FIELD MANUAL

RAYMOND

Railroad Field Manual

for

Civil Engineers

BY

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PREFACE

THIS book is for field use rather than for office use, though it is adapted to a large percentage of office work. It is made on a new plan which is not expected to gain immediate favor but which it is hoped will eventually appeal to railroad engineers as sensible and worthy of adoption, because its use will save time and lessen the liability of error. The degree is divided decimally instead of sexagesimally.

When the author was a young man engaged on railroad location he knew one or two engineers who had one vernier of their transits graduated to read hundredths of degrees for greater convenience in setting out curves. They would have done all their work in decimals if tables had been available.

When the author was planning this book he gave much thought to the question of the division of the degree and the forms of the tables that would be most convenient and time saving for the field men who might use the book. He remembered that in practically every curve problem it is necessary at some stage of the solution to transpose from minutes and seconds to decimals of a degree or vice versa. He remembered that to lay out subchords would require much less mental effort if the transit were divided to read decimals of degrees rather than minutes. He wrote to a half dozen of the leading instrument makers to learn what would be the cost of changing the verniers on an old transit to read decimals of a degree and to know whether there would be any difference in price between two instruments ordered new, one to be divided in the usual way and the other divided to read decimals of a degree. All but one of the makers gave a price in the neighborhood of $20 for changing the verniers on an old instrument, and no difference in cost for new instruments. The author then wrote to about fifty engineers, chief engineers of railroads, independent practicing engineers, and professors of railroad engineering in colleges and asked their opinions as to the desirability of a change in practice from sexagesimal to decimal division of the degree, and whether or not a table book based on the decimal division would help to bring about the change, if desirable. All but one of these engineers replied that the change is desirable. The one was a professor of railroad engineering. Of the others all but two thought it doubtful if the change could be brought about, owing to the conservatism of the craft. Two chief engineers of prominent eastern roads discussed the matter with their assistants and were so favorably impressed with the plan as to say that they would adopt it if they had the tables to make it possible. Those who thought it unlikely that the change could be brought about cited the difficulty with the introduction of the metric system as an argument. To this the author replies that the adoption of the metric system involves a change of unit. The adoption of the decimal division of the degree involves no change of unit and merely does for angle work what American engineers long since did for their linear work. The book still retains the 90° quadrant. To be sure, minutes and even seconds have become a sort of unit, but so were inches, chains, and links. These are practically done away with for surveyor's use and there would seem to be as good reason for doing away with minutes and seconds. Practically every computation involving trigonometric logarithms requires less work by the decimal system than it does by the sexagesimal system. Instruments will be graduated to read to hundredths of degrees directly or 0.6 of a minute.

Although the author believes that the "degree" of a curve should be the angle subtended by an arc of one hundred feet instead of a chord he has not adopted that definition, but has adhered to the definition approved by the American Railway Engineering Association.

Five-place tables have been adopted as representing as high a degree of precision as is warranted by the field work. Computations of tables and some few other calculations require more extended tables but these practically always arise in connection with office work where it is assumed that there are, or may be if necessary, six-place, seven-place, and even ten-place tables. The author has used seven-place tables, and occasionally ten-place tables, for the computation of the tables of this book. Persons do not always realize it, but considerable additional time is required to use six-place tables over that required for five-place tables. In his "Plane Surveying for Classroom and Field," the author discusses this question at some length and works examples to show the relative precision of four-place and five-place tables. The conclusions of the discussion are as follows:

"1. It is useless to make linear measurements with a precision of more than 1 in 3500 if angles are to be read to the nearest minute only.

"2. It is useless to use tables of more than four places for angles read to the nearest minute only.

"It is difficult for many persons to bring themselves to use the smaller tables because they seem to see a greater precision in the use of tables giving results that are true to five and six significant figures, and fail to realize that the field work on which the computations depend does not warrant any such degree of precision, which is therefore only a seeming precision that is misleading and does not exist in fact. It is true that linear measurements can in general be made with greater precision than the angle work gives and, hence, it is the angle work that fixes the precision and the tables to be used. The following rules may be formulated:

" *For angles read to the nearest minute use four-place tables.*

" *For angles read to less than* 0° 00′ 30″ *use five-place tables.*

" For work in general requiring certainty in the third significant figure use four-place tables, in the fourth significant figure five-place tables, and in the fifth significant figure six-place tables.

" But it must be remembered that no ordinary surveying work is precisely enough done to warrant results certain to more than four significant figures, and that five-place tables are as extensive as are warranted by any land, topographic, railroad, or other surveys except the most refined city, bridge, and geodetic surveys.

" Computation labor is increased about 50 per cent by using five-place tables instead of four-place tables, and about one-third by using six-place tables instead of five-place tables."

Before using the logarithmic tables even persons somewhat familiar with the use of logarithms should read the explanatory text preceding the tables.

The text concerning spirals and the spiral tables are based on the American Railway Engineering Association's ten-chord spiral. The author is indebted to Mr. Jenks B. Jenkins, Valuation Engineer for the Baltimore and Ohio Railroad and Chairman of the Track Committee of the A.R.E.A., and who devised the ten-chord spiral, for assistance with this part of the work.

The author has endeavored to include beside bare tables — many of which have been computed for this book and are not found in other books — just so much of explanation of common field problems as would seem necessary to refresh the memory of young engineers who have not had these drilled into them by long experience.

A few tables have been taken from other books. Acknowledgment is due Mr. Shelby S. Roberts for courteous permission to use tables from his "Track Formulæ and Tables" and to the American Book Company for permission to use plates from the author's "Plane Surveying for Classroom and Field " for Tables I, XXIV, and LXXXIII, and to use the matter of Tables LXX, LXXI, and LXXVII.

Great care has been taken with the computations and the proof-reading but it is incredible that so many new computations should have been made and the results printed without error. The author will esteem it a favor if persons will report any errors that may be discovered to him or to the publishers.

This book may be used about as conveniently as other books based on the sexagesimal division of the degree by those who do not care to have their instruments changed or to adopt the decimal division for their final records, and it has some features not found in existing field books that may commend it to field men. Therefore, it is put forth under the hope that it may find immediate approval in a few places; that it may be tried in some other places; and that familiarity and experience with it will convince users that the author is not a mere faddist but has contributed something of real use to the fraternity.

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STATE UNIVERSITY OF IOWA,
IOWA CITY, IOWA,
1915.

CONTENTS

RAILROAD FIELD MANUAL

CHAPTER I

SIMPLE, COMPOUND, AND VERTICAL CURVES

SIMPLE CURVES

Fundamental notations and equations. — The curve running from A to B in Fig. 1,

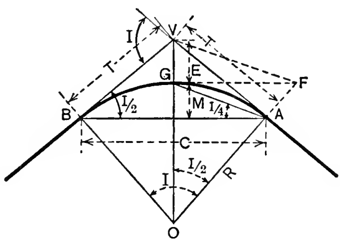

FIG. 1.

$A = T. C.$ (tangent-curve).
$B = C. T.$ (curve-tangent).
$V = P. I.$ (point of intersection of tangents).
I = central angle or deflection angle of tangents.
T = tangent distance $= R \tan \frac{1}{2} I.$
C = long chord $= 2 R \sin \frac{1}{2} I.$
M = middle ordinate $= R \operatorname{vers} \frac{1}{2} I.$
E = external distance $= R \operatorname{exsec} \frac{1}{2} I.$
$E = T \tan \frac{1}{4} I.$
$C = 2 M \cot \frac{1}{4} I.$
$C = 2 T \cos \frac{1}{2} I.$

$$GA = \frac{C}{2} \sec \frac{1}{4} I.$$

Definition. — The "degree" of a curve in American practice is the angle subtended at the center of a circular arc by a chord of 100 feet. In Latin American states where the metric system is used the "degree" is the angle subtended by a chord of 20 meters. If R be the radius and D the degree of a curve, then, in American practice,

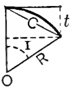

FIG. 2.

$$R = \frac{50}{\sin \frac{1}{2} D}.$$

Table I gives R and its logarithm for various degree curves.

Tangent offset $t = R \text{ vers } I = \dfrac{C^2}{2R}$. The tangent offset for one station is tabulated in Table I. For a subchord c the tangent offset is

$$t_c = t_{100} \frac{c^2}{10{,}000}.$$

Approximate Fundamental Relations. — Approximately, radii are inversely as the degrees or

$$\frac{R}{R'} = \frac{D'}{D} \text{ (approx.).}$$

Radius of a 1° curve is 5729.65 = 5730 (approx.).

$$R_D = \frac{5730}{D} \text{ (approx.).}$$

Tangent distance for a $D°$ curve of central angle I is

$$T_D = \frac{T_{1°}}{D} \text{ (approx.).}$$

Table II gives tangent distances for a 1° curve and various values of I, and Table III gives corrections to $T_D = \dfrac{T_{1°}}{D}$ for more precise results. Values of C, M, and E, for $D°$ curves are also found approximately by dividing the values for a 1° curve for a given I by D. Table IV gives values of E for a 1° curve.

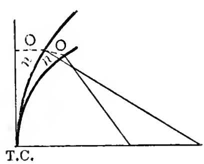

FIG. 3.

A curve departs from a tangent approximately thus: $O = \frac{7}{8} n^2 D$, n being the number of stations from the tangent point and D the degree of curve. Two curves of degrees D and D_1 depart from each other by the same approximate law, substituting the difference of degrees $D - D_1$ or $D_1 - D$ of the D of the foregoing formula.

The deflection angle Δ, for a chord of 100 feet is $\frac{1}{2}D$; for a sub-chord, c, it is given by

$$\sin \delta = \frac{c}{2R},$$

or, with sufficient exactness for all curves under about 8°,

$$\delta = \frac{c}{100} \times \frac{D}{2} = 0.5\,cD, \text{ in hundredths of degrees,}$$

or $$\delta = 0.3\,cD, \text{ in minutes.}$$

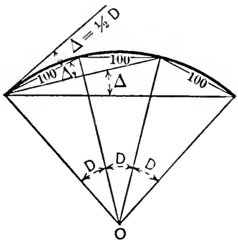

FIG. 4.

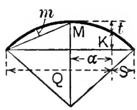

FIG. 5.

The ordinate from a chord at any point given by its distance from the center is

$$K = \sqrt{(R+a)(R-a)} - \sqrt{\left(R+\frac{c}{2}\right)\left(R-\frac{c}{2}\right)}$$

or, approximately,

$$K = M\left(1 - 4\frac{a^2}{c^2}\right).$$

Whence, for

$$\left.\begin{aligned} a &= \tfrac{1}{8}c, & K &= \frac{15}{16}M; \\ a &= \tfrac{1}{4}c, & K &= \frac{3}{4}M; \\ a &= \tfrac{3}{8}c, & K &= \frac{7}{16}M. \end{aligned}\right\} \text{(approx.).}$$

If the point is given by the distance from one extremity,

$$K = \frac{Q \times S}{2R} \text{ (approx.)}$$

$$= \frac{872\,Q \times S \times D}{10{,}000{,}000} \text{ (approx.).}$$

Approximately

$$M = \frac{C^2}{8R}, \qquad m = \frac{M}{4}.$$

Location by Offsets from Long Chord. —

$$AG = 2R\sin\frac{n}{2}D, \quad n = \text{number stations } A \text{ to } G,$$

$$BF = 2R\sin\frac{n-2}{2}D,$$

$$Ab = fG = \frac{AG - BF}{2}; \quad CE = 100 \text{ or } 2R\sin\frac{n-4}{2}D,$$

$$bc = ef = Bc' = e'F = \frac{BF - CE}{2}, \text{ etc.}$$

$$Bb = Ff = Hh - Hh'' = R(\text{vers}\tfrac{1}{2}nD - \text{vers}\tfrac{1}{2}(n-2)D), \text{ etc.,}$$

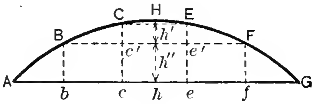

FIG. 6.

or

$$Ab = fG = 100\cos\frac{n-1}{2}D.$$

$$Bc' = e'F = 100\cos\frac{n-3}{2}D, \text{ etc.}$$

$$Bb = Ff = 100\sin\frac{n-1}{2}D.$$

$$Cc' = Ee' = 100\sin\frac{n-3}{2}D.$$

Use natural functions and move decimal.

