TABLES

FOR

AZIMUTHS, GREAT-CIRCLE SAILING,

AND

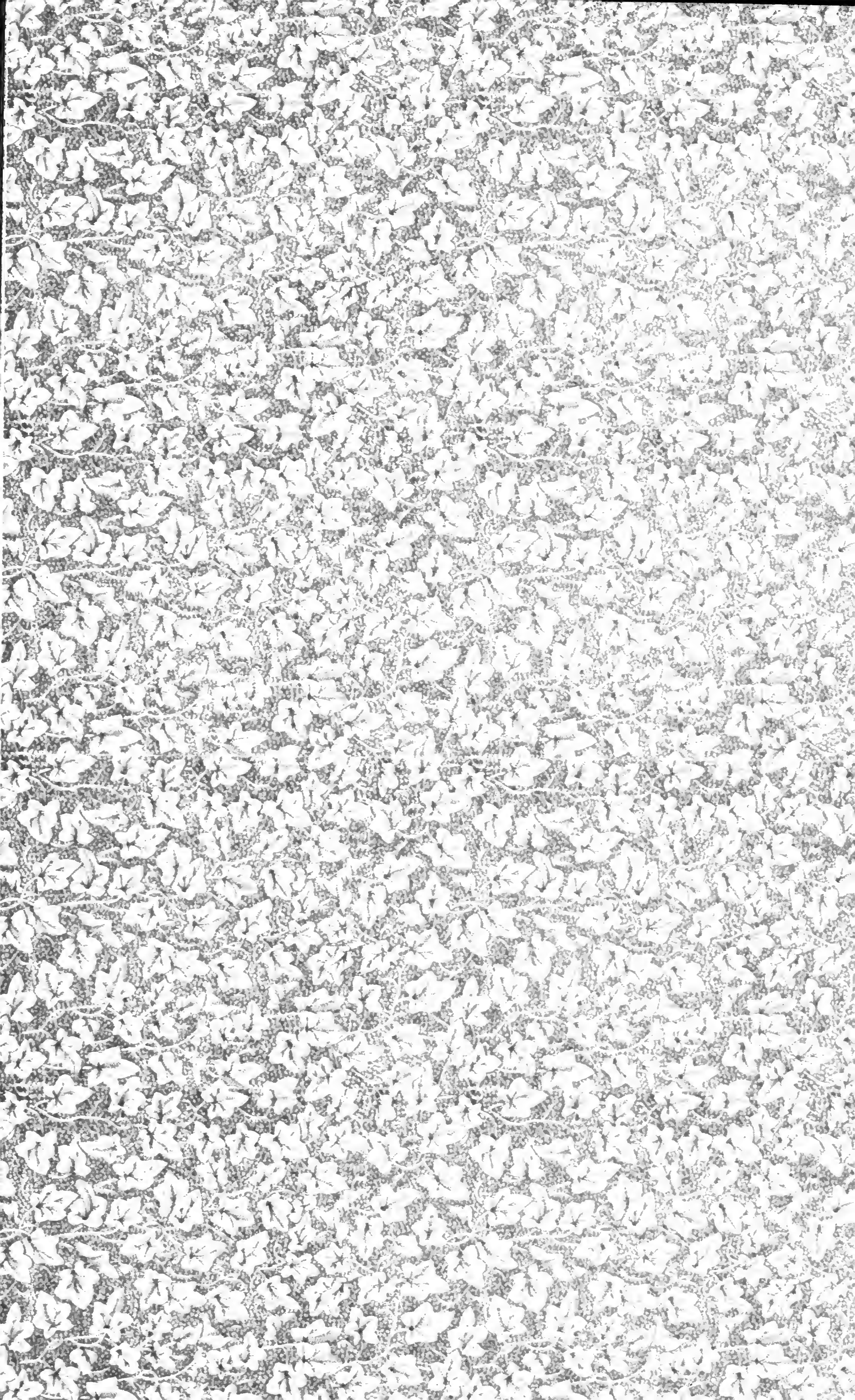
REDUCTION TO THE MERIDIAN.

LATS. AND DECLS. 90° N. to 90° S.

FOURTH EDITION, 1916.

6/-

H. S. BLACKBURNE.



TABLES

FOR

AZIMUTHS, GREAT-CIRCLE SAILING,

AND

REDUCTION TO THE MERIDIAN,

WITH A

NEW AND IMPROVED "SUMNER" METHOD:

LATITUDES - - - - - - 90° N. TO 90° S.
DECLINATIONS - - - - - 90° N. TO 90° S.

Azimuths through Tables A, B, and C (or separately through Table D) for all the Heavenly Bodies at any Time the Body is above the Horizon; and Great-circle Sailing-courses for all Latitudes.

Also other Useful Navigational Tables, with Numerous Examples of Double Altitudes, Equal Altitudes, Azimuths, &c.

BY

H. S. BLACKBURNE (Extra Master),

Principal Examiner of Masters and Mates in New Zealand, and Nautical Adviser to the Government.

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PREFACE.

THE tables and problems here published are a reprint, for the most part of the azimuth tables which have been published in the first three years' issues of the "New Zealand Nautical Almanac."

Tables D and G are now reprinted and brought up to date from the writer's original tables published in 1883, and Tables A, C, and D have been extended from 60° to 85° of latitude. This will meet the needs of Arctic and Antarctic explorers, as well as the traders to such places as Archangel. Some years ago the writer promised Captain Liddle, who was then trading to Archangel, that he would extend his tables to latitude 72° to meet the needs of those trading in these high latitudes, outside the limits of the ordinary azimuth tables. With this extension they now constitute the most complete and comprehensive azimuth tables yet submitted to the seafaring community, giving with great simplicity sufficient accuracy to meet even the requirements of the extra-masters' examination. By the aid of Tables A, B, and C (when the hour-angle is known) the true bearing of the sun, moon, planets, and fifty-one of the brightest stars may be found in a couple of minutes at *any* hour of the day or night by the use of only about half a dozen figures.

As requests have been made from candidates for examination for permission to use these A, B, and C tables for solving some of the problems in the examination for masters and mates, and recommendations have been made for their use in the local examinations in New Zealand, these tables are now published separately, and, for the sake of giving the azimuth with greater precision for examination purposes, the factors are given in Tables A and B to three places of decimals when hour-angles are between four and eight hours, except in the very high latitudes, where so many decimals are unnecessary.

The comprehensiveness of the A, B, and C tables for azimuth purposes is simply marvellous. They cover only forty-two pages, and give not only all the azimuths of the above-mentioned heavenly bodies comprised in the four large tables of inspection (which cover several hundred pages), but also a considerable number of azimuths which are outside the limits of the larger tables. They are therefore especially valuable for use in the "Sumner" and "double altitude" problems, where the large azimuth tables omit to give the azimuth when the body is near either the upper or lower meridian. It was this omission (which is especially felt in low latitudes) which first led the writer to calculate and publish his original A and B azimuth tables. When the price of the large azimuth tables is taken into consideration (Burdwood's and Davis's for the sun, and Davis's and Goodwin's for the higher-declination stars), amounting altogether to £1 13s , the boon to navigators in the price only, apart from the much greater extent of limit comprised in these small tables, must, I think, be recognized and appreciated by those who have only moderate means.

In the writer's old A and B tables the factors throughout were given to three places of decimals for the sake of being able to show that these tables would give the azimuth as accurately as the large tables of inspection. He has, however, often regretted having given the three places of decimals in the smaller hour-angles, as it makes interpolation at sight more difficult, and the azimuth is obtained with sufficient accuracy for practical purposes without it. In this edition three places of decimals have been given wherever necessary to give sufficient accuracy for examination purposes. Even in the Board of Trade extra-masters' examination any azimuth tables which give the azimuth correctly within half a degree may be used in the time-azimuth problem. These tables will nearly always give the azimuth correctly within 0·1° of the truth. To insure the most rigid accuracy in the second place of decimals, whenever the third place of decimals in the writer's old table came to 5 a fresh calculation has been made. In the parts where three places of decimals have been given, new calculations have been made and compared with the old tables.

In Table B all the stars not less bright than 1·0° magnitude have been computed separately for their actual declinations for the epoch 1910; and, as their annual change of declination is so small, these factors will be sufficiently accurate for all practical purposes for the next thirty or forty years, and no interpolation for declination will be needed.

The whole of Table C has been newly calculated on the lines of the late Mr. W. H. Rosser's table published in "Norie's Epitome," but this table (including latitudes to 85°) contains more than eight times the number of his computations, for the sake of giving greater accuracy and less interpolation. This plan will, I believe, be more popular with most navigators than that previously given in the writer's old table, as the azimuth is taken out more directly, and quite accurately enough for all practical purposes.

Tables A and B have been worked to five places of decimals where necessary, and Tables C and C^2, though only given to the nearest decimal of a degree, have been calculated throughout to the nearest decimal of a minute for the sake of accurate checking by differences.

Table D has also been checked from the writer's old calculations, and, where necessary, seven-figure logarithms have been used to determine fine points; otherwise, with the exception of changed heading and the addition of two pages, giving latitudes from 61° to 85°, it remains the same as when first published in 1883.

Table A, from latitude 61° to 82°, was calculated with great care by Captain Thomas Liddle, who very kindly sent to the writer the whole of his work. This was carefully compared by the writer with his own calculations. Throughout the compilation of the whole of these tables such minute care has been taken and rigid accuracy aimed at that the writer has good reason for believing that not one factor in a thousand will be found in the slightest degree in error.

An important feature in this work, which the writer believes he was the first to introduce, and which should prove a boon to navigators, is the method here presented of working the "Sumner" problem on a plane chart in connection with these tables. This method is much shorter than that usually taught in the navigation schools in preparation for the Board of Trade examinations, and at the same time it gives greater accuracy, especially when the plan which is here advocated is adopted, of combining the ex-meridian and chronometer observations when one of the bodies observed is near the meridian; and it has the great advantage of only requiring one chart, instead of having to carry about "Sumner" charts for every change of latitude N. and S. of the Equator. The Marine Department of the New Zealand Government has published some very accurate charts on a convenient scale for this purpose.

As the request from the New Zealand Government to the Board of Trade to allow the use of these tables, and improved "Sumner" method for solving the "Sumner" and "double altitude" problems, in the New Zealand examination for masters and mates was not granted, two examples have been clearly worked and plotted on the chart (see pages 104 and 110)—one of two observations of the sun as given in the masters' and mates' examinations, and the other of observations of two different stars as given in the extra-masters' examination. These examples illustrate the possible errors that *may* arise from the old method. This error is especially aggravated in low latitudes, where in the summer months one of the altitudes must always be great, and often within half an hour of the meridian. The error in such cases would sometimes amount to 6 or 7 minutes of latitude. The summer months, too, in these latitudes are generally the rainy season, when double altitudes are most needed. We trust that after further perusal and trial of these tables and the methods here advocated the Board of Trade may see fit to alter their decision, especially as the tables are now printed separately from the "New Zealand Nautical Almanac."

Although the examples above mentioned are purposely exceptional ones, for the sake of better illustration, smaller errors will often arise if the method at present used by the Board of Trade for the masters' and mates' examinations is always adopted. Many an opportunity of determining the ship's position is lost owing to the impression among many navigators that the "Sumner" method is not of value when one of the observations is within, or a little outside of, the ordinary ex-meridian limits. At other times a false confidence is encouraged about the accuracy of the ship's position by trusting too implicity to the latitude by ex-meridian following a chronometer observation for longitude, without due regard to the bearing when the first observation was taken.

An example from "Norie's Navigation" (the best-known epitome of navigation in the world) will illustrate both these contentions. On pages 368 and 369 of the 1900 edition an example is given of a longitude by chronometer at 8 h. 45 m. a.m., and an ex-meridian at 11 h. 30 m. a.m. At the close of the work the editor says, "Since by reference to the table, page 309, the hour-angle of the second observation is within the limits of the reduction to the meridian, it follows that the latitude found will be the *correct* latitude, unless the latitude and longitude used in the calculation are both very erroneous." He seems to have ignored the fact that when the first observation was taken the sun was not on, or even near, the prime vertical (and never is in the winter months in high latitudes), and therefore the time resulting from this observation was more than 1 minute in error; and, although the sun was only 8½° from the meridian when the second observation was taken, the resulting position was over 2′ in error in the latitude and about 2½′ in error in the longitude from the position given, and which the reader might naturally infer was correct. The editor afterwards goes on to say that "if the second observation had not been within the limits of the table on page 309, and the azimuth had been small, or if the estimated latitude and longitude had been very erroneous, neither the latitude nor the longitude could have been found with any degree of accuracy by the ordinary methods. Now what is termed the 'new navigation' may prove useful." As this closes the chapter in "Norie" on the "Sumner" method, in which is included the above-mentioned example of finding position by chronometer longitude and an ex-meridian, it is presumed that these are what are referred to as the "ordinary methods."

Now, the author maintains that if the "Sumner" method is dealt with in a practical way, either as advocated in these pages by numerous examples, or as given in the "American Practical Navigator," by Bowditch, revised by Lieut. G. W. Logan, U.S. Navy, the "Sumner" position will give quite as accurate results as by the method which is termed the "new navigation," and he ventures to believe that this method, too, will be easier for most men to grasp. He guarantees that he will take any of the double-altitude or simultaneous-altitude problems out of the numerous examples given in Captain Thompson's "Navigation Simplified" (which we may presume are fair specimens of the problems given at the Board of Trade examinations) and by the methods here presented, by the aid of these tables, either with or without the aid of chart, will find the position of ship with similar accuracy to that obtained by the most rigorous methods of trigonometry, and well within the limit of accuracy required in the extra-masters' examination. His contention is that the papers set in the examination-room should above all things tend to make men better practical navigators, and he believes that any impartial judge must admit that the methods advocated in these pages for the "Sumner" problem are superior in many points to that which is at present encouraged by the Board of Trade examinations. The advantages may be thus summarized: (1) Greater accuracy; (2) fewer figures, and consequently less time required for the work; (3) one chart does for any navigable latitude; and (4) many observations which would be considered useless for the ordinary "Sumner" give excellent results with even fewer figures by combining ex-meridian and chronometer observations together, as illustrated in this work by various examples. Most officers pass the examination for master many years before they get command, and it is hardly to be expected that they will keep a supply of "Sumner" charts for the various latitudes that they trade in; consequently the practice of this method, which they have learnt for their examination, is sure to be neglected. The writer, speaking for himself, can testify that he never used it at sea, though, much to his regret, for more than ten years he has had to teach it or examine candidates in their knowledge of it.

Very shortly after the publication of the writer's first edition of the A and B azimuth tables the late Mr. W. H. Rosser published abridged A, B, and C tables for the same purpose, and afterwards slightly extended them for publication in "Norie's Epitome." They are excellent tables, and very concise, but even as enlarged in "Norie" require in most places considerable interpolation, the time-interval being sometimes 20 minutes and 30 minutes apart, which naturally could not admit of as much accuracy as a fuller table. A few years later Captain Lecky asked and obtained the writer's permission to publish the A and B azimuth tables in his famous "Wrinkles." Captain Lecky then extended and improved them, and later on published them in a separate book with further extensions and improvements, showing how the tables can be used for quite a number of navigational problems.

In closing, the author has much pleasure in acknowledging the kind help voluntarily tendered to him by Captain Thomas Liddle, and in thanking him for his disinterested labours in the calculation of much of the extension of these tables. But for his perseverance in continuing to urge the writer to extend his tables it is very improbable that they would ever have been published in their present revised form. He would also like to thank the Hon. Mr. Hall-Jones, Minister of Marine, and the New Zealand Government for valuable clerical assistance in the compilation of a portion of these tables, for the confidence they have reposed in him, and for their liberality and public spirit in the interest of navigation all over the world in thus publishing an extension of navigational tables far beyond the limits of New Zealand's own trade.

H. S. BLACKBURNE.

April, 1905.

PREFACE TO FOURTH EDITION.

SINCE the publication of the first edition of these tables in New Zealand by the New Zealand Marine Department the work has more than doubled in size, and the additional pages have no doubt increased the value and usefulness of the work.

At the request of the Commander and Navigating Lieutenant of the British Antarctic Expedition s.s. "Terra Nova," the limits of the A and B Tables have been further extended so as to include all latitudes and declinations between the terrestial and the celestial North and South Poles. The tables are thus made available for azimuth, great-circle sailing, and reduction to the meridian for every part of the globe, and for every star in the heavens.

A Traverse Table and Table C^1 have been added giving the azimuth to the nearest minute of arc up to 45° from the meridian for use when special accuracy is required in conjunction with the Ex-meridian Table.

This table, given to the decimal of a degree, was used in the author's original A and B Azimuth Tables published in 1883.

Table D has been extended to comprise all latitudes between 85° N. and 85° S.

Mr. H. B. Goodwin, R.N., formerly Examiner at the Royal Naval College, Greenwich, has drawn the writer's attention to the value of this table as an azimuth table, when both altitude and time are given, and he has in this edition given Mr. Goodwin's rule, and an example for using it in this direction, as well as explaining the purposes for which it was first calculated.

The possessor of the book can make his own choice as to whether he uses Table D or Tables A, B, and C in the calculation of azimuths. Probably he will find D the handiest when the body is near the meridian, and (as its accuracy depends principally on the *altitude*) it will give a more accurate azimuth than the time-azimuth tables when the D.R. latitude used in the calculation of the time azimuth is incorrect, while the other tables will certainly give greater accuracy, without any uncertainty as to the naming of the azimuth, when the body is near the prime vertical.

It is not, therefore, recommended that Table D should be used for azimuth purposes when the object of observation is too near the prime vertical, as close accuracy cannot then be expected, and there will then be uncertainty as to the naming of the bearing.

A further extension and improvement on the Ex-meridian Table No. 1 has been made giving the reduction to the meridian with high altitudes up to 45° from the meridian.

This table, as well as Ex-meridian Table No. 2, were published in 1908 for use in conjunction with the A and B Tables. Although the tables only comprise a few pages they cover wider limits of use than most other ex-meridian tables, being available for every degree of latitude and declination from Pole to Pole, and they are equally available for below-Pole, as for above-Pole observations.

The table for correction of sun's and star's altitude has been extended for heights from 6 ft. to 80 ft.

The table giving the apparent times of the meridian passages of the principal fixed stars has been calculated with great care for the year 1910 (midway between two leap years), so that for any year for some time to come the error will not amount to more than about two minutes, with the single exception of Star Polaris, which has an increasing change in R.A. of nearly 29 sec.

In this table the times of *inferior* as well as the *superior* transits of no less than forty-five of the circumpolar stars are given.

This should be a great boon to navigators, as (so far as the author knows) no other navigational works give the times of star's meridian passages at the *inferior* transit, notwithstanding the special value of the below-Pole star for determining latitudes, on account of its slow motion in altitude and azimuth.

A small table comprising two pages has been added after the ex-meridian table showing the error in latitude by ex-meridian due to 4 seconds of error in the time. This table is especially useful in facilitating work in connection with the problem of finding the position of ship from two ex-meridians or one ex-meridian and a chronometer observation, and quite dispenses with any need of a chart.

A year or two ago the Board of Trade sanctioned the use of these tables for the time-azimuth problem in the New Zealand examination-rooms for candidates for foreign-going certificates for masters and mates, and already the great majority of the New Zealand candidates use them in preference to Burdwood's and Davis's Tables.

Even naval officers after a very short trial of our tables have written to the author expressing their preference for them to the larger tables which are in general use in the Navy, quite apart from the fact of their far greater limits of use.

I would again respectfully urge the Board of Trade to allow the use of our tables to candidates in the examinations for masters and mates in other countries, at least in Canada, where much of the Canadian coast-line is outside the latitude limits of the tables which they are obliged to use in the examinations.

It is a matter of regret, and has been much commented on, that, owing to New Zealand having to comply with Board of Trade Regulations in respect to certificates for foreign-going vessels, we are still unable to use in our examinations the methods and navigational tables which we have compiled, at much labour and cost, for facilitating various problems in navigation, notwithstanding that the methods advocated in this work and assisted by the tables published herein give proof of much greater accuracy in the problem of determining the ship's position from two observations of the sun out of the meridian than by the method which we are obliged to use in our examinations to comply with the Board of Trade Regulations.

The use, too, of the plane chart in the Sumner problem, which has been such a boon to the few who know about it, is still precluded from use in the examinations, and consequently it will take many years before the bulk of navigators know the advantages of it.

HAROLD S. BLACKBURNE.

Wellington, New Zealand,
June, 1916.

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EXPLANATION OF TABLES.

The A, B, and C Azimuth Tables.

TABLES A and B are used in combination—(1) for finding the error of the longitude due to an error of one minute (1′) of latitude, and (2) by the aid of Table C to find the azimuth or true bearing of celestial objects.

Enter *Table A* with the hour-angle and latitude, and *Table B* with the hour-angle and declination, naming the factors taken from these tables according to the following rule:—

For *Table A*—When hour-angle is less than 6 hours, name the factors taken from this table *contrary* to name of latitude.

When hour-angle is greater than 6 hours, name the factors taken from Table A the *same* as the name of the latitude.

For *Table B*—Always name the factors taken from Table B the *same* as the name of declination.

Add like and subtract unlike names. The sum or difference then of the factors from A and B will be the difference of longitude correction due to 1′ of error in the latitude. The correction must be named according to the name of the greater factor.

The direction of this longitude correction (or the position-line, as it may be termed) is found by keeping the name thus obtained, and reversing the name of the object's bearing E. or W. of meridian.

For the *Azimuth*—With the A and B cor. thus found and named, enter Table C with the latitude and this cor.; the corresponding azimuth is then taken out direct, and is given to the nearest decimal of a degree. It is named N. or S. according to the name of the cor., and East or West as the hour-angle is east or west of the meridian. The azimuth with these tables never exceeds 90°. This saves the trouble (which also confuses some when using the large azimuth tables) of having to subtract the azimuth taken out from 180°, and change the name of azimuth.

For examples in use of the table see pages 119 and 120, and for great-circle sailing page 121.

Traverse Table and Table C¹.

For the Azimuth when greater accuracy is required.—When using the azimuth table to assist in the reduction to the meridian it is important to take out the azimuth with greater precision than is necessary under ordinary circumstances for compass-correction or position-lines. For this purpose a traverse-table (pages 58–67) and Table C¹ (pages 68–74 are used as follows:—

Rule.—Turn the A ± B (= difference of longitude correction) into departure by the traverse table, and take out the *azimuth* corresponding to the factor from the azimuth Table C¹. The azimuth in this table is given to the nearest minute of arc for 45° from the meridian.

EXAMPLES: TO FIND THE AZIMUTH.

(1.)	Lat.	41°·3 S.	(p. 20)	A	′·274 S.	
	☉'s Decl.	23·5 S.	(p. 21)	B	·455 S.	
	H.A.	7h. 10m. W.	(p. 43)	C	·729 S.	gives Az. S. 61°·2 W.

(2.) Lat.	43° 30′ S.	(p. 20) A	·452 N.	(p. 63)	1′·0	= ·725′
* α Centauri	S.	(p. 21) B	1·955 S.	(p. 60)	·503	= ·365
H.A.	4h. 18m.	D. long.	1·503		Dep.	1·090
		= Dep.	1·090 gives Az. (C^1, p. 69) S. 42° 32′.			

For further examples see pages 119–120, and on page 121 for great-circle sailing-courses.

Formulæ used in the Calculation of the Tables.

A = tang of latitude × cotang of hour-angle.

B = tang of declination × cosec of hour-angle.

For C "Azimuths," cot azim. = cor. × cos latitude, where cor. is the result of the sum or diff. of A and B.

For C^1 "Azimuths," cotan azim. = correction.

For C^2 "Position-lines," tan position-line = correction.

Interpolation.

When it is deemed necessary to interpolate, this can usually be done at sight, except for the hour-angles up to the first hour from the meridian, and in a high latitude up to the second hour from the meridian.

For Table A, when both time and latitude are nearly midway between that given in the table, interpolate diagonally; for example, lat. 40° 30′, hour-angle 2 h. 22 m., it will be seen at a glance that 1·20 is the correct factor. For Table B there is no appreciable difference in 4 m. of time (except in the very small hour-angles), and it is therefore only necessary to interpolate *vertically* for the fraction of the degrees of declination. For the bright stars no interpolation is necessary even for the declination, as the declination of a star does not appreciably change for many years, and the factors are here calculated for the stars' declination corresponding to the year 1910. For both Tables A and B the interpolation of the small hour-angles up to 1 hour should be effected by dividing the quantity given at 1 m. by the number of minutes that the body observed is from the meridian. The variation to 1′ of latitude at 0 h. 1 m. is given to assist in the interpolation for the odd minutes of latitude, in case surveyors or others should require a very accurate azimuth.

The following example will illustrate how the interpolation may here be effected:—

Lat. 40° 36′, H.A. 0 h. 10 m.: required the azimuth.

Lat. 40° at 0 h. 1 m. A. = 192·3′ var. to 1′ of lat. = 6·82″ or 6·82′ to 1° of lat.
Cor. to 36′ = + 4·1   36′ = 0·6° × 6·82′ = 4·09′
10)196·4

Lat. 40° 36′ = 19·64 = from Table C Az. 3·8°

If greater accuracy is required, 19·64′ × cos lat. 40° 36′ gives cot az. 3° 50′ :—

19·64′	log	1·2931
40° 36′	cos	9·8804
3° 50′	cot	11·1735

Example to find the Difference of Longitude due to Error in the Latitude.

In lat. by D.R. 16° 30′ N., hour-angle 2 h. 44 m. E. and ☉'s declination 11° S., the longitude was found to be 40° 50′ E. Required the longitude, in latitude 16° 38 N., the latitude previously worked with having been found to be 8′ in error.

	A = ·34′ S.	
	B = ·30′ S.	
	Sum ·64′ S. to W.	= cor. or error in the longitude due to 1′ of error in the latitude.
Lat. found to be 8′ N. of D.R.	8	
Cor. to 8′ of lat.	5·12′ or 5′ 7·2″ S. to W. or N. to E.	

	°	′	″	
Lat. 16° 30′ N. gives long.	40	50	0	E.
Cor. due to 8′ of lat.	0	5	7	E.
Lat. 16° 38′ N. gives long.	40	55	7	E.

Knowing the error of longitude due to an error of 1′ of latitude, we have the means ready at hand of quickly determining both the latitude and longitude when two suitable observations have been taken of celestial objects.

This may be effected either by plotting the two positions and position-lines on the chart, which is the ordinary "Sumner" problem (worked with only two instead of the usual four hour-angles), or the position may be found even more expeditiously by simple proportion.

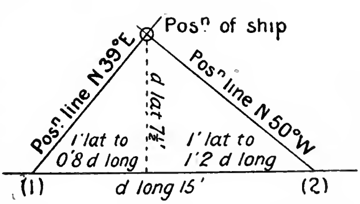
The actual trend of the position-line for plotting on the *plane* chart may be found from Table C^2, attending to the rule there given; or, by subtracting the azimuth as found from Table C from 90°, and reversing the name of the object's bearing, the *true* position-line will be found for plotting on a *Mercator* chart.

Any single observation, whether on or near the meridian, or prime vertical, or any other bearing, simply gives a position as being somewhere on a line of bearing at right angles to the bearing of object. If a second observation is taken after the body has changed its bearing, or another body is observed at the same time having a different bearing, we get another line of position, and the intersection of the two position-lines will give the latitude and longitude of the observer. Without the trouble of putting the position on the chart, the same principle may be worked out by a little proportion sum.

The three elements used in finding the time or longitude are latitude, altitude, and declination. If these three elements are correctly known, the *same* time or the *same* longitude will be found by every celestial body observed, whatever the bearing may be. If, therefore, the declination and altitude *are* correctly known, any difference of longitude found, resulting from the observation of different bodies (or the same body after an interval of time between the observations), must be due to error in the *latitude*.

The error in longitude due to 1′ error of latitude is given by the A and B Tables. It becomes, therefore, a simple matter of proportion to find the correction to apply to the latitude used in finding the longitude. Say the longitudes resulting from the observation of two different stars are 15′ apart, and with star No. 1 every 1′ north of latitude throws the longitude 0·8′ more to the east, with star No. 2 every 1′ north of latitude throws the longitude 1·2′ more to the west; then every 1′ of error in the latitude will throw the longitudes 2′ apart, and the error of latitude will be found by the proportion 2′ d. long. : 15′ d. long. : : 1′ lat. : 7½′ lat.

This would be represented on the chart by the accompanying figure.



The writer has found the ship's position b this method many hundreds of times, and find that he gets a more accurate latitude in this wa than even by the meridian altitude, experience having shown that although an altitude may often be slightly in error, yet a correct *difference* in altitude is generally measured, or the same amount of error will generally be thrown into both observations, and when this is the case (if the observations are suitably chosen) small errors in altitude practically make *no* difference in the latitude. Observations which have been taken in the quicksilver of two stars not near the meridian, or of two sun observations with a suitable interval of time between them, have generally given the latitude within 0·1′ of the truth, when taken where the position of places has been accurately known.

Table C^2.—Position-lines.

Table C^2 gives the position-lines corresponding to the A and B correction at any time for plotting on a plane scale chart. By the aid of this small table any one possessing a protractor rule with the ordinary diagonal, or any other scale of inches, can plot the "Sumner" position in his sight-book with even greater accuracy than he could obtain it from the ordinary "Sumner" Mercator charts. The table does not give the *true* geographical lines of position, but lines of position which will give the same result as to latitude and longitude on a plane chart as the true lines of position would give on a Mercator chart. See instruction at foot of page under the table (p. 75).

Table D.—Altitude and Time-azimuth Table, showing the Error produced in the time or Longitude by an Error of 1′ in the Altitude.

This table gives best results for azimuth when body is near the meridan. It will not give accurate results when body is near the prime vertical, and there is then uncertainty as to naming the azimuth N. or S. of the prime vertical.

Rule for finding the Azimuth.

With H.A. as Az. and decl. as lat., go to Table D.
Take out coefficient; call it M.
With alt. as lat. and M., take out Az. at top or side.

EXAMPLE.

Lat. 41° S. ⁎ Canopus (decl. 52° 39′ S.) H.A. 3h. 10m. 40s. = 47° 40′. Alt. 56° 5′.

Required the Azimuth.

Lat. (decl.) 52° 39′ }
Az. (H.A.) 47° 40′ } gives M. = 8·92. Lat. (alt.) 56° 5′, and M. 8·92 gives Az. 53½°.

Table D will be found very useful in working out separately a set of observations, both with artificial horizon and at sea; or for working out another person's observations, taken within a few minutes of the same time. It also shows at sight the degree of dependence of any observation. And if at any time it is found that an erroneous altitude has been worked with, the longitude will readily be corrected by this table, a greater altitude giving a smaller hour-angle, or with A.M. sights a greater altitude making the longitude more to the eastward, and a lesser altitude making the longitude more to the westward—*vice versa* with P.M. sights.

It will also be found useful when taking time azimuths by the sun or stars (when altitude is low) for readily obtaining the correct hour-angle, as in the following example: Lat. 20° N., ⁎ Arcturus bearing N. 71° E. (true), altitude 5°. Table D at lat. 20° and azimuth 71° gives 4·5 m. of time to 1° change of alt. Table 26 (Raper), lat. 20° N., decl. 20° N., gives ⁎'s hour-angle at rising or setting 6h. 30m.

4·5m. × 5° =	−	22½
⁎'s H.A. at 5° =	6	7½

The results of the table can be easily found by inspection from the traverse table. At the Equator, when the sun or any other heavenly body is on the prime vertical, it moves at the rate of 1° in 4 m., or 1′ in 4 s. of time; and, in any other latitude, when the sun is on the prime vertical, the ratio of its movement will be dep.: diff. long. Having, then, the rate of movement in any latitude on the prime vertical, the rate of movement on any other bearing may be found by the traverse table.

Example.—In latitude 30°, and ⊙'s bearing N. 63° E., required the rate at which it moves. In latitude 30°, against 4 in D. lat. column, is 4·62 in dist. column; with ⊙'s bearing 63°, and 4·62 in dep. column, we have 5·18 in distance column = 5·18 s. to 1′ of altitude.

The following formula was used in the calculation of the table: D = secant of latitude × cosecant of azimuth × 4.

Further examples in the use of the table are given on pages 105 and 125.

Table E.—Altitude Corrections of Sun and Stars.

This table (the upper half for the sun, and the lower half for the stars) gives the lump correction to apply to their observed altitudes, involving for the sun dip, refraction, semidiameter, and parallax, and for the stars dip and refraction.

As the correction for very small altitudes changes rapidly, a supplementary table is given on page 87 for the correction of both sun and stars, at a height of 40 ft. above sea-level, for altitudes between 3° and 11°, for every few minutes of altitude, and for other heights greater or less than 40 ft. a second correction is given in same table.

Heights are given from 6 ft. to 80 ft. so as to meet the need of navigators in every class of vessel, from the smallest to the largest. As standard authorities still slightly differ in their dip and refraction tables, a mean of the dip and refraction given in the three standard works (Raper, Inman, and Norie) has been used in the calculation of the table here given, and great care has been taken to insure accuracy.

Table F.—Acceleration Table.

This table is used for converting intervals of mean solar time into equivalent intervals of sidereal time. The seconds column which is given in most navigational tabular works has here been omitted for the sake of space, and because it is considered quite unnecessary in ordinary practical navigation. In practical navigation it becomes necessary in nearly all the problems where stars are used to convert mean solar time into sidereal time, as, for instance, in the time azimuth, longitude by chronometer, and the ex-meridian problems. In these problems the time is generally taken by a chronometer keeping mean solar time, and to compare this with the sidereal time found by the stellar observation it must be reduced to sidereal time.

Examples will be found among some of the worked-out problems which follow the tables in this book.

Table G.—Star Polaris Azimuth Table.

This table is useful especially in latitudes between 15° N. and 30° N., as, for instance, in the Red Sea. In a high latitude the altitude will be too high for compass-correction work, and it is not therefore given beyond 60° of latitude.

Examples in the use of table are given later on in this book.

The table has been calculated for stars' declination in 1910 — viz., 88° 49′ 33·57″ N.

The Mean Places of 108 of the Brightest Stars, in order of Right Ascension, for 1st January, 1917.

On pages 7–8 the *mean* places of 108 of the brightest stars are given, in the order of their right ascension, for the 1st January, 1917. In the column headed "Mag." the adopted unit of brightness is designated 1·0. The magnitudes of stars are determined to tenths of a magnitude with reference to this adopted unit. The magnitudes of the ten stars brighter than the unit are indicated by figures less than 1·0: thus, the value 0·3 for Arcturus indicates that that star is seven-tenths of a magnitude brighter than the unit; the value −1·4 for Sirius that it is 2·4 magnitudes brighter than the unit. As the right ascensions and declinations of the stars do not change uniformly throughout the year, the correction for intermediate months cannot be made accurately by multiplying the annual change by a fraction of the year; but the change is so small that for navigational purposes at sea the right ascensions and declinations here given may be used without appreciable error for azimuths and latitudes, and even for longitude the error due to using these elements would seldom exceed a mile. When accuracy is required the navigator should use the "Admiralty Nautical Almanac," where the right ascensions and declinations of these and many other stars are given very minutely for every ten days throughout the year.

Approximate Apparent Times of the Meridian Passages of the Principal Fixed Stars.

The times are given in this table for the 1st of each month, and the meridian of Greenwich. To find the time for any other day *subtract* the portion of time corresponding to the day of the month in the day-correction table. Add 1 min. for every 90° of east longitude and subtract 1 min. for every 90° of west longitude.

The time of the meridian passage of each star has been carefully calculated to the nearest second of time, and is given in the table to the nearest minute.

For the circumpolar stars which never set in higher latitudes than 50° N. or S. the times of the meridian passages of the *inferior* as well as the *superior* transit has been given.

EXAMPLE AND CAUTION IN USING THIS TABLE.

Required the meridian passage of ✳ β Centauri on 31st October, in longitude 10° W.

	D.	H.	M.	
Mer. pass. of ✳ **β** Centauri on 1st Oct. is		1	30	p.m.
Cor. for 31st day		− 1	52	
Approx. time	31	23	38	= 11 38 a.m. on 1st Nov.
2nd cor. required			− 4	
Approx. mer. pass. ✳ **β** Centauri	31	23	34	or 11 34 a.m. on 1st. Nov.

The interval in this case is within 2 hours of 31 days instead of 30 days, therefore nearly 4 minutes more correction is required to be subtracted. The correction for longitude would be less than 10 seconds.

The table is calculated for the year 1910, but will be within 2 min. for many years, with the single exception of the ✳ Polaris which has an annual and increasing change in R.A. of over 27 s., and will therefore be about 5 min. later in passing the meridian in 10 years' time.

Supplementary Ex-meridian Tables, &c.

Explanations given on pages 142 and 143.

THE MEAN PLACES OF 108 OF THE BRIGHTEST STARS

IN ORDER OF RIGHT ASCENSION,

FOR 1st JANUARY, 1917.

Star s Name.		Mag.	Right Ascension.	Annual Change.	Declination.	Annual Change.
			H. M. S.	S.	° ′ ″	″
α Andromedæ ..	(Alpheratz) ..	2·2	0 4 5·6	+3·09	N. 28 37 56	+20·0
β Cassiopeiæ ..	.. ..	2·4	0 4 44·4	3·12	N. 58 41 31	+20·0
α Phœnicis ..	.. .. ..	2·4	0 22 11·0	2·95	S. 42 45 25	−20·0
α Cassiopeiæ ..	(Schedar) ..	Var.	0 35 47·2	3·38	N. 56 4 56	+19·8
β Ceti	(Deneb Kaitos) ..	2·2	0 39 25·4	3·00	S. 18 26 31	−19·8
γ Cassiopeiæ ..	.. ..	2·3	0 51 41·2	+3·60	N. 60 16 3	+19·5
β Andromedæ ..	(Mirach) ..	2·4	1 5 4·8	3·34	N. 35 10 51	+19·2
δ Cassiopeiæ ..	.. ..	2·8	1 20 22·4	3·86	N. 59 48 16	+18·8
α Ursæ Minoris ..	(Polaris) ..	2·1	1 30 13·2	28·99	N. 88 51 44	+18·5
α Eridani	(Achernar) ..	0·6	1 34 37·5	2·23	S. 57 39 29	−18·4
β Arietis	.. ..	2·7	1 50 3·1	+3·30	N. 20 24 10	+17·8
γ¹ Andromedæ ..	(Almach) ..	2·3	1 58 47·8	3·67	N. 41 55 55	+17·4
α Arietis	(Hamel) ..	2·2	2 2 29·4	3·36	N. 23 4 14	+17·3
α Ceti	(Menkar) ..	2·8	2 57 56·3	3·13	N. 3 45 53	+14·3
α Persei	(Mirfak) ..	1·9	3 18 23·3	4·27	N. 49 34 0	+13·0
α Tauri	(Aldebaran) ..	1·1	4 31 9·4	+3·44	N. 16 20 36	+ 7·6
β Orionis	(Rigel) ..	0·3	5 10 32·9	2·88	S. 8 17 48	− 4·3
α Aurigæ	(Capella) ..	0·2	5 10 33·3	4·42	N. 45 54 54	+ 4·3
γ Orionis	(Bellatrix) ..	1·7	5 20 40·7	3·22	N. 6 16 31	+ 3·4
β Tauri	(Nath) ..	1·8	5 21 2·6	3·79	N. 28 32 18	+ 3·4
α Leporis	.. ..	2·7	5 29 4·1	+2·65	S. 17 52 51	− 2·7
ε Orionis	(Alnilam) ..	1·7	5 32 0·1	3·04	S. 1 15 15	− 2·4
ζ Orionis	(1st ✳) ..	2·0	5 36 34·2	3·03	S. 1 59 9	− 2·0
α Columbæ	(Phact) ..	2·7	5 36 38·5	2·17	S. 34 7 4	− 2·0
κ Orionis	(Saiph) ..	2·2	5 43 49·2	2·84	S. 9 41 54	− 1·4
α Orionis	(Betelguese) ..	Var.	5 50 40·7	+3·25	N. 7 23 33	+ 0·8
β Aurigæ	(Menkalinan) ..	2·1	5 53 26·4	4·41	N. 44 56 25	+ 0·6
θ Aurigæ	.. ..	2·7	5 54 3·7	4·09	N. 37 12 29	+ 0·5
β Canis Majoris ..	.. ..	2·0	6 19 2·7	2·64	S. 17 54 50	+ 1·7
α Argûs	(Canopus) ..	−0·9	6 22 6·5	1·33	S. 52 39 0	+ 1·9
γ Geminorum ..	(Alhena) ..	1·9	6 32 55·1	+3·46	N. 16 28 16	− 2·9
α Canis Majoris ..	(Sirius) ..	−1·6	6 41 29·3	2·68	S. 16 36 6	+ 3·6
τ Argûs	.. ..	2·8	6 47 52·6	1·49	S. 50 30 56	+ 4·2
ε Canis Majoris ..	(Adara) ..	1·6	6 55 21·8	2·36	S. 28 51 30	+ 4·8
δ Canis Majoris ..	.. ..	2·0	7 5 1·0	2·44	S. 26 15 39	+ 5·6
π Argûs	.. ..	2·7	7 14 12·6	+2·12	S. 36 56 52	+ 6·4
η Canis Majoris ..	.. ..	2·4	7 20 48·8	2·37	S. 29 8 26	+ 6·9
α² Geminorum ..	(Castor) ..	2·0	7 29 18·3	3·85	N. 32 4 19	− 7·6
α Canis Minoris ..	(Procyon) ..	0·5	7 34 57·4	3·19	N. 5 26 19	− 8·1
β Geminorum ..	(Pollux) ..	1·2	7 40 14·4	3·72	N. 28 13 40	− 8·5
ζ Argûs	.. ..	2·3	8 0 40·0	+2·11	S. 39 46 8	+10·1
γ Argûs	.. ..	2·2	8 6 58·4	1·85	S. 47 5 29	+10·5
ε Argûs	.. ..	1·7	8 20 48·7	1·24	S. 59 14 31	+11·6
δ Argûs	.. ..	2·0	8 42 24·7	1·66	S. 54 24 15	+13·0
β Argûs	.. ..	1·8	9 12 17·7	0·70	S. 69 22 31	+14·9
ι Argûs	(Tureis) ..	2·3	9 14 52·0	+1·61	S. 58 55 36	+15·1
κ Argûs	.. ..	2·6	9 19 32·5	1·86	S. 54 39 21	+15·3
α Hydræ	(Alphard) ..	2·2	9 23 30·6	2·95	S. 8 17 54	+15·5
α Leonis	(Regulus) ..	1·3	10 3 57·2	3·21	N. 12 22 24	−17·5
γ¹ Leonis	(Algeiba) ..	2·6	10 15 23·9	3·29	N. 20 15 43	−18·0
μ Argûs	.. ..	2·8	10 43 11·7	+2·57	S. 48 58 53	+18·9
β Ursæ Majoris ..	.. ..	2·4	10 56 50·6	3·63	N. 56 49 39	−19·3
α Ursæ Majoris ..	(Dubhe) ..	2·0	10 58 37·1	3·74	N. 62 11 58	−19·3
δ Leonis	(Zosma) ..	2·6	11 9 41·8	3·18	N. 20 58 43	−19·6
β Leonis	(Denebola) ..	2·2	11 44 49·6	3·10	N. 15 2 10	−20·0

THE MEAN PLACES OF 108 OF THE BRIGHTEST STARS—*continued.*

Star's Name.	Mag.	Right Ascension.	Annual Change.	Declination.	Annual Change.
		H. M. S.	S.	° ′ ″	″
γ Ursæ Majoris .. (*Phecda*)	2·5	11 49 28·3	+3·16	N. 54 9 22	−20·0
δ Centauri	2·9	12 4 3·0	3·10	S. 50 15 37	+20·0
γ Corvi	2·8	12 11 32·1	3·09	S. 17 4 52	+20·0
α Crucis (mean)	1·1	12 21 58·6	3·32	S. 62 38 23	+20·0
γ Crucis	1·6	12 26 33·0	3·31	S. 56 38 54	+19·9
γ Centauri	2·4	12 36 55·9	+3·31	S. 48 30 15	+19·8
β Crucis	1·5	12 42 51·7	3·49	S. 59 14 7	+19·7
ε Ursæ Majoris	1·7	12 50 22·9	2·63	N. 56 24 36	−19·6
ζ¹ Ursæ Majoris	2·4	13 20 35·2	2·41	N. 55 21 31	−18·8
α Virginis .. (*Spica*)	1·2	13 20 49·1	3·16	S. 10 43 43	+18·8
ε Centauri	2·6	13 34 37·1	+3·79	S. 53 2 42	+18·4
η Ursæ Majoris .. (*Benetnasch*)	1·9	13 44 16·3	2·38	N. 49 43 38	−18·0
ζ Centauri	3·1	13 50 21·2	3·73	S. 46 52 49	+17·8
β Centauri	0·9	13 57 57·2	4·21	S. 59 58 24	+17·4
θ Centauri	2·3	14 1 47·5	3·56	S. 35 57 44	+17·3
α Boötis .. (*Arcturus*)	0·2	14 11 52·5	+2·81	N. 19 36 50	−16·8
η Centauri	2·7	14 30 13·8	3·80	S. 41 47 38	+15·9
α² Centauri	0·3	14 33 57·7	4·54	S. 60 29 31	+15·7
α Lupi	2·9	14 36 24·0	3·98	S. 47 1 58	+15·6
ε² Boötis	2·7	14 41 21·7	2·62	N. 27 25 25	−15·3
β Ursæ Minoris .. (*Kochab*)	2·2	14 50 56·0	−0·20	N. 74 29 41	−14·7
β Lupi	2·8	14 53 5·3	+3·92	S. 42 48 2	+14·6
α Coronæ .. (*Alphacca*)	2·3	15 31 10·4	2·53	N. 26 59 36	−12·1
α Serpentis .. (*Unukalhai*)	2·8	15 40 10·7	2·94	N. 6 41 9	−11·5
δ Scorpii	2·5	15 55 25·3	3·54	S. 22 23 12	+10·4
β¹ Scorpii .. (*Akrab*)	2·9	16 0 36·5	+3·48	S. 19 34 45	+10·0
α Scorpii .. (*Antares*)	1·2	16 24 18·9	3·67	S. 26 14 56	+ 8·1
ζ Ophiuchi	2·7	16 32 35·2	3·30	S. 10 24 0	+ 7·5
α Trianguli Australis	1·9	16 39 51·8	6·32	S. 68 52 37	+ 6·9
ε Scorpii	2·4	16 44 47·0	3·93	S. 34 8 37	+ 6·5
η Ophiuchi	2·6	17 5 37·0	+3·44	S. 15 37 24	+ 4·7
β Aræ	2·8	17 18 23·8	4·98	S. 55 27 10	+ 3·6
λ Scorpii	1·7	17 27 58·2	4·07	S. 37 2 40	+ 2·8
α Ophiuchi .. (*Ras Alhague*)	2·1	17 31 4·9	2·78	N. 12 37 10	− 2·5
θ Scorpii	2·0	17 31 21·1	4·31	S. 42 56 47	+ 2·5
κ Scorpii	2·5	17 36 44·7	+4·15	S. 38 59 17	+ 2·0
γ Draconis .. (*Rastaban*)	2·4	17 54 40·7	1·39	N. 51 29 53	− 0·5
ε Sagittarii .. (*Kaus Australis*)	2·0	18 18 39·8	3·99	S. 34 25 30	− 1·6
α Lyræ .. (*Vega*)	0·1	18 34 7·7	2·01	N. 38 42 21	+ 3·0
σ Sagittarii	2·1	18 50 7·2	3·72	S. 26 24 3	− 4·3
ζ Sagittarii	2·7	18 57 19·9	+3·82	S. 30 0 0	− 5·0
σ Octantis .. ('*South Pole Star*)	5·5	19 27 42·2	94·42	S. 89 13 29	− 7·5
α Aquilæ .. (*Altair*)	0·9	19 46 44·0	2·89	N. 8 38 54	+ 9·0
α Pavonis	2·1	20 19 5·4	4·76	S. 57 0 7	−11·4
γ Cygni	2·3	20 19 14·9	2·15	N. 39 59 25	+11·4
α Cygni .. (*Deneb*)	1·3	20 38 36·1	+2·04	N. 44 58 59	+12·8
ε Cygni	2·6	20 42 51·1	2·40	N. 33 39 31	+13·1
α Cephei .. (*Alderamin*)	2·6	21 16 36·0	1·41	N. 62 14 1	+15·2
ε Pegasi	2·5	21 40 6·6	2·94	N. 9 29 38	+16·4
α Gruis	2·2	22 3 0·5	3·78	S. 47 21 49	−17·5
β Gruis	2·2	22 37 43·0	+3·58	S. 47 19 9	−18·8
α Piscis Australis .. (*Fomalhaut*)	1·3	22 53 4·0	3·30	S. 30 3 45	−19·2
α Pegasi .. (*Markab*)	2·6	23 0 37·5	2·98	N. 14 45 30	+19·4

[NOTE.—In this table + means add, and − means subtract.]

In the column headed "Mag." the adopted unit of brightness is designated 1·0. The magnitudes of stars are determined to tenths of a magnitude with reference to this adopted unit: thus the value − 1·6 for Sirius indicates that that star is 2·6 magnitudes brighter than the unit; the value 0·3 for Arcturus indicates that that star is seven-tenths of a magnitude brighter than the unit.

Approximate Apparent Times of the Meridian Passages of the Principal Fixed Stars at Greenwich on the First Day of each Month, 1910.

	Name.	Mag.	Jan.	Feb.	Mar.	April.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
			H. M.	H. M.	H. M.	H. M.	H. M.	H. M.	H. M.	H. M.	H. M.	H. M.	H. M.	H. M.
†S	δ Centauri ..	2·8	5 18	3 6	1 17	23 20	21 29	19 27	17 23	15 18	13 22	11 35	9 39	7 36
	α Andromedæ .	2·1	5 18	3 6	1 17	23 20	21 29	19 27	17 23	15 18	13 23	11 34	9 39	7 36
	β Cassiopeiæ ..	2·4	5 19	3 7	1 18	23 21	21 30	19 27	17 23	15 19	13 23	11 35	9 40	7 36
†S	α[1] Crucis ..	1·0	5 36	3 24	1 35	23 38	21 47	19 44	17 40	15 36	13 40	11 52	9 57	7 53
	α Phœnicis ..	2·4	5 36	3 24	1 35	23 38	21 47	19 45	17 41	15 36	13 41	11 53	9 57	7 54
†S	γ Crucis ..	1·6	5 41	3 29	1 40	23 43	21 51	19 49	17 45	15 41	13 45	11 57	10 1	7 58
†S	γ Centauri ..	2 4	5 51	3 39	1 50	23 53	22 2	19 59	17 55	15 51	13 55	12 7	10 12	8 8
	β Ceti .	2·2	5 54	3 41	1 52	23 55	22 4	20 2	17 58	15 53	13 58	12 10	10 14	8 11
†S	β Crucis ..	1·5	5 57	3 45	1 56	0 2	22 8	20 5	18 1	15 57	14 1	12 13	10 18	8 14
†N	ε Ursæ Majoris	1·8	6 4	3 52	2 3	0 10	22 15	20 13	18 9	16 4	14 9	12 21	10 25	8 22
	γ Cassiopeiæ ..	2·3	6 6	3 54	2 5	0 11	22 16	20 14	18 10	16 6	14 10	12 22	10 26	8 23
	β Andromedæ ..	2·4	6 19	4 7	2 18	0 25	22 30	20 27	18 23	16 19	14 23	12 36	10 40	8 36
	δ Cassiopeiæ ..	2·8	6 34	4 22	2 33	0 40	22 45	20 43	18 39	16 34	14 39	12 51	10 55	8 52
†N	ζ[1] Ursæ Majoris	2·1	6 35	4 23	2 34	0 40	22 46	20 43	18 39	16 35	14 39	12 51	10 55	8 52
	Polaris ..	2·1	6 41	4 29	2 39	0 46	22 51	20 49	18 45	16 41	14 46	12 59	11 3	8 59
†S	ε Centauri ..	2·6	6 48	4 36	2 47	0 54	22 59	20 57	18 53	16 48	14 53	13 5	11 9	9 6
	Achernar ..	0·5	6 49	4 37	2 48	0 54	22 59	20 57	18 53	16 49	14 53	13 5	11 9	9 6
†N	η Ursæ Majoris	1·9	6 58	4 46	2 56	1 4	23 9	21 7	19 3	16 58	15 3	13 15	11 19	9 16
	β Arietis ..	2·7	7 4	4 52	3 3	1 9	23 15	21 12	19 8	17 4	15 8	13 20	11 25	9 21
†S	β Centauri ..	0·8	7 12	5 0	3 11	1 17	23 23	21 20	19 16	17 12	15 16	13 28	11 32	9 29
	γ[1] Andromedæ ..	2·2	7 13	5 1	3 12	1 18	23 23	21 21	19 17	17 13	15 17	13 29	11 33	9 30
†S	θ Centauri ..	2·1	7 16	5 4	3 15	1 21	23 26	21 24	19 20	17 16	15 20	13 32	11 36	9 33
	α Arietis ..	2·2	7 16	5 4	3 15	1 22	23 27	21 25	19 21	17 17	15 21	13 33	11 37	9 34
†S	α[2] Centauri ..	1·0	7 48	5 35	3 47	1 53	0 2	21 56	19 52	17 48	15 52	14 4	12 9	10 5
†S	α Lupi ..	2·5	7 50	5 38	3 49	1 56	0 5	21 58	19 54	17 50	15 54	14 7	12 11	10 7
†N	β Ursæ Minoris	2·2	8 5	5 53	4 4	2 11	0 20	22 13	20 9	18 5	16 9	14 21	12 26	10 22
	α Ceti ..	2·8	8 12	6 0	4 11	2 17	0 26	22 20	20 16	18 12	16 16	14 28	12 32	10 29
	α Persei ..	1·9	8 32	6 20	4 31	2 37	0 47	22 40	20 36	18 32	16 36	14 48	12 53	10 49
	Aldebaran ..	1·1	9 44	7 32	5 44	3 50	1 59	23 53	21 49	19 44	17 49	16 1	14 5	12 2
†S	α Tri. Australis	1·9	9 53	7 41	5 52	3 59	2 8	0 5	21 57	19 53	17 57	16 9	14 14	12 10
	Capella ..	0·2	10 24	8 12	6 23	4 29	2 38	0 36	22 28	20 24	18 28	16 40	14 44	12 41
	Rigel ..	0·3	10 24	8 12	6 23	4 30	2 39	0 36	22 28	20 24	18 28	16 40	14 45	12 41
†S	β Aræ ..	2·7	10 31	8 19	6 30	4 37	2 46	0 44	22 36	20 31	18 36	16 48	14 52	12 49
	γ Orionis ..	1·7	10 34	8 22	6 33	4 40	2 49	0 46	22 38	20 34	18 38	16 50	14 55	12 51
	β Tauri ..	1·8	10 34	8 22	6 33	4 40	2 49	0 47	22 39	20 34	18 39	16 51	14 55	12 52
	α Leporis ..	2·7	10 42	8 30	6 41	4 48	2 57	0 55	22 47	20 42	18 47	16 59	15 3	13 0
	ε Orionis ..	1·7	10 45	8 33	6 44	4 51	3 0	0 58	22 50	20 46	18 50	17 2	15 6	13 3
	ζ Orionis ..	2·0	10 50	8 38	6 49	4 55	3 4	1 2	22 54	20 51	18 54	17 6	15 11	13 7
	κ Orionis ..	2·2	10 57	8 45	6 56	5 3	3 12	1 9	23 1	20 57	19 1	17 14	15 18	13 14
	Betelguese ..	*Var.*	11 4	8 52	7 3	5 9	3 19	1 16	23 8	21 4	19 8	17 20	15 25	13 21
	β Aurigæ ..	2·1	11 6	8 54	7 6	5 12	3 21	1 19	23 11	21 6	19 11	17 23	15 27	13 24
	θ Aurigæ ..	2·7	11 7	8 55	7 6	5 13	3 22	1 20	23 11	21 7	19 11	17 24	15 28	13 25
†N	γ Draconis ..	2·4	11 8	8 56	7 7	5 14	3 23	1 20	23 12	21 8	19 12	17 25	15 29	13 25
	β Canis Majoris	2·0	11 32	9 20	7 31	5 38	3 47	1 45	23 37	21 32	19 37	17 49	15 53	13 50
	Canopus ..	−1·0	11 35	9 23	7 34	5 41	3 50	1 48	23 40	21 35	19 40	17 52	15 56	13 53
	γ Geminorum ..	1·9	11 46	9 34	7 45	5 52	4 1	1 58	23 50	21 46	19 50	18 3	16 7	14 3
†N	*Vega* ..	0·1	11 47	9 35	7 46	5 53	4 2	2 0	23 52	21 47	19 52	18 4	16 8	14 5
	Sirius .	−1·4	11 55	9 43	7 54	6 0	4 9	2 7	0 3	21 55	19 59	18 11	16 15	14 12
	τ Argûs ..	2·8	12 1	9 49	8 0	6 7	4 16	2 13	0 10	22 1	20 5	18 18	16 22	14 18
	ε Canis Majoris	1·6	12 8	9 56	8 8	6 14	4 23	2 21	0 17	22 8	20 13	18 25	16 29	14 26
	δ Canis Majoris	2·0	12 18	10 6	8 17	6 24	4 33	2 30	0 27	22 18	20 22	18 35	16 39	14 35
	π Argûs ..	2·7	12 27	10 15	8 26	6 33	4 42	2 40	0 36	22 27	20 32	18 44	16 48	14 45
	η Canis Majoris	2·4	12 34	10 22	8 33	6 40	4 49	2 46	0 42	22 34	20 38	18 50	16 55	14 51
	Castor ..	2·0	12 42	10 30	8 41	6 48	4 57	2 55	0 51	22 42	20 46	18 59	17 3	15 0
	Procyon ..	0·5	12 48	10 36	8 47	6 54	5 3	3 0	0 56	22 48	20 52	19 4	17 9	15 5
	Pollux ..	1·2	12 53	10 41	8 52	6 59	5 8	3 5	1 2	22 53	20 57	19 10	17 14	15 10
	ζ Argûs ..	2·3	13 14	11 2	9 13	7 19	5 28	3 26	1 22	23 14	21 18	19 30	17 34	15 31
	γ Argûs ..	1·9	13 20	11 8	9 19	7 26	5 35	3 32	1 28	23 20	21 24	19 37	17 41	15 37
†S	α Pavonis ..	2·0	13 32	11 20	9 31	7 38	5 46	3 44	1 40	23 32	21 36	19 48	17 52	15 49
	ε Argûs ..	1·7	13 34	11 23	9 33	7 40	5 49	3 46	1 42	23 34	21 38	19 50	17 55	15 51

† N. or † S.—These times relate to the Meridian Passages of Circumpolar Stars at the *Inferior* Transit, N. or S. denoting the Declination of the Star.

Approximate Apparent Times of the Meridian Passages of the Principal Fixed Stars at Greenwich on the First Day of each Month, 1910—*continued.*

	Name.	Mag.	Jan.	Feb.	Mar.	April.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
			H. M.	H. M.	H. M.	H. M.	H. M.	H. M.	H. M.	H. M.	H. M.	H. M.	H. M.	H. M.
†N	α Cygni	1·3	13 51	11 40	9 50	7 57	6 6	4 4	2 0	23 51	21 56	20 8	18 12	16 9
	δ Argûs	2·0	13 55	11 43	9 54	8 1	6 10	4 8	2 4	23 55	22 0	20 12	18 16	16 13
	β Argûs	1·7	14 25	12 13	10 24	8 31	6 40	4 38	2 34	0 29	22 30	20 42	18 46	16 42
	ι Argûs	2·2	14 28	12 16	10 27	8 33	6 42	4 40	2 36	0 32	22 32	20 44	18 49	16 45
†N	α Cephei	2·6	14 29	12 17	10 28	8 35	6 44	4 42	2 38	0 33	22 34	20 46	18 50	16 47
	κ Argûs	2·6	14 32	12 20	10 31	8 38	6 47	4 45	2 41	0 36	22 37	20 49	18 53	16 50
	α Hydræ	2·2	14 36	12 24	10 35	8 42	6 51	4 49	2 45	0 40	22 40	20 53	18 57	16 53
†S	α Gruis	1·9	15 15	13 3	11 14	9 21	7 30	5 28	3 24	1 19	23 20	21 32	19 36	17 33
	Regulus	1·3	15 16	13 4	11 16	9 22	7 31	5 29	3 25	1 20	23 21	21 33	19 37	17 34
	γ¹ Leonis	·5	15 28	13 16	11 27	9 34	7 43	5 40	3 36	1 32	23 32	21 44	19 49	17 45
†S	β Gruis	2·1	15 50	13 38	11 49	9 56	8 5	6 2	3 59	1 54	23 55	22 7	20 11	18 7
	μ Argûs	2·8	15 55	13 44	11 55	10 1	8 10	6 8	4 4	1 59	0 4	22 12	20 16	18 13
	β Ursæ Majoris	2·4	16 9	13 57	12 8	10 15	8 24	6 22	4 18	2 13	0 17	22 26	20 30	18 26
	Dubhe	2·0	16 11	13 59	12 10	10 17	8 26	6 23	4 19	2 15	0 19	22 28	20 32	18 28
	δ Leonis	2·6	16 22	14 10	12 21	10 28	8 37	6 34	4 30	2 26	0 30	22 39	20 43	18 39
	β Leonis	2·2	16 57	14 45	12 56	11 3	9 12	7 9	5 6	3 1	1 5	23 14	21 18	19 14
	γ Ursæ Majoris	2·5	17 1	14 50	13 1	11 7	9 16	7 14	5 10	3 6	1 10	23 18	21 22	19 19
	δ Centauri	2·8	17 16	15 4	13 15	11 22	9 31	7 29	5 25	3 20	1 24	23 33	21 37	19 33
†N	β Cassiopeiæ	2·4	17 17	15 5	13 16	11 23	9 32	7 29	5 25	3 21	1 25	23 34	21 38	19 34
	γ Corvi	2·7	17 23	15 12	13 23	11 29	9 38	7 36	5 32	3 28	1 32	23 40	21 44	19 41
	α¹ Crucis	1·0	17 34	15 22	13 33	11 40	9 49	7 46	5 43	3 38	1 42	23 51	21 55	19 51
†S	α Phœnicis	2·4	17 34	15 22	13 33	11 40	9 49	7 47	5 43	3 38	1 42	23 51	21 55	19 52
	γ Crucis	1·6	17 38	15 27	13 38	11 44	9 53	7 51	5 47	3 43	1 47	23 55	21 59	19 56
	γ Centauri	2·4	17 49	15 37	13 48	11 55	10 4	8 1	5 57	3 53	1 57	0 9	22 10	20 6
	β Crucis	1·5	17 55	15 43	13 54	12 1	10 10	8 7	6 3	3 59	2 3	0 15	22 16	20 12
	ε Ursæ Majoris	1·8	18 2	15 50	14 2	12 8	10 17	8 15	6 11	4 6	2 11	0 23	22 23	20 19
†N	γ Cassiopeiæ	2·3	18 3	15 52	14 3	12 9	10 18	8 16	6 12	4 8	2 12	0 24	22 24	20 21
†N	β Andromedæ	2·4	18 17	16 5	14 16	12 23	10 32	8 29	6 25	4 21	2 25	0 37	22 38	20 34
†N	δ Cassiopeiæ	2·8	18 32	16 20	14 31	12 38	10 47	8 45	6 41	4 36	2 40	0 53	22 53	20 49
	ζ¹ Ursæ Majoris	2·1	18 32	16 21	14 32	12 38	10 47	8 45	6 41	4 37	2 41	0 53	22 53	20 50
	Spica	1·2	18 33	16 21	14 32	12 39	10 48	8 45	6 41	4 37	2 41	0 53	22 53	20 50
†N	*Polaris*	2·1	18 39	16 27	14 37	12 44	10 53	8 51	6 47	4 43	2 48	1 0	23 1	20 57
†S	*Achernar*	0·5	18 46	16 35	14 46	12 52	11 1	8 59	6 55	4 51	2 55	1 7	23 7	21 4
	ε Centauri	2·6	18 46	16 34	14 46	12 52	11 1	8 59	6 55	4 50	2 55	1 7	23 7	21 4
	η Ursæ Majoris	1·9	18 56	16 44	14 55	13 2	11 11	9 9	7 5	5 0	3 4	1 17	23 17	21 13
	ζ Centauri	2·8	19 2	16 50	15 1	13 8	11 17	9 15	7 11	5 6	2 10	1 22	23 23	21 19
	β Centauri	0·8	19 9	16 58	15 9	13 15	11 24	9 22	7 18	5 14	3 18	1 30	23 30	21 27
†N	γ¹ Andromedæ	2·2	19 10	16 58	15 10	13 16	11 25	9 23	7 19	5 14	3 19	1 31	23 31	21 28
	θ Centauri	2·1	19 13	17 2	15 13	13 19	11 28	9 26	7 22	5 17	3 22	1 34	23 34	21 31
	Arcturus	0·3	19 23	17 12	15 23	13 30	11 39	9 36	7 32	5 28	3 32	1 44	23 44	21 41
	η Centauri	2·7	19 42	17 30	15 41	13 48	11 57	9 54	7 50	5 46	3 50	2 2	0 7	21 59
	α² Centauri	1·0	19 45	17 34	15 45	13 51	12 0	9 58	7 54	5 50	3 54	2 6	0 10	22 3
	α Lupi	2·5	19 48	17 36	15 47	13 54	12 3	10 0	7 56	5 52	3 56	2 8	0 13	22 5
	ε² Boötis	2·6	19 53	17 41	15 52	13 59	12 8	10 6	8 2	5 57	4 1	2 13	0 18	22 10
	β Ursæ Minoris	2·2	20 3	17 51	16 2	14 9	12 18	10 15	8 12	6 7	4 11	2 23	0 28	22 20
	β Lupi	2·7	20 4	17 53	16 4	14 10	12 19	10 17	8 13	6 9	4 13	2 25	0 29	22 22
†N	α Persei	1·9	20 30	18 18	16 29	14 36	12 45	10 42	8 38	6 34	4 38	2 50	0 55	22 47
	Alphacca	2·3	20 43	18 31	16 42	14 49	12 58	10 55	8 51	6 47	4 51	3 3	1 7	23 0
	α Serpentis	2·8	20 51	18 40	16 51	14 58	13 7	11 4	9 0	6 56	5 0	3 12	1 16	23 9
	δ Scorpii	2·5	21 7	18 55	17 6	15 13	13 22	11 19	9 15	7 11	5 15	3 27	1 32	23 24
	β¹ Scorpii	2·7	21 12	19 0	17 11	15 18	13 27	11 24	9 21	7 16	5 20	3 32	1 37	23 29
	Antares	1·3	21 35	19 24	17 35	15 42	13 50	11 48	9 44	7 40	5 44	3 56	2 0	23 53
	ζ Ophiuchi	2·7	21 44	19 32	17 43	15 50	13 59	11 56	9 52	7 48	5 52	4 4	2 9	0 5
	α Tri. Australis	1·9	21 51	19 39	17 50	15 57	14 6	12 3	9 59	7 55	5 59	4 11	2 16	0 12
	ε Scorpii	2·3	21 56	19 44	17 55	16 2	14 11	12 8	10 5	8 0	6 4	4 16	2 21	0 18
	η Ophiuchi	2·6	22 17	20 5	18 16	16 23	14 32	12 29	10 25	8 21	6 25	4 37	2 42	0 38
†N	*Capella*	0·2	22 21	20 10	18 21	16 28	14 36	12 34	10 30	8 26	6 30	4 42	2 46	0 43
	β Aræ	2·7	22 29	20 17	18 29	16 35	14 44	12 42	10 38	8 33	6 38	4 50	2 54	0 51
	λ Scorpii	1·8	22 39	20 27	18 38	16 45	14 54	12 52	10 48	8 43	6 47	5 0	3 4	1 1
	α Ophiuchi	2·1	22 42	20 30	18 42	16 48	14 57	12 55	10 51	8 46	6 51	5 3	3 7	1 4

† N. or † S.—These times relate to the Meridian Passages of Circumpolar Stars at the *Inferior* Transit, N. or S. denoting the Declination of the Star.

Approximate Apparent Times of the Meridian Passages of the Principal Fixed Stars at Greenwich on the First Day of each Month, 1910—*continued.*

	Name.	Mag.	Jan. H. M.	Feb. H. M.	Mar H. M.	April. H. M.	May. H. M.	June. H. M.	July. H. M.	Aug. H. M.	Sept. H. M.	Oct. H. M.	Nov. H. M.	Dec. H. M.
	θ Scorpii ..	2·0	22 42	20 30	18 42	16 48	14 57	12 55	10 51	8 46	6 51	5 3	3 7	1 4
	κ Scorpii ..	2·6	22 48	20 36	18 47	16 54	15 3	13 0	10 56	8 52	6 56	5 8	3 13	1 9
†N	β Aurigæ ..	2·1	23 4	20 52	19 4	17 10	15 19	13 17	11 13	9 8	7 13	5 25	3 29	1 26
	γ Draconis ..	2·4	23 6	20 54	19 5	17 12	15 21	13 18	11 15	9 10	7 14	5 26	3 31	1 28
	ε Sagittarii ..	1·9	23 29	21 18	19 29	17 36	15 44	13 42	11 38	9 34	7 38	5 50	3 54	1 51
†S	*Canopus* ..	−1·0	23 33	21 21	19 33	17 39	15 48	13 46	11 42	9 37	7 42	5 54	3 58	1 54
	Vega	0·1	23 45	21 33	19 44	17 51	16 0	13 58	11 54	9 49	7 53	6 6	4 10	2 7
†S	τ Argûs ..	2·8	0 3	21 47	19 58	18 5	16 14	14 11	12 7	10 3	8 7	6 20	4 24	2 21
	σ Sagittarii ..	2·1	0 5	21 49	20 0	18 7	16 16	14 13	12 10	10 5	8 9	6 22	4 26	2 23
	ζ Sagittarii ..	2·7	0 12	21 56	20 7	18 14	16 23	14 21	12 17	10 12	8 16	6 29	4 33	2 30
	Altair.. ..	0·9	1 2	22 46	20 57	19 3	17 12	15 10	13 6	11 2	9 6	7 18	5 22	3 19
†S	γ Argûs ..	1·9	1 22	23 6	21 17	19 24	17 33	15 30	13 26	11 22	9 26	7 38	5 43	3 39
	α Pavonis ..	2·0	1 33	23 18	21 29	19 36	17 44	15 42	13 38	11 34	9 38	7 50	5 54	3 51
	γ Cygni ..	2·3	1 34	23 18	21 29	19 36	17 45	15 42	13 39	11 34	9 38	7 51	5 55	3 52
†S	ε Argûs ..	1·7	1 36	23 20	21 31	19 38	17 47	15 44	13 40	11 36	9 40	7 52	5 56	3 53
	α Cygni ..	1·3	1 54	23 37	21 49	19 55	18 4	16 2	13 58	11 53	9 58	8 10	6 14	4 12
†S	δ Argûs ..	2·0	1 57	23 41	21 53	19 59	18 8	16 6	14 2	11 57	10 1	8 14	6 18	4 15
	ε Cygni ..	2·6	1 58	23 42	21 53	20 0	18 8	16 6	14 2	11 58	10 2	8 14	6 18	4 15
†S	β Argûs ..	1·7	2 27	0 15	22 22	20 29	18 38	16 36	14 32	12 27	10 31	8 44	6 48	4 45
†S	ι Argûs ..	2·2	2 30	0 18	22 25	20 32	18 40	16 38	14 34	12 30	10 34	8 46	6 50	4 47
	α Cephei ..	2·6	2 31	0 19	22 27	20 33	18 42	16 40	14 36	12 31	10 36	8 48	6 52	4 49
	κ Argûs ..	2·6	2 34	0 22	22 30	20 36	18 45	16 43	14 39	12 34	10 38	8 51	6 55	4 52
	ε Pegasi ..	2·5	2 55	0 43	22 50	20 57	19 6	17 3	14 59	12 55	10 59	9 11	7 15	5 12
	α Gruis ..	1·9	3 17	1 5	23 13	21 19	19 28	17 26	15 22	13 17	11 22	9 34	7 38	5 35
	β Gruis ..	2·1	3 52	1 40	23 47	21 54	20 3	18 0	15 56	13 52	11 56	10 9	8 12	6 10
	Fomalhaut ..	1·3	4 7	1 55	0 6	22 9	20 18	18 16	16 12	14 7	12 12	10 24	8 28	6 25
†N	β Ursæ Majoris	2·4	4 11	1 59	0 10	22 13	20 22	18 19	16 16	14 11	12 15	10 28	8 32	6 29
†N	*Dubhe* ..	2·0	4 13	2 1	0 12	22 15	20 24	18 21	16 17	14 13	12 17	10 29	8 34	6 30
	α Pegasi ..	2·6	4 15	2 3	0 14	22 17	20 26	18 23	16 19	14 15	12 19	10 31	8 36	6 32
†N	γ Ursæ Majoris	2·5	5 4	2 52	1 3	23 6	21 15	19 12	17 8	15 4	13 8	11 20	9 24	7 21

† N or † S.—These times relate to the Meridian Passages of Circumpolar Stars at the *Inferior* Transit, N. or S. denoting the Declination of the Star.

Correction of the Times in the preceding Table for the Day of the Month (to be *subtracted*).

Days.	Jan. H. M.	Feb. H. M.	Mar. H. M.	April. H. M.	May. H. M.	June. H. M.	July. H. M.	Aug. H. M.	Sept. H. M.	Oct. H. M.	Nov. H. M.	Dec. H. M.
1	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	0 4	0 4	0 4	0 4	0 4	0 4	0 4	0 4	0 4	0 4	0 4	0 4
3	0 9	0 8	0 7	0 7	0 8	0 8	0 8	0 8	0 7	0 7	0 8	0 9
4	0 13	0 12	0 11	0 11	0 11	0 12	0 12	0 12	0 11	0 11	0 12	0 13
5	0 18	0 16	0 15	0 15	0 15	0 16	0 16	0 15	0 14	0 15	0 16	0 17
6	0 22	0 20	0 19	0 18	0 19	0 21	0 21	0 19	0 18	0 18	0 20	0 22
7	0 26	0 24	0 22	0 22	0 23	0 25	0 25	0 23	0 22	0 22	0 24	0 26
8	0 30	0 28	0 26	0 26	0 27	0 29	0 29	0 27	0 25	0 25	0 28	0 30
9	0 35	0 32	0 30	0 29	0 30	0 33	0 33	0 31	0 29	0 29	0 32	0 35
10	0 39	0 36	0 33	0 33	0 35	0 37	0 37	0 35	0 32	0 33	0 36	0 39
11	0 43	0 40	0 37	0 36	0 39	0 41	0 41	0 38	0 36	0 37	0 40	0 44
12	0 48	0 44	0 41	0 40	0 42	0 45	0 45	0 42	0 40	0 40	0 44	0 48
13	0 52	0 48	0 44	0 44	0 46	0 49	0 49	0 46	0 43	0 44	0 48	0 52
14	0 56	0 52	0 48	0 48	0 50	0 54	0 53	0 50	0 47	0 48	0 52	0 57
15	1 1	0 56	0 52	0 51	0 54	0 58	0 57	0 53	0 50	0 51	0 56	1 1
16	1 5	1 0	0 55	0 55	0 58	1 2	1 1	0 57	0 54	0 55	1 0	1 6
17	1 9	1 3	0 59	0 59	1 2	1 6	1 5	1 1	0 58	0 59	1 4	1 10
18	1 13	1 7	1 2	1 2	1 6	1 10	1 9	1 5	1 1	1 3	1 9	1 15
19	1 18	1 11	1 6	1 6	1 10	1 14	1 13	1 8	1 5	1 6	1 13	1 19
20	1 22	1 15	1 10	1 10	1 14	1 19	1 17	1 12	1 8	1 10	1 17	1 24
21	1 26	1 19	1 14	1 13	1 18	1 23	1 21	1 16	1 12	1 14	1 21	1 28
22	1 31	1 23	1 17	1 17	1 22	1 27	1 25	1 19	1 16	1 18	1 25	1 32
23	1 35	1 26	1 21	1 21	1 26	1 31	1 29	1 23	1 19	1 21	1 30	1 37
24	1 39	1 30	1 24	1 25	1 30	1 35	1 33	1 27	1 23	1 25	1 34	1 41
25	1 43	1 34	1 28	1 28	1 34	1 39	1 37	1 31	1 26	1 29	1 38	1 46
26	1 47	1 38	1 32	1 32	1 38	1 44	1 41	1 34	1 30	1 33	1 42	1 50
27	1 51	1 42	1 35	1 36	1 42	1 48	1 45	1 38	1 34	1 37	1 47	1 55
28	1 56	1 45	1 39	1 40	1 46	1 52	1 49	1 42	1 37	1 41	1 51	1 59
29	2 0	..	1 43	1 44	1 50	1 56	1 53	1 45	1 41	1 44	1 55	2 3
30	2 4	..	1 46	1 47	1 55	2 0	1 57	1 49	1 44	1 48	1 59	2 8
31	2 8	..	1 50	..	1 59	..	2 1	1 52	..	1 52	..	2 12

Table A.

When hour angle is less than 6 hours, name the factors taken from Table A *contrary* to name of lat.

Lat.	0 HOURS.																1 Hr.
	m. 01	Var. to 1' of Lat.	m. 4	m. 8	m. 12	m. 16	m. 20	m. 24	m. 28	m. 32	m. 36	m. 40	m. 44	m. 48	m. 52	m. 56	m. 00
°	'	"	'	'	'	'	'	'	'	'	'	'	'	'	'	'	'
0	·0	4·00	·00	·00	·00	·00	·00	·00	·00	·00	·00	·00	·00	·00	·00	·00	·00
1	4·0	4·00	1·00	·50	·33	·25	·20	·17	·14	·12	·11	·10	·09	·08	·08	·07	·07
2	8·0	4·01	2·00	1·00	·67	·50	·40	·33	·28	·25	·22	·20	·18	·16	·15	·14	·13
3	12·0	4·01	3·00	1·50	1·00	·75	·60	·50	·43	·37	·33	·30	·27	·25	·23	·21	·20
4	16·0	4·02	4·01	2·00	1·33	1·00	·80	·66	·57	·50	·44	·40	·36	·33	·30	·28	·26
5	20·1	4·03	5·01	2·51	1·67	1·25	1·00	·83	·71	·62	·55	·50	·45	·41	·38	·35	·33
6	24·1	4·05	6·02	3·01	2·01	1·50	1·20	1·00	·86	·75	·66	·60	·54	·49	·46	·42	·39
7	28·1	4·06	7·03	3·52	2·34	1·76	1·40	1·17	1·00	·87	·78	·70	·63	·58	·53	·49	·46
8	32·2	4·08	8·05	4·02	2·68	2·01	1·61	1·34	1·14	1·00	·89	·80	·72	·66	·61	·56	·52
9	36·3	4·10	9·07	4·54	3·02	2·27	1·81	1·51	1·29	1·13	1·00	·90	·81	·75	·69	·64	·59
10	40·4	4·12	10·1	5·05	3·36	2·52	2·02	1·68	1·44	1·25	1·11	1·00	·91	·83	·76	·71	·66
11	44·5	4·15	11·1	5·57	3·71	2·78	2·22	1·85	1·58	1·38	1·23	1·10	1·00	·91	·84	·78	·73
12	48·7	4·18	12·2	6·09	4·06	3·04	2·43	2·02	1·73	1·51	1·34	1·21	1·09	1·00	·92	·85	·79
13	52·9	4·21	13·2	6·61	4·41	3·30	2·64	2·20	1·88	1·64	1·46	1·31	1·19	1·09	1·00	·93	·86
14	57·1	4·25	14·3	7·14	4·76	3·57	2·85	2·37	2·03	1·77	1·57	1·41	1·28	1·17	1·08	1·00	·93
15	61·4	4·29	15·4	7·67	5·11	3·83	3·06	2·55	2·18	1·91	1·69	1·52	1·38	1·26	1·16	1·07	1·00
16	65·7	4·33	16·4	8·21	5·47	4·10	3·28	2·73	2·34	2·04	1·81	1·63	1·48	1·35	1·24	1·15	1·07
17	70·1	4·37	17·5	8·75	5·83	4·37	3·49	2·91	2·49	2·18	1·93	1·73	1·57	1·44	1·32	1·23	1·14
18	74·5	4·42	18·6	9·30	6·20	4·65	3·71	3·09	2·65	2·31	2·05	1·84	1·67	1·53	1·41	1·30	1·21
19	78·9	4·47	19·7	9·86	6·57	4·92	3·94	3·28	2·80	2·45	2·17	1·95	1·77	1·62	1·49	1·38	1·29
20	83·4	4·53	20·9	10·4	6·94	5·21	4·16	3·46	2·96	2·59	2·30	2·06	1·87	1·71	1·58	1·46	1·36
21	88·0	4·59	22·0	11·0	7·32	5·49	4·39	3·65	3·13	2·73	2·42	2·18	1·97	1·81	1·66	1·54	1·43
22	92·6	4·65	23·1	11·6	7·71	5·78	4·62	3·84	3·29	2·87	2·55	2·29	2·08	1·90	1·75	1·62	1·51
23	97·3	4·72	24·3	12·2	8·10	6·07	4·85	4·04	3·46	3·02	2·68	2·41	2·18	2·00	1·84	1·70	1·58
24	102·0	4·79	25·5	12·7	8·50	6·37	5·09	4·24	3·63	3·17	2·81	2·53	2·29	2·09	1·93	1·79	1·66
25	106·9	4·87	26·7	13·4	8·90	6·67	5·33	4·44	3·80	3·32	2·94	2·64	2·40	2·19	2·02	1·87	1·74
26	111·8	4·95	27·9	14·0	9·31	6·97	5·57	4·64	3·97	3·47	3·08	2·77	2·51	2·29	2·11	1·96	1·82
27	116·8	5·04	29·2	14·6	9·72	7·29	5·82	4·85	4·15	3·63	3·22	2·89	2·62	2·40	2·21	2·04	1·90
28	121·9	5·13	30·5	15·2	10·1	7·60	6·08	5·06	4·33	3·78	3·36	3·02	2·74	2·50	2·30	2·13	1·98
29	127·0	5·23	31·8	15·9	10·6	7·93	6·34	5·27	4·51	3·94	3·50	3·14	2·85	2·61	2·40	2·22	2·07
30	132·3	5·33	33·1	16·5	11·0	8·26	6·60	5·49	4·70	4·11	3·65	3·27	2·97	2·72	2·50	2·32	2·15
31	137·7	5·44	34·4	17·2	11·5	8·59	6·87	5·72	4·89	4·28	3·79	3·41	3·09	2·83	2·60	2·41	2·24
32	143·2	5·55	35·8	17·9	11·9	8·94	7·14	5·95	5·09	4·45	3·95	3·54	3·21	2·94	2·71	2·51	2·33
33	148·8	5·69	37·2	18·6	12·4	9·29	7·42	6·18	5·29	4·62	4·10	3·68	3·34	3·06	2·81	2·60	2·42
34	154·6	5·82	38·6	19·3	12·9	9·65	7·71	6·42	5·49	4·80	4·26	3·83	3·47	3·17	2·92	2·71	2·52
35	160·5	5·96	40·1	20·1	13·4	10·0	8·00	6·66	5·70	4·98	4·42	3·97	3·60	3·29	3·03	2·81	2·61
36	166·5	6·11	41·6	20·8	13·9	10·4	8·30	6·91	5·92	5·17	4·59	4·12	3·74	3·42	3·15	2·91	2·71
37	172·7	6·27	43·2	21·6	14·4	10·8	8·61	7·17	6·14	5·36	4·76	4·27	3·88	3·55	3·26	3·02	2·81
38	179·1	6·44	44·8	22·4	14·9	11·2	8·93	7·43	6·36	5·56	4·93	4·43	4·02	3·68	3·38	3·13	2·92
39	185·6	6·62	46·4	23·2	15·5	11·6	9·26	7·70	6·60	5·76	5·11	4·59	4·17	3·81	3·51	3·25	3·02
40	192·3	6·82	48·1	24·0	16·0	12·0	9·59	7·98	6·83	5·97	5·30	4·76	4·32	3·95	3·63	3·37	3·13
41	199·2	7·03	49·8	24·9	16·6	12·4	9·94	8·27	7·08	6·19	5·49	4·93	4·47	4·09	3·77	3·49	3·24
42	206·4	7·25	51·6	25·8	17·2	12·9	10·3	8·57	7·33	6·41	5·68	5·11	4·63	4·24	3·90	3·61	3·36
43	213·7	7·48	53·4	26·7	17·8	13·3	10·7	8·87	7·59	6·64	5·89	5·29	4·80	4·39	4·04	3·74	3·48
44	221·3	7·73	55·3	27·7	18·4	13·8	11·0	9·19	7·86	6·87	6·10	5·48	4·97	4·54	4·18	3·87	3·60
45	229·2	8·00	57·3	28·6	19·1	14·3	11·4	9·51	8·14	7·12	6·31	5·67	5·14	4·70	4·33	4·01	3·73
46	237·3	8·29	59·3	29·7	19·8	14·8	11·8	9·85	8·43	7·37	6·54	5·87	5·33	4·87	4·49	4·15	3·86
47	245·8	8·60	61·4	30·7	20·5	15·3	12·3	10·2	8·73	7·63	6·77	6·08	5·52	5·05	4·64	4·30	4·00
48	254·5	8·93	63·6	31·8	21·2	15·9	12·7	10·6	9·05	7·90	7·01	6·30	5·71	5·23	4·81	4·45	4·14
49	263·6	9·30	65·9	32·9	22·0	16·5	13·1	10·9	9·37	8·19	7·26	6·52	5·92	5·41	4·98	4·61	4·29
50	273·1	9·69	68·3	34·1	22·7	17·0	13·6	11·3	9·71	8·48	7·52	6·76	6·13	5·61	5·16	4·78	4·45
51	283·0	10·1	70·7	35·4	23·6	17·7	14·1	11·7	10·1	8·79	7·80	7·00	6·35	5·81	5·35	4·95	4·61
52	293·3	10·6	73·3	36·7	24·4	18·3	14·6	12·2	10·4	9·11	8·08	7·26	6·58	6·02	5·54	5·13	4·78
53	304·1	11·1	76·0	38·0	25·3	19·0	15·2	12·6	10·8	9·44	8·38	7·53	6·83	6·24	5·75	5·32	4·95
54	315·4	11·6	78·9	39·4	26·3	19·7	15·7	13·1	11·2	9·79	8·69	7·81	7·08	6·48	5·96	5·52	5·14
55	327·3	12·2	81·8	40·9	27·3	20·4	16·3	13·6	11·6	10·2	9·02	8·10	7·35	6·72	6·19	5·73	5·33
56	339·8	12·8	84·9	42·5	28·3	21·2	16·9	14·1	12·1	10·5	9·36	8·41	7·63	6·97	6·42	5·95	5·53
57	352·9	13·5	88·2	44·1	29·4	22·0	17·6	14·7	12·5	11·0	9·72	8·73	7·92	7·24	6·67	6·18	5·75
58	366·8	14·3	91·7	45·8	30·5	22·9	18·3	15·2	13·0	11·4	10·1	9·08	8·23	7·53	6·93	6·42	5·97
59	381·4	15·1	95·3	47·7	31·8	23·8	19·0	15·8	13·6	11·8	10·5	9·44	8·56	7·83	7·21	6·68	6·21
60	397·0	16·0	99·2	49·6	33·0	24·8	19·8	16·5	14·1	12·3	10·9	9·82	8·91	8·15	7·50	6·95	6·46
	m. 59	..	m. 56	m. 52	m. 48	m 44	m. 40	m. 36	m. 32	m. 28	m. 24	m. 20	m. 16	m. 12	m. 8	m. 4	m. 0
	11 HOURS.																

When hour angle is more than 6 hours, name the factors taken from Table A the *same* as the name of the latitude.

Table B.

Always name the factors taken from Table B the *same* as the name of declination.

Decli-nation.	Var. to 1' of Decl.	0 HOURS. m. 1	m. 4	m. 8	m. 12	m. 16	m. 20	m. 24	m. 28	m. 32	m. 36	m. 40	m. 44	m. 48	m. 52	m. 56
°	"	'	'	'	'	'	'	'	'	'	'	'	'	'	'	'
0	4·00	·0	·00	·00	·00	·00	·00	·00	·00	·00	·00	·00	·00	·00	·00	·00
1	4·00	4·0	1·00	·50	·33	·25	·20	·17	·14	·13	·11	·10	·09	·08	·08	·07
2	4·01	8·0	2·00	1·00	·67	·50	·40	·33	·29	·25	·22	·20	·18	·17	·16	·14
3	4·01	12·0	3·00	1·50	1·00	·75	·60	·50	·43	·38	·34	·30	·27	·25	·23	·22
4	4·02	16·0	4·01	2·00	1·34	1·00	·80	·67	·57	·50	·45	·40	·37	·34	·31	·29
5	4·03	20·1	5·01	2·51	1·67	1·25	1·00	·84	·72	·63	·56	·50	·46	·42	·39	·36
6	4·05	24·1	6·02	3·01	2·01	1·51	1·21	1·01	·86	·76	·67	·61	·55	·51	·47	·43
7	4·06	28·1	7·04	3·52	2·35	1·76	1·41	1·17	1·01	·88	·78	·71	·64	·59	·55	·51
8	4·08	32·2	8·05	4·03	2·69	2·01	1·61	1·34	1·15	1·01	·90	·81	·74	·68	·62	·58
9	4·10	36·3	9·08	4·54	3·03	2·27	1·82	1·52	1·30	1·14	1·01	·91	·83	·76	·70	·65
10	4·12	40·4	10·1	5·05	3·37	2·53	2·02	1·69	1·45	1·27	1·13	1·02	·92	·85	·78	·73
11	4·15	44·5	11·1	5·57	3·71	2·79	2·23	1·86	1·59	1·40	1·24	1·12	1·02	·93	·86	·80
12	4·18	48·7	12·2	6·09	4·06	3·05	2·44	2·03	1·74	1·53	1·36	1·22	1·11	1·02	·94	·88
13	4·21	52·9	13·2	6·62	4·41	3·31	2·65	2·21	1·89	1·66	1·48	1·33	1·21	1·11	1·03	·95
14	4·25	57·1	14·3	7·14	4·76	3·57	2·86	2·39	2·05	1·79	1·59	1·44	1·31	1·20	1·11	1·03
15	4·29	61·4	15·4	7·68	5·12	3·84	3·07	2·56	2·20	1·93	1·71	1·54	1·40	1·29	1·19	1·11
16	4·33	65·7	16·4	8·22	5·48	4·11	3·29	2·74	2·35	2·06	1·83	1·65	1·50	1·38	1·27	1·19
17	4·37	70·1	17·5	8·76	5·84	4·38	3·51	2·92	2·51	2·20	1·95	1·76	1·60	1·47	1·36	1·26
18	4·42	74·5	18·6	9·31	6·21	4·66	3·73	3·11	2·67	2·33	2·08	1·87	1·70	1·56	1·44	1·34
19	4·47	78·9	19·7	9·87	6·58	4·94	3·95	3·29	2·83	2·47	2·20	1·98	1·80	1·66	1·53	1·42
20	4·53	83·4	20·9	10·4	6·95	5·22	4·18	3·48	2·99	2·62	2·33	2·10	1·91	1·75	1·62	1·50
21	4·59	88·0	22·0	11·0	7·33	5·50	4·40	3·67	3·15	2·76	2·45	2·21	2·01	1·85	1·71	1·59
22	4·65	92·6	23·2	11·6	7·72	5·79	4·64	3·87	3·32	2·90	2·58	2·33	2·12	1·94	1·80	1·67
23	4·72	97·3	24·3	12·2	8·11	6·09	4·87	4·06	3·48	3·05	2·71	2·44	2·22	2·04	1·89	1·75
23° 28'	4·75	99·5	24·9	12·4	8·29	6·22	4·98	4·15	3·56	3·12	2·78	2·50	2·28	2·09	1·93	1·79
24	4·79	102·0	25·5	12·8	8·51	6·38	5·11	4·26	3·65	3·20	2·85	2·56	2·33	2·14	1·98	1·84
25	4·87	106·9	26·7	13·4	8·91	6·68	5·35	4·46	3·83	3·35	2·98	2·69	2·44	2·24	2·07	1·93
26	4·95	111·8	27·9	14·0	9·32	6·99	5·60	4·67	4·00	3·50	3·12	2·81	2·56	2·35	2·17	2·02
27	5·04	116·8	29·2	14·6	9·74	7·30	5·85	4·87	4·18	3·66	3·26	2·93	2·67	2·45	2·27	2·11
28	5·13	121·9	30·5	15·2	10·2	7·62	6·10	5·09	4·36	3·82	3·40	3·06	2·79	2·56	2·36	2·20
29	5·23	127·0	31·8	15·9	10·6	7·95	6·36	5·30	4·55	3·98	3·54	3·19	2·91	2·67	2·46	2·29
30	5·33	132·3	33·1	16·5	11·0	8·28	6·62	5·52	4·74	4·15	3·69	3·32	3·03	2·78	2·57	2·39
Names of Stars.																
N. Decln. Stars.																
Procyon ..		21·9	5·47	2·74	1·83	1·37	1·10	91	·78	·69	·61	·55	·50	·46	·42	·39
Altair ..		34·8	8·69	4·35	2·90	2·18	1·74	1·45	1·25	1·09	·97	·87	·80	·73	·67	·63
Aldebaran ..		67·1	16·8	8·39	5·60	4·20	3·36	2·80	2·40	2·11	1·87	1·69	1·54	1·41	1·30	1·21
Arcturus ..		81·9	20·5	10·2	6·82	5·12	4·10	3·42	2·93	2·57	2·28	2·06	1·87	1·72	1·59	1·48
Castor ..		143·7	35·9	17·8	12·0	8·99	7·19	6·00	5·14	4·51	4·01	3·61	3·29	3·02	2·79	2·59
Vega ..		183·6	45·9	23·0	15·3	11·5	9·19	7·66	6·57	5·76	5·12	4·61	4·20	3·85	3·56	3·31
Deneb ..		228·9	57·2	28·6	19·1	14·3	11·5	9·55	8·19	7·17	6·38	5·75	5·23	4·80	4·44	4·13
Capella ..		236·6	59·1	29·6	19·7	14·8	11·8	9·87	8·47	7·42	6·60	5·94	5·41	4·96	4·59	4·27
α Persei ..		268·7	67·2	33·6	22·4	16·8	13·5	11·2	9·62	8·43	7·50	6·75	6·15	5·64	5·21	4·85
η Ursæ Majoris		270·8	67·7	33·9	22·6	16·9	13·6	11·3	9·70	8·49	7·55	6·81	6·19	5·68	5·25	4·89
ε Ursæ Majoris		345·6	86·4	43·2	28·8	21·6	17·3	14·4	12·4	10·8	9·64	8·68	7·90	7·25	6·70	6·23
α Ursæ Majoris		435·4	109	54·4	36·3	27·2	21·8	18·2	15·6	13·6	12·1	10·9	9·96	9·14	8·44	7·85
S. Decln. Stars.																
Rigel ..		33·5	8·36	4·18	2·79	2·09	1·67	1·40	1·20	1·05	·93	·84	·77	·70	·65	·60
Sirius ..		68·3	17·1	8·54	5·69	4·27	3·42	2·85	2·44	2·14	1·91	1·72	1·56	1·43	1·32	1·23
ε Sagittarii ..		157·1	39·3	19·6	13·1	9·83	7·86	6·56	5·62	4·92	4·38	3·95	3·59	3·30	3·05	2·83
λ Scorpii ..		172·9	43·2	21·6	14·4	10·8	8·66	7·22	6·19	5·42	4·82	4·35	3·95	3·63	3·35	3·12
γ Argûs ..		246·4	61·6	30·8	20·5	15·4	12·3	10·3	8·82	7·72	6·87	6·19	5·63	5·17	4·78	4·44
α Gruis ..		249·2	62·3	31·2	20·8	15·6	12·5	10·4	8·92	7·81	6·95	6·26	5·70	5·23	4·83	4·49
Canopus ..		300·3	75·1	37·5	25·0	18·8	15·0	12·5	10·8	9·41	8·38	7·54	6·87	6·30	5·82	5·42
γ Crucis ..		347·7	86·9	43·5	29·0	21·7	17·4	14·5	12·4	10·9	9·70	8·74	7·95	7·30	6·74	6·27
α Pavonis ..		353·2	88·3	44·2	29·4	22·1	17·7	14·7	12·6	11·1	9·85	8·88	8·08	7·41	6·85	6·37
Achernar ..		362·4	90·6	45·3	30·3	22·7	18·1	15·1	13·0	11·4	10·1	9·11	8·29	7·61	7·03	6·54
β Crucis or ε Argûs		384·6	96·2	48·1	32·1	24·1	19·3	16·1	13·8	12·1	10·7	9·66	8·79	8·07	7·46	6·94
β Centauri ..		396·0	99·0	49·5	33·0	24·8	19·8	16·5	14·2	12·4	11·0	9·95	9·06	8·31	7·68	7·14
α^2 Centauri ..		404·5	101	50·6	33·7	25·3	20·2	16·9	14·5	12·7	11·3	10·2	9·25	8·49	7·85	7·30
α^1 Crucis ..		442·1	111	55·3	36·9	27·7	22·1	18·5	15·8	13·9	12·3	11·1	10·1	9·28	8·58	7·97
α Trianguli Aus.		592·8	148	74·1	49·4	37·1	29·7	24·7	21·2	18·6	16·5	14·9	13·6	12·4	11·5	10·7
β Argûs ..		608·0	152	76·0	50·7	38·0	30·4	25·4	21·8	19·1	17·0	15·3	13·9	12·8	11·8	11·0
		m. 59	m. 56	m. 52	m. 48	m. 44	m. 40	m. 36	m. 32	m. 28	m. 24	m. 20	m. 16	m. 12	m. 8	m. 4
		11 HOURS.														

Table A.

When hour angle is less than 6 hours, name the factors taken from Table A *contrary* to name of lat.

Lat.	1 HOUR.															2 Hr.
	m. 0	m. 4	m. 8	m. 12	m. 16	m. 20	m. 24	m. 28	m. 32	m. 36	m. 40	m. 44	m. 48	m. 52	m. 56	m. 00
°	′	′	′	′	′	′	′	′	′	′	′	′	′	′	′	′
0	·00	·00	·00	·00	·00	·00	·00	·00	·00	·00	·00	·00	·00	·00	·00	·00
1	·07	·06	·06	·05	·05	·05	·05	·04	·04	·04	·04	·04	·03	·03	·03	·03
2	·13	·12	·11	·11	·10	·10	·09	·09	·08	·08	·07	·07	·07	·07	·06	·06
3	·20	·18	·17	·16	·15	·14	·14	·13	·12	·12	·11	·11	·10	·10	·09	·09
4	·26	24	·23	·22	·20	·19	·18	·17	·16	·16	·15	·14	·14	·13	·13	·12
5	·33	·31	·29	·27	·25	·24	·23	·22	·21	·20	·19	·18	·17	·16	·16	·15
6	·39	·37	·34	·32	·31	·29	·27	·26	·25	·24	·23	·22	·21	·20	·19	·18
7	·46	·43	·40	·38	·36	·34	·32	·30	·29	·28	·26	·25	·24	·23	·22	·21
8	·52	·49	·46	·43	·41	·39	·37	·35	·33	·32	·30	·29	28	·26	·25	·24
9	·59	·55	·52	·49	·46	·44	·41	·39	·37	·36	·34	·32	·31	·30	·29	·27
10	·66	·61	·58	·54	·51	·48	·46	·44	·42	·40	·38	·36	·35	·33	·32	·31
11	·73	·68	·64	·60	·56	·53	·51	·48	·46	·44	·42	·40	·38	·37	·35	·34
12	·79	·74	·70	·65	·62	·58	·55	·53	·50	·48	·46	·44	·42	·40	·38	·37
13	·86	·81	·76	·71	·67	·63	·60	·57	·54	·52	·50	·47	·45	·43	·42	·40
14	·93	·87	·82	·77	·72	·69	·65	·62	·59	·56	·53	·51	·49	·47	·45	·43
15	1·00	·93	·88	·82	·78	·74	·70	66	·63	·60	·57	·55	·53	·50	48	·46
16	1·07	1·00	·94	·88	·83	79	·75	71	·68	·64	·61	·59	·56	·54	·52	·50
17	1·14	1·07	1·00	·94	·89	·84	·80	76	·72	·69	·66	·63	·60	·57	·55	·53
18	1·21	1·13	1·06	1·00	·94	·89	85	80	·77	·73	·70	·67	·64	·61	59	·56
19	1·29	1·20	1·13	1·06	1·00	95	90	·85	·81	·77	·74	·71	·68	·65	·62	·60
20	1·36	1·27	1·19	1·12	1·06	1·00	·95	·90	·86	·82	·78	·75	·71	·68	·66	·63
21	1·43	1·34	1·26	1·18	1·11	1·05	1·00	95	·90	·86	·82	·79	·75	·72	·69	·66
22	1·51	1·41	1·32	1·24	1·17	1·11	1·05	1·00	·95	·91	·87	·83	·79	·76	·73	·70
23	1·58	1·48	1·39	1·31	1·23	1·17	1·11	1·05	1·00	·95	·91	·87	·83	·80	·77	·74
24	1·66	1·55	1·46	1·37	1·29	1·22	1·16	1·10	1·05	1·00	·95	·91	·87	·84	·80	·77
25	1·74	1·63	1·53	1·44	1·35	1·28	1·21	1·15	1·10	1·05	1·00	·96	·92	·88	·84	·81
26	1·82	1·70	1·60	1·50	1·42	1·34	1·27	1·21	1·15	1·10	1·05	1·00	·96	·92	88	·84
27	1·90	1·78	1·67	1·57	1·48	1·40	1·33	1·26	1·20	1·14	1·09	1·04	1·00	·96	·92	·88
28	1·98	1·85	1·74	1·64	1·54	1·46	1·39	1·32	1·25	1·19	1·14	1·09	1·04	1·00	·96	·92
29	2·07	1·93	1·81	1·71	1·61	1·52	1·44	1·37	1·31	1·24	1·19	1·14	1·09	1·04	1·00	·96
30	2·15	2·01	1·89	1·78	1·68	1·59	1·50	1·43	1·36	1·30	1·24	1·18	1·13	1·09	1·04	1·00
31	2·24	2·10	1·97	1·85	1·75	1·65	1·57	1·49	1·42	1·35	1·29	1·23	1·18	1·13	1·08	1·04
32	2·33	2·18	2·04	1·92	1·81	1·72	1·63	1·55	1·47	1·40	1·34	1·28	1·23	1·18	1·13	1·08
33	2·42	2·26	2·12	2·00	1·89	1·78	1·69	1·61	1·53	1·46	1·39	1·33	1·27	1·22	1·17	1·12
34	2·52	2·35	2·21	2·08	1·96	1·85	1·76	1·67	1·59	1·51	1·45	1·38	1·32	1·27	1·22	1·17
35	2·61	2·44	2·29	2·16	2·03	1·92	1·82	1·73	1·65	1·57	1·50	1·44	1·37	1·32	1·26	1·21
36	2·71	2·53	2·38	2·24	2·11	2·00	1·89	1·80	1·71	1·63	1·56	1·49	1·43	1·37	1·31	1·26
37	2·81	2·63	2·46	2·32	2·19	2·07	1·96	1·87	1·78	1·69	1·62	1·55	1·48	1·42	1·36	1·31
38	2·92	2·72	2·56	2·40	2·27	2·15	2·04	1·93	1·84	1·75	1·68	1·60	1·53	1·47	1·41	1·35
39	3·02	2·82	2·65	2·49	2·35	2·22	2·11	2·00	1·91	1·82	1·74	1·66	1·59	1·52	1·46	1·40
40	3·13	2·93	2·74	2·58	2·44	2·31	2·19	2·08	1·98	1·88	1·80	1·72	1·65	1·58	1·51	1·45
41	3·24	3·03	2·84	2·68	2·52	2·39	2·26	2·15	2·05	1·95	1·86	1·78	1·71	1·63	1·57	1·51
42	3·36	3·14	2·95	2·77	2·61	2·47	2·35	2·23	2·12	2·02	1·93	1·85	1·77	1·69	1·62	1·56
43	3·48	3·25	3·05	2·87	2·71	2·56	2·43	2·31	2·20	2·09	2·00	1·91	1·83	1·75	1·68	1·62
44	3·60	3·37	3·16	2·97	2·80	2·65	2·52	2·39	2·28	2·17	2·07	1·98	1·90	1·82	1·74	1·67
45	3·73	3·49	3·27	3·08	2·90	2·75	2·61	2·48	2·36	2·25	2·14	2·05	1·96	1·88	1·80	1·73
46	3·86	3·61	3·39	3·19	3·01	2·85	2·70	2·56	2·44	2 33	2·22	2·12	2·03	1·95	1·87	1·79
47	4·00	3·74	3·51	3·30	3·11	2·95	2·79	2·65	2·53	2·41	2·30	2·20	2·10	2·02	1·93	1·86
48	4·14	3·87	3·63	3·42	3·23	3·05	2·89	2·75	2·62	2·49	2·38	2·28	2·18	2·09	2·00	1·92
49	4·29	4·01	3·76	3·54	3·34	3·16	3·00	2·85	2·71	2·58	2·47	2·36	2·26	2·16	2·08	1·99
50	4·45	4·16	3·90	3·67	3·46	3·27	3·10	2·95	2·81	2·68	2·56	2·44	2·34	2·24	2·15	2·06
51	4·61	4·31	4·04	3·80	3·59	3·39	3·22	3·06	2·91	2·77	2·65	2·53	2·42	2·32	2·23	2·14
52	4·78	4·46	4·19	3·94	3·72	3·52	3·33	3·17	3·02	2·87	2·74	2·62	2·51	2·41	2·31	2·22
53	4·95	4·63	4·34	4·08	3·85	3·65	3·46	3·28	3·13	2·98	2·85	2·72	2·60	2·50	2·39	2·30
54	5·14	4·80	4·50	4·24	4·00	3·78	3·59	3·41	3·24	3·09	2·95	2·82	2·70	2·59	2·48	2·38
55	5·33	4·98	4·67	4·40	4·15	3·92	3·72	3·53	3·36	3·21	3·06	2·93	2·80	2·69	2·58	2·47
56	5·53	5·17	4·85	4·56	4·31	4·07	3·86	3·67	3·49	3·33	3·18	3·04	2·91	2·79	2·67	2·57
57	5·75	5·37	5·04	4·74	4·47	4·23	4·01	3·81	3·63	3·46	3·30	3·16	3·02	2·90	2·78	2·67
58	5·97	5·58	5·23	4·93	4·65	4·40	4·17	3·96	3·77	3·59	3·43	3·28	3·14	3·01	2·89	2·77
59	6·21	5·80	5·44	5·12	4·83	4·57	4·34	4·12	3·92	3·74	3·57	3·41	3·27	3·13	3·00	2·88
60	6·46	6·04	5·67	5·33	5·03	4·76	4·51	4·29	4·08	3·89	3·71	3·55	3·40	3·26	3·12	3·00
	m. 00	m. 56	m. 52	m. 48	m. 44	m. 40	m. 36	m. 32	m. 28	m. 24	m. 20	m. 16	m. 12	m. 8	m. 4	m. 00
	11 HR.	10 HOURS.														

When hour angle is more than 6 hours, name the factors taken from Table A the *same* as the name of latitude.

Table B.

Always name the factors taken from Table B the *same* as the name of declination.

Declination.	1 Hour. m. 00	m. 4	m. 8	m. 12	m. 16	m. 20	m. 24	m. 28	m. 32	m. 36	m. 40	m. 44	m. 48	m. 52	m. 56	2 Hr. m. 00
°	′	′	′	′	′	′	′	′	′	′	′	′	′	′	′	′
0	·00	·00	·00	·00	·00	·00	·00	·00	·00	·00	·00	·00	·00	·00	·00	·00
1	·07	·06	·06	·06	·05	·05	·05	·05	·04	·04	·04	·04	·04	·04	·04	·03
2	·13	·13	·12	·11	·11	·10	·10	·09	·09	·09	·08	·08	·08	·07	·07	·07
3	·20	·19	·18	·17	·16	·15	·15	·14	·13	·13	·12	·12	·12	·11	·11	·10
4	·27	·25	·24	·23	·21	·20	·20	·19	·18	·17	·17	·16	·15	·15	·14	·14
5	·34	·32	·30	·28	·27	·26	·24	·23	·22	·22	·21	·20	·19	·19	·18	·17
6	·41	·38	·36	·34	·32	·31	·29	·28	·27	·26	·25	·24	·23	·22	·22	·21
7	·47	·45	·42	·40	·38	·36	·34	·33	·31	·30	·29	·28	·27	·26	·25	·25
8	·54	·51	·48	·45	·43	·41	·39	·38	·36	·35	·33	·32	·31	·30	·29	·28
9	·61	·57	·54	·51	·49	·46	·44	·42	·41	·39	·37	·36	·35	·34	·33	·32
10	·68	·64	·60	·57	·54	·52	·49	·47	·45	·43	·42	·40	·39	·38	·36	·35
11	·75	·71	·66	·63	·60	·57	·54	·52	·50	·48	·46	·44	·43	·41	·40	·39
12	·82	·77	·73	·69	·65	·62	·59	·57	·54	·52	·50	·48	·47	·45	·44	·43
13	·89	·84	·79	·75	·71	·68	·64	·62	·59	·57	·55	·53	·51	·49	·48	·46
14	·96	·90	·85	·81	·77	·73	·70	·67	·64	·61	·59	·57	·55	·53	·51	·50
15	1·04	·97	·92	·87	·82	·78	·75	·72	·69	·66	·63	·61	·59	·57	·55	·54
16	1·11	1·04	·98	·93	·88	·84	·80	·77	·73	·70	·68	·65	·63	·61	·59	·57
17	1·18	1·11	1·05	·99	·94	·89	·85	·82	·78	·75	·72	·70	·67	·65	·63	·61
18	1·26	1·18	1·11	1·05	1·00	·95	·91	·87	·83	·80	·77	·74	·72	·69	·67	·65
19	1·33	1·25	1·18	1·11	1·06	1·01	·96	·92	·88	·85	·81	·79	·76	·73	·71	·69
20	1·41	1·32	1·24	1·18	1·12	1·06	1·02	·97	·93	·89	·86	·83	·80	·78	·75	·73
21	1·48	1·39	1·31	1·24	1·18	1·12	1·07	1·02	·98	·94	·91	·88	·85	·82	·79	·77
22	1·56	1·47	1·38	1·31	1·24	1·18	1·13	1·08	1·03	·99	·96	·92	·89	·86	·83	·81
23	1·64	1·54	1·45	1·37	1·30	1·24	1·18	1·13	1·09	1·04	1·00	·97	·93	·90	·88	·85
23° 28′	1·68	1·57	1·48	1·40	1·33	1·27	1·21	1·16	1·11	1·07	1·03	·99	·96	·92	·90	·87
24	1·72	1·62	1·52	1·44	1·37	1·30	1·24	1·19	1·14	1·09	1·05	1·02	·98	·95	·92	·89
25	1·80	1·69	1·59	1·51	1·43	1·36	1·30	1·24	1·19	1·15	1·10	1·06	1·03	·99	·96	·93
26	1·88	1·77	1·67	1·58	1·50	1·43	1·36	1·30	1·25	1·20	1·15	1·11	1·07	1·04	1·01	·98
27	1·97	1·85	1·74	1·65	1·57	1·49	1·42	1·36	1·30	1·25	1·21	1·16	1·12	1·09	1·05	1·02
28	2·05	1·93	1·82	1·72	1·63	1·55	1·48	1·42	1·36	1·31	1·26	1·21	1·17	1·13	1·10	1·06
29	2·14	2·01	1·90	1·79	1·70	1·62	1·55	1·48	1·42	1·36	1·31	1·26	1·22	1·18	1·14	1·11
30	2·23	2·09	1·97	1·87	1·77	1·69	1·61	1·54	1·48	1·42	1·37	1·32	1·27	1·23	1·19	1·15
Stars. *N. Decln.*																
Procyon	·37	·35	·33	·31	·29	·28	·27	·26	·24	·23	·23	·22	·21	·20	·20	·19
Altair ..	·59	·55	·52	·49	·47	·45	·42	·41	·39	·37	·36	·35	·33	·32	·31	·31
Aldebar'n	1·13	1·06	1·00	·95	·90	·86	·82	·78	·75	·72	·69	·67	·65	·62	·60	·59
Arcturus	1·38	1·30	1·22	1·16	1·10	1·04	1·00	·95	·91	·88	·84	·81	·79	·76	·74	·71
Castor ..	2·42	2·27	2·14	2·03	1·93	1·83	1·75	1·67	1·60	1·54	1·48	1·43	1·38	1·34	1·29	1·25
Vega ..	3·10	2·91	2·74	2·59	2·46	2·34	2·24	2·14	2·05	1·97	1·90	1·83	1·76	1·71	1·65	1·60
Deneb ..	3·86	3·62	3·42	3·23	3·07	2·92	2·79	2·67	2·56	2·46	2·36	2·28	2·20	2·13	2·06	2·00
Capella	3·99	3·74	3·53	3·34	3·17	3·02	2·88	2·76	2·64	2·54	2·44	2·35	2·27	2·20	2·13	2·06
α Persei ..	4·53	4·25	4·01	3·79	3·60	3·43	3·27	3·13	3·00	2·88	2·77	2·67	2·58	2·50	2·42	2·35
η Ursæ Maj.	4·57	4·29	4·04	3·82	3·63	3·46	3·29	3·15	3·02	2·90	2·80	2·70	2·60	2·52	2·44	2·36
ε Ursæ Maj.	5·83	5·47	5·16	4·88	4·63	4·41	4·21	4·03	3·86	3·71	3·57	3·44	3·32	3·21	3·11	3·02
α Ursæ Maj.	7·34	6·89	6·50	6·15	5·83	5·55	5·30	5·07	4·86	4·67	4·50	4·33	4·18	4·05	3·92	3·80
S. Decln.																
Rigel ..	·56	·53	·49	·47	·45	·43	·41	·39	·37	·36	·35	·33	·32	·31	·30	·29
Sirius ..	1·15	1·08	1·02	·96	·92	·87	·83	·80	·76	·73	·71	·68	·66	·63	·61	·60
ε Sagittarii	2·65	2·49	2·34	2·22	2·11	2·00	1·91	1·83	1·75	1·68	1·62	1·56	1·51	1·46	1·41	1·37
λ Scorpii	2·92	2·74	2·58	2·44	3·32	2·21	2·11	2·01	1·93	1·86	1·79	1·72	1·66	1·61	1·56	1·51
γ Argûs ..	4·15	3·90	3·68	3·48	3·30	3·14	3·00	2·87	2·75	2·64	2·54	2·45	2·37	2·29	2·22	1·15
α Gruis ..	4·20	3·94	3·72	3·52	3·34	3·18	3·03	2·90	2·78	2·67	2·57	2·48	2·40	2·32	2·24	2·17
Canopus	5·06	4·75	4·48	4·24	4·02	3·83	3·66	3·50	3·35	3·22	3·10	2·99	2·89	2·79	2·70	2·62
γ Crucis ..	5·86	5·50	5·19	4·91	4·66	4·44	4·23	4·05	3·88	3·73	3·59	3·46	3·34	3·23	3·13	3·03
α Pavonis	5·96	5·59	5·27	4·99	4·73	4·51	4·30	4·11	3·94	3·79	3·65	3·52	3·40	3·28	3·18	3·08
Achernar	6·11	5·74	5·41	5·12	4·86	4·62	4·41	4·22	4·05	3·89	3·74	3·61	3·48	3·37	3·26	3·16
β Crucis / ε Argûs	6·48	6·09	5·74	5·43	5·15	4·91	4·68	4·48	4·29	4·13	3·97	3·83	3·70	3·57	3·46	3·36
β Centauri	6·68	6·27	5·91	5·59	5·31	5·05	4·82	4·61	4·42	4·25	4·09	3·94	3·81	3·68	3·56	3·46
α^2 Centauri	6·82	6·40	6·04	5·71	5·42	5·16	4·92	4·71	4·52	4·34	4·18	4·03	3·89	3·76	3·64	3·53
α^1 Crucis ..	7·45	7·00	6·60	6·24	5·93	5·64	5·38	5·15	4·93	4·74	4·57	4·40	4·25	4·11	3·98	3·86
α Tri. Aus.	9·99	9·38	8·85	8·37	7·95	7·56	7·22	6·91	6·62	6·36	6·12	5·90	5·70	5·51	5·34	5·17
β Argûs ..	10·25	9·62	9·07	8·59	8·15	7·75	7·40	7·08	6·79	6·52	6·28	6·05	5·84	5·65	5·47	5·31
	m. 00 (11 Hr.)	m. 56 (10 Hours.)	m. 52	m. 48	m. 44	m. 40	m. 36	m. 32	m. 28	m. 24	m. 20	m. 16	m. 12	m. 8	m. 4	m. 00

Table A.

When hour angle is less than 6 hours, name the factors taken from Table A *contrary* to name of lat.

Lat.	2 HOURS.															3 Hr.
	m. 00	m. 4	m. 8	m. 12	m. 16	m. 20	m. 24	m. 28	m. 32	m. 36	m. 40	m. 44	m. 48	m. 52	m. 56	m. 00
°	′	′	′	′	′	′	′	′	′	′	′	′	′	′	′	′
0	·00	·00	·00	·00	·00	·00	·00	·00	·00	·00	·00	·00	·00	·00	·00	·00
1	·03	·03	·03	·03	·03	·02	·02	·02	·02	·02	·02	·02	·02	·02	·02	·02
2	·06	·06	·06	·05	·05	·05	·05	·05	·04	·04	·04	·04	·04	·04	·04	·03
3	09	09	·08	·08	·08	·07	·07	·07	·07	·06	·06	·06	·06	·06	·05	·05
4	·12	·12	·11	·11	·10	·10	·10	·09	·09	·09	·08	·08	·08	·07	·07	·07
5	·15	·15	·14	·13	·13	·12	·12	·12	·11	·11	·10	·10	·10	·09	·09	·09
6	·18	·17	·17	·16	·16	15	·14	·14	·13	·13	·13	·12	·12	·11	·11	·11
7	·21	·20	·20	·19	·18	·18	·17	·16	·16	·15	·15	·14	·14	·13	·13	·12
8	·24	·23	·22	·22	·21	·20	·19	·19	·18	·17	·17	·16	·16	·15	·15	·14
9	·27	·26	·25	·24	·23	·23	·22	·21	·20	·20	·19	·18	·18	·17	·16	·16
10	·31	·29	·28	·27	·26	·25	·24	·23	·23	·22	·21	·20	·20	·19	·18	·18
11	·34	·32	·31	·30	·29	·28	·27	·26	·25	·24	·23	·22	·22	·21	·20	·19
12	·37	·35	·34	·33	·32	·30	·29	·28	·27	·26	·25	·24	·24	·23	·22	·21
13	·40	·38	·37	·36	·34	·33	·32	·31	·30	·29	·28	·27	·26	·25	·24	·23
14	·43	·41	·40	·38	·37	·36	·34	·33	·32	·31	·30	·29	·28	·27	·26	·25
15	·46	·45	·43	·41	·40	·38	·37	·36	·34	·33	·32	·31	·30	·29	·28	·27
16	·50	·48	·46	·44	·43	·41	·39	·38	·37	·35	·34	·33	·32	·31	·30	·29
17	·53	·51	·49	·47	·45	·44	·42	·41	·39	·38	·36	·35	·34	·33	·32	·31
18	·56	·54	·52	·50	·48	·46	·45	·43	·42	·40	·39	·37	·36	·35	·34	·32
19	·60	·57	·55	·53	·51	·49	·47	·46	·44	·43	·41	·40	·38	·37	·36	·34
20	·63	·61	·58	·56	·54	·52	·50	·48	·47	·45	·43	·42	·40	·39	·38	·36
21	·66	·64	·61	·59	·57	·55	·53	·51	·49	·47	·46	·44	·43	·41	·40	·38
22	·70	·67	·65	·62	·60	·58	·56	·54	·52	·50	·48	·46	·45	·43	·42	·40
23	·74	·71	·68	·65	·63	·61	·58	·56	·54	·52	·51	·49	·47	·46	·44	·42
24	·77	·74	·71	·69	·66	·64	·61	·59	·57	·55	·53	·51	·49	·48	·46	·45
25	·81	·78	·75	·72	·69	·67	·64	·62	·60	·58	·56	·54	·52	·50	·48	·47
26	·84	·81	·78	·75	·72	70	·67	·65	·62	·60	·58	·56	·54	·52	·51	·49
27	·88	·85	·82	·78	·76	·73	·70	·68	·65	·63	·61	·59	·57	·55	·53	·51
28	·92	·88	·85	·82	·79	·76	·73	·71	·68	·66	·63	·61	·59	·57	·55	·53
29	·96	·92	·89	·85	·82	·79	·76	·74	·71	·68	·66	·64	·62	·59	·57	·55
30	1·00	·96	·92	·89	·86	·82	·79	·77	·74	·71	·69	·66	·64	·62	·60	·58
31	1·04	1·00	·96	·93	·89	·86	·83	80	77	·74	72	·69	·67	·64	·62	·60
32	1·08	1·04	1·00	·96	·93	·89	·86	·83	·80	·77	·74	·72	·69	·67	·65	·62
33	1·12	1·08	1·04	1·00	·96	·93	·89	·86	·83	·80	·77	·75	·72	·70	·67	·65
34	1·17	1·12	1·08	1·04	1·00	·96	·93	·90	·86	83	·80	·78	·75	·72	·70	·67
35	1·21	1·17	1·12	1·08	1·04	1·00	·96	·93	·90	86	·83	·81	·78	·75	·73	·70
36	1·26	1·21	1·16	1·12	1·08	1·04	1·00	·96	·93	·90	·87	·84	·81	·78	·75	·73
37	1·31	1·25	1·21	1·16	1·12	1·08	1·04	1·00	·96	·93	·90	·87	·84	·81	·78	·75
38	1·35	1·30	1·25	1·20	1·16	1·12	1·08	1·04	1·00	·96	·93	·90	·87	·84	·81	·78
39	1·40	1·35	1·30	1·25	1·20	1·16	1·11	1·07	1·04	1·00	·97	·93	·90	·87	·84	·81
40	1·45	1·40	1·34	1·29	1·24	1·20	1·15	1·11	1·07	1·04	1·00	·97	·93	·90	·87	·84
41	1·51	1·45	1·39	1·34	1·29	1·24	1·20	1·15	1·11	1·07	1·04	1·00	·97	·93	·90	·87
42	1·56	1·50	1·44	1·39	1·33	1·29	1·24	1·19	1·15	1·11	1·07	1·04	1·00	·97	·93	·90
43	1·62	1·55	1·49	1·44	1·38	1·33	1·28	1·24	1·19	1·15	1·11	1·07	1·04	1·00	·97	·93
44	1·67	1·61	1·55	1·49	1·43	1·38	1·33	1·28	1·24	1·19	1·15	1·11	1·07	1·04	1·00	·97
45	1·73	1·66	1·60	1·54	1·48	1·43	1·38	1·33	1·28	1·23	1·19	1·15	1·11	1·07	1·04	1·00
46	1·79	1·72	1·66	1·59	1·54	1·48	1·43	1·37	1·33	1·28	1·23	1·19	1·15	1·11	1·07	1·04
47	1·86	1·78	1·72	1·65	1·59	1·53	1·48	1·42	1·37	1·32	1·28	1·23	1·19	1·15	1·11	1·07
48	1·92	1·85	1·78	1·71	1·65	1·59	1·53	1·47	1·42	1·37	1·32	1·28	1·23	1·19	1·15	1·11
49	1·99	1·91	1·84	1·77	1·71	1·64	1·58	1·53	1·47	1·42	1·37	1·32	1·28	1·23	1·19	1·15
50	2·06	1·98	1·91	1·84	1·77	1·70	1·64	1·58	1·53	1·47	1·42	1·37	1·32	1·28	1·23	1·19
51	2·14	2·06	1·98	1·90	1·83	1·76	1·70	1·64	1·58	1·52	1·47	1·42	1·37	1·32	1·28	1·23
52	2·22	2·13	2·05	1·97	1·90	1·83	1·76	1·70	1·64	1·58	1·53	1·47	1·42	1·37	1·33	1·28
53	2·30	2·21	2·12	2·04	1·97	1·90	1·83	1·76	1·70	1·64	1·58	1·53	1·47	1·42	1·37	1·33
54	2·38	2·29	2·20	2·12	2·04	1·97	1·89	1·83	1·76	1·70	1·64	1·58	1·53	1·48	1·43	1·38
55	2·47	2·38	2·29	2·20	2·12	2·04	1·97	1·90	1·83	1·76	1·70	1·64	1·59	1·53	1·48	1·43
56	2·57	2·47	2·37	2·28	2·20	2·12	2·04	1·97	1·90	1·83	1·77	1·71	1·65	1·59	1·54	1·48
57	2·67	2·56	2·46	2·37	2·28	2·20	2·12	2·04	1·97	1·90	1·84	1·77	1·71	1·65	1·59	1·54
58	2·77	2·66	2·56	2·46	2·37	2·29	2·20	2·12	2·05	1·98	1·91	1·84	1·78	1·72	1·66	1·60
59	2·88	2·77	2·66	2·56	2·47	2·38	2·29	2·21	2·13	2·06	1·98	1·91	1·85	1·78	1·72	1·66
60	3·00	2·88	2·77	2·67	2·57	2·47	2·38	2·30	2·22	2·14	2·06	1·99	1·92	1·86	1·79	1·73
	m. 00	m. 56	m. 52	m. 48	m. 44	m. 40	m. 36	m. 32	m. 28	m. 24	m. 20	m. 16	m. 12	m. 8	m. 4	m. 00
	10 Hr.	9 HOURS.														

When hour angle is more than 6 hours, name the factors taken from Table A the *same* as the name of the latitude.

Table B.

Always name the factors taken from Table B the *same* as the name of declination.

Declination.	2 HOURS.															3 Hr.
	m. 00	m. 4	m. 8	m. 12	m. 16	m. 20	m. 24	m. 28	m. 32	m. 36	m. 40	m. 44	m. 48	m. 52	m. 56	m. 00
°	′	′	′	′	′	′	′	′	′	′	′	′	′	′	′	′
0	·00	·00	·00	·00	·00	·00	·00	·00	·00	·00	·00	·00	·00	·00	·00	·00
1	·03	·03	·03	·03	·03	·03	·03	·03	·03	·03	·03	·03	·03	·03	·03	·02
2	·07	·07	·07	·06	·06	·06	·06	·06	·06	·06	·05	·05	·05	·05	·05	·05
3	·10	·10	·10	·10	·09	·09	·09	·09	·09	·08	·08	·08	·08	·08	·08	·07
4	·14	·14	·13	·13	·13	·12	·12	·12	·11	·11	·11	·11	·10	·10	·10	·10
5	·17	·17	·17	·16	·16	·15	·15	·15	·14	·14	·14	·13	·13	·13	·13	·12
6	·21	·20	·20	·19	·19	·18	·18	·17	·17	·17	·16	·16	·16	·15	·15	·15
7	·25	·24	·23	·23	·22	·21	·21	·20	·20	·20	·19	·19	·18	·18	·18	·17
8	·28	·27	·27	·26	·25	·25	·24	·23	·23	·22	·22	·21	·21	·21	·20	·20
9	·32	·31	·30	·29	·28	·28	·27	·26	·26	·25	·25	·24	·24	·23	·23	·22
10	·35	·34	·33	·32	·32	·31	·30	·29	·29	·28	·27	·27	·26	·26	·25	·25
11	·39	·38	·37	·36	·35	·34	·33	·32	·32	·31	·30	·30	·29	·29	·28	·27
12	·43	·41	·40	·39	·38	·37	·36	·35	·35	·34	·33	·32	·32	·31	·31	·30
13	·46	·45	·44	·42	·41	·40	·39	·38	·37	·37	·36	·35	·35	·34	·33	·33
14	·50	·48	·47	·46	·45	·43	·42	·41	·40	·40	·39	·38	·37	·37	·36	·35
15	·54	·52	·51	·49	·48	·47	·46	·45	·44	·43	·42	·41	·40	·39	·39	·38
16	·57	·56	·54	·53	·51	·50	·49	·48	·47	·46	·45	·44	·43	·42	·41	·41
17	·61	·59	·58	·56	·55	·53	·52	·51	·50	·49	·48	·47	·46	·45	·44	·43
18	·65	·63	·61	·60	·58	·57	·55	·54	·53	·52	·51	·50	·49	·48	·47	·46
19	·69	·67	·65	·63	·62	·60	·59	·57	·56	·55	·54	·52	·51	·50	·50	·49
20	·73	·71	·69	·67	·65	·63	·62	·60	·59	·58	·57	·55	·54	·53	·52	·51
21	·77	·75	·72	·70	·69	·67	·65	·64	·62	·61	·60	·59	·57	·56	·55	·54
22	·81	·78	·76	·74	·72	·70	·69	·67	·66	·64	·63	·62	·60	·59	·58	·57
23	·85	·82	·80	·78	·76	·74	·72	·71	·69	·67	·66	·65	·63	·62	·61	·60
23° 28′	·87	·84	·82	·80	·78	·76	·74	·72	·71	·69	·68	·66	·65	·64	·62	·61
24	·89	·86	·84	·82	·80	·78	·76	·74	·72	·71	·69	·68	·67	·65	·64	·63
25	·93	·91	·88	·86	·83	·81	·79	·77	·76	·74	·73	·71	·70	·68	·67	·66
26	·98	·95	·92	·90	·87	·85	·83	·81	·79	·78	·76	·74	·73	·72	·70	·69
27	1·02	·99	·96	·94	·91	·89	·87	·85	·83	·81	·79	·78	·76	·75	·73	·72
28	1·06	1·03	1·00	·98	·95	·93	·90	·88	·86	·84	·83	·81	·79	·78	·77	·75
29	1·11	1·08	1·05	1·02	·99	·97	·94	·92	·90	·88	·86	·84	·83	·81	·80	·78
30	1·15	1·12	1·09	1·06	1·03	1·01	·98	·96	·94	·92	·90	·88	·86	·85	·83	·82
Stars. *N. Decln.*																
Procyon	·19	·19	·18	·18	·17	·17	·16	·16	·16	·15	·15	·15	·14	·14	·14	·14
Altair ..	·31	·30	·29	·28	·27	·26	·26	·25	·25	·24	·24	·23	·23	·22	·22	·21
Aldebar'n	·59	·57	·55	·54	·52	·51	·50	·49	·48	·47	·46	·45	·44	·43	·42	·41
Arcturus	·71	·69	·67	·66	·64	·62	·61	·59	·58	·57	·56	·54	·53	·52	·51	·51
Castor ..	1·25	1·22	1·18	1·15	1·12	1·09	1·07	1·04	1·02	1·00	·98	·96	·94	·92	·90	·89
Vega ..	1·60	1·56	1·51	1·47	1·43	1·40	1·36	1·33	1·30	1·27	1·25	1·22	1·20	1·17	1·15	1·13
Deneb ..	2·00	1·94	1·88	1·83	1·79	1·74	1·70	1·66	1·62	1·59	1·55	1·52	1·49	1·46	1·44	1·41
Capella	2·06	2·00	1·95	1·90	1·85	1·80	1·76	1·72	1·68	1·64	1·61	1·57	1·54	1·51	1·49	1·46
α Persei ..	2·35	2·28	2·21	2·15	2·10	2·04	1·99	1·95	1·90	1·86	1·82	1·79	1·75	1·72	1·69	1·66
η Ursæ Maj.	2·36	2·29	2·23	2·17	2·11	2·06	2·01	1·96	1·92	1·88	1·84	1·80	1·77	1·73	1·70	1·67
ε Ursæ Maj.	3·02	2·93	2·85	2·77	2·70	2·63	2·57	2·51	2·45	2·40	2·35	2·30	2·25	2·21	2·17	2·13
α Ursæ Maj.	3·80	3·69	3·58	3·49	3·40	3·31	3·23	3·16	3·09	3·02	2·96	2·90	2·84	2·79	2·73	2·69
S. Decln.																
Rigel ..	·29	·28	·28	·27	·26	·25	·25	·24	·24	·23	·23	·22	·22	·21	·21	·21
Sirius ..	·60	·58	·56	·55	·53	·52	·51	·50	·48	·47	·46	·45	·45	·44	·43	·42
ε Sagittarii	1·37	1·33	1·29	1·26	1·23	1·19	1·17	1·14	1·11	1·09	1·07	1·04	1·02	1·00	·99	·97
λ Scorpii	1·51	1·47	1·42	1·39	1·35	1·32	1·28	1·25	1·23	1·20	1·17	1·15	1·13	1·11	1·09	1·07
γ Argûs ..	2·15	2·09	2·03	1·97	1·92	1·87	1·83	1·79	1·75	1·71	1·67	1·64	1·61	1·58	1·55	1·52
α Gruis ..	2·17	2·11	2·05	2·00	1·94	1·90	1·85	1·81	1·77	1·73	1·69	1·66	1·63	1·59	1·57	1·54
Canopus	2·62	2·54	2·47	2·41	2·34	2·28	2·23	2·18	2·13	2·08	2·04	2·00	1·96	1·92	1·89	1·85
γ Crucis ..	3·03	2·95	2·86	2·79	2·71	2·64	2·58	2·52	2·46	2·41	2·36	2·31	2·27	2·22	2·18	2·15
α Pavonis	3·08	2·99	2·91	2·83	2·76	2·69	2·62	2·56	2·50	2·45	2·40	2·35	2·30	2·26	2·22	2·18
Achernar	3·16	3·07	2·98	2·90	2·83	2·76	2·69	2·63	2·57	2·51	2·46	2·41	2·36	2·32	2·28	2·24
β Crucis } ε Argûs }	3·36	3·26	3·17	3·08	3·00	2·93	2·85	2·79	2·73	2·67	2·61	2·56	2·51	2·46	2·42	2·37
β Centauri	3·46	3·35	3·26	3·17	3·09	3·01	2·94	2·87	2·81	2·74	2·69	2·63	2·58	2·53	2·49	2·44
α^2 Centauri	3·53	3·43	3·33	3·24	3·16	3·08	3·00	2·93	2·87	2·80	2·75	2·69	2·64	2·59	2·54	2·50
α^1 Crucis ..	3·86	3·75	3·64	3·54	3·45	3·36	3·28	3·21	3·13	3·07	3·00	2·94	2·88	2·83	2·78	2·73
α Tri. Aus.	5·17	5·02	4·88	4·75	4·63	4·51	4·40	4·30	4·20	4·11	4·02	3·94	3·87	3·79	3·72	3·66
β Argûs ..	5·31	5·15	5·01	4·87	4·74	4·63	4·51	4·41	4·31	4·22	4·13	4·04	3·96	3·89	3·82	3·75
	m. 00	m. 56	m. 52	m. 48	m. 44	m. 40	m. 36	m. 32	m. 28	m. 24	m. 20	m. 16	m. 12	m. 8	m. 4	m. 00
	10 Hr.	9 HOURS.														

Table A.

When hour angle is less than 6 hours, name the factors taken from Table A *contrary* to name of lat.

Lat.	3 HOURS.															4 Hr.
	m. 00	m. 4	m. 8	m. 12	m. 16	m. 20	m. 24	m. 28	m. 32	m. 36	m. 40	m. 44	m. 48	m. 52	m. 56	m. 00
°	′	′	′	′	′	′	′	′	′	′	′	′	′	′	′	′
0	·00	·00	·00	·00	·00	·00	·00	·00	·00	·00	·00	·00	·00	·00	·00	·00
1	·02	·02	·02	·02	·02	·01	·01	·01	·01	·01	·01	·01	·01	·01	·01	·01
2	·03	·03	·03	·03	·03	·03	·03	·03	·03	·03	·02	·02	·02	·02	·02	·02
3	·05	·05	·05	·05	·05	·04	·04	·04	·04	·04	·04	·04	·03	·03	·03	·03
4	·07	·07	·07	·06	·06	·06	·06	·05	·05	·05	·05	·05	·05	·04	·04	·04
5	·09	·08	·08	·08	·08	·07	·07	·07	·07	·06	·06	·06	·06	·05	·05	·05
6	·11	·10	·10	·09	·09	·09	·09	·08	·08	·08	·07	·07	·07	·07	·06	·06
7	·12	·12	·11	·11	·11	·10	·10	·10	·09	·09	·09	·08	·08	·08	·07	·07
8	·14	·14	·13	·13	·12	·12	·11	·11	·11	·10	·10	·09	·09	·09	·08	·08
9	·16	·15	·15	·14	·14	·13	·13	·12	·12	·12	·11	·11	·10	·10	·10	·09
10	·18	·17	·16	·16	·15	·15	·14	·14	·13	·13	·12	·12	·11	·11	·11	·10
11	·19	·19	·18	·18	·17	·16	·16	·15	·15	·14	·14	·13	·13	·12	·12	·11
12	·21	·21	·20	·19	·18	·18	·17	·17	·16	·15	·15	·14	·14	·13	·13	·12
13	·23	·22	·22	·21	·20	·19	·19	·18	·17	·17	·16	·16	·15	·14	·14	·13
14	·25	·24	·23	·22	·22	·21	·20	·19	·19	·18	·17	·17	·16	·16	·15	·14
15	·27	·26	·25	·24	·23	·22	·22	·21	·20	·19	·19	·18	·17	·17	·16	·15
16	·29	·28	·27	·26	·25	·24	·23	·22	·22	·21	·20	·19	·19	·18	·17	·17
17	·31	·30	·29	·28	·27	·26	·25	·24	·23	·22	·21	·21	·20	·19	·18	·18
18	·32	·31	·30	·29	·28	·27	·26	·25	·24	·24	·23	·22	·21	·20	·20	·19
19	·34	·33	·32	·31	·30	·29	·28	·27	·26	·25	·24	·23	·22	·22	·21	·20
20	·36	·35	·34	·33	·32	·31	·29	·28	·27	·26	·25	·25	·24	·23	·22	·21
21	·38	·37	·36	·35	·33	·32	·31	·30	·29	·28	·27	·26	·25	·24	·23	·22
22	·40	·39	·38	·36	·35	·34	·33	·32	·30	·29	·28	·27	·26	·25	·24	·23
23	·42	·41	·40	·38	·37	·36	·34	·33	·32	·31	·30	·29	·28	·27	·25	·25
24	·45	·43	·42	·40	·39	·37	·36	·35	·34	·32	·31	·30	·29	·28	·27	·26
25	·47	·45	·43	·42	·41	·39	·38	·36	·35	·34	·33	·31	·30	·29	·28	·27
26	·49	·47	·45	·44	·42	·41	·39	·38	·37	·35	·34	·33	·32	·30	·29	·28
27	·51	·49	·48	·46	·44	·43	·41	·40	·38	·37	·36	·34	·33	·32	·31	·29
28	·53	·51	·50	·48	·46	·45	·43	·42	·40	·39	·37	·36	·35	·33	·32	·31
29	·55	·54	·52	·50	·48	·47	·45	·43	·42	·40	·39	·37	·36	·35	·33	·32
30	·58	·56	·54	·52	·50	·48	·47	·45	·44	·42	·40	·39	·37	·36	·35	·33
31	·60	·58	·56	·54	·52	·50	·49	·47	·45	·44	·42	·41	·39	·38	·36	·35
32	·62	·60	·58	·56	·54	·52	·51	·49	·47	·45	·44	·42	·41	·39	·38	·36
33	·65	·63	·61	·58	·56	·54	·53	·51	·49	·47	·45	·44	·42	·41	·39	·37
34	·67	·65	·63	·61	·59	·57	·55	·53	·51	·49	·47	·45	·44	·42	·41	·39
35	·70	·68	·65	·63	·61	·59	·57	·55	·53	·51	·49	·47	·45	·44	·42	·40
36	·73	·70	·68	·65	·63	·61	·59	·57	·55	·53	·51	·49	·47	·45	·44	·42
37	·75	·73	·70	·68	·66	·63	·61	·59	·57	·55	·53	·51	·49	·47	·45	·44
38	·78	·75	·73	·70	·68	·66	·63	·61	·59	·57	·55	·53	·51	·49	·47	·45
39	·81	·78	·75	·73	·70	·68	·66	·63	·61	·59	·57	·55	·53	·51	·49	·47
40	·84	·81	·78	·76	·73	·70	·68	·66	·63	·61	·59	·57	·54	·52	·50	·48
41	·87	·84	·81	·78	·76	·73	·70	·68	·65	·63	·61	·59	·56	·54	·52	·50
42	·90	·87	·84	·81	·78	·76	·73	·70	·68	·65	·63	·61	·58	·56	·54	·52
43	·93	·90	·87	·84	·81	·78	·76	·73	·70	·68	·65	·63	·61	·58	·56	·54
44	·97	·93	·90	·87	·84	·81	·78	·75	·73	·70	·68	·65	·63	·60	·58	·56
45	1·00	·97	·93	·90	·87	·84	·81	·78	·75	·73	·70	·67	·65	·62	·60	·58
46	1·04	1·00	·97	·93	·90	·87	·84	·81	·78	·75	·73	·70	·67	·65	·62	·60
47	1·07	1·04	1·00	·97	·93	·90	·87	·84	·81	·78	·75	·72	·70	·67	·64	·62
48	1·11	1·07	1·04	1·00	·97	·93	·90	·87	·84	·81	·78	·75	·72	·69	·67	·64
49	1·15	1·11	1·07	1·04	1·00	·97	·93	·90	·87	·84	·80	·78	·75	·72	·69	·66
50	1·19	1·15	1·11	1·07	1·04	1·00	·97	·93	·90	·87	·83	·80	·77	·74	·72	·69
51	1·23	1·19	1·15	1·11	1·07	1·04	1·00	·96	·93	·90	·86	·83	·80	·77	·74	·71
52	1·28	1·24	1·19	1·15	1·11	1·07	1·04	1·00	·96	·93	·90	·86	·83	·80	·77	·74
53	1·33	1·28	1·24	1·19	1·15	1·11	1·07	1·04	1·00	·96	·93	·90	·86	·83	·80	·77
54	1·38	1·33	1·28	1·24	1·20	1·15	1·11	1·08	1·04	1·00	·96	·93	·89	·86	·83	·79
55	1·43	1·38	1·33	1·29	1·24	1·20	1·16	1·12	1·08	1·04	1·00	·96	·93	·89	·86	·82
56	1·48	1·43	1·38	1·33	1·29	1·24	1·20	1·16	1·12	1·08	1·04	1·00	·96	·93	·89	·86
57	1·54	1·49	1·44	1·39	1·34	1·29	1·25	1·20	1·16	1·12	1·08	1·04	1·00	·96	·93	·89
58	1·60	1·55	1·49	1·44	1·39	1·34	1·30	1·25	1·21	1·16	1·12	1·08	1·04	1·00	·96	·92
59	1·66	1·61	1·55	1·50	1·45	1·40	1·35	1·30	1·25	1·21	1·17	1·12	1·08	1·04	1·00	·96
60	1·73	1·67	1·62	1·56	1·51	1·45	1·40	1·35	1·31	1·26	1·21	1·17	1·12	1·08	1·04	1·00
	m. 00	m. 56	m. 52	m. 48	m. 44	m. 40	m. 36	m. 32	m. 28	m. 24	m. 20	m. 16	m. 12	m. 8	m. 4	m. 00
	9 Hr.	8 HOURS.														

