 6 6 6 6 6 7 8 9 6 6 7 8 9 6 6 7 8 9 6	573	75815	75823	75831	75838	75846	75853	75861	75868	75876	75884	3	2
$ \begin{array}{c c c c c c c c c c c c c c c c c c c $	574	75891	75899	75906	75914	75921	75929	75937	75944	75952	75959	4	3
576 76042 76050 76057 76065 76072 76080 76087 76095 76103 76110 6 4 577 76118 76125 76133 76140 76148 76155 76163 76170 76178 76185 7 5 578 76193 76200 76208 76215 76230 76238 76245 76253 76260 8 6 579 76268 76275 76283 76290 76298 76305 76313 76320 76328 76320 76328 76325 76325 9 6 No. 0 1 2 3 4 5 6 7 8 9	575	75967	75974	75982	75989	75997	76005	76012	76020	76027	76035	5	4
$ \begin{array}{c ccccccccccccccccccccccccccccccccccc$	576	76042	76050	76057	76065	76072	76080	76087	76095	76103	76110	6	4
$ \begin{array}{c ccccccccccccccccccccccccccccccccccc$	577	76118	76125	76133	76140	76148	76155	76163	76170	76178	76185	7	5
$\begin{array}{c c c c c c c c c c c c c c c c c c c $	578	76193	76200	76208	76215	76223	76230	76238	76245	76253	76260	8	$\frac{6}{c}$
No. 0 1 2 3 4 5 6 7 8 9	919	70268	10210	76283	76290	76298	70309	70313	76320	76328	70335	9	0
	No.	0	1	2	3	4	5	6	7	8	9		

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TABLE 42.

Logarithms of Numbers.

No.	5800640	0.							I	.og. 76343		618.
No.	0	1	2	3	4	5	6	7	8	9		
580	76343	76350	76359	76365	76373	76380	76288	76205	76102	76410		8
581	76418	76125	76558	76333	76118	76455	76169	76390	70405	76410		
582	76499	76500	76507	76515	76522	76530	76537	76545	76559	76550	1	1
583	76567	76574	76582	76589	76597	76604	76612	76619	76626	76634	2	2
584	76641	76649	76656	76664	76671	76678	76686	76693	76701	76708	3	$\overline{2}$
585	76716	76793	76730	76738	76745	76753	76760	78789	78775	76700	4	3
586	76790	76797	76805	76812	76819	76827	76831	768.19	78940	76956	5	4
587	76864	76871	76879	76886	76893	76901	76908	76016	76022	70500	6	5
588	76938	76945	76953	76960	76967	76975	76982	76989	76997	77001	7	6
589	77012	77019	77026	77034	77041	77048	77056	77063	77070	77078	8	6
590	77085	77093	77100	77107	77115	77122	77129	77137	77144	77151	9	7
591	77159	77166	77173	77181	77188	77195	77203	77210	77917	77995		1
592	77232	77240	77247	77254	77262	77269	77276	77283	77291	77298		
593	77305	77313	77320	77327	77335	77342	77349	77357	77364	77371		
594	77379	77386	77393	77401	77408	77415	77422	77430	77437	77444		
595	77452	77459	77466	77474	77481	77488	77495	77503	77510	77517		
596	77525	77532	77539	77546	77554	77561	77568	77576	77583	77590		
597	77597	77605	77612	77619	77627	77634	77641	77648	77656	77663		
598	77670	77677	77685	77692	77699	77706	77714	77721	77728	77735		
599	77743	77750	77757	77764	77772	77779	77786	77793	77801	77808		
600	77815	77822	77830	77837	77844	77851	77859.	77866	77873	77880		
601	77887	77895	77902	77909	77916	77924	77931	77938	77945	77952		
602	77960	77967	77974	77981	77988	77996	78003	78010	78017	78025		
603	78032	78039	78046	78053	78061	78068	78075	78082	78089	78097		
604	78104	78111	78118	78125	78132	78140	78147	78154	78161	78168		-
605	78176	78183	78190	78197	78204	78211	78219	78226	78233	78240		-
606	78247	78254	78262	78269	78276	78283	78290	78297	78305	78312	1	1
607	78319	78326	78333	78340	78347	78355	78362	78369	78376	78383	1	1
608	78390	78398	78405	78412	78419	78426	78433	78440	78447	78455	2	9
609	78462	${-78469}$	78476	-78483	78490	78497	$_{-78504}$	78512	78519	78526	4	3
610	78533	78540	78547	78554	78561	78569	78576	78583	78590	78597	5	4
611	78604	78611	78618	78625	78633	78640	78647	78654	78661	78668	ő	4
612	78675	78682	78689	78696	78704	78711	78718	78725	78732	78739	-7	5
613	78746	78753	78760	78767	78774	78781	78789	78796	78803	78810	8	- 6
614	78817	78824	78831	78838	78845	78852	78859	78866	78873	78880	9	6
615	78888	78895	78902	78909	78916	78923	78930	78937	78944	78951		
616	78958	78965	78972	78979	78986	78993	79000	79007	79014	79021		
617	79029	79036	79043	79050	79057	79064	79071	79078	79085	79092		
610	79099	79100	79113	79120	79127	70201	79141	79148	79155	79162		
- 019		79170	79100	- 79190	79197	79204	79211	19218	79220	19232		
020	79239	79240	79203	79260	79267	79274	79281	79288	79295	79302		
699	79309	79310	70202	79550	79337	79344	79301	79308	79300	79372		
622	70.1.10	79.156	70.163	79400	79407	70181	70421	70100	79400	79442		
624	79518	79525	79539	79539	79516	79553	79560	70567	70571	70581		
695	70599	70505	70602	70600	70616	70699	70690	70007	70011	70001		
626	70657	79661	79602	79009	79010	79023	79030	79037	79044	79000		
627	79727	79731	79711	797.18	79754	79761	70768	70775	70789	70780		
628	79796	79803	79810	79817	79891	79831	79837	798.1.1	79851	70858		
629	79865	79872	79879	79886	79893	79900	79906	79913	79920	79927		0
630	79931	79911	79948	79955	79962	79969	70075	79989	70080	70006		0
631	80003	80010	80017	80021	80030	80037	80014	80051	80058	80065		
632	80072	80079	80085	80092	80099	80106	80113	80120	80127	80134		
633	80140	80147	80154	80161	80168	80175	80182	80188	80195	80202	2	1
634	80209	80216	80223	80229	80236	80243	80250	80257	80264	80271	0	2
635	80277	80284	80291	80298	80305	80312	80318	80325	80332	80339	5	3
636	80346	80353	80359	80366	80373	80380	80387	80393	80400	80407	6	4
637	80414	80421	80428	80434	80441	80448	80455	80462	80468	80475	7	4
638	80482	80489	80496	80502	80509	80516	80523	80530	80536	80543	8	5
639	80550	80557	80564	80570	80577	80584	80591	80598	80604	80611	9	5
No.	0	1	2	3	4	5	6	7	8	9		

TABLE 42.

[Page 601

Logarithms of Numbers.

$ \begin{array}{ c c c c c c c c c c c c c c c c c c c$	No	, 6400	00.							L	og. 80618-		0.
	No.	0	1	2	3	4	5	6	7	8	9		
	N0.	0			00000	*	00050	00050		00070			7
	640 641	80618	80623	80632 80699	80638 80706	80645 80713	80652 80720	80659 80726	80665	80672	80679 80747		
	642	80754	80760	80767	80774	80781	80787	80794	80801	80808	80814	1	1
644 S0885 S0895 S08965 S09967 S09967 S09967 S09967 S09967 S0106 S1010 S1010 S1017 S1064 6445 S0030 S1037 S1043 S1050 S1057 S1064 S1007 S1007 S1077 S1074 S1077 S1074 S1077 S1074 S1077 S1074 S1077 S1074 S1077 S1074 S1174 S1175 S1174 S1175 S1176 S1175 S1176 S1175 S1176 S1175 S1176	-643	80821	80828	80835	80841	80848	80855	80862	80868	80875	80882	2	1
645 80066 80043 800463 80043 80044 81004 81007 81007 8107 4 4 646 81023 81034 81034 81036 81037 81044 81111 81117 81174 81171 81174 81171 81174 81171 81174 81171 81174 81171 81171 81171 81171 81171 81171 81171 81171 81171 81171 81171 81171 81171 81171 81171 81171 81171 81171 81175 81575 81554 81355 81331 81338 81345 81411 81611 81617 81673 81644 81617 81673 81644 81617 81673 81644 81617 81675	644	80889	80895	80902	80909	80916	80922	80929	80936	80943	80949	3 1	2
	-645	· 80956	80963	80969	80976	80983	80990	80996	81003	81010	81017	5	4
$\begin{array}{c c c c c c c c c c c c c c c c c c c $	$640 \\ 647$	81025	81050	81057	81045	81050	81007	81131	81070	81077	81084	- 6	4
649 81224 81231 81238 81245 81251 81255 81275 81275 81255 9 6 650 81395 81495 81495 81491 81495 81414 81551 81558 81508 81604 81611 81617 81776 81776 81776 81776 81776 81776 81776 81776 81776 81776 81776 81776 81776 81776 81783 81202 81809 81809 81804 81804 81804 81804 81804 81804 81804 81804 81804 81804 81804 81804 81804 81804 81804 81804 81804 81804	648	81158	81164	81171	81178	81184	81191	81198	81204	81211	81218	7	5
650 81291 81298 81305 81311 81318 81325 81331 81338 81335 8	649	81224	81231	81238	81245	81251	81258	81265	81271	81278	81285		6
651 81355 813365 813371 81378 81329 81391 81398 81405 81417 81478 81445 652 81425 81438 81455 81455 81455 81455 81455 81531 81555 81554 81554 81555 81554 81554 81555 81554 81554 81556 81644 81577 81576 81574 81574 81574 81575 81575 81576 81577 81544 81944 81944 81944 81945 81976 81946 82057 82060 82060 82067 82077 82077 82077 82079 82046 82046 82046 82046 82045 82114 82114 82114 82114 82114 821	650	81291	81298	81305	81311	81318	81325	81331	81338	81345	81351	, e	0
652 81420 81431 81438 81445 81445 81447 81447 81448 81455 653 81491 81456 81501 81511 81518 81558 81531 81551 654 81558 81564 81571 81578 81559 81538 81544 81551 655 81604 81671 81677 81674 81674 81674 81674 81674 81674 81674 81674 81674 81674 81674 81674 81674 81674 81684 81551 81516 81516 81275 81765 81765 81765 81765 81765 81765 81767 81664 81057 81765 81765 81767 81644 81051 81914 81948 81924 81925 82162	651	81358	81365	81371	81378	81385	81391	81398	81405	81411	81418		
04:5 81490 81490 81490 81490 81490 81490 81490 81491 81491 81491 81491 81491 81491 81491 81491 81491 81491 81491 81491 81491 81491 81491 81501 655 81624 81637 81676 81704 81710 81773 81737 81747 81948 81905 81907 82148 82197 82148 82197 82144 82197 82144 82197 82144 82197 82246 82246 82246 82246 82246 82246 82246 82246 82446 82441 82441 82441 82441 82441<	652	81425	81431	81438	81440	81491	81458	81465	81471	81478	81485		
$ \begin{array}{ c c c c c c c c c c c c c c c c c c c$	654	81558	81564	81571	81578	81584	81591	81598	81604	81611	81617		
	655	81624	81631	81637	81644	81651	81657	81664	81671	81677	81684		
$\begin{array}{c ccccccccccccccccccccccccccccccccccc$	656	81690	81697	81704	81710	81717	81723	81730	81737	81743	81750		
668 81823 81823 81836 81842 81849 81856 81802 81862 669 81954 81965 81905 81915 81915 81921 81928 81935 81944 81944 660 81054 81961 81968 81915 81921 82121 82111 82112 82118 82145 82040 82060 82067 82079 82079 662 82066 82092 82040 82246 82243 82244 82246 82246 82246 82246 82246 82246 82246 82466 82471 82367 82368 82466 82471 82446 82446 82456 82446 82456 82446 82456 82446 82456 82466 82471 82562 82568	-657	81757	81763	81770	81776	81783	81790	81796	81803	81809	81816		
660 81889 81892 81992 81991 81921 81922 81928 81948 81944 660 81954 81964 81964 82060 82007 82014 661 82020 82027 82033 82040 82046 82060 82068 82073 82073 82074 662 82026 82238 82112 82119 82125 82133 82144 82191 82127 822376 82236 82237 82334 82341 665 82242 82256 82248 82449 82367 82373 82380 82387 82338 82341 666 82417 82450 82569 82569 82566 82653 82660 82764 82517 82538 82538 82536 82569 82766 82776 82738 82730 82730 82730 82730 82730 82730 82736 82766 82776 82748 82730 82736 82760 82776 </td <td>658</td> <td>81823</td> <td>81829</td> <td>81836</td> <td>81842</td> <td>81849</td> <td>81856</td> <td>81862</td> <td>81869</td> <td>81875</td> <td>81882</td> <td></td> <td></td>	658	81823	81829	81836	81842	81849	81856	81862	81869	81875	81882		
600 81954 81904 81904 81994 82008 82014 82046 82053 82066 82073 82014 661 82020 82020 82099 82105 82111 82125 82132 82138 82145 663 82151 82158 82144 82171 82238 82336 82341 82341 82344 82249 82264 82214 82328 82335 82333 82440 82440 82440 82440 82440 82440 82440 82441 82341 82341 82344 82441 82441 82441 82441 82441 82441 82441 82441 82441 82441 82441 82441 82441 82441 82441 82441 82441 82451 82511 82517 82538 82660 82667 82673 82675 82718 82748 82446 82477 8273 82736 82750 82756 82769 82769 82769 82966 82769	659	81889	81895	81902	81908	81915	81921	81928	81935	81941	81948		
$\begin{array}{ c c c c c c c c c c c c c c c c c c c$	660 661	81954	81961	81968	81974	81981	81987	81994	82000	82007	82014		
$ \begin{array}{ c c c c c c c c c c c c c c c c c c c$	662	82020	82027	82099	82105	82040	82095	82000	82000	82075	82079		
$\begin{array}{c c c c c c c c c c c c c c c c c c c $	663	82151	82158	82164	82171	82178	82184	82191	82197	82204	82210		
665 82282 82289 82295 82302 82308 82315 82321 82323 82341 82341 666 82347 82354 82360 82367 82373 82380 82387 82393 82400 82406 666 82413 82419 82426 82432 82435 82558 82553 82533 82530 82536 667 82607 82614 82620 82627 82633 82769 82776 8278 82789 82789 82789 82789 82789 82789 82789 82789 82789 82789 82789 82789 82789 82879 82879 82879 82879 82879 82879 82893 82906 82911 82918 82924 675 82930 82937 82943 82940 82940 82940 82949 82949 82949 82945 82947 82982 82988 82969 82911 82918 82924 82985 82969 <t< td=""><td>664</td><td>82217</td><td>82223</td><td>82230</td><td>82236</td><td>82243</td><td>82249</td><td>82256</td><td>82263</td><td>82269</td><td>82276</td><td></td><td></td></t<>	664	82217	82223	82230	82236	82243	82249	82256	82263	82269	82276		
666 82347 82367 82373 82380 82387 82393 82400 82406 667 82413 82419 82466 82432 82439 82453 82453 82453 82453 82454 82566 82562 82569 82575 82582 82585 82565 82666 670 82607 82614 826202 82627 82633 82540 82464 82653 82666 671 82673 82763 82769 82778 82783 82789 82783 82789 82783 82944 82847 82850 82666 674 82866 82814 82821 82827 82838 82904 82947 82938 82960 82911 82918 82924 675 82905 82001 83005 83014 83020 83026 83040 83040 83040 83040 83040 83041 83110 83110 83110 83110 83110 83110 83117 83123 83129	665	82282	82289	82295	82302	82308	82315	82321	82328	82334	82341		
667 82413 82426 82432 82439 82445 82445 82465 82465 668 82478 82448 82491 82491 82507 82562 82562 82562 82562 82563 82659 82659 82666 670 82607 82648 82627 82679 82685 82692 82989 82705 82711 82718 82738 82739 82738 82763 82679 82685 82692 82989 82705 82768 82763 82769 82857 82827 82834 82440 82441 82975 82775 82858 82802 82775 82858 82975 82775 82857 82857 82877 82858 82905 82914 82977 82858 82905 82917 82952 82988 82950 82963 82969 82975 82982 82988 82960 82975 82982 82988 82960 83014 83020 83001 83014 83027 83040 83104 83117 83181 83163 83151 83151 83128 <td>666</td> <td>82347</td> <td>82354</td> <td>82360</td> <td>82367</td> <td>82373</td> <td>82380</td> <td>82387</td> <td>82393</td> <td>82400</td> <td>82406</td> <td></td> <td></td>	666	82347	82354	82360	82367	82373	82380	82387	82393	82400	82406		
$\begin{array}{ c c c c c c c c c c c c c c c c c c c$	-667	82413	82419	82426	82432	82439	82445	82452	82458	82465	82471		
$ \begin{array}{ c c c c c c c c c c c c c c c c c c c$	669	82543	82549	82556	82562	82569	82910 82575	82517 82582	82523	82530	82030		
$ \begin{array}{c c c c c c c c c c c c c c c c c c c $	670	82607	82614	82620	82627	82633	82610	82646	82653	82650	82666		
$\begin{array}{c ccccccccccccccccccccccccccccccccccc$	671	82672	82679	82685	82692	82698	82705	82711	82718	82724	82730		
$\begin{array}{c ccccccccccccccccccccccccccccccccccc$	672	- 82737	82743	82750	82756	82763	82769	82776	82782	82789	82795		
674 82866 82872 82872 82872 82982 82995 82905 82905 82911 82918 82924 675 82930 82937 82943 82950 82956 82966 82975 82982 82988 676 82995 83001 83008 83014 83020 83027 83033 83040 83014 83110 677 83059 83065 83072 83078 83025 83037 83104 83110 83117 678 83123 83129 83126 83200 83206 83213 83257 83232 832328 832296 83302 83308 681 83315 83227 83270 83276 83283 83259 83296 83302 83346 681 83315 83321 83327 83334 83340 83417 83453 83429 83429 682 83378 83321 83377 83351 83537 83556 83664 83576 83626 683 83442 83448 83455 83551 83551 83577 83578 83601 83607 83613 83629 687 83669 83772 83771 83778 83746 83773 83746 83773 688 83759 83765 83771 83778 83797 83633 83699 687 83696 83877 83771 83778 83797 83848	673	82802	82808	82814	82821	82827	82834	82840	82847	82853	82860		
675 S2930 S2937 S2943 S2950 S2956 S2967 S2969 S2982 S2988 676 S2995 S3001 S3008 S3014 S3020 S3027 S3033 S3040 S3046 S3052 677 S3059 S3065 S3072 S3078 S3091 S3097 S3104 S3110 S3111 S3117 S3117 S3118 S3121 S3127 S3266 S3226 S3232 S3232 S3238 S32245 S3328 S32245 S3308 S344 S315 S3318 S3211 S3217 S3234 S3348 S34418 S3453 S3353 S3359 S3308 S3445 S3537 S3556 S3308 S3499 S3474 S3453 S3453 S3499 S3448 S3453 S3453 S3429 S34398 S3444 S34418 S3453 S3556 S3566 S3568 S3661 S3675 S3582 S3588 S3544 S3670 S3675 S3683 S3689 S3663 S3669 S3753 S3683 S3698 S3663 S3663 S3663 S3664<	674	82866	82872	82879	82885	82892	82898	82905	82911	82918	82924		
677 83059 83065 83072 83073 83040 83040 83045 83053 677 83059 83065 83072 83075 83104 83110 83117 678 83123 83129 83136 83142 83149 83155 83161 83168 83174 83181 679 83187 83193 83200 83206 83213 83225 83232 83238 83245 680 83251 83357 83327 83334 83340 83347 83353 83329 83365 83372 681 83315 83327 83334 83340 83417 83429 83436 83472 683 83442 83445 83467 83441 83417 83429 83436 683 83569 83575 83582 83588 83594 83607 83613 83620 83626 684 83509 83702 83715 83721 83727 8374 83740 83746 83753 687 83696 83702	675	82930	82937	82943	82950	82956	82963	82969	82975	82982	82988		
6788312383129831368314283143831438315183151831618316483174831816798318783193832008320683213832198322583232833238332468083251832578326483270832768328383289832968330283306681833158332183327833348334083347833538335983366833726828337883321833278333483340834748345383423834298346668383442834488345583461834678347483480834878342383499684835068351283518835258353183577835448350083663836606858366983575835828358883594836018360783613836208362668683622836398364583751837218372183773837468374083746837536878366983759837658377183778837448379083797838038380983816689838228389183897839048391083916839238392983935839238394269083885838918389783904839108397883923839238392383942691841058	677	83059	83065	83072	83078	83085	83091	83097	83104	83110	83117		
6798318783193832008320683213832198322583232832388324568083251832578326483270832768328383289832968330283308681833158332183327833348334083447835538335983366833726828337883385833918339883404834108341783423834298343668383442834458346783474835508355683563684835068351283518835258353183537836448360083677836338362068583669835758358283588835948360183607836138362083626686836328363983645836518365883664836708367783683836896878369683702837788371583778837278373483740837468375368883759836558387183778837788377883797838038389783899690838858389183897839048391083916839238399283998840041116928401184017840238409284098841058411184113032694841368414284055840618406721	678	83123	83129	83136	83142	83149	83155	83161	83168	83174	83181		
$\begin{array}{ c c c c c c c c c c c c c c c c c c c$	679	83187	83193	83200	83206	83213	83219	83225*	83232	83238	83245		
$\begin{array}{ c c c c c c c c c c c c c c c c c c c$	680	83251	83257	83264	83270	83276	83283	83289	83296	83302	83308		
$\begin{array}{ c c c c c c c c c c c c c c c c c c c$	681	83315	83321	83327	83334	83340	83347	83353	83359	83366	83372		
$ \begin{array}{c c c c c c c c c c c c c c c c c c c $	682	83378	83380	83391	83398	83404	83410	83417	83423	83429	83436		
$ \begin{array}{c c c c c c c c c c c c c c c c c c c $	684	83506	83512	83518	83525	83531	83537	83544	83550	83556	83563		
$\begin{array}{c c c c c c c c c c c c c c c c c c c $	685	83569	83575	83582	83588	83594	83601	83607	83613	83620	83626		
$\begin{array}{c c c c c c c c c c c c c c c c c c c $	686	83632	83639	83645	83651	83658	83664	83670	83677	83683	83689		
$\begin{array}{c c c c c c c c c c c c c c c c c c c $	687	83696	83702	83708	83715	83721	83727	83734	83740	83746	83753		
689 83822 53828 83833 83847 83887 83847 83887 83800 83800 83812 83879 6 690 83885 83991 83904 83904 83910 83916 83923 83929 83935 83942 - - 691 83948 83954 83906 83967 83973 83979 83985 83992 83998 84004 1 1 692 84011 84017 84023 84029 84036 84042 84048 84055 84101 84177 84123 84130 3 2 694 84136 84142 84148 84155 84161 84167 84173 84180 84186 84192 4 2 695 84198 84205 84211 84217 84223 84230 84236 84242 84248 84255 5 3 696 84261 84267 84273 84286 84292	688	83759	83765	83771	83778	83784	83790	83797	83803	83809	83816		
$\begin{array}{c ccccccccccccccccccccccccccccccccccc$	-089	09005	83828	00007	83841	83847	83893	83860	83866	83872	83879		6
$ \begin{array}{c ccccccccccccccccccccccccccccccccccc$	691	83918	83951	83960	83904 83967	83910	83910	83923	83929	83930	83942		
$ \begin{array}{c ccccccccccccccccccccccccccccccccccc$	-692	84011	84017	84023	84029	84036	84042	84048	84055	84061	84067	1	1
$\begin{array}{c c c c c c c c c c c c c c c c c c c $	693	84073	84080	84086	84092	84098	84105	84111	84117	84123	84130	- 2	- 2
$\begin{array}{c ccccccccccccccccccccccccccccccccccc$	694	84136	84142	84148	84155	84161	84167	84173	84180	84186	84192	4	$\tilde{2}$
$\begin{array}{c ccccccccccccccccccccccccccccccccccc$	695	84198	84205	84211	84217	84223	84230	84236	84242	84248	84255	5	3
$ \begin{array}{c ccccccccccccccccccccccccccccccccccc$	696	84261	84267	84273	84280	84286	84292	84298	84305	84311	84317	6	4
$\begin{array}{c ccccccccccccccccccccccccccccccccccc$	698	84386	84392	84398	84101	84410	04304 84417	84.192	844907 84490	81125	81119	8	- + 5
No. 0 1 2 3 4 5 6 7 8 9	699	84448	84454	84460	84466	84473	84479	84485	84491	84497	84504	9	$\frac{5}{5}$
	No.	0	1	2	3	4	5	6	7	s	9		

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TABLE 42.

Logarithms of Numbers.

No.	7000-760	0.				-			Lo	g. 84510	-88081	
No.	0	1	2	3	4	5	6	7	s	9		
	0.4710	04510	0 1500	01500	0 1595	0 15 11	91517	0 1559	91550	9 1566	1	7
$\frac{700}{701}$	84010	84010	84522	84528	84597	84603	84609	84615	84621	84628		
$-701 \\ 702$	84634	84640	84646	84652	84658	84665	84671	84677	84683	84689	1	1
703	84696	84702	84708	84714	84720	84726	84733	84739	84745	84751	$\frac{2}{2}$	1
704	84757	84763	84770	84776	84782	84788	84794	84800	84807	84813	3	2
705	84819	84825	84831	84837	84844	84850	84856	84862	84868	84874	5	4
706	84880	84887	84893	84899	84905	84911	84917	84924	84930	84936	6	4
707	· 84942	84948	84994	84960	84907	84973	84979	84980	84991 85059	84997	7	5
$\frac{708}{709}$	85065	85071	85077	85083	85089	85095	85101	85107	85114	85120	8	6
710	85126	85132	85138	85144	85150	85156	85163	85169	85175	85181	9	6
711	85187	85193	85199	85205	85211	85217	85224	85230	85236	85242		
712	85248	85254	85260	85266	85272	85278	85285	85291	85297	85303		
713	85309	85315	85321	85327	85333	85339	85345	85352	85358	85364		
714	85370	85376	85382	80388	80394	85400	85400	80412	85418	80420		
$715 \\ 716$	85101	85407	85502	85500	85516	85599	85528	85521	85540	85546		
$710 \\ 717$	85552	85558	85564	85570	85576	85582	85588	85594	85600	85606		
718	85612	85618	85625	85631	85637	85643	85649	85655	85661	85667		
719	85673	85679	85685	85691	85697	85703	85709	85715	85721	85727		
720	85733	85739	85745	85751	85757	85763	85769	85775	85781	85788		
721	85794	85800	85806	85812	85818	85824	85830	85836	85842	85848		
722	85854	85860	85866	85872	83878	85884	85050	85056	85902	80908		
723	85914	85920	85986	85992	85998	86001	86010	86016	86022	86028	1	
725	86034	86040	86046	86052	86058	86064	86070	86076	86082	86088		6
726	86094	86100	86106	86112	86118	86124	86130	86136	86141	86147	1	1
727	86153	86159	86165	86171	86177	86183	86189	86195	86201	86207	$\frac{1}{9}$	1
728	86213	86219	86225	86231	86237	86243	86249	86255	86261	86267	3	$\frac{1}{2}$
729	86273	86279	86285	86291	86297	86303	86308	86314	86320	86326	4	$\overline{2}$
730	86332	86338	86344	86350	86356	86362	86368	86374	86380	86386	5	3
• 131 799	86392	80398	86463	86.160	86475	86421	80427 86187	86103	86199	86501	6	4
733	86510	86516	86522	86528	86534	86540	86546	86552	86558	86564	ŝ	5
734	86570	86576	86581	86587	86593	86599	86605	86611	86617	86623	9	5
735	86629	86635	86641	86646	86652	86658	86664	86670	86676	86682		
736	86688	86694	86700	86705	86711	86717	86723	86729	86735	86741		
737	86747	86753	86759	86764	86770	86776	86782	86788	86794	86800		
738	86806	86812	86817	86823	86888	80839 86894	86900	86906	86911	86917		
7.10	86092	86020	86935	869.11	86917	86953	86958	86961	86970	86976		
741	86982	86988	86994	86999	87005	87011	87017	87023	87029	87035		
742	87040	87046	87052	87058	87064	87070	87075	87081	87087	87093		
743	87099	87105	87111	87116	87122	87128	87134	87140	87146	87151		
744	87157	87163	87169	87175	87181	87186	87192	87198	87204	87210		
745	87216	87221	87227	87233	87239	87245	87251	87256	87262	87268		
746	87274	87280	87241	87291	87255	87361	87367	87373	87379	87381		
748	87390	87396	87402	87408	87413	87419	87425	87431	87437	87442		
749	87448	87454	87460	87466	87471	87477	87483	87489	87495	87500		5
750	87506	87512	87518	87523	87529	87535	87541	87547	87552	87558		
751	87564	87570	87576	87581	87587	87593	87599	87604	87610	87616	1	1
752	87622	87628	87633	87639	87645	87651	87656	87662	87668	87674	$\frac{2}{2}$	1
751	87679	87685	87691	87697	87760	87708	87779	87777	87783	87789	3	2
704	07101	01140	01149	07010	07700	87209	87200	87925	878.11	87846	5	2
756	87859	87858	87861	87869	87875	87881	87887	87892	87898	87904	6	3
757	87910	87915	87921	87927	87933	87938	87944	87950	87955	87961	7	4
758	87967	87973	87978	87984	87990	87996	88001	88007	88013	88018	8	4
759	88024	88030	88036	88041	88047	88053	88058	88064	88070	88076	9	5
No.	0	1	2	3	+	. 5	6	7	8	9		1

	TABLE 42. [Page 603										
				Log	arithms	of Numb	ers.				
No.	7600-820	0.							I.	og. 88081-	
No.	0	1	2	3	4	õ	6	7	8	9	
$760 \\ 761 \\ 762 $	88081 88138 88195 88252	88087 88144 88201 88258	88093 88150 88207 88264	88098 88156 88213 88270	88104 88161 88218 88275	88110 88167 88224 88281	88116 88173 88230 88287	88121 88178 88235 88292	88127 88184 88241 88298	88133 88190 88247 88304	$\begin{array}{c} 6 \\ 1 & 1 \\ 2 & 1 \end{array}$
$\frac{763}{764}$	88309	88315	88321	88326	88332	88338	88343	88349	88355	88360	$\frac{3}{4}$ $\frac{2}{2}$
$765 \\ 766 \\ 767 \\ 768 \\ 769 \\ 769$	$88366 \\ 88423 \\ 88480 \\ 88536 \\ 88593$	$88372 \\ 88429 \\ 88485 \\ 88542 \\ 88598$	$\begin{array}{r} 88377\\ 88434\\ 88491\\ 88547\\ 88604\end{array}$	$88383 \\ 88440 \\ 88497 \\ 88553 \\ 88610$	88389 88446 88502 88559 88615	$\begin{array}{r} 88395 \\ 88451 \\ 88508 \\ 88564 \\ 88621 \end{array}$	$\begin{array}{r} 88400 \\ 88457 \\ 88513 \\ 88570 \\ 88627 \end{array}$	88406 88463 88519 88576 88632	88412 88468 88525 88581 88638	88417 88474 88530 88587 88643	
770 771 772 773 774	88649 88705 88762 88818 88874	$\frac{88655}{88711}\\ 88767\\ 88824\\ 88880$	88660 88717 88773 88829 88885	88666 88722 88779 88835 88835	88672 88728 88784 88840 88897	$\begin{array}{r} 88677\\ 88734\\ 88790\\ 88846\\ 88902 \end{array}$	88683 88739 88795 88852 88908	88689 88745 88801 88857 88913	88694 88750 88807 88863 88919	88700 88756 88812 88868 88925	9 0
775 776 777 778 778 779	88930 88986 89042 89098 89154	88936 88992 89048 89104 89159	88941 88997 89053 89109 89165	88947 89003 89059 89115 89170	88953 89009 89064 89120 89176	88958 89014 89070 89126 89182	88964 89020 89076 89131 89187	88969 89025 89081 89137 89193	88975 89031 89087 89143 89198	88981 89037 89092 89148 89204	
780 781 782 783 784	89209 89265 89321 89376 89432	89215 89271 89326 89382 89437	89221 89276 89332 89387 89443	89226 89282 89337 89393 89448	89232 89287 89343 89398 89398 89454	89237 89293 89348 89404 89459	89243 89298 89354 89409 89465	89248 89304 89360 89415 89470	89254 89310 89365 89421 89476	89260 89315 89371 89426 89481	
785 786 787 788 788 789	89487 89542 89597 89653 89708	89492 89548 89603 89658 89713	89498 89553 89609 89664 89719	$\begin{array}{r} 89504 \\ 89559 \\ 89614 \\ 89669 \\ 89724 \end{array}$	$\begin{array}{r} 89509 \\ 89564 \\ 89620 \\ 89675 \\ 89730 \end{array}$	$\begin{array}{r} 89515 \\ 89570 \\ 89625 \\ 89680 \\ 89735 \end{array}$	$\begin{array}{r} 89520 \\ 89575 \\ 89631 \\ 89686 \\ 89741 \end{array}$	89526 89581 89636 89691 89746	89531 89586 89642 89697 89752	89537 89592 89647 89702 89757	
790 791 792 793 794	89763 89818 89873 89927 89982	89768 89823 89878 89933 89988	89774 89829 89883 89938 89938	89779 89834 89889 89944 89998	89785 89840 89894 89949 90004	89790 89845 89900 89955 90009	89796 89851 89905 89960 90015	89801 89856 89911 89966 90020	89807 89862 89916 89971 90026	89812 89867 89922 89977 90031	
795 796 797 798 799	$\begin{array}{r} 90037\\90091\\90146\\90200\\90255\end{array}$	90042 90097 90151 90206 90260	90048 90102 90157 90211 90266	90053 90108 90162 90217 90271	90059 90113 90168 90222 90276	90064 90119 90173 90227 90282	90069 90124 90179 90233 90287	90075 90129 90184 90238 90293	90080 90135 90189 90244 90298	$\begin{array}{r} 90086\\90140\\90195\\90249\\90304\end{array}$	
800 801 802 803 804	90309 90363 90417 90472 90526	90314 90369 90423 90477 90531	90320 90374 90428 90482 90536	$\begin{array}{r} 90325\\90380\\90434\\90488\\90542\end{array}$	90331 90385 90439 90493 90547	90336 90390 90445 90499 90553	90342 90396 90450 90504 90558	90347 90401 90455 90509 90563	90352 90407 90461 90515 90569	$\begin{array}{c} 90358\\ 90412\\ 90466\\ 90520\\ 90574 \end{array}$	
805 806 807 808 809	$\begin{array}{r} 90580\\ 90634\\ 90687\\ 90741\\ 90795 \end{array}$	$\begin{array}{r} 90585\\ 90639\\ 90693\\ 90747\\ 90800\\ \end{array}$	90590 90644 90698 90752 90806	90596 90650 90703 90757 90811	90601 90655 90709 90763 90816	$\begin{array}{r} 90607\\ 90660\\ 90714\\ 90768\\ 90822 \end{array}$	90612 90666 90720 90773 90827	90617 90671 90725 90779 90832	90623 90677 90730 90784 90838	90628 90682 90736 90789 90843	5
810 811 812 813 814	$\begin{array}{r} 90849 \\ 90902 \\ 90956 \\ 91009 \\ 91062 \end{array}$	$\begin{array}{r} 90854\\ 90907\\ 90961\\ 91014\\ 91068\end{array}$	90859 90913 90966 91020 91073	$\begin{array}{c} 90865\\ 90918\\ 90972\\ 91025\\ 91078\end{array}$	$\begin{array}{r} 90870 \\ 90924 \\ 90977 \\ 91030 \\ 91084 \end{array}$	$\begin{array}{c} 90875\\ 90929\\ 90982\\ 91036\\ 91089\end{array}$	90881 90934 90988 91041 91094	$\begin{array}{c} 90886\\ 90940\\ 90993\\ 91046\\ 91100 \end{array}$	$\begin{array}{c} 90891 \\ 90945 \\ 90998 \\ 91052 \\ 91105 \end{array}$	90897 90950 91004 91057 91110	$ \begin{array}{cccccccccccccccccccccccccccccccccccc$
$815 \\ 816 \\ 817 \\ 818 \\ 819$	$91\overline{116} \\91169 \\91222 \\91275 \\91328$	$\begin{array}{c} 91121 \\ 91174 \\ 91228 \\ 91281 \\ 91334 \end{array}$	$\begin{array}{c} 91126\\ 91180\\ 91233\\ 91286\\ 91339 \end{array}$	$\begin{array}{c} 91132 \\ 91185 \\ 91238 \\ 91291 \\ 91344 \end{array}$	$\begin{array}{c} 91137 \\ 91190 \\ 91243 \\ 91297 \\ 91350 \end{array}$	$\begin{array}{c} 91142 \\ 91196 \\ 91249 \\ 91302 \\ 91355 \end{array}$	$\begin{array}{c} 91148\\ 91201\\ 91254\\ 91307\\ 91360 \end{array}$	91153 91206 91259 91312 91365	91158 91212 91265 91318 91371	91164 91217 91270 91323 91376	$egin{array}{cccc} 5 & 3 \ 6 & 3 \ 7 & 4 \ 8 & 4 \ 9 & 5 \ \end{array}$
No.	0	1	2	3	4	5	6	7		9	

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TABLE 42.

Logarithms of Numbers.

No.	8200-8800).	_		······				1	.og. 91381-	94	448
No.	0	1	2	3	4	õ	6	7	8	9		
0.20	01001	01005	01000	01007	01400	01 100	01.110	01.110	01.101	01.100	1	6
820 821	91381	91387	91392	91397	91403	91408	91413 91466	$91418 \\ 91471$	91424	91429 91489		
822	91494	91499	91498	91503	91508	91514	91519	91594	91529	91535	1	1
823	91540	91545	91551	91556	91561	91566	91572	91577	91582	91587	2	1
824	91593	91598	91603	91609	91614	91619	91624	91630	91635	91640	3	2
825	91645	91651	91656	91661	91666	91672	91677	91682	91687	91693	-1	2
826	91698	91703	91709	91714	91719	91724	91730	91735	91740	91745	0	3
827	91751	91756	91761	91766	91772	91777	91782	91787	91793	91798	0	+
828	91803	91808	91814	91819	91824	91829	91834	91840	91845	91850	8	5
829	91855	91861	91866	91871	91876	91882	91887	91892	91897	91903	9	5
830	91908	91913	91918	91924	91929	91934	91939	91944	91950	91955	, in the second se	
831	91960	91965	91971	91976	91981	91986	91991	91997	92002	92007		
832	92012	92018	92023	92028	92033	92038	92044	92049	9200 4 09108	92099		
834	92000	92122	92127	92132	92137	92143	92148	92153	92158	92163		
835	92169	92122	92179	92184	92189	92195	92200	92205	92210	92215		
836	92221	92226	92231	92236	92241	92247	92252	92257	92262	92267		
837	92273	92278	92283	92288	92293	92298	92304	92309	92314	92319		
838	92324	92330	92335	92340	92345	92350	92355	92361	92366	92371		
839	92376	92381	92387	92392	92397	92402	92407	92412	92418	92423		
840	92428	92433	92438	92443	92449	92454	92459	92464	92469	92474		
841	92480	92485	92490	92495	92500	92505	92511	92516	92521	92526		
842	92531	92536	92542	92547	92552	92557	92562	92567	92572	92578		
843	92583	92588	92593	92598	92603	92609	92614	92619	92624	92629		
011	92034	92059	92040	92000	92000	92000	92000	92070	92075	92081		ð
840	92080 02727	92691	92090	92701	92700	92711	92710	92722	92727	92732		
847	92788	92793	92799	92102	92108	92703	92108	92824	92110	92100	1	1
848	92840	92845	92850	92855	92860	92865	92870	92875	92881	92886	2	1
849	92891	92896	92901	92906	92911	92916	92921	92927	92932	92937	3	2
850	92942	92947	92952	92957	92962	92967	92973	92978	92983	92988	5	3
851	92993	92998	93003	93008	93013	93018	93024	93029	93034	93039	6	3
852	93044	93049	93054	93059	93064	93069	93075	93080	93085	93090	7	4
853	93095	93100	93105	93110	93115	93120	93125	93131	93136	93141	8	4
804	93146	93151	93156	93161	93166	93171	93176	93181	93186	93192	9	5
800	93197	93202	93207	93212	93217	93222	93227	93232	93237	93242		
857	93247	95202	95208	95205	95208	95475 93293	95416	95265	99769	95495		
858	93349	93354	93359	93364	93369	93374	93379	93384	93389	93394		
859	93399	93404	93409	93414	93420	93425	93430	93435	93440	93445		
860	93450	93455	93460	93465	93470	93475	93480	93485	93490	93495		
861	93500	93505	93510	93515	93520	93526	93531	93536	93541	93546		
862	93551	93556	93561	93566	93571	93576	93581	93586	93591	93596		
863	93601	93606	93611	93616	93621	93626	93631	93636	93641	93646		
804	93601	93656	93661	93666	93671	93676	93682	93687	93692	93697		
860	93702	93707	93712	93717	93722	93727	93732	93131	93742	93/4/		
800 867	93792	93707	93762	93707 02917	93772	93777	93782	93181	93792	93797		
868	93852	93857	93862	93867	93872	93877	93882	93887	93892	93897		
869	93902	93907	93912	93917	93922	93927	93932	93937	93942	93947		4
870	93952	93957	93962	93967	93972	93977	93982	93987	93992	93997		
871	94002	94007	94012	94017	94022	94027	94032	94037	94042	94047	1	0
872	94052	94057	94062	94067	94072	94077	94082	94086	94091	94096	2	1
873	94101	94106	94111	94116	94121	94126	94131	94136	94141	94146	3	1
874	94151	94156	94161	94166	94171	94176	94181	94186	94191	94196	+	$\frac{2}{2}$
875	94201	94206	94211	94216	94221	94226	94231	94236	94240	94245	5	2
876	94260	94200	94260	94265	94270	94275	94280	94285	94290	94290	07	2
878	94300	94000	94310	94310 94264	94320	94520	94330	94381	91380	94394	8	3
879	94399	94404	94409	94414	94419	94424	94429	94433	94438	94443	9	4
		0.101	0.100									
No.	0	1	2	3	+	5	6	7	' S	9		

					TABL	E 42.				[Pa	ige 6	05
				Log	arithms o	of Numb	ers.					
No.	8800940	0,							I	og. 94448-	973	13.
No.	0	1	2	3	4	õ	6	7	8	9		
880 881 882 883 884	$94448 \\94498 \\94547 \\94596 \\94645$	$\begin{array}{r} 94453\\ 94503\\ 94552\\ 94601\\ 94650\end{array}$	$\begin{array}{r} 94458 \\ 94507 \\ 94557 \\ 94606 \\ 94655 \end{array}$	$\begin{array}{r} 94463\\ 94512\\ 94562\\ 94611\\ 94660\end{array}$	$\begin{array}{r} 94468\\ 94517\\ 94567\\ 94616\\ 94665\end{array}$	$94473 \\94522 \\94571 \\94621 \\94670$	$\begin{array}{r} 94478\\ 94527\\ 94576\\ 94626\\ 94675\end{array}$	$94483 \\94532 \\94581 \\94630 \\94680$	$\begin{array}{c} 94488\\ 94537\\ 94586\\ 94635\\ 94635\\ 94685\end{array}$	$\begin{array}{c} 94493\\ 94542\\ 94591\\ 94640\\ 94689\end{array}$	$\frac{1}{2}$	5 1 1 2 2
885 886 887 888 889 890 891 892 893 894	$\begin{array}{r} 94694\\ 94743\\ 94792\\ 94841\\ 94890\\ \hline \\ 94939\\ 94938\\ 95036\\ 95085\\ 95134\\ \end{array}$	94699 94748 94797 94846 94895 94944 94993 95041 95090 95139	$\begin{array}{r} 94704\\ 94753\\ 94802\\ 94851\\ 94900\\ \hline \\ 94949\\ 94949\\ 94998\\ 95046\\ 95095\\ 95143\\ \end{array}$	$\begin{array}{r} 94709\\ 94758\\ 94807\\ 94856\\ 94905\\ \hline \\ 94905\\ \hline \\ 94954\\ 95002\\ 95051\\ 95100\\ 95148\\ \end{array}$	$\begin{array}{r} 94714\\ 94763\\ 94812\\ 94861\\ 94910\\ \hline \\ 94959\\ 95007\\ 95056\\ 95105\\ 95153\\ \end{array}$	94719 94768 94817 94866 94915 94963 95012 95061 95109 95158	94724 94773 94822 94871 94919 94968 95017 95066 95114 95163	$\begin{array}{r} 94729\\ 94778\\ 94827\\ 94826\\ 94924\\ \hline 94924\\ \hline 94973\\ 95022\\ 95071\\ 95119\\ 95168\\ \end{array}$	$\begin{array}{r} 94734\\ 94783\\ 94832\\ 94832\\ 94880\\ 94929\\ \hline \\ 94978\\ 95027\\ 95075\\ 95124\\ 95173\\ \end{array}$	$\begin{array}{c} 94738\\ 94787\\ 94836\\ 94885\\ 94934\\ 94983\\ 95032\\ 95080\\ 95129\\ 95177\\ \end{array}$	+ 5 6 7 8 9	
895 896 897 898 899 900 900	$\begin{array}{r} 95182 \\ 95231 \\ 95279 \\ 95328 \\ 95376 \\ \hline 95424 \\ 95472 \\ \end{array}$	95187 95236 95284 95332 95381 95429 95477	$\begin{array}{r} 95192 \\ 95240 \\ 95289 \\ 95337 \\ 95386 \\ \hline 95434 \\ 95482 \\ \end{array}$	$\begin{array}{r} 95197\\ 95245\\ 95294\\ 95342\\ 95390\\ \hline 95439\\ 95487\\ \end{array}$	$\begin{array}{r} 95202\\ 95250\\ 95299\\ 95347\\ 95395\\ \hline 95444\\ 95492\\ \end{array}$	$\begin{array}{r} 95207\\ 95255\\ 95303\\ 95352\\ 95400\\ \hline 95448\\ 95497\\ \end{array}$	$\begin{array}{r} 95211\\ 95260\\ 95308\\ 95357\\ 95405\\ 95453\\ 95501 \end{array}$	$\begin{array}{r} 95216\\ 95265\\ 95313\\ 95361\\ 95410\\ \hline 95458\\ 95506\\ \end{array}$	$\begin{array}{r} 95221\\ 95270\\ 95318\\ 95366\\ 95415\\ 95463\\ 95511\\ \end{array}$	$\begin{array}{r} 95226\\ 95274\\ 95323\\ 95371\\ 95419\\ 95468\\ 95516\end{array}$		
902 903 904 905 906 907 908 909	$\begin{array}{r} 95521 \\ 95569 \\ 95617 \\ \hline 95665 \\ 95713 \\ 95761 \\ 95809 \\ 95856 \\ \end{array}$	$\begin{array}{r} 95525\\ 95574\\ 95622\\ \hline 95670\\ 95718\\ 95766\\ 95813\\ 95861\\ \hline \end{array}$	$\begin{array}{r} 95530\\ 95578\\ 95626\\ \hline 95674\\ 95722\\ 95770\\ 95818\\ 95866\\ \hline \end{array}$	$\begin{array}{r} 95535\\ 95583\\ 95631\\ \hline 95679\\ 95727\\ 95775\\ 95775\\ 95823\\ 95871\\ \end{array}$	$\begin{array}{r} 95540\\ 95588\\ 95636\\ \hline 95684\\ 95732\\ 95780\\ 95828\\ 95828\\ 95875\\ \end{array}$	$\begin{array}{r} 95545\\ 95593\\ 95641\\ \hline 95689\\ 95737\\ 95785\\ 95785\\ 95832\\ 95880\end{array}$	$\begin{array}{r} 95550\\ 95598\\ 95646\\ \hline 95694\\ 95742\\ 95789\\ 95837\\ 95837\\ 95885\\ \end{array}$	$\begin{array}{r} 95554\\ 95602\\ 95650\\ 95658\\ 95746\\ 95794\\ 95842\\ 95890\\ \end{array}$	$\begin{array}{r} 95559\\ 95607\\ 95655\\ \hline 95703\\ 95751\\ 95799\\ 95847\\ 95895\\ \end{array}$	$\begin{array}{r} 95564\\ 95612\\ 95660\\ 95708\\ 95756\\ 95804\\ 95852\\ 95890\end{array}$		
$ \begin{array}{r} 910 \\ 911 \\ 912 \\ 913 \\ 914 \\ 915 \end{array} $	$\begin{array}{r} 35350\\ \hline 95904\\ 95952\\ 95999\\ 96047\\ \hline 96095\\ \hline 96142 \end{array}$	$\begin{array}{r} 95891 \\ \hline 95909 \\ 95957 \\ 96004 \\ 96052 \\ 96099 \\ \hline 96147 \end{array}$	$\begin{array}{r} -35000 \\ \hline 95914 \\ 95961 \\ 96009 \\ 96057 \\ 96104 \\ \hline 96152 \end{array}$	$\begin{array}{r} -35811\\ \hline 95918\\ 95966\\ 96014\\ 96061\\ 96109\\ \hline 96156\end{array}$	$\begin{array}{r} 36819\\ \hline 95923\\ 95971\\ 96019\\ 96066\\ 96114\\ \hline 96161\end{array}$	$\begin{array}{r} -95928\\ -95928\\ 95976\\ 96023\\ 96071\\ -96118\\ \hline -96166\end{array}$	$\begin{array}{r} 36000 \\ \hline 95933 \\ 95980 \\ 96028 \\ 96028 \\ 96076 \\ 96123 \\ \hline 96171 \end{array}$	$\begin{array}{r} 95030\\ \hline 95938\\ 95985\\ 96033\\ 96080\\ 96128\\ \hline 96175\\ \end{array}$	95942 95990 96038 96085 96133 96180	$\begin{array}{r} 95033\\ 95947\\ 95995\\ 96042\\ 96090\\ 96137\\ \hline 96185 \end{array}$	×	
$916 \\ 917 \\ 918 \\ 919 \\ 920 \\ 921 \\ 921$	$\begin{array}{r} 96190\\ 96237\\ 96284\\ 96332\\ \hline 96379\\ 96426\\ \end{array}$	96194 96242 96289 96336 96384 96431	$\begin{array}{r} 96199\\ 96246\\ 96294\\ 96341\\ \hline 96388\\ 96435\\ \end{array}$	$\begin{array}{r} 96204\\ 96251\\ 96298\\ 96346\\ \hline 96393\\ 96440\\ \end{array}$	$\begin{array}{r} 96209 \\ 96256 \\ 96303 \\ 96350 \\ \hline 96398 \\ 96445 \\ \end{array}$	$96213 \\96261 \\96308 \\96355 \\96402 \\96450$	$\begin{array}{r} 96218\\ 96265\\ 96313\\ 96360\\ \hline 96407\\ 96454 \end{array}$	$\begin{array}{r} 96223\\ 96270\\ 96317\\ 96365\\ \hline 96412\\ 96459\end{array}$	$\begin{array}{r} 96227\\ 96275\\ 96322\\ 96369\\ \hline 96417\\ 96464 \end{array}$	$\begin{array}{r} 96232 \\ 96280 \\ 96327 \\ 96374 \\ \hline 96421 \\ 96468 \end{array}$		
922 923 924 925 926 926	$\begin{array}{r} 96473\\ 96520\\ 96567\\ \hline 96614\\ 96661\\ 96661\\ \hline \end{array}$	$\begin{array}{r} 96478\\ 96525\\ 96572\\ \hline 96619\\ 96666\\ 96666\\ 96666\\ 96666\\ \hline \end{array}$	$\begin{array}{r} 96483\\ 96530\\ 96577\\ \hline 96624\\ 96670\\ 96670\\ \hline \end{array}$	96487 96534 96581 96628 96675	96492 96539 96586 96633 96633	$\begin{array}{r} 96497 \\ 96544 \\ 96591 \\ \hline 96638 \\ 96685 \\ 96685 \\ \hline \end{array}$	96501 96548 96595 96642 96689	96506 96553 96600 96647 96694	$\begin{array}{r} 96511\\ 96558\\ 96605\\ \hline 96652\\ 96699\\ \hline \\ 96699\\ \hline \end{array}$	96515 96562 96609 96656 96703		
$927 \\928 \\929 \\930 \\931 \\932$	$96708 \\96755 \\96802 \\96848 \\96895 \\$	96713 96759 96806 96853 96900	$\begin{array}{r} 96717\\ 96764\\ \underline{96811}\\ \hline 96858\\ 96904\\ \underline{96904}\\ \hline 96904 \end{array}$	96722 96769 96816 96862 96909	$\begin{array}{r} 96727\\ 96774\\ 96820\\ \hline 96867\\ 96914\\ 96914\\ \hline 96922\\ \end{array}$	96731 96778 96825 96872 96918	96736 96783 96830 96876 96923	$96741 \\96788 \\96834 \\96881 \\96928 \\96928 \\96925 \\$	96745 96792 96839 96886 96932	$ \begin{array}{r} 96790 \\ 96797 \\ 96844 \\ 96890 \\ 96937 \\ 96937 \end{array} $	1	4
932 933 934 935 936 937 938	$\begin{array}{r} 96942 \\ 96988 \\ 97035 \\ 97081 \\ 97128 \\ 97174 \\ 97220 \\ 9720 \\ 970 \\ 97$	96946 96993 97039 97086 97132 97179 97225	96951 96997 97044 97090 97137 97183 97230	96956 97002 97049 97095 97142 97188 97188 97234	96960 97007 97053 97100 97146 97192 97239	$\begin{array}{r} 96965\\97011\\97058\\\hline 97104\\97151\\97197\\97243\\97243\\97233\\\hline 97233\\97233\\\hline 97233\\\hline 97232\\\hline 97232$ \hline 97232\hline 97232\hline 97232\hline 97232\hline 97232	96970 97016 97063 97109 97155 97202 97248	$\begin{array}{r} 96974\\ 97021\\ 97067\\ \hline 97114\\ 97160\\ 97206\\ 97253\\ 97253\\ \hline 97253\\ 97253\\ \hline 97253$ \hline 97253	$\begin{array}{r} 96979\\97025\\97072\\\hline 97118\\97165\\97211\\97257\\9757\\97$	96984 97030 97077 97123 97169 97216 97262	$ \begin{array}{c} 2 \\ 3 \\ 4 \\ 5 \\ 6 \\ 7 \\ 8 \\ \end{array} $	$ \begin{array}{c} 1 \\ 2 \\ 2 \\ 3 \\ 3 \\ \end{array} $
939 No.	97267	97271	97276	97280 3	97285	97290 	97294 6	97299	8 91304	97308	9	4

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TABLE 42.

Logarithms of Numbers.

					,							
No.	9400-1000	00.							I	.og. 97313-	999	996.
No.	0	1	2	3	4	ð	G	7	8	9		
940	97313	97317	97399	97327	97331	97336	97340	97345	97350	07354		5
941	97359	97364	97368	97373	97377	97382	97387	97391	97396	07100		
942	97405	97410	97414	97419	97424	97428	97433	97437	97442	97447	1	1
943	97451	97456	97460	97465	97470	97474	97479	97483	97488	97493	$\frac{1}{2}$	i
944	97497	97502	97506	97511	97516	97520	97525	97529	97534	97539	3	2
945	97543	97548	97552	97557	97562	97566	97571	97575	97580	97585	4	2
946	97589	97594	97598	97603	97607	97612	97617	97621	97626	97630	5	3
947	97635	97640	97644	97649	97653	97658	97663	97667	97672	97676	6	3
948	97681	97685	97690	97695	97699	97704	97708	97713	97717	97722	7	4
949	97727	97731	97736	97740	97745	97749	97754	97759	97763	97768	8	4
950	97772	97777	97782	97786	97791	97795	97800	97804	97809	97813	9	ā
951	97818	97823	97827	97832	97836	97841	97845	97850	97855	97859		
952	97864	97868	97873	97877	97882	97886	97891	97896	97900	97905		
953	97909	97914	97918	97923	97928	97932	97937	97941	97946	97950		
954	97955	97959	97964	97968	97973	97978	97982	97987	97991	97996		
955	98000	98005	98009	98014	98019	98023	98028	98032	98037	98041		
956	98046	98050	98055	98059	98064	98068	98073	98078	98082	98087		
957	98091	98096	98100	98105	98109	98114	98118	98123	98127	98132		
958	98137	98141	98146	98150	98155	98159	98164	98168	98173	98177		
959	98182	$_{-98186}$	98191	98195	98200	98204	98209	98214	98218	98223		
960	98227	98232	98236	98241	98245	98250	98254	98259	98263	98268		
961	98272	98277	98281	98286	98290	98295	98299	98304	98308	98313		
962	98318	98322	98327	98331	98336	98340	98340	98349	98354	98358		
905	98505	98307	98372	98370	98381	98389	98390	98394	98399	98403		
0.05	00 152	00.157	00100	00121	00171		00100	00101	90444	901109		
965	98403	98407	98462	98400	98471	98470	98480	98484	98489	98493.		
- 900	98498	98002	98807	98011	02561	98020	98020	98029	98034	98888		
968	98588	98592	98597	98601	98605	98610	98614	98619	98623	98628		
969	98632	98637	98641	98646	98650	98655	98659	98664	98668	98673	-	
970	98677	98682	98686	98691	98695	98700	98704	98709	98713	98717		
971	98722	98726	98731	98735	98740	98744	98749	98753	98758	98762		
972	98767	98771	98776	98780	98784	98789	98793	98798	98802	98807		
973	98811	98816	98820	98825	98829	98834	98838	98843	98847	98851		
974	98856	98860	98865	98869	98874	98878	98883	98887	98892	98896	1	
975	98900	98905	98909	98914	98918	98923	98927	98932	98936	98941		
976	98945	98949	98954	98958	98963	98967	98972	98976	98981	98985		
977	98989	98994	98998	99003	99007	99012	99016	99021	99025	99029		
978	99034	99038	99043	99047	99052	99056	99061	99065	99069	99074		
979_	99078	99083	99087	99092	99096	99100	99105	99109	99114	99118		
980	99123	99127	99131	99136	99140	99145	99149	99154	99158	99162		
981	99167	99171	99176	99180	99185	99189	99193	99198	99202	99207		
982	99211	99216	99220	99224	99229	99233	99238	99242	99247	99251		
983	99255	99260	99264	99269	99273	99277	99282	99286	99291	99295		
984	99300	99304	99308	99313	99317	99322	99320	99330	99335	99339		
985	99344	99348	99352	99357	99361	99366	99370	99374	99379	99383		
986	99388	99392	99396	99401	99405	99410	99414	99419	99423	99427		
987	99432	99430	99441	99440	99449	99404.	99408	99463	99407	99471		
980	99470	99480	00599	99409	00527	99498	99002	99000	99011	99910		
989	99020	00500	99028	99000	99001	00505	99040	99000	99000	990,19		4
990	99364	99368	99372 00616	99077	99581	99585	99590	99994	999999	99003	1	0
991 002	99007	99012	00660 99010	99041	99020	99029	99034	99038	99042 00696	99047	$\frac{1}{2}$	1
992	99695	99699	99704	99708	99712	99717	99721	99726	99730	99091 99734	3	1
994	99739	99743	99717	99752	99756	99760	99765	99769	99774	99778	4	
001	00782	00797	00701	00705	00800	00801	00909	00913	00817	00899	ŝ	2
990	00826	99101	00835	00830	99800	99804	99000	99813	99017 00861	00865	$\check{6}$	2
997	99870	99850	99859	99883	99887	99891	99896	99000	00001	99000	7	3
998	99913	99917	99922	99926	99930	99935	99939	99944	99948	99952	8	3
999	99957	99961	99965	99970	99974	99978	99983	99987	99991	99996	9	4
										1		
No.	0	1	2	3	+	5	6	7	8	9		

			TABLI	E 43.		Page	e 607
Loga	rithmic Sines, 7	angents, and	Secants _, to eve	ery Point and	Quarter Point	of the Compa	ass.
Points.	Sine.	Cosine.	Tangent.	Cotangent.	Secant.	Cosecant.	
0	Inf. neg.	10.00000	Inf. neg.	Ínfinite.	10.00000	Infinite.	8
4	8.69080	9.99948	8.69132	11.30868	10.00052	11.30920	$7\frac{3}{4}$
1	8.99130	9.99790	8.99340	11.00660	10.00210	11.00870	$7\frac{1}{2}$
34	9.16652	9.99527	9.17125	10.82875	10.00473	10.83348	$7\frac{1}{4}$
1	9.29024	9.99157	9.29866	10.70134	10.00843	10.70976	7
11	9.38557	9.98679	9.39879	$10.\ 60121$	10.01321	10.61443	$6\frac{3}{4}$
11	9.46282	9.98088	9.48194	10.51806	10.01912	10.53718	$6\frac{1}{2}$
13	9.52749	9.97384	9.55365	10.44635	10.02616	10.47251	$6\frac{1}{4}$
2	9.58284	9.96562	9.61722	10.38278	10.03438	10.41716	6
21	9.63099	9.95616	9.67483	10.32517	10.04384	10.36901	$5\frac{3}{4}$
21	9.67339	9.94543	9.72796	10.27204	10.05457	10.32661	$5\frac{1}{2}$
$2\frac{3}{4}$	9.71105	9.93335	9.77770	10.22230	10.06665	10.28895	$5\overline{\frac{1}{4}}$
3	9.74474	9,91985	9,82489	10.17511	10.08015	10.25526	5
31	9,77503	9.90483	9,87020	10.12980	10.09517	10,22497	$4\frac{3}{4}$
31	9.80236	9.88819	9.91417	10.08583	10.11181	10.19764	41
$3\frac{3}{4}$	9.82708	9.86979	9.95729	10.04271	10.13021	10.17292	$4\frac{1}{4}$
4	9,84949	9.84949	10.00000	10.00000	10.15051	10.15051	4
	Cosine.	Sine.	Cotangent.	Tangent.	Cosecant.	Sceant.	Point

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Deme	000
rage	600

TABLE 44.