In the particular figure $Hh' = 50\tan\frac{1}{4}D$ because n is odd.

If the number of chords is not more than 8 or the degree more than 20 and of an even number of tenths, the long chords and middle ordinates may be taken from Tables V and VI, thus:

AG = long chord of n stations.

$$Ab = fG = \frac{\text{long chord of } n \text{ stations} - \text{long chord of } (n-2) \text{ stations}}{2}, \text{ etc.}$$

$Bb = Ff$ = middle ordinate for n stations − middle ordinate for $(n - 2)$ stations, etc.

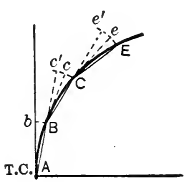

FIG. 7.

Location from Chord Produced. —

$Bb = R$ vers D, or $100 \sin \frac{1}{2} D$ for natural functions.

Bb = tangent offset of Table I.

AV or XA gives line of tangent.

Stretch the tape from A to B so that Bb shall measure as above. Produce AB to c', one tape length, and swing about B until $c'C = 2\,Bb$. Produce BC to e' and swing about C until $e'E = 2\,Bb$, etc. If the curve begins with a subchord, l, swing l feet above A to B (Fig. 8) until $Bb = l \sin \frac{l}{100} \frac{D}{2}$. Swing $100 - l$ about A to F until $Ff = (100 - l) \sin \frac{100 - l}{100} \frac{D}{2}$. Produce FB to c', 100 feet, and swing about B until $c'C = 2 \times 100 \sin \frac{1}{2} D$, or twice the tangent offset of Table I. Produce BC, etc., as

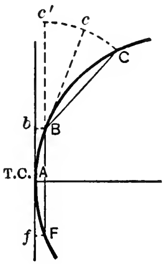

FIG. 8.

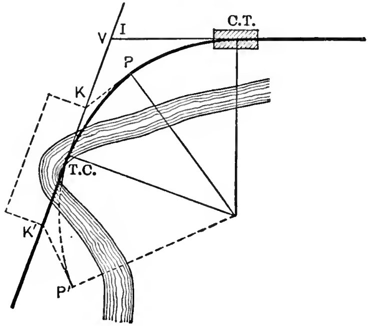

FIG. 9.

before. For ending use the same method reversed. Supposing the curve to be running from C to B to A, locate F by producing CB, measure over Ff and Bb, and establish A between f and b at l feet from B.

Problems. — *Suggestions for passing obstacles.* If TC only is inaccessible:

(*a*) Run to V to CT and run curve backwards.

(*b*) Assume a point on the curve beyond the obstacle; compute the tangent distance for the point, as $TC - K$; run to K; deflect angle at K and run to P and run the curve backward and forward. If CT is inaccessible the same methods with obvious modifications may be used.

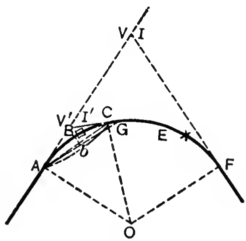

FIG. 10.

To pass an obstacle on a curve one of the methods suggested by the figure may be used. The line AbC is run as ABC would be run only with the center on the opposite side.

To change TC or CT. First method: Assume or know the necessary change in tangent distance and compute a new degree of curve. Second method: Assume a new D a round number, probably such as to accomplish the desired result; change in CT or TC = change in tangent distances, or $m = T_2 - T_1 = (R_2 - R_1) \tan \frac{1}{2} I$.

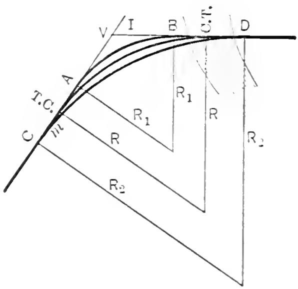

FIG. 11.

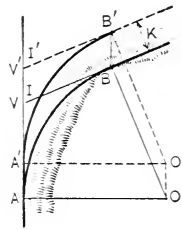

FIG. 12.

A curve ends in VB or V'B'; required to end in V'B' or VB. Degree does not change. It is necessary to find change in A.

$$AA' = VV' = BB' = OO' = \frac{K}{\sin I}.$$

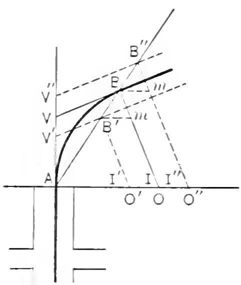

FIG. 13.

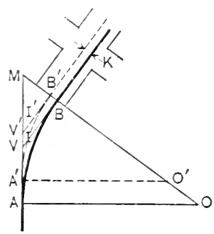

FIG. 14.

A curve ends in VB; required to end in V'B' or V''B'' without changing A. Degree changes.

$$R' = R \mp \frac{K}{\text{vers } I}, \text{ that is, change in } R = \frac{K}{\text{vers } I}.$$

A curve ends in VB; required to end in V'B'. A and *D* change. $R' = R \pm \dfrac{K}{\text{exsec } I}$, according as B' is inward or outward from B.

$AA' = (R - R') \tan I$, or $K \cot \frac{1}{2} I$, A being moved ahead or back according as R' is less or greater than R.

A curve ends in VB; required to end in VB'. Without changing degree $AA' = R\,(\tan \frac{1}{2} I - \tan \frac{1}{2} I')$, and A is moved forward or back according as I' is less or greater than I. Changing degree and keeping A fixed, T is unchanged. $\therefore\ R' = \dfrac{T}{\tan \frac{1}{2} I'}$ or $T \cot \frac{1}{2} I'$.

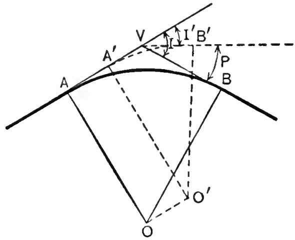

FIG. 15.

A curve ends in VB; required to end in V'B. Fig. 16. D and A change.

$$R' = R\,\frac{\text{vers}\, I}{\text{vers}\, I'}.$$

$AA = (R \sin I - R' \sin I')$ and A is moved forward or back according as I' is greater or less than I.

A curve ends in VB; required to end in V'B'. Fig. 17.

1. Assume new $R' \lesseqgtr R$ according as B' is inside or outside VB. Then

$$\cos \alpha = 1 - \frac{K}{R - R'} \quad \text{or} \quad 1 - \frac{K}{R' - R},$$

$$n \text{ stations} = \frac{\alpha}{D}.$$

Begin at n stations from B and run in curve of D' for n' stations $= \dfrac{\alpha}{D'}$.

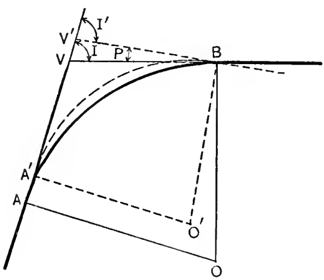

FIG. 16.

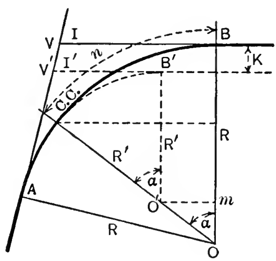

FIG. 17.

2. Or, retaining A and letting n be total number of stations A to B,

$$D' = D \pm \frac{K}{\frac{7}{8} n^2}, \text{ approx.}$$

D' will be greater or less than D according as $V'B'$ lies inside or outside of VB. Take D' nearest round number that will be sufficiently exact and run the curve D' for n' stations $= \frac{I}{D'}$.

3. Or, assuming a new degree less or greater than the original according as the tangent is to be thrown out or in, find n of Method 1 by

$$n = \sqrt{\frac{8\,K}{7\,(D - D')}},\ \text{approx.}$$

$(D - D')$ is to be taken as the difference of degrees, subtracting the smaller from the larger. $\alpha = nD$, $n' = \frac{\alpha}{D'}$ to make the tangents parallel. Run curve of degree D' from $C.C.$

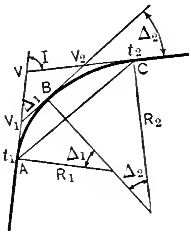

FIG. 18.

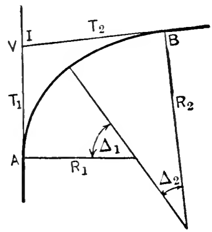

FIG. 19.

COMPOUND CURVES

Given R_1, R_2, Δ_1, and Δ_2; required T_1 and T_2. Fig. 18.

$$V_1 V_2 = t_1 + t_2.$$

Solve triangle VV_1V_2 for V_1V and V_2V.

$$T_1 = VV_1 + t_1; \quad T_2 = VV_2 + t_2.$$

Given I, T_1, T_2, and R_1; required R_2, Δ_1, and Δ_2. Fig. 19.

$$\cot \tfrac{1}{2}\Delta_2 = \frac{T_2 + T_1 \cos I - R_1 \sin I}{T_1 \sin I - R_1 \operatorname{vers} I},$$

$$\Delta_1 = I - \Delta_2,$$

$$R_2 = R_1 + \frac{T_1 \sin I - R_2 \operatorname{vers} I}{\operatorname{vers} \Delta_2}. \qquad \text{(a)}$$

Given I, T_1, T_2, and R_2; required R_1, Δ_1, and Δ_2.

$$\cot \tfrac{1}{2}\Delta_1 = \frac{R_2 \sin I - T_1 - T_2 \cos I}{R_2 \operatorname{vers} I - T_2 \sin I},$$
$$\Delta_2 = I - \Delta_1,$$
$$R_1 = R_2 - \frac{R_2 \operatorname{vers} I - T_2 \sin I}{\operatorname{vers} \Delta_1}. \tag{b}$$

Given I, T_1, R_1, and Δ_1; required Δ_2, R_2, and T_2.

$$\Delta_2 = I - \Delta_1.$$

R_2 is given by equation (a) above.

$$T_2 = (R_2 - R_1) \sin \Delta_2 + R_1 \sin I - T_1 \cos I.$$

Given I_1, T_2, R_2, and Δ_2; required Δ_1, R_1, and T_1.

$$\Delta_1 = I - \Delta_2.$$

R is given by equation (b) above.

$$T_1 = R_2 \sin I - T_2 \cos I - (R_2 - R_1) \sin \Delta_1.$$

To end a compound curve in a new tangent, parallel to that first located.

(*a*) Move the curve parallel to itself along the first tangent, a distance $AA' = \dfrac{K}{\sin I}$.

(*b*) Retaining the first branch, changing only the degree of the second,

$$R_2' = R_2 \pm \frac{K}{\operatorname{vers} \Delta_2},$$
$$R_1' = R_1 \pm \frac{K}{\operatorname{vers} \Delta_1},$$

according as the curve ends with the larger or shorter radius.

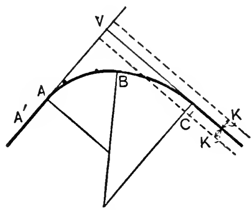

FIG. 20.

(*c*) Retaining both degrees, changing the Δ's and the station of CC. If the new tangent is *inside* and the longer radius ends the curve the CC is advanced; if the new tangent is outside the CC is moved back; if the shorter radius ends the curve the movement of the CC is reversed. The new values for the *final* Δs are had from

$$\operatorname{vers} \Delta_2' = \operatorname{vers} \Delta_2 \pm \frac{K}{R_2 - R_1},$$
$$\operatorname{vers} \Delta_1' = \operatorname{vers} \Delta_1 \pm \frac{K}{R_2 - R_1}.$$

To change the direction of the final tangent by a given amount. Solve the triangle $VV'C$ for the new final tangent and the change in the initial tangent. The new I being known, retain the first radius and solve for the new final radius and the two central angles, by preceding equations.

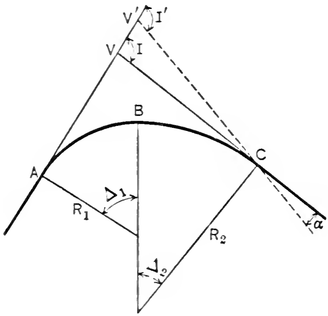

FIG. 21.