When hour angle is more than 6 hours, name the factors taken from Table A the *same* as the name of the latitude.

Table B.

Always **name the factors taken from Table B** the *same* as the name of declination.

Declination.	3 HOURS. m. 00	m. 4	m. 8	m. 12	m. 16	m. 20	m. 24	m. 28	m. 32	m. 36	m. 40	m. 44	m. 48	m. 52	m. 56	4 Hr. m. 00
°	′	′	′	′	′	′	′	′	′	′	′	′	′	′	′	′
0	·00	·00	·00	·00	·00	·00	·00	·00	·00	·00	·00	·00	·00	·00	·00	·00
1	·02	·02	·02	·02	·02	·02	·02	·02	·02	·02	·02	·02	·02	·02	·02	·02
2	·05	·05	·05	·05	·05	·05	·04	·04	·04	·04	·04	·04	·04	·04	·04	·04
3	·07	·07	·07	·07	·07	·07	·07	·07	·07	·06	·06	·06	·06	·06	·06	·06
4	·10	·10	·10	·09	·09	·09	·09	·09	·09	·09	·09	·08	·08	·08	·08	·08
5	·12	·12	·12	·12	·12	·11	·11	·11	·11	·11	·11	·11	·10	·10	·10	·10
6	·15	·15	·14	·14	·14	·14	·14	·13	·13	·13	·13	·13	·13	·12	·12	·12
7	·17	·17	·17	·17	·16	·16	·16	·16	·15	·15	·15	·15	·15	·14	·14	·14
8	·20	·20	·19	·19	·19	·18	·18	·18	·18	·17	·17	·17	·17	·17	·16	·16
9	·22	·22	·22	·21	·21	·21	·20	·20	·20	·20	·19	·19	·19	·19	·18	·18
10	·25	·25	·24	·24	·23	·23	·23	·22	·22	·22	·22	·21	·21	·21	·21	·20
11	·27	·27	·27	·26	·26	·25	·25	·25	·24	·24	·24	·23	·23	·23	·23	·22
12	·30	·30	·29	·29	·28	·28	·27	·27	·27	·26	·26	·26	·25	·25	·25	·25
13	·33	·32	·32	·31	·31	·30	·30	·29	·29	·29	·28	·28	·28	·27	·27	·27
14	·35	·35	·34	·34	·33	·33	·32	·32	·31	·31	·30	·30	·30	·29	·29	·29
15	·38	·37	·37	·36	·36	·35	·34	·34	·34	·33	·33	·32	·32	·32	·31	·31
16	·41	·40	·39	·39	·38	·37	·37	·36	·36	·35	·35	·35	·34	·34	·33	·33
17	·43	·43	·42	·41	·41	·40	·39	·39	·38	·38	·37	·37	·36	·36	·36	·35
18	·46	·45	·44	·44	·43	·42	·42	·41	·41	·40	·40	·39	·39	·38	·38	·38
19	·49	·48	·47	·46	·46	·45	·44	·44	·43	·43	·42	·42	·41	·41	·40	·40
20	·51	·51	·50	·49	·48	·48	·47	·46	·46	·45	·44	·44	·43	·43	·42	·42
21	·54	·53	·52	·52	·51	·50	·49	·49	·48	·47	·47	·46	·46	·45	·45	·44
22	·57	·56	·55	·54	·54	·53	·52	·51	·51	·50	·49	·49	·48	·48	·47	·47
23	·60	·59	·58	·57	·56	·55	·55	·54	·53	·52	·52	·51	·51	·50	·50	·49
23° 28′	·61	·60	·59	·58	·58	·57	·56	·55	·54	·54	·53	·52	·52	·51	·51	·50
24	·63	·62	·61	·60	·59	·58	·57	·57	·56	·55	·54	·54	·53	·53	·52	·51
25	·66	·65	·64	·63	·62	·61	·60	·59	·58	·58	·57	·56	·56	·55	·54	·54
26	·69	·68	·67	·66	·65	·64	·63	·62	·61	·60	·60	·59	·58	·58	·57	·56
27	·72	·71	·70	·69	·68	·67	·66	·65	·64	·63	·62	·61	·61	·60	·59	·59
28	·75	·74	·73	·72	·70	·69	·68	·67	·67	·66	·65	·64	·63	·63	·62	·61
29	·78	·77	·76	·75	·73	·72	·71	·70	·69	·69	·68	·67	·66	·65	·65	·64
30	·82	·80	·79	·78	·76	·75	·74	·73	·72	·71	·70	·70	·69	·68	·67	·67
Stars. *N. Decln.*																
Procyon	·14	·13	·13	·13	·13	·12	·12	·12	·12	·12	·12	·12	·11	·11	·11	·11
Altair ..	·21	·21	·21	·20	·20	·20	·20	·19	·19	·19	·19	·18	·18	·18	·18	·18
Aldebar'n	·41	·41	·40	·39	·39	·38	·38	·37	·37	·36	·36	·35	·35	·35	·34	·34
Arcturus	·51	·50	·49	·48	·47	·47	·46	·45	·45	·44	·44	·43	·43	·42	·42	·41
Castor ..	·89	·87	·86	·84	·83	·82	·81	·80	·79	·77	·77	·76	·75	·74	·73	·72
Vega ..	1·13	1·11	1·10	1·08	1·06	1·05	1·03	1·02	1·00	·99	·98	·97	·96	·94	·93	·93
Deneb ..	1·41	1·39	1·37	1·34	1·32	1·30	1·28	1·27	1·25	1·23	1·22	1·20	1·19	1·18	1·16	1·15
Capella	1·46	1·43	1·41	1·39	1·37	1·35	1·33	1·31	1·29	1·28	1·26	1·25	1·23	1·22	1·20	1·19
α Persei ..	1·66	1·63	1·60	1·58	1·55	1·53	1·51	1·49	1·47	1·45	1·43	1·41	1·40	1·38	1·37	1·35
η Ursæ Maj.	1·67	1·64	1·62	1·59	1·57	1·54	1·52	1·50	1·48	1·46	1·44	1·43	1·41	1·39	1·38	1·36
ε Ursæ Maj.	2·13	2·10	2·06	2·03	2·00	1·97	1·94	1·91	1·89	1·86	1·84	1·82	1·80	1·78	1·76	1·74
α Ursæ Maj.	2·69	2·64	2·60	2·56	2·52	2·48	2·44	2·41	2·38	2·35	2·32	2·29	2·27	2·24	2·22	2·19
S. Decln.																
Rigel ..	·21	·20	·20	·20	·19	·19	·19	·19	·18	·18	·18	·18	·17	·17	·17	·17
Sirius ..	·42	·41	·41	·40	·39	·39	·38	·38	·37	·37	·36	·36	·36	·35	·35	·34
ε Sagittarii	·97	·95	·94	·92	·91	·89	·88	·87	·86	·85	·84	·83	·82	·81	·80	·79
λ Scorpii	1·07	1·05	1·03	1·02	1·00	·99	·97	·96	·94	·93	·92	·91	·90	·89	·88	·87
γ Argûs ..	1·52	1·49	1·47	1·45	1·42	1·40	1·38	1·36	1·35	1·33	1·31	1·30	1·28	1·27	1·25	1·24
α Gruis ..	1·54	1·51	1·49	1·46	1·44	1·42	1·40	1·38	1·36	1·34	1·33	1·31	1·30	1·28	1·27	1·26
Canopus	1·85	1·82	1·79	1·76	1·74	1·71	1·69	1·66	1·64	1·62	1·60	1·58	1·56	1·54	1·53	1·51
γ Crucis ..	2·15	2·11	2·07	2·04	2·01	1·98	1·95	1·93	1·90	1·88	1·85	1·83	1·81	1·79	1·77	1·75
α Pavonis	2·18	2·14	2·11	2·07	2·04	2·01	1·98	1·96	1·93	1·91	1·88	1·86	1·84	1·82	1·80	1·78
Achernar	2·24	2·20	2·16	2·13	2·10	2·06	2·03	2·01	1·98	1·95	1·93	1·91	1·89	1·86	1·84	1·83
β Crucis } ε Argûs }	2·37	2·33	2·29	2·26	2·22	2·19	2·16	2·13	2·10	2·07	2·05	2·02	2·00	1·98	1·96	1·94
β Centauri	2·44	2·40	2·36	2·32	2·29	2·26	2·22	2·19	2·16	2·14	2·11	2·08	2·06	2·04	2·02	2·00
α^2 Centauri	2·50	2·45	2·41	2·37	2·34	2·30	2·27	2·24	2·21	2·18	2·15	2·13	2·10	2·08	2·06	2·04
α^1 Crucis ..	2·73	2·68	2·64	2·60	2·56	2·52	2·48	2·45	2·42	2·38	2·36	2·33	2·30	2·27	2·25	2·23
α Tri. Aus.	3·66	3·60	3·54	3·48	3·43	3·38	3·33	3·28	3·24	3·20	3·16	3·12	3·08	3·05	3·02	2·99
β Argûs ..	3·75	3·69	3·63	3·57	3·52	3·46	3·41	3·37	3·32	3·28	3·24	3·20	3·16	3·13	3·10	3·06
	m. 00 (9 Hr.)	m. 56 (8 HOURS.)	m. 52	m. 48	m. 44	m. 40	m. 36	m. 32	m. 28	m. 24	m. 20	m. 16	m. 12	m. 8	m. 4	m. 00

Table A.

When hour angle is less than 6 hours, name the factors taken from Table A *contrary* to name of lat.

Lat.	4 HOURS.															5 Hr.
	m. 00	m. 4	m. 8	m. 12	m. 16	m. 20	m. 24	m. 28	m. 32	m. 36	m. 40	m. 44	m. 48	m. 52	m. 56	m. 00
°	′	′	′	′	′	′	′	′	′	′	′	′	′	′	′	′
0	·000	·000	·000	·000	·000	·000	·000	·000	·000	·000	·000	·000	·000	·000	·000	·000
1	·010	·010	·009	·009	·009	·008	·008	·007	·007	·007	·006	·006	·006	·005	·005	·005
2	·020	·019	·019	·018	·017	·016	·016	·015	·014	·013	·013	·012	·011	·011	·010	·009
3	·030	·029	·028	·027	·026	·024	·023	·022	·021	·020	·019	·018	·017	·016	·015	·014
4	·040	·039	·037	·036	·034	·033	·031	·030	·028	·027	·025	·024	·023	·021	·020	·019
5	·051	·048	·047	·045	·043	·041	·039	·037	·035	·034	·032	·030	·028	·027	·025	·023
6	·061	·058	·056	·054	·051	·049	·047	·045	·042	·040	·038	·036	·034	·032	·030	·028
7	·071	·068	·065	·063	·060	·057	·055	·052	·050	·047	·045	·042	·040	·038	·035	·033
8	·081	·078	·075	·072	·069	·066	·063	·060	·057	·054	·051	·048	·046	·043	·040	·038
9	·091	·088	·084	·081	·077	·074	·071	·067	·064	·061	·058	·055	·051	·048	·045	·042
10	·102	·098	·094	·090	·086	·082	·079	·075	·071	·068	·064	·061	·057	·054	·051	·047
11	·112	·108	·103	·099	·095	·091	·087	·083	·079	·075	·071	·067	·063	·059	·056	·052
12	·123	·118	·113	·108	·104	·099	·095	·090	·086	·082	·077	·073	·069	·065	·061	·057
13	·133	·128	·123	·118	·113	·108	·103	·098	·093	·089	·084	·079	·075	·071	·066	·062
14	·144	·138	·133	·127	·122	·116	·111	·106	·101	·096	·091	·086	·081	·076	·071	·067
15	·155	·149	·142	·137	·131	·125	·119	·114	·108	·103	·098	·092	·087	·082	·077	·072
16	·166	·159	·152	·146	·140	·134	·128	·122	·116	·110	·104	·099	·093	·088	·082	·077
17	·177	·169	·163	·156	·149	·143	·136	·130	·124	·117	·111	·105	·099	·093	·088	·082
18	·188	·180	·173	·166	·158	·152	·145	·138	·131	·125	·118	·112	·106	·099	·093	·087
19	·199	·191	·183	·175	·168	·161	·153	·146	·139	·132	·125	·119	·112	·105	·099	·092
20	·210	·202	·194	·185	·178	·170	·162	·154	·147	·140	·132	·125	·118	·111	·104	·098
21	·222	·213	·204	·196	·187	·179	·171	·163	·155	·147	·140	·132	·125	·117	·110	·103
22	·233	·224	·215	·206	·197	·188	·180	·171	·163	·155	·147	·139	·131	·124	·116	·108
23	·245	·235	·226	·216	·207	·198	·189	·180	·171	·163	·154	·146	·138	·130	·122	·114
24	·257	·247	·237	·227	·217	·208	·198	·189	·180	·171	·162	·153	·145	·136	·128	·119
25	·269	·258	·248	·238	·227	·217	·208	·198	·188	·179	·170	·161	·152	·143	·134	·125
26	·282	·270	·259	·249	·238	·227	·217	·207	·197	·187	·178	·168	·158	·149	·140	·131
27	·294	·282	·271	·260	·249	·238	·227	·216	·206	·196	·185	·175	·166	·156	·146	·137
28	·307	·295	·283	·271	·259	·248	·237	·226	·215	·204	·194	·183	·173	·163	·152	·142
29	·320	·307	·295	·282	·270	·258	·247	·235	·224	·213	·202	·191	·180	·169	·159	·149
30	·333	·320	·307	·294	·282	·269	·257	·245	·233	·222	·210	·199	·188	·177	·166	·155
31	·347	·333	·319	·306	·293	·280	·268	·255	·243	·231	·219	·207	·195	·184	·172	·161
32	·361	·346	·332	·318	·305	·291	·278	·265	·252	·240	·227	·215	·203	·191	·179	·167
33	·375	·360	·345	·331	·317	·303	·289	·276	·262	·249	·236	·224	·211	·199	·186	·174
34	·389	·374	·359	·344	·329	·315	·300	·286	·273	·259	·246	·232	·219	·206	·193	·181
35	·404	·388	·372	·357	·342	·327	·312	·297	·283	·269	·255	·241	·228	·214	·201	·188
36	·419	·403	·386	·370	·354	·339	·323	·308	·294	·279	·264	·250	·236	·222	·208	·195
37	·435	·418	·401	·384	·368	·351	·336	·320	·304	·289	·274	·259	·245	·230	·216	·202
38	·451	·433	·415	·398	·381	·364	·348	·332	·316	·300	·284	·269	·254	·239	·224	·209
39	·468	·449	·431	·413	·395	·378	·361	·344	·327	·311	·295	·279	·263	·248	·232	·217
40	·484	·465	·446	·428	·409	·391	·374	·356	·339	·322	·305	·289	·273	·257	·241	·225
41	·502	·482	·462	·443	·424	·405	·387	·369	·351	·334	·316	·299	·282	·266	·249	·233
42	·520	·499	·479	·459	·439	·420	·401	·382	·364	·346	·328	·310	·293	·275	·258	·241
43	·538	·517	·496	·475	·455	·435	·415	·396	·377	·358	·339	·321	·303	·285	·267	·250
44	·558	·535	·513	·492	·471	·450	·430	·410	·390	·371	·351	·333	·314	·295	·277	·259
45	·577	·554	·532	·510	·488	·466	·445	·424	·404	·384	·364	·344	·325	·306	·287	·268
46	·598	·574	·551	·528	·505	·483	·461	·440	·418	·398	·377	·357	·336	·317	·297	·277
47	·619	·594	·570	·546	·523	·500	·477	·455	·433	·412	·390	·369	·348	·328	·307	·287
48	·641	·616	·591	·566	·542	·518	·494	·471	·449	·426	·404	·382	·361	·340	·318	·298
49	·664	·638	·612	·586	·561	·536	·512	·488	·465	·442	·419	·396	·374	·352	·330	·308
50	·688	·661	·634	·607	·581	·556	·531	·506	·481	·457	·434	·410	·387	·364	·342	·319
51	·713	·685	·657	·629	·602	·576	·550	·524	·499	·474	·449	·425	·401	·378	·354	·331
52	·739	·709	·681	·652	·624	·597	·570	·543	·517	·491	·466	·441	·416	·391	·367	·343
53	·766	·736	·706	·676	·647	·619	·591	·563	·536	·509	·483	·457	·431	·406	·381	·356
54	·795	·763	·732	·701	·671	·642	·613	·584	·556	·528	·501	·474	·447	·421	·395	·369
55	·825	·792	·759	·728	·697	·666	·636	·606	.577	·548	·520	·492	·464	·437	·410	·383
56	·856	·822	·788	·755	·723	·691	·660	·629	·599	·569	·540	·510	·482	·453	·425	·397
57	·889	·854	·819	·785	·751	·718	·686	·654	·622	·591	·560	·530	·500	·471	·442	·413
58	·924	·887	·851	·815	·781	·746	·713	·679	·647	·614	·582	·551	·520	·489	·459	·429
59	·961	·923	·885	·848	·812	·776	·741	·706	·672	·639	·606	·573	·541	·509	·477	·446
60	1·000	·960	·921	·883	·845	·808	·771	·735	·700	·665	·630	·596	·563	·530	·497	·464
	m. 00	m. 56	m. 52	m. 48	m. 44	m. 40	m. 36	m. 32	m. 28	m. 24	m. 20	m. 16	m. 12	m. 8	m. 4	m. 0
	8 Hr.	7 HOURS.														

When hour angle is more than 6 hours, name the factors taken from Table A the *same* as the name of the latitude.

Table B.

Always name the factors taken from Table B the *same* as the name of declination.

Declination.	4 HOURS.															5 Hr.
	m. 00	m. 4	m. 8	m. 12	m. 16	m. 20	m. 24	m. 28	m. 32	m. 36	m. 40	m. 44	m. 48	m. 52	m. 56	m. 00
°	′	′	′	′	′	′	′	′	′	′	′	′	′	′	′	′
0	·000	·000	·000	·000	·000	·000	·000	·000	·000	·000	·000	·000	·000	·000	·000	·000
1	·020	·020	·020	·020	·019	·019	·019	·019	·019	·019	·019	·018	·018	·018	·018	·018
2	·040	·040	·040	·039	·039	·039	·038	·038	·038	·037	·037	·037	·037	·037	·036	·036
3	·061	·060	·059	·059	·058	·058	·057	·057	·057	·056	·056	·055	·055	·055	·055	·054
4	·081	·080	·079	·078	·078	·077	·077	·076	·075	·075	·074	·074	·074	·073	·073	·072
5	·101	·100	·099	·098	·097	·097	·096	·095	·094	·094	·093	·093	·092	·091	·091	·091
6	·121	·120	·119	·118	·117	·116	·115	·114	·113	·113	·112	·111	·111	·110	·109	·109
7	·142	·140	·139	·138	·137	·135	·134	·133	·132	·132	·131	·130	·129	·128	·128	·127
8	·162	·161	·159	·158	·156	·155	·154	·153	·152	·151	·150	·149	·148	·147	·146	·145
9	·183	·181	·179	·178	·176	·175	·173	·172	·171	·170	·169	·168	·167	·166	·165	·164
10	·204	·202	·200	·198	·196	·195	·193	·192	·190	·189	·188	·186	·185	·184	·183	·183
11	·224	·222	·220	·218	·216	·214	·213	·211	·210	·208	·207	·206	·204	·203	·202	·201
12	·245	·243	·241	·239	·236	·235	·233	·231	·229	·228	·226	·225	·223	·222	·221	·220
13	·267	·264	·261	·259	·257	·255	·253	·251	·249	·247	·246	·244	·243	·241	·240	·239
14	·288	·285	·282	·280	·277	·275	·273	·271	·269	·267	·265	·264	·262	·261	·259	·258
15	·309	·306	·303	·301	·298	·296	·293	·291	·289	·287	·285	·283	·282	·280	·279	·277
16	·331	·328	·325	·322	·319	·316	·314	·312	·309	·307	·305	·303	·302	·300	·298	·297
17	·353	·350	·346	·343	·340	·337	·335	·332	·330	·327	·325	·323	·321	·320	·318	·317
18	·375	·371	·368	·365	·362	·359	·356	·353	·350	·348	·346	·344	·342	·340	·338	·336
19	·398	·394	·390	·386	·383	·380	·377	·374	·371	·369	·366	·364	·362	·360	·358	·356
20	·420	·416	·412	·408	·405	·402	·398	·395	·393	·390	·387	·385	·383	·381	·379	·377
21	·443	·439	·435	·431	·427	·424	·420	·417	·414	·411	·408	·406	·404	·401	·399	·397
22	·467	·462	·458	·453	·450	·446	·442	·439	·436	·433	·430	·427	·425	·422	·420	·418
23	·490	·485	·481	·476	·472	·468	·465	·461	·458	·455	·452	·449	·446	·444	·442	·439
23° 28′	·501	·496	·492	·487	·483	·479	·475	·472	·468	·465	·462	·459	·456	·454	·452	·449
24	·514	·509	·504	·500	·495	·491	·487	·484	·480	·477	·474	·471	·468	·466	·463	·461
25	·538	·533	·528	·523	·519	·515	·510	·507	·503	·499	·496	·493	·490	·488	·485	·483
26	·563	·558	·552	·547	·543	·538	·534	·530	·526	·522	·519	·516	·513	·510	·507	·505
27	·588	·583	·577	·572	·567	·562	·558	·554	·550	·546	·542	·539	·536	·533	·530	·527
28	·614	·608	·602	·597	·592	·587	·582	·578	·573	·570	·566	·562	·559	·556	·553	·550
29	·640	·634	·628	·622	·617	·612	·607	·602	·598	·594	·590	·586	·583	·580	·577	·574
30	·667	·660	·654	·648	·642	·637	·632	·627	·623	·618	·614	·611	·607	·604	·601	·598
Stars.																
N. Decln.																
Procyon	·110	·109	·108	·107	·106	·105	·105	·104	·103	·102	·102	·101	·100	·100	·099	·099
Altair ..	·175	·174	·172	·170	·169	·167	·166	·165	·164	·163	·161	·160	·160	·159	·158	·157
Aldebar'n	·338	·335	·332	·329	·326	·323	·321	·318	·316	·314	·312	·310	·308	·306	·305	·303
Arcturus	·412	·408	·405	·401	·397	·394	·391	·388	·385	·383	·380	·378	·376	·373	·372	·370
Castor ..	·724	·717	·710	·704	·698	·692	·686	·681	·676	·672	·667	·663	·659	·656	·652	·649
Vega ..	·925	·916	·907	·899	·891	·884	·877	·870	·864	·858	·852	·847	·842	·838	·833	·829
Deneb ..	1·15	1·14	1·13	1·12	1·11	1·10	1·09	1·08	1·08	1·07	1·06	1·06	1·05	1·04	1·04	1·03
Capella	1·19	1·18	1·17	1·16	1·15	1·14	1·13	1·12	1·11	1·11	1·10	1·09	1·09	1·08	1·07	1·07
α Persei ..	1·35	1·34	1·33	1·32	1·30	1·29	1·28	1·27	1·26	1·26	1·25	1·24	1·23	1·23	1·22	1·21
η Ursæ Maj	1·36	1·35	1·34	1·33	1·31	1·30	1·29	1·28	1·27	1·27	1·26	1·25	1·24	1·24	1·23	1·22
ε Ursæ Maj.	1·74	1·72	1·71	1·69	1·68	1·66	1·65	1·64	1·63	1·62	1·60	1·59	1·59	1·58	1·57	1·56
α Ursæ Maj	2·19	2·17	2·15	2·13	2·11	2·10	2·08	2·06	2·05	2·03	2·02	2·01	2·00	1·99	1·98	1·97
S. Decln.																
Rigel ..	·169	·167	·165	·164	·162	·161	·160	·159	·157	·156	·155	·154	·153	·153	·152	·151
Sirius ..	·344	·341	·337	·334	·332	·329	·326	·324	·321	·319	·317	·315	·313	·311	·310	·308
ε Sagittarii	·791	·784	·776	·769	·763	·756	·750	·745	·739	·734	·729	·725	·721	·717	·713	·710
λ Scorpii	·871	·863	·855	·847	·840	·833	·826	·820	·814	·808	·803	·798	·793	·789	·785	·781
γ Argûs	1·24	1·23	1·22	1·21	1·20	1·19	1·18	1·17	1·16	1·15	1·14	1·14	1·13	1·12	1·12	1·11
α Gruis	1·26	1·24	1·23	1·22	1·21	1·20	1·19	1·18	1·17	1·16	1·16	1·15	1·14	1·14	1·13	1·13
Canopus	1·51	1·50	1·48	1·47	1·46	1·45	1·43	1·42	1·41	1·40	1·39	1·39	1·38	1·37	1·36	1·36
γ Crucis ..	1·75	1·73	1·72	1·70	1·69	1·67	1·66	1·65	1·64	1·63	1·61	1·60	1·60	1·59	1·58	1·57
α Pavonis	1·78	1·76	1·75	1·73	1·71	1·70	1·69	1·67	1·66	1·65	1·64	1·63	1·62	1·61	1·60	1·60
Achernar	1·83	1·81	1·79	1·77	1·76	1·74	1·73	1·72	1·71	1·69	1·68	1·67	1·66	1·65	1·65	1·64
β Crucis } ε Argûs }	1·94	1·92	1·90	1·88	1·87	1·85	1·84	1·82	1·81	1·80	1·79	1·77	1·76	1·75	1·75	1·74
β Centauri	2·00	1·98	1·96	1·94	1·92	1·91	1·89	1·88	1·86	1·85	1·84	1·83	1·82	1·81	1·80	1·79
α^2 Centauri	2·04	2·02	2·00	1·98	1·96	1·95	1·93	1·92	1·90	1·89	1·88	1·87	1·86	1·85	1·84	1·83
α^1 Crucis ..	2·23	2·21	2·18	2·17	2·15	2·13	2·11	2·10	2·08	2·07	2·05	2·04	2·03	2·02	2·01	2·00
α Tri. Aus.	2·99	2·96	2·93	2·90	2·88	2·85	2·83	2·81	2·79	2·77	2·75	2·74	2·72	2·70	2·69	2·68
β Argûs ..	3·06	3·03	3·00	2·98	2·95	2·93	2·90	2·88	2·86	2·84	2·82	2·81	2·79	2·77	2·76	2·75
	m. 00	m. 56	m. 52	m. 48	m. 44	m. 40	m. 36	m. 32	m. 28	m. 24	m. 20	m. 16	m. 12	m. 8	m. 4	m. 00
	8 Hr.	7 HOURS.														

Table A.

When hour angle is less than 6 hours, name the factors taken from Table A *contrary* to name of lat.

Lat	5 HOURS.															6 Hr.
	m. 00	m. 4	m. 8	m. 12	m. 16	m. 20	m. 24	m. 28	m. 32	m. 36	m. 40	m. 44	m. 48	m. 52	m. 56	m. 00
°	′	′	′	′	′	′	′	′	′	′	′	′	′	′	′	′
0	·000	·000	·000	·000	·000	·000	·000	·000	·000	·000	·000	·000	·000	·000	·000	·000
1	·005	·004	·004	·004	·003	·003	·003	·002	·002	·002	·002	·001	·001	·001	·000	·000
2	·009	·009	·008	·007	·007	·006	·006	·005	·004	·004	·003	·002	·002	·001	·001	·000
3	·014	·013	·012	·011	·010	·009	·008	·007	·006	·006	·005	·004	·003	·002	·001	·000
4	·019	·017	·016	·015	·014	·012	·011	·010	·009	·007	·006	·005	·004	·002	·001	·000
5	·023	·022	·020	·019	·017	·015	·014	·012	·011	·009	·008	·006	·005	·003	·002	·000
6	·028	·026	·024	·022	·020	·019	·017	·015	·013	·011	·009	·007	·006	·004	·002	·000
7	·033	·031	·028	·026	·024	·022	·019	·017	·015	·013	·011	·009	·006	·004	·002	·000
8	·038	·035	·032	·030	·027	·025	·022	·020	·017	·015	·012	·010	·007	·005	·003	·000
9	·042	·039	·037	·034	·031	·028	·025	·022	·019	·017	·014	·011	·008	·006	·003	·000
10	·047	·044	·041	·037	·034	·031	·028	·025	·022	·019	·015	·012	·009	·006	·003	·000
11	·052	·048	·045	·041	·038	·034	·031	·027	·024	·020	·017	·014	·010	·007	·003	·000
12	·057	·053	·049	·045	·041	·037	·034	·030	·026	·022	·019	·015	·011	·007	·004	·000
13	·062	·058	·053	·049	·045	·041	·037	·032	·028	·024	·020	·016	·012	·008	·004	·000
14	·067	·062	·058	·053	·048	·044	·039	·035	·031	·026	·022	017	·013	·009	·004	·000
15	·072	·067	·062	·057	·052	·047	·042	·038	·033	·028	·023	·019	·014	·009	·005	·000
16	·077	·071	·066	·061	·056	·051	·045	·040	·035	·030	·025	·020	·015	·010	·005	·000
17	·082	·076	·071	·065	·059	·054	·048	·043	·038	·032	·027	·021	·016	·011	·005	·000
18	·087	·081	·075	·069	·063	·057	·051	·046	·040	·034	·028	·023	·017	·011	·006	·000
19	·092	·086	·079	·073	·067	·061	·055	·048	·042	·036	·030	·024	·018	·012	·006	·000
20	·098	·091	·084	·077	·071	·064	·058	·051	·045	·038	·032	·025	·019	·013	·006	·000
21	·103	·096	·089	·082	·075	·068	·061	·054	·047	·040	·034	·027	·020	·013	·007	·000
22	·108	·101	·093	·086	·079	·071	·064	·057	·050	·042	·035	·028	·021	·014	·007	·000
23	·114	·106	·098	·090	·083	·075	·067	·060	·052	·045	·037	·030	·022	·015	·007	·000
24	·119	·111	·103	·095	·087	·079	·071	·063	·055	·047	·039	·031	·023	·016	·008	·000
25	·125	·116	·108	·099	·091	·082	·074	·066	·057	·049	·041	·033	·024	·016	·008	·000
26	·131	·122	·113	·104	·095	·086	·077	·069	·060	·051	·043	·034	·026	·017	·009	·000
27	·137	·127	·118	·108	·099	·090	·081	·072	·063	·054	·045	·036	·027	·018	·009	·000
28	·142	·133	·123	·113	·103	·094	·084	·075	·065	·056	·047	·037	·028	·019	·009	·000
29	·149	·138	·128	·118	·108	·098	·088	·078	·068	·058	·048	·039	·029	·019	·010	·000
30	·155	·144	·133	·123	·112	·102	·091	·081	·071	·061	·051	·040	·030	·020	·010	·000
31	·161	·150	·139	·128	·117	·106	·095	·084	·074	·063	·053	·042	·031	·021	·010	·000
32	·167	·156	·144	·133	·121	·110	·099	·088	·077	·066	·055	·044	·033	·022	·011	·000
33	·174	·162	·150	·138	·126	·115	·103	·091	·080	·068	·057	·045	·034	·023	·011	·000
34	·181	·168	·156	·143	·131	·119	·107	·095	·083	·071	·059	·047	·035	·024	·012	·000
35	·188	·175	·162	·149	·136	·123	·111	·098	·086	·074	·061	·049	·037	·024	·012	·000
36	·195	·181	·168	·154	·141	·128	·115	·102	·089	·076	·064	·051	·038	·025	·013	·000
37	·202	·188	·174	·160	·146	·133	·119	·106	·093	·079	·066	·053	·039	·026	·013	·000
38	·209	·195	·180	·166	·152	·138	·124	·110	·096	·082	·068	·055	·041	·027	·014	·000
39	·217	·202	·187	·172	·157	·143	·128	·114	·099	·085	·071	·057	·042	·028	·014	·000
40	·225	·209	·194	·178	·163	·148	·133	·118	·103	·088	·073	·059	·044	·029	·015	·000
41	·233	·217	·201	·185	·169	·153	·138	·122	·107	·091	·076	·061	·046	·030	·015	·000
42	·241	·224	·208	·191	·175	·159	·143	·127	·111	·095	·079	·063	·047	·031	·016	·000
43	·250	·233	·215	·198	·181	·164	·148	·131	·114	·098	·082	·065	·049	·033	·016	·000
44	·259	·241	·223	·205	·188	·170	·153	·136	·119	·101	·084	·068	·051	·034	·017	·000
45	·268	·249	·231	·213	·194	·176	·158	·141	·123	·105	·087	·070	·052	·035	·017	·000
46	·277	·258	·239	·220	·201	·183	·164	·146	·127	·109	·091	·072	·054	·036	·018	·000
47	·287	·267	·248	·228	·208	·189	·170	·151	·132	·113	·094	·075	·056	·037	·019	·000
48	·298	·277	·256	·236	·216	·196	·176	·156	·136	·117	·097	·078	·058	·039	·019	·000
49	·308	·287	·266	·245	·224	·203	·182	·162	·141	·121	·101	·080	·060	·040	·020	·000
50	·319	·297	·275	·253	·232	·210	·189	·167	·146	·125	·104	·083	·062	·042	·021	·000
51	·331	·308	·285	·262	·240	·218	·196	·174	·152	·130	·108	·086	065	·043	·022	·000
52	·343	·319	·295	·272	·249	·226	·203	·180	·157	·135	·112	·090	·067	·045	·022	·000
53	·356	·331	·306	·282	·258	·234	·210	·187	·163	·139	·116	·093	·070	·046	·023	·000
54	·369	·343	·318	·293	·268	·243	·218	·193	·169	·145	·120	·096	·072	·048	·024	·000
55	·383	·356	·330	·304	·278	·252	·226	·201	·175	·150	·125	·100	·075	·050	·025	·000
56	·397	·370	·342	·315	·288	·261	·235	·208	·182	·156	·130	·104	·078	·052	·026	·000
57	·413	·384	·356	·327	·299	·272	·244	·216	·189	·162	·135	·108	·081	·054	·027	·000
58	·429	·399	·369	·340	·311	·282	·253	·225	·196	·168	·140	·112	·084	·056	·028	·000
59	·446	·415	·384	·354	·324	·293	·264	·234	·204	·175	·146	·116	·087	·058	·029	·000
60	·464	·432	·400	·368	·337	·305	·274	·243	·213	·182	·152	·121	·091	·060	·030	·000
	m. 00	m. 56	m. 52	m. 48	m. 44	m. 40	m. 36	m. 32	m. 28	m. 24	m. 20	m. 16	m. 12	m. 8	m. 4	m. 00
	7 Hr.	6 HOURS.														

When hour angle is more than 6 hours, name the factors taken from Table A the *same* as the name of the latitude.

Table B.

Always name the factors taken from Table B the *same* as the name of declination.

Declination.	5 HOURS. m. 00	m. 4	m. 8	m. 12	m. 16	m. 20	m. 24	m. 28	m. 32	m. 36	m. 40	m. 44	m. 48	m. 52	m. 56	6 Hr. m. 00
°	′	′	′	′	′	′	′	′	′	′	′	′	′	′	′	′
0	·000	·000	·000	·000	·000	·000	·000	·000	·000	·000	·000	·000	·000	·000	·000	·000
1	·018	·018	·018	·018	·018	·018	·018	·018	·018	·018	·018	·017	·017	·017	·017	·017
2	·036	·036	·036	·036	·036	·035	·035	·035	·035	·035	·035	·035	·035	·035	·035	·035
3	·054	·054	·054	·054	·053	·053	·053	·053	·053	·053	·053	·053	·052	·052	·052	·052
4	·072	·072	·072	·071	·071	·071	·071	·071	·070	·070	·070	·070	·070	·070	·070	·070
5	·091	·090	·090	·089	·089	·089	·089	·088	·088	·088	·088	·088	·088	·088	·088	·087
6	·109	·108	·108	·107	·107	·107	·106	·106	·106	·106	·106	·105	·105	·105	·105	·105
7	·127	·127	·126	·126	·125	·125	·124	·124	·124	·123	·123	·123	·123	·123	·123	·123
8	·145	·145	·144	·144	·143	·143	·142	·142	·142	·141	·141	·141	·141	·141	·141	·141
9	·164	·163	·163	·162	·161	·161	·160	·160	·160	·159	·159	·159	·159	·158	·158	·158
10	·183	·182	·181	·180	·180	·179	·179	·178	·178	·177	·177	·177	·177	·176	·176	·176
11	·201	·200	·199	·199	·198	·197	·197	·196	·196	·195	·195	·195	·195	·194	·194	·194
12	·220	·219	·218	·217	·217	·216	·215	·215	·214	·214	·213	·213	·213	·213	·213	·213
13	·239	·238	·237	·236	·235	·234	·234	·233	·233	·232	·232	·231	·231	·231	·231	·231
14	·258	·257	·256	·255	·254	·253	·252	·252	·251	·251	·250	·250	·250	·249	·249	·249
15	·277	·276	·275	·274	·273	·272	·271	·271	·270	·269	·269	·269	·268	·268	·268	·268
16	·297	·296	·294	·293	·292	·291	·290	·290	·289	·288	·288	·287	·287	·287	·287	·287
17	·317	·315	·314	·313	·311	·310	·310	·309	·308	·307	·307	·306	·306	·306	·306	·306
18	·336	·335	·333	·332	·331	·330	·329	·328	·327	·327	·326	·326	·325	·325	·325	·325
19	·356	·355	·353	·352	·351	·350	·349	·348	·347	·346	·346	·345	·345	·345	·344	·344
20	·377	·375	·374	·372	·371	·370	·369	·368	·367	·366	·365	·365	·364	·364	·364	·364
21	·397	·396	·394	·392	·391	·390	·389	·388	·387	·386	·385	·385	·384	·384	·384	·384
22	·418	·416	·415	·413	·412	·410	·409	·408	·407	·406	·406	·405	·405	·404	·404	·404
23	·439	·437	·436	·434	·432	·431	·430	·429	·428	·427	·426	·426	·425	·425	·425	·424
23° 28′	·449	·447	·446	·444	·442	·441	·440	·438	·437	·437	·436	·435	·435	·434	·434	·434
24	·461	·459	·457	·455	·454	·452	·451	·450	·449	·448	·447	·446	·446	·445	·445	·445
25	·483	·481	·479	·477	·475	·474	·472	·471	·470	·469	·468	·467	·467	·467	·466	·466
26	·505	·503	·501	·499	·497	·495	·494	·493	·491	·490	·490	·489	·488	·488	·488	·488
27	·527	·525	·523	·521	·519	·517	·516	·515	·513	·512	·511	·511	·510	·510	·510	·510
28	·550	·548	·546	·544	·542	·540	·538	·537	·536	·535	·534	·533	·532	·532	·532	·532
29	·574	·571	·569	·567	·565	·563	·561	·560	·558	·557	·556	·556	·555	·555	·554	·554
30	·598	·595	·593	·590	·588	·586	·585	·583	·582	·581	·580	·579	·578	·578	·577	·577
Stars. *N. Decln.*																
Procyon	·099	·098	·098	·098	·097	·097	·097	·096	·096	·096	·096	·096	·096	·096	·096	·096
Altair ..	·157	·156	·156	·155	·155	·154	·154	·153	·153	·153	·152	·152	·152	·152	·152	·152
Aldebar'n	·303	·302	·301	·300	·298	·297	·297	·296	·295	·295	·294	·294	·293	·293	·293	·293
Arcturus	·370	·368	·367	·365	·364	·363	·362	·361	·360	·359	·359	·358	·358	·357	·357	·357
Castor ..	·649	·646	·643	·641	·639	·637	·635	·633	·632	·630	·629	·628	·628	·627	·627	·627
Vega ..	·829	·826	·822	·819	·816	·813	·811	·809	·807	·806	·804	·803	·802	·802	·801	·801
Deneb ..	1·03	1·03	1·02	1·02	1·02	1·01	1·01	1·01	1·01	1·00	1·00	1·00	1·00	1·00	1·00	1·00
Capella	1·07	1·06	1·06	1·06	1·05	1·05	1·05	1·04	1·04	1·04	1·04	1·03	1·03	1·03	1·03	1·03
α Persei ..	1·21	1·21	1·20	1·20	1·19	1·19	1·19	1·18	1·18	1·18	1·18	1·17	1·17	1·17	1·17	1·17
η Ursæ Maj	1·22	1·22	1·21	1·21	1·20	1·20	1·20	1·19	1·19	1·19	1·19	1·18	1·18	1·18	1·18	1·18
ε Ursæ Maj	1·56	1·55	1·55	1·54	1·54	1·53	1·53	1·52	1·52	1·52	1·51	1·51	1·51	1·51	1·51	1·51
α Ursæ Maj	1·97	1·96	1·95	1·94	1·94	1·93	1·92	1·92	1·91	1·91	1·91	1·90	1·90	1·90	1·90	1·90
S. Decln.																
Rigel ..	·151	·150	·150	·149	·149	·148	·148	·147	·147	·147	·147	·146	·146	·146	·146	·146
Sirius ..	·308	·307	·306	·305	·303	·303	·302	·301	·300	·300	·299	·299	·298	·298	·298	·298
ε Sagittarii	·710	·706	·703	·701	·698	·696	·694	·692	·691	·689	·688	·687	·686	·686	·686	·685
λ Scorpii	·781	·778	·774	·771	·769	·766	·764	·762	·760	·759	·757	·756	·756	·755	·755	·755
γ Argûs	1·11	1·11	1·10	1·10	1·10	1·09	1·09	1·09	1·08	1·08	1·08	1·08	1·08	1·08	1·08	1·08
α Gruis	1·13	1·12	1·12	1·11	1·11	1·10	1·10	1·10	1·10	1·09	1·09	1·09	1·09	1·09	1·09	1·09
Canopus	1·36	1·35	1·34	1·34	1·33	1·33	1·33	1·32	1·32	1·32	1·32	1·31	1·31	1·31	1·31	1·31
γ Crucis ..	1·57	1·56	1·56	1·55	1·55	1·54	1·54	1·53	1·53	1·53	1·52	1·52	1·52	1·52	1·52	1·52
α Pavonis	1·60	1·59	1·58	1·58	1·57	1·57	1·56	1·56	1·55	1·55	1·55	1·55	1·54	1·54	1·54	1·54
Achernar	1·64	1·63	1·62	1·62	1·61	1·61	1·60	1·60	1·59	1·59	1·59	1·59	1·58	1·58	1·58	1·58
β Crucis / ε Argûs	1·74	1·73	1·72	1·72	1·71	1·70	1·70	1·69	1·69	1·69	1·68	1·68	1·68	1·68	1·68	1·68
β Centauri	1·79	1·78	1·77	1·77	1·76	1·75	1·75	1·74	1·74	1·74	1·73	1·73	1·73	1·73	1·73	1·73
α² Centauri	1·83	1·82	1·81	1·80	1·80	1·79	1·79	1·78	1·78	1·77	1·77	1·77	1·77	1·77	1·77	1·76
α¹ Crucis ..	2·00	1·99	1·98	1·97	1·97	1·96	1·95	1·95	1·94	1·94	1·94	1·93	1·93	1·93	1·93	1·93
α Tri. Aus.	2·68	2·67	2·65	2·64	2·64	2·63	2·62	2·61	2·61	2·60	2·60	2·59	2·59	2·59	2·59	2·59
β Argûs ..	2·75	2·73	2·72	2·71	2·70	2·69	2·69	2·68	2·67	2·67	2·66	2·66	2·66	2·65	2·65	2·65
	m. 00	m. 56	m. 52	m. 48	m. 44	m. 40	m. 36	m. 32	m. 28	m. 24	m. 20	m. 16	m. 12	m. 8	m. 4	m. 00
	7 Hr.	6 HOURS.														

Table A.

When hour angle is less than 6 hours, name the factors taken from Table A *contrary* to name of lat.

Lat.	0 HOUR. m. 1	Var. to 1′ of L.	m. 4	m. 8	m. 12	m. 16	m. 20	m. 24	m. 28	m. 32	m. 36	m. 40	m. 44	m. 48	m. 52	m. 56	1 Hr. m. 00
°	′	″	′	′	′	′	′	′	′	′	′	′	′	′	′	′	′
61	413	17·0	103	52	34	26	21	17·2	14·7	12·8	11·4	10·2	9·3	8·5	7·8	7·2	6·7
62	431	18·2	108	54	36	27	21	17·9	15·3	13·4	11·9	10·7	9·7	8·8	8·1	7·5	7·0
63	450	19·4	112	56	37	28	22	18·7	16·0	14·0	12·4	11·1	10·1	9·2	8·5	7·9	7·3
64	470	20·8	117	59	39	29	23	19·5	16·7	14·7	12·9	11·6	10·5	9·6	8·9	8·2	7·7
65	491	22·4	123	61	41	31	25	20·4	17·5	15·3	13·5	12·2	11·0	10·1	9·3	8·6	8·0
66	515	24·2	129	64	43	32	26	21·4	18·3	16·0	14·2	12·7	11·6	10·6	9·7	9·0	8·4
67	540	26·2	135	67	45	34	27	22·4	19·2	16·8	14·9	13·4	12·1	11·1	10·2	9·4	8·8
68	567	28·6	142	71	47	35	28	23·5	20·2	17·6	15·6	14·0	12·7	11·6	10·7	9·9	9·2
69	597	31·2	149	75	50	37	30	24·8	21·2	18·5	16·4	14·8	13·4	12·3	11·3	10·4	9·7
70	630	34·3	157	79	52	39	31	26·1	22·4	19·5	17·3	15·6	14·1	12·9	11·9	11·0	10·3
71	666	37·8	166	83	55	42	33	27·6	23·7	20·7	18·3	16·5	14·9	13·7	12·6	11·6	10·8
72	705	42·0	176	88	59	44	35	29·3	25·1	21·9	19·4	17·5	15·8	14·6	13·3	12·3	11·5
	m. 59	..	m. 56	m. 52	m. 48	m. 44	m. 40	m. 36	m. 32	m. 28	m. 24	m. 20	m. 16	m. 12	m. 8	m. 4	m. 00
	11 HOURS.																

Lat.	1 HOUR. m. 00	m. 4	m. 8	m. 12	m. 16	m. 20	m. 24	m. 28	m. 32	m. 36	m. 40	m. 44	m. 48	m. 52	m. 56	2 Hr. m. 00
°	′	′	′	′	′	′	′	′	′	′	′	′	′	′	′	′
61	6·7	6·3	5·9	5·55	5·24	4·96	4·70	4·47	4·25	4·05	3·87	3·70	3·54	3·39	3·25	3·12
62	7·0	6·6	6·2	5·79	5·46	5·17	4·90	4·65	4·43	4·22	4·03	3·86	3·69	3·54	3·39	3·26
63	7·3	6·8	6·4	6·04	5·70	5·39	5·11	4·86	4·62	4·41	4·21	4·02	3·85	3·69	3·54	3·40
64	7·7	7·2	6·7	6·31	5·95	5·63	5·34	5·07	4·83	4·61	4·40	4·20	4·02	3·86	3·70	3·55
65	8·0	7·5	7·0	6·60	6·23	5·89	5·59	5·31	5·05	4·82	4·60	4·40	4·21	4·03	3·87	3·71
66	8·4	7·8	7·3	6·91	6·52	6·17	5·85	5·56	5·29	5·04	4·82	4·61	4·41	4·22	4·05	3·89
67	8·8	8·2	7·7	7·25	6·84	6·47	6·14	5·83	5·55	5·29	5·05	4·83	4·62	4·43	4·25	4·08
68	9·2	8·6	8·1	7·62	7·19	6·80	6·45	6·13	5·83	5·56	5·31	5·07	4·86	4·65	4·47	4·29
69	9·7	9·1	8·5	8·02	7·57	7·16	6·79	6·45	6·14	5·85	5·59	5·34	5·11	4·90	4·70	4·51
70	10·3	9·6	9·0	8·46	7·98	7·55	7·16	6·80	6·47	6·17	5·89	5·63	5·39	5·17	4·96	4·76
71	10·8	10·1	9·5	8·94	8·43	7·98	7·57	7·19	6·84	6·52	6·23	5·95	5·70	5·46	5·24	5·03
72	11·5	10·7	10·1	9·47	8·94	8·46	8·02	7·62	7·25	6·91	6·60	6·31	6·04	5·79	5·55	5·33
	m. 00	m. 56	m. 52	m. 48	m. 44	m. 40	m. 36	m. 32	m. 28	m. 24	m. 20	m. 16	m. 12	m. 8	m. 4	m. 00
	11 Hr.	10 HOURS.														

Lat.	2 HOURS. m. 00	m. 4	m. 8	m. 12	m. 16	m. 20	m. 24	m. 28	m. 32	m 36	m. 40	m. 44	m. 48	m. 52	m. 56	3 Hr. m. 00
°	′	′	′	′	′	′	′	′	′	′	′	′	′	′	′	′
61	3·12	3·00	2·89	2·78	2·67	2·58	2·48	2·39	2·31	2·23	2·15	2·08	2·00	1·93	1·87	1·80
62	3·26	3·13	3·01	2·90	2·79	2·69	2·59	2·50	2·41	2·32	2·24	2·16	2·09	2·02	1·95	1·88
63	3·40	3·27	3·14	3·02	2·91	2·80	2·70	2·60	2·51	2·42	2·34	2·26	2·18	2·10	2·03	1·96
64	3·55	3·41	3·28	3·16	3·04	2·93	2·82	2·72	2·62	2·53	2·44	2·36	2·28	2·20	2·12	2·05
65	3·71	3·57	3·43	3·30	3·18	3·06	2·95	2·85	2·74	2·65	2·56	2·47	2·38	2·30	2·22	2·14
66	3·89	3·74	3·59	3·46	3·33	3·21	3·09	2·98	2·87	2·77	2·68	2·58	2·49	2·41	2·33	2·25
67	4·08	3·92	3·77	3·63	3·49	3·36	3·24	3·13	3·02	2·91	2·81	2·71	2·62	2·53	2·44	2·36
68	4·29	4·12	3·96	3·81	3·67	3·53	3·41	3·28	3·17	3·06	2·95	2·85	2·75	2·65	2·56	2·48
69	4·51	4·34	4·17	4·01	3·86	3·72	3·59	3·46	3·33	3·22	3·10	3·00	2·89	2·79	2·70	2·61
70	4·76	4·57	4·40	4·23	4·07	3·92	3·78	3·65	3·52	3·39	3·27	3·16	3·05	2·95	2·85	2·75
71	5·03	4·83	4·65	4·47	4·31	4·15	4·00	3·85	3·72	3·59	3·46	3·34	3·23	3·11	3·01	2·90
72	5·33	5·12	4·93	4·74	4·56	4·40	4·24	4·08	3·94	3·80	3·67	3·54	3·42	3·30	3·19	3·08
	m. 00	m. 56	m. 52	m. 48	m. 44	m. 40	m. 36	m. 32	m. 28	m. 24	m. 20	m. 16	m. 12	m. 8	m. 4	m. 00
	10 Hr.	9 HOURS.														

When hour angle is more than 6 hours, name the factors taken from Table A the *same* as the name of the latitude.

Table A.

When hour angle is less than 6 hours, name the factors taken from Table A *contrary* to name of lat.

Lat.	3 HOURS.															4 Hr.
	m. 00	m. 4	m. 8	m. 12	m. 16	m. 20	m. 24	m. 28	m. 32	m. 36	m. 40	m. 44	m. 48	m. 52	m. 56	m. 00
°	′	′	′	′	′	′	′	′	′	′	′	′	′	′	′	′
61	1·80	1·74	1·68	1·62	1·57	1·51	1·46	1·41	1·36	1·31	1·26	1·22	1·17	1·13	1·08	1·04
62	1·88	1·82	1·75	1·69	1·63	1·58	1·52	1·47	1·42	1·37	1·32	1·27	1·22	1·18	1·13	1·09
63	1·96	1·90	1·83	1·77	1·71	1·65	1·59	1·53	1·48	1·43	1·37	1·32	1·27	1·23	1·18	1·13
64	2·05	1·98	1·91	1·85	1·78	1·72	1·66	1·60	1·55	1·49	1·44	1·38	1·33	1·28	1·23	1·18
65	2·14	2·07	2·00	1·93	1·86	1·80	1·74	1·68	1·62	1·56	1·50	1·45	1·39	1·34	1·29	1·24
66	2·25	2·17	2·09	2·02	1·95	1·88	1·82	1·75	1·69	1·63	1·57	1·51	1·46	1·40	1·35	1·30
67	2·36	2·28	2·20	2·12	2·05	1·98	1·91	1·84	1·78	1·71	1·65	1·59	1·53	1·47	1·42	1·36
68	2·48	2·39	2·31	2·23	2·15	2·08	2·00	1·93	1·87	1·80	1·73	1·67	1·61	1·55	1·49	1·43
69	2·61	2·52	2·43	2·35	2·26	2·19	2·11	2·04	1·96	1·89	1·82	1·76	1·69	1·63	1·57	1·50
70	2·75	2·65	2·56	2·47	2·39	2·31	2·22	2·15	2·07	2·00	1·92	1·85	1·78	1·72	1·65	1·59
71	2·90	2·80	2·71	2·61	2·52	2·44	2·35	2·27	2·19	2·11	2·03	1·96	1·89	1·81	1·75	1·68
72	3·08	2·97	2·87	2·77	2·68	2·58	2·49	2·40	2·32	2·24	2·16	2·08	2·00	1·92	1·85	1·78
	m. 00	m. 56	m. 52	m. 48	m. 44	m. 40	m. 36	m. 32	m. 28	m. 24	m. 20	m. 16	m. 12	m. 8	m. 4	m. 00
	9 Hr.	8 HOURS.														

Lat.	4 HOURS.															5 Hr.
	m. 00	m. 4	m. 8	m. 12	m. 16	m. 20	m. 24	m. 28	m. 32	m. 36	m. 40	m. 44	m. 48	m. 52	m. 56	m. 00
°	′	′	′	′	′	′	′	′	′	′	′	′	′	′	′	′
61	1·04	1·00	·96	·92	·88	·84	·80	·77	·73	·69	·66	·62	·59	·55	·52	·48
62	1·09	1·04	1·00	·96	·92	·88	·84	·80	·76	·72	·68	·65	·61	·57	·54	·50
63	1·13	1·09	1·04	1·00	·96	·92	·87	·83	·79	·75	·71	·68	·64	·60	·56	·53
64	1·18	1·14	1·09	1·04	1·00	·96	·91	·87	·83	·79	·75	·71	·67	·63	·59	·55
65	1·24	1·19	1·14	1·09	1·05	1·00	·95	·91	·87	·82	·78	·74	·70	·66	·61	·57
66	1·30	1·24	1·19	1·14	1·10	1·05	1·00	·95	·91	·86	·82	·77	·73	·69	·64	·60
67	1·36	1·31	1·25	1·20	1·15	1·10	1·05	1·00	·95	·90	·86	·81	·77	·72	·68	·63
68	1·43	1·37	1·32	1·26	1·21	1·15	1·10	1·05	1·00	·95	·90	·85	·80	·76	·71	·66
69	1·50	1·44	1·39	1·33	1·27	1·21	1·16	1·11	1·05	1·00	·95	·90	·85	·80	·75	·70
70	1·59	1·52	1·46	1·40	1·34	1·28	1·22	1·17	1·11	1·05	1·00	·95	·89	·84	·79	·74
71	1·68	1·61	1·54	1·48	1·42	1·35	1·29	1·23	1·17	1·11	1·06	1·00	·94	·89	·83	·78
72	1·78	1·71	1·64	1·57	1·50	1·44	1·37	1·31	1·24	1·18	1·12	1·06	1·00	·94	·88	·82
	m. 00	m. 56	m. 52	m. 48	m. 44	m. 40	m. 36	m. 32	m. 28	m. 24	m. 20	m. 16	m. 12	m. 8	m. 4	m. 00
	8 Hr.	7 HOURS.														

Lat.	5 HOURS.															6 Hr.
	m. 00	m. 4	m. 8	m. 12	m. 16	m. 20	m. 24	m. 28	m. 32	m 36	m. 40	m. 44	m. 48	m. 52	m. 56	m. 00
°	′	′	′	′	′	′	′	′	′	′	′	′	′	′	′	′
61	·483	·450	·416	·383	·351	·318	·286	·254	·222	·190	·158	·126	·095	·063	·031	·000
62	·504	·469	·434	·400	·366	·332	·298	·264	·231	·198	·165	·132	·099	·066	·033	·000
63	·526	·489	·453	·417	·381	·346	·311	·276	·241	·206	·172	·137	·103	·069	·034	·000
64	·549	·511	·473	·436	·399	·362	·325	·288	·252	·215	·179	·143	·107	·072	·036	·000
65	·575	·535	·495	·456	·417	·378	·340	·301	·263	·225	·188	·150	·112	·075	·037	·000
66	·602	·560	·519	·477	·437	·396	·356	·316	·276	·236	·197	·157	·118	·078	·039	·000
67	·631	·587	·544	·501	·458	·415	·373	·331	·289	·248	·206	·165	·123	·082	·041	·000
68	·663	·617	·571	·526	·481	·436	·392	·348	·304	·260	·217	·173	·130	·086	·043	·000
69	·698	·650	·601	·554	·506	·459	·413	·366	·320	·274	·228	·182	·137	·091	·045	·000
70	·736	·685	·634	·584	·534	·484	·435	·386	·337	·289	·240	·192	·144	·096	·048	·000
71	·778	·724	·670	·617	·565	·512	·460	·408	·357	·305	·254	·203	·152	·101	·051	·000
72	·825	·767	·711	·654	·598	·543	·487	·433	·378	·323	·269	·215	·161	·107	·054	·000
	m. 00	m. 56	m. 52	m. 48	m. 44	m. 40	m. 36	m. 32	m. 28	m. 24	m. 20	m. 16	m. 12	m. 8	m. 4	m. 00
	7 Hr.	6 HOURS.														

When hour angle is more than 6 hours, name the factors taken from Table A the *same* as the name of the latitude.

Table A.

When hour angle is less than 6 hours, name the factors taken from Table A *contrary* to name of lat.

Lat.	0 HOUR.																1 Hr.
	m. 1	Var. to 1′ of L.	m. 4	m. 8	m. 12	m. 16	m. 20	m. 24	m. 28	m. 32	m. 36	m. 40	m. 44	m. 48	m. 52	m. 56	m. 00
°	′	″	′	′	′	′	′	′	′	′	′	′	′	′	′	′	′
73	750	47	187	94	62	47	37	31	26·6	23·3	20·7	18·5	16·8	15·4	14·2	13·1	12·2
74	799	53	200	100	67	50	40	33	28·4	24·8	22·0	19·8	17·9	16·4	15·1	14·0	13·0
75	855	60	214	107	71	53	43	36	30·4	26·6	23·6	21·2	19·2	17·6	16·2	15·0	13·9
76	919	69	230	115	77	57	46	38	32·7	28·5	25·3	22·7	20·6	18·9	17·4	16·1	15·0
77	993	80	248	124	83	62	50	41	35·3	30·8	27·3	24·6	22·3	20·4	18·8	17·4	16·2
78	1078	93	270	135	90	67	54	45	38·3	33·5	29·7	26·7	24·2	22·1	20·4	18·9	17·6
79	1179	111	295	147	98	74	59	49	41·9	36·6	32·5	29·2	26·5	24·2	22·3	20·6	19·2
80	1300	134	325	162	108	81	65	54	46·2	40·4	35·8	32·2	29·2	26·7	24·6	22·7	21·2
81	1447	165	362	181	120	90	72	60	51·4	44·9	39·9	35·8	32·5	29·7	27·3	25·3	23·6
82	1631	210	408	204	136	102	81	68	58·0	50·6	44·9	40·4	36·6	33·5	30·8	28·5	26·6
83	1867	275	467	233	155	116	93	77	66·3	58·0	51·4	46·2	41·9	38·3	35·3	32·7	30·4
84	2181	377	545	272	181	136	109	91	77·5	67·7	60·1	54·0	48·9	44·8	41·2	38·2	35·5
85	2620	548	655	327	218	163	131	109	93·1	81·3	72·2	64·8	58·8	53·8	49·5	45·8	42·7
	m. 59	..	m. 56	m. 52	m. 48	m. 44	m. 40	m. 36	m. 32	m. 28	m. 24	m. 20	m. 16	m. 12	m. 8	m. 4	m. 00
	11 HOURS.																

Lat.	1 HOUR.															2 Hr.
	m. 00	m. 4	m. 8	m. 12	m. 16	m. 20	m. 24	m. 28	m. 32	m. 36	m. 40	m. 44	m. 48	m. 52	m. 56	m. 00
°	′	′	′	′	′	′	′	′	′	′	′	′	′	′	′	′
73	12·2	11·4	10·7	10·1	9·5	9·0	8·5	8·1	7·7	7·3	7·0	6·7	6·4	6·2	5·9	5·7
74	13·0	12·2	11·4	10·7	10·1	9·6	9·1	8·6	8·2	7·8	7·5	7·2	6·8	6·6	6·3	6·0
75	13·9	13·0	12·2	11·5	10·8	10·3	9·7	9·2	8·8	8·4	8·0	7·7	7·3	7·0	6·7	6·5
76	15·0	14·0	13·1	12·3	11·6	11·0	10·4	9·9	9·4	9·0	8·6	8·2	7·9	7·5	7·2	6·9
77	16·2	15·1	14·2	13·3	12·6	11·9	11·3	10·7	10·2	9·7	9·3	8·9	8·5	8·1	7·8	7·5
78	17·6	16·4	15·4	14·5	13·7	12·9	12·3	11·6	11·1	10·6	10·1	9·6	9·2	8·8	8·5	8·2
79	19·2	17·9	16·8	15·8	14·9	14·1	13·4	12·7	12·1	11·6	11·0	10·5	10·1	9·7	9·3	9·0
80	21·2	19·8	18·5	17·5	16·5	15·6	14·8	14·0	13·4	12·7	12·2	11·6	11·1	10·7	10·2	9·8
81	23·6	22·0	20·7	19·4	18·3	17·3	16·4	15·6	14·9	14·2	13·5	12·9	12·4	11·9	11·4	10·9
82	26·6	24·8	23·3	21·9	20·7	19·5	18·5	17·6	16·8	16·0	15·3	14·6	14·0	13·4	12·8	12·3
83	30·4	28·4	26·6	25·1	23·7	22·4	21·7	20·2	19·2	18·3	17·5	16·7	16·0	15·3	14·7	14·1
84	35·5	33·2	31·1	29·3	27·6	26·1	24·8	23·5	22·4	21·4	20·4	19·5	18·7	17·9	17·2	16·5
85	42·7	39·9	37·4	35·2	33·2	31·4	29·8	28·3	26·9	25·7	24·5	23·4	22·4	21·5	20·6	19·8
	m. 00	m. 56	m. 52	m. 48	m. 44	m. 40	m. 36	m. 32	m. 28	m. 24	m. 20	m. 16	m. 12	m. 8	m. 4	m. 00
	11 Hr.	10 HOURS.														

Lat.	2 HOURS.															3 Hr.
	m. 00	m. 4	m. 8	m. 12	m. 16	m. 20	m. 24	m. 28	m. 32	m 36	m. 40	m. 44	m. 48	m. 52	m. 56	m. 00
°	′	′	′	′	′	′	′	′	′	′	′	′	′	′	′	′
73	5·7	5·4	5·2	5·0	4·8	4·7	4·5	4·3	4·2	4·0	3·9	3·8	3·6	3·5	3·4	3·3
74	6·0	5·8	5·6	5·4	5·2	5·0	4·8	4·6	4·5	4·3	4·2	4·0	3·9	3·7	3·6	3·5
75	6·5	6·2	6·0	5·7	5·5	5·3	5·1	5·0	4·8	4·6	4·4	4·3	4·1	4·0	3·9	3·7
76	6·9	6·7	6·4	6·2	5·9	5·7	5·5	5·3	5·1	5·0	4·8	4·6	4·5	4·3	4·2	4·0
77	7·5	7·2	6·9	6·7	6·4	6·2	6·0	5·7	5·5	5·3	5·2	5·0	4·8	4·6	4·5	4·3
78	8·1	7·8	7·5	7·2	7·0	6·7	6·5	6·2	6·0	5·8	5·6	5·4	5·2	5·0	4·9	4·7
79	8·9	8·6	8·2	7·9	7·6	7·3	7·1	6·8	6·6	6·4	6·1	5·9	5·7	5·5	5·3	5·1
80	9·8	9·4	9·1	8·7	8·4	8·1	7·8	7·5	7·3	7·0	6·8	6·5	6·3	6·1	5·9	5·7
81	10·9	10·5	10·1	9·7	9·4	9·0	8·7	8·4	8·1	7·8	7·5	7·3	7·0	6·8	6·5	6·3
82	12·3	11·8	11·4	11·0	10·5	10·2	9·8	9·4	9·1	8·8	8·5	8·2	7·9	7·6	7·4	7·1
83	14·1	13·6	13·0	12·5	12·1	11·6	11·2	10·8	10·4	10·1	9·7	9·4	9·0	8·7	8·4	8·1
84	16·5	15·8	15·2	14·7	14·1	13·6	13·1	12·6	12·2	11·7	11·3	10·9	10·6	10·2	9·9	9·5
85	19·8	19·0	18·3	17·6	16·9	16·3	15·7	15·2	14·6	14·1	13·6	13·1	12·7	12·3	11·8	11·4
	m. 00	m. 56	m. 52	m. 48	m. 44	m. 40	m. 36	m. 32	m. 28	m. 24	m. 20	m. 16	m. 12	m. 8	m. 4	m. 00
	10 Hr.	9 HOURS.														

When hour angle is more than 6 hours, name the factors taken from Table A the *same* as the name of the latitude.

Table A.

When hour angle is less than 6 hours, name the factors taken from Table A *contrary* to name of lat.

Lat.	3 HOURS.															4 Hr.
	m. 00	m. 4	m. 8	m. 12	m. 16	m. 20	m. 24	m. 28	m. 32	m. 36	m. 40	m. 44	m. 48	m. 52	m. 56	m. 00
°	′	′	′	′	′	′	′	′	′	′	′	′	′	′	′	′
73	3·3	3·2	3·1	2·9	2·84	2·74	2·65	2·56	2·46	2·38	2·29	2·21	2·12	2·04	1·97	1·89
74	3·5	3·4	3·3	3·1	3·03	2·93	2·82	2·72	2·63	2·53	2·44	2·35	2·26	2·18	2·10	2·01
75	3·7	3·6	3·5	3·4	3·24	3·13	3·02	2·92	2·81	2·71	2·61	2·52	2·42	2·33	2·24	2·15
76	4·0	3·9	3·7	3·6	3·49	3·37	3·25	3·13	3·02	2·91	2·81	2·71	2·60	2·51	2·41	2·32
77	4·3	4·2	4·0	3·9	3·77	3·63	3·51	3·38	3·26	3·15	3·03	2·92	2·81	2·71	2·60	2·50
78	4·7	4·5	4·4	4·2	4·09	3·95	3·81	3·68	3·55	3·42	3·29	3·17	3·06	2·94	2·83	2·72
79	5·1	5·0	4·8	4·6	4·47	4·32	4·17	4·02	3·88	3·74	3·60	3·47	3·34	3·21	3·09	2·97
80	5·7	5·5	5·3	5·1	4·93	4·76	4·59	4·43	4·27	4·12	3·97	3·83	3·68	3·54	3·41	3·27
81	6·3	6·1	5·9	5·7	5·49	5·30	5·11	4·93	4·76	4·59	4·42	4·26	4·10	3·95	3·79	3·65
82	7·1	6·9	6·6	6·4	6·19	5·97	5·76	5·56	5·36	5·17	4·98	4·80	4·62	4·45	4·28	4·11
83	8·1	7·9	7·6	7·3	7·08	6·83	6·60	6·36	6·14	5·92	5·70	5·49	5·29	5·09	4·89	4·70
84	9·5	9·2	8·9	8·6	8·27	7·98	7·70	7·43	7·17	6·91	6·66	6·42	6·18	5·95	5·72	5·49
85	11·4	11·0	10·7	10·3	9·94	9·59	9·26	8·93	8·61	8·30	8·00	7·71	7·42	7·14	6·87	6·60
	m. 00	m. 56	m. 52	m. 48	m. 44	m. 40	m. 36	m. 32	m. 28	m. 24	m. 20	m. 16	m. 12	m. 8	m. 4	m. 00
	9 Hr	8 HOURS.														

Lat.	4 HOURS.															5 Hr
	m. 00	m. 4	m. 8	m. 12	m. 16	m. 20	m. 24	m. 28	m. 32	m. 36	m. 40	m. 44	m. 48	m. 52	m. 56	m. 00
°	′	′	′	′	′	′	′	′	′	′	′	′	′	′	′	′
73	1·89	1·81	1·74	1·67	1·60	1·53	1·46	1·39	1·32	1·26	1·19	1·13	1·06	1·00	·94	·88
74	2·01	1·93	1·85	1·78	1·70	1·63	1·55	1·48	1·41	1·34	1·27	1·20	1·13	1·07	1·00	·93
75	2·15	2·07	1·98	1·90	1·82	1·74	1·66	1·58	1·51	1·43	1·36	1·29	1·21	1·14	1·07	1·00
76	2·32	2·22	2·13	2·04	1·96	1·87	1·79	1·70	1·62	1·54	1·46	1·38	1·30	1·23	1·15	1·07
77	2·50	2·40	2·30	2·21	2·11	2·02	1·93	1·84	1·75	1·66	1·58	1·49	1·41	1·32	1·24	1·16
78	2·72	2·61	2·50	2·40	2·29	2·19	2·09	2·00	1·90	1·81	1·71	1·62	1·53	1·44	1·35	1·26
79	2·97	2·85	2·74	2·62	2·51	2·40	2·29	2·18	2·08	1·97	1·87	1·77	1·67	1·57	1·48	1·38
80	3·27	3·14	3·02	2·89	2·77	2·64	2·53	2·41	2·29	2·18	2·06	1·95	1·84	1·73	1·63	1·52
81	3·65	3·50	3·36	3·22	3·08	2·94	2·81	2·68	2·55	2·42	2·30	2·17	2·05	1·93	1·81	1·69
82	4·11	3·94	3·78	3·63	3·47	3·32	3·17	3·02	2·87	2·73	2·59	2·45	2·31	2·18	2·04	1·91
83	4·70	4·51	4·33	4·15	3·97	3·80	3·63	3·46	3·29	3·13	2·96	2·80	2·65	2·49	2·34	2·18
84	5·49	5·27	5·06	4·85	4·64	4·44	4·24	4·04	3·84	3·65	3·46	3·28	3·09	2·91	2·73	2·55
85	6·60	6·34	6·08	5·82	5·57	5·33	5·09	4·85	4·62	4·39	4·16	3·94	3·71	3·49	3·28	3·06
	m 00	m 56	m. 52	m. 48	m. 44	m. 40	m 36	m. 32	m. 28	m. 24	m. 20	m. 16	m. 12	m. 8	m. 4	m. 00
	8 Hr	7 HOURS.														

Lat	5 HOURS.															6 Hr.
	m. 00	m 4	m. 8	m 12	m. 16	m. 20	m 24	m 28	m. 32	m 36	m. 40	m. 44	m. 48	m. 52	m. 56	m. 00
°	′	′	′	′	′	′	′	′	′	′	′	′	′	′	′	′
73	·88	·82	·76	·70	·64	·58	·52	·46	·40	·34	·29	·23	·17	·11	·06	·00
74	93	·87	81	·74	·68	·61	·55	·49	·43	·37	·31	·24	·18	·12	·06	·00
75	1·00	·93	86	·79	73	·66	·59	·52	·46	·39	·33	·26	·20	·13	·07	·00
76	1·07	1·00	93	·85	·78	·71	·64	·56	·49	·42	·35	·28	·21	·14	·07	·00
77	1·16	1·08	1·00	·92	·84	·76	·69	·61	·53	·46	·38	·30	·23	·15	·08	·00
78	1·26	1·17	1·09	1·00	·91	·83	·75	·66	·58	·49	·41	·33	·25	·16	·08	·00
79	1·38	1·28	1·19	1·09	1·00	·91	·81	·72	·63	·54	·45	·36	·27	·18	·09	·00
80	1·52	1·41	1·31	1·21	1·10	1·00	·90	·80	·70	·60	·50	·40	·30	·20	·10	·00
81	1·69	1·57	1·46	1·34	1·23	1·11	1·00	·89	·78	·66	·55	·44	·33	·22	·11	·00
82	1·91	1·77	1·64	1·51	1·38	1·25	1·13	1·00	·87	·75	·62	·50	·37	·25	·12	·00
83	2·18	2·03	1·88	1·73	1·58	1·44	1·29	1·14	1·00	·86	·71	·57	·43	·28	·14	·00
84	2·55	2·37	2·20	2·02	1·85	1·68	1·51	1·34	1·17	1·00	·83	·67	·50	·33	·17	·00
85	3·06	2·85	2·64	2·43	2·22	2·02	1·81	1·61	1·40	1·20	1·00	·80	·60	·40	·20	·00
	m. 00	m. 56	m. 25	m. 48	m. 44	m. 40	m. 36	m. 32	m. 28	m. 24	m. 20	m. 16	m. 12	m. 8	m. 4	m. 00
	7 Hr.	6 HOURS.														

When hour angle is more than 6 hours, name the factors taken from Table A the *same* as the name of the latitude.

Table B.

Always name the factors taken from Table B the *same* as the name of declination.

Declination.	0 HOUR.																1 Hr.
	m. 1	Var. to 1' of Decl.	m. 4	m. 8	m. 12	m. 16	m. 20	m. 24	m. 28	m. 32	m. 36	m. 40	m. 44	m. 48	m. 52	m. 56	m. 00
°	'	"	'	'	'	'	'	'	'	'	'	'	'	'	'	'	'
30	132	5·33	33·1	16·5	11·0	8·28	6·62	5·52	4·74	4·15	3·69	3·32	3·03	2·78	2·57	2·39	2·23
31	138	5·44	34·4	17·2	11·5	8·61	6·89	5·75	4·93	4·32	3·84	3·46	3·15	2·89	2·67	2·48	2·32
32	143	5·56	35·8	17·9	11·9	8·96	7·17	5·98	5·13	4·49	3·99	3·60	3·27	3·01	2·78	2·58	2·41
33	149	5·69	37·2	18·6	12·4	9·31	7·45	6·21	5·33	4·67	4·15	3·74	3·40	3·12	2·89	2·68	2·51
34	155	5·82	38·6	19·3	12·9	9·67	7·74	6·45	5·53	4·85	4·31	3·88	3·53	3·24	3·00	2·79	2·61
35	160	5·96	40·1	20·1	13·4	10·0	8·03	6·70	5·75	5.03	4·48	4·03	3·67	3·37	3·11	2·89	2·71
36	167	6·11	41·6	20·8	13·9	10·4	8·34	6·95	5·96	5·22	4·64	4·18	3·81	3·49	3·23	3·00	2·81
37	173	6·27	43·2	21·6	14·4	10·8	8·65	7·21	6·18	5·41	4·82	4·34	3·95	3·62	3·35	3·11	2·91
38	179	6·44	44·8	22·4	14·9	11·2	8·96	7·47	6·41	5·61	4·99	4·50	4·09	3·76	3·47	3·23	3·02
39	186	6·62	46·4	23·2	15·5	11·6	9·29	7·75	6·64	5·82	5·18	4·66	4·24	3·89	3·60	3·35	3·13
40	192	6·82	48·1	24·0	16·0	12·0	9·63	8·03	6·89	6·03	5·36	4·83	4·40	4·04	3·73	3·47	3·24
41	199	7·03	49·8	24·9	16·6	12·5	9·97	8·32	7·13	6·25	5·56	5·01	4·56	4·18	3·86	3·59	3·36
42	206	7·25	51·6	25·8	17·2	12·9	10·3	8·61	7·39	6·47	5·76	5·19	4·72	4·33	4·00	3·72	3·48
43	214	7·48	53·4	26·7	17·8	13·4	10·7	8·92	7·65	6·70	5·96	5·37	4·89	4·49	4·15	3·85	3·60
44	221	7·73	55·3	27·7	18·5	13·8	11·1	9·24	7·92	6·94	6·17	5·56	5·06	4·64	4·29	3·99	3.73
45	229	8·00	57·3	28·7	19·1	14·3	11·5	9·57	8·21	7·19	6·39	5·76	5·24	4·81	4·45	4·13	3·86
46	237	8·29	59·3	29·7	19·8	14·8	11·9	9·91	8·50	7·44	6·62	5·96	5·43	4·98	4·60	4·28	4·00
47	246	8·60	61·4	30·7	20·5	15·4	12·3	10·3	8·80	7·71	6·86	6·18	5·62	5·16	4·77	4·43	4·14
48	255	8·93	63·6	31·8	21·2	15·9	12·7	10·6	9·11	7·98	7·10	6·40	5·82	5·34	4·94	4·59	4·29
49	264	9·30	65·9	33·0	22·0	16·5	13·2	11·0	9·44	8·27	7·35	6·62	6·03	5·53	5·11	4·76	4·44
50	273	9·69	68·3	34·1	22·8	17·1	13·7	11·4	9·78	8·56	7·62	6·86	6·25	5·73	5·30	4·93	4·60
51	283	10·1	70·8	35·4	23·6	17·7	14·2	11·8	10·1	8·87	7·89	7·11	6·47	5·94	5·49	5·10	4·77
52	293	10·6	73·3	36·7	24·5	18·3	14·7	12·2	10·5	9·20	8·18	7·37	6·71	6·16	5·69	5·29	4·95
53	304	11·1	76·0	38·0	25·4	19·0	15·2	12·7	10·9	9·54	8·48	7·64	6·95	6·38	5·90	5·49	5·13
54	315	11·6	78·9	39·4	26·3	19·7	15·8	13·2	11·3	9·89	8·80	7·93	7·21	6·62	6·12	5·69	5·32
55	327	12·2	81·8	40·9	27·3	20·5	16·4	13·7	11·7	10·3	9·13	8·22	7·48	6·87	6·35	5·90	5·52
56	340	12·8	84·9	42·5	28·3	21·3	17·0	14·2	12·2	10·7	9·48	8·54	7·77	7·13	6·59	6·13	5·73
57	353	13·5	88·2	44·1	29·4	22·1	17·7	14·7	12·6	11·1	9·84	8·87	8·07	7·41	6·85	6·37	5·95
58	367	14·3	91·7	45·9	30·6	22·9	18·4	15·3	13·1	11·5	10·2	9·22	8·39	7·70	7·11	6·62	6·18
59	381	15·1	95·4	47·7	31·8	23·9	19·1	15·9	13·7	12·0	10·6	9·58	8·72	8·00	7·40	6·88	6·43
60	397	16·0	99·2	49·6	33·1	24·8	19·9	16·6	14·2	12·4	11·1	9·97	9·08	8·33	7·70	7·16	6·69
61	413	17·0	103	51·7	34·5	25·9	20·7	17·3	14·8	13·0	11·5	10·4	9·45	8·68	8·02	7·46	6·97
62	431	18·2	108	53·9	35·9	27·0	21·6	18·0	15·4	13·5	12·0	10·8	9·86	9·05	8·36	7·77	7·27
63	450	19·4	112	56·2	37·5	28·1	22·5	18·8	16·1	14·1	12·5	11·3	10·3	9·44	8·72	8·11	7·58
64	470	20·1	117	58·7	39·2	29·4	23·5	19·6	16·8	14·7	13·1	11·8	10·7	9·86	9·11	8·48	7·92
65	491	22·4	123	61·4	41·0	30·7	24·6	20·5	17·6	15·4	13·7	12·3	11·2	10·3	9·53	8·86	8·29
66	515	24·2	129	64·4	42·9	32·2	25·8	21·5	18·4	16·1	14·4	12·9	11·8	10·8	9·98	9·28	8·68
67	540	26·2	135	67·5	45·0	33·8	27·0	22·5	19·3	16·9	15·1	13·6	12·3	11·3	10·5	9·74	9·10
68	567	28·6	142	70·9	47·3	35·5	28·4	23·7	20·3	17·8	15·8	14·3	13·0	11·9	11·0	10·2	9·56
69	597	31·2	149	74·6	49·8	37·3	29·9	24·9	21·4	18·7	16·7	15·0	13·7	12·5	11·6	10·8	10·1
70	630	34·3	157	78·7	52·5	39·4	31·5	26·3	22·5	19·7	17·6	15·8	14·4	13·2	12·2	11·4	10·6
71	666	37·8	166	83·2	55·5	41·6	33·3	27·8	23·8	20·9	18·6	16·7	15·2	14·0	12·9	12·0	11·2
72	705	42·0	176	88·2	58·8	44·1	35·3	29·4	25·3	22·1	19·7	17·7	16·1	14·8	13·7	12·7	11·9
73	750	47	187	93·7	62·5	46·9	37·5	31·3	26·8	23·5	20·9	18·8	17·1	15·7	14·5	13·5	12·6
74	799	53	200	99·9	66·6	50·0	40·0	33·4	28·6	25·1	22·3	20·1	18·3	16·8	15·5	14·4	13·5
75	855	60	214	107	71·3	53·5	42·8	35·7	30·6	26·8	23·9	21·5	19·6	18·0	16·6	15·4	14·4
76	919	69	230	115	76·6	57·5	46·0	38·4	32·9	28·8	25·6	23·1	21·0	19·3	17·8	16·6	15·5
77	993	80	248	124	82·8	62·1	49·7	41·4	35·5	31·1	27·7	24·9	22·7	20·8	19·3	17·9	16·7
78	1078	93	270	135	89·9	67·4	54·0	45·0	38·6	33·8	30·1	27·1	24·7	22·6	20·9	19·4	18·2
79	1179	111	295	147	98·3	73·8	59·0	49·2	42·2	37·0	32·9	29·6	27·0	24·7	22·9	21·3	19·9
80	1300	134	325	163	108	81·3	65·1	54·3	46·5	40·7	36·3	32·7	29·7	27·3	25·2	23·4	21·9
81	1447	165	362	181	121	90·5	72·4	60·4	51·8	45·4	40·4	36·4	33·1	30·4	28·0	26·1	24·4
82	1631	210	408	204	136	102	81·6	68·1	58·4	51·1	45·5	41·0	37·3	34·2	31·6	29·4	27·5
83	1867	275	467	233	156	117	93·4	77·9	66·8	58·5	52·1	46·9	42·7	39·2	36·2	33·7	31·5
84	2180	377	545	273	182	136	109	91·0	78·1	68·4	60·8	54·8	49·9	45·8	42·3	39·3	36·8
85	2620	548	655	328	218	164	131	109	93·8	82·1	73·1	65·8	59·9	55·0	50·8	47·2	44·2
	m. 59	..	m. 56	m. 52	m. 48	m. 44	m. 40	m. 36	m. 32	m. 28	m. 24	m. 20	m. 16	m. 12	m. 8	m. 4	m. 00
	11 HOURS.																

Table B.

Always name the factors taken from Table B the *same* as the name of declination.

Declination.	1 HOUR.															2 Hrs.
	m. 00	m. 4	m. 8	m. 12	m. 16	m. 20	m. 24	m. 28	m. 32	m. 36	m. 40	m. 44	m. 48	m. 52	m. 56	m. 00
°	′	′	′	′	′	′	′	′	′	′	′	′	′	′	′	′
30	2·23	2·09	1·97	1·87	1·77	1·69	1·61	1·54	1·48	1·42	1·37	1·32	1·27	1·23	1·19	1·15
31	2·32	2·18	2·06	1·94	1·85	1·76	1·68	1·60	1·54	1·48	1·42	1·37	1·32	1·28	1·24	1·20
32	2·41	2·27	2·14	2·02	1·92	1·83	1·74	1·67	1·60	1·54	1·48	1·43	1·38	1·33	1·29	1·25
33	2·51	2·36	2·22	2·10	1·99	1·90	1·81	1·73	1·66	1·60	1·54	1·48	1·43	1·38	1·34	1·30
34	2·61	2·45	2·31	2·18	2·07	1·97	1·88	1·80	1·73	1·66	1·60	1·54	1·49	1·44	1·39	1·35
35	2·71	2·54	2·39	2·27	2·15	2·05	1·95	1·87	1·79	1·72	1·66	1·60	1·54	1·49	1·44	1·40
36	2·81	2·64	2·48	2·35	2·23	2·12	2·03	1·94	1·86	1·79	1·72	1·66	1·60	1·55	1·50	1·45
37	2·91	2·73	2·58	2·44	2·31	2·20	2·10	2·01	1·93	1·85	1·78	1·72	1·66	1·61	1·55	1·51
38	3·02	2·83	2·67	2·53	2·40	2·28	2·18	2·09	2·00	1·92	1·85	1·78	1·72	1·66	1·61	1·56
39	3·13	2·94	2·77	2·62	2·49	2·37	2·26	2·16	2·07	1·99	1·92	1·85	1·78	1·72	1·67	1·62
40	3·24	3·04	2·87	2·72	2·58	2·45	2·34	2·24	2·15	2·06	1·99	1·91	1·85	1·79	1·73	1·68
41	3·36	3·15	2·97	2·81	2·67	2·54	2·43	2·32	2·22	2·14	2·06	1·98	1·91	1·85	1·79	1·74
42	3·48	3·27	3·08	2·91	2·77	2·63	2·51	2·40	2·30	2·21	2·13	2·05	1·98	1·92	1·86	1·80
43	3·60	3·38	3·19	3·02	2·86	2·73	2·60	2·49	2·39	2·29	2·21	2·13	2·05	1·99	1·92	1·87
44	3·73	3·50	3·30	3·13	2·97	2·82	2·69	2·58	2·47	2·37	2·29	2·20	2·13	2·06	1·99	1·93
45	3·86	3·63	3·42	3·24	3·07	2·92	2·79	2·67	2·56	2·46	2·37	2·28	2·20	2·13	2·06	2·00
46	4·00	3·76	3·54	3·35	3·18	3·03	2·89	2·76	2·65	2·55	2·45	2·36	2·28	2·21	2·14	2·07
47	4·14	3·89	3·67	3·47	3·29	3·14	2·99	2·86	2·74	2·64	2·54	2·45	2·36	2·28	2·21	2·14
48	4·29	4·03	3·80	3·59	3·41	3·25	3·10	2·96	2·84	2·73	2·63	2·53	2·45	2·37	2·29	2·22
49	4·44	4·17	3·93	3·72	3·53	3·36	3·21	3·07	2·94	2·83	2·72	2·62	2·53	2·45	2·37	2·30
50	4·60	4·32	4·08	3·86	3·66	3·48	3·33	3·18	3·05	2·93	2·82	2·72	2·63	2·54	2·46	2·38
51	4·77	4·48	4·22	4·00	3·79	3·61	3·45	3·30	3·16	3·04	2·92	2·82	2·72	2·63	2·55	2·47
52	4·95	4·64	4·38	4·14	3·93	3·74	3·57	3·42	3·28	3·15	3·03	2·92	2·82	2·73	2·64	2·56
53	5·13	4·81	4·54	4·29	4·08	3·88	3·70	3·54	3·40	3·26	3·14	3·03	2·92	2·83	2·74	2·65
54	5·32	4·99	4·71	4·54	4·23	4·02	3·84	3·67	3·52	3·38	3·26	3·14	3·03	2·93	2·84	2·75
55	5·52	5·18	4·88	4·62	4·39	4·18	3·99	3·81	3·66	3·51	3·38	3·26	3·15	3·04	2·95	2·86
56	5·73	5·38	5·07	4·80	4·55	4·33	4·14	3·96	3·79	3·65	3·51	3·38	3·27	3·16	3·06	2·97
57	5·95	5·59	5·27	4·98	4·73	4·50	4·30	4·11	3·94	3·79	3·64	3·51	3·39	3·28	3·18	3·08
58	6·18	5·81	5·47	5·18	4·92	4·68	4·47	4·27	4·10	3·93	3·79	3·65	3·53	3·41	3·30	3·20
59	6·43	6·04	5·69	5·39	5·11	4·87	4·64	4·44	4·26	4·09	3·94	3·80	3·67	3·55	3·43	3·33
60	6·69	6·28	5·92	5·61	5·32	5·06	4·83	4·62	4·43	4·26	4·10	3·95	3·82	3·69	3·57	3·46
61	6·97	6·55	6·17	5·84	5·54	5·27	5·03	4·82	4·62	4·44	4·27	4·12	3·97	3·84	3·72	3·61
62	7·27	6·82	6·43	6·09	5·78	5·50	5·25	5.02	4·81	4·62	4·45	4·29	4·14	4·01	3·88	3·76
63	7·58	7·12	6·71	6·35	6·03	5·74	5·48	5·24	5·02	4·83	4·64	4·48	4·32	4·18	4·05	3·93
64	7·92	7·44	7·01	6·63	6·30	5·99	5·72	5·47	5·25	5·04	4·85	4·68	4·52	4·37	4·23	4·10
65	8·29	7·78	7·33	6·94	6·59	6·27	5·98	5·72	5·49	5·27	5·07	4·89	4·72	4·57	4·42	4·29
66	8·68	8·15	7·68	7·27	6·90	6·57	6·27	6·00	5·75	5·52	5·31	5·12	4·95	4·78	4·63	4·49
67	9·10	8·55	8·06	7·62	7·24	6·89	6·57	6·29	6·03	5·79	5·57	5·37	5·19	5·02	4·86	4·71
68	9·56	8·98	8·47	8·01	7·60	7·24	6·91	6·61	6·33	6·09	5·86	5·65	5·45	5·27	5·11	4·95
69	10·1	9·45	8·91	8·43	8·00	7·62	7·27	6·95	6·67	6·40	6·16	5·94	5·74	5·55	5·37	5·21
70	10·6	9·97	9·40	8·89	8·44	8·03	7·67	7·33	7·03	6·75	6·50	6·27	6·05	5·85	5·67	5·49
71	11·2	10·5	9·93	9·40	8·92	8·49	8·10	7·75	7·43	7·14	6·87	6·63	6·40	6·19	5·99	5·81
72	11·9	11·2	10·5	9·96	9·45	9·00	8·59	8·22	7·88	7·57	7·28	7·02	6·78	6·56	6·35	6·16
73	12·6	11·9	11·2	10·6	10·0	9·56	9·13	8·73	8·37	8·04	7·74	7·46	7·20	6·97	6·75	6·54
74	13·5	12·7	11·9	11·3	10·7	10·2	9·73	9·31	8·93	8·57	8·25	7·96	7·68	7·43	7·19	6·97
75	14·4	13·5	12·8	12·1	11·5	10·9	10·4	9·96	9·55	9·18	8·83	8·51	8·22	7·95	7·70	7·46
76	15·5	14·6	13·7	13·0	12·3	11·7	11·2	10·7	10·3	9·86	9·49	9·15	8·83	8·54	8·27	8·02
77	16·7	15·7	14·8	14·0	13·3	12·7	12·1	11·6	11·1	10·6	10·2	9·88	9·54	9·23	8·93	8·66
78	18·2	17·1	16·1	15·2	14·5	13·8	13·1	12·6	12·0	11·6	11·1	10·7	10·4	10·0	9·70	9·41
79	19·9	18·7	17·6	16·6	15·8	15·0	14·4	13·7	13·2	12·6	12·2	11·7	11·3	11·0	10·6	10·3
80	21·9	20·6	19·4	18·4	17·4	16·6	15·8	15·1	14·5	13·9	13·4	12·9	12·5	12·1	11·7	11·3
81	24·4	22·9	21·6	20·4	19·4	18·5	17·6	16·9	16·2	15·5	14·9	14·4	13·9	13·4	13·0	12·6
82	27·5	25·8	24·3	23·0	21·9	20·8	19·9	19·0	18·2	17·5	16·8	16·2	15·7	15·2	14·7	14·2
83	31·5	29·5	27·9	26·4	25·0	23·8	22·7	21·7	20·8	20·0	19·3	18·6	17·9	17·3	16·8	16·3
84	36·8	34·5	32·5	30·8	29·2	27·8	26·5	25·4	24·4	23·4	22·5	21·7	21·0	20·3	19·6	19·0
85	44·2	41·5	39·1	37·0	35·1	33·4	31·9	30·5	29·3	28·1	27·0	26·1	25·2	24·3	23·6	22·9
	m. 00	m. 56	m. 52	m. 48	m. 44	m. 40	m. 36	m. 32	m. 28	m. 24	m. 20	m. 16	m. 12	m. 8	m. 4	m. 00
	11 Hrs.	10 HOURS.														

Table B.

Always name the factors taken from Table B the *same* as the name of declination.

Declination.	2 HOURS.															3 Hrs.
	m. 00	m. 4	m. 8	m. 12	m. 16	m. 20	m. 24	m. 28	m. 32	m. 36	m. 40	m. 44	m. 48	m. 52	m. 56	m. 00
°	′	′	′	′	′	′	′	′	′	′	′	′	′	′	′	′
30	1·15	1·12	1·09	1·06	1·03	1·01	·98	·96	·94	·92	·90	·88	·86	·85	·83	·82
31	1·20	1·17	1·13	1·10	1·07	1·05	1·02	1·00	·98	·95	·93	·92	·90	·88	·86	·85
32	1·25	1·21	1·18	1·15	1·12	1·09	1·06	1·04	1·01	·99	·97	·95	·93	·92	·90	·88
33	1·30	1·26	1·23	1·19	1·16	1·13	1·10	1·08	1·05	1·03	1·01	·99	·97	·95	·93	·92
34	1·35	1·31	1·27	1·24	1·21	1·18	1·15	1·12	1·10	1·07	1·05	1·03	1·01	·99	·97	·95
35	1·40	1·36	1·32	1·29	1·25	1·22	1·19	1·16	1·14	1·11	1·09	1·07	1·05	1·03	1·01	·99
36	1·45	1·41	1·37	1·33	1·30	1·27	1·24	1·21	1·18	1·15	1·13	1·11	1·09	1·07	1·05	1·03
37	1·51	1·46	1·42	1·38	1·35	1·31	1·28	1·25	1·22	1·20	1·17	1·15	1·30	1·10	1·08	1·07
38	1·56	1·52	1·47	1·43	1·40	1·36	1·33	1·30	1·27	1·24	1·22	1·19	1·17	1·15	1·12	1·10
39	1·62	1·57	1·53	1·49	1·45	1·41	1·38	1·35	1·32	1·29	1·26	1·23	1·21	1·19	1·17	1·15
40	1·68	1·63	1·58	1·54	1·50	1·46	1·43	1·39	1·36	1·33	1·31	1·28	1·25	1·23	1·21	1·19
41	1·74	1·69	1·64	1·60	1·55	1·52	1·48	1·44	1·41	1·38	1·35	1·33	1·30	1·27	1·25	1·23
42	1·80	1·75	1·70	1·65	1·61	1·57	1·53	1·50	1·46	1·43	1·40	1·37	1·35	1·32	1·30	1·27
43	1·87	1·81	1·76	1·71	1·67	1·63	1·59	1·55	1·51	1·48	1·45	1·42	1·39	1·37	1·34	1·32
44	1·93	1·87	1·82	1·77	1·73	1·68	1·64	1·60	1·57	1·53	1·50	1·47	1·44	1·42	1·39	1·37
45	2·00	1·94	1·89	1·84	1·79	1·74	1·70	1·66	1·62	1·59	1·56	1·52	1·49	1·47	1·44	1·41
46	2·07	2·01	1·95	1·90	1·85	1·81	1·76	1·72	1·68	1·65	1·61	1·58	1·55	1·52	1·49	1·46
47	2·14	2·08	2·02	1·97	1·92	1·87	1·82	1·78	1·74	1·70	1·67	1·63	1·60	1·57	1·54	1·52
48	2·22	2·16	2·10	2·04	1·99	1·94	1·89	1·85	1·80	1·76	1·73	1·69	1·66	1·63	1·60	1·57
49	2·30	2·23	2·17	2·11	2·06	2·01	1·96	1·91	1·87	1·83	1·79	1·75	1·72	1·69	1·66	1·63
50	2·38	2·31	2·25	2·19	2·13	2·08	2·03	1·98	1·94	1·89	1·85	1·82	1·78	1·75	1·72	1·69
51	2·47	2·40	2·33	2·27	2·21	2·15	2·10	2·05	2·01	1·96	1·92	1·88	1·85	1·81	1·78	1·75
52	2·56	2·49	2·42	2·35	2·29	2·23	2·18	2·13	2·08	2·03	1·99	1·95	1·91	1·88	1·84	1·81
53	2·65	2·58	2·50	2·44	2·37	2·31	2·26	2·21	2·16	2·11	2·06	2·02	1·98	1·95	1·91	1·88
54	2·75	2·67	2·60	2·53	2·46	2·40	2·34	2·29	2·24	2·19	2·14	2·10	2·06	2·02	1·98	1·95
55	2·86	2·77	2·70	2·62	2·55	2·49	2·43	2·37	2·32	2·27	2·22	2·18	2·13	2·09	2·06	2·02
56	2·97	2·88	2·80	2·72	2·65	2·58	2·52	2·46	2·41	2·36	2·31	2·26	2·22	2·17	2·13	2·10
57	3·08	2·99	2·91	2·83	2·75	2·68	2·62	2·56	2·50	2·45	2·40	2·35	2·30	2·26	2·22	2·18
58	3·20	3·11	3·02	2·94	2·86	2·79	2·72	2·66	2·60	2·54	2·49	2·44	2·39	2·35	2·30	2·26
59	3·33	3·23	3·14	3·06	2·98	2·90	2·83	2·77	2·70	2·64	2·59	2·54	2·49	2·44	2·40	2·35
60	3·46	3·36	3·27	3·18	3·10	3·02	2·95	2·88	2·81	2·75	2·69	2·64	2·59	2·54	2·49	2·45
61	3·61	3·50	3·40	3·31	3·23	3·15	3·07	3·00	2·93	2·87	2·81	2·75	2·70	2·65	2·60	2·55
62	3·76	3·65	3·55	3·45	3·36	3·28	3·20	3·13	3·05	2·99	2·93	2·87	2·81	2·76	2·71	2·66
63	3·93	3·81	3·70	3·60	3·51	3·42	3·34	3·26	3·19	3·12	3·05	2·99	2·93	2·88	2·83	2·78
64	4·10	3·98	3·87	3·76	3·67	3·57	3·49	3·41	3·33	3·26	3·19	3·13	3·06	3·01	2·95	2·90
65	4·29	4·16	4·05	3·94	3·84	3·74	3·65	3·56	3·48	3·41	3·34	3·27	3·20	3·14	3·09	3·03
66	4·49	4·36	4·24	4·12	4·02	3·92	3·82	3·73	3·65	3·57	3·49	3·42	3·36	3·29	3·23	3·18
67	4·71	4·57	4·45	4·33	4·21	4·11	4·01	3·91	3·83	3·74	3·67	3·58	3·52	3·45	3·39	3·33
68	4·95	4·81	4·67	4·54	4·43	4·32	4·21	4·11	4·02	3·93	3·85	3·77	3·70	3·63	3·56	3·50
69	5·21	5·06	4·92	4·78	4·66	4·54	4·43	4·33	4·23	4·14	4·05	3·97	3·89	3·82	3·75	3·68
70	5·49	5·33	5·18	5·04	4·91	4·79	4·67	4·57	4·46	4·37	4·27	4·19	4·11	4·03	3·96	3·89
71	5·81	5·64	5·48	5·33	5·19	5·06	4·94	4·83	4·72	4·61	4·52	4·43	4·34	4·26	4·18	4·11
72	6·16	5·98	5·81	5·65	5·50	5·37	5·24	5·11	5·00	4·89	4·79	4·69	4·60	4·51	4·43	4·35
73	6·54	6·35	6·17	6·01	5·85	5·70	5·56	5·43	5·31	5·20	5·09	4·99	4·89	4·80	4·71	4·63
74	6·97	6·77	6·58	6·40	6·24	6·08	5·93	5·79	5·66	5·54	5·43	5·32	5·21	5·11	5·02	4·93
75	7·46	7·25	7·04	6·85	6·67	6·51	6·35	6·20	6·06	5·93	5·81	5·69	5·58	5·47	5·37	5·28
76	8·02	7·79	7·57	7·36	7·17	6·99	6·82	6·66	6·51	6·37	6·24	6·11	5·99	5·88	5·77	5·67
77	8·66	8·41	8·17	7·95	7·75	7·55	7·37	7·20	7·04	6·88	6·74	6·60	6·47	6·35	6·24	6·13
78	9·41	9·13	8·88	8·64	8·41	8·20	8·00	7·82	7·64	7·48	7·32	7·17	7·03	6·90	6·77	6·65
79	10·3	9·99	9·71	9·45	9·20	8·97	8·75	8·55	8·36	8·17	8·00	7·84	7·69	7·54	7·41	7·28
80	11·3	11·0	10·7	10·4	10·1	9·89	9·65	9·42	9·21	9·01	8·82	8·64	8·48	8·32	8·16	8·02
81	12·6	12·3	11·9	11·6	11·3	11·0	10·7	10·5	10·3	10·0	9·82	9·62	9·44	9·26	9·09	8·93
82	14·2	13·8	13·4	13·1	12·7	12·4	12·1	11·8	11·6	11·3	11·1	10·8	10·6	10·4	10·2	10·1
83	16·3	15·8	15·4	15·0	14·6	14·2	13·9	13·5	13·2	12·9	12·7	12·4	12·2	11·9	11·7	11·5
84	19·0	18·5	18·0	17·5	17·0	16·6	16·2	15·8	15·5	15·1	14·8	14·5	14·2	14·0	13·7	13·5
85	22·9	22·2	21·6	21·0	20·4	19·9	19·4	19·0	18·6	18·2	17·8	17·4	17·1	16·8	16·5	16·2
	m. 00	m. 56	m. 52	m. 48	m. 44	m. 40	m. 36	m. 32	m. 28	m. 24	m. 20	m. 16	m. 12	m. 8	m. 4	m. 00
	10 Hrs.	9 HOURS.														

Table B.

Always name the factors taken from Table B the *same* as the name of declination.

Declination.	3 HOURS.															4 Hrs.
	m. 00	m. 4	m. 8	m. 12	m. 16	m. 20	m. 24	m. 28	m. 32	m. 36	m. 40	m. 44	m. 48	m. 52	m. 56	m. 00
°	′	′	′	′	′	′	′	′	′	′	′	′	′	′	′	′
30	·82	·80	·79	·78	·76	·75	·74	·73	·72	·71	·70	·70	·69	·68	·67	·67
31	·85	·84	·82	·81	·80	·78	·77	·76	·75	·74	·73	·72	·72	·71	·70	·69
32	·88	·87	·85	·84	·83	·82	·80	·79	·78	·77	·76	·75	·75	·74	·73	·72
33	·92	·90	·89	·87	·86	·85	·84	·82	·81	·80	·79	·78	·77	·77	·76	·75
34	·95	·94	·92	·91	·89	·88	·87	·86	·84	·83	·82	·81	·80	·80	·79	·78
35	·99	·97	·96	·94	·93	·91	·90	·89	·88	·87	·85	·84	·83	·83	·82	·81
36	1·03	1·01	·99	·98	·96	·95	·93	·92	·91	·90	·89	·88	·87	·86	·85	·84
37	1·07	1·05	1·03	1·01	1·00	·98	·97	·96	·94	·93	·92	·91	·90	·89	·88	·87
38	1·10	1·09	1·07	1·05	1·04	1·02	1·01	·99	·98	·97	·95	·94	·93	·92	·91	·90
39	1·15	1·13	1·11	1·09	1·07	1·06	1·04	1·03	1·01	1·00	·99	·98	·97	·95	·94	·94
40	1·19	1·17	1·15	1·13	1·11	1·10	1·08	1·06	1·05	1·04	1·02	1·01	1·00	·99	·98	·97
41	1·23	1·21	1·19	1·17	1·15	1·13	1·12	1·10	1·09	1·07	1·06	1·05	1·04	1·03	1·01	1·00
42	1·27	1·25	1·23	1·21	1·19	1·18	1·16	1·14	1·13	1·11	1·10	1·09	1·07	1·06	1·05	1·04
43	1·32	1·30	1·28	1·25	1·24	1·22	1·20	1·18	1·17	1·15	1·14	1·12	1·11	1·10	1·09	1·08
44	1·37	1·34	1·32	1·30	1·28	1·26	1·24	1·23	1·21	1·19	1·18	1·16	1·15	1·14	1·13	1·12
45	1·41	1·39	1·37	1·35	1·33	1·31	1·29	1·27	1·25	1·24	1·22	1·21	1·19	1·18	1·17	1·15
46	1·46	1·44	1·42	1·39	1·37	1·35	1·33	1·31	1·30	1·28	1·26	1·25	1·23	1·22	1·21	1·20
47	1·52	1·49	1·47	1·44	1·42	1·40	1·38	1·36	1·34	1·33	1·31	1·29	1·28	1·26	1·25	1·24
48	1·57	1·54	1·52	1·49	1·47	1·45	1·43	1·41	1·39	1·37	1·36	1·34	1·32	1·31	1·30	1·28
49	1·63	1·60	1·57	1·55	1·52	1·50	1·48	1·46	1·44	1·42	1·40	1·39	1·37	1·36	1·34	1·33
50	1·69	1·66	1·63	1·60	1·58	1·56	1·53	1·51	1·49	1·47	1·45	1·44	1·42	1·41	1·39	1·38
51	1·75	1·72	1·69	1·66	1·64	1·61	1·59	1·57	1·55	1·53	1·51	1·49	1·47	1·46	1·44	1·43
52	1·81	1·78	1·75	1·72	1·70	1·67	1·65	1·62	1·60	1·58	1·56	1·54	1·53	1·51	1·49	1·48
53	1·88	1·84	1·81	1·79	1·76	1·73	1·71	1·68	1·66	1·64	1·62	1·60	1·58	1·56	1·55	1·53
54	1·95	1·91	1·88	1·85	1·82	1·80	1·77	1·75	1·72	1·70	1·68	1·66	1·64	1·62	1·61	1·59
55	2·02	1·99	1·95	1·92	1·89	1·86	1·84	1·81	1·79	1·77	1·74	1·72	1·70	1·68	1·67	1·65
56	2·10	2·06	2·03	1·99	1·96	1·94	1·91	1·88	1·86	1·83	1·81	1·79	1·77	1·75	1·73	1·71
57	2·18	2·14	2·11	2·07	2·04	2·01	1·98	1·95	1·93	1·90	1·88	1·86	1·84	1·82	1·80	1·78
58	2·26	2·22	2·19	2·15	2·12	2·09	2·06	2·03	2·00	1·98	1·95	1·93	1·91	1·89	1·87	1·85
59	2·35	2·31	2·28	2·24	2·21	2·17	2·14	2·11	2·08	2·06	2·03	2·01	1·98	1·96	1·94	1·92
60	2·45	2·41	2·37	2·33	2·29	2·26	2·23	2·20	2·17	2·14	2·11	2·09	2·07	2·04	2·02	2·00
61	2·55	2·51	2·47	2·43	2·39	2·36	2·32	2·29	2·26	2·23	2·20	2·18	2·15	2·13	2·10	2·08
62	2·66	2·61	2·57	2·53	2·49	2·46	2·42	2·39	2·35	2·32	2·30	2·27	2·24	2·22	2·19	2·17
63	2·78	2·73	2·68	2·64	2·60	2·56	2·53	2·49	2·46	2·43	2·40	2·37	2·34	2·31	2·29	2·27
64	2·90	2·85	2·80	2·76	2·72	2·68	2·64	2·60	2·57	2·53	2·50	2·47	2·44	2·42	2·39	2·37
65	3·03	2·98	2·93	2·89	2·84	2·80	2·76	2·72	2·69	2·65	2·62	2·59	2·56	2·53	2·50	2·48
66	3·18	3·12	3·07	3·02	2·98	2·93	2·89	2·85	2·81	2·78	2·74	2·71	2·68	2·65	2·62	2·59
67	3·33	3·28	3·22	3·17	3·12	3·08	3·03	2·99	2·95	2·91	2·88	2·84	2·81	2·78	2·75	2·72
68	3·50	3·44	3·38	3·33	3·28	3·23	3·18	3·14	3·10	3·06	3·02	2·99	2·95	2·92	2·89	2·86
69	3·68	3·62	3·56	3·51	3·45	3·40	3·35	3·31	3·26	3·22	3·18	3·14	3·11	3·07	3·04	3·01
70	3·89	3·82	3·76	3·70	3·64	3·59	3·54	3·49	3·44	3·40	3·35	3·31	3·28	3·24	3·21	3·17
71	4·11	4·04	3·97	3·91	3·85	3·79	3·74	3·69	3·64	3·59	3·55	3·50	3·46	3·42	3·39	3·35
72	4·35	4·28	4·21	4·14	4·08	4·02	3·96	3·91	3·85	3·80	3·76	3·71	3·67	3·63	3·59	3·55
73	4·63	4·55	4·47	4·40	4·33	4·27	4·21	4·15	4·10	4·04	3·99	3·95	3·90	3·86	3·82	3·78
74	4·93	4·85	4·77	4·69	4·62	4·55	4·49	4·43	4·37	4·31	4·26	4·21	4·16	4·11	4·07	4·03
75	5·28	5·19	5·10	5·02	4·95	4·87	4·80	4·74	4·67	4·61	4·56	4·50	4·45	4·40	4·35	4·31
76	5·67	5·58	5·48	5·40	5·31	5·24	5·16	5·09	5·02	4·96	4·90	4·84	4·78	4·73	4·68	4·63
77	6·13	6·02	5·92	5·83	5·74	5·65	5·57	5·50	5·42	5·35	5·29	5·22	5·16	5·11	5·05	5·00
78	6·65	6·54	6·43	6·33	6·23	6·14	6·05	5·97	5·89	5·82	5·74	5·67	5·61	5·55	5·49	5·43
79	7·28	7·15	7·03	6·92	6·82	6·72	6·62	6·53	6·44	6·36	6·28	6·21	6·13	6·07	6·00	5·94
80	8·02	7·88	7·75	7·63	7·51	7·40	7·30	7·20	7·10	7·01	6·92	6·84	6·76	6·69	6·62	6·55
81	8·93	8·78	8·63	8·50	8·37	8·24	8·12	8·01	7·91	7·80	7·71	7·62	7·53	7·45	7·37	7·29
82	10·1	9·89	9·73	9·57	9·43	9·29	9·16	9·03	8·91	8·80	8·69	8·58	8·48	8·39	8·30	8·22
83	11·5	11·3	11·1	11·0	10·8	10·6	10·5	10·3	10·2	10·1	9·94	9·82	9·71	9·60	9·50	9·40
84	13·5	13·2	13·0	12·8	12·6	12·4	12·2	12·1	11·9	11·8	11·6	11·5	11·3	11·2	11·1	11·0
85	16·2	15·9	15·6	15·4	15·1	14·9	14·7	14·5	14·3	14·1	14·0	13·8	13·6	13·5	13·3	13·2
	m. 00	m. 56	m. 52	m. 48	m. 44	m. 40	m. 36	m. 32	m. 28	m. 24	m. 20	m. 16	m. 12	m. 8	m. 4	m. 00
	9 Hrs.	8 HOURS.														

Table B.

Always name the factors taken from Table B the *same* as the name of declination.

Declination.	4 HOURS.															5 Hrs.
	m. 00	m. 4	m. 8	m. 12	m. 16	m. 20	m. 24	m. 28	m. 32	m. 36	m. 40	m. 44	m. 48	m. 52	m. 56	m. 00
°	′	′	′	′	′	′	′	′	′	′	′	′	′	′	′	′
30	·67	·66	·65	·65	·64	·64	·63	·63	·62	·62	·61	·61	·61	·60	·60	·60
31	·69	·69	·68	·67	·67	·66	·66	·65	·65	·64	·64	·64	·63	·63	·63	·62
32	·72	·71	·71	·70	·70	·69	·68	·68	·67	·67	·66	·66	·66	·65	·65	·65
33	·75	·74	·74	·73	·72	·72	·71	·71	·70	·70	·69	·69	·68	·68	·68	·67
34	·78	·77	·76	·76	·75	·74	·74	·73	·73	·72	·72	·71	·71	·71	·70	·70
35	·81	·80	·79	·79	·78	·77	·77	·76	·76	·75	·75	·74	·74	·73	·73	·72
36	·84	·83	·82	·82	·81	·80	·80	·79	·78	·78	·77	·77	·76	·76	·76	·75
37	·87	·86	·85	·85	·84	·83	·82	·82	·81	·81	·80	·80	·79	·79	·78	·78
38	·90	·89	·88	·88	·87	·86	·86	·85	·84	·84	·83	·83	·82	·82	·81	·81
39	·94	·93	·92	·91	·90	·89	·89	·88	·87	·87	·86	·86	·85	·85	·84	·84
40	·97	·96	·95	·94	·93	·93	·92	·91	·90	·90	·89	·89	·88	·88	·87	·87
41	1·00	·99	·98	·98	·97	·96	·95	·94	·94	·93	·93	·92	·91	·91	·90	·90
42	1·04	1·03	1·02	1·01	1·00	·99	·99	·98	·97	·96	·96	·95	·95	·94	·94	·93
43	1·08	1·07	1·06	1·05	1·04	1·03	1·02	1·01	1·01	1·00	·99	·99	·98	·98	·97	·97
44	1·12	1·10	1·09	1·08	1·07	1·07	1·06	1·05	1·04	1·03	1·03	1·02	1·02	1·01	1·00	1·00
45	1·15	1·14	1·13	1·12	1·11	1·10	1·09	1·09	1·08	1·07	1·06	1·06	1·05	1·05	1·04	1·04
46	1·20	1·18	1·17	1·16	1·15	1·14	1·13	1·12	1·12	1·11	1·10	1·10	1·09	1·08	1·08	1·07
47	1·24	1·23	1·21	1·20	1·19	1·18	1·17	1·16	1·16	1·15	1·14	1·13	1·13	1·12	1·12	1·11
48	1·28	1·27	1·26	1·25	1·24	1·23	1·22	1·21	1·20	1·19	1·18	1·17	1·17	1·16	1·16	1·15
49	1·33	1·32	1·30	1·29	1·28	1·27	1·26	1·25	1·24	1·23	1·22	1·22	1·21	1·20	1·20	1·19
50	1·38	1·36	1·35	1·34	1·33	1·31	1·30	1·29	1·29	1·28	1·27	1·26	1·25	1·25	1·24	1·23
51	1·43	1·41	1·40	1·39	1·37	1·36	1·35	1·34	1·33	1·32	1·31	1·31	1·30	1·29	1·28	1·28
52	1·48	1·46	1·45	1·44	1·42	1·41	1·40	1·39	1·38	1·37	1·36	1·35	1·35	1·34	1·33	1·33
53	1·53	1·52	1·50	1·49	1·48	1·46	1·45	1·44	1·43	1·42	1·41	1·40	1·40	1·39	1·38	1·37
54	1·59	1·57	1·56	1·54	1·53	1·52	1·51	1·50	1·48	1·47	1·46	1·46	1·45	1·44	1·43	1·42
55	1·65	1·63	1·62	1·60	1·59	1·58	1·56	1·55	1·54	1·53	1·52	1·51	1·50	1·49	1·49	1·48
56	1·71	1·70	1·68	1·66	1·65	1·64	1·62	1·61	1·60	1·59	1·58	1·57	1·56	1·55	1·54	1·53
57	1·78	1·76	1·74	1·73	1·71	1·70	1·69	1·67	1·66	1·65	1·64	1·63	1·62	1·61	1 60	1·59
58	1·85	1·83	1·81	1·80	1·78	1·77	1·75	1·74	1·73	1·71	1·70	1·69	1·68	1·67	1·66	1·66
59	1·92	1·90	1·88	1·87	1·85	1·84	1·82	1·81	1·79	1·78	1·77	1·76	1·75	1·74	1·73	1·72
60	2·00	1·98	1·96	1·94	1·93	1·91	1·90	1·88	1·87	1·86	1·84	1·83	1·82	1·81	1·80	1·79
61	2·08	2·06	2·04	2·02	2·01	1·99	1·97	1·96	1·95	1·93	1·92	1·91	1·90	1·89	1·88	1·87
62	2·17	2·15	2·13	2·11	2·09	2·08	2·06	2·04	2·03	2·01	2·00	1·99	1·98	1·97	1·96	1·95
63	2·27	2·24	2·22	2·20	2·18	2·17	2·15	2·13	2·12	2·10	2·09	2·08	2·06	2·05	2·04	2·03
64	2·37	2·34	2·32	2·30	2·28	2·26	2·24	2·23	2·21	2·20	2·18	2·17	2·16	2·14	2·13	2·12
65	2·48	2·45	2·43	2·41	2·39	2·37	2·35	2·33	2·31	2·30	2·28	2·27	2·25	2·24	2·23	2·22
66	2·59	2·57	2·54	2·52	2·50	2·48	2·46	2·44	2·42	2·41	2·39	2·38	2·36	2·35	2·34	2·33
67	2·72	2·69	2·67	2·64	2·62	2·60	2·58	2·56	2·54	2·52	2·51	2·49	2·48	2·46	2·45	2·44
68	2·86	2·83	2·80	2·78	2·75	2·73	2·71	2·69	2·67	2·65	2·63	2·62	2·60	2·59	2·57	2·56
69	3·01	2·98	2·95	2·92	2·90	2·87	2·85	2·83	2·81	2·79	2·77	2·76	2·74	2·72	2·71	2·70
70	3·17	3·14	3·11	3·08	3·06	3·03	3·01	2·98	2·96	2·94	2·92	2·91	2·89	2·87	2·86	2·84
71	3·35	3·32	3·29	3·26	3·23	3·20	3·18	3·16	3·13	3·11	3·09	3·07	3·05	3·04	3·02	3·01
72	3·55	3·52	3·49	3·45	3·42	3·40	3·37	3·34	3·32	3·30	3·28	3·26	3·24	3·22	3·20	3·19
73	3·78	3·74	3·70	3·67	3·64	3·61	3·58	3·55	3·53	3·50	3·48	3·46	3·44	3·42	3·40	3·39
74	4·03	3·99	3·95	3·91	3·88	3·85	3·82	3·79	3·76	3·74	3·71	3·69	3·67	3·65	3·63	3·61
75	4·31	4·27	4·23	4·19	4·15	4·12	4·09	4·05	4·03	4·00	3·97	3·95	3·92	3·90	3·88	3·86
76	4·63	4·59	4·54	4·50	4·46	4·43	4·39	4·36	4·33	4·30	4·27	4·24	4·22	4·19	4·17	4·15
77	5·00	4·95	4·91	4·86	4·82	4·78	4·74	4·71	4·67	4·64	4·61	4·58	4·55	4·53	4·51	4·48
78	5·43	5·38	5·33	5·28	5·23	5·19	5·15	5·11	5·07	5·04	5·01	4·98	4·95	4·92	4·89	4·87
79	5·94	5·88	5·83	5·77	5·72	5·68	5·63	5·59	5·55	5·51	5·47	5·44	5·41	5·38	5·35	5·33
80	6·55	6·48	6·42	6·37	6·31	6·26	6·21	6·16	6·12	6·07	6·04	6·00	5·96	5·93	5·90	5·87
81	7·29	7·22	7·15	7·09	7·02	6·97	6·91	6·86	6·81	6·76	6·72	6·68	6·64	6·60	6·57	6·54
82	8·22	8·14	8·06	7·99	7·92	7·85	7·79	7·73	7·67	7·62	7·57	7·53	7·48	7·44	7·40	7·37
83	9·40	9·31	9·22	9·14	9·06	8·99	8·92	8·85	8·78	8·72	8·67	8·61	8·56	8·52	8·47	8·43
84	11·0	10·9	10·8	10·7	10·6	10·5	10·4	10·3	10·3	10·2	10·1	10·1	10·0	9·95	9·90	9·85
85	13·2	13·1	12·9	12·8	12·7	12·6	12·5	12·4	12·3	12·2	12·2	12·1	12·0	12·0	11·9	11·8
	m. 00	m. 56	m. 52	m. 48	m. 44	m. 40	m. 36	m. 32	m. 28	m. 24	m. 20	m. 16	m. 12	m. 8	m. 4	m. 00
	8 Hrs.	7 HOURS.														

Table B.

Always name the factors taken from Table B the *same* as the name of declination.

Declination.	5 HOURS.															6 Hrs.
	m. 00	m. 4	m. 8	m. 12	m. 16	m. 20	m. 24	m. 28	m. 32	m. 36	m. 40	m. 44	m. 48	m. 52	m. 56	m. 00
°	′	′	′	′	′	′	′	′	′	′	′	′	′	′	′	′
30	·60	·60	·59	·59	·59	·59	·58	·58	·58	·58	·58	·58	·58	·58	·58	·58
31	·62	·62	·62	·61	·61	·61	·61	·61	·61	·60	·60	·60	·60	·60	·60	·60
32	·65	·64	·64	·64	·64	·63	·63	·63	·63	·63	·63	·63	·63	·63	·62	·62
33	·67	·67	·67	·66	·66	·66	·66	·66	·65	·65	·65	·65	·65	·65	·65	·65
34	·70	·70	·69	·69	·69	·68	·68	·68	·68	·68	·68	·68	·68	·67	·67	·67
35	·72	·72	·72	·72	·71	·71	·71	·71	·71	·70	·70	·70	·70	·70	·70	·70
36	·75	·75	·75	·74	·74	·74	·74	·73	·73	·73	·73	·73	·73	·73	·73	·73
37	·78	·78	·77	·77	·77	·77	·76	·76	·76	·76	·76	·76	·75	·75	·75	·75
38	·81	·81	·80	·80	·80	·79	·79	·79	·79	·79	·78	·78	·78	·78	·78	·78
39	·84	·83	·83	·83	·82	·82	·82	·82	·82	·81	·81	·81	·81	·81	·81	·81
40	·87	·86	·86	·86	·85	·85	·85	·85	·85	·84	·84	·84	·84	·84	·84	·84
41	·90	·90	·89	·89	·89	·88	·88	·88	·88	·87	·87	·87	·87	·87	·87	·87
42	·93	·93	·92	·92	·92	·91	·91	·91	·91	·91	·90	·90	·90	·90	·90	·90
43	·97	·96	·96	·95	·95	·95	·94	·94	·94	·94	·94	·93	·93	·93	·93	·93
44	1·00	1·00	·99	·99	·98	·98	·98	·98	·97	·97	·97	·97	·97	·97	·97	·97
45	1·04	1·03	1·03	1·02	1·02	1·02	1·01	1·01	1·01	1·01	1·00	1·00	1·00	1·00	1·00	1·00
46	1·07	1·07	1·06	1·06	1·05	1·05	1·05	1·05	1·04	1·04	1·04	1·04	1·04	1·04	1·04	1·04
47	1·11	1·11	1·10	1·10	1·09	1·09	1·09	1·08	1·08	1·08	1·08	1·07	1·07	1·07	1·07	1·07
48	1·15	1·14	1·14	1·14	1·13	1·13	1·12	1·12	1·12	1·12	1·11	1·11	1·11	1·11	1·11	1·11
49	1·19	1·19	1·18	1·18	1·17	1·17	1·16	1·16	1·16	1·16	1·15	1·15	1·15	1·15	1·15	1·15
50	1·23	1·23	1·22	1·22	1·21	1·21	1·21	1·20	1·20	1·20	1·20	1·19	1·19	1·19	1·19	1·19
51	1·28	1·27	1·27	1·26	1·26	1·25	1·25	1·25	1·24	1·24	1·24	1·24	1·24	1·24	1·24	1·23
52	1·33	1·32	1·31	1·31	1·30	1·30	1·30	1·29	1·29	1·29	1·28	1·28	1·28	1·28	1·28	1·28
53	1·37	1·37	1·36	1·36	1·35	1·35	1·34	1·34	1·34	1·33	1·33	1·33	1·33	1·33	1·33	1·33
54	1·42	1·42	1·41	1·41	1·40	1·40	1·39	1·39	1·39	1·38	1·38	1·38	1·38	1·38	1·38	1·38
55	1·48	1·47	1·47	1·46	1·45	1·45	1·45	1·44	1·44	1·44	1·43	1·43	1·43	1·43	1·43	1·43
56	1·53	1·53	1·52	1·52	1·51	1·51	1·50	1·50	1·49	1·49	1·49	1·49	1·48	1·48	1·48	1·48
57	1·59	1·59	1·58	1·57	1·57	1·56	1·56	1·55	1·55	1·55	1·55	1·54	1·54	1·54	1·54	1·54
58	1·66	1·65	1·64	1·64	1·63	1·63	1·62	1·62	1·61	1·61	1·61	1·60	1·60	1·60	1·60	1·60
59	1·72	1·72	1·71	1·70	1·70	1·69	1·69	1·68	1·68	1·67	1·67	1·67	1·67	1·67	1·66	1·66
60	1·79	1·79	1·78	1·77	1·76	1·76	1·75	1·75	1·75	1·74	1·74	1·74	1·73	1·73	1·73	1·73
61	1·87	1·86	1·85	1·84	1·84	1·83	1·83	1·82	1·82	1·81	1·81	1·81	1·81	1·81	1·80	1·80
62	1·95	1·94	1·93	1·92	1·92	1·91	1·90	1·90	1·89	1·89	1·89	1·89	1·88	1·88	1·88	1·88
63	2·03	2·02	2·01	2·01	2.00	1·99	1·99	1·98	1·98	1·97	1·97	1·97	1·97	1·96	1·96	1·96
64	2·12	2·11	2·10	2·10	2·09	2·08	2·08	2·07	2·07	2·06	2·06	2·06	2·05	2·05	2·05	2·05
65	2·22	2·21	2·20	2·19	2·18	2·18	2·17	2·17	2·16	2·16	2·15	2·15	2·15	2·15	2·14	2·14
66	2·33	2·31	2·31	2·30	2·29	2·28	2·27	2·27	2·26	2·26	2·25	2·25	2·25	2·25	2·25	2·25
67	2·44	2·43	2·42	2·41	2·40	2·39	2·39	2·38	2·37	2·37	2·36	2·36	2·36	2·36	2·36	2·36
68	2·56	2·55	2·54	2·53	2·52	2·51	2·51	2·50	2·49	2·49	2·48	2·48	2·48	2·48	2·48	2·48
69	2·70	2·68	2·67	2·66	2·65	2·65	2·64	2·63	2·62	2·62	2·62	2·61	2·61	2·61	2·61	2·61
70	2·84	2·83	2·82	2·81	2·80	2·79	2·78	2·77	2·77	2·76	2·76	2·75	2·75	2·75	2·75	2·75
71	3·01	2·99	2·98	2·97	2·96	2·95	2·94	2·93	2·93	2·92	2·92	2·91	2·91	2·91	2·90	2·90
72	3·19	3·17	3·16	3·15	3·14	3·13	3·12	3·11	3·10	3·09	3·09	3·09	3·08	3·08	3·08	3·08
73	3·39	3·37	3·36	3·34	3·33	3·32	3·31	3·30	3·30	3·29	3·28	3·28	3·28	3·27	3·27	3·27
74	3·61	3·59	3·58	3·57	3·55	3·54	3·53	3·52	3·51	3·51	3·50	3·50	3·49	3·49	3·49	3·49
75	3·86	3·85	3·83	3·82	3·80	3·79	3·78	3·77	3·76	3·75	3·75	3·74	3·74	3·73	3·73	3·73
76	4·15	4·13	4·12	4·10	4·09	4·07	4·06	4·05	4·04	4·03	4·03	4·02	4·02	4·01	4·01	4·01
77	4·48	4·46	4·45	4·43	4·41	4·40	4·39	4·37	4·36	4·36	4·35	4·34	4·34	4·33	4·33	4·33
78	4·87	4·85	4·83	4·81	4·79	4·78	4·76	4·75	4·74	4·73	4·72	4·72	4·71	4·71	4·71	4·70
79	5·33	5·30	5·28	5·26	5·24	5·22	5·21	5·20	5·18	5·17	5·16	5·16	5·15	5·15	5·15	5·14
80	5·87	5·84	5·82	5·80	5·78	5·76	5·74	5·73	5·71	5·70	5·69	5·69	5·68	5·67	5·67	5·67
81	6·54	6·51	6·48	6·45	6·43	6·41	6·39	6·38	6·36	6·35	6·34	6·33	6·32	6·32	6·31	6·31
82	7·37	7·33	7·30	7·27	7·25	7·23	7·20	7·19	7·17	7·15	7·14	7·13	7·13	7·12	7·12	7·12
83	8·43	8·39	8·36	8·33	8·30	8·27	8·25	8·22	8·21	8·19	8·18	8·16	8·16	8·15	8·15	8·14
84	9·85	9·81	9·76	9·73	9·69	9·66	9·63	9·61	9·59	9·57	9·55	9·54	9·53	9·52	9·52	9·51
85	11·83	11·78	11·73	11·69	11·64	11·61	11·57	11·54	11·52	11·49	11·47	11·46	11·45	11·44	11·43	11·43
	m. 00	m. 56	m. 52	m. 48	m. 44	m. 40	m. 36	m. 32	m. 28	m. 24	m. 20	m. 16	m. 12	m. 8	m. 4	m. 00
	7 Hrs.	6 HOURS.														

Table A.

When hour angle is less than 6 hours, name the factors taken from Table A *contrary* to name of lat.

0 HOUR.

Lat.	m. 1	m. 4	m. 8	m. 12	m. 16	m. 20	m. 24	m. 28	m. 32	m. 36	m. 40	m. 44	m. 48	m. 52	m. 56	m. 60
°	′	′	′	′	′	′	′	′	′	′	′	′	′	′	′	′
85	2620	655	327	218	163	131	109	93·1	81·3	72·2	64·8	58·8	53·8	49·5	45·8	42·7
85½	2912	728	364	243	182	145	121	104	90·4	80·2	72·1	65·4	59·8	55·0	51·0	47·4
86	3277	819	410	273	205	164	136	117	102	90·3	81·1	73·6	67·3	62·0	57·4	53·4
86½	3747	937	468	312	234	187	156	133	116	103	92·7	84·1	76·9	70·8	65·6	61·0
87	4373	1093	546	364	273	218	182	155	136	121	108	98·2	89·8	82·6	76·5	71·2
87½	5259	1312	656	437	328	262	218	187	163	145	130	118	108	99·2	91·9	85·5
88	6563	1641	820	546	410	327	273	233	204	181	162	147	135	124	115	107
88½	8752	2188	1094	729	546	436	363	311	272	241	217	196	180	165	153	143
89	13129	3282	1641	1093	819	655	545	467	408	362	325	295	270	248	230	214
89½	26261	6565	3281	2186	1639	1310	1090	933	815	723	650	590	539	496	460	428
	m. 59	m. 56	m. 52	m. 48	m. 44	m. 40	m. 36	m. 32	m. 28	m. 24	m. 20	m. 16	m. 12	m. 8	m. 4	m. 0

11 HOURS.

1 HOUR.

Lat.	m. 0	m. 4	m. 8	m. 12	m. 16	m. 20	m. 24	m. 28	m. 32	m. 36	m. 40	m. 44	m. 48	m. 52	m. 56	m. 60
°	′	′	′	′	′	′	′	′	′	′	′	′	′	′	′	′
85	42·7	39·9	37·4	35·2	33·2	31·4	29·8	28·3	26·9	25·7	24·5	23·4	22·4	21·5	20·6	19·8
85½	47·4	44·3	41·6	39·1	36·9	34·9	33·1	31·4	29·9	28·5	27·2	26·1	24·9	23·9	22·9	22·0
86	53·4	49·9	46·8	44·0	41·5	39·3	37·3	35·4	33·7	32·1	30·7	29·3	28·1	26·9	25·8	24·8
86½	61·0	57·0	53·5	50·3	47·5	44·9	42·6	40·5	38·5	36·7	35·1	33·5	32·1	30·7	29·5	28·3
87	71·2	66·5	62·4	58·7	55·4	52·4	49·7	47·2	45·0	42·9	40·9	39·1	37·4	35·9	34·4	33·0
87½	85·5	79·9	74·9	70·5	66·5	62·9	59·7	56·7	54·0	51·4	49·1	47·0	45·0	43·1	41·3	39·7
88	107	99·9	93·7	88·1	83·2	78·7	74·6	70·9	67·5	64·3	61·4	58·7	56·2	53·9	51·7	49·6
88½	143	133	125	118	111	105	99·5	94·5	90·0	85·8	81·9	78·3	74·9	71·8	68·9	66·1
89	214	200	187	176	166	157	149	142	135	129	123	117	112	108	103	99·2
89½	428	400	375	353	333	315	299	284	270	257	246	235	225	216	207	198
	m. 60	m. 56	m. 52	m. 48	m. 44	m. 40	m. 36	m. 32	m. 28	m. 24	m. 20	m. 16	m. 12	m. 8	m. 4	m. 0

10 HOURS.

2 HOURS.

Lat.	m. 0	m. 4	m. 8	m. 12	m. 16	m. 20	m. 24	m. 28	m. 32	m. 36	m. 40	m. 44	m. 48	m. 52	m. 56	m. 60
°	′	′	′	′	′	′	′	′	′	′	′	′	′	′	′	′
85	19·8	19·0	18·3	17·6	16·9	16·3	15·7	15·2	14·6	14·1	13·6	13·1	12·7	12·3	11·8	11·4
85½	22·0	21·1	20·3	19·6	18·8	18·2	17·5	16·9	16·3	15·7	15·1	14·6	14·1	13·6	13·2	12·7
86	24·8	23·8	22·9	22·0	21·2	20·4	19·7	19·0	18·3	17·7	17·0	16·5	15·9	15·3	14·8	14·3
86½	28·3	27·2	26·2	25·2	24·2	23·4	22·5	21·7	20·9	20·2	19·5	18·8	18·2	17·5	16·9	16·3
87	33·0	31·8	30·5	29·4	28·3	27·3	26·3	25·3	24·4	23·6	22·7	22·0	21·2	20·5	19·8	19·1
87½	39·7	38·1	36·7	35·3	34·0	32·7	31·5	30·4	29·3	28·3	27·3	26·3	25·4	24·6	23·7	22·9
88	49·6	47·7	45·8	44·1	42·5	40·9	39·4	38·0	36·7	35·4	34·1	32·9	31·8	30·7	29·7	28·6
88½	66·1	63·6	61·1	58·8	56·6	54·5	52·6	50·7	48·9	47·2	45·5	43·9	42·4	41·0	39·5	38·2
89	99·2	95·3	91·7	88·2	84·9	81·8	78·9	76·0	73·3	70·7	68·3	65·9	63·6	61·4	59·3	57·3
89½	198	191	183	176	170	164	158	152	147	142	137	132	127	123	119	115
	m. 60	m. 56	m. 52	m. 48	m. 44	m. 40	m. 36	m. 32	m. 28	m. 24	m. 20	m. 16	m. 12	m. 8	m. 4	m. 0

9 HOURS.

When hour angle is more than 6 hours, name the factors taken from Table A the *same* as the name of the latitude.

Table B.

Always name the factors taken from Table B the *same* as the name of declination.

Declination.	0 HOURS.															
	m. 1	m. 4	m. 8	m. 12	m. 16	m. 20	m. 24	m. 28	m. 32	m. 36	m. 40	m. 44	m. 48	m. 52	m. 56	m. 60
°	′	′	′	′	′	′	′	′	′	′	′	′	′	′	′	′
85	2620	655	328	218	164	131	109	93·8	82·1	73·1	65·8	59·9	55·0	50·8	47·2	44·2
85½	2912	728	364	243	182	146	122	104	91·3	81·2	73·2	66·6	61·1	56·5	52·5	49·1
86	3277	819	410	273	205	164	137	117	103	91·4	82·4	74·9	68·8	63·6	59·1	55·3
86½	3747	937	468	312	234	188	156	134	117	105	94·2	85·7	78·6	72·7	67·6	63·2
87	4373	1093	547	365	274	219	183	157	137	122	110	100	91·8	84·8	78·9	73·7
87½	5259	1312	656	438	328	263	219	188	165	146	132	120	110	102	94·7	88·5
88	6563	1641	821	547	411	329	274	235	206	183	165	150	138	127	118	111
88½	8752	2188	1094	730	547	438	365	313	274	244	220	200	184	170	158	148
89	13129	3283	1642	1095	821	657	548	470	412	366	330	300	276	255	237	221
89½	26261	6566	3283	2190	1643	1315	1096	940	823	733	660	601	551	509	474	443
	m. 59	m. 56	m. 52	m. 48	m. 44	m. 40	m. 36	m. 32	m. 28	m. 24	m. 20	m. 16	m. 12	m. 8	m. 4	m. 0
	11 HOURS.															

Declination.	1 HOUR.															
	m. 0	m. 4	m. 8	m. 12	m. 16	m. 20	m. 24	m. 28	m. 32	m. 36	m. 40	m. 44	m. 48	m. 52	m. 56	m. 60
°	′	′	′	′	′	′	′	′	′	′	′	′	′	′	′	′
85	44·2	41·5	39·1	37·0	35·1	33·4	31·9	30·5	29·3	28·1	27·0	26·1	25·2	24·3	23·6	22·9
85½	49·1	46·1	43·5	41·1	39·0	37·2	35·5	33·9	32·5	31·2	30·1	29·0	28·0	27·1	26·2	25·4
86	55·3	51·9	48·9	46·3	43·9	41·8	39·9	38·2	36·6	35·2	33·8	32·6	31·5	30·5	29·5	28·6
86½	63·2	59·3	55·9	52·9	50·2	47·8	45·6	43·6	41·8	40·2	38·7	37·3	36·0	34·8	33·7	32·7
87	73·7	69·2	65·3	61·7	58·6	55·8	53·2	50·9	48·8	46·9	45·1	43·5	42·0	40·6	39·4	38·2
87½	88·5	83·1	78·3	74·1	70·4	67·0	63·9	61·1	58·6	56·3	54·2	52·2	50·4	48·8	47·2	45·8
88	111	104	97·9	92·7	88·0	83·7	79·9	76·4	73·3	70·4	67·8	65·3	63·1	61·0	59·1	57·3
88½	148	139	131	124	117	112	107	102	97·7	93·9	90·4	87·1	84·1	81·3	78·8	76·4
89	221	208	196	185	176	168	160	153	147	141	136	131	126	122	118	115
89½	443	416	392	371	352	335	320	306	293	282	271	261	252	244	236	229
	m. 60	m. 56	m. 52	m. 48	m. 44	m. 40	m. 36	m. 32	m. 28	m. 24	m. 20	m. 16	m. 12	m. 8	m. 4	m. 0
	10 HOURS.															