Log. Sines, Tangents, and Secants.

0°											179°
М.	Hour A. M.	Hour P. M.	Sine.	Diff. 1'.	Cosecant.	Tangent.	Diff, 1'.	Cotangent.	Secant.	Cosine.	М.
0	12 0 0	0 0 0	Inf. neg.		Infinite.	Inf. neg.		Infinite.	10.00000	10.00000	60
1	11 59 52	0 8	6,46373	30103	13.53627	6.46373	30103	13.53627	00000	00000	59
2	59 44	$0 \ 16$	76476	17609	23524	76476	17609	23524	00000	00000	58
3	59 36	0 24	94085	12494	05915	94085	12494	05915	00000	00000	57
-+	59 28	0 32	7.00079	9091	12.93421	1.06579	9691	12.93421	00000	00000	56
5 6	$11 \ 09 \ 20 \ 50 \ 12$	0 0 40	2.1188	660.1	12.83730	2.16270	1918 6604	12.83730	10.00000	10.00000	- 00 5 1
7	59 12	0 40	30882	5800	69118	30882	5800	69118	00000	00000	53
8	58 56	1 4	36682	5115	63318	36682	5115	63318	00000	00000	52
-9	$58 \ 48$	1 12	41797	4576	58203	41797	4576	58203	00000	00000	51
10	$11 \ 58 \ 40$	0 1 20	7.46373	4139	12.53627	7.46373	4139	12.53627	10.00000	10.00000	50
11	58 32	1 28	50512	3779	49488	50512	3779	49488	00000	00000	49
12	$ 58 24 \\ 58 16 $	1 00	57767	3218	49709	57767	3910	40709	00000	00000	48
14	58 8	1 52	60985	2997	39015	60986	2996	39014	00000	00000	$\frac{1}{46}$
15	11 58 0	0 2 0	7.63982	2802	12.36018	7.63982	2803	12.36018	10,00000	10.00000	45
16	57 52	2 8	66784	2633	33216	66785	2633	33215	00000	00000	44
17	57 44	2 16	69417	2483	30583	69418	2482	30582	00001	9.99999	43
18	57 36	2 24	71900	2348	28100	71900	2348	28100	00001	99999	42
19	04 28	2 52	7 70 175	2227	20702	7 70170	2228	20102	10,00001	99999	41
$\frac{20}{21}$	57 20	0 2 40 2 18	78591	2119	12.25525 21406	78595	2119	21405	00001	9.99999	20
$\frac{21}{22}$	57 4	2 56	80615	1930	19385	80615	1931	19385	00001	99999	38
23	$56 \ 56$	3 4	82545	1848	17455	82546	1848	17454	00001	99999	37
24	56 48	3 12	84393	1773	15607	84394	1773	15606	00001	99999	36
$\frac{25}{22}$	11 56 40	0 3 20	7.86166	1704	12.13834	7.86167	1704	12.13833	10.00001	9.99999	35
26	56 32	3 28	87870	1639 1570	12130	87871	1639 1570	12129	00001	99999	34
$\frac{21}{98}$	56 16	5 50 3 44	91088	1579	08912	91089	1579	08911	00001	99999	- 00 - 29
$\frac{20}{29}$	56 8	3 52	92612	1472	07388	92613	1473	07387	00001	99998	$3\overline{1}$
30	11 56 0	0 4 0	7.94084	1424	12.05916	7.94086	1424	12,05914	10.00002	9.99998	30
31	55 52	4 8	95508	1379	04492	95510	1379	04490	00002	99998	29
$\frac{32}{2}$	55 44	4 16	96887	1336	03113	96889	1336	03111	00002	99998	28
33	$\begin{array}{cccccccccccccccccccccccccccccccccccc$	4 24	98223	1297	00.180	98225	1297	01775	00002	99998	27
35	$\frac{55}{11}$ $\frac{25}{55}$ $\frac{20}{20}$	$\frac{1}{0}$ $\frac{1}{4}$ $\frac{10}{10}$	8 00779	1203	11 00991	8 00781	1200	11 00910	10.00002	0 00008	$\frac{20}{25}$
36	55 12	4 48	02002	/1190	97998	02004	11223	97996	00002	99998	24
37	55 4	4 56	03192	1158	96808	03194	1159	96806	00003	99997	23
38	54 56	5 4	04350	1128	95650	04353	1128	95647	00003	. 99997	22
$\frac{39}{10}$	54 48	5 12	05478	1100	94522	05481	1100	94519	00003	99997	$\frac{21}{21}$
40	$11 \ 04 \ 40 \ 51 \ 39$	0 5 20	8.06578	10/2	11.93422	8.06581	$1072 \\ 1017$	11.93419 022.17	10,00003	9,99997	20
42	54 52 54 24	$5 \frac{20}{5}$	08696	1022	91304	07055	1022	91300	00003	99997	18
43	$54 \ 16$	5 44	09718	999	90282	09722	998	90278	00003	99997	17
44	54 8	5 52	10717	976	89283	10720	976	89280	00004	99996	16
45	11 54 0	0 6 0	8.11693	954	11.88307	8.11696	955	11.88304	10.00004	9.99996	15
46	53 52		12647	934	87353	12651	934	87349	00004	99996	14
47	53 36	6 10 6 24	13381	914 806	85505	13383	915 895	85500	00004	99990	10
$\frac{10}{49}$	53 28	6 32	15391	877	84609	15395	878	84605	00004	99996	līī
50	$11 \ 53 \ 20$	0 6 40	8.16268	860	11.83732	8.16273	860	11.83727	10.00005	9.99995	10
51	$53 \ 12$	$6 \ 48$	17128	843	82872	17133	843	82867	00005	99995	9
52	53 4	$\frac{6}{10}$	17971	827	82029	17976	828	82024	00005	99995	8
53 54	$\begin{array}{c} 52 & 56 \\ 52 & 48 \end{array}$	$\frac{7}{7} \frac{4}{19}$	18798	812	81202	18804	812	81196	00005	99995	
55	$\frac{52}{11}$ $\frac{52}{52}$ $\frac{10}{10}$	$\frac{7}{0}$ $\frac{12}{7}$ 20	8 20.107	789	$\frac{80390}{11}$	8 20.113	799	11 79587	10.00008	1,0000 0	5
56	$52 \ 32$	7 28	21189	769	78811	21195	769	78805	00006	99994	4
57	52 24	7 36	21958	755	78042	21964	756	78036	00006	99994	3
58	$52\ 16$	7 44	22713	743	77287	22720	742	77280	00006	99994	2
59 60	52 8 59 0	752	23456	730	76544	23462	730	76538	00006	99994	
00		8 0	24186	- 117	79814	24192	/18	19808	00007	99993	0
М.	Hour P. M.	Hour A. M.	Cosine.	Diff. 1'.	Secant.	Cotangent.	Diff. 1'.	Tangent.	Cosecant.	Sine.	м.
90°											890
L											
1 °	1° Log. Sines, Tangents, and Secants.										
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М.	Hour A. M.	Hour p. m.	Sine.	Diff. 1'.	Cosecant.	Tangent.	Diff. 1'.	Cotangent.	Secant.	Cosine.	M.
$ \begin{array}{c} 0 \\ 1 \\ 2 \end{array} $	$\begin{array}{cccccccccccccccccccccccccccccccccccc$	$\begin{array}{cccc} 0 & 8 & 0 \\ & 8 & 8 \\ & 8 & 16 \end{array}$	$8.24186 \\ 24903 \\ 25609$	$717 \\ 706 \\ 695$	$11.\ 75814 \\75097 \\74391$	$\begin{array}{r} 8.\ 24192 \\ 24910 \\ 25616 \end{array}$	718 706 696	$11.\ 75808 \\75090 \\74384$	$10.\ 00007 \\ 00007 \\ 00007 \\ 00007$	9. 99993 99993 99993	
$\frac{3}{4}$	$51 \ 36 \\ 51 \ 28$	$\begin{array}{c}8&24\\8&32\end{array}$	$\frac{26304}{26988}$	$\begin{array}{r} 684 \\ 673 \end{array}$	$\frac{73696}{73012}$	$\frac{26312}{26996}$	$\begin{array}{r} 684 \\ 673 \end{array}$,73688 ,73004	00007 00008	99993 99992	$57 \\ 56$
5 6 7	$\begin{array}{cccccccccccccccccccccccccccccccccccc$	$\begin{array}{cccc} 0 & 8 & 40 \\ & 8 & 48 \\ & 8 & 56 \\ & 0 & 4 \end{array}$	$8.27661 \\28324 \\28977 \\20091$		$11.72339 \\71676 \\71023 \\70270$	$8.27669 \\28332 \\28986 \\20620$		$11.72331 \\71668 \\71014 \\70271$	$ \begin{array}{r} 10.00008 \\ 00008 \\ 00008 \\ 00008 \end{array} $	9,99992 99992 99992	$55 \\ 54 \\ 53 \\ 53 \\ 50 $
8 9	$50 50 \\ 50 48$	$9 \frac{4}{9 12}$	30255	624	69745	30263	625	69737	00008	99992	$\frac{52}{51}$
$10 \\ 11 \\ 12 \\ 13 \\ 14$	$ \begin{array}{cccccccccccccccccccccccccccccccccccc$	$ \begin{array}{cccccccccccccccccccccccccccccccccccc$	$\begin{array}{c} 8.30879 \\ 31495 \\ 32103 \\ 32702 \\ 22209 \end{array}$		$ \begin{array}{c} 11.09121 \\ 68505 \\ 67897 \\ 67298 \\ 66708 \end{array} $	31505 32112 32711 32702	607 599 591	$\begin{array}{c} 68495 \\ 67888 \\ 67289 \\ 66608 \end{array}$	10.00009 00009 00010 00010	9.99991 99991 99990 99990	$ \begin{array}{c} 50 \\ 49 \\ 48 \\ 48 \\ 47 \\ 40 \\$
14 15 16 17	$ \begin{array}{r} 30 & 8 \\ 11 & 50 & 0 \\ 49 & 52 \\ 49 & 44 \end{array} $	$ \begin{array}{r} 9 \ 52 \\ \hline 0 \ 10 \ 0 \\ 10 \ 8 \\ 10 \ 16 \\ \end{array} $	$\begin{array}{r} 33292 \\ \hline 8.33875 \\ 34450 \\ 35018 \end{array}$	575 568 560	$ \begin{array}{r} 00708 \\ \overline{11.66125} \\ 65550 \\ 64982 \\ \hline 64982 \end{array} $	$\begin{array}{r} 33302 \\ \hline 8.33886 \\ 34461 \\ 35029 \\ \hline \end{array}$	$575 \\ 568 \\ 561 $	$ \begin{array}{r} & 00038 \\ \hline 11.66114 \\ 65539 \\ 64971 \\ \end{array} $	$\begin{array}{r} 00010\\\hline 10.\ 00010\\00011\\00011\end{array}$	99990 9.99990 99989 99989	40 45 44 43 43 4
$\frac{18}{19}$	$ \begin{array}{r} 49 36 \\ 49 28 \\ \overline{11 49 20} \end{array} $	$ \begin{array}{r} 10 & 24 \\ 10 & 32 \\ \hline 0 & 10 & 40 \end{array} $	$35578 \\ 36131 \\ \hline 8 36678 \\ \hline$	553 547 539	$ \begin{array}{r} 64422 \\ 63869 \\ \overline{11} 63322 \end{array} $	$35590 \\ 36143 \\ \hline 8 36689 \\ \hline$	$553 \\ 546 \\ 540 $	$ \begin{array}{r} 64410 \\ 63857 \\ \overline{11} 63311 \end{array} $		$99989 \\ 99989 \\ 99989 \\ 99988 \\ 99988 \\ 99988 \\ 99988 \\ 99988 \\ 99988 \\ 99988 \\ 99988 \\ 99988 \\ 99988 \\ 99988 \\ 99989 \\ 99988 \\ 9998 $	$42 \\ 41 \\ 40$
21 22 23	$ \begin{array}{r} 11 \ 49 \ 20 \\ 49 \ 12 \\ 49 \ 4 \\ 48 \ 56 \\ 49 \ 49 \\ 48 \ 56 \ 56 \\ 48 \ 56 \ 56 \\ 48 \ 56 \ 56 \ 56 \ 56 \ 56 \ 56 \ 56 \ 5$	$ \begin{array}{c} 10 & 40 \\ 10 & 48 \\ 10 & 56 \\ 11 & 4 \\ 11 & 19 \end{array} $	$\begin{array}{r} 37217\\ 37750\\ 38276\\ 38506\end{array}$	$533 \\ 526 \\ 520 \\ 511$	$\begin{array}{r} 62783 \\ 62250 \\ 61724 \\ 61201 \end{array}$	$\begin{array}{r} 37229 \\ 37762 \\ 38289 \\ 28900 \end{array}$	$533 \\ 527 \\ 520 \\ 511$	$\begin{array}{c} 62771 \\ 62238 \\ 61711 \\ 61101 \end{array}$	00012 00012 00013 00013	99988 99988 99987 99987	39 38 37
$ \frac{24}{25} 26 27 $	$ \begin{array}{r} 48 48 \\ 11 48 40 \\ 48 32 \\ 48 24 \end{array} $	$ \begin{array}{r} 11 12 \\ \hline 0 11 20 \\ 11 28 \\ 11 36 \end{array} $	$ \frac{38796}{8,39310} \\ 39818 \\ 40320 $	$ \begin{array}{r} 508 \\ 502 \\ 496 \end{array} $	$ \begin{array}{r} $	$ \begin{array}{r} 38809 \\ 8.39323 \\ 39832 \\ 40334 \end{array} $	509 502 496	$ \begin{array}{r} $	$ \begin{array}{r} 00013 \\ 10.00013 \\ 00014 \\ 00014 \end{array} $	99987 9.99987 99986 99986	35 34 33
$\frac{28}{29}$	48 16 48 8	$ \begin{array}{r} 11 \ 44 \\ 11 \ 52 \\ \hline 0 \ 12 \ 0 \end{array} $	40816 41307	491 485	59184 58693 11 59909	40830 41321	491 486	59170 58679 11 58109	$00014 \\ 00015 \\ 10,00015$	99986 99985	$\frac{32}{31}$
30 31 32 33 34	$ \begin{array}{cccccccccccccccccccccccccccccccccccc$	$\begin{array}{cccccccccccccccccccccccccccccccccccc$	$\begin{array}{r} 8.41792 \\ 42272 \\ 42746 \\ 43216 \\ 43680 \end{array}$	480 474 470 464 459	$ \begin{array}{r} 11.58208 \\ 57728 \\ 57254 \\ 56784 \\ 56320 \\ 56320 \end{array} $	$8.41807 \\ 42287 \\ 42762 \\ 43232 \\ 43696$	$480 \\ 475 \\ 470 \\ 464 \\ 460$	$ \begin{array}{r} 11.58193 \\ 57713 \\ 57238 \\ 56768 \\ 56304 \\ \end{array} $	10,00015 00015 00016 00016 00016	9.99985 99985 99984 99984 99984	$ \begin{array}{r} 30 \\ 29 \\ 28 \\ 27 \\ 26 \\ 26 \\ 26 \\ 26$
35 36 37	$ \begin{array}{r} 11 & 20 \\ 11 & 47 & 20 \\ 47 & 12 \\ 47 & 4 \end{array} $	$\begin{array}{r} 12 & 02 \\ 0 & 12 & 40 \\ 12 & 48 \\ 12 & 56 \\ 12 & 56 \\ \end{array}$			$ \begin{array}{r} 50520 \\ 11.55861 \\ 55406 \\ 54956 \end{array} $	$ \begin{array}{r} 13030 \\ 8.44156 \\ 44611 \\ 45061 \\ \end{array} $		$ \begin{array}{r} 11.55844 \\ 55389 \\ 54939 \\ 54939 \end{array} $	$\begin{array}{r} 00010\\ \hline 10.\ 00017\\ 00017\\ 00017\\ 00017\\ \end{array}$	9.99983 99983 99983	$\frac{25}{24}$
$\frac{38}{39}{40}$	$ \begin{array}{r} 46 56 \\ 46 48 \\ 11 46 40 \end{array} $	$ \begin{array}{r} 13 & 4 \\ 13 & 12 \\ \hline 0 & 13 & 20 \end{array} $	$ 45489 \\ 45930 \\ \overline{8,46366} $	$\begin{array}{r} 441 \\ 436 \\ \hline 433 \end{array}$	$ 54511 \\ 54070 \\ \overline{11, 53634} $	$\frac{45507}{45948}$		$ 54493 \\ 54052 \\ 11, 53615 $	$ \begin{array}{r} 00018 \\ 00018 \\ 10.00018 \end{array} $	$\frac{99982}{99982}$	$\frac{22}{21}$
$ \begin{array}{r} 41 \\ 42 \\ 43 \\ 44 \end{array} $	$\begin{array}{r} 46 & 32 \\ 46 & 24 \\ 46 & 16 \\ 46 & 8 \end{array}$	$\begin{array}{c} 13 & 28 \\ 13 & 36 \\ 13 & 44 \\ 13 & 52 \end{array}$	$\begin{array}{r} 46799 \\ 47226 \\ 47650 \\ 48069 \end{array}$	$ \begin{array}{r} 427 \\ 424 \\ 419 \\ 416 \end{array} $	53201 52774 52350 51931	$\begin{array}{r} 46817 \\ 47245 \\ 47669 \\ 48089 \end{array}$	$ \begin{array}{r} 428 \\ 424 \\ 420 \\ 416 \end{array} $	53183 52755 52331 51911	00019 00019 00019 00019 00020	99981 99981 99981 99980	$19 \\ 18 \\ 17 \\ 16$
$\begin{array}{r} 45\\ 46\\ 47\end{array}$	$\begin{array}{rrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrr$	$\begin{array}{rrrr} 0 & 14 & 0 \\ 14 & 8 \\ 14 & 16 \end{array}$	$\begin{array}{r} 8.\ 48485 \\ 48896 \\ 49304 \end{array}$	$\begin{array}{r} 411\\ 408\\ 404\end{array}$	$\begin{array}{r} 11.\ 51515\\ 51104\\ 50696\end{array}$	$\begin{array}{r} 8.48505 \\ 48917 \\ 49325 \end{array}$	$\begin{array}{r} 412\\ 408\\ 404\end{array}$	${\begin{array}{c}11.51495\\51083\\50675\end{array}}$	$\frac{10,00020}{00021}\\00021$	9. 99980 99979 99979	$ \begin{array}{c} 15 \\ 14 \\ 13 \end{array} $
$\frac{48}{49}$	$ \begin{array}{r} 45 & 36 \\ 45 & 28 \\ \hline 11 & 45 & 20 \\ \end{array} $	$ \begin{array}{r} 14 & 24 \\ 14 & 32 \\ \hline 0 & 14 & 40 \end{array} $	49708 50108 8 50504	$ 400 \\ 396 \\ 303 $	$\frac{50292}{49892}$	$49729 \\ 50130 \\ 8 50527$	$ 401 \\ 397 \\ 302 $	$50271 \\ 49870 \\ 11 49473 $	$\begin{array}{r} 00021 \\ 00022 \\ \hline 10, 00022 \end{array}$	$99979 \\ 99978 \\ 9997$	$ \begin{array}{r} 12 \\ 11 \\ 10 \end{array} $
50 51 52 ⁄53	$ \begin{array}{r} 11 \ 45 \ 20 \\ 45 \ 12 \\ 45 \ 4 \\ 44 \ 56 \\ \end{array} $	$ \begin{array}{r} 0 & 14 & 40 \\ 14 & 48 \\ 14 & 56 \\ 15 & 4 \end{array} $	$\begin{array}{r} 8.50504 \\ 50897 \\ 51287 \\ 51673 \end{array}$	393 390 386 382	$ \begin{array}{r} 11.49496 \\ 49103 \\ 48713 \\ 48327 \end{array} $	$\begin{array}{r} 8.50527 \\ 50920 \\ 51310 \\ 51696 \end{array}$	393 390 386 383	11. 49473 49080 48690 48304	$\begin{array}{c} 10.\ 00022\\ 00023\\ 00023\\ 00023\\ 00023 \end{array}$	9.99978 99977 99977 99977	10 9 8 7
	$ \begin{array}{r} $	$\begin{array}{r} 15 \ 12 \\ \hline 0 \ 15 \ 20 \\ 15 \ 28 \\ 15 \ 26 \end{array}$	$\begin{array}{r} 52055\\ \hline 8.52434\\ 52810\\ \hline 50100\\ \end{array}$	$379 \\ 376 \\ 373 \\ 920 \\ 373 \\ 920 \\ 373 \\ 920 \\ 373 \\ 920 \\ 373 \\ 920 \\ 373 \\ 920 \\ 375 \\ 920 $	$\frac{47945}{11.47566}\\ 47190$	$52079 \\ 8.52459 \\ 52835 \\ 52000$	$\frac{380}{376}$	$\frac{47921}{11.47541}\\ 47165$	$\begin{array}{r} 00024\\ \hline 10.\ 00024\\ 00025\\ 00025\end{array}$	99976 9.99976 99975	$\frac{6}{5}$
$57 \\ 58 \\ 59 \\ 60$	$\begin{array}{r} 44 & 24 \\ 44 & 16 \\ 44 & 8 \\ 44 & 0 \end{array}$	$egin{array}{cccccccccccccccccccccccccccccccccccc$	$53183 \\ 53552 \\ 53919 \\ 54282$	$ 369 \\ 367 \\ 363 \\ 360 $	$\begin{array}{r} 46817 \\ 46448 \\ 46081 \\ 45718 \end{array}$	$53208 \\ 53578 \\ 53945 \\ 54308$	$370 \\ 367 \\ 363 \\ 361$	$\begin{array}{r} 46792 \\ 46422 \\ 46055 \\ 45692 \end{array}$	00025 00026 00026 00026	99975 99974 99974 99974	$ \begin{array}{c} 3 \\ 2 \\ 1 \\ 0 \end{array} $
M. 91º	Hour P. M.	Hour A. M.	Cosine.	Diff. 1'.	Seeant.	Cotangent,	Diff. 1'.	Tangent.	Cosecant.	Sine.	M.

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TABLE 44.

Log. Sines, Tangents, and Secants.

20											1770
М.	Hour A. M.	Hour P.M.	Sine,	Diff. 1'.	Cosecant.	Tangent.	Diff. 1'.	Cotangent.	Secant.	Cosine.	М.
0	11 44 0	0 16 0	8.54282	360	11.45718	8.54308	361	11.45692	10.00026	9.99974	60
1	43 52	16 8	54642	357	45358	54669	358	45331	00027	99973	59
$\frac{2}{2}$	43 44	16 16 16 16	54999	355	45001	55027	355	44973	00027	99973	58
0 4	$\frac{43}{43}$ $\frac{30}{28}$	$16 24 \\ 16 32$	55705	$\frac{351}{349}$	44295	00382 55734	352 349	44018	00028	99972	97 56
-5	$11 \ 43 \ 20$	0 16 40	8. 56054	346	11. 43946	8.56083	346	11. 43917	10.00029	9,99971	55
6	43 12	16 48	56400	343	43600	56429	344	. 43571	00029	99971	54
7	43 4	16 56	56743	341	43257	56773	341	43227	00030	99970	53
8	42 56	17 4 17 19	57421	337	42916	$\frac{07114}{57452}$	338	42886	00030	99970	52
$\frac{10}{10}$	11 42 40	0 17 20	8 57757	332	11 42243	8 57788	333	11 42212	10 00031	0 00060	50
11	42 32	17 28	58089	330	41911	58121	330	41879	00032	99968	49
12	42 24	$17 \ 36$	58419	328	41581	58451	328	41549	00032	99968	48
$\frac{13}{14}$	42 16	$17 \ 44 \ 17 \ 59$	58747 50072	325	41253	58779	326	41221	00033	99967	47
$\frac{14}{15}$	$\frac{42}{11} \frac{6}{12}$	$\frac{17}{0.18}$ 0	8 59395	320	40928	8 59100	320	40090	10.00033	99907	40
16	41 52	18 8	59715	318	40285	59749	319	40251	00034	99966	44
17	41 44	18 16	60033	316	39967	60068	316	39932	00034	99966	43
18	41 36	18 24	60349	313	39651	60384	314	39616	00035	99965	42
$\frac{19}{19}$	$\frac{41}{11}$ $\frac{28}{11}$	18 32	00002		39338	60698	311	39302	00036	99964	41
$\frac{20}{21}$	41 12	18 48	61282	309	38718	8. 01009 61319	307	38681	10.00036	9,99904	40
$\overline{22}$	41 4	18 56	61589	305	38411	61626	305	38374	00037	99963	38
23	40 56	$19 \ 4$	61894	302	38106	61931	303	38069	00038	99962	37
24	40 48	19 12	62196	301	37804	62234	301	37766	00038	99962	36
25	$11 \ 40 \ 40 \ 10 \ 32$	$\begin{array}{c} 0 & 19 & 20 \\ 10 & 28 \end{array}$	8.62497 62705	298	11.37503 27205	8. 62535	299	11. 37465	10.00039	9.99961	35
$\frac{20}{27}$	40 32	19 28 19 36	63091	290	36909	63131	297	36869	00039	99960	32
$\frac{1}{28}$	40 16	19 44	63385	293	36615	63426	292	36574	00040	99960	32
29	40 8	19 52	63678	290	36322	63718	291	36282	00041	99959	31
30	11 40 0	$\begin{array}{ccc} 0 & 20 & 0 \\ 0 & 0 & 0 \end{array}$	8.63968	288	11.36032	8.64009	289	11.35991	10.00041	9.99959	30
31	. 39 52	$20 8 \\ 20 16$	64206	287	30744	64298	287	35702	00042	99958	29
33	39 36	$20 \ 10 \ 20 \ 24$	64827	283	35173	64870	285	35130	00042	99957	20
34	39 28	20 32	65110	281	34890	65154	281	34846	00044	99956	26
35	$11 \ 39 \ 20$	0 20 40	8.65391	279	11.34609	8.65435	280	11.34565	10.00044	9.99956	25
$\frac{36}{27}$	$\frac{39}{20}$ 12	$20 \ 48$ 20 56	65670	277	34330	65715	278	34285	00045	99955	24
38 - 38	38 56	$20 \ 50$ $21 \ 4$	66223	270	33777	66269	270	33731	00045	99955	$\frac{23}{22}$
39	38 48	21 12	66497	272	33503	66543	273	33457	00046	99954	21
40	11 38 40	0 21 20	8.66769	270	11.33231	8.66816	271	11.33184	10.00047	9.99953	20
41	38 32	21 28	67039	269	32961	67087	269	32913	00048	99952	19
$\frac{42}{42}$	38 24	$21 30 \\ 21 44$	67308	267	32692	67624	268	32644	00048	99952	18
44	38 8		67841	263	32159	67890	264	32110	00049	99951	16
45	11 38 0	0 22 0	8.68104	263	11.31896	8.68154	263	11.31846	10.00050	9.99950	15
46	37 52	22 8	68367	260	31633	68417	261	31583	00051	99949	14
41	$37 \frac{44}{27 26}$	$22 16 \\ 22 21$	68627	209	31373	68678	260	31322	00051	99949	13
49	$37 \ 30 \ 37 \ 28$	$\frac{22}{22}$ $\frac{24}{32}$	69144	256	30856	69196	257	30804	00052	99948	11^{12}
50	11 37 20	0 22 40	8.69400	254	11.30600	8.69453	255	11.30547	$\overline{10,00053}$	9.99947	10
51	37 12	$22 \ 48$	69654	253	30346	69708	254	30292	00054	99946	9
52	37 4	$\frac{22}{22}$ 56	69907	252	30093	69962 70914	252	30038	00054	99946	8
54	$36 \ 48$	23 + 4 23 12	70159	250	29541	70214 70465	201 249	29786	00056	99940	6
55	11 36 40	0 23 20	8,70658	247	11.29342	8.70714	248	11. 29286	10.00056	9,99944	-5
56	36 32	23 28	70905	246	29095	70962	246	29038	00057	99943	4
57	36 24	23 36	71151	244	28849	71208	245	28792	00058	99942	3
- 58 - 59	36 16 36 9	$23 + 4 \\ -23 - 59$	71699	243	28605	71453 71607	244	28547	00058	99942	$\frac{2}{1}$
60	36 0		71880	242	28302	71940	243	28060	00060	99940	Ō
M.	Hour P. M.	Hour A. M.	Cosine.	Diff. 1'.	Secant.	Cotangent.	Diff. 1'.	Tangent.	Coseeant,	Sine.	М.
920											870

	TABLE 44. [Page 611										
90				Log. Si	nes, Tange	ents, and S	Secants.				176°
<u>м</u> .	Hour a. M.	Hour P. M.	Sine.	Diff. 1'.	Cosecant.	Tangent.	Diff. 1'.	Cotangent.	Secant.	Cosine.	М.
$ \begin{array}{c} 0 \\ 1 \\ 2 \\ 9 \end{array} $	$\begin{array}{cccccccccccccccccccccccccccccccccccc$	$\begin{array}{cccc} 0 & 24 & 0 \\ & 24 & 8 \\ & 24 & 16 \\ & 24 & 24 \end{array}$	$8.71880 \\72120 \\72359 \\72597$	$240 \\ 239 \\ 238 \\ 237$	$11.28120 \\ 27880 \\ 27641 \\ 27403$	$8.71940 \\72181 \\72420 \\72659$	$241 \\ 239 \\ 239 \\ 239 \\ 237$	$11.28060 \\ 27819 \\ 27580 \\ 27341$	$\begin{array}{c} 10.\ 00060\\ 00060\\ 00061\\ 00061\end{array}$	9, 99940 99940 99939 99938	
3 -4 	$ 35 50 \\ 35 28 \\ 11 25 20 $	24 24 24 32 0 21 10	72834	$\frac{237}{235}$	27403 27166 11 26931	72896	$\frac{237}{236}$	$\frac{27341}{27104}$	00002 00062 10 00063	99938	$\frac{57}{56}$
5 6 7 8 0	$\begin{array}{cccccccccccccccccccccccccccccccccccc$	$ \begin{array}{c} 0 & 24 & 40 \\ 24 & 48 \\ 24 & 56 \\ 25 & 4 \\ 25 & 12 \end{array} $	$\begin{array}{c} 8.73009 \\ 73303 \\ 73535 \\ 73767 \\ 73007 \end{array}$	232 232 232 230	$\begin{array}{c} 11.20331 \\ 26697 \\ 26465 \\ 26233 \\ 26003 \end{array}$	$\begin{array}{r} 73366 \\ 73600 \\ 73832 \\ 74063 \end{array}$	$ \begin{array}{r} 234 \\ 232 \\ 231 \\ 220 \end{array} $	$\begin{array}{r} 26603 \\ 26634 \\ 26400 \\ 26168 \\ 25937 \end{array}$	00064 00064 00065 00065	99936 99936 99935 99935	$ 53 \\ 53 \\ 52 \\ 51 $
$ \begin{array}{r} 3 \\ \hline 10 \\ 11 \\ 12 \\ 13 \\ 13 \end{array} $	$ \begin{array}{r} 34 \ 40 \\ 34 \ 32 \\ 34 \ 24 \\ 34 \ 16 \\ \end{array} $	$\begin{array}{cccccccccccccccccccccccccccccccccccc$	$\begin{array}{r} 75001 \\ \hline 8.74226 \\ 74454 \\ 74680 \\ 74906 \\ \hline 74906 \end{array}$	$ \begin{array}{r} 228 \\ 226 \\ 226 \\ 224 \\ 229 \end{array} $	$\begin{array}{r} 25003\\ \hline 11.\ 25774\\ 25546\\ 25320\\ 25094\\ 24070\end{array}$	$\begin{array}{r} 8.74292 \\ 74521 \\ 74748 \\ 74974 \\ 74974 \end{array}$	$ \begin{array}{r} 229 \\ 227 \\ 226 \\ 225 \\ 221 \\ \end{array} $	$ \begin{array}{r} 25007 \\ 11.25708 \\ 25479 \\ 25252 \\ 25026 \\ 24001 \end{array} $	10. 00066 00067 00068 00068	9. 99934 99933 99932 99932 99932	$50 \\ 49 \\ 48 \\ 47 \\ 10$
$ \begin{array}{r} 14 \\ 15 \\ 16 \\ 17 \\ 18 \end{array} $	$\begin{array}{rrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrr$	$ \begin{array}{r} 25 52 \\ \hline 0 26 0 \\ 26 8 \\ 26 16 \\ 26 24 \end{array} $	$\begin{array}{r} 75130 \\ \hline 8.75353 \\ 75575 \\ 75795 \\ 76015 \end{array}$	$ \begin{array}{r} 223 \\ \hline 222 \\ 220 \\ 220 \\ 219 \end{array} $	$ \begin{array}{r} 24870 \\ \overline{)11.24647} \\ 24425 \\ 24205 \\ 23985 \end{array} $	75199 8.75423 75645 75867 76087	$ \begin{array}{r} 224 \\ \hline 222 \\ 222 \\ 220 \\ 219 \\ \end{array} $	$ \begin{array}{r} 24801 \\ \overline{11.24577} \\ 24355 \\ 24133 \\ 23913 \end{array} $	$\begin{array}{c} 00069\\ 10,00070\\ 00071\\ 00071\\ 00072\end{array}$	99931 9.99930 99929 99929 99928	
$\begin{array}{r} 19\\ \hline 20\\ 21\\ 22\\ 23 \end{array}$	$\begin{array}{r} 33 \ 28 \\ \hline 11 \ 33 \ 20 \\ 33 \ 12 \\ 33 \ 4 \\ 32 \ 56 \end{array}$	$\begin{array}{r} 26 & 32 \\ \hline 0 & 26 & 40 \\ 26 & 48 \\ 26 & 56 \\ 27 & 4 \end{array}$	$\begin{array}{r} 76234 \\ \hline 8.\ 76451 \\ 76667 \\ 76883 \\ 77097 \end{array}$	$\begin{array}{r} 217 \\ 216 \\ 216 \\ 214 \\ 213 \end{array}$	$\begin{array}{r} 23766\\ \hline 11,23549\\ 23333\\ 23117\\ 22903 \end{array}$	$\begin{array}{r} 76306 \\ \hline 8.\ 76525 \\ 76742 \\ 76958 \\ 77173 \end{array}$	$ \begin{array}{r} 219 \\ 217 \\ 216 \\ 215 \\ 214 \end{array} $	$\begin{array}{r} 23694 \\ 11, 23475 \\ 23258 \\ 23042 \\ 22827 \end{array}$	$\begin{array}{r} 00073 \\ \hline 10,00074 \\ 00074 \\ 00075 \\ 00076 \end{array}$	99927 9,99926 99926 99925 99924	$ \begin{array}{r} 41 \\ 40 \\ 39 \\ 38 \\ 37 \end{array} $
	$\begin{array}{r} 32 & 48 \\ \hline 11 & 32 & 40 \\ 32 & 32 \\ 32 & 24 \\ 32 & 16 \end{array}$	$ \begin{array}{r} 27 \ 12 \\ 0 \ 27 \ 20 \\ 27 \ 28 \\ 27 \ 36 \\ 27 \ 44 \end{array} $	$\begin{array}{r} 77310\\ \hline 8.77522\\ 77733\\ 77943\\ 78152 \end{array}$	$ \begin{array}{r} 212 \\ 211 \\ 210 \\ 209 \\ 208 \end{array} $	$\begin{array}{r} 22690\\ \hline 11,22478\\ 22267\\ 22057\\ 21848 \end{array}$	$ \begin{array}{r} 77387 \\ \overline{8.77600} \\ 77811 \\ 78022 \\ 78232 \end{array} $	$ \begin{array}{r} 213 \\ 211 \\ 211 \\ 210 \\ 209 \end{array} $	$\begin{array}{r} 22613\\ 11,22400\\ 22189\\ 21978\\ 21978\\ 21768\end{array}$	00077 10.00077 00078 00079 00080	99923 9,99923 99922 99921 99920	$ \begin{array}{r} 36 \\ 35 \\ 34 \\ 33 \\ 32 \end{array} $
$ \begin{array}{r} 29 \\ 30 \\ 31 \\ 32 \\ 33 \\ 34 \end{array} $	$\begin{array}{rrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrr$	$ \begin{array}{r} 27 52 \\ \hline 0 28 0 \\ 28 8 \\ 28 16 \\ 28 24 \\ 28 32 \end{array} $	78360 8.78568 78774 78979 79183 79386	$ \begin{array}{r} 208 \\ \hline 206 \\ 205 \\ 204 \\ 203 \\ 202 \end{array} $	$\begin{array}{r} 21640 \\ \hline 11.\ 21432 \\ 21226 \\ 21021 \\ 20817 \\ 20614 \end{array}$	78441 8.78649 78855 79061 79266 79470	$ \begin{array}{r} 208 \\ 206 \\ 205 \\ 204 \\ 203 \end{array} $	$\begin{array}{r} 21559 \\ \hline 11, 21351 \\ 21145 \\ 20939 \\ 20734 \\ 20530 \end{array}$	$\begin{array}{r} 00080\\ 10,00081\\ 00082\\ 00083\\ 00083\\ 00083\\ 00084\end{array}$	99920 9,99919 99918 99917 99917 99916	$ \begin{array}{r} 31 \\ 30 \\ 29 \\ 28 \\ 27 \\ 26 \end{array} $
35 36 37 38 39	$ \begin{array}{r} 31 & 20 \\ 11 & 31 & 20 \\ 31 & 12 \\ 31 & 4 \\ 30 & 56 \\ 30 & 48 \end{array} $	$ \begin{array}{r} 28 & 32 \\ 0 & 28 & 40 \\ 28 & 48 \\ 28 & 56 \\ 29 & 4 \\ 29 & 12 \\ \end{array} $	8. 79588 79789 79990 80189 80388	$ \begin{array}{r} 201 \\ 201 \\ 199 \\ 199 \\ 197 \end{array} $	$\begin{array}{r} 11.\ 20412\\ 20211\\ 20010\\ 19811\\ 19612 \end{array}$	8. 79673 79875 80076 80277 80476	$ \begin{array}{r} 202 \\ 201 \\ 201 \\ 199 \\ 198 \end{array} $	$\begin{array}{r} \hline 11.\ 20327\\ 20125\\ 19924\\ 19723\\ 19524 \end{array}$	$\begin{array}{c} 10.\ 00085\\ 00086\\ 00087\\ 00087\\ 00087\\ 00088\end{array}$	9,99915 99914 99913 99913 99912	$ \begin{array}{r} 25 \\ 24 \\ 23 \\ 22 \\ 21 \end{array} $
$ \begin{array}{r} 40 \\ 41 \\ 42 \\ 43 \\ 44 \end{array} $	$\begin{array}{cccccccccccccccccccccccccccccccccccc$	$\begin{array}{cccccccccccccccccccccccccccccccccccc$	8, 80585 80782 80978 81173 81367	197 196 195 194 193	$\begin{array}{c} 11.\ 19415\\ 19218\\ 19022\\ 18827\\ 18633 \end{array}$	$\begin{array}{r} 8,80674\\ 80872\\ 81068\\ 81264\\ 81459 \end{array}$	198 196 196 195 195	$\begin{array}{r} 11,19326\\19128\\18932\\18736\\18541 \end{array}$	$\begin{array}{c} 10,00089\\ 00090\\ 00091\\ 00091\\ 00091\\ 00092 \end{array}$	9.99911 99910 99909 99909 99908	$ \begin{array}{r} 20 \\ 19 \\ 18 \\ 17 \\ 16 \end{array} $
45 46 47 48 49	$\begin{array}{cccccccccccccccccccccccccccccccccccc$	$\begin{array}{cccccccc} 0 & 30 & 0 \\ & 30 & 8 \\ & 30 & 16 \\ & 30 & 24 \\ & 30 & 32 \end{array}$	$\begin{array}{c} 8.81560\\ 81752\\ 81944\\ 82134\\ 82324 \end{array}$	$ \begin{array}{r} 192 \\ 192 \\ 190 \\ 190 \\ 189 \end{array} $	$11.18440 \\18248 \\18056 \\17866 \\17676$	$\begin{array}{c} 8.81653 \\ 81846 \\ 82038 \\ 82230 \\ 82420 \end{array}$	$ \begin{array}{r} 193 \\ 192 \\ 192 \\ 192 \\ 190 \\ 100 \\ 1$	$\begin{array}{r} 11.18347 \\ 18154 \\ 17962 \\ 17770 \\ 17580 \end{array}$	$\begin{array}{c} 10.\ 00093\\ 00094\\ 00095\\ 00096\\ 00096\end{array}$	9, 99907 99906 99905 99904 99904	$ \begin{array}{r} 15 \\ 14 \\ 13 \\ 12 \\ 11 \end{array} $
$50 \\ 51 \\ 52 \\ 53 \\ 54$	$\begin{array}{cccccccccccccccccccccccccccccccccccc$	$\begin{array}{cccc} 0 & 30 & 40 \\ \cdot & 30 & 48 \\ & 30 & 56 \\ & 31 & 4 \\ & 31 & 12 \end{array}$	$\begin{array}{c} 8,82513\\82701\\82888\\83075\\83261\end{array}$	188 187 187 186 185	$11. 17487 \\17299 \\17112 \\16925 \\16739$	$\begin{array}{c} 8.\ 82610\\ 82799\\ 82987\\ 83175\\ 83361 \end{array}$	189 188 188 186 186	$11.\ 17390 \\17201 \\17013 \\16825 \\16639$	10.00097 00098 00099 00100 00101	9,99903 99902 99901 99900 99899	$\begin{array}{c}10\\9\\8\\7\\6\end{array}$
55 56 57 58 59	$\begin{array}{cccccccccccccccccccccccccccccccccccc$	$\begin{array}{cccccccccccccccccccccccccccccccccccc$	$\begin{array}{c} 8.83446\\ 83630\\ 83813\\ 83996\\ 84177\end{array}$	184 183 183 181 181	$11.\ 16554\\16370\\16187\\16004\\15823$	$\begin{array}{r} 8.83547\\83732\\83916\\84100\\84282\end{array}$	185 184 184 182 182 182	$\begin{array}{c} 11.\ 16453\\ 16268\\ 16084\\ 15900\\ 15718 \end{array}$	$\begin{array}{c} 10.\ 00102\\ 00102\\ 00103\\ 00104\\ 00105 \end{array}$	9, 99898 99898 99897 99896 99895	
60 	28 0 Hour p. m.	32 0 Hour A. M.	84358 Cosine.	181 Diff. 1'.	15642 Secant.	84464 Cotangent.	182 Diff. 1'.	15536 Tangent.	00106 Cosecant.	99894 Sine.	$\frac{0}{M}$
930											86°

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TABLE 44.

Log. Sines, Tangents, and Secants.

40											1750
М.	Hour A. M.	Hour P. M.	Sine.	Diff. 1'.	Cosecant.	Tangent.	Diff. 1'.	Cotangent.	Secant.	Cosine.	М.
0	11 28 0	0.32 0	8.84358	181	11, 15642	8, 84464	182	11, 15536	10,00106	9, 99894	60
1	27 52	32 8	84539	179	15461	84646	180	15354	00107	99893	59
2	27 44	32 16	84718	179	15282	84826	180	15174	00108	99892	58
3	27 36	32 24	84897	178	15103	85006	179	14994	00109	99891	57
4	27 28	32 32	85075	177	14925	85185	178	14815	00109	99891	56
5	$11 \ 27 \ 20$	$0\ 32\ 40$	8.85252	177	11.14748 14571	8,85363	177	11.14637 1.1460	10.00110	9.99890	55 54
6 7	$\frac{27}{27}$ 12	$\frac{32}{32}\frac{48}{56}$	85605	$170 \\ 175$	14395	85717	176	14400	00111	99889	04 53
8	26 56	$\frac{32}{33}$ $\frac{50}{4}$	85780	175	14220	85893	176	14107	00112	99887	52
9	26 48	33 12	85955	173	14045	86069	174	13931	00114	99886	51
10	11 26 40	0 33 20	8.86128	173	11.13872	8.86243	174	11.13757	10.00115	9.99885	50
11	26 32	33 28	86301	173	13699	86417	174	13583	00116	99884	49
$\frac{12}{12}$	26 24	33 36	86474	171	13526	86591	$172 \\ 179$	13409 12927	00117	99883	48
13	26 10 26 8	33 44 33 59	86816	$171 \\ 171$	13184	86935	$172 \\ 171$	13237 13065	00118	99882	46
15	11 26 0	0.34 0	8.86987	169	11, 13013	8.87106	171	11, 12894	10.00120	9,99880	45
16	25 52	34 8	87156	169	12844	87277	170	12723	00121	99879	44
17	25 44	34 16	87325	169	12675	87447	169	12553	00121	99879	43
18	25 36	34 24	87494	167	12506	87616	169	12384	00122	99878	42
$\frac{19}{22}$	25 28	34 32	87661	168	12339	87785	168	12215	00123	99877	41
20	11 25 20	$0\ 34\ 40$	8.87829	166 166	11. 12171	8.87953	167	11.12047 11990	10.00124	9.99876	40 20
21	$23 12 \\ 25 4$	34 48 34 56	87990 88161	165	11839	88287	166	11713	00125	99873	38
23	24 56	35 4	88326	164	11674	88453	165	11547	00127	99873	37
24	24 48	35 12	88490	164	11510	88618	165	11382	00128	99872	36
25	11 24 40	0 35 20	8.88654	163	11.11346	8.88783	165	11.11217	10.00129	9.99871	35
26	24 32	35 28	88817	163	11183	88948	163	= 11052	00130	99870	34
27	24 24	35 36	88980	$162 \\ 169$	11020	89111	163	10889	00131	99869	33
28 20	24 16 94 9	35 52	89142	162	10808	89137	-161	10726	00132	99867	31
30	11 24 0	0.36 0	8 89464	161	11 10536	8 89598	162	11 10402	10.00134	9.99866	30
31	23 52	36 8	89625	159	10375	89760	160	10240	00135	99865	29
32	23 44	36 16	89784	159	10216	89920	160	10080	00136	99864	28
33	23 36	36 24	89943	159	10057	90080	160	09920	00137	99863	27
34	23 28	36 32	90102	158	09898	90240	159	09760	00138	99862	26
35	$11 \ 23 \ 20 \ 92 \ 10$	0 36 40	8.90260	157	11.09740	8.90399	158	11.09601 00119	10.00139 00140	9.99861	20
30 37	$23 12 \\ 23 4$	36 56	90417	157	09383	90715	157	09285	00140	99859	$\frac{24}{23}$
38	22 56	37 4	90730	155	09270	90872	157	09128	00142	99858	22
39	22 48	37 12	90885	155	09115	91029	156	08971	00143	99857	_21
40	11 22 40	0 37 20	8.91040	155	11.08960	8.91185	155	11.08815	10.00144	9.99856	20
41	22 32	37 28	91195	154	08805	91340	155	08660	00145	99855	19
42	22 24	37 36	91349	153	08651	91495	159	08505	00146	99854	18
40	$22 10 \\ 22 8$	$\frac{57}{37}$ $\frac{44}{52}$	91655	152	08345	91803	154	08330	00148	99852	16
45	11 22 0	0 38 0	8,91807	152	11.08193	8,91957	153	11.08043	10.00149	9,99851	15
46	21 52	38 8	91959	151	08041	92110	152	07890	00150	99850	14
47	21 44	38 16	92110	151	07890	92262	152	07738	00152	99848	13
48	21 36	38 24	92261	150	07739	92414	151	07586	00153	99847	12
49	$\frac{21}{11}\frac{28}{91}$	38 32	92411	100	07589	92000	101	0/435	10 00155	0.00015	11
50 51	$11 21 20 \\ -91 19$	0 38 40	8.92561 92710	149	07900	8, 92716 92866	150	07134	10.00155	9.99840	10
$52 \\ 52$	$21 12 \\ 21 4$	38 56	92859	149	07141	93016	149	06984	00157	99843	8
53	20 56	39 4	93007	147	06993	93165	148	06835	00158	99842	7
54	20 48	39 12	93154	147	06846	93313	149	06687	00159	99841	6
55	11 20 40	0 39 20	8,93301	147	11.06699	8.93462	147	11.06538	10.00160	9.99840	5
56	20 32	$\frac{39}{28}$	93448	146	06552	93609	147	06391	00161	99839	4
59	20 24	39-36	93594	146	06406	93496	147	06097	00162	99837	2
59	$20 \ 10$ $20 \ 8$	39 52	93885	145	06115	94049	146	05951	00164	99836	ĩ
60	20 0	40 0	94030	144	05970	94195	145	05805	00166	99834	0
М.	Hour P. M.	Hour A. M.	Cosine.	Diff.1'.	Secant.	Cotangent.	Diff.1'.	Tangent.	Cosecant.	Sine.	[М.
940											850

Log.	Sines,	Tangents,	and	Secants.
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50			А	Log.	A A Sines, 1a	igents, and B	1 660	B B	С		с	174º
M.	Hour A. M.	Hour P. M.	Sine.	Diff.	Cosecant.	Tangent.	Diff.	Cotangent.	Secant.	Diff.	Cosine.	М.
0	11 20 00	0 40 00	8.94030	0	11.05970	8.94195	0	11.05805	10.00166	0	9.99834	60
1	19 52	40 08	94174	2	05826	94340	$\frac{2}{1}$	05660	00167	0	99833	59
$\frac{2}{3}$	$19 \ 44 \\ 19 \ 36$	$40 \ 16 \ 40 \ 24$	94317	+ 7	05539	94485 94630	47	$05515 \\ 05370$	00168	0	99852 99831	- 58 - 57
4	19 28	40 32	94603	9	05397	94773	9	05227	00170	Ŏ	93830	56
$\overline{5}$	11 19 20	0 40 40	8.94746	11	11.05254	8.94917	11	11.05083	10.00171	0	9.99829	55
6	19 12	40 48	94887	13	05113	95060	13	04940	$00172 \\ 00172$	0	99828	54
7	$19 04 \\ 18 56$	40 50	95029 95170	$10 \\ 18$	04971 04830	95202	18	04798	00175	0	99827	52
9	18 48	41 12	95310	20	04690	95486	$\tilde{20}$	04514	00176	Ŏ	99824	51
10	11 18 40	0 41 20	8.95450	22	11.04550	8.95627	22	11.04373	10.00177	0	9.99823	50
11	18 32	41 28	95589	24	04411	95767	24	04233	00178	0	99822	49
$\frac{12}{13}$	$18 24 \\ 18 16$	$41 30 \\ 41 44$	95728	20 29	04272	96047	29	03953	00179	0	99820	47
14	18 08	41 52	96005	31	03995	96187	31	03813	00181	0	99819	46
15	11 18 00	0 42 00	8,96143	-33	11.03857	8.96325	33	11.03675	10.00183	0	9,99817	45
16	17 52	42 08	96280	35	03720	96464	35	03536	00184		99816	44
17	$17 44 \\ 17 36$	$\frac{42}{42}\frac{10}{24}$	96553	39	03447	96739	40	03261	00186	0	99813	$\frac{40}{42}$
$10 \\ 19$	17 28	$42 \ 32$	96689	42	03311	96877	42	03123	00187	Ő	99813	41
20	11 17 20	0 42 40	8.96825	44	11.03175	8.97013	44	11.02987	10.00188	0	9.99812	40
21	17 12	42 48	96960	46	03040	$97150 \\ 07985$	46	02850	00190	0.	99810	39
22	17 04	$42 \ 50 \ 43 \ 04$	97095	48 50	02905 02771	97285	-49	02715 02579	00191		99809	$\frac{38}{37}$
24	16 48	43 12	97363	53	02637	97556	53	02444	00193	Ŏ	99807	36
25	11 16 40	0 43 20	8.97496	55	11.02504	8.97691	55	11.02309	10.00194	1	9,99806	35
26	16 32	43 28	97629	57	02371	97825	58	02175	00196		99804	34
27	16 24	$43 \ 36$	97762	- 59 - 61	02238	97959	62	02041	00197		99803	33
29	16 10	43 52	98026	64	01974	98225	64	01775	00199	1	99801	31
30	11 16 00	0 44 00	8,98157	66	11.01843	8.98358	66	11.01642	10.00200	1	9.99800	30
31	15 52	44 08	98288	68	01712	98490	69	01510	00202	1	99798	29
32	15 44 15 26	44 16	98419	70	01581	98622	71	01378	00203		99797	28
34	15 30 15 28	44 32	98679	75	01321	98884	75	01116	00205	1	99795	26
35	11 15 20	0 44 40	8.98808	77	11.01192	8.99015	77	11.00985	10.00207	1	9.99793	25
36	15 12	44 48	98937	79	01063	99145	80	00855	00208	1	99792	24
37	15 04 11 56	44 56	99066	81	00934	99275	82	00725	00209		99791	23
39	14 48	45 12	99322	86	00678	99534	86	00466	00212	1 î	99788	21
40	11 14 40	0 45 20	8.99450	88	11.00550	8.99662	89	11.00338	10.00213	1	9.99787	20
41	14 32	45 28	99577	90	00423	99791	91	00209	00214	1	99786	19
42	$14 24 \\ 14 16$	40 36	99704	92	00296	9 00016	93	10 99951	00215	1	99780	18
44	14 10	45 52	99956	96	00044	00174	97	99826	00218	1	99782	16
45	11 14 00	0 46 00	9.00082	99	10.99918	9.00301	100	10.99699	10.00219	1	9.99781	15
46	13 52	46 08	00207	101	99793	00427	102	99573	00220	1	99780	14
47	13 44	46 16 16 24	00332	103	99668	00553	104	99447	00222		99778	13
49	$13 \ 50 \ 13 \ 28$	46 32	00581	107	99419	00805	108	99195	00224	1	99776	11
50	$\overline{11}$ 13 20	0 46 40	9.00704	110	10.99296	9.00930	111	10.99070	$10.\overline{00225}$	1	9.99775	10
51	$13 \ 12$	46 48	00828	112	99172	01055	113	98945	00227	1	99773	9
52	$13 04 \\ 12 56$	46 56	00951	114	99049	01179	115	98821	00228		99772	
54	$12 \ 50 \ 12 \ 48$	47 12	01196	118	98804	01303	120	98573	00223	1	99769	6
55	11 12 40	0 47 20	9.01318	121	10.98682	9.01550	122	10, 98450	10.00232	1	99768	$\overline{5}$
56	12 32	47 28	01440	123	98560	01673	124	98327	00233	1	99767	4
57 59	$12 24 \\ 19 16$	$\frac{47}{17}$ 36	01561	125	98439	01796	126	98204	00235	1 1	99765 99761	3
59	$12 10 \\ 12 08$	47 52	01803	$127 \\ 129$	98197	02040	131	97960	00237	1	99763	Ĩ
60	12 00	48 00	01923	132	98077	02162	133	97838	00239	1	99761	0
М.	Hour P. M.	Hour A. M.	Cosine.	Diff.	Secant.	Cotangent.	Diff.	Tangent.	Cosecant.	Diff.	Sine.	М.
95°			А		А	В		В	С		C	840
		-						1	1			

Seconds of time	1 5	2 8	3 *	4.8	5 *	6 *	7 *	
Prop. parts of cols. $\begin{cases} A \\ B \\ C \end{cases}$	$\begin{array}{c} 16\\17\\0\end{array}$	$\begin{array}{c} 33\\33\\0\end{array}$	49 50 0	$\begin{array}{c} 66\\ 66\\ 1\end{array}$	82 83 1	99 100 1	$ \begin{array}{r} 115 \\ 116 \\ 1 \end{array} $	

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Log.	Sines.	Tangents.	and	Secants
1.10	P			- CARLING

60			А	Log.	A A Sines, Tar	igents, an B	a sec	B	С		с	173°
М.	Hour A. M.	Hour P. M.	Sine.	Diff.	Cosecant.	Tangent.	Diff.	Cotangent.	Secant.	Diff.	Cosine.	М,
0	11 12 00	0 48 00	9.01923	0	10. 98077	9.02162	0	10.97838	10.00239	0	9.99761	60
1	11 52	48 08	02043	2	97957	02283	2	97717	00240	0	99760	59
2	11 44	48 16	02163	4	97837	02404	1 4	97596	00241	0	99759	58
3	11 36	48 24	02283	6	97717	02525	6	97475	00243	0	99757	57
-+	11 28	48 324	02402	1	97598	02645	8	97355	00244		99756	- 56
5	11 11 20 11 19	0 48 40	9.02520	9	10.97480	9.02766	9	10.97234	10.00245	0	9.99755	55
0	$11 12 \\ 11 01$	18 48	02639	11	97301	02885	11	97115	00247	0	99753	54
ŝ	10.56	48 50	02757	10	97249	03005	10	90999	00248	0	99752	53
9	10 48	49 12	02992	17	97008	03242	17	96758	00249	0	99751	51
10	11 10 40	0 49 20	9.03109	19	10.96891	9 03361	19	10 96639	10 00252	-0	0 007.18	50
11	10 32	49 28	03226	20	96774	03479	$\overline{21}$	96521	00253	ŏ	99747	49
12	10 24	49-36	03342	22	96658	03597	23	96403	00255	0	99745	48
13	$10 \ 16$	49 44	03458	24	96542	03714	24	96286	00256	0	99744	47
14	10 08	49 52	03574	26	96426	03832	26	96168	00258	0	99742	46
15	11 10 00	0 50 00	9.03690	28	10.96310	9.03948	28	10.96052	10.00259	0	9.99741	45
$16 \\ 17$	9 52	50 08	03805	30	96195	04065	30	95935	00260	0	99740	44
17	9 44	50 16	03920	31	96080	04181	32	95819	00262	0	99738	43
18	9 30	50 24	04034	25	90900	04297	26	95703	00263	0	99737	42
-10	$\frac{9}{11}$ $\frac{20}{20}$	0.50.40	0 01929	97	10 05799	0.01599	- 00	90087	10.00204	-0	99730	41
20	9 19	50 48	04202	39	95691	9. 04928	- 30	10. 99472 95357	10.00260 00267	1	9,99734	40
$\frac{21}{22}$	9 04	50 56	04490	41	95510	04758	41	95242	00207	1	99733	38
23	8 56	51 04	04603	43	95397	04873	43	95127	00200	1	99730	37
$\overline{24}$	8 48	51 12	04715	-14	95285	04987	45	95013	00272	i	99728	36
$\overline{25}$	11 8 40	0 51 20	9.04828	46	10.95172	9.05101	47	10.94899	10.00273	1	9.99727	35
26	8 32	$51 \ 28$	04940	48	95060	05214	49	94786	00274	ĩ	99726	34
27	8 24	$51 \ 36$	05052	50	94948	05328	51	94672	00276	1	99724	- 33
28	8 16	$51 \ 44$	05164	52	94836	05441	53	94559	00277	1	99723	32
29	8 08	51 52	05275	54	94725	05553	54	94447	00279	1	99721	31
30	11 8 00	$0\ 52\ 00$	9.05386	56	10.94614	9.05666	56	10.94334	10.00280	1	9.99720	-30
31	$\frac{7}{2}$ 52	52 08	05497	57	94503	05778	58	94222	00282	1	99718	29
32	7 90	52 16	05607	09	94393	05890	00	94110	00283		99717	28
- 00 - 94	7 98	52 22	05897	63	94200 0.1172	06113	02	95998	00284	1	99710	21
- 25	120 11 7 20	0.52.40	0.05027	65	10 01062	0 06221	88	<u>30001</u> 10 02778	10 00280	1	99714	20
36	7120 712	52 48	06046	67	93954	06335	68	93665	00289	1	9.99715	20
37	704	52 56	06155	69	93845	06445	69	93555	00290	i	99710	23
38	6 56	53 04	06264	70	93736	06556	71	93444	00292	1	99708	22
39	6 48	$53 \ 12$	06372	72	93628	06666	73	93334	00293	1	99707	21
40	11 6 40	0 53 20	9.06481	74	10.93519	9.06775	75	10.93225	10.00295	1	9.99705	$\overline{20}$
41	6 32	$53 \ 28$	06589	76	93411	06885	77	93115	00296	1	99704	19
42	6 24	$53 \ 36$	06696	78	93304	06994	79	93006	00298	1	99702	18
43	6 16	53 44	06804	80	93196	07103	81	92897	00299	1	99701	17
++	6 08	03 02	06911	81	93089	07211	83	92789	00301	1	99699	$\frac{16}{10}$
+0 10	11 6 00	0 04 00	9.07018	83	10.92982 02076	9.07320	84	10.92680	10.00302	1	9,99698	15
40	0 02 5 41	54 08	07124	87	92870	07526	80	92072	00304	1	99090	14
48	5 36	54 24	07337	89	92663	07643	90	92357	00305	1	99693	10
49	528	54 32	07442	91	92558	07751	92	92249	00308	î	99692	11
50	11 5 20	0 54 40	9,07548	93	10.92452	9.07858	94	10.92142	10.00310	1	9,99690	10
51	$5 \ 12$	54 48	07653	94	92347	07964	96	92036	00311	ĩ	99689	9
52	5 04	54 56	07758	96	92242	08071	98	91929	+ 00313	1	99687	8
53	4 56	$55 \ 04$	07863	98	92137	08177	99	91823	00314	1	99686	7
54	4 48	55 12	07968	100	92032	08283	101	91717	00316	1	99684	6
55	$11 \ 4 \ 40$	05520	9.08072	102	10.91928	9.08389	103	10.91611	10.00317	1	9.99683	5
56 57	4 32	- 55-28 55-90	08176	104	91824	08495	105	91505	00319		99681	4
50	4 24	00 00 55 11	08280	$100 \\ 107$	91720	08000	107	91400	00320	1	99080	3
59	4 08	55 59	08186	109	91514	08810	111	91190	00322	1	99677	1
60	$\frac{1}{4}$ 00	56 00	08589	111	91411	08914	113	91086	00325	1	99675	0
W	Hours	Hour	Cosina		Coort	Cotopoort	<u></u>	Tangat	0.000			
M. 0.00	HOUT P, M,	HOUF A, M.	LOSINC.	DIII.	Secant.	Cotangent.	рш.	rangent.	Cosecant.	Diff.	sine.	M.
90~			A		A	в		ы	C		C	839

Seconds of time	1*	2 8	3 *	-1 s	5 *	6 1	7 *
Prop. parts of cols. $\begin{cases} A \\ B \\ C \end{cases}$	14 14 0	$\begin{smallmatrix} 28\\28\\0 \end{smallmatrix}$	$\begin{array}{c} 42\\ 42\\ 1\end{array}$	$56 \\ 56 \\ 1$		83 84 1	$97 \\ 98 \\ 1$

TA	BT	Æ	44.
, L .			