Vertical Curves

The rate of change of grade in passing sags and summits in the grade line, as recommended by the American Railway Engineering Association, is: For first-class railways change not more than 0.1 foot per station on summits and not more than 0.05 foot per station in sags; for second-class roads not more than double these rates. How to determine the elevation of the several stations on the vertical curve will be shown by two examples. The first step is to determine the length of the curve; it will be convenient to adopt a rate of change that will give an even number of stations for the length.

Example 1. Two grades, -0.8 and $+0.6$, meet at station 462 where the elevation is 723. Required a vertical curve to connect with a change of 0.1 per station. The total change in rate is $0.8 + 0.6 = 1.4$, giving 14 stations $= 1.4 \div 0.1$, of curve, or 7 stations each side of the vertex. The beginning of the curve is therefore at sta. $462 - 7 = 455$ and the end is at $455 + 14 = 469$. The elevation of 455 is $723.0 + 7 \times 0.8 = 728.6$; the elevation of sta. 469 is $723.0 + 7 \times 0.6 = 727.2$.

The rate of change for the first station is taken at half the station rate of change or 0.05. Therefore the elevation of

sta. 456 = 728.6 − (0.8 − 0.05) = 728.6 − 0.75 = 727.85
457 = elev. 456 − (0.8 − 0.15) = 727.85 − 0.65 = 727.20
458 = elev. 457 − (0.8 − 0.25) = 727.20 − 0.55 = 726.65
459 = elev. 458 − (0.8 − 0.35) = 726.65 − 0.45 = 726.20
460 = elev. 459 − (0.8 − 0.45) = 726.20 − 0.35 = 725.85
461 = elev. 460 − (0.8 − 0.55) = 725.85 − 0.25 = 725.60
462 = elev. 461 − (0.8 − 0.65) = 725.60 − 0.15 = 725.45
463 = elev. 462 − (0.8 − 0.75) = 725.45 − 0.05 = 725.40
464 = elev. 463 − (0.8 − 0.85) = 725.40 + 0.05 = 725.45

$465 = \text{elev. } 464 - (0.8 - 0.95) = 725.45 + 0.15 = 725.60$
$466 = \text{elev. } 465 - (0.8 - 1.05) = 725.60 + 0.25 = 725.85$
$467 = \text{elev. } 466 - (0.8 - 1.15) = 725.85 + 0.35 = 726.20$
$468 = \text{elev. } 467 - (0.8 - 1.25) = 726.20 + 0.45 = 726.65$
$469 = \text{elev. } 468 - (0.8 - 1.35) = 726.65 + 0.55 = 727.20$

It will be noticed that the final elevation agrees with that computed above; this proves the work. It will also be noticed that after the bottom of the sag is passed the elevations repeat themselves in reverse order. The bottom of the sag is not always the same station as the apex. This depends on the relative rates of the grades.

Example 2. — Two grades, −0.2 and −1.0, meet at station 867.0, where the elevation is 466.0. To connect the grades with a vertical curve changing at the rate of 0.1 per station. Total change in rate 0.8. Length of curve 8 stations. Beginning of curve sta. 867 − 4 = 863; end = sta. 871.

Elev. sta. $863 = 466 + 4 \times 0.2 = 466.8$
Elev. sta. $871 = 466 - 4 \times 1.0 = 462.0$
Elev. sta. $864 = \text{elev. } 863 - (0.2 + 0.05) = 466.8 - 0.25 = 466.55$
Elev. sta. $865 = \text{elev. } 864 - (0.2 + 0.15) = 466.55 - 0.35 = 466.20$
Elev. sta. $866 = \text{elev. } 865 - (0.2 + 0.25) = 466.20 - 0.45 = 465.75$
Elev. sta. $867 = \text{elev. } 866 - (0.2 + 0.35) = 465.75 - 0.55 = 465.20$
Elev. sta. $868 = \text{elev. } 867 - (0.2 + 0.45) = 465.20 - 0.65 = 464.55$
Elev. sta. $869 = \text{elev. } 868 - (0.2 + 0.55) = 464.55 - 0.75 = 463.80$
Elev. sta. $870 = \text{elev. } 869 - (0.2 + 0.65) = 463.80 - 0.85 = 462.95$
Elev. sta. $871 = \text{elev. } 870 - (0.2 + 0.75) = 462.95 - 0.95 = 462.00$

The work is proved since 462.0 is the elevation first found for station 871. There is no summit or bottom in this case as both grades are of the same sign.

TABLE I

Radii and their logarithms, and tangent offsets, and middle ordinates, for 100 feet chords of curves of degrees given. The degrees are given in degrees and decimals of a degree.

Deg. D	Radius R	Logarithm Log R	Tan. Off. t	Mid. Ord. m	Deg. D	Radius R	Logarithm Log R	Tan. Off. t	Mid. Ord. m
°					°				
0.00	∞	∞	.000	.000	1.00	5729.65	3.75813	.873	.218
.02	286478.90	5.45709	.017	.004	.02	5617.31	.74953	.890	.223
.04	143239.45	.15606	.035	.009	.04	5509.29	.74110	.908	.227
.06	95492.97	4.97997	.052	.013	.06	5405.34	.73283	.925	.231
.08	71619.73	.85503	.070	.017	.08	5305.24	.72471	.942	.236
.10	57295.79	4.75812	.087	.022	.10	5208.79	3.71674	.960	.240
.12	47746.49	.67894	.105	.026	.12	5115.78	.70891	.977	.244
.14	40925.57	.61199	.122	.031	.14	5026.03	.70122	.995	.248
.16	35809.87	.55400	.140	.035	.16	4939.38	.69367	1.012	.253
.18	31831.00	.50285	.157	.039	.18	4855.66	.68625	.030	.257
.20	28647.90	4.45709	.175	.044	.20	4774.74	3.67895	1.047	.262
.22	26043.55	.41570	.192	.048	.22	4696.46	.67177	.065	.266
.24	23873.26	.37791	.209	.052	.24	4620.72	.66471	.082	.271
.26	22036.86	.34315	.227	.057	.26	4547.38	.65776	.100	.275
.28	20462.80	.31097	.244	.061	.28	4476.33	.65092	.117	.279
.30	19098.61	4.28100	.262	.065	.30	4407.46	3.64419	1.134	.284
.32	17904.95	.25297	.279	.070	.32	4340.69	.63756	.152	.288
.34	16851.73	.22664	.297	.074	.34	4275.90	.63103	.169	.292
.36	15915.52	.20182	.314	.079	.36	4213.02	.62459	.187	.297
.38	15077.86	.17834	.332	.083	.38	4151.97	.61825	.204	.301
.40	14323.97	4.15606	.349	.087	.40	4092.66	3.61201	1.222	.305
.42	13641.88	.13487	.367	.092	.42	4035.02	.60585	.239	.310
.44	13021.80	.11467	.384	.096	.44	3978.98	.59977	.257	.314
.46	12455.64	.09537	.401	.100	.46	3924.47	.59378	.274	.319
.48	11936.66	.07688	.419	.105	.48	3871.44	.58787	.292	.323
.50	11459.19	4.05915	.436	.109	.50	3819.83	3.58204	1.309	.327
.52	11018.46	.04212	.454	.113	.52	3769.57	.57629	.326	.332
.54	10610.37	.02573	.471	.118	.54	3720.62	.57061	.344	.336
.56	10231.43	.00994	.489	.122	.56	3672.92	.56501	.361	.340
.58	9878.62	3.99470	.506	.127	.58	3626.43	.55948	.379	.345
.60	9549.34	3.97997	.524	.131	.60	3581.10	3.55402	1.396	.349
.62	9241.30	.96573	.541	.135	.62	3536.89	.54862	.414	.353
.64	8952.51	.95194	.559	.140	.64	3493.76	.54329	.431	.358
.66	8681.26	.93858	.576	.144	.66	3451.67	.53803	.449	.362
.68	8425.90	.92562	.593	.148	.68	3410.59	.53283	.466	.367
.70	8185.16	3.91303	.611	.153	.70	3370.46	3.52769	1.483	.371
.72	7957.80	.90079	.628	.157	.72	3331.28	.52261	.501	.375
.74	7742.73	.88889	.646	.161	.74	3292.99	.51759	.518	.380
.76	7539.97	.87731	.663	.166	.76	3255.57	.51263	.536	.384
.78	7345.67	.86603	.681	.170	.78	3218.99	.50772	.553	.388
.80	7162.03	3.85504	.698	.175	.80	3183.23	3.50287	1.571	.393
.82	6987.35	.84431	.716	.179	.82	3148.25	.49807	.588	.397
.84	6820.99	.83385	.733	.183	.84	3114.03	.49332	.606	.401
.86	6662.36	.82363	.750	.188	.86	3080.55	.48863	.623	.406
.88	6510.95	.81364	.768	.192	.88	3047.78	.48398	.641	.410
.90	6366.26	3.80388	.785	.196	.90	3015.71	3.47939	1.658	.415
.92	6227.87	.79434	.803	.201	.92	2984.29	.47484	.675	.419
.94	6095.36	.78500	.820	.205	.94	2953.53	.47034	.693	.423
.96	5968.38	.77586	.838	.209	.96	2923.40	.46589	.710	.428
.98	5846.58	.76690	.855	.214	.98	2893.87	.46148	.728	.432
1.00	5729.65	3.75813	.873	.218	2.00	2864.93	3.45711	1.745	.436

Deg. D	Radius R	Logarithm Log R	Tan. Off. t	Mid. Ord. m	Deg. D	Radius R	Logarithm Log R	Tan. Off. t	Mid. Ord. m
°					°				
2.00	2864.93	3.45711	1.745	.436	3.00	1910.08	3.28105	2.618	.655
.02	2836.57	.45279	.763	.441	.02	1897.43	.27817	.635	.659
.04	2808.76	.44852	.780	.445	.04	1884.95	.27530	.653	.663
.06	2781.50	.44428	.798	.449	.06	1872.63	.27245	.670	.668
.08	2754.76	.44008	.815	.454	.08	1860.48	.26962	.687	.672
.10	2728.52	3.43593	1.832	.458	.10	1848.48	3.26681	2.705	.676
.12	2702.79	.43181	.850	.463	.12	1836.63	.26402	.722	.681
.14	2677.53	.42773	.867	.467	.14	1824.93	.26125	.740	.685
.16	2652.74	.42369	.885	.471	.16	1813.39	.25849	.757	.689
.18	2628.40	.41969	.902	.476	.18	1801.99	.25575	.775	.694
.20	2604.51	3.41573	1.920	.480	.20	1790.73	3.25303	2.792	.698
.22	2581.05	.41180	.937	.484	.22	1779.6[illegible]	.25032	.810	.702
.24	2558.01	.40790	.955	.489	.24	1768.62	.24764	.827	.707
.26	2535.38	.40404	.972	.493	.26	1757.78	.24496	.845	.711
.28	2513.14	.40022	.990	.497	.28	1747.06	.24231	.862	.716
.30	2491.29	3.39642	2.007	.502	.30	1736.48	3.23967	2.879	.720
.32	2469.81	.39266	.024	.506	.32	1726.02	.23705	.897	.724
.34	2448.71	.38894	.042	.511	.34	1715.69	.23444	.914	.729
.36	2427.96	.38524	.059	.515	.36	1705.48	.23185	.932	.733
.38	2407.56	.38158	.077	.519	.38	1695.39	.22927	.949	.737
.40	2387.50	3.37794	2.094	.524	.40	1685.42	3.22671	2.967	.742
.42	2367.77	.37434	.112	.528	.42	1675.56	.22416	.984	.746
.44	2348.36	.37077	.129	.532	.44	1665.83	.22163	3.002	.751
.46	2329.28	.36722	.147	.537	.46	1656.19	.21911	.019	.755
.48	2310.49	.36370	.164	.541	.48	1646.68	.21661	.036	.759
.50	2292.01	3.36022	2.181	.545	.50	1637.28	3.21412	3.054	.764
.52	2273.83	.35676	.199	.550	.52	1627.98	.21165	.071	.768
.54	2255.92	.35332	.216	.554	.54	1618.78	.20919	.089	.772
.56	2238.30	.34992	.234	.559	.56	1609.69	.20674	.106	.777
.58	2220.95	.34654	.251	.563	.58	1600.70	.20431	.124	.781
.60	2203.87	3.34319	2.269	.567	.60	1591.81	3.20189	3.141	.785
.62	2187.05	.33986	.286	.572	.62	1583.02	.19949	.159	.790
.64	2170.49	.33656	.304	.576	.64	1574.32	.19709	.176	.794
.66	2154.17	.33328	.321	.580	.66	1565.72	.19472	.193	.799
.68	2138.10	.33003	.339	.585	.68	1557.22	.19235	.211	.803
.70	2122.26	3.32681	2.356	.589	.70	1548.80	3.19000	3.228	.807
.72	2106.66	.32359	.373	.593	.72	1540.48	.18766	.246	.812
.74	2091.29	.32041	.391	.598	.74	1532.24	.18533	.263	.816
.76	2076.13	.31726	.408	.602	.76	1524.10	.18301	.281	.820
.78	2061.20	.31412	.426	.607	.78	1516.14	.18071	.298	.825
.80	2046.48	3.31101	2.443	.611	.80	1508.06	3.17842	3.316	.829
.82	2031.97	.30792	.460	.615	.82	1500.17	.17614	.333	.833
.84	2017.66	.30485	.478	.620	.84	1492.36	.17387	.351	.838
.86	2003.56	.30180	.496	.624	.86	1484.63	.17162	.368	.842
.88	1989.65	.29878	.513	.628	.88	1476.98	.16937	.385	.847
.90	1975.93	3.29577	2.530	.633	.90	1469.41	3.16714	3.403	.851
.92	1962.40	.29279	.548	.637	.92	1461.91	.16492	.420	.855
.94	1949.05	.28982	.565	.641	.94	1454.49	.16271	.438	.860
.96	1935.88	.28688	.583	.646	.96	1447.15	.16051	.455	.864
.98	1922.89	.28396	.600	.650	.98	1439.88	.15833	.473	.868
3.00	1910.08	3.28105	2.618	.655	4.00	1432.69	3.15615	3.490	.873