Declination.	2 HOURS.															
	m. 0	m. 4	m. 8	m. 12	m. 16	m. 20	m. 24	m. 28	m. 32	m. 36	m. 40	m. 44	m. 48	m. 52	m. 56	m. 60
°	′	′	′	′	′	′	′	′	′	′	′	′	′	′	′	′
85	22·9	22·2	21·6	21·0	20·4	19·9	19·4	19·0	18·6	18·2	17·8	17·4	17·1	16·8	16·5	16·2
85½	25·4	24·7	24·0	23·3	22·7	22·2	21·6	21·1	20·6	20·2	19·8	19·4	19·0	18·6	18·3	18·0
86	28·6	27·8	27·0	26·3	25·6	24·9	24·3	23·8	23·2	22·7	22·2	21·8	21·4	21·0	20·6	20·2
86½	32·7	31·7	30·9	30·0	29·2	28·5	27·8	27·2	26·6	26·0	25·4	24·9	24·4	24·0	23·5	23·1
87	38·2	37·0	36·0	35·0	34·1	33·3	32·5	31·7	31·0	30·3	29·7	29·1	28·5	28·0	27·5	27·0
87½	45·8	44·5	43·2	42·1	41·0	39·9	39·0	38·1	37·2	36·4	35·6	34·9	34·2	33·6	33·0	32·4
88	57·3	55·6	54·0	52·6	51·2	49·9	48·7	47·6	46·5	45·5	44·6	43·6	42·8	42·0	41·2	40·5
88½	76·4	74·1	72·1	70·1	68·3	66·6	65·0	63·5	62·0	60·7	59·4	58·2	57·1	56·0	55·0	54·0
89	115	111	108	105	102	99·9	97·5	95·2	93·1	91·0	89·1	87·3	85·6	84·0	82·5	81·0
89½	229	222	216	210	205	200	195	190	186	182	178	175	171	168	165	162
	m. 60	m. 56	m. 52	m. 48	m. 44	m. 40	m. 36	m. 32	m. 28	m. 24	m. 20	m. 16	m. 12	m. 8	m. 4	m. 0
	9 HOURS.															

Table A.

When hour angle is less than 6 hours, name th; factors taken from Table A *contrary* to name of lat.

Lat.	3 HOURS.															
	m. 0	m. 4	m. 8	m. 12	m. 16	m. 20	m. 24	m. 28	m. 32	m. 36	m. 40	m. 44	m. 48	m. 52	m. 56	m. 60
°	′	′	′	′	′	′	′	′	′	′	′	′	′	′	′	′
85	11·4	11·0	10·7	10·3	9·9	9·6	9·3	8·9	8·6	8·3	8·0	7·7	7·4	7·1	6·9	6·6
85½	12·7	12·3	11·8	11·4	11·1	10·7	10·3	9·9	9·6	9·2	8·9	8·6	8·3	7·9	7·6	7·3
86	14·3	13·8	13·3	12·9	12·4	12·0	11·6	11·2	10·8	10·4	10·0	9·7	9·3	8·9	8·6	8·3
86½	16·3	15·8	15·2	14·7	14·2	13·7	13·2	12·8	12·3	11·9	11·4	11·0	10·6	10·2	9·8	9·4
87	19·1	18·4	17·8	17·2	16·6	16·0	15·5	14·9	14·4	13·9	13·4	12·9	12·4	11·9	11·5	11·0
87½	22·9	22·1	21·4	20·6	19·9	19·2	18·5	17·9	17·3	16·6	16·0	15·4	14·9	14·3	13·8	13·2
88	28·6	27·7	26·7	25·8	24·9	24·0	23·2	22·4	21·6	20·8	20·1	19·3	18·6	17·9	17·2	16·5
88½	38·2	36·9	35·6	34·4	33·2	32·0	30·9	29·8	28·8	27·7	26·7	25·8	24·8	23·9	23·0	22·1
89	57·3	55·3	53·4	51·6	49·8	48·1	46·4	44·8	43·2	41·6	40·1	38·6	37·2	35·8	34·4	33·1
89½	115	111	107	103	99·6	96·2	92·8	89·5	86·3	83·3	80·2	77·3	74·4	71·6	68·9	66·2
	m. 60	m. 56	m. 52	m. 48	m. 44	m. 40	m. 36	m. 32	m. 28	m. 24	m. 20	m. 16	m. 12	m. 8	m. 4	m. 0
	8 HOURS.															

Lat.	4 HOURS.															
	m. 0	m. 4	m. 8	m. 12	m. 16	m. 20	m. 24	m. 28	m. 32	m. 36	m. 40	m. 44	m. 48	m. 52	m. 56	m. 60
°	′	′	′	′	′	′	′	′	′	′	′	′	′	′	′	′
85	6·60	6·34	6·08	5·82	5·57	5·33	5·09	4·85	4·62	4·39	4·16	3·94	3·71	3·49	3·28	3·06
85½	7·34	7·04	6·76	6·47	6·20	5·93	5·66	5·39	5·13	4·88	4·62	4·38	4·13	3·88	3·64	3·40
86	8·26	7·93	7·60	7·29	6·97	6·67	6·37	6·07	5·78	5·49	5·21	4·92	4·65	4·37	4·10	3·83
86½	9·44	9·06	8·69	8·33	7·97	7·62	7·28	6·94	6·61	6·28	5·95	5·63	5·31	5·00	4·69	4·38
87	11·0	10·6	10·1	9·72	9·31	8·90	8·50	8·10	7·71	7·32	6·94	6·57	6·20	5·83	5·47	5·11
87½	13·2	12·7	12·2	11·7	11·2	10·7	10·2	9·72	9·25	8·79	8·34	7·89	7·44	7·00	6·57	6·14
88	16·5	15·9	15·2	14·6	14·0	13·4	12·7	12·2	11·6	11·0	10·4	9·86	9·30	8·76	8·21	7·67
88½	22·1	21·2	20·3	19·5	18·6	17·8	17·0	16·2	15·4	14·7	13·9	13·1	12·4	11·7	11·0	10·2
89	33·1	31·8	30·5	29·2	27·9	26·7	25·5	24·3	23·2	22·0	20·9	19·7	18·6	17·5	16·4	15·4
89½	66·2	63·5	60·9	58·4	55·9	53·4	51·0	48·6	46·3	44·0	41·7	39·5	37·2	35·0	32·9	30·7
	m. 60	m. 56	m. 52	m. 48	m. 44	m. 40	m. 36	m. 32	m. 28	m. 24	m. 20	m. 16	m. 12	m. 8	m. 4	m. 0
	7 HOURS.															

Lat.	5 HOURS.															
	m. 0	m. 4	m. 8	m. 12	m. 16	m. 20	m. 24	m. 28	m. 32	m. 36	m. 40	m. 44	m. 48	m. 52	m. 56	m. 60
°	′	′	′	′	′	′	′	′	′	′	′	′	′	′	′	′
85	3·06	2·85	2·64	2·43	2·22	2·02	1·81	1·61	1·40	1·20	1·00	0·80	0·60	0·40	0·20	·00
85½	3·40	3·17	2·93	2·70	2·47	2·24	2·01	1·79	1·56	1·34	1·11	0·89	0·67	0·44	0·22	·00
86	3·83	3·57	3·30	3·04	2·78	2·52	2·27	2·01	1·76	1·50	1·25	1·00	0·75	0·50	0·25	·00
86½	4·38	4·08	3·77	3·48	3·18	2·88	2·59	2·30	2·01	1·78	1·43	1·14	0·86	0·57	0·29	·00
87	5·11	4·76	4·41	4·06	3·71	3·36	3·02	2·68	2·34	2·01	1·67	1·33	1·00	0·67	0·33	·00
87½	6·14	5·71	5·29	4·87	4·45	4·04	3·63	3·22	2·81	2·41	2·00	1·60	1·20	0·80	0·40	·00
88	7·67	7·14	6·61	6·09	5·57	5·05	4·54	4·05	3·52	3·01	2·51	2·00	1·50	1·00	0·50	·00
88½	10·2	9·52	8·82	8·12	7·42	6·73	6·05	5·37	4·69	4·01	3·34	2·67	2·00	1·33	0·67	·00
89	15·4	14·3	13·2	12·2	11·1	10·1	9·07	8·05	7·03	6·02	5·01	4·01	3·00	2·00	1·00	·00
89½	30·7	28·6	26·5	24·4	22·3	20·2	18·1	16·1	14·1	12·0	10·0	8·01	6·01	4·00	2·00	·00
	m. 60	m. 56	m. 52	m. 48	m. 44	m. 40	m. 36	m. 32	m. 28	m. 24	m. 20	m. 16	m. 12	m. 8	m. 4	m. 0
	6 HOURS.															

When hour angle is more than 6 hours, name the factors taken from Table A the *same* as the name of the latitude.

Table B.

Always name the factors taken from Table B the *same* as the name of declination.

Declination.	3 HOURS.															
	m. 0	m. 4	m. 8	m. 12	m. 16	m. 20	m. 24	m. 28	m. 32	m. 36	m. 40	m. 44	m. 48	m. 52	m. 56	m. 60
85°	16·2	15·9	15·6	15·4	15·1	14·9	14·7	14·5	14·3	14·1	14·0	13·8	13·6	13·5	13·3	13·2
85½	18·0	17·7	17·4	17·1	16·8	16·6	16·3	16·1	15·9	15·7	15·5	15·3	15·2	15·0	14·8	14·7
86	20·2	19·9	19·6	19·2	18·9	18·7	18·4	18·1	17·9	17·7	17·5	17·2	17·1	16·9	16·7	16·5
86½	23·1	22·7	22·4	22·0	21·7	21·3	21·0	20·7	20·5	20·2	20·0	19·7	19·5	19·3	19·1	18·9
87	27·0	26·5	26·1	25·7	25·3	24·9	24·6	24·2	23·9	23·6	23·3	23·0	22·8	22·5	22·3	22·0
87½	32·4	31·8	31·3	30·8	30·3	29·9	29·5	29·1	28·7	28·3	28·0	27·6	27·3	27·0	26·7	26·4
88	40·5	39·8	39·2	38·5	37·9	37·4	36·8	36·3	35·9	35·4	35·0	34·5	34·1	33·8	33·4	33·1
88½	54·0	53·1	52·2	51·4	50·6	49·9	49·1	48·5	47·8	47·2	46·6	46·1	45·5	45·0	44·6	44·1
89	81·0	79·6	78·3	77·1	75·9	74·8	73·7	72·7	71·7	70·8	69·9	69·1	68·3	67·6	66·8	66·2
89½	162	159	157	154	152	150	147	145	143	142	140	138	137	135	134	132
	m. 60	m. 56	m. 52	m. 48	m. 44	m. 40	m. 36	m. 32	m. 28	m. 24	m. 20	m. 16	m. 12	m. 8	m. 4	m. 0
	8 HOURS.															

Declination.	4 HOURS.															
	m. 0	m. 4	m. 8	m. 12	m. 16	m. 20	m. 24	m. 28	m. 32	m. 36	m. 40	m. 44	m. 48	m. 52	m. 56	m. 60
85°	13·2	13·1	12·9	12·8	12·7	12·6	12·5	12·4	12·3	12·2	12·2	12·1	12·0	12·0	11·9	11·8
85½	14·7	14·5	14·4	14·3	14·1	14·0	13·9	13·8	13·7	13·6	13·5	13·4	13·4	13·3	13·2	13·2
86	16·5	16·4	16·2	16·1	15·9	15·8	15·7	15·5	15·4	15·3	15·2	15·1	15·0	15·0	14·9	14·8
86½	18·9	18·7	18·5	18·3	18·2	18·0	17·9	17·8	17·6	17·5	17·4	17·3	17·2	17·1	17·0	16·9
87	22·0	21·8	21·6	21·4	21·2	21·1	20·9	20·7	20·6	20·4	20·3	20·2	20·1	20·0	19·9	19·8
87½	26·4	26·2	25·9	25·7	25·5	25·3	25·1	24·9	24·7	24·5	24·4	24·2	24·1	24·0	23·8	23·7
88	33·1	32·7	32·4	32·1	31·9	31·6	31·3	31·1	30·9	30·7	30·5	30·3	30·1	29·9	29·8	29·6
88½	44·1	43·7	43·3	42·9	42·5	42·1	41·8	41·5	41·2	40·9	40·6	40·4	40·2	39·9	39·7	39·5
89	66·2	65·5	64·9	64·3	63·7	63·2	62·7	62·2	61·8	61·4	61·0	60·6	60·2	59·9	59·6	59·3
89½	132	131	130	129	127	126	125	124	124	123	122	121	120	120	119	119
	m. 0	m. 4	m. 8	m. 12	m. 16	m. 20	m. 24	m. 28	m. 32	m. 36	m. 40	m. 44	m. 48	m. 52	m. 56	m. 60
	7 HOURS.															

Declination.	5 HOURS.															
	m. 0	m. 4	m. 8	m. 12	m. 16	m. 20	m. 24	m. 28	m. 32	m. 36	m. 40	m. 44	m. 48	m. 52	m. 56	m. 60
85°	11·8	11·8	11·7	11·7	11·6	11·6	11·6	11·5	11·5	11·5	11·5	11·5	11·5	11·4	11·4	11·4
85½	13·2	13·1	13·0	13·0	13·0	12·9	12·9	12·8	12·8	12·8	12·8	12·7	12·7	12·7	12·7	12·7
86	14·8	14·7	14·7	14·6	14·6	14·5	14·5	14·4	14·4	14·4	14·4	14·3	14·3	14·3	14·3	14·3
86½	16·9	16·8	16·8	16·7	16·7	16·6	16·6	16·5	16·5	16·4	16·4	16·4	16·4	16·4	16·4	16·3
87	19·8	19·7	19·6	19·5	19·4	19·4	19·3	19·3	19·2	19·2	19·2	19·1	19·1	19·1	19·1	19·1
87½	23·7	23·6	23·5	23·4	23·3	23·3	23·2	23·1	23·1	23·0	23·0	23·0	22·9	22·9	22·9	22·9
88	29·6	29·5	29·4	29·3	29·2	29·1	29·0	28·9	28·9	28·8	28·7	28·7	28·7	28·7	28·6	28·6
88½	39·5	39·4	39·2	39·0	38·9	38·8	38·7	38·6	38·5	38·4	38·3	38·3	38·2	38·2	38·2	38·2
89	59·3	59·0	58·8	58·6	58·4	58·2	58·0	57·9	57·7	57·6	57·5	57·4	57·4	57·3	57·3	57·3
89½	119	118	118	117	117	116	116	116	115	115	115	115	115	115	115	115
	m. 0	m. 4	m. 8	m. 12	m. 16	m. 20	m. 24	m. 28	m. 32	m. 36	m. 40	m. 44	m. 48	m. 52	m. 56	m. 60
	6 HOURS.															

Table C.

AZIMUTHS CORRESPONDING TO THE A AND B CORRECTION.

Azimuth is named N or S according to the name of the A and B correction.

A and B Correction.	LATITUDES.														
	0°	5°	10°	13°	16°	18°	20°	22°	24°	25°	26°	27°	28°	29°	30°
	AZIMUTHS.														
′	°	°	°	°	°	°	°	°	°	°	°	°	°	°	°
·000	90·0	90·0	90·0	90·0	90·0	90·0	90·0	90·0	90·0	90·0	90·0	90·0	90·0	90·0	90·0
·010	89·4	89·4	89·4	89·4	89·4	89·5	89·5	89·5	89·5	89·5	89·5	89·5	89·5	89·5	89·5
·020	88·9	88·9	88·9	88·9	88·9	88·9	88·9	88·9	89·0	89·0	89·0	89·0	89·0	89·0	89·0
·030	88·3	88·3	88·3	88·3	88·3	88·4	88·4	88·4	88·4	88·4	88·5	88·5	88·5	88·5	88·5
·040	87·7	87·7	87·7	87·8	87·8	87·8	87·8	87·9	87·9	87·9	87·9	88·0	88·0	88·0	88·0
·050	87·1	87·1	87·2	87·2	87·2	87·3	87·3	87·3	87·4	87·4	87·4	87·4	87·5	87·5	87·5
·060	86·6	86·6	86·6	86·7	86·7	86·7	86·8	86·8	86·9	86·9	86·9	86·9	87·0	87·0	87·0
·070	86·0	86·0	86·1	86·1	86·2	86·2	86·2	86·3	86·3	86·4	86·4	86·4	86·5	86·5	86·5
·080	85·4	85·4	85·5	85·5	85·6	85·6	85·7	85·8	85·8	85·9	85·9	85·9	86·0	86·0	86·0
·090	84·9	84·9	84·9	85·0	85·1	85·1	85·2	85·2	85·3	85·3	85·4	85·4	85·5	85·5	85·5
·100	84·3	84·3	84·4	84·4	84·5	84·5	84·6	84·7	84·8	84·8	84·9	84·9	85·0	85·0	85·1
·110	83·7	83·7	83·8	83·9	84·0	84·0	84·1	84·2	84·3	84·3	84·4	84·4	84·5	84·5	84·6
·120	83·2	83·2	83·3	83·3	83·4	83·5	83·6	83·7	83·7	83·8	83·8	83·9	84·0	84·0	84·1
·130	82·6	82·6	82·7	82·8	82·9	83·0	83·0	83·1	83·2	83·3	83·3	83·4	83·5	83·5	83·6
·140	82·0	82·1	82·1	82·2	82·3	82·4	82·5	82·6	82·7	82·8	82·8	82·9	83·0	83·0	83·1
·150	81·5	81·5	81·6	81·7	81·8	81·9	82·0	82·1	82·2	82·3	82·3	82·4	82·5	82·5	82·6
·160	80·9	80·9	81·0	81·1	81·3	81·3	81·4	81·6	81·7	81·7	81·8	81·9	82·0	82·0	82·1
·170	80·4	80·4	80·5	80·6	80·7	80·8	80·9	81·0	81·2	81·2	81·3	81·4	81·5	81·5	81·6
·180	79·8	79·8	79·9	80·1	80·2	80·3	80·4	80·5	80·7	80·7	80·8	80·9	81·0	81·1	81·1
·190	79·2	79·3	79·4	79·5	79·6	79·8	79·9	80·0	80·2	80·2	80·3	80·4	80·5	80·6	80·7
·200	78·7	78·7	78·9	79·0	79·1	79·2	79·4	79·5	79·6	79·7	79·8	79·9	80·0	80·1	80·2
·210	78·1	78·2	78·3	78·4	78·6	78·7	78·8	79·0	79·1	79·2	79·3	79·4	79·5	79·6	79·7
·220	77·6	77·6	77·8	77·9	78·1	78·2	78·3	78·5	78·6	78·7	78·8	78·9	79·0	79·1	79·2
·230	77·0	77·1	77·2	77·4	77·5	77·7	77·8	78·0	78·1	78·2	78·3	78·4	78·5	78·6	78·7
·240	76·5	76·6	76·7	76·8	77·0	77·1	77·3	77·5	77·6	77·7	77·8	77·9	78·0	78·1	78·3
·250	76·0	76·0	76·2	76·3	76·5	76·6	76·8	76·9	77·1	77·2	77·3	77·4	77·6	77·7	77·8
·260	75·4	75·5	75·6	75·8	76·0	76·1	76·3	76·4	76·6	76·7	76·8	77·0	77·1	77·2	77·3
·270	74·9	74·9	75·1	75·3	75·5	75·6	75·8	75·9	76·1	76·2	76·4	76·5	76·6	76·7	76·8
·280	74·4	74·4	74·6	74·7	74·9	75·1	75·3	75·4	75·7	75·8	75·9	76·0	76·1	76·2	76·4
·290	73·8	73·9	74·1	74·2	74·4	74·6	74·8	75·0	75·2	75·3	75·4	75·5	75·6	75·8	75·9
·300	73·3	73·4	73·5	73·7	73·9	74·1	74·3	74·5	74·7	74·8	74·9	75·0	75·2	75·3	75·4
·310	72·8	72·8	73·0	73·2	73·4	73·6	73·8	74·0	74·2	74·3	74·4	74·6	74·7	74·8	75·0
·320	72·3	72·3	72·5	72·7	72·9	73·1	73·3	73·5	73·7	73·8	74·0	74·1	74·2	74·4	74·5
·330	71·7	71·8	72·0	72·2	72·4	72·6	72·8	73·0	73·2	73·3	73·5	73·6	73·8	73·9	74·1
·340	71·2	71·3	71·5	71·7	71·9	72·1	72·3	72·5	72·7	72·9	73·0	73·1	73·3	73·4	73·6
·350	70·7	70·8	71·0	71·2	71·4	71·6	71·8	72·0	72·3	72·4	72·5	72·7	72·8	73·0	73·1
·360	70·2	70·3	70·5	70·7	70·9	71·1	71·3	71·5	71·8	71·9	72·1	72·2	72·4	72·5	72·7
·370	69·7	69·8	70·0	70·2	70·4	70·6	70·8	71·1	71·3	71·5	71·6	71·8	71·9	72·1	72·2
·380	69·2	69·3	69·5	69·7	69·9	70·1	70·3	70·6	70·9	71·0	71·1	71·3	71·5	71·6	71·8
·390	68·7	68·8	69·0	69·2	69·4	69·6	69·9	70·1	70·4	70·5	70·7	70·8	71·0	71·2	71·3
·400	68·2	68·3	68·5	68·7	69·0	69·2	69·4	69·7	69·9	70·1	70·2	70·4	70·5	70·7	70·9
·410	67·7	67·8	68·0	68·2	68·5	68·7	68·9	69·2	69·5	69·6	69·8	69·9	70·1	70·3	70·5
·420	67·2	67·3	67·5	67·7	68·0	68·2	68·5	68·7	69·0	69·2	69·3	69·5	69·7	69·8	70·0
·430	66·7	66·8	67·0	67·3	67·5	67·8	68·0	68·3	68·6	68·7	68·9	69·0	69·2	69·4	69·6
·440	66·3	66·3	66·6	66·8	67·1	67·3	67·5	67·8	68·1	68·3	68·4	68·6	68·8	69·0	69·1
·450	65·8	65·9	66·1	66·3	66·6	66·8	67·1	67·4	67·7	67·8	68·0	68·2	68·3	68·5	68·7
·460	65·3	65·4	65·6	65·9	66·1	66·4	66·6	66·9	67·2	67·4	67·5	67·7	67·9	68·1	68·3
·470	64·8	64·9	65·2	65·4	65·7	65·9	66·2	66·5	66·8	66·9	67·1	67·3	67·5	67·7	67·9
·480	64·4	64·4	64·7	64·9	65·2	65·5	65·7	66·0	66·3	66·5	66·7	66·8	67·0	67·2	67·4
·490	63·9	64·0	64·2	64·5	64·8	65·0	65·3	65·6	65·9	66·1	66·2	66·4	66·6	66·8	67·0

Table C.

AZIMUTHS CORRESPONDING TO THE A AND B CORRECTION.

Azimuth is named N or S according to the name of the A and B correction.

A and B Cor-rection.	LATITUDES. 00°	5°	10°	13°	16°	18°	20°	22°	24°	25°	26°	27°	28°	29°	30°
	AZIMUTHS.														
′	°	°	°	°	°	°	°	°	°	°	°	°	°	°	°
·500	63·4	63·5	63·8	64·0	64·3	64·6	64·8	65·1	65·5	65·6	65·8	66·0	66·2	66·4	66·6
·510	63·0	63·1	63·3	63·6	63·9	64·1	64·4	64·7	65·0	65·2	65·4	65·6	65·8	66·0	66·2
·520	62·5	62·6	62·9	63·1	63·4	63·7	64·0	64·3	64·6	64·8	64·9	65·1	65·3	65·5	65·8
·530	62·1	62·2	62·4	62·7	63·0	63·2	63·5	63·8	64·2	64·3	64·5	64·7	64·9	65·1	65·3
·540	61·6	61·7	62·0	62·2	62·6	62·8	63·1	63·4	63·7	63·9	64·1	64·3	64·5	64·7	64·9
·550	61·2	61·3	61·6	61·8	62·1	62·4	62·7	63·0	63·3	63·5	63·7	63·9	64·1	64·3	64·5
·560	60·8	60·8	61·1	61·4	61·7	62·0	62·2	62·6	62·9	63·1	63·3	63·5	63·7	63·9	64·1
·570	60·3	60·4	60·7	61·0	61·3	61·5	61·8	62·1	62·5	62·7	62·9	63·1	63·3	63·5	63·7
·580	59·9	60·0	60·3	60·5	60·9	61·1	61·4	61·7	62·1	62·3	62·5	62·7	62·9	63·1	63·3
·590	59·5	59·6	59·8	60·1	60·4	60·7	61·0	61·3	61·7	61·9	62·1	62·3	62·5	62·7	62·9
·600	59·0	59·1	59·4	59·7	60·0	60·3	60·6	60·9	61·3	61·5	61·7	61·9	62·1	62·3	62·5
·610	58·6	58·7	59·0	59·3	59·6	59·9	60·2	60·5	60·9	61·1	61·3	61·5	61·7	61·9	62·2
·620	58·2	58·3	58·6	58·9	59·2	59·5	59·8	60·1	60·5	60·7	60·9	61·1	61·3	61·5	61·8
·630	57·8	57·9	58·2	58·5	58·8	59·1	59·4	59·7	60·1	60·3	60·5	60·7	60·9	61·1	61·4
·640	57·4	57·5	57·8	58·1	58·4	58·7	59·0	59·3	59·7	59·9	60·1	60·3	60·5	60·8	61·0
·650	57·0	57·1	57·4	57·7	58·0	58·3	58·6	58·9	59·3	59·5	59·7	59·9	60·1	60·4	60·6
·660	56·6	56·7	57·0	57·3	57·6	57·9	58·2	58·5	58·9	59·1	59·3	59·5	59·8	60·0	60·2
·670	56·2	56·3	56·6	56·9	57·2	57·5	57·8	58·2	58·5	58·7	58·9	59·2	59·4	59·6	59·9
·680	55·8	55·9	56·2	56·5	56·8	57·1	57·4	57·8	58·2	58·4	58·6	58·8	59·0	59·3	59·5
·690	55·4	55·5	55·8	56·1	56·4	56·7	57·0	57·4	57·8	58·0	58·2	58·4	58·6	58·9	59·1
·700	55·0	55·1	55·4	55·7	56·1	56·3	56·7	57·0	57·4	57·6	57·8	58·0	58·3	58·5	58·8
·710	54·6	54·7	55·0	55·3	55·7	56·0	56·3	56·6	57·0	57·2	57·5	57·7	57·9	58·2	58·4
·720	54·2	54·3	54·7	54·9	55·3	55·6	55·9	56·3	56·7	56·9	57·1	57·3	57·6	57·8	58·1
·730	53·9	54·0	54·3	54·6	54·9	55·2	55·6	55·9	56·3	56·5	56·7	57·0	57·2	57·4	57·7
·740	53·5	53·6	53·9	54·2	54·6	54·9	55·2	55·5	55·9	56·2	56·4	56·6	56·8	57·1	57·3
·750	53·1	53·2	53·6	53·8	54·2	54·5	54·8	55·2	55·6	55·8	56·0	56·2	56·5	56·7	57·0
·760	52·8	52·9	53·2	53·5	53·8	54·1	54·5	54·8	55·2	55·4	55·7	55·9	56·1	56·4	56·6
·770	52·4	52·5	52·8	53·1	53·5	53·8	54·1	54·5	54·9	55·1	55·3	55·5	55·8	56·0	56·3
·780	52·0	52·2	52·5	52·8	53·1	53·4	53·8	54·1	54·5	54·7	55·0	55·2	55·4	55·7	56·0
·790	51·7	51·8	52·1	52·4	52·8	53·1	53·4	53·8	54·2	54·4	54·6	54·9	55·1	55·4	55·6
·800	51·3	51·4	51·8	52·1	52·4	52·7	53·1	53·4	53·8	54·1	54·3	54·5	54·8	55·0	55·3
·810	51·0	51·1	51·4	51·7	52·1	52·4	52·7	53·1	53·5	53·7	53·9	54·2	54·4	54·7	55·0
·820	50·6	50·8	51·1	51·4	51·8	52·1	52·4	52·8	53·2	53·4	53·6	53·8	54·1	54·4	54·6
·830	50·3	50·4	50·7	51·0	51·4	51·7	52·0	52·4	52·8	53·0	53·3	53·5	53·8	54·0	54·3
·840	50·0	50·1	50·4	50·7	51·1	51·4	51·7	52·1	52·5	52·7	52·9	53·2	53·4	53·7	54·0
·850	49·6	49·7	50·1	50·4	50·7	51·0	51·4	51·8	52·2	52·4	52·6	52·9	53·1	53·4	53·6
·860	49·3	49·4	49·7	50·0	50·4	50·7	51·1	51·4	51·8	52·1	52·3	52·5	52·8	53·1	53·3
·870	49·0	49·1	49·4	49·7	50·1	50·4	50·7	51·1	51·5	51·7	52·0	52·2	52·5	52·7	53·0
·880	48·7	48·8	49·1	49·4	49·8	50·1	50·4	50·8	51·2	51·4	51·7	51·9	52·2	52·4	52·7
·890	48·3	48·4	48·8	49·1	49·5	49·8	50·1	50·5	50·9	51·1	50·3	50·6	50·8	52·1	52·4
·900	48·0	48·1	48·4	48·8	49·1	49·4	49·8	50·2	50·6	50·8	51·0	51·3	51·5	51·8	52·1
·910	47·7	47·8	48·1	48·4	48·8	49·1	49·5	49·8	50·3	50·5	50·7	51·0	51·2	51·5	51·8
·920	47·4	47·5	47·8	48·1	48·5	48·8	49·2	49·5	50·0	50·2	50·4	50·7	50·9	51·2	51·5
·930	47·1	47·2	47·5	47·8	48·2	48·5	48·8	49·2	49·6	49·9	50·1	50·4	50·6	50·9	51·2
·940	46·8	46·9	47·2	47·5	47·9	48·2	48·5	48·9	49·3	49·6	49·8	50·1	50·3	50·6	50·9
·950	46·5	46·6	46·9	47·2	47·6	47·9	48·2	48·6	49·0	49·3	49·5	49·8	50·0	50·3	50·6
·960	46·2	46·3	46·6	46·9	47·3	47·6	47·9	48·3	48·7	49·0	49·2	49·5	49·7	50·0	50·3
·970	45·9	46·0	46·3	46·6	47·0	47·3	47·7	48·0	48·5	48·7	48·9	49·2	49·4	49·7	50·0
·980	45·6	45·7	46·0	46·3	46·7	47·0	47·4	47·7	48·2	48·4	48·6	48·9	49·1	49·4	49·7
·990	45·3	45·4	45·7	46·0	46·4	46·7	47·1	47·5	47·9	48·1	48·3	48·6	48·8	49·1	49·4

Table C.

AZIMUTHS CORRESPONDING TO THE A AND B CORRECTION.

Azimuth is named N or S according to the name of the A and B correction.

A and B Cor-rection.	LATITUDES.														
	00°	5°	10°	13°	16°	18°	20°	22°	24°	25°	26°	27°	28°	29°	30°
	Azimuths.														
′	°	°	°	°	°	°	°	°	°	°	°	°	°	°	°
1·00	45·0	45·1	45·4	45·7	46·1	46·4	46·8	47·2	47·6	47·8	48·1	48·3	48·6	48·8	49·1
1·02	44·4	44·5	44·9	45·2	45·6	45·9	46·2	46·6	47·0	47·2	47·5	47·7	48·0	48·3	48·5
1·04	43·9	44·0	44·3	44·6	45·0	45·3	45·7	46·0	46·5	46·7	46·9	47·2	47·4	47·7	48·0
1·06	43·3	43·4	43·8	44·1	44·5	44·8	45·1	45·5	45·9	46·1	46·4	46·6	46·9	47·2	47·4
1·08	42·8	42·9	43·2	43·5	43·9	44·2	44·6	45·0	45·4	45·6	45·9	46·1	46·4	46·6	46·9
1·10	42·3	42·4	42·7	43·0	43·4	43·7	44·1	44·4	44·9	45·1	45·3	45·6	45·8	46·1	46·4
1·12	41·8	41·9	42·2	42·5	42·9	43·2	43·5	43·9	44·3	44·6	44·8	45·1	45·3	45·6	45·9
1·14	41·3	41·4	41·7	42·0	42·4	42·7	43·0	43·4	43·8	44·1	44·3	44·6	44·8	45·1	45·4
1·16	40·8	40·9	41·2	41·5	41·9	42·2	42·5	42·9	43·3	43·6	43·8	44·1	44·3	44·6	44·9
1·18	40·3	40·4	40·7	41·0	41·4	41·7	42·0	42·4	42·9	43·1	43·3	43·6	43·8	44·1	44·4
1·20	39·8	39·9	40·2	40·5	40·9	41·2	41·6	41·9	42·4	42·6	42·8	43·1	43·3	43·6	43·9
1·22	39·3	39·4	39·8	40·1	40·5	40·8	41·1	41·5	41·9	42·1	42·4	42·6	42·9	43·1	43·4
1·24	38·9	39·0	39·3	39·6	40·0	40·3	40·6	41·0	41·4	41·7	41·9	42·1	42·4	42·7	43·0
1·26	38·4	38·5	38·9	39·2	39·5	39·8	40·2	40·6	41·0	41·2	41·4	41·7	42·0	42·2	42·5
1·28	38·0	38·1	38·4	38·7	39·1	39·4	39·7	40·1	40·5	40·8	41·0	41·2	41·5	41·8	42·1
1·30	37·6	37·7	38·0	38·3	38·7	39·0	39·3	39·7	40·1	40·3	40·6	40·8	41·1	41·3	41·6
1·32	37·1	37·3	37·6	37·9	38·2	38·5	38·9	39·3	39·7	39·9	40·1	40·4	40·6	40·9	41·2
1·34	36·7	36·8	37·2	37·4	37·8	38·1	38·5	38·8	39·2	39·5	39·7	39·9	40·2	40·5	40·8
1·36	36·3	36·4	36·7	37·0	37·4	37·7	38·0	38·4	38·8	39·1	39·3	39·5	39·8	40·1	40·3
1·38	35·9	36·0	36·3	36·6	37·0	37·3	37·6	38·0	38·4	38·6	38·9	39·1	39·4	39·6	39·9
1·40	35·5	35·6	36·0	36·2	36·6	36·9	37·2	37·6	38·0	38·2	38·5	38·7	39·0	39·2	39·5
1·42	35·2	35·3	35·6	35·9	36·2	36·5	36·8	37·2	37·6	37·8	38·1	38·3	38·6	38·8	39·1
1·44	34·8	34·9	35·2	35·5	35·8	36·1	36·5	36·8	37·2	37·5	37·7	37·9	38·2	38·4	38·7
1·46	34·4	34·5	34·8	35·1	35·5	35·8	36·1	36·5	36·9	37·1	37·3	37·6	37·8	38·1	38·3
1·48	34·0	34·1	34·5	34·7	35·1	35·4	35·7	36·1	36·5	36·7	36·9	37·2	37·4	37·7	38·0
1·50	33·7	33·8	34·1	34·4	34·7	35·0	35·4	35·7	36·1	36·3	36·6	36·8	37·1	37·3	37·6
1·52	33·3	33·4	33·7	34·0	34·4	34·7	35·0	35·4	35·8	36·0	36·2	36·4	36·7	36·9	37·2
1·54	33·0	33·1	33·4	33·7	34·0	34·3	34·6	35·0	35·4	35·6	35·8	36·1	36·3	36·6	36·9
1·56	32·7	32·8	33·1	33·3	33·7	34·0	34·3	34·7	35·1	35·3	35·5	35·7	36·0	36·2	36·5
1·58	32·3	32·4	32·7	33·0	33·4	33·6	34·0	34·3	34·7	34·9	35·1	35·4	35·6	35·9	36·2
1·60	32·0	32·1	32·4	32·7	33·0	33·3	33·6	34·0	34·4	34·6	34·8	35·0	35·3	35·5	35·8
1·62	31·7	31·8	32·1	32·4	32·7	33·0	33·3	33·7	34·0	34·3	34·5	34·7	35·0	35·2	35·5
1·64	31·4	31·5	31·8	32·0	32·4	32·7	33·0	33·3	33·7	33·9	34·2	34·4	34·6	34·9	35·1
1·66	31·1	31·2	31·5	31·7	32·1	32·4	32·7	33·0	33·4	33·6	33·8	34·1	34·3	34·6	34·8
1·68	30·8	30·9	31·1	31·4	31·8	32·0	32·4	32·7	33·1	33·3	33·5	33·7	34·0	34·2	34·5
1·70	30·5	30·6	30·9	31·1	31·5	31·7	32·0	32·4	32·8	33·0	33·2	33·4	33·7	33·9	34·2
1·72	30·2	30·3	30·6	30·8	31·2	31·4	31·7	32·1	32·5	32·7	32·9	33·1	33·4	33·6	33·9
1·74	29·9	30·0	30·3	30·5	30·9	31·1	31·4	31·8	32·2	32·4	32·6	32·8	33·1	33·3	33·6
1·76	29·6	29·7	30·0	30·2	30·6	30·9	31·2	31·5	31·9	32·1	32·3	32·5	32·8	33·0	33·3
1·78	29·3	29·4	29·7	30·0	30·3	30·6	30·9	31·2	31·6	31·8	32·0	32·2	32·5	32·7	33·0
1·80	29·1	29·1	29·4	29·7	30·0	30·3	30·6	30·9	31·3	31·5	31·7	31·9	32·2	32·4	32·7
1·82	28·8	28·9	29·2	29·4	29·8	30·0	30·3	30·7	31·0	31·2	31·4	31·7	31·9	32·1	32·4
1·84	28·5	28·6	28·9	29·2	29·5	29·7	30·0	30·4	30·7	30·9	31·2	31·4	31·6	31·9	32·1
1·86	28·3	28·4	28·6	28·9	29·2	29·5	29·8	30·1	30·5	30·7	30·9	31·1	31·3	31·6	31·8
1·88	28·0	28·1	28·4	28·6	29·0	29·2	29·5	29·8	30·2	30·4	30·6	30·8	31·1	31·3	31·6
1·90	27·8	27·8	28·1	28·4	28·7	29·0	29·3	29·6	29·9	30·1	30·4	30·6	30·8	31·0	31·3
1·92	27·5	27·6	27·9	28·1	28·4	28·7	29·0	29·3	29·7	29·9	30·1	30·3	30·5	30·8	31·0
1·94	27·3	27·4	27·6	27·9	28·2	28·5	28·7	29·1	29·4	29·6	29·8	30·1	30·3	30·5	30·8
1·96	27·0	27·1	27·4	27·6	28·0	28·2	28·5	28·8	29·2	29·4	29·6	29·8	30·0	30·3	30·5
1·98	26·8	26·9	27·2	27·4	27·7	28·0	28·3	28·6	29·0	29·1	29·3	29·5	29·8	30·0	30·2

Table C.

AZIMUTHS CORRESPONDING TO THE A AND B CORRECTION.

Azimuth is named N or S according to the name of the A and B correction.

A and B Correction.	LATITUDES.														
	00°	5°	10°	13°	16°	18°	20°	22°	24°	25°	26°	27°	28°	29°	30°
	Azimuths.														
′	°	°	°	°	°	°	°	°	°	°	°	°	°	°	°
2.00	26.6	26.7	26.9	27.2	27.5	27.7	28.0	28.3	28.7	28.9	29.1	29.3	29.5	29.8	30.0
2.05	26.0	26.1	26.4	26.6	26.9	27.2	27.4	27.7	28.1	28.3	28.5	28.7	28.9	29.1	29.4
2.10	25.5	25.5	25.8	26.0	26.4	26.6	26.9	27.2	27.5	27.7	27.9	28.1	28.3	28.6	28.8
2.15	24.9	25.0	25.3	25.5	25.8	26.1	26.3	26.6	27.0	27.2	27.4	27.6	27.8	28.0	28.2
2.20	24.4	24.5	24.8	25.0	25.3	25.5	25.8	26.1	26.5	26.6	26.8	27.0	27.2	27.5	27.7
2.25	24.0	24.0	24.3	24.5	24.8	25.0	25.3	25.6	25.9	26.1	26.3	26.5	26.7	26.9	27.2
2.30	23.5	23.6	23.8	24.0	24.3	24.6	24.8	25.1	25.5	25.6	25.8	26.0	26.2	26.4	26.7
2.40	22.6	22.7	22.9	23.2	23.4	23.7	23.9	24.2	24.5	24.7	24.9	25.1	25.3	25.5	25.7
2.50	21.8	21.9	22.1	22.3	22.6	22.8	23.1	23.3	23.6	23.8	24.0	24.2	24.4	24.6	24.8
2.60	21.0	21.1	21.3	21.5	21.8	22.0	22.3	22.5	22.8	23.0	23.2	23.3	23.5	23.7	23.9
2.70	20.3	20.4	20.6	20.8	21.1	21.3	21.5	21.8	22.1	22.2	22.4	22.6	22.8	23.0	23.2
2.80	19.7	19.7	19.9	20.1	20.4	20.6	20.8	21.1	21.4	21.5	21.7	21.8	22.0	22.2	22.4
2.90	19.0	19.1	19.3	19.5	19.7	19.9	20.2	20.4	20.7	20.8	21.0	21.2	21.3	21.5	21.7
3.00	18.4	18.5	18.7	18.9	19.1	19.3	19.5	19.8	20.0	20.2	20.3	20.5	20.7	20.9	21.1
3.10	17.9	17.9	18.1	18.3	18.6	18.7	18.9	19.2	19.4	19.6	19.7	19.9	20.1	20.2	20.4
3.20	17.4	17.4	17.6	17.8	18.0	18.2	18.4	18.6	18.9	19.0	19.2	19.3	19.5	19.7	19.8
3.30	16.9	16.9	17.1	17.3	17.5	17.7	17.9	18.1	18.4	18.5	18.6	18.8	18.9	19.1	19.3
3.40	16.4	16.4	16.6	16.8	17.0	17.2	17.4	17.6	17.8	18.0	18.1	18.3	18.4	18.6	18.8
3.60	15.5	15.6	15.8	15.9	16.1	16.3	16.5	16.7	16.9	17.0	17.2	17.3	17.5	17.6	17.8
3.80	14.7	14.8	15.0	15.1	15.3	15.5	15.6	15.8	16.1	16.2	16.3	16.5	16.6	16.7	16.9
4.00	14.0	14.1	14.2	14.4	14.6	14.7	14.9	15.1	15.3	15.4	15.5	15.7	15.8	16.0	16.1
4.20	13.4	13.4	13.6	13.7	13.9	14.1	14.2	14.4	14.6	14.7	14.8	15.0	15.1	15.2	15.4
4.40	12.8	12.9	13.0	13.1	13.3	13.4	13.6	13.8	14.0	14.1	14.2	14.3	14.4	14.6	14.7
4.60	12.3	12.3	12.4	12.6	12.7	12.9	13.0	13.2	13.4	13.5	13.6	13.7	13.8	14.0	14.1
4.80	11.8	11.8	11.9	12.1	12.2	12.4	12.5	12.7	12.8	12.9	13.1	13.2	13.3	13.4	13.5
5.00	11.3	11.4	11.5	11.6	11.8	11.9	12.0	12.2	12.3	12.4	12.5	12.7	12.8	12.9	13.0
5.50	10.3	10.3	10.5	10.6	10.7	10.8	11.0	11.1	11.3	11.3	11.4	11.5	11.6	11.7	11.9
6.00	9.5	9.5	9.6	9.7	9.8	9.9	10.1	10.2	10.3	10.4	10.5	10.6	10.7	10.8	10.9
6.50	8.7	8.8	8.9	9.0	9.1	9.2	9.3	9.4	9.6	9.6	9.7	9.8	9.9	10.0	10.1
7.00	8.1	8.2	8.3	8.3	8.5	8.5	8.6	8.8	8.9	9.0	9.0	9.1	9.2	9.3	9.4
8.0	7.1	7.2	7.2	7.3	7.4	7.5	7.6	7.7	7.8	7.9	7.9	8.0	8.1	8.1	8.2
9.0	6.3	6.4	6.4	6.5	6.6	6.7	6.7	6.8	6.9	7.0	7.0	7.1	7.2	7.2	7.3
10.0	5.7	5.7	5.8	5.9	5.9	6.0	6.1	6.2	6.2	6.3	6.3	6.4	6.5	6.5	6.6
11.0	5.2	5.2	5.3	5.3	5.4	5.5	5.5	5.6	5.7	5.7	5.8	5.8	5.9	5.9	6.0
12.0	4.8	4.8	4.8	4.9	5.0	5.0	5.1	5.1	5.2	5.3	5.3	5.3	5.4	5.5	5.5
13.0	4.4	4.4	4.5	4.5	4.6	4.6	4.7	4.7	4.8	4.9	4.9	4.9	5.0	5.0	5.1
15.0	3.8	3.8	3.9	3.9	4.0	4.0	4.1	4.1	4.2	4.2	4.2	4.3	4.3	4.4	4.4
17.0	3.4	3.4	3.4	3.5	3.5	3.5	3.6	3.6	3.7	3.7	3.7	3.8	3.8	3.8	3.9
20.0	2.9	2.9	2.9	2.9	3.0	3.0	3.0	3.1	3.1	3.2	3.2	3.2	3.2	3.3	3.3
25.0	2.3	2.3	2.3	2.4	2.4	2.4	2.4	2.5	2.5	2.5	2.5	2.6	2.6	2.6	2.6
30.0	1.9	1.9	1.9	2.0	2.0	2.0	2.0	2.1	2.1	2.1	2.1	2.1	2.2	2.2	2.2
40.0	1.4	1.4	1.5	1.5	1.5	1.5	1.5	1.5	1.6	1.6	1.6	1.6	1.6	1.6	1.7
50.0	1.1	1.2	1.2	1.2	1.2	1.2	1.2	1.2	1.3	1.3	1.3	1.3	1.3	1.3	1.3
70.0	0.8	0.8	0.8	0.8	0.9	0.9	0.9	0.9	0.9	0.9	0.9	0.9	0.9	0.9	0.9
100.0	0.6	0.6	0.6	0.6	0.6	0.6	0.6	0.6	0.6	0.6	0.6	0.6	0.6	0.7	0.7
150.0	0.4	0.4	0.4	0.4	0.4	0.4	0.4	0.4	0.4	0.4	0.4	0.4	0.4	0.4	0.4
200.0	0.3	0.3	0.3	0.3	0.3	0.3	0.3	0.3	0.3	0.3	0.3	0.3	0.3	0.3	0.3
300.0	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2
400.0	0.1	0.1	0.1	0.1	0.1	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2
800.0	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1

Table C.

AZIMUTHS CORRESPONDING TO THE A AND B CORRECTION.

Azimuth is named N or S according to the name of the A and B correction.

A and B Correction.	31°	32°	33°	34°	35°	36°	37°	38°	39°	40°	41°	42°	43°	44°	45°
	AZIMUTHS.														
′	°	°	°	°	°	°	°	°	°	°	°	°	°	°	°
·000	90·0	90·0	90·0	90·0	90·0	90·0	90·0	90·0	90·0	90·0	90·0	90·0	90·0	90·0	90·0
·010	89·5	89·5	89·5	89·5	89·5	89·5	89·5	89·5	89·6	89·6	89·6	89·6	89·6	89·6	89·6
·020	89·0	89·0	89·0	89·1	89·1	89·1	89·1	89·1	89·1	89·1	89·1	89·1	89·2	89·2	89·2
·030	88·5	88·5	88·6	88·6	88·6	88·6	88·6	88·6	88·7	88·7	88·7	88·7	88·7	88·8	88·8
·040	88·0	88·1	88·1	88·1	88·1	88·1	88·2	88·2	88·2	88·2	88·3	88·3	88·3	88·4	88·4
·050	87·5	87·6	87·6	87·6	87·7	87·7	87·7	87·7	87·8	87·8	87·8	87·9	87·9	87·9	88·0
·060	87·1	87·1	87·1	87·2	87·2	87·2	87·3	87·3	87·3	87·4	87·4	87·4	87·5	87·5	87·6
·070	86·6	86·6	86·6	86·7	86·7	86·8	86·8	86·8	86·9	86·9	87·0	87·0	87·1	87·1	87·2
·080	86·1	86·1	86·2	86·2	86·3	86·3	86·3	86·4	86·4	86·5	86·5	86·6	86·7	86·7	86·8
·090	85·6	85·6	85·7	85·7	85·8	85·8	85·9	85·9	86·0	86·1	86·1	86·2	86·2	86·3	86·4
·100	85·1	85·2	85·2	85·3	85·3	85·4	85·4	85·5	85·6	85·6	85·7	85·7	85·8	85·9	86·0
·110	84·6	84·7	84·7	84·8	84·9	84·9	85·0	85·0	85·1	85·2	85·3	85·3	85·4	85·5	85·6
·120	84·1	84·2	84·3	84·3	84·4	84·5	84·5	84·6	84·7	84·7	84·8	84·9	85·0	85·1	85·1
·130	83·6	83·7	83·8	83·8	83·9	84·0	84·1	84·2	84·2	84·3	84·4	84·5	84·6	84·7	84·7
·140	83·2	83·2	83·3	83·4	83·5	83·5	83·6	83·7	83·8	83·9	84·0	84·1	84·2	84·2	84·3
·150	82·7	82·8	82·8	82·9	83·0	83·1	83·2	83·3	83·4	83·4	83·5	83·6	83·7	83·8	83·9
·160	82·2	82·3	82·4	82·4	82·5	82·6	82·7	82·8	82·9	83·0	83·1	83·2	83·3	83·4	83·5
·170	81·7	81·8	81·9	82·0	82·1	82·2	82·3	82·4	82·5	82·6	82·7	82·8	82·9	83·0	83·1
·180	81·2	81·3	81·4	81·5	81·6	81·7	81·8	81·9	82·0	82·1	82·3	82·4	82·5	82·6	82·7
·190	80·7	80·8	80·9	81·0	81·2	81·3	81·4	81·5	81·6	81·7	81·8	82·0	82·1	82·2	82·3
·200	80·3	80·4	80·5	80·6	80·7	80·8	80·9	81·0	81·2	81·3	81·4	81·5	81·7	81·8	82·0
·210	79·8	79·9	80·0	80·1	80·2	80·4	80·5	80·6	80·7	80·9	81·0	81·1	81·3	81·4	81·6
·220	79·3	79·4	79·5	79·7	79·8	79·9	80·0	80·2	80·3	80·4	80·6	80·7	80·9	81·0	81·2
·230	78·8	79·0	79·1	79·2	79·3	79·5	79·6	79·7	79·9	80·0	80·2	80·3	80·5	80·6	80·8
240	78·4	78·5	78·6	78·7	78·9	79·0	79·1	79·3	79·4	79·6	79·7	79·9	80·0	80·2	80·4
·250	77·9	78·0	78·2	78·3	78·4	78·6	78·7	78·9	79·0	79·2	79·3	79·5	79·6	79·8	80·0
·260	77·4	77·6	77·7	77·8	78·0	78·1	78·3	78·4	78·6	78·7	78·9	79·1	79·2	79·4	79·6
·270	77·0	77·1	77·2	77·4	77·5	77·7	77·8	78·0	78·1	78·3	78·5	78·7	78·8	79·0	79·2
·280	76·5	76·6	76·8	76·9	77·1	77·2	77·4	77·6	77·7	77·9	78·1	78·2	78·4	78·6	78·8
·290	76·0	76·2	76·3	76·5	76·6	76·8	77·0	77·1	77·3	77·5	77·7	77·8	78·0	78·2	78·4
·300	75·6	75·7	75·9	76·0	76·2	76·4	76·5	76·7	76·9	77·1	77·2	77·4	77·6	77·8	78·0
·310	75·1	75·3	75·4	75·6	75·8	75·9	76·1	76·3	76·5	76·6	76·8	77·0	77·2	77·4	77·6
·320	74·7	74·8	75·0	75·1	75·3	75·5	75·7	75·8	76·0	76·2	76·4	76·6	76·8	77·0	78·3
·330	74·2	74·4	74·5	74·7	74·9	75·1	75·2	75·4	75·6	75·8	76·0	76·2	76·4	76·6	76·9
·340	73·8	73·9	74·1	74·3	74·4	74·6	74·8	75·0	75·2	75·4	75·6	75·8	76·0	76·3	76·5
·350	73·3	73·5	73·6	73·8	74·0	74·2	74·4	74·6	74·8	75·0	75·2	75·4	75·6	75·9	76·1
·360	72·9	73·0	73·2	73·4	73·6	73·8	74·0	74·2	74·4	74·6	74·8	75·0	75·2	75·5	75·7
·370	72·4	72·6	72·8	72·9	73·1	73·3	73·5	73·7	74·0	74·2	74·4	74·6	74·9	75·1	75·3
·380	72·0	72·1	72·3	72·5	72·7	72·9	73·1	73·3	73·5	73·8	74·0	74·2	74·5	74·7	75·0
·390	71·5	71·7	71·9	72·1	72·3	72·5	72·7	72·9	73·1	73·4	73·6	73·8	74·1	74·3	74·6
·400	71·1	71·3	71·5	71·7	71·9	72·1	72·3	72·5	72·7	73·0	73·2	73·4	73·7	73·9	74·2
·410	70·6	70·8	71·0	71·2	71·4	71·6	71·9	72·1	72·3	72·6	72·8	73·1	73·3	73·6	73·8
·420	70·2	70·4	70·6	70·8	71·0	71·2	71·5	71·7	71·9	72·2	72·4	72·7	72·9	73·2	73·5
·430	69·8	70·0	70·2	70·4	70·6	70·8	71·0	71·3	71·5	71·8	72·0	72·3	72·5	72·8	73·1
·440	69·3	69·5	69·7	70·0	70·2	70·4	70·6	70·9	71·1	71·4	71·6	71·9	72·2	72·4	72·7
·450	68·9	69·1	69·3	69·5	69·8	70·0	70·2	70·5	70·7	71·0	71·2	71·5	71·8	72·1	72·3
·460	68·5	68·7	68·9	69·1	69·4	69·6	69·8	70·1	70·3	70·6	70·9	71·1	71·4	71·7	72·0
·470	68·1	68·3	68·5	68·7	68·9	69·2	69·4	69·7	69·9	70·2	70·5	70·7	71·0	71·3	71·6
·480	67·6	67·9	68·1	68·3	68·5	68·8	69·0	69·3	69·5	69·8	70·1	70·4	70·7	71·0	71·3
·490	67·2	67·4	67·7	67·9	68·1	68·4	68·6	68·9	69·2	69·4	69·7	70·0	70·3	70·6	70·9

Table C.

AZIMUTHS CORRESPONDING TO THE A AND B CORRECTION.

Azimuth is named N or S according to the name of the A and B correction.

A and B Cor-rection.	LATITUDES.														
	31°	32°	33°	34°	35°	36°	37°	38°	39°	40°	41°	42°	43°	44°	45°
	Azimuths.														
′	°	°	°	°	°	°	°	°	°	°	°	°	°	°	°
·500	66·8	67·0	67·2	67·5	67·7	68·0	68·2	68·5	68·8	69·0	69·3	69·6	69·9	70·2	70·5
·510	66·4	66·6	66·8	67·1	67·3	67·6	67·8	68·1	68·4	68·7	68·9	69·2	69·5	69·9	70·2
·520	66·0	66·2	66·4	66·7	66·9	67·2	67·4	67·7	68·0	68·3	68·6	68·9	69·2	69·5	69·8
·530	65·6	65·8	66·0	66·3	66·5	66·8	67·1	67·3	67·6	67·9	68·2	68·5	68·8	69·1	69·5
·540	65·2	65·4	65·6	65·9	66·1	66·4	66·7	66·9	67·2	67·5	67·8	68·1	68·4	68·8	69·1
·550	64·8	65·0	65·2	65·5	65·7	66·0	66·3	66·6	66·9	67·2	67·5	67·8	68·1	68·4	68·7
·560	64·4	64·6	64·8	65·1	65·4	65·6	65·9	66·2	66·5	66·8	67·1	67·4	67·7	68·1	68·4
·570	64·0	64·2	64·5	64·7	65·0	65·2	65·5	65·8	66·1	66·4	66·7	67·0	67·4	67·7	68·0
·580	63·6	63·8	64·1	64·3	64·6	64·9	65·1	65·4	65·7	66·0	66·4	66·7	67·0	67·4	67·7
·590	63·2	63·4	63·7	63·9	64·2	64·5	64·8	65·1	65·4	65·7	66·0	66·3	66·7	67·0	67·4
·600	62·8	63·0	63·3	63·6	63·8	64·1	64·4	64·7	65·0	65·3	65·6	66·0	66·3	66·7	67·0
·610	62·4	62·6	62·9	63·2	63·4	63·7	64·0	64·3	64·6	65·0	65·3	65·6	66·0	66·3	66·7
·620	62·0	62·3	62·5	62·8	63·1	63·4	63·7	64·0	64·3	64·6	64·9	65·3	65·6	66·0	66·3
·630	61·6	61·9	62·1	62·4	62·7	63·0	63·3	63·6	63·9	64·2	64·6	64·9	65·3	65·6	66·0
·640	61·3	61·5	61·8	62·1	62·3	62·6	62·9	63·2	63·6	63·9	64·2	64·6	64·9	65·3	65·7
·650	60·9	61·1	61·4	61·7	62·0	62·3	62·6	62·9	63·2	63·5	63·9	64·2	64·6	64·9	65·3
·660	60·5	60·8	61·0	61·3	61·6	61·9	62·2	62·5	62·8	63·2	63·5	63·9	64·2	64·6	65·0
·670	60·1	60·4	60·7	60·9	61·2	61·5	61·8	62·2	62·5	62·8	63·2	63·5	63·9	64·3	64·7
·680	59·8	60·0	60·3	60·6	60·9	61·2	61·5	61·8	62·1	62·5	62·8	63·2	63·6	63·9	64·3
·690	59·4	59·7	59·9	60·2	60·5	60·8	61·1	61·5	61·8	62·1	62·5	62·9	63·2	63·6	64·0
·700	59·0	59·3	59·6	59·9	60·2	60·5	60·8	61·1	61·5	61·8	62·2	62·5	62·9	63·3	63·7
·710	58·7	58·9	59·2	59·5	59·8	60·1	60·4	60·8	61·1	61·5	61·8	62·2	62·6	62·9	63·3
·720	58·3	58·6	58·9	59·2	59·5	59·8	60·1	60·4	60·8	61·1	61·5	61·9	62·2	62·6	63·0
·730	58·0	58·2	58·5	58·8	59·1	59·4	59·8	60·1	60·4	60·8	61·1	61·5	61·9	62·3	62·7
·740	57·6	57·9	58·2	58·5	58·8	59·1	59·4	59·8	60·1	60·5	60·8	61·2	61·6	62·0	62·4
·750	57·3	57·5	57·8	58·1	58·4	58·8	59·1	59·4	59·8	60·1	60·5	60·9	61·3	61·7	62·1
·760	56·9	57·2	57·5	57·8	58·1	58·4	58·7	59·1	59·4	59·8	60·2	60·5	60·9	61·3	61·7
·770	56·6	56·9	57·1	57·4	57·8	58·1	58·4	58·8	59·1	59·5	59·8	60·2	60·6	61·0	61·4
·780	56·2	56·5	56·8	57·1	57·4	57·7	58·1	58·4	58·8	59·1	59·5	59·9	60·3	60·7	61·1
·790	55·9	56·2	56·5	56·8	57·1	57·4	57·8	58·1	58·5	58·8	59·2	59·6	60·0	60·4	60·8
·800	55·6	55·8	56·1	56·4	56·8	57·1	57·4	57·8	58·1	58·5	58·9	59·3	59·7	60·1	60·5
·810	55·2	55·5	55·8	56·1	56·4	56·8	57·1	57·4	57·8	58·2	58·6	59·0	59·4	59·8	60·2
·820	54·9	55·2	55·5	55·8	56·1	56·4	56·8	57·1	57·5	57·9	58·2	58·6	59·0	59·5	59·9
·830	54·6	54·9	55·2	55·5	55·8	56·1	56·5	56·8	57·2	57·6	57·9	58·3	58·7	59·2	59·6
·840	54·2	54·5	54·8	55·1	55·5	55·8	56·1	56·5	56·9	57·2	57·6	58·0	58·4	58·9	59·3
·850	53·9	54·2	54·5	54·8	55·2	55·5	55·8	56·2	56·6	56·9	57·3	57·7	58·1	58·6	59·0
·860	53·6	53·9	54·2	54·5	54·8	55·2	55·5	55·9	56·2	56·6	57·0	57·4	57·8	58·3	58·7
·870	53·3	53·6	53·9	54·2	54·5	54·9	55·2	55·6	55·9	56·3	56·7	57·1	57·5	58·0	58·4
·880	53·0	53·3	53·6	53·9	54·2	54·6	54·9	55·3	55·6	56·0	56·4	56·8	57·2	57·7	58·1
·890	52·7	53·0	53·3	53·6	53·9	54·2	54·6	55·0	55·3	55·7	56·1	56·5	56·9	57·4	57·8
·900	52·4	52·6	53·0	53·3	53·6	53·9	54·3	54·7	55·0	55·4	55·8	56·2	56·6	57·1	57·5
·910	52·0	52·3	52·6	53·0	53·3	53·6	54·0	54·4	54·7	55·1	55·5	55·9	56·4	56·8	57·2
·920	51·7	52·0	52·3	52·7	53·0	53·3	53·7	54·1	54·4	54·8	55·2	55·6	56·1	56·5	57·0
·930	51·4	51·7	52·0	52·4	52·7	53·0	53·4	53·8	54·1	54·5	54·9	55·4	55·8	56·2	56·7
·940	51·1	51·4	51·7	52·1	52·4	52·7	53·1	53·5	53·9	54·2	54·6	55·1	55·5	55·9	56·4
·950	50·8	51·1	51·5	51·8	52·1	52·5	52·8	53·2	53·6	54·0	54·4	54·8	55·2	55·7	56·1
·960	50·5	50·9	51·2	51·5	51·8	52·2	52·5	52·9	53·3	53·7	54·1	54·5	54·9	55·4	55·8
·970	50·3	50·6	50·9	51·2	51·5	51·9	52·2	52·6	53·0	53·4	53·8	54·2	54·6	55·1	55·6
·980	50·0	50·3	50·6	50·9	51·2	51·6	52·0	52·3	52·7	53·1	53·5	53·9	54·4	54·8	55·3
·990	49·7	50·0	53·3	50·6	51·0	51·3	51·7	52·0	52·4	52·8	53·2	53·7	54·1	54·5	55·0

Table C.

AZIMUTHS CORRESPONDING TO THE A AND B CORRECTION.

Azimuth is named N or S according to the name of the A and B correction.

A and B Correction.	LATITUDES.														
	31°	32°	33°	34°	35°	36°	37°	38°	39°	40°	41°	42°	43°	44°	45°
	AZIMUTHS.														
′	°	°	°	°	°	°	°	°	°	°	°	°	°	°	°
1·00	49·4	49·7	50·0	50·3	50·7	51·0	51·4	51·8	52·1	52·5	53·0	53·4	53·8	54·3	54·7
1·02	48·8	49·1	49·5	49·8	50·1	50·5	50·8	51·2	51·6	52·0	52·4	52·8	53·3	53·7	54·2
1·04	48·3	48·6	48·9	49·2	49·6	49·9	50·3	50·7	51·1	51·5	51·9	52·3	52·7	53·2	53·7
1·06	47·7	48·0	48·4	48·7	49·0	49·4	49·8	50·1	50·5	50·9	51·3	51·8	52·2	52·7	53·1
1·08	47·2	47·5	47·8	48·2	48·5	48·9	49·2	49·6	50·0	50·4	50·8	51·2	51·7	52·2	52·6
1·10	46·7	47·0	47·3	47·6	48·0	48·3	48·7	49·1	49·5	49·9	50·3	50·7	51·2	51·6	52·1
1·12	46·2	46·5	46·8	47·1	47·5	47·8	48·2	48·6	49·0	49·4	49·8	50·2	50·7	51·1	51·6
1·14	45·7	46·0	46·3	46·6	47·0	47·3	47·7	48·1	48·5	48·9	49·3	49·7	50·2	50·6	51·1
1·16	45·2	45·5	45·8	46·1	46·5	46·8	47·2	47·6	48·0	48·4	48·8	49·2	49·7	50·2	50·6
1·18	44·7	45·0	45·3	45·6	46·0	46·3	46·7	47·1	47·5	47·9	48·3	48·8	49·2	49·7	50·2
1·20	44·2	44·5	44·8	45·1	45·5	45·8	46·2	46·6	47·0	47·4	47·8	48·3	48·7	49·2	49·7
1·22	43·7	44·0	44·3	44·7	45·0	45·4	45·7	46·1	46·5	46·9	47·4	47·8	48·3	48·7	49·2
1·24	43·3	43·6	43·9	44·2	44·6	44·9	45·3	45·7	46·1	46·5	46·9	47·3	47·8	48·3	48·8
1·26	42·8	43·1	43·4	43·8	44·1	44·5	44·8	45·2	45·6	46·0	46·4	46·9	47·3	47·8	48·3
1·28	42·3	42·7	43·0	43·3	43·6	44·0	44·4	44·8	45·2	45·6	46·0	46·4	46·9	47·4	47·9
1·30	41·9	42·2	42·5	42·9	43·2	43·6	43·9	44·3	44·7	45·1	45·5	46·0	46·4	46·9	47·4
1·32	41·5	41·8	42·1	42·4	42·8	43·1	43·5	43·9	44·3	44·7	45·1	45·6	46·0	46·5	47·0
1·34	41·0	41·3	41·7	42·0	42·3	42·7	43·1	43·4	43·8	44·3	44·7	45·1	45·6	46·1	46·5
1·36	40·6	40·9	41·2	41·6	41·9	42·3	42·6	43·0	43·4	43·8	44·3	44·7	45·2	45·6	46·1
1·38	40·2	40·5	40·8	41·2	41·5	41·9	42·2	42·6	43·0	43·4	43·8	44·3	44·7	45·2	45·7
1·40	39·8	40·1	40·4	40·7	41·1	41·4	41·8	42·2	42·6	43·0	43·4	43·9	44·3	44·8	45·3
1·42	39·4	39·7	40·0	40·3	40·7	41·0	41·4	41·8	42·2	42·6	43·0	43·5	43·9	44·4	44·9
1·44	39·0	39·3	39·6	39·9	40·3	40·6	41·0	41·4	41·8	42·2	42·6	43·1	43·5	44·0	44·5
1·46	38·6	38·9	39·2	39·6	39·9	40·3	40·6	41·0	41·4	41·8	42·2	42·7	43·1	43·6	44·1
1·48	38·2	38·5	38·9	39·2	39·5	39·9	40·2	40·6	41·0	41·4	41·8	42·3	42·7	43·2	43·7
1·50	37·9	38·2	38·5	38·8	39·1	39·5	39·9	40·2	40·6	41·0	41·5	41·9	42·4	42·8	43·3
1·52	37·5	37·8	38·1	38·4	38·8	39·1	39·5	39·9	40·2	40·7	41·1	41·5	42·0	42·4	42·9
1·54	37·1	37·4	37·7	38·1	38·4	38·8	39·1	39·5	39·9	40·3	40·7	41·1	41·6	42·1	42·6
1·56	36·8	37·1	37·4	37·7	38·0	38·4	38·8	39·1	39·5	39·9	40·3	40·8	41·2	41·7	42·2
1·58	36·4	36·7	37·0	37·4	37·7	38·0	38·4	38·8	39·2	39·6	40·0	40·4	40·9	41·3	41·8
1·60	36·1	36·4	36·7	37·0	37·3	37·7	38·0	38·4	38·8	39·2	39·6	40·1	40·5	41·0	41·5
1·62	35·8	36·1	36·4	36·7	37·0	37·3	37·7	38·1	38·5	38·9	39·3	39·7	40·2	40·6	41·1
1·64	35·4	35·7	36·0	36·3	36·7	37·0	37·4	37·7	38·1	38·5	38·9	39·4	39·8	40·3	40·8
1·66	35·1	35·4	35·7	36·0	36·3	36·7	37·0	37·4	37·8	38·2	38·6	39·0	39·5	39·9	40·4
1·68	34·8	35·1	35·4	35·7	36·0	36·3	36·7	37·1	37·4	37·8	38·3	38·7	39·1	39·6	40·1
1·70	34·5	34·7	35·0	35·4	35·7	36·0	36·4	36·7	37·1	37·5	37·9	38·4	38·8	39·3	39·8
1·72	34·1	34·4	34·7	35·0	35·4	35·7	36·1	36·4	36·8	37·2	37·6	38·0	38·5	38·9	39·4
1·74	33·8	34·1	34·4	34·7	35·1	35·4	35·7	36·1	36·5	36·9	37·3	37·7	38·2	38·6	39·1
1·76	33·5	33·8	34·1	34·4	34·7	35·1	35·4	35·8	36·2	36·6	37·0	37·4	37·8	38·3	38·8
1·78	33·2	33·5	33·8	34·1	34·4	34·8	35·1	35·5	35·9	36·3	36·7	37·1	37·5	38·0	38·5
1·80	32·9	33·2	33·5	33·8	34·1	34·5	34·8	35·2	35·6	36·0	36·4	36·8	37·2	37·7	38·2
1·82	32·7	32·9	33·2	33·5	33·9	34·2	34·5	34·9	35·3	35·7	36·1	36·5	36·9	37·4	37·8
1·84	32·4	32·7	32·9	33·2	33·6	33·9	34·2	34·6	35·0	35·4	35·8	36·2	36·6	37·1	37·5
1·86	32·1	32·4	32·7	33·0	33·3	33·6	33·9	34·3	34·7	35·1	35·5	35·9	36·3	36·8	37·2
1·88	31·8	32·1	32·4	32·7	33·0	33·3	33·7	34·0	34·4	34·8	35·2	35·6	36·0	36·5	37·0
1·90	31·6	31·8	32·1	32·4	32·7	33·0	33·4	33·7	34·1	34·5	34·9	35·3	35·7	36·2	36·7
1·92	31·3	31·6	31·8	32·1	32·4	32·8	33·1	33·5	33·8	34·2	34·6	35·0	35·5	35·9	36·4
1·94	31·0	31·3	31·6	31·9	32·2	32·5	32·8	33·2	33·6	33·9	34·3	34·7	35·2	35·6	36·1
1·96	30·8	31·0	31·3	31·6	31·9	32·2	32·6	32·9	33·3	33·7	34·1	34·5	34·9	35·3	35·8
1·98	30·5	30·8	31·1	31·3	31·7	32·0	32·3	32·7	33·0	33·4	33·8	34·2	34·6	35·1	35·5

Table C.

AZIMUTHS CORRESPONDING TO THE A AND B CORRECTION.

Azimuth is named N or S according to the name of the A and B correction.

A and B Correction.	LATITUDES.														
	31°	32°	33°	34°	35°	36°	37°	38°	39°	40°	41°	42°	43°	44°	45°
	AZIMUTHS.														
′	°	°	°	°	°	°	°	°	°	°	°	°	°	°	°
2·00	30·3	30·5	30·8	31·1	31·4	31·7	32·0	32·4	32·8	33·1	33·5	33·9	34·4	34·8	35·3
2·05	29·6	29·9	30·2	30·5	30·8	31·1	31·4	31·8	32·1	32·5	32·9	33·3	33·7	34·1	34·6
2·10	29·1	29·3	29·6	29·9	30·2	30·5	30·8	31·1	31·5	31·9	32·3	32·7	33·1	33·5	34·0
2·15	28·5	28·7	29·0	29·3	29·6	29·9	30·2	30·6	30·9	31·3	31·6	32·0	32·5	32·9	33·3
2·20	27·9	28·2	28·5	28·7	29·0	29·3	29·6	30·0	30·3	30·7	31·1	31·5	31·9	32·3	32·7
2·25	27·4	27·7	27·9	28·2	28·5	28·8	29·1	29·4	29·8	30·1	30·5	30·9	31·3	31·7	32·2
2·30	26·9	27·1	27·4	27·7	28·0	28·3	28·6	28·9	29·2	29·6	29·9	30·3	30·7	31·1	31·6
2·40	25·9	26·2	26·4	26·7	27·0	27·2	27·6	27·9	28·2	28·5	28·9	29·3	29·7	30·1	30·5
2·50	25·0	25·3	25·5	25·8	26·0	26·3	26·6	26·9	27·2	27·6	27·9	28·3	28·7	29·1	29·5
2·60	24·2	24·4	24·6	24·9	25·2	25·4	25·7	26·0	26·3	26·7	27·0	27·4	27·7	28·1	28·5
2·70	23·4	23·6	23·8	24·1	24·3	24·6	24·9	25·2	25·5	25·8	26·1	26·5	26·9	27·2	27·6
2·80	22·6	22·8	23·1	23·3	23·6	23·8	24·1	24·4	24·7	25·0	25·3	25·7	26·0	26·4	26·8
2·90	21·9	22·1	22·4	22·6	22·8	23·1	23·4	23·6	23·9	24·2	24·6	24·9	25·2	25·6	26·0
3·00	21·2	21·5	21·7	21·9	22·1	22·4	22·7	22·9	23·2	23·5	23·8	24·2	24·5	24·9	25·2
3·10	20·6	20·8	21·0	21·3	21·5	21·7	22·0	22·3	22·5	22·8	23·1	23·5	23·8	24·2	24·5
3·20	20·0	20·2	20·4	20·7	20·9	21·1	21·4	21·6	21·9	22·2	22·5	22·8	23·1	23·5	23·8
3·30	19·5	19·7	19·9	20·1	20·3	20·5	20·8	21·0	21·3	21·6	21·9	22·2	22·5	22·8	23·2
3·40	18·9	19·1	19·3	19·5	19·8	20·0	20·2	20·5	20·7	21·0	21·3	21·6	21·9	22·2	22·6
3·60	18·0	18·1	18·3	18·5	18·7	19·0	19·2	19·4	19·7	19·9	20·2	20·5	20·8	21·1	21·4
3·80	17·1	17·2	17·4	17·6	17·8	18·0	18·2	18·5	18·7	19·0	19·2	19·5	19·8	20·1	20·4
4·00	16·3	16·4	16·6	16·8	17·0	17·2	17·4	17·6	17·8	18·1	18·3	18·6	18·9	19·2	19·5
4·20	15·5	15·7	15·8	16·0	16·2	16·4	16·6	16·8	17·0	17·3	17·5	17·8	18·0	18·3	18·6
4·40	14·9	15·0	15·2	15·3	15·5	15·7	15·9	16·1	16·3	16·5	16·8	17·0	17·3	17·5	17·8
4·60	14·2	14·4	14·5	14·7	14·9	15·0	15·2	15·4	15·6	15·8	16·1	16·3	16·6	16·8	17·1
4·80	13·7	13·8	14·0	14·1	14·3	14·4	14·6	14 8	15·0	15·2	15·4	15·7	15·9	16·2	16·4
5·00	13·1	13·3	13·4	13·6	13·7	13·9	14·1	14·2	14·4	14·6	14·8	15·1	15·3	15·5	15·8
5·50	12·0	12·1	12·2	12·4	12·5	12·7	12·8	13·0	13·2	13·4	13·5	13·7	14·0	14·2	14·4
6·00	11·0	11·1	11·2	11·4	11·5	11·6	11·8	11·9	12·1	12·3	12·5	12·6	12·8	13·0	13·3
6·50	10·2	10·3	10·4	10·5	10·6	10·8	10·9	11·0	11·2	11·4	11·5	11·7	11·9	12·1	12·3
7·00	9·5	9·6	9·7	9·8	9·9	10·0	10·1	10·3	10·4	10·6	10·7	10·9	11·1	11·2	11·4
8·0	8·3	8·4	8·5	8·6	8·7	8·8	8·9	9·0	9·1	9·3	9·4	9·5	9·7	9·9	10·0
9·0	7·4	7·5	7·5	7·6	7·7	7·8	7·9	8·0	8·1	8·3	8·4	8·5	8·6	8·8	8·9
10·0	6·7	6·7	6·8	6·9	7·0	7·0	7·1	7·2	7·3	7·4	7·5	7·7	7·8	7·9	8·0
11·0	6·1	6·1	6·2	6·3	6·3	6·4	6·5	6·6	6·7	6·8	6·9	7·0	7·1	7·2	7·3
12·0	5·6	5·6	5·7	5·7	5·8	5·9	6·0	6·0	6·1	6·2	6·3	6·4	6·5	6·6	6·7
13·0	5·1	5·2	5·2	5·3	5·4	5·4	5·5	5·6	5·7	5·7	5·8	5·9	6·0	6·1	6·2
15·0	4·4	4·5	4·5	4·6	4·7	4·7	4·8	4·8	4·9	5·0	5·0	5·1	5·2	5·3	5·4
17·0	3·9	4·0	4·0	4·1	4·1	4·2	4·2	4·3	4·3	4·4	4·5	4·5	4·6	4·7	4·8
20·0	3·3	3·4	3·4	3·5	3·5	3·5	3·6	3·6	3·7	3·7	3·8	3·8	3·9	4·0	4·0
25·0	2·7	2·7	2·7	2·8	2·8	2·8	2·9	2·9	2·9	3·0	3·0	3·1	3·1	3·2	3·2
30·0	2·2	2·3	2·3	2·3	2·3	2·4	2·4	2·4	2·5	2·5	2·5	2·6	2·6	2·7	2·7
40·0	1·7	1·7	1·7	1·7	1·7	1·8	1·8	1·8	1·8	1·9	1·9	1·9	2·0	2·0	2·0
50·0	1·3	1·4	1·4	1·4	1·4	1·4	1·4	1·5	1·5	1·5	1·5	1·5	1·6	1·6	1·6
70·0	1·0	1·0	1·0	1·0	1·0	1·0	1·0	1·0	1·1	1·1	1·1	1·1	1·1	1·1	1·2
100·0	0·7	0·7	0·7	0·7	0·7	0·7	0·7	0·7	0·7	0·7	0·8	0·8	0·8	0·8	0·8
150·0	0·4	0·5	0·5	0·5	0·5	0·5	0·5	0·5	0·5	0·5	0·5	0·5	0·5	0·5	0·5
200·0	0·3	0·3	0·3	0·3	0·3	0·4	0·4	0·4	0·4	0·4	0·4	0·4	0·4	0·4	0·4
300·0	0·2	0·2	0·2	0·2	0·2	0·2	0·2	0·2	0·2	0·2	0·3	0·3	0·3	0·3	0·3
400·0	0·2	0·2	0·2	0·2	0·2	0·2	0·2	0·2	0·2	0·2	0·2	0·2	0·2	0·2	0·2
800·0	0·1	0·1	0·1	0·1	0·1	0·1	0·1	0·1	0·1	0·1	0·1	0·1	0·1	0·1	0·1

Table C.

AZIMUTHS CORRESPONDING TO THE A AND B CORRECTION.

Azimuth is named N or S according to the name of the A and B correction.

A and B Correction.	46°	47°	48°	49°	50°	51°	52°	53°	54°	55°	56°	57°	58°	59°	60°
	LATITUDES.														
	AZIMUTHS.														
′	°	°	°	°	°	°	°	°	°	°	°	°	°	°	°
·000	90·0	90·0	90·0	90·0	90·0	90·0	90·0	90·0	90·0	90·0	90·0	90·0	90·0	90·0	90·0
·010	89·6	89·6	89·6	89·6	89·6	89·6	89·6	89·7	89·7	89·7	89·7	89·7	89·7	89·7	89·7
·020	89·2	89·2	89·2	89·2	89·3	89·3	89·3	89·3	89·3	89·3	89·4	89·4	89·4	89·4	89·4
·030	88·8	88·8	88·9	88·9	88·9	88·9	88·9	89·0	89·0	89·0	89·0	89·1	89·1	89·1	89·1
·040	88·4	88·4	88·5	88·5	88·5	88·6	88·6	88·6	88·7	88·7	88·7	88·8	88·8	88·8	88·9
·050	88·0	88·0	88·1	88·1	88·2	88·2	88·2	88·3	88·3	88·4	88·4	88·4	88·5	88·5	88·6
·060	87·6	87·7	87·7	87·7	87·8	87·8	87·9	87·9	88·0	88·0	88·1	88·1	88·2	88·2	88·3
·070	87·2	87·3	87·3	87·4	87·4	87·5	87·5	87·6	87·6	87·7	87·8	87·8	87·9	87·9	88·0
·080	86·8	86·9	86·9	87·0	87·1	87·1	87·2	87·2	87·3	87·4	87·4	87·5	87·6	87·6	87·7
·090	86·4	86·5	86·6	86·6	86·7	86·8	86·8	86·9	87·0	87·0	87·1	87·2	87·3	87·3	87·4
·100	86·0	86·1	86·2	86·2	86·3	86·4	86·5	86·6	86·6	86·7	86·8	86·9	87·0	87·1	87·1
·110	85·6	85·7	85·8	85·9	86·0	86·0	86·1	86·2	86·3	86·4	86·5	86·6	86·7	86·8	86·9
·120	85·2	85·3	85·4	85·5	85·6	85·7	85·8	85·9	86·0	86·1	86·2	86·3	86·4	86·5	86·6
·130	84·8	84·9	85·0	85·1	85·2	85·3	85·4	85·5	85·6	85·7	85·8	86·0	86·1	86·2	86·3
·140	84·4	84·5	84·6	84·8	84·9	85·0	85·1	85·2	85·3	85·4	85·5	85·6	85·8	85·9	86·0
·150	84·1	84·2	84·3	84·4	84·5	84·6	84·7	84·8	85·0	85·1	85·2	85·3	85·5	85·6	85·7
·160	83·7	83·8	83·9	84·0	84·1	84·3	84·4	84·5	84·6	84·8	84·9	85·0	85·2	85·3	85·4
·170	83·3	83·4	83·5	83·6	83·8	83·9	84·0	84·2	84·3	84·4	84·6	84·7	84·9	85·0	85·1
·180	82·9	83·0	83·1	83·3	83·4	83·5	83·7	83·8	84·0	84·1	84·3	84·4	84·6	84·7	84·9
·190	82·5	82·6	82·8	82·9	83·0	83·2	83·3	83·5	83·6	83·8	83·9	84·1	84·3	84·4	84·6
·200	82·1	82·2	82·4	82·5	82·7	82·8	83·0	83·1	83·3	83·5	83·6	83·8	84·0	84·1	84·3
·210	81·7	81·8	82·0	82·2	82·3	82·5	82·6	82·8	83·0	83·1	83·3	83·5	83·7	83·8	84·0
·220	81·3	81·5	81·6	81·8	82·0	82·1	82·3	82·5	82·6	82·8	83·0	83·2	83·4	83·5	83·7
·230	80·9	81·1	81·3	81·4	81·6	81·8	81·9	82·1	82·3	82·5	82·7	82·9	83·1	83·2	83·4
·240	80·5	80·7	80·9	81·1	81·2	81·4	81·6	81·8	82·0	82·2	82·4	82·6	82·8	83·0	83·2
·250	80·1	80·3	80·5	80·7	80·9	81·1	81·2	81·4	81·6	81·8	82·0	82·2	82·5	82·7	82·9
·260	79·8	79·9	80·1	80·3	80·5	80·7	80·9	81·1	81·3	81·5	81·7	81·9	82·2	82·4	82·6
·270	79·4	79·6	79·8	80·0	80·2	80·4	80·6	80·8	81·0	81·2	81·4	81·6	81·9	82·1	82·3
·280	79·0	79·2	79·4	79·6	79·8	80·0	80·2	80·4	80·7	80·9	81·1	81·3	81·6	81·8	82·0
·290	78·6	78·8	79·0	79·2	79·4	79·7	79·9	80·1	80·3	80·6	80·8	81·0	81·3	81·5	81·7
·300	78·2	78·4	78·6	78·9	79·1	79·3	79·5	79·8	80·0	80·2	80·5	80·7	81·0	81·2	81·5
·310	77·8	78·1	78·3	78·5	78·7	79·0	79·2	79·4	79·7	79·9	80·2	80·4	80·7	80·9	81·2
·320	77·5	77·7	77·9	78·1	78·4	78·6	78·9	79·1	79·3	79·6	79·9	80·1	80·4	80·6	80·9
·330	77·1	77·3	77·5	77·8	78·0	78·3	78·5	78·8	79·0	79·3	79·5	79·8	80·1	80·4	80·6
·340	76·7	76·9	77·2	77·4	77·7	77·9	78·2	78·4	78·7	79·0	79·2	79·5	79·8	80·1	80·4
·350	76·3	76·6	76·8	77·1	77·3	77·6	77·8	78·1	78·4	78·6	78·9	79·2	79·5	79·8	80·1
·360	76·0	76·2	76·5	76·7	77·0	77·2	77·5	77·8	78·1	78·3	78·6	78·9	79·2	79·5	79·8
·370	75·6	75·8	76·1	76·4	76·6	76·9	77·2	77·4	77·7	78·0	78·3	78·6	78·9	79·2	79·5
·380	75·2	75·5	75·7	76·0	76·3	76·6	76·8	77·1	77·4	77·7	78·0	78·3	78·6	78·9	79·2
·390	74·8	75·1	75·4	75·6	75·9	76·2	76·5	76·8	77·1	77·4	77·7	78·0	78·3	78·6	79·0
·400	74·5	74·7	75·0	75·3	75·6	75·9	76·2	76·5	76·8	77·1	77·4	77·7	78·0	78·4	78·7
·410	74·1	74·4	74·7	74·9	75·2	75·5	75·8	76·1	76·5	76·8	77·1	77·4	77·7	78·1	78·4
·420	73·7	74·0	74·3	74·6	74·9	75·2	75·5	75·8	76·1	76·5	76·8	77·1	77·5	77·8	78·1
·430	73·4	73·7	73·9	74·2	74·5	74·9	75·2	75·5	75·8	76·1	76·5	76·8	77·2	77·5	77·9
·440	73·0	73·3	73·6	73·9	74·2	74·5	74·8	75·2	75·5	75·8	76·2	76·5	76·9	77·2	77·6
·450	72·6	72·9	73·2	73·6	73·9	74·2	74·5	74·8	75·2	75·5	75·9	76·2	76·6	77·0	77·3
·460	72·3	72·6	72·9	73·2	73·5	73·9	74·2	74·5	74·9	75·2	75·6	75·9	76·3	76·7	77·0
·470	71·9	72·2	72·5	72·9	73·2	73·5	73·9	74·2	74·6	74·9	75·3	75·6	76·0	76·4	76·8
·480	71·6	71·9	72·2	72·5	72·9	73·2	73·5	73·9	74·2	74·6	75·0	75·3	75·7	76·1	76·5
·490	71·2	71·5	71·8	72·2	72·5	72·9	73·2	73·6	73·9	74·3	74·7	75·1	75·4	75·8	76·2

Table C.

AZIMUTHS CORRESPONDING TO THE A AND B CORRECTION.

Azimuth is named N or S according to the name of the A and B correction.

A and B Correction.	LATITUDES.														
	46°	47°	48°	49°	50°	51°	52°	53°	54°	55°	56°	57°	58°	59°	60°
	AZIMUTHS.														
′	°	°	°	°	°	°	°	°	°	°	°	°	°	°	°
·500	70·8	71·2	71·5	71·8	72·2	72·5	72·9	73·3	73·6	74·0	74·4	74·8	75·2	75·6	76·0
·510	70·5	70·8	71·2	71·5	71·8	72·2	72·6	72·9	73·3	73·7	74·1	74·5	74·9	75·3	75·7
·520	70·1	70·5	70·8	71·2	71·5	71·9	72·2	72·6	73·0	73·4	73·8	74·2	74·6	75·0	75·4
·530	69·8	70·1	70·5	70·8	71·2	71·6	71·9	72·3	72·7	73·1	73·5	73·9	74·3	74·7	75·2
·540	69·4	69·8	70·1	70·5	70·9	71·2	71·6	72·0	72·4	72·8	73·2	73·6	74·0	74·5	74·9
·550	69·1	69·4	69·8	70·2	70·5	70·9	71·3	71·7	72·1	72·5	72·9	73·3	73·8	74·2	74·6
·560	68·7	69·1	69·5	69·8	70·2	70·6	71·0	71·4	71·8	72·2	72·6	73·0	73·5	73·9	74·4
·570	68·4	68·8	69·1	69·5	69·9	70·3	70·7	71·1	71·5	71·9	72·3	72·8	73·2	73·6	74·1
·580	68·1	68·4	68·8	69·2	69·6	69·9	70·3	70·8	71·2	71·6	72·0	72·5	72·9	73·4	73·8
·590	67·7	68·1	68·5	68·8	69·2	69·6	70·0	70·5	70·9	71·3	71·7	72·2	72·6	73·1	73·6
·600	67·4	67·7	68·1	68·5	68·9	69·3	69·7	70·1	70·6	71·0	71·5	71·9	72·4	72·8	73·3
·610	67·0	67·4	67·8	68·2	68·6	69·0	69·4	69·8	70·3	70·7	71·2	71·6	72·1	72·6	73·0
·620	66·7	67·1	67·5	67·9	68·3	68·7	69·1	69·5	70·0	70·4	70·9	71·3	71·8	72·3	72·8
·630	66·4	66·7	67·1	67·5	68·0	68·4	68·8	69·2	69·7	70·1	70·6	71·1	71·5	72·0	72·5
·640	66·0	66·4	66·8	67·2	67·6	68·1	68·5	68·9	69·4	69·8	70·3	70·8	71·3	71·8	72·3
·650	65·7	66·1	66·5	66·9	67·3	67·8	68·2	68·6	69·1	69·6	70·0	70·5	71·0	71·5	72·0
·660	65·4	65·8	66·2	66·6	67·0	67·4	67·9	68·3	68·8	69·3	69·7	70·2	70·7	71·2	71·7
·670	65·0	65·4	65·9	66·3	66·7	67·1	67·6	68·0	68·5	69·0	69·5	70·0	70·5	71·0	71·5
·680	64·7	65·1	65·5	66·0	66·4	66·8	67·3	67·7	68·2	68·7	69·2	69·7	70·2	70·7	71·2
·690	64·4	64·8	65·2	65·6	66·1	66·5	67·0	67·4	67·9	68·4	68·9	69·4	69·9	70·4	71·0
·700	64·1	64·5	64·9	65·3	65·8	66·2	66·7	67·2	67·6	68·1	68·6	69·1	69·6	70·2	70·7
·710	63·7	64·2	64·6	65·0	65·5	65·9	66·4	66·9	67·3	67·8	68·3	68·9	69·4	69·9	70·5
·720	63·4	63·8	64·3	64·7	65·2	65·6	66·1	66·6	67·1	67·6	68·1	68·6	69·1	69·7	70·2
·730	63·1	63·5	64·0	64·4	64·9	65·3	65·8	66·3	66·8	67·3	67·8	68·3	68·9	69·4	69·9
·740	62·8	63·2	63·7	64·1	64·6	65·0	65·5	66·0	66·5	67·0	67·5	68·0	68·6	69·1	69·7
·750	62·5	62·9	63·4	63·8	64·3	64·7	65·2	65·7	66·2	66·7	67·2	67·8	68·3	68·9	69·4
·760	62·2	62·6	63·0	63·5	64·0	64·4	64·9	65·4	65·9	66·4	67·0	67·5	68·1	68·6	69·2
·770	61·9	62·3	62·7	63·2	63·7	64·1	64·6	65·1	65·6	66·2	66·7	67·2	67·8	68·4	68·9
·780	61·5	62·0	62·4	62·9	63·4	63·9	64·3	64·9	65·4	65·9	66·4	67·0	67·5	68·1	68·7
·790	61·2	61·7	62·1	62·6	63·1	63·6	64·1	64·6	65·1	65·6	66·2	66·7	67·3	67·9	68·4
·800	60·9	61·4	61·8	62·3	62·8	63·3	63·8	64·3	64·8	65·4	65·9	66·5	67·0	67·6	68·2
·810	60·6	61·1	61·5	62·0	62·5	63·0	63·5	64·0	64·5	65·1	65·6	66·2	66·8	67·4	68·0
·820	60·3	60·8	61·2	61·7	62·2	62·7	63·2	63·7	64·3	64·8	65·4	65·9	66·5	67·1	67·7
·830	60·0	60·5	61·0	61·4	61·9	62·4	62·9	63·5	64·0	64·5	65·1	65·7	66·3	66·9	67·5
·840	59·7	60·2	60·7	61·1	61·6	62·1	62·7	63·2	63·7	64·3	64·9	65·4	66·0	66·6	67·2
·850	59·4	59·9	60·4	60·9	61·3	61·9	62·4	62·9	63·5	64·0	64·6	65·2	65·8	66·4	67·0
·860	59·1	59·6	60·1	60·6	61·1	61·6	62·1	62·6	63·2	63·7	64·3	64·9	65·5	66·1	66·7
·870	58·9	59·3	59·8	60·3	60·8	61·3	61·8	62·4	62·9	63·5	64·1	64·6	65·2	65·9	66·5
·880	58·6	59·0	59·5	60·0	60·5	61·0	61·6	62·1	62·6	63·2	63·8	64·4	65·0	65·6	66·3
·890	58·3	58·7	59·2	59·7	60·2	60·7	61·3	61·8	62·4	63·0	63·5	64·1	64·8	65·4	66·0
·900	58·0	58·5	58·9	59·4	60·0	60·5	61·0	61·6	62·1	62·7	63·3	63·9	64·5	65·1	65·8
·910	57·7	58·2	58·7	59·2	59·7	60·2	60·7	61·3	61·9	62·4	63·0	63·6	64·3	64·9	65·5
·920	57·4	57·9	58·4	58·9	59·4	59·9	60·5	61·0	61·6	62·2	62·8	63·4	64·0	64·6	65·3
·930	57·1	57·6	58·1	58·6	59·1	59·7	60·2	60·8	61·3	61·9	62·5	63·1	63·8	64·4	65·1
·940	56·9	57·3	57·8	58·3	58·9	59·4	59·9	60·5	61·1	61·7	62·3	62·9	63·5	64·2	64·8
·950	56·6	57·1	57·6	58·1	58·6	59·1	59·7	60·2	60·8	61·4	62·0	62·6	63·3	63·9	64·6
·960	56·3	56·8	57·3	57·8	58·3	58·9	59·4	60·0	60·6	61·2	61·8	62·4	63·0	63·7	64·4
·970	56·0	56·5	57·0	57·5	58·1	58·6	59·2	59·7	60·3	60·9	61·5	62·2	62·8	63·5	64·1
·980	55·8	56·2	56·7	57·3	57·8	58·3	58·9	59·5	60·1	60·7	61·3	61·9	62·6	63·2	63·9
·990	55·5	56·0	56·5	57·0	57·5	58·1	58·6	59·2	59·8	60·4	61·0	61·7	62·3	63·0	63·7

Table C.

AZIMUTHS CORRESPONDING TO THE A AND B CORRECTION

Azimuth is named N or S according to the name of the A and B correction.

A and B Correction.	LATITUDES.														
	46°	47°	48°	49°	50°	51°	52°	53°	54°	55°	56°	57°	58°	59°	60°
	Azimuths.														
′	°	°	°	°	°	°	°	°	°	°	°	°	°	°	°
1·00	55·2	55·7	56·2	56·7	57·3	57·8	58·4	59·0	59·6	60·2	60·8	61·4	62·1	62·7	63·4
1·02	54·7	55·2	55·7	56·2	56·7	57·3	57·9	58·5	59·1	59·7	60·3	60·9	61·6	62·3	63·0
1·04	54·2	54·7	55·2	55·7	56·2	56·8	57·4	58·0	58·6	59·2	59·8	60·5	61·1	61·8	62·5
1·06	53·6	54·1	54·7	55·2	55·7	56·3	56·9	57·5	58·1	58·7	59·3	60·0	60·7	61·4	62·1
1·08	53·1	53·6	54·1	54·7	55·2	55·8	56·4	57·0	57·6	58·2	58·9	59·5	60·2	60·9	61·6
1·10	52·6	53·1	53·6	54·2	54·7	55·3	55·9	56·5	57·1	57·8	58·4	59·1	59·8	60·5	61·2
1·12	52·1	52·6	53·2	53·7	54·2	54·8	55·4	56·0	56·6	57·3	57·9	58·6	59·3	60·0	60·8
1·14	51·6	52·1	52·7	53·2	53·8	54·3	54·9	55·5	56·2	56·8	57·5	58·2	58·9	59·6	60·3
1·16	51·1	51·7	52·2	52·7	53·3	53·9	54·5	55·1	55·7	56·4	57·0	57·7	58·4	59·1	59·9
1·18	50·7	51·2	51·7	52·3	52·8	53·4	54·0	54·6	55·3	55·9	56·6	57·3	58·0	58·7	59·5
1·20	50·2	50·7	51·2	51·8	52·4	52·9	53·5	54·2	54·8	55·5	56·1	56·8	57·5	58·3	59·0
1·22	49·7	50·2	50·8	51·3	51·9	52·5	53·1	53·7	54·4	55·0	55·7	56·4	57·1	57·9	58·6
1·24	49·3	49·8	50·3	50·9	51·4	52·0	52·6	53·3	53·9	54·6	55·3	56·0	56·7	57·4	58·2
1·26	48·8	49·3	49·9	50·4	51·0	51·6	52·2	52·8	53·5	54·1	54·8	55·5	56·3	57·0	57·8
1·28	48·4	48·9	49·4	50·0	50·6	51·1	51·8	52·4	53·0	53·7	54·4	55·1	55·9	56·6	57·4
1·30	47·9	48·4	49·0	49·5	50·1	50·7	51·3	52·0	52·6	53·3	54·0	54·7	55·4	56·2	57·0
1·32	47·5	48·0	48·5	49·1	49·7	50·3	50·9	51·5	52·2	52·9	53·6	54·3	55·0	55·8	56·6
1·34	47·1	47·6	48·1	48·7	49·3	49·9	50·5	51·1	51·8	52·5	53·2	53·9	54·6	55·4	56·2
1·36	46·6	47·2	47·7	48·3	48·8	49·4	50·1	50·7	51·4	52·0	52·7	53·5	54·2	55·0	55·8
1·38	46·2	46·7	47·3	47·8	48·4	49·0	49·6	50·3	51·0	51·6	52·3	53·1	53·8	54·6	55·4
1·40	45·8	46·3	46·9	47·4	48·0	48·6	49·2	49·9	50·5	51·2	51·9	52·7	53·4	54·2	55·0
1·42	45·4	45·9	46·5	47·0	47·6	48·2	48·8	49·5	50·1	50·8	51·5	52·3	53·0	53·8	54·6
1·44	45·0	45·5	46·1	46·6	47·2	47·8	48·4	49·1	49·8	50·4	51·2	51·9	52·7	53·4	54·2
1·46	44·6	45·1	45·7	46·2	46·8	47·4	48·0	48·7	49·4	50·1	50·8	51·5	52·3	53·1	53·9
1·48	44·2	44·7	45·3	45·8	46·4	47·0	47·7	48·3	49·0	49·7	50·4	51·1	51·9	52·7	53·5
1·50	43·8	44·3	44·9	45·5	46·0	46·7	47·3	47 9	48·6	49·3	50·0	50·8	51·5	52·3	53·1
1·52	43·4	44·0	44·5	45·1	45·7	46·3	46·9	47·5	48·2	48·9	49·6	50·4	51·1	51·9	52·8
1·54	43·1	43·6	44·1	44·7	45·3	45·9	46·5	47·2	47·8	48·5	49·3	50·0	50·8	51·6	52·4
1·56	42·7	43·2	43·8	44·3	44·9	45·5	46·2	46·8	47·5	48·2	48·9	49·6	50·4	51·2	52·0
1·58	42·3	42·9	43·4	44·0	44·6	45·2	45·8	46·4	47·1	47·8	48·5	49·3	50·1	50·9	51·7
1·60	42·0	42·5	43·0	43·6	44·2	44·8	45·4	46·1	46·8	47·5	48·2	48·9	49·7	50·5	51·3
1·62	41·6	42·1	42·7	43·3	43·8	44·4	45·1	45·7	46·4	47·1	47·8	48·6	49·4	50·2	51·0
1·64	41·3	41·8	42·3	42·9	43·5	44·1	44·7	45·4	46·1	46·8	47·5	48·2	49·0	49·8	50·6
1·66	40·9	41·5	42·0	42·6	43·1	43·7	44·4	45·0	45·7	46·4	47·1	47·9	48·7	49·5	50·3
1·68	40·6	41·1	41·7	42·2	42·8	43·4	44·0	44·7	45·4	46·1	46·8	47·5	48·3	49·1	50·0
1·70	40·3	40·8	41·3	41·9	42·5	43·1	43·7	44·3	45·0	45·7	46·4	47·2	48·0	48·8	49·6
1·72	39·9	40·4	41·0	41·5	42·1	42·7	43·4	44·0	44·7	45·4	46·1	46·9	47·7	48·5	49·3
1·74	39·6	40·1	40·7	41·2	41·8	42·4	43·0	43·7	44·4	45·1	45·8	46·5	47·3	48·1	49·0
1·76	39·3	39·8	40·3	40·9	41·5	42·1	42·7	43·4	44·0	44·7	45·5	46·2	47·0	47·8	48·7
1·78	39·0	39·5	40·0	40·6	41·2	41·8	42·4	43·0	43·7	44·4	45·1	45·9	46·7	47·5	48·3
1·80	38·7	39·2	39·7	40·3	40·8	41·4	42·1	42·7	43·4	44·1	44·8	45·6	46·4	47·2	48·0
1·82	38·3	38·9	39·4	39·9	40·5	41·1	41·7	42·4	43·1	43·8	44·5	45·3	46·0	46·9	47·7
1·84	38·0	38·6	39·1	39·6	40·2	40·8	41·4	42·1	42·8	43·5	44·2	44·9	45·7	46·5	47·4
1·86	37·7	38·2	38·8	39·3	39·9	40·5	41·1	41·8	42·4	43·1	43·9	44·6	45·4	46·2	47·1
1·88	37·4	38·0	38·5	39·0	39·6	40·2	40·8	41·5	42·1	42·8	43·6	44·3	45·1	45·9	46·8
1·90	37·1	37·7	38·2	38·7	39·3	39·9	40·5	41·2	41·8	42·5	43·3	44·0	44·8	45·6	46·5
1·92	36·9	37·4	37·9	38·4	39·0	39·6	40·2	40·9	41·5	42·2	43·0	43·7	44·5	45·3	46·2
1·94	36·6	37·1	37·6	38·2	38·7	39·3	39·9	40·6	41·2	41·9	42·7	43·4	44·2	45·0	45·9
1·96	36·3	36·8	37·3	37·9	38·4	39·0	39·6	40·3	41·0	41·7	42·4	43·1	43·9	44·7	45·6
1·98	36·0	36·5	37·0	37·6	38·2	38·7	39·4	40·0	40·7	41·4	42·1	42·8	43·6	44·4	45·3

Table C.

AZIMUTHS CORRESPONDING TO THE A AND B CORRECTION.

Azimuth is named N or S according to the name of the A and B correction.

A and B Correction.	46°	47°	48°	49°	50°	51°	52°	53°	54°	55°	56°	57°	58°	59°	60°
	LATITUDES.														
	AZIMUTHS.														
′	°	°	°	°	°	°	°	°	°	°	°	°	°	°	°
2·00	35·7	36·2	36·8	37·3	37·9	38·5	39·1	39·7	40·4	41·1	41·8	42·6	43·3	44·2	45·0
2·05	35·1	35·6	36·1	36·6	37·2	37·8	38·4	39·0	39·7	40·4	41·1	41·8	42·6	43·4	44·3
2·10	34·4	34·9	35·4	36·0	36·5	37·1	37·7	38·4	39·0	39·7	40·4	41·2	41·9	42·8	43·6
2·15	33·8	34·3	34·8	35·3	35·9	36·5	37·1	37·7	38·4	39·0	39·8	40·5	41·3	42·1	42·9
2·20	33·2	33·7	34·2	34·7	35·3	35·8	36·4	37·1	37·7	38·4	39·1	39·8	40·6	41·4	42·3
2·25	32·6	33·1	33·6	34·1	34·7	35·2	35·8	36·4	37·1	37·8	38·5	39·2	40·0	40·8	41·6
2·30	32·0	32·5	33·0	33·5	34·1	34·6	35·2	35·8	36·5	37·2	37·9	38·6	39·4	40·2	41·0
2·40	31·0	31·4	31·9	32·4	33·0	33·5	34·1	34·7	35·3	36·0	36·7	37·4	38·2	39·0	39·8
2·50	29·9	30·4	30·9	31·4	31·9	32·4	33·0	33·6	34·2	34·9	35·6	36·3	37·0	37·8	38·7
2·60	29·0	29·4	29·9	30·4	30·9	31·4	32·0	32·6	33·2	33·8	34·5	35·2	36·0	36·8	37·6
2·70	28·1	28·5	29·0	29·4	30·0	30·5	31·0	31·6	32·2	32·9	33·5	34·2	35·0	35·7	36·5
2·80	27·2	27·6	28·1	28·6	29·1	29·6	30·1	30·7	31·3	31·9	32·6	33·3	34·0	34·7	35·5
2·90	26·4	26·8	27·3	27·7	28·2	28·7	29·3	29·8	30·4	31·0	31·7	32·3	33·1	33·8	34·6
3·00	25·6	26·0	26·5	26·9	27·4	27·9	28·4	29·0	29·6	30·2	30·8	31·5	32·2	32·9	33·7
3·10	24·9	25·3	25·7	26·2	26·6	27·1	27·7	28·2	28·8	29·4	30·0	30·6	31·3	32·1	32·8
3·20	24·2	24·6	25·0	25·5	25·9	26·4	26·9	27·4	28·0	28·6	29·2	29·8	30·5	31·2	32·0
3·30	23·6	24·0	24·4	24·8	25·2	25·7	26·2	26·7	27·3	27·8	28·5	29·1	29·8	30·5	31·2
3·40	22·9	23·3	23·7	24·1	24·6	25·0	25·5	26·0	26·6	27·1	27·7	28·4	29·0	29·7	30·5
3·60	21·8	22·2	22·5	22·9	23·4	23·8	24·3	24·8	25·3	25·8	26·4	27·0	27·7	28·3	29·1
3·80	20·7	21·1	21·5	21·9	22·3	22·7	23·1	23·6	24·1	24·6	25·2	25·8	26·4	27·1	27·8
4·00	19·8	20·1	20·5	20·9	21·3	21·7	22·1	22·6	23·0	23·6	24·1	24·7	25·3	25·9	26·6
4·20	18·9	19·2	19·6	19·9	20·3	20·7	21·1	21·6	22·1	22·5	23·1	23·6	24·2	24·8	24·5
4·40	18·1	18·4	18·8	19·1	19·5	19·9	20·3	20·7	21·1	21·6	22·1	22·7	23·2	23·8	24·4
4·60	17·4	17·7	18·0	18·3	18·7	19·1	19·4	19·9	20·3	20·8	21·2	21·8	22·3	22·9	23·5
4·80	16·7	17·0	17·3	17·6	18·0	18·3	18·7	19·1	19·5	20·0	20·4	20·9	21·5	22·0	22·6
5·00	16·1	16·3	16·6	17·0	17·3	17·6	18·0	18·4	18·8	19·2	19·7	20·2	20·7	21·2	21·8
5·50	14·7	14·9	15·2	15·5	15·8	16·1	16·5	16·8	17·2	17·6	18·0	18·5	18·9	19·4	20·0
6·00	13·5	13·7	14·0	14·3	14·5	14·8	15·1	15·5	15·8	16·2	16·6	17·0	17·5	17·9	18·4
6·50	12·5	12·7	12·9	13·2	13·5	13·7	14·0	14·3	14·7	15·0	15·4	15·8	16·2	16·6	17·1
7·00	11·6	11·8	12·1	12·3	12·5	12·8	13·1	13·4	13·7	14·0	14·3	14·7	15·1	15·5	15·9
8·0	10·2	10·4	10·6	10·8	11·0	11·2	11·5	11·7	12·0	12·3	12·6	12·9	13·3	13·6	14·0
9·0	9·1	9·3	9·4	9·6	9·8	10·0	10·2	10·5	10·7	11·0	11·2	11·5	11·8	12·2	12·5
10·0	8·2	8·3	8·5	8·7	8·8	9·0	9·2	9·4	9·7	9·9	10·1	10·4	10·7	11·0	11·3
11·0	7·5	7·6	7·7	7·9	8·0	8·2	8·4	8·6	8·8	9·0	9·2	9·5	9·7	10·0	10·3
12·0	6·8	7·0	7·1	7·2	7·4	7·5	7·7	7·9	8·1	8·3	8·5	8·7	8·9	9·2	9·5
13·0	6·3	6·4	6·6	6·7	6·8	7·0	7·1	7·3	7·5	7·6	7·8	8·0	8·3	8·5	8·7
15·0	5·5	5·6	5·7	5·8	5·9	6·0	6·2	6·3	6·5	6·6	6·8	7·0	7·2	7·4	7·6
17·0	4·8	4·9	5·0	5·1	5·2	5·3	5·5	5·6	5·7	5·9	6·0	6·2	6·3	6·5	6·7
20·0	4·1	4·2	4·3	4·4	4·4	4·5	4·6	4·7	4·9	5·0	5·1	5·2	5·4	5·5	5·7
25·0	3·3	3·4	3·4	3·5	3·6	3·6	3·7	3·8	3·9	4·0	4·1	4·2	4·3	4·4	4·6
30·0	2·7	2·8	2·9	2·9	3·0	3·0	3·1	3·2	3·2	3·3	3·4	3·5	3·6	3·7	3·8
40·0	2·1	2·1	2·1	2·2	2·2	2·3	2·3	2·4	2·4	2·5	2·6	2·6	2·7	2·8	2·9
50·0	1·6	1·7	1·7	1·7	1·8	1·8	1·9	1·9	1·9	2·0	2·0	2·1	2·2	2·2	2·3
70·0	1·2	1·2	1·2	1·2	1·3	1·3	1·3	1·4	1·4	1·4	1·5	1·5	1·5	1·6	1·6
100·0	0·8	0·8	0·9	0·9	0·9	0·9	0·9	1·0	1·0	1·0	1·0	1·1	1·1	1·1	1·1
150·0	0·5	0·6	0·6	0·6	0·6	0·6	0·6	0·6	0·6	0·7	0·7	0·7	0·7	0·7	0·8
200·0	0·4	0·4	0·4	0·4	0·4	0·5	0·5	0·5	0·5	0·5	0·5	0·5	0·5	0·6	0·6
300·0	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	0·4	0·4
400·0	0·2	0·2	0·2	0·2	0·2	0·2	0·2	0·2	0·2	0·2	0·3	0·3	0·3	0·3	0·3
800·0	0·1	0·1	0·1	0·1	0·1	0·1	0·1	0·1	0·1	0·1	0·1	0·1	0·1	0·1	0·1

Table C.

AZIMUTHS CORRESPONDING TO THE A AND B CORRECTION.

Azimuth is named N or S according to the name of the A and B correction.

A and B Correction.	61°	62°	63°	64°	65°	66°	67°	68°	69°	69½°	70°	70½°	71°	71½°	72°
	LATITUDES. AZIMUTHS														
′	°	°	°	°	°	°	°	°	°	°	°	°	°	°	°
.00	90.0	90.0	90.0	90.0	90.0	90.0	90.0	90.0	90.0	90.0	90.0	90.0	90.0	90.0	90.0
.01	89.7	89.7	89.7	89.7	89.8	89.8	89.8	89.8	89.8	89.8	89.8	89.8	89.8	89.8	89.8
.02	89.4	89.5	89.5	89.5	89.5	89.5	89.6	89.6	89.6	89.6	89.6	89.6	89.6	89.6	89.6
.03	89.2	89.2	89.2	89.2	89.3	89.3	89.3	89.4	89.4	89.4	89.4	89.4	89.4	89.5	89.5
.04	88.9	88.9	89.0	89.0	89.0	89.1	89.1	89.1	89.2	89.2	89.2	89.2	89.3	89.3	89.3
.05	88.6	88.7	88.7	88.7	88.8	88.8	88.9	88.9	89.0	89.0	89.0	89.0	89.1	89.1	89.1
.06	88.3	88.4	88.4	88.5	88.5	88.6	88.7	88.7	88.8	88.8	88.8	88.9	88.9	88.9	88.9
.07	88.1	88.1	88.2	88.2	88.3	88.4	88.4	88.5	88.6	88.6	88.6	88.7	88.7	88.7	88.8
.08	87.8	87.8	87.9	88.0	88.1	88.1	88.2	88.3	88.4	88.4	88.4	88.5	88.5	88.5	88.6
.09	87.5	87.6	87.7	87.7	87.8	87.9	88.0	88.1	88.2	88.2	88.2	88.3	88.3	88.4	88.4
.10	87.2	87.3	87.4	87.5	87.6	87.7	87.8	87.9	87.9	88.0	88.0	88.1	88.1	88.2	88.2
.11	86.9	87.0	87.1	87.2	87.3	87.4	87.5	87.6	87.7	87.8	87.8	87.9	87.9	88.0	88.1
.12	86.7	86.8	86.9	87.0	87.1	87.2	87.3	87.4	87.5	87.6	87.6	87.7	87.8	87.8	87.9
.13	86.4	86.5	86.6	86.7	86.9	87.0	87.1	87.2	87.3	87.4	87.5	87.5	87.6	87.6	87.7
.14	86.1	86.2	86.4	86.5	86.6	86.7	86.9	87.0	87.1	87.2	87.3	87.3	87.4	87.5	87.5
.15	85.8	86.0	86.1	86.2	86.4	86.5	86.6	86.8	86.9	87.0	87.1	87.1	87.2	87.3	87.3
.16	85.6	85.7	85.8	86.0	86.1	86.3	86.4	86.6	86.7	86.8	86.9	86.9	87.0	87.1	87.2
.17	85.3	85.4	85.6	85.7	85.9	86.0	86.2	86.4	86.5	86.6	86.7	86.8	86.8	86.9	87.0
.18	85.0	85.2	85.3	85.5	85.6	85.8	86.0	86.1	86.3	86.4	86.5	86.6	86.6	86.7	86.8
.19	84.7	84.9	85.1	85.2	85.4	85.6	85.8	85.9	86.1	86.2	86.3	86.4	86.5	86.5	86.6
.20	84.5	84.6	84.8	85.0	85.2	85.3	85.5	85.7	85.9	86.0	86.1	86.2	86.3	86.4	86.5
.21	84.2	84.4	84.6	84.7	84.9	85.1	85.3	85.5	85.7	85.8	85.9	86.0	86.1	86.2	86.3
.22	83.9	84.1	84.3	84.5	84.7	84.9	85.1	85.3	85.5	85.6	85.7	85.8	85.9	86.0	86.1
.23	83.6	83.8	84.0	84.2	84.4	84.7	84.9	85.1	85.3	85.4	85.5	85.6	85.7	85.8	85.9
.24	83.4	83.6	83.8	84.0	84.2	84.4	84.6	84.9	85.1	85.2	85.3	85.4	85.5	85.6	85.8
.25	83.1	83.3	83.5	83.7	84.0	84.2	84.4	84.6	84.9	85.0	85.1	85.2	85.3	85.5	85.6
.26	82.8	83.0	83.3	83.5	83.7	84.0	84.2	84.4	84.7	84.8	84.9	85.0	85.2	85.3	85.4
.27	82.5	82.8	83.0	83.2	83.5	83.7	84.0	84.2	84.5	84.6	84.7	84.8	85.0	85.1	85.2
.28	82.3	82.5	82.8	83.0	83.3	83.5	83.8	84.0	84.3	84.4	84.5	84.7	84.8	84.9	85.1
.29	82.0	82.2	82.5	82.8	83.0	83.3	83.5	83.8	84.1	84.2	84.3	84.5	84.6	84.7	84.9
.30	81.7	82.0	82.2	82.5	82.8	83.0	83.3	83.6	83.9	84.0	84.1	84.3	84.4	84.6	84.7
.31	81.5	81.7	82.0	82.3	82.5	82.8	83.1	83.4	83.7	83.8	83.9	84.1	84.2	84.4	84.5
.32	81.2	81.5	81.7	82.0	82.3	82.6	82.9	83.2	83.5	83.6	83.8	83.9	84.1	84.2	84.4
.33	80.9	81.2	81.5	81.8	82.1	82.4	82.7	83.0	83.3	83.4	83.6	83.7	83.9	84.0	84.2
.34	80.6	80.9	81.2	81.5	81.8	82.1	82.4	82.7	83.1	83.2	83.4	83.5	83.7	83.8	84.0
.35	80.4	80.7	81.0	81.3	81.6	81.9	82.2	82.5	82.9	83.0	83.2	83.3	83.5	83.7	83.8
.36	80.1	80.4	80.7	81.0	81.3	81.7	82.0	82.3	82.6	82.8	83.0	83.1	83.3	83.5	83.7
.37	79.8	80.1	80.5	80.8	81.1	81.4	81.8	82.1	82.4	82.6	82.8	83.0	83.1	83.3	83.5
.38	79.6	79.9	80.2	80.5	80.9	81.2	81.6	81.9	82.2	82.4	82.6	82.8	82.9	83.1	83.3
.39	79.3	79.6	80.0	80.3	80.6	81.0	81.3	81.7	82.0	82.2	82.4	82.6	82.8	82.9	83.1
.40	79.0	79.4	79.7	80.1	80.4	80.8	81.1	81.5	81.8	82.0	82.2	82.4	82.6	82.8	83.0
.41	78.8	79.1	79.5	79.8	80.2	80.5	80.9	81.3	81.6	81.8	82.0	82.2	82.4	82.6	82.8
.42	78.5	78.8	79.2	79.6	79.9	80.3	80.7	81.1	81.4	81.6	81.8	82.0	82.2	82.4	82.6
.43	78.2	78.6	79.0	79.3	79.7	80.1	80.5	80.8	81.2	81.4	81.6	81.8	82.0	82.2	82.4
.44	78.0	78.3	78.7	79.1	79.5	79.9	80.2	80.6	81.0	81.2	81.4	81.6	81.8	82.1	82.3
.45	77.7	78.1	78.5	78.8	79.2	79.6	80.0	80.4	80.8	81.0	81.3	81.5	81.7	81.9	82.1
.46	77.4	77.8	78.2	78.6	79.0	79.4	79.8	80.2	80.6	80.8	81.1	81.3	81.5	81.7	81.9
.47	77.2	77.6	78.0	78.4	78.8	79.2	79.6	80.0	80.4	80.7	80.9	81.1	81.3	81.5	81.7
.48	76.9	77.3	77.7	78.1	78.5	79.0	79.4	79.8	80.2	80.5	80.7	80.9	81.1	81.3	81.6
.49	76.6	77.0	77.5	77.9	78.3	78.7	79.2	79.6	80.0	80.3	80.5	80.7	80.9	81.2	81.4
.50	76.4	76.8	77.2	77.6	78.1	78.5	78.9	79.4	79.8	80.1	80.3	80.5	80.8	81.0	81.2
.51	76.1	76.5	77.0	77.4	77.8	78.3	78.7	79.2	79.6	79.9	80.1	80.3	80.6	80.8	81.0
.52	75.9	76.3	76.7	77.2	77.6	78.1	78.5	79.0	79.4	79.7	79.9	80.2	80.4	80.6	80.9
.53	75.6	76.0	76.5	76.9	77.4	77.8	78.3	78.8	79.2	79.5	79.7	80.0	80.2	80.5	80.7
.54	75.3	75.8	76.2	76.7	77.1	77.6	78.1	78.6	79.0	79.3	79.5	79.8	80.0	80.3	80.5

Table C.

AZIMUTHS CORRESPONDING TO THE A AND B CORRECTION.

Azimuth is named N or S according to the name of the A and B correction.

A and B Cor-rection.	LATITUDES.														
	61°	62°	63°	64°	65°	66°	67°	68°	69°	69½°	70°	70½°	71°	71½°	72°
	Azimuths.														
′	°	°	°	°	°	°	°	°	°	°	°	°	°	°	°
·55	75·1	75·5	76·0	76·4	76·9	77·4	77·9	78·4	78·8	79·1	79·3	79·6	79·8	80·1	80·4
·56	74·8	75·3	75·7	76·2	76·7	77·2	77·7	78·2	78·7	78·9	79·2	79·4	79·7	79·9	80·2
·57	74·6	75·0	75·5	76·0	76·5	76·9	77·4	77·9	78·5	78·7	79·0	79·2	79·5	79·7	80·0
·58	74·3	74·8	75·2	75·7	76·2	76·7	77·2	77·7	78·3	78·5	78·8	79·0	79·3	79·6	79·8
·59	74·0	74·5	75·0	75·5	76·0	76·5	77·0	77·5	78·1	78·3	78·6	78·9	79·1	79·4	79·7
·60	73·8	74·3	74·8	75·3	75·8	76·3	76·8	77·3	77·9	78·1	78·4	78·7	78·9	79·2	79·5
·61	73·5	74·0	74·5	75·0	75·5	76·1	76·6	77·1	77·7	77·9	78·2	78·5	78·8	79·0	79·3
·62	73·3	73·8	74·3	74·8	75·3	75·8	76·4	76·9	77·5	77·7	78·0	78·3	78·6	78·9	79·2
·63	73·0	73·5	74·0	74·6	75·1	75·6	76·2	76·7	77·3	77·6	77·8	78·1	78·4	77·7	79·0
·64	72·8	73·3	73·8	74·3	74·9	75·4	76·0	76·5	77·1	77·4	77·7	77·9	78·2	78·5	78·8
·65	72·5	73·0	73·6	74·1	74·6	75·2	75·7	76·3	76·9	77·2	77·5	77·8	78·1	78·3	78·6
·66	72·3	72·8	73·3	73·9	74·4	75·0	75·5	76·1	76·7	77·0	77·3	77·6	77·9	78·2	78·5
·67	72·0	72·5	73·1	73·6	74·2	74·8	75·3	75·9	76·5	76·8	77·1	77·4	77·7	78·0	78·3
·68	71·8	72·3	72·8	73·4	74·0	74·5	75·1	75·7	76·3	76·6	76·9	77·2	77·5	77·8	78·1
·69	71·5	72·1	72·6	73·2	73·7	74·3	74·9	75·5	76·1	76·4	76·7	77·0	77·3	77·7	78·0
·70	71·3	71·8	72·4	72·9	73·5	74·1	74·7	75·3	75·9	76·2	76·5	76·8	77·2	77·5	77·8
·71	71·0	71·6	72·1	72·7	73·3	73·9	74·5	75·1	75·7	76·0	76·4	76·7	77·0	77·3	77·6
·72	70·8	71·3	71·9	72·5	73·1	73·7	74·3	74·9	75·5	75·8	76·2	76·5	76·8	77·1	77·5
·73	70·5	71·1	71·7	72·3	72·9	73·5	74·1	74·7	75·3	75·7	76·0	76·3	76·6	77·0	77·3
·74	70·3	70·8	71·4	72·0	72·6	73·2	73·9	74·5	75·1	75·5	75·8	76·1	76·5	76·8	77·1
·75	70·0	70·6	71·2	71·8	72·4	73·0	73·7	74·3	75·0	75·3	75·6	75·9	76·3	76·6	77·0
·76	69·8	70·4	71·0	71·6	72·2	72·8	73·5	74·1	74·8	75·1	75·4	75·8	76·1	76·4	76·8
·77	69·5	70·1	70·7	71·3	72·0	72·6	73·3	73·9	74·6	74·9	75·2	75·6	75·9	76·3	76·6
·78	69·3	69·9	70·5	71·1	71·8	72·4	73·1	73·7	74·4	74·7	75·1	75·4	75·8	76·1	76·4
·79	69·0	69·7	70·3	70·9	71·5	72·2	72·8	73·5	74·2	74·5	74·9	75·2	75·6	75·9	76·3
·80	68·8	69·4	70·0	70·7	71·3	72·0	72·6	73·3	74·0	74·3	74·7	75·0	75·4	75·8	76·1
·81	68·6	69·2	69·8	70·5	71·1	71·8	72·4	73·1	73·8	74·2	74·5	74·9	75·2	75·6	75·9
·82	68·3	68·9	69·6	70·2	70·9	71·6	72·2	72·9	73·6	74·0	74·3	74·7	75·1	75·4	75·8
·83	68·1	68·7	69·4	70·0	70·7	71·3	72·0	72·7	73·4	73·8	74·2	74·5	74·9	75·2	75·6
·84	67·8	68·5	69·1	69·8	70·5	71·1	71·8	72·5	73·2	73·6	74·0	74·3	74·7	75·1	75·4
·85	67·6	68·2	68·9	69·6	70·2	70·9	71·6	72·3	73·1	73·4	73·8	74·2	74·5	74·9	75·3
·86	67·4	68·0	68·7	69·3	70·0	70·7	71·4	72·1	72·9	73·2	73·6	74·0	74·4	74·7	75·1
·87	67·1	67·8	68·4	69·1	69·8	70·5	71·2	71·9	72·7	73·1	73·4	73·8	74·2	74·6	75·0
·88	66·9	67·6	68·2	68·9	69·6	70·3	71·0	71·8	72·5	72·9	73·2	73·6	74·0	74·4	74·8
·89	66·7	67·3	68·0	68·7	69·4	70·1	70·8	71·6	72·3	72·7	73·1	73·5	73·8	74·2	74·6
·90	66·4	67·1	67·8	68·5	69·2	69·9	70·6	71·4	72·1	72·5	72·9	73·3	73·7	74·1	74·5
·91	66·2	66·9	67·6	68·3	69·0	69·7	70·4	71·2	71·9	72·3	72·7	73·1	73·5	73·9	74·3
·92	66·0	66·6	67·3	68·0	68·8	69·5	70·2	71·0	71·8	72·1	72·5	72·9	73·3	73·7	74·1
·93	65·7	66·4	67·1	67·8	68·5	69·3	70·0	70·8	71·6	72·0	72·4	72·8	73·2	73·6	74·0
·94	65·5	66·2	66·9	67·6	68·3	69·1	69·8	70·6	71·4	71·8	72·2	72·6	73·0	73·4	73·8
·95	65·3	66·0	66·7	67·4	68·1	68·9	69·6	70·4	71·2	71·6	72·0	72·4	72·8	73·2	73·6
·96	65·0	65·7	66·5	67·2	67·9	68·7	69·4	70·2	71·0	71·4	71·8	72·2	72·6	73·1	73·5
·97	64·8	65·5	66·2	67·0	67·7	68·5	69·2	70·0	70·8	71·2	71·6	72·1	72·5	72·9	73·3
·98	64·6	65·3	66·0	66·8	67·5	68·3	69·0	69·8	70·6	71·1	71·5	71·9	72·3	72·7	73·2
·99	64·4	65·1	65·8	66·5	67·3	68·1	68·9	69·7	70·5	70·9	71·3	71·7	72·1	72·6	73·0
1·00	64·1	64·9	65·6	66·3	67·1	67·9	68·7	69·5	70·3	70·7	71·1	71·5	72·0	72·4	72·8
1·02	63·7	64·4	65·2	65·9	66·7	67·5	68·3	69·1	69·9	70·3	70·8	71·2	71·6	72·1	72·5
1·04	63·2	64·0	64·7	65·5	66·3	67·1	67·9	68·7	69·6	70·0	70·4	70·9	71·3	71·7	72·2
1·06	62·8	63·5	64·3	65·1	65·9	66·7	67·5	68·3	69·2	69·6	70·1	70·5	71·0	71·4	71·9
1·08	62·4	63·1	63·9	64·7	65·5	66·3	67·1	68·0	68·8	69·3	69·7	70·2	70·6	71·1	71·5
1·10	61·9	62·7	63·5	64·3	65·1	65·9	66·7	67·6	68·5	68·9	69·4	69·8	70·3	70·8	71·2
1·12	61·5	62·3	63·0	63·9	64·7	65·5	66·4	67·2	68·1	68·6	69·0	69·5	70·0	70·4	70·9
1·14	61·1	61·8	62·6	63·4	64·3	65·1	66·0	66·9	67·8	68·2	68·7	69·2	69·6	70·1	70·6
1·16	60·6	61·4	62·2	63·0	63·9	64·7	65·6	66·5	67·4	67·9	68·4	68·8	69·3	69·8	70·3
1·18	60·2	61·0	61·8	62·6	63·5	64·4	65·2	66·2	67·1	67·5	68·0	68·5	69·0	69·5	70·0

Table C.

AZIMUTHS CORRESPONDING TO THE A AND B CORRECTION.

Azimuth is named N or S according to the name of the A and B correction.

A and B Correction.	LATITUDES.														
	61°	62°	63°	64°	65°	66°	67°	68°	69°	69½°	70°	70½°	71°	71½°	72°
	AZIMUTHS.														
′	°	°	°	°	°	°	°	°	°	°	°	°	°	°	°
1·20	59·8	60·6	61·4	62·3	63·1	64·0	64·9	65·8	66·7	67·2	67·7	68·2	68·7	69·2	69·7
1·22	59·4	60·2	61·0	61·9	62·7	63·6	64·5	65·4	66·4	66·9	67·4	67·8	68·3	68·8	69·3
1·24	59·0	59·8	60·6	61·5	62·3	63·2	64·1	65·1	66·0	66·5	67·0	67·5	68·0	68·5	69·0
1·26	58·6	59·4	60·2	61·1	62·0	62·9	63·8	64·7	65·7	66·2	66·7	67·2	67·7	68·2	68·7
1·28	58·2	59·0	59·8	60·7	61·6	62·5	63·4	64·4	65·4	65·9	66·4	66·9	67·4	67·9	68·4
1·30	57·8	58·6	59·5	60·3	61·2	62·1	63·1	64·0	65·0	65·5	66·0	66·5	67·1	67·6	68·1
1·32	57·4	58·2	59·1	59·9	60·8	61·8	62·7	63·7	64·7	65·2	65·7	66·2	66·7	67·3	67·8
1·34	57·0	57·8	58·7	59·6	60·5	61·4	62·4	63·3	64·3	64·9	65·4	65·9	66·4	67·0	67·5
1·36	56·6	57·4	58·3	59·2	60·1	61·1	62·0	63·0	64·0	64·5	65·1	65·6	66·1	66·7	67·2
1·38	56·2	57·1	57·9	58·8	59·7	60·7	61·7	62·7	63·7	64·2	64·7	65·3	65·8	66·4	66·9
1·40	55·8	56·7	57·6	58·5	59·4	60·3	61·3	62·3	63·4	63·9	64·4	65·0	65·5	66·0	66·6
1·42	55·5	56·3	57·2	58·1	59·0	60·0	61·0	62·0	63·0	63·6	64·1	64·6	65·2	65·7	66·3
1·44	55·1	55·9	56·8	57·7	58·7	59·6	60·6	61·7	62·7	63·2	63·8	64·3	64·9	65·4	66·0
1·46	54·7	55·6	56·5	57·4	58·3	59·3	60·3	61·3	62·4	62·9	63·5	64·0	64·6	65·1	65·7
1·48	54·3	55·2	56·1	57·0	58·0	59·0	60·0	61·0	62·1	62·6	63·2	63·7	64·3	64·8	65·4
1·50	54·0	54·8	55·7	56·7	57·6	58·6	59·6	60·7	61·7	62·3	62·8	63·4	64·0	64·5	65·1
1·52	53·6	54·5	55·4	56·3	57·3	58·3	59·3	60·3	61·4	62·0	62·5	63·1	63·7	64·3	64·8
1·54	53·3	54·1	55·0	56·0	56·9	57·9	59·0	60·0	61·1	61·7	62·2	62·8	63·4	64·0	64·6
1·56	52·9	53·8	54·7	55·6	56·6	57·6	58·6	59·7	60·8	61·4	61·9	62·5	63·1	63·7	64·3
1·58	52·5	53·4	54·3	55·3	56·3	57·3	58·3	59·4	60·5	61·0	61·6	62·2	62·8	63·4	64·0
1·60	52·2	53·1	54·0	55·0	55·9	56·9	58·0	59·1	60·2	60·7	61·3	61·9	62·5	63·1	63·7
1·62	51·9	52·7	53·7	54·6	55·6	56·6	57·7	58·7	59·9	60·4	61·0	61·6	62·2	62·8	63·4
1·64	51·5	52·4	53·3	54·3	55·3	56·3	57·3	58·4	59·6	60·1	60·7	61·3	61·9	62·5	63·1
1·66	51·2	52·1	53·0	54·0	54·9	56·0	57·0	58·1	59·3	59·8	60·4	61·0	61·6	62·2	62·8
1·68	50·8	51·7	52·7	53·6	54·6	55·7	56·7	57·8	58·9	59·5	60·1	60·7	61·3	61·9	62·6
1·70	50·5	51·4	52·3	53·3	54·3	55·3	56·4	57·5	58·6	59·2	59·8	60·4	61·0	61·7	62·3
1·72	50·2	51·1	52·0	53·0	54·0	55·0	56·1	57·2	58·4	58·9	59·5	60·1	60·8	61·4	62·0
1·74	49·9	50·8	51·7	52·7	53·7	54·7	55·8	56·9	58·1	58·6	59·2	59·9	60·5	61·1	61·7
1·76	49·5	50·4	51·4	52·3	53·4	54·4	55·5	56·6	57·8	58·4	59·0	59·6	60·2	60·8	61·5
1·78	49·2	50·1	51·1	52·0	53·0	54·1	55·2	56·3	57·5	58·1	58·7	59·3	59·9	60·5	61·2
1·80	48·9	49·8	50·7	51·7	52·7	53·8	54·9	56·0	57·2	57·8	58·4	59·0	59·6	60·3	60·9
1·82	48·6	49·5	50·4	51·4	52·4	53·5	54·6	55·7	56·9	57·5	58·1	58·7	59·4	60·0	60·6
1·84	48·3	49·2	50·1	51·1	52·1	53·2	54·3	55·4	56·6	57·2	57·8	58·4	59·1	59·7	60·4
1·86	48·0	48·9	49·8	50·8	51·8	52·9	54·0	55·1	56·3	56·9	57·5	58·2	58·8	59·5	60·1
1·88	47·7	48·6	49·5	50·5	51·5	52·6	53·7	54·8	56·0	56·6	57·3	57·9	58·5	59·2	59·8
1·90	47·4	48·3	49·2	50·2	51·2	52·3	53·4	54·6	55·7	56·4	57·0	57·6	58·3	58·9	59·6
1·92	47·1	48·0	48·9	49·9	50·9	52·0	53·1	54·3	55·5	56·1	56·7	57·3	58·0	58·6	59·3
1·94	46·8	47·7	48·6	49·6	50·7	51·7	52·8	54·0	55·2	55·8	56·4	57·1	57·7	58·4	59·1
1·96	46·5	47·4	48·3	49·3	50·4	51·4	52·6	53·7	54·9	55·5	56·2	56·8	57·5	58·1	58·8
1·98	46·2	47·1	48·0	49·0	50·1	51·2	52·3	53·4	54·6	55·3	55·9	56·5	57·2	57·9	58·5
2·00	45·9	46·8	47·8	48·8	49·8	50·9	52·0	53·2	54·4	55·0	55·6	56·3	56·9	57·6	58·3
2·05	45·2	46·1	47·1	48·1	49·1	50·2	51·3	52·5	53·7	54·3	55·0	55·6	56·3	57·0	57·6
2·10	44·5	45·4	46·4	47·4	48·4	49·5	50·6	51·8	53·0	53·7	54·3	55·0	55·6	56·3	57·0
2·15	43·8	44·7	45·7	46·7	47·7	48·8	50·0	51·2	52·4	53·0	53·7	54·3	55·0	55·7	56·4
2·20	43·2	44·1	45·0	46·0	47·1	48·2	49·3	50·5	51·7	52·4	53·0	53·7	54·4	55·1	55·8
2·25	42·5	43·4	44·4	45·4	46·4	47·5	48·7	49·9	51·1	51·8	52·4	53·1	53·8	54·5	55·2
2·30	41·9	42·8	43·8	44·8	45·8	46·9	48·1	49·3	50·5	51·1	51·8	52·5	53·2	53·9	54·6
2·40	40·7	41·6	42·5	43·5	44·6	45·7	46·8	48·0	49·3	50·0	50·6	51·3	52·0	52·7	53·4
2·50	39·5	40·4	41·4	42·4	43·4	44·5	45·7	46·9	48·1	48·8	49·5	50·2	50·9	51·6	52·3
2·60	38·4	39·3	40·3	41·3	42·3	43·4	44·5	45·8	47·0	47·7	48·4	49·0	49·8	50·5	51·2
2·70	37·4	38·3	39·2	40·2	41·2	42·3	43·5	44·7	45·9	46·6	47·3	48·0	48·7	49·4	50·2
2·80	36·4	37·3	38·2	39·2	40·2	41·3	42·4	43·6	44·9	45·6	46·2	46·9	47·6	48·4	49·1
2·90	35·4	36·3	37·2	38·2	39·2	40·3	41·4	42·6	43·9	44·6	45·2	45·9	46·6	47·4	48·1
3·00	34·5	35·4	36·3	37·2	38·3	39·3	40·5	41·7	42·9	43·6	44·3	45·0	45·7	46·4	47·2
3·10	33·6	34·5	35·4	36·3	37·4	38·4	39·5	40·7	42·0	42·6	43·3	44·0	44·7	45·5	46·2

Table C.

AZIMUTHS CORRESPONDING TO THE A AND B CORRECTION.

Azimuth is named N or S according to the name of the A and B correction.