70			А	Log	A Sines, T	angents, a B	na se	ecants. B	С		C	1720
М.	Hour A. M.	Hour P. M.	Sine.	Diff.	Cosecant.	Tangent.	Diff.	Cotangent.	Secant.	Diff.	Cosine.	M.
0	11 4 0	0.56 0	9,08589	0	10, 91411	9,08914	0	10,91086	10,00325	0	9, 99675	60
1	3 52	56 8	08692	2	91308	09019	2	90981	00326	0	99674	59
2	3 44	$56\ 16$	08795	3	91205	09123	3	90877	00328	0	99672	58
3	3 36	56 24	08897	5	91103	09227	5	90773	00330	0	99670	57
4	3 28	$\frac{56}{2}$	08999	0	91001	09330		90670	00331	0	99669	56
6	11 3 20	0 56 40	9.09101	10	10, 90899	9.09434	10	10.90566	10.00333	0	9.99667	50
	312 31	56 56	09202	11	90696	09640	: 11	90360	00336	0	99661	53
8	256	57 4	09405	13	90595	09742	13	90258	00337	ŏ	99663	52
9	2 48	$57 \ 12$	09506	14	90494	09845	15	90155	00339	0	99661	51
10	$11 \ 2 \ 40$	$0\ 57\ 20$	9.09606	16	10.90394	9.09947	16	10,90053	10.00341	0	9.99659	50
11	2 32	57 28	09707	18	90293	10049	18	89951	00342	0	99658	49
12	224	57 36	09807	19	90193	10150	20	89850	00344	0	99656	48
10	$210 \\ 28$	57 59	10006	22	80095	10252	-21 -93	89748	00345	0	99000	4/
15	$\frac{2}{11}$ $\frac{0}{2}$ $\frac{0}{1}$	0.58 0	9 10106	21	10 89894	9 10454	94	10 89546	10 00349		9 99651	45
$16 \\ 16$	11 52	58 8	10205	$\tilde{26}$	89795	10555	$\overline{26}$	89445	00350	ŏ	99650	44
17	1 44	$58\ 16$	10304	27	89696	10656	28	89344	00352	0	99648	43
18	1 36	58 24	10402	29	89598	10756	29	89244	00353	1	99647	42
19	1 28	58 32	10501	_30	89499	10856	31	89144	00355	1	99645	41
20^{-01}	$11 1 20 \\ 1 10$	05840	9.10599	32	10.89401	9.10956	33	10.89044	10.00357	1	9.99643	40
21	$1 12 \\ 1 1$	58 48 58 58	10097	- 34 - 25	89303	11050	26	88944	00358	1	99642	39
$\frac{44}{23}$	0.56	50 00 59 4	10795	37	89107	11254	37	88746	00369	1	99638	37
24	0 48	59 12	10990	38	89010	11353	39	88647	00363	1	99637	36
$\overline{25}$	11 0 40	0 59 20	9.11087	40	10.88913	9.11452	41	10.88548	10.00365	1	9.99635	35
26	0.32	$59\ 28$	11184	42	88816	11551	42	88449	00367	1	99633	34
27	0 24	59 36	11281	43	88719	11649	44	88351	00368	1	99632	33
28		59 44	11377	40	88623	11747	46	88253	00370	1	99630	32
$\frac{29}{20}$		09 02	0 11570	40	00020	0 11049	-10	00100	10.00979	1	99029	$\frac{31}{90}$
31	10 59 52		9.11570	50	10. 88430	9.11943	49	10. 88007 87960	10.00375	1	9.99627	30
32	59 44	0 16	11761	51	88239	12138	52	87862	00376	1	99624	28
33	59 36	024	11857	53	88143	12235	54	87765	00378	1	99622	$\bar{27}$
34	$59\ 28$	0.32	11952	54	88048	12332	55	87668	00380	1	99620	26
35	$10\ 59\ 20$	1 0 40	9.12047	56	10.87953	9.12428	57	10.87572	10.00382	1	9.99618	25
36	$59\ 12$	0.48	12142	58	87858	12525	59	87475	00383	1	99617	24
38	$ \begin{array}{ccc} 39 & 4 \\ 58 & 56 \end{array} $	0.00	12230	- 09 - 81	87660	12621	62	87983	00385	1	99010	23
39	58 + 8	1 12	12331	62	87575	12813	64	87187	00388	1	99612	$\tilde{21}$
40	10 58 40	1 1 20	9, 12519	64	10.87481	9, 12909	65	10.87091	10.00390	1	9,99610	$\frac{-20}{20}$
41	$58 \ 32$	1 28	12612	66	87388	13004	67	86996	00392	1	99608	19
42	58 24	$1 \ 36$	12706	67	87294	13099	68	86901	00393	1	99607	18
43	$58\ 16$	1 44	12799	69	87201	13194	70	86806	00395	1	99605	17
44	08 8	$\frac{1}{1}$ $\frac{32}{2}$	12892	-70	8/108	13289	12	86711	00397	-1-	99603	16
40 16	$10 \ 57 \ 59$		9,12980	71	10, 87015	9.13384	13	10.80016	10.00399	1	9.99601	15
47	57 44	$2 - 6 \\ 2 - 16$	13171	75	86829	13573	77	86497	00400	1	99598	14
48	$57 \ 36$	$\frac{2}{2}$ $\frac{10}{24}$	13263	77	86737	13667	78	86333	00404	1	99596	12^{10}
49	57 28	2 32	13355	78	86645	13761	80	86239	00405	1	99595	11
50	$10 \ 57 \ 20$	1 2 40	9.13447	80	10,86553	9.13854	81	10.86146	10.00407	1	9.99593	10
51	57 12	248	13539	82	86461	13948	83	86052	00409	1	99591	9
$\begin{bmatrix} 52 \\ 52 \end{bmatrix}$	56 56	$\frac{2}{9}$ $\frac{56}{1}$	13630	83	86370	14041	80	85959	00411	1	99589	87
54	56, 48	3 12	13/22	87	86187	14104	88	85773	00412	2	99088	Ŕ
55	10,56,40	1 3 20	9.13904	88	10. 86096	9 14320	-90	10.85680	10.00416		9 99581	5
56	56 32	328	13994	90	86006	14412	91	85588	00418	2	99582	4
57	$56\ 24$	3 36	14085	91	85915	14504	93	85496	00419	2	99581	3
58	$56\ 16$	3 44	14175	93	85825	14597	95	85403	00421	2	99579	2
- 59 60	56 8	352	14266	95 0e	85734	14688	96	85312	00423	2	99577	1
00	0 00	+ 0	14990	90	00044	14780	98	59220	00420	2	99919	0
М.	Hour P. M.	Hour A.M.	Cosine,	Diff.	Secant.	Cotangent.	Diff.	Tangent.	Cosecant.	Diff.	Sine.	М.
970			A		А	В		В	С		С	820
												_

Seconds of time	1ª	23	35	4.	5.	63	7*
Prop. parts of cols. $\begin{cases} A \\ B \\ C \end{cases}$	12 12 0	24 24	36 37	48 49	60 61	72 73	84 86

Page 616]

Log.	Sines.	Tangents.	and	Secants
LOG	CHICG:	Tung on tes	CLARCE.	NOCOLLIC:

80			A	.og. i	Sines, 1an A	gents, and B	Seca	unts. B	С		c	1710
М.	Honr A. M.	Hour P. M.	Sine.	Diff,	Cosecant.	Tangent.	Diff.	Cotangent.	Secant.	Diff.	Cosine.	M.
0	10 56 0	1 4 0	9.14356	0	10.85644	9.14780	0	10.85220	10.00425	0	9.99575	60
1	55 52	$\frac{4}{1}$	14445	1	85555	14872	1	85128	00426	0	99574	59
2 2	00 11 55 36	* + 16 1 91	14030	3	80400 85376	14963	3	85037	00428	0	99572 99570	58 57
4	55 28	4 32	14714	6	85286	15145	6	84855	00430	Ő	99568	56
5	10 55 20	1 4 40	9.14803	7	10.85197	9.15236	7	10.84764	10.00434	0	9.99566	55
6	55 12	4 48	14891	8	85109	15327	.9	84673	00435	0	99565	54
7	55 - 4 51 56	$\frac{1}{5}$ $\frac{36}{1}$	14980	10	85020 \$4021	15417	$\frac{10}{12}$	84583	00437	0	99563	53
9	$54 \ 50 \ 54 \ 48$	5 + 4 = 5 + 12	15157	13	84843	15508 15598	$\frac{12}{13}$	84402	00439	ő	99559	02 51
10	10 54 40	1 5 20	9.15245	14	10.84755	9.15688	14	10.84312	10.00443	$\overline{0}$	9,99557	50
11	$54 \ 32$	5 28	15333	16	84667	15777	16	84223	00444	0	99556	49
12	54 24	5 36	15421	17	84579	$15867 \cdot 1505c$	17	84133	00446	0	99554	48
13	54 10 54 8	0 11 5 52	15596	20	84404	16046	19	83954	00448	0	99002 99550	16
$\frac{11}{15}$	$\frac{01}{10}$ $\frac{01}{54}$ 0	1 6 0	9, 15683	21	$\frac{01101}{10,84317}$	9, 16135	22	10.83865	10.00452	-0	9 99548	$\frac{40}{45}$
16	53 52	6 8	15770	23	84230	16224	$\overline{23}$	83776	00454	1	99546	44
17	53 44	6 16	15857	- 24	84143	16312	25	* 83688	00455	1	99545	43
18	53 36	624 629	15944	$20 \\ 97$	84056 82070	16401	26 97	83599	00457	1	99543	42
$\frac{19}{90}$	$\frac{00.20}{10.53.20}$	1 6 40	9 16116		10 83881	9 16577	-21-29	10 83193	10 00.181	$\frac{1}{1}$	99041	41
$\frac{20}{21}$	$ 53 20 \\ 53 12 $	6 48	16203	$\frac{20}{30}$	83797	16665	$\frac{20}{30}$	83335	00463	î	99537	39
22	53 4	6 56	16289	31	83711	16753	32	83247	00465	1	99535	38
23	52 56	7 4 7 10	16374	32	83626	16841	33	83159	00467	1	99533	37
24	$\frac{52}{10}$ $\frac{48}{59}$ $\frac{10}{10}$	$\frac{7.12}{1.7.90}$	10400	34	83040	16928	30	83072	00408		99532	36
20 26	$ \begin{array}{r} 10 & 52 & 40 \\ 52 & 32 \end{array} $	1 7 20 7 28	9, 10040	37	10, 85455 83369	9.17016	30 37	10. 82984 82897	00472	1	9,99530	30
27	52 24	7 36	16716	38	83284	17190	39	82810	00474	î	99526	33
28	$52 \ 16$	7 44	16801	39	83199	17277	40	82723	00476	1	99524	32
29	52 8	752	16886	41	83114	17363	42	82637	00478	1	99522	31
30 21	$\begin{array}{cccccccccccccccccccccccccccccccccccc$	$1 \begin{array}{c} 8 \\ 9 \end{array}$	9.16970 17055	42	10.83030	9.17450 17536	43	10.82550	10.00480 00.182	1	9,99520	30
$\frac{31}{32}$	$51 52 \\ 51 44$	8 16	17055	45	82945	17530	40	82378	00482	1	99518	29
33	$51 \ 36$	8 24	17223	47	82777	17708	48	82292	00485	î	99515	27
34	51 28	8 32	17307	48	82693	17794	49	82206	00487 ·	1	99513	26
35	$10 \ 51 \ 20 \ 51 \ 10$	1 8 40	9.17391	49	10.82609	9.17880	50	10.82120	10.00489	1	9.99511	25
$\frac{30}{37}$	$51 12 \\ 51 4$	$848 \\ 856$	17474	$\frac{51}{52}$	82020 82442	17965	- 52 - 53	82035	00491	1	. 99509	24
38	50 56	9 4	17641	54	82359	18136	55	81864	00495	1	99505	$\frac{20}{22}$
39	50 48	9 12	17724°	55	82276	18221	56	81779	00497	1	99503	21
40	$10 \ 50 \ 40$	1 9 20	9.17807	56	10.82193	9.18306	58	10.81694	10.00499	1	9.99501	20
41	50 32	9 28	17890 17079	58	82110	18391	59 61	81609	00501	1	99499	19
42 43	$50 24 \\ 50 16$	9 50	17975	61	82027	18560	61 62	81525	00505	1	99497	18
44	50 8	952	18137	62	81863	18644	63	81356	00506	1	99494	16
45	$10 \ 50 \ 0$	1 10 0	9.18220	63	10.81780	9.18728	65	10.81272	10.00508	1	9.99492	15
46	49 52	10 8	18302	65	81698	18812	66	81188	00510	1	99490	.14
47	49 44	$10 \ 16 \ 10 \ 21$	18383	66	81617	18896	68 69	81104 81021	00512	1 9	99488	13
49	49 28	$10 \ 24 \ 10 \ 32$	18547	69	81453	19063	71	80937	00514	$1-\tilde{2}$	99484	11
50	10 49 20	1 10 40	9.18628	71	10.81372	9.19146	72	10.80854	10.00518	2	9.99482	10
51	49 12	10 48	18709	72	81291	19229	74	80771	00520	2	99480	- 9
52	$\frac{49}{10}$	1056	18790	73	81210	19312	75	* 80688	00522	2	99478	8
- 00 - 54	48 50	11 19	18871	10	81129 • 81048	19595	70	80000	00524	2	99470	
55	10 48 40	1 11 20	9, 19033	78	10.80967	9, 19561	79	10.80439	10.00528	2	9,99472	5
56	48 32	11 28	19113	79	80887	19643	81	80357	00530	$\frac{1}{2}$	99470	4
57	48 24	11 36	19193	80	80807	19725	82	80275	00532	2	99468	3
58	48 16	$11 44 \\ 11 59$	19273 10252	82	80727	19807	84	80193	00534	2	99466	$\frac{2}{1}$
60	48 0	$\begin{array}{ccc} 11 & 32 \\ 12 & 0 \end{array}$	19333	85	80567	19889	87	80029	00538	$\frac{1}{2}$	99462	0
М.	Hour P. M.	Hour A.M.	Cosine.	Diff.	Secant.	Cotangent.	Diff.	Tangent.	Cosecant.	Diff.	Sine.	М.
980			А		А	, В		В	С		С	81°
-		_										

Seconds of time	1s	25	35	48	55	6s	7s
Prop. parts of cols. $\begin{cases} A \\ B \\ C \end{cases}$	11 11 0	$\begin{smallmatrix} 21\\22\\0\end{smallmatrix}$	$ \begin{array}{c} 32 \\ 32 \\ 1 \end{array} $	42 43 1	53 54 1	$\begin{smallmatrix} 63\\65\\1 \end{smallmatrix}$	$\begin{array}{c} 74 \\ 76 \\ 2 \end{array}$

	Log.	Sines,	Tangents,	and	Secants.	
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90			А	0	A	В		в	С		С	170°
М.	Hour A.M.	Hour P. M.	Sine.	Diff.	Cosecant.	Tangent.	Diff.	Cotangent.	Secant.	Diff.	Cosine.	М,
0	10 48 0	1 12 0	9, 19433	0	10.80567	9. 19971	0	10.80029	10.00538	0	9.99462	60
1	47 52	12 8	19513	1	80487	20053	1	79947	00540	0	99460	59
$\frac{2}{2}$	47 44	12 16	19592	3	80408	20134	3	79865	00542	0	99458	$\overline{58}$
3	47 36	$12 24 \\ 10 20$	19672 10751	4 5	80328	20216	+ 5	79784	00544	0	99406	07 56
4	47 28	$\frac{12}{1}\frac{32}{10}$	19701	- 0	10 80170	0.20231	-6	10 70699	10.00518		0.00159	55
0 6	10 47 20	1 12 40 19 18	9.19860	8	80091	20459	8	79541	00550	0	99450	51
7	47 4	$12 \ 56$	19988	9	80012	20540	9	79460	00552	0	99448	53
8	46 56	13 4	20067	10	79933	20621	10	79379	00554	0	99446	52
- 9	46 48	$13 \ 12$	20145	11	79855	20701	12	79299	00556		99444	51
10	$10 \ 46 \ 40$	$1 \ 13 \ 20$	9.20223	13	10.79777	9.20782	13	10.79218	10.00558	0	9.99442	50
11	46 32	13 28	20302	14	79698	20862	14	79138	00560	0	99440	49
$\frac{12}{12}$	46 24	13 36	20380	10	79620	20942	10	79058	00561	0	99438	48
14	46 10	13 + 13 + 13 + 13 + 52	20400	18	79465	211022	18	78898	00566	0	99434	46
$\frac{11}{15}$	$\frac{10}{10}$ $\frac{0}{46}$ 0	1 14 0	9.20613	19	10.79387	9.21182	$\frac{10}{19}$	10.78818	10.00568		9.99432	45
16	45 52	14 8	20691	$\hat{20}$	79309	21261	21	78739	00571	1	. 99429	44
17	45 44	$14 \ 16$	20768	21	79232	21341	22	78659	00573	1	99427	43
18	45 36	14 24	20845	$\frac{23}{2}$	79155	21420	23	78580	00575	1	99425	42
19	45 28	14 32	20922	24	79078	21499	20	78501	00577		99423	41
$\frac{20}{91}$	$10 \ 45 \ 20$	1 14 40	9.20999	25	10. 79001	9.21578 91857	26	10. 78422	10.00579		9.99421	40
$\frac{21}{99}$	40 12	$14 40 \\ 14 56$	21070	20	78924	21007	28	78964	00583	1	99419	38
23	44 56	15 + 15	21100	29	78771	21814	$\frac{20}{30}$	78186	00585	1	99415	37
24	44 48	$15 \ 12$	21306	30	78694	21893	31	78107	00587	ĩ	99413	36
25	10 44 40	1 15 20	9.21382	31	10.78618	9.21971	32	10.78029	10.00589	1	9.99411	35
26	44 32	15 28	21458	33	78542	22049	34	77951	00591	1	99409	34
27	44 24	15 36	21534	34	78466	22127	35	77873	00593	1	99407	33
$\frac{28}{20}$	44 16	10 44 15 59	21610	30	78390	22205	36	77717	00508		99404	32
29	10 11 0	$\frac{10.02}{1.16}$	21065	- 20	10 78990	0.99361	30	10 77630	10.00600	$\left -\frac{1}{1} \right $	0 00.100	30
31	43 52	168	21836	39	78164	22438	40	77562	00602	1	99398	29
$3\hat{2}$	43 44	16 16	21912	40	78088	22516	41	77484	00604	1	99396	28
33	$43 \ 36$	16 24	21987	42	78013	22593	43	77407	00606	1	99394	27
34	43 28	$16 \ 32$	22062	43	77938	22670	_44	77330	00608	1	99392	26
35	$10 \ 43 \ 20 \ 49 \ 10$	1 16 40	9.22137	44	10.77863	9. 22747	45	10.77253	10.00610	1	9.99390	25
36	43 12 13 1	$16 \ 48 \\ 16 \ 56$	22211	40	77714	22824	47	77000	00612	1	99388	24
38	42 56	10.00 17.4	22361	48	77639	22901	49	77023	00617	Î	99383	22
39	42 48	17 12	22435	49	77565	23054	50	76946	00619	1	99381	21
40	10 42 40	1 17 20	9.22509	50	10.77491	9.23130	52	10.76870	10.00621	1	9.99379	$\overline{20}$
41	$42 \ 32$	17 28	22583	52	77417	23206	53	76794	00623	1	99377	19
42	42 24	17 36	22657	53	77343	23283	54	76717	00625		99375	18
43	42 16	17 44	22731	04	77269	23359	- 00 57	76565	00628	2	99372	16
44	42 0	$\frac{17.52}{1.18.0}$	0.99878	57	10 77199	0.92510	-58	10.76100	10.00632		0 00368	$\frac{10}{15}$
46	41 52	18 8	22952	58	77048	23586	60	76414	00634	$\frac{2}{2}$	99366	14
47	41 44	18 16	23025	59	76975	23661	61	76339	00636	2	99364	13
48	$41 \ 36$	18 24	23098	60	76902	23737	62	76263	00638	2	99362	12
49	41 28	18 32	23171	62	76829	23812	_63_	76188	00641	2	99359	11
50	$10 \ 41 \ 20$	1 18 40	9. 23244	63	10.76756	9.23887	65	10.76113	10.00643	$\frac{2}{2}$	9.99357	10
01 59	+1112	18 48	23317	64	76083	23962	60	75062	00645	2	99300	9
$\frac{52}{53}$	40 56	19 4	23362	67	76538	24037	69	75888	00649	$\frac{2}{2}$	99351	
54	40 48	19 12	23535	68	76465	24186	70	75814	00652	$\overline{2}$	99348	6
55	10 40 40	1 19 20	9.23607	69	10.76393	9. 24261	71	10.75739	10.00654	$\overline{2}$	9.99346	5
56	40 32	19 28	23679	71	76321	24335	73	75665	00656	2	99344	4
57	40 24	19 36	23752	72	76248	24410	74	75590	00658	$\begin{vmatrix} 2\\ a \end{vmatrix}$	99342	3
08 50	40 16 20 0E	19 44 10 59	23823	71	76177	24484	10	75119	00660		99340	1
60	40 - 8 40 - 0	20 0	23967	76	76033	24632	78	75368	00665	2	99335	0
М.	Hour P. M.	Hour A. M.	Cosine.	Diff.	Secant.	Cotangent.	Diff.	Tangent.	Coseeant.	Diff.	Sine.	М.
990			A		А	В		в	С		С	80°

Seconds of time	15	28	38	48	5s	63	75
Prop. parts of cols. $\begin{cases} A \\ B \\ C \end{cases}$	9 10 0	19 19 1	$ \begin{array}{c} 28 \\ 29 \\ 1 \end{array} $	$ 38 \\ 39 \\ 1 $	47 49 1		$\begin{array}{c} 66\\ 68\\ 2\end{array}$

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Log. Sines. Tangents, and Secants.

10°			А		A	В		В	С		С	169°
М.	Hour A. M.	Hour P. M.	Sine.	Diff.	Cosecant.	Tangent.	Diff.	Cotangent.	Secant.	Diff.	Cosine.	М.
0	$10 \ 40 \ 0$	1 20 0	9,23967	0	10,76033	9.24632	0	10.75368	10.00665	0	9,99335	60
1	$39 52 \\ 39 11$	20 8 20 16	$\frac{24059}{24110}$	2	75901	24700	1	75294	00669	0	99333	- 59 - 58
3	39 36	$\frac{20}{20}$ $\frac{10}{24}$	24181	3	75819	24853	4	75147	00672	0	99328	57
4	39 28	20 32	24253	5	75747	24926	5	75074	00674	0	99326	56
5	$10 \ 39 \ 20$	1 20 40	9,24324	$\frac{6}{7}$	10.75676 75605	9,25000	67	10.75000	10.00676	0	9.99324	55
67	$ 39 12 \\ 39 4 $	$20 \ 48 \\ 20 \ 56$	24395	8	75000 75534	25073 25146	8	74927	00678	0	99322 99319	04 53
s	$\frac{38}{56}$	21 4	24536	9	75464	25219	9	74781	00683	Ő	99317	52
9	38 48	21 12	24607	10	75393	25292	11	74708	00685	0	99315	51
10	$10 \ 38 \ 40$	1 21 20 21 28	9.24677 24748	11	10.75323 75252	9,25369 25137	12	10.74635 74563	10.00687	0	9.99313	50
$\frac{11}{12}$	38 24	$ \begin{array}{c} 21 & 26 \\ 21 & 36 \end{array} $	24748	14	75182	. 25510	14	74490	00692	0	99308	48
13	38 16	21 44	24888	15	75112	25582	15	74418	00694	1	99306	47
14	38 8	21 52	24958	$\frac{16}{17}$	75042	25655	$\frac{16}{10}$	74345	00696	1	99304	46
$\frac{15}{16}$	$10 \ 38 \ 0 \ 37 \ 52$	122 0 29 8	9,25028	18	10. 74972 74902	9.25727	18	10. 74273 74201	10.00699 00701	1	9,99301	40
17	37 44	22 16	25168	19	74832	25871	$\frac{10}{20}$	74129	00703	î	99297	43
18	$37 \ 36$	22 24	25237	20	74763	25943	21	74057	00706	1	99294	42
19	$\frac{37 28}{10 07 00}$	$\frac{22}{1}$ $\frac{32}{10}$	25307	22	74693	26015	22	73985	00708	1	99292	$\frac{41}{10}$
$\frac{20}{21}$	$10 \ 37 \ 20 \ 37 \ 12$	$12240 \\ 2248$	9.25376	23	10. 74024 74555	9.20080 26158	24 25	10.73914 73842	00710	1	9,99290	40 39
$\frac{21}{22}$	$37 \frac{12}{4}$	$\frac{22}{22}$ 56	25514	$\overline{25}$	74486	26229	$\overline{26}$	73771	00715	î	99285	38
23	36 56	23 4	25583	26	74417	26301	27	73699	00717	1	99283	37
24	$\frac{36}{10}$ $\frac{48}{10}$	$\frac{23}{1}\frac{12}{29}$	25652	21	14348	26372	$\frac{28}{20}$	10 72557	00719	$\frac{1}{1}$	99281	30
20 26	$10 \ 36 \ 40$ $36 \ 32$	$ \begin{array}{c} 1 & 23 & 20 \\ & 23 & 28 \end{array} $	9.25721	$\frac{20}{30}$	74210	9.20443 26514	$\frac{29}{31}$	73486	00724	1	999276	$\frac{35}{34}$
27	36 24	23 36	25858	31	74142	26585	32	73415	00726	1	99274	33
28	36 16	23 44	25927	32	74073	26655	33	73345	00729 00721		99271	32
$\frac{29}{30}$	$\frac{30}{10}$ $\frac{30}{36}$ $\frac{30}{0}$	$\frac{25.02}{1.94.0}$	9 26063	34	$\frac{74003}{10,73937}$	9 26797	35	10.73203	10.00733	$\frac{1}{1}$	$\frac{33203}{9,99267}$	30
31	35 52	24 8	26131	35	73869	26867	36	73133	00736	î	99264	29
32	35 44	24 16	26199	36	73801	26937	38	73063	00738	1	99262	28
33	$35 36 \\ 35 28$	$24 24 \\ 24 32$	26267 26335	38	73733	27008	39	72992	00740		99260	26
$\frac{34}{35}$	$\frac{55}{10}$ $\frac{26}{20}$	$\frac{24.32}{1.24.40}$	9.26403	40	$\frac{73000}{10,73597}$	9.27148	41	10.72852	10,00745	$\frac{1}{1}$	9, 99255	$\frac{20}{25}$
36	35 12	24 48	26470	41	73530	27218	42	72782	00748	1	99252	24
37	35 4	24 56	26538	42	73462	27288	44	72712	00750	1	99250	23
38	34 50	20 + 4 25 + 12	20000	43	73328	27337	40	72573	00752	$\frac{1}{2}$	99248	$\frac{44}{21}$
40	$10 \ 34 \ 40$	1 25 20	9.26739	45	10.73261	9.27496	47	10.72504	10.00757	$\overline{2}$	9.99243	20
41	$34 \ 32$	25 28	26806	47	73194	27566	48	72434	00759	2	99241	19
42	34 24	25 36	26873	48	73127	27635	49	72365	00762	2	99238	18
44	34 10 34 8	25 + 4 25 + 52	27007	50	72993	27773	$51 \\ 52$	72227	00767	$\frac{2}{2}$	99233	16
45	10 34 0	1 26 0	9.27073	51	10.72927	9.27842	53	10.72158	10.00769	$\overline{2}$	9,99231	15
46	33 52	26 8	27140	52	72860	27911	54	72089	00771	$\begin{vmatrix} 2 \\ 0 \end{vmatrix}$	99229	14
47	$33 + 1 \\ 32 + 26$	26 16 26 21	27206	55	72794	27980	- 00 - 56	72020	00774	2	99226	$13 \\ 12$
49	33 28	$26 \ 32$	27339	56	72661	28117	58	71883	00779	$\overline{2}$	99221	11
50	$10 \ 33 \ 20$	1 26 40	9.27405	57	10.72595	9.28186	59	10.71814	10.00781	$\frac{2}{2}$	9,99219	10
51	33 12	$ 26 48 \\ 26 56 $	$27471 \\ 27527$	58	72529	28254	60	71746	00783	$\begin{vmatrix} 2\\ 9 \end{vmatrix}$	99217	9
- 52 - 53	32 56	20.00 27.4	27602	60	72398	28323 28391	62	71609	00788	2	99212	7
54	32 48	27 12	27668	61	72332	28459	63	71541	00791	2	99209	6
55	$10 \ 32 \ 40$	$1\ 27\ 20$	9.27734	63	10.72266	9.28527	65	10.71473	10.00793	2	9.99207	5
56 57	$\begin{array}{c} 32 & 32 \\ 32 & 24 \end{array}$	27 28	27799 27861	64 65	72201	28095 28662	67	71405	00796	$\begin{vmatrix} 2\\ 2 \end{vmatrix}$	99204	$\frac{4}{3}$
58	32 16	27 44	27930	66	72070	28730	68	71270	00800	2	99200	2
59	32 8	27 52	27995	67	72005	28798	69	71202	00803	2	99197	1
60	32 0	28 0	28060	68	/1940	28865		/1135	00805	2	99199	0
м.	Hour P. M.	Hour A. M.	Cosine.	Diff.	Secant.	Cotangent.	Diff.	Tangent.	Cosecant.	Diff.	Sine.	M.
100	0		A		A	В		В	C		C	790

Seconds of time	. 18	2.	3*	4 ^s	$\tilde{5}^{s}$	6 ³	78
Prop. parts of cols. $\begin{cases} A \\ B \\ C \end{cases}$	9 9 0	17 18 1	$\begin{smallmatrix} 26\\26\\1 \end{smallmatrix}$	$\begin{array}{c} 34\\35\\1\end{array}$	43 44 1	$\begin{smallmatrix} 51\\53\\2 \end{smallmatrix}$	$\begin{smallmatrix} 60\\62\\2 \end{smallmatrix}$

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	Log.	Sines,	Tangents,	and	Secants.	
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M. Itour s. x. Hour s. y. Bune. Difl. Cossecont. Tangent. Difl. Conduct. Difl. Cosine. M. 0 10 32 0 1 280 9 2800 0 10.71135 10.00805 0 9.9112 55 2 31 44 281 56 28125 1 71746 29007 3 70333 008118 0 991187 55 1 31 28 28 28234 3 10.71146 29007 5 10.70189 10.008118 0 9.91187 55 6 31 12 28 44 285127 7 71485 291368 6 10.70189 10.00818 0 9.91175 55 9 30 46 29 12 28573 17 11335 28408 10 70548 10.00830 0 9.91175 45 13 30 24 28505 29056 15 770268 10.00843 19.91175 55 </th <th>110</th> <th></th> <th></th> <th>А</th> <th>0</th> <th>A</th> <th>В</th> <th></th> <th>В</th> <th>С</th> <th></th> <th>С</th> <th>168°</th>	110			А	0	A	В		В	С		С	168°
$ \begin{array}{ c c c c c c c c c c c c c c c c c c c$	М.	Hour A. M.	Hour P. M.	Sine.	Diff.	Cosecant.	Tangent.	Diff.	Cotangent.	Secant.	Diff.	Cosine.	М.
$ \begin{array}{c c c c c c c c c c c c c c c c c c c $	0	10 32 0	1 28 0	9.28060	0	10.71940	9, 28865	0	10.71135	10.00805	0	9.99195	60
$ \begin{array}{cccccccccccccccccccccccccccccccccccc$	1	31 52	28 8	28125		71875	28933		71067	00808	0	99192	59
4 31 55 95 32 58 10 7168 99134 4 70686 00815 0 99185 55 5 10 12 12 44 92834 5 10.7169 10.00759 10.00815 0 99185 55 6 30 56 29 4 28577 7 71438 29402 9 70585 00825 0 99117 55 9 0.4 2912 29 29841 9 71350 29305 11 10.70450 00825 0 99117 55 10 30 0 2946 10 71235 99305 11 10.70450 00835 0 991167 45 13 30 16 29452 28866 13 70335 00835 1 991167 45 14 30 2952 28960 14 701040 29077 10 70236	2	31 + 4 + 91 - 96	28 16	28190	2	71810	29000	2	71000	00810	0	99190	$\frac{58}{57}$
	-0 -4	31 28	$28 \ 32$	28204	4	71681	29134	4	70866	00815	0	99185	56
	$\frac{1}{5}$	10 31 20	12840	9.28384	5	10.71616	9.29201	5	10.70799	10.00818	0	9.99182	55
$ \begin{array}{cccccccccccccccccccccccccccccccccccc$	6	31 12	28 48	28448	6	71552	29268	6	70732	00820	0	99180	54
8 30 56 29 4 28641 9 71359 294488 10 70532 00825 0 991175 50 10 10 30 40 129 20 9.28750 10 10 122 70339 00833 0 991167 45 12 30 24 29 36 28833 12 71167 290601 15 70339 00833 0 991167 45 13 30 16 29.42 28806 14 71040 290734 14 70266 00838 1 991157 45 16 29 52 30 8 29057 17 70913 293082 16 10<70346	7	31 4	28 56	28512	7	71488	29335	8	70665	00823	0	99177	53
9 30 45 10 10.337 2.9335 10 10.337 2.9335 11 0.332 0.0322 0.0322 0.0332 0.93112 50 11 30 32 29 2.8705 11 71167 50 70332 0.0833 0 991167 46 12 30 16 29 42 2.8806 13 711104 29360 15 70332 0.0834 1 991167 45 15 10 30 0 9.20924 16 10.70976 9.29866 16 10.70134 10.00843 19.99157 43 16 29.20 30 30 2.9214 19 70535 2.99981 18 700048 0.00550 1 991152 44 29 28 30 32 2.9214 10 70723 30130 20 608570 0.00555 1 9.99145 44 29 28 30	8	30 56	29 4	28577	8	71423	29402	10	70598	00825	0	99175 00172	$52 \\ 51$
$ \begin{array}{c c c c c c c c c c c c c c c c c c c $	9	30 48	1 29 12	0.99705	10	10 71905	0.20525	11	10.70.165	10.00830		99172	50
$\begin{array}{cccccccccccccccccccccccccccccccccccc$	10	10 50 40 30 32	29 28	28769	11	71231	29601	11^{11}_{12}	70399	00833	0	99167	49
$\begin{array}{c c c c c c c c c c c c c c c c c c c $	$\overline{12}$	30 24	29 36	28833	12	71167	29668	13	70332	00835	1	99165	48
$\begin{array}{c c c c c c c c c c c c c c c c c c c $	13	30 16	29 44	28896	13	71104	29734	14	70266	00838	1	99162	47
$ \begin{array}{c c c c c c c c c c c c c c c c c c c $	14	30 8	29 52	28960	14	71040	29800	15	70200	00840	1	99160	46
$ \begin{array}{cccccccccccccccccccccccccccccccccccc$	15	$10 \ 30 \ 0 \ 52$	$1 \ 30 \ 0 \ 20 \ 8$	9.29024	16	10.70976	9.29866	16	10.70134	10.00843 00845	1	9.99157	40
$ \begin{array}{c c c c c c c c c c c c c c c c c c c $	$10 \\ 17$	29 52	$30 \ 6$	29087	18	70313	29998	18	70003	00848	i	99152	43
$\begin{array}{c c c c c c c c c c c c c c c c c c c $	18	$\frac{20}{29}$ 36	30 24	29214	19	70786	30064	19	69936	00850	Î	99150	42
$\begin{array}{c c c c c c c c c c c c c c c c c c c $	19	29 28	30 32	29277	20	70723	30130	20	69870	00853	1	99147	41
$\begin{array}{c c c c c c c c c c c c c c c c c c c $	20	$10\ 29\ 20$	1 30 40	9.29340	21	10.70660	9.30195	22	10.69805	10.00855	1	9.99145	40
$\begin{array}{cccccccccccccccccccccccccccccccccccc$	$\frac{21}{22}$	29 12	30 48	29403	22	70597	30261	23	69739	00858		99142	39
$ \begin{array}{c c c c c c c c c c c c c c c c c c c $	$\frac{22}{22}$	29 + 28 - 56	30-30 31-4	29400	23	70554	30320	24	69609	00863	1	99140	38
$ \begin{array}{c c c c c c c c c c c c c c c c c c c $	$\frac{23}{24}$	$28 \ 48$	$31 \ 12$	29591	25	70409	30457	$\frac{26}{26}$	69543	00865	i	99135	36
26 28 31 28 29716 27 70284 .30587 28 69348 00870 1 99130 33 27 28 24 31 36 29779 28 70159 30652 29 69348 00873 1 99127 33 29 28 8 31 52 29906 31 07097 30782 31 69283 008876 1 99124 32 30 10 28 8 3152 29906 31 10.70034 9.30846 32 10.69154 10.00881 1 9.99119 33 31 27 54 3206 69872 30911 33 69089 00888 1 99114 25 34 27.28 32.2 30213 35 69725 9.31168 38 10.68321 10.08944 2 99104 24 99109 26 35 107 20 1.32 49 30336 37 69644 31233 9 68767 008994 </td <td>25</td> <td>10 28 40</td> <td>1 31 20</td> <td>9.29654</td> <td>$\overline{26}$</td> <td>10.70346</td> <td>9.30522</td> <td>27</td> <td>10.69478</td> <td>10.00868</td> <td>1</td> <td>9.99132</td> <td>35</td>	25	10 28 40	1 31 20	9.29654	$\overline{26}$	10.70346	9.30522	27	10.69478	10.00868	1	9.99132	35
$\begin{array}{cccccccccccccccccccccccccccccccccccc$	26	$28 \ 32$	31 28	29716	27	70284	· 30587	28	69413	00870	1	99130	34
$\begin{array}{c c c c c c c c c c c c c c c c c c c $	27	28 24	$31 \ 36$	29779	28	70221	30652	29	69348	00873	1	99127	33
$ \begin{array}{c c c c c c c c c c c c c c c c c c c $	$\frac{28}{20}$	$\frac{28}{29}$ 16	$31 + 4 \\ 21 + 50$	29841	29	70159	30717	30	69283	00876		99124	32
$ \begin{array}{c c c c c c c c c c c c c c c c c c c $	$\frac{29}{30}$	28 8	$\frac{31.04}{1.39.0}$	29900 9 20066	31	10 70034	9 30846	39	10 69151	10 00881		99122	30
$\begin{array}{c ccccccccccccccccccccccccccccccccccc$	31	$ \frac{10}{27} \frac{28}{52} $	$\begin{array}{ccc} 1 & 32 & 0 \\ 32 & 8 \end{array}$	30028	32	69972	30911	33	69089	00883	1	99117	29
$\begin{array}{c ccccccccccccccccccccccccccccccccccc$	32	27 44	32 16	30090	33	69910	30975	35	69025	00886	1	99114	$\tilde{28}$
$\begin{array}{c ccccccccccccccccccccccccccccccccccc$	33	$27 \ 36$	32 24	30151	34	69849	31040	36	68960	00888	1	-99112	27
$\begin{array}{c ccccccccccccccccccccccccccccccccccc$	34	27 28	32 32	30213	30	69/8/	31104.	37	68896	00891	1	99109	26
$\begin{array}{c ccccccccccccccccccccccccccccccccccc$	35	$10 \ 27 \ 20 \ 97 \ 19$	1 32 40	9.30275	36	10.69725	9.31168	38	10.68832 68767	10.00894	2	9.99106	25
38 26 56 33 4 30459 39 669541 31361 41 68639 00901 2 99009 22 39 26 48 33 12 30521 40 69479 31425 42 68575 00904 2 99096 21 40 10 26 40 1 33 20 9.30582 41 10.69418 9.31489 43 10.68511 10.09077 2 9.90931 20 41 26 32 33 63 30704 43 69296 31616 45 68384 00912 2 99081 19 42 26 24 33 36 30765 45 69235 31679 46 68321 00914 2 99086 15 45 10 26 0 1 34 9.30887 47 10.69113 9.31806 49 10.68194 10.09202 2 99080 15 46 25 52 34 8 30947 48 69053 31870	$\frac{30}{37}$	$27 12 \\ 27 4$	$\frac{32}{32}$ $\frac{40}{56}$	30398	38	69602	31297	40	68703	00899	2	99104	23
$\begin{array}{c ccccccccccccccccccccccccccccccccccc$	38	26 56	33 4	30459	39	69541	31361	41	68639	00901	$\overline{2}$	99099	22
$\begin{array}{c ccccccccccccccccccccccccccccccccccc$	39	$26 \ 48$	$33 \ 12$	30521	40	69479	31425	42	68575	00904	2	99096	21
$\begin{array}{c ccccccccccccccccccccccccccccccccccc$	40	$10\ 26\ 40$	$1 \ 33 \ 20$	9.30582	41	10.69418	9.31489	43	10.68511	10.00907	2	9.99093	20
$\begin{array}{c ccccccccccccccccccccccccccccccccccc$	41	26 32	33 28	30643 20704	42	69357	31552	115	68448	00909	2	99091	19
H4 26 8 33 52 30826 46 69174 31743 47 68257 00917 2 99083 16 45 10 26 0 1 34 0 9.30887 47 10.69113 9.31806 49 10.68194 10.00920 2 9.99080 15 46 25 52 34 8 30947 48 69053 31870 50 68130 00922 2 99078 14 47 25 44 34 16 31008 49 68992 31933 51 68067 00925 2 99075 13 48 25 28 34 2 31189 52 10.68811 9.32122 54 10.67878 10.0933 2 9.9067 10 50 10 25 20 1 34 8 31250 53 68750 32185 55 67815 00936 2 99067 10 51 25 12 34 31310	42	20 24 26 16	33 44	30765	45	69235	31679	46	68321	00912	2	99086	17
451026013409.308874710.691139.318064910.6819410.0092029.9.99080154625523483094748690533187050681300092229907814472544341631008496899231933516806700925299075134825263424310685068932319965268004009282990721249252834323112951688713205953679410093329.990671050102520134409.311895210.688119.321225410.6787810.0093329.9906710512512344831250536875032185556781500936299064952254345631310546860032248566775200938299062853244835123143056685703237358676270094429905665510244835123143056683713249860675020094929	44	$\frac{10}{26}$ 8	33 52	30826	46	69174	31743	47	68257	00917	$\overline{2}$	99083	16
$ \begin{array}{c ccccccccccccccccccccccccccccccccccc$	45	10 26 0	1 34 0	9.30887	47	10.69113	9.31806	49	10.68194	10.00920	2	9.99080	15
$ \begin{array}{c ccccccccccccccccccccccccccccccccccc$	46	25 52	34 8	30947	48	69053	31870	50	68130	00922	2	99078	14
$\begin{array}{c ccccccccccccccccccccccccccccccccccc$	47	$25 44 \\ 95 96$	34 16 21 91	31008 21068	49	68992	31933	51	68067	00925	2	99075	13
$ \begin{array}{c ccccccccccccccccccccccccccccccccccc$	48	$25 \ 25 \ 28$	$34 \ 44 \ 34 \ 32$	31008	51	68871	31990 32059	53	67941	00928	2	99072	$12 \\ 11$
$ \begin{array}{c ccccccccccccccccccccccccccccccccccc$	$\frac{10}{50}$	$\frac{26}{10}$ $\frac{20}{25}$ $\frac{20}{20}$	$\frac{0102}{13440}$	9.31189	$\frac{01}{52}$	10.68811	9.32122	54	10.67878	10.00933	2	9.99067	10
$ \begin{array}{c ccccccccccccccccccccccccccccccccccc$	51°	25 12	34 48	31250	$\overline{53}$	68750	32185	55	67815	00936	$\overline{2}$	99064	9
$ \begin{array}{c ccccccccccccccccccccccccccccccccccc$	52	25 4	34 56	31310	54	68690	32248	56	67752	00938	$\frac{2}{2}$	99062	8
$ \begin{array}{c ccccccccccccccccccccccccccccccccccc$	53	24 56	$\frac{35}{95}$ 4	31370	50 50	68630	32311 20279	57	67689	00941	2	99059	7
$ \begin{array}{c ccccccccccccccccccccccccccccccccccc$	55	10 21 10	$\frac{30.12}{1.35.20}$	9 31400	57	10 68510	0 2010	50	10.67564	10 00914	-4-9	99000	- 5
57 24 24 35 36 31609 59 68391 32561 61 67439 00952 2 99048 3 58 24 16 35 44 31669 60 68331 32623 63 67377 00954 2 99048 3 59 24 8 35 52 31728 61 68272 32685 64 67315 00957 3 99043 1 60 24 0 36 0 31788 62 68212 32747 65 67253 00960 3 99040 0 M. Hour A. M. Cosine. Diff. Secant. Cotaugent. Diff. Tangent. Cosecant. Diff. Sine. M. 101° A A B B C C 785	$\frac{55}{56}$	24 32	35 20	31549	58	68451	32498	60	67502	00949	2	99051	4
58 24 16 35 44 31669 60 68331 32623 63 67377 00954 2 99046 2 59 24 8 35 52 31728 61 68272 32685 64 67315 00957 3 99043 1 60 24 0 36 0 31788 62 68212 32747 65 67253 00960 3 99040 0 M. Hour A. M. Cosine. Diff. Secant. Cotaugent. Diff. Tangent. Cosecant. Diff. Sine. M. 101° A A B B C C 78	57	$24 \ 24$	$35 \ 36$	31609	59	68391	32561	61	67439	00952	2	99048	3
D9 24 8 35 52 31728 61 68272 32685 64 67315 00957 3 99043 1 60 24 0 36 0 31788 62 68212 32747 65 67253 00960 3 99040 0 M. Hour P. M. Hour A. M. Cosine. Diff. Secant. Cotangent. Diff. Tangent. Cosecant. Diff. Sine. M. 101° A A B B C C 78°	58	24 16	35 44	31669	60	68331	32623	63	67377	00954	2	99046	2
00 24 0 30 0 31765 02 05212 32747 05 07255 00000 3 99040 0 M. Hour P. M. Hour A. M. Cosine. Diff. Secant. Cotangent. Diff. Tangent. Cosecant. Diff. Sine. M. 101° A A B B C C 78%	59 60	24 8	$\frac{35}{36}$ 52	$31728 \\ 21799$	61	68272	32685	64	67315	00957	3	99043	
M. Hour P. M. Hour A. M. Cosine. Diff. Secant. Cotangent. Diff. Tangent. Cosecant. Diff. Sine. M. 101° A A B B C C 78°	-00	<u></u> + ∪		51/88	-02	08212	02141	-00	07293	00900	ð 	99040	0
101° A A B B C C 78°	М.	Hour P. M.	Hour A. M.	Cosine.	Diff.	Secant.	Cotangent.	Diff.	Tangent.	Cosecant.	Diff.	Sine.	М.
	101°			A		A	В		B	С		С	78°

Seconds of time	18	2^s	33	4 ª		6ª	7s
Prop. parts of cols. $\begin{cases} A \\ B \\ C \end{cases}$	8 8 0	$\begin{array}{c}16\\16\\1\end{array}$	$\begin{array}{c} 23\\24\\1\end{array}$	$\begin{array}{c} 31\\32\\1\end{array}$	$\begin{array}{r} 39 \\ 40 \\ 2 \end{array}$	$47 \\ 49 \\ 2$	$54 \\ 57 \\ 2$

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Log. Sines, Tangents, and Secants.