Deg. D	Radius R	Logarithm Log R	Tan. Off. t	Mid. Ord. m	Deg. D	Radius R	Logarithm Log R	Tan. Off. t	Mid. Ord. m
°					°				
4.00	1432.69	3.15615	3.490	.873	5.00	1146.28	3.05929	4.362	1.091
.02	1425.56	.15399	.507	.877	.02	1141.72	.05756	.379	.095
.04	1418.51	.15183	.525	.881	.04	1137.19	.05583	.397	.100
.06	1411.52	.14969	.542	.886	.06	1132.70	.05411	.414	.104
.08	1404.60	.14755	.560	.890	.08	1128.24	.05240	.432	.108
.10	1397.76	3.14543	3.577	.895	.10	1123.82	3.05070	4.449	1.113
.12	1390.98	.14332	.595	.899	.12	1119.43	.04900	.467	.117
.14	1384.26	.14122	.612	.903	.14	1115.08	.04731	.484	.122
.16	1377.61	.13912	.629	.908	.16	1111.00	.04571	.501	.126
.18	1371.02	.13704	.647	.912	.18	1106.47	.04394	.519	.130
.20	1364.49	3.13497	3.664	.916	.20	1102.22	3.04227	4.536	1.135
.22	1358.03	.13291	.682	.921	.22	1098.00	.04060	.554	.139
.24	1351.31	.13076	.699	.925	.24	1093.81	.03894	.571	.143
.26	1345.28	.12881	.717	.929	.26	1089.66	.03729	.589	.148
.28	1339.00	.12678	.734	.934	.28	1085.53	.03564	.606	.152
.30	1332.77	3.12476	3.752	.938	.30	1081.44	3.03400	4.623	1.156
.32	1326.61	.12274	.769	.943	.32	1077.38	.03237	.641	.161
.34	1320.49	.12074	.786	.947	.34	1073.34	.03074	.658	.165
.36	1314.44	.11874	.804	.951	.36	1069.34	.02912	.676	.170
.38	1308.44	.11675	.821	.956	.38	1065.37	.02750	.693	.174
.40	1302.50	3.11478	3.839	.960	.40	1061.43	3.02589	4.711	1.178
.42	1296.61	.11281	.856	.964	.42	1057.51	.02429	.728	.183
.44	1290.77	.11085	.874	.969	.44	1053.63	.02269	.746	.187
.46	1284.98	.10890	.891	.973	.46	1049.77	.02109	.763	.191
.48	1279.25	.10696	.909	.978	.48	1045.94	.01951	.780	.196
.50	1273.57	3.10502	3.926	.982	.50	1042.14	3.01793	4.798	1.200
.52	1267.93	.10310	.943	.986	.52	1038.37	.01635	.815	.205
.54	1262.35	.10118	.961	.991	.54	1034.62	.01478	.833	.209
.56	1256.82	.09927	.978	.995	.56	1030.90	.01322	.850	.213
.58	1251.33	.09737	.996	.999	.58	1027.21	.01166	.868	.218
.60	1245.89	3.09548	4.013	1.004	.60	1023.55	3.01011	4.885	1.222
.62	1240.50	.09360	.031	.008	.62	1019.91	.00856	.902	.226
.64	1235.16	.09172	.048	.012	.64	1016.29	.00702	.920	.231
.66	1229.86	.08986	.065	.017	.66	1012.70	.00548	.937	.235
.68	1224.61	.08800	.083	.021	.68	1009.14	.00395	.955	.239
.70	1219.40	3.08615	4.100	1.026	.70	1005.60	3.00243	4.972	1.244
.72	1214.24	.08430	.118	.030	.72	1002.09	.00091	.990	.248
.74	1209.12	.08247	.135	.034	.74	998.60	2.99939	5.007	.253
.76	1204.04	.08064	.153	.039	.76	995.14	.99788	.024	.257
.78	1199.00	.07882	.170	.043	.78	991.68	.99638	.042	.261
.80	1194.01	3.07701	4.188	1.047	.80	988.28	2.99488	5.059	1.266
.82	1189.06	.07520	.205	.052	.82	984.89	.99339	.077	.270
.84	1184.15	.07341	.222	.056	.84	981.52	.99190	.094	.274
.86	1179.28	.07162	.240	.060	.86	978.17	.99041	.112	.279
.88	1174.45	.06983	.257	.065	.88	974.66	.98885	.129	.283
.90	1169.66	3.06806	4.275	1.069	.90	971.54	2.98746	5.146	1.287
.92	1164.91	.06629	.292	.074	.92	968.26	.98599	.164	.292
.94	1160.19	.06453	.310	.078	.94	965.01	.98453	.181	.296
.96	1155.52	.06278	.327	.082	.96	961.77	.98307	.199	.301
.98	1150.88	.06103	.345	.087	.98	958.56	.98162	.216	.305
5.00	1146.28	3.05929	4.362	1.091	6.00	955.37	2.98017	5.234	1.309

Deg. D	Radius R	Logarithm Log R	Tan. Off. t	Mid. Ord. m	Deg. D	Radius R	Logarithm Log R	Tan. Off. t	Mid. Ord. m
°					°				
6.00	955.37	2.98017	5.234	1.309	7.00	819.02	2.91329	6.105	1.528
.02	952.20	.97873	.251	.314	.02	816.69	.91206	.122	.532
.04	949.05	.97729	.268	.318	.04	814.37	.91082	.140	.536
.06	945.92	.97585	.286	.322	.06	812.07	.90959	.157	.541
.08	942.81	.97442	.303	.327	.08	809.78	.90837	.175	.545
.10	939.72	2.97300	5.321	1.331	.10	807.50	2.90714	6.192	1.550
.12	936.65	.97158	.338	.335	.12	805.23	.90592	.209	.554
.14	933.60	.97016	.356	.340	.14	802.98	.90471	.227	.558
.16	930.57	.96875	.373	.344	.16	800.74	.90349	.244	.563
.18	927.58	.96734	.390	.349	.18	798.51	.90228	.262	.567
.20	924.58	2.96594	5.408	1.353	.20	796.30	2.90108	6.279	1.572
.22	921.61	.96455	.425	.357	.22	794.10	.89987	.296	.576
.24	918.66	.96315	.443	.362	.24	791.90	.89867	.314	.580
.26	915.72	.96176	.460	.366	.26	789.73	.89748	.331	.584
.28	912.81	.96038	.478	.370	.28	787.56	.89628	.349	.589
.30	909.92	2.95900	5.495	1.375	.30	785.40	2.89509	6.366	1.593
.32	906.48	.95736	.512	.379	.32	783.26	.89391	.384	.598
.34	904.18	.95625	.530	.384	.34	781.13	.89272	.401	.602
.36	901.34	.95489	.547	.389	.36	779.01	.89154	.418	.606
.38	898.52	.95353	.565	.392	.38	776.90	.89037	.436	.611
.40	895.71	2.95217	5.582	1.397	.40	774.81	2.88919	6.453	1.615
.42	892.92	.95081	.600	.401	.42	772.72	.88802	.471	.619
.44	890.15	.94947	.617	.405	.44	770.65	.88685	.488	.624
.46	887.40	.94812	.634	.410	.46	768.58	.88569	.505	.628
.48	884.67	.94678	.652	.414	.48	766.53	.88453	.523	.632
.50	881.95	2.94544	5.669	1.418	.50	764.49	2.88337	6.540	1.637
.52	879.24	.94411	.687	.423	.52	762.46	.88222	.558	.641
.54	876.56	.94278	.704	.427	.54	760.44	.88106	.575	.646
.56	873.89	.94146	.722	.432	.56	758.45	.87993	.593	.650
.58	871.24	.94014	.739	.436	.58	756.43	.87877	.610	.654
.60	868.60	2.93882	5.756	1.440	.60	754.44	2.87763	6.627	1.659
.62	865.98	.93751	.774	.445	.62	752.47	.87649	.645	.663
.64	863.37	.93620	.791	.449	.64	750.50	.87535	.662	.667
.66	860.78	.93489	.809	.453	.66	748.54	.87422	.680	.672
.68	858.21	.93359	.826	.458	.68	746.60	.87309	.697	.676
.70	855.65	2.93230	5.844	1.462	.70	744.66	2.87196	6.714	1.680
.72	853.10	.93100	.861	.466	.72	742.74	.87083	.732	.685
.74	850.58	.92971	.878	.471	.74	740.82	.86971	.749	.689
.76	848.06	.92843	.896	.475	.76	738.91	.86859	.767	.694
.78	845.56	.92715	.913	.480	.78	737.02	.86748	.784	.698
.80	843.08	2.92587	5.931	1.484	.80	735.13	2.86636	6.802	1.702
.82	840.61	.92459	.948	.488	.82	733.25	.86525	.819	.707
.84	838.16	.92332	.965	.493	.84	731.38	.86415	.836	.711
.86	835.71	.92206	.983	.497	.86	729.53	.86304	.854	.715
.88	833.29	.92080	6.000	1.501	.88	727.68	.86194	.871	.720
.90	830.88	2.91954	6.018	1.505	.90	725.85	2.86084	6.889	1.724
.92	828.48	.91828	.035	.510	.92	724.01	.85974	.906	.729
.94	826.09	.91703	.053	.515	.94	722.19	.85865	.923	.733
.96	823.72	.91578	.070	.519	.96	720.38	.85756	.941	.737
.98	821.36	.91454	.087	.523	.98	718.57	.85647	.958	.742
7.00	819.02	2.91329	6.105	1.528	8.00	716.78	2.85539	6.976	1.746