A and B Correction.	61°	62°	63°	64°	65°	66°	67°	68°	69°	69½°	70°	70½°	71°	71½°	72°
	LATITUDES.														
	AZIMUTHS.														
′	°	°	°	°	°	°	°	°	°	°	°	°	°	°	°
3·20	32·8	33·6	34·5	35·5	36·5	37·5	38·7	39·8	41·1	41·7	42·4	43·1	43·8	44·6	45·3
3·30	32·0	32·8	33·7	34·7	35·6	36·7	37·8	39·0	40·2	40·9	41·5	42·2	42·9	43·7	44·4
3·40	31·2	32·1	32·9	33·9	34·8	35·9	37·0	38·1	39·4	40·0	40·7	41·4	42·1	42·8	43·6
3·60	29·8	30·6	31·5	32·4	33·3	34·3	35·4	36·6	37·8	38·4	39·1	39·8	40·5	41·2	42·0
3·80	28·5	29·3	30·1	31·0	31·9	32·9	34·0	35·1	36·3	36·9	37·6	38·3	38·9	39·7	40·4
4·00	27·3	28·0	28·8	29·7	30·6	31·6	32·6	33·7	34·9	35·5	36·2	36·8	37·5	38·2	39·0
4·20	26·2	26·9	27·7	28·5	29·4	30·3	31·4	32·4	33·6	34·2	34·8	35·5	36·2	36·9	37·6
4·40	25·1	25·8	26·6	27·4	28·3	29·2	30·2	31·2	32·4	33·0	33·6	34·2	34·9	35·6	36·3
4·60	24·2	24·8	25·6	26·4	27·2	28·1	29·1	30·1	31·2	31·8	32·4	33·1	33·7	34·4	35·1
4·80	23·3	23·9	24·6	25·4	26·2	27·1	28·1	29·1	30·2	30·7	31·3	32·0	32·6	33·3	34·0
5·00	22·4	23·1	23·8	24·5	25·3	26·2	27·1	28·1	29·2	29·7	30·3	30·9	31·6	32·2	32·9
5·20	21·6	22·3	23·0	23·7	24·5	25·3	26·2	27·2	28·2	28·8	29·3	29·9	30·6	31·2	31·9
5·40	20·9	21·5	22·2	22·9	23·7	24·5	25·4	26·3	27·3	27·9	28·4	29·0	29·6	30·3	30·9
5·60	20·2	20·8	21·5	22·2	22·9	23·7	24·6	25·5	26·5	27·0	27·6	28·1	28·7	29·4	30·0
5·80	19·6	20·2	20·8	21·5	22·2	23·0	23·8	24·7	25·7	26·2	26·8	27·3	27·9	28·5	29·2
6·00	19·0	19·5	20·2	20·8	21·5	22·3	23·1	24·0	24·9	25·4	26·0	26·5	27·1	27·7	28·3
6·20	18·4	19·0	19·6	20·2	20·9	21·6	22·4	23·3	24·2	24·7	25·2	25·8	26·4	26·9	27·6
6·40	17·9	18·4	19·0	19·6	20·3	21·0	21·8	22·6	23·6	24·0	24·6	25·1	25·6	26·2	26·8
6·60	17·4	17·9	18·5	19·1	19·7	20·4	21·2	22·0	22·9	23·4	23·9	24·4	25·0	25·5	26·1
6·80	16·9	17·4	17·9	18·5	19·2	19·9	20·6	21·4	22·3	22·8	23·3	23·8	24·3	24·9	25·4
7·00	16·4	16·9	17·5	18·0	18·7	19·4	20·1	20·9	21·7	22·2	22·7	23·2	23·7	24·2	24·8
7·20	16·0	16·5	17·0	17·6	18·2	18·9	19·6	20·3	21·2	21·6	22·1	22·6	23·1	23·6	24·2
7·40	15·6	16·1	16·6	17·1	17·7	18·4	19·1	19·8	20·7	21·1	21·6	22·0	22·5	23·1	23·6
7·60	15·2	15·7	16·2	16·7	17·3	17·9	18·6	19·4	20·2	20·6	21·0	21·5	22·0	22·5	23·1
7·80	14·8	15·3	15·8	16·3	16·9	17·5	18·2	18·9	19·7	20·1	20·5	21·0	21·5	22·0	22·5
8·00	14·5	14·9	15·4	15·9	16·5	17·1	17·7	18·5	19·2	19·6	20·1	20·5	21·0	21·5	22·0
8·20	14·1	14·6	15·0	15·5	16·1	16·7	17·3	18·0	18·8	19·2	19·6	20·1	20·5	21·0	21·5
8·40	13·8	14·2	14·7	15·2	15·7	16·3	16·9	17·6	18·4	18·8	19·2	19·6	20·1	20·6	21·1
8·60	13·5	13·9	14·4	14·9	15·4	16·0	16·6	17·2	18·0	18·4	18·8	19·2	19·7	20·1	20·6
8·80	13·2	13·6	14·1	14·5	15·1	15·6	16·2	16·9	17·6	18·0	18·4	18·8	19·2	19·7	20·2
9·00	12·9	13·3	13·8	14·2	14·7	15·3	15·9	16·5	17·2	17·6	18·0	18·4	18·8	19·3	19·8
9·20	12·6	13·0	13·5	13·9	14·4	15·0	15·5	16·2	16·9	17·2	17·6	18·0	18·5	18·9	19·4
9·40	12·4	12·8	13·2	13·6	14·1	14·7	15·2	15·9	16·5	16·9	17·3	17·7	18·1	18·5	19·0
9·60	12·1	12·5	12·9	13·4	13·8	14·4	14·9	15·5	16·2	16·6	16·9	17·3	17·7	18·2	18·6
9·80	11·9	12·3	12·7	13·1	13·6	14·1	14·6	15·2	15·9	16·2	16·6	17·0	17·4	17·8	18·3
10·0	11·7	12·0	12·4	12·9	13·3	13·8	14·4	14·9	15·6	15·9	16·3	16·7	17·1	17·5	17·9
11·0	10·6	11·0	11·3	11·7	12·1	12·6	13·1	13·6	14·2	14·6	14·9	15·2	15·6	16·0	16·4
12·0	9·8	10·1	10·4	10·8	11·2	11·6	12·0	12·5	13·1	13·4	13·7	14·0	14·4	14·7	15·1
13·0	9·0	9·3	9·6	10·0	10·3	10·7	11·1	11·6	12·1	12·4	12·7	13·0	13·3	13·6	14·0
14·0	8·4	8·7	8·9	9·3	9·6	10·0	10·4	10·8	11·3	11·5	11·8	12·1	12·4	12·7	13·0
16·0	7·3	7·6	7·8	8·1	8·4	8·7	9·1	9·5	9·9	10·1	10·4	10·6	10·9	11·1	11·4
18·0	6·5	6·7	7·0	7·2	7·5	7·8	8·1	8·4	8·8	9·0	9·2	9·4	9·7	9·9	10·2
20·0	5·9	6·1	6·3	6·5	6·7	7·0	7·3	7·6	7·9	8·1	8·3	8·5	8·7	9·0	9·2
22·0	5·4	5·5	5·7	5·9	6·1	6·4	6·6	6·9	7·2	7·4	7·6	7·8	7·9	8·2	8·4
24·0	4·9	5·1	5·2	5·4	5·6	5·8	6·1	6·3	6·6	6·7	6·9	7·1	7·3	7·5	7·7
26·0	4·5	4·7	4·8	5·0	5·2	5·4	5·6	5·9	6·1	6·3	6·4	6·6	6·7	6·9	7·1
28·0	4·2	4·4	4·5	4·7	4·8	5·0	5·2	5·4	5·7	5·8	6·0	6·1	6·3	6·4	6·6
30·0	3·9	4·1	4·2	4·3	4·5	4·7	4·9	5·1	5·3	5·4	5·6	5·7	5·8	6·0	6·2
40·0	3·0	3·0	3·2	3·3	3·4	3·5	3·7	3·8	4·0	4·1	4·2	4·3	4·4	4·5	4·6
50·0	2·4	2·4	2·5	2·6	2·7	2·8	2·9	3·1	3·2	3·3	3·3	3·4	3·5	3·6	3·7
70·0	1·7	1·7	1·8	1·9	1·9	2·0	2·1	2·2	2·3	2·3	2·4	2·5	2·5	2·6	2·6
100·0	1·2	1·2	1·3	1·3	1·4	1·4	1·5	1·5	1·6	1·6	1·7	1·7	1·8	1·8	1·9
200·0	0·6	0·6	0·6	0·7	0·7	0·7	0·7	0·8	0·8	0·8	0·8	0·9	0·9	0·9	0·9
400·0	0·3	0·3	0·3	0·3	0·3	0·4	0·4	0·4	0·4	0·4	0·4	0·4	0·4	0·5	0·5
800·0	0·1	0·2	0·2	0·2	0·2	0·2	0·2	0·2	0·2	0·2	0·2	0·2	0·2	0·2	0·2

Table C.

AZIMUTHS CORRESPONDING TO THE A AND B CORRECTION.

Azimuth is named N or S according to the name of the A and B correction.

A and B Correction.	LATITUDES.														
	73°	74°	75°	76°	77°	78°	79°	80°	81°	82°	83°	83½°	84°	84½°	85°
	Azimuths.														
′	°	°	°	°	°	°	°	°	°	°	°	°	°	°	°
·00	90·0	90·0	90·0	90·0	90·0	90·0	90·0	90·0	90·0	90·0	90·0	90·0	90·0	90·0	90·0
·02	89·7	89·7	89·7	89·7	89·7	89·8	89·8	89·8	89·8	89·8	89·9	89·9	89·9	89·9	89·9
·04	89·3	89·4	89·4	89·4	89·5	89·5	89·6	89·6	89·6	89·7	89·7	89·7	89·8	89·8	89·8
·06	89·0	89·1	89·1	89·2	89·2	89·3	89·3	89·4	89·5	89·5	89·6	89·6	89·6	89·7	89·7
·08	88·7	88·7	88·8	88·9	89·0	89·0	89·1	89·2	89·3	89·4	89·4	89·5	89·5	89·6	89·6
·10	88·3	88·4	88·5	88·6	88·7	88·8	88·9	89·0	89·1	89·2	89·3	89·4	89·4	89·5	89·5
·12	88·0	88·1	88·2	88·3	88·5	88·6	88·7	88·8	88·9	89·0	89·2	89·2	89·3	89·3	89·4
·14	87·7	87·8	87·9	88·1	88·2	88·3	88·5	88·6	88·7	88·9	89·0	89·1	89·2	89·2	89·3
·16	87·3	87·5	87·6	87·8	87·9	88·1	88·3	88·4	88·6	88·7	88·9	89·0	89·0	89·1	89·2
·18	87·0	87·2	87·3	87·5	87·7	87·9	88·0	88·2	88·4	88·6	88·7	88·8	88·9	89·0	89·1
·20	86·7	86·8	87·0	87·2	87·4	87·6	87·8	88·0	88·2	88·4	88·6	88·7	88·8	88·9	89·0
·22	86·3	86·5	86·7	87·0	87·2	87·4	87·6	87·8	88·0	88·2	88·5	88·6	88·7	88·8	88·9
·24	86·0	86·2	86·4	86·7	86·9	87·1	87·4	87·6	87·8	88·1	88·3	88·4	88·6	88·7	88·8
·26	85·7	85·9	86·2	86·4	86·7	86·9	87·2	87·4	87·7	87·9	88·2	88·3	88·4	88·6	88·7
·28	85·3	85·6	85·9	86·1	86·4	86·7	86·9	87·2	87·5	87·8	88·0	88·2	88·3	88·5	88·6
·30	85·0	85·3	85·6	85·8	86·1	86·4	86·7	87·0	87·3	87·6	87·9	88·1	88·2	88·4	88·5
·32	84·7	85·0	85·3	85·6	85·9	86·2	86·5	86·8	87·1	87·4	87·8	87·9	88·1	88·2	88·4
·34	84·3	84·6	85·0	85·3	85·6	86·0	86·3	86·6	87·0	87·3	87·6	87·8	88·0	88·1	88·3
·36	84·0	84·3	84·7	85·0	85·4	85·7	86·1	86·4	86·8	87·1	87·5	87·7	87·8	88·0	88·2
·38	83·7	84·0	84·4	84·7	85·1	85·5	85·9	86·2	86·6	87·0	87·3	87·5	87·7	87·9	88·1
·40	83·3	83·7	84·1	84·5	84·9	85·2	85·6	86·0	86·4	86·8	87·2	87·4	87·6	87·8	88·0
·42	83·0	83·4	83·8	84·2	84·6	85·0	85·4	85·8	86·2	86·7	87·1	87·3	87·5	87·7	87·9
·44	82·7	83·1	83·5	83·9	84·3	84·8	85·2	85·6	86·1	86·5	86·9	87·1	87·4	87·6	87·8
·46	82·3	82·8	83·2	83·7	84·1	84·5	85·0	85·4	85·9	86·3	86·8	87·0	87·2	87·5	87·7
·48	82·0	82·5	82·9	83·4	83·8	84·3	84·8	85·2	85·7	86·2	86·7	86·9	87·1	87·4	87·6
·50	81·7	82·2	82·6	83·1	83·6	84·1	84·6	85·0	85·5	86·0	86·5	86·8	87·0	87·3	87·5
·52	81·4	81·8	82·3	82·8	83·3	83·8	84·3	84·8	85·3	85·9	86·4	86·6	86·9	87·1	87·4
·54	81·0	81·5	82·0	82·6	83·1	83·6	84·1	84·6	85·2	85·7	86·2	86·5	86·8	87·0	87·3
·56	80·7	81·2	81·8	82·3	82·8	83·4	83·9	84·4	85·0	85·5	86·1	86·4	86·6	86·9	87·2
·58	80·4	80·9	81·5	82·0	82·6	83·1	83·7	84·2	84·8	85·4	86·0	86·2	86·5	86·8	87·1
·60	80·1	80·6	81·2	81·7	82·3	82·9	83·5	84·1	84·6	85·2	85·8	86·1	86·4	86·7	87·0
·62	79·7	80·3	80·9	81·5	82·1	82·7	83·3	83·9	84·5	85·1	85·7	86·0	86·3	86·6	86·9
·64	79·4	80·0	80·6	81·2	81·8	82·4	83·0	83·7	84·3	84·9	85·5	85·9	86·2	86·5	86·8
·66	79·1	79·7	80·3	80·9	81·6	82·2	82·8	83·5	84·1	84·8	85·4	85·7	86·1	86·4	86·7
·68	78·8	79·4	80·0	80·7	81·3	82·0	82·6	83·3	83·9	84·6	85·3	85·6	85·9	86·3	86·6
·70	78·4	79·1	79·7	80·4	81·1	81·7	82·4	83·1	83·8	84·4	85·1	85·5	85·8	86·2	86·5
·72	78·1	78·8	79·4	80·1	80·8	81·5	82·2	82·9	83·6	84·3	85·0	85·3	85·7	86·1	86·4
·74	77·8	78·5	79·2	79·9	80·5	81·3	82·0	82·7	83·4	84·1	84·8	85·2	85·6	85·9	86·3
·76	77·5	78·2	78·9	79·6	80·3	81·0	81·7	82·5	83·2	84·0	84·7	85·1	85·5	85·8	86·2
·78	77·2	77·9	78·6	79·3	80·0	80·8	81·5	82·3	83·0	83·8	84·6	85·0	85·3	85·7	86·1
·80	76·8	77·6	78·3	79·0	79·8	80·6	81·3	82·1	82·9	83·6	84·4	84·8	85·2	85·6	86·0
·82	76·5	77·3	78·0	78·8	79·5	80·3	81·1	81·9	82·7	83·5	84·3	84·7	85·1	85·5	85·9
·84	76·2	77·0	77·7	78·5	79·3	80·1	80·9	81·7	82·5	83·3	84·2	84·6	85·0	85·4	85·8
·86	75·9	76·7	77·5	78·2	79·1	79·9	80·7	81·5	82·3	83·2	84·0	84·4	84·9	85·3	85·7
·88	75·6	76·4	77·2	78·0	78·8	79·6	80·5	81·3	82·2	83·0	83·9	84·3	84·7	85·2	85·6
·90	75·3	76·1	76·9	77·7	78·6	79·4	80·3	81·1	82·0	82·9	83·7	84·2	84·6	85·1	85·5
·92	74·9	75·8	76·6	77·5	78·3	79·2	80·0	80·9	81·8	82·7	83·6	84·1	84·5	85·0	85·4
·94	74·6	75·5	76·3	77·2	78·1	78·9	79·8	80·7	81·6	82·5	83·5	83·9	84·4	84·9	85·3
·96	74·3	75·2	76·0	76·9	77·8	78·7	79·6	80·5	81·5	82·4	83·3	83·8	84·3	84·7	85·2
·98	74·0	74·9	75·8	76·7	77·6	78·5	79·4	80·3	81·3	82·2	83·2	83·7	84·2	84·6	85·1
1·00	73·7	74·6	75·5	76·4	77·3	78·3	79·2	80·1	81·1	82·1	83·1	83·5	84·0	84·5	85·0
1·02	73·4	74·3	75·2	76·1	77·1	78·0	79·0	80·0	80·9	81·9	82·9	83·4	83·9	84·4	84·9
1·04	73·1	74·0	74·9	75·9	76·8	77·8	78·8	79·8	80·8	81·8	82·8	83·3	83·8	84·3	84·8
1·06	72·8	73·7	74·7	75·6	76·6	77·6	78·6	79·6	80·6	81·6	82·6	83·2	83·7	84·2	84·7
1·08	72·5	73·4	74·4	75·4	76·3	77·3	78·4	79·4	80·4	81·5	82·5	83·0	83·6	84·1	84·6

Table C.

AZIMUTHS CORRESPONDING TO THE A AND B CORRECTION.

Azimuth is named N or S according to the name of the A and B correction.

A and B Correction.	LATITUDES. 73°	74°	75°	76°	77°	78°	79°	80°	81°	82°	83°	83½°	84°	84½°	85°
	AZIMUTHS.														
′	°	°	°	°	°	°	°	°	°	°	°	°	°	°	°
1·08	72·5	73·4	74·4	75·4	76·3	77·3	78·4	79·4	80·4	81·5	82·5	83·0	83·6	84·1	84·6
1·10	72·2	73·1	74·1	75·1	76·1	77·1	78·1	79·2	80·2	81·3	82·4	82·9	83·4	84·0	84·5
1·20	70·7	71·7	72·7	73·8	74·9	76·0	77·1	78·2	79·4	80·5	81·7	82·3	82·9	83·4	84·0
1·30	69·2	70·3	71·4	72·5	73·7	74·9	76·1	77·3	78·5	79·7	81·0	81·6	82·3	82·9	83·5
1·40	67·7	68·9	70·1	71·3	72·5	73·8	75·0	76·3	77·6	79·0	80·3	81·0	81·7	82·4	83·0
1·50	66·3	67·5	68·8	70·1	71·4	72·7	74·0	75·4	76·8	78·2	79·6	80·4	81·1	81·8	82·6
1·60	64·9	66·2	67·5	68·8	70·2	71·6	73·0	74·5	75·9	77·4	79·0	79·7	80·5	81·3	82·1
1·70	63·6	64·9	66·3	67·6	69·1	70·5	72·0	73·6	75·1	76·7	78·3	79·1	79·9	80·7	81·6
1·80	62·2	63·6	65·0	66·5	68·0	69·5	71·0	72·6	74·3	75·9	77·6	78·5	79·3	80·2	81·1
1·90	60·9	62·4	63·8	65·3	66·9	68·4	70·1	71·7	73·4	75·2	77·0	77·9	78·8	79·7	80·6
2·00	59·7	61·1	62·6	64·2	65·8	67·4	69·1	70·8	72·6	74·4	76·3	77·2	78·2	79·1	80·1
2·10	58·5	59·9	61·5	63·1	64·7	66·4	68·2	70·0	71·8	73·7	75·6	76·6	77·6	78·6	79·6
2·20	57·3	58·8	60·3	62·0	63·7	65·4	67·2	69·1	71·0	73·0	75·0	76·0	77·0	78·1	79·1
2·30	56·1	57·6	59·2	60·9	62·6	64·4	66·3	68·2	70·2	72·2	74·3	75·4	76·5	77·6	78·7
2·40	54·9	56·5	58·2	59·9	61·6	63·5	65·4	67·4	69·4	71·5	73·7	74·8	75·9	77·0	78·2
2·50	53·8	55·4	57·1	58·8	60·6	62·5	64·5	66·5	68·6	70·8	73·1	74·2	75·4	76·5	77·7
2·60	52·8	54·4	56·1	57·8	59·7	61·6	63·6	65·7	67·9	70·1	72·4	73·6	74·8	76·0	77·2
2·70	51·7	53·3	55·1	56·8	58·7	60·7	62·7	64·9	67·1	69·4	71·8	73·0	74·2	75·5	76·8
2·80	50·7	52·3	54·1	55·9	57·8	59·8	61·9	64·1	66·3	68·7	71·2	72·4	73·7	75·0	76·3
2·90	49·7	51·4	53·1	54·9	56·9	58·9	61·0	63·3	65·6	68·0	70·5	71·8	73·1	74·5	75·8
3·00	48·7	50·4	52·2	54·0	56·0	58·0	60·2	62·5	64·9	67·3	69·9	71·2	72·6	74·0	75·3
3·10	47·8	49·5	51·3	53·1	55·1	57·2	59·4	61·7	64·1	66·7	69·3	70·7	72·0	73·5	74·9
3·20	46·9	48·6	50·4	52·3	54·3	56·4	58·6	60·9	63·4	66·0	68·7	70·1	71·5	72·9	74·4
3·30	46·0	47·7	49·5	51·4	53·4	55·5	57·8	60·2	62·7	65·3	68·1	69·5	71·0	72·4	74·0
3·40	45·2	46·9	48·7	50·6	52·6	54·7	57·0	59·4	62·0	64·7	67·5	68·9	70·4	72·0	73·5
3·50	44·3	46·0	47·8	49·7	51·8	54·0	56·3	58·7	61·3	64·0	66·9	68·4	69·9	71·5	73·0
3·60	43·5	45·2	47·0	48·9	51·0	53·2	55·5	58·0	60·6	63·4	66·3	67·8	69·4	71·0	72·6
3·70	42·8	44·4	46·2	48·2	50·2	52·4	54·8	57·3	59·9	62·8	65·7	67·3	68·9	70·5	72·1
3·80	42·0	43·7	45·5	47·4	49·5	51·7	54·1	56·6	59·3	62·1	65·2	66·7	68·3	70·0	71·7
3·90	41·3	42·9	44·7	46·7	48·7	51·0	53·3	55·9	58·6	61·5	64·6	66·2	67·8	69·5	71·2
4·00	40·5	42·2	44·0	45·9	48·0	50·3	52·6	55·2	58·0	60·9	64·0	65·6	67·3	69·0	70·8
4·10	39·8	41·5	43·3	45·2	47·3	49·6	52·0	54·6	57·3	60·3	63·5	65·1	66·8	68·5	70·3
4·20	39·2	40·8	42·6	44·5	46·6	48·9	51·3	53·9	56·7	59·7	62·9	64·6	66·3	68·1	69·9
4·30	38·5	40·2	41·9	43·9	46·0	48·2	50·6	53·3	56·1	59·1	62·3	64·0	65·8	67·6	69·5
4·40	37·9	39·5	41·3	43·2	45·3	47·5	50·0	52·6	55·5	58·5	61·8	63·5	65·3	67·1	69·0
4·50	37·2	38·9	40·6	42·6	44·7	46·9	49·3	52·0	54·9	57·9	61·3	63·0	64·8	66·7	68·6
4·60	36·6	38·3	40·0	41·9	44·0	46·3	48·7	51·4	54·3	57·4	60·7	62·5	64·3	66·2	68·2
4·70	36·0	37·7	39·4	41·3	43·4	45·7	48·1	50·8	53·7	56·8	60·2	62·0	63·8	65·7	67·7
4·80	35·5	37·1	38·8	40·7	42·8	45·1	47·5	50·2	53·1	56·3	59·7	61·5	63·4	65·3	67·3
4·90	34·9	36·5	38·3	40·2	42·2	44·5	46·9	49·6	52·5	55·7	59·2	61·0	62·9	64·8	66·9
5·00	34·4	36·0	37·7	39·6	41·6	43·9	46·3	49·0	52·0	55·2	58·6	60·5	62·4	64·4	66·5
5·20	33·3	34·9	36·6	38·5	40·5	42·8	45·2	47·9	50·9	54·1	57·6	59·5	61·5	63·5	65·6
5·40	32·3	33·9	35·6	37·4	39·5	41·7	44·1	46·8	49·8	53·1	56·7	58·6	60·6	62·6	64·8
5·60	31·4	32·9	34·6	36·4	38·4	40·7	43·1	45·8	48·8	52·1	55·7	57·6	59·7	61·8	64·0
5·80	30·5	32·0	33·7	35·5	37·5	39·7	42·1	44·8	47·8	51·1	54·7	56·7	58·8	60·9	63·2
6·00	29·7	31·2	32·8	34·6	36·5	38·7	41·1	43·8	46·8	50·1	53·8	55·8	57·9	60·1	62·4
6·20	28·9	30·3	31·9	33·7	35·6	37·8	40·2	42·9	45·9	49·2	52·9	54·9	57·1	59·3	61·6
6·40	28·1	29·5	31·1	32·9	34·8	36·9	39·3	42·0	45·0	48·3	52·0	54·1	56·2	58·5	60·8
6·60	27·4	28·8	30·3	32·1	34·0	36·1	38·5	41·1	44·1	47·4	51·2	53·2	55·4	57·7	60·1
6·80	26·7	28·1	29·6	31·3	33·2	35·3	37·6	40·3	43·2	46·6	50·4	52·4	54·6	56·9	59·3
7·00	26·0	27·4	28·9	30·6	32·4	34·5	36·8	39·4	42·4	45·7	49·5	51·6	53·8	56·1	58·6
7·20	25·4	26·7	28·2	29·9	31·7	33·7	36·1	38·7	41·6	44·9	48·7	50·8	53·0	55·4	57·9
7·40	24·8	26·1	27·6	29·2	31·0	33·0	35·3	37·9	40·8	44·2	48·0	50·0	52·3	54·7	57·2
7·60	24·2	25·5	26·9	28·5	30·3	32·3	34·6	37·2	40·1	43·4	47·2	49·3	51·5	53·9	56·5
7·80	23·7	24·9	26·4	27·9	29·7	31·7	33·9	36·4	39·3	42·7	46·5	48·6	50·8	53·2	55·8

Table C.

AZIMUTHS CORRESPONDING TO THE A AND B CORRECTION.

Azimuth is named N or S according to the **name** of the A and B correction.

A and B Correction.	LATITUDES. 73°	74°	75°	76°	77°	78°	79°	80°	81°	82°	83°	83½°	84°	84½°	85°
	AZIMUTHS.														
′	°	°	°	°	°	°	°	°	°	°	°	°	°	°	°
8·0	23·1	24·4	25·8	27·3	29·1	31·0	33·2	35·7	38·6	41·9	45·7	47·8	50·1	52·5	55·1
8·2	22·6	23·9	25·2	26·8	28·5	30·4	32·6	35·1	37·9	41·2	45·0	47·1	49·4	51·8	54·4
8·4	22·2	23·4	24·7	26·2	27·9	29·8	32·0	34·4	37·3	40·5	44·3	46·4	48·7	51·2	53·8
8·6	21·7	22·9	24·2	25·7	27·3	29·2	31·4	33·8	36·6	39·9	43·7	45·8	48·0	50·5	53·1
8·8	21·2	22·4	23·7	25·2	26·8	28·7	30·8	33·2	36·0	39·2	43·0	45·1	47·4	49·9	52·5
9·0	20·8	22·0	23·2	24·7	26·3	28·1	30·2	32·6	35·4	38·6	42·4	44·5	46·7	49·2	51·9
9·2	20·4	21·5	22·8	24·2	25·8	27·6	29·7	32·0	34·8	38·0	41·7	43·8	46·1	48·6	51·3
9·4	20·0	21·1	22·3	23·7	25·3	27·1	29·1	31·5	34·2	37·4	41·1	43·2	45·5	48·0	50·7
9·6	19·6	20·7	21·9	23·3	24·8	26·6	28·6	31·0	33·7	36·8	40·5	42·6	44·9	47·4	50·1
9·8	19·2	20·3	21·5	22·9	24·4	26·1	28·1	30·4	33·1	36·2	39·9	42·0	44·3	46·8	49·5
10·0	18·9	19·9	21·1	22·5	24·0	25·7	27·7	29·9	32·6	35·7	39·4	41·5	43·7	46·2	48·9
10·2	18·5	19·6	20·7	22·1	23·5	25·2	27·2	29·4	32·1	35·2	38·8	40·9	43·2	45·6	48·4
10·4	18·2	19·2	20·4	21·7	23·1	24·8	26·7	29·0	31·6	34·6	38·3	40·3	42·6	45·1	47·8
10·6	17·9	18·9	20·1	21·3	22·8	24·4	26·3	28·5	31·1	34·1	37·7	39·8	42·1	44·5	47·3
10·8	17·6	18·6	19·7	20·9	22·4	24·0	25·9	28·1	30·6	33·6	37·2	39·3	41·5	44·0	46·7
11·0	17·3	18·3	19·4	20·6	22·0	23·6	25·5	27·6	30·2	33·2	36·7	38·8	41·0	43·5	46·2
11·2	17·0	17·9	19·0	20·3	21·6	23·2	25·1	27·2	29·7	32·7	36·2	38·3	40·5	43·0	45·7
11·4	16·7	17·7	18·7	19·9	21·3	22·9	24·7	26·8	29·3	32·2	35·7	37·8	40·0	42·5	45·2
11·6	16·4	17·4	18·4	19·6	21·0	22·5	24·3	26·4	28·9	31·8	35·3	37·3	39·5	42·0	44·7
11·8	16·2	17·1	18·1	19·3	20·6	22·2	23·9	26·0	28·4	31·3	34·8	36·8	39·0	41·5	44·2
12·0	15·9	16·8	17·8	19·0	20·3	21·8	23·6	25·6	28·0	30·9	34·4	36·4	38·6	41·0	43·7
12·2	15·7	16·6	17·6	18·7	20·0	21·5	23·2	25·3	27·7	30·5	33·9	35·9	38·1	40·5	43·2
12·4	15·4	16·3	17·3	18·4	19·7	21·2	22·9	24·9	27·3	30·1	33·5	35·5	37·7	40·1	42·8
12·6	15·2	16·1	17·0	18·2	19·4	20·9	22·6	24·6	26·9	29·7	33·1	35·0	37·2	39·6	42·3
12·8	15·0	15·8	16·8	17·9	19·2	20·6	22·3	24·2	26·5	29·3	32·7	34·6	36·8	39·2	41·9
13·0	14·7	15·6	16·6	17·6	18·9	20·3	22·0	23·9	26·2	28·9	32·3	34·2	36·3	38·7	41·4
13·2	14·5	15·4	16·3	17·4	18·6	20·0	21·7	23·6	25·8	28·6	31·9	33·8	35·9	38·3	41·0
13·4	14·3	15·1	16·1	17·1	18·4	19·7	21·4	23·3	25·5	28·2	31·5	33·4	35·5	37·9	40·6
13·6	14·1	14·9	15·9	16·9	18·1	19·5	21·1	22·9	25·2	27·8	31·1	33·0	35·1	37·5	40·2
13·8	13·9	14·7	15·6	16·7	17·9	19·2	20·8	22·7	24·9	27·5	30·7	32·6	34·7	37·1	39·7
14·0	13·7	14·5	15·4	16·5	17·6	19·0	20·5	22·4	24·5	27·2	30·4	32·3	34·3	36·7	39·3
14·2	13·5	14·3	15·2	16·2	17·4	18·7	20·3	22·1	24·2	26·8	30·0	31·9	34·0	36·3	38·9
14·4	13·4	14·1	15·0	16·0	17·2	18·5	20·0	21·8	23·9	26·5	29·7	31·5	33·6	35·9	38·5
14·6	13·2	14·0	14·8	15·8	16·9	18·2	19·7	21·5	23·6	26·2	29·3	31·2	33·2	35·6	38·2
14·8	13·0	13·8	14·6	15·6	16·7	18·0	19·5	21·3	23·4	25·9	29·0	30·8	32·9	35·2	37·8
15·0	12·8	13·6	14·4	15·4	16·5	17·8	19·3	21·0	23·1	25·6	28·7	30·5	32·5	34·8	37·4
15·2	12·7	13·4	14·3	15·2	16·3	17·6	19·0	20·8	22·8	25·3	28·4	30·2	32·2	34·5	37·0
15·4	12·5	13·3	14·1	15·0	16·1	17·3	18·8	20·5	22·5	25·0	28·0	29·8	31·8	34·1	36·7
15·6	12·4	13·1	13·9	14·8	15·9	17·1	18·6	20·3	22·3	24·7	27·7	29·5	31·5	33·8	36·3
15·8	12·2	12·9	13·7	14·7	15·7	16·9	18·4	20·0	22·0	24·5	27·4	29·2	31·2	33·4	36·0
16·0	12·1	12·8	13·6	14·5	15·5	16·7	18·1	19·8	21·8	24·2	27·2	28·9	30·9	33·1	35·6
16·2	11·9	12·6	13·4	14·3	15·3	16·5	17·9	19·6	21·5	23·9	26·9	28·6	30·6	32·8	35·3
16·4	11·8	12·5	13·3	14·1	15·2	16·3	17·7	19·3	20·3	23·7	26·6	28·3	30·3	32·5	35·0
16·6	11·6	12·3	13·1	14·0	15·0	16·2	17·5	19·1	21·1	23·4	26·3	28·0	30·0	32·2	34·7
16·8	11·5	12·2	13·0	13·8	14·8	16·0	17·3	18·9	20·8	23·2	26·0	27·7	29·7	31·8	34·3
17·0	11·4	12·0	12·8	13·7	14·7	15·8	17·1	18·7	20·6	22·9	25·8	27·5	29·4	31·5	34·0
17·2	11·2	11·9	12·7	13·5	14·5	15·6	16·9	18·5	20·4	22·7	25·5	27·2	29·1	31·2	33·7
17·4	11·1	11·8	12·5	13·4	14·3	15·5	16·8	18·3	20·2	22·4	25·2	26·9	28·8	30·9	33·4
17·6	11·0	11·6	12·4	13·2	14·2	15·3	16·6	18·1	20·0	22·2	25·0	26·7	28·5	30·7	33·1
17·8	10·9	11·5	12·2	13·1	14·0	15·1	16·4	17·9	19·8	22·0	24·7	26·4	28·3	30·4	32·8
18·0	10·8	11·4	12·1	12·9	13·9	15·0	16·2	17·7	19·6	21·8	24·5	26·1	28·0	30·1	32·5
18·2	10·6	11·3	12·0	12·8	13·7	14·8	16·1	17·6	19·4	21·5	24·3	25·9	27·7	29·8	32·2
18·4	10·5	11·2	11·9	12·7	13·6	14·6	15·9	17·4	19·2	21·3	24·0	25·6	27·5	29·6	31·9
18·6	10·4	11·0	11·7	12·5	13·4	14·5	15·7	17·2	19·0	21·1	23·8	25·4	27·2	29·3	31·7
18·8	10·3	10·9	11·6	12·4	13·3	14·3	15·6	17·0	18·8	20·9	23·6	25·2	27·0	29·0	31·4

Table C.

AZIMUTHS CORRESPONDING TO THE A AND B CORRECTION

Azimuth is named N or S according to the name of the A and B correction.

A and B Cor-rection.	LATITUDES. 73°	74°	75°	76°	77°	78°	79°	80°	81°	82°	83°	83½°	84°	84½°	85°
	AZIMUTHS.														
′	°	°	°	°	°	°	°	°	°	°	°	°	°	°	°
19·0	10·2	10·8	11·5	12·3	13·2	14·2	15·4	16·9	18·6	20·7	23·4	24·9	26·7	28·8	31·1
19·2	10·1	10·7	11·4	12·1	13·0	14·1	15·3	16·7	18·4	20·5	23·1	24·7	26·5	28·5	30·9
19·4	10·0	10·6	11·3	12·0	12·9	13·9	15·1	16·5	18·2	20·3	22·9	24·5	26·2	28·3	30·6
19·6	9·9	10·5	11·2	11·9	12·8	13·8	15·0	16·4	18·1	20·1	22·7	24·3	26·0	28·0	30·3
19·8	9·8	10·4	11·0	11·8	12·7	13·7	14·8	16·2	17·9	19·9	22·5	24·0	25·8	27·8	30·1
20·0	9·7	10·3	10·9	11·7	12·5	13·5	14·7	16·1	17·7	19·8	22·3	23·8	25·6	27·5	29·8
21·0	9·3	9·8	10·4	11·1	12·0	12·9	14·0	15·3	16·9	18·9	21·3	22·8	24·5	26·4	28·7
22·0	8·8	9·4	10·0	10·6	11·4	12·3	13·4	14·7	16·2	18·1	20·5	21·9	23·5	25·4	27·5
23·0	8·5	9·0	9·5	10·2	10·9	11·8	12·8	14·1	15·5	17·3	19·6	21·0	22·6	24·4	26·5
24·0	8·1	8·6	9·1	9·8	10·5	11·3	12·3	13·5	14·9	16·7	18·9	20·2	21·7	23·5	25·6
25·0	7·8	8·3	8·8	9·4	10·1	10·9	11·8	13·0	14·3	16·0	18·2	19·5	20·9	22·6	24·7
26·0	7·5	7·9	8·5	9·0	9·7	10·5	11·4	12·5	13·8	15·4	17·5	18·8	20·2	21·9	23·8
27·0	7·2	7·7	8·1	8·7	9·3	10·1	11·0	12·0	13·3	14·9	16·9	18·1	19·5	21·1	23·0
28·0	7·0	7·4	7·9	8·4	9·0	9·7	10·6	11·6	12·9	14·4	16·3	17·5	18·9	20·4	22·3
29·0	6·7	7·1	7·6	8·1	8·7	9·4	10·2	11·2	12·4	13·9	15·8	16·9	18·3	19·8	21·6
30·0	6·5	6·9	7·3	7·8	8·4	9·1	9·9	10·9	12·0	13·5	15·3	16·4	17·7	19·2	20·9
31·0	6·3	6·7	7·1	7·6	8·2	8·8	9·6	10·5	11·7	13·0	14·8	15·9	17·2	18·6	20·3
32·0	6·1	6·5	6·9	7·4	7·9	8·5	9·3	10·2	11·3	12·7	14·4	15·4	16·6	18·1	19·7
33·0	5·9	6·3	6·7	7·1	7·7	8·3	9·0	9·9	11·0	12·3	14·0	15·0	16·2	17·5	19·2
34·0	5·7	6·1	6·5	6·9	7·4	8·1	8·8	9·6	10·6	11·9	13·6	14·6	15·7	17·1	18·6
35·0	5·6	5·9	6·3	6·7	7·2	7·8	8·5	9·3	10·4	11·6	13·2	14·2	15·3	16·6	18·2
36·0	5·4	5·8	6·1	6·6	7·0	7·6	8·3	9·1	10·1	11·3	12·8	13·8	14·9	16·2	17·7
37·0	5·3	5·6	6·0	6·4	6·9	7·4	8·1	8·8	9·8	11·0	12·5	13·4	14·5	15·7	17·2
38·0	5·1	5·5	5·8	6·2	6·7	7·2	7·9	8·6	9·5	10·7	12·2	13·1	14·1	15·4	16·8
40·0	4·9	5·2	5·5	5·9	6·3	6·9	7·5	8·2	9·1	10·2	11·6	12·5	13·5	14·6	16·0
42·0	4·7	4·9	5·3	5·6	6·0	6·5	7·1	7·8	8·7	9·7	11·1	11·9	12·8	14·0	15·3
44·0	4·4	4·7	5·0	5·4	5·8	6·2	6·8	7·5	8·3	9·3	10·6	11·4	12·3	13·3	14·6
46·0	4·3	4·5	4·8	5·1	5·5	6·0	6·5	7·1	7·9	8·9	10·1	10·9	11·7	12·8	14·0
48·0	4·1	4·3	4·6	4·9	5·3	5·7	6·2	6·8	7·6	8·5	9·7	10·4	11·3	12·3	13·4
50·0	3·9	4·2	4·4	4·7	5·1	5·5	6·0	6·6	7·3	8·2	9·3	10·0	10·8	11·8	12·9
52·0	3·8	4·0	4·2	4·5	4·9	5·3	5·8	6·3	7·0	7·9	9·0	9·6	10·4	11·3	12·4
54·0	3·6	3·8	4·1	4·4	4·7	5·1	5·5	6·1	6·8	7·6	8·6	9·3	10·0	10·9	12·0
56·0	3·5	3·7	3·9	4·2	4·5	4·9	5·3	5·9	6·5	7·3	8·3	9·0	9·7	10·6	11·6
58·0	3·4	3·6	3·8	4·1	4·4	4·7	5·2	5·7	6·3	7·1	8·1	8·7	9·4	10·2	11·2
60·0	3·3	3·5	3·7	3·9	4·2	4·6	5·0	5·5	6·1	6·8	7·8	8·4	9·1	9·9	10·8
62·0	3·2	3·3	3·6	3·8	4·1	4·4	4·8	5·3	5·9	6·6	7·5	8·1	8·8	9·6	10·5
64·0	3·1	3·2	3·5	3·7	4·0	4·3	4·7	5·1	5·7	6·4	7·3	7·9	8·5	9·3	10·2
66·0	3·0	3·1	3·4	3·6	3·9	4·2	4·5	5·0	5·5	6·2	7·1	7·6	8·2	9·0	9·9
68·0	2·9	3·1	3·3	3·5	3·7	4·0	4·4	4·8	5·4	6·0	6·9	7·4	8·0	8·7	9·6
70·0	2·8	3·0	3·2	3·4	3·6	3·9	4·3	4·7	5·2	5·9	6·7	7·2	7·8	8·5	9·3
80·0	2·4	2·6	2·8	3·0	3·2	3·4	3·7	4·1	4·6	5·1	5·9	6·3	6·8	7·4	8·2
90·0	2·2	2·3	2·5	2·6	2·8	3·1	3·3	3·7	4·1	4·6	5·2	5·6	6·1	6·6	7·3
100·0	2·0	2·1	2·2	2·4	2·5	2·8	3·0	3·3	3·7	4·1	4·7	5·0	5·5	6·0	6·5
120·0	1·6	1·7	1·8	2·0	2·1	2·3	2·5	2·7	3·0	3·4	3·9	4·2	4·6	5·0	5·5
140·0	1·4	1·5	1·6	1·7	1·8	2·0	2·1	2·4	2·6	2·9	3·4	3·6	3·9	4·3	4·7
160·0	1·2	1·3	1·4	1·5	1·6	1·7	1·9	2·1	2·3	2·6	2·9	3·2	3·4	3·7	4·1
180·0	1·1	1·2	1·2	1·3	1·4	1·5	1·7	1·8	2·0	2·3	2·6	2·8	3·0	3·3	3·6
200·0	1·0	1·0	1·1	1·2	1·3	1·4	1·5	1·6	1·8	2·1	2·3	2·5	2·7	3·0	3·3
300·0	0·7	0·7	0·7	0·8	0·8	0·9	1·0	1·1	1·2	1·4	1·6	1·7	1·8	2·0	2·2
400·0	0·5	0·5	0·6	0·6	0·6	0·7	0·8	0·8	0·9	1·0	1·2	1·3	1·4	1·5	1·6
500·0	0·4	0·4	0·4	0·5	0·5	0·6	0·6	0·7	0·7	0·8	0·9	1·0	1·1	1·2	1·3
600·0	0·3	0·3	0·4	0·4	0·4	0·5	0·5	0·5	0·6	0·7	0·8	0·8	0·9	1·0	1·1
700·0	0·3	0·3	0·3	0·3	0·4	0·4	0·4	0·5	0·5	0·6	0·7	0·7	0·8	0·9	0·9
800·0	0·2	0·3	0·3	0·3	0·3	0·3	0·4	0·4	0·5	0·5	0·6	0·6	0·7	0·7	0·8
1000·0	0·2	0·2	0·2	0·2	0·3	0·3	0·3	0·3	0·4	0·4	0·5	0·5	0·5	0·6	0·7

Traverse Table.

Showing Difference of Longitude and Corresponding Departure.

Lat.	DIFFERENCE OF LONGITUDE.															
	·10	·11	·12	·13	·14	·15	·16	·17	·18	·19	·20	·21	·22	·23	·24	·25
2°	·100	·110	·120	·130	·140	·150	·160	·170	·180	·190	·200	·210	·220	·230	·240	·250
4	·100	·110	·120	·130	·140	·150	·160	·170	·180	·190	·200	·209	·219	·229	·239	·249
6	·099	·109	·119	·129	·139	·149	·159	·169	·179	·189	·199	·209	·219	·229	·239	·249
8	·099	·109	·119	·129	·139	·148	·158	·168	·178	·188	·198	·208	·218	·228	·238	·248
10	·098	·108	·118	·128	·138	·148	·158	·167	·177	·187	·197	·207	·217	·227	·236	·246
11	·098	·108	·118	·128	·137	·147	·157	·167	·177	·187	·196	·206	·216	·226	·236	·245
12	·098	·108	·117	·127	·137	·147	·157	·166	·176	·186	·196	·205	·215	·225	·235	·245
13	·097	·107	·117	·127	·136	·146	·156	·166	·175	·185	·195	·205	·214	·224	·234	·244
14	·097	·107	·116	·126	·136	·146	·155	·165	·175	·184	·194	·204	·213	·223	·233	·243
15	·097	·106	·116	·126	·135	·145	·155	·164	·174	·184	·193	·203	·213	·222	·232	·241
16	·096	·106	·115	·125	·135	·144	·154	·163	·173	·183	·192	·202	·211	·221	·231	·240
17	·096	·105	·115	·124	·134	·143	·153	·163	·172	·182	·191	·201	·210	·220	·230	·239
18	·095	·105	·114	·124	·133	·143	·152	·162	·171	·181	·190	·200	·209	·219	·228	·238
19	·095	·104	·113	·123	·132	·142	·151	·161	·170	·180	·189	·199	·208	·217	·227	·236
20	·094	·103	·113	·122	·132	·141	·150	·160	·169	·179	·188	·197	·207	·216	·226	·235
21	·093	·103	·112	·121	·131	·140	·149	·159	·168	·177	·187	·196	·205	·215	·224	·233
22	·093	·102	·111	·121	·130	·139	·148	·158	·167	·176	·185	·195	·204	·213	·223	·232
23	·092	·101	·110	·120	·129	·138	·147	·156	·166	·175	·184	·193	·203	·212	·221	·230
24	·091	·100	·110	·119	·128	·137	·146	·155	·164	·174	·183	·192	·201	·210	·219	·228
25	·091	·100	·109	·118	·127	·136	·145	·154	·163	·172	·181	·190	·199	·208	·218	·227
26	·090	·099	·108	·117	·126	·135	·144	·153	·162	·171	·180	·189	·198	·207	·216	·225
27	·089	·098	·107	·116	·125	·134	·143	·151	·160	·169	·178	·187	·196	·205	·214	·223
28	·088	·097	·106	·115	·124	·132	·141	·150	·159	·168	·177	·185	·194	·203	·212	·221
29	·087	·096	·105	·114	·122	·131	·140	·149	·157	·166	·175	·184	·192	·201	·210	·219
30	·087	·095	·104	·113	·121	·130	·139	·147	·156	·165	·173	·182	·191	·199	·208	·217
31	·086	·094	·103	·111	·120	·129	·137	·146	·154	·163	·171	·180	·189	·197	·206	·214
32	·085	·093	·102	·110	·119	·127	·136	·144	·153	·161	·170	·178	·187	·195	·204	·212
33	·084	·092	·101	·109	·117	·126	·134	·143	·151	·159	·168	·176	·185	·193	·201	·210
34	·083	·091	·099	·108	·116	·124	·133	·141	·149	·158	·166	·174	·182	·191	·199	·207
35	·082	·090	·098	·106	·115	·123	·131	·139	·147	·156	·164	·172	·180	·188	·197	·205
36	·081	·089	·097	·105	·113	·121	·129	·138	·146	·154	·162	·170	·178	·186	·194	·202
37	·080	·088	·096	·104	·112	·120	·128	·136	·144	·152	·160	·168	·176	·184	·192	·200
38	·079	·087	·095	·102	·110	·118	·126	·134	·142	·150	·158	·165	·173	·181	·189	·197
39	·078	·085	·093	·101	·109	·117	·124	·132	·140	·148	·155	·163	·171	·179	·187	·194
40	·077	·084	·092	·100	·107	·115	·123	·130	·138	·146	·153	·161	·169	·176	·184	·192
41	·075	·083	·091	·098	·106	·113	·121	·128	·136	·143	·151	·158	·166	·174	·181	·189
42	·074	·082	·089	·097	·104	·111	·119	·126	·134	·141	·149	·156	·163	·171	·178	·186
43	·073	·080	·088	·095	·102	·110	·117	·124	·132	·139	·146	·154	·161	·168	·176	·183
44	·072	·079	·086	·094	·101	·108	·115	·122	·129	·137	·144	·151	·158	·165	·173	·180
45	·071	·078	·085	·092	·099	·106	·113	·120	·127	·134	·141	·148	·156	·163	·170	·177
46	·069	·076	·083	·090	·097	·104	·111	·118	·125	·132	·139	·146	·153	·160	·167	·174
47	·068	·075	·082	·089	·095	·102	·109	·116	·123	·130	·136	·143	·150	·157	·164	·170
48	·067	·074	·080	·087	·094	·100	·107	·114	·120	·127	·134	·141	·147	·154	·161	·167
49	·066	·072	·079	·085	·092	·098	·105	·112	·118	·125	·131	·138	·144	·151	·157	·164
50	·064	·071	·077	·084	·090	·096	·103	·109	·116	·122	·129	·135	·141	·148	·154	·161
51	·063	·069	·076	·082	·088	·094	·101	·107	·113	·120	·126	·132	·138	·145	·151	·157
52	·062	·068	·074	·080	·086	·092	·099	·105	·111	·117	·123	·129	·135	·142	·148	·154
53	·060	·066	·072	·078	·084	·090	·096	·102	·108	·114	·120	·126	·132	·138	·144	·150
54	·059	·065	·071	·076	·082	·088	·094	·100	·106	·112	·118	·123	·129	·135	·141	·147
55	·057	·063	·069	·075	·080	·086	·092	·098	·103	·109	·115	·120	·126	·132	·138	·143
56	·056	·062	·067	·073	·078	·084	·089	·095	·101	·106	·112	·117	·123	·129	·134	·140
57	·054	·060	·065	·071	·076	·082	·087	·093	·098	·103	·109	·114	·120	·125	·130	·136
58	·053	·058	·064	·069	·074	·079	·085	·090	·095	·101	·106	·111	·117	·122	·127	·132
59	·052	·057	·062	·067	·072	·077	·082	·088	·093	·098	·103	·108	·113	·118	·124	·129
60	·050	·055	·060	·065	·070	·075	·080	·085	·090	·095	·100	·105	·110	·115	·120	·125
61	·048	·053	·058	·063	·068	·073	·078	·082	·087	·092	·097	·102	·107	·112	·116	·121
62	·047	·052	·056	·061	·066	·070	·075	·080	·085	·089	·094	·099	·103	·108	·113	·117
63	·045	·050	·054	·059	·064	·068	·073	·077	·082	·086	·091	·095	·100	·104	·109	·113
64	·044	·048	·053	·057	·061	·066	·070	·075	·079	·083	·088	·092	·096	·101	·105	·110
65	·042	·046	·051	·055	·059	·063	·068	·072	·076	·080	·085	·089	·093	·097	·101	·106

Traverse Table.

SHOWING DIFFERENCE OF LONGITUDE AND CORRESPONDING DEPARTURE.

Lat.	DIFFERENCE OF LONGITUDE.														
	·26	·27	·28	·29	·30	·31	·32	·33	·34	·35	·36	·37	·38	·39	·40
2°	·260	·270	·280	·290	·300	·310	·320	·330	·340	·350	·360	·370	·380	·390	·400
4	·259	·269	·279	·289	·299	·309	·319	·329	·339	·349	·359	·369	·379	·389	·399
6	·259	·269	·278	·288	·298	·308	·318	·328	·338	·348	·358	·368	·378	·388	·398
8	·257	·267	·277	·287	·297	·307	·317	·327	·337	·347	·356	·366	·376	·386	·396
10	·256	·266	·276	·286	·295	·305	·315	·325	·335	·345	·355	·364	·374	·384	·394
11	·255	·265	·275	·285	·294	·304	·314	·324	·334	·344	·353	·363	·373	·383	·393
12	·254	·264	·274	·284	·293	·303	·313	·323	·333	·342	·352	·362	·372	·381	·391
13	·253	·263	·273	·283	·292	·302	·312	·322	·331	·341	·351	·361	·370	·380	·390
14	·252	·262	·272	·281	·291	·301	·310	·320	·330	·340	·349	·359	·369	·378	·388
15	·251	·261	·270	·280	·290	·299	·309	·319	·328	·338	·348	·357	·367	·377	·386
16	·250	·260	·269	·279	·288	·298	·308	·317	·327	·336	·346	·356	·365	·375	·385
17	·249	·258	·268	·277	·287	·296	·306	·316	·325	·335	·344	·354	·363	·373	·383
18	·247	·257	·266	·276	·285	·295	·304	·314	·323	·333	·342	·352	·361	·371	·380
19	·246	·255	·265	·274	·284	·293	·303	·312	·321	·331	·340	·350	·359	·369	·378
20	·244	·254	·263	·273	·282	·291	·301	·310	·319	·329	·338	·348	·357	·366	·376
21	·243	·252	·261	·271	·280	·289	·299	·308	·317	·327	·336	·345	·355	·364	·373
22	·241	·250	·260	·269	·278	·287	·297	·306	·315	·325	·334	·343	·352	·362	·371
23	·239	·249	·258	·267	·276	·285	·295	·304	·313	·322	·331	·341	·350	·359	·368
24	·238	·247	·256	·265	·274	·283	·292	·301	·311	·320	·329	·338	·347	·356	·365
25	·236	·245	·254	·263	·272	·281	·290	·299	·308	·317	·326	·335	·344	·353	·363
26	·234	·243	·252	·261	·270	·279	·288	·297	·306	·315	·324	·333	342	·351	·360
27	·232	·241	·249	·258	·267	·276	·285	·294	·303	·312	·321	·330	·339	·347	·356
28	·230	·238	·247	·256	·265	·274	·283	·291	·300	·309	·318	·327	·336	·344	·353
29	·227	·236	·245	·254	·262	·271	·280	·289	·297	·306	·315	·324	·332	·341	·350
30	·225	·234	·242	·251	·260	·268	·277	·286	·294	·303	·312	·320	·329	·338	·346
31	·223	·231	·240	·249	·257	·266	·274	·283	·291	·300	·309	·317	·326	·334	·343
32	·220	·229	·237	·246	·254	·263	·271	·280	·288	·297	·305	·314	·322	·331	·339
33	·218	·226	·235	·243	·252	·260	·268	·277	·285	·294	·302	·310	·319	·327	·335
34	·216	·224	·232	·240	·249	·257	·265	·274	·282	·290	·298	·307	·315	·323	·332
35	·213	·221	·229	·238	·246	·254	·262	·270	·279	·287	·295	·303	·311	·319	·328
36	·210	·218	·227	·235	·243	·251	·259	·267	·275	·283	·291	·299	·307	·316	·324
37	·208	·216	·224	·232	·240	·248	·256	·264	·272	·280	·288	·295	·303	·311	·319
38	·205	·213	·221	·229	·236	·244	·252	·260	·268	·276	·284	·292	·299	·307	·315
39	·202	·210	·218	·225	·233	·241	·249	·256	·264	·272	·280	·288	·295	·303	·311
40	·199	·207	·214	·222	·230	·237	·245	·253	·260	·268	·276	·283	·291	·299	·306
41	·196	·204	·211	·219	·226	·234	·242	·249	·257	·264	·272	·279	·287	·294	·302
42	·193	·201	·208	·216	·223	·230	·238	·245	·253	·260	·268	·275	·282	·290	·297
43	·190	·197	·205	·212	·219	·227	·234	·241	·249	·256	·263	·271	·278	·285	·293
44	·187	·194	·201	·209	·216	·223	·230	·237	·245	·252	·259	·266	·273	·281	·288
45	·184	·191	·198	·205	·212	·219	·226	·233	·240	·247	·255	·262	·269	·276	·283
46	·181	·188	·195	·201	·208	·215	·222	·229	·236	·243	·250	·257	·264	·271	·278
47	·177	·184	·191	·198	·205	·211	·218	·225	·232	·239	·246	·252	·259	·266	·273
48	·174	·181	·187	·194	·201	·207	·214	·221	·228	·234	·241	·248	·254	·261	·268
49	·171	·177	·184	·190	·197	·203	·210	·216	·223	·230	·236	·243	·249	·256	·262
50	·167	·174	·180	·186	·193	·199	·206	·212	·219	·225	·231	·238	·244	·251	·257
51	·164	·170	·176	·183	·189	·195	·201	·208	·214	·220	·227	·233	·239	·245	·252
52	·160	·166	·172	·179	·185	·191	·197	·203	·209	·215	·222	·228	·234	·240	·246
53	·156	·162	·169	·175	·181	·187	·193	·199	·205	·211	·217	·223	·229	·235	·241
54	·153	·159	·165	·170	·176	·182	·188	·194	·200	·206	·212	·217	·223	·229	·235
55	·149	·155	·161	·166	·172	·178	·184	·189	·195	·201	·206	·212	·218	·224	·229
56	·145	·151	·157	·162	·168	·173	·179	·185	·190	·196	·201	·207	·212	·218	·224
57	·142	·147	·152	·158	·163	·169	·174	·180	·185	·191	·196	·202	·207	·212	·218
58	·138	·143	·148	·154	·159	·164	·170	·175	·180	·185	·191	·196	·201	·207	·212
59	·134	·139	·144	·149	·155	·160	·165	·170	·175	·180	·185	·191	·196	·201	·206
60	·130	·135	·140	·145	·150	·155	·160	·165	·170	·175	·180	·185	·190	·195	·200
61	·126	·131	·136	·141	·145	·150	·155	·160	·165	·170	·175	·179	·184	·189	·194
62	·122	·127	·131	·136	·141	·146	·150	·155	·160	·164	·169	·174	·178	·183	·188
63	·118	·123	·127	·132	·136	·141	·145	·150	·154	·159	·163	·168	·173	·177	·182
64	·114	·118	·123	·127	·132	·136	·140	·145	·149	·153	·158	·162	·167	·171	·751
65	·110	·114	·118	·123	·127	·131	·135	·139	·144	·148	·152	·156	·161	·165	·169

Traverse Table.

SHOWING DIFFERENCE OF LONGITUDE AND CORRESPONDING DEPARTURE.

Lat.	DIFFERENCE OF LONGITUDE.														
	·41	·42	·43	·44	·45	·46	·47	·48	·49	·50	·51	·52	·53	·54	·55
°															
2	·410	·420	·430	·440	·450	·460	·470	·480	·490	·500	·510	·520	·530	·540	·550
4	·409	·419	·429	·439	·449	·459	·469	·479	·489	·499	·509	·519	·529	·539	·549
6	·408	·418	·428	·438	·448	·457	·467	·477	·487	·497	·507	·517	·527	·537	·547
8	·406	·416	·426	·436	·446	·456	·465	·475	·485	·495	·505	·515	·525	·535	·545
10	·404	·414	·423	·433	·443	·453	·463	·473	·483	·492	·502	·512	·522	·532	·542
11	·402	·412	·422	·432	·442	·452	·461	·471	·481	·491	·501	·510	·520	·530	·540
12	·401	·411	·421	·430	·440	·450	·460	·470	·479	·489	·499	·509	·518	·528	·538
13	·399	·409	·419	·429	·438	·448	·458	·468	·477	·487	·497	·507	·516	·526	·536
14	·398	·408	·417	·427	·437	·446	·456	·466	·475	·485	·495	·505	·514	·524	·534
15	·396	·406	·415	·425	·435	·444	·454	·464	·473	·483	·493	·502	·512	·522	·531
16	·394	·404	·413	·423	·433	·442	·452	·461	·471	·481	·490	·500	·509	·519	·529
17	·392	·402	·411	·421	·430	·440	·449	·459	·469	·478	·488	·497	·507	·516	·526
18	·390	·399	·409	·418	·428	·437	·447	·457	·466	·476	·485	·495	·504	·514	·523
19	·388	·397	·407	·416	·425	·435	·444	·454	·463	·473	·482	·492	·501	·511	·520
20	·385	·395	·404	·413	·423	·432	·442	·451	·460	·470	·479	·489	·498	·507	·517
21	·383	·392	·401	·411	·420	·429	·439	·448	·457	·467	·476	·485	·495	·504	·513
22	·380	·389	·399	·408	·417	·427	·436	·445	·454	·464	·473	·482	·491	·501	·510
23	·377	·387	·396	·405	·414	·423	·433	·442	·451	·460	·469	·479	·488	·497	·506
24	·375	·384	·393	·402	·411	·420	·429	·439	·448	·457	·466	·475	·484	·493	·502
25	·372	·381	·390	·399	·408	·417	·426	·435	·444	·453	·462	·471	·480	·489	·498
26	·369	·377	·386	·395	·404	·413	·422	·431	·440	·449	·458	·467	·476	·485	·494
27	·365	·374	·383	·392	·401	·410	·419	·428	·437	·446	·454	·463	·472	·481	·490
28	·362	·371	·380	·388	·397	·406	·415	·424	·433	·441	·450	·459	·468	·477	·486
29	·359	·367	·376	·385	·394	·402	·411	·420	·429	·437	·446	·455	·464	·472	·481
30	·355	·364	·372	·381	·390	·398	·407	·416	·424	·433	·442	·450	·459	·468	·476
31	·351	·360	·369	·377	·386	·394	·403	·411	·420	·429	·437	·446	·454	·463	·471
32	·348	·356	·365	·373	·382	·390	·399	·407	·416	·424	·433	·441	·449	·458	·466
33	·344	·352	·361	·369	·377	·386	·394	·403	·411	·419	·428	·436	·444	·453	·461
34	·340	·348	·356	·365	·373	·381	·390	·398	·406	·415	·423	·431	·439	·448	·456
35	·336	·344	·352	·360	·369	·377	·385	·393	·401	·410	·418	·426	·434	·442	·451
36	·332	·340	·348	·356	·364	·372	·380	·388	·396	·405	·413	·421	·429	·437	·445
37	·327	·335	·343	·351	·359	·367	·375	·383	·391	·399	·407	·415	·423	·431	·439
38	·323	·331	·339	·347	·355	·362	·370	·378	·386	·394	·402	·410	·418	·426	·433
39	·319	·326	·334	·342	·350	·357	·365	·373	·381	·389	·396	·404	·412	·420	·427
40	·314	·322	·329	·337	·345	·352	·360	·368	·375	·383	·391	·398	·406	·414	·421
41	·309	·317	·325	·332	·340	·347	·355	·362	·370	·377	·385	·392	·400	·408	·415
42	·305	·312	·320	·327	·334	·342	·349	·357	·364	·372	·379	·386	·394	·401	·409
43	·300	·307	·314	·322	·329	·336	·344	·351	·358	·366	·373	·380	·388	·395	·402
44	·295	·302	·309	·317	·324	·331	·338	·345	·352	·360	·367	·374	·381	·388	·396
45	·290	·297	·304	·311	·318	·325	·332	·339	·346	·354	·361	·368	·375	·382	·389
46	·285	·292	·299	·306	·313	·320	·326	·333	·340	·347	·354	·361	·368	·375	·382
47	·280	·286	·293	·300	·307	·314	·321	·327	·334	·341	·348	·355	·361	·368	·375
48	·274	·281	·288	·294	·301	·308	·314	·321	·328	·335	·341	·348	·355	·361	·368
49	·269	·276	·282	·289	·295	·302	·308	·315	·321	·328	·335	·341	·348	·354	·361
50	·264	·270	·276	·283	·289	·296	·302	·309	·315	·321	·328	·334	·341	·347	·354
51	·258	·264	·271	·277	·283	·289	·296	·302	·308	·315	·321	·327	·334	·340	·346
52	·252	·259	·265	·271	·277	·283	·289	·296	·302	·308	·314	·320	·326	·332	·339
53	·247	·253	·259	·265	·271	·277	·283	·289	·295	·301	·307	·313	·319	·325	·331
54	·241	·247	·253	·259	·265	·270	·276	·282	·288	·294	·300	·306	·312	·317	·323
55	·235	·241	·247	·252	·258	·264	·270	·275	·281	·287	·293	·298	·304	·310	·315
56	·229	·235	·240	·246	·252	·257	·263	·268	·274	·280	·285	·291	·296	·302	·308
57	·223	·229	·234	·240	·245	·251	·256	·261	·267	·272	·278	·283	·289	·294	·300
58	·217	·223	·228	·233	·238	·244	·249	·254	·260	·265	·270	·276	·281	·286	·291
59	·211	·216	·221	·227	·232	·237	·242	·247	·252	·258	·263	·268	·273	·278	·283
60	·205	·210	·215	·220	·225	·230	·235	·240	·245	·250	·255	·260	·265	·270	·275
61	·199	·204	·208	·213	·218	·223	·228	·233	·238	·242	·247	·252	·257	·262	·267
62	·192	·197	·202	·207	·211	·216	·221	·225	·230	·235	·239	·244	·249	·254	·258
63	·186	·191	·195	·200	·204	·209	·213	·218	·222	·227	·232	·236	·241	·245	·250
64	·180	·184	·188	·193	·197	·202	·206	·210	·215	·219	·224	·228	·232	·237	·241
65	·173	·177	·182	·186	·190	·194	·199	·203	·207	·211	·216	·220	·224	·228	·232

Traverse Table.

SHOWING DIFFERENCE OF LONGITUDE AND CORRESPONDING DEPARTURE.

Lat.	DIFFERENCE OF LONGITUDE.														
°	·56	·57	·58	·59	·60	·61	·62	·63	·64	·65	·66	·67	·68	·69	·70
2	·560	·570	·580	·590	·600	·610	·620	·630	·640	·650	·660	·670	·680	·690	·700
4	·559	·569	·579	·589	·599	·609	·618	·628	·638	·648	·658	·668	·678	·688	·698
6	·557	·567	·577	·587	·597	·607	·617	·627	·636	·646	·656	·666	·676	·686	·696
8	·555	·564	·574	·584	·594	·604	·614	·624	·634	·644	·654	·663	·673	·683	·693
10	·551	·561	·571	·581	·591	·601	·611	·620	·630	·640	·650	·660	·670	·680	·689
11	·550	·560	·569	·579	·589	·599	·609	·618	·628	·638	·648	·658	·668	·677	·687
12	·548	·558	·567	·577	·587	·597	·606	·616	·626	·636	·646	·655	·665	·675	·685
13	·546	·555	·565	·575	·585	·594	·604	·614	·624	·633	·643	·653	·663	·672	·682
14	·543	·553	·563	·572	·582	·592	·602	·611	·621	·631	·640	·650	·660	·670	·679
15	·541	·551	·560	·570	·580	·589	·599	·609	·618	·628	·638	·647	·657	·666	·676
16	·538	·548	·558	·567	·577	·586	·596	·606	·615	·625	·634	·644	·654	·663	·673
17	·536	·545	·555	·564	·574	·583	·593	·602	·612	·622	·631	·641	·650	·660	·669
18	·533	·542	·552	·561	·571	·580	·590	·599	·609	·618	·628	·637	·647	·656	·666
19	·529	·539	·548	·558	·567	·577	·586	·596	·605	·615	·624	·633	·643	·652	·662
20	·526	·536	·545	·554	·564	·573	·583	·592	·601	·611	·620	·630	·639	·648	·658
21	·523	·532	·541	·551	·560	·569	·579	·588	·597	·607	·616	·625	·635	·644	·654
22	·519	·528	·538	·547	·556	·565	·575	·584	·593	·603	·612	·621	·630	·640	·649
23	·515	·525	·534	·543	·552	·562	·571	·580	·589	·598	·608	·617	·626	·635	·644
24	·512	·521	·530	·539	·548	·557	·566	·576	·585	·594	·603	·612	·621	·630	·639
25	·508	·517	·526	·535	·544	·553	·562	·571	·580	·589	·598	·607	·616	·625	·634
26	·503	·512	·521	·530	·539	·548	·557	·566	·575	·584	·593	·602	·611	·620	·629
27	·499	·508	·517	·526	·535	·544	·552	·561	·570	·579	·588	·597	·606	·615	·624
28	·494	·503	·512	·521	·530	·539	·547	·556	·565	·574	·583	·592	·600	·609	·618
29	·490	·499	·507	·516	·525	·534	·542	·551	·560	·569	·577	·586	·595	·603	·612
30	·485	·494	·502	·511	·520	·528	·537	·546	·554	·563	·572	·580	·589	·598	·606
31	·480	·489	·497	·506	·514	·523	·531	·540	·549	·557	·566	·574	·583	·591	·600
32	·475	·483	·492	·500	·509	·517	·526	·534	·543	·551	·560	·568	·577	·585	·594
33	·470	·478	·486	·495	·503	·512	·520	·528	·537	·545	·554	·562	·570	·579	·587
34	·464	·473	·481	·489	·497	·506	·514	·522	·531	·539	·547	·555	·564	·572	·580
35	·459	·467	·475	·483	·491	·500	·508	·516	·524	·532	·541	·549	·557	·565	·573
36	·453	·461	·469	·477	·485	·494	·502	·510	·518	·526	·534	·542	·550	·558	·566
37	·447	·455	·463	·471	·479	·487	·495	·503	·511	·519	·527	·535	·543	·551	·559
38	·441	·449	·457	·465	·473	·481	·489	·496	·504	·512	·520	·528	·536	·544	·552
39	·435	·443	·451	·459	·466	·474	·482	·490	·497	·505	·513	·521	·528	·536	·544
40	·429	·437	·444	·452	·460	·467	·475	·483	·490	·498	·506	·513	·521	·529	·536
41	·423	·430	·438	·445	·453	·460	·468	·475	·483	·491	·498	·506	·513	·521	·528
42	·416	·424	·431	·438	·446	·453	·461	·468	·476	·483	·490	·498	·505	·513	·520
43	·410	·417	·424	·431	·439	·446	·453	·461	·468	·475	·483	·490	·497	·505	·512
44	·403	·410	·417	·424	·432	·439	·446	·453	·460	·468	·475	·482	·489	·496	·504
45	·396	·403	·410	·417	·424	·431	·438	·445	·453	·460	·467	·474	·481	·488	·495
46	·389	·396	·403	·410	·417	·424	·431	·438	·445	·452	·458	·465	·472	·479	·486
47	·382	·389	·396	·402	·409	·416	·423	·430	·436	·443	·450	·457	·464	·471	·477
48	·375	·381	·388	·395	·401	·408	·415	·422	·428	·435	·442	·448	·455	·462	·468
49	·367	·374	·381	·387	·394	·400	·407	·413	·420	·426	·433	·440	·446	·453	·459
50	·360	·366	·373	·379	·386	·392	·399	·405	·411	·418	·424	·431	·437	·444	·450
51	·352	·359	·365	·371	·378	·384	·390	·396	·403	·409	·415	·422	·428	·434	·441
52	·345	·351	·357	·363	·369	·376	·382	·388	·394	·400	·406	·412	·419	·425	·431
53	·337	·343	·349	·355	·361	·367	·373	·379	·385	·391	·397	·403	·409	·415	·421
54	·329	·335	·341	·347	·353	·359	·364	·370	·376	·382	·388	·394	·400	·406	·411
55	·321	·327	·333	·338	·344	·350	·356	·361	·367	·373	·379	·384	·390	·396	·402
56	·313	·319	·324	·330	·336	·341	·347	·352	·358	·363	·369	·375	·380	·386	·391
57	·305	·310	·316	·321	·327	·332	·338	·343	·349	·354	·359	·365	·370	·376	·381
58	·297	·302	·307	·313	·318	·323	·329	·334	·339	·344	·350	·355	·360	·366	·371
59	·288	·294	·299	·304	·309	·314	·319	·324	·330	·335	·340	·345	·350	·355	·361
60	·280	·285	·290	·295	·300	·305	·310	·315	·320	·325	·330	·335	·340	·345	·350
61	·271	·276	·281	·286	·291	·296	·301	·305	·310	·315	·320	·325	·330	·335	·339
62	·263	·268	·272	·277	·282	·286	·291	·296	·300	·305	·310	·315	·319	·324	·329
63	·254	·259	·263	·268	·272	·277	·281	·286	·291	·295	·300	·304	·309	·313	·318
64	·245	·250	·254	·259	·263	·267	·272	·276	·281	·285	·289	·294	·298	·302	·307
65	·237	·241	·245	·249	·254	·258	·262	·266	·270	·275	·279	·283	·287	·292	·296

Traverse Table.

SHOWING DIFFERENCE OF LONGITUDE AND CORRESPONDING DEPARTURE.

Lat.	DIFFERENCE OF LONGITUDE.														
	·71	·72	·73	·74	·75	·76	·77	·78	·79	·80	·81	·82	·83	·84	·85
° 2	·710	·720	·730	·740	·750	·760	·770	·780	·790	·800	·810	·819	·829	·839	·849
4	·708	·718	·728	·738	·748	·758	·768	·778	·788	·798	·808	·818	·828	·838	·848
6	·706	·716	·726	·736	·746	·756	·766	·776	·786	·796	·806	·816	·825	·835	·845
8	·703	·713	·723	·733	·743	·753	·763	·772	·782	·792	·802	·812	·822	·832	·842
10	·699	·709	·719	·729	·739	·748	·758	·768	·778	·788	·798	·808	·817	·827	·837
11	·697	·707	·717	·726	·736	·746	·756	·766	·775	·785	·795	·805	·815	·825	·834
12	·694	·704	·714	·724	·734	·743	·753	·763	·773	·783	·792	·802	·812	·822	·831
13	·692	·702	·711	·721	·731	·741	·750	·760	·770	·779	·789	·799	·809	·818	·828
14	·689	·699	·708	·718	·728	·737	·747	·757	·767	·776	·786	·796	·805	·815	·825
15	·686	·695	·705	·715	·724	·734	·744	·753	·763	·773	·782	·792	·802	·811	·821
16	·682	·692	·702	·711	·721	·731	·740	·750	·759	·769	·779	·788	·798	·807	·817
17	·679	·689	·698	·708	·717	·727	·736	·746	·755	·765	·775	·784	·794	·803	·813
18	·675	·685	·694	·704	·713	·723	·732	·742	·751	·761	·770	·780	·789	·799	·808
19	·671	·681	·690	·700	·709	·719	·728	·738	·747	·756	·766	·775	·785	·794	·804
20	·667	·677	·686	·695	·705	·714	·724	·733	·742	·752	·761	·771	·780	·789	·799
21	·663	·672	·682	·691	·700	·710	·719	·728	·738	·747	·756	·766	·775	·784	·794
22	·658	·668	·677	·686	·695	·705	·714	·723	·732	·742	·751	·760	·770	·779	·788
23	·654	·663	·672	·681	·690	·700	·709	·718	·727	·736	·746	·755	·764	·773	·782
24	·649	·658	·667	·676	·685	·694	·703	·713	·722	·731	·740	·749	·758	·767	·777
25	·643	·653	·662	·671	·680	·689	·698	·707	·716	·725	·734	·743	·752	·761	·770
26	·638	·647	·656	·665	·674	·683	·692	·701	·710	·719	·728	·737	·746	·755	·764
27	·633	·642	·650	·659	·668	·677	·686	·695	·704	·713	·722	·731	·740	·748	·757
28	·627	·636	·645	·653	·662	·671	·680	·689	·698	·706	·715	·724	·733	·742	·751
29	·621	·630	·638	·647	·656	·665	·673	·682	·691	·700	·708	·717	·726	·735	·743
30	·615	·624	·632	·641	·650	·658	·667	·675	·684	·693	·701	·710	·719	·727	·736
31	·609	·617	·626	·634	·643	·651	·660	·669	·677	·686	·694	·703	·711	·720	·729
32	·602	·611	·619	·628	·636	·645	·653	·661	·670	·678	·687	·695	·704	·712	·721
33	·595	·604	·612	·621	·629	·637	·646	·654	·663	·671	·679	·688	·696	·704	·713
34	·589	·597	·605	·613	·622	·630	·638	·647	·655	·663	·672	·680	·688	·696	·705
35	·582	·590	·598	·606	·614	·623	·631	·639	·647	·655	·664	·672	·680	·688	·696
36	·574	·582	·591	·599	·607	·615	·623	·631	·639	·647	·655	·663	·671	·680	·688
37	·567	·575	·583	·591	·599	·607	·615	·623	·631	·639	·647	·655	·663	·671	·679
38	·559	·567	·575	·583	·591	·599	·607	·615	·623	·630	·638	·646	·654	·662	·670
39	·552	·560	·567	·575	·583	·591	·598	·606	·614	·622	·629	·637	·645	·653	·661
40	·544	·552	·559	·567	·575	·582	·590	·598	·605	·613	·620	·628	·636	·643	·651
41	·536	·543	·551	·558	·566	·574	·581	·589	·596	·604	·611	·619	·626	·634	·642
42	·528	·535	·542	·550	·557	·565	·572	·580	·587	·595	·602	·609	·617	·624	·632
43	·519	·527	·534	·541	·549	·556	·563	·570	·578	·585	·592	·600	·607	·614	·622
44	·511	·518	·525	·532	·540	·547	·554	·561	·568	·575	·583	·590	·597	·604	·611
45	·502	·509	·516	·523	·530	·537	·544	·552	·559	·566	·573	·580	·587	·594	·601
46	·493	·500	·507	·514	·521	·528	·535	·542	·549	·556	·563	·570	·577	·584	·590
47	·484	·491	·498	·505	·511	·518	·525	·532	·539	·546	·552	·559	·566	·573	·580
48	·475	·482	·488	·495	·502	·509	·515	·522	·529	·535	·542	·549	·555	·562	·569
49	·466	·472	·479	·485	·492	·499	·505	·512	·518	·525	·531	·538	·545	·551	·558
50	·456	·463	·469	·476	·482	·489	·495	·501	·508	·514	·521	·527	·534	·540	·546
51	·447	·453	·459	·466	·472	·478	·485	·491	·497	·503	·510	·516	·522	·529	·535
52	·437	·443	·449	·456	·462	·468	·474	·480	·486	·493	·499	·505	·511	·517	·523
53	·427	·433	·439	·445	·451	·457	·463	·469	·475	·481	·487	·493	·500	·506	·512
54	·417	·423	·429	·435	·441	·447	·453	·458	·464	·470	·476	·482	·488	·494	·500
55	·407	·413	·419	·424	·430	·436	·442	·447	·453	·459	·465	·470	·476	·482	·488
56	·397	·403	·408	·414	·419	·425	·431	·436	·442	·447	·453	·459	·464	·470	·475
57	·387	·392	·398	·403	·408	·414	·419	·425	·430	·436	·441	·447	·452	·457	·463
58	·376	·382	·387	·392	·397	·403	·408	·413	·419	·424	·429	·435	·440	·445	·450
59	·366	·371	·376	·381	·386	·391	·397	·402	·407	·412	·417	·422	·427	·433	·438
60	·355	·360	·365	·370	·375	·380	·385	·390	·395	·400	·405	·410	·415	·420	·425
61	·344	·349	·354	·359	·364	·368	·373	·378	·383	·388	·393	·398	·402	·407	·412
62	·333	·338	·343	·347	·352	·357	·361	·366	·371	·376	·380	·385	·390	·394	·399
63	·322	·327	·331	·336	·340	·345	·350	·354	·359	·363	·368	·372	·377	·381	·386
64	·311	·316	·320	·324	·329	·333	·338	·342	·346	·351	·355	·359	·364	·368	·373
65	·300	·304	·309	·313	·317	·321	·325	·330	·334	·338	·342	·347	·351	·355	·359

Traverse Table.

SHOWING DIFFERENCE OF LONGITUDE AND CORRESPONDING DEPARTURE.

Lat.	DIFFERENCE OF LONGITUDE.														
	·86	·87	·88	·89	·90	·91	·92	·93	·94	·95	·96	·97	·98	·99	1·00
2°	·859	·869	·879	·889	·899	·909	·919	·929	·939	·949	·959	·969	·979	·989	·999
4	·858	·868	·878	·888	·898	·908	·918	·928	·938	·948	·958	·968	·978	·988	·998
6	·855	·865	·875	·885	·895	·905	·915	·925	·935	·945	·955	·965	·975	·985	·995
8	·852	·862	·871	·881	·891	·901	·911	·921	·931	·941	·951	·961	·970	·980	·990
10	·847	·857	·867	·876	·886	·896	·906	·916	·926	·936	·945	·955	·965	·975	·985
11	·844	·854	·864	·874	·883	·893	·903	·913	·923	·933	·942	·952	·962	·972	·982
12	·841	·851	·861	·871	·880	·890	·900	·910	·919	·929	·939	·949	·959	·968	·978
13	·838	·848	·857	·867	·877	·887	·896	·906	·916	·926	·935	·945	·955	·965	·974
14	·834	·844	·854	·864	·873	·883	·893	·902	·912	·922	·931	·941	·951	·961	·970
15	·831	·840	·850	·860	·869	·879	·889	·898	·908	·918	·927	·937	·947	·956	·966
16	·827	·836	·846	·856	·865	·875	·884	·894	·904	·913	·923	·932	·942	·952	·961
17	·822	·832	·842	·851	·861	·870	·880	·889	·899	·908	·918	·928	·937	·947	·956
18	·818	·827	·837	·846	·856	·865	·875	·884	·894	·904	·913	·923	·932	·942	·951
19	·813	·823	·832	·842	·851	·860	·870	·879	·889	·898	·908	·917	·927	·936	·946
20	·808	·818	·827	·836	·846	·855	·865	·874	·883	·893	·902	·912	·921	·930	·940
21	·803	·812	·822	·831	·840	·850	·859	·868	·878	·887	·896	·906	·915	·924	·934
22	·797	·807	·816	·825	·834	·844	·853	·862	·872	·881	·890	·899	·909	·918	·927
23	·792	·801	·810	·819	·828	·838	·847	·856	·865	·874	·884	·893	·902	·911	·921
24	·786	·795	·804	·813	·822	·831	·840	·850	·859	·868	·877	·886	·895	·904	·914
25	·779	·788	·798	·807	·816	·825	·834	·843	·852	·861	·870	·879	·888	·897	·906
26	·773	·782	·791	·800	·809	·818	·827	·836	·845	·854	·863	·872	·881	·890	·899
27	·766	·775	·784	·793	·802	·811	·820	·829	·838	·846	·855	·864	·873	·882	·891
28	·759	·768	·777	·786	·795	·803	·812	·821	·830	·839	·848	·856	·865	·874	·883
29	·752	·761	·770	·778	·787	·796	·805	·813	·822	·831	·840	·848	·857	·866	·875
30	·745	·753	·762	·771	·779	·788	·797	·805	·814	·823	·831	·840	·849	·857	·866
31	·737	·746	·754	·763	·771	·780	·789	·797	·806	·814	·823	·831	·840	·849	·857
32	·729	·738	·746	·755	·763	·772	·780	·789	·797	·806	·814	·823	·831	·840	·848
33	·721	·730	·738	·746	·755	·763	·772	·780	·788	·797	·805	·814	·822	·830	·839
34	·713	·721	·730	·738	·746	·754	·763	·771	·779	·788	·796	·804	·812	·821	·829
35	·704	·713	·721	·729	·737	·745	·754	·762	·770	·778	·786	·795	·803	·811	·819
36	·696	·704	·712	·720	·728	·736	·744	·752	·760	·769	·777	·785	·793	·801	·809
37	·687	·695	·703	·711	·719	·727	·735	·743	·751	·759	·767	·775	·783	·791	·799
38	·678	·686	·693	·701	·709	·717	·725	·733	·741	·749	·756	·764	·772	·780	·788
39	·668	·676	·684	·692	·699	·707	·715	·723	·731	·738	·746	·754	·762	·769	·777
40	·659	·666	·674	·682	·689	·697	·705	·712	·720	·728	·735	·743	·751	·758	·766
41	·649	·657	·664	·672	·679	·687	·694	·702	·709	·717	·725	·732	·740	·747	·755
42	·639	·647	·654	·661	·669	·676	·684	·691	·699	·706	·713	·721	·728	·736	·743
43	·629	·636	·644	·651	·658	·666	·673	·680	·687	·695	·702	·709	·717	·724	·731
44	·619	·626	·633	·640	·647	·655	·662	·669	·676	·683	·691	·698	·705	·712	·719
45	·608	·615	·622	·629	·636	·643	·651	·658	·665	·672	·679	·686	·693	·700	·707
46	·597	·604	·611	·618	·625	·632	·639	·646	·653	·660	·667	·674	·681	·688	·695
47	·587	·593	·600	·607	·614	·621	·627	·634	·641	·648	·655	·662	·668	·675	·682
48	·575	·582	·589	·596	·602	·609	·616	·622	·629	·636	·642	·649	·656	·662	·669
49	·564	·571	·577	·584	·590	·597	·604	·610	·617	·623	·630	·636	·643	·649	·656
50	·553	·559	·566	·572	·579	·585	·591	·598	·604	·611	·617	·624	·630	·636	·643
51	·541	·548	·554	·560	·566	·573	·579	·585	·592	·598	·604	·610	·617	·623	·629
52	·529	·536	·542	·548	·554	·560	·566	·573	·579	·585	·591	·597	·603	·610	·616
53	·518	·524	·530	·536	·542	·548	·554	·560	·566	·572	·578	·584	·590	·596	·602
54	·505	·511	·517	·523	·529	·535	·541	·547	·553	·558	·564	·570	·576	·582	·588
55	·493	·499	·505	·510	·516	·522	·528	·533	·539	·545	·551	·556	·562	·568	·574
56	·481	·486	·492	·498	·503	·509	·514	·520	·526	·531	·537	·542	·548	·554	·559
57	·468	·474	·479	·485	·490	·496	·501	·507	·512	·517	·523	·528	·534	·539	·545
58	·456	·461	·466	·472	·477	·482	·488	·493	·498	·503	·509	·514	·519	·525	·530
59	·443	·448	·453	·458	·464	·469	·474	·479	·484	·489	·494	·500	·505	·510	·515
60	·430	·435	·440	·445	·450	·455	·460	·465	·470	·475	·480	·485	·490	·495	·500
61	·417	·422	·427	·431	·436	·441	·446	·451	·456	·461	·465	·470	·475	·480	·485
62	·404	·408	·413	·418	·423	·427	·432	·437	·441	·446	·451	·455	·460	·465	·469
63	·390	·395	·400	·404	·409	·413	·418	·422	·427	·431	·436	·440	·445	·449	·454
64	·377	·381	·386	·390	·395	·399	·403	·408	·412	·416	·421	·425	·430	·434	·438
65	·363	·368	·372	·376	·380	·385	·389	·393	·397	·401	·406	·410	·414	·418	·423

Traverse Table.

Showing Difference of Longitude and Corresponding Departure.

Lat.	DIFFERENCE OF LONGITUDE.															
	·10	·11	·12	·13	·14	·15	·16	·17	·18	·19	·20	·21	·22	·23	·24	·25
65°	·042	·046	·051	·055	·059	·063	·068	·072	·076	·080	·085	·089	·093	·097	·101	·106
66	·041	·045	·049	·053	·057	·061	·065	·069	·073	·077	·081	·085	·089	·094	·098	·102
67	·039	·043	·047	·051	·055	·059	·063	·066	·070	·074	·078	·082	·086	·090	·094	·098
68	·037	·041	·045	·049	·052	·056	·060	·064	·067	·071	·075	·079	·082	·086	·090	·094
69	·036	·039	·043	·047	·050	·054	·057	·061	·065	·068	·072	·075	·079	·082	·086	·090
70	·034	·038	·041	·044	·048	·051	·055	·058	·062	·065	·068	·072	·075	·079	·082	·086
71	·033	·036	·039	·042	·046	·049	·052	·055	·059	·062	·065	·068	·072	·075	·078	·081
72	·031	·034	·037	·040	·043	·046	·049	·053	·056	·059	·062	·065	·068	·071	·074	·077
73	·029	·032	·035	·038	·041	·044	·047	·050	·053	·056	·058	·061	·064	·067	·070	·073
74	·028	·030	·033	·036	·039	·041	·044	·047	·050	·052	·055	·058	·061	·063	·066	·069
75	·026	·028	·031	·034	·036	·039	·041	·044	·047	·049	·052	·054	·057	·060	·062	·065
76	·024	·027	·029	·031	·034	·036	·039	·041	·044	·046	·048	·051	·053	·056	·058	·060
77	·022	·025	·027	·029	·031	·034	·036	·038	·040	·043	·045	·047	·049	·052	·054	·056
78	·021	·023	·025	·027	·029	·031	·033	·035	·037	·040	·042	·044	·046	·048	·050	·052
79	·019	·021	·023	·025	·027	·029	·031	·032	·034	·036	·038	·040	·042	·044	·046	·048
80	·017	·019	·021	·023	·024	·026	·028	·030	·031	·033	·035	·036	·038	·040	·042	·043
81	·016	·017	·019	·020	·022	·023	·025	·027	·028	·030	·031	·033	·034	·036	·038	·039
82	·014	·015	·017	·018	·019	·021	·022	·024	·025	·026	·028	·029	·031	·032	·033	·035
83	·012	·013	·015	·016	·017	·018	·019	·021	·022	·023	·024	·026	·027	·028	·029	·030
84	·010	·011	·013	·014	·015	·016	·017	·018	·019	·020	·021	·022	·023	·024	·025	·026
85	·009	·010	·010	·011	·012	·013	·014	·015	·016	·017	·017	·018	·019	·020	·021	·022
86	·007	·008	·008	·009	·010	·010	·011	·012	·013	·013	·014	·015	·015	·016	·017	·017
87	·005	·006	·006	·007	·007	·008	·008	·009	·009	·010	·010	·011	·012	·012	·013	·013
88	·003	·004	·004	·005	·005	·005	·006	·006	·006	·007	·007	·007	·008	·008	·008	·009
89	·002	·002	·002	·002	·002	·003	·003	·003	·003	·003	·003	·004	·004	·004	·004	·004

Lat.	DIFFERENCE OF LONGITUDE.															
	·25	·26	·27	·28	·29	·30	·31	·32	·33	·34	·35	·36	·37	·38	·39	·40
65°	·106	·110	·114	·118	·123	·127	·131	·135	·139	·144	·148	·152	·156	·161	·165	·169
66	·102	·106	·110	·114	·118	·122	·126	·130	·134	·138	·142	·146	·150	·155	·159	·163
67	·098	·102	·105	·109	·113	·117	·121	·125	·129	·133	·137	·141	·145	·148	·152	·156
68	·094	·097	·101	·105	·109	·112	·116	·120	·124	·127	·131	·135	·139	·142	·146	·150
69	·090	·093	·097	·100	·104	·108	·111	·115	·118	·122	·125	·129	·133	·136	·140	·143
70	·086	·089	·092	·096	·099	·103	·106	·109	·113	·116	·120	·123	·127	·130	·133	·137
71	·081	·085	·088	·091	·094	·098	·101	·104	·107	·111	·114	·117	·120	·124	·127	·130
72	·077	·080	·083	·087	·090	·093	·096	·099	·102	·105	·108	·111	·114	·117	·121	·124
73	·073	·076	·079	·082	·085	·088	·091	·094	·096	·099	·102	·105	·108	·111	·114	·117
74	·069	·072	·074	·077	·080	·083	·085	·088	·091	·094	·096	·099	·102	·105	·107	·110
75	·065	·067	·070	·072	·075	·078	·080	·083	·085	·088	·091	·093	·096	·098	·101	·104
76	·060	·063	·065	·068	·070	·073	·075	·077	·080	·082	·085	·087	·090	·092	·094	·097
77	·057	·058	·061	·063	·065	·067	·070	·072	·074	·076	·079	·081	·083	·085	·088	·090
78	·052	·054	·056	·058	·060	·062	·064	·067	·069	·071	·073	·075	·077	·079	·081	·083
79	·048	·050	·052	·053	·055	·057	·059	·061	·063	·065	·067	·069	·071	·073	·074	·076
80	·043	·045	·047	·049	·050	·052	·054	·056	·057	·059	·061	·063	·064	·066	·068	·069
81	·039	·041	·042	·044	·045	·047	·048	·050	·052	·053	·055	·056	·058	·059	·061	·063
82	·035	·036	·038	·039	·040	·042	·043	·045	·046	·047	·049	·050	·051	·053	·054	·056
83	·030	·032	·033	·034	·035	·037	·038	·039	·040	·041	·043	·044	·045	·046	·048	·049
84	·026	·027	·028	·029	·030	·031	·032	·033	·034	·036	·037	·038	·039	·040	·041	·042
85	·022	·023	·024	·024	·025	·026	·027	·028	·029	·030	·031	·031	·032	·033	·034	·035
86	·017	·018	·019	·020	·020	·021	·022	·022	·023	·024	·024	·025	·026	·027	·027	·028
87	·013	·014	·014	·015	·015	·016	·016	·017	·017	·018	·018	·019	·019	·020	·020	·021
88	·009	·009	·009	·010	·010	·010	·011	·011	·012	·012	·012	·013	·013	·013	·014	·014
89	·004	·005	·005	·005	·005	·005	·005	·006	·006	·006	·006	·006	·006	·007	·007	·007

Traverse Table.

SHOWING DIFFERENCE OF LONGITUDE AND CORRESPONDING DEPARTURE.

Lat.	DIFFERENCE OF LONGITUDE.															
	·40	·41	·42	·43	·44	·45	·46	·47	·48	·49	·50	·51	·52	·53	·54	·55
65°	·169	·173	·177	·182	·186	·190	·194	·199	·203	·207	·211	·216	·220	·224	·228	·232
66	·163	·167	·171	·175	·179	·183	·187	·191	·195	·199	·203	·207	·212	·216	·220	·224
67	·156	·160	·164	·168	·172	·176	·180	·184	·188	·191	·195	·199	·203	·207	·211	·215
68	·150	·154	·157	·161	·165	·169	·172	·176	·180	·184	·187	·191	·195	·199	·202	·206
69	·143	·147	·151	·154	·158	·161	·165	·168	·172	·176	·179	·183	·186	·190	·194	·197
70	·137	·140	·144	·147	·150	·154	·157	·161	·164	·168	·171	·174	·178	·181	·185	·188
71	·130	·133	·137	·140	·143	·147	·150	·153	·156	·160	·163	·166	·169	·173	·176	·179
72	·124	·127	·130	·133	·136	·139	·142	·145	·148	·151	·155	·158	·161	·164	·167	·170
73	·117	·120	·123	·126	·129	·132	·134	·137	·140	·143	·146	·149	·152	·155	·158	·161
74	·110	·113	·116	·119	·121	·124	·127	·130	·132	·135	·138	·141	·143	·146	·149	·152
75	·104	·106	·109	·111	·114	·116	·119	·122	·124	·127	·129	·132	·135	·137	·140	·142
76	·097	·099	·102	·104	·106	·109	·111	·114	·116	·119	·121	·123	·126	·128	·131	·133
77	·090	·092	·094	·097	·099	·101	·103	·106	·108	·110	·112	·115	·117	·119	·121	·124
78	·083	·085	·087	·089	·091	·094	·096	·098	·100	·102	·104	·106	·108	·110	·112	·114
79	·076	·078	·080	·082	·084	·086	·088	·090	·092	·193	·095	·097	·099	·101	·103	·105
80	·069	·071	·073	·075	·076	·078	·080	·082	·083	·085	·087	·089	·090	·092	·094	·096
81	·063	·064	·066	·067	·069	·070	·072	·074	·075	·077	·078	·080	·081	·083	·084	·086
82	·056	·057	·058	·060	·061	·063	·064	·065	·067	·068	·070	·071	·072	·074	·075	·077
83	·049	·050	·051	·052	·054	·055	·056	·057	·058	·060	·061	·062	·063	·065	·066	·067
84	·042	·043	·044	·045	·046	·047	·048	·049	·050	·051	·052	·053	·054	·055	·056	·057
85	·035	·036	·037	·037	·038	·039	·040	·041	·042	·043	·044	·044	·045	·046	·047	·048
86	·028	·029	·029	·030	·031	·031	·032	·033	·033	·034	·035	·036	·036	·037	·038	·038
87	·021	·021	·022	·023	·023	·024	·024	·025	·025	·026	·026	·027	·027	·028	·028	·029
88	·014	·014	·015	·015	·015	·016	·016	·016	·017	·017	·017	·018	·018	·018	·019	·019
89	·007	·007	·007	·008	·008	·008	·008	·008	·008	·009	·009	·009	·009	·009	·009	·010

Lat.	DIFFERENCE OF LONGITUDE															
	·55	·56	·57	·58	·59	·60	·61	·62	·63	·64	·65	·66	·67	·58	·69	·70
65°	·232	·237	·241	·245	·249	·254	·258	·262	·266	·270	·275	·279	·283	·287	·292	·296
66	·224	·228	·232	·236	·240	·244	·248	·252	·256	·260	·264	·268	·273	·277	·281	·285
67	·215	·219	·223	·227	·231	·234	·238	·242	·246	·250	·254	·258	·262	·266	·270	·274
68	·206	·210	·214	·217	·221	·225	·229	·232	·236	·240	·243	·247	·251	·255	·258	·262
69	·197	·201	·204	·208	·211	·215	·219	·222	·226	·229	·233	·237	·240	·244	·247	·251
70	·188	·192	·195	·198	·202	·205	·209	·212	·215	·219	·222	·226	·229	·233	·236	·239
71	·179	·182	·186	·189	·192	·195	·199	·202	·205	·208	·212	·215	·218	·221	·225	·228
72	·170	·173	·176	·179	·182	·185	·189	·192	·195	·198	·201	·204	·207	·210	·213	·216
73	·161	·164	·167	·170	·172	·175	·178	·181	·184	·187	·190	·193	·196	·199	·202	·205
74	·152	·154	·157	·160	·163	·165	·168	·171	·174	·176	·179	·182	·185	·187	·190	·193
75	·142	·145	·148	·150	·153	·155	·158	·160	·163	·166	·168	·171	·173	·176	·179	·181
76	·133	·135	·138	·140	·143	·145	·148	·150	·152	·155	·157	·160	·162	·165	·167	·169
77	·124	·126	·128	·130	·133	·135	·137	·139	·142	·144	·146	·148	·151	·153	·155	·157
78	·114	·116	·119	·121	·123	·125	·127	·129	·131	·133	·135	·137	·139	·141	·143	·146
79	·105	·107	·109	·111	·113	·114	·116	·118	·120	·122	·124	·126	·128	·130	·132	·134
80	·096	·097	·099	·101	·102	·104	·106	·108	·109	·111	·113	·115	·116	·118	·120	·122
81	·086	·088	·089	·091	·092	·094	·095	·097	·099	·100	·102	·103	·105	·106	·108	·110
82	·077	·078	·079	·081	·082	·084	·085	·086	·088	·089	·090	·092	·093	·095	·096	·097
83	·067	·068	·069	·071	·072	·073	·074	·076	·077	·078	·079	·080	·082	·083	·084	·085
84	·057	·059	·060	·061	·062	·063	·064	·065	·066	·067	·068	·069	·070	·071	·072	·073
85	·048	·049	·050	·051	·051	·052	·053	·054	·055	·056	·057	·058	·058	·059	·060	·161
86	·038	·039	·040	·040	·041	·042	·043	·043	·044	·045	·045	·046	·047	·047	·048	·049
87	·029	·029	·030	·030	·031	·031	·032	·032	·033	·033	·034	·035	·035	·036	·036	·037
88	·019	·020	·020	·020	·021	·021	·021	·022	·022	·022	·023	·023	·023	·024	·024	·024
89	·010	·010	·010	·010	·010	·010	·011	·011	·011	·011	·011	·012	·012	·012	·012	·012

Traverse Table.

SHOWING DIFFERENCE OF LONGITUDE AND CORRESPONDING DEPARTURE.

Lat.	DIFFERENCE OF LONGITUDE.															
	·70	·71	·72	·73	·74	·75	·76	·77	·78	·79	·80	·81	·82	·83	·84	·85
65°	·296	·300	·304	·309	·313	·317	·321	·325	·330	·334	·338	·342	·347	·351	·355	·359
66	·285	·289	·293	·297	·301	·305	·309	·313	·317	·321	·325	·329	·334	·338	·342	·346
67	·274	·277	·281	·285	·289	·293	·297	·301	·305	·309	·313	·316	·320	·324	·328	·332
68	·262	·266	·270	·273	·277	·281	·285	·288	·292	·296	·300	·303	·307	·311	·315	·318
69	·251	·254	·258	·262	·265	·269	·272	·276	·280	·283	·287	·290	·294	·297	·301	·305
70	·239	·243	·246	·250	·253	·257	·260	·263	·267	·270	·274	·277	·280	·284	·287	·291
71	·228	·231	·234	·238	·241	·244	·247	·251	·254	·257	·260	·264	·267	·270	·273	·277
72	·216	·219	·222	·226	·229	·232	·235	·238	·241	·244	·247	·250	·253	·256	·260	·263
73	·205	·208	·211	·213	·216	·219	·222	·225	·228	·231	·234	·237	·240	·243	·246	·249
74	·193	·196	·198	·201	·204	·207	·209	·212	·215	·218	·221	·223	·226	·229	·232	·234
75	·181	·184	·186	·189	·192	·194	·197	·199	·202	·204	·207	·210	·212	·215	·217	·220
76	·169	·172	·174	·177	·179	·181	·184	·186	·189	·191	·194	·196	·198	·201	·203	·206
77	·157	·160	·162	·164	·166	·169	·171	·173	·175	·178	·180	·182	·184	·187	·189	·191
78	·146	·148	·150	·152	·154	·156	·158	·160	·162	·164	·166	·168	·170	·173	·175	·177
79	·134	·135	·137	·139	·141	·143	·145	·147	·149	·151	·153	·155	·156	·158	·160	·162
80	·122	·123	·125	·127	·128	·130	·132	·134	·135	·137	·139	·141	·142	·144	·146	·148
81	·110	·111	·113	·114	·116	·117	·119	·120	·122	·124	·125	·127	·128	·130	·131	·133
82	·097	·099	·100	·102	·103	·104	·106	·107	·109	·110	·111	·113	·114	·116	·117	·118
83	·085	·087	·088	·089	·090	·091	·093	·094	·095	·096	·097	·099	·100	·101	·102	·104
84	·073	·074	·075	·076	·077	·078	·079	·080	·082	·083	·084	·085	·086	·087	·088	·089
85	·061	·062	·063	·064	·064	·065	·066	·067	·068	·069	·070	·071	·071	·072	·073	·074
86	·049	·050	·050	·051	·052	·052	·053	·054	·054	·055	·056	·057	·057	·058	·059	·059
87	·037	·037	·038	·038	·039	·039	·040	·040	·041	·041	·042	·042	·043	·043	·044	·044
88	·024	·025	·025	·025	·026	·026	·027	·027	·027	·028	·028	·028	·029	·029	·029	·030
89	·012	·012	·013	·013	·013	·013	·013	·013	·014	·014	·014	·014	·014	·014	·015	·015

Lat.	DIFFERENCE OF LONGITUDE.															
	·85	·86	·87	·88	·89	·90	·91	·92	·93	·94	·95	·96	·97	·98	·99	1·00
65°	·359	·363	·368	·372	·376	·380	·385	·389	·393	·397	·401	·406	·410	·414	·418	·423
66	·346	·350	·354	·358	·362	·366	·370	·374	·378	·382	·386	·390	·395	·399	·403	·407
67	·332	·336	·340	·344	·348	·352	·356	·359	·363	·367	·371	·375	·379	·383	·387	·391
68	·318	·322	·326	·330	·333	·337	·341	·345	·348	·352	·356	·360	·363	·367	·371	·375
69	·305	·308	·312	·315	·319	·323	·326	·330	·333	·337	·340	·344	·348	·351	·355	·358
70	·291	·294	·298	·301	·304	·308	·311	·315	·318	·321	·325	·328	·332	·335	·339	·342
71	·277	·280	·283	·287	·290	·293	·296	·300	·303	·306	·309	·313	·316	·319	·322	·326
72	·263	·266	·269	·272	·275	·278	·281	·284	·287	·290	·294	·297	·300	·303	·306	·309
73	·249	·251	·254	·257	·260	·263	·266	·269	·272	·275	·278	·281	·284	·287	·289	·292
74	·234	·237	·240	·243	·245	·248	·251	·254	·256	·259	·262	·265	·267	·270	·273	·276
75	·220	·223	·225	·228	·230	·233	·236	·238	·241	·243	·246	·248	·251	·254	·256	·259
76	·206	·208	·210	·213	·215	·218	·220	·223	·225	·227	·230	·232	·235	·237	·240	·242
77	·191	·193	·196	·198	·200	·202	·205	·207	·209	·211	·214	·216	·218	·220	·223	·225
78	·177	·179	·181	·183	·185	·187	·189	·191	·193	·195	·198	·200	·202	·204	·206	·208
79	·162	·164	·166	·168	·170	·172	·174	·176	·177	·179	·181	·183	·185	·187	·189	·191
80	·148	·149	·151	·153	·155	·156	·158	·160	·161	·163	·165	·167	·168	·170	·172	·174
81	·133	·135	·136	·138	·139	·141	·142	·144	·145	·147	·149	·150	·152	·153	·155	·156
82	·118	·120	·121	·122	·124	·125	·127	·128	·129	·131	·132	·134	·135	·136	·138	·139
83	·104	·105	·106	·107	·108	·110	·111	·112	·113	·115	·116	·117	·118	·119	·121	·122
84	·089	·090	·091	·092	·093	·094	·095	·096	·097	·098	·099	·100	·101	·102	·103	·105
85	·074	·075	·076	·077	·078	·078	·079	·080	·081	·082	·083	·084	·085	·085	·086	·087
86	·059	·060	·061	·061	·062	·063	·063	·064	·065	·066	·066	·067	·068	·068	·069	·070
87	·044	·045	·046	·046	·047	·047	·048	·048	·049	·049	·050	·050	·051	·051	·052	·052
88	·030	·030	·030	·031	·031	·031	·032	·032	·032	·033	·033	·034	·034	·034	·035	·035
89	·015	·015	·015	·015	·016	·016	·016	·016	·016	·016	·017	·017	·017	·017	·017	·017

Traverse Table.

SHOWING DIFFERENCE OF LONGITUDE AND CORRESPONDING DEPARTURE.

Lat.	DIFFERENCE OF LONGITUDE.															
	1·00	1·01	1·02	1·03	1·04	1·05	1·06	1·07	1·08	1·09	1·10	1·11	1·12	1·13	1·14	1·15
65°	·423	·427	·431	·435	·440	·444	·448	·452	·456	·461	·465	·469	·473	·478	·482	·486
66	·407	·411	·415	·419	·423	·427	·431	·435	·439	·443	·447	·451	·456	·460	·464	·468
67	·391	·395	·399	·402	·406	·410	·414	·418	·422	·426	·430	·434	·438	·442	·445	·449
68	·375	·378	·382	·386	·390	·393	·397	·401	·405	·408	·412	·416	·420	·423	·427	·431
69	·358	·362	·366	·369	·373	·376	·380	·383	·387	·391	·394	·398	·401	·405	·409	·412
70	·342	·345	·349	·352	·356	·359	·363	·366	·369	·373	·376	·380	·383	·386	·390	·393
71	·326	·329	·332	·335	·339	·342	·345	·348	·352	·355	·358	·361	·365	·368	·371	·374
72	·309	·312	·315	·318	·321	·324	·328	·331	·334	·337	·340	·343	·346	·349	·352	·355
73	·292	·295	·298	·301	·304	·307	·310	·313	·316	·319	·322	·325	·327	·330	·333	·336
74	·276	·278	·281	·284	·287	·289	·292	·295	·298	·300	·303	·306	·309	·311	·314	·317
75	·259	·261	·264	·267	·269	·272	·274	·277	·280	·282	·285	·287	·290	·292	·295	·298
76	·242	·244	·247	·249	·252	·254	·256	·259	·261	·264	·266	·269	·271	·273	·276	·278
77	·225	·227	·229	·232	·234	·236	·238	·241	·243	·245	·247	·250	·252	·254	·256	·259
78	·208	·210	·212	·214	·216	·218	·220	·222	·225	·227	·229	·231	·233	·235	·237	·239
79	·191	·193	·195	·197	·198	·200	·202	·204	·206	·208	·210	·212	·214	·216	·218	·219
80	·174	·175	·177	·179	·181	·182	·184	·186	·188	·189	·191	·193	·194	·196	·198	·200
81	·156	·158	·160	·161	·163	·164	·166	·167	·169	·171	·172	·174	·175	·177	·178	·180
82	·139	·141	·142	·143	·145	·146	·148	·149	·150	·152	·153	·154	·156	·157	·159	·160
83	·122	·123	·124	·126	·127	·128	·129	·130	·132	·133	·134	·135	·136	·138	·139	·140
84	·105	·106	·107	·108	·109	·110	·111	·112	·113	·114	·115	·116	·117	·118	·119	·120
85	·087	·088	·089	·090	·091	·092	·092	·093	·094	·095	·096	·097	·098	·098	·099	·100
86	·070	·070	·071	·072	·073	·073	·074	·075	·075	·076	·077	·077	·078	·079	·080	·080
87	·052	·053	·053	·054	·054	·055	·055	·056	·057	·057	·058	·058	·059	·059	·060	·060
88	·035	·035	·036	·036	·036	·037	·037	·037	·038	·038	·038	·039	·039	·039	·040	·040
89	·017	·018	·018	·018	·018	·018	·018	·019	·019	·019	·019	·019	·020	·020	·020	·020

Lat.	DIFFERENCE OF LONGITUDE.															
	1·15	1·16	1·17	1·18	1·19	1·20	1·21	1·22	1·23	1·24	1·25	1·26	1·27	1·28	1·29	1·30
65°	·486	·490	·494	·499	·503	·507	·511	·516	·520	·524	·528	·532	·537	·541	·545	·549
66	·468	·472	·476	·480	·484	·488	·492	·496	·500	·504	·508	·512	·517	·521	·525	·529
67	·449	·453	·457	·461	·465	·469	·473	·477	·481	·485	·488	·492	·496	·500	·504	·508
68	·431	·435	·438	·442	·446	·450	·453	·457	·461	·465	·468	·472	·476	·479	·483	·487
69	·412	·416	·419	·423	·426	·430	·434	·437	·441	·444	·448	·452	·455	·459	·462	·466
70	·393	·397	·400	·404	·407	·410	·414	·417	·421	·424	·428	·431	·434	·438	·441	·445
71	·374	·378	·381	·384	·387	·391	·394	·397	·400	·404	·407	·410	·413	·417	·420	·423
72	·355	·358	·362	·365	·368	·371	·374	·377	·380	·383	·386	·389	·392	·396	·399	·402
73	·336	·339	·342	·345	·348	·351	·354	·357	·360	·363	·365	·368	·371	·374	·377	·380
74	·317	·320	·322	·325	·328	·331	·334	·336	·339	·342	·345	·347	·350	·353	·356	·358
75	·298	·300	·303	·305	·308	·311	·313	·316	·318	·321	·324	·326	·329	·331	·334	·336
76	·278	·281	·283	·285	·288	·290	·293	·295	·298	·300	·302	·305	·307	·310	·312	·314
77	·259	·261	·263	·265	·268	·270	·272	·274	·277	·279	·281	·283	·286	·288	·290	·292
78	·239	·241	·243	·245	·247	·249	·252	·254	·256	·258	·260	·262	·264	·266	·268	·270
79	·219	·221	·223	·225	·227	·229	·231	·233	·235	·237	·239	·240	·242	·244	·246	·248
80	·200	·201	·203	·205	·207	·208	·210	·212	·214	·215	·217	·219	·221	·222	·224	·226
81	·180	·181	·183	·185	·186	·188	·189	·191	·192	·194	·196	·197	·199	·200	·202	·203
82	·160	·161	·163	·164	·166	·167	·168	·170	·171	·173	·174	·175	·177	·178	·180	·181
83	·140	·141	·143	·144	·145	·146	·147	·149	·150	·151	·152	·154	·155	·156	·157	·158
84	·120	·121	·122	·123	·124	·125	·126	·128	·129	·130	·131	·132	·133	·134	·135	·136
85	·100	·101	·102	·103	·104	·105	·105	·106	·107	·108	·109	·110	·111	·112	·112	·113
86	·080	·081	·082	·082	·083	·084	·084	·085	·086	·086	·087	·088	·089	·089	·090	·091
87	·060	·061	·061	·062	·062	·063	·063	·064	·064	·065	·065	·066	·066	·067	·068	·068
88	·040	·040	·041	·041	·042	·042	·042	·043	·043	·043	·044	·044	·044	·045	·045	·045
89	·020	·020	·020	·021	·021	·021	·021	·021	·021	·022	·022	·022	·022	·022	·022	·023

Table C¹.

Azimuth Corresponding to A and B Correction in Departure.

A & B	Az.	A & B	Az.	A & B	Az.	A & B	Az.	A & B	Az.	A & B	Az.	A & B	Az.
′	°	′	°	′	°	′	°	′	°	′	°	′	°
·000	90·0	·112	83·6	·227	77·2	·348	70·8	·479	64·4	·627	57·9	·798	51·4
·002	89·9	·114	·5	·229	·1	·350	·7	·481	·3	·630	·8	·801	·3
·003	·8	·116	·4	·231	77·0	·352	·6	·483	·2	·632	·7	·804	·2
·005	·7	·117	·3	·233	76·9	·354	70·5	·486	·1	·635	·6	·807	·1
·007	·6	·119	·2	·235	·8	·356	·4	·488	64·0	·637	57·5	·810	51·0
·009	89·5	·121	·1	·236	·7	·358	·3	·490	63·9	·640	·4	·813	50·9
·010	·4	·123	83·0	·238	·6	·360	·2	·492	·8	·642	·3	·816	·8
·012	·3	·125	82·9	·240	76·5	·362	·1	·494	·7	·644	·2	·818	·7
·014	·2	·126	·8	·242	·4	·364	70·0	·496	·6	·647	·1	·821	·6
·016	·1	·128	·7	·244	·3	·366	69·9	·499	63·5	·649	57·0	·824	50·5
·017	89·0	·130	·6	·246	·2	·368	·8	·501	·4	·652	56·9	·827	·4
·019	88·9	·132	82·5	·248	·1	·370	·7	·503	·3	·654	·8	·830	·3
·021	·8	·133	·4	·249	76·0	·372	·6	·505	·2	·657	·7	·833	·2
·023	·7	·135	·3	·251	75·9	·374	69·5	·507	·1	·659	·6	·836	50·1
·024	·6	·137	·2	·253	·8	·376	·4	·510	63·0	·662	56·5	·839	50·0
·026	88·5	·139	·1	·255	·7	·378	·3	·512	62·9	·664	·4	·842	49·9
·028	·4	·141	82·0	·257	·6	·380	·2	·514	·8	·667	·3	·845	·8
·030	·3	·142	81·9	·259	75·5	·382	·1	·516	·7	·669	·2	·848	·7
·031	·2	·144	·8	·261	·4	·384	69·0	·518	·6	·672	·1	·851	·6
·033	·1	·146	·7	·262	·3	·386	68·9	·521	62·5	·674	56·0	·854	49·5
·035	88·0	·148	·6	·264	·2	·388	·8	·523	·4	·677	55·9	·857	·4
·037	87·9	·149	81·5	·266	·1	·390	·7	·525	·3	·680	·8	·860	·3
·038	·8	·151	·4	·268	75·0	·392	·6	·527	·2	·682	·7	·863	·2
·040	·7	·153	·3	·270	74·9	·394	68·5	·530	·1	·685	·6	·866	·1
·042	·6	·155	·2	·272	·8	·396	·4	·532	62·0	·687	55·5	·869	49·0
·044	87·5	·156	·1	·274	·7	·398	·3	·534	61·9	·690	·4	·872	48·9
·045	·4	·158	81·0	·275	·6	·400	·2	·536	·8	·692	·3	·875	·8
·047	·3	·160	80·9	·277	74·5	·402	·1	·538	·7	·695	·2	·878	·7
·049	·2	·162	·8	·279	·4	·404	68·0	·541	·6	·698	·1	·882	·6
·051	·1	·164	·7	·281	·3	·406	67·9	·543	61·5	·700	55·0	·885	48·5
·052	87·0	166	·6	·283	·2	·408	·8	·545	·4	·703	54·9	·888	·4
·054	86·9	·167	80·5	·285	·1	·410	·7	·547	·3	·705	·8	·891	·3
·056	·8	·169	·4	·287	74·0	·412	·6	·550	·2	·708	·7	·894	·2
·058	·7	·171	·3	·289	73·9	·414	67·5	·552	·1	·711	·6	·897	·1
·059	·6	·173	·2	·290	·8	·416	·4	·554	61·0	·713	54·5	·900	48·0
·061	86·5	·175	·1	·292	·7	·418	·3	·557	60·9	·716	·4	·904	47·9
·063	·4	·176	80·0	·294	·6	·420	·2	·559	·8	·719	·3	·907	·8
·065	·3	·178	79·9	·296	73·5	·422	·1	·561	·7	·721	·2	·910	·7
·066	·2	·180	·8	·298	·4	·424	67·0	·563	·6	·724	·1	·913	·6
·068	·1	·182	·7	·300	·3	·427	66·9	·566	60·5	·727	54·0	·916	47·5
·070	86·0	·184	·6	·302	·2	·429	·8	·568	·4	·729	53·9	·919	·4
·072	85·9	·185	79·5	·304	·1	·431	·7	·570	·3	·732	·8	·923	·3
·073	·8	·187	·4	·306	73·0	·433	·6	·573	·2	·735	·7	·926	·2
·075	·7	·189	·3	·308	72·9	·435	66·5	·575	·1	·737	·6	·929	·1
·077	·6	·191	·2	·310	·8	·437	·4	·577	60·0	·740	53·5	·932	47·0
·079	85·5	·193	·1	·311	·7	·439	·3	·580	59·9	·743	·4	·936	46·9
·080	·4	·194	79·0	·313	·6	·441	·2	·582	·8	·745	·3	·939	·8
·082	·3	·196	78·9	·315	72·5	·443	·1	·584	·7	·748	·2	·942	·7
·084	·2	·198	·8	·317	·4	·445	66·0	·587	·6	·751	·1	·946	·6
·086	·1	·200	·7	·319	·3	·447	65·9	·589	59·5	·754	53·0	·949	46·5
·087	85·0	·202	·6	·321	·2	·449	·8	·591	·4	·756	52·9	·952	·4
·089	84·9	·203	·5	·323	·1	·452	·7	·594	·3	·759	·8	·956	·3
·091	·8	·205	·4	·325	72·0	·454	·6	·596	·2	·762	·7	·959	·2
·093	·7	·207	·3	·327	71·9	·456	65·5	·598	·1	·765	·6	·962	·1
·095	·6	·209	·2	·329	·8	·458	·4	·601	59·0	·767	52·5	·966	46·0
·096	84·5	·211	·1	·331	·7	·460	·3	·603	58·9	·770	·4	·969	45·9
·098	·4	·213	78·0	·333	·6	·462	·2	·606	·8	·773	·3	·972	·8
·100	·3	·214	77·9	·335	71·5	·464	·1	·608	·7	·776	·2	·976	·7
·102	·2	·216	·8	·336	·4	·466	65·0	·610	·6	·778	·1	·979	·6
·103	·1	·218	·7	·338	·3	·468	64·9	·613	58·5	·781	52·0	·983	45·5
·105	84·0	·220	·6	·340	·2	·471	·8	·615	·4	·784	51·9	·986	·4
·107	83·9	·222	77·5	·342	·1	·473	·7	·618	·3	·787	·8	·990	·3
·109	·8	·224	·4	·344	71·0	·475	·6	·620	·2	·790	·7	·993	·2
·110	·7	·225	·3	·346	70·9	·477	64·5	·622	·1	·793	·6	·996	·1
·112	·6	·227	·2	·348	·8	·479	·4	·625	58·0	·795	51·5	1·000	45·0

Table C′.

AZIMUTH CORRESPONDING TO A AND B CORRECTION IN DEPARTURE.

A & B	Az.		A & B	Az.		A & B	Az.		A & B	Az.		A & B	Az.		A & B	Az.		A & B	Az.	
′	°	′	′	°	′	′	°	′	′	°	′	′	°	′	′	°	′	′	°	′
1·000	45	0	1·038	43	55	1·078	42	51	1·119	41	47	1·162	40	43	1·207	39	39	1·253	38	35
1·001	44	59	1·039		54	1·079	42	50	1·120		46	1·163		42	1·207		38	1·254		34
1·001		58	1·040		53	1·079		49	1·120	41	45	1·163		41	1·208		37	1·255		33
1·002		57	1·040		52	1·080		48	1·121		44	1·164	40	40	1·209		36	1·256		32
1·002		56	1·041		51	1·080		47	1·122		43	1·165		39	1·209	39	35	1·256		31
1·003	44	55	1·042	43	50	1·081		46	1·122		42	1·165		38	1·210		34	1·257	38	30
1·003		54	1·042		49	1·082	42	45	1·123		41	1·166		37	1·211		33	1·258		29
1·004		53	1·043		48	1·082		44	1·124	41	40	1·167		36	1·212		32	1·259		28
1·005		52	1·043		47	1·083		43	1·124		39	1·167	40	35	1·212		31	1·259		27
1·005		51	1·044		46	1·084		42	1·125		38	1·168		34	1·213	39	30	1·260		26
1·006	44	50	1·045	43	45	1·084		41	1·126		37	1·169		33	1·214		29	1·261	38	25
1·006		49	1·045		44	1·085	42	40	1·126		36	1·169		32	1·214		28	1·262		24
1·007		48	1·046		43	1·086		39	1·127	41	35	1·170		31	1·215		27	1·262		23
1·008		47	1·046		42	1·086		38	1·128		34	1·171	40	30	1·216		26	1·263		22
1·008		46	1·047		41	1 087		37	1·128		33	1·171		29	1·217	39	25	1·264		21
1·009	44	45	1·048	43	40	1·087		36	1·129		32	1·172		28	1·217		24	1·265	38	20
1·009		44	1·048		39	1·088	42	35	1·130		31	1·173		27	1·218		23	1·265		19
1·010		43	1·049		38	1·089		34	1·130	41	30	1·174		26	1·219		22	1·266		18
1·010		42	1·049		37	1·089		33	1·131		29	1·174	40	25	1·220		21	1·267		17
1·011		41	1·050		36	1·090		32	1·132		28	1·175		24	1·220	39	20	1·268		16
1·012	44	40	1·051	43	35	1·091		31	1·132		27	1·176		23	1·221		19	1·268	38	15
1·012		39	1·051		34	1·091	42	30	1·133		26	1·176		22	1·222		18	1·269		14
1·013		38	1·052		33	1·092		29	1·134	41	25	1·177		21	1·222		17	1·270		13
1·013		37	1·053		32	1·093		28	1·134		24	1·178	40	20	1·223		16	1·271		12
1·014		36	1·053		31	1·093		27	1·135		23	1·178		19	1·224	39	15	1·271		11
1·015	44	35	1·054	43	30	1·094		26	1·136		22	1·179		18	1·225		14	1·272	38	10
1·015		34	1·054		29	1·094	42	25	1·136		21	1·180		17	1·226		13	1·273		9
1·016		33	1·055		28	1·095		24	1·137	41	20	1·181		16	1·226		12	1·274		8
1·016		32	1·056		27	1·096		23	1·137		19	1·181	40	15	1·227		11	1·275		7
1·017		31	1·056		26	1·096		22	1·138		18	1·182		14	1·228	39	10	1·275		6
1·018	44	30	1·057	43	25	1·097		21	1·139		17	1·183		13	1·228		9	1·276	38	5
1·018		29	1·057		24	1·098	42	20	1·140		16	1·183		12	1·229		8	1·277		4
1·019		28	1·058		23	1·098		19	1·140	41	15	1·184		11	1·230		7	1·278		3
1·019		27	1·059		22	1·099		18	1·141		14	1·185	40	10	1·230		6	1·278		2
1·020		26	1·059		21	1·100		17	1·142		13	1·185		9	1·231	39	5	1·279		1
1·021	44	25	1·060	43	20	1·100		16	1·142		12	1·186		8	1·232		4	1·280	38	0
1·021		24	1·061		19	1·101	42	15	1·143		11	1·187		7	1·233		3	1·281	37	59
1·022		23	1·061		18	1·102		14	1·144	41	10	1·187		6	2·233		2	1·281		58
1·022		22	1·062		17	1·102		13	1·144		9	1·188	40	5	1·234		1	1·282		57
1·023		21	1·062		16	1·103		12	1·145		8	1·189		4	1·235	39	0	1·283		56
1·023	44	20	1·063	43	15	1·103		11	1·146		7	1·190		3	1·236	38	59	1·284	37	55
1·024		19	1·064		14	1·104	42	10	1·146		6	1·190		2	1·236		58	1·285		54
1·025		18	1·064		13	1·105		9	1·147	41	5	1·191		1	1·237		57	1·285		53
1·025		17	1·065		12	1·105		8	1·148		4	1·192	40	0	1·238		56	1·286		52
1·026		16	1·065		11	1·106		7	1·148		3	1·192	39	59	1·239	38	55	1·287		51
1·026	44	15	1 066	43	10	1·107		6	1·149		2	1·193		58	1·239		54	1·288	37	50
1·027		14	1·067		9	1·107	42	5	1·150		1	1·194		57	1·240		53	1·288		49
1·028		13	1·067		8	1·108		4	1·150	41	0	1·195		56	1·241		52	1·289		48
1·028		12	1·068		7	1·109		3	1·151	40	59	1·195	39	55	1·241		51	1·290		47
1·029		11	1·069		6	1·109		2	1·152		58	1·196		54	1·242	38	50	1·291		46
1·029	44	10	1·069	43	5	1·110		1	1·152		57	1·197		53	1·243		49	1·291	37	45
1·030		9	1·070		4	1·111	42	0	1·153		56	1·197		52	1·244		48	1·292		44
1·031		8	1·070		3	1·111	41	59	1·154	40	55	1·198		51	1·244		47	1·293		43
1·031		7	1·071		2	1·112		58	1·154		54	1·199	39	50	1·245		46	1·294		42
1·032		6	1·072		1	1·113		57	1·155		53	1·199		49	1·246	38	45	1·295		41
1·032	44	5	1·072	43	0	1·113		56	1·156		52	1·200		48	1·247		44	1·295	37	40
1·033		4	1·073	42	59	1·114	41	55	1·156		51	1·201		47	1·247		43	1·296		39
1·034		3	1·074		58	1·114		54	1·157	40	50	1·202		46	1·248		42	1·297		38
1·034		2	1·074		57	1·115		53	1·158		49	1·202	39	45	1·249		41	1·298		37
1·035		1	1·075		56	1·116		52	1·158		48	1·203		44	1·250	38	40	1·298		36
1·035	44	0	1·075	42	55	1·116		51	1·159		47	1·204		43	1·250		39	1·299	37	35
1·036	43	59	1·076		54	1·117	41	50	1·160		46	1·204		42	1·251		38	1·300		34
1·037		58	1·077		53	1·118		49	1·161	40	45	1·205		41	1·252		37	1·301		33
1·037		57	1·077		52	1·118		48	1·161		44	1·206	39	40	1·253		36	1·302		32
1·038		56	1·078		51	1·119		47	1·162		43	1·207		39	1·253	38	35	1·302		31

Table C[1].

AZIMUTH CORRESPONDING TO A AND B CORRECTION IN DEPARTURE.

A & B	Az.	A & B	Az.	A & B	Az.	A & B	Az.	A & B	Az.	A & B	Az.	A & B	Az.
′	° ′	′	° ′	′	° ′	′	° ′	′	° ′	′	° ′	′	° ′
1·303	37 30	1·355	36 25	1·410	35 21	1·467	34 17	1·527	33 13	1·591	32 9	1·659	31 5
1·304	29	1·356	24	1·411	35 20	1·468	16	1·528	16	1·592	8	1·660	4
1·305	28	1·357	23	1·411	19	1·469	34 15	1·529	11	1·593	7	1·661	3
1·306	27	1·358	22	1·412	18	1·470	14	1·530	33 10	1·594	6	1·662	2
1·306	26	1·359	21	1·413	17	1·470	13	1·531	9	1·595	32 5	1·663	1
1·307	37 25	1·360	36 20	1·414	16	1·471	12	1·532	8	1·596	4	1·664	31 0
1·308	24	1·360	19	1·415	35 15	1·472	11	1·533	7	1·597	3	1·665	30 59
1·309	23	1·361	18	1·416	14	1·473	34 10	1·534	6	1·598	2	1·666	58
1·309	22	1·362	17	1·417	13	1·474	9	1·535	33 5	1·599	1	1·668	57
1·310	21	1·363	16	1·418	12	1·475	8	1·536	4	1·600	32 0	1·669	56
1·311	37 20	1·364	36 15	1·418	11	1·476	7	1·537	3	1·601	31 59	1·670	30 55
1·312	19	1·365	14	1·419	35 10	1·477	6	1·538	2	1·602	58	1·671	54
1·313	18	1·365	13	1·420	9	1·478	34 5	1·539	1	1·603	57	1·672	53
1·313	17	1·366	12	1·421	8	1·479	4	1·540	33 0	1·604	56	1·673	52
1·314	16	1·367	11	1·422	7	1·480	3	1·541	32 59	1·605	31 55	1·674	51
1·315	37 15	1·368	36 10	1·423	6	1·481	2	1·542	58	1·607	54	1·675	30 50
1·316	14	1·369	9	1·424	35 5	1·482	1	1·543	57	1·608	53	1·676	49
1·317	13	1·370	8	1·425	4	1·483	34 0	1·544	56	1·609	52	1·677	48
1·317	12	1·370	7	1·425	3	1·483	33 59	1·545	32 55	1·610	51	1·679	47
1·318	11	1·371	6	1·426	2	1·484	58	1·546	54	1·611	31 50	1·680	46
1·319	37 10	1·372	36 5	1·427	1	1·485	57	1·547	53	1·612	49	1·681	30 45
1·320	9	1·373	4	1·428	35 0	1·486	56	1·548	52	1·613	48	1·682	44
1·321	8	1·374	3	1·429	34 59	1·487	33 55	1·549	51	1·614	47	1·683	43
1·321	7	1·375	2	1·430	58	1·488	54	1·550	32 50	1·615	46	1·684	42
1·322	6	1·375	1	1·431	57	1·489	53	1·551	49	1·616	31 45	1·685	41
1·323	37 5	1·376	36 0	1·432	56	1·490	52	1·552	48	1·617	44	1·686	30 40
1·324	4	1·377	35 59	1·433	34 55	1·491	51	1·553	47	1·618	43	1·687	39
1·325	3	1·378	58	1·433	54	1·492	33 50	1·554	46	1·619	42	1·689	38
1·325	2	1·379	57	1·434	53	1·493	49	1·555	32 45	1·620	41	1·690	37
1·326	1	1·380	56	1·435	52	1·494	48	1·556	44	1·621	31 40	1·691	36
1·327	37 0	1·381	35 55	1·436	51	1·495	47	1·557	43	1·622	39	1·692	30 35
1·328	36 59	1·381	54	1·437	34 50	1·496	46	1·558	42	1·623	38	1·693	34
1·329	58	1·382	53	1·438	49	1·497	33 45	1·559	41	1·624	37	1·694	33
1·329	57	1·383	52	1·439	48	1·498	44	1·560	32 40	1·625	36	1·695	32
1·330	56	1·384	51	1·440	47	1·498	43	1·561	39	1·626	31 35	1·696	31
1·331	36 55	1·385	35 50	1·441	46	1·499	42	1·562	38	1·628	34	1·698	30 30
1·332	54	1·386	49	1·441	34 45	1·500	41	1·563	37	1·629	33	1·699	29
1·333	53	1·386	48	1·442	44	1·501	33 40	1·564	36	1·630	32	1·700	28
1·333	52	1·387	47	1·443	43	1·502	39	1·565	32 35	1·631	31	1·701	27
1·334	51	1·388	46	1·444	42	1·503	38	1·566	34	1·632	31 30	1·702	26
1·335	36 50	1·389	35 45	1·445	41	1·504	37	1·567	33	1·633	29	1·703	30 25
1·336	49	1·390	44	1·446	34 40	1·505	36	1·568	32	1·634	28	1·704	24
1·337	48	1·391	43	1·447	39	1·506	33 35	1·569	31	1·635	27	1·706	23
1·337	47	1·392	42	1·448	38	1·507	34	1·570	32 30	1·636	26	1·707	22
1·338	46	1·392	41	1·449	37	1·508	33	1·571	29	1·637	31 25	1·708	21
1·339	36 45	1·393	35 40	1·450	36	1·509	32	1·572	28	1·638	24	1·709	30 20
1·340	44	1·394	39	1·450	34 35	1·510	31	1·573	27	1·639	23	1·710	19
1·341	43	1·395	38	1·451	34	1·511	33 30	1·574	26	1·640	22	1·711	18
1·342	42	1·396	37	1·452	33	1·512	29	1·575	32 25	1·641	21	1·712	17
1·342	41	1·397	36	1·453	32	1·513	28	1·576	24	1·643	31 20	1·714	16
1·343	36 40	1·398	35 35	1·454	31	1·514	27	1·577	23	1·644	19	1·715	30 15
1·344	39	1·398	34	1·455	34 30	1·515	26	1·578	22	1·645	18	1·716	14
1·345	38	1·399	33	1·456	29	1·516	33 25	1·579	21	1·646	17	1·717	13
1·346	37	1·400	32	1·457	28	1·517	24	1·580	32 20	1·647	16	1·718	12
1·346	36	1·401	31	1·458	27	1·517	23	1·581	19	1·648	31 15	1·719	11
1·347	36 35	1·402	35 30	1·459	26	1·518	22	1·582	18	1·649	14	1·720	30 10
1·348	34	1·403	29	1·460	34 25	1·519	21	1·583	17	1·650	13	1·722	9
1·349	33	1·404	28	1·460	24	1·520	33 20	1·584	16	1·651	12	1·723	8
1·350	32	1·404	27	1·461	23	1·521	19	1·585	32 15	1·652	11	1·724	7
1·351	31	1·405	26	1·462	22	1·522	18	1·586	14	1·653	31 10	1·725	6
1·351	36 30	1·406	35 25	1·463	21	1·523	17	1·587	13	1·654	9	1·726	30 5
1·352	29	1·407	24	1·464	34 20	1·524	16	1·588	12	1·655	8	1·727	4
1·353	28	1·408	23	1·465	19	1·525	33 15	1·589	11	1·657	7	1·729	3
1·354	27	1·409	22	1·466	18	1·526	14	1·590	32 10	1·658	6	1·730	2
1·355	26	1·410	21	1·467	17	1·527	13	1·591	9	1·659	31 5	1·731	1

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A & B	Az.		A & B	Az.		A & B	Az.		A & B	Az.		A & B	Az.		A & B	Az.		A & B	Az.	
′	°	′	′	°	′	′	°	′	′	°	′	′	°	′	′	°	′	′	°	′
1·732	30	0	1·810	28	55	1·893	27	51	1·981	26	47	2·076	25	43	2·179	24	39	2·291	23	35
1·733	29	59	1·811		54	1·894	27	50	1·982		46	2·078		42	2·181		38	2·293		34
1·734		58	1·813		53	1·895		49	1·984	26	45	2·079		41	2·182		37	2·294		33
1·736		57	1·814		52	1·897		48	1·985		44	2·081	25	40	2·184		36	2·296		32
1·737		56	1·815		51	1·898		47	1·987		43	2·082		39	2·186	24	35	2·298		31
1·738	29	55	1·816	28	50	1·899		46	1·988		42	2·084		38	2·188		34	2·300	23	30
1·739		54	1·818		49	1·901	27	45	1·990		41	2·086		37	2·189		33	2·302		29
1·740		53	1·819		48	1·902		44	1·991	26	40	2·087		36	2·191		32	2·303		28
1·741		52	1·820		47	1·903		43	1·993		39	2·089	25	35	2·193		31	2·305		27
1·743		51	1·821		46	1·905		42	1·994		38	2·090		34	2·194	24	30	2·307		26
1·744	29	50	1·823	28	45	1·906		41	1·995		37	2·092		33	2·196		29	2·309	23	25
1·745		49	1·824		44	1·907	27	40	1·997		36	2·093		32	2·198		28	2·311		24
1·746		48	1·825		43	1·909		39	1·998	26	35	2·095		31	2·199		27	2·313		23
1·747		47	1·826		42	1·910		38	2·000		34	2·096	25	30	2·201		26	2·315		22
1·748		46	1·828		41	1·911		37	2·001		33	2·098		29	2·203	24	25	2·316		21
1·750	29	45	1·829	28	40	1·913		36	2·003		32	2·100		28	2·204		24	2·318	23	20
1·751		44	1·830		39	1·914	27	35	2·004		31	2·101		27	2·206		23	2·320		19
1·752		43	1·832		38	1·915		34	2·006	26	30	2·103		26	2·208		22	2·322		18
1·753		42	1·833		37	1·917		33	2·007		29	2·104	25	25	2·210		21	2·324		17
1·754		41	1·834		36	1·918		32	2·009		28	2·106		24	2·211	24	20	2·326		16
1·756	29	40	1·835	28	35	1·920		31	2·010		27	2·108		23	2·213		19	2·328	23	15
1·757		39	1·837		34	1·921	27	30	2·011		26	2·109		22	2·215		18	2·329		14
1·758		38	1·838		33	1·922		29	2·013	26	25	2·111		21	2·216		17	2·331		13
1·759		37	1·839		32	1·924		28	2·014		24	2·112	25	20	2·218		16	2·333		12
1·760		36	1·840		31	1·925		27	2·016		23	2·114		19	2·220	24	15	2·335		11
1·761	29	35	1·842	28	30	1·926		26	2·017		22	2·115		18	2·222		14	2·337	23	10
1·763		34	1·843		29	1·928	27	25	2·019		21	2·117		17	2·223		13	2·339		9
1·764		33	1·844		28	1·929		24	2·020	26	20	2·119		16	2·225		12	2·341		8
1·765		32	1·846		27	1·931		23	2·022		19	2·120	25	15	2·227		11	2·343		7
1·766		31	1·847		26	1·932		22	2·023		18	2·122		14	2·229	24	10	2·344		6
1·767	29	30	1·848	28	25	1·933		21	2·025		17	2·123		13	2·230		9	2·346	23	5
1·769		29	1·849		24	1·935	27	20	2·026		16	2·125		12	2·232		8	2·348		4
1·770		28	1·851		23	1·936		19	2·028	26	15	2·127		11	2·234		7	2·350		3
1·771		27	1·852		22	1·937		18	2·029		14	2·128	25	10	2·235		6	2·352		2
1·772		26	1·853		21	1·939		17	2·031		13	2·130		9	2·237	24	5	2·354		1
1·773	29	25	1·855	28	20	1·940		16	2·032		12	2·131		8	2·239		4	2·356	23	0
1·775		24	1·856		19	1·942	27	15	2·034		11	2·133		7	2·241		3	2·358	22	59
1·776		23	1·857		18	1·943		14	2·035	26	10	2·135		6	2·242		2	2·360		58
1·777		22	1·858		17	1·944		13	2·037		9	2·136	25	5	2·244		1	2·362		57
1·778		21	1·860		16	1·946		12	2·038		8	2·138		4	2·246	24	0	2·363		56
1·780	29	20	1·861	28	15	1·947		11	2·040		7	2·140		3	2·248	23	59	2·365	22	55
1·781		19	1·862		14	1·949	27	10	2·041		6	2·141		2	2·250		58	2·367		54
1·782		18	1·864		13	1·950		9	2·043	26	5	2·143		1	2·251		57	2·369		53
1·783		17	1·865		12	1·951		8	2·044		4	2·144	25	0	2·253		56	2·371		52
1·784		16	1·866		11	1·953		7	2·046		3	2·146	24	59	2·255	23	55	2·373		51
1·786	29	15	1·868	28	10	1·954		6	2·047		2	2·148		58	2·257		54	2·375	22	50
1·787		14	1·869		9	1·956	27	5	2·049		1	2·149		57	2·258		53	2·377		49
1·788		13	1·870		8	1·957		4	2·050	26	0	2·151		56	2·260		52	2·379		48
1·789		12	1·871		7	1·958		3	2·052	25	59	2·153	24	55	2·262		51	2·381		47
1·790		11	1·873		6	1·960		2	2·053		58	2·154		54	2·264	23	50	2·383		46
1·792	29	10	1·874	28	5	1·961		1	2·055		57	2·156		53	2·265		49	2·385	22	45
1·793		9	1·875		4	1·963	27	0	2·056		56	2·158		52	2·267		48	2·387		44
1·794		8	1·877		3	1·964	26	59	2·058	25	55	2·159		51	2·269		47	2·389		43
1·795		7	1·878		2	1·965		58	2·059		54	2·161	24	50	2·271		46	2·391		42
1·797		6	1·879		1	1·967		57	2·061		53	2·163		49	2·273	23	45	2·392		41
1·798	29	5	1·881	28	0	1·968		56	2·062		52	2·164		48	2·274		44	2·394	22	40
1·799		4	1·882	27	59	1·970	26	55	2·064		51	2·166		47	2·276		43	2·396		39
1·800		3	1·883		58	1·971		54	2·065	25	50	2·167		46	2·278		42	2·398		38
1·802		2	1·885		57	1·972		53	2·067		49	2·169	24	45	2·280		41	2·400		37
1·803		1	1·886		56	1·974		52	2·069		48	2·171		44	2·282	23	40	2·402		36
1·804	29	0	1·887	27	55	1·975		51	2·070		47	2·172		43	2·283		39	2·404	22	35
1·805	28	59	1·889		54	1·977	26	50	2·072		46	2·174		42	2·285		38	2·406		34
1·806		58	1·890		53	1·978		49	2·073	25	45	2·176		41	2·287		37	2·408		33
1·808		57	1·891		52	1·980		48	2·075		44	2·177	24	40	2·290		36	2·410		32
1·809		56	1·893		51	1·981		47	2·076		43	2·179		39	2·291	23	35	2·412		31

Table C¹.

Azimuth Corresponding to A and B Correction in Departure.