120			A	108.	A	В		В	С		с	167°
м.	Hour A. M.	Hour P, M.	Sine.	Diff.	Coseeant.	Tangent.	Diff.	Cotangent.	Secant. *	Diff.	Cosine.	М.
0	10 24 0	1 36 0	9.31788	0	10.68212	9.32747	0	10.67253	10.00960	0	9.99040	60
	23 52	36 8 26 16	31847	1	68153	32810 22879	1	67190	00962	0	99038	59
3	$23 \ 36$	36 24	31966	3	68034	32933		67067	00965	0	99032	- 8 - 57
4	$\frac{1}{23}$ $\frac{1}{28}$	36 32	32025	4	67975	32995	4	67005	00970	Ŏ	99030	56
5	10 23 20	1 36 40	9.32084	5	10.67916	9,33057	5	10.66943	10.00973	0	9.99027	55
6	23 12	$\frac{36}{96}$ $\frac{48}{56}$	32143	6	67857	33119	. 6	66881	00976		99024	54
8	23 - 4 22 56	30 00	32202	8	67739	33180	8	66758	00978	0	99022	59
9	$\frac{22}{22}$ 48	37 12	32319	9	67681	33303	9	66697	00984	0	99016	51^{-52}
10	10 22 40	1 37 20	9.32378	10	10.67622	9.33365	10	10.66635	10.00987	0	9.99013	50
11	22 32	37 28	32437	10	67563	33426	11	66574	00989	1	99011	49
12	22 24 22 16	$\frac{37}{27}$	32495 32553	11	67808	33487	$12 \\ 13$	66152	00992	1	99008	48
13	$22 \ 10 \ 22 \ 8$	37 52	32600 32612	13	67388	33609	14	66391	00998	1	99002	46
15	10 22 0	1 38 0	9.32670	14	10.67330	9.33670	15	10.66330	10.01000	1	9.99000	45
16	21 52	38 8	32728	15	67272	33731	16	66269	01003	1	98997	44
17	21 44	38 16 99 91	32786	16	67214	33792	17	66208	01006		98994	43
18	$21 \ 50$ $21 \ 28$	$\frac{36}{38}\frac{24}{32}$	32902	18	67098	33913	19	66087	01005	1	98991	42
20	10 21 20	1 38 40	9.32960	19	10.67040	9.33974	20	10.66026	10.01014	$\frac{1}{1}$	9,98986	40
21	21 12	38 48	33018	20	66982	34034	21	65966	01017	1	98983	39
22	21 4	$\frac{38}{20}$ $\frac{56}{10}$	33075	21	66925	34095	$ \frac{22}{22} $	65905	01020	1	98980	38
23	20 56	39 4 30 19	33133	22	66867	34155	23	65785	01022	1	98978	37
24	$\frac{2040}{102040}$	$\frac{33}{1}$ $\frac{12}{39}$ 20	9 33248	24	10.66752	9 34276	25	10.65724	10.01028	$\frac{1}{1}$	9 98972	35
$\frac{26}{26}$	$20 \ 32$	39 28	33305	25	66695	34336	26	65664	01031	î	98969	34
27	20 24	39 36	33362	26	66638	34396	27	65604	01033	1	98967	33
28	20 16	$39 44 \\ 20 59$	$33420 \\ 22477$	27	66580	34456 24516	28	65.18.1	01036	1	98964	$\frac{32}{21}$
29	$\frac{20}{10} \frac{8}{20}$	$\frac{39.02}{1.40.0}$	0 33531	20	10 66466	9 31576	30	10 65494	10 01039	-1	9 98958	30
31	$10 \ 20 \ 0 \ 19 \ 52$	40 8	33591	29	66409	34635	31	65365	01042	1	98955	29
32	19 44	40 16	33647	30	66353	34695	32	65305	01047	1	98953	28
33	19 36	40 24	33704	31	66296	34755	33	65245	01050	$\begin{vmatrix} 2 \\ 0 \end{vmatrix}$	98950	27
34	19 28	40 32	33/01	32	00239	0 91071	25	00180	01000	$\frac{2}{9}$	98947	- 20
- 30 - 36	$10 19 20 \\ 19 12$	40 48	9. 33874	34	66126	9. 34074	36	65067	01059	$\begin{vmatrix} \frac{2}{2} \end{vmatrix}$	98941	20
37	19 4	40 56	33931	35	66069	34992	37	65008	01062	2	98938	23
38	18 56	41 4	33987	36	66013	35051	38	64949	01064	2	98936	22
39	18 48	41 12	34043	$\frac{31}{90}$	65957	35111	39	04889	01007	-2	98933	21
40	10 18 40 18 32	$ \begin{array}{r} 1 41 20 \\ 41 28 \end{array} $	9. 34156	39	65844	9. 35170	41	64771	01073		9. 98930	19
42	18 24	41 36	34212	40	65788	35288	42	64712	01076	$\overline{2}$	98924	18
43	$18 \ 16$	41 44	34268	41	65732	35347	43	64653	01079	2	98921	17
44	18 8	41 52	34324	42	65676	35405	44	64595	01081	$-\frac{2}{2}$	98919	$-\frac{16}{15}$
45	$10 18 0 \\ 17 52$	1 42 0 49 8	9.34380	43	10.65620	9.30404	40	10. 04030	01084	$\frac{2}{2}$	9.98910	10
40	17 44	42 16	34491	45	65509	35581	47	64419	01090	2	98910	13
48	$17 \ 36$	42 24	34547	46	65453	35640	48	64360	01093	2	98907	12
49	17 28	42 32	34602	47	65398	35698	49	64302	01096	$\frac{2}{2}$	98904	11
- 50 - 51	$10 \ 17 \ 20 \ 17 \ 19$	1 42 40 12 48	9.34658 3.1713	48	10.65342	9.30707	50	10.64243	10.01099		9,98901	01
$51 \\ 52$	17 12	42 56	34769	49	65231	35873	52	64127	01102	$\overline{2}$	98896	8
53	16 56	43 4	34824	50	65176	35931	53	64069	01107	2	98893	7
54	16 48	43 12	34879	51	65121	35989	54	64011	01110	3	98890	6
55	$10 \ 16 \ 40$	1 43 20	9.34934	52	10.65066	9.36047	55	10.63953	10.01113	3	9.98887	5
06 57	$16 32 \\ 16 24$	43 28	34989	- 33 - 54	64956	36103 36163	57	63837	01116		98881	43
58	16 16	43 44	35099	55	64901	36221	58	63779	01122	3	98878	2
59	16 8	43 52	35154	56	64846	36279	59	63721	01125	3	98875	1
60	16 0	44 0	35209	57	64791	36336	60	63664	01128	3	98872	0
М.	Hour P. M.	Hour A. M.	Cosine.	Diff	Seeant.	Cotangent	. Diff.	. Tangent.	Cosecant.	Diff.	Sine.	М.
10	20		А	5 1 alto 14	А	В		В	C		С	770

Seconds of time	15	28	3.	- 1 *	51	6*	7s
Prop. parts of cols. $\begin{cases} A \\ B \\ C \end{cases}$	7 7 0	$\begin{array}{c}14\\15\\1\end{array}$	$\begin{array}{c}21\\22\\1\end{array}$	$ \begin{array}{r} 29 \\ 30 \\ 1 \end{array} $		$\begin{array}{c} 43\\ 45\\ 2\end{array}$	$50 \\ 52 \\ 2$

			1		TAI	5LE 14 .					Page
			3	Log.	Sines, Tar	igents, and	l Sec	ants.			
130			Λ		А	В		В	C	1	С
M.	Hour A. M.	Hour P.M.	Sine.	Diff.	Cosecant.	Tangent.	Diff.	Cotangent.	Secant.	Diff.	Cosine
0	10 16 0	1 44 0	9.35209	0	10.64791	9.36336	0	10.63664	10.01128	0	9.9887
1	15 52	44 8	35263	1	64737	36394	1	63606	01131	0	9886
$\frac{2}{3}$	$10 + 4 \\ 15 + 36$	$\frac{44}{14}$ 10	35373	3	64627	36509	3	63491	01136	0	9886
4	$15 \ 28$	44 32	35427	4	64573	36566	4	63434	01139	0	9886
5	10 15 20	1 44 40	.9. 35481	4	10.64519	9.36624	5	10.63376	10.01142	0	9.9885
6	15 12	44 48	35536	5	64464	36681	6	63319	01145	0	9885
7	15 4	$\frac{44}{15}$ 56	35590	67	64410	36738	67	63262	01148	0	9885
9	14 00	45 12	35698	8	64302	36852	8	63148	01154	0	9884
10	10 14 40	1 45 20	9.35752	9	10.64248	9.36909	9	10.63091	10.01157	1	9.9884
11	$14 \ 32$	45 28	35806	10	64194	36966	10	63034	01160	1	9884
12	14 24	$45 \ 36$	35860	11	64140	37023	11	62977	01163		9883
13	14 16	40 44	35914	11	64086	37080	$\frac{12}{13}$	62920	01160	1	9883
$\frac{14}{15}$	10 11 0	$\frac{40.02}{1.46}$	9 36022	13	10 63978	9 37193	14	10 62807	10.01172	1	9 9882
16	1352	46 8	36075	14	63925	37250	15	62750	01175	1	9882
17	13 44	46 16	36129	15	63871	37306	16	62694	01178	1	9882
18	13 36	46 24	36182	$ 16 \\ 17$		37363	17	62637	01181		9881
19	13 28	40 32	30230	$\frac{17}{10}$	03704	3/419	$\frac{18}{10}$	02081	10 01187		9881
20	$10 \ 13 \ 20 \ 13 \ 12$	14040 4648	9.36289 36342	18	63658	9. 57470	19	62468	01190	1	9881
$\frac{21}{22}$		46 56	36395	19	63605	37588	20	62412	01193	Î	9880
23	12 56	47 4	36449	20	63551	37644	21	62356	01196	1	9880
24	12 48	47 12	36502	21	63498	37700	22	62300	01199	1	9880
25	$10 \ 12 \ 40 \ 19 \ 29$	$1 \ 47 \ 20 \ 17 \ 98$	9,36555	22	10, 63445	9.37756	23	10.62244	10.01202 01205	1	9.9879
$\frac{20}{27}$	$12 \ 52 \ 12 \ 24$	$\frac{47}{47}$ $\frac{28}{36}$	36660	20 24	63340	37868	$\frac{24}{25}$	62132	01205	1	9879
28	12 16	47 44	36713	25	63287	37924	26	62076	01211	1	9878
29	12 8	47 52	36766	25	63234	37980	27	62020	01214	1	9878
30	$10 \ 12 \ 0$	1 48 0	9.36819	26	10.63181	9.38035	28	10,61965	10.01217	$\begin{vmatrix} 2 \\ 0 \end{vmatrix}$	9.9878
31	11 52 11 11	48 8	36871 26024	21	63129	38091	29	61853	01220	$\frac{2}{2}$	9878
33	$11 44 \\11 36$	48 24	36976	29	63024	38202	31	61798	01226	$\overline{2}$	9877
34	11 28	48 32	37028	30	62972	38257	32	61743	01229	2	9877
35	$10 \ 11 \ 20$	1 48 40	9.37081	31	10.62919	9.38313	32	10.61687	10.01232	2	9.9876
36	11 12	$\frac{48}{19} \frac{48}{56}$	37133	32	62867	38368	33	61632	01235	$\frac{2}{2}$	9876
38	11 4 10.56	48 00 49 4	37237	33	62763	38479	35	61521	01200	$\frac{2}{2}$	9875
39	10 48	49 12	37289	34	62711	38534	36	61466	01244	2	9875
40	10 10 40	$1 \ 49 \ 20$	9.37341	35	10.62659	9.38589	37	10.61411	10.01247	2	9.9875
41	$10 \ 32$	49 28	37393	36	62607	38644	38	61356	01250	$\frac{2}{3}$	9875
$\frac{42}{13}$	$10 24 \\ 10 16$	$49 36 \\ 10 11$	37440 37497	31	62000	38699	39	61301	01254	$\frac{2}{2}$	9874
44	$10 10 \\ 10 8$	49 52	37549	39	62451	38808	41	61192	01260	2	9874
45	10 10 0	1 50 0	9.37600	39	10.62400	9.38863	42	10.61137	10.01263	2	9.9878
46	9 52	50 - 8	37652	40	62348	38918	43	61082	01266	$\begin{vmatrix} 2 \\ 0 \end{vmatrix}$	9873
47	9 44	50 16 50 24	$37703 \\ 37755$	41	62297	38972	44	61028	01269	$\begin{vmatrix} 2\\ 2 \end{vmatrix}$	9878
49	9.28	$50 \frac{14}{32}$	37806	43	62194	39082	45	60918	01275	$ $ $\frac{5}{2}$	9872
50	10 9 20	1 50 40	9.37858	44	10.62142	9.39136	46	10.00864	10.01278	3	9.9872
51	9 12	$50 \ 48$	37909	45	62091	39190	47	60810	01281	3	9871
52	94	50 56	37960	46	62040	39245	48	60755	01285		9871
53 54	8 48	$\frac{1}{51}$ $\frac{4}{12}$	38062	47	61989	39353	49 50	60647	01288	3	9871
55	$\frac{8 10}{10 8 40}$	1 51 20	9.38113	48	10.61887	9.39407	$\frac{50}{51}$	10,60593	10.01294	3	9.9870
56	8 32	51 28	38164	49	61836	39461	52	60539	01297	3	9870
57	8 24	$51 \ 36$	38215	50	61785	39515	53	60485	01300	3	9870
58 50	816	51 44	38266	51	61734	39569	54	60431	01303	3	986
60 60	8 0	$51 52 \\ 52 0$	38368	53	61632	39677	56	60323	01310	3	9869
M	HOUPPY	Hour A M	Cosine	Diff	Secont	Cotangent	Diff	Tangent	 Cosecant	Diff	Sine
		and the state of t		1		I	J ~	D		1	0

Seconds of time	1.	2.	3s	4.	5^{s}	6 ^s	78
Prop. parts of cols. $\begin{cases} A \\ B \\ C \end{cases}$	7 7 0	$\begin{array}{c}13\\14\\1\end{array}$	$\begin{array}{c} 20\\21\\1\end{array}$	$\begin{smallmatrix} 26\\28\\2\end{smallmatrix}$	$33 \\ 35 \\ 2$	$\begin{array}{c} 39\\ 42\\ 2\end{array}$	46 49 3

Dogo	600
rage	022

Log. Sines, Tangents, and Secants,

140				A	Log.	A A Sines, 1ar	B B	i sec	B	С		с	165°
м.	Hou	ır a. m.	Hour P. M.	Sine.	Diff.	Cosecant.	Tangent.	Diff.	Cotangent.	Secant.	Diff.	Cosine.	М.
$\begin{array}{c} 0\\ 1\\ 2\\ 3\\ 4\end{array}$	10	$\begin{array}{rrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrr$	$\begin{array}{cccccccccccccccccccccccccccccccccccc$	$\begin{array}{c} 9.\ 38368\\ 38418\\ 38469\\ 38519\\ 38570\end{array}$	$\begin{array}{c} 0\\ 1\\ 2\\ 2\\ 3 \end{array}$	$10.\ 61632\\ 61582\\ 61531\\ 61481\\ 61430$	9. 39677 39731 39785 39838 39892	$\begin{array}{c} 0\\ 1\\ 2\\ 3\\ 3\\ \end{array}$	$10.\ 60323\\60269\\60215\\60162\\60108$	$10.\ 01310\\01313\\01316\\01319\\01322$	0 0 0 0 0	$\begin{array}{c} 9.\ 98690\\ 98687\\ 98684\\ 98681\\ 98678\end{array}$	
5 6 7 8 9	10	$\begin{array}{cccc} 7 & 20 \\ 7 & 12 \\ 7 & 4 \\ 6 & 56 \\ 6 & 48 \end{array}$	$\begin{array}{rrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrr$	38620 38670 38721 38771 38821		$\begin{array}{r} 10.\ 61380\\ 61330\\ 61279\\ 61229\\ 61179\end{array}$	$\begin{array}{r} \textbf{9.39945}\\\textbf{39999}\\\textbf{40052}\\\textbf{40106}\\\textbf{40159} \end{array}$		$\begin{array}{r} 10.\ 60055\\ 60001\\ 599\pm 8\\ 59894\\ 59841 \end{array}$	$\begin{array}{r} \hline 10.\ 01325\\ 01329\\ 01332\\ 01335\\ 01335\\ 01338 \end{array}$	0 0 0 0 0	$\begin{array}{r} 9.\ 98675\\ 98671\\ 98668\\ 98665\\ 98665\\ 98662\end{array}$	$55 \\ 54 \\ 53 \\ 52 \\ 51$
$10 \\ 11 \\ 12 \\ 13 \\ 14$	10	$\begin{array}{cccc} 6 & 40 \\ 6 & 32 \\ 6 & 24 \\ 6 & 16 \\ 6 & 8 \end{array}$	$\begin{array}{cccccccccccccccccccccccccccccccccccc$	$\begin{array}{c} 9.\ 38871\\ 38921\\ 38971\\ 39021\\ 39071\end{array}$		$\begin{array}{c} 10.\ 61129\\ 61079\\ 61029\\ 60979\\ 60929\end{array}$	$9.40212 \\ 40266 \\ 40319 \\ 40372 \\ 40425$	$9 \\ 10 \\ 10 \\ 11 \\ 12$	$10.59788 \\ 59734 \\ 59681 \\ 59628 \\ 59575$	$10.\ 01341 \\01344 \\01348 \\01351 \\01354$	1 1 1 1 1	$\begin{array}{r} 9.98659 \\ 98656 \\ 98652 \\ 98649 \\ 98646 \end{array}$	$50 \\ 49 \\ 48 \\ 47 \\ 46$
$ \begin{array}{r} 15 \\ 16 \\ 17 \\ 18 \\ 19 \\ \end{array} $	10	$\begin{array}{ccc} 6 & 0 \\ 5 & 52 \\ 5 & 44 \\ 5 & 36 \\ 5 & 28 \end{array}$	$ \begin{array}{rrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrr$	$\begin{array}{c} 9.\ 39121\\ 39170\\ 39220\\ 39270\\ 39319\end{array}$	$12 \\ 13 \\ 14 \\ 15 \\ 15 \\ 15 \\ 15 \\ 15 \\ 15 \\ 15$	$10.\ 60879 \\ 60830 \\ 60780 \\ 60730 \\ 60681$	$9.\ 40478 \\ 40531 \\ 40584 \\ 40636 \\ 40689$	$ \begin{array}{r} 13 \\ 14 \\ 15 \\ 16 \\ 17 \end{array} $	$\begin{array}{c} 10.\ 59522\\ 59469\\ 59416\\ 59364\\ 59311 \end{array}$	$10,01357 \\01360 \\01364 \\01367 \\01370$	$\begin{array}{c}1\\1\\1\\1\\1\\1\end{array}$	$\begin{array}{c} 9,98643\\ 98640\\ 98636\\ 98633\\ 98630\\ \end{array}$	$ \begin{array}{r} 45 \\ 44 \\ 43 \\ 42 \\ 41 \end{array} $
$20 \\ 21 \\ 22 \\ 23 \\ 24$	10	$5 20 \\ 5 12 \\ 5 4 \\ 4 56 \\ 4 48$	$\begin{array}{cccccccccccccccccccccccccccccccccccc$	$\begin{array}{r} 9.\ 39369\\ 39418\\ 39467\\ 39517\\ 39566\end{array}$	$ \begin{array}{r} 16 \\ 17 \\ 18 \\ 19 \\ 20 \end{array} $	$10.\ 60631\\ 60582\\ 60533\\ 60483\\ 60434$	$9.\ 40742 \\ 40795 \\ 40847 \\ 40900 \\ 40952$	$ \begin{array}{r} 17 \\ 18 \\ 19 \\ 20 \\ 21 \end{array} $	$\begin{array}{c} 10.\ 59258\\ 59205\\ 59153\\ 59100\\ 59048 \end{array}$	$10.\ 01373 \\ 01377 \\ 01380 \\ 01383 \\ 01383 \\ 01386$	1 1 1 1 1	$\begin{array}{c} 9.\ 98627\\ 98623\\ 98620\\ 98617\\ 98614 \end{array}$	$ \begin{array}{r} 40 \\ 39 \\ 38 \\ 37 \\ 36 \end{array} $
$25 \\ 26 \\ 27 \\ 28 \\ 29$	10	$\begin{array}{r} 4 & 40 \\ 4 & 32 \\ 4 & 24 \\ 4 & 16 \\ 4 & 8 \end{array}$	$\begin{array}{cccccccccccccccccccccccccccccccccccc$	$\begin{array}{c} \textbf{9.39615}\\ \textbf{39664}\\ \textbf{39713}\\ \textbf{39762}\\ \textbf{39811} \end{array}$	$20 \\ 21 \\ 22 \\ 23 \\ 24$	$10.\ 60385\\ 60336\\ 60287\\ 60238\\ 60189$	$9. \ 41005 \\ 41057 \\ 41109 \\ 41161 \\ 41214$	$22 \\ 23 \\ 23 \\ 24 \\ 25$	$10.58995 \\ 58943 \\ 58891 \\ 58839 \\ 58839 \\ 58786$	$\begin{array}{c} 10.\ 01390\\ 01393\\ 01396\\ 01396\\ 01399\\ 01403 \end{array}$	$\begin{array}{c c}1\\1\\1\\2\\2\end{array}$	$9.98610 \\98607 \\98604 \\98601 \\98597$	$ \begin{array}{r} 35 \\ 34 \\ 33 \\ 32 \\ 31 \end{array} $
30 31 32 33 34	10	$\begin{array}{ccc} 4 & 0 \\ 3 & 52 \\ 3 & 44 \\ 3 & 36 \\ 3 & 28 \end{array}$	$\begin{array}{cccccccc} 1 & 56 & 0 \\ & 56 & 8 \\ & 56 & 16 \\ & 56 & 24 \\ & 56 & 32 \end{array}$	$\begin{array}{c} 9.\ 39860\\ 39909\\ 39958\\ 40006\\ 40055\end{array}$	$ \begin{array}{r} 24 \\ 25 \\ 26 \\ 27 \\ 28 \end{array} $	$\begin{array}{c} 10.\ 60140\\ 60091\\ 60042\\ 59994\\ 59945 \end{array}$	$9. \ 41266 \\ 41318 \\ 41370 \\ 41422 \\ 41474$	$26 \\ 27 \\ 28 \\ 29 \\ 30$	$\begin{array}{c} 10.\ 58734\\ 58682\\ 58630\\ 58578\\ 58526\end{array}$	$\begin{array}{c} 10.\ 01406\\ 01409\\ 01412\\ 01416\\ 01416\\ 01419 \end{array}$	$\begin{array}{c}2\\2\\2\\2\\2\\2\\2\end{array}$	$\begin{array}{c} 9.\ 98594\\ 98591\\ 98588\\ 98584\\ 98581\end{array}$	$30 \\ 29 \\ 28 \\ 27 \\ 26$
35 36 37 38 39	10	$\begin{array}{cccc} 3 & 20 \\ 3 & 12 \\ 3 & 4 \\ 2 & 56 \\ 2 & 48 \end{array}$	$\begin{array}{cccccccccccccccccccccccccccccccccccc$	$9.40103 \\ 40152 \\ 40200 \\ 40249 \\ 40297$	$ \begin{array}{r} 29 \\ 29 \\ 30 \\ 31 \\ 32 \end{array} $	$10.59897 \\59848 \\59800 \\59751 \\59703$	$\begin{array}{r} 9.\ 41526\\ 41578\\ 41629\\ 41681\\ 41733\end{array}$	$30 \\ 31 \\ 32 \\ 33 \\ 34$	$10.58474 \\58422 \\58371 \\58319 \\58267$	$\begin{array}{c} 01422 \\ 01426 \\ 01429 \\ 01432 \\ 0!435 \end{array}$	$\begin{array}{c}2\\2\\2\\2\\2\\2\\2\\2\end{array}$	$\begin{array}{r} 9.\ 98578\\98574\\98571\\98568\\98568\\98565\end{array}$	$25 \\ 24 \\ 23 \\ 22 \\ 21$
$ \begin{array}{r} 40 \\ 41 \\ 42 \\ 43 \\ 44 \end{array} $	10	$\begin{array}{cccc} 2 & 40 \\ 2 & 32 \\ 2 & 24 \\ 2 & 16 \\ 2 & 8 \end{array}$	$\begin{array}{cccccccccccccccccccccccccccccccccccc$	$\begin{array}{r} 9.\ 40346 \\ 40394 \\ 40442 \\ 40490 \\ 40538 \end{array}$	$ \begin{array}{r} 33 \\ 33 \\ 34 \\ 35 \\ 36 \end{array} $	$\begin{array}{c} 10.\ 59654\\ 59606\\ 59558\\ 59510\\ 59462 \end{array}$	$\begin{array}{r} 9.\ 41784\\ 41836\\ 41887\\ 41939\\ 41990 \end{array}$	$ \begin{array}{r} 35 \\ 36 \\ 36 \\ 37 \\ 38 \end{array} $	$\begin{array}{c} 10.\ 58216\\ 58164\\ 58113\\ 58061\\ 58010 \end{array}$	$10.\ 01439 \\ 01442 \\ 01445 \\ 01445 \\ 01449 \\ 01452$	$\begin{array}{c}2\\2\\2\\2\\2\\2\end{array}$	$\begin{array}{c} 9.\ 98561\\ 98558\\ 98555\\ 98551\\ 98548\end{array}$	$20 \\ 19 \\ 18 \\ 17 \\ 16$
$ \begin{array}{r} 45 \\ 46 \\ 47 \\ 48 \\ 49 \\ \end{array} $	10	$\begin{array}{cccc} 2 & 0 \\ 1 & 52 \\ 1 & 44 \\ 1 & 36 \\ 1 & 28 \end{array}$	$\begin{array}{ccccccc} 1 & 58 & 0 \\ & 58 & 8 \\ & 58 & 16 \\ & 58 & 24 \\ & 58 & 32 \end{array}$	$9.40586 \\ 40634 \\ 40682 \\ 40730 \\ 40778$	$ \begin{array}{r} 37 \\ 37 \\ 38 \\ 39 \\ 40 \end{array} $	$10. 59414 \\59366 \\59318 \\59270 \\59222$	$9.\ 42041 \\ 42093 \\ 42144 \\ 42195 \\ 42246$	$ \begin{array}{r} 39 \\ 40 \\ 41 \\ 42 \\ 43 \end{array} $	$10.\ 57959\\57907\\57856\\57805\\57754$	$10.\ 01455 \\ 01459 \\ 01462 \\ 01465 \\ 01465 \\ 01469$	$ \begin{array}{c} 2 \\ 3 \\ 3 \\ 3 \\ 3 \end{array} $	$\begin{array}{r} 9.\ 98545\\ 98541\\ 98538\\ 98535\\ 98535\\ 98531\end{array}$	$ \begin{array}{r} 15 \\ 14 \\ 13 \\ 12 \\ 11 \\ \end{array} $
$50 \\ 51 \\ 52 \\ 53 \\ 54$	10	$\begin{array}{cccc} 1 & 20 \\ 1 & 12 \\ 1 & 4 \\ 0 & 56 \\ 0 & 48 \end{array}$	$\begin{array}{cccccccccccccccccccccccccccccccccccc$	$\begin{array}{r} 9.\ 40825\\ 40873\\ 40921\\ 40968\\ 41016\end{array}$	$ \begin{array}{r} 41 \\ 42 \\ 42 \\ 43 \\ 44 \end{array} $	$\begin{array}{c} 10.\ 59175\\ 59127\\ 59079\\ 59032\\ 58984 \end{array}$	$\begin{array}{r} 9.\ 42297 \\ 42348 \\ 42399 \\ 42450 \\ 42501 \end{array}$	$ \begin{array}{r} 43 \\ 44 \\ 45 \\ 46 \\ 47 \\ \end{array} $	$\begin{array}{c} 10.\ 57703\\ 57652\\ 57601\\ 57550\\ 57499 \end{array}$	$10.01472 \\ 01475 \\ 01479 \\ 01482 \\ 01485$	3 3 3 3 3 3 3 3 3 3 3 3 3 3 3 3 3 3 3	$\begin{array}{c} 9.\ 98528\\ 98525\\ 98521\\ 98518\\ 98515\end{array}$	$ \begin{array}{c} 10\\ 9\\ 8\\ 7\\ 6\\ \hline \end{array} $
$55 \\ 56 \\ 57 \\ 58 \\ 59 \\ 60$	10	$\begin{array}{c} 0 & 40 \\ 0 & 32 \\ 0 & 24 \\ 0 & 16 \\ 0 & 8 \\ 0 & 0 \end{array}$	$\begin{array}{cccccccccccccccccccccccccccccccccccc$	$9.41063 \\ 41111 \\ 41158 \\ 41205 \\ 41252 \\ 41300$	45 46 46 47 48 49	$10.58937 \\58889 \\58842 \\58795 \\58748 \\58700$	$9. 42552 \\ 42603 \\ 42653 \\ 42704 \\ 42755 \\ 12805$	$ \begin{array}{r} 48 \\ 49 \\ 50 \\ 50 \\ 51 \\ 52 \\ \end{array} $	$\begin{array}{r} 10.\ 57448\\ 57397\\ 57347\\ 57296\\ 57245\\ 57195\\ \end{array}$	$\begin{array}{c} 10.\ 01489\\ 01492\\ 01495\\ 01499\\ 01502\\ 01506 \end{array}$	30 00 00 00 00 00 00 00 00 00 00	$\begin{array}{r} 9.\ 98511\\ 98508\\ 98505\\ 98501\\ 98498\\ 98494 \end{array}$	$ \begin{array}{c} 5 \\ 4 \\ 3 \\ 2 \\ 1 \\ 0 \end{array} $
M.	Нот	ıг Р. М.	Hour A. M.	Cosine.	Diff.	Secant.	Cotangent.	Diff.	Tangent.	Cosecant.	Diff.	Sine.	M. 75°
101				~			~			Ŭ		-	

Seconds of time	1*	28	38	44	ð ^s	6 ^s	78
Prop. parts of cols. $\begin{cases} A \\ B \\ C \end{cases}$	6 7 0	12 13 1	$\begin{array}{c}18\\20\\1\end{array}$	$\begin{array}{c} 24\\ 26\\ 2\end{array}$	$\begin{array}{c} 31\\ 33\\ 2\end{array}$	$37 \\ 39 \\ 2$	$\begin{array}{c} 43\\ 46\\ 3\end{array}$

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				TAF	3LE 44.					Page 6	23
			Log.	Sines, Ta	ngents, an	d Sec	ants.				
		А		А	В		в	С		С	164°
our A. M.	Hour P. M.	Sine.	Diff.	Cosecant.	Tangent.	Diff.	Cotangent.	Secant.	Diff.	Cosine.	М.
0 0	2 0 0	9.41300	0	10.58700	9.42805	0	10.57195	10.01506	0	9.98494	60
59 52	0 8	41347	1	58653	42856	1	57144	01509	0	98491	59
59 44	0 16	41394	2	58606	42906	2	57094	01512	0	98488	58
59 36	0.24	41441	2	58559	42957	2	57043	01516	0	98484	57
59 28	$0 \ 32$	41488	3	58512	43007	3	56993	01519	0	98481	56
59 20	2 0 40	9,41535	4	10.58465	9,43057	4	10.56943	10.01523	. 0	9,98477	55
59 12	0 48	41582	5	58418	43108	5	56892	01526	0	98474	54
59 4	0.56	41628	5	58372	43158	6	56842	01529	0	98471	53
58 56	1 4	41675	6	58325	43208	7	56792	01533	0	98467	52
58 48	1 12	41722	7	58278	43258	7	56742	01536	1	98464	51
58 40	2 1 20	9.41768	8	10.58232	9.43308	8	10.56692	10.01540	1	9.98460	$\overline{50}$
$58 \ 32$	1 28	41815	8	58185	43358	9	56642	01543	1	98457	49
58 24	1 36	41861	. 9	58139	43408	10	56592	01547	1	98453	48
$58 \ 16$	1 44	41908	- 10	58092	43458	11	56542	01550	1	98450	47
58 8	1 52	41954	. 11	58046	43508	11	56492	01553	1	98447	46
58 0	2 2 0	9.42001	11	10.57999	9.43558	12	10.56442	10.01557	1	9.98443	45
57 52	2 8	42047	12	57953	43607	13	56393	01560	1	98440	44
57 44	2 16	42093	13	57907	43657	14	56343	01564	1	98436	43
$57 \ 36$	2 24	42140	. 14	57860	43707	. 15	56293	01567	1	98433	42
$57 \ 28$	2 32	42186	14	57814	43756	- 16	56244	01571	1	98429	41
57 20	2 2 40	9.42232	15	10.57768	9.43806	16	10.56194	10.01574	1	9.98426	- 40
$57 \ 12$	2.48	42278	16	57722	43855	: 17	56145	01578	1	98422	39
57 4	256	42324	17	57676	43905	18	56095	01581	1	98419	38
$56 \ 56$	3 4	42370	17	57630	43954	19	56046	01585	1	98415	37
56 48	3 12	42416	18	57584	44004	20	55996	01588	1	98412	36
56 40	2 3 20	9.42461	19	10.57539	9.44053	20	10.55947	10.01591	1	9.98409	35
56 32	3 28	42507	20	57493	44102	21	55898	01595	2	98405	34

150			А		A	B		В	С		С	164°
М.	Hour A.M.	Hour P. M.	Sine.	Diff.	Coseeant.	Tangent.	Diff.	Cotangent.	Secant.	Diff.	Cosine.	м.
0	10 0 0	2 0 0	9.41300	0	10.58700	9.42805	0	10.57195	10.01506	0	9.98494	60
1	$9 59 52 \\ 59 41$	0 8 0 16	41347 4130.1	1 9	58653 58606	42856 42906	$\frac{1}{2}$	57144 5709.1	01509	0	98491	59
$\frac{2}{3}$	59 36	$0 10 \\ 0 24$	41441	2	58559	42957	$\frac{2}{2}$	57043	01516	0	98484	57
4	$59\ 28$	$0 \ 32$	41488	3	58512	43007	3	56993	01519	0	98481	56
5	9 59 20	2 0 40	9.41535	4	10.58465	9.43057	4	10.56943	10.01523	0	9.98477	55
$\frac{6}{7}$	$59\ 12$ 59 1	$ \begin{array}{c} 0 & 48 \\ 0 & 56 \end{array} $	41582	05	58418 58379	43108	0 6	56842	01526	0	98474	04
8	59 - 4 58 56	1 4	41675	6	58325	43208	7	56792	01533	0	98467	$53 \\ 52$
9	58 48	1 12	41722	7	58278	43258	7	56742	01536	1	98464	51
10	9 58 40	$\begin{array}{cccccccccccccccccccccccccccccccccccc$	9.41768	8	10.58232	9.43308	8	10.56692	10.01540	1	9.98460	50
11	$\frac{58}{58} \frac{32}{24}$	1 28	41810	9		43308	10	56592	01543	1	98407	49
12^{12}	58 16	1 44	41908	10	58092	43458	11	56542	01550	1	98450	47
14	58 8	1 52	41954	11	58046	43508	11	56492	01553	1	98447	46
15	9 58 0	$2 \ 2 \ 0$	9.42001	11	10.57999	9.43558	12	10.56442	10.01557	1	9.98443	45
16	$\frac{2}{57}$ $\frac{1}{14}$	$\frac{2}{2}$ $\frac{8}{16}$	42047	$\frac{12}{13}$	07903 57907	$\frac{43607}{43657}$	13	56343	01564	1	98440	44
18	$57 \ 36$	$ \frac{2}{2} \frac{10}{24} $	42033	14	57860	43707	15	56293	01567	1	98433	42
19	$57\ 28$	2 32	-42186	14	57814	43756	16	56244	01571	1	98429	41
20	9 57 20	$2 \ 2 \ 40$	9.42232	15	10.57768	9.43806	16	10.56194	10.01574	1	9.98426	40
$\frac{21}{22}$	$57 12 \\ 57 4$	$\frac{2}{2}$ $\frac{48}{56}$	42278	$10 \\ 17$	57676	43800	17	56095	01578	1	98422	39
$\frac{22}{23}$	56 56	$\frac{2}{3}$ $\frac{60}{4}$	42370	17	57630	43954	19	56046	01585	1	98415	37
24	$56 \ 48$	3 12	42416	18	57584	44004	20	55996	01588	1	98412	36
25	9 56 40	$\begin{array}{cccccccccccccccccccccccccccccccccccc$	9.42461	19	10.57539	9.44053	20	10.55947	10.01591	1	9.98409	35
$\frac{26}{27}$	$56 32 \\ 56 94$	3 28 3 36	42507	20	57493 57447	44102	21 99	55849 55849	01598	$\frac{2}{2}$	98405	34
$\frac{2}{28}$	56 16	3 44	42599	21	57401	44201	$\tilde{23}$	55799	01602	$\overline{2}$	98398	32
29	56 - 8	3 52	42644	22	57356	44250	24	55750	01605	2	98395	31
30	9560	$2 \ 4 \ 0$	9,42690	23	10.57310	9.44299	25	10.55701	10.01609	2	9.98391	30
31	55 52	+ 8 + 16	42730	24	57260 57219	44348 11397	20	55603	01612	2	98388	29
33	$55 \ 36$	$\frac{4}{4}$ $\frac{10}{24}$	42826	25	57174	44446	$\frac{20}{27}$	55554	01619	2	98381	27
34	$55 \ 28$	4 32	42872	26	57128	44495	28	55505	01623	2	98377	26
35	9 55 20	2 4 40	9.42917	27	10.57083	9.44544	29	10.55456	10.01627	2	9,98373	25
$\frac{36}{37}$	$\begin{array}{cccccccccccccccccccccccccccccccccccc$	+ 48 + 56	42962	$\frac{27}{28}$	56992	44592	29	55359	01630	2	98370	24
38	54 56	$\frac{1}{5}$ $\frac{1}{4}$	43053	$\frac{20}{29}$	56947	44690	. 31	55310	01637	$\frac{1}{2}$	98363	$\frac{23}{22}$
39	54 48	$5 \ 12$	43098	30	56902	44738	32	55262	01641	2	98359	21
40	95440	2 5 20	9.43143	30	10.56857	9.44787	33	10.55213	10.01644	2	9.98356	20
$\frac{41}{49}$	$\begin{array}{c} 54 & 52 \\ 54 & 94 \end{array}$	5 28 5 36	43188	- 31 - 39	-26812 56767	44830	34	55116	01648	$\frac{2}{2}$	98352	19
43	$54 \ 16$	5 44	43278	33	56722	44933	35	55067	01655	3	98345	17
44	54 8	5 52	43323	33	56677	44981	36	55019	01658	3	98342	16
45	9540	$\begin{array}{cccccccccccccccccccccccccccccccccccc$	9.43367	34	10.56633	9.45029	37	10.54971	10.01662	3	9.98338	15
40	53 52 53 44	0 8 6 16	43412	- 30 - 36	00088 56543	45126	38	54874	01669	3	98334	14
48	$53 \ 36$	624	43502	36	56498	45174	39	54826	01673	3	98327	12
49	53 28	6_32	43546	37	56454	45222	40	54778	01676	3	98324	11
50	9 53 20	$\begin{array}{cccccccccccccccccccccccccccccccccccc$	9.43591	38	10.56409	9.45271	41	10.54729	10.01680	3	9.98320	10
$\frac{51}{52}$	53 12 53 4	0 48. 6 56	43680	- 39	00300 56320	45367	42	54633	01683	3	98317	9
53	52 56	7 4	43724	40	56276	45415	43	54585	01691	3	98309	7
54	52 48	7 12	43769	41	56231	45463	44	54537	01694	3	98306	_6
55 56	95240	$\begin{array}{cccccccccccccccccccccccccccccccccccc$	9.43813	42	10.56187	9.45511	45	10.54489	10.01698	3	9.98302	5
57	$52 \ 52 \ 24$	$728 \\ 736$	43901	43	56099	45606	+0 -47+	54394 54394	01701	3	98299	43
58	$52 \ 16$	7 44	43946	44	56054	45654	47	54346	01709	3	98291	2
59 60	52 8 52 0	752	43990	45	56010	45702	48	54298	01712	3	98288	
		8 0	44034	46	99966	49790	49	54250	01716	+	98284	0
М.	Hour P. M.	Hour A. M.	Cosine.	Diff.	Secant.	Cotangent.	Diff.	Tangent.	Cosecant.	Diff.	Sine.	м.
1050)		A		A	В		В	С		С	740

Seconds of time	18	2^{8}	3*	4 \$	5^{s}	6,	7*
Prop. parts of eols. $\begin{cases} A \\ B \\ C \end{cases}$	6 6 0	$\begin{array}{c}11\\12\\1\end{array}$	17 18 1	$23 \\ 25 \\ 2$	$\begin{array}{c} 28\\31\\2\end{array}$	$^{34}_{37}_{3}$	40 43 3

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TABLE 44.

Log. Sines, Tangents, and Secants.

16°			А	e.	A	В		В	С		с	163°
М.	Hour A. M	Hour P. M.	Sine.	Diff.	Cosecant.	Tangent.	Diff.	Cotangent.	Secant.	Diff.	Cosine.	м.
0	9 52 0	2 8 0	9, 44034	0	10, 55966	9.45750	0	10.54250	10.01716	0	9.98284	60
1	51 52	8 8	44078		55922	45797	1	54203	01719	0	98281	59
2	01 44 51 36	8 10	44122	1 9	00878 55834	40840	- 2 5	04100 54108	01723 01727	0	98277	58 57
4	$51 \ 28$	8 32	44210	3	55790	45940	3	54060	01730	0	98270	56
5	9 51 20	2 8 40	9,44253	4	10.55747	9.45987	4	10.54013	10.01734	0	9.98266	55
6	$51 \ 12$	8 48	44297	4	55703	46035	5	53965	01738	0	98262	54
7	51 4	8 56	44341	5	55659	46082	$\frac{5}{c}$	53918	01741	0	98259	53
8	50.18	9 4	44380	6	00010 55572	46130 46177	07	03870 53823	01740	0	98200	$\frac{52}{51}$
$\frac{0}{10}$	9 50 40	2 9 20	9 44472	$\frac{1}{7}$	10.55528	9 46994		10.53776	$\frac{01743}{10,01752}$	-1	9 98918	$\frac{51}{50}$
11	50 32	928	44516	8	55484	46271	9	53729	01756	i	98244	49
12	50.24	9-36	44559	- 9	55441	46319	9	53681	01760	1	98240	48
13	50.16	9 44	44602	9	55398	46366	10	53634	01763	1	98237	47
14	$\frac{30}{50}$ $\frac{8}{50}$	9 82	44040	10	00504	40415	11	0.59540	01/0/		98233	46
10	9 30 0 - 1) 59	2 10 0	9.44089	11	10. 55267	9.40400	12	10. 55540	01774	1	9. 98229 98226	40
17	49 44	10 16	44776	12	55224	46554	13	53446	01778	1	98222	43
18	40 36	10 24	44819	: 13	55181	46601	14	53399	01782	1	98218	42
19	49 28	10 32	44862	14	55138	46648	15	53352	01785		98215	41
20	9 49 20	2 10 40	9.44905	14	10.55095	9.46694	15	10.53306	10.01789	1	9.98211	40
$\frac{21}{22}$	49 12	10 + 8 10 - 56	44992	16	55008	46788	17	53212	01795	1	98207	39
23	48 56	11 4	45035	16	54965	46835	18	53165	01800	1	98200	37
24	48 48	11 12	45077	17	54923	46881	19	53119	01804	1	98196	36
25	9 48 40	2 11 20	9.45120	18	10.54880	9.46928	19	10.53072	10.01808	2	9.98192	35
26	48 32	11 28	45163	18	54837	46975	20	53025	01811	2	98189	34
21 28	48 16	11 50	45249	20	54751	47021	22	52979	01819	$\frac{2}{2}$	98180	- 32 - 32
$\frac{20}{29}$	48 8	11 52	45292	21	54708	47114	$\frac{1}{22}$	52886	01823	$\frac{1}{2}$	98177	31
30	9 48 0	2 12 0	9.45334	21	10.54666	9.47160	23	10.52840	10.01826	2	9.98174	30
31	47 52	12 8	45377	22	54623	47207	24	52793	01830	$\frac{2}{2}$	98170	29
32	47 44	12 16	45419	23	54581	47253	25	52747	01834	$\frac{2}{9}$	98166	28
ээ 34	47 28	$12 24 \\ 12 32$	45402	20	54496	47295	$\frac{20}{26}$	52654	01833	$\frac{2}{2}$	98159	$\frac{27}{26}$
35	9 47 20	2 12 40	9,45547	25	10. 54453	9.47392	27	10. 52608	10.01845	$\frac{-2}{2}$	9,98155	$\frac{20}{25}$
36	47 12	12 48	45589	26	54411	47438	28	52562	01849	2	98151	24
37	47 4	12 56	45632	26	54368	47484	29	52516	01853	$\frac{2}{2}$	98147	23
38	46 56	13 4	45716	21	51981	47576	29	52470	01860	$\frac{2}{9}$	98144	22
10	9 16 10	2 13 20	9 15758	20	10 51919	9 47622	31	10 52378	10 01864		9 98136	$\frac{21}{20}$
41	46 32	13 28	45801	$\tilde{29}$	54199	47668	32	52332	01868	3	98132	19
42	46 24	$13 \ 36$	45843	30	54157	47714	32	52286	01871	3	98129	18
43	46 16	13 44	45885	31	54115	47760	33	52240	01875	3	98125	17
44	46 8	$\frac{13}{9}$ $\frac{52}{14}$	40927	31	54073	4/806	34	52194	01879	$-\frac{3}{2}$	98121	$\frac{16}{15}$
40	9 40 U 45 59	2140 118	9.40909	-32 -33	10. 54031	9.47892	- 39 - 36	10. 52148 52103	01887	3	9.98117	10
47	45 44	14 16	46053	33	53947	47943	36	52057	01890	3	98110	13
48	45 36	14 24	46095	34	53905	47989	37	52011	01894	3	98106	12
49	45_28	14 32	46136	_35	53864	48035	38	51965	01898	3	98102	11
50	9 45 20	2 14 40	9.46178	36	10.53822	9.48080	39	10.51920	10.01902	3	9.98098	10
01 52	40 14	14 48	46220	30	52738	48171	40	51829	01900	3	98094	8
53	44 56	15 4	46303	-38	53697	48217	41	51783	01913	3	98087	7
54	44 48	$15 \ 12$	46345	38	53655	48262	42	51738	01917	3	98083	6
55	9 44 40	2 15 20	9,46386	- 39	10.53614	9.48307	43	10.51693	10,01921	3	9.98079	5
$\frac{56}{57}$	$\frac{44}{11}\frac{32}{91}$	15-28 15-20	46428	40	59521	48353	43	51609	01925	3	98075	4
58	44 16	10 00	46511	41	53489	48443	45	51557	01929	4	98067	2
59	44 8	15 52	46552	42	53448	48489	46	51511	01937	4	98063	1
60	44 0	16 0	46594	43	53406	48534	46	51466	01940	4	98060	0
м.	Hour P. M.	Hour A. M.	Cosine.	Diff.	Secant.	Cotangent	Diff.	Tangent.	Cosecant.	Diff	Sine.	М.
106°	•		А		А	В		В	С		С	73°

Seconds of time	1*	28	3.	45	5*	6s	7*
Prop. parts of cols. $\begin{cases} A \\ B \\ C \end{cases}$		11 12 1	$\begin{array}{r}16\\17\\1\end{array}$	$\begin{array}{c} 21\\ 23\\ 2\end{array}$	$\begin{array}{c} 27\\29\\2\end{array}$	$32 \\ 35 \\ 3$	$\begin{array}{c} 37\\41\\3\end{array}$

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	-		
5 20	25	30	35
7 22	28	33	39
	$\begin{array}{cccc} 5 & 20 \\ 7 & 22 \\ 1 & 2 \end{array}$	$\begin{array}{c ccccccccccccccccccccccccccccccccccc$	$egin{array}{cccccccccccccccccccccccccccccccccccc$

Log. Sines, Targents, and Secants. 11 ² A A B C C M. Hour A.M. Hour A.M. Sine. Diff. Cosecant. Tangent. Diff. Colangent. Diff. Colangent. Diff. Colangent. Diff. Colangent. Diff. Colangent. Diff. Colangent. Secant. Secant.		TABLE 44. [Page 625											
$ \begin{array}{ c c c c c c c c c c c c c c c c c c c$				3	Log.	Sines, Tan	gents, and	l Sec	ants.				
	170			A	1	A	B	1	В	С	1	С	162°
0 = 9 + 4 = 0 = 2 + 6 = 0 = 9 + 6 + 5 + 4 = 0 = 0 = 5 + 5 + 3 + 6 = 0 = 1 = 5 + 3 + 4 = 0 = 0 = 9 + 4 = 0 = 0 = 9 + 4 = 0 = 0 = 9 + 4 = 0 = 0 = 9 + 4 = 0 = 0 = 9 + 4 = 0 = 0 = 9 + 4 = 0 = 0 = 9 + 4 = 0 = 0 = 9 + 4 = 0 = 0 = 9 + 4 = 0 = 0 = 9 + 4 = 0 = 0 = 9 + 4 = 0 = 0 = 9 + 4 = 0 = 0 = 9 + 4 = 0 = 0 = 9 + 4 = 0 = 0 = 9 + 4 = 0 = 0 = 9 + 4 = 0 = 0 = 9 + 4 = 0 = 0 = 9 + 4 = 0 = 0 = 9 + 4 = 0 = 0 = 0 = 0 = 0 = 0 = 0 = 0 = 0 =	M.	Hour A.M.	Hour P.M.	Sine.	Diff.	Coseeant.	Tangent.	Diff.	Cotangent.	Secant.	Diff.	Cosine.	М.
$ \begin{array}{cccccccccccccccccccccccccccccccccccc$	0	9440 1259	2 16 0	9.46594	0	10.53406 53365	9.48534 48579	0	10.51466 51421	10.01940	0	9.98060	60
$ \begin{array}{c c c c c c c c c c c c c c c c c c c $	2	43 52 43 44	16 16	46676	1	53324	48624	1	51376	01944	0	98050	58
$ \begin{array}{c c c c c c c c c c c c c c c c c c c $	3	43 36	16 24	46717	$\begin{vmatrix} 2 \\ 2 \end{vmatrix}$	53283	48669	$\begin{vmatrix} 2 \\ 2 \end{vmatrix}$	51331	01952	0	98048	57
		43 28	$\frac{16 32}{2 16 40}$	46758	$\frac{3}{3}$	$\frac{54242}{10.53200}$	48/14	- 3	51286 10 51241	01956	$-\frac{0}{0}$	98044	55
$ \begin{array}{cccccccccccccccccccccccccccccccccccc$	6	43 12	16 48	46841	4	53159	48804	4	51196	01964	0	98036	54
$ \begin{array}{cccccccccccccccccccccccccccccccccccc$	7	43 4	16 56	46882	5	53118	48849	5	51151	01968	0	98032	53
$ \begin{array}{cccccccccccccccccccccccccccccccccccc$	9	$42 \ 30$ $42 \ 48$	17 4 17 12	46923	$\begin{vmatrix} 3\\6 \end{vmatrix}$	53036	48939		51061	01975	1	98029 98025	$52 \\ 51$
	10	9 42 40	2 17 20	9.47005	7	10.52995	9.48984	7	10.51016	10.01979	1	9.98021	50
$ \begin{array}{cccccccccccccccccccccccccccccccccccc$	$\frac{11}{12}$	$42 \ 32$ $42 \ 24$	$17 28 \\ 17 36$	47045	8	52955 52914	49029	8	50971 50927	01983	1	98017	49
	$1\overline{3}$	42 16	17 44	47127	9	52873	49118	10	50882	01991	1	98009	47
	14	42 8	17 52	47168	$-\frac{9}{2}$	52832	49163	10	50837	01995	1	98005	46
$ \begin{array}{cccccccccccccccccccccccccccccccccccc$	$10 \\ 16$	$9 42 0 \\ 41 52$	$ \begin{array}{ccccccccccccccccccccccccccccccccc$	9.47209 47249	10	52791 52751	9.49207 49252	$11 \\ 12$	10. 50793	$10.01999 \\ 02003$	1	9.98001 97997	40
$ \begin{array}{cccccccccccccccccccccccccccccccccccc$	17	41 44	18 16	47290	11	52710	49296	12	50704	02007	1	97993	43
$\begin{array}{c c c c c c c c c c c c c c c c c c c $	18 19	$ 41 36 \\ 41 98 $	$18 24 \\ 18 32$	$47330 \\ 47371$	$\frac{12}{13}$	52670 52629	$49341 \\ 49385$	$13 \\ 14$	50659 50615	$02011 \\ 02014$		97989 97986	42
$ \begin{array}{c c c c c c c c c c c c c c c c c c c $	$\frac{10}{20}$	9 41 20	$\frac{1002}{21840}$	9.47411	13	10.52589	9.49430	15	10.50570	10.02018	$\frac{1}{1}$	9.97982	40
$\begin{array}{cccccccccccccccccccccccccccccccccccc$	21	41 12	18 48	47452	14	52548	49474	15	50526	02022	1	97978	39
$ \begin{array}{c c c c c c c c c c c c c c c c c c c $	$\frac{22}{23}$	41 4 40 56	18 56	$47492 \\ 47533$	$10 \\ 15$	52508 52467	49519	$16 \\ 17$	50481	02026	$\frac{1}{2}$	97974	38
$ \begin{array}{cccccccccccccccccccccccccccccccccccc$	24	40 48	19 12	47573	16	52427	49607	18	50393	02034	2	97966	36
$ \begin{array}{cccccccccccccccccccccccccccccccccccc$	$\frac{25}{96}$	9 40 40	2 19 20 10 28	9.47613	17	10.52387	9.49652	18	10.50348	10.02038	$\frac{2}{2}$	9.97962	35
$\begin{array}{c ccccccccccccccccccccccccccccccccccc$	$\frac{26}{27}$	$40 32 \\ 40 24$	$19 28 \\ 19 36$	47694	18	52306	49696	$\frac{19}{20}$	50260	02042 02046	$\frac{1}{2}$	97958	33
$\begin{array}{c ccccccccccccccccccccccccccccccccccc$	28	40 16	19 44	47734	19	52266	49784	21	50216	02050	2	97950	32
$ \begin{array}{c ccccccccccccccccccccccccccccccccccc$	$\frac{29}{30}$	$\frac{40}{9}$ $\frac{8}{10}$ $\frac{10}{0}$	$\frac{19.52}{2.20}$	47774	-19	$\frac{52226}{10.52186}$	49828	$\frac{21}{-99}$	$\frac{50172}{10,50128}$	02054 10 02058	2	97946	$\frac{31}{30}$
$\begin{array}{c ccccccccccccccccccccccccccccccccccc$	31	39 52	$\begin{bmatrix} 2 & 0 & 0 \\ 20 & 8 \end{bmatrix}$	47854	21	52146	49916	23	50084	02062	$\overline{2}$	97938	29
$ \begin{array}{cccccccccccccccccccccccccccccccccccc$	$\frac{32}{22}$	39 44	20 16	47894 47024	$\frac{21}{22}$	52106	49960	24	50040	02066	$\frac{2}{2}$	97934	28
$\begin{array}{c ccccccccccccccccccccccccccccccccccc$	$\frac{33}{34}$	39 28	$20 \ 32$	47974	$\frac{1}{23}$	52026	50044	25	49952	02070	$\frac{2}{2}$	97926	$\frac{2}{26}$
$ \begin{array}{cccccccccccccccccccccccccccccccccccc$	35	9 39 20	2 20 40	9.48014	23	10.51986	9.50092	26	10.49908	10.02078	2	9.97922	25
$ \begin{array}{c ccccccccccccccccccccccccccccccccccc$	$\frac{36}{37}$	$39 12 \\ 39 4$	$20 \ 48 \\ 20 \ 56$	$\frac{48054}{48094}$	$\frac{24}{25}$	$51946 \\ 51906$	50136 50180	$\frac{26}{27}$	49864	02082	$\frac{2}{2}$	97918	24
$\begin{array}{c ccccccccccccccccccccccccccccccccccc$	38	38 56	21 4	48133	25	51867	50223	28	49777	02090	3	97910	$\overline{22}$
$ \begin{array}{cccccccccccccccccccccccccccccccccccc$	$\frac{39}{10}$	$\frac{38}{0}$ $\frac{48}{10}$	21 12	48173	26	$\frac{51827}{10.51787}$	50267	$\frac{29}{20}$	49733	02094		97906	$\frac{21}{90}$
$ \begin{array}{c ccccccccccccccccccccccccccccccccccc$	40	38 32	2121 20 21 28	48252	$\frac{27}{27}$	51748	50355	$\frac{29}{30}$	49645	02102	3	97898	$120 \\ 19$
$ \begin{array}{c ccccccccccccccccccccccccccccccccccc$	42	38 24	21 36	48292	28	51708	50398	31	49602	02106	3	97894	18
$ \begin{array}{c ccccccccccccccccccccccccccccccccccc$	43 44	$\frac{38}{38}$	$ \begin{array}{ccc} 21 & 44 \\ 21 & 52 \end{array} $	$\frac{48332}{48371}$	$\frac{29}{29}$	$51668 \\ 51629$	50442 50485	$\frac{32}{32}$	49515	02110	3	97890 97886	11/16
$ \begin{array}{c ccccccccccccccccccccccccccccccccccc$	45	9 38 0	2 22 0	9.48411	30	10.51589	9.50529	33	10. 49471	10.02118	3	9.97882	15
$\begin{array}{cccccccccccccccccccccccccccccccccccc$	$\frac{46}{47}$	$\begin{array}{ccc} 37 & 52 \\ 37 & 44 \end{array}$	22 8 29 16	48450	31	51550	50572 50616	34	49428	02122	$\begin{vmatrix} 3\\ 2 \end{vmatrix}$	97878 9787.1	14
$ \begin{array}{ c c c c c c c c c c c c c c c c c c c$	48	37 + 11 = 37 - 36	$22 10 \\ 22 24$	48529	32	51471	50659	35	49341	02120	3	97870	12^{13}
$ \begin{array}{c ccccccccccccccccccccccccccccccccccc$	49	37 28	22 32	48568	33	51432	50703	36	49297	02134	3	97866	11
$ \begin{array}{cccccccccccccccccccccccccccccccccccc$	$\frac{50}{51}$	$9 \ 37 \ 20 \ 37 \ 19$	$2 22 40 \\ 22 48$	9.48607 48617	33	10.51393 51353	9.50746	$\frac{37}{37}$	$10.49254 \\ 49211$	10.02139 02143	3	$9.97861 \\97857$	$\frac{10}{9}$
	52	37 4	22 56	48686	35	51314	50833	38	49167	02147	3	97853	8
$\begin{bmatrix} 53 \\ 54 \end{bmatrix}$ $\begin{bmatrix} 36 \\ 56 \end{bmatrix}$ $\begin{bmatrix} 23 \\ 4 \end{bmatrix}$ $\begin{bmatrix} 48/20 \\ 574 \end{bmatrix}$ $\begin{bmatrix} 30 \\ 51236 \end{bmatrix}$ $\begin{bmatrix} 50010 \\ 40 \end{bmatrix}$ $\begin{bmatrix} 49124 \\ 02151 \end{bmatrix}$ $\begin{bmatrix} 2101 \\ 4 \end{bmatrix}$ $\begin{bmatrix} 4 \\ 9/849 \end{bmatrix}$	$\frac{53}{54}$	$\frac{36}{36}$	$23 \ 4$ 23 19	48725	$\frac{35}{36}$	51275 51226	50876 50010	39	49124	$02151 \\ 02155$	4	97849 97845	7
$\begin{array}{c ccccccccccccccccccccccccccccccccccc$	$\frac{54}{55}$	9 36 40	$\frac{23}{2}$ $\frac{12}{23}$ $\frac{12}{20}$	9.48803	$\frac{30}{37}$	$\frac{51250}{10.51197}$	9, 50962	40	$\frac{10001}{10.49038}$	$\frac{02155}{10.02159}$	4	9. 97841	5
$\begin{array}{cccccccccccccccccccccccccccccccccccc$	56	36 32	23 28	48842	37	51158	51005	41	48995	02163	4	97837	4
$egin{array}{c c c c c c c c c c c c c c c c c c c $	$\frac{57}{58}$	$\frac{36}{36} \frac{24}{16}$	$23 \ 36 \\ 23 \ 44$	$48881 \\ 48920$	$\frac{38}{39}$	$51119 \\ 51080$	$51048 \\ 51092$	$\frac{42}{43}$	48952 48908	$02167 \\ 02171$	4	97833 97829	$\frac{3}{2}$
$ \begin{array}{c ccccccccccccccccccccccccccccccccccc$	59	36 8	23 52	48959	39	51041	51135	43	48865	02175	4	97825	1
$\begin{array}{c ccccccccccccccccccccccccccccccccccc$	60	36 0	24 0	48998	40	51002	51178	-14	48822	02179	4	97821	0
M. Hour P. M. Hour A. M. Cosine. Diff. Secant. Cotangent. Diff. Tangent. Cosecant. Diff. Sine.	М.	Hour P.M.	Hour A.M.	Cosine.	Diff.	Secant.	Cotangent.	Diff.	Tangent.	Cosecant.	Diff.	Sine.	М.
107° A A B B C C	1070			A		А	В		В	С		С	720

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Log.	Sines.	Tangents.	and	Secant
1.02.	DILLON.	THECHINE	CLIICE.	Nound