Deg. D	Radius R	Logarithm Log R	Tan. Off. t	Mid. Ord. m	Deg. D	Radius R	Logarithm Log R	Tan. Off. t	Mid. Ord. m
°					°				
8.00	716.78	2.85539	6.976	1.746	9.00	637.27	2.80433	7.846	1.965
.02	714.99	.85430	.993	.750	.02	635.86	.80336	.863	.969
.04	713.22	.85322	7.010	.755	.04	634.46	.80240	.881	.973
.06	711.45	.85215	.028	.759	.06	633.06	.80145	.898	.978
.08	709.69	.85107	.045	.764	.08	631.67	.80049	.916	.982
.10	707.94	2.85000	7.063	1.768	.10	630.29	2.79954	7.933	1.987
.12	706.20	.84893	.080	.772	.12	628.91	.79859	.950	.991
.14	704.47	.84786	.098	.777	.14	627.53	.79764	.968	.995
.16	702.75	.84680	.115	.781	.16	626.17	.79669	.985	.999
.18	701.03	.84574	.132	.785	.18	624.81	.79574	8.002	2.004
.20	699.33	2.84468	7.150	1.790	.20	623.45	2.79480	8.020	2.008
.22	697.63	.84362	.167	.794	.22	622.10	.79386	.037	.013
.24	695.94	.84257	.185	.798	.24	620.76	.79292	.055	.017
.26	694.25	.84152	.202	.803	.26	619.42	.79198	.072	.021
.28	692.58	.84047	.219	.807	.28	618.09	.79105	.090	.026
.30	690.91	2.83942	7.237	1.811	.30	616.76	2.79012	8.107	2.030
.32	689.26	.83838	.254	.816	.32	615.44	.78919	.124	.034
.34	687.61	.83734	.272	.820	.34	614.12	.78826	.142	.039
.36	685.96	.83630	.289	.825	.36	612.82	.78733	.159	.043
.38	684.33	.83527	.306	.829	.38	611.51	.78640	.176	.048
.40	682.70	2.83423	7.324	1.833	.40	610.21	2.78548	8.194	2.052
.42	681.09	.83320	.341	.838	.42	608.92	.78456	.211	.056
.44	679.47	.83217	.359	.842	.44	607.63	.78364	.229	.061
.46	677.87	.83115	.376	.847	.46	606.35	.78272	.246	.065
.48	676.27	.83012	.393	.851	.48	605.08	.78181	.263	.069
.50	674.69	2.82910	7.411	1.855	.50	603.80	2.78090	8.281	2.074
.52	673.11	.82808	.428	.860	.52	602.54	.77999	.298	.078
.54	671.53	.82707	.446	.864	.54	601.28	.77908	.316	.083
.56	669.97	.82605	.463	.868	.56	600.02	.77817	.333	.087
.58	668.41	.82504	.480	.873	.58	598.77	.77726	.350	.091
.60	666.86	2.82403	7.498	1.877	.60	597.53	2.77636	8.368	2.096
.62	665.33	.82303	.515	.881	.62	596.29	.77546	.385	.100
.64	663.77	.82202	.533	.886	.64	595.06	.77456	.403	.104
.66	662.24	.82102	.550	.890	.66	593.83	.77366	.420	.109
.68	660.72	.82002	.567	.895	.68	592.60	.77276	.437	.113
.70	659.21	2.81902	7.585	1.899	.70	591.38	2.77187	8.455	2.117
.72	657.70	.81803	.602	.903	.72	590.17	.77098	.472	.121
.74	656.19	.81703	.620	.908	.74	588.96	.77009	.490	.126
.76	654.70	.81604	.637	.912	.76	587.76	.76920	.507	.131
.78	653.21	.81505	.655	.916	.78	586.56	.76831	.524	.135
.80	651.73	2.81407	7.672	1.921	.80	585.36	2.76743	8.542	2.139
.82	650.25	.81308	.689	.925	.82	584.17	.76654	.559	.144
.84	648.79	.81210	.707	.930	.84	582.99	.76566	.576	.148
.86	647.32	.81112	.724	.934	.86	581.81	.76478	.594	.152
.88	645.87	.81014	.742	.938	.88	580.64	.76390	.611	.157
.90	644.42	2.80917	7.759	1.943	.90	579.46	2.76303	8.629	2.161
.92	642.98	.80820	.776	.947	.92	578.30	.76215	.646	.166
.94	641.54	.80723	.794	.951	.94	577.14	.76128	.663	.170
.96	640.11	.80626	.811	.956	.96	575.99	.76041	.681	.174
.98	638.69	.80529	.829	.960	.98	574.83	.75954	.698	.179
9.00	637.27	2.80433	7.846	1.965	10.00	573.69	2.75867	8.716	2.183

Deg. D	Radius R	Logarithm Log R	Tan. Off. t	Mid. Ord. m	Deg. D	Radius R	Logarithm Log R	Tan. Off. t	Mid. Ord. m
°					°				
10.0	573.69	2.75867	8.716	2.183	15.0	383.06	2.58327	13.053	3.277
.1	568.02	.75436	.803	.205	.1	380.54	.58040	.139	.299
.2	562.47	.75010	.889	.227	.2	378.05	.57755	.226	.321
.3	557.02	.74587	.976	.234	.3	375.60	.57472	.312	.343
.4	551.68	.74169	9.063	.270	.4	373.17	.57191	.399	.365
.5	546.44	2.73754	9.150	2.293	.5	370.78	2.56912	13.485	3.387
.6	541.30	.73344	.237	.314	.6	368.42	.56634	.572	.409
.7	536.25	.72937	.324	.336	.7	366.09	.56358	.658	.431
.8	531.30	.72534	.411	.358	.8	363.78	.56084	.744	.452
.9	526.44	.72135	.498	.380	.9	361.51	.55812	.831	.474
11.0	521.67	2.71740	9.585	2.402	16.0	359.26	2.55541	13.917	3.496
.1	516.99	.71348	.671	.423	.1	357.05	.55273	14.004	.518
.2	512.38	.70960	.758	.445	.2	354.86	.55006	.090	.540
.3	507.86	.70575	.845	.467	.3	352.70	.54740	.177	.562
.4	503.42	.70193	.932	.489	.4	350.56	.54476	.263	.584
.5	499.06	2.69815	10.019	2.511	.5	348.45	2.54214	14.349	3.606
.6	494.77	.69441	.106	.533	.6	346.37	.53953	.436	.628
.7	490.56	.69069	.192	.555	.7	344.31	.53694	.522	.650
.8	486.42	.68701	.279	.577	.8	342.27	.53437	.608	.672
.9	482.34	.68336	.366	.598	.9	340.26	.53181	.695	.694
12.0	478.34	2.67974	10.453	2.620	17.0	338.27	2.52927	14.781	3.716
.1	474.40	.67614	.540	.642	.1	336.31	.52674	.867	.738
.2	470.53	.67258	.626	.664	.2	334.37	.52423	.954	.760
.3	466.72	.66905	.713	.686	.3	332.45	.52173	15.040	.781
.4	462.96	.66555	.800	.708	.4	330.56	.51924	.126	.803
.5	459.28	2.66207	10.887	2.730	.5	328.69	2.51677	15.212	3.825
.6	455.65	.65863	.973	.752	.6	326.83	.51432	.299	.847
.7	452.07	.65521	11.060	.774	.7	325.00	.51188	.385	.869
.8	448.56	.65182	.147	.795	.8	323.18	.50945	.471	.891
.9	445.09	.64845	.234	.817	.9	321.39	.50704	.557	.913
13.0	441.68	2.64511	11.320	2.839	18.0	319.62	2.50464	15.643	3.935
.1	438.33	.64180	.407	.861	.1	317.87	.50225	.730	.957
.2	435.02	.63851	.494	.883	.2	316.14	.49988	.816	.979
.3	431.76	.63525	.580	.905	.3	314.43	.49752	.902	4.001
.4	428.56	.63201	.667	.927	.4	312.73	.49517	.988	.023
.5	425.40	2.62879	11.754	2.949	.5	311.06	2.49284	16.074	4.045
.6	422.28	.62560	.840	.971	.6	309.40	.49052	.160	.067
.7	419.22	.62244	.927	.992	.7	307.76	.48821	.246	.089
.8	416.19	.61929	12.014	3.014	.8	306.14	.48591	.333	.111
.9	413.21	.61617	.100	.036	.9	304.53	.48363	.419	.133
14.0	410.28	2.61308	12.187	3.058	19.0	302.94	2.48136	16.505	4.155
.1	407.38	.61000	.274	.080	.1	301.37	.47910	.591	.177
.2	404.53	.60695	.360	.102	.2	299.82	.47686	.677	.199
.3	401.71	.60391	.447	.124	.3	298.28	.47462	.763	.221
.4	398.94	.60090	.533	.146	.4	296.75	.47240	.849	.243
.5	396.20	2.59791	12.620	3.168	.5	295.25	2.47019	16.935	4.265
.6	393.50	.59495	.706	.190	.6	293.76	.46799	17.021	.287
.7	390.84	.59200	.793	.211	.7	292.28	.46580	.107	.308
.8	388.21	.58907	.880	.233	.8	290.82	.46362	.193	.330
.9	385.62	.58616	.966	.255	.9	289.37	.46145	.279	.352
15.0	383.06	2.58327	13.053	3.277	20.0	287.94	2.45930	17.365	4.374

Deg. D	Radius R	Logarithm Log R	Tan. Off. t	Mid. Ord. m	Deg. D	Radius R	Logarithm Log R	Tan. Off. t	Mid. Ord. m
°					°				
20.0	287.94	2.45930	17.365	4.374	25.0	231.01	2.36363	21.644	5.476
.1	286.52	.45716	.451	.396	.1	230.11	.36193	.729	.498
.2	285.12	.45502	.537	.418	.2	229.21	.36023	.814	.520
.3	283.73	.45290	.623	.440	.3	228.32	.35854	.899	.542
.4	282.35	.45079	.708	.462	.4	227.43	.35685	.985	.564
.5	280.99	2.44869	17.794	4.484	.5	226.55	2.35517	22.070	5.586
.6	279.64	.44660	.880	.506	.6	225.68	.35350	.155	.608
.7	278.30	.44452	.966	.528	.7	224.82	.35184	.240	.630
.8	276.98	.44245	18.052	.550	.8	223.96	.35018	.325	.653
.9	275.67	.44039	.138	.572	.9	223.11	.34853	.410	.675
21.0	274.37	2.43834	18.224	4.594	26.0	222.27	2.34688	22.495	5.697
.1	273.08	.43630	.309	.616	.1	221.43	.34524	.580	.719
.2	271.81	.43427	.395	.638	.2	220.60	.34361	.665	.741
.3	270.55	.43225	.481	.660	.3	219.78	.34199	.750	.763
.4	269.30	.43024	.567	.682	.4	218.96	.34037	.835	.785
.5	268.06	2.42824	18.652	4.704	.5	218.15	2.33875	22.920	5.807
.6	266.84	.42624	.738	.726	.6	217.34	.33715	23.005	.829
.7	265.62	.42426	.824	.748	.7	216.54	.33555	.090	.852
.8	264.42	.42229	.910	.770	.8	215.75	.33395	.175	.874
.9	263.22	.42033	.995	.792	.9	214.96	.33237	.260	.896
22.0	262.04	2.41837	19.081	4.814	27.0	214.18	2.33078	23.345	5.918
.1	260.87	.41643	.167	.836	.1	213.41	.32921	.429	.940
.2	259.71	.41449	.252	.858	.2	212.64	.32764	.514	.962
.3	258.56	.41256	.338	.881	.3	211.87	.32608	.599	.984
.4	257.42	.41064	.423	.903	.4	211.11	.32452	.684	6.006
.5	256.29	2.40873	19.509	4.925	.5	210.36	2.32297	23.769	6.029
.6	255.17	.40683	.595	.947	.6	209.61	.32142	.853	.051
.7	254.06	.40494	.680	.969	.7	208.87	.31988	.938	.073
.8	252.96	.40306	.766	.991	.8	208.14	.31835	24.023	.095
.9	251.87	.40118	.851	5.013	.9	207.40	.31682	.108	.117
23.0	250.79	2.39931	19.937	5.035	28.0	206.68	2.31529	24.192	6.139
.1	249.72	.39746	20.022	.057	.1	205.96	.31378	.277	.161
.2	248.66	.39561	.108	.079	.2	205.24	.31227	.362	.184
.3	247.61	.39376	.193	.101	.3	204.53	.31076	.446	.206
.4	246.56	.39193	.279	.123	.4	203.83	.30926	.531	.228
.5	245.53	2.39010	20.364	5.145	.5	203.13	2.30776	24.615	6.250
.6	244.50	.38829	.450	.167	.6	202.43	.30627	.700	.272
.7	243.49	.38647	.535	.189	.7	201.74	.30479	.784	.294
.8	242.48	.38467	.620	.211	.8	201.05	.30331	.869	.316
.9	241.48	.38288	.706	.233	.9	200.37	.30184	.954	.339
24.0	240.49	2.38109	20.791	5.255	29.0	199.70	2.30037	25.038	6.361
.1	239.50	.37931	.877	.278	.1	199.02	.29891	.122	.383
.2	238.53	.37754	.962	.299	.2	198.36	.29745	.207	.405
.3	237.56	.37578	21.047	.321	.3	197.70	.29600	.291	.427
.4	236.60	.37402	.132	.343	.4	197.04	.29455	.376	.450
.5	235.65	2.37227	21.218	5.366	.5	196.38	2.29311	25.460	6.472
.6	234.71	.37053	.303	.388	.6	195.74	.29167	.545	.494
.7	233.77	.36879	.388	.410	.7	195.09	.29024	.629	.516
.8	232.84	.36707	.474	.432	.8	194.45	.28881	.713	.538
.9	231.92	.36535	.559	.454	.9	193.82	.28739	.798	.560
25.0	231.01	2.36363	21.644	5.476	30.0	193.19	2.28597	25.882	6.583