A & B	Az.		A & B	Az.		A & B	Az.		A & B	Az.		A & B	Az.		A & B	Az.		A & B	Az.	
′	°	′	′	°	′	′	°	′	′	°	′	′	°	′	′	°	′	′	°	′
2·414	22	30	2·549	21	25	2·696	20	21	2·858	19	17	3·038	18	13	3·240	17	9	3·468	16	5
2·416		29	2·552		24	2·699	20	20	2·861		16	3·041		12	3·244		8	3·472		4
2·418		28	2·554		23	2·701		19	2·864	19	15	3·044		11	3·247		7	3·476		3
2·420		27	2·556		22	2·703		18	2·866		14	3·047	18	10	3·251		6	3·480		2
2·422		26	2·558		21	2·706		17	2·869		13	3·050		9	3·254	17	5	3·484		1
2·424	22	25	2·560	21	20	2·708		16	2·872		12	3·053		8	3·257		4	3·487	16	0
2·426		24	2·563		19	2·711	20	15	2·874		11	3·056		7	3·261		3	3·491	15	59
2·428		23	2·565		18	2·713		14	2·877	19	10	3·059		6	3·264		2	3·495		58
2·430		22	2·567		17	2·715		13	2·880		9	3·062	18	5	3·267		1	3·499		57
2·432		21	2·569		16	2·718		12	2·882		8	3·066		4	3·271	17	0	3·503		56
2·434	22	20	2·571	21	15	2·720		11	2·885		7	3·069		3	3·274	16	59	3·507	15	55
2·436		19	2·574		14	2·723	20	10	2·888		6	3·072		2	3·278		58	3·510		54
2·438		18	2·576		13	2·725		9	2·891	19	5	3·075		1	3·281		57	3·514		53
2·440		17	2·578		12	2·728		8	2·893		4	3·078	18	0	3·284		56	3·518		52
2·442		16	2·580		11	2·730		7	2·896		3	3·081	17	59	3·288	16	55	3·522		51
2·444	22	15	2·583	21	10	2·733		6	2·899		2	3·084		58	3·291		54	3·526	15	50
2·446		14	2·585		9	2·735	20	5	2·901		1	3·087		57	3·295		53	3·530		49
2·448		13	2·587		8	2·737		4	2·904	19	0	3·090		56	3·298		52	3·534		48
2·450		12	2·589		7	2·740		3	2·907	18	59	3·093	17	55	3·302		51	3·538		47
2·452		11	2·592		6	2·742		2	2·910		58	3·096		54	3·305	16	50	3·542		46
2·454	22	10	2·594	21	5	2·745		1	2·912		57	3·099		53	3·309		49	3·546	15	45
2·457		9	2·596		4	2·747	20	0	2·915		56	3·102		52	3·312		48	3·550		44
2·459		8	2·598		3	2·750	19	59	2·918	18	55	3·105		51	3·316		47	3·554		43
2·461		7	2·601		2	2·752		58	2·921		54	3·108	17	50	3·319		46	3·558		42
2·463		6	2·603		1	2·755		57	2·923		53	3·111		49	3·323	16	45	3·562		41
2·465	22	5	2·605	21	0	2·757		56	2·926		52	3·115		48	3·326		44	3·566	15	40
2·467		4	2·607	20	59	2·760	19	55	2·929		51	3·118		47	3·330		43	3·570		39
2·469		3	2·610		58	2·762		54	2·932	18	50	3·121		46	3·333		42	3·574		38
2·471		2	2·612		57	2·765		53	2·935		49	3·124	17	45	3·337		41	3·578		37
2·473		1	2·614		56	2·767		52	2·937		48	3·127		44	3·340	16	40	3·582		36
2·475	22	0	2·616	20	55	2·770		51	2·940		47	3·130		43	3·344		39	3·586	15	35
2·477	21	59	2·619		54	2·773	19	50	2·943		46	3·133		42	3·347		38	3·590		34
2·479		58	2·621		53	2·775		49	2·946	18	45	3·136		41	3·351		37	3·594		33
2·481		57	2·623		52	2·778		48	2·949		44	3·140	17	40	3·354		36	3·598		32
2·483		56	2·626		51	2·780		47	2·951		43	3·143		39	3·358	16	35	3·602		31
2·485	21	55	2·628	20	50	2·783		46	2·954		42	3·146		38	3·362		34	3·606	15	30
2·488		54	2·630		49	2·785	19	45	2·957		41	3·149		37	3·365		33	3·610		29
2·490		53	2·632		48	2·788		44	2·960	18	40	3·152		36	3·369		32	3·614		28
2·492		52	2·635		47	2·790		43	2·963		39	3·156	17	35	3·372		31	3·618		27
2·494		51	2·637		46	2·793		42	2·966		38	3·159		34	3·376	16	30	3·622		26
2·496	21	50	2·639	20	45	2·795		41	2·969		37	3·162		33	3·379		29	3·626	15	25
2·498		49	2·642		44	2·798	19	40	2·971		36	3·165		32	3·383		28	3·630		24
2·500		48	2·644		43	2·801		39	2·974	18	35	3·168		31	3·387		27	3·635		23
2·502		47	2·646		42	2·803		38	2·977		34	3·172	17	30	3·390		26	3·639		22
2·504		46	2·649		41	2·806		37	2·980		33	3·175		29	3·394	16	25	3·643		21
2·507	21	45	2·651	20	40	2·808		36	2·983		32	3·178		28	3·398		24	3·647	15	20
2·509		44	2·653		39	2·811	19	35	2·986		31	3·181		27	3·401		23	3·651		19
2·511		43	2·656		38	2·813		34	2·989	18	30	3·184		26	3·405		22	3·655		18
2·513		42	2·658		37	2·816		33	2·992		29	3·188	17	25	3·409		21	3·660		17
2·515		41	2·660		36	2·819		32	2·994		28	3·191		24	3·412	16	20	3·664		16
2·517	21	40	2·663	20	35	2·821		31	2·997		27	3·194		23	3·416		19	3·668	15	15
2·519		39	2·665		34	2·824	19	30	3·000		26	3·197		22	3·420		18	3·672		14
2·521		38	2·667		33	2·826		29	3·003	18	25	3·201		21	3·423		17	3·676		13
2·523		37	2·670		32	2·829		28	3·006		24	3·204	17	20	3·427		16	3·681		12
2·526		36	2·672		31	2·832		27	3·009		23	3·207		19	3·431	16	15	3·685		11
2·528	21	35	2·675	20	30	2·834		26	3·012		22	3·211		18	3·434		14	3·689	15	10
2·530		34	2·677		29	2·837	19	25	3·015		21	3·214		17	3·438		13	3·693		9
2·532		33	2·679		28	2·840		24	3·018	18	20	3·217		16	3·442		12	3·698		8
2·534		32	2·682		27	2·842		23	3·021		19	3·220	17	15	3·446		11	3·702		7
2·536		31	2·684		26	2·845		22	3·024		18	3·224		14	3·450	16	10	3·706		6
2·539	21	30	2·686	20	25	2·848		21	3·027		17	3·227		13	3·453		9	3·710	15	5
2·541		29	2·689		24	2·850	19	20	3·030		16	3·230		12	3·457		8	3·715		4
2·543		28	2·691		23	2·853		19	3·033	18	15	3·234		11	3·461		7	3·719		3
2·545		27	2·694		22	2·856		18	3·036		14	3·237	17	10	3·465		6	3·723		2
2·547		26	2·696		21	2·858		17	3·038		13	3·240		9	3·468	16	5	3·728		1

Table C¹.

Azimuth Corresponding to A and B Correction in Departure.

A & B	Az.	A & B	Az.	A & B	Az.	A & B	Az.	A & B	Az.	A & B	Az.	A & B	Az.
′	° ′	′	° ′	′	° ′	′	° ′	′	° ′	′	° ′	′	° ′
3·732	15 0	4·036	13 55	4·384	12 51	4·794	11 47	5·284	10 43	5·881	9 39	6·625	8 35
3·736	14 59	4·041	54	4·390	12 50	4·801	46	5·292	42	5·891	38	6·638	34
3·741	58	4·046	53	4·396	49	4·808	11 45	5·301	41	5·902	37	6·651	33
3·745	57	4·051	52	4·401	48	4·815	44	5·309	10 40	5·912	36	6·665	32
3·749	56	4·056	51	4·407	47	4·822	43	5·318	39	5·923	9 35	6·678	31
3·754	14 55	4·061	13 50	4·413	46	4·829	42	5·326	38	5·933	34	6·691	8 30
3·758	54	4·066	49	4·419	12 45	4·836	41	5·335	37	5·944	33	6·704	29
3·763	53	4·071	48	4·425	44	4·843	11 40	5·343	36	5·954	32	6·718	28
3·767	52	4·076	47	4·431	43	4·850	39	5·352	10 35	5·965	31	6·731	27
3·771	51	4·081	46	4·437	42	4·857	38	5·361	34	5·976	9 30	6·745	26
3·776	14 50	4·087	13 45	4·443	41	4·864	37	5·369	33	5·986	29	6·758	8 25
3·780	49	4·092	44	4·449	12 40	4·871	36	5·378	32	5·997	28	6·772	24
3·785	48	4·097	43	4·455	12 39	4·879	11 35	5·387	31	6·008	27	6·786	23
3·789	47	4·102	42	4·461	38	4·886	34	5·395	10 30	6·019	26	6·799	22
3·794	46	4·107	41	4·468	37	4·893	33	5·404	29	6·030	9 25	6·813	21
3·798	14 45	4·113	13 40	4·474	36	4·901	32	5·413	28	6·040	24	6·827	8 20
3·803	44	4·118	39	4·480	12 35	4·908	31	5·422	27	6·051	23	6·841	19
3·807	43	4·123	38	4·486	34	4·915	11 30	5·431	26	6·062	22	6·855	18
3·812	42	4·128	37	4·492	33	4·922	29	5·440	10 25	6·073	21	6·869	17
3·816	41	4·133	36	4·498	32	4·930	28	5·449	24	6·084	9 20	6·883	16
3·821	14 40	4·139	13 35	4·504	31	4·937	27	5·457	23	6·095	19	6·897	8 15
3·825	39	4·144	34	4·511	12 30	4·945	26	5·466	22	6·107	18	6·911	14
3·830	38	4·149	33	4·517	29	4·952	11 25	5·475	21	6·118	17	6·925	13
3·834	37	4·155	32	4·523	28	4·959	24	5·484	10 20	6·129	16	6·939	12
3·839	36	4·160	31	4·529	27	4·967	23	5·494	19	6·140	9 15	6·954	11
3·844	14 35	4·165	13 30	4·536	26	4·974	22	5·503	18	6·151	14	6·968	8 10
3·848	34	4·171	29	4·542	12 25	4·982	21	5·512	17	6·163	13	6·983	9
3·853	33	4·176	28	4·548	24	4·989	11 20	5·521	16	6·174	12	6·997	8
3·857	32	4·181	27	4·554	23	4·997	19	5·530	10 15	6·186	11	7·012	7
3·862	31	4·187	26	4·561	22	5·005	18	5·539	14	6·197	9 10	7·026	6
3·867	14 30	4·192	13 25	4·567	21	5·012	17	5·548	13	6·208	9	7·041	8 5
3·871	29	4·197	24	4·574	12 20	5·020	16	5·558	12	6·220	8	7·056	4
3·876	28	4·203	23	4·580	19	5·027	11 15	5·567	11	6·232	7	7·071	3
3·881	27	4·208	22	4·586	18	5·035	14	5·576	10 10	6·243	6	7·085	2
3·885	26	4·214	21	4·593	17	5·043	13	5·586	9	6·255	9 5	7·100	1
3·890	14 25	4·219	13 20	4·599	16	5·050	12	5·595	8	6·267	4	7·115	8 0
3·895	24	4·225	19	4·606	12 15	5·058	11	5·604	7	6·278	3	7·130	7 59
3·899	23	4·230	18	4·612	14	5·066	11 10	5·614	6	6·290	2	7·146	58
3·904	22	4·236	17	4·619	13	5·074	9	5·623	10 5	6·302	1	7·161	57
3·909	21	4·241	16	4·625	12	5·081	8	5·633	4	6·314	9 0	7·176	56
3·914	14 20	4·247	13 15	4·632	11	5·089	7	5·642	3	6·326	8 59	7·191	7 55
3·918	19	4·252	14	4·638	12 10	5·097	6	5·652	2	6·338	58	7·207	54
3·923	18	4·258	13	4·645	9	5·105	11 5	5·662	1	6·350	57	7·222	53
3·928	17	4·263	12	4·651	8	5·113	4	5·671	10 0	6·362	56	7·237	52
3·933	16	4·269	11	4·658	7	5·121	3	5·681	9 59	6·374	8 55	7·253	51
3·937	14 15	4·275	13 10	4·665	6	5·129	2	5·691	58	6·386	54	7·269	7 50
3·942	14	4·280	9	4·671	12 5	5·136	1	5·700	57	6·398	53	7·284	49
3·947	13	4·286	8	4·678	4	5·145	11 0	5·710	56	6·410	52	7·300	48
3·952	12	4·292	7	4·685	3	5·153	10 59	5·720	9 55	6·422	51	7·316	47
3·957	11	4·297	6	4·691	2	5·161	58	5·730	54	6·435	8 50	7·332	46
3·962	14 10	4·303	13 5	4·698	1	5·169	57	5·740	53	6·447	49	7·348	7 45
3·967	9	4·309	4	4·705	12 0	5·177	56	5·749	52	6·460	48	7·364	44
3·971	8	4·314	3	4·711	11 59	5·185	10 55	5·759	51	6·472	47	7·380	43
3·976	7	4·320	2	4·718	58	5·193	54	5·769	9 50	6·485	46	7·396	42
3·981	6	4·326	1	4·725	57	5·201	53	5·779	49	6·497	8 45	7·412	41
3·986	14 5	4·331	13 0	4·732	56	5·209	52	5·789	48	6·510	44	7·429	7 40
3·991	4	4·337	12 59	4·738	11 55	5·217	51	5·799	47	6·522	43	7·445	39
3·996	3	4·343	58	4·745	54	5·226	10 50	5·809	46	6·535	42	7·461	38
4·001	2	4·349	57	4·752	53	5·234	49	5·820	9 45	6·548	41	7·478	37
4·006	1	4·355	56	4·759	52	5·242	48	5·830	44	6·561	8 40	7·495	36
4·011	14 0	4·360	12 55	4·766	51	5·250	47	5·840	43	6·573	39	7·511	7 35
4·016	13 59	4·366	54	4·773	11 50	5·259	46	5·850	42	6·586	38	7·528	34
4·021	58	4·372	53	4·780	49	5·267	10 45	5·860	41	6·599	37	7·545	33
4·026	57	4·378	52	4·787	48	5·275	44	5·871	9 40	6·612	36	7·562	32
4·031	56	4·384	51	4·794	47	5·284	43	5·881	39	6·625	8 35	7·579	31

Table C¹.

Azimuth Corresponding to A and B Correction in Departure.

A & B	Az.	A & B	Az.	A & B	Az.	A & B	Az.	A & B	Az.	A & B	Az.	A & B	Az.
′	° ′	′	° ′	′	° ′	′	° ′	′	° ′	′	° ′	′	° ′
7·60	7 30	8·89	6 25	10·71	5 20	13·4	4 16	17·9	3 12	26·8	2 8	53·7	1 4
7·61	29	8·92	24	10·75	19	13·5	4 15	18·0	11	27·1	7	54·6	3
7·63	28	8·94	23	10·78	18	13·5	14	18·1	3 10	27·3	6	55·4	2
7·65	27	8·96	22	10·81	17	13·6	13	18·2	9	27·5	2 5	56·4	1
7·66	26	8·99	21	10·85	16	13·6	12	18·3	8	27·7	4	57·3	1 0
7·68	7 25	9·01	6 20	10·88	5 15	13·7	11	18·4	7	27·9	3	58·3	0 59
7·70	24	9·03	19	10·92	14	13·7	4 10	18·5	6	28·2	2	59·3	58
7·72	23	9·06	18	10·95	13	13·8	9	18·6	3 5	28·4	1	60·3	57
7·73	22	9·08	17	10·99	12	13·8	8	18·7	4	28·6	2 0	61·4	56
7·75	21	9·11	16	11·02	11	13·9	7	18·8	3	28·9	1 59	62·5	0 55
7·77	7 20	9·13	6 15	11·06	5 10	14·0	6	18·9	2	29·1	58	63·7	54
7·79	19	9·16	14	11·10	9	14·0	4 5	19·0	1	29·4	57	64·9	53
7·81	18	9·18	13	11·13	8	14·1	4	19·1	3 0	29·6	56	66·1	52
7·82	17	9·21	12	11·17	7	14·1	3	19·2	2 59	29·9	1 55	67·4	51
7·84	16	9·23	11	11·20	6	14·2	2	19·3	58	30·1	54	68·7	0 50
7·86	7 15	9·26	6 10	11·24	5 5	14·2	1	19·4	57	30·4	53	70·2	49
7·88	14	9·28	9	11·28	4	14·3	4 0	19·5	56	30·7	52	71·6	48
7·90	13	9·31	8	11·32	3	14·4	3 59	19·6	2 55	31·0	51	73·1	47
7·92	12	9·33	7	11·35	2	14·4	58	19·7	54	31·2	1 50	74·7	46
7·93	11	9·36	6	11·39	1	14·5	57	19·9	53	31·5	49	76·4	0 45
7·95	7 10	9·38	6 5	11·43	5 0	14·5	56	20·0	52	31·8	48	78·1	44
7·97	9	9·41	4	11·47	4 59	14·6	3 55	20·1	51	32·1	47	79·9	43
7·99	8	9·44	3	11·51	58	14·7	54	20·2	2 50	32·4	46	81·8	42
8·01	7	9·46	2	11·55	57	14·7	53	20·3	49	32·7	1 45	83·8	41
8·03	6	9·49	1	11·59	56	14·8	52	20·4	48	33·0	44	85·9	0 40
8·05	7 5	9·51	6 0	11·62	4 55	14·9	51	20·6	47	33·4	43	88·1	39
8·07	4	9·54	5 59	11·67	54	14·9	3 50	20·7	46	33·7	42	90·5	38
8·09	3	9·57	58	11·71	53	15·0	49	20·8	2 45	34·0	41	92·9	37
8·10	2	9·59	57	11·74	52	15·1	48	20·9	44	34·4	1 40	95·5	36
8·12	1	9·62	56	11·78	51	15·1	47	21·1	43	34·7	39	98·2	0 35
8·14	7 0	9·65	5 55	11·83	4 50	15·2	46	21·2	42	35·1	38	101	34
8·16	6 59	9·68	54	11·87	49	15·3	3 45	21·3	41	35·4	37	104	33
8·18	58	9·70	53	11·91	48	15·3	44	21·5	2 40	35·8	36	107	32
8·20	57	9·73	52	11·95	47	15·4	43	21·6	39	36·2	1 35	111	31
8·22	56	9·76	51	11·99	46	15·5	42	21·7	38	36·6	34	115	0 30
8·24	6 55	9·79	5 50	12·03	4 45	15·5	41	21·9	37	37·0	33	118	29
8·26	54	9·82	49	12·08	44	15·6	3 40	22·0	36	37·4	32	123	28
8·28	53	9·84	48	12·12	43	15·7	39	22·2	2 35	37·8	31	127	27
8·30	52	9·87	47	12·16	42	15·7	38	22·3	34	38·2	1 30	132	26
8·32	51	9·90	46	12·21	41	15·8	37	22·5	33	38·6	29	138	0 25
8·34	6 50	9·93	5 45	12·25	4 40	15·9	36	22·6	32	39·0	28	143	24
8·36	49	9·96	44	12·29	39	16·0	3 35	22·8	31	39·5	27	149	23
8·39	48	9·99	43	12·34	38	16·0	34	22·9	2 30	40·0	26	156	22
8·41	47	10·02	42	12·38	37	16·1	33	23·1	29	40·4	1 25	164	21
8·43	46	10·05	41	12·43	36	16·2	32	23·2	28	40·9	24	172	0 20
8·45	6 45	10·08	5 40	12·47	4 35	16·3	31	23·4	27	41·4	23	181	19
8·47	44	10·11	39	12·52	34	16·3	3 30	23·5	26	41·9	22	191	18
8·49	43	10·13	38	12·57	33	16·4	29	23·7	2 25	42·4	21	202	17
8·51	42	10·17	37	12·61	32	16·5	28	23·9	24	43·0	1 20	215	16
8·53	41	10·20	36	12·66	31	16·6	27	24·0	23	43·5	19	229	0 15
8·56	6 40	10·23	5 35	12·71	4 30	16·7	26	24·2	22	44·1	18	246	14
8·58	39	10·26	34	12·75	29	16·7	3 25	24·4	21	44·6	17	264	13
8·60	38	10·29	33	12·80	28	16·8	24	24·5	2 20	45·2	16	286	12
8·62	37	10·32	32	12·85	27	16·9	23	24·7	19	45·8	1 15	313	11
8·64	36	10·35	31	12·90	26	17·0	22	24·9	18	46·4	14	344	0 10
8·66	6 35	10·39	5 30	12·95	4 25	17·1	21	25·1	17	47·1	13	382	9
8·69	34	10·42	29	13·00	24	17·2	3 20	25·2	16	47·7	12	430	8
8·71	33	10·45	28	13·05	23	17·3	19	25·5	2 15	48·4	11	491	7
8·73	32	10·48	27	13·10	22	17·3	18	25·6	14	49·1	1 10	573	6
8·75	31	10·51	26	13·15	21	17·4	17	25·8	13	49·8	9	688	0 5
8·78	6 30	10·55	5 25	13·20	4 20	17·5	16	26·0	12	50·5	8	859	4
8·80	29	10·58	24	13·25	19	17·6	3 15	26·2	11	51·3	7	1146	3
8·82	28	10·61	23	13·30	18	17·7	14	26·4	2 10	52·1	6	1719	2
8·85	27	10·65	22	13·35	17	17·8	13	26·6	9	52·9	1 5	3438	1
8·87	26	10·68	21	13·40	16	17·9	12	26·8	8	53·7	4	Infinite	0 0

Table C2.

POSITION-LINES CORRESPONDING TO THE A AND B CORRECTION, FOR USE WITH THE PLANE-SCALE CHART IN THE SUMNER PROBLEM.

Name the position-line according to the name of the A and B correction, and contrary to the name of the bearing of the body observed.

A and B Correction.	Position-lines.	A and B Correction.	Position-lines.	A and B Correction.	Position-lines.	A and B Correction.	Position-lines.	A and B Correction.	Position-lines.	A and B Correction.	Position-lines.	A and B Correction.	Position-lines.	A and B Correction.	Position-lines.
′	°	′	°	′	°	′	°	′	°	′	°	′	°	′	°
·00 =	0·0	·25 =	14·0	·50 =	26·6	75 =	36·9	1·00 =	45·0	1·42 =	54·8	1·92 =	62·5	4·2 =	76·6
·01	0·6	·26	14·6	·51	27·0	·76	37·2	1·01	45·3	1·44	55·2	1·94	62·7	4·4	77·2
·02	1·1	·27	15·1	·52	27·5	·77	37·6	1·02	45·6	1·46	55·6	1·96	63·0	4·6	77·7
·03	1·7	·28	15·6	·53	27·9	78	38·0	1·03	45·8	1·48	56·0	1·98	63·2	4·8	78·2
·04	2·3	·29	16·2	·54	28·4	·79	38·3	1·04	46·1	1·50	56·3	2·00	63·4	5·0	78·7
·05	2·9	·30	16·7	·55	28·8	·80	38·7	1·05	46·4	1·52	56·7	2·05	64·0	5·5	79·7
·06	3·4	·31	17·2	56	29·2	·81	39·0	1·06	46·7	1·54	57·0	2·10	64·5	6·0	80·5
·07	4·0	32	17·7	·57	29·7	·82	39·4	1·07	46·9	1·56	57·3	2·15	65·1	6·5	81·3
·08	4·6	·33	18·3	·58	30·1	·83	39·7	1·08	47·2	1·58	57·7	2·20	65·6	7·0	81·9
·09	5·1	·34	18·8	·59	30·5	·84	40·0	1·10	47·7	1·60	58·0	2·25	66·0	8·0	82·9
·10	5·7	·35	19·3	·60	31·0	·85	40·4	1·12	48·2	1·62	58·3	2·30	66·5	9·0	83·7
·11	6·3	·36	19·8	·61	31·4	·86	40·7	1·14	48·7	1·64	58·6	2·40	67·4	10·0	84·3
·12	6·8	·37	20·3	·62	31·8	·87	41·0	1·16	49·2	1·66	58·9	2·50	68·2	11·0	84·8
·13	7·4	·38	20·8	·63	32·2	·88	41·3	1·18	49·7	1·68	59·2	2·60	69·0	12·0	85·2
·14	8·0	·39	21·3	·64	32·6	·89	41·7	1·20	50·2	1·70	59·5	2·70	69·7	13·0	85·6
·15	8·5	·40	21·8	·65	33·0	·90	42·0	1·22	50·7	1·72	59·8	2·80	70·3	15·0	86·2
·16	9·1	·41	22·3	·66	33·4	·91	42·3	1·24	51·1	1·74	60·1	2·90	71·0	17·0	86·6
·17	9·6	·42	22·8	·67	33·8	·92	42·6	1·26	51·6	1·76	60·4	3·00	71·6	20·0	87·1
·18	10·2	·43	23·3	·68	34·2	·93	42·9	1·28	52·0	1·78	60·7	3·10	72·1	25·0	87·7
·19	10·8	·44	23·7	69	34·6	·94	43·2	1·30	52·4	1·80	60·9	3·20	72·6	30·0	88·1
·20	11·3	45	24·2	·70	35·0	·95	43·5	1·32	52·9	1·82	61·2	3·30	73·1	40·0	88·6
·21	11·9	·46	24·7	·71	35·4	96	43·8	1·34	53·3	1·84	61·5	3·40	73·6	50·0	88·9
·22	12·4	·47	25·2	72	35·8	·97	44·1	1·36	53·7	1·86	61·7	3·60	74·5	100·0	89·4
·23	13·0	·48	25·6	·73	36·1	·98	44·4	1·38	54·1	1·88	62·0	3·80	75·3	200·0	89·7
·24	13·5	·49	26·1	·74	36·5	·99	44·7	1·40	54·5	1·90	62·2	4·00	76·0	Infinite	90·0

It must be borne in mind that this table does not give the *true* geographical lines of position, but lines of position which will give the same result as to latitude and longitude on a plane chart as the true lines of position would give on a Mercator's chart. It is given here for the purpose of saving the trouble of getting out a chart. All that is required for plotting the Sumner position will be a horizontal line in the work-book representing the D.R. latitude, and a perpendicular line to the former for use in laying off the position-lines by a protractor. On the horizontal line set off the points of two longitudes at a distance from one another of, say, 1 in. to 10′ of longitude. From these two points lay down the Sumner lines, and from the point where they intersect draw a perpendicular to the line of D.R. latitudes. The longitude at the point struck by the perpendicular is the longitude required, and can be measured from either of the points of longitude. The same scale is used for the latitude as for the longitude.

A small 5 in. boxwood protractor rule with a diagonal scale of inches for measuring to $\frac{1}{100}$ part of an inch may be bought for 1s., and is the only instrument which will be required.

To find the *true* position-line from this table consider the A and B correction as a diff. long., the dep. corresponding to this diff. long. will then give the true line of position, and will give the same position—*i e.*, latitude and longitude—on the Mercator chart that the other lines of position give on the plane chart.

Example for true position-line: In lat 47° S. a.m. sun's obsn., when A and B cor. = d. long. ·85′ N. dep = ·58′ N. = true position-line N. 30·1° W.

Table D.

SHOWING THE ERROR PRODUCED IN THE TIME OR LONGITUDE BY AN ERROR OF 1′ IN THE ALTITUDE.

Lat.	AZIMUTHS.														
	90°	89°	88°	87°	86°	85°	84°	83°	82°	81°	80°	79°	78°	77°	76°
°	s.	s.	s.	s.	s.	s.	s.	s.	s.	s.	s.	s.	s.	s.	s.
0	4·00	4·00	4·00	4·01	4·01	4·02	4·02	4·03	4·04	4·05	4·06	4·07	4·09	4·10	4·12
1	4·00	4·00	4·00	4·01	4·01	4·02	4·02	4·03	4·04	4·05	4·06	4·08	4·09	4·11	4·12
2	4·00	4·00	4·00	4·01	4·01	4·02	4·02	4·03	4·04	4·05	4·06	4·08	4·09	4·11	4·12
3	4.01	4·01	4·01	4·01	4·02	4·02	4·03	4·04	4·04	4·06	4·07	4·08	4·09	4·11	4·13
4	4·01	4·01	4·01	4·02	4·02	4·03	4·03	4·04	4·05	4·06	4·07	4·08	4·10	4·12	4·13
5	4·01	4·02	4·02	4·02	4·03	4·03	4·04	4·05	4·05	4·07	4·08	4·09	4·10	4·12	4·14
6	4·02	4·02	4·02	4·03	4·03	4·04	4·04	4·05	4·06	4·07	4·08	4·10	4·11	4·13	4·15
7	4·03	4·03	4·03	4·04	4·04	4·05	4·05	4·06	4·07	4·08	4·09	4·11	4·12	4·14	4·15
8	4·04	4·04	4·04	4·04	4·05	4·05	4·06	4·07	4·08	4·09	4·10	4·11	4·13	4·15	4·16
9	4·05	4·05	4·05	4·06	4·06	4·07	4·07	4·08	4·09	4·10	4·11	4·13	4·14	4·16	4·17
10	4·06	4·06	4·06	4·07	4·07	4·08	4·08	4·09	4·10	4·11	4·12	4·14	4·15	4·17	4·19
11	4·07	4·08	4·08	4·08	4·08	4·09	4·10	4·11	4·11	4·13	4·14	4·15	4·17	4·18	4·20
12	4·09	4·09	4·09	4·09	4·10	4·10	4·11	4·12	4·13	4·14	4·15	4·17	4·18	4·20	4·21
13	4·10	4·11	4·11	4·11	4·12	4·12	4·13	4·14	4·15	4·16	4·17	4·18	4·20	4·21	4·23
14	4·12	4·12	4·12	4·13	4·13	4·14	4·15	4·15	4·16	4·17	4·19	4·20	4·21	4·23	4·25
15	4·14	4·14	4·14	4·15	4·15	4·16	4·16	4·17	4·18	4·19	4·20	4·22	4·23	4·25	4·27
16	4·16	4·16	4·16	4·17	4·17	4·18	4·18	4·19	4·20	4·21	4·23	4·24	4·25	4·27	4·29
17	4·18	4·18	4·19	4·19	4·19	4·20	4·21	4·21	4·22	4·23	4·25	4·26	4·28	4·29	4·31
18	4·21	4·21	4·21	4·21	4·22	4·22	4·23	4·24	4·25	4·26	4·27	4·28	4·30	4·32	4·33
19	4·23	4·23	4·23	4·24	4·24	4·25	4·25	4·26	4·27	4·28	4·30	4·31	4·32	4·34	4·36
20	4·26	4·26	4·26	4·26	4·27	4·27	4·28	4·29	4·30	4·31	4·32	4·34	4·35	4·37	4·39
21	4·28	4·29	4·29	4·29	4·30	4·30	4·31	4·32	4·33	4·34	4·35	4·36	4·38	4·40	4·42
22	4·31	4·31	4·32	4·32	4·32	4·33	4·34	4·35	4·36	4·37	4·38	4·39	4·41	4·43	4·45
23	4·34	4·35	4·35	4·35	4·36	4·36	4·37	4·38	4·39	4·40	4·41	4·43	4·44	4·46	4·48
24	4·38	4·38	4·38	4·38	4·39	4·40	4·40	4·41	4·42	4·43	4·45	4·46	4·48	4·49	4·51
25	4·41	4·41	4·42	4·42	4·42	4·43	4·44	4·45	4·46	4·47	4·48	4·50	4·51	4·53	4·55
26	4·45	4·45	4·45	4·46	4·46	4·47	4·47	4·48	4·49	4·51	4·52	4·53	4·55	4·57	4·59
27	4·49	4·49	4·49	4·49	4·50	4·51	4·51	4·52	4·53	4·55	4·56	4·57	4·59	4·61	4·63
28	4·53	4·53	4·53	4·54	4·54	4·55	4·55	4·56	4·57	4·59	4·60	4·62	4·63	4·65	4·67
29	4·57	4·57	4·58	4·58	4·58	4·59	4·60	4·61	4·62	4·63	4·64	4·66	4·68	4·69	4·71
30	4·62	4·62	4·62	4·63	4·63	4·64	4·64	4·65	4·66	4·68	4·69	4·71	4·72	4·74	4·76
31	4·67	4·67	4·67	4·67	4·68	4·68	4·69	4·70	4·71	4·72	4·74	4·75	4·77	4·79	4·81
32	4·72	4·72	4·72	4·72	4·73	4·73	4·74	4·75	4·76	4·78	4·79	4·80	4·82	4·84	4·86
33	4·77	4·77	4·77	4·78	4·78	4·79	4·80	4·81	4·82	4·83	4·84	4·86	4·88	4·89	4·92
34	4·82	4·82	4·83	4·83	4·84	4·84	4·85	4·86	4·87	4·89	4·90	4·92	4·93	4·95	4·97
35	4·88	4·88	4·89	4·89	4·90	4·90	4·91	4·92	4·93	4·94	4·96	4·97	4·99	5·01	5·03
36	4·94	4·95	4·95	4·95	4·96	4·96	4·97	4·98	4·99	5·01	5·02	5·04	5·05	5·07	5·10
37	5·01	5·01	5·01	5·02	5·02	5·03	5·04	5·05	5·06	5·07	5·09	5·10	5·12	5·14	5·16
38	5·08	5·08	5·08	5·08	5·09	5·10	5·10	5·11	5·13	5·14	5·15	5·17	5·19	5·21	5·23
39	5·15	5·15	5·15	5·15	5·16	5·17	5·18	5·18	5·20	5·21	5·23	5·24	5·26	5·28	5·30
40	5·22	5·22	5·22	5·23	5·23	5·24	5·25	5·26	5·27	5·29	5·30	5·32	5·34	5·36	5·38
41	5·30	5·30	5·30	5·31	5·31	5·32	5·33	5·34	5·35	5·37	5·38	5·40	5·42	5·44	5·46
42	5·38	5·38	5·39	5·39	5·40	5·40	5·41	5·42	5·44	5·45	5·47	5·48	5·50	5·52	5·55
43	5·47	5·47	5·47	5·48	5·48	5·49	5·50	5·51	5·52	5·54	5·55	5·57	5·59	5·61	5·64
44	5·56	5·56	5·56	5·57	5·57	5·58	5·59	5·60	5·62	5·63	5·65	5·66	5·68	5·71	5·73
45	5·66	5·66	5·66	5·66	5·67	5·68	5·69	5·70	5·71	5·73	5·74	5·76	5·78	5·81	5·83
46	5·76	5·76	5·76	5·77	5·77	5·78	5·79	5·80	5·81	5·83	5·85	5·87	5·89	5·91	5·93
47	5·87	5·87	5·87	5·87	5·88	5·89	5·90	5·91	5·92	5·94	5·96	5·97	6·00	6·02	6·04
48	5·98	5·98	5·98	5·99	5·99	6·00	6·01	6·02	6·04	6·05	6·07	6·09	6·11	6·14	6·16
49	6·10	6·10	6·10	6·11	6·11	6·12	6·13	6·14	6·16	6·17	6·19	6·21	6·23	6·26	6·28
50	6·22	6·22	6·23	6·23	6·24	6·25	6·26	6·27	6·28	6·30	6·32	6·34	6·36	6·39	6·41
51	6·36	6·36	6·36	6·36	6·37	6·38	6·39	6·40	6·42	6·44	6·45	6·48	6·50	6·52	6·55
52	6·50	6·50	6·50	6·51	6·51	6·52	6·53	6·55	6·56	6·58	6·60	6·62	6·64	6·67	6·70
53	6·65	6·65	6·65	6·66	6·66	6·67	6·68	6·70	6·71	6·73	6·75	6·77	6·80	6·82	6·85
54	6·81	6·81	6·81	6·81	6·82	6·83	6·84	6·86	6·87	6·89	6·91	6·93	6·96	6·98	7·01
55	6·97	6·97	6·98	6·98	6·99	7·00	7·01	7·03	7·04	7·06	7·08	7·10	7·13	7·16	7·19
56	7·15	7·15	7·16	7·16	7·17	7·18	7·19	7·21	7·22	7·24	7·26	7·29	7·31	7·34	7·37
57	7·34	7·35	7·35	7·35	7·36	7·37	7·38	7·40	7·42	7·44	7·46	7·48	7·51	7·54	7·57
58	7·55	7·55	7·55	7·56	7·57	7·58	7·59	7·61	7·62	7·64	7·66	7·69	7·72	7·75	7·78
59	7·77	7·77	7·77	7·78	7·79	7·80	7·81	7·82	7·84	7·86	7·89	7·91	7·94	7·97	8·00
60	8·00	8·00	8·00	8·01	8·02	8·03	8·04	8·06	8·08	8·10	8·12	8·15	8·18	8·21	8·24

To convert time into longitude divide by 4. Thus 8·00 s. ÷ 4 = 2′ long.

Table D.

SHOWING THE ERROR PRODUCED IN THE TIME OR LONGITUDE BY AN ERROR OF 1′ IN THE ALTITUDE.

Lat.	AZIMUTHS.														
	75°	74°	73°	72°	71°	70°	69°	68°	67°	66°	65°	64°	63°	62°	61°
°	s.	s.	s.	s.	s.	s.	s.	s.	s.	s.	s.	s.	s.	s.	s.
0	4·14	4·16	4·18	4·21	4·23	4·26	4·28	4·31	4·35	4·38	4·41	4·45	4·49	4·53	4·57
1	4·14	4·16	4·18	4·21	4·23	4·26	4·29	4·31	4·35	4·38	4·41	4·45	4·49	4·53	4·57
2	4·14	4·16	4·19	4·21	4·23	4·26	4·29	4·32	4·35	4·38	4·42	4·45	4·49	4·53	4·58
3	4·15	4·17	4·19	4·21	4·24	4·26	4·29	4·32	4·35	4·38	4·42	4·46	4·50	4·54	4·58
4	4·15	4·17	4·19	4·22	4·24	4·27	4·30	4·32	4·36	4·39	4·42	4·46	4·50	4·54	4·58
5	4·16	4·18	4·20	4·22	4·25	4·27	4·30	4·33	4·36	4·40	4·43	4·47	4·51	4·55	4·59
6	4·16	4·18	4·21	4·23	4·25	4·28	4·31	4·34	4·37	4·40	4·44	4·47	4·51	4·56	4·60
7	4·17	4·19	4·21	4·24	4·26	4·29	4·32	4·35	4·38	4·41	4·45	4·48	4·52	4·56	4·61
8	4·18	4·20	4·22	4·25	4·27	4·30	4·33	4·36	4·39	4·42	4·46	4·49	4·53	4·57	4·62
9	4·19	4·21	4·23	4·26	4·28	4·31	4·34	4·37	4·40	4·43	4·47	4·51	4·55	4·59	4·63
10	4·20	4·23	4·25	4·27	4·30	4·32	4·35	4·38	4·41	4·45	4·48	4·52	4·56	4·60	4·64
11	4·22	4·24	4·26	4·28	4·31	4·34	4·36	4·39	4·43	4·46	4·50	4·53	4·57	4·62	4·66
12	4·23	4·25	4·28	4·30	4·32	4·35	4·38	4·41	4·44	4·48	4·51	4·55	4·59	4·63	4·68
13	4·25	4·27	4·29	4·32	4·34	4·37	4·40	4·43	4·46	4·49	4·53	4·57	4·61	4·65	4·69
14	4·27	4·29	4·31	4·33	4·36	4·39	4·42	4·45	4·48	4·51	4·55	4·59	4·63	4·67	4·71
15	4·29	4·31	4·33	4·35	4·38	4·41	4·44	4·47	4·50	4·53	4·57	4·61	4·65	4·69	4·73
16	4·31	4·33	4·35	4·38	4·40	4·43	4·46	4·49	4·52	4·56	4·59	4·63	4·67	4·71	4·76
17	4·33	4·35	4·37	4·40	4·42	4·45	4·48	4·51	4·54	4·58	4·62	4·65	4·69	4·74	4·78
18	4·35	4·38	4·40	4·42	4·45	4·48	4·51	4·54	4·57	4·60	4·64	4·68	4·72	4·76	4·81
19	4·38	4·40	4·42	4·45	4·47	4·50	4·53	4·56	4·60	4·63	4·67	4·71	4·75	4·79	4·84
20	4·41	4·43	4·45	4·48	4·50	4·53	4·56	4·59	4·62	4·66	4·70	4·74	4·78	4·82	4·87
21	4·44	4·46	4·48	4·51	4·53	4·56	4·59	4·62	4·65	4·69	4·73	4·77	4·81	4·85	4·90
22	4·47	4·49	4·51	4·54	4·56	4·59	4·62	4·65	4·69	4·72	4·76	4·80	4·84	4·89	4·93
23	4·50	4·52	4·54	4·57	4·60	4·62	4·65	4·69	4·72	4·76	4·79	4·83	4·88	4·92	4·97
24	4·53	4·56	4·58	4·60	4·63	4·66	4·69	4·72	4·76	4·79	4·83	4·87	4·91	4·96	5·01
25	4·57	4·59	4·62	4·64	4·67	4·70	4·73	4·76	4·79	4·83	4·87	4·91	4·95	5·00	5·05
26	4·61	4·63	4·65	4·68	4·71	4·74	4·77	4·80	4·83	4·87	4·91	4·95	4·99	5·04	5·09
27	4·65	4·67	4·69	4·72	4·75	4·78	4·81	4·84	4·88	4·91	4·95	5·00	5·04	5·08	5·13
28	4·69	4·71	4·74	4·76	4·79	4·82	4·85	4·89	4·92	4·96	5·00	5·04	5·08	5·13	5·18
29	4·73	4·76	4·78	4·81	4·84	4·87	4·90	4·93	4·97	5·01	5·05	5·09	5·13	5·18	5·23
30	4·78	4·80	4·83	4·86	4·88	4·92	4·95	4·98	5·02	5·06	5·10	5·14	5·18	5·23	5·28
31	4·83	4·85	4·88	4·91	4·94	4·97	5·00	5·03	5·07	5·11	5·15	5·19	5·24	5·29	5·34
32	4·88	4·91	4·93	4·96	4·99	5·02	5·05	5·09	5·12	5·16	5·20	5·25	5·29	5·34	5·39
33	4·94	4·96	4·99	5·01	5·04	5·08	5·11	5·14	5·18	5·22	5·26	5·31	5·35	5·40	5·45
34	5·00	5·02	5·05	5·07	5·10	5·13	5·17	5·20	5·24	5·28	5·32	5·37	5·42	5·46	5·52
35	5·06	5·08	5·11	5·13	5·16	5·20	5·23	5·27	5·30	5·35	5·39	5·43	5·48	5·53	5·58
36	5·12	5·14	5·17	5·20	5·23	5·26	5·30	5·33	5·37	5·41	5·46	5·50	5·55	5·60	5·65
37	5·19	5·21	5·24	5·27	5·30	5·33	5·36	5·40	5·44	5·48	5·53	5·57	5·62	5·67	5·73
38	5·26	5·28	5·31	5·34	5·37	5·40	5·44	5·47	5·51	5·56	5·60	5·65	5·70	5·75	5·80
39	5·33	5·35	5·38	5·41	5·44	5·48	5·51	5·55	5·59	5·63	5·68	5·73	5·78	5·83	5·88
40	5·41	5·43	5·46	5·49	5·52	5·56	5·59	5·63	5·67	5·72	5·76	5·81	5·86	5·91	5·97
41	5·49	5·51	5·54	5·57	5·61	5·64	5·68	5·72	5·76	5·80	5·85	5·90	5·95	6·00	6·06
42	5·57	5·60	5·63	5·66	5·69	5·73	5·77	5·81	5·85	5·89	5·94	5·99	6·04	6·10	6·15
43	5·66	5·69	5·72	5·75	5·78	5·82	5·86	5·90	5·94	5·99	6·03	6·09	6·14	6·19	6·25
44	5·76	5·78	5·81	5·85	5·88	5·92	5·96	6·00	6·04	6·09	6·14	6·19	6·24	6·30	6·36
45	5·86	5·88	5·92	5·95	5·98	6·02	6·06	6·10	6·15	6·19	6·24	6·29	6·35	6·41	6·47
46	5·97	5·99	6·02	6·05	6·09	6·13	6·17	6·21	6·26	6·30	6·35	6·41	6·46	6·52	6·58
47	6·07	6·10	6·13	6·17	6·20	6·24	6·28	6·33	6·37	6·42	6·47	6·53	6·58	6·64	6·71
48	6·19	6·22	6·25	6·29	6·32	6·36	6·40	6·45	6·49	6·54	6·60	6·65	6·71	6·77	6·83
49	6·31	6·34	6·38	6·41	6·45	6·49	6·53	6·58	6·62	6·67	6·73	6·78	6·84	6·91	6·97
50	6·44	6·47	6·51	6·54	6·58	6·62	6·67	6·71	6·76	6·81	6·87	6·92	6·98	7·05	7·11
51	6·58	6·61	6·65	6·68	6·72	6·76	6·81	6·86	6·90	6·96	7·01	7·07	7·13	7·20	7·27
52	6·73	6·76	6·79	6·83	6·87	6·91	6·96	7·01	7·06	7·11	7·17	7·23	7·29	7·36	7·43
53	6·88	6·91	6·95	6·99	7·03	7·07	7·12	7·17	7·22	7·28	7·33	7·39	7·46	7·53	7·60
54	7·05	7·08	7·12	7·16	7·20	7·24	7·29	7·34	7·39	7·45	7·51	7·57	7·64	7·71	7·78
55	7·22	7·25	7·29	7·33	7·38	7·42	7·47	7·52	7·58	7·63	7·69	7·76	7·83	7·90	7·97
56	7·41	7·44	7·48	7·52	7·57	7·61	7·66	7·71	7·77	7·83	7·89	7·96	8·03	8·10	8·18
57	7·60	7·64	7·68	7·72	7·77	7·82	7·87	7·92	7·98	8·04	8·10	8·17	8·24	8·32	8·40
58	7·81	7·85	7·89	7·94	7·98	8·03	8·09	8·14	8·20	8·26	8·33	8·40	8·47	8·55	8·63
59	8·04	8·08	8·12	8·17	8·21	8·26	8·32	8·38	8·44	8·50	8·57	8·64	8·72	8·80	8·88
60	8·28	8·32	8·37	8·41	8·46	8·51	8·57	8·63	8·69	8·76	8·83	8·90	8·98	9·06	9·15

To convert time into longitude divide by 4. Thus 8·28 s. ÷ 4 = 2·07′ long.

Table D.

SHOWING THE ERROR PRODUCED IN THE TIME OR LONGITUDE BY AN ERROR OF 1′ IN THE ALTITUDE.

Lat.	AZIMUTHS.														
	60°	59°	58°	57°	56°	55°	54°	53°	52°	51°	50°	49°	48°	47°	46°
°	s.	s.	s.	s.	s.	s.	s.	s.	s.	s.	s.	s.	s.	s.	s.
0	4·62	4·67	4·72	4·77	4·82	4·88	4·94	5·01	5·08	5·15	5·22	5·30	5·38	5·47	5·56
1	4·62	4·67	4·72	4·77	4·83	4·88	4·95	5·01	5·08	5·15	5·22	5·30	5·38	5·47	5·56
2	4·62	4·67	4·72	4·77	4·83	4·89	4·95	5·01	5·08	5·15	5·22	5·30	5·39	5·47	5·56
3	4·63	4·67	4·72	4·78	4·83	4·89	4·95	5·02	5·08	5·15	5·23	5·31	5·39	5·48	5·57
4	4·63	4·68	4·73	4·78	4·84	4·90	4·96	5·02	5·09	5·16	5·23	5·31	5·40	5·48	5·57
5	4·64	4·68	4·73	4·79	4·84	4·90	4·96	5·03	5·10	5·17	5·24	5·32	5·40	5·49	5·58
6	4·64	4·69	4·74	4·80	4·85	4·91	4·97	5·04	5·10	5·17	5·25	5·33	5·41	5·50	5·59
7	4·65	4·70	4·75	4·81	4·86	4·92	4·98	5·05	5·11	5·19	5·26	5·34	5·42	5·51	5·60
8	4·66	4·71	4·76	4·82	4·87	4·93	4·99	5·06	5·13	5·20	5·27	5·35	5·44	5·52	5·62
9	4·68	4·72	4·78	4·83	4·89	4·94	5·01	5·07	5·14	5·21	5·29	5·37	5·45	5·54	5·63
10	4·69	4·74	4·79	4·84	4·90	4·96	5·02	5·09	5·15	5·23	5·30	5·38	5·47	5·55	5·65
11	4·71	4·75	4·81	4·86	4·92	4·97	5·04	5·10	5·17	5·24	5·32	5·40	5·48	5·57	5·66
12	4·72	4·77	4·82	4·88	4·93	4·99	5·05	5·12	5·19	5·26	5·34	5·42	5·50	5·59	5·68
13	4·74	4·79	4·84	4·89	4·95	5·01	5·07	5·14	5·21	5·28	5·36	5·44	5·52	5·61	5·71
14	4·76	4·81	4·86	4·92	4·97	5·03	5·10	5·16	5·23	5·30	5·38	5·46	5·55	5·64	5·73
15	4·78	4·83	4·88	4·94	5·00	5·06	5·12	5·19	5·26	5·33	5·41	5·49	5·57	5·66	5·76
16	4·80	4·85	4·91	4·96	5·02	5·08	5·14	5·21	5·28	5·35	5·43	5·51	5·60	5·69	5·78
17	4·83	4·88	4·93	4·99	5·05	5·11	5·17	5·24	5·31	5·38	5·46	5·54	5·63	5·72	5·81
18	4·86	4·91	4·96	5·01	5·07	5·13	5·20	5·27	5·34	5·41	5·49	5·57	5·66	5·75	5·85
19	4·88	4·94	4·99	5·04	5·10	5·16	5·23	5·30	5·37	5·44	5·52	5·60	5·69	5·78	5·88
20	4·92	4·97	5·02	5·08	5·13	5·20	5·26	5·33	5·40	5·48	5·56	5·64	5·73	5·82	5·92
21	4·95	5·00	5·05	5·11	5·17	5·23	5·30	5·36	5·44	5·51	5·59	5·68	5·77	5·86	5·96
22	4·98	5·03	5·09	5·14	5·20	5·27	5·33	5·40	5·47	5·55	5·63	5·72	5·81	5·90	6·00
23	5·02	5·07	5·12	5·18	5·24	5·30	5·37	5·44	5·51	5·59	5·67	5·76	5·85	5·94	6·04
24	5·06	5·11	5·16	5·22	5·28	5·34	5·41	5·48	5·56	5·63	5·72	5·80	5·89	5·99	6·09
25	5·10	5·15	5·20	5·26	5·32	5·39	5·46	5·53	5·60	5·68	5·76	5·85	5·94	6·03	6·13
26	5·14	5·19	5·25	5·31	5·37	5·43	5·50	5·57	5·65	5·73	5·81	5·90	5·99	6·09	6·19
27	5·18	5·24	5·29	5·35	5·42	5·48	5·55	5·62	5·70	5·78	5·86	5·95	6·04	6·14	6·24
28	5·23	5·28	5·34	5·40	5·46	5·53	5·60	5·67	5·75	5·83	5·91	6·00	6·10	6·19	6·30
29	5·28	5·34	5·39	5·45	5·52	5·58	5·65	5·73	5·80	5·88	5·97	6·06	6·15	6·25	6·36
30	5·33	5·39	5·45	5·51	5·57	5·64	5·71	5·78	5·86	5·94	6·03	6·12	6·22	6·32	6·42
31	5·39	5·44	5·50	5·56	5·63	5·70	5·77	5·84	5·92	6·00	6·09	6·18	6·28	6·38	6·49
32	5·45	5·50	5·56	5·62	5·69	5·76	5·83	5·91	5·99	6·07	6·16	6·25	6·35	6·45	6·56
33	5·51	5·56	5·62	5·69	5·75	5·82	5·90	5·97	6·05	6·14	6·23	6·32	6·42	6·52	6·63
34	5·57	5·63	5·69	5·75	5·82	5·89	5·96	6·04	6·12	6·21	6·30	6·39	6·49	6·60	6·71
35	5·64	5·70	5·76	5·82	5·89	5·96	6·04	6·11	6·20	6·28	6·37	6·47	6·57	6·68	6·79
36	5·71	5·77	5·83	5·90	5·96	6·04	6·11	6·19	6·27	6·36	6·45	6·55	6·65	6·76	6·87
37	5·78	5·84	5·91	5·97	6·04	6·11	6·19	6·27	6·36	6·44	6·54	6·64	6·74	6·85	6·96
38	5·86	5·92	5·99	6·05	6·12	6·20	6·27	6·36	6·44	6·53	6·63	6·73	6·83	6·94	7·06
39	5·94	6·00	6·07	6·14	6·21	6·28	6·36	6·44	6·53	6·62	6·72	6·82	6·93	7·04	7·16
40	6·03	6·09	6·16	6·23	6·30	6·37	6·45	6·54	6·63	6·72	6·82	6·92	7·03	7·14	7·26
41	6·12	6·18	6·25	6·32	6·39	6·47	6·55	6·64	6·73	6·82	6·92	7·02	7·13	7·25	7·37
42	6·22	6·28	6·35	6·42	6·49	6·57	6·65	6·74	6·83	6·93	7·03	7·13	7·24	7·36	7·48
43	6·32	6·38	6·45	6·52	6·60	6·68	6·76	6·85	6·94	7·04	7·14	7·25	7·36	7·48	7·60
44	6·42	6·49	6·56	6·63	6·71	6·79	6·87	6·96	7·06	7·16	7·26	7·37	7·48	7·60	7·73
45	6·53	6·60	6·67	6·75	6·82	6·91	6·99	7·08	7·18	7·28	7·38	7·50	7·61	7·73	7·86
46	6·65	6·72	6·79	6·87	6·95	7·03	7·12	7·21	7·31	7·41	7·52	7·63	7·75	7·87	8·00
47	6·77	6·84	6·92	6·99	7·07	7·16	7·25	7·34	7·44	7·55	7·66	7·77	7·89	8·02	8·15
48	6·90	6·97	7·05	7·13	7·21	7·30	7·39	7·49	7·59	7·69	7·80	7·92	8·04	8·17	8·31
49	7·04	7·11	7·19	7·27	7·35	7·44	7·54	7·63	7·74	7·85	7·96	8·08	8·20	8·34	8·48
50	7·19	7·26	7·34	7·42	7·51	7·60	7·69	7·79	7·90	8·01	8·12	8·25	8·37	8·51	8·65
51	7·34	7·42	7·49	7·58	7·67	7·76	7·86	7·96	8·07	8·18	8·30	8·42	8·55	8·69	8·84
52	7·50	7·58	7·66	7·75	7·84	7·93	8·03	8·14	8·24	8·36	8·48	8·61	8·74	8·88	9·03
53	7·67	7·75	7·84	7·93	8·02	8·11	8·22	8·32	8·43	8·55	8·68	8·81	8·94	9·09	9·24
54	7·86	7·94	8·02	8·11	8·21	8·31	8·41	8·52	8·64	8·76	8·88	9·02	9·16	9·30	9·46
55	8·05	8·14	8·22	8·32	8·41	8·51	8·62	8·73	8·85	8·97	9·10	9·24	9·38	9·54	9·69
56	8·26	8·35	8·43	8·53	8·63	8·73	8·84	8·96	9·08	9·20	9·34	9·48	9·63	9·78	9·94
57	8·48	8·57	8·66	8·76	8·86	8·97	9·08	9·20	9·32	9·45	9·59	9·73	9·88	10·04	10·21
58	8·72	8·81	8·90	9·00	9·10	9·21	9·33	9·45	9·58	9·71	9·85	10·00	10·16	10·32	10·49
59	8·97	9·06	9·16	9·26	9·37	9·48	9·60	9·72	9·86	9·99	10·14	10·29	10·45	10·62	10·80
60	9·24	9·33	9·43	9·54	9·65	9·77	9·89	10·02	10·15	10·29	10·44	10·60	10·77	10·94	11·12

To convert time into longitude divide by 4. Thus 9·24 s. ÷ 4 = 2·31′ long.

Table D.

SHOWING THE ERROR PRODUCED IN THE TIME OR LONGITUDE BY AN ERROR OF 1′ IN THE ALTITUDE.

Lat.	AZIMUTHS.														
	45°	44°	43°	42°	41°	40°	39°	38°	37°	36°	35°	34°	33°	32°	31°
0	s.	s.	s.	s.	s.	s.	s.	s.	s.	s.	s.	s.	s.	s.	s.
0	5·66	5·76	5·87	5·98	6·10	6·22	6·36	6·50	6·65	6·81	6·97	7·15	7·34	7·55	7·77
1	5·66	5·76	5·87	5·98	6·10	6·22	6·36	6·50	6·65	6·81	6·97	7·15	7·35	7·55	7·77
2	5·66	5·76	5·87	5·98	6·10	6·23	6·36	6·50	6·65	6·81	6·98	7·16	7·35	7·55	7·77
3	5·66	5·77	5·87	5·99	6·11	6·23	6·36	6·51	6·66	6·81	6·98	7·16	7·35	7·56	7·78
4	5·67	5·77	5·88	5·99	6·11	6·24	6·37	6·51	6·66	6·82	6·99	7·17	7·36	7·57	7·79
5	5·68	5·78	5·89	6·00	6·12	6·25	6·38	6·52	6·67	6·83	7·00	7·18	7·37	7·58	7·80
6	5·69	5·79	5·90	6·01	6·13	6·26	6·39	6·53	6·68	6·84	7·01	7·19	7·38	7·59	7·81
7	5·70	5·80	5·91	6·02	6·14	6·27	6·40	6·55	6·70	6·86	7·03	7·21	7·40	7·61	7·82
8	5·71	5·81	5·92	6·04	6·16	6·28	6·42	6·56	6·71	6·87	7·04	7·22	7·42	7·62	7·84
9	5·73	5·83	5·94	6·05	6·17	6·30	6·44	6·58	6·73	6·89	7·06	7·24	7·44	7·64	7·86
10	5·74	5·85	5·96	6·07	6·19	6·32	6·45	6·60	6·75	6·91	7·08	7·26	7·46	7·66	7·89
11	5·76	5·87	5·97	6·09	6·21	6·34	6·48	6·62	6·77	6·93	7·10	7·29	7·48	7·69	7·91
12	5·78	5·89	6·00	6·11	6·23	6·36	6·50	6·64	6·80	6·96	7·13	7·31	7·51	7·72	7·94
13	5·81	5·91	6·02	6·14	6·26	6·39	6·52	6·67	6·82	6·98	7·16	7·34	7·54	7·75	7·97
14	5·83	5·93	6·04	6·16	6·28	6·41	6·55	6·70	6·85	7·01	7·19	7·37	7·57	7·78	8·00
15	5·86	5·96	6·07	6·19	6·31	6·44	6·58	6·73	6·88	7·05	7·22	7·41	7·60	7·81	8·04
16	5·88	5·99	6·10	6·22	6·34	6·47	6·61	6·76	6·91	7·08	7·25	7·44	7·64	7·85	8·08
17	5·92	6·02	6·13	6·25	6·38	6·51	6·65	6·79	6·95	7·12	7·29	7·48	7·68	7·89	8·12
18	5·95	6·05	6·17	6·28	6·41	6·54	6·68	6·83	6·99	7·16	7·33	7·52	7·72	7·94	8·17
19	5·98	6·09	6·20	6·32	6·45	6·58	6·72	6·87	7·03	7·20	7·38	7·57	7·77	7·98	8·21
20	6·02	6·13	6·24	6·36	6·49	6·62	6·76	6·91	7·07	7·24	7·42	7·61	7·82	8·03	8·26
21	6·06	6·17	6·28	6·40	6·53	6·67	6·81	6·96	7·12	7·29	7·47	7·66	7·87	8·09	8·32
22	6·10	6·21	6·33	6·45	6·58	6·71	6·86	7·01	7·17	7·34	7·52	7·71	7·92	8·14	8·38
23	6·15	6·26	6·37	6·49	6·62	6·76	6·90	7·06	7·22	7·39	7·58	7·77	7·98	8·20	8·44
24	6·19	6·30	6·42	6·54	6·67	6·81	6·96	7·11	7·28	7·45	7·63	7·83	8·04	8·26	8·50
25	6·24	6·35	6·47	6·60	6·73	6·87	7·01	7·17	7·33	7·51	7·69	7·89	8·10	8·33	8·57
26	6·29	6·41	6·53	6·65	6·78	6·92	7·07	7·23	7·39	7·57	7·76	7·96	8·17	8·40	8·64
27	6·35	6·46	6·58	6·71	6·84	6·98	7·13	7·29	7·46	7·64	7·83	8·03	8·24	8·47	8·72
28	6·41	6·52	6·64	6·77	6·91	7·05	7·20	7·36	7·53	7·71	7·90	8·10	8·32	8·55	8·80
29	6·47	6·58	6·71	6·83	6·97	7·11	7·27	7·43	7·60	7·78	7·97	8·18	8·40	8·63	8·88
30	6·53	6·65	6·77	6·90	7·04	7·19	7·34	7·50	7·67	7·86	8·05	8·26	8·48	8·72	8·97
31	6·60	6·72	6·84	6·97	7·11	7·26	7·42	7·58	7·75	7·94	8·14	8·35	8·57	8·81	9·06
32	6·67	6·79	6·92	7·05	7·19	7·34	7·49	7·66	7·84	8·02	8·22	8·43	8·66	8·90	9·16
33	6·74	6·87	6·99	7·13	7·27	7·42	7·58	7·75	7·93	8·11	8·32	8·53	8·76	9·00	9·26
34	6·82	6·95	7·07	7·21	7·35	7·51	7·67	7·84	8·02	8·21	8·41	8·63	8·86	9·10	9·37
35	6·91	7·03	7·16	7·30	7·44	7·60	7·76	7·93	8·11	8·31	8·51	8·73	8·97	9·21	9·48
36	6·99	7·12	7·25	7·39	7·54	7·69	7·86	8·03	8·22	8·41	8·62	8·84	9·08	9·33	9·60
37	7·08	7·21	7·34	7·49	7·63	7·79	7·96	8·14	8·32	8·52	8·73	8·96	9·20	9·45	9·72
38	7·18	7·31	7·44	7·59	7·74	7·90	8·07	8·24	8·43	8·64	8·85	9·08	9·32	9·58	9·86
39	7·28	7·41	7·55	7·69	7·85	8·01	8·18	8·36	8·55	8·76	8·97	9·20	9·45	9·71	9·99
40	7·38	7·52	7·66	7·80	7·96	8·12	8·30	8·48	8·68	8·88	9·10	9·34	9·59	9·85	10·14
41	7·50	7·63	7·77	7·92	8·08	8·25	8·42	8·61	8·81	9·02	9·24	9·48	9·73	10·00	10·29
42	7·61	7·75	7·89	8·04	8·20	8·37	8·55	8·74	8·94	9·16	9·38	9·63	9·88	10·16	10·45
43	7·73	7·87	8·02	8·17	8·34	8·51	8·69	8·88	9·09	9·30	9·54	9·78	10·04	10·32	10·62
44	7·86	8·00	8·15	8·31	8·48	8·65	8·84	9·03	9·24	9·46	9·69	9·94	10·21	10·49	10·80
45	8·00	8·14	8·29	8·45	8·62	8·80	8·99	9·19	9·40	9·62	9·86	10·12	10·39	10·67	10·98
46	8·14	8·29	8·44	8·61	8·78	8·96	9·15	9·35	9·57	9·80	10·04	10·30	10·57	10·87	11·18
47	8·29	8·44	8·60	8·77	8·94	9·12	9·32	9·53	9·75	9·98	10·23	10·49	10·77	11·07	11·39
48	8·45	8·61	8·77	8·93	9·11	9·30	9·50	9·71	9·93	10·17	10·42	10·69	10·97	11·25	11·61
49	8·62	8·78	8·94	9·11	9·29	9·49	9·69	9·90	10·13	10·37	10·63	10·90	11·19	11·51	11·84
50	8·80	8·96	9·12	9·30	9·49	9·68	9·89	10·11	10·34	10·59	10·85	11·13	11·43	11·74	12·08
51	8·99	9·15	9·32	9·50	9·69	9·89	10·10	10·30	10·56	10·81	11·08	11·37	11·67	11·99	12·34
52	9·19	9·35	9·53	9·71	9·90	10·11	10·32	10·55	10·80	11·05	11·33	11·62	11·93	12·26	12·61
53	9·40	9·57	9·75	9·93	10·13	10·34	10·56	10·80	11·04	11·31	11·59	11·89	12·20	12·54	12·90
54	9·62	9·80	9·98	10·17	10·37	10·59	10·81	11·05	11·31	11·58	11·86	12·17	12·50	12·84	13·21
55	9·86	10·04	10·23	10·42	10·63	10·85	11·08	11·33	11·59	11·86	12·16	12·47	12·80	13·16	13·54
56	10·12	10·30	10·49	10·69	10·90	11·13	11·37	11·62	11·89	12·17	12·47	12·79	13·13	13·50	13·89
57	10·39	10·57	10·77	10·97	11·19	11·43	11·67	11·92	12·20	12·49	12·80	13·13	13·48	13·86	14·26
58	10·67	10·87	11·07	11·28	11·51	11·74	11·99	12·26	12·54	12·84	13·16	13·50	13·86	14·24	14·66
59	10·98	11·18	11·39	11·61	11·84	12·08	12·34	12·61	12·90	13·21	13·54	13·89	14·26	14·66	15·08
60	11·31	11·52	11·73	11·96	12·19	12·45	12·71	12·99	13·29	13·61	13·95	14·31	14·69	15·10	15·53

To convert time into longitude divide by 4. Thus 12·0 s. ÷ 4 = 3′ long.

Table D.

Showing the Error produced in the Time or Longitude by an Error of 1′ in the Altitude.

Lat.	AZIMUTHS.														
	30°	29°	28°	27°	26°	25°	24°	23°	22°	21°	20°	19°	18°	17°	16°
°	s.	s.	s.	s.	s.	s.	s.	s.	s.	s.	s.	s.	s.	s.	s.
0	8·00	8·25	8·52	8·81	9·12	9·46	9·83	10·2	10·7	11·2	11·7	12·3	13·0	13·7	14·5
1	8·00	8·25	8·52	8·81	9·13	9·47	9·84	10·2	10·7	11·2	11·7	12·3	13·0	13·7	14·5
2	8·00	8·26	8·53	8·82	9·13	9·47	9·84	10·2	10·7	11·2	11·7	12·3	13·0	13·7	14·5
3	8·01	8·26	8·53	8·82	9·14	9·48	9·85	10·3	10·7	11·2	11·7	12·3	13·0	13·7	14·5
4	8·02	8·27	8·54	8·83	9·15	9·49	9·86	10·3	10·7	11·2	11·7	12·3	13·0	13·7	14·5
5	8·03	8·28	8·55	8·84	9·16	9·50	9·87	10·3	10·7	11·2	11·7	12·3	13·0	13·7	14·6
6	8·04	8·30	8·57	8·86	9·17	9·52	9·89	10·3	10·7	11·2	11·8	12·4	13·0	13·8	14·6
7	8·06	8·31	8·58	8·88	9·19	9·54	9·91	10·3	10·8	11·2	11·8	12·4	13·0	13·8	14·6
8	8·08	8·33	8·60	8·90	9·21	9·56	9·93	10·3	10·8	11·3	11·8	12·4	13·1	13·8	14·7
9	8·10	8·35	8·63	8·92	9·24	9·58	9·96	10·4	10·8	11·3	11·8	12·4	13·1	13·9	14·7
10	8·12	8·38	8·65	8·95	9·27	9·61	9·99	10·4	10·8	11·3	11·9	12·5	13·1	13·9	14·7
11	8·15	8·41	8·68	8·98	9·30	9·64	10·0	10·4	10·9	11·4	11·9	12·5	13·2	13·9	14·8
12	8·18	8·43	8·71	9·01	9·33	9·68	10·1	10·5	10·9	11·4	12·0	12·6	13·2	14·0	14·8
13	8·21	8·47	8·74	9·04	9·36	9·71	10·1	10·5	11·0	11·5	12·0	12·6	13·3	14·0	14·9
14	8·24	8·50	8·78	9·08	9·40	9·75	10·1	10·6	11·0	11·5	12·1	12·7	13·3	14·1	15·0
15	8·28	8·54	8·82	9·12	9·45	9·80	10·2	10·6	11·1	11·6	12·1	12·7	13·4	14·2	15·0
16	8·32	8·58	8·86	9·17	9·49	9·85	10·2	10·6	11·1	11·6	12·2	12·8	13·5	14·2	15·1
17	8·37	8·63	8·91	9·21	9·54	9·90	10·3	10·7	11·2	11·7	12·2	12·8	13·5	14·3	15·2
18	8·41	8·68	8·96	9·26	9·59	9·95	10·3	10·8	11·2	11·7	12·3	12·9	13·6	14·4	15·3
19	8·46	8·73	9·01	9·32	9·65	10·0	10·4	10·8	11·3	11·8	12·4	13·0	13·7	14·5	15·3
20	8·51	8·78	9·07	9·38	9·71	10·1	10·5	10·9	11·4	11·9	12·4	13·1	13·8	14·6	15·4
21	8·57	8·84	9·13	9·44	9·77	10·1	10·5	11·0	11·4	12·0	12·5	13·2	13·9	14·7	15·5
22	8·63	8·90	9·19	9·50	9·84	10·2	10·6	11·0	11·5	12·0	12·6	13·3	14·0	14·8	15·7
23	8·69	8·96	9·26	9·57	9·91	10·3	10·7	11·1	11·6	12·1	12·7	13·3	14·1	14·9	15·8
24	8·76	9·03	9·33	9·64	9·99	10·4	10·8	11·2	11·7	12·2	12·8	13·4	14·2	15·0	15·9
25	8·83	9·10	9·40	9·72	10·1	10·4	10·9	11·3	11·8	12·3	12·9	13·6	14·3	15·1	16·0
26	8·90	9·18	9·48	9·80	10·2	10·5	10·9	11·4	11·9	12·4	13·0	13·7	14·4	15·2	16·1
27	8·98	9·26	9·56	9·89	10·2	10·6	11·0	11·5	12·0	12·5	13·1	13·8	14·5	15·3	16·3
28	9·06	9·34	9·65	9·98	10·3	10·7	11·1	11·6	12·1	12·6	13·2	13·9	14·7	15·5	16·4
29	9·15	9·43	9·74	10·1	10·4	10·8	11·2	11·7	12·2	12·8	13·4	14·0	14·8	15·6	16·6
30	9·24	9·53	9·84	10·2	10·5	10·9	11·4	11·8	12·3	12·9	13·5	14·2	14·9	15·8	16·8
31	9·33	9·63	9·94	10·3	10·6	11·0	11·5	11·9	12·5	13·0	13·6	14·3	15·1	16·0	16·9
32	9·43	9·73	10·0	10·4	10·8	11·2	11·6	12·1	12·6	13·2	13·8	14·5	15·3	16·1	17·1
33	9·54	9·84	10·2	10·5	10·9	11·3	11·7	12·2	12·7	13·3	14·0	14·6	15·4	16·3	17·3
34	9·65	9·95	10·3	10·6	11·0	11·4	11·9	12·3	12·9	13·5	14·1	14·8	15·6	16·5	17·5
35	9·77	10·1	10·4	10·8	11·1	11·6	12·0	12·5	13·0	13·6	14·3	15·0	15·8	16·7	17·7
36	9·89	10·2	10·5	10·9	11·3	11·7	12·2	12·7	13·2	13·8	14·5	15·2	16·0	16·9	17·9
37	10·0	10·3	10·7	11·0	11·4	11·9	12·3	12·8	13·4	14·0	14·6	15·4	16·2	17·1	18·2
38	10·2	10·5	10·8	11·2	11·6	12·0	12·5	13·0	13·6	14·2	14·8	15·6	16·4	17·4	18·4
39	10·3	10·6	11·0	11·3	11·7	12·2	12·7	13·2	13·7	14·4	15·0	15·8	16·7	17·6	18·7
40	10·4	10·8	11·1	11·5	11·9	12·4	12·8	13·4	13·9	14·6	15·3	16·0	16·9	17·9	18·9
41	10·6	10·9	11·3	11·7	12·1	12·5	13·0	13·6	14·1	14·8	15·5	16·3	17·2	18·1	19·2
42	10·8	11·1	11·5	11·9	12·3	12·7	13·2	13·8	14·4	15·0	15·7	16·5	17·4	18·4	19·5
43	10·9	11·3	11·6	12·0	12·5	12·9	13·4	14·0	14·6	15·3	16·0	16·8	17·7	18·7	19·8
44	11·1	11·5	11·8	12·2	12·7	13·2	13·7	14·2	14·8	15·5	16·3	17·1	18·0	19·0	20·2
45	11·3	11·7	12·0	12·5	12·9	13·4	13·9	14·5	15·1	15·8	16·5	17·4	18·3	19·3	20·5
46	11·5	11·9	12·3	12·7	13·1	13·6	14·2	14·7	15·4	16·1	16·8	17·7	18·6	19·7	20·9
47	11·7	12·1	12·5	12·9	13·4	13·9	14·4	15·0	15·7	16·4	17·1	18·0	19·0	20·1	21·3
48	12·0	12·3	12·7	13·2	13·6	14·1	14·7	15·3	16·0	16·7	17·5	18·4	19·3	20·4	21·7
49	12·2	12·6	13·0	13·4	13·9	14·4	15·0	15·6	16·3	17·0	17·8	18·7	19·7	20·9	22·1
50	12·4	12·8	13·3	13·7	14·2	14·7	15·3	15·9	16·6	17·4	18·2	19·1	20·1	21·3	22·6
51	12·7	13·1	13·5	14·0	14·5	15·0	15·6	16·3	17·0	17·7	18·6	19·5	20·6	21·7	23·1
52	13·0	13·4	13·8	14·3	14·8	15·4	16·0	16·6	17·3	18·1	19·0	20·0	21·0	22·2	23·6
53	13·3	13·7	14·2	14·6	15·2	15·7	16·3	17·0	17·7	18·5	19·4	20·4	21·5	22·7	24·1
54	13·6	14·0	14·5	15·0	15·5	16·1	16·7	17·4	18·2	19·0	19·9	20·9	22·0	23·3	24·7
55	13·9	14·4	14·9	15·4	15·9	16·5	17·1	17·8	18·6	19·5	20·4	21·4	22·6	23·9	25·3
56	14·3	14·8	15·2	15·8	16·3	16·9	17·6	18·3	19·1	20·0	20·9	22·0	23·1	24·5	26·0
57	14·9	15·1	15·6	16·2	16·8	17·4	18·1	18·8	19·6	20·5	21·5	22·6	23·8	25·1	26·4
58	15·1	15·6	16·1	16·6	17·2	17·9	18·6	19·3	20·1	21·1	22·1	23·2	24·4	25·8	27·4
59	15·5	16·0	16·5	17·1	17·7	18·4	19·1	19·9	20·7	21·7	22·7	23·9	25·1	26·6	28·2
60	16·0	16·5	17·0	17·6	18·2	18·9	19·7	20·5	21·4	22·3	23·4	24·6	25·9	27·4	29·0

To convert time into longitude divide by 4. Thus 16 s. ÷ 4 = 4′ long.

Table D.

Showing the Error produced in the Time or Longitude by an Error of 1′ in the Altitude.

Lat.	AZIMUTHS.														
	15°	14°	13°	12°	11°	10°	9°	3°	7°	6°	5°	4°	3°	2°	1°
°	s.	s.	s.	s.	s.	s.	s.	s.	s.	s.	s.	s.	s.	s.	s.
0	15·4	16·5	17·8	19·2	21·0	23·0	25·6	28·7	32·8	38·3	45·9	57·4	76·4	115	229
1	15·5	16·5	17·8	19·3	21·0	23·0	25·6	28·7	32·8	38·3	45·9	57·4	76·4	115	229
2	15·5	16·5	17·8	19·3	21·0	23·0	25·6	28·8	32·8	38·3	45·9	57·4	76·5	115	229
3	15.5	16·6	17·8	19·3	21·0	23·1	25·6	28·8	32·9	38·3	46·0	57·4	76·5	115	230
4	15·5	16·6	17·8	19·3	21·0	23·1	25·6	28·8	32·9	38·4	46·0	57·5	76·6	115	230
5	15·5	16·6	17·8	19·3	21·0	23·1	25·7	28·9	32·9	38·4	46·1	57·6	76·7	115	230
6	15·5	16·6	17·9	19·3	21·1	23·2	25·7	28·9	33·0	38·5	46·1	57·7	76·9	115	230
7	15·6	16·7	17·9	19·4	21·1	23·2	25·8	29·0	33·1	38·6	46·2	57·8	77·0	115	231
8	15·6	16·7	18·0	19·4	21·2	23·3	25·8	29·0	33·1	38·6	46·3	57·9	77·2	116	231
9	15·6	16·7	18·0	19·5	21·2	23·3	25·9	29·1	33·2	38·7	46·5	58·1	77·4	116	232
10	15·7	16·8	18·1	19·5	21·3	23·4	26·0	29·2	33·3	38·9	46·6	58·2	77·6	116	233
11	15·7	16·8	18·1	19·6	21·4	23·5	26·0	29·3	33·4	39·0	46·8	58·4	77·9	117	233
12	15·8	16·9	18·2	19·7	21·4	23·5	26·1	29·4	33·6	39·1	46·9	58·6	78·1	117	234
13	15·9	17·0	18·2	19·7	21·5	23·6	26·2	29·5	33·7	39·3	47·1	58·9	78·4	118	235
14	15·9	17·0	18·3	19·8	21·6	23·7	26·4	29·6	33·8	39·4	47·3	59·1	78·8	118	236
15	16·0	17·1	18·4	19·9	21·7	23·8	26·5	29·8	34·0	39·6	47·5	59·4	79·1	119	237
16	16·1	17·2	18·5	20·0	21·8	24·0	26·6	29·9	34·1	39·8	47·7	59·7	79·5	119	238
17	16·2	17·3	18·6	20·1	21·9	24·1	26·7	30·1	34·3	40·0	48·0	60·0	79·9	120	240
18	16·2	17·4	18·7	20·2	22·0	24·2	26·9	30·2	34·5	40·2	48·3	60·3	80·4	121	241
19	16·3	17·5	18·8	20·3	22·2	24·4	27·0	30·4	34·7	40·5	48·5	60·6	80·8	121	242
20	16·4	17·6	18·9	20·5	22·3	24·5	27·2	30·6	34·9	40·7	48·8	61·0	81·3	122	244
21	16·6	17·7	19·0	20·6	22·5	24·7	27·4	30·8	35·2	41·0	49·2	61·4	81·9	123	246
22	16·7	17·8	19·2	20·7	22·6	24·8	27·6	31·0	35·4	41·3	49·5	61·8	82·4	124	247
23	16·8	18·0	19·3	20·9	22·8	25·0	27·8	31·2	35·7	41·6	49·9	62·3	83·0	125	249
24	16·9	18·1	19·5	21·1	22·9	25·2	28·0	31·5	35·9	41·9	50·2	62·8	83·7	125	251
25	17·1	18·2	19·6	21·2	23·1	25·4	28·2	31·7	36·2	42·2	50·6	63·3	84·3	126	253
26	17·2	18·4	19·8	21·4	23·3	25·6	28·4	32·0	36·5	42·6	51·1	63·8	85·0	128	255
27	17·3	18·6	20·0	21·6	23·5	25·8	28·7	32·3	36·8	42·9	51·5	64·4	85·8	129	257
28	17·5	18·7	20·1	21·8	23·7	26·1	29·0	32·6	37·2	43·3	52·0	64·9	86·6	130	260
29	17·7	18·9	20·3	22·0	24·0	26·3	29·2	32·9	37·5	43·8	52·5	65·6	87·4	131	262
30	17·8	19·1	20·5	22·2	24·2	26·6	29·5	33·2	37·9	44·2	53·0	66·2	88·3	132	265
31	18·0	19·3	20·7	22·4	24·5	26·9	29·8	33·5	38·3	44·6	53·5	66·9	89·2	134	267
32	18·2	19·5	21·0	22·7	24·7	27·2	30·2	33·9	38·7	45·1	54·1	67·6	90·1	135	270
33	18·4	19·7	21·2	22·9	25·0	27·5	30·5	34·3	39·1	45·6	54·7	68·4	91·1	137	273
34	18·6	19·9	21·4	23·2	25·3	27·8	30·8	34·7	39·6	46·2	55·4	69·2	92·2	138	276
35	18·9	20·2	21·7	23·5	25·6	28·1	31·2	35·1	40·1	46·7	56·0	70·0	93·3	140	280
36	19·1	20·4	22·0	23·8	25·9	28·5	31·6	35·5	40·6	47·3	56·7	70·9	94·5	142	283
37	19·4	20·7	22·3	24·1	26·2	28·8	32·0	36·0	41·1	47·9	57·5	71·8	95·7	144	287
38	19·6	21·0	22·6	24·4	26·6	29·2	32·4	36·5	41·7	48·6	58·2	72·8	97·0	145	291
39	19·9	21·3	22·9	24·8	27·0	29·6	32·9	37·0	42·2	49·2	59·1	73·8	98·3	147	295
40	20·2	21·6	23·2	25·1	27·4	30·1	33·4	37·5	42·8	50·0	59·9	74·9	99·8	150	299
41	20·5	21·9	23·6	25·5	27·8	30·5	33·9	38·1	43·5	50·7	60·8	76·0	101	152	304
42	20·8	22·2	23·9	25·9	28·2	31·0	34·4	38·7	44·2	51·5	61·8	77·2	103	154	308
43	21·1	22·6	24·3	26·3	28·7	31·5	35·0	39·3	44·9	52·3	62·8	78·4	105	157	313
44	21·5	23·0	24·7	26·7	29·1	32·0	35·5	40·0	45·6	53·2	63·8	79·7	106	159	319
45	21·9	23·4	25·1	27·2	29·6	32·6	36·2	40·6	46·4	54·1	64·9	81·1	108	162	324
46	22·2	23·8	25·6	27·7	30·2	33·2	36·8	41·4	47·2	55·1	66·1	82·5	110	165	330
47	22·7	24·2	26·1	28·2	30·7	33·8	37·5	42·1	48·1	56·1	67·3	84·1	112	168	336
48	23·1	24·7	26·6	28·8	31·3	34·4	38·2	43·0	49·1	57·2	68·6	85·7	114	171	343
49	23·6	25·2	27·1	29·3	32·0	35·1	39·0	43·8	50·0	58·3	70·0	87·4	116	175	349
50	24·0	25·7	27·7	29·9	32·6	35·8	39·8	44·7	51·1	59·5	71·4	89·2	119	178	357
51	24·6	26·3	28·3	30·6	33·3	36·6	40·6	45·7	52·2	60·8	72·9	91·1	121	182	364
52	25·1	26·9	28·9	31·2	34·1	37·4	41·5	46·7	53·3	62·2	74·5	93·1	124	186	372
53	25·7	27·5	29·5	32·0	34·8	38·3	42·5	47·8	54·5	63·6	76·3	95·3	127	190	381
54	26·3	28·1	30·3	32·7	35·7	39·2	43·5	48·9	55·8	65·1	78·1	97·6	130	195	390
55	26·9	28·8	31·0	33·5	36·5	40·2	44·6	50·1	57·2	66·7	80·0	100·0	133	200	400
56	27·6	29·6	31·8	34·4	37·5	41·2	45·7	51·4	58·7	68·4	82·1	102·5	137	205	410
57	28·4	30·4	32·6	35·3	38·5	42·3	46·9	52·8	60·3	70·3	84·3	105·3	140	210	421
58	29·2	31·2	33·6	36·3	39·6	43·5	48·3	54·2	61·9	72·2	86·6	108·2	144	216	432
59	30·0	32·1	34·5	37·4	40·7	44·7	49·6	55·8	63·7	74·3	89·1	111·3	148	223	445
60	30·9	33·1	35·6	38·5	41·9	46·1	51·1	57·5	65·6	76·5	91·8	114·7	153	229	458

To convert time into longitude divide by 4. Thus 35·6 s. ÷ 4 = 8·9′ long.

Table D.

Showing the Error produced in the Time or Longitude by an Error of 1′ in the Altitude.

Azimuths.	LATITUDES.														
	61°	62°	63°	64°	65°	66°	67°	68°	69°	70°	71°	72°	73°	74°	75°
°	s.	s.	s.	s.	s.	s.	s.	s.	s.	s.	s.	s.	s.	s.	s.
0½	945	976	1010	1046	1085	1127	1173	1224	1279	1340	1408	1483	1568	1663	1771
1	473	488	505	523	542	563	587	612	640	670	704	742	784	832	886
1½	315	325	337	349	362	376	391	408	426	447	469	495	523	554	590
2	236	244	252	262	271	282	293	306	320	335	352	371	392	416	443
2½	189	195	202	209	217	225	235	245	256	268	282	297	314	333	354
3	158	163	168	174	181	188	196	204	213	223	235	247	261	277	295
3½	135	140	144	150	155	161	168	175	183	192	201	212	224	237	253
4	118	122	126	131	136	141	147	153	160	168	176	186	196	208	222
4½	105	109	112	116	121	125	130	136	142	149	157	165	174	185	197
5	94·7	97·8	101	105	109	113	117	123	128	134	141	149	157	167	177
5½	86·1	88·9	91·9	95·2	98·8	103	107	111	116	122	128	135	143	151	161
6	79·1	81·5	84·3	87·3	90·5	94·1	97·9	102	107	112	118	124	131	139	148
6½	72·9	75·3	77·8	80·6	83·6	86·9	90·4	94·3	98·6	103	109	114	121	128	137
7	67·7	69·9	72·3	74·9	77·7	80·7	84·0	87·6	91·6	96·0	101	106	112	119	127
7½	63·2	65·3	67·5	69·9	72·5	75·3	78·4	81·8	85·5	89·6	94·1	99·2	105	111	118
8	59·3	61·2	63·3	65·6	68·0	70·7	73·6	76·7	80·2	84·0	88·3	93·0	98·3	104	111
8½	55·8	57·6	59·6	61·7	64·0	66·5	69·3	72·2	75·5	79·1	83·1	87·6	92·6	98·2	105
9	52·7	54·5	56·3	58·3	60·5	62·9	65·4	68·3	71·4	74·8	78·5	82·7	87·5	92·8	98·8
9½	50·0	51·6	53·4	55·3	57·3	59·6	62·0	64·7	67·6	70·9	74·4	78·4	82·9	87·9	93·6
10	47·5	49·1	50·7	52·6	54·5	56·6	59·0	61·5	64·3	67·4	70·8	74·5	78·8	83·6	89·0
10½	45·3	46·8	48·3	50·1	51·9	54·0	56·2	58·6	61·2	64·2	67·4	71·0	75·1	79·6	84·8
11	43·2	44·7	46·2	47·8	49·6	51·5	53·7	56·0	58·5	61·3	64·4	67·8	71·7	76·1	81·0
11½	41·4	42·7	44·2	45·8	47·5	49·3	51·3	53·6	56·0	58·7	61·6	64·9	68·6	72·8	77·5
12	39·7	41·0	42·4	43·9	45·5	47·3	49·2	51·4	53·7	56·3	59·1	62·3	65·8	69·8	74·3
12½	38·1	39·4	40·7	42·2	43·7	45·4	47·3	49·3	51·6	54·0	56·8	59·8	63·2	67·0	71·4
13	36·7	37·9	39·2	40·6	42·1	43·7	45·5	47·5	49·6	52·0	54·6	57·5	60·8	64·5	68·7
13½	35·3	36·5	37·7	39·1	40·5	42·1	43·9	45·7	47·8	50·1	52·6	55·4	58·6	62·2	66·2
14	34·1	35·2	36·4	37·7	39·1	40·7	42·3	44·1	46·1	48·3	50·8	53·5	56·6	60·0	63·9
14½	33·0	34·0	35·2	36·4	37·8	39·3	40·9	42·6	44·6	46·7	49·1	51·7	54·6	58·0	61·7
15	31·9	32·9	34·0	35·3	36·6	38·0	39·6	41·3	43·1	45·2	47·5	50·0	52·9	56·1	59·7
15½	30·9	31·9	33·0	34·1	35·4	36·8	38·3	40·0	41·8	43·8	46·0	48·4	51·2	54·3	57·8
16	29·9	30·9	32·0	33·1	34·3	35·7	37·1	38·7	40·5	42·4	44·6	47·0	49·6	52·6	56·1
16½	29·1	30·0	31·0	32·1	33·3	34·6	36·0	37·6	39·3	41·2	43·3	45·6	48·2	51·1	54·4
17	28·2	29·1	30·1	31·2	32·4	33·6	35·0	36·5	38·2	40·0	42·0	44·3	46·8	49·6	52·9
17½	27·4	28·3	29·3	30·3	31·5	32·7	34·0	35·5	37·1	38·9	40·9	43·0	45·5	48·3	51·4
18	26·7	27·6	28·5	29·5	30·6	31·8	33·1	34·6	36·1	37·8	39·8	41·9	44·3	47·0	50·0
18½	26·0	26·9	27·8	28·8	29·8	31·0	32·3	33·7	35·2	36·9	38·7	40·8	43·1	45·7	48·7
19	25·3	26·2	27·1	28·0	29·1	30·2	31·4	32·8	34·3	35·9	37·7	39·8	42·0	44·6	47·5
19½	24·7	25·5	26·4	27·3	28·4	29·5	30·7	32·0	33·4	35·0	36·8	38·8	41·0	43·5	46·3
20	24·1	24·9	25·8	26·7	27·7	28·8	29·9	31·2	32·6	34·2	35·9	37·8	40·0	42·4	45·2
20½	23·6	24·3	25·2	26·1	27·0	28·1	29·2	30·5	31·9	33·4	35·1	37·0	39·1	41·4	44·1
21	23·0	23·8	24·6	25·5	26·4	27·4	28·6	29·8	31·1	32·6	34·3	36·1	38·2	40·5	43·1
21½	22·5	23·2	24·0	24·9	25·8	26·8	27·9	29·1	30·5	31·9	33·5	35·3	37·3	39·6	42·2
22	22·0	22·7	23·5	24·4	25·3	26·3	27·3	28·5	29·8	31·2	32·8	34·6	36·5	38·7	41·3
22½	21·6	22·3	23·0	23·8	24·7	25·7	26·8	27·9	29·2	30·6	32·1	33·8	35·8	37·9	40·4
23	21·1	21·8	22·5	23·3	24·2	25·2	26·2	27·3	28·6	29·9	31·4	33·1	35·0	37·1	39·6
23½	20·7	21·4	22·1	22·9	23·7	24·7	25·7	26·8	28·0	29·3	30·8	32·5	34·3	36·4	38·8
24	20·3	20·9	21·7	22·4	23·3	24·2	25·2	26·3	27·4	28·8	30·2	31·8	33·6	35·7	38·0
24½	19·9	20·5	21·2	22·0	22·8	23·7	24·7	25·7	26·9	28·2	29·6	31·2	33·0	35·0	37·3
25	19·5	20·2	20·8	21·6	22·4	23·3	24·2	25·3	26·4	27·7	29·1	30·6	32·4	34·3	36·6
25½	19·2	19·8	20·5	21·2	22·0	22·8	23·8	24·8	25·9	27·2	28·5	30·1	31·8	33·7	35·9
26	18·8	19·4	20·1	20·8	21·6	22·4	23·4	24·4	25·5	26·7	28·0	29·5	31·2	33·1	35·3
26½	18·5	19·1	19·7	20·4	21·2	22·0	22·9	23·9	25·0	26·2	27·5	29·0	30·7	32·5	34·6
27	18·2	18·8	19·4	20·1	20·8	21·7	22·5	23·5	24·6	25·8	27·1	28·5	30·1	32·0	34·0
27½	17·9	18·5	19·1	19·8	20·5	21·3	22·2	23·1	24·2	25·3	26·6	28·0	29·6	31·4	33·5
28	17·6	18·1	18·8	19·4	20·2	20·9	21·8	22·7	23·8	24·9	26·2	27·6	29·1	30·9	32·9
28½	17·3	17·9	18·5	19·1	19·8	20·6	21·5	22·4	23·4	24·5	25·7	27·1	28·7	30·4	32·4
29	17·0	17·6	18·2	18·8	19·5	20·3	21·1	22·0	23·0	24·1	25·3	26·7	28·2	29·9	31·9
29½	16·8	17·3	17·9	18·5	19·2	20·0	20·8	21·7	22·7	23·8	25·0	26·3	27·8	29·5	31·4
30	16·5	17·0	17·6	18·2	18·9	19·7	20·5	21·4	22·3	23·4	24·6	25·9	27·4	29·0	30·9

To convert time into longitude divide by 4. Thus 29·2s. ÷ by 4 = 7·3′ longitude.

Table D.

SHOWING THE ERROR PRODUCED IN THE TIME OR LONGITUDE BY AN ERROR OF 1′ IN THE ALTITUDE.

Azimuths.	LATITUDES.														
	76°	77°	78°	79°	80°	80½°	81°	81½°	82°	82½°	83°	83½°	84°	84½°	85°
0	s.	s.	s.	s.	s.	s.	s.	s.	s.	s.	s.	s.	s.	s.	s.
0½	1895	2038	2205	2402	2640	2777	2930	3101	3294	3512	3761	4049	4385	4782	5259
1	947	1019	1102	1201	1320	1389	1466	1551	1647	1756	1881	2025	2193	2391	2630
1½	632	679	735	801	880	926	977	1034	1098	1171	1254	1350	1462	1594	1753
2	474	510	551	601	660	694	733	775	824	878	940	1012	1096	1193	1315
2½	379	408	441	481	528	556	586	620	659	703	752	810	877	957	1052
3	316	340	368	401	440	463	489	517	549	586	627	675	731	797	877
3½	271	291	315	343	377	397	419	443	471	502	538	579	627	684	752
4	237	255	276	301	330	347	367	388	412	439	471	507	549	598	658
4½	211	227	245	267	294	309	326	345	366	391	418	450	488	532	585
5	190	204	221	241	264	278	293	310	330	352	377	405	439	479	527
5½	173	186	201	219	240	253	267	282	300	320	342	369	399	435	479
6	158	170	184	201	220	232	245	259	275	293	314	338	366	399	439
6½	146	157	170	185	203	214	226	239	254	271	290	312	338	369	405
7	136	146	158	172	189	199	210	222	236	251	269	290	314	343	377
7½	127	136	147	161	176	186	196	207	220	235	251	271	293	320	352
8	119	128	138	151	166	174	184	194	207	220	236	254	275	300	330
8½	112	120	130	142	156	164	173	183	194	207	222	239	259	282	311
9	106	114	123	134	147	155	163	173	184	196	210	226	245	267	293
9½	100	108	117	127	140	147	155	164	174	186	199	214	232	253	278
10	95·2	102	111	121	133	140	147	156	166	176	189	203	220	240	264
10½	90·7	97·6	106	115	126	133	140	148	158	168	180	194	210	229	252
11	86·7	93·2	101	110	121	127	134	142	151	161	172	185	201	219	241
11½	82·9	89·2	96·5	105	116	122	128	136	144	154	165	177	192	209	230
12	79·5	85·5	92·5	101	111	117	123	130	138	147	158	170	184	201	221
12½	76·4	82·2	88·9	96·9	106	112	118	125	133	142	152	163	177	193	212
13	73·5	79·0	85·5	93·2	102	108	114	120	128	136	146	157	170	186	204
13½	70·8	76·2	82·4	89·8	98·7	104	110	116	123	131	141	151	164	179	197
14	68·3	73·5	79·5	86·7	95·2	100	106	112	119	127	136	146	158	173	190
14½	66·0	71·0	76·8	83·7	92·0	96·8	102	108	115	122	131	141	153	167	183
15	63·9	68·7	74·3	81·0	89·0	93·6	98·8	105	111	118	127	137	148	161	177
15½	61·9	66·5	72·0	78·4	86·2	90·7	95·7	101	108	115	123	132	143	156	172
16	60·0	64·5	69·8	76·0	83·6	87·9	92·8	98·2	104	111	119	128	139	151	167
16½	58·2	62·6	67·7	73·8	81·1	85·3	90·0	95·3	101	108	116	124	135	147	161
17	56·6	60·8	65·8	71·7	78·8	82·9	87·5	92·6	98·3	105	112	121	131	143	157
17½	55·0	59·1	64·0	69·7	76·6	80·6	85·0	90·0	95·6	102	109	118	127	139	153
18	53·5	57·5	62·3	67·8	74·5	78·4	82·7	87·6	93·0	99·2	106	114	124	135	149
18½	52·1	56·0	60·6	66·1	72·6	76·4	80·6	85·3	90·6	96·6	103	111	121	132	145
19	50·8	54·6	59·1	64·4	70·8	74·4	78·5	83·1	88·3	94·1	101	109	118	128	141
19½	49·5	53·3	57·6	62·8	69·0	72·6	76·6	81·1	86·1	91·8	98·3	106	115	125	137
20	48·3	52·0	56·3	61·3	67·4	70·9	74·8	79·1	84·0	89·6	96·0	103	112	122	134
20½	47·2	50·8	54·9	59·9	65·8	69·2	73·0	77·3	82·1	87·5	93·7	101	109	119	131
21	46·1	49·6	53·7	58·5	64·3	67·6	71·4	75·5	80·2	85·5	91·6	98·6	107	116	128
21½	45·1	48·5	52·5	57·2	62·9	66·1	69·8	73·8	78·4	83·6	89·6	96·4	104	114	125
22	44·1	47·5	51·4	56·0	61·5	64·7	68·3	72·2	76·7	81·8	87·6	94·3	102	111	123
22½	43·2	46·5	50·3	54·8	60·2	63·3	66·8	70·7	75·1	80·1	85·8	92·3	100	109	120
23	42·3	45·5	49·2	53·7	59·0	62·0	65·4	69·3	73·6	78·4	84·0	90·4	97·9	107	117
23½	41·5	44·6	48·2	52·6	57·8	60·8	64·1	67·9	72·1	76·9	82·3	88·6	96·0	105	115
24	40·7	43·7	47·3	51·5	56·6	59·6	62·9	66·5	70·7	75·3	80·7	86·9	94·1	103	113
24½	39·9	42·9	46·4	50·5	55·5	58·4	61·7	65·3	69·3	73·9	79·1	85·2	92·3	101	111
25	39·1	42·1	45·5	49·6	54·5	57·3	60·5	64·0	68·0	72·5	77·7	83·6	90·5	98·8	109
25½	38·4	41·3	44·7	48·7	53·5	56·3	59·4	62·9	66·8	71·2	76·2	82·1	88·9	96·9	107
26	37·7	40·6	43·9	47·8	52·5	55·3	58·3	61·7	65·6	69·9	74·9	80·6	87·3	95·2	105
26½	37·1	39·9	43·1	47·0	51·6	54·3	57·3	60·6	64·4	68·7	73·6	79·2	85·8	93·5	103
27	36·4	39·2	42·4	46·2	50·7	53·4	56·3	59·6	63·3	67·5	72·3	77·8	84·3	91·9	101
27½	35·8	38·5	41·7	45·4	49·9	52·5	55·4	58·6	62·2	66·4	71·1	76·5	82·9	90·4	99·4
28	35·2	37·9	41·0	44·7	49·1	51·6	54·5	57·6	61·2	65·3	69·9	75·3	81·5	88·9	97·8
28½	34·7	37·3	40·3	43·9	48·3	50·8	53·6	56·7	60·2	64·2	68·8	74·1	80·2	87·5	96·2
29	34·1	36·7	39·7	43·2	47·5	50·0	52·7	55·8	59·3	63·2	67·7	72·9	78·9	86·1	94·7
29½	33·6	36·1	39·1	42·6	46·8	49·2	51·9	55·0	58·4	62·2	66·7	71·8	77·7	84·8	93·2
30	33·1	35·6	38·5	41·9	46·1	48·5	51·1	54·1	57·5	61·3	65·6	70·7	76·5	83·5	91·8

To convert time into longitude divide by 4. Thus 50·8s. ÷ by 4 = 12·7′ longitude.

Table D.

SHOWING THE ERROR PRODUCED IN THE TIME OR LONGITUDE BY AN ERROR OF 1′ IN THE ALTITUDE.

Azimuths.	LATITUDES.														
	61°	62°	63°	64°	65°	66°	67°	68°	69°	69½°	70°	70½°	71°	71½°	72°
°	s.	s.	s.	s.	s.	s.	s.	s.	s.	s.	s.	s.	s.	s.	s.
30	16·5	17·0	17·6	18·2	18·9	19·7	20·5	21·4	22·3	22·8	23·4	24·0	24·6	25·2	25·9
31	16·0	16·5	17·1	17·7	18·4	19·1	19·9	20·7	21·7	22·2	22·7	23·3	23·9	24·5	25·1
32	15·6	16·1	16·6	17·2	17·9	18·6	19·3	20·1	21·1	21·6	22·1	22·6	23·2	23·8	24·4
33	15·1	15·6	16·2	16·8	17·4	18·1	18·8	19·6	20·5	21·0	21·5	22·0	22·6	23·1	23·8
34	14·8	15·2	15·8	16·3	16·9	17·6	18·3	19·1	20·0	20·4	20·9	21·4	22·0	22·5	23·1
35	14·4	14·9	15·4	15·9	16·5	17·1	17·8	18·6	19·5	19·9	20·4	20·9	21·4	22·0	22·6
36	14·0	14·5	15·0	15·5	16·1	16·7	17·4	18·2	19·0	19·4	19·9	20·4	20·9	21·4	22·0
37	13·7	14·2	14·6	15·2	15·7	16·3	17·0	17·7	18·5	19·0	19·4	19·9	20·4	20·9	21·5
38	13·4	13·8	14·3	14·8	15·4	16·0	16·6	17·3	18·1	18·6	19·0	19·5	20·0	20·5	21·0
39	13·1	13·5	14·0	14·5	15·0	15·6	16·3	17·0	17·7	18·1	18·6	19·0	19·5	20·0	20·6
40	12·8	13·3	13·7	14·2	14·7	15·3	15·9	16·6	17·4	17·8	18·2	18·6	19·1	19·6	20·1
41	12·6	13·0	13·4	13·9	14·4	15·0	15·6	16·3	17·0	17·4	17·8	18·3	18·7	19·2	19·7
42	12·3	12·7	13·2	13·6	14·1	14·7	15·3	16·0	16·7	17·1	17·5	17·9	18·4	18·8	19·3
43	12·1	12·5	12·9	13·4	13·9	14·4	15·0	15·7	16·4	16·7	17·1	17·6	18·0	18·5	19·0
44	11·9	12·3	12·7	13·1	13·6	14·2	14·7	15·4	16·1	16·4	16·8	17·3	17·7	18·1	18·6
45	11·7	12·0	12·5	12·9	13·4	13·9	14·5	15·1	15·8	16·2	16·5	16·9	17·4	17·8	18·3
46	11·5	11·8	12·2	12·7	13·2	13·7	14·2	14·8	15·5	15·9	16·3	16·7	17·1	17·5	18·0
47	11·3	11·6	12·0	12·5	12·9	13·4	14·0	14·6	15·3	15·6	16·0	16·4	16·8	17·2	17·7
48	11·1	11·5	11·9	12·3	12·7	13·2	13·8	14·4	15·0	15·4	15·7	16·1	16·5	17·0	17·4
49	10·9	11·3	11·7	12·1	12·5	13·0	13·6	14·1	14·8	15·1	15·5	15·9	16·3	16·7	17·2
50	10·8	11·1	11·5	11·9	12·4	12·8	13·4	13·9	14·6	14·9	15·3	15·6	16·0	16·5	16·9
51	10·6	11·0	11·3	11·7	12·2	12·7	13·2	13·7	14·4	14·7	15·0	15·4	15·8	16·2	16·7
52	10·5	10·8	11·2	11·6	12·0	12·5	13·0	13·6	14·2	14·5	14·8	15·2	15·6	16·0	16·4
53	10·3	10·7	11·0	11·4	11·9	12·3	12·8	13·4	14·0	14·3	14·6	15·0	15·4	15·8	16·2
54	10·2	10·5	10·9	11·3	11·7	12·2	12·7	13·2	13·8	14·1	14·5	14·8	15·2	15·6	16·0
55	10·1	10·4	10·8	11·1	11·5	12·0	12·5	13·0	13·6	13·9	14·3	14·6	15·0	15·4	15·8
56	9·95	10·3	10·6	11·0	11·4	11·9	12·3	12·9	13·5	13·8	14·1	14·5	14·8	15·2	15·6
57	9·84	10·2	10·5	10·9	11·3	11·7	12·2	12·7	13·3	13·6	13·9	14·3	14·6	15·0	15·4
58	9·73	10·0	10·4	10·8	11·2	11·6	12·1	12·6	13·2	13·5	13·8	14·1	14·5	14·9	15·3
59	9·63	9·94	10·3	10·6	11·0	11·5	11·9	12·5	13·0	13·3	13·6	14·0	14·3	14·7	15·1
60	9·53	9·84	10·2	10·5	10·9	11·4	11·8	12·3	12·9	13·2	13·5	13·8	14·2	14·6	14·9
61	9·43	9·74	10·1	10·4	10·8	11·2	11·7	12·2	12·8	13·1	13·4	13·7	14·0	14·4	14·8
62	9·34	9·65	10·0	10·3	10·7	11·1	11·6	12·1	12·6	12·9	13·2	13·6	13·9	14·3	14·7
63	9·26	9·56	9·89	10·2	10·6	11·0	11·5	12·0	12·5	12·8	13·1	13·4	13·8	14·1	14·5
64	9·18	9·48	9·80	10·2	10·5	10·9	11·4	11·9	12·4	12·7	13·0	13·3	13·7	14·0	14·4
65	9·10	9·40	9·72	10·1	10·4	10·9	11·3	11·8	12·3	12·6	12·9	13·2	13·6	13·9	14·3
66	9·03	9·33	9·64	9·99	10·4	10·8	11·2	11·7	12·2	12·5	12·8	13·1	13·4	13·8	14·2
67	8·96	9·26	9·57	9·91	10·3	10·7	11·1	11·6	12·1	12·4	12·7	13·0	13·3	13·7	14·1
68	8·90	9·19	9·50	9·84	10·2	10·6	11·0	11·5	12·0	12·3	12·6	12·9	13·3	13·6	14·0
69	8·84	9·13	9·44	9·77	10·1	10·5	11·0	11·4	12·0	12·2	12·5	12·8	13·2	13·5	13·9
70	8·78	9·07	9·38	9·71	10·1	10·5	10·9	11·4	11·9	12·2	12·4	12·8	13·1	13·4	13·8
71	8·73	9·01	9·32	9·65	10·0	10·4	10·8	11·3	11·8	12·1	12·4	12·7	13·0	13·3	13·7
72	8·68	8·96	9·26	9·59	9·95	10·3	10·8	11·2	11·7	12·0	12·3	12·6	12·9	13·3	13·6
73	8·63	8·91	9·21	9·54	9·90	10·3	10·7	11·2	11·7	11·9	12·2	12·5	12·8	13·2	13·5
74	8·58	8·86	9·17	9·49	9·85	10·2	10·6	11·1	11·6	11·9	12·2	12·5	12·8	13·1	13·5
75	8·54	8·82	9·12	9·45	9·80	10·2	10·6	11·1	11·6	11·8	12·1	12·4	12·7	13·1	13·4
76	8·50	8·78	9·08	9·40	9·75	10·1	10·6	11·0	11·5	11·8	12·1	12·3	12·7	13·0	13·3
77	8·47	8·74	9·04	9·36	9·71	10·1	10·5	11·0	11·5	11·7	12·0	12·3	12·6	12·9	13·3
78	8·44	8·71	9·01	9·33	9·68	10·1	10·5	10·9	11·4	11·7	12·0	12·3	12·6	12·9	13·2
79	8·41	8·68	8·98	9·30	9·64	10·0	10·4	10·9	11·4	11·6	11·9	12·2	12·5	12·8	13·2
80	8·38	8·65	8·95	9·27	9·61	9·99	10·4	10·8	11·3	11·6	11·9	12·2	12·5	12·8	13·1
81	8·35	8·63	8·92	9·24	9·58	9·96	10·4	10·8	11·3	11·6	11·8	12·1	12·4	12·8	13·1
82	8·33	8·60	8·90	9·21	9·56	9·93	10·3	10·8	11·3	11·5	11·8	12·1	12·4	12·7	13·1
83	8·31	8·58	8·88	9·19	9·54	9·91	10·3	10·8	11·2	11·5	11·8	12·1	12·4	12·7	13·0
84	8·30	8·57	8·87	9·17	9·52	9·89	10·3	10·7	11·2	11·5	11·8	12·0	12·4	12·7	13·0
85	8·28	8·55	8·84	9·16	9·50	9·87	20·3	10·7	11·2	11·5	11·7	12·0	12·3	12·7	13·0
86	8·27	8·54	8·83	9·15	9·49	9·86	10·3	10·7	11·2	11·4	11·7	12·0	12·3	12·6	13·0
87	8·26	8·53	8·82	9·14	9·48	9·85	10·3	10·7	11·2	11·4	11·7	12·0	12·3	12·6	13·0
88	8·26	8·53	8·82	9·13	9·47	9·84	10·2	10·7	11·2	11·4	11·7	12·0	12·3	12·6	13·0
89	8·25	8·52	8·81	9·13	9·47	9·84	10·2	10·7	11·2	11·4	11·7	12·0	12·3	12·6	12·9
90	8·25	8·52	8·81	9·12	9·46	9·83	10·2	10·7	11·2	11·4	11·7	12·0	12·3	12·6	12·9

To convert time into longitude divide by 4. Thus 12s. ÷ 4 = 3′ long.

Table D.

SHOWING THE ERROR PRODUCED IN THE TIME OR LONGITUDE BY AN ERROR OF 1′ IN THE ALTITUDE.

Azimuths.	LATITUDES.														
	73°	74°	75°	76°	77°	78°	79°	80°	81°	82°	83°	83½°	84°	84½°	85°
°	s.	s.	s.	s.	s.	s.	s.	s.	s.	s.	s.	s.	s.	s.	s.
30	27·4	29·0	30·9	33·1	35·6	38·5	41·9	46·1	51·1	57·5	65·6	70·7	76·5	83·5	91·8
31	26·6	28·2	30·0	32·1	34·5	37·4	40·7	44·7	49·6	55·8	63·7	68·6	74·3	81·0	89·1
32	25.8	27·4	29·2	31·2	33·6	36·3	39·6	43·5	48·3	54·2	61·9	66·7	72·2	78·8	86·6
33	25·1	26·6	28·4	30·4	32·6	35·3	38·5	42·3	46·9	52·8	60·3	64·9	70·3	76·6	84·3
34	24·5	26·0	27·6	29·6	31·8	34·4	37·5	41·2	45·7	51·4	58·7	63·2	68·4	74·6	82·1
35	23·9	25·3	26·9	28·8	31·0	33·5	36·5	40·2	44·6	50·1	57·2	61·6	66·7	72·8	80·0
36	23·3	24·7	26·3	28·1	30·3	32·7	35·7	39·2	43·5	48·9	55·8	60·1	65·1	71·0	78·1
37	22·7	24·1	25·7	27·5	29·5	32·0	34·8	38·3	42·5	47·8	54·5	58·7	63·6	69·4	76·3
38	22·2	23·6	25·1	26·9	28·9	31·2	34·0	37·4	41·5	46·7	53·3	57·4	62·2	67·8	74·5
39	21·7	23·1	24·6	26·3	28·3	30·6	33·3	36·6	40·6	45·7	52·2	56·1	60·8	66·3	72·9
40	21·3	22·6	24·0	25·7	27·7	29·9	32·6	35·8	39·8	44·7	51·1	55·0	59·5	64·9	71·4
41	20·9	22·1	23·6	25·2	27·1	29·3	32·0	35·1	39·0	43·8	50·0	53·9	58·3	63·6	70·0
42	20·4	21·7	23·1	24·7	26·6	28·8	31·3	34·4	38·2	43·0	49·1	52·8	57·2	62·4	68·6
43	20·1	21·3	22·7	24·2	26·1	28·2	30·7	33·8	37·5	42·1	48·1	51·8	56·1	61·2	67·3
44	19·7	20·9	22·2	23·8	25·6	27·7	30·2	33·2	36·8	41·4	47·2	50·9	55·1	60·1	66·1
45	19·3	20·5	21·9	23·4	25·1	27·2	29·6	32·6	36·2	40·6	46·4	50·0	54·1	59·0	64·9
46	19·0	20·2	21·5	23·0	24·7	26·7	29·1	32·0	35·5	40·0	45·6	49·1	53·2	58·0	63·8
47	18·7	19·8	21·1	22·6	24·3	26·3	28·7	31·5	35·0	39·3	44·9	48·3	52·3	57·1	62·7
48	18·4	19·5	20·8	22·2	23·9	25·9	28·2	31·0	34·4	38·7	44·2	47·5	51·5	56·2	61·8
49	18·1	19·2	20·5	21·9	23·6	25·5	27·8	30·5	33·9	38·1	43·5	46·8	50·7	55·3	60·8
50	17·9	18·9	20·2	21·6	23·2	25·1	27·4	30·1	33·4	37·5	42·9	46·1	50·0	54·5	59·9
51	17·6	18·7	19·9	21·3	22·9	24·8	27·0	29·6	32·9	37·0	42·2	45·5	49·2	53·7	59·1
52	17·4	18·4	19·6	21·0	22·6	24·4	26·6	29·2	32·5	36·5	41·7	44·8	48·6	53·0	58·2
53	17·1	18·2	19·4	20·7	22·3	24·1	26·2	28·8	32·0	36·0	41·1	44·2	47·9	52·3	57·5
54	16·9	17·9	19·1	20·4	22·0	23·8	25·9	28·5	31·6	35·5	40·6	43·7	47·3	51·6	56·7
55	16·7	17·7	18·9	20·2	21·7	23·5	25·6	28·1	31·2	35·1	40·1	43·1	46·7	50·9	56·0
56	16·5	17·5	18·6	19·9	21·4	23·2	25·3	27·8	30·8	34·7	39·6	42·6	46·2	50·3	55·4
57	16·3	17·3	18·4	19·7	21·2	22·9	25·0	27·5	30·5	34·3	39·1	42·1	45·6	49·8	54·7
58	16·1	17·1	18·2	19·5	21·0	22·7	24·7	27·2	30·2	33·9	38·7	41·7	45·1	49·2	54·1
59	16·0	16·9	18·0	19·3	20·7	22·4	24·5	26·9	29·8	33·5	38·3	41·2	44·6	48·7	53·5
60	15·8	16·8	17·8	19·1	20·5	22·2	24·2	26·6	29·5	33·2	37·9	40·8	44·2	48·2	53·0
61	15·6	16·6	17·7	18·9	20·3	22·0	24·0	26·3	29·2	32·9	37·5	40·4	43·8	47·7	52·5
62	15·5	16·4	17·5	18·7	20·1	21·8	23·7	26·1	29·0	32·6	37·2	40·0	43·3	47·3	52·0
63	15·3	16·3	71·3	18·6	20·0	21·6	23·5	25·9	28·7	32·3	36·8	39·7	42·9	46·8	51·5
64	15·2	16·1	17·2	18·4	19·8	21·4	23·3	25·6	28·4	32·0	36·5	39·3	42·6	46·4	51·1
65	15·1	16·0	17·1	18·2	19·6	21·2	23·1	25·4	28·2	31·7	36·2	39·0	42·2	46·0	50·6
66	15·0	15·9	16·9	18·1	19·5	21·1	22·9	25·2	28·0	31·5	35·9	38·7	41·9	45·7	50·2
67	14·9	15·8	16·8	18·0	19·3	20·9	22·8	25·0	27·8	31·2	35·7	38·4	41·6	45·3	49·9
68	14·8	15·7	16·7	17·8	19·2	20·7	22·6	24·8	27·6	31·0	35·4	38·1	41·3	45·0	49·5
69	14·7	15·5	16·6	17·7	19·0	20·6	22·5	24·7	27·4	30·8	35·2	37·8	41·0	44·7	49·2
70	14·6	15·4	16·4	17·6	18·9	20·5	22·3	24·5	27·2	30·6	34·9	37·6	40·7	44·4	48·8
71	14·5	15·3	16·3	17·5	18·8	20·3	22·2	24·4	27·0	30·4	34·7	37·4	40·5	44·1	48·5
72	14·4	15·3	16·3	17·4	18·7	20·2	22·0	24·2	26·9	30·2	34·5	37·2	40·2	43·9	48·3
73	14·3	15·2	16·2	17·3	18·6	20·1	21·9	24·1	26·7	30·1	34·3	36·9	40·1	43·6	48·0
74	14·2	15·1	16·1	17·2	18·5	20·0	21·8	24·0	26·6	29·9	34·1	36·8	39·8	43·4	47·7
75	14·2	15·0	16·0	17·1	18·4	19·9	21·7	23·8	26·5	29·8	34·0	36·6	39·6	43·2	47·5
76	14·1	15·0	15·9	17·0	18·3	19·8	21·6	23·7	26·4	29·6	33·8	36·4	39·4	43·0	47·3
77	14·0	14·9	15·9	17·0	18·2	19·7	21·5	23·6	26·2	29·5	33·7	36·3	39·3	42·8	47·1
78	14·0	14·8	15·8	16·9	18·2	19·7	21·4	23·5	26·1	29·4	33·6	36·1	39·1	42·7	46·9
79	13·9	14·8	15·7	16·8	18·1	19·6	21·4	23·5	26·0	29·3	33·4	36·0	39·0	42·5	46·8
80	13·9	14·7	15·7	16·8	18·1	19·5	21·3	23·4	26·0	29·2	33·3	35·9	38·9	42·4	46·6
81	13·9	14·7	15·6	16·7	18·0	19·5	21·2	23·3	25·9	29·1	33·2	35·8	38·7	42·3	46·5
82	13·8	14·7	15·6	16·7	18·0	19·4	21·2	23·3	25·8	29·0	33·1	35·7	38·6	42·1	46·3
83	13·8	14·6	15·6	16·7	17·9	19·4	21·1	23·2	25·8	29·0	33·1	35·6	38·6	42·0	46·2
84	13·8	14·6	15·5	16·6	17·9	19·3	21·1	23·2	25·7	28·9	33·0	35·5	38·5	42·0	46·1
85	13·7	14·6	15·5	16·6	17·8	19·3	21·0	23·2	25·7	28·9	32·9	35·5	38·4	41·9	46·1
86	13·7	14·5	15·5	16·6	17·8	19·3	21·0	23·1	25·6	28·8	32·9	35·4	38·4	41·8	46·0
87	13·7	14·5	15·5	16·6	17·8	19·3	21·0	23·1	25·6	28·8	32·9	35·4	38·3	41·8	46·0
88	13·7	14·5	15·5	16·5	17·8	19·2	21·0	23·0	25·6	28·8	32·8	35·4	38·3	41·8	45·9
89	13·7	14·5	15·5	16·5	17·8	19·2	21·0	23·0	25·6	28·7	32·8	35·3	38·3	41·7	45·9
90	13·7	14·5	15·5	16·5	17·8	19·2	21·0	23·0	25·6	28·7	32·8	35·3	38·3	41·7	45·9

Table E.

CORRECTIONS OF ALTITUDE OF THE SUN AND STARS
(INVOLVING DIP, REFRACTION, ⊙'s SEMIDIAMETER, AND PARALLAX).

Add the Cor. to the Alt. of the ⊙'s *Lower Limb.*

Sun's Obs. Alt.	Height of the Eye, in Feet.									
	6 ft.	8 ft.	10 ft.	12 ft.	14 ft.	16 ft.	18 ft.	20 ft.	22 ft.	24 ft.
°	'	'	'	'	'	'	'	'	'	'
5	3·9	3·5	3·1	2·8	2·5	2·2	1·9	1·7	1·5	1·3
6	5·2	4·8	4·5	4·2	3·9	3·7	3·4	3·2	2·9	2·7
7	6·4	5·9	5·6	5·3	5·0	4·8	4·5	4·3	4·0	3·8
8	7·2	6·8	6·5	6·2	5·9	5·6	5·4	5·2	4·9	4·7
9	7·9	7·5	7·2	6·8	6·6	6·3	6·1	5·8	5·6	5·4
10	8·4	8·0	7·7	7·4	7·1	6·9	6·6	6·4	6·2	6·0
11	8·9	8·5	8·2	7·9	7·6	7·4	7·1	6·9	6·7	6·5
12	9·3	8·9	8·6	8·3	8·0	7·8	7·5	7·3	7·1	6·9
13	9·6	9·2	8·9	8·6	8·4	8·1	7·9	7·6	7·4	7·2
14	9·9	9·5	9·2	8·9	8·6	8·4	8·1	7·9	7·7	7·5
15	10·2	9·8	9·5	9·2	8·9	8·6	8·4	8·2	8·0	7·8
16	10·4	10·0	9·7	9·4	9·1	8·9	8·6	8·4	8·2	8·0
17	10·6	10·3	9·9	9·6	9·4	9·1	8·9	8·6	8·4	8·2
18	10·8	10·4	10·1	9·8	9·5	9·3	9·0	8·8	8·6	8·4
19	10·9	10·6	10·3	9·9	9·7	9·4	9·2	8·9	8·7	8·5
20	11·1	10·7	10·4	10·1	9·8	9·6	9·3	9·1	8·9	8·7
22	11·3	11·0	10·7	10·3	10·1	9·8	9·6	9·4	9·2	9·0
24	11·6	11·2	10·9	10·6	10·3	10·0	9·8	9·6	9·4	9·2
26	11·7	11·4	11·1	10·7	10·5	10·2	10·0	9·8	9·5	9·3
28	11·9	11·5	11·2	10·9	10·6	10·4	10·2	9·9	9·7	9·5
30	12·1	11·7	11·4	11·1	10·8	10·5	10·3	10·1	9·9	9·7
35	12·4	12·0	11·7	11·3	11·1	10·8	10·6	10·4	10·1	9·9
40	12·6	12·2	11·9	11·6	11·3	11·0	10·8	10·6	10·4	10·2
45	12·8	12·4	12·1	11·8	11·5	11·2	11·0	10·8	10·5	10·3
50	12·9	12·5	12·2	11·9	11·6	11·4	11·2	10·9	10·7	10·5
55	13·1	12·7	12·4	12·1	11·8	11·5	11·3	11·1	10·9	10·7
60	13·2	12·8	12·5	12·2	11·9	11·6	11·4	11·2	11·0	10·8
65	13·3	12·9	12·6	12·3	12·0	11·8	11·5	11·3	11·1	10·9
70	13·4	13·0	12·7	12·4	12·1	11·9	11·6	11·4	11·2	11·0
80	13·6	13·2	12·9	12·6	12·3	12·0	11·8	11·6	11·4	11·2
90	13·7	13·4	13·0	12·7	12·5	12·2	12·0	11·7	11·5	11·3

CORRECTION OF A STAR'S ALTITUDE. (*Subtract.*)

Star's Alt.	Height of the Eye, in Feet.									
	6 ft.	8 ft.	10 ft.	12 ft.	14 ft.	16 ft.	18 ft.	20 ft.	22 ft.	24 ft.
°	'	'	'	'	'	'	'	'	'	'
5	12·3	12·6	13·1	13·4	13·7	13·9	14·2	14·4	14·6	14·8
6	10·9	11·3	11·6	12·0	12·3	12·5	12·8	13·0	13·2	13·4
7	9·7	10·2	10·5	10·9	11·1	11·4	11·6	11·9	12·1	12·3
8	9·0	9·3	9·7	10·0	10·3	10·5	10·8	11·0	11·2	11·4
9	8·3	8·7	9·0	9·3	9·6	9·8	10·1	10·3	10·5	10·7
10	7·7	8·1	8·4	8·7	9·0	9·3	9·5	9·7	10·0	10·2
11	7·3	7·6	7·9	8·3	8·5	8·8	9·0	9·3	9·5	9·7
12	6·9	7·2	7·5	7·9	8·1	8·4	8·6	8·9	9·1	9·3
13	6·5	6·9	7·2	7·5	7·8	8·0	8·3	8·5	8·7	8·9
14	6·2	6·6	6·9	7·2	7·5	7·8	8·0	8·2	8·5	8·7
15	6·0	6·3	6·6	7·0	7·2	7·5	7·7	8·0	8·2	8·4
16	5·8	6·1	6·4	6·8	7·0	7·3	7·5	7·7	8·0	8·2
17	5·5	5·9	6·2	6·5	6·8	7·0	7·3	7·5	7·7	7·9
18	5·4	5·7	6·0	6·4	6·6	6·9	7·1	7·3	7·6	7·8
19	5·2	5·6	5·9	6·2	6·5	6·7	7·0	7·2	7·4	7·6
20	5·0	5·4	5·7	6·0	6·3	6·6	6·8	7·0	7·3	7·5
22	4·8	5·2	5·5	5·8	6·1	6·3	6·5	6·8	7·0	7·2
24	4·6	4·9	5·3	5·6	5·8	6·1	6·3	6·6	6·8	7·0
26	4·4	4·8	5·1	5·4	5·7	5·9	6·1	6·4	6·6	6·8
28	4·2	4·6	4·9	5·2	5·5	5·7	6·0	6·2	6·4	6·6
30	4·1	4·4	4·8	5·1	5·3	5·6	5·8	6·1	6·3	6·5
35	3·8	4·2	4·5	4·8	5·1	5·3	5·5	5·8	6·0	6·2
40	3·6	3·9	4·3	4·6	4·8	5·1	5·3	5·6	5·8	6·0
45	3·4	3·8	4·1	4·4	4·6	4·9	5·1	5·4	5·6	5·8
50	3·2	3·6	3·9	4·2	4·5	4·7	5·0	5·2	5·4	5·6
55	3·1	3·4	3·8	4·1	4·4	4·6	4·8	5·1	5·3	5·5
60	3·0	3·3	3·7	4·0	4·2	4·5	4·7	5·0	5·2	5·4
65	2·9	3·2	3·6	3·9	4·1	4·4	4·6	4·9	5·1	5·3
70	2·8	3·1	3·5	3·8	4·0	4·3	4·5	4·8	5·0	5·2
80	2·6	2·9	3·3	3·6	3·9	4·1	4·3	4·6	4·8	5·0
90	2·4	2·8	3·1	3·4	3·7	3·9	4·2	4·4	4·6	4·8

Table F.

Acceleration.				
H.	M.	S.	M.	S.
1	0	9·86	1	0·16
2	0	19·71	2	0·33
3	0	29·57	3	0·49
4	0	39·43	4	0·66
5	0	49·28	5	0·82
6	0	59·14	6	0·98
7	1	9·00	7	1·15
8	1	18·85	8	1·31
9	1	28·71	9	1·48
10	1	38·56	10	1·64
11	1	48·42	11	1·81
12	1	58·28	12	1·97
13	2	8·13	13	2·13
14	2	17·99	14	2·30
15	2	27·85	15	2·46
16	2	37·70	16	2·63
17	2	47·56	17	2·79
18	2	57·42	18	2·96
19	3	7·27	19	3·12
20	3	17·13	20	3·29
21	3	26·99	21	3·45
22	3	36·84	22	3·61
23	3	46·70	23	3·78
24	3	56·56	24	3·94
			25	4·11
			26	4·27
			27	4·44
			28	4·60
			29	4·76
			30	4·93
			31	5·09
			32	5·26
			33	5·42
			34	5·59
			35	5·75
			36	5·91
			37	6·08
			38	6·24
			39	6·40
			40	6·57
			41	6·74
			42	6·90
			43	7·06
			44	7·23
			45	7·39
			46	7·56
			47	7·72
			48	7·89
			49	8·05
			50	8·21
			51	8·38
			52	8·54
			53	8·71
			54	8·87
			55	9·04
			56	9·20
			57	9·36
			58	9·53
			59	9·69
			60	9·86

Month Cor. to Sun's Alt.	
	'
Jan.	+ 0·3
Feb.	+ 0·2
Mar.	+ 0·1
April	− 0·1
May	− 0·2
June	− 0·2
July	− 0·3
Aug.	− 0·2
Sep.	− 0·1
Oct.	+ 0·1
Nov.	+ 0·2
Dec.	+ 0·3

Table E.

CORRECTIONS OF ALTITUDE OF THE SUN AND STARS

(Involving Dip, Refraction, ☉'s Semidiameter, and Parallax).

Add the Cor. to the Alt. of the ☉'s *Lower Limb*, except *where marked* − (minus).

Sun's Obs. Alt.	Height of the Eye, in Feet.										
	26 ft.	28 ft.	30 ft.	35 ft.	40 ft.	45 ft.	50 ft.	55 ft.	60 ft.	70 ft.	80 ft.
°	′	′	′	′	′	′	′	′	′	′	′
5	1·1	0·9	0·7	0·3	−0·1	−0·5	−0·8	−1·2	−1·6	−2·8	−3·3
6	2·5	2·4	2·2	1·7	1·3	0·9	0·6	0·2	−0·1	−0·7	−1·3
7	3·6	3·5	3·3	2·8	2·4	2·1	1·7	1·3	1·0	0·4	−0·2
8	4·5	4·3	4·2	3·7	3·3	3·0	2·6	2·2	1·9	1·3	0·7
9	5·2	5·0	4·8	4·4	4·0	3·6	3·3	2·9	2·6	2·0	1·4
10	5·8	5·6	5·4	5·0	4·6	4·2	3·8	3·5	3·2	2·5	2·0
11	6·3	6·1	5·9	5·5	5·0	4·7	4·3	4·0	3·6	3·0	2·5
12	6·7	6·5	6·3	5·9	5·5	5·1	4·7	4·4	4·1	3·5	2·9
13	7·0	6·8	6·6	6·2	5·8	5·4	5·1	4·7	4·4	3·8	3·2
14	7·3	7·1	6·9	6·5	6·1	5·7	5·4	5·0	4·7	4·1	3·5
15	7·6	7·4	7·2	6·8	6·4	6·0	5·6	5·3	5·0	4·4	3·8
16	7·8	7·6	7·4	7·0	6·6	6·2	5·9	5·5	5·2	4·6	4·0
17	8·0	7·8	7·6	7·2	6·8	6·4	6·1	5·7	5·4	4·8	4·2
18	8·2	8·0	7·8	7·4	7·0	6·6	6·3	5·9	5·6	5·0	4·4
19	8·3	8·2	8·0	7·5	7·1	6·8	6·4	6·1	5·8	5·1	4·6
20	8·5	8·3	8·1	7·7	7·3	6·9	6·5	6·2	5·9	5·3	4·7
22	8·7	8·6	8·4	7·9	7·5	7·2	6·8	6·5	6·2	5·5	5·0
24	9·0	8·8	8·6	8·2	7·8	7·4	7·0	6·7	6·4	5·8	5·2
26	9·1	9·0	8·8	8·3	7·9	7·6	7·2	6·9	6·6	5·9	5·4
28	9·3	9·1	8·9	8·5	8·1	7·7	7·4	7·0	6·7	6·1	5·5
30	9·5	9·3	9·1	8·7	8·3	7·9	7·5	7·2	6·9	6·3	5·7
35	9·7	9·6	9·4	8·9	8·5	8·2	7·8	7·5	7·2	6·5	6·0
40	10·0	9·8	9·6	9·2	8·8	8·4	8·0	7·7	7·4	6·8	6·2
45	10·1	10·0	9·8	9·4	9·0	8·6	8·2	7·9	7·6	7·0	6·4
50	10·3	10·1	9·9	9·5	9·1	8·7	8·4	8·0	7·7	7·1	6·5
55	10·5	10·3	10·1	9·7	9·3	8·9	8·5	8·2	7·9	7·3	6·7
60	10·6	10·4	10·2	9·8	9·4	9·0	8·6	8·3	8·0	7·4	6·8
65	10·7	10·5	10·3	9·9	9·5	9·1	8·7	8·4	8·1	7·5	6·9
70	10·8	10·6	10·4	10·0	9·6	9·2	8·8	8·5	8·2	7·6	7·0
80	11·0	10·8	10·6	10·2	9·8	9·4	9·0	8·7	8·4	7·8	7·2
90	11·1	10·9	10·8	10·3	9·9	9·6	9·2	8·9	8·5	7·9	7·4

CORRECTION OF A STAR'S ALTITUDE. (*Subtract.*)

Star's Alt.	Height of the Eye, in Feet.										
	26 ft.	28 ft.	30 ft.	35 ft.	40 ft.	45 ft.	50 ft.	55 ft.	60 ft.	70 ft.	80 ft.
°	′	′	′	′	′	′	′	′	′	′	′
5	15·0	15·2	15·4	15·8	16·3	16·6	17·0	17·4	17·7	18·4	18·9
6	13·6	13·8	14·0	14·4	14·8	15·2	15·6	15·9	16·3	16·9	17·5
7	12·5	12·7	12·9	13·3	13·7	14·1	14·6	14·8	15·1	15·8	16·3
8	11·6	11·8	12·0	12·4	12·8	13·2	13·6	13·9	14·3	14·9	15·4
9	10·9	11·1	11·3	11·7	12·1	12·5	12·9	13·2	13·5	14·2	14·7
10	10·4	10·6	10·7	11·2	11·6	11·9	12·3	12·6	13·0	13·6	14·2
11	9·9	10·1	10·3	10·7	11·1	11·5	11·9	12·2	12·5	13·1	13·7
12	9·5	9·7	9·8	10·3	10·7	11·0	11·4	11·8	12·1	12·7	13·3
13	9·1	9·3	9·5	9·9	10·3	10·7	11·1	11·4	11·7	12·3	12·9
14	8·9	9·0	9·2	9·7	10·1	10·4	10·8	11·1	11·4	12·1	12·6
15	8·6	8·8	8·9	9·4	9·8	10·1	10·5	10·8	11·2	11·8	12·3
16	8·4	8·5	8·7	9·2	9·6	9·9	10·3	10·6	10·9	11·6	12·1
17	8·1	8·3	8·5	8·9	9·3	9·7	10·1	10·4	10·7	11·4	11·9
18	7·9	8·1	8·3	8·8	9·2	9·5	9·9	10·2	10·5	11·2	11·7
19	7·8	8·0	8·2	8·6	9·0	9·4	9·7	10·1	10·4	11·0	11·6
20	7·7	7·8	8·0	8·5	8·9	9·2	9·6	9·9	10·2	10·9	11·4
22	7·4	7·6	7·8	8·2	8·6	9·0	9·3	9·7	10·0	10·6	11·2
24	7·2	7·4	7·5	8·0	8·4	8·7	9·1	9·4	9·8	10·4	10·9
26	7·0	7·2	7·4	7·8	8·2	8·6	8·9	9·3	9·6	10·2	10·8
28	6·8	7·0	7·2	7·6	8·0	8·4	8·8	9·1	9·4	10·0	10·6
30	6·7	6·9	7·0	7·5	7·9	8·2	8·6	8·9	9·3	9·9	10·4
35	6·4	6·6	6·8	7·2	7·6	8·0	8·3	8·7	9·0	9·6	10·2
40	6·2	6·4	6·5	7·0	7·4	7·7	8·1	8·4	8·8	9·4	9·9
45	6·0	6·2	6·4	6·8	7·2	7·6	7·9	8·3	8·6	9·2	9·8
50	5·8	6·0	6·2	6·6	7·0	7·4	7·8	8·1	8·4	9·0	9·6
55	5·7	5·9	6·1	6·5	6·9	7·3	7·6	7·9	8·3	8·9	9·5
60	5·6	5·8	5·9	6·4	6·8	7·1	7·5	7·8	8·2	8·8	9·3
65	5·5	5·7	5·8	6·3	6·7	7·0	7·4	7·7	8·1	8·7	9·2
70	5·4	5·6	5·7	6·2	6·6	6·9	7·3	7·6	8·0	8·6	9·1
80	5·2	5·4	5·6	6·0	6·4	6·8	7·1	7·5	7·8	8·4	9·0
90	5·0	5·2	5·4	5·8	6·2	6·6	6·9	7·3	7·6	8·2	8·8

SUPPLEMENTARY TABLES FOR LOW ALTITUDES.

Correction for Small Altitudes.

Sun's Obs. Altitude.	Height, 40 ft.	2nd Correction, Various Heights.	
		—	*Add* to / *Subt.* from } Alt.
° ′	′	Ft.	′
3 0	−4·9	6	+3·8
3 10	4·4	8	3·4
3 20	3·9	10	3·1
3 30	3·4	12	2·8
3 40	3·0	14	2·5
3 50	2·5	16	2·3
4 0	2·1	18	2·1
4 10	1·8	20	1·8
4 20	1·4	22	1·6
4 30	1·0	24	1·4
4 40	0·8	26	1·2
5 0	0·2	28	1·0
5 20	+0·4	30	0·8
5 40	0·9	32	0·7
6 0	1·3	34	0·5
6 20	1·7	36	0·3
6 40	2·1	38	0·2
7 0	2·4	40	0·0
7 20	2·7	42	−0·2
7 40	3·0	44	0·3
8 0	3·3	46	0·5
8 20	3·5	48	0·6
8 40	3·8	50	0·7
8 50	3·9	52	0·9
9 0	4·0	54	1·0
9 20	4·2	56	1·1
9 40	4·4	60	1·4
10 0	4·6	65	1·7
10 30	4·8	70	2·0
11 0	5·0	75	2·3

Star's Altitude.	Height, 40 ft.	2nd Correction, Various Heights.	
		—	*Add* to / *Subt.* from } Alt.
° ′	′	Ft.	′
3 0	21·1	6	+3·8
3 10	20·6	8	3·4
3 20	20·0	10	3·1
3 30	19·5	12	2·8
3 40	19·1	14	2·5
3 50	18·7	16	2·3
4 0	18·3	18	2·1
4 10	17·9	20	1·8
4 20	17·5	22	1·6
4 30	17·2	24	1·4
4 40	16·9	26	1·2
5 0	16·3	28	1·0
5 20	15·8	30	0·8
5 40	15·3	32	0·7
6 0	14·8	34	0·5
6 20	14·4	36	0·3
6 40	14·1	38	0·2
7 0	13·7	40	0·0
7 20	13·4	42	−0·2
7 40	13·1	44	0·3
8 0	12·8	46	0·5
8 20	12·6	48	0·6
8 40	12·4	50	0·7
8 50	12·3	52	0·9
9 0	12·1	54	1·0
9 20	11·9	56	1·1
9 40	11·7	60	1·4
10 0	11·6	65	1·7
10 30	11·3	70	2·0
11 0	11·1	75	2·3

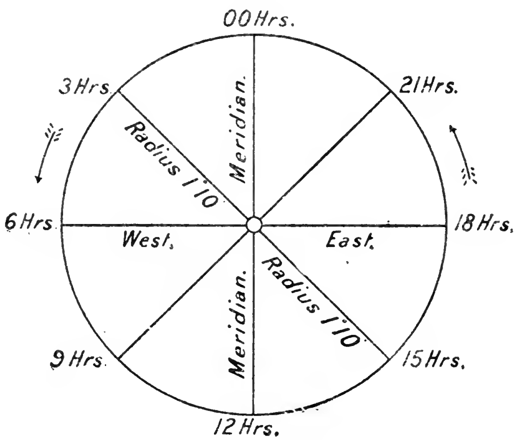
Table G.

STAR POLARIS AZIMUTH TABLE.

*'s Hr. Angle.	LATITUDES.										*'s Hr. Angle.
	0°	10°	20°	30°	35°	40°	45°	50°	55°	60°	
	Azimuths.										
H. M.	°	°	°	°	°	°	°	°	°	°	H. M.
0 00	0·0	0·0	0·0	0·0	0·0	0·0	0·0	0·0	0·0	0·0	12 00
0 20	0·1	0·1	0·1	0·1	0·1	0·1	0·1	0·2	0·2	0·2	11 40
0 40	0·2	0·2	0·2	0·2	0·3	0·3	0·3	0·3	0·4	0·4	11 20
1 00	0·3	0·3	0·3	0·4	0·4	0·4	0·4	0·5	0·5	0·6	11 00
1 20	0·4	0·4	0·4	0·5	0·5	0·5	0·6	0·6	0·7	0·8	10 40
1 40	0·5	0·5	0·5	0·6	0·6	0·7	0·7	0·8	0·9	1·0	10 20
2 00	0·6	0·6	0·6	0·7	0·7	0·8	0·8	0·9	1·1	1·2	10 00
2 20	0·7	0·7	0·7	0·8	0·8	0·9	1·0	1·0	1·2	1·4	9 40
2 40	0·8	0·8	0·8	0·9	0·9	1·0	1·1	1·2	1·3	1·6	9 20
3 00	0·8	0·8	0·9	1·0	1·0	1·1	1·2	1·3	1·5	1·7	9 00
3 20	0·9	0·9	1·0	1·0	1·1	1·2	1·3	1·4	1·6	1·8	8 40
3 40	1·0	1·0	1·0	1·1	1·2	1·3	1·4	1·5	1·7	2·0	8 20
4 00	1·0	1·0	1·1	1·2	1·2	1·3	1·5	1·6	1·8	2·1	8 00
4 20	1·1	1·1	1·1	1·2	1·3	1·4	1·5	1·7	1·9	2·2	7 40
4 40	1·1	1·1	1·2	1·3	1·4	1·4	1·6	1·7	1·9	2·2	7 20
5 00	1·1	1·2	1·2	1·3	1·4	1·5	1·6	1·8	2·0	2·3	7 00
5 20	1·2	1·2	1·2	1·3	1·4	1·5	1·6	1·8	2·0	2·3	6 40
5 40	1·2	1·2	1·2	1·4	1·4	1·5	1·7	1·8	2·0	2·3	6 20
6 00	1·2	1·2	1·2	1·4	1·4	1·5	1·7	1·8	2·0	2·4	6 00

For the twelve hours before the meridian passage (*above* the Pole) it is east of north, and for the twelve hours after it is west of north.

Diagram to illustrate the Apparent Motion of Star α Ursæ Minoris (Polaris) round the Pole. Declination of Star in 1910, 88° 49½′ N.; Right Ascension, 1 h. 27 m.



REDUCTION TO THE MERIDIAN TABLE FOR ✳ POLARIS.

AT HOUR-ANGLES FROM UPPER MERIDIAN.

Add Reduction to obtain Meridian Altitude.