180			А	rog.	A	B B	u pet	B	С		С	1610
М.	Hour A. M.	Hour P. M.	Sine.	Diff.	Coseeant.	Tangent.	Diff.	Cotangent.	Secant.	Diff.	Cosine.	М.
	9.36 0	2 24 0	9, 48998	0	10.51002	9.51178	0	10, 48822	10.02179	0	9,97821	60
1	35 52	24 8	49037	ĩ	50963	51221	ĭ	48779	02183	0	97817	59
2	35 44	24 16	49076	1	50924	51264	1	48736	02188	0	97812	58
3	35 36	24 24	49115	2	50885	51306	20	48694	02192	0	97808	57
-+	35 28	24 (52	49103	- 0-	00847	0 51900	- 0	48001	02190	-0	97804	<u>- 90</u> 5=
- 0 - 6	9 55 20 35 19	2 24 40 91 48	9.49192	3	50769	9. 01392 51435	3 4	48565	02200 02204	0	97796	00 54
7	35 4	24 56	49269	4	50731	51478	5	48522	02208	ŏ	97792	53
8	34 56	25 4	49308	5	50692	51520	6	48480	02212	1	97788	52
9	34 48	25 12	49347	6	50653	51563		48437	02216	1	97784	51
10	9 34 40	2 25 20	9.49385	$\frac{6}{7}$	10.50615 50576	9.51606		10.48394	10.02221 02225	1	9.97779	50
$\frac{11}{12}$	34 54 34 24	$25 26 \\ 25 36$	49462	8	50538	51691	8	48309	02229	1	97771	45
$1\overline{3}$	34 16	25 44	49500	8	50500	51734	9	48266	02233	1	97767	47
14	34 8	25 52	49539	9	50461	51776	10	48224	02237	1	97763	46
15	9 34 0	$2\ 26\ 0$	9.49577	9	10.50423	9.51819	10	10.48181	10.02241	. 1	9.97759	45
16	33 52	26 8	49615	10	5024e	51861	11	48139	02246	1	97754	44
$\frac{17}{18}$	- 55 44 - 32 36	20 10 26 24	49004	11	50346	51903	$\frac{12}{13}$	48054	02250	1	97746	40
19	33 28	26 32	49730	12	50270	51988	13	48012	02258	Î	97742	41
20	9 33 20	2 26 40	9.49768	13	10.50232	9.52031	14	10.47969	10.02262	1	9.97738	40
21	. 33 12	$26 \ 48$	49806	13	50194	52073	15	47927	02266	1	97734	39
22	$\frac{33}{20}$	$\frac{26}{97}$ 56	49844	14	50156	52115	15_{10}	47885	02271	$\begin{vmatrix} 2 \\ 0 \end{vmatrix}$	97729	38
23	32 36 39 49	$\frac{27}{97}$ 19	49882	14	50080	02107 52200	10	47843	02275	29	97725	37
-24	9 32 40	2 27 20	9 40058	16	10 50049	9 52200	17	10 47758	10 02213	2	9.97717	35
$\frac{20}{26}$	$32 \ 32 \ 32$	27 28	49996	16	500042	52284	18	47716	02287	$\frac{1}{2}$	97713	34
27	32 24	$27 \ 36$	50034	17	49966	52326	19	47674	02292	2	97708	33
28	$32 \ 16$	27 44	50072	18	49928	52368	20	47632	02296	2	97704	32
$\frac{29}{82}$	32 8	27 52	50110	18	49890	52410	20	47590	02300	2	97700	31
30	9320 3150	2280	9. 50148	19	10.49852	9. 52452	21	10. 47548	10.02304 02200		9.97696	30
$\frac{31}{32}$	$ 31 \ 32 \\ 31 \ 44 $	$20 \\ 28 \\ 16$	50180 50223	20	49810	52536	$\frac{22}{22}$	47464	02309	$\frac{2}{2}$	97687	$\frac{20}{28}$
33	31 36	$\frac{28}{28}$ 24	50261	21	49739	52578	$\overline{23}$	47422	02317	$\overline{2}$	· 97683	27
34	31 28	$28 \ 32$	50298	21	49702	52620	24	47380	02321	2	97679	26
35	$9 \ 31 \ 20$	$2 \ 28 \ 40$	9.50336	22	10.49664	9.52661	24	10.47339	10.02326	2	9.97674	25
36	31 12	28 48	50374	23	49626	52703	25	47297	02330	3	97670	24
37	31 - 4 30 - 56	28 96 90 1	00411 50440	23	49089	52740 52787	20	47200	02338	3	97662	20
39	30 48	$\frac{29}{29}$ 12	50486	25	49514	52829	27	47171	02343	3	97657	21
40	9 30 40	2 29 20	9.50523	25	10.49477	9,52870	28	10.47130	10.02347	3	9.97653	20
41	$30 \ 32$	29 28	50561	26	49439	52912	29	47088	02351	3	97649	19
42	30 24	29 36	50598	26	49402	52953	$ \frac{29}{20} $	47047	02355	3	97645	18
43	30 16	29 44	50635 50679	27	49365	02995 52027	30	47000	02360	3	97636	$\frac{17}{16}$
45	9 30 0	2 30 0	9 50710	98	10 49990	9.53078	31	10.46922	10. 02368	3	9,97632	15
46	29 52	$\frac{2}{30}$ $\frac{30}{8}$	50747	29	49253	53120	32	46880	02372	3	97628	14
47	29 44	30 16	50784	30	49216	53161	33	46839	02377	3	97623	13
48	29 36	30 24	50821	30	49179	53202	34	46798	02381	3	97619	$12 \\ 11$
49	29 28	30 32	50858	31	49142	53244	34	46756	02385	3	97015	11
50	9 29 20	2 30 40	9.50896	31	10.49104 40087	9. 53285	30	10.46715	10.02390 02391	4	97606	10
$51 \\ 52$	$ \begin{array}{ccc} 29 & 12 \\ 29 & 4 \end{array} $	30 48	50953	33	49030	53368	36	46632	02398	4	97602	8
53	28 56	31 4	51007	33	48993	53409	37	46591	02403	-4	97597	7
54	28 48	31 12	51043	34	48957	53450	38	46550	02407	4	97593	6
55	9 28 40	$2 \ 31 \ 20$	9.51080	35	10.48920	9.53492	38	10.46508	10.02411	4	9.97589	5
56	28 32	31 28	51117	35	48883	52574	39	46467 46496	02416 02420	-+	97580	4
58	$28 24 \\ 28 16$	31 44	51194	37	48809	53615	41	46385	02420	4	97576	2
59	28 8	31 52	51227	37	48773	53656	41	46344	02429	4	97571	1
60	28 0	32 0	51264	38	48736	53697	42	46303	02433	4	97567	0
M	Hour P. M.	Hour A. M.	Cosine.	Diff.	Secant.	Cotangent	Diff.	Tangent.	Cosecant.	Diff.	Sine.	М.
108	0	1	A	1	A	В	1	B	С	1	C	710

Seconds of time	13	25	3*	.4*	5*	6s	7 8
Prop. parts of cols. $\begin{cases} A \\ B \\ C \end{cases}$		9 10 1	$\begin{array}{c}14\\16\\2\end{array}$	$\begin{array}{c}19\\21\\2\end{array}$	$\begin{array}{c} 24\\ 26\\ 3\end{array}$	$\begin{smallmatrix}28\\31\\3\end{smallmatrix}$	$\begin{array}{c} 33\\37\\4 \end{array}$

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19 ⁵ Λ Λ B B C C 10 ² M Hour s. x. Hour s. x. Sine 10 ¹ Cosecant Tangent Infit Costance Mett Dift Costance Mett Mett Out O 9.753 Si Si <th></th> <th colspan="12">Log. Sines, Tangents, and Secants.</th>		Log. Sines, Tangents, and Secants.											
M Hour A.S. Hour P. A. Sine. Dift. Coscant. Tangent. Dift. Costance M. M. 0 9 28 0 2 32 8 512014 0 10.48738 1 40603 10.04333 10 927563 58 2 27 44 32 24 511314 2 48609 537757 1 40221 02442 0 975543 58 4 27 28 32 24 514417 2 48553 6.53843 4 40516 024481 0 975745 55 6 977 23 24 515445 5 44435 5 440576 024481 0 975745 51 10 92 448 33 12 515485 5 444057 024541 1 975728 51 12 26 24 33 35 516496 7 48343 545410 7 455431 024541 1 975728 51	19°			А		А	В		В	С		С	106°
$ \begin{array}{c c c c c c c c c c c c c c c c c c c $	М.	Hour A.M.	Hour P.M.	Sine.	Diff.	Cosecant.	Tangent.	Diff.	Cotangent.	Secant.	Diff.	Cosine.	М.
$ \begin{array}{c c c c c c c c c c c c c c c c c c c $	0	9 28 0	2 32 0	9.51264	0	10.48736	9.53697	0	10.46303	10,02433	0	9.97567	60
$\begin{array}{c c c c c c c c c c c c c c c c c c c $	1	27 52	32 8	51301	1	48699	53738	1	46262	02437	0	97563	59
$\begin{array}{c c c c c c c c c c c c c c c c c c c $	$\frac{2}{3}$	27 44	32 16	51338	1	48662	53690	9	46221	02442 02.146	0	97551	- 3 8 - 57
$ \begin{array}{c c c c c c c c c c c c c c c c c c c $	- 3 - 1	$\frac{27}{97}\frac{30}{98}$	$\frac{52}{32}\frac{24}{32}$	51411	2	48589	53861	$\frac{2}{3}$	46139	02440	0	97550	56
$ \begin{array}{cccccccccccccccccccccccccccccccccccc$	$\frac{\pi}{5}$	9 27 20	2 32 40	9 51447		10, 48553	9.53902	3	10.46098	10.02455	$-\frac{0}{0}$	9,97545	55
$ \begin{array}{c c c c c c c c c c c c c c c c c c c $	6	27 12	32 48	51484	4	48516	53943	4	46057	02459	ŏ	97541	54
$ \begin{array}{c c c c c c c c c c c c c c c c c c c $	7	27 4	32 56	51520	4	48480	53984	5	46016	02464	1	97536	53
$\begin{array}{c c c c c c c c c c c c c c c c c c c $	8	26 56	33 4	51557	5	48443	54025	5	45975	02468	1	97532	52
$ \begin{array}{c c c c c c c c c c c c c c c c c c c $		26 48	33 12	51593	<u> </u>	48407	0-54060	6	40930	02472		97828	$\frac{16}{50}$
$\begin{array}{c c c c c c c c c c c c c c c c c c c $	$10 \\ 11$	$9\ 26\ 40$	2 33 20	9.51629	6	10.48371	9. 54106	4	10. 45859	10.02477 02481	1	9,97823	10
$\begin{array}{c c c c c c c c c c c c c c c c c c c $	11	20.52 26.94	33 36	51702	7	48298	54187	8	45813	02481	1	97515	48
$\begin{array}{c c c c c c c c c c c c c c c c c c c $	13^{-12}	26 16	33 44	51738	8	48262	54228	9	45772	02490	î	97510	47
$ \begin{array}{c c c c c c c c c c c c c c c c c c c $	14	26 8	33 52	51774	8	48226	54269	9	45731	02494	1	97506	46
$\begin{array}{c c c c c c c c c c c c c c c c c c c $	15	9 26 0	2 34 0	9.51811	9	10.48189	9.54309	10	10.45691	10.02499	1	9.97501	45
$\begin{array}{c c c c c c c c c c c c c c c c c c c $	16	25 52	34 8	51847	10	48153	54350	11	45650	02503	1	97497	44
$\begin{array}{c c c c c c c c c c c c c c c c c c c $	17	25 + 44 95 + 96	34 16 94 94	51883	10	48117	51121	11	45560	02508	1	97492	43
$ \begin{array}{c c c c c c c c c c c c c c c c c c c $	10	20 30	34 24 34 39	51919	11	48045	54471	12	45529	02512	1	97484	41
$\begin{array}{c c c c c c c c c c c c c c c c c c c $	$\frac{10}{20}$	9 25 20	2 34 40	9 51991	12	$\frac{10010}{10,48009}$	9 54512	13	10.45488	10.02521	1	9.97479	40
$\begin{array}{c c c c c c c c c c c c c c c c c c c $	$\frac{1}{21}$	25 12	34 48	52027	12	47973	54552	14	45448	02525	$\overline{2}$	97475	39
$\begin{array}{c c c c c c c c c c c c c c c c c c c $	22	25 - 4	34 56	52063	13	47937	54593	15	45407	02530	2	97470	-38
$\begin{array}{c c c c c c c c c c c c c c c c c c c $	23	24 56	35 4	52099	14	47901	54633	15	45367	02534	2	97466	37
$\begin{array}{c c c c c c c c c c c c c c c c c c c $	24	24 48	35 12	52135	14	47865	54673	16	45327	02539	2	97461	_36
$ \begin{array}{c c c c c c c c c c c c c c c c c c c $	25	9 24 40	$\begin{array}{c} 2 & 35 & 20 \\ & 25 & 28 \end{array}$	9.52171 59907	15	10.47829	9.54714 54754	17	10.45286	10.02543 02547	2	9.97457	35
$ \begin{array}{c c c c c c c c c c c c c c c c c c c $	$\frac{20}{97}$	$24 \ 32$ $24 \ 24$	$35 \ 36$	52207	16	47758	54794	18	45240	02547	2	97443	33
$\begin{array}{c c c c c c c c c c c c c c c c c c c $	$\frac{2}{28}$	24 16	35 44	52278	17	47722	54835	19	45165	02556	$\overline{2}$	97444	32
$\begin{array}{c c c c c c c c c c c c c c c c c c c $	29	24 8	35 52	52314	17	47686	54875	19	45125	02561	2	97439	31
$\begin{array}{c c c c c c c c c c c c c c c c c c c $	30	9 24 0	$2 \ 36 \ 0$	9.52350	18	10.47650	9.54915	20	10.45085	10.02565	2	9.97435	30
$\begin{array}{c ccccccccccccccccccccccccccccccccccc$	31	23 52	$\frac{36}{96}$	52385	18	47615	54955	21	45045	02570	2	97430	29
$\begin{array}{c c c c c c c c c c c c c c c c c c c $	$\frac{32}{32}$	$23 44 \\ 93 36$	30 10	52421 52456	19	47579	04990 55035	21	40000	02074	2	97420	28
$\begin{array}{c c c c c c c c c c c c c c c c c c c $	34	$23 \ 23 \ 28$	$36 \ 32$	52492	$\frac{20}{20}$	47508	55075	23	44925	02583	3	97417	$\frac{2}{26}$
3623123648525632147437551552444845025923974082437234365652598224736255195254480502597397403233822256374526342347366552522544470502601397394214099240237209.527052410.472959.553152710.4468510.0261039.973902041223237285274024472605535527446450261939.973802041223237365277525472255539528446050261939.9738717442283752528462647154554342944566026243973761744228375252846264715455543314446050263339.97367154621523885291627470495559331444600.0263339.9736314472144381652951284704955593314446702647497353124921283832530212946979	35	9 23 20	2 36 40	9.52527	$\frac{-3}{21}$	10.47473	9.55115	$\frac{-3}{23}$	10, 44885	10.02588	3	9.97412	$\frac{-5}{25}$
$\begin{array}{c ccccccccccccccccccccccccccccccccccc$	36	$23 \ 12$	36 48	52563	21	47437	55155	24	44845	02592	3	97408	24
$\begin{array}{c ccccccccccccccccccccccccccccccccccc$	37	23 4	36 56	52598	22	47402	55195	25	44805	02597	3	97403	23
$\begin{array}{c c c c c c c c c c c c c c c c c c c $	38	2256	$37 \pm 97 \pm 19$	52634	23	47366	55235	25	44765	02601	3	97399	22
$ \begin{array}{c ccccccccccccccccccccccccccccccccccc$	- 39	9 22 40	9 37 20	0 59705	20	47001	0.55915	- 97	44720	02000		97394	21
$\begin{array}{c ccccccccccccccccccccccccccccccccccc$	41	$ \begin{array}{c} 22 & 40 \\ 22 & 32 \end{array} $	$\frac{2}{37}$ $\frac{37}{28}$	52740	24	47260	55355	27	44645	02615	3	97385	19
$\begin{array}{c ccccccccccccccccccccccccccccccccccc$	42	22 24	$37 \ 36$	52775	25	47225	55395	28	44605	02619	3	97381	18
442283752528462647154554742944526026283973721645992023809528812710.471199555143010.4448610.0263339.97367154621523885291627470845555431444460263739736314472144381652951284704955593314440702647497358134821363824529862947014556333244367026474973531249212838325302129469795567333443270265149.7349115092120238409.530563010.469449.557123310.4428810.0265649.734095221438565312631468745579135442090266549.734095320563945316132468395581335441690266749.7325654204839125319632468045587036441300267449.7326655920 <td< td=""><td>43</td><td>$22 \ 16$</td><td>$37 \ 44$</td><td>52811</td><td>26</td><td>47189</td><td>55434</td><td>29</td><td>44566</td><td>02624</td><td>3</td><td>97376</td><td>17</td></td<>	43	$22 \ 16$	$37 \ 44$	52811	26	47189	55434	29	44566	02624	3	97376	17
$ \begin{array}{c ccccccccccccccccccccccccccccccccccc$	44	22 8	37 52	52846	26	47154	55474	_29	44526	02628	3	97372	16
10^{-10} 21^{-0} 21^{-0} 41084 30344 31^{-1} 414407 02037 3^{-5} 97356 14^{-1} 47^{-1} 21^{-14} 38^{-16} 52951^{-12} $28^{-4}7049$ 55593^{-3} $31^{-14}4407^{-10}$ 02642^{-13} 97358^{-13} 11^{-13} 49^{-12} 21^{-28} 38^{-22} 53021^{-29} 46979^{-9} 55673^{-3} $33^{-144367}$ 02647^{-14} 4^{-97353} 11^{-12} 49^{-12} 22^{-38} 40^{-9} $9,53056^{-3}$ 30^{-10} 46979^{-9} 55673^{-3} $33^{-144367}$ 02656^{-14} 9.97344^{-10} 51^{-21} 22^{-38} 40^{-9} $9,53056^{-3}$ 30^{-10} 46908^{-5} 55752^{-3} 34^{-14228} 10.02656^{-14} 9.97344^{-10} 51^{-21} 21^{-4} 38^{-56} 53126^{-31} 46874^{-55791} 35^{-44209} 02665^{-4} 9.97345^{-8} 8^{-53} 53^{-20} 20^{-56} 39^{-4} 53161^{-32} 46834^{-5} 55752^{-34} 444299^{-0} 02665^{-4} 9.97331^{-7} 8^{-53} 53^{-20} 20^{-56} 39^{-4} 53161^{-32} 32^{-46804} 55870^{-36} 36^{-44130} 0267^{-4} 4^{-9} 97326^{-6} 55^{-56} 20^{-32} 39^{-28} 53266^{-33} 46734^{-55949} $37^{-10.44090}$ 10.02678^{-8} $4^{-9.97317}^{-7}$ 4^{-57}^{-7} 56^{-20} 23^{-9} 29^{-5} 33^{-46734} $55949^{-37}^{-37}^{-44051}$ $02683^{$	45	922 0 9159	$\begin{array}{cccc} 2 & 38 & 0 \\ & 39 & 9 \end{array}$	9.52881	27	17004	9.55514	30	10. 44486	10.02633	3 9	9.97367	15
1.2136245205420110055063311446702047339366194921283832530212946979556733344327026514973491150992120238409,530563010,469449,557123310,4428810,0265649,973441051211238485309230409085575234442480266049734095221438565312631468745579135442090266549733585320563945319632468045587036441300267449732665592040239209,532313310.467699,559103710.4409010.0267849,9732255620323928532663346734559493744051026834973174572024393653301344669955989384401102688497312358201639445333634466695602839,4393302697497303160200405340536	47	21 02 21 44	38 16	52910	21	47044	55593	31	44440	02037	0	97358	111
$\begin{array}{c c c c c c c c c c c c c c c c c c c $	48	$21 \ 36$	38 24	52986	29	47014	55633	32	44367	02647	4	97353	12^{10}
$ \begin{array}{c ccccccccccccccccccccccccccccccccccc$	49	21 28	$38 \ 32$	53021	29	46979	55673	-33	44327	02651	4	97349	11
$ \begin{array}{c ccccccccccccccccccccccccccccccccccc$	50	9 21 20	$2 \ 38 \ 40$	9.53056	30	10.46944	9.55712	33	10.44288	10.02656	4	9.97344	10
$\begin{array}{c ccccccccccccccccccccccccccccccccccc$	51	21 12	38 48	53092	30	46908	55752	34	44248	02660	4	97340	9
54 20 48 39 12 50001 52 40055 50501 55 41130 02007 4 97301 6 55 9 20 40 2 39 20 9,53231 33 10.46769 9,55910 37 10.44090 10.2673 4 97326 6 56 20 32 39 28 53266 33 46304 555910 37 10.44090 10.02678 4 9.97322 5 5 5 5 20 24 39 36 53301 34 46699 55949 37 44051 02678 4 9.97317 4 57 20 24 39 36 53301 34 46699 55989 38 44011 02688 4 97312 3 58 20 16 39 44 53336 34 46664 56028 39 43933 02697 4 97308 2 3 3 46630 560667 39 43933 02697	$\frac{52}{53}$	$\frac{21}{20}$ $\frac{4}{56}$	06 86 39 1		31	46874	00791 55831	30	44209	02665	1	97335	
55 9 20 40 2 39 20 9 53231 33 10.46769 9.55910 37 10.44090 10.02678 4 9.97322 5 56 20 32 39 28 53266 33 46734 55949 37 44051 02683 4 97317 4 57 20 24 39 36 53301 34 46699 55989 38 44011 02688 4 97312 3 58 20 16 39 44 53336 34 46664 56028 39 43972 02692 4 97308 2 59 20 8 39 52 53370 35 46630 56067 39 43933 02697 4 97303 1 60 20 0 40 53405 36 46595 56107 40 43893 02701 4 97299 0 M. Hour A. M. Cosine. Diff. Sceant. Cotangent. Diff	54	20 48	39 12	53196	$\frac{32}{32}$	46804	55870	36	44130	02674	4	97326	6
56 20 32 39 28 53266 33 46734 55949 37 44051 02683 4 97317 4 57 20 24 39 36 53301 34 46699 55989 38 44011 02683 4 97317 4 58 20 16 39 44 53336 34 46664 56028 39 43972 02692 4 97308 2 59 20 8 39 52 53370 35 46630 56067 39 43933 02697 4 97303 1 60 20 0 40 53405 36 46595 56107 40 43893 02701 4 97299 0 M. Hour A. M. Cosine. Diff. Sceant. Cotangent. Diff. Tangent. Coseeant. Diff. Sine. M. 109° A A B B C C 70°	55	9 20 40	2 39 20	9.53231	33	10. 46769	9,55910	37	10.44090	10.02678	4	9.97322	5
57 20 24 39 36 53301 34 46699 55989 38 44011 02688 4 97312 3 58 20 16 39 44 53336 34 46664 56028 39 43972 02692 4 97308 2 59 20 8 39 52 53370 35 46630 56067 39 43933 02697 4 97303 1 60 20 0 40 53405 36 46595 56107 40 43893 02701 4 97299 0 M. Hour A. M. Cosine. Diff. Sceant. Cotangent. Diff. Tangent. Coseeant. Diff. Sine. M. 109° A A B B C C 70°	56	20 32	39 28	53266	33	46734	55949	37	44051	02683	4	97317	4
55 20 10 39 44 53336 34 46664 56028 39 43972 02692 4 97308 2 59 20 8 39 52 53370 35 46630 56067 39 43933 02697 4 97303 1 60 20 0 40 0 53405 36 46595 56107 40 43893 02697 4 97299 0 M. Hour P. M. Hour A. M. Cosine. Diff. Sceant. Cotangent. Diff. Tangent. Coseeaut. Diff. Sine. M. 109° A A B B C C 70°	57	20 24	$\frac{39}{20}$	53301	34	46699	55989	38	44011	02688	4	97312	3
$ \begin{array}{c ccccccccccccccccccccccccccccccccccc$	- 58 - 59	20 16	39 44 30 59	52970	34	46664	56028	39.	43972	02692	+	97308	1
M. Hour P. M. Hour A. M. Cosine. Diff. Sceant. Cotangent. Diff. Tangent. Cosecant. Diff. Sine. M. 109° A A B B C C 70°	60	20 0	40 0	53405	36	46595	56107	40	43893	02097	4	97299	
M. Hour A. M. Cosine. Diff. Secant. Cotangent. Diff. Tangent. Cosecant. Diff. Sine. M. 109° A A B B C C 70°		Hours	Hour										-
A A B B C C 70°	M.	Hour P. M.	Hour A. M.	Cosine.	Diff.	Secant.	Cotangent.	Diff.	Tangent.	Cosecant.	Diff.	Sine.	M.
	1080			A		A	В		В	С		С	70°

Seconds of time	1.8	2s	35	4*	ðs.	6*	78
Prop. parts of cols, $\begin{cases} A \\ B \\ C \end{cases}$	$\frac{4}{5}$ 1	9 10 1	$\begin{array}{c}13\\15\\2\end{array}$	$\begin{array}{c}18\\20\\2\end{array}$	$\frac{22}{25}_{3}$	$\begin{array}{c} 27\\30\\3\end{array}$	$\begin{array}{c} 31\\35\\4\end{array}$

	7
Domo	COD
Paye	nzo

Log. Sines, Tangents, and Secants.

20°			А		A	В		В	С		с	1590
М.	Hour A. M.	Hour P. M.	Sine.	Diff.	Cosecant.	Tangent.	Diff.	Cotangent.	Secant.	Diff.	Cosine.	м.
0	9 20 0	2 40 0	9.53405	0	10. 46595	9.56107	0	10.43893	10.02701	0	9.97299	60
$\frac{1}{2}$	$19 52 \\ 10 11$	$40 8 \\ 40 16$	53440	1	46525	56185	1	+3804 +3815	02706	0	97294	59
-3	$19 \ 36$	$40 \ 10 \ 40 \ 24$	53509	2	46491	56224	2	43776	02715	ŏ	97285	57
4	19/28	40 32	53544	2	46456	56264	- 3	43736	02720	. 0	97280	56
5	9 19 20	2 40 40	9.53578	3	10.46422	9.56303	3	10.43697	10.02724	0	9.97276	55
6	19 12	40 48 10 56	53613	3	46387	56342	-1	43658	02729 02721	0	97271	54
8	19 4 18 56	40 50	53682	5	46318	56420	5	43580	02734	1 1	97260	- 55 - 52
9	18 48	41 12	53716	5	46284	56459	6	43541	.02743	1	97257	51
.10	9 18 40	2 41 20	9.53751	6	10.46249	9.56498	6	10.43502	10.02748	1	9.97252	50
11	18 32	-41.28	53785	$\frac{6}{7}$	46215	56537	7	43463	02752	1	97248 07942	49
$\frac{12}{13}$	$18 24 \\ 18 16$	41 44	53854	7	46146	56615	8	43385	$02757 \\ 02762$	1	97243	48
14	18 8	41 52	53888	8	46112	56654	9	43346	02766	1	97234	46
15	9 18 0	2 42 0	9.53922	8	10.46078	9.56693	10	10.43307	10.02771	1	9.97229	45
16	17 52	42 8	53957	9	46043	56732	10	43268	02776	1	97224	44
17	$17 44 \\ 17 36$	42 10 42 91	54025	10	45975	56810	11	43229	02780	1	97220	43
19	$17 \ 28$	$42 \ 32$	54059	11	45941	56849	12	43151	02790	1	97210	41
20	9 17 20	2 42 40	9.54093	11	10.45907	9.56887	13	10.43113	10.02794	2	9,97206	40
21	$17 \ 12$	42 48	54127	12	45873	56926	13	43074	02799	2	97201	39
22	17 - 4 16 56	$\frac{42}{12}$ $\frac{56}{12}$	54161	12	45839	56965	14	43035	02804	2	97196	38
$\frac{20}{24}$	$16 \ 30$ $16 \ 48$	43 + 43 + 43 + 12	54229	14	45771	57042	15	42958	02803	$\frac{1}{2}$	97182	36
25	9 16 40	2 43 20	9.54263	14	10.45737	9.57081	16	10.42919	10.02818	$\overline{2}$	9.97182	35
26	$16 \ 32$	43 28	54297	15	45703	57120	17	42880	02822	2	97178	34
27	16 24 16 16	43 36 42 41	54331	15	45669	57158	17	42842	02827,	2	97173	33
$\frac{28}{29}$	$16 10 \\ 16 8$	$43 \ 52$	54399	16	45601	57235	19	42765	02832	$\frac{2}{2}$	97163	31
30	9 16 0	2 44 0	9.54433	17	10.45567	9.57274	19	10.42726	10.02841	$\overline{2}$	9,97159	30
31	15 52	44 8	54466	17	45534	57312	20	42688	02846	2	97154	29
$\frac{32}{99}$	15 44	44 16	54500	18	45500	57351	21	42649	02851	3	97149	28
- 33 - 34	$15 50 \\ 15 28$	$\frac{44}{44}$ $\frac{24}{32}$	•54567	19	45433	57428	$\frac{21}{22}$	42572	02855	3	97145	$\frac{27}{26}$
$\frac{01}{35}$	9 15 20	2 44 40	9.54601	20	10.45399	9.57466	22	10.42534	10.02865	3	9.97135	25
36	$15 \ 12$	44 48	54635	20	45365	57504	23	42496	02870	3	97130	24
37	15 4	44 56	54668	21	45332	57543	24	42457	02874		97126	23
$\frac{38}{39}$	$14 \ 00 \\ 14 \ 48$	$\frac{40}{45}$ $\frac{4}{12}$	54702 54735	$\frac{21}{22}$	45265	57619	24 25	42419	02879	3	97121	22
40	9 14 40	$\frac{10}{2}$ 45 20	9.54769	${23}$	10, 45231	9, 57658	26	10. 42342	10.02889	3	9,97111	20
41	14 32	45 28	54802	23	45198	57696	26	42304	02893	3	97107	19
42	14 24	45 36	54836	24	45164	57734	27	42266	02898	3	97102	18
43	14 10 14 8	40 44	54809 54903	24	45131	57810	$\frac{28}{28}$	42228	02903	3	97097	16
45	9 14 0	$\frac{10 02}{2 46 0}$	9, 54936	25	10, 45064	9.57849	29	10, 42151	10.02913	4	9.97087	$\frac{10}{15}$
46	13 52	46 8	54969	26	45031	57887	30	42113	02917	4	97083	14
47	13 44	46 16	55003	26	44997	57925	30	42075	02922	4	97078	13
48	13 36	46 24 16 32	55069	21	44964	58001	31	42037	02927	+	97073	112
$\frac{49}{50}$	9 13 20	2 46 40	9.55102	$\frac{20}{28}$	10.44898	9.58039	32	10. 41961	10.02937	-+	9,97063	10
51	13 12	46 48	55136	29	44864	58077	33	41923	02941	4	97059	9
52	13 4	46 56	55169	29	44831	58115	33	41885	02946	4	97054	8
53	$12 56 \\ 12 19$	47 4	55202 55925	30	44798	58153 58101	34	41847	02951	4	97049	· 7 6
55	9 19 10	2 47 20	9 55268	31	10. 44739	9. 58229	35	10.41771	10, 02961		9, 97039	5
56	$12 \ 32$	47 28	55301	32	44699	58267	36	41733	02965	4	97035	4
57	12 24	47 36	55334	32	44666	58304	37	41696	02970	4	97030	3
58 50	12 16	47 44	55367	33	44633	58342	37	41658	02975	5	97025	2
-59 -60	$12 \ 0$	$\frac{47}{48}$ 0	55433	34	44567	58418	39	41582	02985	5	97015	0
	Hourp	Hours	Cosina	Diff	Secont	Cotangent	Diff	Tangent	Coscent	Diff	Sine	M
M.	HOUP P. M.	HOUF A. M.	s sources	Duff.	secant.	R R	DIII.	R R	Cosecant.	Din.	C.	690
110.			-11									

Seconds of time	15	28	3.	4.8	58	61	78
Prop. parts of cols. $\begin{cases} A \\ B \\ C \end{cases}$	4 5 1	8 10 1	$\begin{array}{c}13\\14\\2\end{array}$	$\begin{array}{c} 17\\19\\2\end{array}$	$\begin{array}{c}21\\24\\3\end{array}$	$ \begin{array}{c} 25 \\ 29 \\ 4 \end{array} $	$\begin{array}{c} 30\\34\\4\end{array}$

TA	BL	Æ	44.
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210			А	Log.	Sines, Tar	igents, and B	1 Sec	ants. B	С		С	1580
м.	Hour A.M.	Hour P.M.	Sine.	Diff.	Cosecant.	Tangent.	Diff.	Cotangent.	Secant.	Diff.	Cosine.	М.
0	9 12 0	2 48 0	9, 55433	0	10. 44567	9. 58418	0	10.41582	10.02985	0	9.97015	60
1	11 52	48 8	55466	1	44534	58455	1	41545	02990	0	97010	59
2	11 44	48 16	55499	1	44501	58493	9	41007	02995	0	97005	58
5 1	11 30	48 24	55564	2	44436	58569	$\frac{2}{2}$	41405	02999	0	96996	56
- 5	9 11 20	2 48 40	9.55597	3	10, 44403	9.58606	$\frac{-}{3}$	10. 41394	10.03009	0	9,96991	55
6	11 12	48 48	55630	3	44370	58644	4	41356	03014	0	96986	54
7	11 4	48 56	55663	4	44337	58681	+	41319	03019	1	96981	53
8	10 56	49 4	55695	+ 5	44305	58719	D B	41281	03024	1	96976	52
9	10 48	49 12	0 55761	5	10 11990	0.58701	6	10 41245	03029		0 06066	50
11	9 10 40	49 20	55793	6	44207	58832	7	41168	03038	1	96962	49
$\hat{1}\hat{2}$	10 24	49 36	55826	6	44174	58869	7	41131	03043	1	96957	48
13	10 16	49 44	55858	7	44142	58907	8	41093	03048	1	96952	47
14	10 8	49 52	55891	1	44109	58944	9	41056	03053	1	96947	46
15	$9\ 10\ 0$ 0 59	2500	9. 55923	8	10, 44077	9.58981	10	10.41019	10, 03058	1	9.96942	40
$10 \\ 17$	9 52	50 - 8 50 16	55988	9	44012	59056	10	40944	03068	1	96932	43
18	9 36	50 24	56021	10	43979	59094	11	40906	03073	1	96927	42
19	9 28	50 32	56053	10	43947	59131	12	40869	03078	2	96922	41
20	9 9 20	25040	9.56085	11	10.43915	9.59168	12	10.40832	10.03083	2	9.96917	40
21	9 12	50 48 50 56	56118	11	43882	50200 502.13	13	40795	03088	2	96912	39
$\frac{22}{23}$		$50 \ 50 \ 51 \ 4$	56182	12	43818	59280	14	40720	03097	2	96903	37
24	8 48	51 12	56215	13	43785	59317	15	40683	03102	2	96898	36
25	9 8 40	2 51 20	9.56247	13	10.43753	9,59354	15	10.40646	10.03107	2	9,96893	-35
26	8 32	51 28	56279	14	43721	59391	16	40609	03112	2	96888	34
27	8 24	51 36	56311	14	43689 12657	59429 59466	117	40571	03117	2 2	96883	33
20	8 8	51 + 4 51 52	56375	16	43625	59503	18	40497	03122	2	96873	31
30	9 8 0	2 52 0	9, 56408	16	10, 43592	9, 59540	-19	10.40460	10.03132	2	9,96868	30
31	7 52	52 8	56440	17	43560	59577	19	40423	03137	3	96863	29
32	7 44	$52 \ 16$	56472	17	43528	59614	20	40386	03142	1 3	96858	28
33	7 36	$52 24 \\ 59 99$	56504 56596	18	43496	59651	20	40349	03147	3	96853	27
-04	0 7 20	02 02	0.56568	10	43404	9 50795	- 00	10 10275	10 03152	·	0 068.12	$\frac{20}{95}$
36	$ \frac{3}{7} \frac{7}{12} $	$52 \ 40 \ 52 \ 48$	56599	19	43401	59762	22	40238	03162	3	96838	24
37	7 4	52 56	56631	20	43369	59799	23	40201	03167	3	96833	23
38	6 56	53 4	56663	20	43337	59835	23	40165	03172	3	96828	22
39	6 48	53 12	56695	21	43305	59872	24	40128	03177	3	96823	21
40	9 6 40	2 03 20	9.00727	21	10, 43273	9. 59909	20 95	10, 40091	10, 03182 03187	- ð 9	9.90818	20
42	6 24	$53 \ 36$	56790	22	43210	59983	26	40017	03192	3	96808	18
43	6 16	53 44	56822	23	43178	60019	27	39981	03197	4	96803	17
44	6 8	53 52	56854	24	43146	60056	27	39944	03202	4	96798	16
45	9 6 0	2540	9.56886	24	10.43114	9.60093	28	10.39907	10.03207	4	9,96793	15
40	0 02 5 11	04 8 51 16	96917 560.10	20	43083	60130	28	39870	$03212 \\ 03217$	+	96788	14
48	5 36	54 24	56980	$\frac{10}{26}$	43020	60203	30	39797	03222	4	96778	12
49	5 28	54 32	57012	26	42988	60240	30	39760	03228	4	96772	11
50	9 5 20	25440	9.57044	27	10.42956	9.60276	31	10.39724	10.03233	4	9.96767	10
51	5 12	54 48	57075	27	42925	60313	31	39687	03238	4	96762	9
52 52	0 1 1 56	04 -06 	$\frac{97107}{57138}$	- 28	42893	60349	32	39651 3061.i	03243	+ +	96752	8
54	4 48	55 12	57169	$\frac{10}{29}$	42802	60422	33	39578	03253	4	96747	6
55	9 4 40	2 55 20	9.57201	29	10.42799	9,60459	34	10.39541	10.03258	5	9.96742	5
56	4 32	55 28	57232	30	42768	60495	35	39505	03263	õ	96737	4
57	4 24	55 36	57264	30	42736	60532	35	39468	03268	õ	96732	- 3
$\frac{58}{59}$	+ 16 1 8	00 44 55 59	07290 57898	31 39	42700	60605	36 38	39432 30205	03273	0 5	96727 98799	1
60	4 0	56 0	57358	32	42642	60641	37	39359	03283	5	96717	0
М.	Hour P.M.	Hour A. M.	Cosine,	Diff.	Secant.	Cotangent.	Diff.	Tangent.	Cosecant.	Diff.	Sine.	 M.
1110			4		A	R		R	C	1]	C	650
			-1		<i>.</i>						~	00-

Second of time	1 *	2s	3 ^s	4 s	5s	6s	7s
Prop. parts of cols, $\begin{cases} A \\ B \\ C \end{cases}$		8 9 1	$\begin{array}{c}12\\14\\2\end{array}$	$\begin{array}{c} 16\\19\\2\end{array}$.	$20 \\ 23 \\ 3$	$\begin{array}{c} 24\\ 28\\ 4\end{array}$	$\begin{array}{c} 28\\32\\4\end{array}$

-	0007
Page	6301

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220	Log. Sines, Tangents, and Secants.											
М.	Hour A. M.	Hour P. M.	Sine.	Diff.	Cosecant.	Tangent.	Diff.	Cotangent.	Secant.	Diff.	Cosine,	M.
0	9 4 0	2 56 0	9.57358	0	10 42642	9.60641	0	10 39359	10 03283	0	9 96717	60
1	3 52	56 8	57389	1	42611	60677	1	39323	03289	Ő	96711	59
2	3 44	$56\ 16$	57420	1	42580	60714	1	39286	03294	0	96706	58
3	3 36	56 24	57451	2	42549	60750	2	39250	03299	0	96701	57
4	3 28	56 32	57482	2	42518	60786	2	39214	03304		96696	_56
e e	9 3 20	25640	9.57514	3	10.42486	9.60823	. 3	10.39177	10.03309	0	9.96691	55
7	3 12	00 48 56 56	57576	6 1	42400	60895	1	39141	03314		90080	04 52
8	256	57 - 4	57607	4	42393	60931	5	39069	03324	1	96676	52
9	2 48	57 12	57638	5	42362	60967	5	39033	03330	1	96670	51
10	9 2 40	2 57 20	9.57669	5	10.42331	9.61004	6	10.38996	10.03335	1	9.96665	50
11	2 32	57 28	57700	6	42300	61040	7	38960	03340	1	96660	49
$\frac{12}{12}$	$2 24 \\ 9 16$	57 36	57769	- 6	42269	61076	6	38924	03345	1	96655	48
14	$\frac{2}{2}$ $\frac{10}{8}$	57 59	57793		42208	61148	8	38852	03330	1	90000	47
15	9 2 0	2 58 0	9.57824		10. 42176	9.61184	-9	10.38816	10 03360	-1	9 96640	45
$1\ddot{6}$	152	58 8	57855	8	42145	61220	10	38780	03366	1	96634	44
17	1 44	$58 \ 16$	57885	9	42115	61256	10	38744	03371	1	96629	43
18	1 36	58 24	57916	9	42084	61292	11	38708	03376	2	96624	42
19	1 28	58 32	57947	10	42053	61328	11	38672	03381	2	96619	41
20	9 1 20 1 10	25840	9.57978	10	10.42022	9.61364	12	10.38636	10.03386	$\begin{vmatrix} 2 \\ 0 \end{vmatrix}$	9.96614	40
$\frac{21}{99}$	<u>دا ا</u>	08 48 58 56	58039	11	41992	61.136	13	38600	03392		96608	39
$\frac{22}{23}$	0.56	59 4	58070	12	41930	61472	14	38528	03105	2	96598	37
24	0 48	59 12	58101	$1\overline{2}$	41899	61508	14	38492	03407	2	96593	36
$\overline{25}$	9 0 40	2 59 20	9.58131	13	10.41869	9.61544	15	10.38456	10.03412	$\frac{-}{2}$	9,96588	35
26	0 32	$59\ 28$	58162	13	41838	61579	15	38421	03418	$\overline{2}$	96582	34
27	0 24	59 36	58192	14	41808	61615	16	38385	03423*	2	96577	33
28	0 16	59 44	58223	14	41777	61651	17	38349	03428	2	96572	32
29	0 8	$\frac{39}{2}$	0.5000 (10	41/4/	0.01500	$\frac{17}{10}$	38313	03433	3	96567	31
- 30 - 31	9 0 0	300	9.08284 58314	10	10. 41/16	9.61722	18	10.38278	10.03438	3	9.96562	30
32	59 44	0 16	58345	16	41655	61794	19	38206	03444	3	96551	$\frac{29}{28}$
33	59 36	024	58375	17	41625	61830	20	38170	03454	3	96546	$\frac{20}{27}$
34	$59\ 28$	$0 \ 32$	58406	17	41594	61865	20	38135	03459	3	96541	$\overline{26}$
35	8 59 20	3 0 40	9.58436	18	10.41564	9.61901	21	10.38099	10.03465	3	9.96535	25
36	$59\ 12$	0 48	58467	18	41533	61936	21	38064	03470	3	96530	24
31	09 4 58 56	0 56	08497 58597	19	41503	61972	22	38028	03475	3	96525	23
39	$58 \ 48$	1 4 1 12	58557	20	41473	62043	20	57992 37957	03480	ୀ ସ	90020	22
$\frac{1}{40}$	8 58 40	$\frac{1}{3}$ 1 20	9.58588	20	10.41412	9.62079	24	10 37921	10 03491	$\frac{-3}{3}$	9 96509	$\frac{21}{20}$
41	$58 \ 32$	1 28	58618	$\overline{21}$	41382	62114	24	37886	03496	4	96504	19
42	58 24	1 36	58648	21	41352	62150	25	37850	03502	4	96498	18
43	58 16	1 44	58678	22	41322	62185	26	37815	03507	4	96493	17
44	08 8	1 32	0.50700	22	41291	62221	26	37779	03512	4	96488	16
40	57 52	3 2 0	9. 08/39	23	10.41261 41921	9.62256	27	10. 37744	10.03517	4	9.96483	15
47	57 44	$\frac{2}{2}$ 16	58799	24	41201	62327	28	37673	03528	4	96477	14
48	$57 \ 36$	2 24	58829	24	41171	62362	29	37638	03533	4	96467	12^{10}
49	57 28	2 32	58859	25	41141	62398	29 \	37602	03539	4	96461	11
50	8 57 20	3 2 40	9.58889	25	10.41111	9.62433	30	10.37567	10.03544	4	9.96456	10
51 59	$57 12 \\ 57 4$	248	58919	26	41081	62468	30	37532	03549	+	96451	9
53	56 56	2 80	58979	$\frac{20}{27}$	41091	62520	31	37496	03555	5	96445	8
54	56 48	312	59009	27	40991	62574	$\frac{32}{32}$	37491	03565	5	96435	- 6
55	8 56 40	3 3 20	9, 59039	28	10, 40961	9,62609	33	10.37391	10.03571	-5	9 96429	$\frac{-5}{5}$
56	56 32	3 28	59069	28	40931	62645	33	37355	03576	5	96424	4
57	56 24	3 36	59098	29	40902	62680	34	37320	03581	5	96419	3
58	56 16 56 0	3 44	59128	29	40872	62715	35	37285	03587	5	96413	2
-99 -60	56 0	3 52	09108 50100	30	40842	62750	35	37250	03592	5	96408	1
					40012	02180	- 06	57210	03097	9	90403	0
М.	Hour P. M.	Hour A. M.	Cosine.	Diff.	Secant.	Cotangent.	Diff.	Tangent.	Cosecant.	Diff.	Sine.	М.
1120			А		А	В		В	С		С	67°

Seconds of time	18	2ª	34	4*	51	6*	7=
Prop. parts of cols. $\begin{cases} A \\ B \\ C \end{cases}$	4 4 1	8 9 1	$ \begin{array}{c} 11 \\ 13 \\ 2 \end{array} $	$\begin{array}{c}15\\18\\3\end{array}$	$\begin{array}{c}19\\22\\3\end{array}$	$\begin{array}{c} 23\\ 27\\ 4\end{array}$	$\begin{array}{r} 27\\31\\5\end{array}$

TABLE 44.											[Page 6	31
			I	Log.	Sines, Tan	gents, and	l Seca	ants.				
230			A		A	В		В	<u>с</u>		С	156°
М.	Hour A. M.	Hour P.M.	Sine.	Diff.	Cosecant.	Tangent.	Diff.	Cotangent:	Secant.	Diff.	Cosine.	М.
0	8 56 0	$3 \ 4 \ 0$	9.59188	0	10.40812	9.62785	0	10.37215	10.03597	0	9,96403	60
$\frac{1}{2}$	55 52	4 8 1 16	59218 59247	0	40782 40753	$62820 \\ 62855$	1	$37180 \\ 37145$	03603	0	96397	59 58
3	$55 \ 36$	4 24	59277	î	40723	62890	2	37110	03613	0	96387	57
_4	55 28	4 32	59307	2	40693	62926	$\frac{2}{-2}$	37074	03619	0	96381	56
5		$\begin{array}{r} 3 & 4 & 40 \\ 4 & 48 \end{array}$	9. 59336 59366	$\frac{2}{3}$	$10, 40664 \\ 40634$	9,62961 62996	3	10.37039 37004	$10.03624 \\ 03630$	1	9.96376 96370	00 54
7	$55 \frac{12}{4}$	4 56	59396	3	40604	63031	4	36969	03635	1	96365	53
8	54 56	5 4 5 19	59425 59455	4	40575 40545	$63066 \\ 63101$	5	36934 36899	$03640 \\ 03646$	1	96360	52
$\frac{9}{10}$	8 54 40	$\frac{5}{3}$ $\frac{12}{5}$ $\frac{20}{20}$	9.59484	$\frac{\tau}{5}$	10, 40516	9.63135	$\frac{0}{6}$	10.36865	10.03651	1	9.96349	$\frac{51}{50}$
11	54 32	5 28	59514	5	40486	63170	6	36830	03657	1	96343	49
$\frac{12}{13}$	$54 24 \\ 54 16$	5 36 5 44	59543 59573	6	40457 40427	63205 63240	$\frac{1}{7}$	36795	03662	1	96338	48
$13 \\ 14$	$54 \ 10$ 54 8	5 52	59602	7	40398	63275	8	36725	03673	î	96327	46
15	8 54 0	3 6 0	9,59632	7	10.40368	9.63310	9	10.36690	10.03678	1	9.96322	45
$\frac{16}{17}$	$53 52 \\ 53 41$		59661 59690	8	40339	63345	10	36621	03684	$\frac{1}{2}$	96316	44
18	$53 \ 36$	6 24	59720	9	40280	63414	10	36586	03695	$\overline{2}$	96305	42
19	53 28	6 32	59749	9	40251	63449	11	36551	03700	$\frac{2}{2}$	96300	41
$\frac{20}{21}$	$85320 \\ 5319$	$\begin{array}{rrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrr$	9.59778	10	$10.40222 \\ 40192$	9.63484	$\frac{12}{12}$	10.36516 36481	10.03706 03711	$\frac{2}{2}$	9,96294	39
$\frac{21}{22}$	$53 12 \\ 53 4$		59837	11	40163	63553	13	36447	03716	$\overline{2}$	96284	38
23	52 56	7 4	59866	11	40134	63588	13	36412	03722	2	96278	37
$\frac{24}{95}$	52 48	1 12	<u>59895</u> 0 50091	12	40105	0.62657	14	30377	$\frac{03727}{10.03733}$		· 90275	- 30
$\frac{20}{26}$			59954	13	40046	63692	15	36308	03738	$\frac{1}{2}$	96262	34
27	$52\ 24$	7 36	59983	13	40017	63726	16	36274	03744	2	96256	33
28	52 16 52 8	7 44 7 59	60012	14	39988	63761	16	36239	$03749 \\ 03755$	3	96251	32
$\frac{29}{30}$	$\frac{52}{8}, \frac{52}{52}, \frac{0}{0}$	3 8 0	9,60070	15	10.39930	9.63830	17	10.36170	10.03760	3	9.96240	$-\frac{01}{30}$
31	51 52	8 8	60099	15	39901	63865	18	36135	03766	3	96234	29
$\frac{32}{22}$	51 44 51 26	8 16	60128 60157	15	39872	63899	18	36101	03771	3	96229 96223	$\frac{28}{97}$
33 34	$51 \ 50 \ 51 \ 28$	8 32	60186	16	39814	63968	20^{10}	36032	03782	3	96218	26
35	8 51 20	3 8 40	9,60215	17	10.39785	9,64003	20	10.35997	10.03788	3	9.96212	25
$\frac{36}{27}$	51 12	8 48 8 56	60244 60273	17	39756 39727	64037	21	35963	03793	3	96207	24
38 	50 56	9 4	60302	18	39698	64106	$\frac{21}{22}$	35894	03804	3	96196	22
39	50 48	9 12	60331	19	39669	64140	22	35860	03810	4	96190	21
40	8 50 40	$\begin{array}{cccc} 3 & 9 & 20 \\ & 0 & 28 \end{array}$	9.60359	19	10.39641 20612	9,64175	$\frac{23}{24}$	10.35825 35791	10.03815 03821	+	9.96185	10
41 42	$50 52 \\ 50 24$	9.26 9.36	60417	$\frac{20}{20}$	39583	64243	24	35757	03826	4	96174	18
43	50 16	9 44	60446	21	39554	64278	25	35722	03832	4	96168	17
44	$\frac{30}{8}$	9 52	0.60502	21	39526	$\frac{04312}{0.61346}$	20	30088	10 03813	+	90102	-10 15
46		$10 \ 0 \ 10 \ 8$	60532	22	39468	64381	26	35619	03849	4	96151	14
47	49 44	10 16	60561	23	39439	64415	27	35585	03854	4	96146	13
48	$49 36 \\ 19 28$	$10 24 \\ 10 32$	60589 60618	23	39411	64483	$\frac{28}{28}$	30001	$03860 \\ 03865$	+	96140	112
50	8 49 20	3 10 40	9,60646	24	10.39354	9.64517	29	10.35483	10.03871	5	9.96129	10
51	49 12	10 48	60675	25	39325	64552	29	35448	03877	5	96123	- 9
$52 \\ 53$	49 4	10 56	60704	25 26	39296	64586	30	35414 35380	03882	5	96118	7
54	48 48	11 12	60761	26	39239	64654	31	35346	03893	5	/96107	6
55	8 48 40	3 11 20	9.60789	27	10.39211	9.64688	32	10.35312	10.03899	5	9.96101	5
56	48 32	11 28	60818	27	39182	64722	32	35278	03905	5	96095	1
58	48 16	11 50	60875	28	39125	64790	33	35210	03916	5	96084	2
59	48 8	11 52	60903	29	39097	64824	34	35176	03921	5	96079	1
- 60	48 0	12 0	60931	- 29	39069	04898	- 30	39142	03927	0	90073	
M. 119	Hour P. M.	Hour A. M.	Cosine.	Diff	Secant.	Cotangent	. Diff	. Tangent. R	Cosecant.	Diff.	C Sine.	66 ¹
L.1.9			1		A			17				

Seconds of time	1 s	28	3ª	48	5s	6 ³	7:
Prop. parts of cols. $\begin{cases} A \\ B \\ C \end{cases}$	4 4 1	7 9 1	$\begin{array}{c}11\\13\\2\end{array}$	$\begin{array}{c}15\\17\\3\end{array}$	$\begin{smallmatrix} 18\\22\\3\end{smallmatrix}$	$\begin{array}{c} 22\\ 26\\ 4\end{array}$	$25 \\ 31 \\ 5$

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-			-	
Log.	Sines.	Tangents,	and	Secants.