Deg. D	Radius R	Logarithm Log R	Tan. Off. t	Mid. Ord. m	Deg. D	Radius R	Logarithm Log R	Tan. Off. t	Mid. Ord. m
°					°				
30.0	193.19	2.28597	25.882	6.583	35.0	166.28	2.22083	30.071	7.696
.1	192.56	.28456	.966	.605	.1	165.82	.21963	.154	.718
.2	191.94	.28315	26.050	.627	.2	165.36	.21843	.237	.740
.3	191.32	.28175	.135	.649	.3	164.91	.21724	.320	.763
.4	190.70	.28036	.219	.671	.4	164.46	.21605	.403	.785
.5	190.09	2.27896	26.303	6.694	.5	164.01	2.21486	30.486	7.807
.6	189.49	.27757	.387	.716	.6	163.56	.21368	.570	.830
.7	188.88	.27619	.471	.738	.7	163.12	.21250	.653	.852
.8	188.28	.27481	.556	.760	.8	162.68	.21133	.736	.874
.9	187.69	.27344	.640	.782	.9	162.24	.21016	.819	.897
31.0	187.10	2.27207	26.724	6.805	36.0	161.80	2.20899	30.902	7.919
.1	186.51	.27071	.808	.827	.1	161.37	.20782	.985	.942
.2	185.93	.26935	.892	.849	.2	160.94	.20666	31.068	.964
.3	185.35	.26799	.976	.871	.3	160.51	.20550	.151	.986
.4	184.77	.26664	27.060	.894	.4	160.08	.20435	.233	8.009
.5	184.20	2.26530	27.144	6.916	.5	159.66	2.20320	31.316	8.031
.6	183.63	.26395	.228	.938	.6	159.24	.20205	.399	.053
.7	183.07	.26262	.312	.960	.7	158.82	.20091	.482	.076
.8	182.51	.26128	.396	.983	.8	158.40	.19977	.565	.098
.9	181.95	.25996	.480	7.005	.9	157.99	.19863	.648	.121
32.0	181.40	2.25863	27.564	7.027	37.0	157.58	2.19749	31.730	8.143
.1	180.85	.25731	.648	.049	.1	157.17	.19636	.813	.165
.2	180.30	.25600	.731	.072	.2	156.76	.19523	.896	.188
.3	179.76	.25469	.815	.094	.3	156.35	.19411	.979	.210
.4	179.22	.25338	.899	.116	.4	155.95	.19299	32.061	.233
.5	178.68	2.25208	27.983	7.138	.5	155.55	2.19187	32.144	8.255
.6	178.15	.25078	28.067	.161	.6	155.15	.19076	.227	.277
.7	177.62	.24949	.150	.183	.7	154.75	.18964	.309	.300
.8	177.09	.24820	.234	.205	.8	154.36	.18854	.392	.322
.9	176.57	.24691	.318	.227	.9	153.97	.18743	.474	.345
33.0	176.05	2.24563	28.402	7.250	38.0	153.58	2.18633	32.557	8.367
.1	175.53	.24435	.485	.272	.1	153.19	.18523	.639	.390
.2	175.02	.24308	.569	.294	.2	152.80	.18413	.722	.412
.3	174.51	.24181	.652	.316	.3	152.42	.18304	.804	.434
.4	174.00	.24054	.736	.339	.4	152.04	.18195	.887	.457
.5	173.49	2.23928	28.820	7.361	.5	151.66	2.18086	32.969	8.479
.6	172.99	.23802	.903	.383	.6	151.28	.17978	33.051	.502
.7	172.49	.23677	.987	.406	.7	150.90	.17870	.134	.524
.8	172.00	.23552	29.070	.428	.8	150.53	.17762	.216	.547
.9	171.50	.23428	.154	.450	.9	150.16	.17655	.298	.569
34.0	171.02	2.23303	29.237	7.473	39.0	149.79	2.17547	33.381	8.592
.1	170.53	.23180	.321	.495	.1	149.42	.17441	.463	.614
.2	170.04	.23056	.404	.517	.2	149.05	.17334	.545	.636
.3	169.56	.22933	.487	.539	.3	148.69	.17228	.627	.659
.4	169.09	.22811	.571	.562	.4	148.33	.17122	.710	.681
.5	168.61	2.22688	29.654	7.584	.5	147.97	2.17016	33.792	8.704
.6	168.14	.22567	.737	.606	.6	147.61	.16911	.874	.726
.7	167.67	.22445	.821	.629	.7	147.25	.16805	.956	.749
.8	167.20	.22324	.904	.651	.8	146.89	.16701	34.038	.771
.9	166.74	.22203	.987	.673	.9	146.54	.16596	.120	.794
35.0	166.28	2.22083	30.071	7.696	40.0	146.19	2.16492	34.202	8.816

TABLE II. — Tangent Distances for a 1° Curve for Varying I's

$T_D = T_{1°}/D + C$ of Table III

I	0°	1°	2°	3°	4°	5°	6°	7°	I
.00	0.00	50.00	100.01	150.04	200.08	250.16	300.28	350.44	.00
.02	1.00	51.00	101.01	151.04	201.08	251.16	301.28	351.44	.02
.04	2.00	52.00	102.01	152.04	202.09	252.17	302.28	352.45	.04
.06	3.00	53.00	103.01	153.04	203.09	253.17	303.29	353.45	.06
.08	4.00	54.00	104.01	154.04	204.09	254.17	304.29	354.46	.08
.10	5.00	55.00	105.01	155.04	205.09	255.17	305.29	355.46	.10
.12	6.00	56.00	106.01	156.04	206.09	256.17	306.30	356.46	.12
.14	7.00	57.00	107.01	157.04	207.09	257.18	307.30	357.47	.14
.16	8.00	58.00	108.01	158.04	208.09	258.18	308.30	358.47	.16
.18	9.00	59.00	109.01	159.04	209.10	259.18	309.30	359.48	.18
.20	10.00	60.00	110.01	160.04	210.10	260.18	310.31	360.48	.20
.22	11.00	61.00	111.02	161.04	211.10	261.18	311.31	361.48	.22
.24	12.00	62.00	112.02	162.05	212.10	262.19	312.31	362.49	.24
.26	13.00	63.00	113.02	163.05	213.10	263.19	313.32	363.49	.26
.28	14.00	64.00	114.02	164.05	214.10	264.19	314.32	364.50	.28
.30	15.00	65.00	115.02	165.05	215.10	265.19	315.32	365.50	.30
.32	16.00	66.00	116.02	166.05	216.11	266.19	316.32	366.50	.32
.34	17.00	67.00	117.02	167.05	217.11	267.20	317.33	367.51	.34
.36	18.00	68.00	118.02	168.05	218.11	268.20	318.33	368.51	.36
.38	19.00	69.00	119.02	169.05	219.11	269.20	319.33	369.52	.38
.40	20.00	70.00	120.02	170.05	220.11	270.20	320.34	370.52	.40
.42	21.00	71.00	121.02	171.05	221.11	271.21	321.34	371.52	.42
.44	22.00	72.00	122.02	172.05	222.11	272.21	322.34	372.53	.44
.46	23.00	73.00	123.02	173.05	223.12	273.21	323.35	373.53	.46
.48	24.00	74.01	124.02	174.06	224.12	274.21	324.35	374.54	.48
.50	25.00	75.01	125.02	175.06	225.12	275.21	325.35	375.54	50
.52	26.00	76.01	126.02	176.06	226.12	276.22	326.36	376.55	.52
.54	27.00	77.01	127.02	177.06	227.12	277.22	327.36	377.55	.54
.56	28.00	78.01	128.02	178.06	228.12	278.22	328.36	378.55	.56
.58	29.00	79.01	129.02	179.06	229.12	279.22	329.37	379.56	.58
.60	30.00	80.01	130.02	180.06	230.13	280.23	330.37	380.56	.60
.62	31.00	81.01	131.02	181.06	231.13	281.23	331.37	381.57	.62
.64	32.00	82.01	132.03	182.06	232.13	282.23	332.38	382.57	.64
.66	33.00	83.01	133.03	183.06	233.13	283.23	333.38	383.58	.66
.68	34.00	84.01	134.03	184.07	234.13	284.24	334.38	384.58	.68
.70	35.00	85.01	135.03	185.07	235.13	285.24	335.39	385.59	.70
.72	36.00	86.01	136.03	186.07	236.14	286.24	336.39	386.59	.72
.74	37.00	87.01	137.03	187.07	237.14	287.24	337.39	387.59	.74
.76	38.00	88.01	138.03	188.07	238.14	288.25	338.40	388.60	.76
.78	39.00	89.01	139.03	189.07	239.14	289.25	339.40	389.60	.78
.80	40.00	90.01	140.03	190.07	240.14	290.25	340.40	390.61	.80
.82	41.00	91.01	141.03	191.07	241.15	291.25	341.41	391.61	.82
.84	42.00	92.01	142.03	192.07	242.15	292.26	342.41	392.62	.84
.86	43.00	93.01	143.03	193.07	243.15	293.26	343.42	393.62	.86
.88	44.00	94.01	144.03	194.08	244.15	294.26	344.42	394.63	.88
.90	45.00	95.01	145.03	195.08	245.15	295.26	345.42	395.63	.90
.92	46.00	96.01	146.03	196.08	246.15	296.27	346.43	396.64	.92
.94	47.00	97.01	147.03	197.08	247.16	297.27	347.43	397.64	.94
.96	48.00	98.01	148.03	198.08	248.16	298.27	348.43	398.65	.96
.98	49.00	99.01	149.04	199.08	249.16	299.28	349.44	399.65	.98
1.00	50.00	100.01	150.04	200.08	250.16	300.28	350.44	400.66	1.00

TABLE II. — (*Continued*)