Hour-angle.	LATITUDES. 10°	20°	30°	40°	50°	60°	Var. in 10 years Subt. from Reduction
H. M.	° ′	° ′	° ′	° ′	° ′	° ′	′
0 10	0·1	0·1	0·1	0·1	0·1	0·1	
20	0·3	0·3	0·3	0·3	0·3	0·3	
30	0·6	0·6	0·6	0·6	0·6	0·6	
40	1·1	1·1	1·1	1·1	1·1	1·1	
50	1·7	1·7	1·7	1·7	1·7	1·7	0·0
I 0	2·4	2·4	2·4	2·4	2·5	2·5	0·1
10	3·3	3·3	3·3	3·3	3·3	3·4	0·1
20	4·3	4·3	4·3	4·3	4·4	4·4	0·2
30	5·4	5·4	5·4	5·4	5·5	5·5	0·2
40	6·6	6·6	6·7	6·7	6·7	6·8	0·3
50	8·0	8·0	8·0	8·0	8·1	8·2	0·3
II 0	9·5	9·5	9·5	9·6	9·7	9·8	0·4
10	11·0	11·1	11·2	11·2	11·3	11·4	0·5
20	12·8	12·8	12·9	12·9	13·0	13·2	0·5
30	14·6	14·6	14·7	14·8	14·9	15·0	0·7
40	16·5	16·6	16·7	16·7	16·8	17·0	0·7
50	18·6	18·6	18·7	18·8	18·9	19·1	0·8
III 0	20·7	20·8	20·8	20·9	21·1	21·3	0·9
10	22·9	23·0	23·1	23·2	23·3	23·5	1·0
20	25·2	25·3	25·4	25·5	25·7	25·9	1·1
30	27·6	27·7	27·8	27·9	28·1	28·4	1·2
40	30·1	30·2	30·3	30·4	30·6	30·9	1·3
50	32·7	32·8	32·9	33·0	33·2	33·5	1·4
IV 0	35·3	35·4	35·5	35·7	35·9	36·2	1·5
10	38·0	38·1	38·2	38·4	38·6	38·9	1·6
20	40·8	40·9	41·0	41·2	41·4	41·7	1·7
30	43·6	43·7	43·9	44·0	44·2	44·6	1·9
40	46·5	46·6	46·7	46·9	47·1	47·4	2·0
50	49·4	49·5	49·6	49·8	50·1	50·4	2·1
V 0	52·3	52·4	52·6	52·8	53·0	53·3	2·2
10	55·3	55·4	55·6	55·8	56·0	56·3	2·4
20	58·3	58·5	58·6	58·8	59·0	59·4	2·5
30	1 1·4	1 1·5	1 1·7	1 1·8	1 2·1	1 2·5	2·6
40	1 4·4	1 4·5	1 4·7	1 4·9	1 5·1	1 5·5	2·8
50	1 7·5	1 7·6	1 7·8	1 8·0	1 8·2	1 8·6	2·9
VI 0	1 10·6	1 10·7	1 10·8	1 11·0	1 11·3	1 11·7	3·1

AT HOUR-ANGLES FROM LOWER MERIDIAN.

Subtract Reduction to obtain Meridian Altitude.

Hour-angle.	LATITUDES. 10°	20°	30°	40°	50°	60°
H. M.	° ′	° ′	° ′	° ′	° ′	° ′
0 10	0·1	0·1	0·1	0·1	0·1	0·1
20	0·3	0·3	0·3	0·3	0·3	0·3
30	0·6	0·6	0·6	0·6	0·6	0·6
40	1·1	1·1	1·1	1·1	1·1	1·0
50	1·7	1·7	1·7	1·7	1·7	1·6
I 0	2·4	2·4	2·4	2·4	2·3	2·3
10	3·3	3·2	3·2	3·2	3·2	3·1
20	4·2	4·2	4·2	4·2	4·1	4·1
30	5·3	5·3	5·3	5·3	5·2	5·2
40	6·6	6·6	6·5	6·5	6·4	6·4
50	7·9	7·9	7·9	7·8	7·8	7·7
II 0	9·4	9·4	9·3	9·3	9·2	9·1
10	11·0	10·9	10·9	10·9	10·8	10·7
20	12·7	12·6	12·6	12·5	12·5	12·3
30	14·5	14·5	14·4	14·3	14·2	14·1
40	16·4	16·4	16·3	16·2	16·1	16·0
50	18·5	18·4	18·3	18·2	18·1	18·0
III 0	20·6	20·5	20·4	20·3	20·2	20·0
10	22·8	22·7	22·6	22·5	22·4	22·2
20	25·1	25·0	24·9	24·8	24·7	24·5
30	27·5	27·4	27·3	27·2	27·0	26·8
40	29·9	29·9	29·8	29·6	29·5	29·2
50	32·5	32·4	32·3	32·2	32·0	31·7
IV 0	35·1	35·0	34·9	34·8	34·6	34·3
10	37·8	37·7	37·6	37·4	37·2	36·9
20	40·6	40·5	40·3	40·2	40·0	39·7
30	43·4	43·3	43·1	43·0	42·8	42·4
40	46·2	46·1	46·0	45·8	45·6	45·2
50	49·1	49·0	48·9	48·7	48·5	48·1
V 0	52·1	52·0	51·8	51·6	51·4	51·0
10	55·1	54·9	54·8	54·6	54·4	54·0
20	58·1	58·0	57·8	57·6	57·4	57·0
30	1 1·1	1 1·0	1 0·8	1 0·6	1 0·4	1 0·0
40	1 4·2	1 4·0	1 3·9	1 3·7	1 3·4	1 3·1
50	1 7·2	1 7·1	1 7·0	1 6·8	1 6·5	1 6·1
VI 0	1 10·3	1 10·2	1 10·0	1 9·8	1 9·6	1 9·2

For Azimuths of ✳ Polaris see page 88.

Examples in the Use of the above Table.

Example 1.—On April 2nd, 1914, at 3h. 30m. a.m., A.T. Sp. in latitude by D.R. 40° 15′ N., longitude 11° W. Required the approximate altitude of ✳ Polaris for setting the sextant for an observation to obtain the latitude. Height of eye, 40 ft.

	H. M.	
Mer. pass of ✳ in 1910 (p. 10)	0 44	a.m. below Pole.
Cor. for 4 years (see p. 6)	+ 2	
Mer. pass. in 1914	0 46	a.m.
Time at ship	3 30	a.m.
✳'s Approx. H.A. (below Pole)	2 44	gives reduction 16′·7.

Reduction at 2 h. 40 m. =	16′·2	′·2 × 4 m.	= + ′·8
Cor.	+ ·5	·7 × ·4 var in 4 years	= − ·3
True reduction	16·7		+ ·5

	° ′
Lat. by D.R.	40 15 N.
P.D. of ✳	−1 9·2
Mer. alt.	39 5·8
40 ft. cor. (p. 87)	+ 7·5
	39 13·3
Reduction	+ 16·7
Alt. for sextant	39 30 N.

	° ′
✳'s Dl.	88 50·8 N.
	90 0·0
P.D.	1 9·2 N.

Example 2.—On April 2nd, 1914, at 3h. 35m. a.m., A.T. Sp. in latitude by D.R. 40° 15′ N., longitude 11° W. Observed altitude of ✳ Polaris was found to be 39° 40′ N. Height of eye, 37 ft. Required the latitude.

	° ′
Obsd. alt. of ✳	39 40 N.
Eye, 40ft. (cor. p. 87)	− 7·5
	39 32·5
Reduction	− 17·7
Mer. alt. (below Pole)	39 14·8
P. dist. in 1914	1 9·2
Latitude	40 24·0 N.

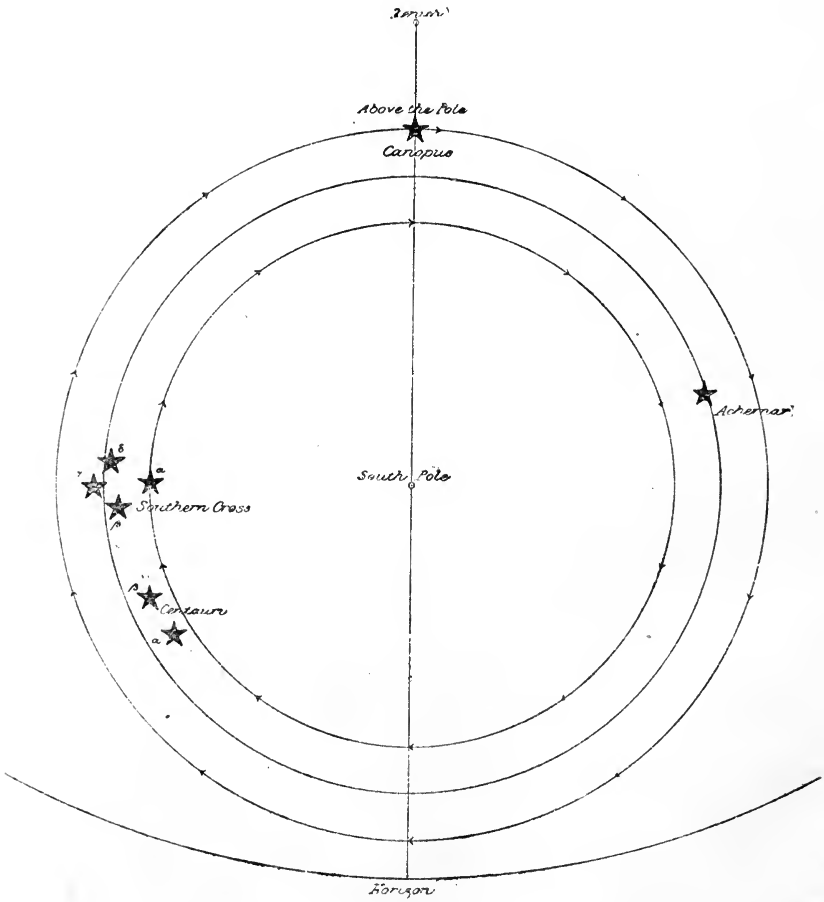
	H. M.	
Mer. pass. of ✳ in 1914	− 0 46	a.m.
Time of observation	3 35	a.m.
✳'s Approx. H.A. (below Pole)	2 49	gives reduction 17′·7.

	′
Reduction	18·0
Cor. for 4 years	−·3
True reduction	17·7

✳'s Sidereal H.A. would be nearly ½ m. greater; this correction, if required, may be made from the acceleration table, (page 86). It will be nearly 1 m. greater for 6 hours.

DIAGRAM TO AID IN FINDING THE POSITION OF SOUTH POLE.

This diagram represents the apparent motion of the bright high-declination stars Achernar, Canopus, and those in the constellations of the Southern Cross and Centaurs to an observer in the latitude of Wellington, New Zealand, in about 41° S. In this latitude none of these stars ever set, and they appear to describe a circle round an imaginary South Pole, with a radius equal to the co-declination of the star. The radius of α Crucis, for instance, is about $27\frac{1}{2}$°. It will be seen from the diagram that β Centauri and Achernar are always on opposite sides of the circle to one another, and that both stars are at nearly equal distances from the Pole; therefore the *approximate* position of the South Pole in the heavens will always be at a point midway between these two stars. When β Centauri is on the meridian above the Pole, Achernar will be close to the meridian below the Pole, or when β Centauri is east of the Pole Achernar will be about the same distance west of the Pole. The Centaurs will appear in almost exactly the same position in the heavens at, say, 6 p.m. on any given day that Achernar was in at 6 a.m. on the same day, or the Centaurs will appear in almost exactly the same position at 6 p.m. on one day that Achernar was in at the same hour of the day six months previously.



GENERAL REMARKS, RULES, AND EXAMPLES.

GENERAL REMARKS ON THE DOUBLE-ALTITUDE AND "SUMNER" PROBLEM.

Many navigators undervalue "Sumner's" method in low latitudes; first, because of the small change of bearing between the usual times of taking the observations, and, secondly, because with a high altitude the circle of altitude or line of position is not to the same extent a straight line on the chart. But in practice I have found "Sumner's" method give equally good, or better results in low latitudes than in high, if the observations are taken—or, at any rate, the second one is taken—within an hour of noon, or considerably less than an hour when in the tropics and latitude and declination are of the same name, in which case the "Sumner" or double-altitude method is all the more valuable, as an ex-meridian of the sun by itself would not give a dependable latitude unless the observation was taken within a very few minutes from noon; whereas in high latitudes an ex-meridian will often give a latitude fairly near the truth when the observation has been taken nearly an hour from the meridian. In low latitudes, when observations are taken on both sides of the meridian, 90° change of bearing may often be obtained within an hour, and by the aid of Blackburne's and Westland's ex-meridian tables a good "Sumner" position may be very quickly and accurately obtained from ex-meridian east and west of the meridian. To illustrate this an extreme case is given in this work where the greater altitude is 89°, and the change in bearing in 5 m. amounted to 72°.

It is impressed on navigators in these pages by the numerous examples and illustrations following that the lines of position need never be of great length, so that they may always be considered as straight lines even in tropical latitudes. When D.R. latitude is very uncertain, and one of the observations has been taken anywhere near the meridian, it may be worked out as an ex-meridian, plotted on the chart, and combined with another observation taken nearer the prime vertical, which would be worked out for a longitude; or two ex-meridian observations may be be taken and plotted on the chart, examples of which are given on pp. 152 and 153. Reviewers of former editions of this work have been much struck with the simplicity and practical value of this problem. Although the work is simplified and graphically illustrated by plotting the latitudes or longitudes on the chart, the resulting position is readily obtained by calculation without the aid of chart, as shown on pp. 92 to 95.

As most ex-meridian tables and methods of calculation only give a correct latitude when the observation is taken not far from the meridian, a method is given in this work which gives a correct latitude corresponding to a given hour-angle when the sun or other celestial body is several hours away from the meridian. The D.R. latitude is not used in this calculation.

In obtaining the latitude by the double-altitude or "Sumner" method it is best, if the observations are taken on the same side of the meridian, for the same person to observe both; and generally the truest *latitude* will be found if both observations are taken on the *same* side of the meridian, as it is probable that, if for any reason the altitude is observed too high or too low, the same thing will occur in both observations. For the same reason the truest *longitude* will be found from observations taken on *different* sides of the meridian. An example to illustrate this is given on pp. 114 and 115.

REMARKS ON P.M. OBSERVATIONS.

Any one who is in the habit of regularly taking p.m. sights must have noticed the large differences which sometimes occur between a.m. and p.m. observations, which is generally attributed to current, and some men have even been led to believe from this that p.m. sights are not of any value, as though the sun—or, rather, the earth—did not move as uniformly in the afternoon as in the forenoon. The principal *difference* between the result of the two observations is probably generally due to erroneous altitude, especially in rough weather, and sometimes, of course, to erroneous latitude, and the mean of the results from the two observations will generally be nearest the true position. It has often been noticed when there is a heavy sea on that p.m. sights place the longitude a long way to the eastward of the a.m. ones, owing probably to the sun being observed on the top of a wave, and consequently, the altitude being too small, an error which in the morning would place the ship to the westward of the true position, but in the afternoon just as much to the eastward of it; so that, supposing the ship to be in latitude 48° and the sun to be 30° from meridian at each observation, an error in the latitude of 2′ too little on both occasions would make a *difference* of 12′ of longitude, as may be seen from Table D, on p. 80. Suppose, then, that on the same occasion both observations have been worked with an error of 2′ south of the true latitude; this would make another difference of about 10½′ of longitude, making the p.m. sights 22½′ of longitude to eastward of the a.m. observation, and a slight easterly current in the interval between the two observations might easily make over 30′ difference. Generally, no doubt, one of these errors will in a measure counteract another, but exceptional occasions are almost sure to arise when they will all combine in the same direction.

RULE FOR FINDING THE POSITION OF SHIP FROM TWO OBSERVATIONS BY AID OF TABLES A, B, AND C² WITHOUT THE USE OF CHART.

From Two Chronometer Observations of the Sun.

(1.) Let two chronometer observations be taken at an interval of about an hour and a half or two hours,* and let the first be worked out with the D.R. latitude at the time of observation.

(2.) Let the D.R. latitude and longitude thus obtained be corrected for the run of the ship in the interval between the observations, and let the second observation be worked with the *corrected* latitude. Name these longitudes (1) and (2).

(2.) With the hour-angle, latitude, and declination at each observation, take out the difference of longitude correction from Tables A and B, and name the position-lines corresponding to these corrections according to the instruction under the heading of Table C² (p. 75).

Tables A ± B give the error in longitude due to 1′ of error in latitude.

When both Position-lines go through the Same or Opposite Quadrants.

(3.) The *difference* between the two A and B corrections will give the difference in the resulting longitudes due to 1′ of error in the latitude. (See example on p. 100.)

When both Position-lines go through Adjacent Quadrants.

(4.) The *sum* of the two A and B corrections will give the difference in the resulting longitudes due to 1′ of error in the latitude. (See example on pp. 102 and 107.)

The three elements used in the calculation of time, or longitude, are altitude, latitude, and polar distance. Presuming that the altitude and polar distance are correct, the resulting difference in longitude between the two observations must be due to error in the latitude. The sum or difference of the two A and B corrections give the difference of longitude in the two observations due to 1′ of error in the latitude used in the calculation, and the amount of error in the latitude will therefore be found by a simple proportion sum (see p. 100) from which it will be seen that the error or correction to be applied to the D.R. latitude will be found by dividing the difference between longitudes (1) and (2) by the sum or difference of the A and B corrections. It must be applied to the latitude used in the *last* observation, and to the N. or S. according to whether the position-lines cut one another N. or S. of the D.R. latitude used in the calculation. The true longitude is then found by multiplying either of the A and B corrections by the latitude error, and applying the correction according to the trend of the position-line.

To prevent the possibility of making a mistake in the application of the correction to the latitude, a short horizontal line representing the parallel of D.R. latitude may be drawn with a free hand in the work-book; on this line put down longitudes (1) and (2), and roughly draw the position-lines through each longitude, following the rule for naming the position-lines given on p. 75, under the heading of Table C², also bearing in mind that if the line runs in a north-easterly direction it is equally

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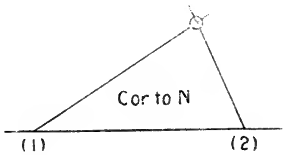
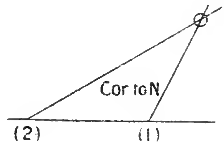
* Provided the sun's bearing has changed not less than two points.

true that the line must also run in the opposite direction or south-westerly. No scale for longitude need be used, or protractor for laying down the bearings, but simply put longitude (1) or (2) to the right or left of the other, as they are to the east or west of one another, then draw the general trend of the position-lines through these two longitudes, thus :—





For Stellar Observations.

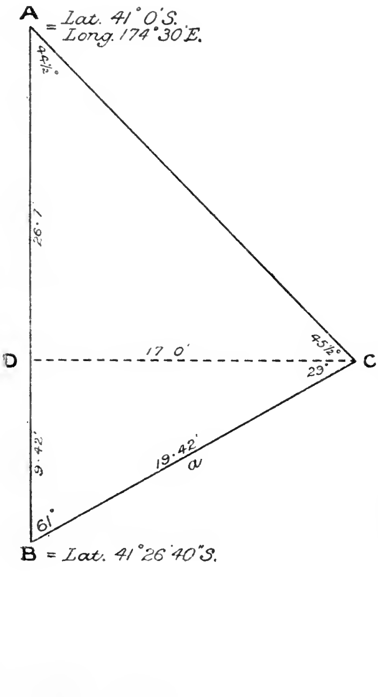
When finding the position of ship from stellar observations, it is best to observe the altitude of *two* stars which have a considerable difference in bearing from one another, and to take both observations within a few minutes of the same time. If the ship has not appreciably changed her position during the interval between the observations, both observations may be worked with the same latitude, and no correction for run need be applied to the first-observation latitude or longitude. Otherwise the same rules apply as for the observations by the sun.

When the ship has appreciably changed her position during the interval between the observations, rules Nos. 1 and 2 must be observed as in the sun observations.

From Ex-meridian and Chronometer Observation Combined.

Let two observations be taken with a suitable difference in bearing between them, and let the one nearest the prime vertical be used for a longitude (working it with the D.R. latitude), and the other one for a latitude, using the time deduced from the longitude found by observation in the calculation for latitude: bring both results up to the same instant of time by applying the run in interval between the observations.

Take out the A and B correction for the H.A. and latitude of each observation, and with this enter Table C^2 (p. 75) and take out the corresponding position-lines. We have then two latitudes and their corresponding position-lines starting from different points on the same meridian. Where these lines cut with one another on a plane chart will be the position of the ship.



From the figure representing these positions and position-lines it will be easy for any one having a knowledge of plane trigonometry to complete the calculation. For the sake of those who have not this knowledge, examples taken from the problems given in this book are now given to illustrate the different cases.

Example 1 (p. 109).—*Observations East and West of Meridian.*

With lat. 41° 0' S., long. by chron. from ✱ Canopus gave 174° 30' E. and position-line S. 44½° E.

With long. 174° 30' E., lat. by ex-mer. of ✱ α Centauri gave 41° 26' 40" S. and position-line N. 61° E.

For the figure.—From A, in lat. 41° 0' S. and long. 174° 30' E., draw a meridian-line to B, in lat. 41° 26' 40" S.; from A and B draw the lines S. 44½° E. and N. 61° E. respectively to cut one another at C. From C drop a perp. on A B at D.

In the right-angled triangles A D C and B D C the angles at C will be respectively 45½° and 29°, and therefore the angle at C in the △ A B C will = 74½°. We then have in the △ A B C, A = 44½°, C = 74½°, and A B = 26·7°. First find *a*, then B D, and next C D.

Formula.

$a = AB \cdot \sin A \cdot \operatorname{cosec} C$
$BD = a \cdot \cos B$
$CD = a \cdot \cos C.$

	A B	26·7′	Log	1·4265
	B	44½°	Sin	9·8457
	C	74½°	Cosec	0·0161
	a	19·42′	Log	1·2883
	B	61°	Cos	9·6856
Cor. for lat.	B D	9·42′	Log	0·9739
	a	19·42′	Log	1·2883
	C	29°	Cos	9·9418
Cor. for long.	C D	17·0′	Log	1·2301

	° ′ ″			° ′
Lat. by ex-mer.	41 26 40 S		Long. by chron.	174 30 E
Cor.	9 25 N		Cor.	17 E
Correct lat.	41 17 17 S		Correct long.	174 47 E

From Two Ex-meridian Observations on Different Sides of the Meridian.

Let two observations be taken with a suitable difference in bearing between them, one east and the other west of the meridian, deducing the hour-angle by applying the equation of time and longitude by D.R. Bring both results up to the same instant of time by applying the run in interval between the observations. The latitude from either observation (if worked by a correct method) is the latitude where the circle of altitude of the body observed cuts the meridian used in deducing the time. If both latitudes agree when observations have a considerable difference in bearing between them the longitude must be correct. If the latitudes do not agree the true latitude and longitude may readily be found by plotting on the chart, or by the formula used in preceding example, or by No. 2 method explained below.

Method No. 2.

By Aid of Table giving the Error in Latitude by Ex-meridian due to 4 sec. Error in Time or 1′ of Longitude.

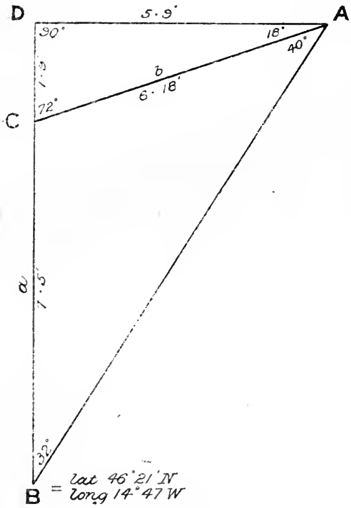
By the aid of the above-named table the double altitude problem may be worked from the meridian, on the same principle as two chronometer observations are worked from a parallel of latitude. If the azimuth is not over 70° (the limit of the table), the problem may be worked from the meridian with either an ex-meridian and chronometer observation combined or from two ex-meridians.

When both observations are on same side of meridian, the *difference* between the two errors in latitude, due to 1′ of error in the longitude, taken from the table, will be the divisor for the two differences of latitude resulting from the two observations, and will give the correction for the longitude used.

When one observation is east and the other west of meridian the error of longitude will be found by dividing the differences of latitude resulting from the two observations by the *sum* of the factors taken from the table. The error in latitude will then be found by multiplying the error in longitude by the correction taken from the table (in preference using the azimuth nearest to the meridian) and applying this to the ex-meridian latitude in the direction of the trend of the position-line, which is always at right angles to the bearing of object.

When the altitude is high and near the meridian the azimuth should be obtained by the time and altitude. This may be done either by Table D or by the rule of sines. (See examples on p. 105.)

EXAMPLE 2 (p. 105). *Both Observations on Same Side of Meridian.*



With lat. 46° 21′ N., long. by chron. from ⊙ obsn. gave 14° 46′ 55″ W. and position-line N. 32° E.

With long. 14° 46′ 55″ W., lat. by ex-mer. from second ⊙ obsn. gave 46° 28′ 30″ N. and position-line N. 72° E.

For the figure.—From B, in lat. 46° 21′ N. and 14° 47′ W., draw a meridian-line to C = lat. 46° 28·5′ N.; and from B and C draw two lines N. 32° E. and N. 72° E. respectively to cut one another at A. From A drop a perp. on BC produced at D.

We now have in the right-angled triangle ABD angle B = 32° ∴ A = 58°; and in the right-angled triangle ACD angle C = 72° ∴ A = 18°

In the triangle ABC, A will therefore = 40°

Then in the triangle ACB, B = 32°, A = 40°, and a = 7·5′

First find b, then CD = lat. cor., and AD = long. cor.

Formula.

$b = a \cdot \sin B \cdot \operatorname{cosec} A$
$CD = b \cdot \cos C$
$AD = b \cdot \cos A.$

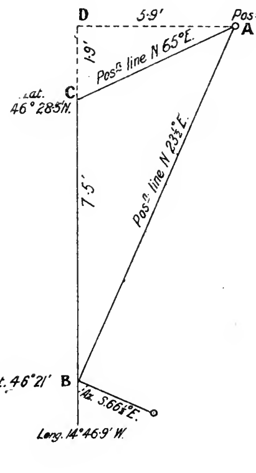
a	7·5′	Log	0·8751
B	32°	Sin	9·7242
A	40°	Cosec	0·1919
b	6·18′	Log	0·7912
C	72°	Cos	9·4900
Cor. for lat. CD	1·91₆	Log	0·2812
	1′ 54·6″		

b	6·18′	Log	0·7912
A	18°	Cos	9·9782
Cor. for long. AD	5·88′₆	Log	0·7694
	5′ 52·8″		

	° ′ ″
Lat. by ex-mer.	46 28 30 N
Cor.	1 55 N
Correct lat.	46 30 25 N

	° ′ ″
Long. by chron.	14 46 55 W
Cor.	5 53 E
Correct long.	14 41 2 W

BY NO. 2 METHOD.



1st obsn. ⊙'s Az. S 66½° E gives (Table M, pp. 150–151) 1′·59 N to Ed.
2nd obsn. ⊙'s Az. S 25° E gives (Table M, pp. 150–151) 0′·32 N to Ed.

Diff. 1′·27

Lat. error		Long.		Dift. lat.		Long. cor.
1·27′	:	1′	::	7·5′	:	5·9′

Lat. (1) 46° 21′·0 N
Lat. (2) 46° 28′·5 N

1′·27) 7′·5 (5′·9 E × ′·32 = Lat. cor. 1′·888 N

	° ′		° ′
Lat. by ex-mer. (2nd obsn.)	46 28·5 N	Long.	14 46·9 W
Cor.	1·9 N	Cor.	5·9 E
Lat. in	46 30·4 N	Long.	14 41·0 W

EXAMPLE 3.—*Two Ex-meridians on Different Sides of the Meridian.*

AT TIME OF 2ND OBSERVATION.

With long. D.R. 2° 35′ 40″ W., lat. by ex-mer. a.m. ⊙ Obsn. 10° 10·4′ S. and position-line for plane chart N. 64·8° W.

With long. D.R. 2° 35′ 40″ W., lat. by ex-mer. p.m. ⊙ Obsn. 9° 55·9′ S. and position-line for plain chart S. 63·7° W.

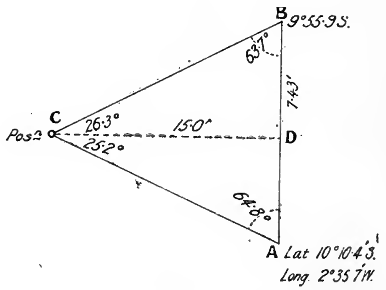
For the figure.—From A in lat. 10° 10·4′ S. and long. 2° 35·7′ W. draw a meridian line to B at 9° 55·9′ S. and from A and B draw two lines N. 64·8° W. and S. 63·7° W. respectively to cut one another at C. From C drop a perpendicular on A B at D.

In the right-angled triangles A C D and B C D the angles at C will be respectively 25·2° and 26·3°, and therefore the angle at C in the triangle A B C will equal 51·5°. We then have in the triangle A B C, A = 64·8°, C = 51·5°, and A B (diff. lat.) = 14·5′. First find *a*, then B D = lat. cor., and C D = long. cor.

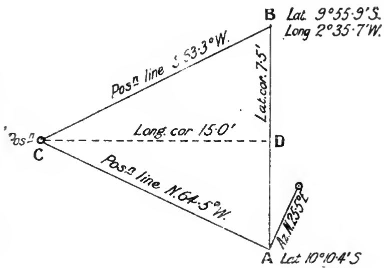
Formula.

$$a = \text{A B} \cdot \sin \text{A} \quad \text{cosec C}$$
$$\text{B D} = a \cdot \cos \text{B}$$
$$\text{C D} = a \cdot \cos \text{B C D}$$

A B	14·5′	Log	1·1614			
A	64° 48′	Sin	9·9566			
C	51° 30′	Cosec	0·1066			
a	16·77′	Log	1·2246	. . . . .		1·2246
B	63° 42′	Cos	9·6465	B C D	26° 18′ Cos	9·9525
B D d. lat.	7·43		0·8711	C D long. Cor.	15·04′	1·1771



	° ′		° ′
Lat.	9 55·9 S	Long.	2 35·7 W
Cor.	7·4 S	Cor.	15·0 W
Lat. in	10 3·3 S	Long. in	2 50·7 W



BY NO. 2 METHOD

A.M. obsn. ⊙'s Az. N 25°·5 E gives (Table M, pp. 156–157) ·47′ N to Wd.
P.M. obsn. ⊙'s Az. N 26·7 W gives (Table M, pp. 156–157) ·50 S to Wd.

Sum ·97 : 1′ long.

Lat. error		Long.		Diff. lat.		Long. cor.
·97′	:	1′	::	14·5′	:	15′ W.

	° ′
Lat. (1)	10 10·4 S
Lat. (2)	9 55·9

′ ′ ′ ′
·97) 14·5 (15 × ·5 = 7·5 S

	° ′		° ′
Lat. (2)	9 55·9 S	Long.	2 35·7 W
Cor.	7·5 S	Long. cor.	15·0 W
Lat. in	10 3·4 S	Long. in	2 50·7 W

REMARKS ON THE POSITION-LINE AND "SUMNER" PROBLEM IN CONNECTION WITH EX-MERIDIANS.

Although most navigators are now fully alive to the value of the position-line in connection with the *longitude by chronometer*, the value of the position-line in connection with the *latitude by ex-meridian* is seldom presented in works of navigation. It is generally supposed that an ex-meridian, if taken within a certain time from noon, will give a correct latitude, and that therefore the ship's line of position is anywhere on that parallel of latitude. This, however, is only the case when the ship time (which depends on the longitude) is nearly correct.

The further the object is in bearing away from the meridian the greater will be the error due to an error in the time. (See Table M, pp. 156 and 157).

The time, however, might be uncertain to 4 or 5 minutes, and yet the ex-meridian observation may be of great value in connection with the position-line, either when near the land by combining this line of bearing with some sounding or bearing of the land (see p. 170), or by combining it with another astronomical position-line, as in the "Sumner" problem. When the body which is used as an ex-meridian is within the limits of ex-meridian tables, an accurate starting point for a position-line may be obtained with very few figures. For cases where the body is outside the usual ex-meridian limits, a formula is here given (pp. 97 to 98) which will give a correct latitude for *any time* from the meridian corresponding to the true hour-angle of the sun or other heavenly body, and the latitude on an approximate D.R. longitude will give the starting point for the position-line which these tables give, cutting this longitude meridian, at that latitude.

It is very generally believed by navigators that an observation taken near the meridian is of no use in connection with the "Sumner" problem. To some extent this is true when the problem is worked by the usually taught methods, and the D.R. latitude is much in error. I have endeavoured to show by the following examples how the ex-meridian problem may be combined with the chronometer observation in the "Sumner" problem: and, if this is done, it matters little how the sun or stars bear when the observations are taken, provided there is a suitable *difference* in bearing (say, 3 points or more) between the two position-lines.

The latest ex-meridian tables by Blackburne and Westland enable the navigator to very readily obtain his position from two ex-meridians, or by an ex-meridian and chronometer observation, which may be worked as a double altitude, or plotted on the chart, just as accurately and even more rapidly than it could be done from two chronometer observations.

When observations are taken at the best possible time—shortly before sunrise and after sunset, when probably only three or four of the brightest stars are visible—we can not expect always to get two stars sufficiently far from the meridian and prime vertical as is considered by some necessary (*vide* "Wrinkles," 9th Ed., p. 514) for a satisfactory double altitude to be worked on the "Sumner" principle. However, if advantage is taken of the methods shown in the following examples, it will be seen how little this matters. The only necessary condition of importance to insure good results is that the stars should be sufficiently far apart in bearing to give a good cut; and if one observation be near the prime vertical, and the other one near the meridian, the writer would say so much the better, rather than that this should be looked upon as an objection.

The following figures give the cases for any time from the meridian, when from a given hour-angle the latitude is required to be found.

LATITUDE BY EX-MERIDIAN WHEN OUTSIDE ORDINARY LIMITS.

CASE No. 1.—Object above the Pole, Angle at Z (= Bearing of Object) more than 90° reckoned from Observer's Pole.

In the spherical triangle Z P D, let Z P = co-lat., Z D = co-alt, and P D = Polar Dist.

Given Z D, P D, and angle at P: to find P Z = co-lat.

From D drop a perpendicular on the meridian at M, then in the right-angled spher. triangle P M D we have P D and angle at P to find P M = arc (1).

Formula.—Cos P = tan (1) · cot P D ∴ tan (1) = cos P · tan P D.

Next find Z M = arc (2).

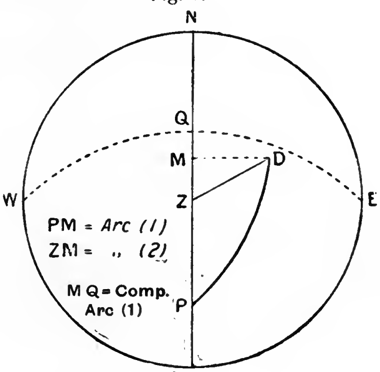
In the spher. triangle P M D, cos P D = cos (1) · cos M D.

In the spher. triangle Z M D, cos Z D = cos (2) · cos M D.

$$\therefore \frac{\text{Cos (2)}}{\text{Cos (1)}} = \frac{\text{Cos ZD}}{\text{Cos PD}} \therefore \left\{ \begin{array}{l} \cos(2) = \cos(1) \cdot \\ \cos ZD \cdot \sec PD. \end{array} \right.$$

P Z (co-lat. = arc (1) − arc (2).

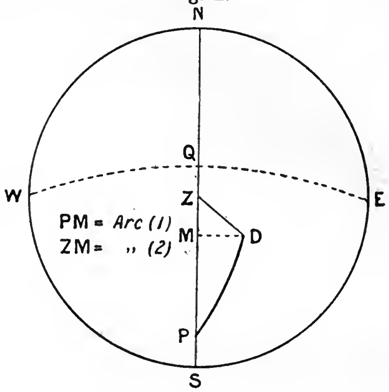
Fig. 1.



CASE NO. 2.—Angle at Z less than 90°

Same formula as in previous case, but P Z (co-lat.) = arc (1) + arc (2).

Fig. 2.

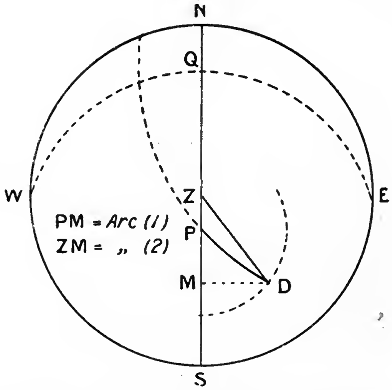


CASE NO. 3.—Object below the Pole.

In the spher. triangle P M D, angle at P = supplement of hour-angle. Then follow the same formula as in Case No. 1

P Z (co-lat.) = arc (2) − arc (1).

Fig. 3.



By using the complements of P D and Z D, and comp. of P M for arc (1) when object is above the Pole, or comp. of Z M when object is below the Pole, the formula may be arranged as follows, and the rule as below applied:—

OBJECT ABOVE THE POLE.

Cot arc (1) = cos H.A. × cot decl.
Cos arc (2) = cosec decl. × sin arc (1) × sin alt.
Name arc (1) *same* as decl.
Name arc (2) *contrary* to bearing of object—*i.e.*, N. or S. of the prime vertical.
Add like and subtract unlike names. Sum or diff. of arc (1) and arc (2) = latitude.

OBJECT BELOW THE POLE.

Tan arc (1) = cos suppt. of H.A. × cot decl.
Sin arc (2) = cosec decl. × cos arc (1) × sin alt.
Name both arc (1) and arc (2) *same* as the decl.
Latitude = sum of arc (1) and arc (2) always named *same* as the decl.

NOTE.— It is not advisable to use the formulæ here given when other methods can be used, if the declination of object is within 3° or 4° N. or S. decl. If it is then used, six-figure logarithms should be taken out, and the corrections made for odd seconds of arc.

Examples in the use of these formulæ are given in the problems following.

FORMULÆ FOR EX-MERIDIANS.

Worked-out Examples to illustrate each Case.

As some have been puzzled in trying to follow the ex-meridian formulæ from the figures here given when latitude and declination are of contrary names, owing to P D and P M being over 90°, the reader is reminded that to take out the tan and sec of an arc if over 90° he must take out the cotan and cosec of amount in excess of 90°.

If the *rule* is followed independently of the figure this confusion will be avoided, as decl. and alt. are used, instead of P.D. and Z.D.

Examples of each case, following either figure or rule, are here fully worked out which can be easily followed.

Case No. 1.—Hour-angle 2 h. 17 m. 10 s., Lat. S., Decl. 23° N., and Altitude 16° N. Required the latitude.

Formula from the Figure.

	H. M. S.		
H.A.	2 17 10	Cos 9·91707	
P D	113°	Tan 0·37215	Sec 0·40812
P M	117° $11\frac{1}{2}'$	Tan 0·28922	Cos 9·65989
		Z D 74°	Cos 9·44034
Z M	71 $11\frac{1}{2}$	. . . .	Cos 9·50835
Co-lat. P Z	46 0		
Lat.	44 0 S		

Formula deduced as per Rule.

	H. M. S.		
H.A.	2 17 10	Cos 9·91707	
Dl.	23° N	Cot 0·37215	Cosec 0·40812
Arc (1)	27° $11\frac{1}{2}'$ N	Cot 0·28922	Sin 9·65989
		Alt. 16°	Sin 9·44034
Arc (2)	71 $11\frac{1}{2}$ S	. . . .	Cos 9·50835
Lat.	44 0 S		

Case No. 2.—Hour-angle 1 h. 38 m. 12 s., Lat. N., Decl. 40° N., and Altitude 61° N. Required the latitude.

	H. M. S.		
H.A.	1 38 12	Cos 9·95885	
P D	50°	Tan 0·07619	Sec 0·19193
P M	47° $18\frac{1}{2}'$	Tan 0·03504	Cos 9·83126
		Z D 29°	Cos 9·94182
Z M	22 $41\frac{1}{2}$	. . . .	Cos 9·96501
Co-lat. P Z	70 0		
Lat.	20 0 N		

	H. M. S.		
H.A.	1 38 12	Cos 9·95885	
Decl.	40°	Cot 0·07619	Cosec 0·19193
Arc (1)	42° $41\frac{1}{2}'$ N	Cot 0·03504	Sin 9·83126
		Alt. 61°	Sin 9·94182
Arc (2)	22 $41\frac{1}{2}$ S	. . . .	Cos 9·96501
Lat.	20 0 N		

Case No. 3.—Hour-angle 9 h. 23 m. 47 s., Lat. S., Decl. 62° 34′ S., and Altitude 22° S. Required the latitude.

	H. M. S.		
H.A.	9 23 47		
	12 0 0		
Supt.	2 36 13	Cos 9·89017	
P D	27° 26′	Tan 9·71524	Sec 0·05181
P M	21° $57\frac{1}{4}'$	Tan 9·60541	Cos 9·96731
		Z D 68°	Cos 9·57357
Z M	66 $57\frac{1}{4}$	. . . .	Cos 9·59269
Co-lat. P Z	45 0		
Lat.	45 0 S		

	H. M. S.		
H.A.	9 23 47		
	12 0 0		
Supt.	2 36 13	Cos 9·89017	
Decl.	62° 34′ S	Cot 9·71524	Cosec 0·05181
Arc (1)	21° $57\frac{1}{4}'$ S	Tan 9·60541	Cos 9·96731
		Alt. 22°	Sin 9·57357
(Comp) Arc (2)	23 $2\frac{3}{4}$ S	. . . .	Sin 9·59269
Lat.	45 0 S		

The accuracy of this method may easily be proved by reversing the process, and finding the hour-angle from the latitude, declination, and altitude given.

Case No. 3 is especially useful, as with high-declination stars the latitude will generally be fairly correct, even when the time is in error a couple of minutes and the body observed is an hour or more from the meridian below the Pole. For instance, in the latitudes of last example, an ex-meridian of ✱ α Crucis with hour-angle 11 h., or 1 h. from meridian below the Pole, and 2 m. of error in the time used, would only cause an error of $2\frac{1}{2}'$ in the resulting latitude.

DOUBLE-ALTITUDE POSITION BY TWO SUN OBSERVATIONS.

1902.—March 29th, p.m., the following observations were taken in the artificial horizon, at 56 Hawker Street, Wellington:—

	D. H. M. S.		° ′ ″
M. T. G. by chron.	28 13 17 31	Obsd. alt. of ⊙ (double)	89 0 30
" "	28 15 51 18	" "	52 5 10

Required the true bearing of the sun at each observation, and the position of place, assuming latitude to be 41° 0′ S. Index error of sextant + 1′ 23″; ther. 70°; bar. 30·0in.

1st Observation.

M.T.G.	28 13 17 31 (D. H. M. S.)	Dl. var.	58″·52 × 10·71 H.
Before noon, 29th	10 42 29	Cor.	− 10 26·7 (° ′ ″)
		Dl., 29th	3 7 20·7 N
Eq. T. var.	0·767 S. × 10·7 H.	Cor. Dl.	2 56 54 N
Cor.	+ 8·2 (M. S.)	P.D.	92 56 54
Eq. T., 29th	5 5·1		
Cor. Eq. T.	5 13·3 + A. T.		
Obsd. alt. ⊙ (double)	89 0 30 (° ′ ″)		
I. E.	+ 1 23		
	2) 89 1 53		
App. alt.	44 30 56·5		
Ref. and par.	− 50·5		
	44 30 6		
Semi-d.	− 16 2		
T. alt.	44 14 4		
Lat.	41 0 0	Sec	0·122220
P. D.	92 56 54	Cosec	0·000575
	178 10 58		
S	89 5 29	Cos	8·200237
S − A	44 51 25	Sin	9·848398
H.A.	0h 55m 58·6s	Sin²	8·171430
Eq. T.	+ 5 13·3		
M. T. place	29 1 1 11·9	A	3′·49 N
M. T. G.	28 13 17 31·0	B	·22 N
Long. in T.	11 43 40·9	Cor.	3·71 N
Long. (1)	175° 55′ 13″ E	C gives Az.	N 19·7° W

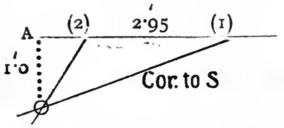
T. C² gives Pos.-line for plane chart N 75° E

2nd Observation.

M.T.G.	28 15 51 18 (D. H. M. S.)	Dl. var.	58″·51 × 8·15 H.
Before noon	8 8 42 = 8·15 hr.	Cor.	− 7 56·8 (° ′ ″)
		Dl., 29th	3 7 20·7 N
Eq. T. var.	0·767 S. × 8·1 H.	Cor. Dl.	2 59 24 N
Cor.	+ 6·2 (M. S.)	P. D.	92 59 24
Eq. T., 29th	5 5·1		
Cor. Eq. T.	5 11·3		
Obsd. alt. ⊙ (double)	52 5 10 (° ′ ″)		
I. E.	+ 1 23		
	2) 52 6 33		
App. alt.	26 3 16·5		
Ref. and par.	− 1 44		
	26 1 32·5		
Semi-d.	− 16 2·5		
T. alt.	25 45 30		
Lat.	41 0 0	Sec	0·122220
P. D.	92 59 24	Cosec	0·000591
	159 44 54		
S	79 52 27	Cos	9·245045
S − A	54 6 57	Sin	9·908594
H.A.	3h 26m 8·8s	Sin²	9·276450
Eq. T.	+ 5 11·3		
M. T. place	29 3 31 20·1	A	′·69 N
M. T. G.	28 15 51 18·0	B	·07 N
Long. in T.	11 40 2·1	Cor.	·76 N
Long. (2)	175 0 31 E	C gives Az.	N 60·2° W
Long. (1)	175 55 13 E		
Diff. long.	54 42 = 54·7′	Pos.-line T. C²	N 37·2° E

Long. (1) cor. = 3′·71 N to E (1) to A ⎫ in Fig.
Long. (2) " ·76 N to E (2) to A ⎭

D. long. 2′·95 : d. long. 54′·7 :: lat. 1′ : lat. cor. 18′·5



	° ′ ″			° ′ ″
Lat. used	41 0 0 S	Long. (2)		175 0 31 E
Cor.	18 30 S	18·5′ × ·76′	=	14 4 W
Lat. in	41 18 30 S	Long. in		174 46 27 E

In this example, with the latitude used in the calculation 17½′ in error, the resulting latitude is 1′ in error. This is due to the sun's azimuth differing nearly 2° at the position corresponding to the hour-angle found with 41° lat. from that of the true hour-angle and latitude. If the position had been worked in the usual way as given in the Board of Trade examinations with two latitudes, say, 17′ in error on each side of the true latitude, the resulting latitude would have been just 2′ north of that here found, or 1′ north of the true latitude. When the hour-angle is small, and the two latitudes used on each side of the true latitude are far apart, the resulting position-line always places the ship on the Equatorial side of the true position-line or circle of altitude. When the problem is worked with the D.R. latitude, and a position-line at right angles to the bearing of the object observed, the resulting position-line will place the ship on the Polar side of the true line of position; an error of 30′ in the D.R. latitude in either case will sometimes make 2′ to 3′ error in the latitude. When one of the hour-angles is not far from the meridian, as in this case, the problem as worked on the following page will give a more accurate position, and the work is not longer.

These observations when reworked on the same principle, when using a latitude near the the truth, give the latitude of position within 0·1′ of the truth. Several observations were taken at the same time, and all the resulting latitudes agreed within a few seconds of one another.

For position of place plotted on the chart, see chartlet on next page.

DOUBLE-ALTITUDE POSITION BY TWO SUN OBSERVATIONS

(Combining Chron. Long. Observation with an Ex-meridian).

1902.—March 29th, p.m. In assumed latitude 41° 0′ S. the true altitude of sun's centre was 44° 14′ 4″ when a chronometer showed M. T. G. 28 d. 13 h. 17 m. 31 s.; and again on the same afternoon the true altitude of sun's centre was found to be 25° 45′ 30″ when a chronometer showed M. T. G. 28 d. 15 h. 51 m. 18 s. Required the position of place by projection on the chart.

1st Obsn. West of Meridian.

	D. H. M. S.		
M. T. Greenwich	28 13 17 31		
Long. in T. by 2nd obsn.	+ 11 40 2 E		
M. T. place	29 0 57 33		
Eq. T.	− 5 13		
⊙'s H.A.	0 52 20	Cos 9·988578	
⊙'s Dl.	2° 56′ 54″ N	Cot 11·288163	Cosec 11·288738
Arc (1)	3° 1′ 36″ N	Cot 11·276741	Sin 8·722640
	True alt. 44° 14′ 4″		Sin 9·843604
Arc (2)	44 15 56 S		Cos 9·854982
Latitude	41° 14′ 20″ S		

0h. 52 m.			
Lat. 41¼° S	A	3′·80 N	
Dl. 3° N	B	·23 N	
Pos.-line from Table C2	N 76° E	4·03 N	

2nd Obsn. West of Meridian.

	° ′ ″	
T. alt.	25 45 30	
Lat.	41 0 0	sec
P. D.	92 59 24	cosec
	159 44 54	
S	79 52 27	cos
S − A	54 6 57	sin

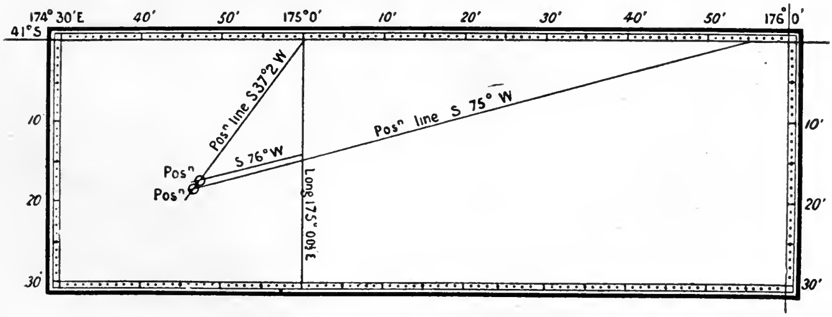
Sec	0·122220
Cosec	0·000591
Cos	9·245045
Sin	9·908594
Sin²	9·276450

	H. M. S.
H.A. = A.T. place	3 26 8·8
Eq. T.	+ 5 11·3
M. T. place	29 3 31 20·1
M. T. G.	28 15 51 18
Long. in T.	11 40 2·1
Longitude	175° 0′ 31″ E

Position by Chart.

Lat. 41° 17½′ S
Long. 174 47 E

H.A. 3 h. 26 m.			
Lat. 41° S		A	·69′ N
Dl. 3° N		B	·07 N
Pos.-line from Table C2	N 37·2° E		·76 N



Position by two chron. observations = Lat 41° 18½′ S.
(see previous page) Long. 174 46½ E.

The following example is taken from Captain Thompson's excellent book, "Navigation Simplified," which, I presume, is now in the hands of nearly all those navigators who desire to obtain the highest certificates. This example is taken as the work is there given in detail, with the plotting on the chart, so that the reader can compare the working, and see for himself the saving in figures, while maintaining equal, if not greater, accuracy by using the A and B Tables.

POSITION BY DOUBLE ALTITUDE OF SUN.

1900.—July 2nd, at about 6 h. 50 m. a.m., and again at 11 a.m., from the following observations:—

Mean Time at Greenwich by Chron. D. H. M. S.	True Altitude of the Sun's Centre. ° ′ ″
1 7 43 12	25 51 6
1 11 57 36	69 50 25

Find the true bearing of the sun when the first altitude was observed, and the position of the ship when the second altitude was taken, assuming the ship to be between latitudes 49° 50′ N. and 50° 20′ N. The ship's course and distance between the observations was N. 67° W., dist. 30 miles.

	° ′ ″			° ′ ″	
1st obsn. ⊙'s Cor. Dl. =	23 6 49 N	Cor. Eq. T. 3 m. 35 s. + A. T.	2nd obsn. ⊙'s Cor. Dl. =	23 6 7 N	Cor. Eq. T. 3 m. 36·4 s.
	90 0 0			90 0 0	
N. P. D.	66 53 11		N. P. D.	66 53 53	

Run between observations, N 67° W 30 m. = 11·7′ N. 27·6′ W = 43′ d. long.

	° ′ ″
Lat. (1)	49 50 0 N
Run. d. lat.	11 42 N
Lat. (2)	50 1 42 N

1st Obsn.

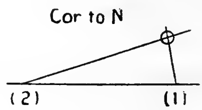
	° ′ ″	
A	25 51 6	
L	49 50 0	Sec 0·190431
P	66 53 11	Cosec 0·036340
	142 34 17	
S	71 17 8·5	Cos 9·506301
S − A	45 26 2·5	Sin 9·852750
	H. M. S. 24 0 0	
H. A. east −	5 6 58	Sin² 9·585822
A. T. ship	18 53 2	
Eq. T.	+ 3 35	A ·28′ S
		B ·44 N
M. T. S.	18 56 37	
M. T. G.	7 43 12	C ·16 N gives Az. N 84° E
Long. in T.	11 13 25	Pos.-line for plane chart, Table C², gives N 9·1° W
	° ′ ″	
Long.	168 21 15 E	
Run d. long.	43 0 W	
Long. (1)	167 38 15 E	
Cor ·16′ × 8·5′	1 22 W	
Long. in	167 36 53 E at time of 2nd observation.	

2nd Obsn.

	° ′ ″		
A	60 50 25		
L	50 1 42	Sec 0·192188	
P	66 53 53	Cosec 0·036302	
	177 46 0		
S	88 53 0	Cos 8·289773	
S − A	28 2 35	Sin 9·672223	
	H. M. S. 24 0 0		
H.A.	− 0 57 13·5	Sin² 8·190486	
A. T. ship	23 2 46·5		
Eq. T.	+ 3 36·5	A 4·68′ S	
		B 1·72 N	
M. T. S.	23 6 23		
M. T. G.	11 57 36	T. C 2·96 S	Posn.-line for plane chart, S 71·3° W. See Table C²
Long. in T.	11 8 47		
	° ′ ″		
Long. (2)	167 11 45 E	2·96′ S to W and N to E	
Long. (1)	167 38 15 E	·16 N to W	
D. long.	26′ 30″	3·12 sum of A and B cor.	

d. long.		d. long.		lat.		lat.
3·12′	:	26·5′	::	1′	:	8·5′ cor.

	° ′ ″
Lat. at 2nd obsn.	50 1 42 N
Cor.	8 30 N
Lat. in	50 10 12 N



For position of ship when plotted on the chart, see chartlet on next page.

DOUBLE ALTITUDE OF THE SUN

(COMBINING CHRON. LONG. OBSERVATION WITH AN EX-MERIDIAN).

1900.—2nd July, at about 6 h. 50 m. a.m., and again at 11 a.m., from the following observations :—

Mean Time at Greenwich by Chron.	True Altitude of the Sun's Centre.
D. H. M. S.	° ′ ″
1 7 43 12	25 51 6
1 11 57 36	60 50 25

Find the true bearing of the sun when first altitude was observed, and the position of the ship when the second altitude was taken, assuming the ship to be between latitudes 49° 50′ N. and 50° 20′ N. The ship's course and distance between the observations was N. 67° W., dist. 30 miles.

1st obsn. ⊙'s Cor. Dl. = 23° 6′ 49″ N Cor. Eq. T. = 3 m. 35 s. + A.T.
90 0 0
N. P. D. 66 53 11

2nd obsn. ⊙'s Cor. Dl. = 23° 6′ 7″ N Cor. Eq. T. = 3 m. 36·4 s. + A.T
90 0 0
N. P. D. 66 53 53

Run between observations, N 67° W 30 m. = 27·6 m. dep. = 43′ W d. long.

1st Obsn.

A 25° 51′ 6″
L 49 50 0 Sec 0·190431
P 66 53 11 Cosec 0·036340
142 34 17
S 71 17 8·5 Cos 9·506301
S − A 45 26 2·5 Sine 9·852750
 H. M. S.
 24 0 0
H.A. east − 5 6 58 Sin² 9·585822
A. T. ship 18 53 2
Eq. T. + 3 35
M. T. ship 18 56 37
M. T. G. 7 43 12
Long. in T. 11 13 25
Longitude 168° 21′ 15″ E
Run d. long 43 0 W
Long. (2) 167 38 15 E = 11 h. 10 m. 33 s.
M. T. G. + 11 57 36
M. T. ship 23 8 9

H.A. 5 h. 8 m E }
Lat. 50° N } A ·28 S
Dl. 23° N } B ·55 N

Cor. Table C ·16 N gives Az. N 84·1° E and Pos.-line for plane chart, Table C², N 9° W

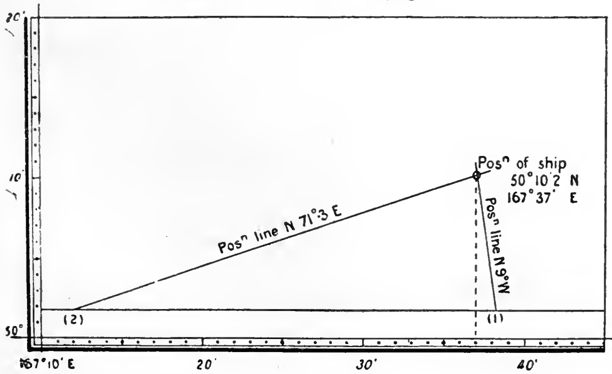
2nd Obsn.

 H. M. S.
M.T. ship 23 8 9 (see M.T. ship, 1st obsn.)
Eq. T. − 3 36
A.T. ship 23 4 33
 24 0 0
H.A. 0 55 27 Cos 9·987163
Dl. 23° 6′ 7″ Cot 0·370003 Cosec 0·406306
Arc (1) 23° 43′ 10″ N Cot 0·357166 Sin 9·604505
 T. alt. 60° 50′ 25″ Sin 9·941146
Arc (2) 26 27 22 N . . . . . . Cos 9·951957
Lat. 50° 10′ 32″ N

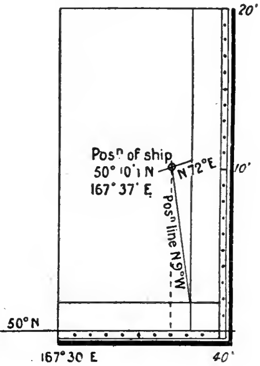
H.A. 0 h 56 m E }
Lat. 50 N } A 4′·78 S
Dl. 23 N } B 1·75 N

Cor. T. C. 3·03 S gives Az. S 27·4° E = Pos.-line for plane chart, Table C², S 71·7° W and N 71·7° E

Chartlet for Problem on page 102.



For above Problem.



With the desire to show the especial utility of these tables for obtaining accuracy of position and conciseness in work, and the superiority of the method here advocated over the method still employed in the Board of Trade Examinations of Masters and Mates, for the "Sumner" problem, the following example is given and plotted on the chart by both methods. For the sake of better illustrating the possible error due to the old method, a wider range of latitude has been taken than is usually given in the examination papers, though, considering the high speed of some of the present-day steamers, the range is not excessive, as the run in interval itself might often amount to over 1° of latitude

"SUMNER" PROBLEM AS GIVEN IN THE B. OF T. EXAMINATIONS.

1898.—On 20th June, a.m., at ship, at sea, and uncertain of my ship's position: when a chronometer indicated M. T. Green. 19 d. 22 h. 30 m. the true altitude of sun's centre was 52° 9′; and again, a.m. on same day, when chronometer indicated 20 d. 0 h. 16 m. the true altitude of sun's centre was 65° 18′, the ship having made 23 miles on a true N. 24° E. course during the interval between the observations. Required the line of position and true bearing of the sun at time of 1st observation; and the position of the ship when 2nd observation was taken assuming latitudes 46° N. and 47° N.

		D. H. M. S.		D. H. M. S.		° ′
1st obsn.	M. T. Green.	19 22 30 0	2nd obsn.	20 0 16 0	Decl.	23 27 N
	Eq. of time	– 1 16·7		– 1 17·7		90 0
	A. T. Green.	19 22 28 43·3	A. T. G.	20 0 14 42·3	P. D.	66 33

1st Observation.

	° ′				° ′		
A	52 9			A	52 9		
L	46 0	Sec	0·158229	L	47 0	Sec	0·166217
P	66 33	Cosec	0·037438	P	66 33	Cosec	0·037438
	164 42				165 42		
S	82 21	Cos	9·124248	S	82 51	Cos	9·095056
S – A	30 12	Sin	9·701585	S – A	30 42	Sin	9·708032
H. A.	D. H. M. S. 2 31 18·8 E	Sin²	9·021500	H. A.	D. H. M. S. 2 28 40·3 E	Sin²	9·006743
A. T. ship	19 21 28 41·2			A. T. ship	19 21 31 19·7		
A. T. G.	19 22 28 43·3			A. T. G.	19 22 28 43·3		
Long. in T.	1 0 2·1			Long. in T.	0 57 23·6		
Long. A	15° 0′ 31″ W			Long. B	14° 20′ 54″ W		

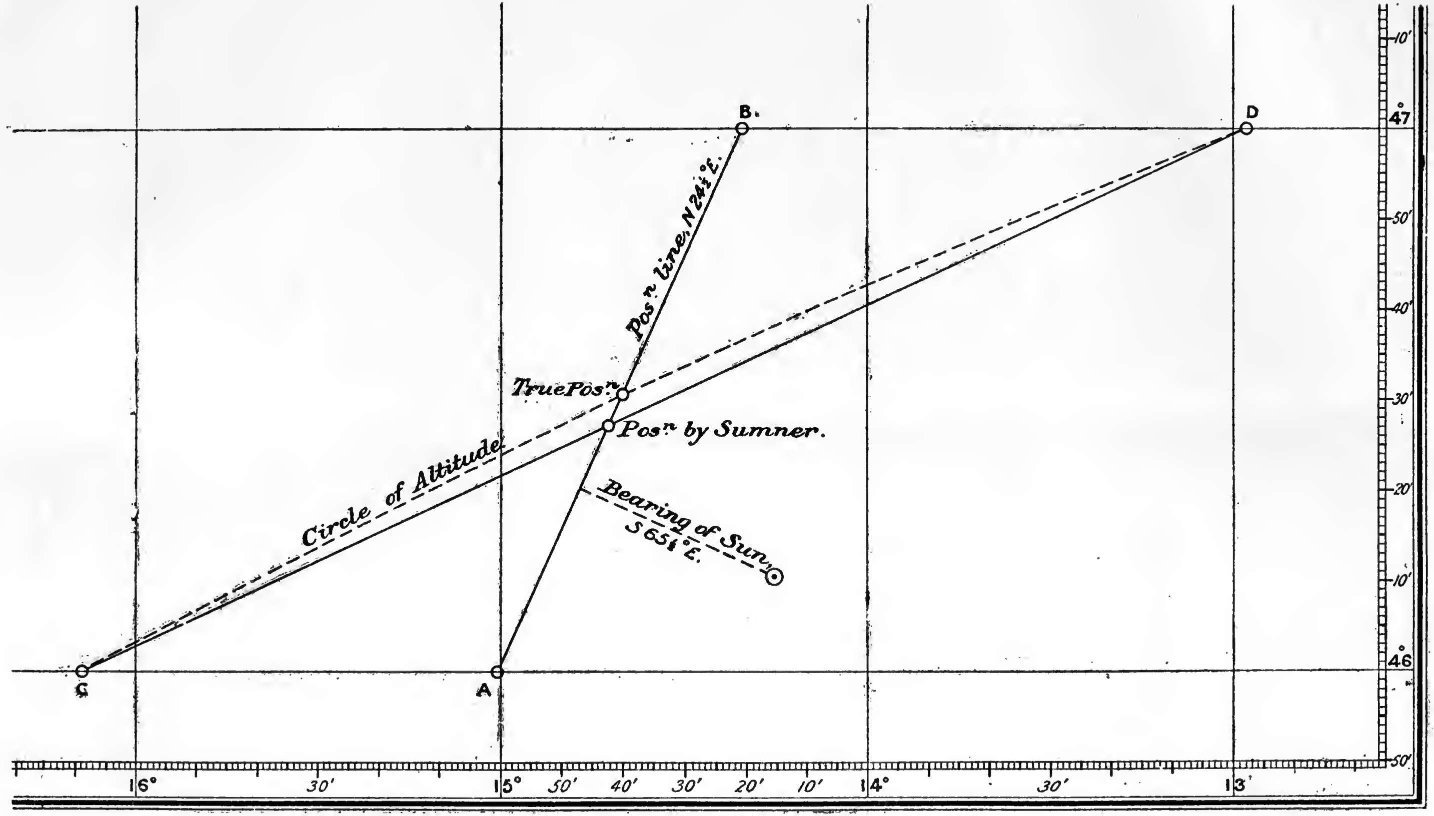
2nd Observation.

	° ′				° ′		
A	65 18			A	65 18		
L	46 0	Sec	0·158229	L	47 0	Sec	0·166217
P	66 33	Cosec	0·037438	P	66 33	Cosec	0·037438
	177 51				178 51		
S	88 55½	Cos	8·273260	S	89 25½	Cos	8·001538
S – A	23 37½	Sin	9·602872	S – A	24 7½	Sin	9·611435
H. A.	D. H. M. S. 0 49 53·1 E	Sin²	8·071799	H. A.	D. H. M. S. 0 37 9·2 E	Sin²	7·816628
A. T. ship	19 23 10 6·9			A. T. ship	19 23 22 50·8		
A. T. G.	19 24 14 42·3			A. T. G.	19 24 14 42·3		
Long. in T.	1 4 35·4			Long. in T.	0 51 51·5		
Long. C	16° 8′ 51″ W			Long. D	12° 57′ 52″ W		

Line of position N 24½° E — Sun's bearing S 65½° E

Position at 2nd obsn.—Lat. 46° 27′ N, Long. 14° 43′ W

True posn.—Lat. 46° 30′ 20″ N, Long. 14° 41′ 0″ W


B.
D
47°
Posn line, N 24¼° E.
True Posn
Posn by Sumner.
Circle of Altitude
Bearing of Sun,
S 65¾° E.
46°
G
A
16°
30'
15°
50'
40'
30'
20'
10'
14°
30'
13°
10'
50'
40'
30'
20'
10'
50'

SUMNER PROBLEM FACILITATED BY A, B, AND C² TABLES.

1898.—On 20th June, a.m., at ship, at sea, and uncertain of my ship's position: when a chronometer indicated M. T. Green. 19 d. 22 h. 30 m. the true altitude of sun's centre was 52° 9′; and again on same day when chronometer indicated 20 d. 0 h. 16 m. the true altitude of sun's centre was 65° 18′, the ship having made 23 miles on a true N. 24° E. course during the interval between the observations. Required the line of position and true bearing of the sun at time of 1st observation; and the position of the ship when 2nd observation was taken, assuming D.R. latitude to be 46° N. when 1st observation was taken.

1st Obsn.

	D. H. M. S.		
M. T. Green.	19 22 30 0		
Eq. of time	– 1 16·7		
A. T. Green	19 22 28 43·3		

Decl. 23° 27′ N = P. D. 66° 33′

	° ′		
A	52 9		
L	46 0	Sec	0·158229
P	66 33	Cosec	0·037438
	164 42		
S	82 21	Cos	9·124248
S – A	30 12	Sin	9·701585
H.A.	D. H. M. S. 2 31 18·8	Sin²	9·021500

A.T. ship	19 21 28 41·2	H.A.	2 h. 32 m.	A	1·33 S
A.T.G.	19 22 28 43·3	Lat.	46° N	B	0·71 N
Long. in T.	1 0 2·1	Dl.	23½° N	C	0·62 S gives Az. S 66°·7 E.
Long.	15° 0′ 31″ W				
Run. d. long.	13 36 E				
Long. (1)	14 46 55 W				
Long. in T.	$0^h 59^m 7{\cdot}7^s$				

C² gives Posn.-line for plane chart N 31·8° E

Lat. 46° 21′ N and Posn.-line N 32° E

Position from chart.—Lat. 46° 30′·5 N
Long. 14 41·0 W

2nd Obsn.

	D. H. M. S.
M.T.G.	20 0 16 0
Eq. of time	– 1 17·7
A.T. Green.	0 14 42·3
Long. (1)	– 0 59 7·7 W
A.T. ship	19 23 15 34·6
	24 0 0
H.A.	0 44 25·4

Run N 24° E 23 M. = 21′ N 9′·4 E = 13′·6 d. long.
Lat. (1) 46° 0 N
Lat. D.R. 46 21 N at time of 2nd obsn.

For Az. by Table D.

Az. (H.A.)	44·4 M. = 11·1°	(p. 81)	
Lat. (decl.)	23·5° N	M = 22·6	
Lat. (alt.)	65·3°	(p. 82)	
M.	22·6	gives Az. 25°, which gives (p. 49) A & B 3·10′.	
A & B	3·10′ gives (p. 75) posn.-line for Plane Chart N. 72° E.		

Lat. by Ex-mer. Table No. 3.

Decl.	23° 27′ N	Arc. cor.	+ 23′·8
H.A.	$44{\cdot}4^m$	Dec.	23 27·0 N
Arc (1)	. . . .		23 50·8 N
Az.	25° 0′	Arc cor. –	2° 4′·2
Alt.	65 18 S	Z D	24 42·0 N
Z D	24 42 N	Arc (2)	22 37·8 N
		" (1)	23 50·8 N
		Lat.	46 28·6 N

RULE FOR FINDING LATITUDE BY EX-MERIDIAN TABLE No. 3 (ABOVE POLE OBSERVATION).

With declination at side and hour-angle from top take out arc reduction.

Add this reduction to the declination for arc (1).

Name it the same as declination.

With altitude at the side and azimuth from the top take out 2nd arc reduction.

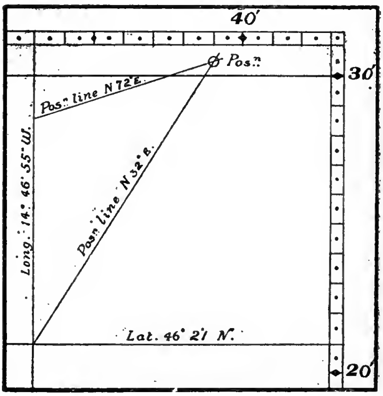
Subtract the reduction from Z D for arc (2).

Name arc (2) contrary to bearing of object.

Latitude = arc (1) ± arc (2).

\+ when arcs are of like names.

– when arcs are of unlike names.



Note.—This problem worked by the old method (which is still used in the Board of Trade examinations) would give a result 3½′ in error in the latitude and 2′ in error in the longitude. (See page 104.)

EXAMPLE TO SHOW METHOD OF FINDING THE TRUE LINE OF POSITION OR CIRCLE OF ALTITUDE BY USE OF THE A AND B TABLES.

This is given in response to an inquiry by a correspondent, who asked for an explanation of author's remark about the tables doing this, in the preface to the first edition in 1883.

EXAMPLE PLOTTED ON CHARTLET FACING PAGE 104.

Lat. 46° 0' N	A 4'·77 S	Lat. 46° 0' gives Long. 16° 8'·9 W	H.A. 0h 49m 53s
Dl. 23 27 N	B 2·05 N	Cor. for 10 N = 27·2 E	− 1 49
H.A. 0h 49m E	C 2·72 S to W or N to E		0 48 4
		Lat. 46° 10' N gives Long. 15 41·7 W	− 1 0
Cor. for 10' N = 27'·2 E = 1m 49s			0 47 0 for next.

Lat. 46° 15' N	A 5'·02 S	Lat. 46° 10' N gives Long. 15° 41'·7 W	H.A. 0h 48m 4s
Dl. 23 27 N	B 2·12 N	Cor for 10 N = 29·0 E	− 1 56
H.A. 0h 47m E	C 2·90 S		0 46 8
		Lat. 46° 20' N gives Long. 15 12·7 W	− 1 0
Cor. for 10' N = 29'·0 E = 1m 56s			0 45 0 for next.

Lat. 46° 25' N	A 3'·28 S	Lat. 46° 20' N gives Long. 15° 12'·7 W	H.A. 0h 46m 8s
Dl. 23 27 N	B 2·22 N	Cor. for 10 N = 30·6 E	− 2 2
H.A. 0h 45m E	C 3·06 S		0 44 6
		Lat. 46° 30' N gives Long. 14 42·1 W	− 1 0
Cor. for 10' N = 30'·6 E = 2m 2s			0 43 0 for next.

Lat. 46° 35' N	A 5'·56 S	Lat. 46° 30' N gives Long. 14° 42'·1 W	H.A. 0h 44m 6s
Dl. 23 27 N	B 2·32 N	Cor. for 10 N = 32·4 E	− 2 10
H.A. 0h 43m E	C 3·24 S		0 41 56
		Lat. 46° 40' N gives Long. 14 9·7 W	− 1 6
Cor. for 10' N = 32'·4 E = 2m 10s			0 40 50 for next.

Lat. 46° 45' N	A 5'·88 S	Lat. 46° 40' N gives Long. 14° 9'·7 W	H.A. 0h 41m 56s
Dl. 23 27 N	B 2·44 N	Cor. for 10 N = 34·4 E	− 2 18
H.A. 0h 41m	C 3·44 S		0 39 38
		Lat. 46° 50' N gives Long. 13 35·3 W	− 1 10
Cor. for 10' N = 34'·4 E = 2m 18s			0 38 28 for next.

Lat. 46° 55' N	A 6'·30 S	Lat. 46° 50' N gives Long. 13° 35'·3 W
Dl. 23 2 N	B 2·54 N	Cor. for 10 N = 37·6 E
H.A. 0h 38½m	C 3·76 S	Lat. 47° 0' N gives Long. 12 57·7 W
Cor. for 10' N = 37'·6 E = 2m 30s		

[NOTE.—It will be seen that as the latitude increases so the H.A. will decrease, according to the change of longitude, 15' of long. making 1m change of time in the H.A. Therefore, to get the true cor. we must use the *mean* H.A. and the *mean* lat. corresponding to the two parallels which we require the cor. for. The long. found by the application of the A and B cor. at 47° N is practically the same as that found by direct calculation.]

DOUBLE-ALTITUDE POSITION BY TWO STELLAR OBSERVATIONS.

1902.—On 15th March, p.m., the following observations were taken in the artificial horizon, at 56 Hawker Street, Wellington: True position from chart, lat. 41° 17′ 32″ S., long. 174° 46′ 57″ E.:—

	D.	H.	M.	S.		°	′	″	
M.T. at Greenwich by chron.	14	21	6	6	Obsd. alt. of ✱ Sirius	116	33	0	to N. Wd.
" " "	14	22	26	7	" ✱ Canopus	112	10	10	to S. Wd.

Required the true bearing of both stars, and the position of place, assuming latitude to be 41° 0′ S. (17½′ in error). Index error of sextant + 1′ 20″.

	D. H. M. S.		H. M. S.
M.T.G.	14 21 6 6	Sid. T. (G. noon)	23 24 40·46
M. ☉'s R.A.	+ 23 28 8·45	Accl. 21 h. 6 m.	+ 3 27·99
Sid. T. G.	20 34 14·45	M. ☉'s R.A.	23 28 8·45

	H. M. S.		H. M. S.
M.T.G.	22 26 7	Sid. T. (G. noon)	23 24 40·46
M. ☉'s R.A.	23 28 21·6	Accl.	+ 3 41·13
Sid. T. G.	21 54 28·6	M. ☉'s R.A.	23 28 21·59

✱ Sirius to N.Wd.

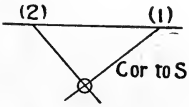
	° ′ ″		
Obsd. alt. of ✱	116 33 0	Dl.	16 35 14 S
I. E.	+ 1 20		90 0 0
	2) 116 34 20	P. D.	73 24 46
App. alt.	58 17 10		
Ref.	− 34		
A	58 16 36		
L	41 0 0	Sec	0·122220
P	73 24 46	Cosec	0·018460
	172 41 22		
S	86 20 41	Cos	8·804503
S − A	28 4 5	Sine	9·672578
	H. M. S.		
✱'s H.A.	1 34 0·2	Sine²	8·617761
✱'s R.A.	6 40 51·6		
Sid. T. place	8 14 51·8	A	2′·00 N
" Green.	20 34 14·45	B	·75 S
Long. in time	11 40 37·35	C	1·25 N to
Long. (1)	175° 9′ 20″ E	gives Az. N 46·6° W	
17·6′ × 1·25′	22 0 W	and C² gives Pos.-line	
Long. in	174 47 20 E	N 51°·3 E	
		S 51·3 W	

✱ Canopus to S.Wd.

	° ′ ″		
Obsd. alt. of ✱	112 10 10	Dl.	52 38 59 S
I. E	+ 1 20		90 0 0
	2) 112 11 30	P. D.	37 21 1
App. alt.	56 5 45		
Ref.	− 38		
A	56 5 7		
L	41 0 0	Sec	0·122220
P	37 21 1	Cosec	0·217036
	134 26 8		
S	67 13 4	Cos	9·587969
S − A	11 7 57	Sin	9·285798
	H. M. S.		
✱'s H.A	3 10 41·3 W	Sin²	9·213023
✱'s R.A.	6 21 47·6	A	0′·79 N
Sid. T. place.	9 32 28·9	B	1·77 S
Sid. T. Green	21 54 28·6	C	0·98 S to E
Long. in time	11 38 0·3	gives Az. S 53½° W	
Long. (2)	174° 30′ 5″ E	and C² gives Pos.-line	
Long. (1)	175 9 20	S 44·4° E	
Diff. long.	39′ 15″		

Long. (1) cor. = 1′·25 S to W
" (2) " 0·98 S to E

D. long. 2·23 : d. long. 39·25′ :: lat. 1′ : lat. cor. 17·6′



	° ′ ″		° ′ ″
Lat. used	41 0 0 S	Long. by Canopus	174 30 5 E
Cor.	17 36 S	17·6′ × 0·98′ =	17 15 E
Lat. in	41 17 36 S	Long. in	174 47 20 E

The above were *bona fide* observations taken on a windy night, needing patience to wait till the quicksilver was quite steady; being on different sides of the prime vertical, the observations naturally give a good latitude, as 1′ error of altitude due to instrument or refraction would make practically *no* difference in the resulting latitude. This problem reworked with a latitude near the truth only makes a few seconds difference in the resulting position.

[Note.—A, true alt.; L, lat.; P, Polar dist.; S, half sum of A + L + P; S − A, diff. between S and A; H.A., hour-angle.]

DOUBLE-ALTITUDE POSITION BY TWO STELLAR OBSERVATIONS.

1902.—On 15th March, p.m., the following observations were taken in the artificial horizon:—

	D. H. M. S.		° ′ ″	
M.T. at Greenwich by chron.	14 21 23 43	Obsd. alt. of ✳ α Centauri	69 36 50	to S.Ed.
" " "	14 22 26 7	" ✳ Canopus	112 10 10	to S.Wd.

Required the true bearing of both stars, and the position of place, assuming latitude to be 41° 0′ S. Index error of sextant + 1′ 20″.

1st Observation.

	H. M. S.	Dl. of ✳ α Centauri.
M. T. Green.	21 23 43	° ′ ″
Sid. T. (G. noon)	23 24 40·46	60 25 37 S
Accl.	+ 3 30·89	90 0 0
Sid. T. Green.	20 51 54·35	P. D. 29 34 23

2nd Observation.

	H. M. S.	Dl. of ✳ Canopus
M. T. G.	22 26 7	° ′ ″
Sid. T. (G. noon)	23 24 40·46	52 38 59 S
Accl.	+ 3 41·13	90 0 0
Sid. T. Green.	21 54 28·59	P. D. 37 21 1

✳ α Centauri to S.Ed.

	° ′ ″		
Obsd. alt. of ✳	69 36 50		
I. E.	+ 1 20		
	2) 69 38 10		
App. alt.	34 49 5		
Ref.	− 1 22		
T. alt.	34 47 43		
Lat.	41 0 0	Sec	0·12222
P. D.	29 34 23	Cosec	0·306684
	105 22 6		
S	52 41 3	Cos	9·782622
S − A	17 53 20	Sin	9·487382
	H. M. S.		
✳'s H.A.	5 59 58·0 E	Sin²	9·698908
✳'s R.A.	14 33 1·3		
Sid. T. place	8 33 3·3	A	′·00
Sid. T. G.	20 51 54·3	B	1·76 S
Long. in T.	11 41 9·0	C	1·76 S gives Az. S 37° E
Long. (1)	175° 17′ 15″ E		
Long. (2)	174 30 5 E	C² Pos.-line	S 60·4° W
Diff. long.	47 10 = 47′·17		

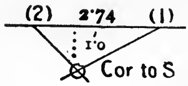
✳ Canopus to S.Wd.

	° ′ ″		
Obsd. alt. of ✳	112 10 10		
I. E.	+ 1 20		
	2) 112 11 30		
App. alt.	56 5 45		
Ref.	− 38		
T. alt.	56 5 7		
Lat.	41 0 0	Sec	0·122220
P. D.	37 21 1	Cosec	0·217036
	134 26 8		
S	67 13 4	Cos	9·587969
S − A	11 7 57	Sin	9·285798
	H. M. S.		
✳'s H.A.	3 10 41·3 W	Sin²	9·213023
✳'s R.A.	6 21 47·6		
Sid. T. lace	9 32 28·9	A	′·79 N
Sid. T. G.	21 54 28·6	B	1·77 S
Long. in T.	11 38 0·3	C	·98 S to E
Long. (2)	174° 30′ 5″ E		gives Az. S 53½° W
		C² Pos.-line	S 44·4° E.

Long. (1) cor. = 1′·76 S to W
" (2) " 0·98 S to E

D. long. 2·74 : d. long. 47·17′ : lat. 1′ : lat. cor. 17·22′ = 17′ 13″

	° ′ ″		° ′ ″
Lat. used	41 0 0 S	Long. (2)	174 30 5 E
Cor.	17 13 S	17·22′ × ·98′ = cor.	16 53 E
Lat. in	41 17 13 S	Long. in	174 46 58 E



These observations were taken on the same evening as those given on the preceding page. As one star was east of the meridian and the other one west, the case is not good for latitude; but it should give the truest longitude, as instrumental errors, &c., will practically eliminate one another in the resulting longitude. This problem reworked with a latitude near the truth makes no appreciable difference in the resulting position.

For position of ship when plotted on chart, see chartlet on next page.

DOUBLE ALTITUDE OF TWO STARS

(Combining Chron. Long. Observation with an Ex-meridian).

1902.—On 15th March, p.m., the following observations were taken :—

	D. H. M. S.		° ′ ″
M. T. G. by chron.	14 21 23 43	T. alt. of ✳ α Centauri	34 47 43 to S.Ed.
M. T. G. „	14 22 26 7	„ ✳ Canopus	56 5 7 to S.Wd.

Required position of place by projection on the chart, assuming the approximate latitude to be 41° 0′ S.

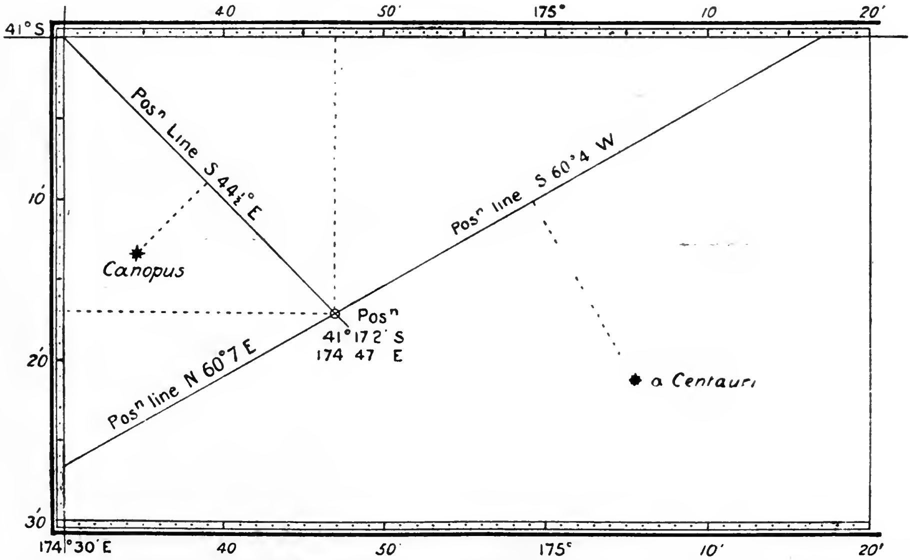
✳ Canopus to S.Wd.

	M. H. S.		
M. T. G.	22 26 7		
Sid. T. (G. noon)	23 24 40·46		° ′ ″
Accl.	+ 3 41·13	Dl. of ✳	52 38 59 S
Sid. T. Green.	21 54 28·59	P. D.	37 21 1
	° ′ ″		
A	56 5 7		
L	41 0 0	Sec	0·122220
P	37 21 1	Cosec	0·217036
	134 26 8		
S	67 13 4	Cos	9·587969
S – A	11 7 57	Sin	9·285798
	H. M. S.		
✳'s H.A.	3 10 41·3 W	Sin²	9·213023
✳'s R.A.	6 21 47·6		′
Sid. T. place	9 32 28·9	A	·79 N
Sid. T. G.	21 54 28·6	B	1·77 S
Long. in T.	11 38 0·3	Cor	·98 S Pos.-line from C² gives S 44·4° E
Long.	174° 30′ 5″ E		

✳ α Centauri to S.Ed.

	H. M. S.				H. M. S.
M. T. G.	21 23 43			Sid. T. G. noon	23 24 40·46
Long. in T.	+ 11 38 0·3			Accl.	+ 3 30·89
M. T. place	9 1 43·3			M. ⊙'s R.A.	23 28 11·35
M. ⊙'s R.A.	23 28 11·3				
Sid. T. place	8 29 54·6				° ′ ″
✳'s R.A.	14 33 1·3			✳'s Dl.	= 60 25 37 S
✳'s H.A.	6 3 6·7				
Supt.	5 56 53·3 } 89° 13′ 20″ }	Cos	8·132720		
Dl.	60 25 37	Cot	9·753933	Cosec	0·060617
Arc (1)*	0° 26′ 29″ S	Tan	7·886653	Cos	9·999987
		Alt. 34° 47′ 43″		Sin	9·756366
Arc (2)	41 0 11 S			Sin	9·816970
Latitude	41 26 40 S				
A	′ ·01 S				
B	1·77 S				
Cor	1·78 S gives Pos.-line S 60·7° W				

The chartlet below serves to illustrate both the problem above and the one on previous page. In the first case the position-lines are laid down from the two longitudes corresponding to the parallel of latitude 41° S., and in the second case the position-lines are laid down from the meridian of longitude 174° 30′ E., the longitude found by chronometer from observation of star Canopus in latitude 41° S. The observation of star α Centauri is worked as an ex-meridian from the time deduced from longitude 174° 30′ E. Though the hour-angle in this case is a little over six hours, the latitude found is perfectly correct.



* As the logs for sines and tangents are practically the same for very small angles are (1) may be taken out from the log sine table to save calculating for the seconds.

SIMULTANEOUS(a) OBSERVATIONS OF TWO DIFFERENT STARS BY THE OLD "SUMNER" METHOD.

1898.— Shortly after sunset on March 3rd, somewhere between the parallels of 51° 15′ N. and 51° 50′ N., a chronometer indicated mean time at Greenwich 3 d. 6 h. 48 m. 38 s. when the true altitude of ✱ Procyon was 31° 57′ east of meridian; again, after running east (true) 3¾ m., a chronometer indicated 3 d. 6 h. 59 m. 20 s. when the true altitude of ✱ Capella was 83° 50′ east of meridian.

Required the position of the ship at time of last observation, and the true bearing of the stars by Sumner's method of progression on the chart.

1st Observation: ✱ Procyon to S.Ed.

	D. H. M. S.		° ′
M.T. Green.	3 6 48 38	T. alt. of ✱	31 57 E
Sid. T. (G. noon)	22 45 7·9		
Accl.	+ 1 7·1	✱'s Dl.	5 29 N
Sid. T. Green.	5 34 53·0	P D	84 31 N

2nd Observation: ✱ Capella to S.Ed.

	D. H. M. S.		° ′
M.T. Green.	3 6 59 20	T. alt. of ✱	83 50 E
Sid. T. (G. noon)	22 45 7·9		
Accl.	+ 1 8·9	✱'s Dl.	45 54 N
Sid. T. Green.	5 45 36·8	P D	44 6 N

Run between observations, East 3·75 m. = d. long. 6·0′ E

	° ′		
A	31 57		
L	51 15	Sec	0·203479
	84 31	Cosec	0·001992
	167 43		
S	83 51½	Cos	9·029332
S − A	51 54½	Sin	9·895988
	H. M. S.		
✱'s H.A.	− 2 52 33·0 E	Sin2	9·130791
✱'s R.A.	7 34 0·3		
Sid. T. Sp.	4 41 27·3		
Sid. T. G.	5 34 53·0		
Long. in T.	0 53 25·7		
Long	13° 21′ 25″ W		
Run	6 0 E		
Long. A	13 15 25 W		

	° ′		
A	83 50		
L	51 15	Sec	0·20348
P	44 6	Cosec	0·15745
	179 11		
S	89 35½	Cos	7·85289
S − A	5 45½	Sin	9·00144
	H. M. S.		
✱'s H.A.	− 0 18 34·6 E	Sin2	7·21526
✱'s R.A.	5 9 11·4		
Sid. T. Sp.	4 50 36·8		
Sid. T. G.	5 45 36·8		
Long. in T.	0 55 0·0		
Long. C	13° 45′ 0″ W		

	° ′		
A	31 57		
L	51 50	Sec	0·209046
P	84 31	Cosec	0·001992
	168 18		
S	84 9	Cos	9·008278
S − A	52 12	Sin	9·897712
	H. M. S.		
✱'s H.A.	− 2 49 42·3 E	Sin2	9·117028
✱'s R.A.	7 34 0·3		
Sid. T. Sp.	4 44 18·0		
Sid. T. G.	5 34 53·0		
Long. in T.	0 50 35·0		
Long.	12° 38′ 45″ W		
Run	6 0 E		
Long. B	13 32 45 W		

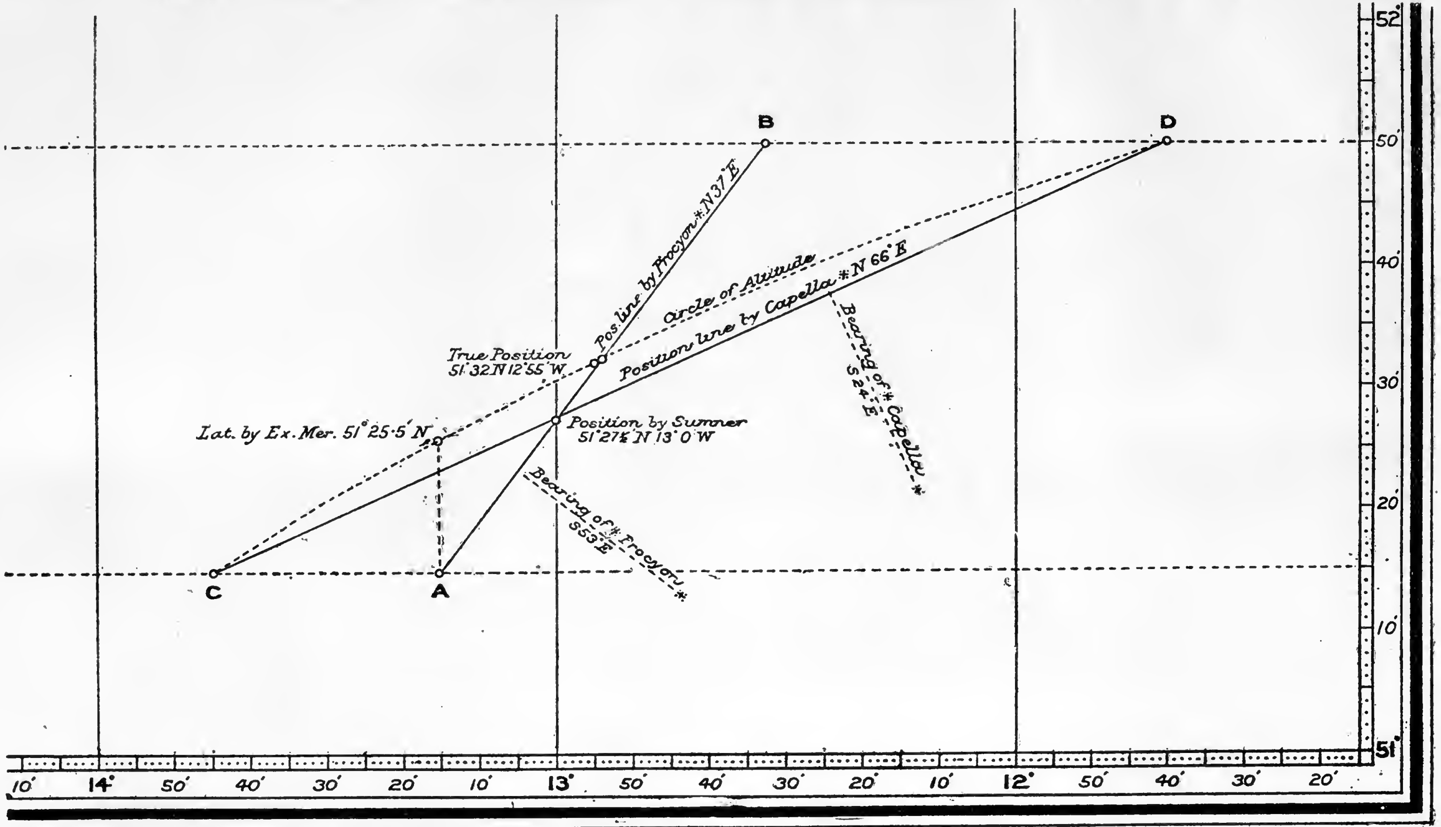
	° ′		
A	83 50		
L	51 50	Sec	0·20905
P	44 6	Cosec	0·15744
	179 46		
S	89 53	Cos	7·30882
S − A	6 3	Sin	9·02283
	H. M. S.		
✱'s H.A.	− 0 10 14·4 E	Sin2	6·69814
✱'s R.A.	5 9 11·4		
Sid. T. Sp.	4 58 57·0		
Sid. T. G.	5 45 36·8		
Long. in T.	0 46 39·8		
Long. D	11° 39′ 57″ W		

Position of ship by Sumner: Lat. 51° 27½′ N., long. 13° 0′ W.
True position of ship: Lat. 51° 32′ N., long. 12° 55′ W.
Bearing of ✱ Procyon, S. 53° E.; and bearing of ✱ Capella, S. 24° E.

(a) Practically though not absolutely simultaneous.

Note.—This is the problem (*b*) of the Board of Trade Examination for Extra Master, with the exception that as set for that examination both observations are taken at the same instant, only one chronometer time being given. As this is probably never realized in practice, the more usual experience of having a few minutes' interval between the observations is here given.

Position by "Sumner" plotted on chart from four calculated hour-angles, as required to be worked when the chart is used for Board of Trade Examination of an Extra Master.



NOTE. The difference between the true circle of altitude from A to B and the straight line joining these two points is so small that it could not be well shown on this chartlet. The straight line cuts the circle of altitude between C and D at lat. 51° 32½′ N. and long. 12° 54′ W. The true position of ship, where the two circles of altitude would cut, is lat. 51° 32′ N. and long. 12° 55′ W.

SIMULTANEOUS (a) OBSERVATIONS OF TWO DIFFERENT STARS BY THE IMPROVED "SUMNER" METHOD.

1898.—Shortly after sunset on March 3rd, in latitude by D.R. 51° 15′ N., longitude 13° 40′ W., a chronometer indicated mean time at Greenwich 3 d. 6 h. 48 m. 38 s. when the true altitude of ✱ Procyon was 31° 57′ east of meridian; again, after running east (true) 3¾ m., a chronometer indicated 3 d. 6 h. 59 m. 20 s. when the true altitude of ✱ Capella was 83° 50′ east of meridian.

Required the position of the ship at the time of last observation, and the true bearing of each star at the time of their observation.

1st Observation: ✱ Procyon to S.Ed.

	H. M. S.		° ′
M.T. Green.	6 48 38	T. alt. of ✱	31 57
Sid. T. (G. noon)	22 45 7·9		
Accl.	+ 1 7·1	✱'s Dl.	5 29 N
Sid. T. Green	5 34 53·0	P.D.	84 31 N

Run between observations, East 3·75 m. = d. long. 6·0′ E.

	° ′		
A	31 57		
L	51 15	Sec	0·203479
P	84 31	Cosec	0·001992
	167 43		
S	83 51½	Cos	9·029332
S − A	51 54½	Sin	9·895988
	H. M. S.		
✱'s H.A.	2 52 33·0 E	Sin²	9·130791
✱'s R.A.	7 34 0·3		
Sid. T. Sp.	4 41 27·3		
Sid. T. G.	5 34 53·0		
Long. in T.	0 53 25·7		
Long.	13° 21′ 25″ W		
Run	6 0 E		
Long. (1)	13° 15′ 25″ W		
	H. M. S.		
Long. in T.	0 53 1·7		

		′
Lat. 51¼°	A	1·33 S
✱ Procyon	B	·14 N
H. M. H.A. 2 52	C	1·19 S

Gives Az. S 53·3° E and Pos.-line N 36·7° E

2nd Observation: ✱ Capella to S.Ed.

	H. M. S.		° ′
M.T. Green.	6 59 20	T. alt. of ✱	83 50 Sd
Long. in T.	− 0 53 1·7 W	Z.D.	6 10
M. T. Sp.	6 6 18·3		
Sid. T. (G. noon)	22 45 7·9		
Accl.	+ 1 8·9		
Sid. T. Sp.	28 52 35·1		
✱'s R.A. (+24)	29 9 11·4		
✱'s H.A.	0 16 36·3 E	Sin	8·8595
Dec.	45° 54′ N	Cos	9·8426
Alt.	83° 50′	Sec	0·9689
Az.	S 27° 57′ E	Sin	9·6710
Pos.-line	N 62° E.		

Lat. by Ex-mer. Table No. 3 of Blackburne's and Westland's Tables.

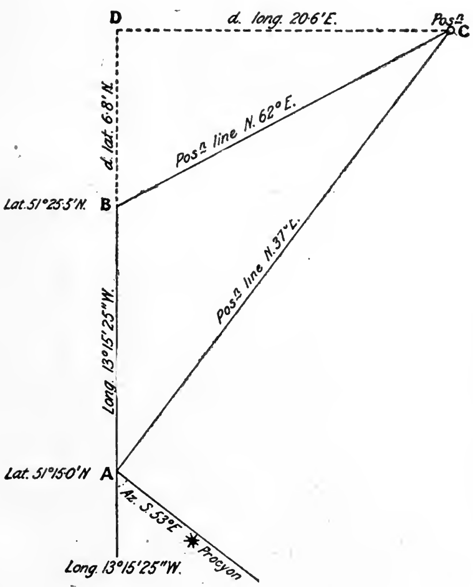
H. M.		° ′		° ′
H.A. 0 16·6	Cor.	+ 4·5	Alt. 83 50	Cor. − 43
Dec. 45° 54′ N		45 54	Az. 27 57	Z D 6 10 N
Arc (1)		45° 58·5′ N	Arc (2)	5 57 N
Arc (2)		5 57 N		
Lat.		51° 25·5′ N		

1st obsn. ✱'s Az. S 53·3° E gives lat. error from Table M ·84′ N to E at lat. 51° 15′ N

2nd obsn. ✱'s Az. S 28° E gives lat. error from Table M ·33 N to E at lat. 51 25·5 N

Lat. error ·51′ : diff. lat. 10·5 :: long. 1·0′ : long. cor. 20·6′ E.

Figure.



	° ′
Long.	13 15·4 W
Cor.	20·6 E
Long. in	12 54·8 W

Long. cor. 20·6′ × ·33′ = ·618, 6·18; Lat. cor. 6·798 N

	° ′
Lat.	51 25·5 N
Cor.	6·8 N
Lat. in	51 32·3 N

Note.—This example illustrates very forcibly the superiority of the improved Sumner method over the old Sumner method which the Board of Trade so tenaciously hold on to in their examinations. By the old method the work is about twice as long, requires the aid of a chart, and gives a result 4½′ in error in the latitude and 5′ of error in the longitude. By the improved method no chart is required (though it may be used if preferred with the same result), and the position is less than ½′ in error in either latitude or longitude.

The Marcq St. Hilaire method of calculation gives 2′ of error in latitude and 2′ in the longitude.

(a) Practically though not absolutely simultaneous.

IMPROVED "SUMNER" POSITION FROM TWO STELLAR OBSERVATIONS

(Combining Chron. Long. Observation with an Ex-meridian below the Pole).

1898.—Soon after sunset on 25th December, at about 8 h. 2 m. p.m., in latitude by D.R. 46° S., and longitude 164° 30′ E. Suppose the following observations:—

M. T. Green. 21 h. 1 m. 20 s. when T. alt. of ✳ Sirius was 28° 26′ E. of meridian.

M. T. Green. 21 h. 7 m. 26 s. when T. alt. of α Crucis was 20° 45′ E. of meridian.

Run in interval between observations, S. 80°, E. 1 m. = dep. 0·98′ = d. long. 1·4′ E. Required the position of ship at time of second observation.

1st Observation.

	H. M. S.		
M. T. Green.	21 1 20	Dl. of ✳ Sirius.	
Sid. T. (G. noon)	18 12 8·3		° ′
Accl.	3 27·2		16 35 S
Sid. T. Green.	15 16 55·5	P.D.	73 25

✳ Sirius to N.Ed.

	° ′		
A	28 26		
L	46 0	Sec	0·158229
P	73 25	Cosec	0·018451
	147 51		
S	73 55½	Cos	9·442316
S − A	45 29½	Sin	9·853180
	H. M. S.		
✳'s H.A.	− 4 23 59 E	Sin²	9·472176
✳'s R.A.	6 40 44		
Sid. T. Sp.	2 16 45	A	′·46 N
Sid. T. Green.	15 16 55·5	B	·33 S
Long. in T.	10 59 49·5	C²	·13 N
Long.	164° 57′ 22″ E	Pos.-line	N 7½° W
Run	1 24 E		
Long. (1) at time of 2nd obsn.	164 58 46 E	= 10h. 59m. 55s.	

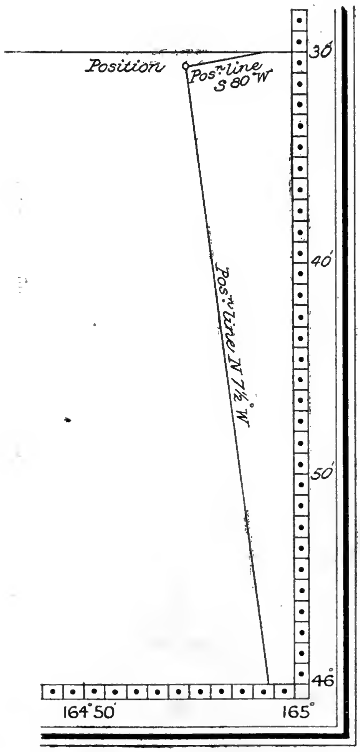
2nd Observation: ✳ α Crucis.

	H. M. S.		H. M. S.
M. T. Green.	21 7 26	Sid.T. (G. noon)	18 12 8·3
Long. E	+ 10 59 55	Accl.	+ 3 28·0
M. T. Sp.	8 7 21	M. ⊙'s R.A.	18 15 36·3
M. ⊙'s R.A.	18 15 36·3		
Sid. T. Sp.	− 2 22 57·3	H.A. (H. M.) 9 58	A ′1·76 S
✳'s R.A.	12 20 59·6	Lat. 46° S	B 3·80 S
✳'s H.A.	− 9 58 2·3 E	✳ α Crucis	C 5·56 S
	12 0 0	gives Az. S 14°·5 E	
Supt.	2 1 58		

Table C² gives Posn.-line for Plane Chart, S 79¾° W

For Latitude by Ex-meridian Table No. 3 of Blackburne's and Westland's Tables.

				° ′
Decl.	62° 32′ S	p. 149	Arc cor.	− 3 20·3
H.A.	2 h. 2 m.		P D	27 28·0 S
			Arc (1)	24 7·7 S
	° ′			° ′
Alt.	20 45 S	p. 145	Arc cor.	+ 0 37·3
Az.	14 30 S		Alt.	20 45·0 S
			Arc (2)	21 22·3 S
			" (1)	24 7·7 S
			Lat.	45 30·0 S



Rule for Use of Ex-meridian Table No. 3.

With Hour-angle from Lower Meridian.

With declination and hour-angle take out arc reduction; *subtract* this reduction from P D for arc (1).

With altitude and azimuth take out 2nd arc reduction; *add* this reduction to altitude for arc (2).

Arc (1) + arc (2) = latitude.

✳ Sirius with latitude 46° S. gives longitude 164° 58′ 45″ E., and position-line for plane chart N. 7½° W.

✳ α Crucis with longitude 164° 58′ 45″ E. gives latitude 45° 30′ S., and position-line S. 80° W.

Chart position: Latitude 45° 30·7′ S., longitude 164° 55′ E.

High-declination stars, such as α Crucis, are very useful for ex-meridians, as, if the time is only approximately correct, the latitude will not be far from the truth if the body is within an hour from the meridian below the Pole.

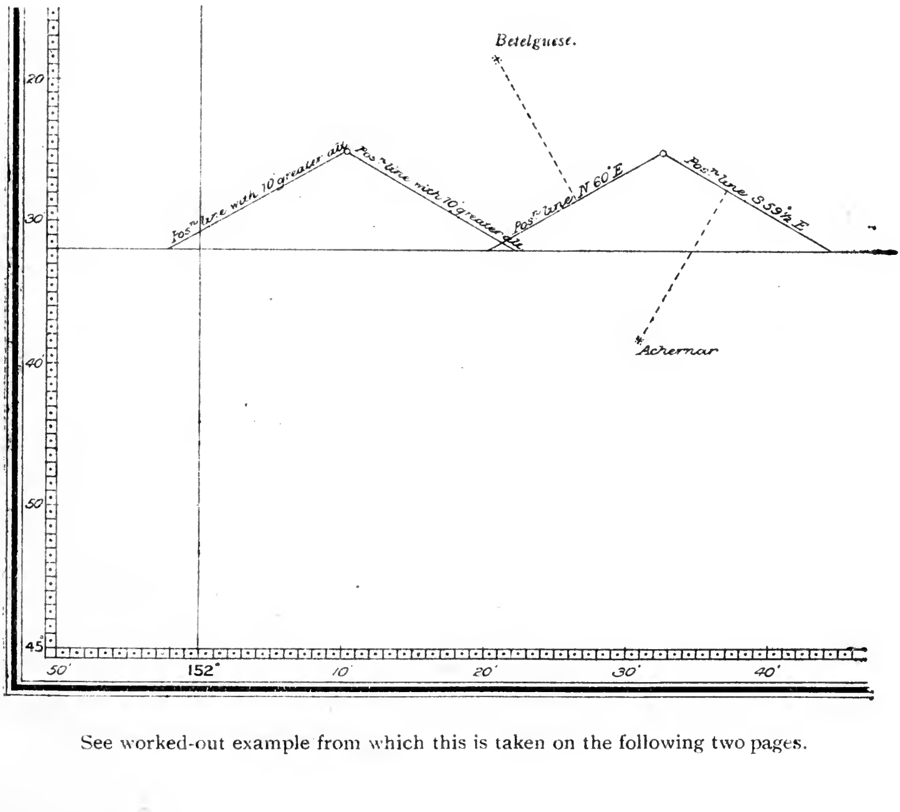
In this example, notwithstanding that the star α Crucis is over 2 hours from the lower meridian passage, 1 m. of error in the time used for ex-meridian would only make 2½′ of error in the resulting latitude.

THE SUPERIORITY OF STELLAR OVER SOLAR OBSERVATIONS.

The two great advantages of stellar over solar observations are (1) that by the stars the latitude and longitude can be obtained simultaneously, instead of having an interval of three or four hours between the observations as is often the case when the sun is used, and (2) that uncertain errors in altitude resulting from personal equation, arc errors of sextant, or exceptional refraction may be practically eliminated by a proper choice of stars. If meridian altitudes can be obtained about the same time to the north and south of observer, it will be apparent to any one that the errors would be eliminated by taking the mean result of the two observations for the true latitude; and in the same way the true longitude would be found by the mean result of observations taken nearly east and west of meridian. But it may happen that stars are not to be found north, south, east, and west of observer during the short time that the horizon is good for observation. The following is the plan that the writer used for several years with great success: Take three stars, and of these choose two on the *same* side of the meridian northward and southward of the observer for a good *latitude*. If they both happen to be the same distance from the meridian, as in the following example, 10′ of error in the altitude will make practically *no difference* in the resulting latitude as found by the "Sumner" or double-altitude problem. Then choose another star on the other side of the meridian, as near as possible the same distance from the meridian; calculate the longitude with the latitude found from the previous observations, and the true longitude will be obtained by taking the mean between the eastern and western stars worked with the correct latitude.

Elimination of Errors in Altitude.

Diagram showing how the true latitude may be found by the "Sumner" method even when altitudes have been observed by a sextant with large unknown arc errors.



See worked-out example from which this is taken on the following two pages.

POSITION OF SHIP FROM OBSERVATION OF THREE STARS,

Thereby eliminating Errors in Position resulting from Unknown Errors in Altitude.

1898.—On March 18th, at 8 h. 11 m. p.m., A.T. at ship, in latitude by D.R. 44° 32′ S., longitude 152° 20′ E. Required the position of ship from the following observations:—

		° ′		D. H. M. S.
(1) * Achernar's	corrected alt.	33 27	W of mer. when chron. showed M. T. Green.	17 22 5 50
(2) * Betelguese	"	30 13	W " " "	17 22 9 33
(3) * β Centauri	"	38 32	E " " "	17 22 12 17

Ship making a true east course at speed of 12 miles per hour.

	° ′ ″		° ′ ″		° ′ ″
(1) Decl.	57 45 17 S	(2) Decl.	7 23 16 N	(3) Decl.	59 52 58 S
	90 0 0		90 0 0		90 0 0
P. D.	32 14 43	P. D.	97 23 16	P. D.	30 7 2

Sid. T. (G. Noon).	H. M. S.	Sid. T. (G. Noon).	H. M. S.	Sid. T. (G. Noon).	H. M. S.
17th	23 40 19·67	. . . . . .	23 40 19·67	. . . . . .	23 40 19·76
Accl. 22 h. 5⅚ m.	+ 3 37·8	Accl. 22 h. 9½ m.	+ 3 38·40	Accl. 22 h. 12¼ m.	+ 3 38·86
Cor. Sid. T.	23 43 57·47	Cor. Sid. T.	23 43 58·07	Cor. Sid. T.	23 43 58·53
M. T. G.	22 5 5	M. T. G.	22 9 33	M. T. G.	22 12 17
Sid. T. Green.	21 49 47·47	Sid. T. Green.	21 53 31·07	Sid. T. Green.	21 56 15·53

*** Achernar to S.Wd.**

	° ′		
A	33 27		
L	44 32	Sec	0·147006
P	32 15	Cosec	0·272772
	101 14		
S	55 7	Cos	9·757326
S − A	21 40	Sin	9·567269
	H. M. S.		
*'s H.A.	6 25 18·5 W	Sin²	9·744337
*'s R.A.	1 33 54·4		
Sid. T. Sp.	7 59 12·9	A	·11′ S
Sid. T. Green.	21 49 47·5	B	1·59 S
Long. in T.	10 9 25·4	C²	1·70 S gives
Longitude	152° 21′ 21″ E	Pos.-line	S 59½° E
Run	1 0 E		
Long. (1)	152 22 21 E		

*** Betelguese to N.Wd.**

	° ′		
A	30 13		
L	44 32	Sec	0·147006
P	97 23	Cosec	0·003616
	172 8		
S	86 4	Cos	8·836297
S − A	55 51	Sin	9·917805
	H. M. S.		
*'s H.A.	2 11 41·6 W	Sin²	8·904724
*'s R.A.	5 49 40·6		
Sid. T. Sp.	8 1 22·2	A	1·52′ N
Sid. T. Green.	21 53 31·1	B	1·24 N
Long. in T.	10 7 51·1	C²	1·76 N gives
Longitude (2)	151° 57′ 46″ E	Pos.-line	N 60½° E
" (1)	152 22 21 E		
Diff. long.	24 35 = 24·6′		

*** β Centauri to S.Ed.**

	° ′		
A	38 32		
L	44 25	Sec	0·146138
P	30 7	Cosec	0·299502
	113 4		
	56 32	Cos	9·741508
S − A	18 0	Sin	9·489982
	H. M. S.		
*'s H.A.	− 5 48 45·3 E	Sin²	9·677130
*'s R.A.	13 56 41·2		
Sid. T. Sp.	8 7 55·9	A	·05′ N
Sid. T. Green.	56 15·6	B	1·73 S
Long. in T.	10 11 40·3	C²	1·68 S gives
Long.	152° 55′ 5″ E	Pos.-line	S 59·2° W

Long. (1) cor. = 1·70′ S to E
Long. (2) cor. = 1·76 N to E

D. long. 3·46′ : d. long. 24·6′ :: lat. 1′ : lat. cor. 7·1′ N

	° ′ ″
Lat. used	44 32 0 S
Cor.	7 6 N
Lat. in	44 24 54 S
Long. (1)	152 22 21 E
7·1′ × 1·7′	12 4 W
Long. in	152 10 17 E
Run in interval	45 E
Long.	152 11 2 E when β Centauri was observed.

	° ′ ″
Long. by W star	152 55 5 E
" E star	152 11 2 E
	2) 304 66 7
" by mean of obsns.	152 33 3 E

POSITION OF SHIP FROM OBSERVATION OF THREE STARS.

(This is previous example worked with 10′ less altitude for each star. Result the same.)

1898.—On 18th March, at 8 h. 11 m. p.m., A.T. ship, in latitude by D.R. 44° 32′ S., longitude 152° 20′ E. Required the position of ship from the following observations:—

				D. H. M. S.
(1) ✱ Achernar	true alt.	33° 17′ W. of mer.	when chron. showed M. T. Green.	17 22 5 50
(2) ✱ Betelguese	„	30 3 W.	„ „ „	17 22 9 33
(3) ✱ β Centauri	„	38 22 E.	„ „	17 22 12 17

Ship making a true east course at speed of 12 miles per hour.

(1) Decl.	57 45 17 S	(2) Decl.	7 23 16 N	(3) Decl.	59° 52′ 58″ S
	90 0 0		90 0 0		90 0 0
P. D.	32 14 43		97 23 16		30 7 2

Sid. T. (G. Noon).	H. M. S.	Sid. T. (G. Noon).	H. M. S.	Sid. T. (G. Noon).	H. M. S.
17th	23 40 19·67	. . . . . .	23 40 19·67	. . . . . .	23 40 19·67
Accl. 22 h. 5¾ m.	+ 3 37·80	Accl. 22 h. 9½ m.	+ 3 38·40	Accl. 22 h. 12¼ m.	+ 3 38·86
Cor. Sid. T.	23 43 57·47	Cor. Sid. T.	23 43 58·07	Cor. Sid. T.	23 43 58·53
M. T. Green.	22 5 50	M. T. Green.	22 9 33	M. T. Green.	22 12 17
Sid. T. Green.	21 49 47·47		21 53 31·07	Sid. T. Green.	21 56 15·53

✱ Achernar to S.Wd.

	° ′		
A	33 17		
L	44 32	Sec	0·147006
P	32 15	Cosec	0·272772
	110 4		
S	55 2	Cos	9·758230
S − A	21 45	Sin	9·568856
	H. M. S.		
✱'s H.A.	6 26 46·9 W	Sin²	9·746864
✱'s R.A.	1 33 54·4		
Sid. T. Sp.	8 0 41·3	A	·12′ S
Sid. T. Green.	21 49 47·5	B	1·59 S
Long. in T.	10 10 53·8	C²	1·71 S gives
Longitude	152° 43′ 27″ E	Pos.-line	S 59·6° E
Run	1 0 E		
Long. (1)	152 44 27 E		

✱ Betelguese to N.Wd.

	° ′		
A	30 3		
L	44 32	Sec	0·147006
P	97 23	Cosec	0·003616
	171 58		
S	85 59	Cos	8·845387
S − A	55 56	Sin	9·918233
	H. M. S.		
✱'s H.A.	2 13 11·2 W	Sin²	8·914242
✱'s R.A.	5 49 40·6		
Sid. T. Sp.	8 2 51·8	A	1·50′ N
Sid. T. Green.	21 53 31·1	B	·24 N
Long. in T.	10 9 20·7	C²	1·74 N gives
Longitude (1)	152° 20′ 10″ E	Pos.-line	N 60·1° E
„ (2)	152 44 27 E		
Diff. long.	24 17 = 24·3′		

✱ β Centauri to S.Ed.

	° ′		
A	38 22		
L	44 25	Sec	0·146138
P	30 7	Cosec	0·299502
	112 54		
S	56 27	Cos	9·742462
S − A	18 5	Sin	9·491922
	H. M. S.		
✱'s H.A.	5 50 12·8 E	Sin²	9·680024
✱'s R.A.	3 56 41·2		
Sid. T. Sp.	8 6 28·4		
Sid. T. Green.	21 56 15·5		
Long. in T.	10 10 12·9		
Long.	152° 33′ 14″ E		

	° ′ ″
Long. by W star	152 33 14 E
„ E star	152 33 10 E
„ by mean of obsns.	152 33 12 E

Long. (1) cor. 1·71′ S to E
Long. (2) cor. 1·74 N to E

D. long. 3·45 : d. long. 24·3′ : : lat. 1′ : lat. cor. 7·04′

	° ′ ″
Lat. used	44 32 0 S
Cor.	7 0 N
Lat. in	44 25 0 S

	° ′ ″
Long. (1)	152 44 27 E
7·04′ × 1·71	12 2 W
	152 32 25 E
Run in interval	45 E
Long.	152 33 10 E when β Centauri was observed.

With the above correct altitudes, the longitude calculated with correct latitude, 44° 25′ S, would be practically the same by all three stars.

EXAMPLES TO FIND STARS SUITABLE FOR DETERMINING POSITION BY SIMULTANEOUS ALTITUDES.

Example 1.

1898.—On 22nd February, at about 5h. 30m. p.m., in lat. by D.R. 49° 20′ N., long. 8° 45′ W. Find what stars not less bright than mag. 0·5 are suitable for determining the position of ship by simultaneous altitudes.

	H. M.		H. M.		H. M.		H. M.
A. ⊙'s R.A.	22 24						
A. T. Sp. +	5 30						
R.A. mer.	3 54		3 54		3 54		3 54
* Capella R.A.	5 9	* Rigel	5 10	* Sirius	6 40	* Procyon	7 34
*'s H.A.	1 15 E	H.A.	1 16 E	H.A.	2 46 E	*'s H.A.	3 40 E

	H. M.
R.A. mer. + 24 h.	27 54
* Vega	18 33
*'s H.A.	9 21 W

The only stars of this magnitude (not including planets) which would be above the horizon would be Capella, Rigel, Sirius, and Procyon east of meridian, and Vega to the west.

Rigel and Capella, having nearly the same R.A. and a large difference in declination, will always make a good cut with one another; also, position-lines from Vega and Capella will nearly always cross one another at a good angle in the Northern Hemisphere, as these stars are about 10½ hours apart in R.A., and in high northern latitudes they both remain almost continuously above the horizon. In this case either Capella or Procyon, worked for longitude, would make a good cut with any of the other three stars, which would be nearer the meridian than the prime vertical, and could therefore be worked for latitude, Rigel and Sirius being to the south and Vega to the north.

Example 2.

1898.—On 25th June, at about 5h. p.m., in lat. by D.R. 40° S., long. 171° E. Find what stars not less bright than mag. 0·5 are suitable for determining the position of ship by simultaneous altitudes.

	H. M.		H. S.		H. M.
A. ⊙'s R.A.	6 16				
A. T. Sp. +	5 0				
R.A. mer.	11 16		11 16		11 16
* Achernar R.A.	1 34	* Rigel R.A.	5 10	* Canopus R.A.	6 22
*'s H.A.	9 42 W	*'s R.A.	6 6 W	*'s H.A.	4 54 W

	H. M.		H. S.		H. M.
R.A. mer.	11 16		11 16		11 16
* Sirius	6 41	* Procyon	7 33	* Arcturus	14 11
*'s H.A.	4 35 W	*'s H.A.	3 43 W	*'s H.A.	2 55 E

It will be seen at once that Sirius, nearly on the prime vertical, and Achernar, near the meridian below the Pole, will give a splendid position. Canopus would also give a good longitude in combination with Achernar, or position-line from Procyon to N.W. would cross well with Arcturus to N.E. Rigel, having a very small altitude, would probably not be seen.

Note.—The planets Venus, Jupiter, Saturn, and Mars make good daylight stars for observation. Venus, the brightest of all, is nearly always available for longitude either in the early morning or evening. The relative positions of the other planets with the sun vary continuously.

In the Northern Hemisphere Vega and Altair, or Rigel and Capella, nearly always pair well together: when the first pair are morning the other are evening stars, and *vice versa*. In the Southern Hemisphere Canopus and Sirius, or either α or β Centauri and Arcturus, make good pairs for determining positions. In higher latitudes, in place of Arcturus, Achernar will always make a good cut with either of the Centaurs.

DOUBLE-ALTITUDE POSITION BY SUN AND MOON.

LONGITUDE BY CHRONOMETER, AND EX-MERIDIAN 3 HOURS FROM THE MERIDIAN.

1898.—On 2nd January, at about 3 p.m., A.T. at ship, observed altitude of moon's U.L. was 26° 33′ 0″ E. of meridian when chronometer showed M.T. Green. 3 h. 48 m. 30 s., and observed altitude of sun's L.L. was 5° 30′ 45″ W. of meridian when chronometer showed M. T. Green. 3 h. 53 m. 7 s. Latitude by D.R. 51° 30′ N., longitude 12° 20′ W. Height of eye, 33 ft. Run in interval between observations, 1 m. on a true S. 85° E. course = dep. 1·0′ = d. long. 1·6′ E.

Required the position of ship at time of second observation.

	° ′ ″
Obsd. alt. of $\overline{☾}$	26 33 0 E
Dip 33 ft.	− 5 39
	26 27 21
Semi-d.	− 14 55
App. alt. ☾'s centre	26 12 26
Cor. T. 39 Raper, H.P. 54′ 10″	+ 46 39
T. alt. ☾'s centre	26 59 5

	H. M. S.
☾'s R.A. 4 h.	2 40 33·3
2·035 s. × 11·5 m.	− 23·4
Cor. R.A.	2 40 9·9

	° ′ ″
☾'s decl. 4 h.	20 54 29 N
8·3″ × 11·5 m.	1 35 S
Cor. decl.	20 52 54 N
P. D.	69 7 6

	H. M. S.
Sid. T. (G. noon)	18 48 34·53
Accl. 3 h. 48½ m.	+ 37·54
M. ☉'s R.A.	18 48 12·07

	° ′ ″
Obsd. alt. ☉	5 30 45 W
33 ft. T. E. 1·4′, Jan. + ·3	+ 1 42
T. alt. -☉-	5 32 27

	° ′		
A	26 59		
L	51 30	Sec	0·205850
P	69 7	Cosec	0·029510
	147 36		
S	73 48	Cos	9·445590
S − A	46 49	Sin	9·862827

	H. M. S.		
☾'s H.A.	− 4 50 3·4 E	Sin²	9·543777
☾'s R.A. + 24 h.	26 40 9·9		
R.A. mer.	21 50 6·5	A	·40 S
M. ☉'s R.A.	18 48 12·1	B	·40 N
M. T. Sp.	3 0 54·4	C	·00 gives Az. N 90° E
M. T. Green.	3 48 30·0		
Long. in T.	0 47 35·6		
Long.	11° 53′ 54″ W		
Run	1 36 E		
Long. (1)	11 52 18 W = 0 47 29·2 (H. M. S.)		

	° ′ ″		M. S.
☉'s decl.	22 53 42 S	Eq. T	4 23·25
14·0″ × 3·9 h.	− 55	1·16 s. × 3·9 h	+ 4·52
Cor. decl.	22 52 47 S	Cor. Eq. T.	4 27·77

	H. M. S.				
M. T. G.	3 53 7				
Long. W	0 47 29·2				
M. T. Sp.	3 5 37·8				
Eq. T.	− 4 27·8				
A. T. Sp.	3 1 10	Cos	9·847263		
☉'s decl.	22 52 47	Cot	0·374688	Cosec	0·410276
Arc (1)	30° 57′ 28″ S	Cot	0·221951	Sin	9·711306
		T. alt. 5° 32½′		Sin	8·984840
Arc (2)	82 39 34 N	. . . . . .		Cos	9·106422
Lat.	51° 42′ 6″ N				

Position of ship = Lat. 51° 42′ N., Long. 11° 52¼′ W.

As the moon was on the prime vertical when the altitude was taken, the time deduced from this observation should be absolutely correct, and the latitude by ex-meridian of the sun will also be correct without any additional work.

NOTE.—The work of correcting the moon's semidiameter and horizontal parallax is not here shown. These elements should be taken from the Nautical Almanac (p. III) of the month, where they are given for Greenwich noon, and midnight, for every day of the year. For accuracy, a correction is necessary for the number of hours from noon or midnight, and also two other small corrections—one for parallax, for the figure of the earth, and the other for moon's augmentation with increase of altitude. For sea observations these corrections can usually be made with sufficient accuracy at sight.

POSITION FROM TWO CHRONOMETER LONGITUDES BY SUN AND MOON.

1898.—On 10th July, at about 8 h. 5 m. a.m., A.T. ship, the observed altitude of ☉'s L.L. was 35° 12′ 30″ when a chronometer showed M. T. Green. 20 h. 45 m. 40 s., and observed altitude of ☾'s U.L. was 39° 47′ 20″ W. of meridian when the chronometer showed M. T. Green. 20 h. 48 m. 48 s. Latitude by D.R. 49° N., longitude 10° 45′ W. Height of eye, 28 ft. Run in interval between observations, N. 80° E. 0·5′ = d. lat. 0·1′ N.; dep. 0·5′ E. = d. long. 0·66′ = 0′ 40″ E.

	° ′		° ′ ″		° ′ ″		H. M. S.
Obsd. alt. of ☉	35 12·5	☉'s Dl. 11th	22 13 1 N	Obsd. alt. of ☾	39 47 20	☾'s R.A. 21 h.	0 44 6·65
Cor. Table E 28 ft.	+ 9·5	3¾ h. × 19″	+ 1 2	Dip 28 ft.	− 5 13	11·2 m. × 2·0 s.	− 22·4
T. alt. ☉	35 22	Cor. decl.	22 14 3 N		39 42 7	Cor. R.A.	0 43 44·25
		P. D.	67 46	Semi-d.*	− 15 36		
				App. alt.	39 26 31		° ′ ″
	M. S.		H. M. S.	H.P. 56′ 26¼″ Cor. Raper T. 39	+ 42 25	☾'s Dl. 21 h.	10 29 20 N
Eq. T. 11th	5 5·67	Sid. T. (G. noon)	7 9 47·03			11·2 m. × 12·8″	− 2 23
h. × ·35 s.	− 1·14	Accl. 20 h. 48¾ m.	+ 3 25·15	T. alt. ☾'s centre	40 8 56	Cor. decl.	10 26 57 N
Cor. Eq. T.	5 4·53	M. ☉'s R.A.	7 13 12·18			P. D.	79 33 3

	° ′		
A	35 22		
L	49 0	Sec	0·183057
P	67 46	Cosec	0·033553
	152 8		
S	76 4	Cos	9·381643
S − A	40 42	Sin	9·814313
	H. M. S.		
☉'s H.A.	4 4 30·4 E	Sin²	9·412566
A. T. Sp.	19 55 29·6	A	′ ·64 S
Eq. T.	+ 5 4·5	B	·47 N
M. T. Sp.	20 0 34·1		
M. T. Green.	20 45 40	C²	·17 S to W
Long. in T.	0 45 6		
Longitude	11° 16′ 30″ W		
Run	40 E		
Long. (1)	11 15 50 W		

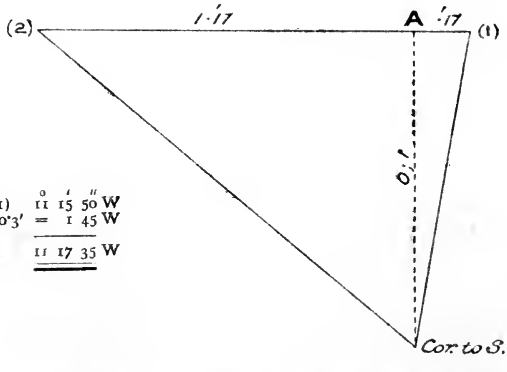
	° ′		
A	40 9		
L	49 0	Sec	0·183057
P	79 33	Cosec	0·007265
	168 42		
S	84 21	Cos	8·993222
S − A	44 12	Sin	9·843336
	H. M. S.		
☾'s H.A.	2 32 17·4 W	Sin²	9·026880
☾'s R.A.	0 43 44·2		
R.A. Mer.	3 16 1·6	A	′ 1·47 S
M. ☉'s R.A.	− 7 13 12·2	B	·30 N
M. T. Sp.	20 2 49·4	C²	1·17 S to E
M. T. G.	20 48 48		
Long. in T.	0 45 58·6		
Long. (1)	11° 29′ 39″ W	Cor.	′ 1·17 S to E
Long. (2)	11 15 50 W	Cor.	·17 S to W
Diff. long.	13 49	d. long.	1·34

1·34′) 13·8′ (10·3′
13·4

400
402

d. long. 1·34′ : lat. 1·0′ ::

d. long. 13·8 : lat. cor. 10·3′ S



	° ′ ″		° ′ ″
Lat. used	49 0 0 N	Long. (1)	11 15 50 W
Cor.	10 18 S	·17′ × 10·3′ =	1 45 W
Lat. in	48 49 42 N	Long. in	11 17 35 W

* See note on previous page about correcting moon's semidiameter and horizontal parallax for Greenwich date.

EXAMPLES TO FIND THE ERROR AND DEVIATION OF THE COMPASS.

(1.) By Sun's Azimuth.

1903.—On 23rd June, p.m., at ship, in latitude 35° 30′ S., long. 175° 0′ E., when a chronometer which kept mean time at Greenwich showed 22 d. 16 h. 11 m. 39 s. the sun bore by compass N. 70° W.

Required the true azimuth and error of the compass by the A, B, C, Azimuth Tables; and supposing the variation to be 13° 30′ E., required the deviation of the compass for the direction of the ship's head.

	D. H. M. S.		
M.T.G.	22 16 11 39		
Long. E	+ 11 40 0		
M.T. ship	23 3 51 39		
Eq. T.	− 1 39		
A.T. ship	3 50 0	H.A. West	
Lat.	35° 30′ S	A	·45 N
Decl.	23 27 N	B	·51 N

Decl. 23° 27′ S

	M. S.
Eq. T.	1 42·8
Cor.	− 4·2
Cor. Eq. T.	1 38·6 − M.T

S. H.
·54 × 7·8 = 4·2 s.

Cor. ·96 N gives True Az. from Table C	N 52° W
Compass bearing	N 70° W
Error	18 E
Var.	13½ E
Deviation	4½ E

(2.) By Star's Azimuth.

1903.—On 15th November, at about 3 h. 20 m. a.m., at ship, in latitude 39° 30′ S., longitude 177° 30′ E., when a chronometer (corrected) indicated mean time at Greenwich 14 d. 3 h. 30 m. the star α^2 Centauri bore by compass S. 41° E.

Required the true azimuth and error of compass by the A, B, C, Time Azimuth Tables; and supposing the variation to be 15° 30′ E., required the deviation of the compass for the direction of the ship's head.

	D. H. M. S.
M.T.G.	14 3 30 0
Long. E	+ 11 50 0
M.T. ship	14 15 20 0
M. ☉'s R.A.	+ 15 30 13
Sid. T. ship	− 6 50 13 or R.A. of the meridian
✱'s R.A.	14 33 1
✱'s H.A.	7 42 48
Lat.	39° 30′ S
✱ α Centauri	Table B

	H. M. S.
Sid. T. (G. noon)	15 29 38·6
Accl. 3 h. 30 m.	+ 34·5
M. ☉'s R.A.	15 30 13·1

A	·39 S		
B	1·96 S		
Table C	2·35 S	gives True Az.	S 28°·9 E
		Compass bearing	S 41·0 E
		Error	12·1 E
		Var.	15·5 E
		Deviation	3·4 W

Note.—The H.A. of a star is found by taking the difference between the Sid. T. at ship and the star's R.A. The H.A. is east when Sid. T. is least, and west when Sid. T. is best.

EXAMPLES TO FIND THE CORRECT HOUR-ANGLE AND AZIMUTH WHEN TIME IS GIVEN IN NEW ZEALAND MEAN TIME.

(1.) Sun's Azimuth.

1904.—On 24th May, at 3 h. 0 m. p.m., New Zealand mean time. Required the sun's true azimuth by the A, B, C, Azimuth Tables, at Nelson, in lat. 41° 17′ S. and long. 173° 15′ E. = 11 h. 33 m.

	D. H. M.		° ′ ″		M. S.
M.T.N.Z.	24 3 0	⊙'s Decl., 23rd	20 24 11 N	Eq. of Time	3 32·3
Long. 170° 30′ E	− 11 30	Hr. var. 29″ × 15·5 h. = cor.	+ 7 30	Hr. var. 0·18 s. × 15·5 h. = cor.	− 2·8
M.T. Green.	23 15 30	Cor. Decl.	20 31 41 N	Cor. Eq. Time	3 29·5
Long. Nelson	+ 11 33 E				
M.T. Nelson	24 3 3	Lat. 41°·3 S	A ·84′ N		
Eq. of Time	+ 3½	Decl. 20·5 N	B ·51 N		
A.T. Nelson	24 3 6½	H.A. 3 h. 6 m.	C 1·35 N gives ⊙'s true Az. N 44°·7 W		

⊙'s Azimuth by Burdwood's Tables, N 44°·6 W

(2.) Sun's Azimuth.

1904.—On 23rd December, at 7 h. 0 m. p.m., New Zealand mean time. Required the sun's true azimuth by the A, B, C, Azimuth Tables, at Wellington, in lat. 41° 17′ S. and long. 174° 45′ E.

	° ′
Long. for Standard time	172 30 E
" Wellington	174 45 E
Cor. for diff. of long.	2 15 = + 9 m. to N.Z. M. time

[Note.—The Decl. and Eq. of Time may be taken out at sight with sufficient accuracy for azimuth purposes.]

	D. H. M.		
M.T. N.Z.	23 7 0		
Cor. for long.	+ 9		
M.T. at Wellington	23 7 9	Lat. 41°·3 S	A ·28′ S named S because H. A. is more than 6 h.
Eq. of Time	+ 1	Decl. 23·5 S	B ·45 S
A.T. Wellington	23 7 10	H.A. 7 h. 10 m.	C ·73 S gives ⊙'s Az. S 61°·2 W

⊙'s Azimuth by Burdwood's Tables, S 61·2 W

(3.) Star's Azimuth.

1904.—On 15th September, at 7 h. 30 m. p.m., New Zealand mean time, in lat. 43° 30′ S. and long. 169° 40′ E. Required the true azimuth of star α Centauri by the A, B, C, Azimuth Tables.

	D. H. M. S.		H. M. S.
M.T. N.Z.	15 7 30 0	Sid. T. (Green. noon) 14th	11 29 8·8
Long. 172° 30′ E	− 11 30 0	Accl. for 20 h.	+ 3 17·1
M.T. Green.	14 20 0 0	M. ⊙'s R.A.	11 32 25·9
Long. 169° 40′ E	+ 11 18 40		
M.T. ship	15 7 18 40		
M. ⊙'s R.A.	+ 11 32 26	Lat. 43°·5 S	A ·45′ N
		α Centauri	B 1·95 S
Sid. T. ship	18 51 6		
✱'s R.A.	14 33 1	H.A. 4 h. 18 m.	C 1·50 S gives Azimuth S 42·6 W
✱'s H.A.	4 18 5 W		

True Azimuth by calculation, S 42°·55

GREAT-CIRCLE SAILING-COURSES.

The initial great-circle courses between any two places on the globe comprised within the zones of latitudes 85° N. and 85° S. may be quickly determined by the aid of the A, B, and C Tables. (See rule and examples below.)

RULE.—Turn the difference of longitude between the two places into time, and consider this as the *hour-angle;* with this H.A. and the latitude of *departure* as latitude, take out the factor from Table A, and with the latitude of *destination* as declination, enter Table B. Follow the same rules as for finding and naming the azimuth, and Table C (azimuths) will give the *initial* course. Reverse the process, and we have the course at point of destination.

The following examples are taken from Norie's Epitome, so that it may be readily seen that there is no appreciable difference between the course as found by these tables and that obtained by the more rigorous and lengthy calculation which is generally used :—

Example (1).—Required the great-circle initial courses between Cape Runaway, New Zealand, in latitude 37° 31′ S., longitude 178° 1′ E., and Cape Horn, in latitude 55° 59′ S., longitude 67° 16′ W.

(1.) Lat. 37° 31′ S.	Long. 178° 1′ E.	d. long.	H. M. S.
(2.) Lat. 55 59 S.	Long. 67 16 W.	114° 43′ =	7 38 52.

H.A. 7 H. 39 M.	A ·35′ S.	H.A. 7 H. 39 M.	A ·68′ S.
Lat. 37½° 0′ S.	B 1·64 S.	Lat. 56° 0′ S.	B ·84 S.
Decl. 56 0 S.	C 1·99 S. gives Co. S. 32½° E.	Decl. 37½ 0 S.	C 1·52 S. gives Co. S. 49½° W.

Course from Cape Runaway, S. 32½° E; or from Cape Horn, S. 49½° W.

Example (2).—Required the initial great-circle courses between Otago, in latitude 45° 47′ S., longitude 170° 45′ E., and Panama, in latitude 8° 57′ N., longitude 79° 31′ W.

(1.) Lat. 45° 47′ S.	Long. 170° 45′ E.	d. long.	H. M. S.
(2.) Lat. 8 57 N.	Long. 79 31 W.	109° 44′ =	7 18 56.

H.A. 7 H. 19 M.	A ·37′ S.	H.A. 7 H. 19 M.	A ·06′ N.
Lat. 45¾° 0′ S.	B ·17 N.	Lat. 9° 0′ N.	B 1·09 S.
Decl. 9 0 N.	C ·20 S. gives Co. S. 82° E.	Decl. 45¾ 0 S.	C 1·03 S. gives Co. S. 44½° W.

Course from Otago, S. 82° E.; or from Panama, S. 44½° W.

Example (3).—Required the initial great-circle courses between a position off Lizard, in latitude 49° 50′ N., longitude 5° 12′ W., and 5 m. E. of Barbadoes, in latitude 13° 6′ N, longitude 59° 20′ W.

(1.) Lat. 49° 50′ N.	Long. 5° 12′ W.	d. long.	H. M. S.
(2.) Lat. 13 6 N.	Long. 59 20 W.	54° 8′ =	3 36 32.

H.A. 3 H. 36 M.	A ·86′ S.	H.A. 3 H. 36 M.	A ·17′ S.
Lat. 49° 50′ N.	B ·29 N.	Lat. 13° 0′ N.	B 1·46 N.
Decl. 13 0 N.	C ·57 S. gives Co. S. 69°·8 W.	Decl. 49 50 N.	C 1·29 N. gives Co. N. 38½° E

Course from Lizard, S. 70° W.; or from Barbadoes, N. 38½° E.

EXAMPLES TO FIND THE ERROR OF COMPASS FROM BEARINGS OF THE MOON AND OF THE STAR POLARIS.

(1.) By Moon's Azimuth.

1898.—On 6th January, at about 9h. 46m. a.m., M.T. at ship, in latitude 72° N., and longitude 25° 15′ E., when a chronometer showed M.T. Green. 20h. 5m. 3s. the moon bore by compass N. 25° W. Required the moon's true bearing and the error of compass for the direction of ship's head.

	H. M. S.
M. T. Green. 5 d.	20 5 3
Long. E	+ 1 41 0
M. T. Sp.	21 46 3
Sid. T. (G. noon)	19 0 24
Accl. 20 h. 5 m.	+ 3 18
R.A. mer.	16 49 45
☾'s R.A.	5 49 45
☾'s H.A.	11 0 0 W

		H. M. S.
☾'s R.A. 20 h.		5 49 34
2·2 s. × 5 m.	=	+ 11
Cor. R.A.		5 49 45

		° ′ ″
☾'s decl. 20 h		26 0 28 N
1″·86 × 5 m.	=	− 9
Cor. decl.		26 0 19 N

H.A. 11 h. 0 m.	A	11′·5 N
Lat. 72° N	B	1·88 N
Decl. 26° N	C	13·38 N gives Az. N 13°·6 W
	Compass bearing	N 25·0 W
	Error	11·4 E

(2.) By Star Polaris Azimuth.

1906.—On 6th February, at 10h. 30m. p.m., A.T. at ship, in latitude 25° N., longitude 35° 45′ E. Suppose ✱ Polaris bore N. 4° E. Required the error of compass for the direction of ship's head.

	H. M.
A ☉'s R.A	21 18
✱'s R.A. + (24 h.)	25 25
A.T. of ✱'s mer. pass.	4 7
A.T. at ship	10 30
✱'s approximate H.A.	6 23 W

Lat. 25° N.; H.A. 6 h. 23 m.; Table G., p. 88	gives Az. N 1°·3 W.
Compass bearing	N 4·0 E.
Compass error	5·3 W.