240			А	nog.	A A	B	a bet	B	С		с	1550
М.	Hour A. M.	Hour P. M.	Sine.	Diff.	Cosecant.	Tangent.	Diff.	Cotangent.	Secant.	Diff.	Cosine.	М.
0	8 48 0	3 12 0	9.60931	0	10.39069	9.64858	0	10.35142	10.03927	0	9.96073	60
1	47 52	12 8 19 16	60960	0	39040	64892	1	35108	03933	0	96067	59
- 2-	47 44	12 10 12 94	61016		39012	04920	1	30074	03938		96062	58
4	47 28	$12 \ 32$	61045	2	38955	64994	$\tilde{2}$	35006	03950		96050	56
5	8 47 20	3 12 40	9.61073	2	10.38927	9,65028	- 3	10.34972	10.03955	0	9,96045	55
6	47 12	12 48	61101	3	38899	65062	3	34938	03961	1	96039	54
7	47 4	1256	61129	3	38871	. 65096	4	34904	03966	1	96034	53
0	40 00	10 4	61186	1 1	38814	65164	5	34870	03972	1	96028	51
10	8 46 40	3 13 20	9.61214	5	10.38786	9.65197	$\frac{0}{6}$	10.34803	10 03983	1	9.96017	50
11	46 32	13 28	61242	5	38758	65231	6	34769	03989	i	96011	49
12	46 24	$13 \ 36$	61270	6	38730	65265	7	34735	03995	1	96005	48
13	$\frac{46}{46}$	13 44	61298	6	38702	65299		34701	04000	1	96000	47
14	40 8	$\frac{13}{9}\frac{32}{14}$	01320	0	38074	00333	8	34067	04006	1	95994	46
$10 \\ 16$	45 52	14 0	9.01504	7	10. 58040	9.05500	9	10, 54054	04012		9.90988	40
17	45 44	14 16	61411	8	38589	65434	9	34566	04013	$\frac{1}{2}$	95977	43
18	$45 \ 36$	14 24	61438	8	38562	65467	10	34533	04029	2	95971	42
19	45 28	14 32	61466	9	38534	65501	11	34499	04035	2	95965	41
20	8 45 20	3 14 40	9.61494	9	10.38506	9.65535	11	10. 34465	10.04040	2	9.95960	40
21	+60 12 -15 1	14 48 14 56	61522	10	38478	00008	12	31132	04046	2	95954	39
23	44 56	15 4	61578	11	38422	65636	12	34364	04052	2	95948	37
24	44 48	15 12	61606	11	38394	65669	13	34331	04063	$\overline{2}$	95937	36
25	8 44 40	$3 \ 15 \ 20$	9.61634	12	10.38366	9.65703	14	10.34297	10.04069	2	9.95931	35
26	44 32	15 28	61662	12	38338	65736	15	34264	04075	2	95925	34
21	$\frac{44}{11}\frac{24}{16}$	$15 36 \\ 15 11$	61689 61717	12	38311	65770	15	34230	04080		95920	33
29	44 8	15 + 4 + 15 + 52	61745	13	38255	65837	16	34163	04080	3	95914	32
30	8 44 0	3 16 0	9.61773	14	10.38227	9,65870	17	10.34130	10.04098	-3	9 95902	$\frac{01}{30}$
31	43 52	16 8	61800	14	38200	65904	17	34096	04103	3	95897	29
32	43 44	16 16	61828	15	38172	65937	18	34063	04109	- 3	95891	28
33	43 36	16 24	61856	15	38144	65971	18	34029	04115	3	95885	27
25	40 20	$\frac{10.52}{2.16.10}$	01865	10	38117	00004	19	33990	04121		90879	26
36	43 12	16 48	61939	17	38061	9.00058	$\frac{20}{20}$	10, 55902	04127	3	9.95868	20
37	43 4	16 56	61966	17	38034	66104	21	33896	04138	4	95862	23
38	42 56	17 4	61994	18	38006	66138	21	33862	04144	4	95856	22
39	42 48	17 12	62021	18	37979	66171	_22_	33829	04150	4	95850	21
40	8 42 40 19 29	$\begin{array}{c} 3 & 17 & 20 \\ 17 & 99 \end{array}$	9.62049	$\frac{18}{10}$	10.37951	9.66204	22	10.33796	10.04156	4	9.95844	20
$\frac{41}{42}$	$42 \ 32$ $42 \ 24$	$17 20 \\ 17 36$	62104	19	37896	66271	20	33729	04161	4	95839	19
43	42 16	17 44	62131	20	37869	66304	24	33696	04173	4	95827	17
44	42 8	17 52	62159	20	37841	66337	25	33663	04179	4	95821	16
45	8 42 0	3 18 0	9.62186	21	10.37814	9.66371	25	10.33629	10.04185	4	9.95815	15
46	$\frac{41}{41}\frac{52}{41}$	18 8	62214	21	37786	66404	26	33596	04190	4	95810	14
$\frac{41}{48}$	41 36	$18 10 \\ 18 24$	62268	- 22	37732	66470	$\frac{20}{97}$	33530	04190) 5	95798	$13 \\ 19$
49	41 28	$18 \ 32$	62296	23	37704	66503	27	33497	04208	5	95792	11
50	8 41 20	3 18 40	9.62323	23	10.37677	9.66537	$\overline{28}$	10.33463	10.04214	5	9,95786	10
51	41 12	18 48	62350	24	37650	66570	28	33430	04220	5	95780	9
52 52	41 +	18 56 10 1	62377	24	37623	66603	29	33397	04225	5	95775	8
54	40 48	19 + 19 + 19 + 19	62409	24	37568	66669	30 30	3330 1 33331	04231 04237		95763	ß
55	8 40 40	3 19 20	9.62459	25	10.37541	9 66702	31	10.33298	10 04243	5	9 95757	-5-
56	40 32	$19 \ 28$	62486	26	37514	66735	31	33265	04249	5	95751	4
57	40 24	19 36	62513	$\frac{26}{26}$	37487	66768	32	33232	04255	5	95745	3
58 50	$40 \ 16$	19 44 10 59	62541	27	37459	66801	32	33199	04261	6	95739	2
60	40 8	$ \frac{19}{20} \frac{52}{0} $	62505	21	57432 37405	66867	33 32	33166 32122	04267	6 8	99733 05790	
			02000	40	07400	00807	00	00100	04272	0	00128	0
М.	Hour P.M.	Hour A.M	Cosine,	Diff.	Secant.	Cotangent.	Diff.	Tangent.	Cosecant.	Diff.	Sine.	М.
1140			А		А	в		В	С		С	65°

Seconds of time	18	2.	\mathbb{B}^{s}	4*	58	6*	7*
Prop. parts of cols, $\begin{cases} A \\ B \\ C \end{cases}$		7 8 1	$\begin{array}{c}10\\13\\2\end{array}$	14 17 3	17 21 4	$21 \\ 25 \\ 4$	$ \begin{array}{r} 24 \\ 29 \\ 5 \end{array} $

	TABLE 11.Page 633												
				Log.	Sines, Tan	igents, and	1 Sec	ants.					
250			A		A	В	1	В	C		С	1540	
M.	Hour A. M.	Hour P. M.	Sine.	Diff.	Cosecant.	Tangent.	Diff.	Cotangent.	Secant.	Diff.	Cosine.	M. 	
0	8 40 0	3 20 0	9.62595	0	10.37405	9.66867	$0 \\ 1$	10.33133	10.04272 04278	0	9.95728 05722	60 50	
$\frac{1}{2}$	$39 52 \\ 39 44$	$20 8 \\ 20 16$	62642	1	37351	66933	1	33067	04278	0	957122 95716	$58 \\ 58$	
3	39 36	20 24	62676	1	37324	66966	2	33034	04290	0	95710	57	
4	$\frac{39\ 28}{8\ 30\ 20}$	$\frac{20}{3}$ $\frac{32}{20}$ $\frac{40}{40}$	$\frac{62703}{9.62730}$	$\frac{2}{2}$	$\frac{37297}{10,37270}$	9.67032	$\frac{2}{3}$	$\frac{33001}{10.32968}$	10.04302	$\frac{0}{1}$	95704	$\frac{50}{55}$	
$\frac{5}{6}$	39 20 39 12	$ \begin{array}{r} 3 & 20 & 40 \\ 20 & 48 \end{array} $	62757	3	37243	67065	3	32935	04308	î	95692	54	
7	39 4	2056	62784	3	$37216 \\ 27180$	67098	4	32902	04314	1	95686	53	
- 8	$\frac{38}{38} \frac{50}{48}$	$21 4 \\ 21 12$	$62811 \\ 62838$	4	37169	67163	5	32837	04326	1	95674	51^{-52}	
10	8 38 40	3 21 20	9.62865	4	$\overline{10.37135}$	9.67196	5	10.32804	10.04332	1	9.95668	50	
11	$\frac{38}{29}$ $\frac{32}{21}$	21 28 21 26	62892	5	$37108 \\ 37082$	67229 67262	$\begin{bmatrix} 6\\7 \end{bmatrix}$	32771 32738	04337		95663	49	
$12 \\ 13$	$\frac{38}{38} \frac{24}{16}$	$21 \ 30$ $21 \ 44$	62945	6	37055	67295	7	32705	04349	1	95651	47	
14	38 8	21 52	62972	6	37028	67327	8	32673	04355	1	95645	46	
$15 \\ 16$	8 38 0 $ 37 59 $	$\begin{array}{cccc} 3 & 22 & 0 \\ & 22 & 8 \end{array}$	9.62999	77	10.37001 36974	9.67360 67393	8	10.32640 32607	$10.04361 \\ 04367$		9.95639	41	
17	$37 52 \\ 37 44$	$\frac{22}{22}$ 16	63052	8	36948	67426	9	32574	04373	2	95627	43	
18	$\frac{37}{97}$	22 24	63079 62106	8	36921	67458 67401	$10 \\ 10$	32542	04379 04285	$\begin{vmatrix} 2\\ 2 \end{vmatrix}$	$95621 \\ 05615$	42	
19	<u> </u>	$\frac{22}{3} \frac{32}{22} \frac{32}{40}$	9 63133	9	$\frac{30894}{10.36867}$	9.67524	$\frac{10}{11}$	$\frac{32505}{10,32476}$	10.04391	$\frac{2}{2}$	$\frac{35019}{9,95609}$	40	
$\frac{20}{21}$	37 12	22 48	63159	9	36841	67556	11	32444	04397	$\overline{2}$	95603	39	
22	$\frac{37}{20}$ $\frac{4}{50}$	2256	63186	10	$36814 \\ 26797$	67589 67699	12	32411	04403	$\begin{vmatrix} 2\\ 9 \end{vmatrix}$	95597	38	
$\frac{23}{24}$	$30 50 \\ 36 48$	$23 4 \\ 23 12$	63239	11	36761	67654	12	32346	04405	$\frac{1}{2}$	95585	36	
$\frac{-}{25}$	8 36 40	3 23 20	9.63266	11	10.36734	9.67687	14	10.32313	10.04421	3	9.95579	35	
26	$\frac{36}{20}$	23 28	63292	11	36708	67719	14	32281	04427	3	95573	34	
$\frac{27}{28}$	$30 24 \\ 36 16$	$23 \ 30 \ 23 \ 44$	63345	$12 \\ 12$	36655	67785	$15 \\ 15$	32248	04439	3	95561	32	
$\overline{29}$	36 8	23 52	63372	13	36628	67817	16	32183	04445	3	95555	31	
30	8 36 0	3 24 0	9.63398	13	10.36602	9.67850	16	10.32150	10.04451	3	9,95549	30	
$\frac{31}{32}$	$\begin{array}{c} 35 & 52 \\ 35 & 44 \end{array}$	$24 8 \\ 24 16$	63420 63451	14	36549	67882	$17 \\ 17$	$32118 \\ 32085$	04463	3	95537	$\frac{29}{28}$	
33	$35 \ 36$	24 24	63478	15	36522	67947	18	32053	04469	3	95531	$\overline{27}$	
34	35 28	24 32	63504	15	$\frac{36496}{10,96460}$	67980	18	$\frac{32020}{10, 21022}$	04475	3	95525	26	
$\frac{35}{36}$		$ 3 24 40 \\ 24 48 $	9,63531 63557	$10 \\ 16$	10.36469 36443	9.68012	$\frac{19}{20}$	10.31988 31956	04487	4	9.95519	$\frac{23}{24}$	
37	35 4	24 56	63583	16	36417	68077	20	31923	04493	4	95507	23	
$\frac{38}{20}$	34 56 24 19	$25 4 \\ 25 19$	63610	17	36390	68109 68142	$ \frac{21}{21} $	$31891 \\ 31858$	04500	4	95500	22	
$\frac{33}{40}$	8 34 40	$\frac{20}{3}$ $\frac{12}{25}$ $\frac{20}{20}$	9.63662	18	10, 36338	9.68174	22	$\overline{10.31826}$	10.04512	4	9.95488	20	
41	34 32	25 28	63689	18	36311	68206	22	31794	04518	4	95482	19	
$42 \\ 43$	$\begin{array}{c} 34 & 24 \\ 34 & 16 \end{array}$	$25 36 \\ 25 44$	63715 63741	19	36285 36259	68239 68271	$\frac{23}{22}$	31761 31729	04524 04530	4	95476	18	
44	34 8	25 52	63767	19	36233	68303	24	31697	04536	4	95464	16	
45	8 34 0	3 26 0	9.63794	.20	10.36206	9,68336	24	10.31664	10.04542	5	9.95458	15	
$\frac{46}{47}$	$33 52 \\ 33 44$	$26 8 \\ 26 16$	63820 63846	$\frac{20}{21}$	$36180 \\ 36154$	68368	$\frac{20}{25}$	31632	04548) 5	95446	14	
48	33 36		63872	21	36128	68432	$\frac{1}{26}$	31568	04560	5	95440	12	
49	33 28	26 32	63898	22	36102	68465	27	31535	04566	5	95434	11	
50 51	$8 \ 33 \ 20 \ 33 \ 12$	$ 3 26 40 \\ 26 48 $	9.63924 63950	22	10.36076	9. 68497	27	10.31503 31471	10.04573	0 5	9.95427	10	
52	33 4	26 56	63976	23	36024	68561	$\frac{1}{28}$	31439	04585	5	95415	8	
53	+3256	$27 4 \\ 27 12$	64002	23	35998	68593 68626	29	31407 31374	$04591 \\ 04597$	5	95409 95403	7	
55	$\frac{3240}{83240}$	$\frac{27}{3}$ $\frac{12}{27}$ $\frac{20}{20}$	9.64054	24	$\frac{35972}{10.35946}$	9.68658	$\frac{29}{30}$	$\frac{31374}{10,31342}$	10.04603	6	9,95397	$\frac{0}{5}$	
56	$32 \ 32$	27 28	64080	25	35920	68690	30	31310	04609	6	95391	4	
57	32 24	$27 \ 36$	64106 64129	25	35894	68722	31	31278	04616	6	95384 95379	3	
59	$32 \ 8$	27 52	64152	$\frac{20}{26}$	35842	68786	$\frac{31}{32}$	31214	04628	6	95372	ĩ	
60	32 0	28 0	64184	26	35816	68818	33	31182	04634	6	95366	0	
М.	Hour P. M.	Hour A. M.	Cosine,	Diff.	Secant.	Cotangent	Diff.	Tangent.	Cosecant.	Diff.	Sine.	М.	
1150			А		A	В		В	С		С	640	
					-								

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Seconds of time	1 *	2 5	3 s	4 *	5 *	6 *	7 s
Prop. parts of cols. $\begin{cases} A \\ B \\ C \end{cases}$		7 8 2	$\begin{array}{c}10\\12\\2\end{array}$	$\begin{array}{c}13\\16\\3\end{array}$	$\begin{array}{c}17\\20\\4\end{array}$	$20 \\ 24 \\ 5$	$ \begin{array}{c} 23 \\ 28 \\ 5 \end{array} $

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rage	004

Log. Sines. Tangents, and Secants.

260			A	Log.	Sines, Tar A	igents, and B	i sec	B	с		с	1530
М.	Hour A. M.	Hour P. M.	Sine.	Diff.	Cosecant.	Tangent.	Diff.	Cotangent.	Secant.	Diff.	Cosine.	М.
$\begin{array}{c} 0\\ 1\\ 2\end{array}$		$egin{array}{cccc} 3&28&0\\ &28&8\\ &28&16 \end{array}$	9, 64184 64210 64236	0 0 1	$\begin{array}{r} 10.\ 35816\\ 35790\\ 35764\end{array}$	$9.68818 \\ 68850 \\ 68882$	$\begin{array}{c} 0\\ 1\\ 1\end{array}$	$\begin{array}{r} 10.\ 31182\\ 31150\\ 31118 \end{array}$	$10.04634 \\ 04640 \\ 04646 \\ 04646$	0 0 0	9, 95366 95360 95354	
3	$\begin{array}{r} 31 & 36 \\ 31 & 28 \end{array}$	$\begin{array}{ccc} 28 & 24 \\ 28 & 32 \end{array}$	$\begin{array}{r} 64262 \\ 64288 \end{array}$	$\frac{1}{2}$	$35738 \\ 35712$	$\begin{array}{r} 68914 \\ 68946 \end{array}$	2	$31086 \\ 31054$	04652 04659	0	$95348 \\ 95341$	$\frac{57}{56}$
$\frac{5}{6}$		$\begin{array}{c}3&28&40\\&28&48\\&&28&5\end{array}$	$9.64313 \\ 64339 \\ 64339$	23	10.35687 35661	$9.68978 \\ 69010 \\ 69010$	3.	$\begin{array}{c} 10.\ 31022 \\ 30990 \\ 20050 \end{array}$	$10.04665 \\ 04671 \\ 04671$	1 1	9.95335 95329	$55 \\ 54 \\ 54$
7 8 9	$\begin{array}{cccc} 31 & 4 \\ 30 & 56 \\ 30 & 48 \end{array}$	$\begin{array}{ccc} 28 & 56 \\ 29 & 4 \\ 29 & 12 \end{array}$		$\frac{3}{4}$	35635 35609 35583	$69042 \\ 69074 \\ 69106$	$\frac{1}{4}$	30958 30926 30894	$04677 \\ 04683 \\ 04690$	1 1 1	$95323 \\ 95317 \\ 95310$	$53 \\ 52 \\ 51$
$\frac{10}{11}$		$\begin{array}{r} 3 & 29 & 20 \\ & 29 & 28 \end{array}$	$9.64442 \\ 64468$	$\frac{1}{5}$	$\overline{\underline{10.35558}}_{35532}$	9.69138 69170	$\frac{5}{6}$	$\frac{10.30862}{30830}$	$\frac{10.04696}{04702}$	$\frac{1}{1}$	$\overline{9.95304}$ 95298	$\frac{50}{49}$
$\frac{12}{13}$	$\begin{array}{c} 30 \hspace{0.1cm} 24 \\ 30 \hspace{0.1cm} 16 \end{array}$	$\begin{array}{ccc} 29 & 36 \\ 29 & 44 \end{array}$	$64494 \\ 64519$		$35506 \\ 35481$	$69202 \\ 69234$	$\frac{6}{7}$.	$30798 \\ 30766$	$04708 \\ 04714$	1	$95292 \\ 95286$	48 47
$\frac{14}{15}$	$\begin{array}{c c} 30 & 8 \\ \hline 8 & 30 & 0 \end{array}$	$\begin{array}{c c} 29 & 52 \\\hline 3 & 30 & 0 \end{array}$	64545 9.64571	$\frac{6}{6}$	$\frac{35455}{10,35429}$	69266 9.69298	$\frac{7}{8}$	$\frac{30734}{10.30702}$	$\frac{04721}{10.04727}$	$\frac{1}{2}$	$\frac{95279}{9,95273}$	$\frac{46}{45}$
$\frac{16}{17}$	$ \begin{array}{cccc} 29 & 52 \\ 29 & 44 \\ 20 & 22 \end{array} $	$ \begin{array}{ccc} 30 & 8 \\ 30 & 16 \\ 22 & 24 \end{array} $	$64596 \\ 64622 \\ 010017$	777	$35404 \\ 35378 \\ 5537$	$69329 \\ 69361 \\ 69300$	8 9	30671 30639	$04733 \\ 04739 \\ 04739$	$\frac{2}{2}$	$95267 \\ 95261$	44 43
$\frac{18}{19}$	$\begin{array}{r} 29 & 36 \\ \hline 29 & 28 \end{array}$	$ \begin{array}{r} 30 & 24 \\ 30 & 32 \end{array} $	64647 64673	8	35353 35327	$69393 \\ 69425 \\ 0.00155$	$\frac{9}{10}$	30607 30575	04746 04752	$\frac{2}{2}$	95254 95248	$\frac{42}{41}$
20 21 99	$8 29 20 \\ 29 12 \\ 20 4$	$\begin{array}{r} 3 & 30 & 40 \\ & 30 & 48 \\ & 20 & 56 \end{array}$	9. 64698 64724 61740	8 9 0	10. 35302 35276 25251	9.69457 69488 60590	11 11 19	10. 30543 30512 30480	$10.04758 \\ 04764 \\ 04771$	$\frac{2}{2}{2}$	9,95242 95236 05220	40 39 20
$\frac{22}{23}$ 24	$ \begin{array}{r} 29 & 4 \\ 28 & 56 \\ 28 & 48 \end{array} $	$ \begin{array}{r} 30 & 50 \\ 31 & 4 \\ 31 & 12 \end{array} $	64775 64800	$10 \\ 10 \\ 10$	35225 35200	69520 69552 69584	$12 \\ 12 \\ 13$	30430 30448 30416	04777 04783	$\frac{2}{3}$	95229 95223 95217	37 36
$\frac{25}{26}$		$\begin{array}{r} 3 & 31 & 20 \\ 31 & 28 \end{array}$	$9.64826 \\ 64851$	11 11	$\frac{10.\ 35174}{35149}$	9.69615 69647	$\frac{13}{14}$	$\frac{10,30385}{30353}$	10.04789 04796	$\frac{3}{3}$	9.95211 95204	$\frac{35}{34}$
$\frac{27}{28}$	$\begin{array}{ccc} 28 & 24 \\ 28 & 16 \end{array}$	$\begin{array}{c} 31 & 36 \\ 31 & 44 \end{array}$	$\begin{array}{c} 64877 \\ 64902 \end{array}$	$\frac{11}{12}$	$35123 \\ 35098$	$69679 \\ 69710$	• 14 15	$30321 \\ 30290$	$\begin{array}{c} 04802\\ 04808 \end{array}$	$\frac{3}{3}$	$95198 \\ 95192$	$\frac{33}{32}$
$\frac{29}{30}$	$\begin{array}{c ccccccccccccccccccccccccccccccccccc$	$\begin{array}{c c} 31 & 52 \\\hline 3 & 32 & 0 \end{array}$	$\frac{64927}{9.64953}$	$\frac{12}{13}$	$\frac{35073}{10.\ 35047}$	$\frac{69742}{9.69774}$	$\frac{15}{16}$	$\frac{30258}{10.\ 30226}$	$\frac{04815}{10.04821}$	$\frac{3}{3}$	95185 9,95179	$\frac{31}{30}$
$\frac{31}{32}$	$ \begin{array}{ccccccccccccccccccccccccccccccccccc$	$\begin{array}{ccc} 32 & 8 \\ 32 & 16 \\ 22 & 24 \end{array}$	$64978 \\ 65003 \\ 65003$	$ \begin{array}{c} 13 \\ 14 \\ 14 \end{array} $	$35022 \\ 34997 \\ 3497$	$69805 \\ 69837 \\ 69837$	16 17 17	30195 30163	$\begin{array}{c} 04827\\ 04833\\ 04104 \end{array}$	3	95173 95167	29 28
33	$27 36 \\ 27 28 \\ \hline 0 27 28 \\ $		65029 65054	14	34971 34946	69868 69900	$\frac{17}{18}$	30132 30100	04840 04846	4	95160 95154	$\frac{27}{26}$
30 36 37	$8 27 20 \\ 27 12 \\ 27 1$	$\begin{array}{cccccccccccccccccccccccccccccccccccc$	9.65079 65104 65130	10 15 16	$ \begin{array}{r} 10.34921 \\ 34896 \\ 34870 \end{array} $	9,69932 69963 60005	18 19 20	10, 30068 30037 30005	$ \begin{array}{r} 10.04852 \\ 04859 \\ 04853 \end{array} $	4	9.95148 95141 95125	$ \begin{array}{c} 25 \\ 24 \\ 22 \end{array} $
38 39		$ \begin{array}{r} 32 & 50 \\ 33 & 4 \\ 33 & 12 \end{array} $	$65155 \\ 65180$	$16 \\ 16 \\ 16$	$34845 \\ 34820$	70026 70058	$ \begin{array}{c} 20 \\ 21 \end{array} $	29974 29942	04871 04878	$\frac{1}{4}$	95139 95129 95122	$ \begin{array}{c} 23 \\ 22 \\ 21 \end{array} $
$\frac{40}{41}$	$\begin{array}{r} 8 \hspace{0.1cm} 26 \hspace{0.1cm} 40 \\ 26 \hspace{0.1cm} 32 \end{array}$	$\begin{array}{rrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrr$	$9.65205 \\ 65230$	$\frac{17}{17}$	$\frac{10.\ 34795}{34770}$	9.70089 70121	$\frac{21}{22}$	$\frac{10.\ 29911}{29879}$	$\frac{10.04884}{04890}$	4	9.95116 95110	$\begin{array}{c} \hline 20 \\ 19 \end{array}$
$\frac{42}{43}$	$\begin{array}{ccc} 26 & 24 \\ 26 & 16 \end{array}$	$\begin{array}{c} 33 & 36 \\ 33 & 44 \end{array}$	$65255 \\ 65281$	18 18	$34745 \\ 34719$	$\begin{array}{c} 70152 \\ 70184 \end{array}$	$\begin{array}{c} 22 \\ 23 \\ \end{array}$	$29848 \\ 29816$	$04897 \\ 04903$	$\frac{4}{5}$	$95103 \\ 95097$	18 17
44 45	$\begin{array}{r} 26 & 8 \\ \hline 8 & 26 & 0 \\ \hline \end{array}$	$\begin{array}{r} 33 52 \\ \hline 3 34 0 \\ \hline \end{array}$	$\frac{65306}{9,65331}$	19 19	$\frac{34694}{10, 34669}$	70215 9.70247	$\frac{23}{24}$	$\frac{29785}{10,29753}$	$\frac{04910}{10.04916}$	$\frac{5}{5}$	95090 9.95084	$\frac{16}{15}$
46 47	$25 52 \\ 25 44 \\ 25 26$	$ \begin{array}{r} 34 & 8 \\ 34 & 16 \\ 24 & 24 \end{array} $	65381 6546	$\frac{19}{20}$	34614 34619 24504	70278 70309 70311	24 25 25	29722 29691 20650	04922 04929 04935	5 5	95078 95071 95065	$14 \\ 13 \\ 19$
49	$25 \ 50 \\ 25 \ 28 \\ \hline 8 \ 25 \ 20 \\ \hline$	$ \frac{34}{34} \frac{24}{32} $	65431 9 65456	21	34569	70372	$\frac{20}{26}$	29628 10 29596	04941	5	95059	$\frac{12}{11}$
$50 \\ 51 \\ 52$	$ \begin{array}{r} 8 & 25 & 20 \\ 25 & 12 \\ 25 & 4 \end{array} $	34 40 34 48 34 56	65481 65506	$\frac{21}{22}$	34519 34494	5. 70404 70435 70466		29565 29534	04954 04961	5	95032 95046 95039	10 9 8
$53 \\ 54$	$ \begin{array}{r} 24 & 56 \\ 24 & 48 \end{array} $	$\begin{array}{ccc} 35 & 4 \\ 35 & 12 \end{array}$	65531 65556	$\frac{1}{22}$ 23	34469_ 34444	$70498 \\ 70529$	28 28	$29502 \\ 29471$	$04967 \\ 04973$	$\frac{6}{6}$	95033· 95027	
$\begin{array}{c} 55\\56\end{array}$		$\begin{array}{cccccccccccccccccccccccccccccccccccc$	$9.65580 \\ 65605$	$\frac{23}{24}$	$\frac{10.34420}{34395}$	$9.70560 \\70592$	$\frac{29}{30}$	$\frac{10.29440}{29408}$	$\frac{10.04980}{04986}$	6 6	9.95020 95014	$\frac{5}{4}$
57 58	$\begin{array}{ccc} 24 & 24 \\ 24 & 16 \\ \end{array}$	$\begin{array}{cccccccccccccccccccccccccccccccccccc$	65630 65655	$\frac{24}{25}$	$34370 \\ 34345$	$70623 \\ 70654$	30 31	29377 29346	04993 04999	6 6	$95007 \\ 95001$	$\frac{3}{2}$
59 60	$ \begin{array}{ccc} 24 & 8 \\ 24 & 0 \end{array} $	$\begin{array}{ccc} 35 & 52 \\ 36 & 0 \end{array}$	$65680 \\ 65705$	$\frac{25}{25}$	$34320 \\ 34295$	70685 70717	$\frac{31}{32}$	$29315 \\ 29283$	$05005 \\ 05012$	$\begin{array}{c} 6\\ 6\end{array}$	94995 94988	$\begin{array}{c} 1\\ 0\end{array}$
М.	Hour P. M.	Hour A. M.	Cosine.	Diff.	Secant.	Cotangent.	Diff.	Tangent.	Cosecant.	Diff.	Sine.	М.
116°			A		A	В		В	С		C	63°

Seconds of time		1 *	2 =	3 =	4 *	5.	6.8	7 *
Prop. parts of cols.	$ \begin{cases} A \\ B \\ C \end{cases} $	3 4 1		$\begin{array}{c}10\\12\\2\end{array}$	$\begin{array}{c}13\\16\\3\end{array}$	$\begin{array}{c}16\\20\\4\end{array}$	19 24 5	$22 \\ 28 \\ 6$

TABLE 44.												35
				Log.	Sines, Ta	ngents, an	d See	eants.				
270			A		A	• B		В	C		С	1520
М.	Hour A. M.	Honr P. M.	Sine.	Diff.	Cosecant.	Tangent.	Diff.	Cotangent.	Secant.	Diff.	Cosine.	М.
0	8 24 0 23 52	$\begin{array}{cccc} 3 & 36 & 0 \\ & 36 & 8 \end{array}$	9.65705 65729	0	10.34295 34271	9.70717	$\begin{vmatrix} 0\\ 1 \end{vmatrix}$	10.29283 29252	$10.05012 \\ 05018$	0	9,94988	60 50
$\frac{1}{2}$	$23 \ 44$	36 16	65754	1	34246	70779	1	29221	05025	0	94975	58
3	$23 \ 36 \\ 23 \ 28$	$ 36 24 \\ 36 32 $	$65779 \\ 65804$	$\frac{1}{2}$	$34221 \\ 34196$	$70810 \\ 70841$	$\frac{2}{2}$	$29190 \\ 29159$	05031	0	94969 94962	57
$\frac{-4}{5}$	8 23 20	3 36 40	9.65828	2	10. 34172	9.70873	3	10. 29127	10.05044	1	9.94956	55
6	23 12	$\frac{36}{26} \frac{48}{56}$	65853	2	34147	70904 70925	3	29096	05051	1	94949	54
8	23 + 4 22 56	$ 30 50 \\ 37 4 $	65902	3	34098	70966	+ +	29003 29034	05064	1	94945	$\frac{55}{52}$
9	22 48	37 12	65927	4	34073	70997	5	29003	05070	1	94930	51
$10 \\ 11$	$8 22 40 \\ 22 32$	$\begin{array}{c} 3 & 37 & 20 \\ & 37 & 28 \end{array}$	$9.65952 \\ 65976$	4	$10.34048 \\ 34024$	9.71028	$\begin{vmatrix} 5\\6 \end{vmatrix}$	10.28972 28941	$10.05077 \\ 05083$	1	9.94923 94917	50 49
12	22 24	37 36	66001	5	33999	71090	6	28910	05089	1	94911	48
13 14	$ \begin{array}{cccc} 22 & 16 \\ 22 & 8 \end{array} $	$\begin{array}{c} 37 & 44 \\ 37 & 52 \end{array}$	66025 66050	5 6	33975	71121 71153	$\left \begin{array}{c} 7\\7\end{array} \right $	28879 28847	05096	$\frac{1}{2}$	94904	$\frac{47}{46}$
15	8 22 0	3 38 0	9.66075	6	10. 33925	9.71184	8	10. 28816	10.05109	$\frac{-}{2}$	9.94891	45
$\frac{16}{17}$	21 52 21 41	$\frac{38}{38}$ $\frac{8}{16}$	66099	$\frac{6}{7}$	$33901 \\ 33876$	$71215 \\ 71246$		28785 28754	05115	$\frac{2}{2}$	94885	44
18	$21 \ 44 \ 21 \ 36$	$\frac{38}{38} \frac{10}{24}$	66148	7	33852	71277	9	28723	05129	$\frac{1}{2}$	94871	42
19	21 28	38 32	66173	8	33827	71308	$\frac{10}{10}$	28692	05135	2	94865	41
$\frac{20}{21}$	$8 21 20 \\ 21 12$	$\begin{array}{r} 3 & 38 & 40 \\ & 38 & 48 \end{array}$	9.66197 66221	8	10.33803 33779	9.71339 71370	10	10.28661 28630	05148	$\frac{2}{2}$	$9.94858 \\ 94852$	$\frac{40}{39}$
$\overline{22}$	21 - 4	38 56	66246	9	33754	71401	11	28599	05155	2	94845	38
$\frac{23}{24}$	$20 56 \\ 20 48$	39 4 39 12	66270 66295	10	33730	$71431 \\ 71462$	$12 \\ 12$	$28569 \\ 28538$	$05161 \\ 05168$	3	94839 94832	37
25	8 20 40	$\frac{36}{3}$ 39 20	9.66319	10	10. 33681	9.71493	13	10.28507	10.05174	3	9.94826	35
26	20 32	39 28 39 36	66343	11	33657	71524	13	28476	05181	3	94819	34
$\frac{27}{28}$	$20 24 \\ 20 16$	$39 \ 44$	66392	11	33608	71586	14	28414	05194	3	94806	$\frac{33}{32}$
29	20 8	$\frac{39}{2}$ 52	66416	12	33584	71617	15	28383	05201	3	94799	31
$\frac{30}{31}$	$8 \ 20 \ 0 \ 19 \ 52$	$ \begin{array}{r} 3 40 & 0 \\ 40 & 8 \end{array} $	$9.66441 \\ 66465$	$\frac{12}{13}$	10.33559 33535	9.71648	$15 \\ 16$	10.28352 28321	10.05207 05214	3	9.94793 94786	$\frac{30}{29}$
32	19 44	40 16	66489	13	33511	71709	16	28291	05220	4	94780	28
33 34	$19 \ 36 \\ 19 \ 28$	40 24 40 32	66513	13	33487 33463	71740	$\frac{17}{17}$	28260 28229	$05227 \\ 05233$	+++++++++++++++++++++++++++++++++++++++	94773 94767	$ \frac{27}{26} $
35	8 19 20	3 40 40	9.66562	14	10.33438	9.71802	18	10.28198	10.05240	4	9.94760	25
$\frac{36}{27}$	$19 12 \\ 19 4$	$40 48 \\ 40 56$	66586 66610	$\frac{15}{15}$	33414	71833 71863	19	28167 28137	$05247 \\ 05253$	4	94753 94747	24
38	18 56	41 4	66634	15	33366	71894	20	28106	05260	4	94740	$\frac{10}{22}$
$\frac{39}{10}$	18 48	41 12	66658	16	$\frac{33342}{10,99910}$	71925	$\frac{20}{21}$	$\frac{28075}{10,28015}$	05266		94734	$\frac{21}{20}$
40	$8 18 40 \\ 18 32$		9.00082 66706	10	10. 55518 33294	9.71955	$\frac{21}{21}$	28043	05280	+	9.94727 94720	19
42	18 24	41 36	66731	17	33269	72017	22	27983	05286	5	94714	18
43	$18 16 \\ 18 8$	$\frac{41}{41}$ $\frac{44}{52}$	-66779	11/	33245	$72048 \\ 72078$	$\frac{22}{23}$	27952	05293	0 5	94707 94700	$17 \\ 16$
45	8 18 0	3 42 0	9.66803	18	10.33197	9.72109	23	10.27891	10.05306	5	9.94694	15
$\frac{46}{47}$	$17 52 \\ 17 44$	$+42 - 8 \\ +42 - 16$	66827 66851	19 19	33173 33149	$72140 \\ 72170$	$\frac{24}{24}$	$27860 \\ 27830$	05313	5	94687 94680	14
48	17 36	42 24	66875	19	33125	72201	$\tilde{25}$	27799	05326	5	94674	12
$\frac{49}{50}$	17 28	$\frac{42}{2}.32$	66899 9 66899	$\frac{20}{20}$	33101	72231	$\frac{25}{98}$	27769 10 27738	05333	5	94667	$\frac{11}{10}$
$\frac{50}{51}$	17 12		66946	$\frac{20}{21}$	33054	72293	$\frac{20}{26}$	27707	05346	6	9. 94660 94654	10
52	17 4	$\frac{42}{12}$ 56	66970 8600.1	21	33030	72323	27	27677	05353	6	94647	8
$\frac{55}{54}$	$16 \ 56 \ 16 \ 48$	$\frac{40}{43}$ $\frac{4}{12}$	67018	$\frac{21}{22}$	32982	72394 72384	$\frac{27}{28}$	27646 27616	05366	0 6	94634	6
55	8 16 40	3 43 20	9.67042	22	10. 32958	9.72415	28	10.27585	10.05373	6	9.94627	5
$\frac{56}{57}$	$\begin{array}{c}16&32\\-16&24\end{array}$	$ 43 28 \\ 43 36 $	67066 67090	$\frac{23}{23}$	$32934 \\ 32910$	$72445 \\ 72476$	$\frac{29}{29}$	$27555 \\ 27524$	05380 05386	6	94620 94614	$\begin{bmatrix} 4\\ 3 \end{bmatrix}$
58	16 16	43 44	67113	23	32887	72506	30	27494	05393	6	94607	2
59 60	16 8 16 0	$\begin{array}{c} 43 & 52 \\ 44 & 0 \end{array}$	$67137 \\ 67161$	24 24	$32863 \\ 32839$	72537 72567	30	$27463 \\ 27433$	$05400 \\ 05407$	$\frac{6}{7}$	94600 94593	$\begin{bmatrix} 1\\ 0 \end{bmatrix}$
м.	Hour P. M.	Hour A. M.	Cosine.	Diff.	Secant.	Cotangent.	Diff.	Tangent.	Cosecant,	Diff.	Sine.	М.
1170			A		A	В		В	с		С	620

Seconds of time	1.8	25	3.	4 s	$\mathbf{\tilde{5}}^{s}$	6ª	74
Prop. parts of cols, $\begin{cases} A \\ B \\ C \end{cases}$	8 4 1		$\begin{array}{r} 9\\12\\2\end{array}$	$\begin{array}{c}12\\15\\3\end{array}$	$\begin{array}{r}15\\19\\4\end{array}$	$ \begin{array}{r} 18 \\ 23 \\ 5 \end{array} $	$\begin{smallmatrix} 21\\27\\6\end{smallmatrix}$

Page	636]
rage	0001

Log. Sines, Tangents, and Secants.

280			A	LUZ.	A A	B	. Dec	B	С		с	151°
М.	Hour A. M.	Hour P. M.	Sine.	Diff.	Cosecant.	Tangent.	Diff.	Cotangent.	Secant.	Diff.	Cosine.	М.
0	8 16 0	3 44 0	9.67161	0	10.32839	9.72567	0	10.27433	10.05407 05112	0	9.94593	60 50
$\frac{1}{2}$	$15 \ 52 \ 15 \ 44$	$\frac{44}{44}$ 8	67208	1	$32813 \\ 32792$	72628	1	27372	05415	0	94580	58
3	$15 \ 36$	44 24	67232	1	32768	72659	2	27341	05427	0	94573	57
4	15 28	44 32	67256	2	$\frac{32744}{10,99790}$	72689	$\frac{2}{2}$	27311	05433	$\frac{0}{1}$	94567	56
5 6	$8 15 20 \\ 15 12$	$3 44 40 \\ 44 48$	9.67280	$\frac{z}{2}$	10.32720 32697	$9.72720 \\72750$	3	27250	10.05440 05447	1	9.94000	- ээ 1 54
7	15 4	44 56	67327	$\overline{3}$	32673	72780	4	27220	05454	1	94546	53
8	14 56	45 4	67350	3	32650	72811	4	27189 27150	05460	1	94540	$52 \\ 51$
$\frac{9}{10}$	8 14 48	$\frac{40 12}{3 45 20}$	9 67398	$\frac{\partial}{4}$	$\frac{32020}{10,32602}$	9.72872	-5	$\frac{27109}{10,27128}$	$\frac{0.0407}{10.05474}$	$\frac{1}{1}$	9.94526	$\frac{51}{50}$
11	14 32	45 28	67421	4	32579	72902	ő	27098	05481	1	94519	49
12	14 24	45 36	67445	5	32555	72932	$\frac{6}{7}$	27068 27027	05487	1	94513	48
$\frac{13}{14}$	$14 10 \\ 14 8$	$40 \ 44 \ 45 \ 52$	67408	5	32508	72903	7	27037	05494	$\frac{1}{2}$	94499	$\frac{\pm 7}{46}$
$\frac{11}{15}$	8 14 0	3 46 0	9.67515	6	10.32485	9.73023	8	10.26977	10.05508	$\overline{2}$	9.94492	45
16	13 52	46 8	67539	6	32461	73054	8	26946	05515	2	94485	44
$17 \\ 18$	$13 \ 44 \\ 13 \ 36$	$\frac{46}{46}$ $\frac{16}{24}$	67586	7	32438 32414	$73084 \\ 73114$	9	26916	$05521 \\ 05528$	$\frac{2}{2}$	94472	43 42
19	$13 \ 28$	46 32	67609	7	32391	73144	10	26856	05535	2	94465	41
20	8 13 20	3 46 40	9.67633	8	10.32367	9.73175	10	10.26825	10.05542	2	9.94458	40
21	$13 12 \\ 13 1$	$46 48 \\ 46 56$	67656 67680	8	$32344 \\ 32320$	$73200 \\ 73235$	11	26795	05555		94401	$\frac{39}{38}$
$\frac{22}{23}$	13 - 4 12 - 56	47 4	67703	9	32297	73265	12	26735	05562	3	94438	37
24	12 48	47 12	67726	9	32274	73295	12	26705	05569	3	94431	36
25	$8 12 40 \\ 19 22$	$3\ 47\ 20$	9.67750 67773	10	10.32250 32227	9.73326 73356	$13 \\ 13$	10.26674 26614	$10.05576 \\ 05583$	3	9.94424	35 34
$\frac{20}{27}$	$12 \ 32 \ 12 \ 24$	47 20	67796	10	32204	73386	14	26614	05590	3	94410	33
28	$12 \ 16$	47 44	67820	11	32180	73416	14	26584	05596	3	94404	32
$\frac{29}{20}$	12 8	$\frac{47\ 52}{2\ 49\ 0}$	67843	$\frac{11}{19}$	$\frac{32157}{10,22121}$	$\frac{73446}{0.72476}$	$\frac{15}{15}$	26594	00603	$\frac{3}{2}$	94397	$\frac{31}{20}$
30			9.07800	$12 \\ 12$	32134 32110	73507	$10 \\ 16$	26493	05617		94383	$\frac{30}{29}$
32	11 44	48 16	67913	12	32087	73537	16	26463	05624	4	94376	28
33	11 36	48 24 48 39	67936	13	32064 32041	73567 73597	17	26433	05631	. 4	94369	27
35	$\frac{11}{8} \frac{20}{11}$	$\frac{+6}{3}$ $\frac{52}{48}$ $\frac{40}{40}$	9.67982	$\frac{10}{14}$	$\frac{02041}{10,32018}$	9,73627	18	$\frac{20100}{10,26373}$	10.05645	+	9,94355	25
36	11 12	48 48	68006	14	31994	73657	18	26343	05651	4	94349	24
37	11 4 10 56	48 56	68029	14	$31971 \\ 21948$	73687 73717	19	$26313 \\ 26283$	05658	4	94342	$\frac{23}{22}$
$\frac{39}{39}$	$10 \ 30 \ 10 \ 48$	49 49 4	68075	15	31925	73747	20	26253	05672	4	94328	$\frac{52}{21}$
40	8 10 40	3 49 20	9.68098	16	10.31902	9.73777	20	10.26223	10.05679	5	9.94321	20
41	10 32	49 28	68121	$16 \\ 16$	31879	73807	21	26193	05686	5	94314	19
$\frac{42}{43}$	$10 24 \\ 10 16$	49 50	68167	17	31833	73867	$\frac{21}{22}$	26133	05700	5	94300	17
44	10 8	49 52	68190	17	31810	73897	22	26103	05707	5	94293	16
45	$8 \ 10 \ 0$	3500	9.68213	17	10.31787	9.73927	23	10.26073	10.05714 05721	5	9.94286	15
40	$9 52 \\ 9 44$	$ 50 8 \\ 50 16 $	68260	18	31740	73987	$\frac{23}{24}$	26043	$05721 \\ 05727$	5	94273	$14 \\ 13$
48	9 36	50 24	68283	19	31717	74017	24	25983	05734	5	94266	12
49	9 28	50 32	68305	$\frac{19}{10}$	$\frac{31695}{10,91679}$	74047	25	25953	05741	6	94259	$\frac{11}{10}$
50 51	$ 8 9 20 \\ 9 12 $	3 50 40	$9.68328 \\ 68351$	19	31649	9.74077	$\frac{23}{26}$	10. 25923	10.05748 05755	6	9.94252	10
52	$9^{-}4$	50 56	68374	$\frac{1}{20}$	31626	74137	26	25863	05762	6	94238	8
53	8 56	$51 \ 4$ 51 19	68397	$ 21 \\ 21$	31603 31580	$74166 \\ 74196$	$\frac{27}{27}$	25834 25804	05769	6	94231	
55	8 8 40	$\frac{51}{3}$ $\frac{12}{51}$ 20	9.68443	$\frac{21}{21}$	10. 31557	9,74226	$\frac{21}{28}$	10.25774	10.05783	$\frac{0}{6}$	9,94217	-5
56	8 32	51 28	68466	22	31534	74256	$\frac{1}{28}$	25744	05790	6	94210	4
57	8 24	51 36	68489	22	31511	74286	29	25714	05797	7	94203	3 9
$\frac{58}{59}$	8 16	$51 \ 44 \ 51 \ 52$	68534	$\frac{22}{23}$	$31488 \\ 31466$	74310	$\frac{29}{30}$	25054 25655	05804	7	94189	Ĩ
60	8 0	52 0	68557	23	31443	74375	30	25625	05818	7	94182	0
м.	Hour P. M.	Hour A. M.	Cosine.	Diff.	Secant.	Cotangent.	Diff.	Tangent.	Cosecant.	Diff.	Sine.	М
1189)		А		А	В		В	С		С	61°
-												

Seconds of time	1,	28	3:	4 s	5:	6*	78
Prop. parts of cols. $\begin{cases} A \\ B \\ C \end{cases}$	3 4 1		9 11 3	$\begin{array}{c}12\\15\\3\end{array}$	15 19 4	$\begin{array}{c} 17\\23\\5\end{array}$	20 26 6

TABLE 44. [Pa												
			I	Log.	Sines, Tan	gents, and	l Sec	ants.				
290			A		A	В		B	C		С	150°
M.	Hour A. M.	Hour P. M.	Sine.	Diff.	Cosecant.	Tangent.	Diff.	Cotangent.	Secant.	Diff.	Cosine.	M.
0	8 8 0	$3\ 52\ 0$	9.68557	0	10.31443	9.74375	0	10.25625	10.05818	0	9.94182	60
$\frac{1}{2}$	$752 \\ 744$	$\begin{array}{rrr} 52 & 8 \\ 52 & 16 \end{array}$	68580 68603	1	31420 31397	74405	1	25565	05825	0	94175 94168	$\frac{59}{58}$
3	7 36	52 24	68625	1	31375	74465	1	25535	05839	0	94161	57
$\frac{4}{5}$	$\frac{728}{8720}$	$\frac{52}{3} \frac{32}{52} \frac{32}{40}$	$\frac{68648}{9.68671}$	$\frac{1}{2}$	$\frac{31352}{10,31329}$	9,74524	$\frac{2}{2}$	$\frac{25500}{10.25476}$	$\frac{03840}{10,05853}$	$\frac{0}{1}$	$\frac{94134}{9.94147}$	55
6	7 12	52 48	68694	2	31306	74554	3	25446	05860	1	94140	54
7	$ \begin{array}{c} 7 & 4 \\ 6 & 56 \end{array} $	$52 56 \\ 53 4$	$68716 \\ 68739$	3	$\frac{31284}{31261}$	74583	3	25417 25387	05867	1	94133	$\frac{53}{52}$
9	$6 \ 48$	53 12	68762	3	31238	74643	4	25357	05881	1	94119	51
10		$\begin{array}{rrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrr$	9.68784 68807	4	$10.31216 \\31193$	9.74673 74702	5	$10.25327 \\ 25298$	$10.05888 \\ 05895$	1	9.94112 94105	50 49
$11 \\ 12$		$53 \ 36$	68829	4	31171	74732	6	25268	05902	1	94098	48
$\frac{13}{14}$		$53 44 \\ 53 52$	$68852 \\ 68875$	5	$31148 \\ 31125$	$74762 \\ 74791$	$\begin{array}{c} 6\\7\end{array}$	$25238 \\ 25209$	05910 05917	$\frac{2}{2}$	94090 94083	47
$\frac{14}{15}$	8 6 0	3 54 0	9.68897	6	10. 31103	9.74821	7	$\overline{10.25179}$	10.05924	2	9.94076	45
16	552	$54 8 \\ 51 16$	68920 68912	6	31080	74851	8	25149 25120	$05931 \\ 05938$	$\frac{2}{2}$	94069	44
17	5 + 4 - 5 - 36	$54 10 \\ 54 24$	68965	7	31035	74910	9	25090	05945	$\tilde{2}$	94055	42
19	5 28	54 32	68987	7	31013	74939	$\frac{9}{10}$	$\frac{25061}{10, 25021}$	05952	$\frac{2}{2}$	94048	41
$\frac{20}{21}$	$\begin{array}{rrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrr$	$\begin{array}{r} 3 54 40 \\ 54 48 \end{array}$	$9.69010 \\ 69032$	8	10.30990	9.74969 74998	10	25002	05966	3	94034	39
22	5 4	54 56	69055	8	30945	75028	11	24972	05973	3	94027	$\frac{38}{27}$
$\frac{23}{24}$	$ 4 56 \\ 4 48 $	$ 55 4 \\ 55 12 $	69077	9	30923	75058	11 12	24942 24913	05980	3	94020	36
$\frac{21}{25}$	8 4 40	3 55 20	9.69122	9	10.30878	9.75117	12	10.24883	10.05995	3	9.94005	35
$\frac{26}{27}$	$\frac{4}{1}\frac{32}{21}$	$55 28 \\ 55 36$	$69144 \\ 69167$	10	30856	75146 75176	$13 \\ 13$	$24854 \\ 24824$	06002	3	93998	34
$\frac{2}{28}$	416	55 44	69189	10	30811	75205	14	24795	06016	3	93984	32
$\frac{29}{90}$	4 8	$\frac{55'52}{2.56}$	$\frac{69212}{0.60221}$	11	$\frac{30788}{10,20768}$	75235	$\frac{14}{15}$	$\frac{24765}{10-24736}$	06023	$\frac{3}{1}$	93977	31
31		$56 \ 8$	69256	12	30744	75294	15	24706	06037	4	93963	29
$\frac{32}{22}$	$3 44 \\ 2 26$	56 16 56 21	69279	$12 \\ 12$	30721	$75323 \\ 75353$	16	24677	06045	+	93955	$\frac{28}{27}$
$\frac{33}{34}$	328	$56 \ 32$	69323	$12 \\ 13$	30677	75382	17	24618	06059	4	93941	$\tilde{26}$
35	8 3 20	3 56 40	9.69345	13	10.30655	9.75411	17	10.24589	10,06066	+	9.93934 03027	25
$\frac{36}{37}$	$312 \\ 34$	$ 56 48 \\ 56 56 $	69390	10	30632	75441	18	24539	06073	4	93920	$\frac{24}{23}$
38	2 56	$57 \ 4$	69412 60424	14	30588	$75500 \\ 75520$	19	24500 21171	06088	5	93912	$22 \\ 21$
$\frac{39}{40}$	$\frac{248}{8240}$	$\frac{57}{3}$ $\frac{12}{57}$ 20	9,69456	$\frac{10}{15}$	$\frac{30500}{10,30544}$	9,75558	$\frac{19}{20}$	10. 24442	$\frac{00033}{10.06102}$	$\frac{5}{5}$	9.93898	$\frac{21}{20}$
41	232	57 28	69479	15	30521	75588	20	24412	06109	5	93891	19
$\frac{42}{43}$	$\begin{array}{c}2&24\\2&16\end{array}$	$57 \ 36 \\ 57 \ 44$	$69501 \\ 69523$	$16 \\ 16$	30499	75617 75647	$\frac{21}{21}$	24383 24353	06116 06124	5	93884	$18 \\ 17$
44	2 8	57 52	69545	16	30455	75676	22	24324	06131	5	93869	•16
$\frac{45}{46}$		$\begin{array}{cccc} 3 & 58 & 0 \\ & 58 & 8 \end{array}$	$9.69567 \\ 69589$	$\frac{17}{17}$	$10.30433 \\ 30411$	9.75705 75735	$\begin{vmatrix} 22 \\ 23 \end{vmatrix}$	10.24295 24265	$10.06138 \\ 06145$	э 5	9.93862 93855	15
47	1 44	$58 \ 16$	69611	17	30389	75764	23	24236	06153	6	93847	13
48 49	$ \begin{array}{r} 1 36 \\ 1 28 \end{array} $	$58 24 \\ 58 32$	69633 69655	18 18	$30367 \\ 30345$	$75793 \\ 75822$	24	24207 24178	06160	6	$93840 \\ 93833$	$12 \\ 11$
50	8 1 20	$\frac{358}{358}$ 40	9.69677	19	$\frac{30313}{10.30323}$	9.75852	25	10.24148	10.06174	6	9.93826	10
51 59	112	$58 48 \\ 58 56$	69699 69721	19	30301	$75881 \\ 75910$	25	24119	$06181 \\ 06189$	$\begin{bmatrix} 6\\ 6\end{bmatrix}$	93819 93811	9
53		$59 \ 4$	69743	20	30257	75939	$\frac{20}{26}$	24061	06196	6	93804	7
54	0 48	59 12	69765	20	$\frac{30235}{10,20212}$	75969	$\frac{27}{97}$	24031	$\frac{06203}{10,06211}$	$\frac{-6}{-7}$	$\frac{93797}{0.02780}$	$\frac{-6}{5}$
$\frac{55}{56}$		$\begin{array}{rrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrr$	9.09787 69809	$\frac{20}{21}$	30191	9.75998 76027	21 28	23973	06211	7	93782	4
57	024	59 36	69831	21	30169	76056	28	23944	06225	77	93775	3
$\frac{58}{59}$	$\begin{array}{c}0.16\\0.8\end{array}$	$59 \ 44 \ 59 \ 52$	69853 69875	$\frac{22}{22}$	30147	76086	$\frac{29}{29}$	23885	06232	7	93760	
60	. 0 0	4 0 0	69897	22	30103	76144	29	23856	06247	7	93753	0
M.	Hour P. M.	Hour A. M.	Cosine.	Diff.	Secant.	Cotangent.	Diff.	Tangent.	Cosecant.	Diff.	Sine.	М.
1190			А		А	В		в	С		С	60°

Seconds of time	15	25	3.	4 ª	5*	6 ^s	78
Prop. parts of cols. $\begin{cases} A \\ B \\ C \end{cases}$		$\begin{array}{c} 6\\7\\2\end{array}$	$ \begin{array}{c} 8\\ 11\\ 3\end{array} $	$\begin{array}{c}11\\15\\4\end{array}$	$\begin{array}{c}14\\18\\4\end{array}$	$\begin{smallmatrix} 17\\22\\5\end{smallmatrix}$	$\begin{array}{c} 20\\ 26\\ 6\end{array}$

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Log. Sines, Tangents, and Secants.

30°				A	Log.	A A	B	i beta	B	С		С	1490
М.	Hour A.M.	Hour P.	м.	Sine.	Diff.	Cosecant.	Tangent.	Diff.	Cotangent.	Secant.	Diff.	Cosine.	М.
0	8 0 0	4 0	0	9.69897	0	10. 30103	9.76144	0	10. 23856	10.06247	0	9.93753	60
1	7 59 52	0	8	69919	0	30081	76173	0	23827 23708	06254	0	93746	59
$\frac{2}{3}$	59 36	0	24	69963	1	30037	76231	1	23769	06269	0	93731	57
4	59 28	0	32	69984	1	30016	76261	2	23739	06276	0	93724	56
5	7 59 20	4 0	40	9.70006	2	10.29994	9.76290	2	10.23710	10.06283	1	9.93717	55
6	$59\ 12$	0 -	48	70028	20	29972	76319	3	23681 22652	06291	1	93709	54
8	$\frac{59}{58}$ $\frac{4}{56}$	1	4	70050	3	29928	76377	4	23623	06305	1	93695	52
- 9	$58 \ 48$	Î	$1\hat{2}$	70093	3	29907	76406	4	23594	06313	1	93687	51
10	7 58 40	4 1 :	20	9.70115	4	10.29885	9.76435	5	10.23565	10.06320	1	9.93680	50
11	58 32	1	28 96	70137	+ .	29863	$76464 \\ 76402$	8	23536	06327	1	93673	49
$\frac{12}{13}$	$ 58 24 \\ 58 16 $	1	$\frac{50}{14}$	70159	5	29841	76495 76522	6	23478	06342	$\frac{1}{2}$	93658	47
14	58 8	1	52	70202	5	29798	76551	7	23449	06350	$\overline{2}$	93650	46
15	7580	4 2	0	9,70224	5	10.29776	9.76580	7	10.23420	10.06357	2	9.93643	45
16	57 52	2	8	70245	$-\frac{6}{c}$	29755	76609	8	23391	06364	$\begin{vmatrix} 2\\ 9 \end{vmatrix}$	93636	44
17	$57 \frac{44}{57}$	$\frac{2}{2}$	$\frac{16}{21}$	70267	6	29733	76668	9	23301	06372	$\frac{2}{2}$	93628	43
$10 \\ 19$	57 28	$\frac{1}{2}$	32	70200	7	29690	76697	9	23303	06386	$\tilde{2}$	93614	41
20	7 57 20	4 2	40	9.70332	7	10.29668	9.76725	10	10.23275	10.06394	$\overline{2}$	9.93606	40
21	$57 \ 12$	2.	48	70353	8	29647	76754	10	23246	06401	3	93599	39
22	56 56	2	56	70375	8	29625	76783	11 11	23217	06409	3	93591	38
$\frac{20}{24}$	$56 \ 48$	3	12^{4}	70350	9	29582	76841	$\frac{11}{12}$	23159	06423	3	93577	36
25	7 56 40	4 3	$\frac{1}{20}$	9.70439	-9	10.29561	9.76870	$\overline{12}$	10.23130	10.06431	3	9.93569	35
26 *	$56 \ 32$	3 :	28	70461	9	29539	76899	13	23101	06438	3	93562	34
27	56 24	3	36	70482	10	29518	76928	$13 \\ 19$	23072	06446	3	93554	33
$\frac{28}{29}$	56 8	3	44 52	70504	10	29490	76986	13	23043	06461	3	93547	32 31
$\frac{20}{30}$	7560	4 4	0	9,70547	$\frac{10}{11}$	$\frac{20110}{10,29453}$	9,77015	$\frac{11}{14}$	10. 22985	10.06468	4	9,93532	30
31	55 52	4	8	70568	11	29432	77044	15	22956	06475	4	93525	29
32	55 44	4	16	70590	11	29410	77073	15	22927	06483	4	93517	28
33	55 28	4	24 39	70611	$\frac{12}{19}$	29389	77101 77130	16 16	22899	06490	+ 1	93510	27
35	7 55 20	4 4	40	9.70654	$\frac{12}{13}$	10.29346	9.77159	$\frac{10}{17}$	10. 22841	10.06505		9,93495	25
36	55 12	4	48	70675	13	29325	77188	17	22812	06513	4	93487	$\overline{24}$
37	55 4	4	56	70697	13	29303	77217	18	22783	06520	5	93480	23
38	54 56	5	4	70718	14	29282	$77246 \\ 77974$	18	22704	06528	05	93472	22
40	7 54 40	4 5	20	9 70761	14	10 29239	9 77303	$\frac{10}{19}$	10 22697	10.06543	$\frac{-0}{5}$	9.93457	20
41	54 32	5	$\bar{28}$	70782	15	29218	77332	$\frac{10}{20}$	22668	06550	5	93450	19
42	54 24	5	36	70803	15	29197	77361	20	, 22639	06558	5	93442	18
43	$54\ 16$ 54 8	5	44 59	70824 70846	15	29176 2015.1	77390	$\frac{21}{21}$	22610	06565	5	93435	$17 \\ 16$
45	7 54 0	4 6	0	9 70867	$\frac{10}{16}$	10 29133	9 77447	$\frac{21}{92}$	10 22553	10 06580	6	9 93420	15
46	53 52	6	8	70888	16	29112	77476	$\frac{1}{22}$	22524	06588	6	93412	14
47	53 44	6	16	70909	17	29091	77505	23	22495	06595	6	93405	13
48	53 36	6	$\frac{24}{29}$	$70931 \\ 70052$	17	29069	77533	23	22467	06603	6	93397	12
49	7 53 20		$\frac{52}{10}$	0 70952	18	29048	9 77501	$\frac{24}{9.1}$	22408	10.06618	$\frac{0}{6}$	90090	$\frac{11}{10}$
51	53 12	- 6	48	70994	18	29006	77619	$\frac{24}{25}$	22381	06625	6	93375	10
52	53 4	6	56	71015	19	28985	77648	25	22352	06633	6	93367	8
53	5256	7	4	71036	19	28964	77677	$\frac{26}{96}$	22323	06640	7	93360	
<u>-04</u> -55	7 52 40	1 7	$\frac{12}{20}$	9 71079	$\frac{19}{20}$	$\frac{28942}{10,28021}$	9 77731	$\frac{20}{-96}$	10 99966	10.06656	$\frac{1}{7}$	95552	5
56	52 32	7	$\tilde{28}$	71100	$\frac{1}{20}$	28900	77763	27	22237	06663	7	93337	4
57	52 24	7	36	71121	20	28879	77791	27	22209	06671	7	93329	3
58	52 16	7	44	71142	$ 21 \\ 31$	28858	77820	28	22180	06678	7	93322	$\frac{2}{1}$
- 60 - 60	52 8 52 0	8	$\frac{52}{0}$	71163	$\frac{21}{21}$	28837 28816	77877	$\frac{28}{29}$	$22151 \\ 22123$	06693	7	93314 93307	$\begin{bmatrix} 1\\0 \end{bmatrix}$
M	Hour P. M	Hour	. M	Cosine.	Diff	Secant	Cotangent	Diff	Tangent	Cosecant	Diff	Sine.	
1200)	A A		A		A	R		B	C		C	590
							-						

Seconds of time	18	2 8	38	4 s	5s	65	7×
Prop. parts of cols. $\begin{cases} A \\ B \\ C \end{cases}$	3 4 1	5 7 2		11 14 4	$ \begin{array}{c} 13 \\ 18 \\ 5 \end{array} $	$\begin{array}{c}16\\22\\6\end{array}$	19 25 7

					TAI	3LE 44.					[Page 6	39
				Log.	Sines, Tai	ngents, and	l Sec	ants.				
31°		,	A		A	В	-	В	С		С	1480
М.,	Hour A. M.	Hour P. M.	Sine.	Diff.	Cosecant.	Tangent.	Diff.	Cotangent.	Secant.	Diff.	Cosine.	М
0	$7\ 52\ 0$	4 8 0	9.71184	0	10.28816	9.77877	0	10.22123	10.06693	0	9.93307	60
1	$\frac{51}{51}$ $\frac{52}{44}$	8 8	$71205 \\ 71226$	1	28795	77906	1	22094 22065	06701	0	93299	59
$\frac{2}{3}$	$51 \frac{44}{36}$	8 24	71247	i	28753	77963	i	22000 22037	06716	Ő	93284	5
4	$51 \ 28$	8 32	71268	1	28732	77992	2	22008	06724	1	93276	5
5	7 51 20	4 8 40	9.71289	2	10.28711	9.78020	2	10.21980	10.06731	1	9.93269	5
6	51 12	8 48	$71310 \\ 71331$	2	28690	78049	0 3	21901 91093	06739	1	93261	0.5
8	50 56	9 4	71352	3	28648	78106	4	21894	06754	1	93246	5
9	$50 \ 48$	9 12	71373	3	28627	78135	4	21865	06762	1	93238	5
10	7 50 40	4 9 20	9.71393	.3	10.28607	9.78163	5	10.21837	10.06770	1	9.93230	5
11	50 32	9 28	71414	+	28585	78192	0 6	21808	06785	-)	93223	143
$\frac{12}{13}$	50 24 50 16	9 44	71456	4	28544	78249	6	21750 21751	06793	2	93207	1
14	50 8	9 52	71477	5	28523	78277	7	21723	06800	2	93200	4
15	7 50 0	4 10 0	9.71498	5	10.28502	9.78306	7	10.21694	10.06808	2	9.93192	4
16	49 52	10 8	71519	- 5 	28481	$78334 \\ 78262$	8	$21666 \\ 21627$	06816	20	93184	
18	49 44	$10 \ 10 \ 10 \ 10 \ 10 \ 10 \ 10 \ 10 \$	71560	6	28440	78391	9	21609 21609	06831	2	93169	4
$10 \\ 19$	49 28	$10 \ 32$	71581	7	28419	78419	9	21581	06839	2	93161	4
$\overline{20}$	7 49 20	4 10 40	9.71602	7	10.28398	9.78448	9	10.21552	10.06846	3	9.93154	4
21	$49\ 12$	10 48	71622	7	28378	78476	10	21524	06854	1 3	93146	3
$\frac{22}{22}$	49 4	10 00	71664	8	28397	78533	11	$21495 \\ 21467$	06869	3	93138	3
$\frac{23}{24}$	48 48	11 12	71685	8	28315	78562	11	21438	06877	3	93123	3
25	7 48 40	4 11 20	9.71705	9	10.28295	9.78590	12	10.21410	10.06885	3	9.93115	3
26	48 32	11 28	71726	9	28274	78618	12	21382	06892	3	93108	3
27	48 24	11 36 11 44	71747	19	28203	78675	13	21303	06900	3	93100	3
$\frac{20}{29}$	48 8	$11 \ 52.$	71788	10	28212	78704	14	21020 21296	06916	4	93084	3
$\frac{-0}{30}$	7 48 0	4 12 0	9.71809	10	10.28191	9.78732	14	10.21268	10.06923	4	9.93077	- 30
31	47 52	12 8	71829	11	28171	78760	15	21240	06931	4	93069	29
$\frac{32}{22}$	47 44	$12 16 \\ 12 21$	71850	11	28150	78789	10	$21211 \\ 21183$	06939	+	93061	$\frac{2}{2}$
33 34	47 28	$12 \ 32$	71891	$11 \\ 12$	28100	78845	16	$21105 \\ 21155$	06954	4	93046	2
$\frac{35}{35}$	7 47 20	4 12 40	9.71911	12	10.28089	9.78874	17	10.21126	10.06962	5	9.93038	2
36	47 12	12 48	71932	12	28068	78902	17	21098	06970	5	93030	2.
37	47 4	12 56 13 4	$71952 \\ 71072$	13	28048	78930	17	21070 21041	06978	5	93022	$\begin{bmatrix} 2\\ 2 \end{bmatrix}$
39	46 48	13 + 13 + 13 + 12	71994	13	28027	78987	18	21041	06993	5	93007	$\frac{2}{2}$
40	7 46 40	4 13 20	9,72014	14	10.27986	9.79015	19	10.20985	10.07001	5	9.92999	2
41	$46 \ 32$	13 28	72034	14	27966	79043	19	20957	07009	5	92991	1
42	46 24	$13 \ 36$	72055 72075	14	27945	79072	20	20928	07017	i õ e	92983	
43	46 8	13 + 13 - 52	72075	15	27923	79100	$\frac{20}{21}$	20500	07024	6	92968	
45	7 46 0	4 14 0	9,72116	15	10.27884	9.79156	21	10.20844	10.07040	6	9.92960	1
46	45 52	14 8	72137	16	27863	79185	22	20815	07048	6	92952	1
47	45 44	14 16	72157	16	27843	79213	22	20787	07056	6	92944	1
48 .10	45 36	14 24	72177	10	27823	79241	23	20759 20731	07064	6	92950	
$\frac{10}{50}$	7 45 20	4 14 40	9 72218	17	10. 27782	9.79297	24	10. 20703	10.07079	6	9.92921	1
51	45 12	14 48	72238	18	27762	79326	24	20674	07087	7	92913	
52	45 4	14 56	72259	18	27741	79354	25	20646	07095	7	92905	
53	-11 56	10 + 15 + 19	72279	18	27721	79382	20	20618 20590	07103		92897	
55	7 11 10	1 15 20	9 72320	19	10 27680	9 79438	-26	10 20562	10 07119	7	9.92881	
$\frac{55}{56}$	44 32	15 28	72340	19	27660	79466	-26	20534	07126	7	92874	
57	44 24	$15 \ 36$	72360	20	27640	79495	27	20505	07134	7	92866	
58 50	44 16	15 44 15 59	72381	$\frac{20}{20}$	27619 27500	79523	27	20477	07142	7	92858	
60	44 0	10-02 16 0	72401	$\frac{20}{21}$	27579	79579	$\frac{10}{28}$	20443	07158	8	92842	Ó
м.	Hour P. M.	Hour A.M.	Cosine.	Diff.	Secant.	Cotangent.	Diff.	Tangent.	Cosecant.	Diff.	Sine.	М
			• • • • • • • • • • • • • • • • • • • •			·	,					-

Seconds of time	1 s	28	3 5	4 s	5 s	6 s	7 s
Prop. parts of cols, $\begin{cases} A \\ B \\ C \end{cases}$	3 4 1	5 7 2		$\begin{array}{c}10\\14\\4\end{array}$	$\begin{smallmatrix}13\\18\\5\end{smallmatrix}$	$\begin{smallmatrix}15\\21\\6\end{smallmatrix}$	$ \begin{array}{c} 18 \\ 25 \\ 7 \end{array} $

Page	640]
Lago	UTUI

Log	Sines	Tangents	and	Secants
17051	Ennes,	rangents,	ana	wecame.