I	8°	9°	10°	11°	12°	13°	14°	15°	I
.00	400.66	450.93	501.28	551.70	602.21	652.81	703.51	754.32	.00
.02	401.66	451.94	502.29	552.71	603.22	653.82	704.53	755.34	.02
.04	402.67	452.95	503.29	553.72	604.23	654.84	705.54	756.36	.04
.06	403.67	453.95	504.30	554.73	605.24	655.85	706.56	757.38	.06
.08	404.68	454.96	505.31	555.74	606.26	656.86	707.57	758.39	.08
.10	405.68	455.96	506.32	556.75	607.27	657.88	708.59	759.41	.10
.12	406.69	456.97	507.33	557.76	608.28	658.89	709.60	760.43	.12
.14	407.69	457.98	508.33	558.77	609.29	659.90	710.62	761.45	.14
.16	408.70	458.98	509.34	559.78	610.30	660.92	711.63	762.46	.16
.18	409.70	459.99	510.35	560.79	611.31	661.93	712.65	763.48	.18
.20	410.71	461.00	511.36	561.80	612.32	662.94	713.67	764.50	.20
.22	411.71	462.00	512.37	562.81	613.33	663.96	714.68	765.52	.22
.24	412.72	463.01	513.37	563.82	614.35	664.97	715.70	766.53	.24
.26	413.72	464.02	514.38	564.83	615.36	665.98	716.71	767.55	.26
.28	414.73	465.02	515.39	565.84	616.37	667.00	717.73	768.57	.28
.30	415.73	466.03	516.40	566.85	617.38	668.01	718.74	769.59	.30
.32	416.74	467.04	517.41	567.86	618.39	669.02	719.76	770.61	.32
.34	417.74	468.04	518.41	568.87	619.40	670.04	720.78	771.62	.34
.36	418.75	469.05	519.42	569.88	620.42	671.05	721.79	772.64	.36
.38	419.75	470.06	520.43	570.89	621.43	672.07	722.81	773.66	.38
.40	420.76	471.06	521.44	571.90	622.44	673.08	723.82	774.68	.40
.42	421.76	472.07	522.45	572.91	623.45	674.09	724.84	775.70	.42
.44	422.77	473.08	523.46	573.92	624.46	675.11	725.86	776.72	.44
.46	423.78	474.08	524.46	574.93	625.47	676.12	726.87	777.73	.46
.48	424.78	475.09	525.47	575.94	626.49	677.13	727.89	778.75	.48
.50	425.79	476.10	526.48	576.95	627.50	678.15	728.90	779.77	.50
.52	426.79	477.10	527.49	577.96	628.51	679.16	729.92	780.79	.52
.54	427.80	478.11	528.50	578.97	629.52	680.18	730.94	781.81	.54
.56	428.80	479.12	529.51	579.98	630.54	681.19	731.95	782.83	.56
.58	429.81	480.13	530.51	580.99	631.55	682.21	732.97	783.85	.58
.60	430.81	481.13	531.52	582.00	632.56	683.22	733.99	784.86	.60
.62	431.82	482.14	532.53	583.01	633.57	684.23	735.00	785.88	.62
.64	432.83	483.15	533.54	584.02	634.58	685.25	736.02	786.90	.64
.66	433.83	484.15	534.55	585.03	635.60	686.26	737.03	787.92	.66
.68	434.84	485.16	535.56	586.04	636.61	687.28	738.05	788.94	.68
.70	435.84	486.17	536.57	587.05	637.62	688.29	739.07	789.96	.70
.72	436.85	487.18	537.57	588.06	638.63	689.31	740.08	790.98	.72
.74	437.85	488.18	538.58	589.07	639.65	690.32	741.10	792.00	.74
.76	438.86	489.19	539.59	590.08	640.66	691.33	742.12	793.02	.76
.78	439.87	490.20	540.60	591.09	641.67	692.35	743.13	794.04	.78
80	440.87	491.20	541.61	592.10	642.68	693.36	744.15	795.05	.80
.82	441.88	492.21	542.62	593.11	643.70	694.38	745.17	796.07	.82
.84	442.88	493.22	543.63	594.12	644.71	695.39	746.19	797.09	.84
.86	443.89	494.23	544.64	595.13	645.72	696.41	747.20	798.11	.86
.88	444.90	495.23	545.65	596.14	646.73	697.42	748.22	799.13	.88
.90	445.90	496.24	546.66	597.16	647.75	698.44	749.24	800.15	.90
.92	446.91	497.25	547.67	598.17	648.76	699.45	750.25	801.17	.92
.94	447.91	498.26	548.67	599.18	649.77	700.47	751.27	802.19	.94
.96	448.92	499.26	549.68	600.19	650.79	701.48	752.29	803.21	.96
.98	449.93	500.27	550.69	601.20	651.80	702.50	753.31	804.23	.98
1.00	450.93	501.28	551.70	602.21	652.81	703.51	754.32	805.25	1.00

I	16°	17°	18°	19°	20°	21°	22°	23°	*I*
.00	805.25	856.30	907.49	958.81	1010.29	1061.93	1113.73	1165.71	.00
.02	806.27	857.32	908.51	959.84	1011.32	1062.96	1114.77	1166.75	.02
.04	807.29	858.35	909.54	960.87	1012.35	1064.00	1115.81	1167.79	.04
.06	808.31	859.37	910.56	961.90	1013.39	1065.03	1116.85	1168.83	.06
.08	809.33	860.39	911.59	962.93	1014.42	1066.07	1117.88	1169.88	.08
.10	810.35	861.41	912.61	963.96	1015.45	1067.10	1118.92	1170.92	.10
.12	811.37	862.44	913.64	964.98	1016.48	1068.14	1119.96	1171.96	.12
.14	812.39	863.46	914.66	966.01	1017.51	1069.17	1121.00	1173.00	.14
.16	813.41	864.48	915.69	967.04	1018.54	1070.21	1122.04	1174.04	.16
.18	814.43	865.51	916.72	968.07	1019.58	1071.24	1123.07	1175.09	.18
.20	815.45	866.53	917.74	969.10	1020.61	1072.27	1124.11	1176.13	.20
.22	816.47	867.55	918.77	970.13	1021.64	1073.31	1125.15	1177.17	.22
.24	817.49	868.57	919.79	971.16	1022.67	1074.35	1126.19	1178.21	.24
.26	818.51	869.60	920.82	972.19	1023.70	1075.38	1127.23	1179.25	.26
.28	819.53	870.62	921.84	973.21	1024.73	1076.42	1128.27	1180.30	.28
.30	820.55	871.64	922.87	974.24	1025.77	1077.45	1129.31	1181.34	.30
.32	821.57	872.67	923.90	975.27	1026.80	1078.49	1130.35	1182.38	.32
.34	822.59	873.69	924.92	976.30	1027.83	1079.52	1131.38	1183.43	.34
.36	823.61	874.71	925.95	977.33	1028.86	1080.56	1132.42	1184.47	.36
.38	824.63	875.74	926.97	978.36	1029.89	1081.59	1133.46	1185.51	.38
.40	825.66	876.76	928.00	979.39	1030.93	1082.63	1134.50	1186.55	.40
.42	826.68	877.78	929.03	980.42	1031.96	1083.66	1135.54	1187.60	.42
.44	827.70	878.81	930.05	981.45	1032.99	1084.70	1136.58	1188.64	.44
.46	828.72	879.83	931.08	982.48	1034.02	1085.74	1137.62	1189.68	.46
.48	829.74	880.85	932.11	983.50	1035.06	1086.77	1138.66	1190.73	.48
.50	830.76	881.88	933.13	984.53	1036.09	1087.81	1139.70	1191.77	.50
.52	831.78	882.90	934.16	985.56	1037.12	1088.84	1140.74	1192.81	.52
.54	832.80	883.92	935.19	986.59	1038.16	1089.88	1141.78	1193.86	.54
.56	833.82	884.95	936.21	987.62	1039.19	1090.92	1142.82	1194.90	.56
.58	834.84	885.97	937.24	988.65	1040.22	1091.95	1143.86	1195.94	.58
.60	835.87	887.00	938.27	989.68	1041.25	1092.99	1144.90	1196.99	.60
.62	836.89	888.02	939.29	990.71	1042.29	1094.03	1145.94	1198.03	.62
.64	837.91	889.04	940.32	991.74	1043.32	1095.06	1146.98	1199.07	.64
.66	838.93	890.07	941.35	992.77	1044.35	1096.10	1148.02	1200.12	.66
.68	839.95	891.09	942.37	993.80	1045.39	1097.14	1149.06	1201.16	.68
.70	840.97	892.12	943.40	994.83	1046.42	1098.17	1150.10	1202.21	.70
.72	841.99	893.14	944.43	995.86	1047.45	1099.21	1151.14	1203.25	.72
.74	843.02	894.17	945.46	996.89	1048.49	1100.25	1152.18	1204.29	.74
.76	844.04	895.19	946.48	997.92	1049.52	1101.28	1153.22	1205.34	.76
.78	845.06	896.21	947.51	998.95	1050.55	1102.32	1154.26	1206.38	.78
.80	846.08	897.24	948.54	999.98	1051.59	1103.36	1155.30	1207.43	.80
.82	847.10	898.26	949.57	1001.01	1052.62	1104.39	1156.34	1208.47	.82
.84	848.12	899.29	950.59	1002.04	1053.66	1105.43	1157.38	1209.52	.84
.86	849.15	900.31	951.62	1003.08	1054.69	1106.47	1158.42	1210.56	.86
.88	850.17	901.34	952.65	1004.11	1055.72	1107.51	1159.46	1211.60	.88
.90	851.19	902.36	953.68	1005.14	1056.76	1108.54	1160.50	1212.65	.90
.92	852.21	903.39	954.70	1006.17	1057.79	1109.58	1161.55	1213.69	.92
.94	853.24	904.41	955.73	1007.20	1058.83	1110.62	1162.59	1214.74	.94
.96	854.26	905.44	956.76	1008.23	1059.86	1111.66	1163.63	1215.78	.96
.98	855.28	906.46	957.79	1009.26	1060.89	1112.69	1164.67	1216.83	.98
1.00	856.30	907.49	958.81	1010.29	1061.93	1113.73	1165.71	1217.87	1.00

TABLE II. — (*Continued*)

I	24°	25°	26°	27°	28°	29°	30°	31°	I
.00	1217.87	1270.23	1322.79	1375.57	1428.56	1481.79	1535.25	1588.97	.00
.02	1218.92	1271.28	1323.85	1376.62	1429.62	1482.86	1536.33	1590.05	.02
.04	1219.97	1272.33	1324.90	1377.68	1430.69	1483.92	1537.40	1591.13	.04
.06	1221.01	1273.38	1325.95	1378.74	1431.75	1484.99	1538.47	1592.20	.06
.08	1222.06	1274.43	1327.01	1379.80	1432.81	1486.06	1539.54	1593.28	.08
.10	1223.10	1275.48	1328.06	1380.86	1433.87	1487.12	1540.62	1594.36	.10
.12	1224.14	1276.53	1329.12	1381.91	1434.94	1488.19	1541.69	1595.44	.12
.14	1225.19	1277.58	1330.17	1382.97	1436.00	1489.26	1542.76	1596.51	.14
.16	1226.24	1278.63	1331.22	1384.03	1437.06	1490.33	1543.83	1597.59	.16
.18	1227.28	1279.68	1332.28	1385.09	1438.13	1491.39	1544.91	1598.67	.18
.20	1228.33	1280.73	1333.33	1386.15	1439.19	1492.46	1545.98	1599.75	.20
.22	1229.38	1281.78	1334.39	1387.21	1440.25	1493.53	1547.05	1600.82	.22
.24	1230.42	1282.83	1335.44	1388.27	1441.32	1494.60	1548.12	1601.90	.24
.26	1231.47	1283.88	1336.50	1389.32	1442.38	1495.67	1549.20	1602.98	.26
.28	1232.52	1284.93	1337.55	1390.38	1443.44	1496.73	1550.27	1604.06	.28
.30	1233.56	1285.98	1338.60	1391.44	1444.51	1497.80	1551.34	1605.14	.30
.32	1234.61	1287.03	1339.66	1392.50	1445.57	1498.87	1552.42	1606.22	.32
.34	1235.65	1288.08	1340.71	1393.56	1446.63	1499.94	1553.49	1607.30	.34
.36	1236.70	1289.13	1341.77	1394.62	1447.70	1501.01	1554.56	1608.37	.36
.38	1237.75	1290.18	1342.82	1395.68	1448.76	1502.08	1555.64	1609.45	.38
.40	1238.79	1291.23	1343.88	1396.74	1449.82	1503.15	1556.71	1610.53	.40
.42	1239.84	1292.28	1344.93	1397.80	1450.89	1504.21	1557.79	1611.61	.42
.44	1240.89	1293.33	1345.99	1398.86	1451.95	1505.28	1558.86	1612.69	.44
.46	1241.93	1294.39	1347.04	1399.92	1453.02	1506.35	1559.93	1613.77	.46
.48	1242.98	1295.44	1348.10	1400.98	1454.08	1507.42	1561.01	1614.85	.48
.50	1244.03	1296.49	1349.15	1402.04	1455.15	1508.49	1562.08	1615.93	.50
.52	1245.08	1297.54	1350.21	1403.10	1456.21	1509.56	1563.16	1617.01	.52
.54	1246.12	1298.59	1351.26	1404.16	1457.27	1510.63	1564.23	1618.09	.54
.56	1247.17	1299.64	1352.32	1405.22	1458.34	1511.70	1565.31	1619.17	.56
.58	1248.22	1300.69	1353.38	1406.28	1459.40	1512.77	1566.38	1620.25	.58
.60	1249.27	1301.74	1354.43	1407.34	1460.47	1513.84	1567.46	1621.33	.60
.62	1250.31	1302.80	1355.49	1408.40	1461.53	1514.91	1568.53	1622.41	.62
.64	1251.36	1303.85	1356.54	1409.46	1462.60	1515.98	1569.60	1623.49	.64
.66	1252.41	1304.90	1357.60	1410.52	1463.66	1517.05	1570.68	1624.57	.66
.68	1253.46	1305.95	1358.66	1411.58	1464.73	1518.12	1571.76	1625.65	.68
.70	1254.50	1307.00	1359.71	1412.64	1465.80	1519.19	1572.83	1626.73	.70
.72	1255.55	1308.06	1360.77	1413.70	1466.86	1520.26	1573.91	1627.81	.72
.74	1256.60	1309.11	1361.83	1414.76	1467.93	1521.33	1574.98	1628.89	.74
.76	1257.65	1310.16	1362.88	1415.82	1468.99	1522.40	1576.06	1629.97	.76
.78	1258.70	1311.21	1363.94	1416.88	1470.06	1523.47	1577.13	1631.05	.78
.80	1259.75	1312.27	1365.00	1417.94	1471.12	1524.54	1578.21	1632.14	.80
.82	1260.79	1313.32	1366.05	1418.01	1472.19	1525.61	1579.28	1633.21	.82
.84	1261.84	1314.37	1367.11	1420.07	1473.26	1526.68	1580.36	1634.30	.84
.86	1262.89	1315.42	1368.17	1421.13	1474.32	1527.76	1581.44	1635.38	.86
.88	1263.94	1316.48	1369.22	1422.19	1475.39	1528.83	1582.51	1636.46	.88
.90	1264.99	1317.53	1370.28	1423.25	1476.45	1529.90	1583.59	1637.54	.90
.92	1266.04	1318.58	1371.34	1424.31	1477.52	1530.97	1584.67	1638.62	.92
.94	1267.09	1319.63	1372.39	1425.38	1478.59	1532.04	1585.74	1639.70	.94
.96	1268.14	1320.69	1373.45	1426.44	1479.66	1533.11	1586.82	1640.79	.96
.98	1269.18	1321.74	1374.51	1427.50	1480.72	1534.18	1587.90	1641.87	.98
1.00	1270.23	1322.79	1375.57	1428.56	1481.79	1535.25	1588.97	1642.95	1.00