ILLUSTRATIONS TO SHOW HOW LIVES AND SHIPS MAY BE SAVED BY THE CAREFUL OBSERVER, AND, CONVERSELY, HOW LIVES MAY BE LOST.

As it has been the duty of the writer for the last few years to carefully go over all the evidences in connection with strandings, &c., on the New Zealand coast, he has been more than ever impressed with the value of keeping up regular systematic bearings and astronomical observations. Personally, he has known the comfort and benefit of doing so by several years' experience, and of late has many times noted the sad consequences of neglect to do so.

As an illustration, let us take the case of a barque which stranded a few years ago, about 11 miles south of Kaipara Harbour. She was bound to Kaipara Harbour from Sydney in ballast, and at noon was about 143 miles from Kaipara Heads, with a fresh fair wind for her port. Towards evening (the weather apparently still fine) the barometer began to fall, and at 3 a.m. the wind had increased to gale force from W.S.W. Shortly afterwards land was seen, estimated to be 6 to 8 miles off. The land sighted was considerably to the southward of Kaipara Harbour, and the ship being in ballast it was impossible to beat off the coast to make either Kaipara or Manukau Harbours; there was therefore nothing left to be done but to run the ship on the softest spot on a lee shore. Now, had the master of this vessel been in the *habit* of getting the ship's position shortly after sunset by stellar observations, he would in all probability have been able to get a very accurate determination of the ship's position at about 7 p.m., or a little later, when only 50 miles or less from the range of Kaipara light, which he could then have steered for with confidence, and a certainty of making; and, as it happened to be H.W. at about 2 a.m., he would have had everything in his favour for an easy run into the harbour.

Another case was that of a large passenger steamer which was wrecked on the Three Kings—a disaster which caused the loss of many lives. So far as we are able to gather from the evidence given at the inquiry, the weather was fine, on the evening before the disaster, and in all probability the position of the ship might have been very accurately determined at about 7 p.m., when the ship was about 90 miles in advance of the noon position. Such an observation would most likely have shown which way the current was setting, and many lives would have been saved.

The third case within three years which has come before the New Zealand Courts in which a ship has been totally lost, but would in all human probability have been saved had the master taken stellar observations before dark, was that of a barque (2,192 tons) which was wrecked on Palmerston Island, Cook Islands.

At noon on 6th November observations were taken which showed that the South Point of islands bore S. 52° W. 98 miles, and north end bore S. 55° W. distant 95 miles. The ship was then on port tack, wind S.S.E. (true). The Captain then decided to go to leeward of the islands, and kept away a point. At 4 a.m. the look-out reported land on the starboard beam, and almost immediately afterwards the ship was on the reef.

From the evidence it was stated that the sky was clear at that time, so that there is little doubt but that a position obtained by stellar observation at about 7 p.m. would have shown the master how the current was setting, and enabled him to set a safe course to go clear of all dangers.

A fourth and more recent case was that of an auxiliary schooner which was stranded and wrecked on Minerva Reef in about 24° south latitude in June, 1915.

At 4 p.m. an observation was taken which made the ship to be 5 or 6 miles to westward of D.R. longitude from the noon position, but the master stated that he did not place much reliance on this observation.

Had the master been conversant with the problem of determining his position by two stars he could no doubt have got an accurate latitude and longitude simultaneously at twilight, at about 5.30 p.m., about two hours before the time when the ship was wrecked.

Since the loss of some of the vessels just mentioned I have received the more cheering news of the probable salvation of two large steamers owing to the master, or his officers, taking stellar observations, and so being warned in time of a dangerous set by an unusually strong current. The captain of a large liner of over 7,500 tons gross register wrote to the author in March, 1906, as follows: "During my ten years of command I have always used your tables for sun and star navigation, and invariably with excellent results and great success. In one instance particularly (of which I send you the working) it saved me from a narrow escape off Lincoln Island (northern extreme Island of Paracel group). Having experienced unusually strong currents setting to westward I kept well over to Macclesfield Bank, but nevertheless I took good observations in the morning and obtained cross bearings of stars, and was able to alter my course in time. Another shipmaster expressed gratitude that these tables had taught him the value of stellar observations, as such observations had been the means of saving his ship from stranding in the Bay of Bengal."

VALUE OF TWILIGHT STELLAR OBSERVATIONS.

Twilight (a few minutes after sunset, or a few minutes before sunrise) is far and away the best time out of the twenty-four hours for reliable observations. The horizon at that time is generally very clearly defined, without any glare, requiring no shades for the sextant, and two or three of the brightest stars with a suitable difference of bearing between them can often be observed, which will give a perfect position in both latitude and longitude at practically the same instant of time. The writer having made a regular practice of taking these observations for several years of his sea life knows well from experience that no other observations are to be compared with them. The noon position is as best only an approximation, and should never be relied on too implicitly, for though half a dozen men may take the meridian altitude and get the *same* result they may all be several miles in error, owing to some unusual excessive refraction near the horizon. The very agreement of so many observers would only give a false confidence, which is the more dangerous as there is no opportunity with the sun observation (except when near land) of checking it, and thereby determining the error. Then, again, the *so-called* noon longitude generally depends on an observation taken at about 8 or 9 a.m., and the calculation of the time from this observation is often made with an erroneous latitude, thereby giving a wrong result; and currents, or bad steering, &c., may again combine to still further throw the position out. With the position, however, obtained by simultaneous observations of two or three stars, errors resulting from uncertainty of refraction, &c., may be eliminated, and the position altogether should be much more accurate.

POWER OF SHIPOWNERS AND BOARD OF TRADE TO MINIMIZE DISASTER.

If shipowners made it compulsory for their officers to obtain the ship's position whenever possible by stellar observations at twilight, it would, I believe, be the means of saving many ships from disaster, and the saving of not a few lives; also, if this problem were given in our Board of Trade examinations for master and mate it would help greatly in making our ship officers familiar with it, and to further encourage the more frequent observations of this very important problem we would advocate that short and accurate methods of solving the problem by the use of up-to-date tables for facilitating the work should be allowed in the examination. The problem is now given in the voluntary examination for extra master, but it is given in a very unpractical way, requiring two observers with sextants as well as an officer to take the time; and the lengthy way in which it is required to be worked in the examination-room will be quite enough to deter most men from making anything like a daily practice of such an observation after their examination is over. To obtain confidence in the result of observations for any problem the navigator must make more than an occasional trial of it.

VALUE OF COMBINED OBSERVATIONS OF MOON AND PLANETS WITH THE SUN.

It may not be amiss here to remind navigators that when the moon is up in the daytime observations of moon and sun will also give both latitude and longitude at the same instant of time. Reference to example on p. 117, shows that the moon may often be observed on the prime vertical when, in the winter months, the sun never comes near to it. When the sun has a high south declination, the moon, when near the full, will have a high north declination, and *vice versa*, so that in the winter months it is especially good when in this quarter for longitude, and during the summer months for latitude. This observation, however, is even less frequently taken than that of simultaneous observations of two stars, as this problem is not given even in the extra masters' examination; it also entails more work in the calculation, and the upper limb has often to be taken, which without practice is liable to be confusing. The planet Venus, too, may sometimes be utilized in the daytime. The writer has occasionally obtained the latitude from an observation of Venus when on or near the meridian, at about 9 a.m., or 3 p.m., when the usual sights were taken for longitude. Captain W. P. Dawson, R.N., of H.M. surveying-ship "Penguin," has informed him that he has sometimes observed Jupiter, Sirius, and Canopus during the daytime. This must require good eyesight and a very clear atmosphere. The approximate altitude of the planet should, of course, be calculated, and the sextant set to it; then, if the observer looks at the horizon in the direction of the meridian through a good telescope, he may see a little white speck near the horizon, which will be the reflected star. A pelorus set to the true north or south will be found helpful in directing to the spot where it should be seen.

On the back of the United States pilot chart of the North Pacific Ocean for November, 1909, published by the Hydrographic Office of the United States of America Navy Department, some very interesting experiences of stellar observations during strong daylight were given by Captain R. E. Thomas, of the British steamer "Swedish Prince." He states that on the passage from New York to the Brazils noon observations of Venus for longitude were made simultaneously with observations of the sun for latitude on fourteen dates, between September 21st and October 8th, 1906. On another occasion, while on a passage from Rio to New York, similar observations were taken on sixteen dates, between February 8th and February 26th, 1907. Using Venus and Jupiter in conjunction with the sun while on the passage from Cape San Roque to Barbadoes, in a current varying in strength and direction, he was able for a number of days to obtain four absolute positions in broad daylight during each day—viz., about 9 a.m., longitude sun, latitude Venus; about 10.30 a.m., latitude and longitude by observing Venus S.W. and sun S.E.; at noon, latitude sun, longitude Venus W.; and about 4 p.m., latitude Jupiter, longitude sun. During these days the noon longitude obtained solely by the sun could not but be considerably in error. In concluding he says: "I may add that Jupiter, though not so easily observed as Venus, is still worthy of a place as an observable object by daylight, and one that will repay the patience and practice which its successful observing calls for."

EXAMPLE OF FINDING THE ERROR OF CHRONOMETER BY OBSERVATIONS IN ARTIFICIAL HORIZON,

Showing the Use of Table D in working out several Observations separately.

1898.—On 16th April, at about 7 h. 10 m. a.m., M.T. at place. Suppose the following observations to have been taken at Observation Spot, Suez Dock. Index error of sextant − 0′ 34″. Lat. 29° 56′ 3″ N., long. 32° 33′ 12″ E. = 2 h. 10 m. 12·8 s.

	H. M. S.			° ′ ″	Alt. diff. ′ ″
Approx. times at Green. by chron.	16 59 33	Obsd. alt. $\underline{\underline{\odot}}$	(1)	39 38 40	
	16 59 57·5		(2)	39 49 20	10 40
	17 0 23		(3)	40 0 20	11 0
	17 0 47		(4)	40 10 50	10 30
	17 1 11		(5)	40 21 10	10 20
	17 1 35·5		(6)	40 31 40	10 30
	17 2 0		(7)	40 43 20	11 40

Required the error of chronometer.

	D. H. M. S.
M. T. G.	5 17 0 47
	24 0 0
From noon 6th	7 h.

	° ′ ″
⊙'s Dl.	10 13 50 N
53·1″ × 7 h.	6 12 S
Cor. Dl.	10 7 38 N
P. D.	79 52 22

	M. S.
Eq. T.	0 16·65
0·6 s. × 7 h.	− 4·2
Cor. E. T.	0 12·45

No. 4.—Middle Sight

	° ′ ″
Alt. $\underline{\underline{\odot}}$	40 10 50
I. E.	− 0 34
	2) 40 10 16
App. lat.	20 5 8
Ref. & par.	− 2 30
	20 2 38
S. D.	+ 15 57
T. alt. -⊖-	20 18 35

	° ′ ″		
A	20 18 35		
L	29 56 3	Sec	0·062182
P	79 52 22	Cosec	0·006820
	130 7 0		
S	65 3 30	Cos	9·624999
S − A	44 44 55	Sin	9·847572
	H. M. S.		
H.A.	4 49 12·3	Sin²	9·541573
A. T. Sp.	19 10 47·7		
Eq. T.	− 12·4		
M. T. Sp.	19 10 35·3		
Long. E −	2 10 12·8		
M. T. G.	17 0 22·5		
Chron. (4)	17 0 47·0		
Chron. fast	0 24·5		

Table D.

L. 30°, Az. 90°, gives 4·62 s. to 1′ alt. ÷ 2 = 2·31 s., because altitude is doubled in artificial horizon.

A	·19 S
B	·19 N
C	·00 gives Az. 90°

	H. M. S.
M. T. G. (No. 4)	17 0 22·5
2·31 s. × 10½′	− 24·2
M. T. G. (No. 3)	16 59 58·3
Chron.	17 0 23·0
Chron. fast	0 24·7

	H. M. S.
M. T. G. (No. 3)	16 59 58·3
2·31 s. × 11′	− 25·4
M. T. G. (No. 2)	16 59 32·9
Chron.	16 59 57·5
Chron. fast	0 24·6

	H. M. S.
M. T. G. (No. 2)	16 59 32·9
2·31 s. × 10⅔′	− 24·6
M. T. G. (No. 1)	16 59 8·3
Chron.	16 59 33·0
Chron. fast	0 24·7

	H. M. S.
M. T. G. (No. 4)	17 0 22·5
2·31 s. × 10⅓′	+ 23·9
M. T. G. (No. 5)	17 0 46·4
Chron.	17 1 11·0
Chron. fast	0 24·6

	H. M. S.
M. T. G. (No. 5)	17 0 46·4
2·31 s. × 10½′	+ 24·2
M. T. G. (No. 6)	17 1 10·6
Chron.	17 1 35·5
Chron. fast	0 24·9

	H. M. S.
M. T. G. (No. 6)	17 1 10·6
2·31 s. × 11⅔′	+ 27
M. T. G. (No. 7)	17 1 37·6
Chron.	17 2 0·0
Chron. fast	0 22·4

It is evident that the last observation was in error, probably owing to the altitude having been either read off or put down incorrectly. It is therefore rejected, and a mean taken of the other six.

Results.

	s.
Chron. fast	24·7
	24·6
	24·7
	24·6
	24·9
Mean	24·66

Observations with artificial horizon are not so much needed as they were twenty or thirty years ago, as of late years time signals giving G.M.T. have been established at most places of importance. Still, it is well to be independent of such aids. In the first place, they are not *always* reliable, and, secondly, in these days of steam and rush a vessel sometimes arrives at and leaves a port again, as at Port Said, before the time when the signal is given; and there are still many places where such aids are not to be found. The writer, when second officer, used sometimes to check the chronometer by observations of stars in the quicksilver, in his middle watch at night, when tied up in the Suez Canal or at anchor in the Bitter Lakes. Results were very satisfactory, as proved by observations east and west of the meridian, which did not generally differ more than 1 s. from one other.

He never found it possible to get such observations of the *sun* on board ship, as in the daytime so many people are moving about; but in a large ship at anchor in smooth water observations in the quicksilver can often be taken at night, when all on board except the observer and time-taker are in bed, and everything is quiet.

REMARKS ON THE VALUE OF EQUAL ALTITUDES BY SEA.

We would draw attention here to the value of the short equal-altitude problem, as this method of obtaining the longitude, though very simple and useful, is seldom noticed by nautical writers. The problem is more especially useful in the case of stars, owing to there being no appreciable change in a star's declination, and because suitable ones can generally be found in any latitude. Even on dark nights a very fair longitude can generally be obtained, errors of altitude eliminating one another in a similar way as when stars are observed for latitude north and south of the meridian. An equally good result is obtained if *both* altitudes are observed the same amount too great, or too small, as if they had both been correct, and the problem is so simple that it takes very little longer than to get the latitude by meridian altitude—we mean, of course, when within the limits where correction for change of latitude and declination are not necessary.

The writer has often taken these equal altitudes about the same time as other observations have been taken—sometimes before daylight with an indifferent horizon, and at others with a good horizon a little before sunrise or after sunset—and they have nearly always agreed splendidly with the star-position longitude obtained by double altitude.

The navigator should not, however, use this method beyond its proper limits, and when the sun is observed it will seldom be useful except in the tropics, and then principally when running nearly due east or west, as on passages from Penang to Ceylon and Aden. When running due east or west *no* correction of altitude or time is required for ship's change of position, as she would change her longitude only by the portion of time which she gains or loses on the sun in the interval. Also, when the body observed bears east or west, *no* correction is required for several miles' change of latitude to the north or south; therefore it follows that when the observed body is near the prime vertical, and the change of latitude is small, it is not practically necessary to make any corrections for change of ship's position. Table 29 in Raper gives the hour-angle and altitude of a body on the prime vertical; and most other epitomes also have a table at any rate for giving the hour-angle of same, which is always useful for showing the best time to observe for longitude.

(1.) The Computation (Raper, p. 801).

Take the mean of a.m. and p.m. times by chronometer: this, when the ship does not change her latitude, is the time by chronometer of *apparent* noon; when the latitude changes, this time is the time of approximate noon. Apply chronometer error and equation of time (p. II., N.A.), which will then show the A.T.G.; the difference between that and the apparent noon at ship being the longitude in time.

(2.) Correction for Change of Latitude.

With half the interval as an hour-angle, compute the azimuth. To the log. sine of half the D. lat. made good, add the log. sec. of the lat. and the log. cotan. of the azimuth; the sum, rejecting tens, is the log. sine of the correction *in time*.

When the ship has approached the sun or star in the interval, *subtract* this time from the above mean; when she has receded from the sun, *add* it. The result is the time by chronometer at apparent noon.

Note.—When the observed body is within 10° or so of meridian, the D. lat. made good in the interval may be added or subtracted from the altitude according as the ship has approached or receded from the sun, instead of going through the longer but more accurate computation.

Longitude by Equal Altitudes of the Sun.

Example 1.—*Ship steering nearly East or West.*

In lat. by D.R. 6° N. and ☉'s decl. 5° N. Equal altitudes of the sun were taken when chronometer times, a.m. and p.m., showed respectively 18h. 10m. 36s. and 18h. 42m. 52s. Chronometer fast on G.M.T. 10m. 6s. Required the longitude.

	H. M. S.
Chron. time a.m.	18 10 36
Chron. time p.m	18 42 52
	2) 36 53 28
Middle time by chron.	18 26 44
Chron. fast	− 10 6
M. T. G. of Sp. A. noon	18 16 38
Eq. T.	− 3 34
A. T. G. of Sp. A. noon	18 13 4
A. T. Sp.	24 0 0
Long. in. time	5 46 56
Longitude	86° 44′ 0″ E

EXAMPLE 2.—*Where Ship has changed her Latitude between Sights.*

Using the preceding example, with course made good N. 73° E. 7 m. = D. lat. 2′.

	H. M. S.		′			
Half intl. as H.A.	0 16 8			Half D. lat. 1·0′	Sin	6·464
Lat. 6° N	Table A		1·50 S	Lat. 6°	Sec	0·002
Decl. 5° N	„ B		1·25 N	Az. 76°	Cot	9·397
Az. S 76°	„ C		·25 S	15″ = 1 s. to add.	Sin	5·863

	H. M. S.
Middle time of observations by chron.	18 26 44
Correction for change of latitude	+ 1
	18 26 45

Here the sun is to the southward and the course is to the northward, or the ship has *receded* from the sun.

As the change in ☉'s decl. never exceeds 1′ in an hour, the correction for this may be disregarded when observations are taken within a few minutes of noon.

EXAMPLE 3.—*Longitude by Equal Altitudes of a Star near the Meridian.*

* 1898.—On 6th September, at about 5 h. 26 m. and 5 h. 36 m. a.m., A.T. at ship, in lat. by D.R. 9° 30′ N., long. 63° E. Observed equal altitudes of ✱ Aldebaran to the northward at 13 h. 49 m. 5 s. and 13 h. 59 m. 5 s. by chronometer which was fast of G.M.T. 37 m. 36 s. Run in interval between observations, S. 75° E. 2 m. = D. lat. 0·5′.

	H. M. S.
1st chron. time	13 49 5
2nd chron. time	13 59 5
	2)27 48 10
Chron. time of transit	13 54 5
Chron. error	− 37 36
M. T. G. of transit	13 16 29
Sid. T. (G. noon), 5th	10 58 2 ·2
Accl. for 13 h. 16½ m.	+ 2 107·8
Sid. T. at Green.	24 17 7·0
Sid. T. at Sp. (✱'s R.A.)	28 30 8
Long. in time	4 13 1 = 63° 15′ 15″ E

In this example, as the star was only 10° from the meridian, and the ship had receded from the star, 0′ 30″ less altitude was set to the sextant for the second observation.

There is no more work here than with the sun, as there is no equation of time to apply, and it is even easier to correct the sidereal time than the equation of time.

The writer's usual morning double altitude was taken 3 m. before this first sight, by Saturn and Sirius, both east of meridian, the resultant giving longitude, when brought up to the same time, within 1′ of the equal-altitude longitude. He has taken several with equally good results, though in this case it was probably accidental that so near an agreement with the other observations was obtained, as better results might have been expected with a longer interval of time, when the star would have been nearer the prime vertical; daylight, however, prevented this.

It is best to choose stars with declination nearly the same as latitude, or else of the *same* name and the declination less than the latitude. If the declination is greater than the latitude, as in the last example, it does not come to the prime vertical at all; neither does it if the declination and latitude are of contrary names. With latitude and declination of *same* name, when the numbers corresponding to the hour-angles in Tables A and B nearly agree is always a good time. For instance, in latitude 46° N., at hour-angle 0 h. 20 m., with ✱ Capella, the numbers in Tables A and B exactly agree, both being 11·8′; Capella, therefore, with that latitude and hour-angle would be exactly on the prime vertical.

The following example (on p. 128) will show how a star may sometimes be observed almost on the prime vertical to within 2 or 3 minutes of its meridian passage, or at any time within 2 or 3 hours of its transit.

* The actual observations for this and the following example were taken in 1885, but for the sake of uniformity are here worked for the year 1898.

EXAMPLE 4.—*Longitude by Equal Altitudes of a Star nearly East or West.*

1898.—Colombo towards Aden. On 13th October, at 6 h. 24 m. and 6 h. 34 m. p.m. (ship time). Observed equal altitudes of ✱ Altair at 2 h. 16 m. 55 s. and 2 h. 28 m. 24 s. by a chronometer which was fast of G.M.T. 39 m. 4 s. Star's azimuth at 1st obns., S. 80° E. Lat. by meridian altitude, 8° 46′ N. Run in interval, N. 80° W., distance 2½ m.

	H. M. S.
1st chron. time	2 16 55
2nd chron. time	2 28 24
	2) 4 45 19
Chron. time of transit	2 22 39·5
Chron. error	− 39 4
M.T.G. of transit	1 43 35·5
Sid. T. (G. noon)	13 28 16·3
Accl. for 1 h. 43½ m.	+ 17
Sid. T. at Green.	15 12 8·8
Sid. T. at Sp. (✱'s R.A.)	19 45 51·6
Long. in time	4 33 42·8 = long. 68° 25′ 42″ E

Equal altitudes of this star were taken in the twilight for three or four evenings running. A few miles change of ship's position N. or S. in this case would not have affected the longitude 1′.

The following example gives the position of ship, latitude by ex-meridian (with azimuth 45°), and longitude from equal altitude observations. The problem is also plotted on the chart, and the same result obtained.

POSITION OF SHIP BY SHORT EQUAL ALTITUDE OBSERVATIONS OF SUN.

1898.—On March 20th, about noon, approximate position of ship on Equator in longitude 75° E. Observed alt. of ⊙'s L.L. was 89° 20′ S.E. when a chronometer indicated M.T.G. 19 d. 19 h. 6 m. 9 s., and again (p.m.) the observed alt. of ⊙'s L.L. was 89° 20′ S.W. when chronometer indicated M.T.G. 19 d. 19 h. 9 m. 1 s. Course and distance run between the observations west 0½m. Height of eye 40 ft.

Required position of the ship at apparent noon.

	D. H. M. S.
M.T.G. (a.m.)	19 19 6 9
M.T.G. (p.m.)	19 9 1
	2) 38 15 10
Middle time by Chron.	19 7 35
Eq. of time	− 7 35
A.T.G.	19 0 0
A.T. Sp.	24 0 0
Long. in time	5 0 0
Longitude noon	75 0 0 E
Long. at 2nd Obn	74 59 45 E

	M. S.
Interval	2 52
Run W	− 2
	2) 2 50
H. A.	1 25

	° ′ ″
Decl.	0 1 57 S
	4 57 S
Cor. decl.	0 6 54 S

	° ′
Obsd. alt.	89 20 Sd.
Cor. (p. 87)	+ 10
True alt.	89 30

	″ hrs.
Hr. var.	59·3 × 5
	296·5
	4 56·5

	M. S.	*Var.* s. hrs.
Eq. T.	7 31·4	
Cor.	+ 3·7	·75 × 5
Cor. eq. T	7 35·1	3·75

FOR REDUCTION.

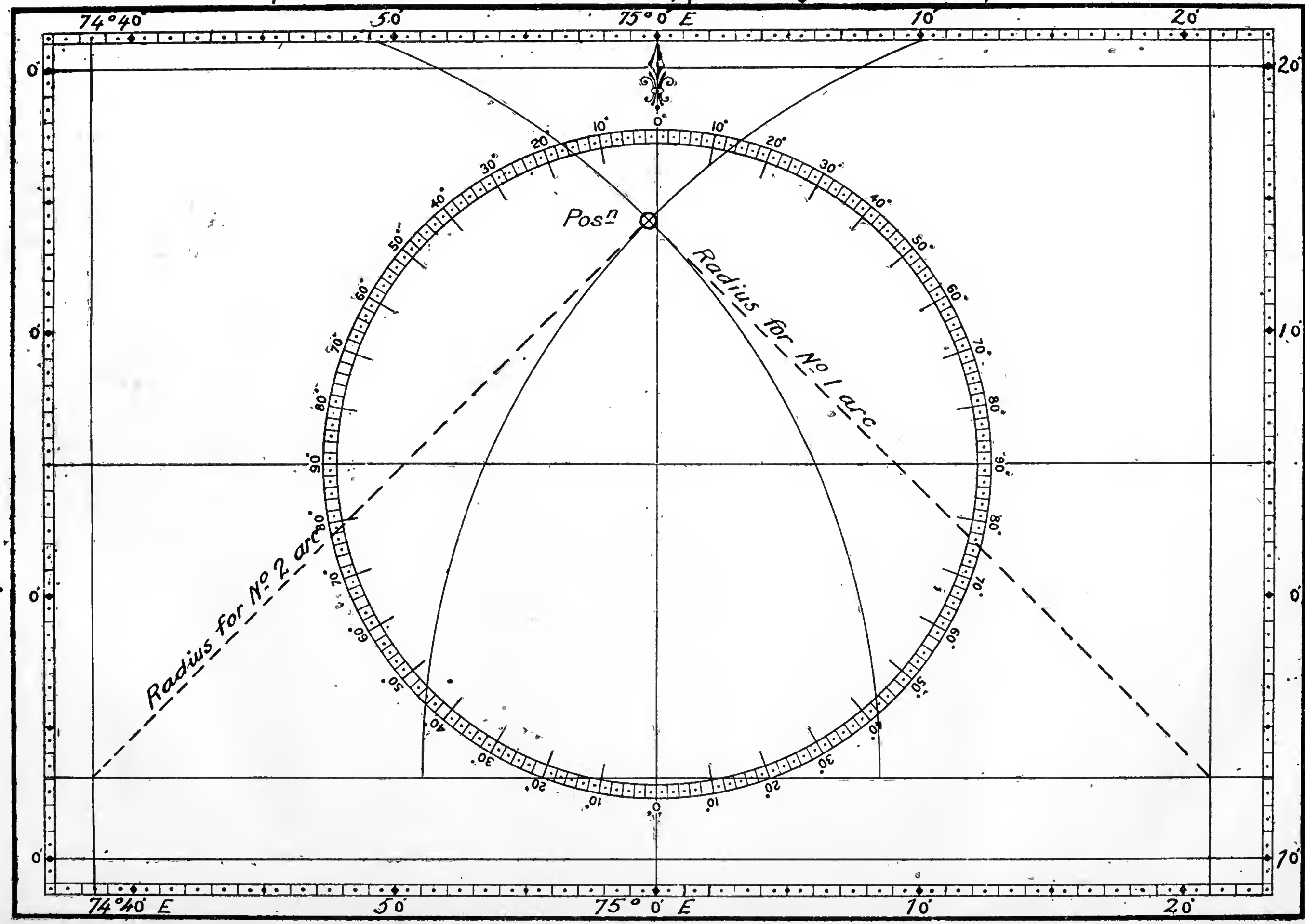
	° ′
T. Alt.	89 30·0 S
Redn	+ 8·8
Mer. Alt.	89 38·8 S
	90 0·0
M.Z.D.	0 21·2 N
Decl.	0 6·9 S
Lat.	0 14·3 N

FOR AZIMUTH.

	M. S.	
H.A.	1 25	Sin 7·791
Alt.	89° 30′	Sec 2·059
Az.	45° 6	Sin 9·850

Az. 45°, Table C (p. 40) gives in Lat. 0° A and B Cor. 1·0′ which gives (p. 145) Redn at 1 m. = 6·2′ × 1·42 m. = Redn 8·8′

Specimen of blank "Sumner" Plane Chart, published by N.Z. Marine Department.



The accompanying chartlet gives a good illustration of the "Sumner" principle in connection with this problem without any logarithmic calculations for H.A., azimuth, or reduction, and it confirms the above method of calculation.

We are indebted for this method to the writer's old friend Captain T. S. Angus, Nautical Inspector for the P. and O. S. N. Company, one of the keenest and most enthusiastic navigators he ever met. The method is as follows, viz.: Observe an altitude while the azimuth is yet large, and as soon as the Z.D. is small enough to be conveniently measured on the chart with a pair of dividers. Plot the geographical position of the sun (lat. = decl., long. = G.A.T.), and from this position as centre sweep an arc with Z.D. as radius. This is a position-line. Wait until the azimuth has sufficiently changed to give a good cut, and repeat the operation, the intersection gives the position at once without any further calculation.

The following figures give all that is necessary for plotting on the chart.

	H. M. S.		° ′		H. M. S.
1st obsn. A.T.G.	18 58 34 W or	Lat. (decl.)	0 6·9 S	2nd obsn.	19 1 26 W or
		Z.D.	0 30 as radius		
	5 1 26 E				4 58 34 E
Long.	75 21 30 E			Long.	74° 38′ 30″ E
Run west	30 W				
Long. at time of 2nd obsn.	75 21 0 E	Chart position at 2nd obsn.	Lat. 0° 14·2′ N, Long. 74° 59′ 45″ E.		

REMARKS ON EX-MERIDIAN AND MERIDIAN ALTITUDES.

Although we have at the present day quite a number of special very useful ex-meridian tables, apart from the standard navigational epitomes, we would here remind those who use Raper that there are tables in that epitome which make very short work of this problem when within the ordinary ex-meridian limits, and the limits of 35° of declination. When within the limits of latitude 35° these tables may also be used for stars of any declination up to 62° N. or S., by using the declination as latitude, and *vice versa*. The following examples will illustrate this :—

EXAMPLE 1.—In lat. by D.R. 10° N., T. alt. of ✳ α Crucis 16° 10′, hour-angle of star 1 h. 10 m. Required the reduction to meridian.

H.A. 1 h. 10 m.				
Lat. 10° N. as decl.	decl. 62° 35′ S. as lat.	Table 70	Log	9·978
		1 h. 10 m.	Sin²	8·364
	Reduction	1° 15′ 34″ .	Sine	8·342
	True reduction	1 15 19		

EXAMPLE 2.—In lat. by D.R. 23° 30′ S., T. alt. of ✳ α Crucis 50° 53′, hour-angle 0 h. 10 m. Required the reduction to meridian.

H.A. 0 h. 10 m.				
Lat. 23° 30′ S. as decl.	decl. 62° 35′ S. as lat.	Table 70	Log.	0·127
		0 h. 10 m.	Sin²	6·678
	Reduction 2′ 12″	. . . .	Sine	6·805

In the first example the error from the calculated reduction by Raper's table only amounted to 15″ with no error in the second, although the first example was outside the limits of the ex-meridian tables of Brent, Walter, and Williams, which tables until lately were considered to have exceptional limits, especially on account of comprising declination limits up to 70°.

The tables, however, at the end of this book are available for any latitude, or declination from Pole to Pole, and the time-limits of the first example might have been extended for another 50 min. without making more than about ½′ of error in the reduction. See limits on pp. 144 and 152.* Larger ex-meridian tables by the author, which are published in another volume, give still more extensive limits, sometimes as much as 3 hours from the meridian (and in a new edition of the work now in the Press) when the azimuth is sometimes over 70° from the meridian.

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* Tables of Calculated Hour-angles and Altitude Azimuth Tables (30° N. to 30° S.), Ex-meridian Tables (70° N. to 70° S.), and Calculated Reduction and Azimuths of 30 Bright Stars (64° N. to 60° S.), by H. S. Blackburne. Second Edition. Price 10s. 6d. Published in United Kingdom by Thos. Ainsley, James Brown and Son, and J. D. Potter.

In this work the actual reductions and azimuths are taken out at sight for 30 of the brightest stars for limits far exceeding that of any other reduction tables, and as the reductions and azimuths have been calculated for the actual declination of the stars a minimum of interpolation is required in the use of the table. It would be impossible to make position-finding from two stars simpler than by the aid of these tables. An example is given on p. 128 of this work with an altitude of 89½° and azimuth of 45°. In this example the hour-angle was accurately determined by equal altitudes close to the meridian, otherwise this latitude by ex-meridian would only be of value as giving a latitude on the meridian of the D.R. longitude, and the position-line or circle of altitude at right angles to the bearing of the object, to be used in conjunction with another observation. Taken as a single observation 4 sec. of error in the time would make 1′ of error in the latitude. (See Table M, pp. 156 and 157.)

EXTENSION OF LIMITS IN USE OF TABLES No. 1 AND No. 2.

A very considerable extension of the ex-meridian limits of Tables No. 1 and No. 2 in this work can also be obtained by transposing latitude and declination as shown in example on p. 163. For instance, in Table 1, in latitude 25° and declination 50°, contrary names, the limits of time within which a correct reduction can be obtained by the table is 150 m., but with latitude 50° and declination 25° it is only 49 m. *Caution.*—It must, however, be remembered that you cannot get the correct azimuth or position-line by transposing latitude and declination, so that if latitude and declination are transposed for the reduction a further determination of the A and B correction will be required to find the position-line.

VALUE OF HIGH DECLINATION STARS FOR EX-MERIDIANS.

Stars with high declinations are especially valuable for ex-meridian observations, and in high latitudes it is best to choose circumpolar stars, near the meridian *below* the Pole, as these stars change very slowly both in altitude and azimuth, and consequently errors in time only produce small errors in the resulting latitude. The amount of error due to 4 sec. of time is seen at a glance from Table M, pp. 156 and 157. It was the recognition of the great value of these stars for both latitude and azimuth that induced the writer to calculate the actual true reduction and azimuth for twenty of the brightest circumpolar stars up to 2 to 3 hours from the meridian at the *inferior* transit. These tables make it almost as easy to determine the latitude by ex-meridian as by the meridian altitude when within the limits of the table, and also to set the sextant to the approximate altitude, which is a great advantage when taking twilight stars. The writer has lately calculated the reduction and azimuth in the same way for thirty of the brightest stars when near the meridian at the *superior* transit. High-declination stars are also preferable for observations of the meridian altitude, as a few minutes will then generally elapse without any appreciable change of altitude, both before and after meridian passage; and it is a good plan to take several observations—say, 5 m. before to 5 m. after meridian passage—unclamping the index each time, and to take the *mean* of these observations for meridian altitude. This plan is far preferable with stellar observations for latitude (except when altitude is very high) to that which is so often adopted of watching for the star beginning to fall.

It is necessary to caution against this prevailing plan (in these days of rapid steam navigation) even with the sun, as by so doing the observation is sometimes taken 10 m. or more after *noon*, and at others a few minutes before noon. This was brought prominently to the writer's notice many years ago, when second officer of a new mail-steamer. He made it a practice always to correct his watch and the ship clock before noon by comparison with chronometer and longitude applied. On one occasion when proceeding due south off Cape Finisterre, in a winter month, the captain and a couple of officers were observing for the meridian altitude. The writer reported that it was noon when his watch came round to the hour, but the captain said he did not make it so, and the sun was still rising; we all therefore remained aft by compulsion until the captain made the sun to *dip*, at about 10 m. after noon, and the writer was wrongly and thoughtlessly blamed for the clock being in error. In this particular case the ship was steaming directly towards the sun at about 14 knots an hour, and by this change of position, had the sun been stationary, the altitude would have increased 14″ in 1 m. of time, or 70″ in 5 m. of time, and had the *ship* been stationary the sun would have only dipped 0′ 36″ in that time; therefore the altitude would have increased to observer 0′ 34″. The sun's change of declination in 10 m. would only amount to 2″, and is not therefore taken into account.

If the clock had then been put back, and bearings of the land had been obtained, the supposed meridian altitude would have given a latitude 2·4′ N. of that by bearings; or if the time had been taken by chronometer, and the observation worked out as an ex-meridian, it would be found that a correction of 2·4′ was required to be added to the altitude. Should the observation be taken of a high-declination star, such as α Crucis, anywhere in the tropics, either north or south of the Equator, the natural fall of altitude in 10m. would be less than $2\frac{1}{2}'$ if latitude and declination were of *same* name, and barely $1\frac{1}{2}'$ with latitude and declination of *contrary* name. When the meridian altitude of the moon is observed for latitude the moon's change of declination must also be remembered, which is very rapid when near the Equator, varying in different years from a little over 9′ to a little over 18′ an hour.

Mr. C. Westland has drawn the writer's attention to a method of finding the hour-angle of maximum altitude by the help of the A & B Tables, as follows:—

Assume reduction at 1 m. from meridian $= \dfrac{15'}{2\,[A \pm B]}$ (Formula of Ex-meridian Table No. 2.)

Then H.A. of maximum altitude is given in minutes of time by $\dfrac{K\,[A \pm B]}{15'}$ and since 1 m. of time is equal to 15′ of arc it follows that the numerator of this fraction is the required H.A. expressed in arc.

Rule.—Express the difference in motion of lat. ± decl. (that is K) in minutes of arc per minutes of time, and multiply it by A ± B for 1 m. To reduce to time subtract one third and move decimal point one place to left.

Example.—Using data above, and disregarding change of decl. (as it only amounts to 0·2″ in 1 m. of time), K = 14″ = 0·233′.

Lat.	43° N	A	213′·7 S
Decl.	23 S	B	97·3 S
		C	311′·0 × K 0′·233 = 72′·46 = 4·83m. = 4m. 50s. Required H.A. of maximum altitude.
			Subt. ⅓ 24·15
			48·31

This method is considerably shorter and easier to remember than the methods usually given in navigational books.

A FEW NAVIGATIONAL NOTES AND CAUTIONS.

EXCEPTIONAL EXCESSIVE REFRACTION NEAR THE HORIZON.*

It has often been pointed out in text-books of navigation and elsewhere that altitudes observed at sea are subject to error when peculiar atmospheric conditions operate to produce an extraordinary deflection of the ray of light from the horizon, and thus to make the actual angle of dip vary from its tabulated value. It is believed that attention can not be too frequently directed to this important subject, for the reason that there are undoubtedly many navigators who do not realize the magnitude of the error that may be involved: some have the impression that this error is such as to throw the results out by no more than a mile or so, and hence may be neglected for all practical purposes; others, while knowing that in the Red Sea and other special localities the error is to be guarded against, do not consider that it need ordinarily be feared by the navigator. It can be demonstrated that this error may attain a value so great as to jeopardize a vessel, even if a very large margin be allowed for inaccuracy of the sights, and that the conditions under which it is produced are such that it may occur in any region of the ocean.

It has been seen that the conditions necessary to produce extraordinary deflections of the rays require that the atmosphere shall arrange itself in a series of horizontal strata of uniformly varying density. It follows, therefore, that the mere difference in temperature between air and water is not sufficient in itself to produce the error, and that any cause that interferes with the formation of strata will prevent the occurrence of the deflection. As wind, by keeping the air in motion, renders the conditions unfavourable for the existence of layers of unequal density, it follows that a light breeze will,

* Extract from a publication issued by the Bureau of Equipment, Department of the Navy, Washington D.C.; by Lieutenant G. W. Logan, U.S. Navy.

in general, greatly reduce the error, and that a strong one will effectually prevent it. Hence it is that the maximum bending of rays is to be expected in calm weather. It seems probable that the stratification is more likely to be disturbed when the air is colder than the sea than in the opposite condition, since the heavier particles are then above the lighter, and the atmosphere is in a state of unstable equilibrium that may be easily disturbed.

Both theory and experience show that the higher the eye of the observer is placed above sea-level the smaller are the deflections from the causes under consideration. It is therefore well, especially when there is reason to suspect the conditions that produce abnormal deflections, to observe altitudes from the highest available position.

One of the most dangerous features of this error is that there is no satisfactory method of arriving at a correct estimate of its amount. If the conditions with which it is necessary to deal were fixed in their nature, such, for example, as the mean atmospheric conditions for which the ordinary dip-table is computed, it would be a simple matter to arrive, either by theory or experiment, at the amount of the deflection. But the elements of the problem can not, in their nature, be known. For instance, the conditions of temperature and wind at a distance of several miles from the observer, which can not be determined at the ship, have an important bearing on the solution; so also with the amount of moisture in the air, which is doubtless a material factor. The navigator may, however, recognize the existence of the disturbing conditions and the probable direction in which the disturbance will affect the results of his observations, and with this knowledge he must make ample allowance for possible errors.

From a very large number of recorded instances of abnormal deflections of the rays of light from the horizon, due to inequality of temperature between sea and air, a few will be chosen to illustrate the possible magnitude of this error.

It is related that on one of Captain Cook's voyages the meridian altitude of the sun was being taken when a light snow-squall came on. The horizon and sun remaining visible, the altitude shown by the sextant had almost instantly to be altered 32′ to maintain contact, the horizon having appeared to fall by that amount when the air surrounding the observers was cooled by the snow-squall. At the same time a distant mountain-peak, which before had stood well above the horizon, almost disappeared from view. Both of these effects vanished with the passing of the squall, the measured altitude resuming its former value and the peak rising again above the horizon, Even if we are inclined to doubt the instruments of those times, and therefore the exactness of the observed difference, this account is of interest in showing at how early a day the presence of this error was recognized in navigation.

According to Raper, Mr. Fisher observed in the Arctic regions a variation of 18′ in the place of the horizon.

The late Captain Lecky, in his "Wrinkles," states that on a clear day in midwinter, off the coast of Long Island, five observers at noon closely agreed upon an altitude which gave a certain latitude; in less than two hours afterwards the land was sighted, and the latitude brought forward from the meridian altitude was found to be 14′ in error.

Lieutenant Koss and Ensign Thun-Hohenstein, of the Austrian Navy, while conducting observations near Pola for finding the variation in the dip of the horizon, observed on a quiet day a rise of the apparent horizon above its computed position of 8′ 47″ at a height of 50 ft., and of 9′ 23″ at a height of 33 ft. above water.

Of the numerous instances that might be cited of extraordinary errors in the results given by astronomical sights in the Red Sea (so extraordinary as to have given rise to an erroneous belief as to the currents existing in that body of water), it may be mentioned briefly that Lieutenant Marshall, U.S. Navy, of the U.S.S. "Detroit," found errors of position from 12′ to 18′ arising from sights of the sun; Captain Nedden, of the s.s. "Madeline," found the latitude by observation to differ 10 miles from the correct one, and images of islands to be greatly distorted; and Captain Lecky discovered the positions of certain islands to be apparently 7 to 8 miles in error in one direction from morning sights, and a similar amount in error in the opposite direction from afternoon sights.

A similar instance of error in the region of the Gulf Stream was reported by Lieutenant-Commander W. L. Rodgers, U.S. Navy, of the U.S.S. "Lancaster," two lines of position from the sun intersecting at about 7 miles to the south-east of the ship's true position, and two from stars intersecting at a like distance in the opposite direction, the direction of the error in each case according with that which was to be expected from the observed differences in temperature of air and water.

As a result of what has been set forth, the following brief summary may be given for the guidance of navigators:—

(*a*.) The inaccuracy of tables showing the dip and the visibility of objects should always be suspected when there is a marked difference between the temperature of the air and that of the sea-water.

(*b*.) The errors will be largest in calm weather and when the eye is not far elevated above the sea, and will decrease as the wind increases and the eye is raised.

(*c*.) When the air is warmer than the water, the visible horizon is raised above its normal position; the altitude corrected by the ordinary dip-table will be too small, and the resulting Sumner line will be farther from the observed body than the true line. An object will be sighted from a greater distance than usual.

(*d*.) When the water is warmer than the air, the visible horizon is lowered below its normal position; the altitude corrected by the ordinary dip-table will be too large, and the resulting Sumner line will be nearer the observed body than the true line. An object will be sighted from a less distance than usual.

A few years before the time of writing this a very well authenticated case of undoubted excessive refraction was brought to the notice of the writer by an old pupil (Captain W. H. Sweny), then commanding the P. and O. s.s. "Mooltan." At about 6 p.m. on April 11th, 1910, he took observations of four different stars for a position—viz., Procyon (ex-meridian) to northward, Rigel to north-westward, Canopus to south-westward, and β Centauri to south-eastward, to cross with one another. The chief officer took an ex-meridian of Pollux to northward, and Rigel and β Centauri for a cross. Shortly afterwards the fourth officer took Procyon, Canopus, β Centauri, and Jupiter to eastward. Captain Sweny first sent the writer his own observations, asking him to work them out and let him know what he made the resulting position. This was done, and when the captain afterwards sent the results of his work both positions were in agreement and evidently not more than about 1′ in error in either latitude or longitude. The captain also sent the worked-out observations of the other two officers, and from all these observations the writer was able to deduce fairly accurate separate positions, and it was evident from these observations that refraction was excessive all round the horizon, but greatest to the northward, where it was about 11·0′, and in other parts of the horizon averaging about 6¾′, the altitudes being smaller by these amounts than they should have been by allowing the usual tabular corrections. The height of eye when these observations were taken was 50 ft. If the captain had been satisfied with the ex-meridian observations of Procyon and Pollux, and the longitude of β Centauri, he would have been 11′ or 12′ out in the latitude and 33′ out in the longitude. By using the observations intelligently he was practically correct in his position, and made Rottnest Light nearly ahead at 2 a.m. His position at the time was about 30° 4′ S. and 113° 47′ E.

The above related experiences, though undoubtedly *very exceptional*, should tend to warn navigators not to trust too implicitly even in daylight to observations taken on one side *only* of the meridian, or prime vertical; for though such excessive refraction is *very rare*, and may not be experienced in the lifetime of a frequent observer, it is probable that such amounts as 2′ difference from the tabulated value of refraction is not uncommon.

EFFECT OF ALTITUDE ERRORS.

With a.m. sights too great an altitude will place a ship to eastward of true position, and *vice versa* with p.m. sights and too small an altitude. The amount of error in longitude or time due to 1′ error of altitude is shown in Table D.

OBSERVATIONS IN ARTIFICIAL HORIZON.

In correcting the altitude taken in artificial horizon, *first* apply index error, then halve the altitude after which apply the other corrections—viz., refraction, parallax, and semidiameter.

When the lower limb is taken with a.m. sights the suns appear to be separating, and when the upper limb is taken the suns appear to be closing in on one another. *Vice versa* with p.m. sights.

NUMBER OF FIGURES TO USE WITH LOGARITHMS.

Using more than four figures of logarithms in working any of the sailings is generally a waste of figures; as also in working an altitude or time azimuth or the time when hour-angle is less than 2 hours.

In Bowditch's "American Practical Navigator" not more than five figures are given in any of the tables, and the work is thereby much facilitated.

CORRECTIONS OF SUN'S DECLINATION AND EQUATION OF TIME.

For ordinary sea practice it is generally useless precision when correcting the sun's declination to take out the hourly variation to decimals of a second; also, one place of decimal is amply sufficient when correcting the equation of time.

CORRECTION OF A PLANET'S R.A. AND DECL.

The R.A. and decl. of a planet may often be quickly corrected by the aid of the traverse-table used as a proportional table. The following example will illustrate this:—

1898.—30th August; M. T. G. 9h. 36m. Required the corrections for R.A. and decl. Daily change of R.A. was 236·3 s., and of decl. 28·8′.

To find correction for R.A. due to 9·6h. from noon: Add a cipher to 24 h., then with 240 in dist. column look out the nearest number abreast it in either the dep. or d. lat. column. This will be found at 10° in d. lat. column—viz., 236·4. Having added a cipher to 24 h. the decimal point in 9·6 h. must be removed one figure to the right; then look out the number in d. lat. column against 96 in dist. column and the correction 94·5 s. will be found.

To find correction for decl. due to 9·6h. from noon: 28·8′ is the change in 24 h. At 33° in the traverse-table we find 239·9 in d. lat. column against 286 in dist. column, and again 96·4 in d. lat. against 115 in dist. ∴ 11·5′ will be the correction (nearly).

NOTES ON MERCATOR AND MIDDLE-LATITUDE SAILINGS.

Mercator's sailing should be used generally when the course is between 1° and 70°, especially with long distances and in high latitudes. With a large course, and using either Raper or Norie, the distance may sometimes be considerably in error owing to the meridional parts not being given to decimals. The following examples will illustrate this:—

Find the true course and distance from lat. 5° 28′ N., long. 85° 30′ E., to lat. 5° 34′ N., long. 91° 0′ E.

By Mercator's Sailing (Raper's Tables).

Lat. 5° 28′ N	Mer. pts. 328′	Long. 85° 30′ E					
Lat. 5 39 N	Mer. pts. 340	Long. 91 0 E					
D. lat. 11 N	M. d. lat. 12	5 30 E					
		60					
		D. long.	330′	Log	12·5185		
		M. d. lat.	12′	Log	1·0792	D. lat. Log	1·0414
		Course N. 87° 55′ E.		Tan	11·4393	Sec	1·4396
						Log	2·4810
						Distance	302·7 miles

By Inman's Tables.

5° 28′ N	Mer. pts. 328·50	D. long. 330′	Log 12·5185			
5 39 N	Mer. pts. 339·55	M. d. lat. 11·05′	Log 1·0434	D. lat. 11′	Log 1·0414
D. lat. 11 N	M. d. lat. 11·05	Course N. 88° 5′	Tan 11·4751	Sec of Co.		1·4753
			Distance	328·6 miles	Log	2·5167
			Raper	302·7		
			Difference	25·9 miles		

By Middle-latitude Sailing.

Lat. 5° 28′ N	D. long. 330′	Log 2·5185			
Lat. 5 39 N	Mid. lat. 5° 33½′	Cos 9·9980	Course 88° 5′	Sec	1·4753
Mid. L. 5 33½	Dep. 328·5	Log 12·5165	D. lat. 11′	Log	1·0414
	D. lat. 11′	Log 1·0414	Dist. 328·6 miles	Log	2·5167
	Course 88° 5′	Tan 11·4751			

To take out the distance accurately for a large course, as between 85° and 90°, the log. of secant should be taken out to seconds; this may be practically done by bearing in mind that the secant and tangent differences here are almost the same. Thus in the last example the difference between the sec. and tan. in the fourth figure is about 2; then add 2 to the log. tan. of course.

When the course is large the distance is very readily found from the traverse-table by a comparison of the dep. with the dist. column. For instance, with an 88° course, distance 329 is 0·2 greater than the departure; with an 87° course, distance 329 is 0·5 greater than the departure. In the same way, when the course is within 3° or 4° of the meridian, the distance will be nearly the same, but a trifle greater than the d. lat.

SIMPLE METHODS OF FINDING THE SHIP'S DISTANCE FROM A POINT BY TWO BEARINGS AND THE RUN IN INTERVAL BETWEEN THEM.

As so many strandings have occurred on the New Zealand coast owing to the neglect to take or make use of bearings, it has been thought advisable to give the following simple methods for *approximately* determining the ship's distance from a single point or light when cross-bearings are not obtainable. The methods here given have the advantage of being determined quickly, with a minimum of calculation, without leaving the deck or having to plot the bearings on a chart. Figure 3 and Table H were first published in the writer's first edition of "A and B Tables," &c., and their value has since been further impressed on navigators by the late Captain Lecky in the latest editions of his famous "Wrinkles." The writer has also been pleased to notice that some of the local steamers now have a brass plate on the bridge marked somewhat after the style of Figure 3.

PROBLEM 1.—*To find the Distance from a Point when the Angle on Bow is doubled.*

Whenever the angle between the course and object is doubled, the distance run in the interval is the distance off at second bearing. The well-known four-point bearing illustrates this, and, as the second bearing then gives the distance off abeam, it is most frequently used; but it is often very useful to be able to know the distance off at an earlier period, as illustrated by Fig. 1.

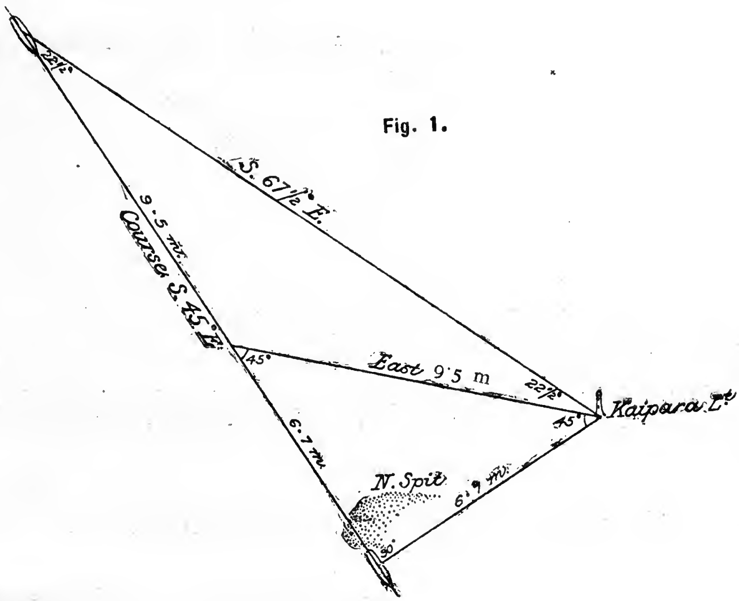


Fig. 1.

Example.—A ship making 10 miles an hour on a S.E. course by compass sighted Kaipara light, bearing E.S.E.; after continuing to make good the same course and speed for 57 m. the light bore E. Required the distance from the light when second bearing was taken.

First bearing E.S.E. 2 points on bow; second bearing E. 4 points on bow; angle doubled: the distance run in interval between bearings will be the distance off at last bearing. Interval 57 m. = $\frac{57}{60}$ or 0·95 of an hour × 10 gives run in interval, 9·5 m. the distance off.

It is apparent from the figure that if this course is continued the ship will probably run foul of the North Spit. (See Fig. 1.)

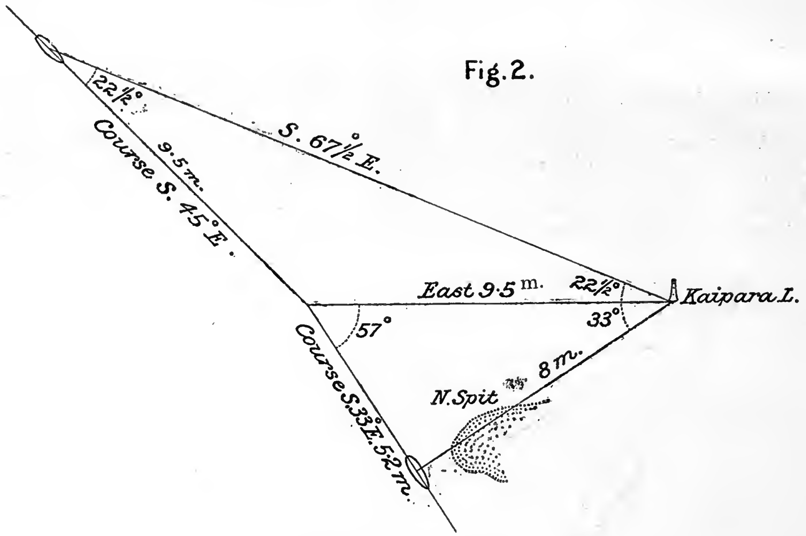
Problem 2 will illustrate how by the aid of the traverse-table the course may quickly be set to pass a safe distance off.

PROBLEM 2.—*From a known Distance from Object, to set Course to pass any required Distance from it.*

Rule.—Enter the traverse-table with the distance required to pass off in the dep. column and the present distance off in dist. column. The course heading this will be the angle to bring the object on the bow.

Example as shown in Fig. 2.—Ship steering S. 45° E. by compass, Kaipara light bore E. distant 9·5 m. Set the course to pass 8 m. off the light. Enter the traverse-table with distance 9·5 in dist. column, and turn over until the nearest to 8·0 is found in dep. column. This is found at 57°. Bring the lighthouse 57° on bow, or course by compass S. 33° E. 9·5 in dist. column gives 7·97 in dep., and 5·17 in D. lat. column, the distance to run. Fig. 2 illustrates this

Fig. 2.

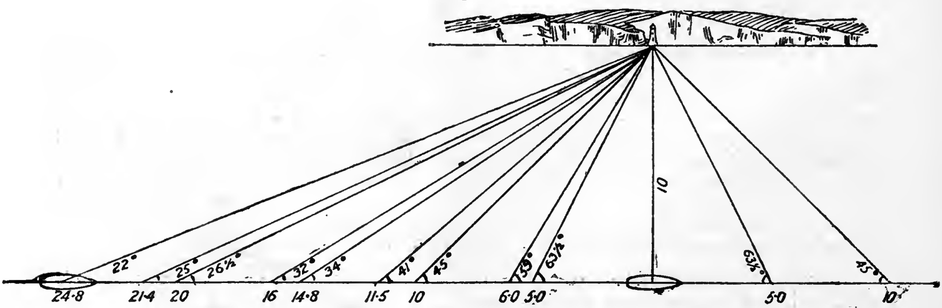


The advantage of knowing the distance that a ship will *pass off* a point on a given course, in good time before coming up to it, struck the writer many years ago when he was quite a junior officer, and he then made out the figure given below, which has often been used since.

The distance run in the interval between any two of the following bearings will give the distance that the ship will *pass off* the object if the same course is continued and *made good*.

PROBLEM 3.—*To find the Distance a Ship will pass off an Object when abeam by the Distance run in Interval between certain Bearings as given below.*

Fig. 3.



Between 22° and 34°
" 25° " 41°
" 26½° " 45°
" 32° " 59°
" 37° " 72°
" 45° " 90°
} The distance run will be the distance the ship will pass off

" 45° " 63½° the distance run will be half the distance the ship will pass off.

The numbers under base of figure represent the length of the base of the right-angled triangle proportionate to the perpendicular of 10. Thus, should the ship be passing 10 miles off an object, and the object be 22° on bow, ship will be 24·8 miles from the beam bearing.

The traverse-table gives the three sides of right-angled triangles for every degree of angle subtending the base or perpendicular. If, therefore, we know the angle on bow and the perpendicular—*i.e.*, the distance the ship will pass off the point when abeam—the other two sides of the triangle—viz., the distance off at the time, and the distance to run to beam bearing—are seen at a glance from the table.

Say angle on bow is 32°, and previous bearings give distance to pass off 10 m. Open traverse-table at 32° and against 10 in dep. column, we have 18·9 in dist. column as the distance off, and 16·0 in the D. lat. column as the distance to run to beam bearing.

Example.—A ship steering north observes a light bearing N. 32° E.; after running on same course for 6·0 miles the light bears N. 59° E. Required the distance the ship will pass *off* the light if she continues on the same course, and the distance *from* the light at time of second bearing.—*Answer:* Distance run in interval (6·0 miles) will be the distance the ship will pass off the light. Then, opening the traverse-table with 59° as course, and 6 in dep. column, we find 7 in dist. column as the distance the ship will be *from* object at that time.

As a ship changes the bearing of an object much more rapidly when nearing the beam bearing than at any other time, the distance that a ship passes off a point will be better determined by the run in interval between the two bearings of 63½° on bow and 63½° from stern—or, in other words, when it is 26½° from the beam bearing before and abaft—than at any other time.

It sometimes happens that a light or point is not sighted till after the ship has passed the four-point bearing. In such case Table H will be found useful, and might be copied out and put inside the wheel-house for ready reference.

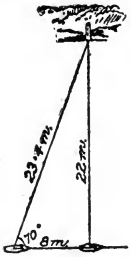
Problem 4 (by Table H).—*To find the Distance from an Object when abeam by the Distance run between Beam Bearing and any other Bearing before or abaft the Beam.*

Table H.

°		°		°		°		°	
35	·70	45	1·00	55	1·43	65	2·14	75	3·73
36	·73	46	1·04	56	1·48	66	2·25	76	4·01
37	·75	47	1·07	57	1·54	67	2·36	77	4·33
38	·78	48	1·11	58	1·60	68	2·48	78	4·70
39	·81	49	1·15	59	1·66	69	2·61	79	5·14
40	·84	50	1·19	60	1·73	70	2·75	80	5·67
41	·87	51	1·23	61	1·80	71	2·90	81	6·31
42	·90	52	1·28	62	1·88	72	3·08	82	7·12
43	·93	53	1·33	63	1·96	73	3·27	83	8·14
44	·97	54	1·38	64	2·05	74	3·49	84	9·51

Rule.—Enter the table above with the number of degrees that the object is on the bow, and take out the factor given in the table abreast it. This factor multiplied by the run in the interval between the bearing on the bow and the bearing of the object when abeam will give the distance off when abeam.

Fig. 4.



Example.—A lighthouse is observed 70° on bow, ship's speed 10 m., and interval in time to beam bearing 48 min.

48 min. = 0·8 of an hour × 10 m. = 8 m. for the run in the interval.

Against 70° in the table is 2·75, which × 8 m. gives 22 m., the distance off when abeam; or by traverse-table, enter with 70°, and with distance run 8 m. in D. lat. column, gives distance off in dep. column = 22 m., and 23·4 m. the distance off when first bearing was taken.

Chart Methods.

Problem 1.—*To find the Distance from an Object by Two Bearings, and the Run in Interval between them.*

Rule.—Lay off the first bearing and the ship's course, then lay off the last bearing, and measure off the distance run on the course since the first one was taken; through this distance draw a line parallel to the first bearing: the point of intersection between this line and the second bearing should be the ship's position.

Example (see Fig. 5).—A ship steering from A towards B on a N. 20° E. course sights a point bearing N. 65° E.; after running on this course for 18·5 m. the point bears S. 70° E. Required the distance off at second bearing by plotting on the chart.

Lay off the course N. 20° E., also the bearing of P. N. 65° E.; then measure 18·5 m. on the line of course from this bearing, and make a mark; through this mark draw a line parallel to the bearing N. 65° E.; then the intersection of this line with the second bearing will be the ship's position, which gives 18·5 m. as the distance off.

Problem 2.—*To find the Distance from an Object by Two Bearings of Differen Objects with Run in Interval between the Two Bearings.*

This problem is exactly the same in principle as the "Sumner" with two sun observations, and the writer when at sea often found it of great practical use, though he never found other navigators make use of the method (except after he had drawn their attention to it), nor is the method presented, so far as he is aware, in other nautical works. It is now given occasionally in New Zealand in the examination of masters and mates in the chart-examination problems.

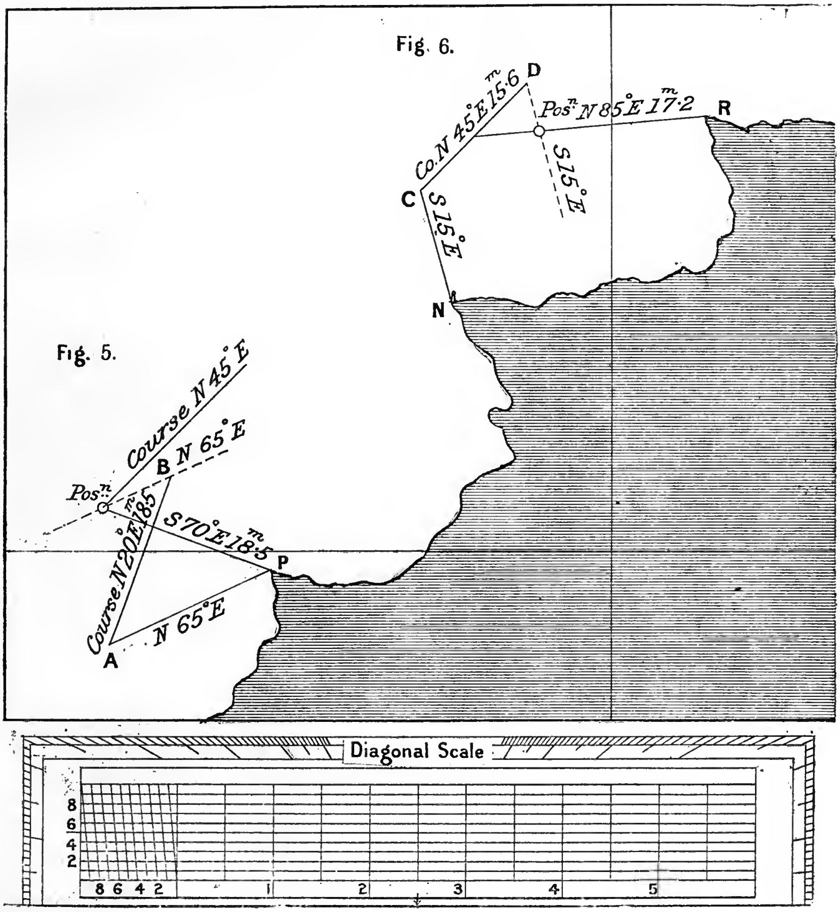
Rule.—The rule for problem 2 will be exactly the same as for problem 1.

Example (see Fig. 6).—A ship steering from C towards D on a N. 45° E course sights a point N. bearing S. 15° E.; after running on this course for 15·6 m. point R is sighted bearing N. 85° E. Required the distance from R at second bearing.

Lay off the course N. 45° E. from C to D, also the bearing of N. S. 15° E.; then measure 15·6 m. on the line of course from this bearing, and make a mark; through this mark draw a line parallel to the bearing S. 15° E.; then the intersection of this line with the second bearing will be the ship's position—viz., S. 85° W. 17·2 m. from point R.

This problem may often be used with advantage at night-time with two lights when one light is sighted shortly after the other one has been lost; or where the simultaneous bearing of two lights or two points makes too large an angle for a good fix. It will also be found useful in foggy weather in close navigation, where one near point after another may be just seen for a few minutes and then obscured again. The bearing of these points in combination (the first bearing having been moved forward for the run in interval) will then generally give a good fix.

The distances in these plottings have been taken from the diagonal scale below the figures; the opportunity having been taken to draw attention to this handy useful scale, which any one can easily make for himself.



Explanation of the Diagonal Scale and Protractor.

In the diagonal scale, the shorter lines dividing the length into equal portions (units) are crossed perpendicularly by 10 others extending the length of the scale. The end division, or unit, has its upper and lower edge subdivided into 10 equal parts, and diagonal lines are drawn from the beginning of one division to the end of the opposite one. This effects a further subdivision by 10, as an example will show. To take the No. 18·5 from this scale by the compasses: Set one foot at 1, and the other at the 8th line on the lower edge of the subdivided unit; this gives 18. Now follow up the diagonal line at the 8 to the 5th line of the long parallel lines, and fixing the point there, extend the other point to meet the line which rises at 1, crossing the breadth; and the number is taken.

The same process serves for tens and units as for units and tenths, and so on; thus the No. 1·85 or 185 is taken as above.

To lay off or measure an angle by the marked divisions. Place the middle point of the scale or ruler (which is strongly marked) on the meridian line, and, keeping it there, incline the ruler to the required angle, which is shown by the graduated scale of degrees coinciding with the upper part of the meridian line. Field's parallel ruler is marked in this way, and is very useful in laying off true bearings.

Caution.—The distance found by any of these methods from bearings with a run interval must only be considered as an *approximation*, as they depend on the course and distance run in interval having been made good. If, therefore, a current is known to exist, allowance must be made for it.

Cross-bearings of two (or, better still, three) prominent points will give a more certain position, provided the error of compass is known, and the angles are neither too large nor too small for a good "fix," and the points are accurately laid down on the chart; but every careful man will have at least two strings to his bow, and the position as found by run and interval will be a good check against possible errors. I think every one will admit their liability to such mistakes as reading off the wrong bearing, or applying the variation the wrong way, &c., and for this reason it is therefore always better to take *three* cross-bearings, when such are available.

Examples in the use of all these methods of finding the position of the ship by bearings, either with or without the chart, are given in the New Zealand examinations of either the home or foreign-going candidates for masters and mates.

The Compass and Pelorus.

Some owners do not seem to realize the value of having a proper compass, with a suitable position selected for it in the ship. Dozens of New Zealand ships would but for the Adjusters' reports be without any proper appliances for taking bearings, and many of the compasses are so closely surrounded by iron that no deviation card can be depended on. I would like here to point out the value in coastal navigation of having a Pelorus, which can be shifted to a stand made for it from one side of the bridge to the other, as is needed. The instrument is generally made of brass, being a *dumb* compass card *without needles*. It is a convenient plan to have the Pelorus set to the true geographical course, or else the magnetic course the ship is steering; then any bearings taken by it will be true, or magnetic, as the case may be, and free from the trouble of applying the error or variation of the compass. It may also be set to zero, N. or S., and the angle on the bow will then be readily read off for greater convenience in finding the distance off points, as in the problems which have been here mentioned.

Warning.—Do not use the Pelorus for long-distance bearings, such as Mount Egmont, 50 miles off.

Lecky's Danger-angle Table.

When mentioning up-to-date methods of finding the ship's position at sea, Lecky's splendid little book, "The Danger-angle and Off-shore Distance Tables," ought not to be passed over. The book is in two parts: The tables in Part I comprise heights from 50 ft. to 1,100 ft., and distances from a cable's length up to five miles; they can only be used in connection with objects lying *on* or *within* the bounding line of the observer's horizon; for objects *beyond* the horizon Part II has been calculated. The tables in Part II comprise heights from 200 ft. to 18,000 ft., and distances from five miles up to 100 miles. They are intended to be used with objects lying *beyond* the horizon, and the observed altitude must be corrected after the index has been applied by subtracting the true depression corresponding to the height of the eye, and also one-twelfth of the roughly estimated distance from the mountain. Under the result as a corrected altitude, and abreast the height of the summit in the left-hand margin of the tables, will be found a very close approximation to the true distance. This distance, combined with a bearing of the mountain, fixes the ship's position with a minimum of labour. For an example, suppose the peak of Mount Egmont to be observed from the ship's deck 25 ft. above the water, bearing east magnetic,

Altitude	2° 32′ 0″	
25 ft. dip (from table)	− 5 19	
Approximate distance	2 26 41	
One-twefth of approximate distance	− 2 30	
Corrected altitude	2 24 11	gives distance off 29½ m.
Height of Mount Egmont ..	8,270 ft.	

SUPPLEMENTARY EX-MERIDIAN TABLES.

EXPLANATION OF TABLES.

Ex-meridian Table No. 1.

The factor under the heading of Reduction abreast the A and B Correction is the reduction at 1 min. from the meridian to apply to an altitude to reduce it to the meridian altitude.

Instructions concerning the Use of Table and Rule for Application.

Multiply the factor corresponding to the A and B correction under the heading of Reduction by the number of minutes and decimals in the hour-angle from the meridian, which then gives the correction to apply to the observed altitude to reduce it to the meridian altitude. *Add* this correction to the observation taken near the upper meridian passage, and *subtract* the correction when observation is taken near the meridian below the Pole.

This reduction will not be more than ½′ in error when the hour-angle is less than that shown in the accompanying table immediately following, which shows the limits within which it is safe to use the table without appreciable error.

The table gives the correct reduction at 1 m. from the meridian for any azimuth up to 45° from the meridian, or the equivalent A ± B correction in latitude 0°, and has been rigorously calculated by seven figure logarithms from the following formulæ:—

Cot. Z.D. = sin. azim. · cot. H.A. 1 m.
Tan. decl. = sin. H.A. 1 m. · cot. azim.
Cot. az. = A ± B correction.

In latitude 0° decl. = M.Z.D. and Z.D. − M.Z.D. = reduction.

Table showing Limits of Reduction Tables No. 1 and No. 2.

These two tables show at a glance the hour-angles at which it is safe to use Reduction Tables No. 1 and No. 2, so that with the *correct time* the reduction will not be in error more than ½′. It must, however, be borne in mind that the resulting latitude is the latitude corresponding to the meridian of longitude used in the deduction of the time. The A and B correction through Table C readily gives the azimuth, which subtracted from 90° gives the true line of position for a Mercator Chart; or through Table C² it gives at once the position-line for use with a plane chart. This position-line must be laid down from the meridian of the D.R. longitude used in determining the time.

When the H.A. is on, or four or five minutes less than the limit given in the table, 0·4′ may be added to or subtracted from the reduction calculated by Ex-meridian Tables No. 1 and No. 2, according as the letter against the minutes is *g* or *l*. If the H.A. is more than 5 m. less than the limits in the table the reduction may be considered as correct, and in either case the resulting reduction would seldom be as much as ¼′ in error.

When the letter *n* is marked after the minutes in the table the resulting reduction will seldom be as much as ¼′ in error. When the altitude is over 75° both time and altitude should be used in the determination of the azimuth, and the A and B correction corresponding to this azimuth should be used in finding the reduction. See examples on pages 105, 128, 158, 160, &c.

Ex-meridian Table No. 2.

The instructions and rules relating to this table are exactly the same as for Table No. 1.

Formula used in the calculation :

$$\text{Reduction for 1 min.} = \frac{15'}{2\,[A \pm B]}.$$

NOTE.—This table is entirely independent of Table No. 1, which will generally give the best results and widest limit. Table No. 2 is given on account of the wide limits of reduction which it gives with high declinations and low latitudes ; and the same wide limits may be obtained when in high latitudes, and low declinations by transposing latitude for declination, and *vice versa*. A glance at the tables showing the limits of the two ex-meridian tables will at once show whether it is most advantageous to use No. 1 or No. 2 Ex-meridian Tables. (See example page 163.)

Table M.

SHOWING THE ERROR IN LATITUDE DUE TO AN ERROR OF 4 SECONDS IN TIME OR 1′ OF LONGITUDE.

This table (pages 156 and 157) shows at a glance the error which would result in the latitude from any single observation out of the meridian for every 4 sec. of error in the time.

When two observations are taken the factors given in this table facilitate the problem of finding the ship's position from two ex-meridian observations, or one chronometer observation, and an ex-meridian (see page 95).

Formula used in the calculation : Lat. error = Tan. azim. cos. lat.

Table showing the Hour-angle Limits within which the Error of the Reduction calculated by Ex-meridian Table No. 1 will not exceed 0·5.

LATITUDE AND DECLINATION OF *SAME* NAME.

Lat.	Declination.															
	0	2°	4°	6°	8°	10°	15°	20°	25°	30°	35°	40°	45°	50°	60°	70°
°	M.	M.	M.	M.	M.	M.	M.	M.	M.	M.	M.	M.	M.	M.	M.	M.
0	..	8*n*	16*n*	24*n*	32*n*	40*g*	42*g*	44*g*	46*g*	48*g*	51*g*	53*g*	55*g*	58*g*	63*g*	71*g*
1	4*n*	4*n*	12*n*	20*n*	28*n*	35*g*	39*g*	42*g*	45*g*	47*g*	50*g*	51*g*	55*g*	56*g*	62*g*	71*g*
2	8*n*	..	8*n*	16*n*	24*n*	32*g*	36*g*	40*g*	43*g*	46*g*	48*g*	50*g*	53*g*	56*g*	62*g*	70*g*
3	12*n*	4*n*	4*n*	12*n*	20*n*	28*g*	35*g*	38*g*	42*g*	46*g*	48*g*	49*g*	52*g*	56*g*	62*g*	69*g*
4	16*n*	8*n*	..	8*n*	16*n*	24*g*	34*g*	35*g*	41*g*	45*g*	47*g*	48*g*	50*g*	55*g*	62*g*	68*g*
5	20*n*	12*n*	4*n*	4*n*	12*n*	20*n*	31*g*	35*g*	40*g*	44*g*	46*g*	48*g*	50*g*	54*g*	62*g*	68*g*
6	24*l*	16*l*	8*n*	..	8*n*	16*n*	30*g*	35*g*	39*g*	43*g*	46*g*	48*g*	50*g*	53*g*	60*g*	67*g*
8	24*l*	20*l*	16*l*	8*n*	..	8*n*	29*g*	34*g*	37*g*	41*g*	44*g*	47*g*	48*g*	52*g*	60*g*	66*g*
10	25*l*	22*l*	17*l*	14*l*	8*l*	..	20*n*	34*g*	36*g*	39*g*	42*g*	44*g*	48*g*	52*g*	57*g*	66*g*
12	26*l*	22*l*	20*l*	17*l*	13*l*	8*l*	12*l*	35*g*	35*g*	37*g*	40*g*	44*g*	46*g*	50*g*	57*g*	66*g*
15	27*l*	25*l*	22*l*	20*l*	17*l*	14*l*	..	18*l*	40*g*	36*g*	39*g*	43*g*	44*g*	48*g*	55*g*	65*g*
20	28*l*	27*l*	24*l*	23*l*	20*l*	19*l*	11*l*	..	16*l*	51*g*	39*g*	42*g*	42*g*	46*g*	53*g*	63*g*
25	30*l*	28*l*	27*l*	26*l*	24*l*	22*l*	17*l*	10*l*	..	13*l*	29*l*	45*g*	43*g*	46*g*	51*g*	61*g*
30	32*l*	30*l*	29*l*	28*l*	26*l*	25*l*	21*l*	16*l*	9*l*	..	12*l*	27*l*	54*g*	46*g*	48*g*	59*g*
35	34*l*	32*l*	31*l*	30*l*	28*l*	27*l*	24*l*	20*l*	15*l*	9*l*	..	13*l*	26*l*	60*g*	47*g*	57*g*
40	35*l*	34*l*	33*l*	32*l*	31*l*	30*l*	27*l*	23*l*	20*l*	16*l*	10*l*	..	11*l*	26*l*	50*g*	56*g*
45	38*l*	36*l*	34*l*	34*l*	32*l*	32*l*	30*l*	27*l*	24*l*	21*l*	16*l*	10*l*	..	13*l*	65*g*	54*g*
50	39*l*	37*l*	35*l*	35*l*	34*l*	35*l*	33*l*	32*l*	28*l*	25*l*	21*l*	16*l*	11*l*	..	30*l*	54*g*
55	40*l*	40*l*	38*l*	37*l*	37*l*	37*l*	36*l*	34*l*	32*l*	29*l*	25*l*	21*l*	17*l*	12*l*	15*l*	59*g*
60	42*l*	41*l*	40*l*	39*l*	39*l*	40*l*	39*l*	39*l*	35*l*	32*l*	29*l*	26*l*	23*l*	19*l*	..	48*l*

INFERIOR TRANSIT.

Lat.	Declination.									
	25°	30°	35°	40°	45°	50°	55°	60°	65°	70°
°	M.	M.	M.	M.	M.	M.	M.	M.	M.	M.
25	..	..	..	..	..	..	..	..	..	88*g*
30	..	..	..	..	..	..	..	..	103*g*	95*g*
35	..	..	..	..	..	..	..	130*l*	112*g*	107*g*
40	..	..	..	..	..	..	80*l*	100*l*	180*l*	123*g*
45	..	..	..	..	..	68*l*	75*l*	86*l*	110*l*	170*g*
50	..	..	..	..	60*l*	65*l*	70*l*	80*l*	90*l*	120*l*
55	..	..	..	56*l*	60*l*	63*l*	68*l*	74*l*	86*l*	105*l*
60	..	..	54*l*	57*l*	59*l*	62*l*	67*l*	70*l*	78*l*	92*l*
65	..	48*l*	54*l*	55*l*	59*l*	61*l*	65*l*	69*l*	74*l*	84*l*
70	53*l*	53*l*	55*l*	57*l*	59*l*	60*l*	62*l*	63*l*	70*l*	79*l*
75	54*l*	54*l*	56*l*	58*l*	60*l*	61*l*	62*l*	66*l*	70*l*	78*l*
80	58*l*	59*l*	60*l*	62*l*	63*l*	64*l*	66*l*	68*l*	72*l*	75*l*
85	66*l*	68*l*	69*l*	70*l*	72*l*	72*l*	74*l*	74*l*	76*l*	78*l*

NOTE.

g signifies that true reduction is *greater* than tabular reduction.

l signifies that true reduction is *less* than tabular reduction.

n signifies that there is no error as great as 0.5′ within limits of hour-angle which give A ± B greater than 1·000′

LATITUDE AND DECLINATION OF *CONTRARY* NAMES.

Lat.	Declination.															
	0°	2°	4°	6°	8°	10°	15°	20°	25°	30°	35°	40°	45°	50°	60°	70°
°	M.	M.	M.	M.	M.	M.	M.	M.	M.	M.	M.	M.	M.	M.	M.	M.
1	4*n*	12*n*	20*n*	28*n*	36*n*	42*g*	45*g*	45*g*	48*g*	50*g*	52*g*	55*g*	57*g*	59*g*	62*g*	71*g*
2	8*n*	16*n*	24*n*	32*n*	40*n*	44*g*	48*g*	48*g*	50*g*	52*g*	54*g*	56*g*	58*g*	59*g*	63*g*	72*g*
3	12*n*	20*n*	28*n*	36*l*	44*l*	50*n*	52*g*	53*g*	54*g*	54*g*	55*g*	57*g*	58*g*	60*g*	63*g*	73*g*
4	16*n*	24*n*	32*l*	40*l*	48*l*	56*n*	56*g*	58*g*	56*g*	56*g*	58*g*	58*g*	58*g*	61*g*	64*g*	74*g*
5	20*n*	26*l*	32*l*	39*l*	44*l*	60*l*	80*n*	62*g*	59*g*	59*g*	59*g*	58*g*	60*g*	62*g*	67*g*	74*g*
6	24*l*	28*l*	32*l*	38*l*	41*l*	48*l*	85*n*	72*g*	62*g*	58*g*	58*g*	60*g*	64*g*	64*g*	68*g*	75*g*
8	24*l*	30*l*	31*l*	34*l*	40*l*	44*l*	60*l*	112*n*	76*g*	68*g*	66*g*	63*g*	64*g*	66*g*	69*g*	76*g*
10	25*l*	29*l*	32*l*	34*l*	39*l*	40*l*	52*l*	64*l*	115*l*	80*g*	72*g*	68*g*	68*g*	70*g*	70*g*	76*g*
12	26*l*	29*l*	32*l*	34*l*	36*l*	40*l*	46*l*	58*l*	74*l*	120*g*	88*g*	74*g*	74*g*	71*g*	72*g*	77*g*
15	27*l*	30*l*	33*l*	34*l*	36*l*	39*l*	48*l*	53*l*	60*l*	74*l*	140*n*	98*g*	80*g*	76*g*	74*g*	80*g*
20	28*l*	32*l*	32*l*	35*l*	36*l*	38*l*	44*l*	49*l*	54*l*	60*l*	72*l*	90*l*	130*n*	100*g*	90*g*	..
25	30*l*	34*l*	34*l*	35*l*	37*l*	39*l*	43*l*	46*l*	50*l*	56*l*	62*l*	70*l*	86*l*	150*l*	90*g*	..
30	32*l*	33*l*	35*l*	37*l*	37*l*	39*l*	43*l*	46*l*	49*l*	53*l*	61*l*	66*l*	72*l*	86*l*	..	..
35	34*l*	35*l*	36*l*	38*l*	39*l*	40*l*	42*l*	45*l*	48*l*	52*l*	56*l*	62*l*	69*l*	78*l*	..	..
40	35*l*	36*l*	38*l*	39*l*	40*l*	40*l*	42*l*	44*l*	48*l*	52*l*	56*l*	60*l*	65*l*	..	..	..
45	38*l*	38*l*	39*l*	39*l*	41*l*	42*l*	44*l*	46*l*	49*l*	52*l*	55*l*	56*l*	..	..	..	..
50	39*l*	40*l*	40*l*	41*l*	41*l*	43*l*	45*l*	47*l*	49*l*	52*l*	55*l*	..	..	..	..	..
55	40*l*	41*l*	42*l*	42*l*	43*l*	44*l*	46*l*	48*l*	49*l*	52*l*	..	..	..	..	..	..
60	42*l*	42*l*	44*l*	44*l*	45*l*	45*l*	46*l*	48*l*	50*l*	..	..	..	..	..	..	..

EX-MERIDIAN TABLE No. 1.

Showing the Reduction at 1 min. from the Meridian corresponding to the A and B Corrections given on Pages 12 to 37 of this Work.

A and B Cor.	Reduction.	A and B Cor.	Reduction.	A and B Cor.	Reduction.	A and B Cor.	Reduction.	A and B Cor.	Reduction.	A and B Cor.	Reduction.	A and B Cor.	Reduction.
′	′	′	′	′	′	′	′	′	′	′	′	′	′
1·000	6·213	1·070	5·918	1·140	5·647	1·210	5·396	1·280	5·165	1·350	4·951	1·420	4·752
1·001	6·209	1·071	5·914	1·141	5·643	1·211	5·393	1·281	5·162	1·351	4·948	1·421	4·749
1·002	6·205	1·072	5·910	1·142	5·639	1·212	5·390	1·282	5·158	1·352	4·945	1·422	4·746
1·003	6·200	1·073	5·906	1·143	5·636	1·213	5·386	1·283	5·155	1·353	4·942	1·423	4·744
1·004	6·196	1·074	5·902	1·144	5·632	1·214	5·382	1·284	5·152	1·354	4·939	1·424	4·741
1·005	6·191	1·075	5·898	1·145	5·628	1·215	5·379	1·285	5·149	1·355	4·936	1·425	4·738
1·006	6·187	1·076	5·894	1·146	5·624	1·216	5·376	1·286	5·146	1·356	4·933	1·426	4·735
1·007	6·183	1·077	5·890	1·147	5·621	1·217	5·372	1·287	5·143	1·357	4·930	1·427	4·733
1·008	6·178	1·078	5·886	1·148	5·617	1·218	5·369	1·288	5·140	1·358	4·927	1·428	4·730
1·009	6·174	1·079	5·882	1·149	5·613	1·219	5·365	1·289	5·136	1·359	4·924	1·429	4·727
1·010	6·170	1·080	5·878	1·150	5·610	1·220	5·362	1·290	5·133	1·360	4·921	1·430	4·724
1·011	6·165	1·081	5·874	1·151	5·606	1·221	5·358	1·291	5·130	1·361	4·918	1·431	4·722
1·012	6·161	1·082	5·870	1·152	5·602	1·222	5·355	1·282	5·127	1·362	4·915	1·432	4·719
1·013	6·157	1·083	5·866	1·153	5·599	1·223	5·352	1·293	5·124	1·363	4·912	1·433	4·716
1·014	6·152	1·084	5·862	1·154	5·595	1·224	5·348	1·294	5·121	1·364	4·910	1·434	4·714
1·015	6·148	1·085	5·858	1·155	5·591	1·225	5·345	1·295	5·118	1·365	4·907	1·435	4·711
1·016	6·144	1·086	5·854	1·156	5·588	1·226	5·342	1·296	5·115	1·366	4·904	1·436	4·708
1·017	6·139	1·087	5·850	1·157	5·584	1·227	5·338	1·297	5·111	1·367	4·901	1·437	4·705
1·018	6·135	1·088	5·846	1·158	5·580	1·228	5·335	1·298	5·108	1·368	4·898	1·438	4·703
1·019	6·131	1·089	5·842	1·159	5·577	1·229	5·331	1·299	5·105	1·369	4·895	1·439	4·700
1·020	6·127	1·090	5·838	1·160	5·573	1·230	5·328	1·300	5·102	1·370	4·892	1·440	4·698
1·021	6·122	1·091	5·834	1·161	5·569	1·231	5·325	1·301	5·099	1·371	4·889	1·441	4·695
1·022	6·118	1·092	5·830	1·162	5·566	1·232	5·321	1·302	5·096	1·372	4·886	1·442	4·692
1·023	6·114	1·093	5·826	1·163	5·562	1·233	5·318	1·303	5·093	1·373	4·883	1·443	4·690
1·024	6·110	1·094	5·823	1·164	5·559	1·234	5·315	1·304	5·089	1·374	4·881	1·444	4·687
1·025	6·105	1·095	5·819	1·165	5·555	1·235	5·311	1·305	5·086	1·375	4·878	1·445	4·684
1·026	6·101	1·096	5·815	1·166	5·551	1·236	5·308	1·306	5·083	1·376	4·875	1·446	4·682
1·027	6·097	1·097	5·811	1·167	5·548	1·237	5·305	1·307	5·080	1·377	4·872	1·447	4·679
1·028	6·093	1·098	5·807	1·168	5·544	1·238	5·301	1·308	5·077	1·378	4·869	1·448	4·676
1·029	6·089	1·099	5·803	1·169	5·541	1·239	5·298	1·309	5·074	1·379	4·866	1·449	4·674
1·030	6·084	1·100	5·799	1·170	5·537	1·240	5·295	1·310	5·071	1·380	4·864	1·450	4·671
1·031	6·080	1·101	5·795	1·171	5·533	1·241	5·291	1·311	5·068	1·381	4·861	1·451	4·668
1·032	6·076	1·102	5·791	1·172	5·530	1·242	5·288	1·312	5·065	1·382	4·858	1·452	4·666
1·033	6·072	1·103	5·787	1·173	5·526	1·243	5·285	1·313	5·062	1·383	4·855	1·453	4·663
1·034	6·067	1·104	5·784	1·174	5·522	1·244	5·282	1·314	5·059	1·384	4·852	1·454	4·660
1·035	6·063	1·105	5·780	1·175	5·519	1·245	5·278	1·315	5·056	1·385	4·849	1·455	4·658
1·036	6·059	1·106	5·776	1·176	5·515	1·246	5·275	1·316	5·053	1·386	4·847	1·456	4·655
1·037	6·055	1·107	5·772	1·177	5·512	1·247	5·272	1·317	5·049	1·387	4·844	1·457	4·652
1·038	6·050	1·108	5·768	1·178	5·508	1·248	5·268	1·318	5·046	1·388	4·841	1·458	4·650
1·039	6·046	1·109	5·764	1·179	5·505	1·249	5·265	1·319	5·043	1·389	4·838	1·459	4·647
1·040	6·042	1·110	5·760	1·180	5·501	1·250	5·262	1·320	5·040	1·390	4·835	1·460	4·644
1·041	6·038	1·111	5·757	1·181	5·497	1·251	5·259	1·321	5·037	1·391	4·833	1·461	4·642
1·042	6·033	1·112	5·753	1·182	5·494	1·252	5·255	1·322	5·034	1·392	4·830	1·462	4·639
1·043	6·029	1·113	5·749	1·183	5·490	1·253	5·252	1·323	5·031	1·393	4·827	1·463	4·637
1·044	6·025	1·114	5·745	1·184	5·487	1·254	5·249	1·324	5·028	1·394	4·824	1·464	4·634
1·045	6·021	1·115	5·741	1·185	5·483	1·255	5·246	1·325	5·025	1·395	4·821	1·465	4·631
1·046	6·017	1·116	5·737	1·186	5·480	1·256	5·242	1·326	5·022	1·396	4·819	1·466	4·629
1·047	6·012	1·117	6·734	1·187	5·476	1·257	5·239	1·327	5·019	1·397	4·816	1·467	4·626
1·048	6·008	1·118	5·730	1·188	5·473	1·258	5·236	1·328	5·016	1·398	4·813	1·468	4·624
1·049	6·004	1·119	5·726	1·189	5·469	1·259	5·233	1·329	5·013	1·399	4·810	1·469	4·621
1·050	6·000	1·120	5·722	1·190	5·466	1·260	5·229	1·330	5·010	1·400	4·807	1·470	4·618
1·051	5·996	1·121	5·718	1·191	5·462	1·261	5·226	1·331	5·007	1·401	4·805	1·471	4·616
1·052	5·992	1·122	5·714	1·192	5·459	1·262	5·223	1·332	5·004	1·402	4·802	1·472	4·613
1·053	5·988	1·123	5·711	1·193	5·455	1·263	5·220	1·333	5·001	1·403	4·799	1·473	4·611
1·054	5·983	1·124	5·707	1·194	5·452	1·264	5·216	1·334	4·998	1·404	4·796	1·474	4·608
1·055	5·979	1·125	5·703	1·195	5·448	1·265	5·213	1·335	4·995	1·405	4·793	1·475	4·605
1·056	5·975	1·126	5·699	1·196	5·445	1·266	5·210	1·336	4·992	1·406	4·790	1·476	4·603
1·057	5·971	1·127	5·696	1·197	5·441	1·267	5·207	1·337	4·989	1·407	4·788	1·477	4·600
1·058	5·967	1·128	5·692	1·198	5·438	1·268	5·203	1·338	4·986	1·408	4·785	1·478	4·598
1·059	5·963	1·129	5·688	1·199	5·434	1·269	5·200	1·339	4·983	1·409	4·782	1·479	4·595
1·060	5·959	1·130	5·684	1·200	5·431	1·270	5·197	1·340	4·980	1·410	4·779	1·480	4·593
1·061	5·955	1·131	5·681	1·201	5·427	1·271	5·194	1·341	4·977	1·411	4·776	1·481	4·590
1·062	5·951	1·132	5·677	1·202	5·424	1·272	5·190	1·342	4·974	1·412	4·774	1·482	4·588
1·063	5·947	1·133	5·673	1·203	5·421	1·273	5·187	1·343	4·971	1·413	4·771	1·483	4·585
1·064	5·943	1·134	5·669	1·204	5·417	1·274	5·184	1·344	4·968	1·414	4·768	1·484	4·582
1·065	5·938	1·135	5·666	1·205	5·414	1·275	5·181	1·345	4·965	1·415	4·765	1·485	4·580
1·066	5·934	1·136	5·662	1·206	5·410	1·276	5·178	1·346	4·962	1·416	4·763	1·486	4·577
1·067	5·930	1·137	5·658	1·207	5·407	1·277	5·174	1·347	4·959	1·417	4·760	1·487	4·575
1·068	5·926	1·138	5·654	1·208	5·403	1·278	5·171	1·348	4·957	1·418	4·757	1·488	4·572
1·069	5·922	1·139	5·651	1·209	5·400	1·279	5·168	1·349	4·954	1·419	4·755	1·489	4·570

EX-MERIDIAN TABLE No. 1.

Showing the Reduction at 1 min. from the Meridian corresponding to the A and B Corrections given on Pages 12 to 37 of this Work.

A and B Cor.	Reduction.	A and B Cor.	Reduction.	A and B Cor.	Reduction.	A and B Cor.	Reduction.	A and B Cor.	Reduction.	A and B Cor.	Reduction.	A and B Cor.	Reduction.
′	′	′	′	′	′	′	′	′	′	′	′	′	′
1·490	4·567	1·560	4·396	1·630	4·235	1·700	4·085	1·770	3·944	1·840	3·813	1·910	3·689
1·491	4·564	1·561	4·393	1·631	4·232	1·701	4·083	1·771	3·942	1·841	3·811	1·911	3·688
1·492	4·561	1·562	4·390	1·632	4·230	1·702	4·081	1·772	3·941	1·842	3·809	1·912	3·686
1·493	4·559	1·563	4·388	1·633	4·228	1·703	4·078	1·773	3·939	1·843	3·807	1·913	3·684
1·494	4·557	1·564	4·386	1·634	4·226	1·704	4·076	1·774	3·937	1·844	3·805	1·914	3·682
1·495	4·554	1·565	4·383	1·635	4·224	1·705	4·074	1·775	3·935	1·845	3·804	1·915	3·681
1·496	4·552	1·566	4·381	1·636	4·221	1·706	4·072	1·776	3·933	1·846	3·802	1·916	3·679
1·497	4·549	1·567	4·379	1·637	4·219	1·707	4·070	1·777	3·931	1·847	3·800	1·917	3·677
1·498	4·547	1·568	4·376	1·638	4·217	1·708	4·068	1·778	3·929	1·848	3·798	1·918	3·676
1·499	4·544	1·569	4·374	1·639	4·215	1·709	4·066	1·779	3·927	1·849	3·796	1·919	3·674
1·500	4·542	1·570	4·371	1·640	4·213	1·710	4·064	1·780	3·925	1·850	3·794	1·920	3·672
1·501	4·539	1·571	4·369	1·641	4·211	1·711	4·062	1·781	3·923	1·851	3·793	1·921	3·670
1·502	4·537	1·572	4·367	1·642	4·208	1·712	4·060	1·782	3·921	1·852	3·791	1·922	3·669
1·503	4·534	1·573	4·364	1·643	4·206	1·713	4·058	1·783	3·919	1·853	3·789	1·923	3·667
1·504	4·532	1·574	4·362	1·644	4·204	1·714	4·056	1·784	3·917	1·854	3·787	1·924	3·665
1·505	4·529	1·575	4·360	1·645	4·202	1·715	4·054	1·785	3·915	1·855	3·786	1·925	3·664
1·506	4·527	1·576	4·357	1·646	4·200	1·716	4·052	1·786	3·914	1·856	3·784	1·926	3·662
1·507	4·524	1·577	4·355	1·647	4·197	1·717	4·050	1·787	3·912	1·857	3·782	1·927	3·660
1·508	4·522	1·578	4·353	1·648	4·195	1·718	4·048	1·788	3·910	1·858	3·780	1·928	3·659
1·509	4·519	1·579	4·350	1·649	4·193	1·719	4·046	1·789	3·908	1·859	3·778	1·929	3·657
1·510	4·517	1·580	4·348	1·650	4·191	1·720	4·044	1·790	3·906	1·860	3·777	1·930	3·655
1·511	4·514	1·581	4·346	1·651	4·189	1·721	4·042	1·791	3·904	1·861	3·775	1·931	3·654
1·512	4·512	1·582	4·343	1·652	4·186	1·722	4·040	1·792	3·902	1·862	3·773	1·932	3·652
1·513	4·509	1·583	4·341	1·653	4·184	1·723	4·038	1·793	3·900	1·863	3·771	1·933	3·650
1·514	4·507	1·584	4·339	1·654	4·182	1·724	4·036	1·794	3·898	1·864	3·769	1·934	3·649
1·515	4·504	1·585	4·336	1·655	4·180	1·725	4·034	1·795	3·896	1·865	3·768	1·935	3·647
1·516	4·502	1·586	4·334	1·656	4·178	1·726	4·031	1·796	3·894	1·866	3·766	1·936	3·645
1·517	4·499	1·587	4·332	1·657	4·176	1·727	4·029	1·797	3·893	1·867	3·764	1·937	3·644
1·518	4·497	1·588	4·329	1·658	4·174	1·728	4·027	1·798	3·891	1·868	3·762	1·938	3·642
1·519	4·494	1·589	4·327	1·659	4·171	1·729	4·025	1·799	3·888	1·869	3·761	1·939	3·640
1·520	4·492	1·590	4·325	1·660	4·169	1·730	4·023	1·800	3·887	1·870	3·759	1·940	3·639
1·521	4·489	1·591	4·323	1·661	4·167	1·731	4·021	1·801	3·885	1·871	3·757	1·941	3·637
1·522	4·487	1·592	4·320	1·662	4·165	1·732	4·019	1·802	3·883	1·872	3·755	1·942	3·635
1·523	4·484	1·593	4·318	1·663	4·163	1·733	4·017	1·803	3·881	1·873	3·753	1·943	3·634
1·524	4·482	1·594	4·316	1·664	4·161	1·734	4·015	1·804	3·879	1·874	3·752	1·944	3·632
1·525	4·479	1·595	4·313	1·665	4·158	1·735	4·013	1·805	3·878	1·875	3·750	1·945	3·630
1·526	4·477	1·596	4·311	1·666	4·156	1·736	4·011	1·806	3·876	1·876	3·748	1·946	3·629
1·527	4·475	1·597	4·309	1·667	4·154	1·737	4·009	1·807	3·874	1·877	3·746	1·947	3·627
1·528	4·472	1·598	4·307	1·668	4·152	1·738	4·007	1·808	3·872	1·878	3·745	1·948	3·625
1·529	4·470	1·599	4·304	1·669	4·150	1·739	4·005	1·809	3·870	1·879	3·743	1·949	3·624
1·530	4·467	1·600	4·302	1·670	4·148	1·740	4·003	1·810	3·868	1·880	3·741	1·950	3·622
1·531	4·465	1·601	4·300	1·671	4·146	1·741	4·001	1·811	3·866	1·881	3·739	1·951	3·620
1·532	4·462	1·602	4·297	1·672	4·143	1·742	3·999	1·812	3·864	1·882	3·738	1·952	3·619
1·533	4·460	1·603	4·295	1·673	4·141	1·743	3·997	1·813	3·863	1·883	3·736	1·953	3·617
1·534	4·457	1·604	4·293	1·674	4·139	1·744	3·995	1·814	3·861	1·884	3·734	1·954	3·615
1·535	4·455	1·605	4·291	1·675	4·137	1·745	3·993	1·815	3·859	1·885	3·732	1·955	3·614
1·536	4·453	1·606	4·288	1·676	4·135	1·746	3·991	1·816	3·857	1·886	3·731	1·956	3·612
1·537	4·450	1·607	4·286	1·677	4·133	1·747	3·989	1·817	3·855	1·887	3·729	1·957	3·610
1·538	4·448	1·608	4·284	1·678	4·131	1·748	3·988	1·818	3·853	1·888	3·727	1·958	3·609
1·539	4·445	1·609	4·282	1·679	4·129	1·749	3·986	1·819	3·851	1·889	3·725	1·959	3·607
1·540	4·443	1·610	4·279	1·680	4·127	1·750	3·984	1·820	3·849	1·890	3·724	1·960	3·606
1·541	4·441	1·611	4·277	1·681	4·124	1·751	3·982	1·821	3·848	1·891	3·722	1·961	3·604
1·542	4·438	1·612	4·275	1·682	4·122	1·752	3·980	1·822	3·846	1·892	3·720	1·962	3·602
1·543	4·436	1·613	4·273	1·683	4·120	1·753	3·978	1·823	3·844	1·893	3·718	1·963	3·601
1·544	4·433	1·614	4·270	1·684	4·118	1·754	3·976	1·824	3·842	1·894	3·717	1·964	3·599
1·545	4·431	1·615	4·268	1·685	4·116	1·755	3·974	1·825	3·840	1·895	3·715	1·965	3·597
1·546	4·429	1·616	4·266	1·686	4·114	1·756	3·972	1·826	3·838	1·896	3·713	1·966	3·596
1·547	4·426	1·617	4·264	1·687	4·112	1·757	3·970	1·827	3·836	1·897	3·712	1·967	3·594
1·548	4·424	1·618	4·261	1·688	4·110	1·759	3·968	1·828	3·835	1·898	3·710	1·968	3·593
1·549	4·421	1·619	4·259	1·689	4·108	1·759	3·966	1·829	3·833	1·899	3·708	1·969	3·591
1·550	4·419	1·620	4·257	1·690	4·105	1·760	3·964	1·830	3·831	1·900	3·706	1·970	3·589
1·551	4·417	1·621	4·255	1·691	4·103	1·761	3·962	1·831	3·829	1·901	3·705	1·971	3·588
1·552	4·414	1·622	4·252	1·692	4·101	1·762	3·960	1·832	3·827	1·902	3·703	1·972	3·586
1·553	4·412	1·623	4·250	1·693	4·099	1·763	3·958	1·833	3·825	1·903	3·701	1·973	3·584
1·554	4·409	1·624	4·248	1·694	4·097	1·764	3·956	1·834	3·824	1·904	3·699	1·974	3·583
1·555	4·407	1·625	4·246	1·695	4·095	1·765	3·954	1·835	3·822	1·905	3·698	1·975	3·581
1·556	4·405	1·626	4·244	1·696	4·093	1·766	3·952	1·836	3·820	1·906	3·696	1·976	3·580
1·557	4·402	1·627	4·241	1·697	4·091	1·767	3·950	1·837	3·818	1·907	3·694	1·977	3·578
1·558	4·400	1·628	4·239	1·698	4·089	1·768	3·948	1·838	3·816	1·908	3·693	1·978	3·576
1·559	4·398	1·629	4·237	1·699	4·087	1·769	3·946	1·839	3·814	1·909	3·691	1·979	3·575

EX-MERIDIAN TABLE No. I.

Showing the Reduction at 1 min. from the Meridian corresponding to the A and B Corrections given on Pages 12 to 37 of this Work.

A and B Cor.	Reduction.	A and B Cor.	Reduction.	A and B Cor.	Reduction.	A and B Cor.	Reduction.	A and B Cor.	Reduction.	A and B Cor.	Reduction	A and B Cor.	Reduction.
′	′	′	′	′	′	′	′	′	′	′	′	′	′
1·980	3·573	2·050	3·463	2·120	3·360	2·190	3·263	2·260	3·170	2·330	3·084	2·400	3·001
1·981	3·571	2·051	3·462	2·121	3·359	2·191	3·261	2·261	3·169	2·331	3·082	2·401	3·000
1·982	3·570	2·052	3·460	2·122	3·357	2·192	3·260	2·262	3·168	2·332	3·081	2·402	2·999
1·983	3·568	2·053	3·459	2·123	3·356	2·193	3·259	2·263	3·167	2·333	3·080	2·403	2·997
1·984	3·567	2·054	3·457	2·124	3·355	2·194	3·257	2·264	3·165	2·334	3·079	2·404	2·996
1·985	3·565	2·055	3·456	2·125	3·353	2·195	3·256	2·265	3·164	2·335	3·077	2·405	2·995
1·986	3·563	2·056	3·454	2·126	3·352	2·196	3·255	2·266	3·163	2·336	3·076	2·406	2·994
1·987	3·562	2·057	3·453	2·127	3·350	2·197	3·253	2·267	3·162	2·337	3·075	2·407	2·993
1·988	3·560	2·058	3·451	2·128	3·349	2·198	3·252	2·268	3·160	2·338	3·074	2·408	2·992
1·989	3·559	2·059	3·450	2·129	3·347	2·199	3·250	2·269	3·159	2·339	3·073	2·409	2·990
1·990	3·557	2·060	3·448	2·130	3·346	2·200	3·249	2·270	3·158	2·340	3·071	2·410	2·989
1·991	3·555	2·061	3·447	2·131	3·345	2·201	3·248	2·271	3·156	2·341	3·070	2·411	2·988
1·992	3·554	2·062	3·445	2·132	3·343	2·202	3·246	2·272	3·155	2·342	3·069	2·412	2·987
1·993	3·552	2·063	3·444	2·133	3·342	2·203	3·245	2·273	3·154	2·343	3·068	2·413	2·986
1·994	3·551	2·064	3·442	2·134	3·340	2·204	3·244	2·274	3·153	2·344	3·067	2·414	2·985
1·995	3·549	2·065	3·441	2·135	3·339	2·205	3·242	2·275	3·151	2·345	3·065	2·415	2·984
1·996	3·547	2·066	3·439	2·136	3·337	2·206	3·241	2·276	3·150	2·346	3·064	2·416	2·982
1·997	3·546	2·067	3·438	2·137	3·336	2·207	3·240	2·277	3·149	2·347	3·063	2·417	2·981
1·998	3·544	2·068	3·436	2·138	3·335	2·208	3·238	2·278	3·148	2·348	3·062	2·418	2·980
1·999	3·543	2·069	3·435	2·139	3·333	2·209	3·237	2·279	3·146	2·349	3·061	2·419	2·979
2·000	3·541	2·070	3·433	2·140	3·332	2·210	3·236	2·280	3·145	2·350	3·059	2·420	2·978
2·001	3·539	2·071	3·432	2·141	3·330	2·211	3·234	2·281	3·144	2·351	3·058	2·421	2·977
2·002	3·538	2·072	3·430	2·142	3·329	2·212	3·233	2·282	3·143	2·352	3·057	2·422	2·976
2·003	3·536	2·073	3·429	2·143	3·328	2·213	3·232	2·283	3·141	2·353	3·056	2·423	2·975
2·004	3·535	2·074	3·427	2·144	3·326	2·214	3·230	2·284	3·140	2·354	3·055	2·424	2·973
2·005	3·533	2·075	3·426	2·145	3·325	2·215	3·229	2·285	3·139	2·355	3·053	2·425	2·972
2·006	3·532	2·076	3·424	2·146	3·323	2·216	3·228	2·286	3·138	2·356	3·052	2·426	2·971
2·007	3·530	2·077	3·423	2·147	3·322	2·217	3·226	2·287	3·136	2·357	3·051	2·427	2·970
2·008	3·528	2·078	3·421	2·148	3·321	2·218	3·225	2·288	3·135	2·358	3·050	2·428	2·969
2·009	3·527	2·079	3·420	2·149	3·319	2·219	3·224	2·289	3·134	2·359	3·049	2·429	2·968
2·010	3·525	2·080	3·418	2·150	3·318	2·220	3·222	2·290	3·133	2·360	3·048	2·430	2·967
2·011	3·524	2·081	3·417	2·151	3·316	2·221	3·221	2·291	3·131	2·361	3·046	2·431	2·965
2·012	3·522	2·082	3·416	2·152	3·315	2·222	3·220	2·292	3·130	2·362	3·045	2·432	2·964
2·013	3·521	2·083	3·414	2·153	3·314	2·223	3·218	2·293	3·129	2·363	3·044	2·433	2·963
2·014	3·519	2·084	3·413	2·154	3·312	2·224	3·217	2·294	3·128	2·364	3·043	2·434	2·962
2·015	3·517	2·085	3·411	2·155	3·311	2·225	3·216	2·295	3·126	2·365	3·042	2·435	2·961
2·016	3·516	2·086	3·410	2·156	3·309	2·226	3·215	2·296	3·125	2·366	3·040	2·436	2·960
2·017	3·514	2·087	3·408	2·157	3·308	2·227	3·213	2·297	3·124	2·367	3·039	2·437	2·959
2·018	3·513	2·088	3·407	2·158	3·307	2·228	3·212	2·298	3·123	2·368	3·038	2·438	2·958
2·019	3·511	2·089	3·405	2·159	3·305	2·229	3·211	2·299	3·121	2·369	3·037	2·439	2·957
2·020	3·510	2·090	3·404	2·160	3·304	2·230	3·209	2·300	3·120	2·370	3·036	2·440	2·955
2·021	3·508	2·091	3·402	2·161	3·302	2·231	3·208	2·301	3·119	2·371	3·035	2·441	2·954
2·022	3·506	2·092	3·401	2·162	3·301	2·232	3·207	2·302	3·118	2·372	3·033	2·442	2·953
2·023	3·505	2·093	3·399	2·163	3·300	2·233	3·205	2·303	3·116	2·373	3·032	2·443	2·952
2·024	3·503	2·094	3·398	2·164	3·298	2·234	3·204	2·304	3·115	2·374	3·031	2·444	2·951
2·025	3·502	2·095	3·396	2·165	3·297	2·235	3·203	2·305	3·114	2·375	3·030	2·445	2·950
2·026	3·500	2·096	3·395	2·166	3·296	2·236	3·201	2·306	3·113	2·376	3·029	2·446	2·949
2·027	3·499	2·097	3·394	2·167	3·294	2·237	3·200	2·307	3·112	2·377	3·028	2·447	2·948
2·028	3·497	2·098	3·392	2·168	3·293	2·238	3·199	2·308	3·110	2·378	3·026	2·448	2·947
2·029	3·496	2·099	3·391	2·169	3·291	2·239	3·197	2·309	3·109	2·379	3·025	2·449	2·945
2·030	3·494	2·100	3·389	2·170	3·290	2·240	3·196	2·310	3·108	2·380	3·024	2·450	2·944
2·031	3·493	2·101	3·388	2·171	3·289	2·241	3·195	2·311	3·107	2·381	3·023	2·451	2·943
2·032	3·491	2·102	3·386	2·172	3·287	2·242	3·194	2·312	3·105	2·382	3·022	2·452	2·942
2·033	3·490	2·103	3·385	2·173	3·286	2·243	3·192	2·313	3·104	2·383	3·021	2·453	2·941
2·034	3·488	2·104	3·383	2·174	3·284	2·244	3·191	2·314	3·103	2·384	3·019	2·454	2·940
2·035	3·486	2·105	3·382	2·175	3·283	2·245	3·190	2·315	3·102	2·385	3·018	2·455	2·939
2·036	3·485	2·106	3·380	2·176	3·282	2·246	3·188	2·316	3·101	2·386	3·017	2·456	2·938
2·037	3·483	2·107	3·379	2·177	3·280	2·247	3·187	2·317	3·099	2·387	3·016	2·457	2·937
2·038	3·482	2·108	3·378	2·178	3·279	2·248	3·186	2·318	3·098	2·388	3·015	2·458	2·935
2·039	3·480	2·109	3·376	2·179	3·278	2·249	3·184	2·319	3·097	2·389	3·014	2·459	2·934
2·040	3·479	2·110	3·375	2·180	3·276	2·250	3·183	2·320	3·096	2·390	3·012	2·460	2·933
2·041	3·477	2·111	3·373	2·181	3·275	2·251	3·182	2·321	3·094	2·391	3·011	2·461	2·932
2·042	3·476	2·112	3·372	2·182	3·274	2·252	3·181	2·322	3·093	2·392	3·010	2·462	2·931
2·043	3·474	2·113	3·370	2·183	3·272	2·253	3·179	2·323	3·092	2·393	3·009	2·463	2·930
2·044	3·473	2·114	3·369	2·184	3·271	2·254	3·178	2·324	3·091	2·394	3·008	2·464	2·929
2·045	3·471	2·115	3·367	2·185	3·269	2·255	3·177	2·325	3·090	2·395	3·007	2·465	2·928
2·046	3·470	2·116	3·366	2·186	3·268	2·256	3·176	2·326	3·088	2·396	3·005	2·466	2·927
2·047	3·468	2·117	3·365	2·187	3·267	2·257	3·174	2·327	3·087	2·397	3·004	2·467	2·925
2·048	3·457	2·118	3·363	2·188	3·265	2·258	3·173	2·328	3·086	2·398	3·003	2·468	2·924
2·049	3·465	2·119	3·362	2·189	3·264	2·259	3·172	2·329	3·085	2·399	3·002	2·469	2·923

EX-MERIDIAN TABLE No. I.

Showing the Reduction at 1 min. from the Meridian corresponding to the A and B Corrections given on Pages 12 to 37 of this Work.

A and B Cor.	Reduction.	A and B Cor.	Reduction.	A and B Cor.	Reduction.	A and B Cor.	Reduction.	A and B Cor.	Reduction.	A and B Cor.	Reduction.	A and B Cor.	Reduction.
′	′	′	′	′	′	′	′	′	′	′	′	′	′
2·470	2·922	2·540	2·847	2·660	2·727	2·800	2·598	2·940	2·482	3·080	2·374	3·220	2·276
2·471	2·921	2·541	2·846	2·662	2·725	2·802	2·597	2·942	2·480	3·082	2·373	3·222	2·274
2·472	2·920	2·542	2·845	2·664	2·723	2·804	2·595	2·944	2·478	3·084	2·371	3·224	2·273
2·473	2·919	2·543	2·844	2·666	2·721	2·806	2·593	2·946	2·477	3·086	2·370	3·226	2·272
2·474	2·918	2·544	2·843	2·668	2·719	2·808	2·592	2·948	2·475	3·088	2·368	3·228	2·270
2·475	2·917	2·545	2·842	2·670	2·717	2·810	2·590	2·950	2·474	3·090	2·367	3·230	2·269
2·476	2·916	2·546	2·841	2·672	2·715	2·812	2·588	2·952	2·472	3·092	2·366	3·232	2·267
2·477	2·914	2·547	2·840	2·674	2·714	2·814	2·586	2·954	2·470	3·094	2·364	3·234	2·266
2·478	2·913	2·548	2·839	2·676	2·712	2·816	2·585	2·956	2·469	3·096	2·363	3·236	2·265
2·479	2·912	2·549	2·838	2·678	2·710	2·818	2·583	2·958	2·467	3·098	2·361	3·238	2·264
2·480	2·911	2·550	2·837	2·680	2·708	2·820	2·581	2·960	2·466	3·100	2·360	3·240	2·262
2·481	2·910	2·551	2·836	2·682	2·706	2·822	2·579	2·962	2·464	3·102	2·358	3·242	2·261
2·482	2·909	2·552	2·835	2·684	2·704	2·824	2·578	2·964	2·463	3·104	2·357	3·244	2·260
2·483	2·908	2·553	2·834	2·686	2·702	2·826	2·576	2·966	2·461	3·106	2·355	3·246	2·258
2·484	2·907	2·554	2·833	2·688	2·700	2·828	2·574	2·968	2·459	3·108	2·354	3·248	2·257
2·485	2·906	2·555	2·832	2·690	2·698	2·830	2·573	2·970	2·458	3·110	2·352	3·250	2·256
2·486	2·905	2·556	2·831	2·692	2·696	2·832	2·571	2·972	2·456	3·112	2·351	3·252	2·254
2·487	2·904	2·557	2·830	2·694	2·694	2·834	2·569	2·974	2·455	3·114	2·350	3·254	2·253
2·488	2·903	2·558	2·829	2·696	2·693	2·836	2·567	2·976	2·453	3·116	2·348	3·256	2·252
2·489	2·901	2·559	2·828	2·698	2·691	2·838	2·566	2·978	2·452	3·118	2·347	3·258	2·250
2·490	2·900	2·560	2·826	2·700	2·689	2·840	2·564	2·980	2·450	3·120	2·345	3·260	2·249
2·491	2·899	2·562	2·824	2·702	2·687	2·842	2·562	2·982	2·448	3·122	2·344	3·262	2·248
2·492	2·898	2·564	2·822	2·704	2·685	2·844	2·561	2·984	2·447	3·124	2·342	3·264	2·246
2·493	2·897	2·566	2·820	2·706	2·683	2·846	2·559	2·986	2·445	3·126	2·341	3·266	2·245
2·494	2·896	2·568	2·818	2·708	2·681	2·848	2·557	2·988	2·444	3·128	2·339	3·268	2·244
2·495	2·895	2·570	2·816	2·710	2·680	2·850	2·556	2·990	2·442	3·130	2·338	3·270	2·242
2·496	2·894	2·572	2·814	2·712	2·678	2·852	2·554	2·992	2·441	3·132	2·337	3·272	2·241
2·497	2·893	2·574	2·812	2·714	2·676	2·854	2·552	2·994	2·439	3·134	2·335	3·274	2·240
2·498	2·892	2·576	2·810	2·716	2·674	2·856	2·551	2·996	2·438	3·136	2·334	3·276	2·238
2·499	2·891	2·578	2·808	2·718	2·672	2·858	2·549	2·998	2·436	3·138	2·332	3·278	2·237
2·500	2·890	2·580	2·806	2·720	2·670	2·860	2·547	3·000	2·435	3·140	2·331	3·280	2·236
2·501	2·889	2·582	2·804	2·722	2·668	2·862	2·546	3·002	2·433	3·142	2·330	3·282	2·234
2·502	2·888	2·584	2·802	2·724	2·667	2·864	2·544	3·004	2·431	3·144	2·328	3·284	2·233
2·503	2·886	2·586	2·800	2·726	2·665	2·866	2·542	3·006	2·430	3·146	2·327	3·286	2·232
2·504	2·885	2·588	2·797	2·728	2·663	2·868	2·540	3·008	2·428	3·148	2·325	3·288	2·231
2·505	2·884	2·590	2·796	2·730	2·661	2·870	2·539	3·010	2·427	3·150	2·324	3·290	2·229
2·506	2·883	2·592	2·794	2·732	2·659	2·872	2·537	3·012	2·425	3·152	2·322	3·292	2·228
2·507	2·882	2·594	2·792	2·734	2·657	2·874	2·535	3·014	2·424	3·154	2·321	3·294	2·227
2·508	2·881	2·596	2·790	2·736	2·656	2·876	2·534	3·016	2·422	3·156	2·320	3·296	2·225
2·509	2·880	2·598	2·788	2·738	2·654	2·878	2·532	3·018	2·421	3·158	2·318	3·298	2·224
2·510	2·879	2·600	2·786	2·740	2·652	2·880	2·530	3·020	2·419	3·160	2·317	3·300	2·223
2·511	2·878	2·602	2·784	2·742	2·650	2·882	2·529	3·022	2·418	3·162	2·315	3·302	2·221
2·512	2·877	2·604	2·782	2·744	2·648	2·884	2·527	3·024	2·416	3·164	2·314	3·304	2·220
2·513	2·876	2·606	2·780	2·746	2·646	2·886	2·525	3·026	2·415	3·166	2·313	3·306	2·219
2·514	2·875	2·608	2·778	2·748	2·645	2·888	2·524	3·028	2·413	3·168	2·311	3·308	2·218
2·515	2·874	2·610	2·776	2·750	2·643	2·890	2·522	3·030	2·412	3·170	2·310	3·310	2·216
2·516	2·873	2·612	2·774	2·752	2·641	2·892	2·521	3·032	2·410	3·172	2·308	3·312	2·215
2·517	2·871	2·614	2·772	2·754	2·639	2·894	2·519	3·034	2·409	3·174	2·307	3·314	2·214
2·518	2·870	2·616	2·770	2·756	2·637	2·896	2·517	3·036	2·407	3·176	2·306	3·316	2·212
2·519	2·869	2·618	2·768	2·758	2·636	2·898	2·516	3·038	2·406	3·178	2·304	3·318	2·211
2·520	2·868	2·620	2·766	2·760	2·634	2·900	2·514	3·040	2·404	3·180	2·303	3·320	2·210
2·521	2·867	2·622	2·764	2·762	2·632	2·902	2·512	3·042	2·403	3·182	2·302	3·322	2·209
2·522	2·866	2·624	2·762	2·764	2·630	2·904	2·511	3·044	2·401	3·184	2·300	3·324	2·207
2·523	2·865	2·626	2·760	2·766	2·628	2·906	2·509	3·046	2·400	3·186	2·299	3·326	2·206
2·524	2·864	2·628	2·758	2·768	2·627	2·908	2·507	3·048	2·398	3·188	2·297	3·328	2·205
2·525	2·863	2·630	2·756	2·770	2·625	2·910	2·506	3·050	2·397	3·190	2·296	3·330	2·204
2·526	2·862	2·632	2·754	2·772	2·623	2·912	2·504	3·052	2·395	3·192	2·295	3·332	2·202
2·527	2·861	2·634	2·752	2·774	2·621	2·914	2·503	3·054	2·394	3·194	2·293	3·334	2·201
2·528	2·860	2·636	2·750	2·776	2·620	2·916	2·501	3·056	2·392	3·196	2·292	3·336	2·200
2·529	2·859	2·638	2·748	2·778	2·618	2·918	2·499	3·058	2·391	3·198	2·291	3·338	2·199
2·530	2·858	2·640	2·746	2·780	2·616	2·920	2·498	3·060	2·389	3·200	2·289	3·340	2·197
2·531	2·857	2·642	2·744	2·782	2·614	2·922	2·496	3·062	2·388	3·202	2·288	3·342	2·196
2·532	2·856	2·644	2·742	2·784	2·613	2·924	2·494	3·064	2·386	3·204	2·286	3·344	2·195
2·533	2·855	2·646	2·740	2·786	2·611	2·926	2·493	3·066	2·385	3·206	2·285	3·346	2·193
2·534	2·854	2·648	2·738	2·788	2·609	2·928	2·491	3·068	2·383	3·208	2·284	3·348	2·192
2·535	2·853	2·650	2·737	2·790	2·607	2·930	2·490	3·070	2·382	3·210	2·282	3·350	2·191
2·536	2·852	2·652	2·735	2·792	2·605	2·932	2·488	3·072	2·380	3·212	2·281	3·352	2·190
2·537	2·850	2·654	2·733	2·794	2·604	2·934	2·486	3·074	2·379	3·214	2·280	3·354	2·188
2·538	2·849	2·656	2·731	2·796	2·602	2·936	2·485	3·076	2·377	3·216	2·278	3·356	2·187
2·539	2·848	2·658	2·729	2·798	2·600	2·938	2·483	3·078	2·376	3·218	2·277	3·358	2·186

EX-MERIDIAN TABLE No. 1.

Showing the Reduction at 1 min. from the Meridian corresponding to the A and B Corrections given on Pages 12 to 37 of this Work.

A and B Cor.	Reduction.	A and B Cor.	Reduction.	A and B Cor.	Reduction.	A and B Cor.	Reduction.	A and B Cor.	Reduction.	A and B Cor.	Reduction.	A and B Cor.	Reduction.
′	′	′	′	′	′	′	′	′	′	′	′	′	′
3·360	2·185	3·500	2·101	3·640	2·023	3·780	1·951	3·920	1·883	4·060	1·820	4·200	1·761
3·362	2·183	3·502	2·100	3·642	2·022	3·782	1·950	3·922	1·882	4·062	1·819	4·202	1·760
3·364	2·182	3·504	2·098	3·644	2·021	3·784	1·949	3·924	1·881	4·064	1·818	4·204	1·759
3·366	2·181	3·506	2·097	3·646	2·020	3·786	1·948	3·926	1·880	4·066	1·818	4·206	1·759
3·368	2·180	3·508	2·096	3·648	2·019	3·788	1·947	3·928	1·879	4·068	1·817	4·208	1·758
3·370	2·178	3·510	2·095	3·650	2·018	3·790	1·946	3·930	1·878	4·070	1·816	4·210	1·757
3·372	2·177	3·512	2·094	3·652	2·017	3·792	1·945	3·932	1·878	4·072	1·815	4·212	1·756
3·374	2·176	3·514	2·093	3·654	2·016	3·794	1·944	3·934	1·877	4·074	1·814	4·214	1·755
3·376	2·175	3·516	2·092	3·656	2·015	3·796	1·943	3·936	1·876	4·076	1·813	4·216	1·755
3·378	2·173	3·518	2·090	3·658	2·014	3·798	1·942	3·938	1·875	4·078	1·812	4·218	1·754
3·380	2·172	3·520	2·089	3·660	2·012	3·800	1·941	3·940	1·874	4·080	1·811	4·220	1·753
3·382	2·171	3·522	2·088	3·662	2·011	3·802	1·940	3·942	1·873	4·082	1·811	4·222	1·752
3·384	2·170	3·524	2·087	3·664	2·010	3·804	1·939	3·944	1·872	4·084	1·810	4·224	1·751
3·386	2·169	3·526	2·086	3·666	2·009	3·806	1·938	3·946	1·871	4·086	1·809	4·226	1·751
3·388	2·167	3·528	2·085	3·668	2·008	3·808	1·937	3·948	1·870	4·088	1·808	4·228	1·750
3·390	2·166	3·530	2·084	3·670	2·007	3·810	1·936	3·950	1·869	4·090	1·807	4·230	1·749
3·392	2·165	3·532	2·083	3·672	2·006	3·812	1·935	3·952	1·868	4·092	1·806	4·232	1·748
3·394	2·164	3·534	2·081	3·674	2·005	3·814	1·934	3·954	1·867	4·094	1·805	4·234	1·747
3·396	2·162	3·536	2·080	3·676	2·004	3·816	1·933	3·056	1·867	4·096	1·805	4·236	1·747
3·398	2·161	3·538	2·079	3·678	2·003	3·818	1·932	3·958	1·866	4·098	1·804	4·238	1·746
3·400	2·160	3·540	2·078	3·680	2·002	3·820	1·931	3·960	1·865	4·100	1·803	4·240	1·745
3·402	2·159	3·542	2·077	3·682	2·001	3·822	1·930	3·962	1·864	4·102	1·802	4·242	1·744
3·404	2·158	3·544	2·076	3·684	2·000	3·824	1·929	3·964	1·863	4·104	1·801	4·244	1·743
3·406	2·156	3·546	2·075	3·686	1·999	3·826	1·928	3·966	1·862	4·106	1·800	4·246	1·743
3·408	2·155	3·548	2·074	3·688	1·998	3·828	1·927	3·968	1·861	4·108	1·799	4·248	1·742
3·410	2·154	3·550	2·072	3·690	1·997	3·830	1·926	3·970	1·860	4·110	1·799	4·250	1·741
3·412	2·153	3·552	2·071	3·692	1·996	3·832	1·925	3·972	1·859	4·112	1·798	4·252	1·740
3·414	2·152	3·554	2·070	3·694	1·995	3·834	1·924	3·974	1·858	4·114	1·797	4·254	1·739
3·416	2·150	3·556	2·069	3·696	1·994	3·836	1·923	3·976	1·857	4·116	1·796	4·256	1·739
3·418	2·149	3·558	2·068	3·698	1·993	3·838	1·922	3·978	1·857	4·118	1·795	4·258	1·738
3·420	2·148	3·560	2·067	3·700	1·992	3·840	1·921	3·980	1·856	4·120	1·794	4·260	1·737
3·422	2·147	3·562	2·066	3·702	1·990	3·842	1·920	3·982	1·855	4·122	1·794	4·262	1·736
3·424	2·145	3·564	2·065	3·704	1·989	3·844	1·919	3·984	1·854	4·124	1·793	4·264	1·735
3·426	2·144	3·566	2·063	3·706	1·988	3·846	1·918	3·986	1·853	4·126	1·792	4·266	1·735
3·428	2·143	3·568	2·062	3·708	1·987	3·848	1·917	3·988	1·852	4·128	1·791	4·268	1·734
3·430	2·142	3·570	2·061	3·710	1·986	3·850	1·916	3·990	1·851	4·130	1·790	4·270	1·733
3·432	2·141	3·572	2·060	3·712	1·985	3·852	1·915	3·992	1·851	4·132	1·789	4·272	1·732
3·434	2·139	3·574	2·059	3·714	1·984	3·854	1·914	3·994	1·849	4·134	1·788	4·274	1·732
3·436	2·138	3·576	2·058	3·716	1·983	3·856	1·913	3·996	1·848	4·136	1·788	4·276	1·731
3·438	2·137	3·578	2·057	3·718	1·982	3·858	1·912	3·998	1·848	4·138	1·787	4·278	1·730
3·440	2·136	3·580	2·056	3·720	1·981	3·860	1·911	4·000	1·847	4·140	1·786	4·280	1·729
3·442	2·135	3·582	2·055	3·722	1·980	3·862	1·911	4·002	1·846	4·142	1·785	4·282	1·728
3·444	2·134	3·584	2·054	3·724	1·979	3·864	1·910	4·004	1·845	4·144	1·784	4·284	1·728
3·446	2·132	3·586	2·052	3·726	1·978	3·866	1·909	4·006	1·844	4·146	1·783	4·286	1·727
3·448	2·131	3·588	2·051	3·728	1·977	3·868	1·908	4·008	1·843	4·148	1·783	4·288	1·726
3·450	2·130	3·590	2·050	3·730	1·976	3·870	1·907	4·010	1·842	4·150	1·782	4·290	1·725
3·452	2·129	3·592	2·049	3·732	1·975	3·872	1·906	4·012	1·841	4·152	1·781	4·292	1·725
3·454	2·128	3·594	2·048	3·734	1·974	3·874	1·905	4·014	1·840	4·154	1·780	4·294	1·724
3·456	2·126	3·596	2·047	3·736	1·973	3·876	1·904	4·016	1·839	4·156	1·779	4·296	1·723
3·458	2·125	3·598	2·046	3·738	1·972	3·878	1·903	4·018	1·839	4·158	1·778	4·298	1·722
3·460	2·124	3·600	2·045	3·740	1·971	3·880	1·902	4·020	1·838	4·160	1·778	4·300	1·721
3·462	2·123	3·602	2·044	3·742	1·970	3·882	1·901	4·022	1·837	4·162	1·777	4·302	1·721
3·464	2·122	3·604	2·043	3·744	1·969	3·884	1·900	4·024	1·836	4·164	1·776	4·304	1·720
3·466	2·121	3·606	2·041	3·746	1·968	3·886	1·899	4·026	1·835	4·166	1·775	4·306	1·719
3·468	2·119	3·608	2·040	3·748	1·967	3·888	1·898	4·028	1·834	4·168	1·774	4·308	1·718
3·470	2·118	3·610	2·039	3·750	1·966	3·890	1·897	4·030	1·833	4·170	1·773	4·310	1·717
3·472	2·117	3·612	2·038	3·752	1·965	3·892	1·896	4·032	1·832	4·172	1·773	4·312	1·717
3·474	2·116	3·614	2·037	3·754	1·964	3·894	1·895	4·034	1·831	4·174	1·772	4·314	1·716
3·476	2·115	3·616	2·036	3·756	1·963	3·896	1·894	4·036	1·831	4·176	1·771	4·316	1·715
3·478	2·114	3·618	2·035	3·758	1·962	3·898	1·893	4·038	1·830	4·178	1·770	4·318	1·714
3·480	2·112	3·620	2·034	3·760	1·961	3·900	1·892	4·040	1·829	4·180	1·769	4·320	1·713
3·482	2·111	3·622	2·033	3·762	1·960	3·902	1·892	4·042	1·828	4·182	1·768	4·322	1·713
3·484	2·110	3·624	2·032	3·764	1·959	3·904	1·891	4·044	1·827	4·184	1·768	4·324	1·712
3·486	2·109	3·626	2·031	3·766	1·958	3·906	1·890	4·046	1·826	4·186	1·767	4·326	1·711
3·488	2·108	3·628	2·030	3·768	1·957	3·908	1·889	4·048	1·825	4·188	1·766	4·328	1·710
3·490	2·107	3·630	2·029	3·770	1·956	3·910	1·888	4·050	1·824	4·190	1·765	4·330	1·710
3·492	2·105	3·632	2·027	3·772	1·955	3·912	1·887	4·052	1·824	4·192	1·764	4·332	1·709
3·494	2·104	3·634	2·026	3·774	1·954	3·914	1·886	4·054	1·823	4·194	1·764	4·334	1·708
3·496	2·103	3·636	2·025	3·776	1·953	3·916	1·885	4·056	1·822	4·196	1·763	4·336	1·707
3·498	2·102	3·638	2·024	3·778	1·952	3·918	1·884	4·058	1·821	4·198	1·762	4·338	1·707

EX-MERIDIAN TABLE No. I.

Showing the Reduction at 1 min. from the Meridian corresponding to the A and B Corrections given on Pages 12 to 37 of this Work.

A and B Cor.	Reduction.	A and B Cor.	Reduction.	A and B Cor.	Reduction.	A and B Cor.	Reduction.	A and B Cor.	Reduction.	A and B Cor.	Reduction.	A and B Cor.	Reduction.
′	′	′	′	′	′	′	′	′	′	′	′	′	′
4·340	1·706	4·480	1·654	4·620	1·605	4·760	1·559	4·900	1·515	5·500	1·353	6·200	1·202
4·342	1·705	4·482	1·653	4·622	1·604	4·762	1·558	4·902	1·514	5·510	1·350	6·210	1·200
4·344	1·704	4·484	1·652	4·624	1·604	4·764	1·557	4·904	1·514	5·520	1·348	6·220	1·198
4·346	1·703	4·486	1·652	4·626	1·603	4·766	1·557	4·906	1·513	5·530	1·345	6·230	1·196
4·348	1·703	4·488	1·651	4·628	1·602	4·768	1·556	4·908	1·513	5·540	1·343	6·240	1·194
4·350	1·702	4·490	1·650	4·630	1·602	4·770	1·555	4·910	1·512	5·550	1·341	6·250	1·192
4·352	1·701	4·492	1·649	4·632	1·601	4·772	1·555	4·912	1·511	5·560	1·338	6·260	1·191
4·354	1·700	4·494	1·649	4·634	1·600	4·774	1·554	4·914	1·511	5·570	1·336	6·270	1·189
4·356	1·700	4·496	1·648	4·636	1·599	4·776	1·554	4·916	1·510	5·580	1·333	6·280	1·187
4·358	1·699	4·498	1·647	4·638	1·599	4·778	1·553	4·918	1·510	5·590	1·331	6·290	1·185
4·360	1·698	4·500	1·647	4·640	1·598	4·780	1·552	4·920	1·509	5·600	1·329	6·300	1·183
4·362	1·697	4·502	1·646	4·642	1·597	4·782	1·552	4·922	1·508	5·610	1·326	6·310	1·181
4·364	1·697	4·504	1·645	4·644	1·597	4·784	1·551	4·926	1·507	5·620	1·324	6·320	1·179
4·366	1·696	4·506	1·645	4·646	1·596	4·786	1·550	4·930	1·506	5·630	1·322	6·330	1·177
4·368	1·695	4·508	1·644	4·648	1·595	4·788	1·550	4·940	1·503	5·640	1·320	6·340	1·176
4·370	1·694	4·510	1·643	4·650	1·595	4·790	1·549	4·950	1·500	5·650	1·317	6·350	1·174
4·372	1·694	4·512	1·642	4·652	1·594	4·792	1·548	4·960	1·497	5·660	1·315	6·360	1·172
4·374	1·693	4·514	1·642	4·654	1·593	4·794	1·548	4·970	1·494	5·670	1·313	6·370	1·170
4·376	1·692	4·516	1·641	4·656	1·593	4·796	1·547	4·980	1·491	5·680	1·310	6·380	1·168
4·378	1·691	4·518	1·640	4·658	1·592	4·798	1·547	4·990	1·488	5·690	1·308	6·390	1·167
4·380	1·691	4·520	1·640	4·660	1·591	4·800	1·546	5·000	1·485	5·700	1·306	6·400	1·165
4·382	1·690	4·522	1·639	4·662	1·591	4·802	1·545	5·010	1·482	5·710	1·303	6·410	1·163
4·384	1·689	4·524	1·638	4·664	1·590	4·804	1·545	5·020	1·480	5·720	1·301	6·420	1·161
4·386	1·688	4·526	1·637	4·666	1·589	4·806	1·544	5·030	1·477	5·730	1·299	6·430	1·159
4·388	1·688	4·528	1·637	4·668	1·589	4·808	1·544	5·040	1·474	5·740	1·297	6·440	1·158
4·390	1·687	4·530	1·636	4·670	1·588	4·810	1·543	5·050	1·471	5·750	1·294	6·450	1·156
4·392	1·686	4·532	1·635	4·672	1·587	4·812	1·542	5·060	1·468	5·760	1·292	6·460	1·154
4·394	1·685	4·534	1·635	4·674	1·587	4·814	1·542	5·070	1·465	5·770	1·290	6·470	1·152
4·396	1·685	4·536	1·634	4·676	1·586	4·816	1·541	5·080	1·462	5·780	1·288	6·480	1·150
4·398	1·684	4·538	1·633	4·678	1·585	4·818	1·540	5·090	1·460	5·790	1·286	6·490	1·149
4·400	1·683	4·540	1·632	4·680	1·585	4·820	1·540	5·100	1·457	5·800	1·284	6·500	1·147
4·402	1·682	4·542	1·632	4·682	1·584	4·822	1·539	5·110	1·454	5·810	1·281	6·510	1·145
4·404	1·682	4·544	1·631	4·684	1·583	4·824	1·538	5·120	1·451	5·820	1·279	6·520	1·144
4·406	1·681	4·546	1·630	4·686	1·583	4·826	1·538	5·130	1·448	5·830	1·277	6·530	1·142
4·408	1·680	4·548	1·630	4·688	1·582	4·828	1·537	5·140	1·446	5·840	1·275	6·540	1·140
4·410	1·679	4·550	1·629	4·690	1·581	4·830	1·537	5·150	1·443	5·850	1·273	6·550	1·138
4·412	1·679	4·552	1·628	4·692	1·581	4·832	1·536	5·160	1·440	5·860	1·270	6·560	1·137
4·414	1·678	4·554	1·628	4·694	1·580	4·834	1·535	5·170	1·437	5·870	1·268	6·570	1·135
4·416	1·677	4·556	1·627	4·696	1·579	4·836	1·535	5·180	1·435	5·880	1·266	6·580	1·133
4·418	1·676	4·558	1·626	4·698	1·579	4·838	1·534	5·190	1·432	5·890	1·264	6·590	1·131
4·420	1·676	4·560	1·625	4·700	1·578	4·840	1·533	5·200	1·429	5·900	1·262	6·600	1·130
4·422	1·675	4·562	1·625	4·702	1·577	4·842	1·533	5·210	1·427	5·910	1·260	6·610	1·128
4·424	1·674	4·564	1·624	4·704	1·577	4·844	1·532	5·220	1·424	5·920	1·258	6·620	1·127
4·426	1·673	4·566	1·623	4·706	1·576	4·846	1·532	5·230	1·421	5·930	1·256	6·630	1·125
4·428	1·673	4·568	1·623	4·708	1·576	4·848	1·531	5·240	1·418	5·940	1·254	6·640	1·123
4·430	1·672	4·570	1·622	4·710	1·575	4·850	1·530	5·250	1·416	5·950	1·252	6·650	1·122
4·432	1·671	4·572	1·621	4·712	1·574	4·852	1·530	5·260	1·413	5·960	1·250	6·660	1·120
4·434	1·671	4·574	1·621	4·714	1·574	4·854	1·529	5·270	1·411	5·970	1·247	6·670	1·118
4·436	1·670	4·576	1·620	4·716	1·573	4·856	1·528	5·280	1·408	5·980	1·245	6·680	1·117
4·438	1·669	4·578	1·619	4·718	1·572	4·858	1·528	5·290	1·405	5·990	1·243	6·690	1·115
4·440	1·668	4·580	1·618	4·720	1·572	4·860	1·527	5·300	1·403	6·000	1·241	6·700	1·113
4·442	1·668	4·582	1·618	4·722	1·571	4·862	1·527	5·310	1·400	6·010	1·239	6·710	1·112
4·444	1·667	4·584	1·617	4·724	1·570	4·864	1·526	5·320	1·398	6·020	1·237	6·720	1·110
4·446	1·666	4·586	1·616	4·726	1·570	4·866	1·525	5·330	1·395	6·030	1·235	6·730	1·108
4·448	1·665	4·588	1·616	4·728	1·569	4·868	1·525	5·340	1·392	6·040	1·233	6·740	1·107
4·450	1·665	4·590	1·615	4·730	1·568	4·870	1·524	5·350	1·390	6·050	1·231	6·750	1·105
4·452	1·664	4·592	1·614	4·732	1·568	4·872	1·524	5·360	1·387	6·060	1·229	6·760	1·103
4·454	1·663	4·594	1·614	4·734	1·567	4·874	1·523	5·370	1·385	6·070	1·227	6·770	1·102
4·456	1·663	4·596	1·613	4·736	1·566	4·876	1·522	5·380	1·382	6·080	1·225	6·780	1·100
4·458	1·662	4·598	1·612	4·738	1·566	4·878	2·522	5·390	1·380	6·090	1·223	6·790	1·099
4·460	1·661	4·600	1·612	4·740	1·565	4·880	2·521	5·400	1·377	6·100	1·221	6·800	1·097
4·462	1·660	4·602	1·611	4·742	1·565	4·882	2·521	5·410	1·375	6·110	1·219	6·810	1·095
4·464	1·660	4·604	1·610	4·744	1·564	4·884	2·520	5·420	1·372	6·120	1·217	6·820	1·094
4·466	1·659	4·606	1·610	4·746	1·563	4·886	2·520	5·430	1·370	6·130	1·215	6·830	1·092
4·468	1·658	4·608	1·609	4·748	1·563	4·888	2·519	5·440	1·367	6·140	1·213	6·840	1·091
4·470	1·657	4·610	1·608	4·750	1·562	4·890	2·518	5·450	1·365	6·150	1·211	6·850	1·089
4·472	1·657	4·612	1·608	4·752	1·561	4·892	2·517	5·460	1·362	6·160	1·210	6·860	1·088
4·474	1·656	4·614	1·607	4·754	1·561	4·894	2·517	5·470	1·360	6·170	1·208	6·870	1·086
4·476	1·655	4·616	1·606	4·756	1·560	4·896	2·516	5·480	1·357	6·180	1·206	6·880	1·084
4·478	1·655	4·618	1·606	4·758	1·559	4·898	2·516	5·490	1·355	6·190	1·204	6·890	1·083

EX-MERIDIAN TABLE No. 1.