320			A	og. e	A	B	Geca	B	С		С	1470
М.	Hour A. M.	Hour P. M.	Sine.	Diff.	Cosecant.	Tangent.	Diff.	Cotangent.	Secant.	Diff.	Cosine,	М.
0	7 44 0	4 16 0	9.72421	0	10. 27579	9. 79579	0	10. 20421	10.07158	0	9.92842	60
1	$\frac{43}{42}$ 52	16 8 16 16	72441	0	27559	79607	0	20393	07166	0	92834	- 59 - 59
43	43 36	16 10 10 16 94	72401	1	$\frac{27539}{27518}$	79663	1	20305 20337	07182	0	92818	57
4	43 28	16 32	72502	î	27498	79691	2	20309	07190	1	92810	56
5	7 43 20	4 16 40	9.72522	2	10.27478	9.79719	2	10.20281	10.07197	1	9.92803	55
6	43 12	$16 \ 48$	72542	2	27458	79747	3	20253	07205	1	92795	54
7	43 4	16 56	72562	20	27438	79776	3	20224	07213	1	92787	53
9	42 30	17 19	72082 72602	3	27398	79832	4	20168	07229	i	92771	51^{-52}
10	7 42 40	4 17 20	9.72622	$-\frac{2}{3}$	10.27378	9.79860	5	10.20140	10.07237	1	9.92763	50
11	42 32	17 28	72643	-4	27357	79888	5	20112	07245	1	92755	49
12	42 24	$17 \ 36$	72663	4	27337	79916	6	20084	07253		92747	48
13	42 16	$17 \ 44$ 17 59	72683	+ 5	27317 97907	79944 70079	57	20096	07261		92739	47
$\frac{14}{15}$	7 12 0	$\frac{17.52}{4.18.0}$	9 79793	-5	10 27277	9 80000	7	10 20000	10 07277		9 92723	45
$10 \\ 16$	41 52	18 8	72743	5	27257	80028	7	19972	07285	2	92715	44
17	41 44	18 16	72763	- 6	27237	80056	8	19944	07293	2	92707	43
18	41 36	18 24	72783	6	27217	80084	8	19916	07301	$\frac{2}{3}$	92699	42
$\frac{19}{29}$	41 28	$\frac{18 \ 32}{10 \ 42}$	72803		2/19/	80112	9	19888	07309	3	92691	41
$\frac{20}{21}$	41 20	+ 18 +0	9.72823 72843	$\frac{4}{7}$	27177 27157	9. 50140	10	19832	07325	3	92675	40 39
$\frac{21}{22}$	41 4	18 56	72863	7	27137	80195	10	19805	07333	3	92667	38
23	40 56	19 - 4	72883	8	27117	80223	11	19777	Ó7341	3	92659	37
24	40 48	19 12	72902	8	27098	80251	11	19749	07349	3	92651	36
25	7 40 40	$\begin{bmatrix} 4 & 19 & 20 \\ 10 & 20 \end{bmatrix}$	9.72922	8	10.27078	9.80279	12	10.19721	10.07357	3	9.92643	35
26 97	40 32	19 28 10 26	72942	9	27038	80307	12	19095	07303	3	92633	33
$\frac{21}{28}$	40 16	19 44	72982	9	27018	80363	13	19637	07381	4	92619	32
29	40 8	19 52	73002	10	26998	80391	13	19609	07389	4	92611	31
30	7 40 0	4 20 0	9.73022	10	10.26978	9.80419	14	10.19581	10.07397	4	9.92603	30
31	$\frac{39}{20}$ 52	20 8	73041	10	26959	80447	14	19553	07405	4	92595	29
02 33	39 36	20 10 20 24	73081	11	20959	80502	$15 \\ 15$	19520	07413	1	92579	$\frac{20}{27}$
34	39 28	$\frac{20}{20}$ $\frac{21}{32}$	73101	11	26899	80530	16	19470	07429	5	92571	26
35	7 39 20	4 20 40	9.73121	$\overline{12}$	10.26879	9.80558	16	10.19442	10.07437	5	9.92563	25
36	39 12	20 48	73140	12	26860	80586	17	19414	07445	5	92555	24
37	$\frac{39}{28} \frac{4}{56}$	2056	73160	12	26840	80614	11	19386	07454 07469	5	92546	23
39	$\frac{38}{38}$ 48	$\frac{21}{21}$ $\frac{4}{12}$	73200	13	26800	80669	18	19331	07402	5	92530	$\frac{22}{21}$
40	7 38 40	4 21 20	9.73219	13	10.26781	9.80697	19	10.19303	10.07478	5	9.92522	$\overline{20}$
41	$38 \ 32$	$21 \ 28$	73239	14	26761	80725	19	19275	07486	6	92514	19
42	$\frac{38}{29}$	21 36	73259	14	26741	80753	20	19247	07494		92506	18
43	-38 10 -38 8	21 + 4 21 - 52	73278 - 73298	14	26722	80781	20	19219	07502		92498	16
45	7 38 0	4 22 0	9.73318	15	10 26682	9.80836	21	10.19164	10.07518	6	9.92482	$\frac{10}{15}$
46	37 52	22 8	73337	15	26663	80864	$\overline{21}$	19136	07527	6	92473	14
47	37 44	$22 \ 16$	73357	16	26643	80892	22	19108	07535	6	92465	13
48	37 36	22 24	73377	16	26623	80919	22	19081	07543	6	92457	$12 \\ 11$
49	7 37 20	1 22 32	0 73.116	$\frac{10}{17}$	20004	0 80075	20	19000	10.07559	7	92449	$\frac{11}{10}$
51	37 12	22 48	73435	17	26565	81003	24	18997	07567	7	92433	10
52	37 4	22 56	73455	17	26545	81030	24	18970	07575	7	92425	8
53	$\frac{36}{20}$	23 4	73474	18	26526	81058	25	18942	07584	1	92416	7
04	7 96 10	$\frac{23}{1.92}$	13494	18	20000	$\frac{81080}{0.91112}$	$\frac{29}{96}$	18914	07592		92408	0
56 56	36 32	$\pm 23 20$ 23 28	9.73513 73533	18	26487 26467	9.81113	20	18859	07608	8	92392	5
57	· 36 24	$23 \ 36$	73552	19	26448	81169	26	18831	07616	8	92384	3
58	36 16	23 44	73572	19	26428	81196	27	18804	07624	8	92376	2
59 60	$\frac{36}{36}$	23 52	73591 72611	20	26409	81224	27	18776 18749	07633	8	92367 92350	1.
		U		0					07041		92009	
М.	Hour P. M.	Hour A. M.	Cosine,	Diff.	Secant.	Cotangent.	Diff.	Tangent.	Cosecant.	Diff.	Sine.	М.
1220			A		А	В		В	C		С	57°

Seconds of time	1 8	2 6	3 3	4 8	5 s	6 *	7.8
Prop. parts of cols. $\begin{cases} A \\ B \\ C \end{cases}$			$\begin{array}{c} 7\\10\\3\end{array}$	$\begin{array}{c}10\\14\\4\end{array}$	$12 \\ 17 \\ 5 \\ 5$	$\begin{smallmatrix}15\\21\\6\end{smallmatrix}$	$\begin{array}{c} 17\\24\\7\end{array}$

22489 - 03 - -41

Seconds of time	18	28	33	- 1 *	5 8	65	78
Prop. parts of cold A	2	5	7	10	12	14	17
Prop. parts of cols. B	3	2	10	14	17	21 6	24

	Log. Sines, Tangents, and Secants.											
33°			A		A	В		В	С		С	146°
М.	Hour A. M.	Hour P. M.	Sine.	Diff,	Cosecant.	Tangent.	Diff.	Cotangent.	Secant.	Diff.	Cosine.	М,
0	7 36 0	4 24 0	9.73611	0	10.26389	9.81252	0	10.18748	10.07641	0	9.92359	60
1	35 52	24 8	73630	0	26370	81279	0	18721	07649 07657	0	92351	59 50
$\frac{2}{2}$	$35 \ 44$ 25 26	24 10	73669	1	26331	81335	1	18665	07665	0	92335	57 57
$\frac{3}{4}$	35 28	24 24 32	73689	1	26311	81362	$\frac{1}{2}$	18638	07674	1 1	92326	56
$\frac{1}{5}$	7 35 20	4 24 40	9.73708	$\overline{2}$	10.26292	9.81390	$\overline{2}$	10.18610	10.07682	1	9.92318	55
6	35 12	24 48	73727	2	26273	81418	3	18582	07690	1	92310	54
7	35 4	2456	73747	$\begin{vmatrix} 2 \\ 0 \end{vmatrix}$	26253	81445	3	18555	07698		92302	53
8	34 56	25 + 35 + 19	$73760 \\ 72785$	3	$26234 \\ 26215$	81473	4	18927	07715	1	92295	51
$\frac{\partial}{10}$	7 34 40	4 25 20	9 73805	$\frac{-0}{3}$	$\frac{20210}{10,26195}$	9.81528	-5	10.18472	10.07723	1	9.92277	50
11	34 32	25 28	73824	3	26176	81556	5	18444	07731	$\overline{2}$	92269	49
12	34 24	$25 \ 36$	73843	4	26157	81583	5	18417	07740	$\begin{vmatrix} 2 \\ \end{vmatrix}$	92260	48
13	34 16	25.44	73863	4	26137	81611	6	18389	07748		92252	47
14	7 91 0	20 02	0 72001		20110	01000	7	10 18331	10.07765	$\frac{2}{2}$	9 92244	40
10	3352	$\frac{420}{268}$	73921	5	26079	81693	7	18307	07773	$\overline{2}$	92227	44
17	33 44	26 16	73940	5	26060	81721	8	18279	07781	2	92219	43
18	$33 \ 36$	26 24	73959	6	26041	81748	8	18252	07789	3	92211	42
19	33 28	26 32	7,3978	6	26022	81776	9	18224	07798	3	92202	$\frac{41}{40}$
20	7 33 20	4 26 40	9.73997	67	10.26003	9.81803	10	10. 18197	07814	3	9.92194	40 30
$\frac{21}{22}$	$33 \ 4$	20 + 6 26 56	74017	7	25964	81858	10	18142	07823	3	92177	38
$\frac{22}{23}$	32 56	$\frac{20}{27}$ $\frac{00}{4}$	74055	7	25945	81886	11	18114	07831	3	92169	37
24	$32 \ 48$	$27 \ 12$	74074	8	25926	81913	11	18087	07339	3	92161	36
25	7 32 40	4 27 20	9.74093	8	10.25907	9.81941	11	10.18059	10.07848		9.92152	35
26	32 32	27 28	$74113 \\ 74129$	8	25887	81968	12	18032	07861	1	92144	34
$\frac{21}{28}$	$32 24 \\ 32 16$	$27 \ 30 \ 27 \ 44$	74152	9	25849	82023	13	17977	07873	4	92127	$\frac{30}{32}$
$\frac{20}{29}$	32 8	$27 \ 52$	74170	9	25830	82051	13	17949	07881	4	92119	31
30	7 32 0	4 28 0	9.74189	10	10.25811	9.82078	14	10.17922	10.07889	4	9.92111	-30
31	31 52	28 8	74208	10	25792	82106	14	17894	07898	4	92102	29
$\frac{32}{22}$	31 + 4 + 31 + 36	28 16 28 24	74227	10	25754	82133	10	17807	07900	5	92094	$\frac{28}{27}$
34 34	$31 30 \\ 31 28$	28 24 28 32	74265	11	25735	82188	16	17812	07923	5	92077	$\overline{26}$
35	7 31 20	4 28 40	9.74284	11	10.25716	9.82215	16	10.17785	10.07931	5	9.92069	25
36	31 12	$28 \ 48$	74303	11	25697	82243	16	17757	07940	5	92060	24
37	31 4	28 56	74322	12	25678	82270	17	17730	07948	5	92052	23
38	30 30	29 4	74360	$\frac{12}{12}$	25640	82298	18	17702 17675	07965	5	92044	$\frac{22}{21}$
40	7 30 40	4 29 20	9.74379	13	10. 25621	9.82352	18	10. 17648	10.07973	6	$\frac{02003}{9,92027}$	$\frac{-1}{20}$
41	30 32	29 28	74398	13	25602	82380	19	17620	07982	6	92018	19
42	30 24	29 36	74417	13	25583	82407	19	17593	07990	6	92010	18
43	30 16	29 44	$74436 \\ 71455$	14	25564	82435	$\frac{20}{20}$	17538	07998	6	92002	17
44	7300	$\frac{29.02}{4.30.0}$	0 74474	14	10 25526	9 82402	$\frac{20}{21}$	10 17511	10 08015	6	9 91985	15
46	29 52	30 8	74493	15	25507	82517	$\frac{21}{21}$	17483	08024	6	91976	14
47	29 44	30 16	74512	15	25488	82544	22	17456	08032	7	91968	13
48	29 36	30 24	74531	15	25469	82571	22	17429	08041	7	91959	12
49	29 28	30 32	74549	$\frac{16}{10}$	20401	82099	22	17401	08049		91991	-11
50	7 29 20	4 30 40	9.74008	16	10.25432 25413	9,82626	23	10.17374	08066	1 4	9.91942	10
$51 \\ 52$	$29 \ 4$	$30 \ 56$	74606	17	25394	82681	$\frac{20}{24}$	17319	08075	7	91925	8
53	28 56	31 4	74625	17	25375	82708	24	17292	08083	7	91917	7
54	28 48	31 12	74644	17	25356	82735	25	17265	08092	8	91908	6
55	7 28 40	4 31 20	9.74662	17	10. 25338	9.82762	$\frac{25}{96}$	10.17238 17910	10.08100	8	9.91900	5
00 57	$28 32 \\ 28 21$	31 28	$74681 \\ 74700$	18	25319	82790	26	17210	08109	8	91891	$\frac{4}{3}$
58	28 16	31 44	74719	18	25281	82844	27	17156	08126	8	91874	2
59	28 8	31 52	74737	19	25263	82871	27	17129	08134	8	91866	1
60	28 0	32 0	74756	19	25244	82899	27	17101	08143	8	91857	0
М.	Hour P. M.	Honr A. M.	Cosine.	Diff.	Secant.	Cotangent.	Diff.	Tangent.	Cosecant,	Diff.	Sine.	М.
1230	>		Α		A	В		В	С		С	56°

TABLE 44.

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Log. Sines, Tangents, and Secants.

340			A	Log.	Sines, Tan	gents, and B	i Sec	ants. B	С		C	1450
M	Hours	Hours	Sino	Diff	Cosecont	Tangent	Diff	Cotangent	Secont	Diff	Cosino	N N
<u></u>		HOUF P. M.	Sille.		Cosecant					<u> </u>	Cosine.	<u> </u>
0	7 28 0	4 32 0	9.74756	0	10.25244	9.82899	0	10.17101	10.08143	0	9.91857	60
$\frac{1}{2}$	$27 52 \\ 97 44$	$\frac{32}{32}$ $\frac{8}{16}$	74775		25225	82920	1	17074	08151	0	91849	59
$\frac{2}{3}$	27 36	$\frac{32}{32}$ $\frac{10}{24}$	74812	1	25188	82980	1	17020	08168	0	91832	57
4	27 28	$32 \ 32$	74831	1	25169	83008	2	16992	08177	1	91823	56
5	7 27 20	4 32 40	9.74850	2	10.25150	9.83035	2	10.16965	10.08185	1	9.91815	55
67	$\frac{27}{27}$ $\frac{12}{4}$	$\frac{32}{29}$ $\frac{48}{56}$	74868 74867	$\frac{2}{2}$	$25132 \\ 25113$	83062	3	16938	08194		91806	54
ŝ	$\frac{27}{26}$ $\frac{1}{56}$	$\frac{32}{33}$ $\frac{30}{4}$	74906	2	25094	83117	4	16883	08202	1	91789	$\frac{55}{52}$
9	$26 \ 48$	33 12	74924	3	25076	83144	4	16856	08219	1	91781	51
10	7 26 40	4 33 20	9.74943	3	10.25057	9.83171	5	10.16829	10.08228	1	9.91772	50
11	$26 32 \\ 26 24$	$\frac{33}{22} \frac{28}{26}$	74961	3	25039	83198	5	16802	08237	$\frac{2}{9}$	91763	49
12^{12}	26 16	33 44	74999	4	25001	83252	6	16748	08254	$\frac{1}{2}$	91746	47
14	26 8	33 52	75017	4	24983	83280	6	16720	08262	2	91738	46
15	7 26 0	4 34 0	9.75036	5	10.24964	9.83307	7	10.16693	10.08271	2	9.91729	45
16 17	$20 \ 02 \ 25 \ 14$	34 8 21 16	$75054 \\ 75073$	5	24946 24927	83334	8	16639	08280	2	91720	44
18	$25 \ 36$	34 24	75091	6	24909	83388	8	16612	08297	3	91703	42
19	$25 \ 28$	34 32	75110	6	24890	83415	9	16585	08305	3	91695	41
20	7 25 20	4 34 40	9.75128	6	10.24872	9.83442	9	10.16558	10.08314	3	9.91686	40
21	25 12 25 1	34 48	75147	$\frac{6}{7}$	24853 24825	83470	10	16530	08323	3	91677	39
$\frac{22}{23}$	$\frac{20}{24}$ $\frac{4}{56}$	34 00 35 4	75184	1 7	24816	83524	10	16476	08340	3	91660	37
24	24 48	35 12	75202	7	24798	83551	11	16449	08349	3	91651	36
25	7 24 40	4 35 20	9.75221	8	10.24779	9,83578	11	10.16422	$\overline{10.08357}$ ·	4	9.91643	35
26	24 32	35 28	75239	8	24761	83605	12	16395	08366	4	91634	34
21	24 24 24 24 16	35 30 35 44	75276	9	24742	83659	12	16308	08375	4	91625	33
29	24 8	35 52	75294	9	24706	83686	13	16314	08392	4	91608	31
30	7 24 0	4 36 0	9.75313	9	10.24687	9.83713	14	10.16287	10.08401	4	9.91599	30
31	23 52	36 8	75331	9	24669	83740	14	16260	08409	4	91591	29
32	$23 44 \\ 23 36$	36 16 36 94	75368	10	24650 24632	83768	14	16232	08418		91582	28
34	$ \frac{23}{23} \frac{30}{28} $	$36 \ 32$	75386	10	24614	83822	15	16178	08435	5	91565	$\frac{27}{26}$
35	7 23 20	4 36 40	9.75405	11	10.24595	9.83849	16	10.16151	10.08444	5	9.91556	25
36	23 12	36 48	75423	11	24577	83876	16	16124	08453	5	91547	24
37	23 + 4 22 56	$\frac{36}{27}$	70441 75450	11	$24509 \\ 24541$	83903	17	16097	08462	05	91538	23
39	$22 \ 48$	37 + 12	75478	12	24522	83957	18	16043	08479	6	91521	$\frac{22}{21}$
40	7 22 40	4 37 20	9.75496	12^{-12}	10.24504	9.83984	18	10.16016	10.08488	$\overline{6}$	9.91512	20
41	22 32	37 28	75514	13	24486	84011	18	15989	08496	6	91504	19
42	$22 24 \\ 22 16$	$\frac{37}{27}$ $\frac{36}{11}$	75533	13	24467	84038	19	15962 15025	08505	6	91495	18
44	$\frac{22}{22}$ 8	37 52	75569	13	24431	84092	20	15908	08523	6	91477	16
45	7 22 0	4 38 0	9.75587	14	10.24413	9.84119	20	10.15881	10.08531	7	9.91469	15
46	21 52	38 8	75605	14	24395	84146	21	15854	08540	7	91460	14
47	$21 44 \\ 21 36$	$\frac{38}{38} \frac{16}{24}$	$75624 \\ 75642$	14	24376	84173	21	15827	08549	77	91451	13
49	$21 \ 30 \ 21 \ 28$	38 32	75660	15	24340	84227	22	15773	08567	7	91433	11
50	7 21 20	4 38 40	9.75678	15	10.24322	9.84254	23	10.15746	10.08575	7	9.91425	10
51	21 12	38 48	75696	16	24304	84280	23	15720	08584	7	91416	9
52	21 4 20 56	$\frac{38}{20}$	75714 75799	16	24286	84307	23	15693	08593	8	91407	87
54	$20 \ 30 \ 20 \ 48$	39 12	75751	17	24207	84361	24	15639	08611	8	91398	6
55	7 20 40	4 39 20	9.75769	17	10. 24231	9.84388	25	10.15612	10.08619	8	9.91381	5
56	20 32	39 28	75787	17	24213	84415	25	15585	08628	8	91372	4
57	20 24	39 36	75805	17	24195	84442	26	15558	08637	8	91363	3
59	20 10 20 8	$39 44 \\ 39 52$	75841	18	24177 24159	84496	20	15504	08646	8	91354	
60	20 0	40 0	75859	18	24141	84523	27	15477	08664	9	91336	0
M.	Hour P. M.	Hour A. M.	Cosine.	Diff.	Secant.	Cotangent	Diff.	Tangent.	Cosecant.	Diff.	Sine.	M.
1249)		A		A	B		B	C		C	55
											_	

Seconds of time)	1*	28	3:	4*	58	6s	7=
Prop. parts of cols.	A B C	2 3 1	5 7 2	7 10 3	9 14 4	11 17 5	$\begin{array}{c}14\\20\\7\end{array}$	$\begin{array}{c} 16\\ 24\\ 8\end{array}$

	TABLE 44.										[Page 643		
			0	Log.	Sines, Tar	igents, and	l Seca	ants.					
350			A		A	В		В	C		C	1440	
М.	Hour A.M.	Hour P.M.	Sine.	Diff.	Cosecant.	Tangent.	Diff.	Cotangent.	Secant.	Diff.	Cosine.	M.	
0	7 20 0 10 59	4 40 0	9.75859	0	10.24141 2.1123	9.84523 84550	0	10.15477 15450	10.08664 08672	0	9.91336	60 50	
$\frac{1}{2}$	$19 52 \\ 19 44$	40 8	75895	1	24125	84576	1	15424	08681	0	91319	58	
$\frac{3}{4}$	19 36 19 28	$40 24 \\ 40 32$	$75913 \\ 75931$	1	$24087 \\ 24069$	$84603 \\ 84630$	$\frac{1}{2}$	$15397 \\ 15370$	$08690 \\ 08699$	0	$91310 \\ 91301$	57	
5	7 19 20	4 40 40	9.75949	1	10. 24051	9.84657	2	10.15343	10.08708	1	9.91292	55	
$\frac{6}{7}$	19 12 19 1	$40 48 \\ 40 56$	$75967 \\ 75985$	$\frac{2}{2}$	$24033 \\ 24015$	$84684 \\ 84711$	$\frac{3}{3}$	$15316 \\ 15289$	$08717 \\ 08726$	1	91283 91274	54 53	
8	18 56	41 4	76003	$\frac{1}{2}$	23997	84738	4	15262	08734	1	91266	52	
$\frac{9}{10}$	$\frac{18}{7}$ $\frac{48}{18}$ $\frac{40}{18}$	$\frac{41}{4}$ 12	76021	$\frac{3}{3}$	$\frac{23979}{10,23961}$	84764	4	$\frac{15236}{10, 15209}$	$08743 \\ 10 08752$	- I - 2	$\frac{91257}{9.91248}$	51	
11	$18 \ 40 \ 18 \ 32$	41 28	76057	3	23943	84818	5	15182	08761	2	91239	49	
12	$18 24 \\ 18 16$	41 36	76075	4	$23925 \\ 23907$	$84845 \\ 84872$	5	$15155 \\ 15128$	$08770 \\ 08779$	$\frac{2}{2}$	91230 91221	48 47	
14	18 10 $18 8$	41 52	76111	4	23889	84899	6	15101	08788	$\tilde{2}$	91212	46	
15	7 18 0 17 59	4 42 0	9.76129	4 5	10.23871 2385.1	9.84925	$\frac{7}{7}$	10. 15075	10.08797	$\frac{2}{2}$	9.91203	45	
10 17	$17 52 \\ 17 44$	$42 & 6 \\ 42 & 16$	76164	5	23836	84979	8	15021	08815	3	91185	43	
18	$17 \ 36 \ 17 \ 28$	42 24 42 32	$76182 \\ 76200$	5	23818 23800	85006 85033	8	$14994 \\ 14967$	08824	3	$91176 \\ 91167$	42	
$\frac{10}{20}$	$\frac{17}{7}$ $\frac{28}{17}$ $\frac{17}{20}$	4 42 40	9.76218	$\frac{-6}{6}$	10.23782	9.85059	9	10. 14941	10.08842	3	9.91158	$\frac{1}{40}$	
21	17 12	42 48	76236	6	23764 227.17	85086	9	14914	08851	3	91149 91141	39	
$\frac{22}{23}$	17 - 4 16 56	42 50 43 4	76255	7	23729	85140	10	14860	08868	3	91132	37	
24	16 48	43 12	76289	7	$\frac{23711}{10,000000000000000000000000000000000$	85166	11	14834	08877	4	91123	36	
$\frac{25}{26}$	$7 16 40 \\ 16 32$	$\begin{array}{r} 4 & 43 & 20 \\ 43 & 28 \end{array}$	9.76307 76324	8	$ 10.23693 \\ 23676 $	9.85193	$11 \\ 12$	14780	08895	4	9. 91114 91105	30	
27	16.24	$\frac{43}{42}$ $\frac{36}{14}$	76342	8	23658	85247	12	$14753 \\ 14797$	08904	4	91096	33	
$\frac{28}{29}$	$16 16 \\ 16 8$	$43 44 \\ 43 52$	76378	9	23622	85300	$12 \\ 13$	14727	08913	4	91087	31	
30	7 16 0	4 44 0	9.76395	9	10. 23605	9.85327	13	10.14673	10.08931	5	9.91069	30	
$\frac{31}{32}$	$15 52 \\ 15 44$	$\begin{array}{r} 44 & 8 \\ 44 & 16 \end{array}$	76413	9	23587 23569	$85354 \\ 85380$	14	14640	08940	$\begin{vmatrix} 0\\5 \end{vmatrix}$	91060	29	
33	15 36	44 24	76448	10	23552	85407	15	14593	08958	5	91042	27	
35	$\frac{15}{7}$ $\frac{28}{15}$ $\frac{28}{20}$	$\frac{44}{4}$ $\frac{32}{4}$	9, 76484	$\frac{10}{10}$	$\frac{23034}{10,23516}$	$\frac{80404}{9,85460}$	$\frac{13}{16}$	14500 10. 14540	$\frac{08967}{10,08977}$	$\frac{-5}{5}$	$\frac{91033}{9,91023}$	$\frac{.20}{25}$	
36	15 12	44 48	76501	11	23499	85487	16	14513	08986	5	91014	24	
$\frac{37}{38}$	$15 - 4 \\ 14 - 56$	$\begin{array}{rrr} 44 & 56 \\ 45 & 4 \end{array}$	$76519 \\ 76537$	11	$23481 \\ 23463$	$85514 \\ 85540$	$16 \\ 17$	$14486 \\ 14460$	08995 09004	6	91005	$\frac{23}{22}$	
39	14 48	45 12	76554	12	23446	85567	17	14433	09013	6	90987	21	
40 41	1,7 14 40 14 32	$\begin{array}{r} 4 & 45 & 20 \\ & 45 & 28 \end{array}$	$9.76572 \\76590$	$\frac{12}{12}$	$10.23428 \\ 23410$	$9.85594 \\ 85620$	18 18	$10.14406 \\ 14380$	$10.09022 \\ 09031$	6	9,90978	20	
42	14 24	45 36	76607	12	23393	85647	19	14353	09040	6	90960	18	
43 44	$14 16 \\ 14 8$	$ 45 44 \\ 45 52 $	$76625 \\ 76642$	$13 \\ 13$	$23375 \\ 23358$	85674 85700	$\frac{19}{20}$	$14326 \\ 14300$	09049	67	90951	$17 \\ 16$	
45	7 14 0	4 46 0	9.76660	13	10. 23340	9.85727	$\frac{20}{20}$	10. 14273	10.09067	7	9,90933	15	
$\frac{46}{47}$	$\begin{array}{c}13 \ 52\\13 \ 44\end{array}$	46 8 46 16	$76677 \\ 76695$	14	23323	$85754 \\ 85780$	$\frac{20}{21}$	$14246 \\ 14220$	$09076 \\ 09085$	77	90924 90915	14	
48	13 36	46 24	76712	14	23288	85807	$\overline{21}$	14193	09094	$\dot{7}$	90906	12	
$\frac{49}{50}$	$\frac{13}{7} \frac{28}{13} \frac{28}{20}$	$\frac{46}{46} \frac{32}{40}$	76730	14	23270	85834	22	14166 10 14140	09104	1	90896	$-\frac{11}{10}$	
51	13 12	46 48	76765	15	23235	85887	23	14113	09122	8	90878	9	
$\frac{52}{53}$	13 4 12 56	$\begin{array}{c} 46 56 \\ 47 4 \end{array}$	$76782 \\ 76800$	15	$23218 \\ 23200$	$85913 \\ 85940$	$\frac{23}{24}$	14087 14060	09131	8	90869		
54	12 48	47 12	76817	16	23183	85967	24	14033	09149	_8	90851	6	
$\frac{55}{56}$	$7 12 40 \\ 12 29$	$\begin{array}{r}4 & 47 & 20 \\ & 47 & 28\end{array}$	9.76835	$16 \\ 17$	10.23165 23149	9.85993	24 95	10. 14007	10.09158	8	9,90842 90822	5	
57	12 24	47 36	76870	17	23130	86046	$\frac{20}{25}$	13954	09177	9	90823	3	
$\frac{58}{59}$	$\begin{array}{ccc} 12 & 16 \\ 12 & 8 \end{array}$	$47 44 \\ 47 52$	76887 76904	17	23113 23096	86073 86100	$\frac{26}{26}$	$13927 \\ 13900$	$09186 \\ 09195$	9	90814 90805	$ ^{2}_{1}$	
60	12 0	48 0	76922	18	23078	86126	27	13874	09204	9	90796	0	
M.	Hour P.M.	Hour A.M.	Cosine.	Diff.	Secant,	Cotangent.	Diff.	Tangent.	Cosecant.	Diff.	Sine.	М.	
1250)		A		A	В		В	С		C	540	

Seconds of time	18	28	3.	4 *	51	68	78
Prop. parts of cols. $\begin{cases} A \\ B \\ C \end{cases}$	$2 \\ 3 \\ 1$	$\begin{array}{c} 4\\7\\2\end{array}$	$\begin{smallmatrix} 7\\10\\3\end{smallmatrix}$	9 13 5	$\begin{array}{c}11\\17\\6\end{array}$	$\begin{array}{c}13\\20\\7\end{array}$	

Page 644]

Log.	Sines.	Tangents.	and	Secants.
LOG.	A ALLCO	THEFT	een ce	P.COMILLE.

360	A A B B C C 14										1430	
М.	Hour A. M.	Hour P. M.	Sine.	Diff.	Cosecant.	Tangent.	Diff.	Cotangent.	Secant.	Diff.	Cosine.	М.
0	7 12 0	4 48 0	9.76922	0	10.23078	9.86126	0	10.13874	10.09204	0	9.90796	60
1	11 52	48 8	76939	0	23061	86153	0	13847	09213	0	90787	59
2	11 44	48 16	76937	1	23043	86179	1	13821	09223	0	90777	58
- 1	11 30 11 28	48 32	76974	1 1	23020	86232	.,	13768	09232	1	90768	07 56
-5	$\frac{11}{7}$ $\frac{20}{11}$ $\frac{20}{20}$	4 48 40	9.77009	1	10 22991	9.86259		10, 13741	10 09250	1	9 90750	55
6	11 12	48 48	77026	2	22974	86285	3	13715	09259	î	90741	54
7	11 4	48 56	77043	2	22957	86312	3	13688	09269	1	90731	53
8	1056	49 4	77061	2	22939	86338	4	13662	09278	1	90722	52
	$\frac{10.48}{7.10.10}$	$\frac{49}{12}$	0 77005	3	10 99005	80300	+	13050	09287	1	90713	50
11	$10 \ 40$ 10 32	4 49 20	9.77095	3	22900	9.80392	5	13582	10. 09290	2	9.90704	06
$\tilde{12}$	10 24	49 36	77130	3	22870	86445	5	13555	09315	$\overline{2}$	90685	49
13	10 16	49 44	77147	4	22853	86471	6	13529	09324	2	90676	47
14	10 8	49 52	77164	4	22836	86498	6	13502	09333	2	90667	46
15	$7 \ 10 \ 0 \ 50$	4500	9.77181	1	10.22819	9.86524	7	10.13476	10.09343	2	9.90657	45
$10 \\ 17$	9 52	50 8	77199	5	22801	86577	4	13449	09352		90648	44
$\frac{1}{18}$	9 36	$50 \ 10$ 50 24	77233	5	22767	86603	8	13397	09301	3	90630	43
19	9 28	50 32	77250	5	22750	86630	8	13370	09380	3	90620	41
$\overline{20}$	7 9 20	4 50 40	9.77268	6	10.22732	9.86656	9	10.13344	10.09389	3	9.90611	40
21	9 12	$50 \ 48$	77285	6	22715	86683	- 9	13317	09398	3	90602	39
22	9 4	50 56	77302	6	22698	86709	10	13291	09408	3	90592	38
$\frac{23}{24}$	8 00	$ \begin{array}{r} 51 \\ 51 \\ 19 \end{array} $	77319	7	22681	86762	10	13264	09417	+	90583	37
25	7 8 10	4 51 20	9 77353		10 22647	9 86789	11	$\frac{10200}{10, 13911}$	10 00125	-+	0.00565	25
$\frac{26}{26}$	8 32	51 20 51 28	77370	7	22630	86815	11	13185	09445	4	90555	34
27	8 24	$51 \ 36$	77387	8	22613	86842	12	13158	09454	4	90546	33
28	8 16	51 44	77405	8	22595	86868	12	13132	09463	4	90537	32
29	8 8	51 52	77422	8	22578	86894	13	13106	09473	5	90527	31
30	$\begin{bmatrix} 7 & 8 & 0 \\ & 7 & 59 \end{bmatrix}$	$\begin{array}{ccc} 4 & 52 & 0 \\ & 52 & 9 \end{array}$	9.77439 77456	9	10.22561	9.86921	13	10.13079 12052	10.09482		4.90518	30
$\frac{51}{32}$	7 32	$\frac{52}{52}$ $\frac{8}{16}$	77473	9	22044 22527	86971	14	13033	09491	05	90509	29
33	$7 \ 36$	52 24	77490	9	22510	87000	15	13000	09510	5	90490	27
34	7 28	$52 \ 32$	77507	10	22493	87027	15	12973	09520	5	90480	26
35	7 7 20	4 52 40	9.77524	10	10.22476	9.87053	15	10.12947	10.09529	5	9,90471	25
$\frac{36}{97}$	$\frac{7}{2}$ 12	52 48	77541	10	22459	87079	16	12921	09538	6	90462	24
31	7 4 8 58	$\frac{52}{53}$	77575	11	$22442 \\ 22495$	87106	$16 \\ 17$	12894	09548		90452	23
39	6 48	53 12	77592	11	22420	87152	$\frac{17}{17}$	12808	09566	6	90445	22
40	7 6 40	4 53 20	9,77609	11	10. 22391	9.87185	18	10, 12815	10. 09576	-6	9.90424	20
41	6 32	53 28	77626	12	22374	87211	18	12789	09585	6	90415	19
42	6 24	53 36	77643	12	22357	87238	18	12762	09595	7	90405	18
43		53 44	77660	$\frac{12}{12}$	22340	87264	19	12736	09604	7	90396	17
44	$\frac{0}{7}$ $\frac{8}{6}$ $\frac{0}{0}$	1 51 0	0.77601	10	22323	87290	19	12/10	09614		90386	16
46	5 52	54 8	9.77094	$10 \\ 13$	22300	9.87317 87313	20	10.12083 12657	10,09623	4	9.90377	10
47	5 44	54 16	77728	13	22272	87369	$\tilde{21}$	12631	09642	7	90358	$14 \\ 13$
48	$5 \ 36$	54 24	77744	14	22256	87396	21	12604	09651	7	90349	12
49	5 28	54 32	77761	14	22239	87422	22	12578	09661	8	90339	11
50	7 5 20	4 54 40	9.77778	14	10. 22222	9.87448	$\frac{22}{22}$	10.12552	10.09670	8	9.90330	10
01 52	5 12 5 1	54 + 8 54 56	77812	10	22205	87475	22	12525	09680	8	90320	9
53	4 56	55 4	77829	15	$22100 \\ 22171$	87527	$\frac{20}{23}$	12499	09089	8	90301	2
54	4 48	$55 \ 12$	77846	15	22154	87554	$\frac{1}{24}$	12446	09708	8	90292	6
55	7 4 40	4 55 20	9.77862	16	10.22138	9.87580	24	10.12420	10.09718	9	9.90282	5
56	4 32	55 28	77879	16	22121	87606	25	12394	09727	9	90273	4
57	4 24	55 36	77896	16	22104	87633	25	12367	09737	9	90263	3
$\frac{58}{59}$	4 10 4 8	$ \begin{array}{r} 50 \\ 55 \\ 59 \end{array} $	77913	16	22087	87659	26	$12341 \\ 19215$	09746 0075 c	9	90254	2
60	4 0	56 0	77946	17	22070 22054	87711	$\frac{20}{26}$	$12510 \\ 12289$	09765	9	90244	0
	House	House	Cant									
M.	HOUF P. M.	HOUF A, M.	Costne,	Diff.	Secant.	Cotangent.	Diff.	Tangent.	Cosecant.	Diff.	Sine.	M.
1260			A		A	В		В	C		С	530

Seconds of time	15	28	3.	. 4 s	5 8	6 ⁱ	7=					
Prop. parts of cols.	$\begin{cases} \mathbf{A} \\ \mathbf{B} \\ \mathbf{C} \end{cases}$	$\frac{2}{3}$ 1	$\frac{4}{7}$	$\begin{smallmatrix}&6\\10\\&4\end{smallmatrix}$	$\begin{smallmatrix}&9\\13\\5\end{smallmatrix}$	$\begin{array}{c}11\\17\\6\end{array}$	$ \begin{array}{c} 13 \\ 20 \\ 7 \end{array} $	$\begin{array}{c}15\\23\\8\end{array}$				
					TAE	LE 44.					[Page 64	45
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				Log.	Sines, Tar	igents, and	d Sec	ants.	~			
370			A	D10	A	B	Diff	B	C	Dia	C	1429
M.	Hour A, M.	Hour P. M.	sine.	<u>D</u> 1п.	Cosecant,	Tangent.	<u> </u>	Cotangent.	secant.	<u>Diii</u> ,	Cosine.	. <u>M</u>
0	$\begin{array}{ccc} 7 & 4 & 0 \\ 2 & 59 \end{array}$	$4560 \\ 568$	9.77946 77963	0	10.22054 22037	9.87711 87738	0	10.12289 12262	$10.09765 \\ 09775$	0	9,90235 90225	60
$\frac{1}{2}$	$3 52 \\ 3 44$	$56 \ 16$	77980	1	22020	87764	1	12236	09784	ŏ	90216	58
3	3 36	56 24	77997	1	22003	87790	1	12210	09794	0	90206	5
4 5	$\frac{3}{7}$ $\frac{28}{3}$ $\frac{20}{20}$	$\frac{36}{4}\frac{32}{56}\frac{40}{40}$	9 78013	$\frac{1}{1}$	$\frac{21987}{10,21970}$	9 87843	$\frac{2}{2}$	12185 10, 12157	10.09803	1	$\frac{90197}{9.90187}$	$-\frac{36}{52}$
6	312	$\frac{1}{56}$ $\frac{10}{48}$	78047	2	21953	87869	3	12131	09822	1	90178	5
7	3 4	56 56	78063	$\begin{vmatrix} 2\\ 9 \end{vmatrix}$	21937	87895	3	12105 12078	09832	1	90168	5
$\frac{8}{9}$	$\frac{2}{2} \frac{30}{48}$	57 + 4 57 12	78097	$\frac{1}{2}$	21920	87948	4	12078	09851	. 1	90139	5
10	7 2 40	4 57 20	9.78113	3	10.21887	9.87974	4	10.12026	10.09861	2	9.90139	5
$\frac{11}{10}$	$ \begin{array}{c} 2 & 32 \\ 9 & 91 \end{array} $	$57 28 \\ 57 26$	78130	9 9 9	21870 21853	88000 88027	5	$12000 \\ 11973$	09870	2.	90130	4
$\frac{12}{13}$	$ \begin{array}{c} 2 & 24 \\ 2 & 16 \end{array} $	$57 \ 50 \ 57 \ 44$	78147	4	$\frac{21805}{21837}$	88053	6	11947	09889	2	90111	4
14	2^{-8}	57 52	78180	-4	21820	88079	6	11921	09899	2	90101	4
$\frac{15}{16}$	$\begin{array}{cccc} 7 & 2 & 0 \\ 1 & 5 \end{array}$	4580	9.78197 79212	+	10.21803 21787	9.88105	7	10.11895	10.09909	$\frac{2}{2}$	9.90091	4
$\frac{10}{17}$	$1 \frac{52}{144}$	$58 \ 16$	$78213 \\ 78230$	± 5	21770	88158		11809	09928	3	90082	4
18	1 36	58 24	78246	5	21754	88184	8	11816	09937	3	90063	4
$\frac{19}{20}$	$\frac{1.28}{7.1.90}$	$\frac{58 32}{1.58 10}$	78263	$\frac{1}{5}$	21737 10 91590	88210	8	11790	09947	3	90053	- 4
$\frac{20}{21}$	$\begin{array}{c} 7 & 1 & 20 \\ 1 & 12 \end{array}$	$+ 58 + 40 \\- 58 + 48$	9.78280 78296	- 0 - 6	21704	9.88250	9	10.11704	09966	3	9. 90045	3
$\bar{2}\bar{2}$	1 4	58 56	78313	6	21687	88289	10	11711	09976	4	90024	3
23	0 56	$59 4 \\ 50 19$	78329	$\frac{6}{7}$	21671 21651	88315	$10 \\ 10$	11685 11650	09986	+	90014	3
$\frac{24}{25}$	7 0 40	$\frac{59}{4}$ $\frac{12}{59}$ $\frac{20}{20}$	9.78362	-7	10.21638	9.88367	11	$\frac{11000}{10,11633}$	10, 10005		9, 89995	$\frac{1}{3}$
$\frac{10}{26}$	0 32	59 28	78379	7	21621	88393	11	11607	10015	-Ĵ	89985	3
27	024	59 36	78395	7	21605	88420	12	11580	10024 10021	4	89976	3
$\frac{28}{29}$		59 52	78428	8	21588 21572	88472	13	11528	10034	5	89956	3
$\frac{1}{30}$	7 0 0	5 0 0	9.78445	8	10.21555	9.88498	13	10.11502	$10.\ 10053$	5	9.89947	3
31	65952	0 8	78461	9	21539	88524	14	11476	10063 10072	5 5	89937	$\frac{2}{9}$
$\frac{32}{33}$	59 44 59 36	0 10 0 24	78494	9	21522 21506	88577	14	11430	10073	5	89927	$\frac{2}{2}$
34	$59\ 28$	0 32	78510	9	21490	88603	15	11397	10092	5	89908	2
$\frac{35}{26}$	65920	5 0 40	9.78527	10	10.21473 21.157	9.88629	15	10.11371 11215	10.10102 10112	6	9.89898	$\frac{1}{9}$
$\frac{30}{37}$	$59 12 \\ 59 4$	$0.48 \\ 0.56$	78560	10	2140	88681	16	11349	10112	6	89879	$\frac{2}{2}$
38	58 56	14	78576	10	21424	88707	17	11293	10131	6	89869	2
$\frac{39}{40}$	58 48	$\frac{1}{5}$ 1 20	78592	11	$\frac{21408}{10,91201}$	88733	$\frac{17}{17}$	$\frac{11267}{10,11241}$	10141 10.10151	$\frac{-6}{-6}$	89859	$\frac{2}{3}$
40	$ 58 40 \\ 58 32 $	$ \begin{array}{r} 3 & 1 & 20 \\ 1 & 28 \end{array} $	9.78009 78625	11	21375	9. 88786	18	10.11241 11214	10160	7	89840	
42	$58\ 24$	$1 \ 36$	78642	12	21358	88812	18	11188	10170	7	89830	1
$\frac{43}{44}$	$58 16 \\ 58 8$	$1 44 \\ 1 59$	78658	$\frac{12}{12}$	21342	88838	19	11162	10180	$\frac{i}{4}$	89820 89810	
45	6 58 0	5 2 0	9.78691	$\frac{12}{12}$	$\frac{21020}{10,21309}$	9.88890	20	10. 11110	10. 10199	7	9.89801	$\overline{1}$
46	57 52	2 8	78707	13	21293	88916	20	11084	10209	7	89791	1
47 18	$ 57 44 \\ 57 36 $	2 16 9 91	78723	$13 \\ 13$	21277	88942	20	11058	10219 10229	8	89781	1
49	57 28		78756	13	21244	88994	21	11006	10239	8	89761	1
50	6 57 20	5 2 40	9.78772	14	10.21228	9,89020	22	10.10980	10.10248	8	9.89752	1
$\frac{51}{52}$	$ \begin{array}{r} 57 & 12 \\ 57 & 4 \end{array} $	$248 \\ 256$	18188 78805	14	21212 21195	89046 89073	$\frac{22}{23}$	10954 10927	$10258 \\ 10268$	8	89742 89732	
53	$56 \ 56$	3 4	78821	15	21179	89099	23	10901	10278	9	89722	
54	56 48	3 12	78837	15	21163	89125	24	10875	10288	9	89712	
55 56	0 56 40 56 32	ə 320 328	9.78853 78869	$15 \\ 15$	$ 10.21147 \\ 21131 $	$9.89151 \\ 89177$	24	$10.10849 \\ 10823$	10.10298 10307	9	9.89702	
57	56 24	3 36	78886	16	21114	89203	25	10797	10317	9	\$9683	
58 50	$56 \ 16$	3 44	78902	$\begin{bmatrix} 16 \\ 18 \end{bmatrix}$	21098	89229 80255	25	10771	10327 10227	9	89673	
60	$56 \ 0$		78934	16	21082	89281	$\frac{20}{26}$	10745	10347	10	89653	
<u>в</u> М.	Hour P. M.	Hour A. M.	Cosine.	Diff.	Sccant.	Cotangent.	Diff,	Tangent.	Cosecant.	Diff.	Sine.	м
		1		1	1		1		1		ſ	

Seconds of time	18	23	3×	4s	5,	6*	7s
Prop. parts of cols. $\begin{cases} A \\ B \\ C \end{cases}$	$\frac{2}{3}$ 1	$\frac{4}{7}$	$\begin{array}{c} 6\\10\\4\end{array}$		$\begin{array}{c}10\\16\\6\end{array}$	$ \begin{array}{c} 12 \\ 20 \\ 7 \end{array} $	$\begin{array}{c}14\\23\\8\end{array}$

Page	646
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TABLE 44.

Low	Sinne	Tangante	and	Seconte
LOT.	Sines.	Tangents.	ana	secants.

380			1	log. i	sines, Tan	gents, and B	sec	nuts. B	C		C	1410
M	HourAN	Hourpy	Sine	Diff	Cosecant	Tangent	Diff	Cotangent	Secant	Diff	Cosine	M
	HUULA, M.	HOUR P. M.	Sine.	<u></u>		Tangent.		conangent.	eccant.			
$ \begin{array}{c} 0 \\ 1 \end{array} $	$\begin{array}{cccc} 6 & 56 & 0 \\ & 55 & 59 \end{array}$	5 + 0 4 + 8	9.78934	0	$10.21066 \\ 21050$	$9.89281 \\ 89307$	0	$\frac{10.10719}{10693}$	$10.10347 \\ 10357$	0	9.89653	60 59
2	55 44	4 16	78967	1	21033	89333	1	10667	10367	0	89633	58
3	55 36	4 24	78983	1	21017	89359	1	10641	10376	1	89624	57
4	55 28	4 32	78999		21001	89385	_2	10615	10386	1	89614	56
5 6	6 bb 20 55 19	04 40 4 40	9.79015	1	10, 20985 20969	$9.89411 \\ 89437$	21 23	10.10589 10563	10.10396 10406	1	9.89604	- 55 - 54
7	55 4	4 56	79047	$\frac{1}{2}$	20953	89463	3	10537	10416	1	89584	53
8	54 56	5 4	79063	2	20937	89489	3	10511	10426	1	89574	52
9	54 48	5 12	79079	$\frac{2}{2}$	20921	89515	- 4	10485	10436	2	89564	51
$\frac{10}{11}$	0 04 40 54 32	$ \begin{array}{cccc} 5 & 20 \\ 5 & 28 \end{array} $	9.79095 79111	3	$ \frac{10.20905}{20889} $	9.89541 89567	$\frac{1}{5}$	10.10439 10433	10.10446 10456	$\frac{2}{2}$	9.89554	- 50 - 49
12	54 24	5 36	79128	3	$\frac{20800}{20872}$	89593	5	10407	10466	$\overline{2}$	89534	48
13	54 16	5 44	79144	3	20856	89619	6	10381	10476	2	89524	47
14	04 S	<u> 5 8 0</u>	79160		20840	89645	6	10355	10486 10, 10, 102	2	89514	46
$\frac{10}{16}$	5352	0 0 0 6 8	9.79176 79192	+ +	20824 20808	9. 89071 89697	7	10.10329	10.10490 10505	3	9. 89304 89495	40
17	53 44	6 16	79208	5	20792	89723	7	10277	10515	3	89485	43
18	53 36	6 24	79224	5	20776	89749	8	10251	10525	3	89475	42
$\frac{19}{-90}$	03 28 8 59 90	6 32	79240	- 5	$\frac{20760}{10,20711}$	0 20201	8	10220	10035	3	89465	$\frac{41}{10}$
$\frac{20}{21}$	5320 5312	5 6 40 6 48	9.79230	6	20728	89827	9	10.10199	10.10540 10555	3 4	9. 89400 89445	40 39
22	53 4	6 56	79288	6	20712	89853	10	10147	10565	4	89435	38
23	52 56	$\frac{7}{7}$ 4	79304	6	20696	89879 80005	10	10121	10575	4	89425	37
24	8 52 10	5 7 90	79319	7	20681	0 80021	10	10095	10380 10 10505	-+	0 80 105	30
$\frac{20}{26}$	$52 \ 40 \ 52 \ 32$	720 728	9. 19350 79351	7	20649	89957	11	100.10009	10605	4	89395	ээ 34
27	52 24	$7 \ 36$	79367	7	20633	89983	12	10017	10615	5	89385	33
28	52 16	7 44	79383	7	20617	90009	12	09991	10625	5	89375	32
29	02 8 6 52 0	1 52	79399	8	20001	90035	$\frac{13}{12}$	10 00090	10636 10.1081F	- 5	0 80251	$\frac{31}{20}$
31	$552 0 \\ 51 52$		9.79415 79431	8	20569	90086	13	09914	10656	0 5	9. 09304 89344	30 29
32	51 44	8 16	79447	8	20553	90112	14	09888	10666	5	89334	28
33	51 36 51 90	· 8 24	79463	9	20537	90138	14	09862	10676	6	89324	27
34	<u>8 51 20</u>	5 8 40	79478	-9	20522	90104	10	09836	10086	0	0 80204	26
36	51 12	8 48	79510	10	20490	90216	16	09784	10706	6	89294	$\frac{20}{24}$
37	51 4	8 56	79526	10	20474	90242	16	09758	10716	6	89284	23
38	50 56	· 9 4	79542	10	20458	90268	$16 \\ 17$	09732	$10726 \\ 10726$	67	89274	$\frac{22}{21}$
-40	6 50 40	<u>9 12</u> 5 9 20	79008	10	$\frac{20442}{10,20127}$	9 90294	$\frac{17}{17}$	10 09700	10730	7	9 89204	$\frac{21}{20}$
41	50 32	9 28	79589	11	20411	90346	18	09654	10756	7	89244	19
42	50 24	9 36	79605	11	20395	90371	18	09629	10767	7	89233	18
43	$50 16 \\ 50 8$	9 44	79621	11	20379	90397	19	$09603 \\ 09577$	10777 10787	$\frac{7}{7}$	89223	17
45	6 50 0	5 10 0	9. 79652	$\frac{12}{12}$	10. 20348	9, 90449	19	10.09551	10787		9,89203	$\frac{10}{15}$
46	49 52	10 8	79668	12	20332	90475	$\frac{10}{20}$	09525	10807	8	89193	14
47	49 44	10 16	79684	12	20316	90501	20	09499	10817	8	89183	13
48	49 36	$10 24 \\ 10 32$	79699 79715	13	20301	90527 90553	21	09473	10827 10838	8	89173	$12 \\ 11$
50	6 49 20	$\frac{10.02}{5.10.40}$	9.79731	$\frac{10}{13}$	$\frac{20269}{10,20269}$	9,90578	22	10.09422	10000	8	9,89152	$\frac{11}{10}$
51	49 12	10 48	79746	14	20254	90604	22	09396	10858	9	89142	9
52	49 4	10 56	79762	14	20238	90630	22	09370	10868	9	89132	8
54	$48 \ 48 \ 48$	$11 4 \\ 11 12$	79778	14	20222	90656	$\frac{23}{23}$	09344	10878	9	89122	6
55	6 48 40	5 11 20	9,79809	15	10, 20191	9,90708	24	10.09292	10,10899	- 9	9.89101	5
56	48 32	11 28	79825	15	20175	90734	24	09266	10909	9	89091	4
57	48 24	11 36	79840	15	20160	90759	25	09241	10919	10	89081	3
$58 \\ 59$	48 10 48 8	$11 \frac{11}{11} \frac{11}{52}$	79856 79872	10	20144 20128	90785 90811	$\begin{vmatrix} 25\\ 26 \end{vmatrix}$	09215	10929	10	89071	
60	48 0	12 0	79887	16	20113	90837	$ \tilde{26} $	09163	10950	10	89050	Ô
М.	Hour P. M.	Hour A. M.	Cosine	Diff	Secant	Cotangent	Diff	Tangent	Cosecant	Diff	Sine.	М.
1280)	1	A		A	R		B	C		C	510
120			А		Α	D		D	C			012

Seconds of time	1.	28	3*	4 s	5.	6.	7=
Prop. parts of cols. $\begin{cases} A \\ B \\ C \end{cases}$	$ \begin{array}{c} 2\\ 3\\ 1 \end{array} $	4 6 3	$\begin{smallmatrix}&6\\10\\&4\end{smallmatrix}$		$\begin{smallmatrix}10\\16\\6\end{smallmatrix}$		$\begin{array}{c}14\\23\\9\end{array}$

					TAI	BLE 44.			,		[Page 64	1 7
900				Log.	Sines, Tar	ngents, and B	l Sec	ants. B	C		c	1.1.00
39° М.	Hour A. M.	Hour P. M.	Sine.	Diff.	Cosecant.	Tangent.	Diff.	Cotangent.	Secant.	Diff.	Cosine.	M.
$\begin{array}{c} 0 \\ 1 \\ 2 \end{array}$	$\begin{array}{cccc} 6 & 48 & 0 \\ & 47 & 52 \\ & 47 & 44 \end{array}$	$5 \begin{array}{ccc} 12 & 0 \\ 12 & 8 \\ 12 & 16 \\ \end{array}$	9, 79887 79903 79918	0 0 1	$10.\ 20113\\20097\\20082$	9.90837 90863 90889	$\begin{array}{c} 0\\ 0\\ 1\\ \end{array}$	$10.09163 \\ 09137 \\ 09111 \\ 00000$	$10.10950 \\ 10960 \\ 10970 \\ 10970$	$\begin{array}{c} 0\\ 0\\ 0\\ 1\end{array}$	$9.89050 \\89040 \\89030 \\89030$	
3	$ 47 36 \\ 47 28 $	$12 24 \\ 12 32 \\ \hline 12 4 \\ 12 - 12 \\ \hline 12 $	79934 79950		20066	90914 90940	$\frac{1}{2}$	09086	10980		89020 89009	56 56
5 6 7 8	$ \begin{array}{r} 6 \ 47 \ 20 \\ 47 \ 12 \\ 47 \ 4 \\ 46 \ 56^{\circ} \end{array} $	$5 12 40 \\ 12 48 \\ 12 56 \\ 13 4$	$\begin{array}{r} 9.79965 \\ 79981 \\ 79996 \\ 80012 \end{array}$	$\frac{1}{2}$	$ \begin{array}{r} 10.20035 \\ 20019 \\ 20004 \\ 19988 \end{array} $	$9.90966 \\90992 \\91018 \\91043$	1 00 00 00	$\begin{array}{c} 10.\ 09034\\ 09008\\ 08982\\ 08957\end{array}$	$ \begin{array}{r} 10.11001 \\ 11011 \\ 11022 \\ 11032 \end{array} $	1 1 1	9.88999 88989 88978 88968	50 54 53 52
$\frac{\tilde{9}}{10}$	46 48	$\frac{13}{5}$ 12 $\frac{12}{20}$	80027	$\frac{2}{3}$	19973 10, 19957	91069 9.91095	4	$08931 \\ 10,08905$	$\frac{11042}{10, 11052}$	$-\frac{2}{2}$	88958 9,88948	$\frac{51}{50}$
$ \begin{array}{c} 11 \\ 12 \\ 13 \\ 14 \end{array} $	$\begin{array}{r} 46 & 32 \\ 46 & 24 \\ 46 & 16 \\ 46 & 8 \end{array}$	$ \begin{array}{r} 13 & 28 \\ 13 & 36 \\ 13 & 44 \\ 13 & 52 \end{array} $	80058 80074 80089 80105	$\frac{3}{3}$ $\frac{3}{3}$ $\frac{3}{4}$	$ \begin{array}{r} 19942 \\ 19926 \\ 19911 \\ 19895 \end{array} $	$91121 \\91147 \\91172 \\91198$		$\begin{array}{c} 08879 \\ 08853 \\ 08828 \\ 08802 \end{array}$	$ \begin{array}{r} 11063 \\ 11073 \\ 11083 \\ 11094 \end{array} $	$\frac{2}{2}$ $\frac{2}{2}$ $\frac{2}{2}$	88937 88927 88917 88906	49 48 47 46
$ \begin{array}{c} 15 \\ 16 \\ 17 \\ 18 \end{array} $	$\begin{array}{rrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrr$	$5 \ 14 \ 0 \\ 14 \ 8 \\ 14 \ 16 \\ 14 \ 24$	$\begin{array}{r} 9.\ 80120\\ 80136\\ 80151\\ 80166\end{array}$	$\frac{4}{4}$ $\frac{4}{5}$	$\begin{array}{r} 10.\ 19880 \\ 19864 \\ 19849 \\ 19834 \end{array}$	$\begin{array}{r} 9.\ 91224\\ 91250\\ 91276\\ 91301 \end{array}$	6 7 7 8	$\begin{array}{c} 10.\ 08776\\ 08750\\ 08724\\ 08699 \end{array}$	$\begin{array}{c} 10.\ 11104\\ 11114\\ 11125\\ 11135 \end{array}$	3 3 3 3 3	$\begin{array}{c} 9.88896\\88886\\88875\\88865\end{array}$	$ \begin{array}{r} 45 \\ 44 \\ 43 \\ 42 \end{array} $
	$ \begin{array}{r} 45 & 28 \\ \hline 6 & 45 & 20 \\ 45 & 12 \\ 45 & 4 \end{array} $	$ \begin{array}{r} 14 & 32 \\ 5 & 14 & 40 \\ 14 & 48 \\ 14 & 56 \end{array} $	$\begin{array}{r} 80182 \\ 9,80197 \\ 80213 \\ 80928 \end{array}$	5 5 5 6	$19818 \\10. 19803 \\19787 \\19772$	$91327 \\9.91353 \\91379 \\91404$	8 9 9 9		$\frac{11145}{10.11156}\\\frac{11166}{11176}$	$\frac{3}{3}$	88855 9.88844 88834 88834	$ \frac{41}{40} 39 38 $
$\frac{23}{24}$	$ \begin{array}{r} 46 & 4 \\ 44 & 56 \\ 44 & 48 \\ 6 & 44 & 40 \end{array} $	$ \begin{array}{r} 14 & 50 \\ 15 & 4 \\ 15 & 12 \\ 5 & 15 & 20 \end{array} $	80228 80244 80259 9.80274		19756 19741 10.19726	$ \begin{array}{r} 91401 \\ 91430 \\ 91456 \\ \hline 9.91482 \\ \end{array} $	10 10 11	$ \begin{array}{r} 08570 \\ 08544 \\ \overline{10.08518} \end{array} $	11187 11197 10.11207	$\begin{array}{c} 1\\ 1\\ 1\\ -1\\ -1 \end{array}$	88813 88803 9.88793	
$26 \\ 27 \\ 28 \\ 29$	$\begin{array}{rrrr} 44 & 32 \\ 44 & 24 \\ 44 & 16 \\ 44 & 8 \end{array}$	$\begin{array}{cccc} 15 & 28 \\ 15 & 36 \\ 15 & 44 \\ 15 & 52 \end{array}$	80290 80305 80320 80336	11111	$ 19710 \\ 19695 \\ 19680 \\ 19664 $	$91507 \\ 91533 \\ 91559 \\ 91585$	$ \begin{array}{c} 11 \\ 12 \\ 12 \\ 12 \\ 12 \end{array} $	$\begin{array}{c} 08493 \\ 08467 \\ 08441 \\ 08415 \end{array}$	$ \begin{array}{r} 11218 \\ 11228 \\ 11239 \\ 11249 \end{array} $	5 5 5 5	88782 88772 88761 88751	$ \begin{array}{r} 34 \\ 33 \\ 32 \\ 31 \end{array} $
$ \begin{array}{r} 30 \\ 31 \\ 32 \\ 33 \\ 34 \end{array} $	$\begin{array}{cccccccccccccccccccccccccccccccccccc$	$\begin{array}{cccccccccccccccccccccccccccccccccccc$	$\begin{array}{r} 9.\ 80351\\ 80366\\ 80382\\ 80397\\ 80412 \end{array}$	8 8 8 9	$\begin{array}{r} \hline 10.\ 19649 \\ 19634 \\ 19618 \\ 19603 \\ 19588 \end{array}$	$\begin{array}{r} 9.\ 91610\\ 91636\\ 91662\\ 91688\\ 91713 \end{array}$	$ \begin{array}{r} 13 \\ 13 \\ 14 \\ 14 \\ 15 \end{array} $	$\begin{array}{c} 10.08390\\ 08364\\ 08338\\ 08312\\ 08287 \end{array}$	$10.11259 \\11270 \\11280 \\11291 \\11301$		$\begin{array}{c} 9.88741 \\ 88730 \\ 88720 \\ 88709 \\ 88699 \end{array}$	$ \begin{array}{r} 30 \\ 29 \\ 28 \\ 27 \\ 26 \end{array} $
35 36 37 38 39	$\begin{array}{r} 6 \ 43 \ 20 \\ 43 \ 12 \\ 43 \ 4 \\ 42 \ 56 \\ 42 \ 48 \end{array}$	$5 16 40 \\ 16 48 \\ 16 56 \\ 17 4 \\ 17 19$	$9.80428 \\80443 \\80458 \\80473 \\80489$	$9 \\ 9 \\ 9 \\ 10 \\ 10$	$10. 19572 \\19557 \\19542 \\19527 \\19511$	9.91739 91765 91791 91816 91849	$ \begin{array}{r} 15 \\ 15 \\ 16 \\ 16 \\ 17 \end{array} $	$10.08261 \\08235 \\08209 \\08184 \\08158$	$\begin{array}{r} 10.\ 11312 \\ 11322 \\ 11332 \\ 11343 \\ 11353 \end{array}$		9, 88688 88678 88668 88657 88647	$25 \\ 24 \\ 23 \\ 22 \\ 21$
	$\begin{array}{cccccccccccccccccccccccccccccccccccc$	$ \begin{array}{r} 17 & 12 \\ \hline 5 & 17 & 20 \\ 17 & 28 \\ 17 & 36 \\ . & 17 & 44 \\ . & 17 & 50 \end{array} $	$\begin{array}{r} 9.80504 \\ 80519 \\ 80534 \\ 80550 \\ 80550 \end{array}$	10 10 11 11	$ \begin{array}{r} 10.19496 \\ 19481 \\ 19466 \\ 19450 \\ 19450 \end{array} $	$9.91868 \\91893 \\91919 \\91945 \\91945$	17 18 18 18	$ \begin{array}{r} 10.08132 \\ 08107 \\ 08081 \\ 08055 \\ 08020 \\ 08055 \\ 08020 \\ 08000 \\ $	$ \begin{array}{r} 11355 \\ 10.11364 \\ 11374 \\ 11385 \\ 11395 \\ 11395 \end{array} $	77777	$\begin{array}{c} 88636\\ 9.88636\\ 88626\\ 88615\\ 88605\\ 88605\\ \end{array}$	$ \begin{array}{r} 20 \\ 19 \\ 18 \\ 17 \\ 10 \end{array} $
	$\begin{array}{r} 42 & 8 \\ 6 & 42 & 0 \\ 41 & 52 \\ 41 & 44 \\ 41 & 36 \end{array}$	$ \begin{array}{r} 17 \ 52 \\ 5 \ 18 \ 0 \\ 18 \ 8 \\ 18 \ 16 \\ 18 \ 24 \end{array} $	$ \begin{array}{r} 80505 \\ 9.80580 \\ 80595 \\ 80610 \\ 80625 \end{array} $	$ \begin{array}{c} 11 \\ 12 \\ 12 \\ 12 \\ 12 \\ 12 \end{array} $	$ \begin{array}{r} 19435 \\ 10. 19420 \\ 19405 \\ 19390 \\ 19375 \end{array} $	$ \begin{array}{r} 91971 \\ \hline 9.91996 \\ 92022 \\ 92048 \\ 92073 \\ \end{array} $	19 19 20 20 21	$\begin{array}{r} 08029\\\hline 10,08004\\07978\\07952\\07952\\07927\end{array}$	$ \begin{array}{r} 11400 \\ 10.11416 \\ 11427 \\ 11437 \\ 11448 \end{array} $	8 8 8 8 8	$ \begin{array}{r} 88594 \\ 9.88584 \\ 88573 \\ 88563 \\ 88552 \\ \end{array} $	16 15 14 13 12
	$\begin{array}{r} 41 \ 28 \\ 6 \ 41 \ 20 \\ 41 \ 12 \\ 41 \ 4 \end{array}$	$ \begin{array}{r} 18 \ 32 \\ 5 \ 18 \ 40 \\ 18 \ 48 \\ 18 \ 56 \end{array} $	$\frac{80641}{9,80656}\\\frac{80671}{80686}$	$ \begin{array}{c} 13 \\ 13 \\ 13 \\ 13 \end{array} $	$ \begin{array}{r} 19359 \\ \overline{10.19344} \\ 19329 \\ 19314 \end{array} $	$\begin{array}{r} 92099\\ 9,92125\\ 92150\\ 92176\end{array}$	$21 \\ 21 \\ 22 \\ 22 \\ 22$	$\begin{array}{r} 07901 \\ \hline 10.\ 07875 \\ 07850 \\ 07824 \end{array}$	$ \begin{array}{r} 11458 \\ 10.11469 \\ 11479 \\ 11490 \\ \end{array} $	9 9 9 9	88542 9.88531 88521 88510	$\begin{array}{c} 11 \\ 10 \\ 9 \\ 8 \end{array}$
$ 53 \\ 54 \\ 55 \\ 56 $	$ \begin{array}{r} 40 & 56 \\ 40 & 48 \\ \hline 6 & 40 & 40 \\ 40 & 32 \end{array} $	$ \begin{array}{r} 19 & 4 \\ 19 & 12 \\ \overline{5} & 19 & 20 \\ 19 & 28 \end{array} $		$ \begin{array}{r} 14 \\$	$19299 \\ 19284 \\ 10.19269 \\ 19254$	$92202 \\ 92227 \\ 9,92253 \\ 9,9270$	$23 \\ 23 \\ 24 \\ 24 \\ 24 \\ 24 \\ 24 \\ 24 \\ $	$07798 \\ 07773 \\ 10.07747 \\ 07721 \\ 077721 \\ 0777721 \\ 07777721 \\ 07777721 \\ 07777721 \\ 07777777777$	$ \begin{array}{r} 11501 \\ 11511 \\ 10, 11522 \\ 11532 \end{array} $	$ \begin{array}{r} 9 \\ 9 \\ 10 \\ 10 \end{array} $	$ \frac{88499}{88489} \\ \overline{9,88478} \\ 88468 $	7 6 5
57 58 59 60	$ \begin{array}{r} 40 & 32 \\ 40 & 24 \\ 40 & 16 \\ 40 & 8 \\ 40 & 0 \end{array} $	$ \begin{array}{cccccccccccccccccccccccccccccccccccc$	80762 80777 80792 80807	$15 \\ 15 \\ 15 \\ 15 \\ 15 \\ 15 \\ 15 \\ 15 \\$	$ 19238 \\ 19223 \\ 19208 \\ 19193 $	$\begin{array}{r} 92304 \\ 92330 \\ 92336 \\ 92356 \\ 92381 \end{array}$	$ \begin{array}{c} 24 \\ 25 \\ 25 \\ 26 \end{array} $	$\begin{array}{c} 07696 \\ 07670 \\ 07644 \\ 07619 \end{array}$	$ \begin{array}{r} 11552 \\ 11543 \\ 11553 \\ 11564 \\ 11575 \end{array} $	10 10 10 10 10 10 10 10 10	$\begin{array}{r} 88403 \\ 88457 \\ 88447 \\ 88436 \\ 88425 \end{array}$	
M.	Hour P. M.	Hour A. M.	Cosine.	Diff.	Secant.	Cotangent.	Diff.	Tangent.	Cosecant.	Diff.	Sine.	<u>м</u> .
1290		·	А		А	В		В	С		C	50°

Seconds of time	1 8	2 5	3 *	4 *	5 *	6 s	78
Prop. parts of cols $\begin{cases} A \\ B \\ C \end{cases}$	$\begin{array}{c}2\\3\\1\end{array}$	4 6 3	$\begin{smallmatrix}&6\\10\\4\end{smallmatrix}$		$\begin{array}{c}10\\16\\7\end{array}$	$\begin{array}{c}12\\19\\8\end{array}$	13 23 9

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TABLE 44.

-	age 010]					DL12 44.						
				Log.	Sines, Ta	ngents, an	d Se	cants.				
40°			А		А	В		в	С		С	1390
М.	Hour A. M.	Hour P. M.	Sine.	DAIT.	Cosecant.	Tangent.	Diff.	Cotangent.	Secant.	Diff.	Cosine.	М.
0	6 40 0	5 20 0	9.80807	0	10. 19193	9.92381	0	10.07619	10.11575	0	9.88425	60
1	39 52	20 8	80822	. 0	19178	92407	0	07593	11585	0	88415	59
2	39 44	20 16	80837	0	19163	92433	1	07567	11596	0	88404	58
3	39 36	20 24	80852	1	19148	92458	1	07516	11606	1	88394	57
-+	09 28 70 00 00	20 32	0 00000	1	10 10119	92404		10 07510	10 11699	1	0.00070	1 30
6	0 59 20	0 20 40 20 48	9. 80882	: 1	10. 19118	9.92510	3	07465	11638	1	9.88972	00
7	39^{-12}	20 56	80912	2	19088	92561	3	07439	11649	1	88351	53
8	38 56	21 - 4	80927	2	19073	92587	3	07413	11660	1	88340	52
9	38 48	$21_{-}12_{-}$	80942	_2	19058	92612	4	07388	11670	2	88330	51
10	6 38 40	5 21 20	9.80957	1 2	10.19043	9.92638	+	10.07362	10.11681	$\frac{2}{2}$	9,88319	50
11	38 32	21 28	80972	3	19028	92663	0 5	07337	11692		88308	49
12	38 24	$\frac{21}{21}$ $\frac{30}{1.1}$	80987	3	19015	92089	6	07311	11702	2	88298	148
14	38 8	21 52	81002	3	18983	92740	6	07260	11724	3	88276	46
15	6 38 0	5 22 0	9.81032	4	10.18968	9.92766	6	10.07234	10.11734	3	9.88266	45
16	37 52	22 8	81047	4	18953	92792	7	07208	11745	3	88255	44
17	37 44	·22 16	81061	4	18939	92817	7	07183	11756	3	88244	43
18	$\frac{37}{97}$	22 24	81076	4	18924	92843	8	07157	11766	3	88234	42
19	37 28	<u> </u>	81091	- 5	10 1000	0 09201	0	07152	10 11700	0	88223	41
20	$ \begin{array}{r} 0 & 37 & 20 \\ 37 & 19 \end{array} $	$ \begin{array}{c} 3 & 22 & 40 \\ & 99 & 18 \end{array} $	9.81100	5	10, 18879	9.92894	9	07080	11700	1	9.88212	40
$\frac{21}{22}$	$37 12 \\ 37 4$	22 56	81136	5	18864	92945	9	07055	11809	4	88191	38
23	36 56	23 4	81151	6	18849	92971	10	07029	11820	4	88180	37
24	36 48	$23 \ 12$	81166	6	18834	92996	10	07004	11831	4	88169	36
25	6 36 40	5,23,20	9.81180	· 6	10.18820	9.93022	11	10.06978	10.11842	4	9.88158	35
26	36 32	23 28	81195	6	18805	93048	11	06952	11852		88148	34
21	36 24 26 16	23 30 23 11	81210	7	18790	93073	12	06927	11803	05	88137	33
$\frac{20}{29}$	36 8	$\frac{23}{23}$ $\frac{44}{52}$	81220	7	18760	93124	12^{12}	06876	11885	5	88115	31
30	6 36 0	5 24 0	9.81254	7	10.18746	9.93150	13	10.06850	10.11895	5	9.88105	30
31	35 52	24 8	81269	8	18731	93175	13	06825	11906	6	88094	29
32	35 44	24 16	81284	8	18716	93201	14	06799	11917	6	88083	28
33	35 36	24 24	81299	8	18701	93227	14	06773	11928		88072	27
34	30 28	5 91 10	0 01900	0	10000	95252	12	10 06799	11959	0	0.0001	20
30 36	0 35 20	0 24 40 94 18	9.81328	9	10. 18072	93303	10	06697	10. 11949	6	9,88031	20
37	$35 \frac{12}{4}$	$ \frac{21}{24} \frac{10}{56} $	81358	9	18642	93329	$16 \\ 16$	06671	11971	7	88029	23
38	34 56	25 - 4	81372	9	18628	93354	16	06646	11982	7	88018	22
39	34 48	$25 \ 12$	81387	10	18613	93380	17	06620	11993	_7_	88007	21
40	6 34 40	5 25 20	9.81402	10	10.18598	9.93406	17	10.06594	10.12004	7	9.87996	20
41	34 32	20 28	81417	10	18560	93431	11	06543	12015		87980	19
43	34 16	25 44	81446	11	18554	93482	18	06518	12026	.8	87964	17
44	34 8	25 52	81461	11	18539	93508	19	06492	12047	8	87953	16
45	6 34 0	$5\ 26\ 0$	9.81475	11	10.18525	9.93533	19	10.06467	10.12058	8	9.87942	15
46	33 52	26 8	81490	11	18510	93559	20	06441	12069	8	87931	14
47	33 44	26 16	81505	12	18495	93584	20	06416	12080	8	87920	$13 \\ 19$
48	33-36 33-38	$20 24 \\ 26 32$	81519 81534	12	18466	93610	20	06364	12091	9	87909	12
50	6 33 20	5 26 40	9 81549	19	10100 1018451	9 93661	-21	10.06339	10 12113	$-\frac{\sigma}{q}$	9 87887	$\frac{11}{10}$
51	$\frac{0}{33}$ 12	$\frac{26}{26}$ 48	81563	13	18437	93687	$\frac{1}{22}$	06313	12123	9	87877	10
52	33 4	26 56	81578	13	18422	93712	22	06288	12134	9	87866	8
53	32 56	27 4	81592	13	18408	93738	23	06262	12145	10	87855	7
54	32 48	27 12	81607	13	18393	93763	23	06237	12156	10	87844	6
00 50	6 32 40	5 27 20 97 99	9,81622	14	10.18378	9.93789	23	10.06211	10.12167 19179	10	9.87833	5
00 57	32 32 32 91	$\frac{21}{27}$ $\frac{28}{36}$	81651	11	18004	93814	24 91	06160	12178	10	87811	4 3
58	32 16	27 44	81665	14	18335	93865	25^{-1}	06135	12200	10	87800	2
59	32 8	27 52	81680	15	18320	93891	25	06109	12211	11	87789	1
60	32 0	28 0	81694	15	18306	93916	26	06084	12222	11	87778	0
м.	Hour P. M.	Hour A.M.	Cosine.	Diff.	Secant.	Cotangent.	Diff.	Tangent.	Cosecant.	Diff.	Sine.	М.
130	>		A		A	В		В	С		С	490

Seconds of time	1 8	2 :	3 *	4 *	5 5	6 s	78
Prop. parts of cols. $\begin{cases} A \\ B \\ C \end{cases}$	$\frac{2}{3}$ 1	$\begin{array}{c} 4\\ 6\\ 3\end{array}$	$\begin{smallmatrix}&6\\10\\&4\end{smallmatrix}$	7 13 5	9 16 7	$\begin{array}{c}11\\19\\8\end{array}$	$ \begin{array}{c} 13 \\ 22 \\ 9 \end{array} $

					TAI	BLE 44.	7				[Page 64	19
				Log.	Sines, Ta	ngents, and	l Sec	ants.				
410			А		А	В		В	С		С	1380
М.	Hour A. M.	Hour P. M.	Sine.	Diff	Cosecant.	Tangent.	Diff.	Cotangent.	Secant.	Diff.	Cosine.	М.
0	6 32 0	5 28 0	9.81694	0	10.18306	9,93916	0	10.06084	10. 12222	0	9.87778	60
$\frac{1}{2}$	$31 52 \\ 31 44$	$ 28 8 \\ 28 16 $	81709 81723	0	18291 18277	93942 93967	1	06033	12233 12244	0	87756	59
3	31 36	28 24	81738	1	18262	93993	1	06007	12255	1	87745	57
$-\frac{4}{5}$	$\frac{51}{6}\frac{28}{31}\frac{28}{20}$	$\frac{28}{5} \frac{32}{28} \frac{40}{40}$	$\frac{81752}{9,81767}$	1	$\frac{18248}{10,18233}$	9,94044	$\frac{2}{2}$	$\frac{05982}{10,05956}$	12200 10, 12277	1	9.87723	$\frac{96}{55}$
6	31 12	28 48	81781	1	18219	94069	3	05931	12288	1	87712	54
$-\frac{7}{8}$	$31 - 4 \\ 30 - 56$	$ 28 56 \\ 29 4 $	81796	$\frac{2}{2}$	18204	94095 94120	3	05905	12299 12310	1	$87701 \\ 87690$	53
9	30 48	29 12	81825	2	18175	94146	4	05854	12321	2	87679	51
$10 \\ 11$	$\begin{bmatrix} 6 & 30 & 40 \\ & 30 & 32 \end{bmatrix}$	$5 29 20 \\ 29 28$	9.81839 81854	23	$10.18161 \\ 18146$	$9.94171 \\ 94197$	$\frac{1}{5}$	10.05829 05803	$10.12332 \\ 12343$	$\frac{2}{2}$	9.87668 87657	50
12	30 24	$\frac{29}{29}$ $\frac{20}{36}$	81868	3	18132	94222	5	05778	12354	$\overline{2}$	87646	48
$13 \\ 14$	$-30\ 16$	$ \begin{array}{c} 29 & 44 \\ 29 & 52 \end{array} $	81882 81897	3	18118	94248	6	$05752 \\ 05727$	12365 12376	$\frac{2}{3}$	87635 87624	47
$\frac{11}{15}$	6 30 0	$\frac{2002}{5300}$	9.81911	4	10.18089	9,94299	6	10.05701	10. 12387	3	9.87613	$\frac{10}{45}$
16	29 52	30 8	81926	4	18074	94324	7	05676	12399	3	87601	44
$17 \\ 18$	$29 44 \\ 29 36$	$30 \ 10 \ 30 \ 24$	81940	4	18045	94375	8	05625	12410	0 3	87590	$\frac{43}{42}$
19	29 28	30 32	81969	5	18031	94401	8	05599	12432	4	87568	41
$\frac{20}{21}$	$ \begin{array}{r} 6 29 20 \\ 29 12 \end{array} $	$ 5 30 40 \\ 30 48 $	9.81983	5 5	10. 18017 18002	9.94426 94452	9	$10.05574 \\ 05548$	$10.12443 \\ 12454$	+++++++++++++++++++++++++++++++++++++++	9.87546	$\frac{40}{39}$
22	$\frac{1}{29}$ $\frac{1}{4}$	30 56	82012	5	17988	94477	9	05523	12465	4	87535	38
$\frac{23}{24}$	$28 56 \\ 28 48$	$\frac{31}{31}$ $\frac{4}{12}$	82026 82041		17974 17959	94503 94528	10	$05497 \\ 05472$	12476 12487	$\frac{1}{4}$	87524 87513	$\frac{37}{36}$
25	6 28 40	5 31 20	9.82055	6	10.17945	9.94554	11	10.05446	10.12499	5	9.87501	35
26	$\frac{28}{29}$ $\frac{32}{21}$	31 28	82069	6	17931	94579	11	05421	12510 12521	5	87490	34
$\frac{27}{28}$	$ 28 24 \\ 28 16 $	$31 \ 30 \ 31 \ 44$	82098	7	17902	94630	$11 \\ 12$	05350	12521 12532	5	87468	$\frac{33}{32}$
29	28 8	$\frac{31}{5}$ $\frac{52}{2}$	82112	7	17888	94655	$\frac{12}{12}$	05345	12543	$\frac{5}{c}$	87457	31
$\frac{30}{31}$	$ \begin{array}{r} 6 28 0 \\ 27 52 \end{array} $	$ \begin{array}{ccccccccccccccccccccccccccccccccccc$	9.82126 82141	7	10. 17874	9. 94681 94706	13	10.05319 05294	10.12564 12566	6	9.87440	$\frac{30}{29}$
32	27 44	32 16	82155	8	17845	94732	14	05268	12577	6	87423	28
$\frac{33}{34}$	$27 \ 36 \ 27 \ 28$	$\begin{array}{c} 32 & 24 \\ 32 & 32 \end{array}$	82169 82184	8	17851	94757 94783	14	05243	$12588 \\ 12599$		87412 87401	$\frac{27}{26}$
35	6 27 20	5 32 40	9.82198	8	10.17802	9.94808	15	10.05192	10.12610	7	9.87390	25
$\frac{36}{37}$	$\begin{array}{ccc} 27 & 12 \\ 27 & 4 \end{array}$	$\frac{32}{32}\frac{48}{56}$	$82212 \\ 82226$	9	17788 17774	94834 94859	$10 \\ 16$	$05166 \\ 05141$	$12622 \\ 12633$		87378	$\frac{24}{23}$
38	26 56	33 4	82240	9	17760	94884	16	05116	12644	$\frac{1}{2}$	87356	22
$\frac{10}{39}$	$\frac{26.48}{6.26.40}$	$\frac{33}{5} \frac{12}{20}$	82255	$\frac{9}{10}$	$\frac{17745}{10,17731}$	94910	$\frac{17}{17}$	05090	12655	$\frac{7}{7}$	87345	$\frac{21}{20}$
41	$ \begin{array}{c} 20 \\ 26 \\ 32 \end{array} $	33 28	82283	10	17717	94961	17	05039	12678	8	87322	19
$\frac{42}{43}$	$26 24 \\ 26 16$	$\frac{33}{23}$	82297 82311	10	17703	94986	18	05014	$12689 \\ 12700$	8	87311	18
44	$\frac{20}{26}$ $\frac{10}{8}$	33 52	82326	10	17674	95037	$10 \\ 19$	04963	12700 12712	8	87288	16
45	$\begin{array}{cccccccccccccccccccccccccccccccccccc$	5 34 0	9.82340	11	10.17660	9.95062	$\frac{19}{20}$	10.04938	10.12723	8	9.87277	15
40 47	$ \begin{array}{ccccccccccccccccccccccccccccccccccc$	$ 34 8 \\ 34 16 $	$82354 \\ 82368$	11	17646	95088 95113	$\frac{20}{20}$	$04912 \\ 04887$	12734 12745	$\frac{9}{9}$	87255	$14 \\ 13$
48	25 36	34 24	82382	11	17618	95139	20	04861	12757	9	87243	12
$\frac{49}{50}$	$\frac{23}{6}\frac{28}{25}\frac{28}{20}$	$\frac{34}{5}\frac{32}{34}\frac{32}{40}$	9,82410	$\frac{12}{12}$	$\frac{17004}{10,17590}$	9.95190	$\frac{21}{21}$	$\frac{04830}{10,04810}$	12708 10, 12779	$\frac{9}{9}$	9,87221	$\frac{11}{10}$
51	25 12	34 48	82424	12	17576	95215	22	04785	12791	10	87209	- 9
$\frac{52}{53}$	25 - 4 24 - 56	$ 34 56 \\ 35 4 $	82439 82453	$\frac{12}{13}$	$17561 \\ 17547$	95240 95266	22	$04760 \\ 04734$	12802 12813	10 10	$87198 \\ 87187$	$\frac{8}{7}$
54	24 48	35 12	82467	13	17533	95291	$\bar{2}\bar{3}$	04709	12825	10	87175	6
55 56	$6 24 40 \\ 24 20$	5 35 20 35 20	9.82481 82405	$\frac{13}{12}$	10.17519 17505	9.95317 95212	23 24	10.04683 04659	10.12836 12847	10	$9.87164 \\ 87152$	5
$\frac{50}{57}$	$ \begin{array}{c} 24 & 52 \\ 24 & 24 \end{array} $	$35 \ 36$	82509	10	17503 17491	95368	$\frac{24}{24}$	04632	12847 12859	11	87141	* 3
$\frac{58}{50}$	$ \begin{array}{cccc} 24 & 16 \\ 24 & 9 \end{array} $	$35 \ 44$ 25 50	82523	14	17477	95393	$\frac{25}{25}$	04607	12870	11	87130 87110	2
60 60	$ \begin{array}{ccc} 24 & 8 \\ 24 & 0 \end{array} $	36 0	82551 82551	14	17403	95444	$\frac{40}{25}$	04556	12891 12893	11	87107	0
М.	Hour P. M.	Hour A. M.	Cosine.	Diff.	Secant.	Cotangent.	Diff.	Tangent.	Cosecant.	Diff.	Sine.	М.
1310		•	А		A	В		В	С		С	480

Seconds of time	15	2s	3s	-4 *	55	63	78
Prop. parts of cols. $\begin{cases} A \\ B \\ C \end{cases}$	$\frac{2}{3}$ 1		$\begin{smallmatrix}&5\\10\\&4\end{smallmatrix}$	$\begin{array}{c} 7\\13\\6\end{array}$	$\begin{array}{c}9\\16\\7\end{array}$	$\begin{smallmatrix} 11\\19\\8\end{smallmatrix}$	$ \begin{array}{c} 12 \\ 22 \\ 10 \end{array} $

Page	650]
Lago	0001

TABLE 44.

				Log.	Sines, Tar	igents, and	l Seca	ants.				
420		1	A		A	B	The second	B	C		C	1370
M.	Hour A. M.	Hour P. M.	Sine.	Diff.	Cosecant.	Tangent.	Din.	Cotangent.	Secant.	Diff.	Cosine.	М.
0	$\begin{array}{ccc} 6 & 24 & 0 \\ & 22 & 52 \end{array}$	$5\ 36\ 0$	9.82551	0	10.17449 17.135	9.95444 95469	0	$10.04556 \\ 04531$	10.12893 12904	0	9.87107	60 50
$\frac{1}{2}$	$23 \ 52$ 23 44	36 8 36	82000	0	17435	95495	1	04505	12904 12915	0	87085	58
3	23 36	36 24	82593	1	17407	95520	1	04480	12927	1	87073	57
_4	$23 \ 28$	36 32	82607	1	17393	95545	2	04455	12938	1	87062	56
5	6 23 20	5 36 40	9.82621	1	10.17379	9.95571	$\frac{2}{2}$	10.04429	10.12950	1	9.87050	55
$\frac{6}{7}$	$ 23 12 \\ 93 1 $	36 48 36 56	82635 82640	9	17300	95699	3	04378	12901 12972	1	87039	04 53
8	23 + 4 22 56	30 50 37 4	82663	$\overline{2}$	17337	95647	3	04353	12984	2	87016	52
9	22 48	37 12	82677	2	17323	95672	-4	04328	12995	2	87005	51
10	6 22 40	5 37 20	9.82691	2	10.17309	9.95698	4	10.04302	10.13007	2	9.86993	50
11	22 32	37 28	82705	3	17295	95723	05	04277	13018	2	86982	49
12	$22 24 \\ 22 16$	37 30	82719	3	17281	95774	5	04202	13050	$\begin{vmatrix} 2\\ 3 \end{vmatrix}$	86970	40
14	$\frac{22}{22}$ 8	37 52	82747	3	17253	95799	6	04201	- 13053	3	86947	46
15	6 22 0	5 38 0	9.82761	- 3	10.17239	9.95825	6	10.04175	10.13064	3	9.86936	45
16	21 52	38 8	82775	-1	17225	95850	7	04150	13076	3	86924	44
17	21 44 91 26	$\frac{38}{20}$ $\frac{16}{21}$	82788	1	17212 17108	95875	8	04125	13087		86913	43
10	$21 50 \\ 91 98$	38 32	82816	4	17198	95926	8	04074	13038	4	86890	41
$\frac{10}{20}$	6 21 20	5 38 40	9,82830	5	10. 17170	9.95952	8	10.04048	10.13121	4	9,86879	40
21	21 12	38 48	82844	5	17156	95977	9	04023	13133	4	86867	39
22	21 4	38 56	82858	5	17142	96002	9	03998	13145	4	86855	38
23	2056	39 4	82872	5	17128	96028	$10 \\ 10$	03972	13156 19169	4	86844	37
24	8 20 48	5 20 20	0 99900		17110 10 17101	90000	11	10 03947	10100 10 13170	5	0 86891	30
$\frac{20}{26}$	$ \begin{array}{c} 0 & 20 & 40 \\ 20 & 32 \end{array} $	39 28	82913	6	17087	96104	11	03896	13191	5	86809	34
27	20 24	39 36	82927	6	17073	96129	11	03871	13202	5	86798	33
28	20 16	39 44	82941	6	17059	96155	12	03845	13214	5	86786	32
29	20 8	39 52	82955	1	17045	96180	12	03820	13225	$\frac{6}{2}$	86775	31
30	$ \begin{array}{cccc} 6 & 20 & 0 \\ 19 & 52 \end{array} $	5 + 0 = 0 40 = 8	9.82968	7	10.17032	9.96200	13	10.03795	10.13237 13948	. 0	9.86752	30
32	$19 \ 52$ 19 44	40 16	82996	7	17013	96256	14	03744	13260	6	86740	28
33	19 36	40 24	83010	8	16990	96281	14	03719	13272	6	86728	27
34	19 28	40 32	83023	8	16977	96307	14	03693	13283	7	86717	26
35	6 19 20 10 10	5 40 40	9.83037		10.16963	9.96332	15	10.03668	10.13295	7	9.86705	25
- 30 - 37	19 12	40 48 40 56	83065	8	16949	96383	10	03617	13318	7	86689	24
38	18 56	41 4	83078	9	16922	96408	16	03592	13330	17	86670	22
39	18 48	$41 \ 12$	83092	9	16908	96433	16	03567	13341	8	86659	21
40	6 18 40	5 41 20	9.83106	9	10.16894	9.96459	17	10.03541	10.13353	8	9.86647	20
41	18 32	41 28	83120	9	16880	96484	17	03516	13365	8	86635	19
42	18 24 18 16	$\frac{41}{41}$ $\frac{30}{41}$	83133 83147	10	16853	96535	18	03465	13388	8	86612	17
44	18 8	41 52	83161	10	16839	96560	19	03440	13400	8	86600	16
45	6 18 0	5 42 0	9.83174	10	10.16826	9.96586	19	10.03414	10.13411	9	9.86589	15
46	17 52	42 8	83188	11	16812	96611	19	03389	13423	9	86577	14
47	$17 \ 44 \\ 17 \ 96$	42 16	83202		16798 16795	96636	$20 \\ 20$	03364	13435 12116	9	86565	13
49	$17 \ 30 \ 17 \ 28$	42 24 42 32	83229	11	16771	96687	$\frac{20}{21}$	03313	13458	9	86542	111
$\frac{10}{50}$	6 17 20	5 42 40	9.83242	11	10.16758	9.96712	$\frac{-1}{21}$	10.03288	10.13470	10	9.86530	10
51	$17 \ 12$	42 48	83256	12	16744	96738	22	03262	13482	10	86518	9
52	17 4	42 56	83270	12	16730	96763	22	03237	13493	10	86507	8
53	16 56	43 - 4 42 - 10	83283	12	16717 16702	96788	22	03212	13505 12517	10	86495	1 7
55	6 16 40	5 12 20	0.83210	$\frac{14}{12}$	10.16600	0 06830	20	10 03161	10 12598	-11-	0.86179	
56	16 32	43 28	83324	13	16676	96864	24	03136	13520 13540	11	86460	4
57	16 24	43 36	83338	13	16662	96890	24	03110	13552	11	86448	3
58	16 16	43 44	83351	13	16649	96915	25	03085	13564	11	86436	2
- 69 - 60	$16 8 \\ 16 0$	43 52	83365	14	16635	96940 0608#	25	03060	13575	11	86425	
	10 0	U 111	00010	1.4	10022	90900 		00004	19991	14	00413	
М.	Hour P.M.	Hour A. M.	Cosine.	Diff.	Secant.	Cotangent.	Diff.	Tangent.	Cosecant.	Diff.	Sine.	М.
132	0		А		A	В		В	С		С	470
			G		1 .	a. 1 a.		1				

Seconds of time	18	2.	3.	45	- O ⁵	03	4.5
Prop. parts of cols. $\begin{cases} A \\ B \\ C \end{cases}$		$\begin{array}{c} 3\\ 6\\ 3\end{array}$	$5 \\ 10 \\ 4$	$\begin{array}{c} 7\\13\\6\end{array}$	$\begin{array}{c} 9\\16\\7\end{array}$	$10 \\ 19 \\ 9$	$12 \\ 22 \\ 10$

					TAF	BLE 44.					[Page (651
				Log.	Sines, Tar	igents, and	l Sec	ants.				
43°			A		A	В		B	C		С	136°
М.	Hour A.M.	Hour P.M.	Sine.	Diff.	Cosecant.	Tangent.	Diff.	Cotangent.	Secant.	Diff.	Cosine.	М
0	6 16 0	5 44 0	9.83378	0	10.16622	9, 96966	0	10.03034	10.13587	0	9.86413	60
1	$15 52 \\ 15 11$	44 8 44 16	83392	0	$16608 \\ 16595$	$96991 \\ 97016$	0	03009	$13599 \\ 13611$	0	86401 86389	59
$\frac{2}{3}$	$15 \ 44 \ 15 \ 36$	44 24	83419	1	16581	97042	î	02958	13623	1	86377	57
4	15 28	44 32	83432	1	16568	97067	$\frac{2}{2}$	02933	13634	1	86366	56
5	$\begin{array}{c} 6 & 15 & 20 \\ & 15 & 12 \end{array}$	$5 \frac{44}{11} \frac{40}{18}$	$9.83446 \\ 83459$	1	$10.16534 \\ 16541$	9.97092	$\frac{2}{3}$	10.02908 02882	$10.13646 \\ 13658$	1	9.86354 86342	54
7	$15 12 \\ 15 4$	44 56	83473	2	16527	97143	3	02857	13670	1	86330	53
8	14 56	45 4	83486	2	$16514 \\ 16500$	$97168 \\ 97102$	3	02832	13682 12601	$\frac{2}{2}$	86318	52
$\frac{9}{10}$	<u>14 48</u> <u>6 14 40</u>	$\frac{40.12}{5.45.90}$	9.83513	$-\frac{4}{2}$	10,16487	97195	-1	10 02781	13094 10 13705	$\frac{2}{2}$	86205	$\frac{51}{50}$
11	$14 \ 32$	45 28	83527	$\tilde{2}$	16473	97244	5	02756	13717	$\overline{2}$	86283	49
12	14 24	$45 \ 36$	83540	3	16460	97269	5	02731	13729	2	86271	48
$\frac{13}{14}$	$14 16 \\ 14 8$	$\frac{40}{45}$ $\frac{44}{52}$	83004 83567	3	16440 16433	97295 97320	0 6	02705	13741 13753	3	86209	4/
$\frac{11}{15}$	6140	$\frac{10 \ 02}{5 \ 46 \ 0}$	$\frac{0.0001}{9,83581}$	3	10.16419	9,97345	$\frac{-6}{6}$	10.02655	10.13765	3	9.86235	45
16	13 52	46 8	83594	4	16406	97371	7	02629	13777	3	86223	44
17	13 44	46 16	83608 82621	4	$16392 \\ 16270$	97396 97121	7.	$02604 \\ 02570$	13789	3	86211	43
$\frac{18}{19}$	$13 \ 30 \ 13 \ 28$	$40 24 \\ 46 32$	83634	4	16366	97421	8	02573	13812	4	86188	41
$\frac{10}{20}$	6 13 20	5 46 40	9.83648	4	10.16352	9.97472	8	$\overline{10.02528}$	10.13824	4	9.86176	40
21	$13 \ 12$	46 48	83661	5	16339	97497	9	02503	13836	4	86164	39
22	13 4 12 56	46 56 17 1	83674	5	16326	97523 97548	10	02477	$13848 \\ 13860$	4 5	86152	38
$\frac{23}{24}$	$12 \ 48$	47 12	83701	5	16299	97573	10	02427	13872	5	86128	36
25	6 12 40	5 47 20	9.83715	6	10.16285	9.97598	11	10.02402	10.13884	5	9.86116	35
26	$12 \ 32$	$\frac{47}{47}$ 28	83728	6	16272	97624	11	02376	13896	5	86104	34
$\frac{27}{28}$	$12 24 \\ 12 16$	$\frac{47}{47}$ $\frac{50}{44}$	83755	6	16259 16245	97649	$11 \\ 12$	02331	13908	6	86080	32
$\tilde{29}$	12 8	47 52	83768	6	16232	97700	12	02300	13932	6	86068	31
30	6 12 0	5 48 0	9.83781	7	10.16219	9.97725	13	10.02275	10.13944	6	9.86056	30
31	11 52 11 44	$\frac{48}{48}$ $\frac{8}{16}$	83795	$\frac{7}{7}$	16205 16192	97750 97776	13	02250	13956	6	86044	29
33	$11 \ 36$	48 24	83821	7	16179	97801	14	02199	13980	7	86020	27
34	11 28	48 32	83834	8	16166	97826	14	02174	13992	7	86008	26
$\frac{35}{2e}$	6 11 20	5 48 40	9.83848	8	10.16152 16120	9.97851 07877	15	10.02149	10.14004	7	9.85996	25
$\frac{30}{37}$	$11 12 \\ 11 4$	48 56	83874	8	16126	97902	$10 \\ 16$	02123	14010	7	85972	$\frac{24}{23}$
38	10 56	49,4	83887	8	16113	97927	16	02073	14040	8	85960	22
39	$\frac{10}{0}$ $\frac{48}{10}$	49 12	83901	9	16099	97953	$\frac{16}{17}$	02047	14052	$-\frac{8}{2}$	85948	21
40	$10 \ 10 \ 40$	$ \begin{array}{r} 3 49 20 \\ 49 28 \end{array} $	9.83914	9	10.16086 16073	9.97978	$17 \\ 17$	01997	14076	8	9.85930	19
42	10 24	49 36	83940	9	16060	98029	18	01971	14088	8	85912	18
43	10 16	49 44	83954	10	16046	98054	18	01946	14100	9	85900	17
44	6 10 0	5 50 0	9.83980	10	10055	9.98104	19	10.01921	14112	- 9	9.85876	$\frac{10}{15}$
46	9 52	50 8	83993	10	16007	98130	19	01870	14136	9	85864	14
47	9 44	50 16	84006	10	15994	98155	20	01845	14149	9	85851	13
$\frac{48}{49}$	9 36 9 28	50 24 50 32	84020 84033	11	15980	98180	$\frac{20}{21}$	01820	$14161 \\ 14173$	10	85827	$12 \\ 11$
$\frac{10}{50}$	6 9 20	5 50 40	9.84046	11	10. 15954	9.98231	21	10.01769	10. 14185	10	9.85815	10
51	9 12	50 48	84059	11	15941	98256	22	01744	14197	10	85803	9
$\frac{52}{53}$	94	5056	84072	$\frac{12}{19}$	15928	98281	$\frac{22}{99}$	01719	14209 14201	10	85791	
54	8 48	51 12	84098	12	15902	98332	$\frac{22}{23}$	01668	14221	11	85766	6
55	6 8 40	5 51 20	9.84112	12	10.15888	9.98357	23	10.01643	10.14246	11	9.85754	5
$\frac{56}{57}$	8 32	51 28 51 26	84125	$\frac{12}{12}$	15875	98383	24	01617	14258	11	85742	4
58		$51 50 \\ 51 44$	84151	13	15849	98408 98433	$\frac{24}{24}$	01592	14270 14282	$11 \\ 12$	85718	$\begin{vmatrix} 3\\2 \end{vmatrix}$
59	8 8	51 52	84164	13	15836	98458	25	01542	14294	12	85706	1
60	8 0	52 0	84177	13	15823	98484	25	01516	14307	12	85693	0
M.	Hour P.M.	Hour A. M.	Cosine.	Diff.	Secant.	Cotangent.	Diff.	Tangent.	Cosecant.	Diff.	Sine.	M.
133°			A		A	В		В	С		С	46
							_					

Seconds of time	15	23	33	4.4	5s	6ª	7=
Prop. parts of cols, $\begin{cases} A \\ B \\ C \end{cases}$	232	$\begin{array}{c} 3\\ 6\\ 3\end{array}$	5 9 5	$\begin{array}{c} 7\\13\\6\end{array}$	$\begin{smallmatrix}&8\\16\\&8\end{smallmatrix}$	$ \begin{array}{c} 10 \\ 19 \\ 9 \end{array} $	$ \begin{array}{c} 12 \\ 22 \\ 11 \end{array} $

Pa	ge 652]				TA	BLE 44.						
				Log.	Sines, Ta	ngents, an	d Sec	eants.				
440		2	A		A	B		В	С		C	1350
М.	Hour A. M.	Hour P. M.	Sine.	Diff.	Cosecant.	Tangent.	Diff.	Cotangent.	Secant.	Diff.	Cosine.	M.
0	6 8 0	5 52 0	9.84177	0	10.15823	9.98484	0	10.01516	10.14307	0	9.85693	60
$\frac{1}{2}$	$752 \\ 744$	52 8 52 16	84190		15810	98509		01491	14319 14221	0	85681	59
3	$7 \frac{44}{36}$	$52 \ 10 \ 52 \ 24$	84203		15784	98560	1	01400	14343	1	85657	- 3 8 - 57
4	7 28	52 32.	84229	1	15771	98585	2	01415	14355	1	85645	56
5	$\begin{array}{cccccccccccccccccccccccccccccccccccc$	5 52 40	9.84242	1	10. 15758	9.98610	2	10.01390 01265	10.14368	1	9.85632	55
$\frac{0}{7}$	$7 \frac{12}{4}$	$52 + 6 \\ 52 - 56$	84269	$\frac{1}{2}$	15731	98661	3	01305	14380	1	85608	- 53
8	6 56	53 4	84282	2	15718	98686	3	01314	14404	2	85596	52
$\frac{9}{10}$	6 48		84295	$-\frac{2}{5}$	10 15609	98711	+	01289 10.01962	14417 10 11190	$\frac{2}{2}$	85583	$\frac{51}{50}$
11		$5 53 20 \\ 53 28$	9.84308	$\frac{1}{2}$	10.15652 15679	9. 98757	5	$01203 \\ 01238$	14441	$\frac{2}{2}$	9.80071	- 0 0 - 49
12	6 24	$53 \ 36$	84334	3	15666	98787	5	01213	14453	2	85547	48
13		$53 \ 44 \\ 53 \ 52$	84347 84360	3	15640	98812	5	$01188 \\ 01162$	$14466 \\ 14478$	30	85534	47
15	6 6 0	5 54 0	9.84373	-3	$\frac{15010}{10, 15627}$	9.98863	$\frac{0}{6}$	10.01137	10. 14490	$\frac{-3}{3}$	$\frac{85522}{9.85510}$	$\frac{40}{45}$
16	5 52	54 8	84385	3	15615	98888	7	01112	14503	3	85497	44
17	5 44 5 36	$54 \ 16 \\ 54 \ 24$	$\frac{84398}{84411}$	+	$15602 \\ 15589$	98913	7	01087	14515 14597	4	85485	43
19	5 28	54 32	84424	4	15576	98964	8	01036	14540	4	85460	41
20	6 5 20	5 54 40	9.84437	4	10.15563	9.98989	8	10.01011	10.14552	4	9.85448	40
21	$5 12 \\ 5 1$	$54 \ 48 \\ 51 \ 56$	84450	5	15550 15527	99015	9	00985	14564	4	85436	39
$\frac{22}{23}$	456	54 - 50 - 55 - 4	84476	5	15524	99040 99065	10^{-9}	00900	14577	5	85411	37
24	4 48	$55 \ 12$	84489	5	15511	99090	10	00910	14601	5	85399	36
25	6 4 40	5 55 20	9.84502	5	10.15498	9.99116	11	10.00884	10.14614	5	9,85386	35
$\frac{26}{27}$	$\frac{4}{4}\frac{52}{24}$	$ 55 28 \\ 55 36 $	84528	6	15485 15472	99141	11	00839	14620	0 6	85361	34
28	4 16	$55 \ 44$	84540	6	15460	99191	12	00809	14651	ő	85349	32
$\frac{29}{20}$	4 8	55 52	84553	$\frac{6}{a}$	15447	99217	12	00783	14663	$\frac{6}{2}$	85337	31
30 31		50 0 56 8	9.84566	67	10, 15434	9.99242 99267	13	10.00758 00733	10.14676 14688	6	9.85324 85312	30
$\tilde{32}$	3 44	$56 \ 16$	84592	7	15408	99293	13	00707	14701	7	85299	28
33	3 36 2 90	56 24	84605	77	15395	99318	14	00682	$14713 \\ 14796$	7	85287	27
35	$\frac{320}{6320}$	$\frac{50}{5}$ $\frac{56}{56}$ $\frac{40}{40}$	9 84630		10382 10 15370	9 99368	15	$\frac{00037}{10,00632}$	10 14738	$\frac{i}{7}$	9 85262	$\frac{20}{25}$
36	312	56 48	84643	8	15357	99394	15	00606	14750	7	85250	24
37	$\frac{3}{9}\frac{4}{56}$	56 56	84656	8	15344	99419	16	00581	14763	8	85237	23
$\frac{30}{39}$	$ \begin{array}{c} 2 & 30 \\ 2 & 48 \end{array} $	57 + 4 57 12	84682	8	15318	99444	$10 \\ 16$	00530	14775 14788	8	85225 85212	$\frac{22}{21}$
40	6 2 40	5 57 20	9.84694	9	10.15306	9.99495	17	10.00505	10.14800	8	9.85200	20
41	2 32	57 28	84707	9	15293	99520	17	00480	14813	8	85187	19
42	$ \begin{array}{c} 2 & 24 \\ 2 & 16 \end{array} $	57 50 57 44	84720	9	15280 15267	99545 99570	18	00430	14820 14838	9	85175 85162	18
44	2^{-8}	57 52	84745	9	15255	99596	19	00404	14850	- ğ	85150	16
45	$\begin{array}{cccc} 6 & 2 & 0 \\ 1 & 5 \end{array}$	5 58 0	9.84758	10	10.15242	9.99621	19	10.00379	10.14863	9	9.85137	15
40	$1 \ 52 \\ 1 \ 44$	$ \begin{array}{r} 58 & 8 \\ 58 & 16 \end{array} $	84784	10	15229	99646 99672	19	00354 00328	14870	10	$85125 \\ 85112$	14
48	1 36	58 24	84796	10	15204	99697	$\overline{20}$	00303	14900	10	85100	12^{10}
49	1 28	58 32	84809	11	15191	99722	21	00278	14913	10	85087	11
50 51	$\begin{array}{cccc} 6 & 1 & 20 \\ & 1 & 12 \end{array}$	$ \begin{array}{r} 5 3 40 \\ 58 48 \end{array} $	9.84822 84835	11	10. 15178	9.99747	21	10.00253 00227	10, 14926 14938	$10 \\ 11$	9.85074 85062	10
52^{-1}	1 4	58 56	84847	11	15155 15153	99798	$\frac{21}{22}$	00202	14951	11	85049	8
53	0 56	59 4	84860	11	15140	99823	22	00177	14963	11	85037	7
55	6 0 48	5 59 90	9 81885	$\frac{12}{19}$	$\frac{10127}{10, 15115}$	99848	23	$\frac{00152}{10,00196}$	14976	11	85024	$\frac{6}{5}$
56	0 32	59 28	84898	12^{12}	15102	99899	24	00101	15001	12	84999	4
57	0 24	59 36	84911	12	15089	99924	24	00076	15014	12	84986	3
$\frac{58}{59}$	0 16	$59 \ 44 \ 59 \ 52$	84923 84936	$\frac{12}{13}$	15077	99949 99975	$\frac{24}{25}$	00051 00025	15026 15039	$\frac{12}{12}$	84974 84961	$\frac{2}{1}$
60	0 0	6 0 0	84949	13	15051	10.00000	25	00000	15051	$1\overline{2}$	84949	0
M	Hour P. M	Hour A. M	Cosine	Diff	Secont	Cotangent	Diff	Tangent	Coseeant	Diff	Sine	v
1840			A		A	B		B	C		C	450
101						D		Б			0	10.

Seconds of time	18	2*	38	4.	-5s	6ª	78
Prop. parts of cols, $\begin{cases} A \\ B \\ C \end{cases}$	$2 \\ 3 \\ 2$	3 6 3	5 9 5	$\begin{array}{c} 6\\ 13\\ 6\end{array}$	8 16 8	$ \begin{array}{c} 10 \\ 19 \\ 9 \end{array} $	$ \begin{array}{c} 11 \\ 22 \\ 11 \end{array} $
(E	OFO	A A A	-			



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REC. CIR. MAR	27 '75

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