Showing the Reduction at 1 min. from the Meridian corresponding to the A and B Corrections given on Pages 12 to 37 of this Work.

A and B Cor.	Reduction.	A and B Cor.	Reduction.	A and B Cor.	Reduction.	A and B Cor.	Reduction.	A and B Cor.	Reduction.	A and B Cor.	Reduction.	A and B Cor.	Reduction.
′	′	′	′	′	′	′	′	′	′	′	′	′	′
6·90	1·081	7·60	·983	8·60	·869	10·00	·748	11·40	·657	12·80	·585	14·20	·527
6·91	1·080	7·61	·981	8·62	·867	10·02	·747	11·42	·655	12·82	·584	14·22	·527
6·92	1·078	7·62	·980	8·64	·865	10·04	·745	11·44	·654	12·84	·583	14·24	·526
6·93	1·077	7·63	·979	8·66	·863	10·06	·744	11·46	·653	12·86	·582	14·26	·525
6·94	1·075	7·64	·977	8·68	·861	10·08	·742	11·48	·652	12·88	·581	14·28	·525
6·95	1·074	7·65	·976	8·70	·859	10·10	·741	11·50	·651	12·90	·581	14·30	·524
6·96	1·072	7·66	·975	8·72	·857	10·12	·739	11·52	·650	12·92	·580	14·32	·523
6·97	1·071	7·67	·974	8·74	·855	10·14	·738	11·54	·649	12·94	·579	14·34	·522
6·98	1·069	7·68	·972	8·76	·853	10·16	·736	11·56	·648	12·96	·578	14·36	·522
6·99	1·068	7·69	·971	8·78	·852	10·18	·735	11·58	·646	12·98	·577	14·38	·521
7·00	1·066	7·70	·970	8·80	·850	10·20	·734	11·60	·645	13·00	·576	14·40	·520
7·01	1·065	7·71	·969	8·82	·848	10·22	·732	11·62	·644	13·02	·575	14·42	·519
7·02	1·063	7·72	·967	8·84	·846	10·24	·731	11·64	·643	13·04	·574	14·44	·519
7·03	1·062	7·73	·966	8·86	·844	10·26	·729	11·66	·642	13·06	·573	14·46	·518
7·04	1·060	7·74	·965	8·88	·842	10·28	·728	11·68	·641	13·08	·573	14·48	·517
7·05	1·059	7·75	·964	8·90	·840	10·30	·726	11·70	·640	13·10	·572	14·50	·517
7·06	1·057	7·76	·962	8·92	·838	10·32	·725	11·72	·639	13·12	·571	14·60	·513
7·07	1·056	7·77	·961	8·94	·836	10·34	·724	11·74	·638	13·14	·570	14·70	·510
7·08	1·054	7·78	·960	8·96	·835	10·36	·722	11·76	·637	13·16	·569	14·80	·506
7·09	1·053	7·79	·959	8·98	·833	10·38	·721	11·78	·636	13·18	·568	14·90	·503
7·10	1·051	7·80	·958	9·00	·831	10·40	·720	11·80	·634	13·20	·567	15·00	·499
7·11	1·050	7·81	·956	9·02	·829	10·42	718	11·82	·633	13·22	·566	15·10	·496
7·12	1·048	7·82	·955	9·04	·827	10·44	·717	11·84	·632	13·24	·566	15·20	·493
7·13	1·047	7·83	·954	9·06	·825	10·46	·715	11·86	·631	13·26	·565	15·30	·490
7·14	1·045	7·84	·953	9·08	·824	10·48	·714	11·88	·630	13·28	·564	15·40	·487
7·15	1·044	7·85	·952	9·10	·822	10·50	·713	11·90	·629	13·30	·563	15·50	·483
7·16	1·042	7·86	·950	9·12	·820	10·52	·711	11·92	·628	13·32	·562	15·60	·480
7·17	1·041	7·87	·949	9·14	·818	10·54	·710	11·94	·627	13·34	·561	15·70	·477
7·18	1·040	7·88	·948	9·16	·816	10·56	·709	11·96	·626	13·36	·561	15·80	·474
7·19	1·038	7·89	·947	9·18	·815	10·58	·707	11·98	·625	13·38	·560	15·90	·471
7·20	1·037	7·90	·946	9·20	·813	10·60	·706	12·00	·624	13·40	·559	16·00	·468
7·21	1·035	7·91	·944	9·22	·811	10·62	·705	12·02	·623	13·42	·558	16·10	·465
7·22	1·034	7·92	·943	9·24	·809	10·64	·703	12·04	622	13·44	·557	16·20	·463
7·23	1·032	7·93	·942	9·26	·808	10·66	·702	12·06	·621	13·46	·556	16·30	·460
7·24	1·031	7·94	·941	9·28	·806	10·68	·701	12·08	·620	13·48	·556	16·40	·457
7·25	1·030	7·95	·940	9·30	·804	10·70	·699	12·10	·619	13·50	·555	16·50	·454
7·26	1·028	7·96	·939	9·32	·802	10·72	·698	12·12	·618	13·52	·554	16·60	·451
7·27	1·027	7·97	·937	9·34	·801	10·74	·697	12·14	·617	13·54	·553	16·70	·449
7·28	1·025	7·98	·936	9·36	·799	10·76	·696	12·16	·616	13·56	·552	16·80	·446
7·29	1·024	7·99	·935	9·38	·797	10·78	·694	12·18	·615	13·58	·551	16·90	·443
7·30	1·023	8·00	·934	9·40	796	10·80	·693	12·20	·614	13·60	·551	17·00	·441
7·31	1·021	8·02	·932	9·42	·794	10·82	·692	12·22	·613	13·62	·550	17·10	·438
7·32	1·020	8·04	·929	9·44	·792	10·84	·690	12·24	·612	13·64	·549	17·20	·436
7·33	1·018	8·06	·927	9·46	·791	10·86	·689	12·26	·611	13·66	·548	17·30	·433
7·34	1·017	8·08	·925	9·48	·789	10·88	·688	12·28	·610	13·68	·548	17·40	·431
7·35	1·016	8·10	·922	9·50	·787	10·90	·687	12·30	·609	13·70	·547	17·50	·428
7·36	1·014	8·12	·920	9·52	·786	10·92	·685	12·32	·608	13·72	·546	17·60	·426
7·37	1·013	8·14	·918	9·54	·784	10·94	·684	12·34	·607	13·74	·545	17·70	·423
7·38	1·012	8·16	·916	9·56	·782	10·96	·683	12·36	606	13·76	·544	17·80	·421
7·39	1·010	8·18	·913	9·58	·781	10·98	·682	12·38	·605	13·78	·543	17·90	·419
7·40	1·009	8·20	·911	9·60	·779	11·00	·680	12·40	·604	13·80	·543	18·00	·416
7·41	1·008	8·22	·909	9·62	·778	11·02	·679	12·42	·603	13·82	·542	18·10	·414
7·42	1·006	8·24	·907	9·64	·776	11·04	·678	12·44	·602	13·84	·541	18·20	·412
7·43	1·005	8·26	·905	9·66	·774	11·06	·677	12·46	·601	13·86	·540	18·30	·410
7·44	1·004	8·28	·902	9·68	·773	11·08	·676	12·48	·600	13·88	·540	18·40	·407
7·45	1·002	8·30	·900	9·70	·771	11·10	·674	12·50	·599	13·90	·539	18·50	·405
7·46	1·001	8·32	·898	9·72	·770	11·12	·673	12·52	·598	13·92	·538	18·60	·403
7·47	·999	8·34	·896	9·74	·768	11·14	·672	12·54	·597	13·94	·537	18·70	·401
7·48	·998	8·36	·894	9·76	·766	11·16	·671	12·56	·596	13·96	·536	18·80	·399
7·49	·997	8·38	·892	9·78	·765	11·18	·670	12·58	·595	13·98	·536	18·90	·397
7·50	·996	8·40	·890	9·80	·763	11·20	·668	12·60	·594	14·00	·535	19·00	·394
7·51	·994	8·42	·888	9·82	·762	11·22	·667	12·62	·593	14·02	·534	19·10	·392
7·52	·993	8·44	·885	9·84	·760	11·24	·666	12·64	·592	14·04	·533	19·20	·390
7·53	·992	8·46	·883	9·86	·759	11·26	·665	12·66	·591	14·06	·533	19·30	·388
7·54	·990	8·48	·881	9·88	·757	11·28	·664	12·68	·591	14·08	·532	19·40	·386
7·55	·989	8·50	·879	9·90	·756	11·30	·662	12·70	·590	14·10	·531	19·50	·384
7·56	·988	8·52	·877	9·92	·754	11·32	·661	12·72	·589	14·12	·530	19·60	·382
7·57	·986	8·54	·875	9·94	·753	11·34	·660	12·74	·588	14·14	·530	19·70	·380
7·58	·985	8·56	·873	9·96	·751	11·36	·659	12·76	·587	14·16	·529	19·80	·379
7·59	·984	8·58	·871	9·98	·750	11·38	·658	12·78	·586	14·18	·528	20·00	·375

Table showing the Hour-angle Limits within which the Error of the Reduction calculated by Ex-meridian Table No. 2 will not exceed 0·5′.

LATITUDE AND DECLINATION OF *SAME* NAME.

Lat.	Declination.															
	54°	55°	56°	57°	58°	59°	60°	62°	64°	66°	68°	70°	73°	76°	80°	85°
°	M.	M.	M.	M.	M.	M.	M.	M.	M.	M.	M.	M.	M.	M.	M.	M.
0	72*l*	77*l*	86*l*	123*n*	128*n*	130*g*	110*g*	98*g*	91*g*	81*g*	80*g*	78*g*	78*g*	80*g*	85*g*	102*g*
2	71*l*	76*l*	83*l*	102*l*	126*n*	122*g*	118*g*	93*g*	86*g*	81*g*	78*g*	78*g*	80*g*	80*g*	85*g*	102*g*
4	68*l*	75*l*	83*l*	109*l*	122*n*	116*g*	104*g*	90*g*	84*g*	77*g*	77*g*	77*g*	80*g*	80*g*	85*g*	102*g*
6	66*l*	75*l*	83*l*	113*l*	120*n*	113*g*	103*g*	87*g*	83*g*	77*g*	76*g*	76*g*	79*g*	80*g*	85*g*	102*g*
8	63*l*	74*l*	83*l*	110*l*	118*n*	110*g*	99*g*	84*g*	80*g*	76*g*	76*g*	76*g*	76*g*	78*g*	84*g*	101*g*
10	61*l*	73*l*	81*l*	108*l*	114*n*	108*g*	96*g*	84*g*	79*g*	73*g*	73*g*	75*g*	75*g*	77*g*	84*g*	101*g*
12	60*l*	65*l*	76*l*	106*l*	110*n*	106*g*	92*g*	81*g*	78*g*	73*g*	73*g*	73*g*	75*g*	76*g*	84*g*	101*g*
14	59*l*	60*l*	74*l*	104*l*	108*n*	104*g*	92*g*	80*g*	77*g*	72*g*	72*g*	73*g*	75*g*	76*g*	84*g*	101*g*
16	57*l*	59*l*	74*l*	94*l*	106*n*	104*g*	92*g*	80*g*	76*g*	72*g*	72*g*	72*g*	74*g*	76*g*	84*g*	100*g*
18	56*l*	59*l*	72*l*	85*l*	102*n*	107*g*	92*g*	80*g*	75*g*	72*g*	72*g*	72*g*	74*g*	74*g*	83*g*	99*g*
20	54*l*	58*l*	62*l*	76*l*	100*l*	106*g*	92*g*	80*g*	75*g*	69*g*	71*g*	69*g*	74*g*	74*g*	83*g*	99*g*
22	52*l*	58*l*	60*l*	72*l*	88*l*	102*g*	97*g*	81*g*	74*g*	69*g*	68*g*	69*g*	70*g*	73*g*	82*g*	98*g*
24	49*l*	56*l*	58*l*	64*l*	73*l*	98*n*	100*g*	82*g*	74*g*	69*g*	68*g*	68*g*	70*g*	72*g*	80*g*	98*g*
26	45*l*	52*l*	54*l*	61*l*	65*l*	94*l*	102*g*	83*g*	72*g*	69*g*	67*g*	68*g*	70*g*	72*g*	80*g*	98*g*
28	43*l*	49*l*	52*l*	55*l*	61*l*	77*l*	98*n*	84*g*	71*g*	68*g*	67*g*	67*g*	68*g*	72*g*	79*g*	98*g*
30	39*l*	42*l*	46*l*	51*l*	54*l*	66*l*	94*l*	86*g*	73*g*	68*g*	67*g*	67*g*	67*g*	70*g*	78*g*	98*g*

INFERIOR TRANSIT.

NOTE.

g signifies that true reduction is *greater* than tabular reduction.

l signifies that true reduction is *less* than tabular reduction.

n signifies that there is no error as great as 0·5′ within limits of hour-angle which give A ± B greater than 3·000′.

Lat.	Declination.										
	68°	70°	72°	74°	76°	78°	80°	82°	84°	86°	88°
°	M.	M.	M.	M.	M.	M.	M.	M.	M.	M.	M.
4	..	..	..	..	..	..	..	..	..	..	128*g*
6	..	..	..	..	..	..	..	..	..	107*g*	128*g*
8	..	..	..	..	..	..	..	..	100*g*	108*g*	128*g*
10	..	..	..	..	..	..	..	94*g*	100*g*	108*g*	129*g*
12	..	..	..	..	..	..	90*g*	94*g*	100*g*	108*g*	130*g*
15	..	..	..	..	..	90*g*	92*g*	94*g*	100*g*	108*g*	130*g*
20	100*g*	99*g*	90*g*	90*g*	90*g*	90*g*	94*g*	96*g*	102*g*	110*g*	130*g*
25	118*g*	104*g*	100*g*	97*g*	92*g*	94*g*	96*g*	98*g*	103*g*	112*g*	130*g*
30	136*g*	123*g*	106*g*	100*g*	93*g*	96*g*	98*g*	100*g*	104*g*	109*g*	130*g*
35	154*l*	152*g*	119*g*	101*g*	101*g*	100*g*	100*g*	100*g*	106*g*	112*g*	130*g*
40	110*l*	180*n*	150*g*	124*g*	113*g*	108*g*	104*g*	104*g*	108*g*	114*g*	130*g*

LATITUDE AND DECLINATION OF *CONTRARY* NAMES.

Lat.	Declination.															
	54°	55°	56°	57°	58°	59°	60°	62°	64°	66°	68°	70°	73°	76°	80°	85°
°	M.	M.	M.	M.	M.	M.	M.	M.	M.	M.	M.	M.	M.	M.	M.	M.
0	72*l*	77*l*	86*l*	123*n*	128*n*	130*g*	110*g*	98*g*	91*g*	81*g*	80*g*	78*g*	78*g*	80*g*	85*g*	102*g*
2	70*l*	77*l*	83*l*	94*l*	122*l*	134*g*	120*g*	98*g*	91*g*	83*g*	80*g*	81*g*	81*g*	82*g*	88*g*	104*g*
4	70*l*	77*l*	82*l*	93*l*	114*l*	140*g*	130*g*	102*g*	92*g*	84*g*	81*g*	81*g*	81*g*	84*g*	88*g*	105*g*
6	70*l*	76*l*	82*l*	90*l*	106*l*	142*n*	136*g*	108*g*	96*g*	85*g*	84*g*	83*g*	81*g*	84*g*	90*g*	..
8	70*l*	76*l*	80*l*	88*l*	97*l*	142*l*	150*g*	113*g*	100*g*	86*g*	85*g*	84*g*	82*g*	84*g*	90*g*	..
10	70*l*	75*l*	80*l*	86*l*	92*l*	109*l*	154*n*	120*g*	103*g*	89*g*	85*g*	84*g*	82*g*	85*g*	..	..
12	70*l*	75*l*	78*l*	85*l*	90*l*	103*l*	131*l*	133*g*	110*g*	94*g*	85*g*	86*g*	85*g*	86*g*	..	..
14	69*l*	73*l*	76*l*	83*l*	87*l*	96*l*	110*l*	145*g*	114*g*	104*g*	90*g*	90*g*	88*g*	..	..	..
16	69*l*	73*l*	75*l*	81*l*	86*l*	92*l*	102*l*	162*g*	124*g*	106*g*	95*g*	93*g*	..	..	..	..
18	68*l*	73*l*	75*l*	79*l*	84*l*	90*l*	98*l*	178*n*	134*g*	109*g*	99*g*	94*g*	..	..	..	..
20	68*l*	72*l*	74*l*	78*l*	82*l*	88*l*	94*l*	116*l*	150*g*	120*g*	100*g*	..	..	..	..	..
22	68*l*	72*l*	73*l*	77*l*	80*l*	86*l*	90*l*	108*l*	140*n*	110*n*	..	..	..	..	..	..
24	68*l*	69*l*	72*l*	76*l*	78*l*	84*l*	86*l*	100*l*	110*n*	..	..	..	..	..	..	..
26	66*l*	68*l*	72*l*	75*l*	76*l*	82*l*	84*l*	92*l*	..	..	..	..	..	..	..	..
28	65*l*	68*l*	70*l*	73*l*	76*l*	80*l*	82*l*	..	..	..	..	..	..	..	..	..
30	65*l*	68*l*	70*l*	72*l*	76*l*	78*l*	..	..	..	..	..	..	..	..	..	..

EX-MERIDIAN TABLE No. 2.

Showing the Reduction at 1 min. from the Meridian corresponding to the A and B Corrections given on Pages 12 to 37 of this Work.

A and B Cor.	Reduction.	A and B Cor.	Reduction.	A and B Cor.	Reduction.	A and B Cor.	Reduction.	A and B Cor.	Reduction.	A and B Cor.	Reduction.	A and B Cor.	Reduction.
′	′	′	′	′	′	′	′	′	′	′	′	′	′
3·00	2·500	3·70	2·027	4·40	1·705	5·10	1·471	5·80	1·293	6·50	1·154	7·20	1·042
3·01	2·492	3·71	2·022	4·41	1·701	5·11	1·468	5·81	1·291	6·51	1·152	7·21	1·040
3·02	2·483	3·72	2·016	4·42	1·697	5·12	1·465	5·82	1·289	6·52	1·150	7·22	1·039
3·03	2·475	3·73	2·011	4·43	1·693	5·13	1·462	5·83	1·286	6·53	1·148	7·23	1·037
3·04	2·467	3·74	2·005	4·44	1·689	5·14	1·459	5·84	1·284	6·54	1·147	7·24	1·036
3·05	2·459	3·75	2·000	4·45	1·685	5·15	1·456	5·85	1·282	6·55	1·145	7·25	1·034
3·06	2·451	3·76	1·995	4·46	1·682	5·16	1·453	5·86	1·280	6·56	1·143	7·26	1·033
3·07	2·443	3·77	1·989	4·47	1·678	5·17	1·451	5·87	1·278	6·57	1·142	7·27	1·032
3·08	2·435	3·78	1·984	4·48	1·674	5·18	1·448	5·88	1·276	6·58	1·140	7·28	1·030
3·09	2·427	3·79	1·979	4·49	1·670	5·19	1·445	5·89	1·273	6·59	1·138	7·29	1·029
3·10	2·419	3·80	1·974	4·50	1·667	5·20	1·442	5·90	1·271	6·60	1·136	7·30	1·027
3·11	2·412	3·81	1·969	4·51	1·663	5·21	1·440	5·91	1·269	6·61	1·135	7·31	1·026
3·12	2·404	3·82	1·963	4·52	1·659	5·22	1·437	5·92	1·267	6·62	1·133	7·32	1·025
3·13	2·396	3·83	1·958	4·53	1·655	5·23	1·434	5·93	1·265	6·63	1·131	7·33	1·023
3·14	2·389	3·84	1·953	4·54	1·652	5·24	1·431	5·94	1·263	6·64	1·130	7·34	1·022
3·15	2·381	3·85	1·948	4·55	1·648	5·25	1·429	5·95	1·261	6·65	1·128	7·35	1·020
3·16	2·373	3·86	1·943	4·56	1·645	5·26	1·426	5·96	1·258	6·66	1·126	7·36	1·019
3·17	2·366	3·87	1·938	4·57	1·641	5·27	1·423	5·97	1·256	6·67	1·124	7·37	1·018
3·18	2·358	3·88	1·933	4·58	1·638	5·28	1·420	5·98	1·254	6·68	1·123	7·38	1·016
3·19	2·351	3·89	1·928	4·59	1·634	5·29	1·418	5·99	1·252	6·69	1·121	7·39	1·015
3·20	2·344	3·90	1·923	4·60	1·630	5·30	1·415	6·00	1·250	6·70	1·119	7·40	1·014
3·21	2·336	3·91	1·918	4·61	1·627	5·31	1·412	6·01	1·248	6·71	1·118	7·41	1·012
3·22	2·329	3·92	1·913	4·62	1·623	5·32	1·410	6·02	1·246	6·72	1·116	7·42	1·011
3·23	2·322	3·93	1·908	4·63	1·620	5·33	1·407	6·03	1·244	6·73	1·114	7·43	1·009
3·24	2·315	3·94	1·904	4·64	1·616	5·34	1·404	6·04	1·242	6·74	1·113	7·44	1·008
3·25	2·308	3·95	1·899	4·65	1·613	5·35	1·402	6·05	1·240	6·75	1·111	7·45	1·007
3·26	2·301	3·96	1·894	4·66	1·609	5·36	1·399	6·06	1·238	6·76	1·109	7·46	1·005
3·27	2·294	3·97	1·889	4·67	1·606	5·37	1·397	6·07	1·236	6·77	1·108	7·47	1·004
3·28	2·287	3·98	1·884	4·68	1·603	5·38	1·394	6·08	1·234	6·78	1·106	7·48	1·003
3·29	2·280	3·99	1·880	4·69	1·599	5·39	1·391	6·09	1·232	6·79	1·105	7·49	1·001
3·30	2·273	4·00	1·875	4·70	1·596	5·40	1·389	6·10	1·230	6·80	1·103	7·50	1·000
3·31	2·266	4·01	1·870	4·71	1·592	5·41	1·386	6·11	1·227	6·81	1·101	7·51	·999
3·32	2·259	4·02	1·866	4·72	1·589	5·42	1·384	6·12	1·225	6·82	1·100	7·52	·997
3·33	2·252	4·03	1·861	4·73	1·586	5·43	1·381	6·13	1·223	6·83	1·098	7·53	·996
3·34	2·246	4·04	1·856	4·74	1·582	5·44	1·379	6·14	1·221	6·84	1·096	7·54	·995
3·35	2·239	4·05	1·852	4·75	1·579	5·45	1·376	6·15	1·220	6·85	1·095	7·55	·993
3·36	2·232	4·06	1·847	4·76	1·576	5·46	1·374	6·16	1·218	6·86	1·093	7·56	·992
3·37	2·226	4·07	1·843	4·77	1·572	5·47	1·371	6·17	1·216	6·87	1·092	7·57	·991
3·38	2·219	4·08	1·838	4·78	1·569	5·48	1·369	6·18	1·214	6·88	1·090	7·58	·989
3·39	2·212	4·09	1·834	4·79	1·566	5·49	1·366	6·19	1·212	6·89	1·089	7·59	·988
3·40	2·206	4·10	1·829	4·80	1·563	5·50	1·364	6·20	1·210	6·90	1·087	7·60	·987
3·41	2·199	4·11	1·825	4·81	1·559	5·51	1·361	6·21	1·208	6·91	1·085	7·61	·986
3·42	2·193	4·12	1·820	4·82	1·556	5·52	1·359	6·22	1·206	6·92	1·084	7·62	·984
3·43	2·187	4·13	1·816	4·83	1·553	5·53	1·356	6·23	1·204	6·93	1·082	7·63	·983
3·44	2·180	4·14	1·812	4·84	1·550	5·54	1·354	6·24	1·202	6·94	1·081	7·64	·982
3·45	2·174	4·15	1·807	4·85	1·546	5·55	1·351	6·25	1·200	6·95	1·079	7·65	·980
3·46	2·168	4·16	1·803	4·86	1·543	5·56	1·349	6·26	1·198	6·96	1·078	7·66	·979
3·47	2·161	4·17	1·799	4·87	1·540	5·57	1·346	6·27	1·196	6·97	1·076	7·67	·978
3·48	2·155	4·18	1·794	4·88	1·537	5·58	1·344	6·28	1·194	6·98	1·074	7·68	·977
3·49	2·149	4·19	1·790	4·89	1·534	5·59	1·342	6·29	1·192	6·99	1·073	7·69	·975
3·50	2·143	4·20	1·786	4·90	1·531	5·60	1·339	6·30	1·190	7·00	1·071	7·70	·974
3·51	2·137	4·21	1·781	4·91	1·527	5·61	1·337	6·31	1·189	7·01	1·070	7·71	·973
3·52	2·131	4·22	1·777	4·92	1·524	5·62	1·335	6·32	1·187	7·02	1·068	7·72	·972
3·53	2·125	4·23	1·773	4·93	1·521	5·63	1·332	6·33	1·185	7·03	1·067	7·73	·970
3·54	2·119	4·24	1·769	4·94	1·518	5·64	1·330	6·34	1·183	7·04	1·065	7·74	·969
3·55	2·113	4·25	1·765	4·95	1·515	5·65	1·327	6·35	1·181	7·05	1·064	7·75	·968
3·56	2·107	4·26	1·761	4·96	1·512	5·66	1·325	6·36	1·179	7·06	1·062	7·76	·966
3·57	2·101	4·27	1·756	4·97	1·509	5·67	1·323	6·37	1·177	7·07	1·061	7·77	·965
3·58	2·095	4·28	1·752	4·98	1·506	5·68	1·320	6·38	1·176	7·08	1·059	7·78	·964
3·59	2·089	4·29	1·748	4·99	1·503	5·69	1·318	6·39	1·174	7·09	1·058	7·79	·963
3·60	2·083	4·30	1·744	5·00	1·500	5·70	1·316	6·40	1·172	7·10	1·056	7·80	·962
3·61	2·078	4·31	1·740	5·01	1·497	5·71	1·313	6·41	1·170	7·11	1·055	7·81	·960
3·62	2·072	4·32	1·736	5·02	1·494	5·72	1·311	6·42	1·168	7·12	1·053	7·82	·959
3·63	2·066	4·33	1·732	5·03	1·491	5·73	1·309	6·43	1·166	7·13	1·052	7·83	·958
3·64	2·060	4·34	1·728	5·04	1·488	5·74	1·307	6·44	1·165	7·14	1·050	7·84	·957
3·65	2·055	4·35	1·724	5·05	1·485	5·75	1·304	6·45	1·163	7·15	1·049	7·85	·955
3·66	2·049	4·36	1·720	5·06	1·482	5·76	1·302	6·46	1·161	7·16	1·047	7·86	·954
3·67	2·044	4·37	1·716	5·07	1·479	5·77	1·300	6·47	1·159	7·17	1·046	7·87	·953
3·68	2·038	4·38	1·712	5·08	1·476	5·78	1·298	6·48	1·157	7·18	1·045	7·88	·952
3·69	2·033	4·39	1·708	5·09	1·473	5·79	1·295	6·49	1·156	7·19	1·043	7·89	·951

EX-MERIDIAN TABLE No. 2.

Showing the Reduction at 1 min. from the Meridian corresponding to the A and B Corrections given on Pages 12 to 37 of this Work.

A and B Cor.	Reduction.	A and B Cor.	Reduction.	A and B Cor.	Reduction.	A and B Cor.	Reduction	A and B Cor.	Reduction,	A and B Cor.	Reduction.	A and B Cor.	Reduction.
′	′	′	′	′	′	′	′	′	′	′	′	′	′
7·90	·949	8·60	·872	9·30	·806	10·00	·750	10·70	·701	11·40	·658	12·20	·615
7·91	·948	8·61	·871	9·31	·806	10·01	·749	10·71	·700	11·41	·657	12·22	·614
7·92	·947	8·62	·870	9·32	·805	10·02	·749	10·72	·700	11·42	·657	12·24	·613
7·93	·946	8·63	·869	9·33	·804	10·03	·748	10·73	·699	11·43	·656	12·26	·612
7·94	·945	8·64	·868	9·34	·803	10·04	·747	10·74	·698	11·44	·656	12·28	·611
7·95	·943	8·65	·867	9·35	·802	10·05	·746	10·75	·698	11·45	·655	12·30	·610
7·96	·942	8·66	·866	9·36	·801	10·06	·746	10·76	·697	11·46	·654	12·32	·609
7·97	·941	8·67	·865	9·37	·800	10·07	·745	10·77	·696	11·47	·654	12·34	·608
7·98	·940	8·68	·864	9·38	·800	10·08	·744	10·78	·696	11·48	·653	12·36	·607
7·99	·939	8·69	·863	9·39	·799	10·09	7·43	10·79	·695	11·49	·653	12·38	·606
8·00	·938	8·70	·862	9·40	·798	10·10	·743	10·80	·694	11·50	·652	12·40	·605
8·01	·936	8·71	·861	9·41	·797	10·11	·742	10·81	·694	11·51	·652	12·42	·604
8·02	·935	8·72	·860	9·42	·796	10·12	·741	10·82	·693	11·52	·651	12·44	·603
8·03	·934	8·73	·859	9·43	·795	10·13	·740	10·83	·693	11·53	·650	12·46	·602
8·04	·933	8·74	·858	9·44	·794	10·14	·740	10·84	·692	11·54	·650	12·48	·601
8·05	·932	8·75	·857	9·45	·794	10·15	·739	10·85	·691	11·55	·649	12·50	·600
8·06	·931	8·76	·856	9·46	·793	10·16	·738	10·86	·691	11·56	·649	12·52	·599
8·07	·929	8·77	·855	9·47	·792	10·17	·737	10·87	·690	11·57	·648	12·54	·598
8·08	·928	8·78	·854	9·48	·791	10·18	·737	10·88	·689	11·58	·648	12·56	·597
8·09	·927	8·79	·853	9·49	·790	10·19	·736	10·89	·689	11·59	·647	12·58	·596
8·10	·926	8·80	·852	9·50	·789	10·20	·735	10·90	·688	11·60	·647	12·60	·595
8·11	·925	8·81	·851	9·51	·789	10·21	·735	10·91	·687	11·61	·646	12·62	·594
8·12	·924	8·82	·850	9·52	·788	10·22	·734	10·92	·687	11·62	·645	12·64	·593
8·13	·923	8·83	·849	9·53	·787	10·23	·733	10·93	·686	11·63	·645	12·66	·592
8·14	·921	8·84	·848	9·54	·786	10·24	·732	10·94	·686	11·64	·644	12·68	·591
8·15	·920	8·85	·847	9·55	·785	10·25	·732	10·95	·685	11·65	·644	12·70	·591
8·16	·919	8·86	·847	9·56	·785	10·26	·731	10·96	·684	11·66	·643	12·72	·590
8·17	·918	8·87	·846	9·57	·784	10·27	·730	10·97	·684	11·67	·643	12·74	·589
8·18	·917	8·88	·845	9·58	·783	10·28	·730	10·98	·683	11·68	·642	12·76	·588
8·19	·916	8·89	·844	9·59	·782	10·29	·729	10·99	·682	11·69	·642	12·78	·587
8·20	·915	8·90	·843	9·60	·781	10·30	·728	11·00	·682	11·70	·641	12·80	·586
8·21	·914	8·91	·842	9·61	·780	10·31	·727	11·01	·681	11·71	·640	12·82	·585
8·22	·912	8·92	·841	9·62	·780	10·32	·727	11·02	·681	11·72	·640	12·84	·584
8·23	·911	8·93	·840	9·63	·779	10·33	·726	11·03	·680	11·73	·639	12·86	·583
8·24	·910	8·94	·839	9·64	·778	10·34	·725	11·04	·679	11·74	·639	12·88	·582
8·25	·909	8·95	·838	9·65	·777	10·35	·725	11·05	·679	11·75	·638	12·90	·581
8·26	·908	8·96	·837	9·66	·776	10·36	·724	11·06	·678	11·76	·638	12·92	·580
8·27	·907	8·97	·836	9·67	·776	10·37	·723	11·07	·678	11·77	·637	12·94	·580
8·28	·906	8·98	·835	9·68	·775	10·38	·723	11·08	·677	11·78	·637	12·96	·579
8·29	·905	8·99	·834	9·69	·774	10·39	·722	11·09	·676	11·79	·636	12·98	·578
8·30	·904	9·00	·833	9·70	·773	10·40	·721	11·10	·676	11·80	·636	13·00	·577
8·31	·903	9·01	·832	9·71	·772	10·41	·720	11·11	·675	11·81	·635	13·02	·576
8·32	·901	9·02	·831	9·72	·772	10·42	·720	11·12	·674	11·82	·635	13·04	·575
8·33	·900	9·03	·831	9·73	·771	10·43	·719	11·13	·674	11·83	·634	13·06	·574
8·34	·899	9·04	·830	9·74	·770	10·44	·718	11·14	·673	11·84	·633	13·08	·573
8·35	·898	9·05	·829	9·75	·769	10·45	·718	11·15	·673	11·85	·633	13·10	·573
8·36	·897	9·06	·828	9·76	·768	10·46	·717	11·16	·672	11·86	·632	13·12	·572
8·37	·896	9·07	·827	9·77	·768	10·47	·716	11·17	·671	11·87	·632	13·14	·571
8·38	·895	9·08	·826	9·78	·767	10·48	·716	11·18	·671	11·88	·631	13·16	·570
8·39	·894	9·09	·825	9·79	·766	10·49	·715	11·19	·670	11·89	·631	13·18	·569
8·40	·893	9·10	·824	9·80	·765	10·50	·714	11·20	·670	11·90	·630	13·20	·568
8·41	·892	9·11	·823	9·81	·765	10·51	·714	11·21	·669	11·91	·630	13·22	·567
8·42	·891	9·12	·822	9·82	·764	10·52	·713	11·22	·668	11·92	·629	13·24	·566
8·43	·890	9·13	·821	9·83	·763	10·53	·712	11·23	·668	11·93	·629	13·26	·566
8·44	·889	9·14	·821	9·84	·762	10·54	·712	11·24	·667	11·94	·628	13·28	·565
8·45	·888	9·15	·820	9·85	·761	10·55	·711	11·25	·667	11·95	·628	13·30	·564
8·46	·887	9·16	·819	9·86	·761	10·56	·710	11·26	·666	11·96	·627	13·32	·563
8·47	·885	9·17	·818	9·87	·760	10·57	·710	11·27	·665	11·97	·627	13·34	·562
8·48	·884	9·18	·817	9·88	·759	10·58	·709	11·28	·665	11·98	·626	13·36	·561
8·49	·883	9·19	·816	9·89	·758	10·59	·708	11·29	·664	11·99	·626	13·38	·561
8·50	·882	9·20	·815	9·90	·758	10·60	·708	11·30	·664	12·00	·625	13·40	·560
8·51	·881	9·21	·814	9·91	·757	10·61	·707	11·31	·663	12·02	·624	13·42	·559
8·52	·880	9·22	·813	9·92	·756	10·62	·706	11·32	·663	12·04	·623	13·44	·558
8·53	·879	9·23	·813	9·93	·755	10·63	·706	11·33	·662	12·06	·622	13·46	·557
8·54	·878	9·24	·812	9·94	·755	10·64	·705	11·34	·661	12·08	·621	13·48	·556
8·55	·877	9·25	·811	9·95	·754	10·65	·704	11·35	·661	12·10	·620	13·50	·556
8·56	·876	9·26	·810	9·96	·753	10·66	·704	11·36	·660	12·12	·619	13·52	·555
8·57	·875	9·27	·809	9·97	·752	10·67	·70[illegible]	11·37	·660	12·14	·618	13·54	·554
8·58	·874	9·28	·808	9·98	·752	10·68	·702	11·38	·659	12·16	·617	13·56	·553
8·59	·873	9·29	·807	9·99	·751	10·69	·702	11·39	·658	12·18	·616	13·58	·552

EX-MERIDIAN TABLE No. 2.

Showing the Reduction at 1 min. from the Meridian corresponding to the A and B Corrections given on Pages 12 to 37 of this Work.

A and B Cor.	Reduction.	A and B Cor.	Reduction.	A and B Cor.	Reduction.	A and B Cor.	Reduction.	A and B Cor.	Reduction.	A and B Cor.	Reduction.	A and B Cor.	Reduction.
′	′	′	′	′	′	′	′	′	′	′	′	′	′
13·60	·551	17·10	·439	20·60	·364	24·50	·306	31·50	·238	45·20	·166	77·0	·097
13·65	·549	17·15	·437	20·65	·363	24·60	·305	31·60	·237	45·40	·165	78·0	·096
13·70	·547	17·20	·436	20·70	·362	24·70	·304	31·70	·237	45·60	·165	79·0	·095
13·75	·545	17·25	·435	20·75	·361	24·80	·302	31·80	·236	45·80	·164	80·0	·094
13·80	·543	17·30	·434	20·80	·361	24·90	·301	32·00	·234	46·00	·163	81·0	·093
13·85	·542	17·35	·432	20·85	·360	25·00	·300	32·20	·233	46·20	·162	82·0	·091
13·90	·540	17·40	·431	20·90	·359	25·10	·299	32·40	·232	46·40	·162	83·0	·090
13·95	·538	17·45	·430	20·95	·358	25·20	·298	32·60	·230	46·60	·161	84·0	·089
14·00	·536	17·50	·429	21·00	·357	25·30	·296	32·80	·229	46·80	·160	85·0	·088
14·05	·534	17·55	·427	21·05	·356	25·40	·295	33·00	·227	47·00	·160	86·0	·087
14·10	·532	17·60	·426	21·10	·355	25·50	·294	33·20	·226	47·20	·159	87·0	·086
14·15	·530	17·65	·425	21·15	·355	25·60	·293	33·40	·225	47·40	·158	88·0	·085
14·20	·528	17·70	·424	21·20	·354	25·70	·292	33·60	·223	47·60	·158	89·0	·084
14·25	·526	17·75	·423	21·25	·353	25·80	·291	33·80	·222	47·80	·157	90·0	·083
14·30	·524	17·80	·421	21·30	·352	25·90	·290	34·00	·221	48·00	·156	91·0	·082
14·35	·523	17·85	·420	21·35	·351	26·00	·289	34·20	·219	48·20	·156	92·0	·082
14·40	·521	17·90	·419	21·40	·351	26·10	·287	34·40	·218	48·40	·155	93·0	·081
14·45	·519	17·95	·418	21·45	·350	26·20	·286	34·60	·217	48·60	·154	94·0	·080
14·50	·517	18·00	·417	21·50	·349	26·30	·285	34·80	·216	48·80	·154	95·0	·079
14·55	·515	18·05	·416	21·55	·348	26·40	·284	35·00	·214	49·00	·153	96·0	·078
14·60	·514	18·10	·414	21·60	·347	26·50	·283	35·20	·213	49·20	·152	97·0	·077
14·65	·512	18·15	·413	21·65	·346	26·60	·282	35·40	·212	49·40	·152	98·0	·077
14·70	·510	18·20	·412	21·70	·346	26·70	·281	35·60	·211	49·60	·151	99·0	·076
14·75	·508	18·25	·411	21·75	·345	26·80	·280	35·80	·210	49·80	·151	100·0	·075
14·80	·507	18·30	·410	21·80	·344	26·90	·279	36·00	·208	50·00	·150	110·0	·068
14·85	·505	18·35	·409	21·85	·343	27·00	·278	36·20	·207	50·20	·149	120·0	·063
14·90	·503	18·40	·408	21·90	·343	27·10	·277	36·40	·206	50·40	·149	130·0	·058
14·95	·502	18·45	·407	21·95	·342	27·20	·276	36·60	·205	50·60	·148	140·0	·054
15·00	·500	18·50	·405	22·00	·341	27·30	·275	36·80	·204	50·80	·148	150·0	·050
15·05	·498	18·55	·404	22·05	·340	27·40	·274	37·00	·203	51·00	·147	160·0	·047
15·10	·497	18·60	·403	22·10	·339	27·50	·273	37·20	·202	51·20	·147	170·0	·044
15·15	·495	18·65	·402	22·15	·339	27·60	·272	37·40	·201	51·40	·146	180·0	·042
15·20	·493	18·70	·401	22·20	·338	27·70	·271	37·60	·200	51·60	·145	190·0	·039
15·25	·492	18·75	·400	22·25	·337	27·80	·270	37·80	·198	51·80	·145	200·0	·038
15·30	·490	18·80	·399	22·30	·336	27·90	·269	38·00	·197	52·00	·144	210·0	·036
15·35	·489	18·85	·398	22·35	·336	28·00	·268	38·20	·196	52·20	·144	220·0	·034
15·40	·487	18·90	·397	22·40	·335	28·10	·267	38·40	·195	52·40	·143	230·0	·033
15·45	·485	18·95	·396	22·45	·334	28·20	·266	38·60	·194	52·60	·143	240·0	·031
15·50	·484	19·00	·395	22·50	·333	28·30	·265	38·80	·193	52·80	·142	250·0	·030
15·55	·482	19·05	·394	22·55	·333	28·40	·264	39·00	·192	53·00	·142	260·0	·029
15·60	·481	19·10	·393	22·60	·332	28·50	·263	39·20	·191	53·20	·141	270·0	·028
15·65	·479	19·15	·392	22·65	·331	28·60	·262	39·40	·190	53·40	·140	280·0	·027
15·70	·478	19·20	·391	22·70	·330	28·70	·261	39·60	·189	53·60	·140	290·0	·026
15·75	·476	19·25	·390	22·75	·330	28·80	·260	39·80	·188	53·80	·139	300·0	·025
15·80	·475	19·30	·389	22·80	·329	28·90	·260	40·00	·188	54·00	·139	320·0	·023
15·85	·473	19·35	·388	22·85	·328	29·00	·259	40·20	·187	54·40	·138	340·0	·022
15·90	·472	19·40	·387	22·90	·328	29·10	·258	40·40	·186	54·80	·137	360·0	·021
15·95	·470	19·45	·386	22·95	·327	29·20	·257	40·60	·185	55·20	·136	380·0	·020
16·00	·469	19·50	·385	23·00	·326	29·30	·256	40·80	·184	55·60	·135	400·0	·019
16·05	·467	19·55	·384	23·05	·325	29·40	·255	41·00	·183	56·00	·134	420·0	·018
16·10	·466	19·60	·383	23·10	·325	29·50	·254	41·20	·182	57·00	·132	440·0	·017
16·15	·464	19·65	·382	23·15	·324	29·60	·253	41·40	·181	58·00	·129	460·0	·016
16·20	·463	19·70	·381	23·20	·323	29·70	·253	41·60	·180	59·00	·127	480·0	·016
16·25	·462	19·75	·380	23·25	·323	29·80	·252	41·80	·179	60·00	·125	500·0	·015
16·30	·460	19·80	·379	23·30	·322	29·90	·251	42·00	·179	61·00	·123	520·0	·014
16·35	·459	19·85	·378	23·35	·321	30·00	·250	42·20	·178	62·00	·121	540·0	·014
16·40	·457	19·90	·377	23·40	·321	30·10	·249	42·40	·177	63·00	·119	560·0	·013
16·45	·456	19·95	·376	23·45	·320	30·20	·248	42·60	·176	64·00	·117	580·0	·013
16·50	·455	20·00	·375	23·50	·319	30·30	·248	42·80	·175	65·00	·115	600·0	·013
16·55	·453	20·05	·374	23·55	·319	30·40	·247	43·00	·174	66·00	·114	650·0	·012
16·60	·452	20·10	·373	23·60	·318	30·50	·246	43·20	·174	67·00	·112	700·0	·011
16·65	·450	20·15	·372	23·65	·317	30·60	·245	43·40	·173	68·00	·110	750·0	·010
16·70	·449	20·20	·371	23·70	·317	30·70	·244	43·60	·172	69·00	·109	800·0	·009
16·75	·448	20·25	·370	23·80	·315	30·80	·244	43·80	·171	70·00	·107	900·0	·008
16·80	·446	20·30	·370	23·90	·314	30·90	·243	44·00	·171	71·00	·106	1000·0	·008
16·85	·445	20·35	·369	24·00	·313	31·00	·242	44·20	·170	72·00	·104	1200·0	·006
16·90	·444	20·40	·368	24·10	·311	31·10	·241	44·40	·169	73·00	·103	1500·0	·005
16·95	·442	20·45	·367	24·20	·310	31·20	·240	44·60	·168	74·00	·101	2000·0	·004
17·00	·441	20·50	·366	24·30	·309	31·30	·240	44·80	·167	75·00	·100	2500·0	·003
17·05	·440	20·55	·365	24·40	·307	31·40	·239	45·00	·167	76·00	·099	3000·0	·003

TABLE M.

Error in Latitude due to an Error of 4 Seconds in Time or 1′ of Longitude.

Azimuth.	LATITUDE.															
	0°	5°	10°	15°	18°	20°	22°	24°	26°	28°	30°	32°	34°	36°	38°	40°
°	′	′	′	′	′	′	′	′	′	′	′	′	′	′	′	′
2	·03	·03	·03	·03	·03	·03	·03	·03	·03	·03	·03	·03	·03	·03	·03	·03
4	·07	·07	07	·07	·07	·07	·06	·06	·06	·06	·06	·06	·06	·06	·06	·05
6	·11	·10	·10	·10	·10	·10	·10	·10	·09	·09	·09	·09	·09	·09	·08	·08
8	·14	·14	·14	·14	·13	·13	·13	·13	·13	·12	·12	·12	·12	·11	·11	·11
10	·18	·18	·17	·17	·17	·17	·16	·16	·16	·16	·15	·15	·15	·14	·14	·14
12	·21	·21	·21	·21	·20	·20	·20	·19	·19	·19	·18	·18	·18	·17	·17	·16
14	·25	·25	·25	·24	·24	·23	·23	·23	·22	·22	·22	·21	·21	·20	·20	·19
16	·29	·29	·28	·28	·27	·27	·27	·26	·26	·25	·25	·24	·24	·23	·23	·22
18	·32	·32	·32	·31	·31	·31	·30	·30	·29	·29	·28	·28	·27	·26	·26	·25
20	·36	·36	·36	·35	·35	·34	·34	·33	·33	·32	·32	·31	·30	·29	·29	·28
21	·38	·38	·38	·37	·37	·36	·36	·35	·35	·34	·33	·33	·32	·31	·30	·29
22	·40	·40	·40	·39	·38	·38	·37	·37	·36	·36	·35	·34	·33	·33	·32	·31
23	·42	·42	·42	·41	·40	·40	·39	·39	·38	·37	·37	·36	·35	·34	·33	·33
24	·45	·44	·44	·43	·42	·42	·41	·41	·40	·39	·39	·38	·37	·36	·35	·34
25	·47	·46	·46	·45	·44	·44	·43	·43	·42	·41	·40	·40	·39	·38	·37	·36
26	·49	·49	·48	·47	·46	·46	·45	·45	·44	·43	·42	·41	·40	·39	·38	·37
27	·51	·51	·50	·49	·48	·48	·47	·47	·46	·45	·44	·43	·42	·41	·40	·39
28	·53	·53	·52	·51	·51	·50	·49	·49	·48	·47	·46	·45	·44	·43	·42	·41
29	·55	·55	·55	·54	·53	·52	·51	·51	·50	·49	·48	·47	·46	·45	·44	·42
30	·58	·58	·57	·56	·55	·54	·54	·53	·52	·51	·50	·49	·48	·47	·45	·44
31	·60	·60	·59	58	·57	·56	·56	·55	·54	·53	·52	·51	·50	·49	·47	·46
32	·62	·62	·62	·60	·59	·59	·58	·57	·56	·55	·54	·53	·52	·51	·49	·48
33	·65	·65	·64	·63	·62	·61	·60	·59	·58	·57	·56	·55	·54	·53	·51	·50
34	·67	·67	·66	·65	·64	·63	·63	·62	·61	·60	·58	·57	·56	·55	·53	·52
35	·70	·70	·69	·68	·67	·66	·65	·64	·63	·62	·61	·59	·58	·57	·55	·54
36	·73	·72	·72	·70	·69	·68	·67	·66	·65	·64	·63	·62	·60	·59	·57	·56
37	·75	·75	·74	·73	·72	·71	·70	·69	·68	·67	·65	·64	·62	·61	·59	·58
38	·78	·78	·77	·75	·74	·73	·72	·71	·70	·69	·68	·66	·65	·63	·62	·60
39	·81	·81	·80	·78	·77	·76	·75	·74	·73	·72	·70	·69	·67	·66	·64	·62
40	·84	·84	·83	·81	·80	·79	·78	·77	·75	·74	·73	·71	·70	·68	·66	·64
41	·87	·87	·86	·84	·83	·82	·81	·79	·78	·77	·75	·74	·72	·70	·69	·67
42	·90	·90	·89	·87	·86	·85	·83	·82	·81	·79	·78	·76	·75	·73	·71	·69
43	·93	·93	·92	·90	·89	·88	·86	·85	·84	·82	·81	·79	·77	·75	·73	·71
44	·97	·96	·95	·93	·92	·91	·90	·88	·87	·85	·84	·82	·80	·78	·76	·74
45	1·00	1·00	·98	·97	·95	·94	·93	·91	·90	·88	·87	·85	·83	·81	·79	·77
46	1·05	1·03	1·02	1·00	·98	·97	·96	·95	·93	·91	·90	·88	·86	·84	·82	·79
47	1·07	1·07	1·06	1·04	1·02	1·01	·99	·98	·96	·95	·93	·91	·89	·87	·84	·82
48	1·11	1·11	1·09	1·07	1·06	1·04	1·03	1·01	1·00	·98	·96	·94	·92	·90	·88	·85
49	1·15	1·15	1·13	1·11	1·09	1·08	1·07	1·05	1·03	1·02	1·00	98	·95	·93	·91	·88
50	1·19	1·19	1·17	1·15	1·13	1·12	1·10	1·09	1·07	1·05	1·03	1·01	·99	·96	·94	·91
51	1·23	1·23	1·22	1·19	1·17	1·16	1·14	1·13	1·11	1·09	1·07	1·05	1·02	1·00	·97	·95
52	1·28	1·28	1·26	1·24	1·22	1·20	1·19	1·17	1·15	1·13	1·11	1·09	1·06	1·04	1·01	·98
53	1·33	1·32	1·31	1·28	1·26	1·25	1·23	1·21	1·19	1·17	1·15	1·13	1·10	1·07	1·05	1·02
54	1·38	1·38	1·36	1·33	1·31	1·29	1·28	1·26	1·24	1·22	1·19	1·17	1·14	1·11	1·08	1·05
55	1·43	1·42	1·41	1·38	1·36	1·34	1·32	1·30	1·28	1·26	1·24	1·21	1·18	1·16	1·13	1·09
56	1·48	1·48	1·46	1·43	1·41	1·39	1·37	1·35	1·33	1·31	1·28	1·26	1·23	1·20	1·17	1·14
57	1·54	1·53	1·52	1·49	1·46	1·45	1·43	1·41	1·38	1·36	1·33	1·31	1·28	1·25	1·21	1·18
58	1·60	1·59	1·58	1·55	1·52	1·50	1·48	1·46	1·44	1·41	1·39	1·36	1·33	1·29	1·26	1·23
59	1·66	1·66	1·64	1·61	1·58	1·56	1·54	1·52	1·50	1·47	1·44	1·41	1·38	1·35	1·31	1·27
60	1·73	1·73	1·71	1·67	1·65	1·63	1·61	1·58	1·56	1·53	1·50	1·47	1·44	1·40	1·36	1·33
61	1·80	1·80	1·78	1·74	1·72	1·71	1·67	1·65	1·62	1·59	1·56	1·53	1·50	1·46	1·42	1·38
62	1·88	1·87	1·85	1·82	1·79	1·77	1·74	1·72	1·69	1·66	1·63	1·59	1·56	1·52	1·48	1·44
63	1·96	1·95	1·93	1·90	1·87	1·84	1·82	1·79	1·76	1·73	1·70	1·66	1·63	1·59	1·55	1·50
64	2·05	2·04	2·02	1·98	1·95	1·93	1·90	1·87	1·84	1·81	1·78	1·74	1·70	1·66	1·62	1·57
65	2·14	2·14	2·11	2·07	2·04	2·02	1·99	1·96	1·93	1·89	1·86	1·82	1·78	1·74	1·69	1 64
66	2·25	2·24	2·21	2·17	2·14	2·11	2·08	2·05	2·02	1·98	1·95	1·90	1·86	1·82	1·77	1·72
67	2·36	2·35	2·32	2·28	2·24	2·21	2·18	2·15	2·12	2·08	2·04	2·00	1·95	1·91	1·86	1·80
68	2·48	2·47	2·44	2·39	2·35	2·33	2·30	2·26	2·22	2·19	2·14	2·10	2·05	2·00	1·95	1·90
69	2·61	2·59	2·57	2·52	2·48	2·45	2·42	2·38	2·34	2·30	2·26	2·21	2·16	2·11	2·05	2·00
70	2·75	2·74	2·71	2·65	2·61	2·58	2·55	2·51	2·47	2·43	2·38	2·33	2·28	2·22	2·16	2·10

TABLE M.

Error in Latitude due to an Error of 4 Seconds in Time or 1′ of Longitude.

Azimuth.	LATITUDES															
	42°	44°	46°	48°	49°	50°	51°	52°	53°	54°	55°	56°	57°	58°	59°	60°
°	′	′	′	′	′	′	′	′	′	′	′	′	′	′	′	′
2	·03	·03	·02	·02	·02	·02	·02	·02	·02	·02	·02	·02	·02	·02	·02	·02
4	·05	·05	·05	·05	·05	·04	·04	·04	·04	·04	·04	·04	·04	·04	·04	·03
6	·08	·08	·07	·07	·07	·07	·07	·06	·06	·06	·06	·06	·06	·06	·05	·05
8	·10	·10	·10	·09	·09	·09	·09	·09	·08	·08	·08	·08	·08	·07	·07	·07
10	·13	·13	·12	·12	·12	·11	·11	·11	·11	·10	·10	·10	·10	·09	·09	·09
12	·16	·15	·15	·14	·14	·14	·13	·13	·13	·12	·12	·12	·12	·11	·11	·11
14	·19	·18	·17	·17	·16	·16	·16	·15	·15	·15	·14	·14	·14	·13	·13	·12
16	·21	·21	·20	·19	·19	·18	·18	·18	·17	·17	·16	·16	·16	·15	·15	·14
18	·24	·23	·23	·22	·21	·21	·20	·20	·20	·19	·19	·18	·18	·17	·17	·16
20	·27	·26	·25	·24	·24	·23	·23	·22	·22	·21	·21	·20	·20	·19	·19	·18
21	·29	·28	·27	·26	·25	·25	·24	·24	·23	·23	·22	·21	·21	·20	·20	·19
22	·30	·29	·28	·27	27	·26	·25	·25	·24	·24	·23	·23	·22	·21	·21	·20
23	·32	·31	·29	·28	·28	·27	·27	·26	·26	·25	·24	·24	·23	·22	·22	·21
24	·33	·32	·31	·30	·29	·29	·28	·27	·27	·26	·26	·25	·24	·24	·23	·22
25	·35	·34	·32	·31	·31	·30	·29	·29	·28	·27	·27	·26	·25	·25	·24	·23
26	·36	·35	·34	·33	·32	·31	·31	·30	·29	·29	·28	·27	·27	·26	·25	·24
27	·38	·37	·35	·34	·33	·33	·32	·31	·31	·30	·29	·28	·28	·27	·26	·25
28	·40	·38	·37	·36	·35	·34	·33	·33	·32	·31	·30	·30	·29	·28	·27	·27
29	·41	·40	·39	·37	·36	·36	·35	·34	·33	·33	·32	·31	·30	·29	·29	·28
30	·43	·42	·40	·39	·38	·37	·36	·36	·35	·34	·33	·32	·31	·31	·30	·29
31	·45	·43	·42	·40	·39	·39	·38	·37	·36	·35	·34	·34	·33	·32	·31	·30
32	·46	·45	·43	·42	·41	·40	·39	·38	·38	·37	·36	·35	·34	·33	·32	·31
33	·48	·47	·45	·43	·43	·42	·41	·40	·39	·38	·37	·36	·35	·34	·33	·32
34	·50	·49	·47	·45	·44	·43	·42	·42	·41	·40	·39	·38	·37	·36	·35	·34
35	·52	·50	·49	·47	·46	·45	·44	·43	·42	·41	·40	·39	·38	·37	·36	·35
36	·54	·52	·50	·49	·48	·47	·46	·45	·44	·43	·42	·41	·40	·39	·37	·36
37	·56	·54	·52	·50	·49	·48	·47	·46	·45	·44	·43	·42	·41	·40	·39	·38
38	·58	·56	·54	·52	·51	·50	·49	·48	·47	·46	·45	·44	·43	·41	·40	·39
39	·60	·58	·56	·54	·53	·52	·51	·50	·49	·48	·46	·45	·44	·43	·42	·40
40	·62	·60	·58	·56	·55	·54	·53	·52	·51	·49	·48	·47	·46	·44	·43	·42
41	·65	·63	·60	·58	·57	·56	·55	·54	·52	·51	·50	·49	·47	·46	·45	·43
42	·67	·65	·63	·60	·59	·58	·57	·55	·54	·53	·52	·50	·49	·48	·46	·45
43	·69	·67	·65	·62	·61	·60	·59	·57	·56	·55	·53	·52	·51	·49	·48	·47
44	·72	·69	·67	·65	·63	·62	·61	·59	·58	·57	·55	·54	·53	·51	·50	·48
45	·74	·72	·69	·67	·66	·64	·63	·62	·60	·59	·57	·56	·54	·53	·52	·50
46	·77	·74	·72	·69	·68	·67	·65	·64	·62	·61	·59	·58	·56	·55	·53	·52
47	·80	·77	·74	·72	·70	·69	·67	·66	·65	·63	·62	·60	·58	·57	·55	·54
48	·83	·80	·77	·74	·73	·71	·70	·68	·67	·65	·64	·62	·60	·59	·57	·56
49	·85	·83	·80	·77	·75	·74	·72	·71	·69	·68	·66	·64	·63	·61	·59	·58
50	·89	·86	·83	·80	·78	·77	·75	·73	·72	·70	·68	·67	·65	·63	·61	·60
51	·92	·89	·86	·83	·81	·79	·78	·76	·74	·73	·71	·69	·67	·65	·64	·62
52	·95	·92	·89	·86	·84	·82	·81	·79	·77	·75	·73	·72	·70	·68	·66	·64
53	·99	·95	·92	·89	·87	·85	·84	·82	·80	·78	·76	·74	·72	·70	·68	·66
54	1·02	·99	·96	·92	·90	·88	·87	·85	·83	·81	·79	·77	·75	·73	·71	·69
55	1·06	1·03	·99	·96	·94	·92	·90	·88	·86	·84	·82	·80	·78	·76	·74	·71
56	1·10	1·07	1·03	·99	·97	·95	·93	·91	·89	·87	·85	·83	·81	·79	·76	·74
57	1·14	1·11	1·07	1·03	1·01	·99	·97	·95	·93	·91	·88	·86	·84	·82	·79	·77
58	1·19	1·15	1·11	1·07	1·05	1·03	1·01	·99	·96	·94	·92	·89	·87	·85	·82	·80
59	1·24	1·20	1·16	1·11	1·09	1·07	1·05	1·02	1·00	·98	·95	·93	·91	·88	·86	·83
60	1·29	1·25	1·20	1·16	1·14	1·11	1·09	1·07	1·04	1·02	·99	·97	·94	·92	·89	·87
61	1·34	1·30	1·25	1·21	1·18	1·16	1·14	1·11	1·09	1·06	1·05	1·01	·98	·96	·93	·90
62	1·40	1·35	1·31	1·26	1·23	1·21	1·18	1·16	1·13	1·11	1·08	1·05	1·02	1·00	·97	·94
63	1·46	1·41	1·36	1·31	1·29	1·26	1·24	1·21	1·18	1·15	1·13	1·10	1·07	1·04	1·01	·98
64	1·52	1·47	1·42	1·37	1·34	1·32	1·29	1·26	1·23	1·21	1·18	1·15	1·12	1·09	1·06	1·03
65	1·59	1·54	1·49	1·43	1·41	1·38	1·35	1·32	1·29	1·26	1·23	1·20	1·17	1·14	1·10	1·07
66	1·67	1·62	1·56	1·50	1·47	1·44	1·41	1·38	1·35	1·32	1·29	1·26	1·22	1·19	1·16	1·12
67	1·75	1·69	1·64	1·58	1·55	1·51	1·48	1·45	1·42	1·38	1·35	1·32	1·28	1·25	1·21	1·18
68	1·84	1·78	1·72	1·66	1·62	1·59	1·56	1·52	1·49	1·45	1·42	1·38	1·35	1·31	1·27	1·24
69	1·94	1·87	1·81	1·74	1·71	1·67	1·64	1·60	1·57	1·53	1·49	1·46	1·42	1·38	1·34	1·30
70	2·04	1·98	1·91	1·84	1·80	1·77	1·73	1·69	1·65	1·61	1·58	1·54	1·50	1·46	1·41	1·37

POSITION OF SHIP FROM TWO SUN EX-MERIDIAN OBSERVATIONS, USING A AND B EX-MERIDIAN TABLES AND LOGARITHMS.

1917.—On January 21st, a.m. at ship, in lat. by D.R. 8° 0′ N. and long. 74° 22′ E., when a chronometer indicated M.T. Green. 20 d. 17 h. 33 m. 51 s., the true altitude of sun's centre was 52° 34′ S.; and again on same afternoon when chronometer indicated 20 d. 21 h. 1 m. 21 s., the true altitude of sun's centre was 52° 12′ S., the ship having made 52½ miles on a true N. 79° W. course during the interval between the observations. Required the position of ship at time of 2nd observation, and prove work by two different methods.

A.M. Observation.—Latitude by Ex-meridian Tables.

	D. H. M. S.
M.T. Green,	20 17 33 51
Long. 74° 22′ E.	+ 4 57 28
M.T. ship	22 31 19
Eq. of time	− 11 19
A.T. ship	22 20 0
H.A.	1 40 0
Decl. 20° 1½′	
Alt. 52° 34′	

Azim. S. 40° 47′ E. gives A and B 1·17′ which gives (p. 75) position-line S. 49½° W., and (p. 145) Redn. at 1 m. 5·537′ × 100 m. = Redn. 553·7, = 9° 13·7′.

	° ′ ″
Decl. (21st)	19 57 56 S.
33·2″ × 6·5 h.	+ 3 36
Cor. dl.	20 1 32 S.

Sin.	9·6259
Cos.	9·9729
Sec.	0·2162
Sin.	9·8150
Az.	40° 47′

	M. S.
Eq. T.	11 23·4
·71 s. × 6·5 h.	− 4·6
Cor. Eq. T.	11 18·8

Run N. 79° W. 52½ = 10·0′ N.
51·5′ W. = 52′ W.

	° ′
Long.	74 22·0 E.
Run	52·0 W.
Long. at time of 2nd obsn.	73 30·0 E.

	° ′
T. alt -⊖-	52 34·0 S.
Redn.	+ 9 13·7
Mer. alt.	61 47·7
M.Z.D.	28 12·3 N
Decl.	20 1·5 S.
Lat.	8 10·8 N.
Run	10·0 N.
Lat. at time of 2nd obsn.	8 20·8 N.

P.M. Observation.—Ex-meridian Latitude by Spherical Calculation.

	D. H. M. S.
M.T. Green.	20 21 1 21
Long. 73° 30′ E.	+ 4 54 0
M.T. ship	21 1 55 21
Eq. time	− 11 21

	° ′
T. alt. -⊖-	52 12·0 S.
Z.D.	37 48 N.

	° ′ ″
Decl. (21st)	19 57 56 S.
Var. 33·2″ × 3 h.	+ 1 40
Cor. decl.	19 59 36 S.

	M. S.
Eq. T. (21st)	11 23·4
Var. ·71 s. × 3 h.	− 2·1
Cor. Eq. T.	11 21·3

					For Azimuth.		
A.T. ship (H.A.) 1 44 0	Cos.	9·95366			Sin. 9·64184		
Decl. 19° 59′ 36″ S.	Cot.	0·43909			Cos. 9·97300		
Arc. (1) 22° 2′ 18″ S.	Cot.	0·39375	Alt. 52° 12′		Sec. 0·21261	Cot.	9·88968
Arc. (2) 29 52 14 N.			Azim. S. 42° 13′ 52″ W.		Sin. 9·82745	Cos.	9·86949
Latitude 7 49 56 N.					Arc. (2) 29° 52′ 14″ N.	Tan.	9·75917

As a Check on the Work the Ex-meridian Table No. 1 may be used.

	° ′	
Lat.	7 50 N.	A. ·282 S.
Dl.	20 0 S.	B. ·830 S.
H.A.	1h. 44m.	C. 1·112 S. gives position-line N. 48° W. and redn. at 1 min. 5·753′ × 104 m. = Redn. 598·3′ = + 9° 58·3′

	° ′
Z.D.	37 48·0 N.
Redn.	− 9 58·3
M.Z.D.	27 49·7 N.
Decl.	19 59·6 S.
Latitude	7 50·1 N.

Position on Chart.

Lat. 8° 5·8′ N.
Long. 73 12·4 E.

	° ′
With Long. at time of 2nd obsn.	73 30 E.
Lat. (1) ,,	8 20·8 N.
,, (2) ,,	7 50·0 N.

Gives position on Chart

Lat. 8° 5·8′ N.
Long. 73 12·2 E.

EXAMPLE FROM PREVIOUS PAGE WORKED FROM TWO LONGITUDE CALCULATIONS.

A.M. Observation.

	D. H. M. S.
M.T. Green.	20 17 33 51
Eq. time	. — 11 19
A.T. Green.	20 17 22 32

True alt. –⊖– 52° 34′ S.
Decl. 20° 1′ 32″ S.

P.M. Observation.

	H. M. S.
M.T. Green.	21 1 21
Eq. time	— 11 21·3
A.T. Green.	20 49 59·7

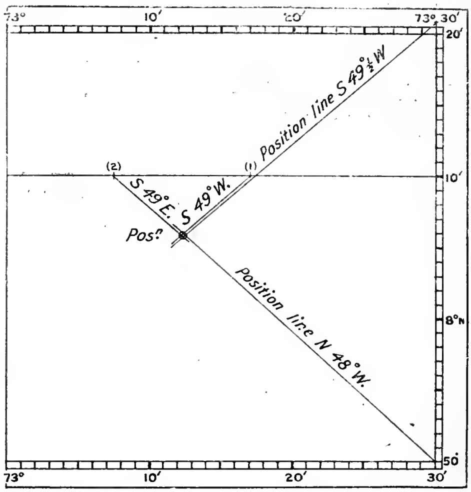
True alt. 52° 12′·0 S.
Decl. 19° 59′ 36″ S.

Run N. 79° W. 52½ m. = 10·0′ N. 51·5′ =52·0′ W.

	° ′ ″		
A	52 34 0		
L	8 0 0	Sec.	0·00425
P	110 1 32	Cosec.	0·02708
	170 35 32		
S	85 17 46	Cos.	8·91384
S – A	32 43 46	Sin.	9·73293
		Sin.2	8·67810

H.A.	1 40 52
A.T. ship	22 19 8
A.T. Green.	17 22 32
Long. in time	4 56 36
Longitude	74 9 0 E.
Run	52 0 W.
Long. at time of 2nd obsn.	73 17 0 E.

A ·30′ S.
B .86 S.
C2 1·16 S. gives posn.-line S. 49·2° W.



Position by chart Lat. 8° 5·8 N. Long. 73° 12·2′ E.

P.M. Observation.

	° ′ ″		
A	52 12 0		
L	8 10 0	Sec.	0·00443
P	109 59 36	Cosec.	0·02700
	170 21 36		
S	85 10 48	Cos.	8·92441
S – A	32 58 48	Sin.	9·73588
H.A. 1h. 42m. 29.7s.		Sin.2	8·69172

	H. M. S.
A.T. ship	1 42 29·7
A.T. Green.	20 49 59·7
Long. in time	4 52 30 E.
Longitude	73° 7′ 30″ E.

A ·30′ S.
B ·84 S.
C2 1·14 S. gives posn.-line S. 48·7° E.

Worked without the aid of Chart.

Long. (1)	73° 17′·0 E.	A & B	1·16′ S. to W.
„ (2)	73 7·5 E.	„	1·14 S. to E.
Diff. long.	9·5	÷	2·30 = Lat. Cor. 4·1′ S × 1·14′ = Long. Cor. 4·7′ E.

Lat. (2)	8° 10′·0 N.	Long. (2)	73° 7′·5 E.
Cor.	4·1 S.	Cor.	4·7 E.
Lat. in	8 5·9 N.	Long. in	73 12·2 E.

Example from 2nd edition of "Calculated Hour-angles and Ex-meridian Tables," &c., by H. S. Blackburne, giving a true position from a right-angle cross of two sun observations less than 5 minutes from noon.

POSITION FROM TWO EX-MERIDIAN OBSERVATIONS OF SUN WITH ALTITUDES LESS THAN 1½° FROM ZENITH.

1917.—March 19th, in approximate position in lat. 0° and long. 45° W., with the following observations find the position of ship at time of second observation :—

		H.	M.	S.			
(A.M. at ship)	M.T. Greenwich	3	2	51	T. alt. of ⊖	88° 41′	S.Ed.
(P.M. at ship)	,,	3	9	27	,,	88 47·4	S.Wd.

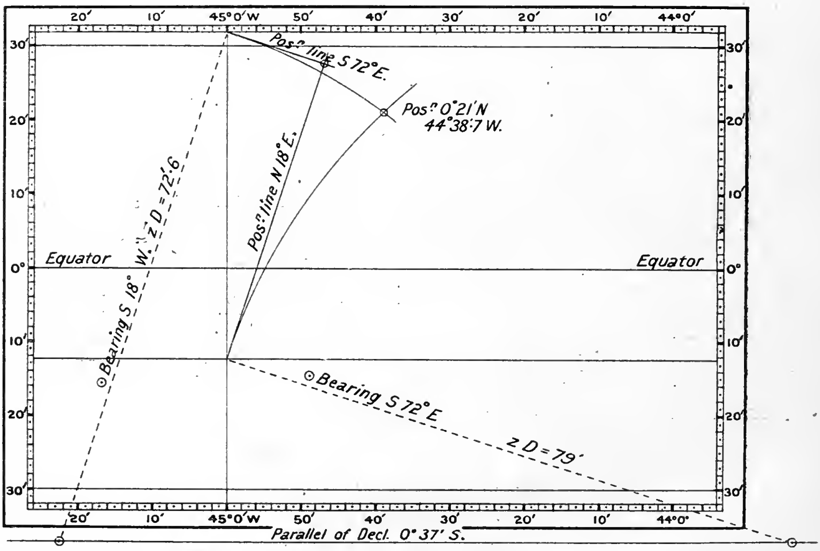
Run in interval between observations West. 1½ miles.

A.M. Observation.

	H. M. S.				
M.T. Green.	3 2 51			T. alt. ⊖	88° 41′ S.
Eq. time	− 7 57			Redn.	+ 54·2
A.T. Green.	2 54 54			Mer. alt.	89 35·2
Long. 44° 58½′ W.	2 59 54			M.Z.D.	0 24·8 N.
A.T. Sp.	23 55 0			Decl.	0 37·0 S.
H.A.	0 5 0	Sin.	8·3388	Lat.	0 12·2 S.
Alt. 88° 41′		Sec.	1·6387		
Azim. S. 71° 43′ E. gives (p. 293) Redn. at 1 m. = 10·835 s. × 5 m. = Redn. 54·2′.		Sin.	9·9775		
				Posn. on chart	0° 21′·0 N.
					44 38·7 W.

P.M. Observation.

	H. M. S.		
M.T. Green.	3 9 27		
Eq. time	− 7 57		
A.T. Green.	3 1 30		
Long. 45° W.	3 0 0		
H.A. West.	0 1 30	Sin.	7·8159
Alt. 88° 47·4′		Sec.	1·6754
Azim. S. 18° 3½′ W. gives Redn. at 1 m 2·38′ × 1½ m. = Redn. 3·6′.		Sin.	9·4913
T. alt.	88° 47′·4 S.		
Redn.	+ 3·6		
Mer. alt.	88 51·0		
M.Z.D.	1 9·0 N.		
Decl.	0 37·0 S.		
Lat.	0 32·0 N.		



This example as an extreme case where both altitudes were near the zenith, and the D.R. position considerably in error illustrates clearly the errors which would result from considering the position-lines as straight lines ; the resulting position being 0° 27·7′ N. and 44° 46·8′ W. A perfectly true position, however, is obtained by the method here shown.

On the meridian of 45° W. lat. (1) was found to be 0° 12·2′ S. when sun bore S. 72° E. with Z.D. 79′.

On the meridian of 45° W. lat. (2) was found to be 0° 32·0′ N. when sun bore S. 18° W. with Z.D. 72·6′.

In such an extreme case, if inconvenient to adopt this method, a second calculation could very quickly be made by the use of the ex-meridian table with a new hour-angle deduced from the approximate longitude obtained by the first calculation. When nearly under the sun the longitude is seldom likely to be much in error as the sun would be close to the prime vertical during almost the whole day.

DOUBLE PROOF OF CORRECTNESS OF POSITION AS DETERMINED BY THE METHOD AND CALCULATION OF PREVIOUS EXAMPLE.

The following is a very good and simple way of proving the accuracy of double altitude observations, viz. :—

With the resulting *longitude* deduce a new hour-angle, and recalculate the latitude by a *true method* from both observations. If both latitudes are the same as from previous determinations it is a good guarantee of the correctness of position ; or

With the resulting *latitude* recalculate the longitude from both observations. If they both agree with previous results we may rely with confidence on the correctness of the calculations, but of course this will not guarantee the correctness of position if a wrong altitude has been observed or a wrong declination used in the calculations.

For Determination of Latitudes.

A.M. Observation.

	H. M. S.		
A.T. Green.	2 54 54		
Long. 44° 37·2′ W.	2 58 29		
A.T. Sp.	23 56 25		
H.A. East	0 3 35	Sin.	8·1941
Alt.	88° 41′	Sec.	1·6387
Azim. S. 42° 53′ E. gives Redn. at 1 m. = 5·89′ × 3·58 m. = Red. 21·1′.		Sin.	9·8328

P.M. Observation.

	H. M. S.		
A.T. Green.	3 1 30		
Long. 44° 38·7′ W.	2 58 35		
A.T. Sp. West	0 2 55	Sin.	8·1047
Alt.	88° 47·4′	Sec.	8·6754
Azim. S. 37° 4′ W. gives Redn. at 1 min. = 5·03′ × 2·92 min. = Red. 14·7′.		Sin.	6·7801

	° ′
True alt. ⊙	88 41·0 S.
Redn.	+ 21·1
Mer. alt.	89 2·1
M.Z.D.	0 57·9 N.
Decl.	0 37·0 N.
Latitude	0 20·9 N.

	° ′
True alt. ⊙	88 47·4 S.
Redn.	+ 14·7
Mer. alt.	89 2·1
M.Z.D.	0 57·9 N.
Decl.	0 37·0 N.
Latitude	0 20·9 N.

Determination of Longitudes.

	° ′		
A	88 41		
L	0 21	Sec.	0·0000
P	90 37	Cosec.	0·0000
	179 39		
S	89 49½	Cos.	7·4849
S − A	1 8½	Sin.	8·2994
H.A. 0 h. 3 m. 34·5 s.		Sin²	5·7843

	° ′ ″		
A	88 47 24		
L	0 21 0		
P	90 37 0		
	179 45 24		
S	89 52 42	Cos.	7·3270
S − A	1 5 18	Sin.	8·2786
H.A. 0 h. 2 m. 54·6 s.		Sin²	5·6056

	H. M. S.
A.T. Ship	23 56 25·5
A.T. Green.	26 54 54·0
Long. in time	2 58 28·5
Longitude	44° 37·1′ W.
Run	1·5 W.
Longitude at time of 2nd obsn.	44° 38·6′ W.

	H. M. S.
A.T. Ship	0 2 54·6
A.T. Green.	3 1 30·0
Long. in time	2 58 35·4
Longitude	44° 38·8′ W.

NOTE.—The determination of latitude by the use of Table VIII should only be made within the limits of time given in Tables VII or VIIA, as it will not give a true result outside these limits.

"SUMNER" POSITION FROM A.M. AND P.M. SUN OBSERVATIONS NEAR THE MERIDIAN.

1898.—On August 31st, in lat. by D.R. 7° 42′ N., long. 73° 50′ E. Obsd. alt. of ⊙'s L.L. (a.m. at ship) was 88° 50′ N. when a chronometer indicated M.T.G. 30 d. 19 h. 2 m. 53 s., and again (p.m.) the obsd. alt. of ⊙'s L.L. was 88° 44′ when chronometer indicated M.T.G. 30 d. 19 h. 7 m. 57 s. Run in interval, N. 80° W., 1 m., gives 0·2′ N., 1·0′ W. Height of eye, 35 ft. Required, posn. of ship by "Sumner's" method from ex-meridian tables.

A.M. Observation.

	D. H. M. S.		° ′		° ′ ″
M.T. Green.	30 19 2 53	Obsd. alt. ⊙'s L.L.	88 50 N Ed	Decl. 31st	8 33 0 N
Long. 73° 50′ E	4 55 20	Cor. 35 ft. (p. 87)	+ 10	54·4″ × 5 h.	+ 4 32
M.T. at ship	23 58 13	True alt. -⊖-	89 0·0	Decl.	8 37 32 N
Eq. time	− 13	Redn	+ 7·8		M. S.
A.T. Sp.	23 58 0	Mern Alt.	89 7·8N	Eq. of time	0 9·36
				·78 s. × 5 h.	+ 3·9
H.A.	E. 2 0			Cor. Eq. T.	0 13·26

For Azimuth and Reduction.

H.A.	2 m.	Sin.	7·9408
Decl.	8° 37½′	Cos	9·9951
Alt.	89°	Sec.	1·7581
Az.	29° 37½′	Sin.	9·6940

gives (p. 40) A & B 1·78′ gives (p. 75) position-line for plane chart N 60·7° W., and (p. 146) Redn at 1 min. 3·92′ × 2 m. = Redn 7·8′.

For the Latitude.

	° ′
Mern Alt.	89 7.8 N
M.Z.D.	0 52·2 S
Decl.	8 37·5 N
Lat.	7 45·3 N
Run.	·2 N
Lat. at time of 2nd Obsn	7 45·5 N

P.M. Observation.

	D. H. M S.
M.T. Green.	30 19 7 57
Long. 73° 49′ E	+ 4 55 16
M.T. at Sp.	31 0 3 12
Eq. T.	− 13
A.T. Sp.	31 0 3 0
H.A.	W. 3 0

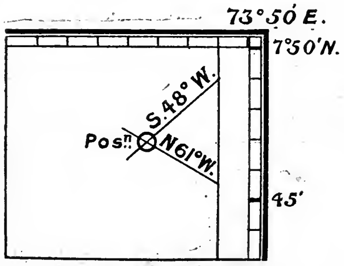
For the Latitude.

	° ′
Obsd. alt. ⊙'s L.L.	88 44N Wd
35 ft. cor.	+ 10
T. alt. -⊙-	88 54 N
Redn	+ 17·3
Mern Alt.	89 11·3 N
M.Z.D.	0 48·7 S
Decl.	8 37·5 N
Latitude	7 48·8 N

For Azimuth.

H.A.	3 m.	Sin.	8·1169
Dl.	8° 37½′	Cos.	9·9951
Alt.	88° 54′	Sec.	1·7168
Az.	42° 24′	Sin.	9·8288

gives (p. 40) A & B 1·11′ gives (p. 37) position-line for plane chart N 48° E, or S 48° W., and (p. 145) Redn at 1 min. 5·76′ × 3 m. = Reduction 17·3′



Position from chart:
Latitude 7° 46¾′ N., longitude 73° 46¾′ E.

Position worked without the Aid of Chart.

	° ′		°		′
1st lat.	7 45·5 N.	⊙'s Az.	N. 29½ E. (Table M)		0·56 N. to W
2nd. lat.	7 48·8 N.	"	N. 42½ W.	"	0·91 S. to W
d. lat.	3·3			lat. error (Sum.)	1·47 to 1·0 long.

lat. error : long. :: d. lat. : long. cor. × 0·56′ = lat. cor.
1·47′ : 1·0′ :: 3·3′ : 2·25′ × 0·56′ = 1·26′ N

	° ′		° ′
Lat. (1)	7 45·5 N	Long. (2)	73 49·0 E
Cor.	0 1·3 N	Cor.	0 2·3 W
Lat. in	7 46·8 N	Long. in	73 46·7 E

Note.—The long. by chron. at 2nd observation, calculated with this lat. found from the two observations, was 73° 46′ 30″ E., and the lat. reworked from the H.A. resulting from this long. was 7° 47′ N.

POSITION BY CHRONOMETER AND EX-MERIDIAN OBSERVATIONS OF SUN AND MOON.

1898.—On March 30th, at about 1 h. 24 m. p.m., at ship, observed alt. of ☾'s U.L. was 27° 57′ east of meridian when a chronometer indicated M.T.G. 2 h. 18 m. 57 s., and after running on an east course 2 miles the ⊙'s L.L. was observed to be 32° 51′ when the chronometer indicated 2 h. 26 m. 35 s. Lat. by D.R. 58° 2½′ N., long. 12° 30′ W., height of eye 35 ft.

1st Observation, ☾.

	D. H. M. S.
M.T. Green	30 2 18 57
Sid. T. (G. noon)	+ 31 34·8
Accl. 2 h. 19 m.	+ 22·8
Sid. T. Green.	2 50 54·6
	H. M. S.
☾'s R.A. 2 hrs.	6 55 51·6
2·13 s. × 19 m.	+ 40·5
Cor. R.A.	6 56 32·1
	° ′ ″
☾'s decl. 2 hrs.	23 46 57 N.
5·44″ × 19 m.	− 1 43
Cor. decl.	23 45 14 N.
P.D.	66 14 46 N.

	° ′ ″
Obsd. alt. ☾'s U.L.	27 57 0
Dip. 35 ft.	− 5 50
	27 51 10
Semi-d.	− 14 58
App. alt. ☾'s centre	27 36 12
Cor. T. (39, Raper) H.P. 54′ 16″	+ 46 15
T. alt. ☾'s centre	28 22 27

	′
A	·459 S.
B	·458 N.
C	·001 S.

gives Az. 90°

A	28 22½		
L	58 2½	Sec.	0·27630
P	66 15	Cosec.	0·03843
	152 40		
S	76 20	Cos.	9·37341
S − A	47 57½	Sin.	9·87079
	H. M. S.		
H.A.	4 56 0	Hav.	9·55893
☾'s R.A.	6 56 32·1		
Sid. T. Sp.	2 0 32·1		
Sid. T. G.	2 50 54·6		
Long. in time	50 22·5		
	° ′ ″		
Long.	12 35 38 W.		
Run	3 48 E.		
Long. at 2nd obsn.	12 31 50 W.		
Long. in time	50m. 7·3s.		

Run east 2 m. = d. long. 3·8′ E.

2nd Observation, ⊙.

LAT. BY EX-MERIDIAN TABLE NO. 2.

By reference to page 152 it will be seen that with a low latitude and high declination this table may be used without appreciable error to about 2 hours from the meridian. Therefore, by transposing lat. and dec. the same wide range may be obtained. The example below illustrates this case.

	H. M. S.
M.T.G.	2 26 35
Long. W	− 50 7·3
M.T. Sp.	1 36 27·7
Eq. T.	− 4 27·0
H.A.	1 32 0·7

	° ′		
Lat. (dec.)	3 56 N	A	·16 S.
Dec. (lat.)	58 0 N	B	4·10 N.
		C	3·94 N. gives (p. 153)

1·904′ × 92 m. = 175·168′ = 2° 55·2′ redn.

	° ′
Obsd. alt. of ⊙'s L.L.	32 51 S.
35 ft. cor. (p. 87)	+ 9
T. alt.	33 0·0 S.
Redn.	2 55·2
Mer. alt.	35 55·2
M.Z.D.	54 4·8 N.
Decl.	3 55·7 N.
Lat.	58 0·5 N.

	° ″
⊙'s decl.	3 53 21 N.
58·2″ × 2·4 hrs.	2 20 N.
Cor. decl.	3 55 41 N.
	M. S.
Eq. time	4 28·8
·76 s × 2·4 hrs.	− 1·8
Cor. Eq. T.	4 27·0

CORRECTNESS OF WORK BY THE ABOVE METHODS WITH EX-MERIDIAN TABLE NO. 2 PROVED BY RIGOROUS CALCULATION.

	H. M.				
H.A.	1 32	Cos.	9·964026		
Decl.	3° 55′ 41″ N	Cot.	1·163267	Cosec.	1·164289
	° ′ ″				
Arc (1)	4 15 58 N	Cot.	1·127293	Sin.	8·871502
		⊙'s alt.	33° 0′	Sin.	9·736109
" (2)	53 44 30 N.	. . . . . .		Cos.	9·771900
Lat.	58 0 28 N.				

As the moon was on the prime vertical when the altitude was taken, the time deduced from this observation should be absolutely correct, and the latitude by ex-meridian of the sun will also be correct without any additional work.

See note on page 117 about correcting moon's semidiameter and horizontal parallax for Greenwich date.

POSITION OF SHIP FROM COMBINED EX-MERIDIAN OBSERVATIONS OF TWO STARS, USING STAR-REDUCTION AND AZIMUTH EX-MERIDIAN TABLES.

1917.—On March 26th, soon after sunset, at about 6 h. 5 m. and 6 h. 12 m. p.m., in approximate latitude 18° S., and longitude D.R. 3° 36′ W., the true altitude of ⁎ Capella was 24° 5′ N.Wd., when chronometer showed M.T.G. 6 h. 24 m. 18 s., and after running N. 45° W. 1½ miles the true altitude of ⁎ Sirius was 87° 10½′ N.Ed. when chronometer showed 6 h. 31 m. 17 s. Required, the position of ship at 2nd observation. Run N. 45° W. 1·5 m. = 1·0′ N. 1·1′ W.

⁎ Capella to North-westward.

	H. M. S.		° ′
M.T. Green.	6 24 18	⁎'s Alt.	24 5·0 N.
Long. 3° 36′ W.	−0 14 24	Redn.	+2 9·1
M.T. Ship	6 9 54	Mer. alt.	26 14·1
Sid. T.G. noon	0 13 26		
Accl.	+ 1 3	M.Z.D.	63 45·9 S.
		Decl.	45 55·1 N
Sid. T. Ship	6 24 23		
⁎'s R.A.	5 10 35	Lat.	17 50·8 S.
		Run	1·0 N.
⁎'s H.A. W.	1 13 48	Lat. at time of 2nd obsn.	17 49·8 S.

Gives (p. 319*) Redn. 2° 9·1′ and Azim. N. 14° W.

For Position-line on Plane Chart.

Az. N. 14° W. gives (Table IV, p. 260*) lat. var. 17·0 s., which gives (p. 270*) posn.-line S. 76·8° W.

	Lat.	Long.
Position on chart	17° 51′·4 S.	and 3° 43′·5 W.
True position	17 51·1 S.	3 43·3 W.

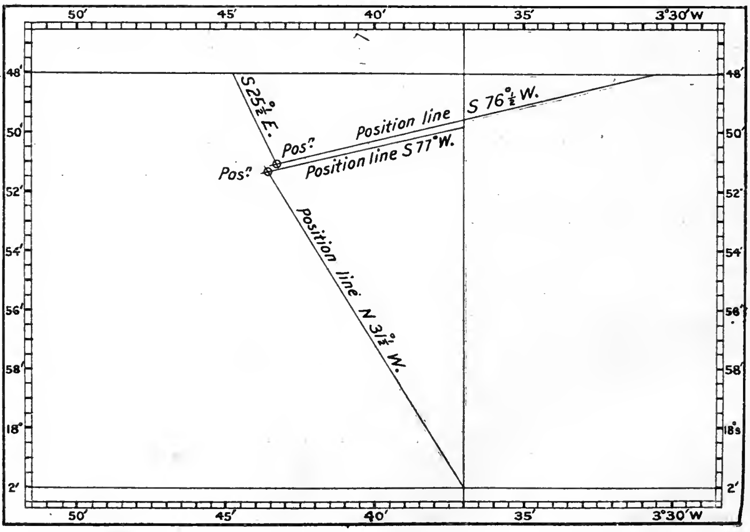
⁎ Sirius to North-eastward.

	H. M. S.		° ′
M.T.G.	6 31 17	⁎'s Alt.	87 10·5 N.
Long. 3° 37′ W.	− 14 28	Redn.	+1 23·8
M.T. Sp.	6 16 49	Mer. alt.	88 34·3
S.T.G.N.	0 13 26		
Accl.	+ 1 4	M.Z.D.	1 25·7 S.
		Decl.	16 36·3 S.
S.T. Sp.	6 31 19		
⁎'s R.A.	6 41 31	Latitude	18 2·0 S.
⁎'s H.A. E.	0 10 12	Sin.	8·6483
Decl.	16° 36′·3 S.	Cos.	9·9815
Alt.	87 10·5 N.	Sec.	1·3073
		Sin.	9·9371

Azim. N. 59° 54′ E. gives
(p. 291*) Redn. at 1 min. 8·22′ × 10·2 m. = Redn. 83·8′
1° 23·8′

For Position-line on Plane Chart.

Az. N. 59·9° E. gives (p. 258*) lat. var. 2·44 s., which gives (p. 270*) posn.-line N. 31·4° W.



* Page references to "Tables of Calculated Hour-angles," &c., by Blackburne. 2nd Edition.

Extract of Azimuth Ex-meridian Table, from Blackburne's New Book.

Latitude.	AZIMUTHS.														
	58°·6	58°·7	58°·8	58°·9	59°·0	59°·1	59°·2	59°·3	59°·4	59°·5	59°·6	59°·7	59°·8	59°·9	60°·0
	REDUCTION TO THE MERIDIAN AT HOUR-ANGLE OF 1 MIN.														
0°	8′·42	8′·43	8′·45	8′·47	8′·49	8′·50	8′·52	8′·54	8′·56	8′·57	8′·59	8′·61	8′·63	8′·64	8′·66
2	8·41	8·43	8·45	8·46	8·48	8·50	8·52	8·53	8·55	8·57	8·58	8·60	8·62	8·64	8·65
4	8·40	8·41	8·43	8·45	8·47	8·48	8·50	8·52	8·54	8·55	8·57	8·59	8·61	8·62	8·64
6	8·37	8·39	8·41	8·42	8·44	8·46	8·47	8·49	8·51	8·53	8·54	8·56	8·58	8·60	8·61
8	8·34	8·35	8·37	8·39	8·40	8·42	8·44	8·46	8·47	8·49	8·51	8·52	8·54	8·56	8·58
9	8·31	8·33	8·35	8·37	8·38	8·40	8·42	8·43	8·45	8·47	8·48	8·50	8·52	8·54	8·55
10	8·29	8·31	8·32	8·34	8·36	8·37	8·39	8·41	8·43	8·44	8·46	8·48	8·49	8·51	8·53
11	8·26	8·28	8·30	8·31	8·33	8·35	8·37	8·38	8·40	8·42	8·43	8·45	8·47	8·48	8·50
12	8·23	8·25	8·27	8·28	8·30	8·32	8·34	8·35	8·37	8·39	8·40	8·42	8·44	8·45	8·47
13	8·20	8·22	8·23	8·25	8·27	8·29	8·30	8·32	8·34	8·35	8·37	8·39	8·40	8·42	8·44
14	8·17	8·18	8·20	8·22	8·23	8·25	8·27	8·29	8·30	8·32	8·34	8·35	8·37	8·39	8·40
15	8·13	8·15	8·16	8·18	8·20	8·21	8·23	8·25	8·26	8·28	8·30	8·31	8·33	8·35	8·36
16	8·09	8·11	8·12	8·14	8·16	8·17	8·19	8·21	8·22	8·24	8·26	8·27	8·29	8·31	8·32
17	8·05	8·07	8·08	8·10	8·12	8·13	8·15	8·17	8·18	8·20	8·22	8·23	8·25	8·27	8·28
18	8·01	8·02	8·04	8·05	8·07	8·09	8·10	8·12	8·14	8·15	8·17	8·19	8·20	8·22	8·24

EXAMPLE FROM PREVIOUS PAGE WORKED FROM TWO CALCULATED LONGITUDES AND PLOTTED ON PLANE CHART.

⁎ Capella to N.Wd.

	H. M. S.		
M.T.G.	6 24 18	True Alt.	24° 5′
M. ☉'s R.A.	0 14 29		
Sid. T.G.	6 38 47		

⁎ Sirius to N.Ed.

	H. M. S.		
M.T.G.	6 31 17	True alt.	87° 10½′
M. ☉'s R.A.	0 14 30		
Sid. T.G.	6 45 47		

Run N. 45° W. 1·5 m. = 1·0′ N. 1·1′ W.

Capella

	° ′ ″				
A.	24 5 0				
L.	17 49 0	Sec.	0·0213		
P.	135 55 6	Cosec.	0·1576	A.	·96 N.
				B.	3·24 N.
	177 49 6				
				C.	4·20 N.
S.	88 54 33	Cos.	8·2796		
S − A	64 49 33	Sin.	9·9567		Gives posn.-line S. 76·6° W.
		Sin.²	8·4152		

	H. M. S.
⁎'s H.A. West	1 14 15
⁎'s R.A.	5 10 35
Sid. T. Ship	6 24 50
Sid. T. Green.	6 38 47
Long. in time	0 13 57 =
	° ′ ″
Longitude	3 29 15 W.
Run	1 6 W.
Long at time of 2nd obsn.	3 30 21 W.

Sirius

	° ′ ″				
A.	87 10 30				
L.	17 48 0	Sec.	0·0213		
P.	73 23 42	Cosec.	0·0185	A.	6·86 N.
				B.	6·38 S.
	178 22 12				
				C.	0·48 N.
S.	89 11 6	Cos.	8·1530		
S − A	2 0 36	Sin.	8·5450		Gives posn-line S. 25½° E.
		Sin.²	6·7378		

	H. M. S.
⁎'s H.A. East	−0 10 43
⁎'s R.A.	6 41 31
Sid. T. Ship	6 30 48
Sid. T. Green.	6 45 47
Long. in time	0 14 59
Longitude	3° 44′ 45″ W.

Position on chart 17° 51′·1 S. and 3° 43′·3 W.

NOTE.—To get accurate results with so high an altitude when working from the meridian the D.R. longitude should not be more than 5′ or 6′ in error if the azimuth is large, or when working from a parallel of latitude the D.R. latitude should not be much in error when the azimuth is small. The slight error (0¼′) in latitude from the ex-meridian observation is due to neglect to interpolate in the reduction table for ⁎ Capella for 10′ of error in the D.R. latitude, and the 0·3′ of error in the longitude is due to curvature in the position-line in 12½′ of arc, with a small Z D.

POSITION OF SHIP BY COMBINED OBSERVATIONS OF SUN AND PLANET VENUS. LONGITUDE AND EX-MERIDIAN OBSERVATIONS.

1917.—December 29th, p.m. at ship, in approximate latitude 30° S., the true altitude of sun's centre was 52° 3′ when a chronometer (corrected) indicated M.T.G. 1 h. 51 m. 58 s., and about the same time the true altitude of planet Venus (centre) was 74° 43′ N. when chronometer (corrected) indicated M.T.G. 1 h. 53 m. 15 s. Run in interval N. 41° W. 0·3 m. = d. long. 0′ 15″ W. Required, position of ship at time of second observation.

⊙ P.M. Observation for Longitude.

	H. M. S.		° ′
M.T. Green.	1 51 58		
Eq. time	− 2 2	True alt. -⊖-	52 3 W.
A.T. Green.	1 49 56	Decl.	23 15 S.

By Blackburne's Hour-angle Tables.

	° ′		s. ′ s.
Lat.	30 0 S.	Dl. var.	+ 1·56 × 15 = + 23·40
Decl.	23 15 S.	Alt. var.	− 4·62 × 3 = − 13·86
Alt.	52 3		

		Cor. to Tabular H.A.	+ 9·54
	°		H. M.
L.	30 S.	Gives H.A.	2 47 54·2
D.	23 S.		
A.	52	Cor. A.T. Ship	2 48 3·7
		A.T. Green.	1 49 56·0
		Long. in time	0 58 7·7
		Longitude	14 31 55 E.
		Run	15 W.
		Long. at time of 2nd obsn.	14 31 40 E.

Planet Venus. Ex-meridian for Latitude.

	H. M. S.
M.T. Green.	1 53 15
Sid. T.G. noon	18 29 28·7
Accl.	+ 18·6
Sid. T. Green.	20 23 2·3
Long. E.	0 58 6·7
Sid. T. Sp.	21 21 9·0
✱'s R.A.	21 31 39
✱'s H.A.	10 30 E.

	° ′
True alt. of ✱	74 43·0 N.
Reduction	+ 11·5
Mer. alt.	74 54·5
M.Z.D.	15 5·5 S.
Decl.	15 4·8 S.
Lat.	30 10·3 S.

For Azim. and Reduction.

	M. S.		
H.A.	10 30	Sin.	8·6609
Dl.	15 5	Cos.	9·9848
Alt.	74 43	Sec.	0·5791
		Sin.	9·2248

Az. N. 9° 39½′ E. gives A. and B. cor. 6·80′ which gives Redn. at 1 min. = 1·10′ × 10·5 m = Reduction 11·55′.

Latitude by Spherical Calculation.

H.A.	M. S. 10 30	Cos.	9·999544		
Dl.	15° 4′ 48″	Cot.	0·569527	Cosec.	0·584747
Arc. (1)	15 5 42½ S.	Cot.	0·569071	Sin.	9·415679
		Alt.	74° 43′	Sin.	9·984363
,, (2)	15 4 33 S.	. . . .		Cos.	9·984789
Lat.	30 10 15½ S.				

True Position.

	° ′
Lat.	30 10·3 S.
Long.	14 31·7 E.

NOTE.—As the sun was on the prime vertical when the observation for longitude was taken 10′ of error in the latitude worked with makes no difference in the longitude; the hour-angle deduced from this longitude for calculation of ex-meridian would be correct, and consequently the latitude by ex-meridian will also be correct without any plotting on the chart or further calculation. The hour-angle worked by direct spherics by logarithms gives exactly the same result to the decimal of a second.

POSITION FROM TWO STELLAR OBSERVATIONS.

(Combining Chron. Long. Observation with an Ex-meridian below the Pole.)

1898.—On October 8th, at about 6h. 44m. p.m. A.T. at ship, observed altitude of ✳ Canopus east of meridian was 15° 14′ S., when a chronometer indicated mean time at Greenwich 7d. 19h. 36m. 16s., and after running on a true S. 55° E. course for three-quarters of a mile observed altitude of ✳ Fomalhaut to north-eastward was 49° 20′, when chronometer indicated 7d. 19h. 40m. 6s. Height of eye, 28 ft. Required, true bearing of stars and position of ship at time of *second* observation, the approximate position at the time being latitude 51° S. and longitude 163° E.

✳ Canopus to South-eastward.

	D. H. M. S.	
M.T.G.	7 19 36 20	
Long. 162° 59′ E.	+ 10 51 56	
M.T. Sp.	8 6 28 16	
M. ☉'s R.A.	+ 13 7 50·2	
Sid. T. at Sp.	19 36 6·2	
✳'s R.A.	− 6 21 43	
H.A.	13 14 23·2	W.
Supt.	1 14 23·2	E.
H.A. at *Inferior* Transit.		
Az. from Table*	S. 11½°	E.
Position-line	N. 78½	E.

	° ′	
Obsd. alt. ✳ Canopus	15 14·0	S.
Cor. 28 ft.	− 8·7	
True alt.	15 5·3	S.
Redn. from Table*	− 1 10·8	
Mer. alt.	13 54·5	S.
P. Dist.	37 22·0	S.
Lat.	51 16·5	S.
Run	0·4	S.
Lat. at 2nd obsn.	51 16·9	S.

	H. M. S.	
Sid. T. (G. noon)	13 4 37·0	
Accl. 19h. 36⅓m.	+ 3 13·2	
M. ☉'s R.A.	13 7 50·2	
	° ′	
✳'s Decl.	52 38	S
P. Dist.	37 22	S.

Run S. 55° E., 0·75 m. = 0·4′ S., 0·6′ E. = 1·0′ E.

✳ Fomalhaut to North-eastward.

	D. H. M. S.
M.T.G.	7 19 40 6
Sid. Time	+ 13 4 37
Accl.	+ 3 13·9
Sid. T.G.	8 47 56·9

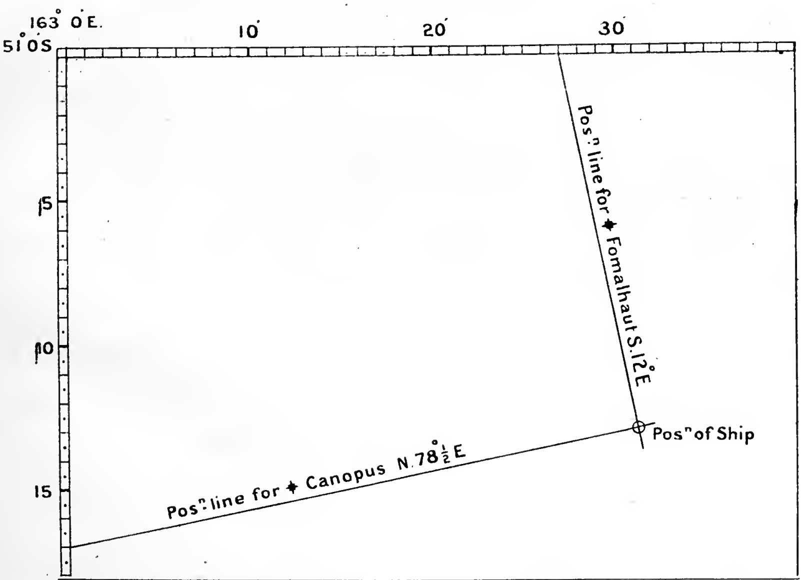
	° ′
Obsd. alt .of ✳ Fomalhaut	49 20·0
Cor. 28ft.	− 6·0
True alt.	49 14·0

	° ′ ″	
✳'s Decl.	30 9 24	S.
P. Dist.	59 50 36	

	° ′		
A	49 14		
L	51 0	Sec	0·20113
P	59 51	Cosec	0·06313
	160 5		
S	80 2½	Cos	9·23787
S − A	30 48½	Sin	9·70941
		Sin²	9·21154

	H. M. S.	
✳'s H.A.	− 3 10 20·6	E.
✳'s R.A.	22 52 5·7	
Sid. T. at Ship	19 41 45·1	
Sid. T. at Green	8 47 57	
Long in Time	10 53 48	
Longitude	163° 27′ 0″	E.

	′		
A	1·13	N.	
B	0·79	S.	
C	0·34	N. gives Azimuth	N. 78° E.
		Position-line	S. 12 E.



Position of ship, 51° 12¾′ S. 163° 31⅓′ E.

Note.—As time is often lost in getting hold of the log-book and working up the D.R. position, this example is worked with the nearest whole degree of latitude and longitude, and this will generally be near enough for a pretty accurate result when working by the improved "Sumner" method.

This problem worked closely by spherics gives within ¼′ of same result.

* Blackburne's and Westland's "Reduction and Azimuth Tables.'

TO FIND APPROXIMATE ALTITUDES AND BEARINGS OF SUITABLE STARS FOR OBSERVATION TO QUICKLY OBTAIN POSITION OF SHIP.*

1917.—On July 9th, soon after sunset, at about 7 h. 50 m. p.m. and 7 h. 54 m., in approximate latitude 47° N. and longitude 7° W., find what stars of first magnitude within the limits of the Reduction and Azimuth Tables would be suitable for quickly determining the ship's position, and the approximate altitudes and bearings of the stars. Height of eye, 40 ft.

First find the Sid. Time at ship = A.T. Sp. + A. ⊙'s R.A.

	H. M.
A.T. Sp.	7 50
A. ⊙'s R.A.	+7 13
Sid. T. Sp.	15 3

Next look up Table of Stars in order of R.A. (p. 283) and see what stars in adjacent quadrants come within the limits of this Sid. Time.

It will be seen at a glance that Capella to N.W. and Arcturus to S.W. are the two most suitable stars.

	H. M.		° ′
Sid. Time	15 3	*'s Decl.	45 54·9 N.
* Capella Mer. Pass.	17 11 below Pole.	P.D.	−44 5·1 N.
*'s H.A.	2 8	Lat.	47 0·0 N.
Lat.	47° N.	Mer. Alt.	2 54·9 N.
Gives Redn.	4° 8·8′	Redn.	+4 8·8
and Azim. N. 22° W.		Cor. 40 ft.	+13·7
		Alt. for sextant	7 17·4 N.

	H. M.		° ′
Sid. Time	15 7	*'s Decl.	19 36·7 N.
* Arcturus Mer. Pass.	14 12	Lat.	47 0·0 N.
*'s H.A.	0 55	M.Z.D.	27 23·3
Lat.	47° N.	Mer. Alt.	62 36·7 S.
Gives Redn. − 2° 13′		Redn.	−2 13
and Azim. S. 27° W.		True Alt.	60 23·7
		40 ft. Cor.	+7
		Alt. for sextant	60 30·7 S.

POSITION FROM COMBINED ALTITUDES OF TWO EX-MERIDIAN STARS.

1917.—On July 9th, soon after sunset, at about 7 h. 50 m. p.m., in approximate latitude 47° N. and longitude 7° W., the true altitude of * Capella was 7° 2·2′ N.W., when chronometer showed M.T.G. 8 h. 23 m. 48 s., and true altitude of * Arcturus was 60° 23·7′ S.W., when chronometer showed M.T.G. 8 h. 26 m. 59 s. Run in interval N. 32° E. 0·7 m. Required, position of ship at time of 2nd observation.

* Capella to N.W.

	H. M. S.		° ′		H. M. S.
M.T.G.	8 23 48	Alt. of *	7 2·2 N.	Sid. T.G. Noon	7 7 24·7
Long. 7° W.	− 28 0	Redn.	− 4 1·3	Accl. 8 h. 23½ m.	+1 22·7
M.T. Sp.	7 55 48	Mer. Alt.	3 0·9	M. ⊙'s R.A. (1)	7 8 47·4
M. ⊙'s R.A.	+7 8 47	*'s P.D.	44 5·1 N.	Accl. 3 m.	+0·5
Sid. T. Sp.	15 4 35	Approx. Lat.	47 6·0 N.	M. ⊙'s R.A. (2)	7 8 47·9
*'s R.A.	−5 10 35	Cor. for 6′	+0·4		
*'s H.A.	−9 54 0 W.	Lat.	47 6·4 N.		° ′
	12 0 0	Run	0·6 N.	*'s Decl.	45 54·9 N.
Supt. or below Pole H.A.	2 6 0 W.	Lat. at time of 2nd Obsn.	47 7·0 N.	P.D.	44 5·1 N.

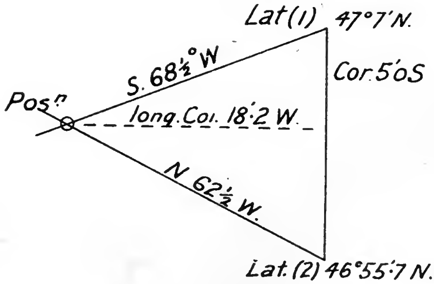
Gives from Reduction and Azim. Table (p. 346) Redn. 4° 1·3′, Azim. N. 21½° W.; Posn.-line S. 68½° W.

Run N. 32° E. 0·7 m. = 0·6′ N. 0·4′ E. d. long. 0·5′ E.

* Arcturus to S.W.

	H. M. S.
M.T.G.	8 26 59
Long. 6° 59½′	−27 58
M.T. Sp.	7 59 1
M. ⊙'s R.A.	+7 8 48
Sid. T. Sp.	15 7 49
*'s R.A.	14 11 55
*'s H.A.	0 55 54 W.

gives from Reduction and Azimuth Table (p. 325) Redn. 2° 16·8′ and Azim. S. 27½° W.; Posn.-line N. 62½° W.



	° ′
Alt. of *	60 23·7 S.
Redn.	+2 16·8
Mer. Alt.	62 40·5
M.Z.D.	27 19·5 N.
*'s Decl.	19 36·7
Approx. Lat.	46 56·2
Cor. for 4′	−·5
Lat.	46 55·7 N.

(Table IX, p. 301.)

	° ′				° ′		° ′
1st Obs. Lat.	47 7·0 N.	Azim. N. 21°·5 W. gives	0′·27 S. to W.	Lat.	47 7 N.	Long. (2)	6 59·5 W.
2nd ,, ,,	46 55·7 N.	,, S. 27·5 W. ,,	0·35 N. to W.	Cor.	5 S.	Cor.	18·2 W.
Diff. Lat.	11·3	Lat. Error	0·62 to 1′ of long.	Lat.	47 2 N.	Lng.	7 17·7 W.

Lat. Error.		D. Lat.		Long.		Long. Cor.		Lat. Cor.
0·62′	:	11·3	::	1·0′	:	18·2′ W. × 0·27′ = 5·01′ S.		

* This example is taken from "Tables of Calculated Hour-angles and Altitude Azimuths, Ex-meridian Tables, and Calculated Reductions and Azimuths of Bright Stars," by H. S. Blackburne. James Brown and Son, Glasgow. 10s. 6d.

POSITION FROM CALCULATED EX-MERIDIAN OF TWO STARS, EACH OVER FOUR HOURS FROM THE MERIDIAN OF INFERIOR TRANSIT.

1898.—On 10th Nov., at about 7 h. 25 m. p.m. A.T. at ship in lat. by D.R. 40° 30′ S. and long. 173° 0′ E. Observed altitude of ✳ Canopus was 17° 10′ to S.E. when a chronometer indicated M.T.G. 9 d. 19 h. 35 m. 28 s., and again after running east (true) for ½ m. observed altitude of ✳ α^2 Centauri 22° 51¼′ to S.W. when a chronometer indicated M.T.G. 19 h. 37 m. 48 s. Height of eye, 36 ft. Required the position of ship at the time of second observation.

1st Observation.

	D. H. M. S.
M.T.G.	9 19 35 28
Long. 173° E +	11 32 0
M.T. at Sp.	7 7 28
M. ☉'s R.A.	15 17 56·3
Sid. T. at Sp.	22 25 24·3
✳'s R.A.	6 21 44·3
✳'s H.A.	7 56 20·0 E
Supt.	4 3 40 E

	H. M. S.
Sid. T. at G. noon	15 14 43·2
Accl. 19h 35½m	+ 3 13·1
M. ☉'s R.A. (1st obsn.)	15 17 56·3
	+ ·2
M. ☉'s R.A. (2nd obsn.)	15 17 56·5

✳ Canopus to S.Ed.

	° ′
Obsd. alt. of ✳	17 10
36 ft. cor.	− 9
T. alt. of ✳	17 1

For Azimuth

A	0·473 S
B	1·50 S
C	1·973 S
dep.	1·500 gives Az. S 33° 41′ E
Pos.-line	S 56° 19′ W

Latitude by Ex-meridian.

H.A.	4h 3m 40s	Cos	9·68671
Decl	52° 38′	Cot	9·88289
Arc (1)	20° 21′·9 S	Tan	9·56960
„ (2)	20 11·6 S		
Lat.	40 33·5 S and posn.-line S 56·3° W		

	° ′		
Az.	33 41	Cos	9·92018
Alt.	17 1	Cot	0·51421
Arc (2)	20 11·6	Cot	0·43439

2nd Observation.

	H. M. S.
M.T.G.	19 37 49
Long. 173° 0½′ E	11 32 2
M.T. at Sp.	7 9 51
M. ☉'s R.A.	15 17 56·5
Sid. T. at Sp.	22 27 47·5
✳'s R.A.	14 32 43·0
✳'s H.A.	7 55 4·5 W
Supt.	4 4 55·5 W

For Azimuth.

H. M. S.	4 4 56	Sin	9·9428
Dl.	60° 25′	Cos	9·6934
Alt.	22° 43′	Sec	0·0351
Az. S 27° 59′ W or posn.-line N 62° W		Sin	9·6713

✳ α^2 Centauri to S. Wd

	° ′
Obsd. alt. of ✳	22 51·2
36 ft. Cor.	− 8·2
T. alt. of ✳	22 43·0

Latitude by Ex-meridian.

H.A.	4h 4m 56s	Cos	9·68236
Dl.	(0° 25′	Cot	9·75411
Arc (1)	15° 16′·8 S	Tan	9·43647
„ (2)	25 21·9 S		
Lat.	40 38·7 S and posn.-line N 62° W		

	° ′		
Az.	27 59	Cos	9·94600
Alt.	22 43	Cot	0·37815
Arc (2)	25 21·9	Cot	0·32415

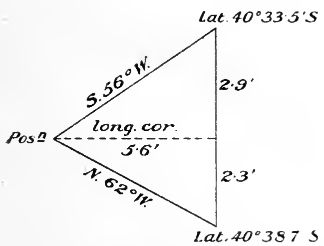


Table M (page 156).

1st obsn. Az. S. 34° E. and Lat. 40° 33′·5 S. gives ·51′ lat. error S. to Wd.
2nd obsn. Az. S. 28 W. and Lat. 40 38·7 S. gives ·41 lat. error N. to Wd.

D. lat. 5·2 ÷ ·92 = long. cor. 5·6′ W. × ·51′ = lat. cor. 2·86′ S.

	° ′		° ′
Lat. (1) =	40 33·5 S	Long. (1)	173 0·5 E
Cor.	2·9 S	Cor.	5·6 W
Lat. in	40 36·4 S	Long. in	172 54·9 E

Note.—These observations worked as two chronometer problems gave exactly the same results, but had the second ex-meridian latitude been worked with the azimuth as found by the A and B Tables the latitude would have been nearly 1′ in error, due to a slight change in the star's declination in twelve years; the B Table having been calculated for ✳'s declination in 1910 It is well to remember, however, that the best results will always be obtained by using the sine method with hour-angle and altitude in the calculation of the azimuth, and this is especially the case where the altitude is high.

BELOW POLE EX-MERIDIAN AND POSITION-LINE.

1910.—On April 1st, soon after sunset, at 6h. 42m. p.m., observed altitude of ✳ α Cygni (Deneb) 8° 46′ W. of meridian when a chronometer indicated mean time at Greenwich 7h. 34m. 13s. Approximate latitude 52° N., and longitude 12° W. Required, latitude of meridian, and position-line from it.

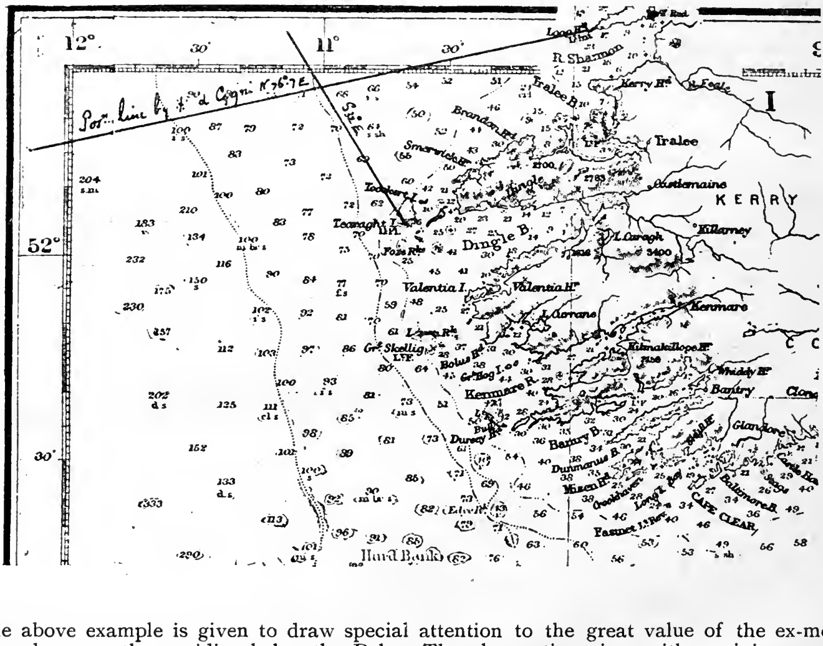
✳ α Cygni to Northward.

	H. M. S.
M.T. Green.	7 34 13
Long. 12° W.	− 48 0
M.T. Sp.	6 46 13
M. ⊙'s R.A.	+ 0 37 6
Sid. T. at Sp.	7 23 19
✳'s R.A.	20 38 21
✳'s H.A.	10 44 58 W.
Supt.	1 15 2 W.

H.A. at *Inferior* Transit.

	H. M. S.
Sid. T. (G. noon)	0 35 51·6
Accl. 7h. 34m.	+ 1 14·6
M. ⊙'s R.A.	0 37 6·2
	°
Azimuth from table*	N. 13·3 W.
	90·0
Position-line	N. 76·7 E.

	° ′
Obsd. alt. of ✳	8 46·0 N.
Cor. (40ft.)	− 12·3
T. alt.	8 33·7
Redn.*	− 1 20·2
Mer. alt.	7 13·5 N.
P.D.	45 2·9 N.
Lat.	52 16·4 N.
Cor. for 16′	+ 0·4
Lat.	52 16·8 N.



The above example is given to draw special attention to the great value of the ex-meridian problem when near the meridian below the Pole. The observation gives with a minimum amount of work (when within the limits of these tables) the latitude on a certain meridian, and the position-line from this meridian. The curvature of this position-line is seen at a glance from the azimuth table, which is given on the same page as the reduction table. In this example the change of azimuth only amounts to 0·7 of a degree in 4m. of time, or 1° of longitude.

The position-line at Loop Head would be N. 78° E.

This position-line crossed by a bearing of Tearaght Island light (if sighted) would give a good reliable position, provided the observation was good. A sounding in conjunction with this position-line would also give a fairly accurate position.

The latitude and position-line could also have been found at the same time from these tables by ✳ Sirius, the position-line of which would have then been S. 79° E. The crossing of these two position-lines would give an excellent latitude, but the longitude would not be reliable, as the angle is small, and both observations are west of the meridian.

* From Blackburne's and Westland's "Azimuth and Reduction Tables."

FORMULÆ FOR CALCULATION OF EX-MERIDIAN LATITUDE WHEN AZIMUTH IS KNOWN.

It will be seen from the accompanying figure that if we drop a perpendicular on the meridian from D at M the following arcs, P M arc (1), and Z M arc (2), are readily calculated. The sum or difference of arc (1) and arc (2) = latitude.

Rule for Object above the Pole.

Name arc (1) *same* as declination.
Name arc (2) *contrary* to bearing of object—*i.e.*, N. or S. of the prime vertical.
Add like and *subtract* unlike names, which will give the required latitude.

Formulæ of Calculation.

Cot. P M arc (1) = Cos H.A. × Cot. decl.
Tan Z M arc (2) = Cos. Az. × Cot. Alt.

Rule for Object below the Pole.

Name both arc (1) and arc (2) same as the decl.
Latitude = Sum of arc (1) and arc (2).

Formulæ for the Calculation.

H.A. = Supplement of H.A. from upper meridian.
For Arc (2) use comp. of Z M, or M N, then
Tan. arc (1) = Cos. H.A. × Cot. decl.
Cot. arc (2) = Cos. Az. × Cot. alt.
P M + M N = comp. P Z = latitude.

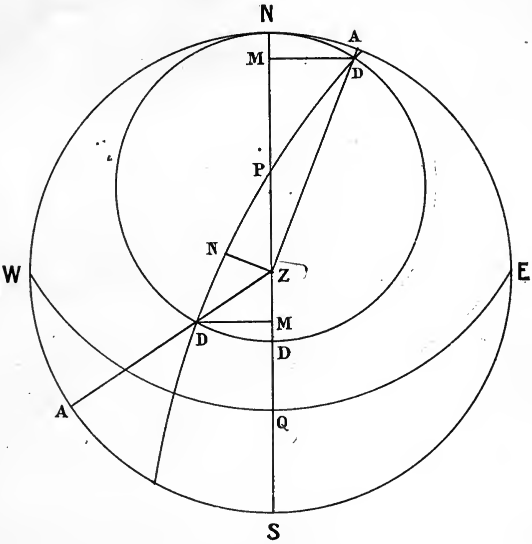


FIGURE SHOWING:
Latitude, 60° N. Declination, 30° N.
Hour-angle, 2 hours.
Arc (1), P M or comp. Q M.
Arc (2), Z M or comp. M N or M S.

Arc (1) is found by the same formula as is used on p. 97, and the same arc is used for arc (2), but with a trifle less work; and as an ex-meridian outside the ordinary limits of ex-meridian tables is seldom of much use without the azimuth, this method is recommended in preference, if the azimuth is calculated with the H.A. and altitude. This method should always be used in preference when the declination of object is small. The writer's attention was first drawn to this excellent method of obtaining the latitude by a letter to the *Nautical Magazine*, August, 1899, p. 581, from E. S. Haynes, master of the tug "Cuzuni," and the value of it has been further impressed on him by a study of Admiral H. E. Purey Cust's valuable little book on "Sumner's" method. In this work Admiral Cust, R.N. (late Hydrographer to the Admiralty), strongly advocates this method.

Formulæ to compute Altitudes.

Using the accompanying figure. From Z drop a perp. on the hour circle at N. This will be outside the usual spherical triangle when the hour-angle is over 6 h. Arc (1) = P N. Arc (2) = P D − P N = N D when H.A. is less than 6 h. Arc (2) = P D + P N when H.A. is more than 6 h. Then Tan. Arc (1) = Cos. P × Cot. Lat.

Sin. Alt. = sin. lat. × sec. arc (1) × Cos. arc (2).

H.A. 6 h = 90° *Formula*.
Sin. Alt. = sin. decl. × sin. lat.

EXTRACTS FROM PRESS REVIEWS

ON THE

Tables for Azimuths, Great-circle Sailing,

AND

REDUCTION TO THE MERIDIAN.

[From the *Syren and Shipping*, 23rd August, 1905, and 4th November, 1908.]

Captain Blackburne's labour-saving aids for navigators are known all over the world by his brethren who keep themselves posted in up-to-date methods; and this collection of tables now published leaves nothing to desire by the navigator wishful of finding his ship's geographical position, or the error of her compass, with the least possible chance of error, and in the shortest possible interval of time, anywhere within the usual limits of navigation. There is one point in connection with these tables which is deserving of the close consideration of the Board of Trade. Although the practical seaman will almost invariably use such data at sea, yet the Board compels the candidates for certificates to plod along in a way which gives admittedly erroneous results under certain conditions. . . . That the Board of Trade should examine along one line—that of antiquity—and that practical navigators should work along quite another line—that of labour-saving tables—is surely ludicrous. The New Zealand Government requested the Board of Trade to allow the use in the examination-room of tables like those of Captain Blackburne's, together with improved methods of working, but the request has not been granted. We sincerely trust that the Board of Trade will see fit to adopt modern methods by allowing the candidates permission to use the A, B, C Azimuth Tables of Blackburne, or any similar labour-saving work. More convenient in form or more utilitarian in application these tables could not be.

[Extract from the *Nautical Magazine*, September and December, 1908.]

In the new edition of his well-known A, B, C, and D Tables, Captain Blackburne must surely have cut all existing records. . . . Captain Blackburne is as indefatigable as ever in his efforts to lighten the labours of those who go down to the sea in ships. Early in the present year he published an edition of the A, B, and C Tables. They are now republished, with an appendix entitled Ex-meridian and Azimuth Inspection Tables. . . . The author seems here to have hit upon a happy idea, for we have a maximum of information in a minimum of space; and, as he points out, once calculated, the reduction and azimuths will hold good for a long series of years.

[Extract from the *Shipping World*, 9th December, 1908.]

The new issue of his A, B, and C Tables for Azimuth, &c., is undoubtedly the most complete and comprehensive volume on this subject yet published. . . .

[Extract from the *United Service Magazine*, December, 1908.]

These tables now make it possible to determine the position of the ship more readily at any time, and with less trouble than ever before.

[Extract from the *Mariner*, 15th December, 1908.]

Sufficient is it to say that the various navigation tables, rules and examples, including a new and improved " Sumner " method, make the volume on all counts one of the most complete and authoritative that we know in nautical literature.

[Extract from *Shipping Illustrated*, New York, 5th December, 1909.]

These tables, as set forth in the present edition, are the most complete and comprehensive Azimuth and Ex-meridian Tables for practical work yet published.

[Extract from *New Zealand Military Journal*, October, 1913.]

As an adjunct to marching or flying by day and night without a compass may be taken another work for the reason that the tables it contains practically enabled a revolution to be made in the old methods of night marching. This is "Tables for Azimuths and Great-circle Sailing," by H. S. Blackburne.

Inset—Azimuth.

EXTRACTS FROM LETTERS TO THE AUTHOR

RE THE

TABLES FOR AZIMUTHS AND REDUCTION TO THE MERIDIAN.

Mr. W. H. Sweny, Chief Officer, P. and O. s.s. "Mooltan," writes,—

I have now had your new edition of Azimuth and Reduction to the Meridian Tables in use for one Australian voyage, using them almost daily for stellar observation. The results obtained have been surprising, and so satisfactory that I have discarded all other books on these problems.—23rd January, 1909.

Captain John Owen, Teacher of Navigation, Cardiff, writes,—

Your method of solving the Time Azimuth problem by the A, B, C Tables is concise, and easy of solution. If these tables were more generally known I think seafarers would use them in preference to Burdwood's or any other special tables employed at present.—25th January, 1909.

Mr. John Blencowe, late Second Officer, B.I. s.s. "Shirala," writes,—

In Lyttelton I obtained a copy of your new Azimuth and Ex-meridian Tables, and on showing them to my brother officers they were so taken with them that they all bought a copy for themselves. I think the tables are splendid, and for the sake of the profession will do all I can to make them more widely known.—9th February, 1909.

Captain P. Thompson, late Secretary to the Local Marine Board, and Examiner of Masters and Mates, London; Author of "Navigation Simplified," &c., writes,—

Having gone carefully through your book I am satisfied that your short methods of solving the most practical problems in navigation will commend themselves to the officers of the Mercantile Marine; for myself, I cannot too strongly express how highly I appreciate what you have done to simplify the every-day calculations of those navigators whose duties in the ordinary work of a steamer leave them little leisure for working out a ship's position by the longer methods expected from them when undergoing the Board of Trade examination for a qualifying certificate.—12th February, 1909.

Mr. S. C. Warner, Chief Officer, P. and O. s.s. "Socotra," writes,—

I should like to add my humble testimonial to the new A, B, C book you have brought out, and to tell you how much it is appreciated here on board. I certainly think it is the very best book of navigation ever printed.—13th September, 1910.

Captain George Burton, Instructor of Cadets, Ocean Training-ship "Port Jackson," writes,—

I have shown your book to all our senior cadets, and advised them to procure copies. The book is certainly altogether the most complete education in modern navigation yet published.—26th November, 1910.

Captain Herbert H. Edmonds, Teacher of Navigation, Sydney, Australia, writes,—

Of the two systems the Marcq-Hilaire and that which you so strongly advocate I decidedly prefer the latter. . . . I like your Ex-meridian Tables; it is no extra work finding the azimuth beforehand, since it is required in the after-plotting. It is a great pity the Board of Trade do not keep abreast of the times in adopting this system.—17th December, 1910.

Captain J. King Davis, commanding the Australasian Antarctic Expedition, S.Y. "Aurora," writes,—

Macquarie Island, 16th December, 1911.

We have already several copies of the previous edition, as I use nothing else, and have insisted on my officers learning to use them, as they are the only suitable tables for our work, and are much handier, in my opinion, for any latitude.

Mr. H. ROCHFORD HUGHES, Navigating Officer, H.M. Cable Steamer "Iris," writes,

Having just returned from Sydney, New South Wales, after sounding proposed track for the new cable from Auckland to that port, I hasten to write to say what a boon your splendid A, B, C Tables have proved during the expedition, more especially the C^2 Table. . . . I have tried "new navigation" methods, and all the principal tables of the day, during my search for the shortest and most accurate methods, and have come to the conclusion that for our work your tables and system generally are the best.—5th and 8th February, 1912.

Commander RICHARD HYDE, R.N., Navigation School, Portsmouth, writes,—

I have just returned from a cruise with our gunboats the "Dryad" and "Harrier," when I used your tables exclusively for finding azimuths, and personally I prefer them to Burdwood or Weir's diagram.—12th April, 1912.

Lieutenant EDWARD R. G. R. EVANS, R.N., who Commanded the British Antarctic Expedition R.Y.S. "Terra Nova" from England to Antarctic in 1910, writes,—

I shall endeavour to bring your tables into more general use in the Navy, as I consider them *facile princeps* of their kind. Burdwood and Davis are so cumbersome. I think you will be pleased to hear that on the southern journey I used your tables exclusively, and worked out all magnetic variations and true bearings by means of them up to latitude 85° and hence to 88° almost by exterpolation.—17th April, 1912.

Captain L. B. BENNETT GILLMAN, s.s. "Matatua," writes,—

Before leaving Wellington on our last homeward voyage I procured a 1911 edition of your tables for azimuth and reduction to the meridian. I think it is the cheapest and best book on practical navigation ever offered to the seafaring community. Had the price been two guineas instead of six shillings it would have been nearer the intrinsic value of the book. The tables are absolutely the last word in modern and up-to-date navigation.—30th April, 1912.

Lieutenant HARRY PENNELL, R.N., Commanding the British Antarctic Expedition R.Y.S. "Terra Nova," writes,—

I have used your A, B, C and Ex-meridian Tables whenever the "Terra Nova" has made a voyage south, and have found them invaluable. In parts of Ross Sea the variation changes 1° for every four miles run at right angles to the lines of equal variation, and the large number of azimuths that it is necessary to take during the twenty-four hours would mean a prohibitive amount of work if your all-embracing tables were not at hand.—3rd June, 1912.

Captain THOMAS LIDDLE, Sunderland, writes,—

Your last 1911 edition is undoubtedly the best book published for navigators, and the cheapest.—28th December, 1912.

Lieut.-Col. W. A. TILNEY, commanding 17th Lancers, Sialkot, India, writes,—

Your tables have practically enabled us to revolutionize night marching, as you see by the enclosed report.—29th July, 1913.

Lieut. E. BALLARD DALBY, R.N.R., Extra Master (London), H.M.S. "Carmania," at sea, writes,—

The officers who joined this ship in Liverpool when she was converted into an armed cruiser were drawn from nearly every company under the British flag, and no less than *six* of them had brought copies of your A and B Tables with them. It is a *significant* fact that *once* an officer commences to use them he *never* goes back to Burwood and Davis, where interpolation is in many cases tedious. Your tables certainly are the tables *par excellence* for an officer of the watch.—10th May, 1915.

EXTRACTS FROM PAPER REVIEWS

AND LETTERS ON

MODERN UP-TO-DATE NAVIGATION.

[The *Nautical Magazine*, Glasgow, July, 1914.]

One advantage that should accrue to this little book and to all those who use it is the fact that its editor and compiler, in addition to being a good theoretical man, is also an experienced navigator and practical shipmaster. Having spent some time in preparing candidates for the Board of Trade examinations, he has acquired the "knack" of putting things as men can understand them, and in a way in which they will be most useful to them. The book throughout shows a sound knowledge of the subject, and will, with the help of the worked examples and chartlets, surely be the means of a larger number of navigators becoming interested in modern up-to-date navigation.

[The *United Service Gazette*, London, 15th October, 1914.]

The book contains some nautical tables of great value for ready position-finding from observations of two stars out of the meridian. They also give by simple inspection the true bearing within certain limits of a few bright stars, and the calculated reduction to the meridian up to about an hour or a little over from the meridian, enabling a navigator to determine his latitude and position-line from a single observation of a star, with little more trouble than when the star is on the meridian. The book also contains several fully worked-out examples showing the use of the tables, with some well executed diagrams illustrating the problems; the different methods of determining the ship's position by the "Old Sumner Method," the "Improved Sumner Method," and the "New Navigation Method" are contrasted, and the author clearly exposes some of the fallacious claims which have been made by one or two recent writers for the so-called "New Navigation" or "Marcq St. Hilaire" system of dealing with observations for position-finding. The value of the below Pole reduction and Azimuth Tables is well illustrated by the example on page 47. Small as the work is, having been printed on thin paper, it contains the tabulated results of about 19,900 calculations.

Captain H. H. Edmonds, Teacher of Navigation, Sydney, writes,—

I thoroughly endorse all you say on the Marcq St. Hilaire method; it is the truest thing that has been written on the subject.

Captain T. L. Evans, F.R.G.S., Manager, Donald Steamship Company, Bristol, writes,—

I am convinced that the book "Modern Up-to-date Navigation" is one of the best auxiliaries to the navigator that I have yet perused, and would have been glad of such a book during my career as master in the foreign service. I must congratulate you on the very excellent methods which you have published in your book, which I consider most valuable to all navigators who wish to ascertain the position of their ship, by the splendid methods contained in your book, and which are so simply illustrated and explained that any one with an ordinary amount of intelligence can grasp without any instructions except that which is contained in your book. I shall certainly have the greatest pleasure in recommending it to all my younger friends who are now masters and officers of ships.

Captain Thos. Liddle, Sunderland, writes,—

It's wonderful the information you have got in such a small space, and so far I have never seen any book to equal it. Why the Board of Trade will not sanction the use of your books for the examinations I cannot understand.

Captain J. W. Maxwell, King Edward VII Nautical School, London E, writes,—

I agree with your remarks, and see in this little work how very clear and sound your knowledge is.

EXTRACTS FROM PRESS REVIEWS AND LETTERS

ON

TABLES OF CALCULATED HOUR-ANGLES

AND

ALTITUDE AZIMUTH TABLE, ETC.

[Extract from *Shipping Illustrated*, New York, U.S.A., April 3rd, 1915.]

The main purpose of these tables is to make as easy as possible the problem of finding the ship's position from combined altitudes of the sun, moon, or stars, and especially to facilitate the much-neglected practice of determining the ship's position from two or three stars at twilight, a few minutes before sunrise, and a few minutes after sunset. By the aid of the calculated star reduction and azimuth tables in this book a latitude and position line can be obtained at any time when the stars are visible almost as easily as by meridian altitude of a star. This method is the simplest yet brought forth for quickly and accurately solving the problem of determining position from stellar observations out of the meridian, or for determining latitude and position line from a single observation, which may be used in connection with a sounding, or the bearing of some mountain peak or light.

Captain G. N. Tomlin, R.N., H.M.S. "Agincourt," writes,—"I have already found your tables most useful and simple; I hope they will meet with the success they deserve."

Commander Harry Pennell, R.N., H.M.S. "Duke of Edinburgh," writes,—"These hour-angle and azimuth tables reduce sights now to the minimum of work conceivable when they fall within its limits. . . .

Captain Thos. Washington, U.S. Navy, Hydrographer, writes,—"I am sure your tables are going to prove to be a most useful and accurate help for shipmasters and others interested in navigation; I congratulate you upon the excellence of the work."

Captain Herbert H. Edmonds, Teacher of Navigation, Sydney, writes,—"Received my copy of your book with which I am greatly pleased. I have tested a few critical cases and find results all that can be desired, both with hour-angle and azimuths. What a boon to have all you want with a position-line in one act."

Commander Edward R. G. R. Evans, R.N., H.M.S. "Viking," writes,—"Very many thanks for 'Tables of Calculated Hour-angles, Star Reductions, and Azimuth Tables.' Like all your works this is excellent, and simple enough for any navigator who will read the explanation and work a few examples until he is familiar with their use—then they are a pleasure."

Lieut. E. B. Dalby, R.N.R., H.M.S. "Carmania," writes,—"I have purchased a copy of your new book, and hasten to say how much I like it. The printing is good, the arrangement could not be bettered, the explanations are copious, and the whole book a marvel of cheapness. I have checked the hour-angles in Table 1 by working out quite a number of sights in the usual way and then working the same sights by this table. In no case did I get a difference of over a second, and in most cases the error was under half a second. The facility and accuracy with which the azimuth is obtained through the latitude variation (with a little mental interpolation in some cases) is certainly remarkable. For your star reduction and azimuth tables I have nothing but admiration. For stellar navigation *I know of nothing to equal these incomparable tables.*"

Captain Robert W. Ferguson, of Brisbane, Queensland, writes,—"The tables are magnificent, and the most singular part of them is the truly graphic Altitude Azimuth Table No. IV, it being the best and most ingenious I have ever seen. . . . These and your 'Tables for Azimuth, Great-circle Sailing, and Reduction to the Meridian' 90° N. to 90° S. are of inestimable value to the science of navigation, and your methods supersede all others in accuracy and brevity, for which you deserve well and worthily at the hands of the profession."

Authority: Marcus F. Marks, Government Printer, Wellington, 1916.

[Extract from *N.Z. Gazette* No. 103, 14th Sept., 1916.]

Notice to Mariners No. 74 of 1916.

NEW EDITION OF NAUTICAL TABLES PUBLISHED.

Marine Department,
Wellington, N.Z., 11th September, 1916.

NOTICE is hereby given that the New Zealand Marine Department have just published a fourth edition of "Tables for Azimuth, Great Circle Sailing, and Reduction to the Meridian," Lats. 90° N. to 90° S.

The azimuth tables, which for some years have been acknowledged to be the most complete and comprehensive azimuth tables published, remain the same as in last edition. They include limits from pole to pole for sun, moon, and all the stars in the heavens, for any hour angle from the meridian.

The reduction tables, though still very compact, have been more than doubled in size since issue of last edition, and their limits of use have been considerably enlarged. They are available for all latitudes and declinations, and for any altitude, often with more than double the hour-angle limits from the meridian given in the ex-meridian tables in the standard works of navigation in general use.

They are also available for below pole hour-angles as well as the hour-angles from upper meridian. As an illustration of the wide limits of these tables an example is given on page 158, which will no doubt surprise navigators generally. The position of ship is accurately determined from two ex-meridian latitudes where the reduction to both zenith distances was over 9°, hour-angles over 1 h. 40 m., and azimuth over 40° from the meridian.

The accuracy of resulting position from these observations is proved by a fresh calculation of two longitudes from a near parallel of latitude, by the ordinary double altitude method, with the use of the A and B Tables. Other new and interesting problems have also been added in this edition.

Published by Marine Department, New Zealand Government, Wellington, New Zealand. Price 6s.

Sold in New Zealand at the shipping offices and by booksellers. Sole agents in United Kingdom: James Brown and Son, 52–58 Darnley Street, Glasgow, Scotland.

GEORGE ALLPORT,
Secretary.