TABLE II. — (*Continued*)

I	32°	33°	34°	35°	36°	37°	38°	39°	*I*
.00	1642.95	1697.20	1751.73	1806.55	1861.68	1917.11	1972.88	2028.98	.00
.02	1644.04	1698.29	1752.82	1807.65	1862.78	1918.23	1974.00	2030.10	.02
.04	1645.12	1699.37	1753.92	1808.75	1863.89	1919.34	1975.11	2031.23	.04
.06	1646.20	1700.46	1755.01	1809.85	1864.99	1920.45	1976.23	2032.35	.06
.08	1647.28	1701.55	1756.10	1810.95	1866.10	1921.56	1977.35	2033.48	.08
.10	1648.36	1702.64	1757.20	1812.05	1867.21	1922.68	1978.47	2034.60	.10
.12	1649.45	1703.73	1758.29	1813.15	1868.31	1923.79	1979.59	2035.73	.12
.14	1650.53	1704.82	1759.39	1814.25	1869.42	1924.90	1980.71	2036.86	.14
.16	1651.61	1705.91	1760.48	1815.35	1870.53	1926.01	1981.83	2037.98	.16
.18	1652.70	1706.99	1761.58	1816.45	1871.63	1927.13	1982.95	2039.11	.18
.20	1653.78	1708.08	1762.67	1817.55	1872.74	1928.24	1984.07	2040.24	.20
.22	1654.86	1709.17	1763.77	1818.65	1873.85	1929.35	1985.19	2041.36	.22
.24	1655.95	1710.26	1764.86	1819.75	1874.95	1930.47	1986.31	2042.49	.24
.26	1657.03	1711.35	1765.95	1820.85	1876.06	1931.58	1987.43	2043.62	.26
.28	1658.11	1712.44	1767.05	1821.96	1877.17	1932.69	1988.55	2044.74	.28
.30	1659.20	1713.53	1768.14	1823.06	1878.27	1933.81	1989.67	2045.87	.30
.32	1660.28	1714.62	1769.24	1824.16	1879.38	1934.92	1990.79	2047.00	.32
.34	1661.36	1715.71	1770.34	1825.26	1880.49	1936.04	1991.91	2048.13	.34
.36	1662.45	1716.80	1771.43	1826.36	1881.60	1937.15	1993.03	2049.26	.36
.38	1663.53	1717.89	1772.53	1827.46	1882.71	1938.26	1994.15	2050.38	.38
.40	1664.62	1718.98	1773.62	1828.56	1883.81	1939.38	1995.28	2051.51	.40
.42	1665.70	1720.07	1774.72	1829.67	1884.92	1940.49	1996.40	2052.64	.42
.44	1666.79	1721.16	1775.81	1830.77	1886.03	1941.61	1997.52	2053.77	.44
.46	1667.87	1722.25	1776.91	1831.87	1887.14	1942.72	1998.64	2054.90	.46
.48	1668.96	1723.34	1778.00	1832.97	1888.25	1943.84	1999.76	2056.03	.48
.50	1670.04	1724.43	1779.10	1834.08	1889.36	1944.95	2000.88	2057.15	.50
.52	1671.13	1725.52	1780.20	1835.18	1890.46	1946.07	2002.01	2058.38	.52
.54	1672.21	1726.61	1781.30	1836.28	1891.57	1947.18	2003.13	2059.41	.54
.56	1673.30	1727.70	1782.39	1837.38	1892.68	1948.30	2004.25	2060.54	.56
.58	1674.38	1728.79	1783.49	1838.49	1893.79	1949.42	2005.37	2061.67	.58
.60	1675.47	1729.88	1784.59	1839.59	1894.90	1950.53	2006.49	2062.80	.60
.62	1676.55	1730.97	1785.68	1840.69	1896.01	1951.65	2007.62	2063.93	.62
.64	1677.64	1732.07	1786.78	1841.80	1897.12	1952.76	2008.74	2065.06	.64
.66	1678.72	1733.16	1787.88	1842.90	1898.23	1953.88	2009.86	2066.19	.66
.68	1679.81	1734.25	1788.98	1844.00	1899.34	1955.00	2010.99	2067.32	.68
.70	1680.90	1735.34	1790.07	1845.11	1900.45	1956.12	2012.11	2068.45	.70
.72	1681.98	1736.43	1791.17	1846.21	1901.56	1957.23	2013.23	2069.58	.72
.74	1683.07	1737.52	1792.27	1847.31	1902.67	1958.35	2014.36	2070.71	.74
.76	1684.15	1738.62	1793.37	1848.42	1903.78	1959.47	2015.48	2071.84	.76
.78	1685.24	1739.71	1794.46	1849.52	1904.89	1960.58	2016.60	2072.97	.78
.80	1686.33	1740.80	1795.56	1850.63	1906.00	1961.70	2017.73	2074.10	.80
.82	1687.41	1741.89	1796.66	1851.73	1907.11	1962.82	2018.85	2075.24	.82
.84	1688.50	1742.99	1797.76	1852.84	1908.22	1963.93	2019.98	2076.37	.84
.86	1689.59	1744.08	1798.86	1853.94	1909.33	1965.05	2021.10	2077.50	.86
.88	1690.67	1745.17	1799.96	1855.04	1910.44	1966.17	2022.22	2078.63	.88
.90	1691.76	1746.26	1801.06	1856.15	1911.56	1967.28	2023.35	2079.76	.90
.92	1692.85	1747.36	1802.15	1857.25	1912.67	1968.40	2024.47	2080.89	.92
.94	1693.94	1748.45	1803.25	1858.36	1913.78	1969.52	2025.60	2082.03	.94
.96	1695.02	1749.54	1804.35	1859.46	1914.89	1970.64	2026.72	2083.16	.96
.98	1696.11	1750.64	1805.45	1860.57	1916.00	1971.76	2027.85	2084.29	.98
1.00	1697.20	1751.73	1806.55	1861.68	1917.11	1972.88	2028.98	2085.42	1.00

TABLE II. — (*Continued*)

I	40°	41°	42°	43°	44°	45°	46°	47°	I
.00	2085.42	2142.23	2199.41	2256.97	2314.93	2373.30	2432.09	2491.32	**.00**
.02	2086.55	2143.37	2200.55	2258.12	2316.09	2374.47	2433.27	2492.51	.02
.04	2087.69	2144.51	2201.70	2259.28	2317.26	2375.64	2434.45	2493.70	.04
.06	2088.82	2145.65	2202.85	2260.44	2318.42	2376.81	2435.63	2494.89	.06
.08	2089.95	2146.79	2204.00	2261.59	2319.58	2377.99	2436.71	2496.08	.08
.10	2091.09	2147.93	2205.15	2262.75	2320.75	2379.16	2438.00	2497.27	.10
.12	2092.22	2149.07	2206.29	2263.90	2321.91	2380.33	2439.18	2498.46	.12
.14	2093.35	2150.21	2207.44	2265.06	2323.08	2381.50	2440.36	2499.65	.14
.16	2094.49	2151.35	2208.59	2266.22	2324.24	2382.68	2441.54	2500.84	.16
.18	2095.62	2152.49	2209.74	2267.37	2325.40	2383.85	2442.72	2502.03	.18
.20	2096.75	2153.63	2210.89	2268.53	2326.57	2385.02	2443.90	2503.22	**.20**
.22	2097.89	2154.78	2212.04	2269.69	2327.73	2386.20	2445.08	2504.41	.22
.24	2099.02	2155.92	2213.19	2270.84	2328.90	2387.37	2446.27	2505.60	.24
.26	2100.16	2157.06	2214.33	2272.00	2330.06	2388.54	2447.45	2506.80	.26
.28	2101.29	2158.20	2215.48	2273.16	2331.23	2389.72	2448.63	2507.99	.28
.30	2102.43	2159.34	2216.63	2274.31	2332.40	2390.89	2449.82	2509.18	.30
.32	2103.56	2160.48	2217.78	2275.47	2333.56	2392.07	2451.00	2510.37	.32
.34	2104.70	2161.63	2218.93	2276.63	2334.73	2393.24	2452.18	2511.56	.34
.36	2105.83	2162.77	2220.08	2277.79	2335.89	2394.41	2453.36	2512.75	.36
.38	2106.97	2163.91	2221.23	2278.95	2337.06	2395.59	2454.55	2513.95	.38
.40	2108.10	2165.05	2222.38	2280.10	2338.23	2396.76	2455.73	2515.14	**.40**
.42	2109.24	2166.20	2223.53	2281.26	2339.39	2397.94	2456.91	2516.33	.42
.44	2110.37	2167.34	2224.68	2282.42	2340.56	2399.11	2458.10	2517.53	.44
.46	2111.51	2168.48	2225.84	2283.58	2341.73	2400.29	2459.28	2518.72	.46
.48	2112.64	2169.63	2226.99	2284.74	2342.89	2401.47	2460.47	2519.91	.48
.50	2113.78	2170.77	2228.14	2285.90	2344.06	2402.64	2461.65	2521.11	.50
.52	2114.92	2171.91	2229.29	2287.06	2345.23	2403.82	2462.84	2522.30	.52
.54	2116.05	2173.06	2230.44	2288.22	2346.40	2404.99	2464.02	2523.49	.54
.56	2117.19	2174.20	2231.59	2289.38	2347.56	2406.17	2465.21	2524.69	.56
.58	2118.32	2175.34	2232.74	2290.54	2348.73	2407.35	2466.39	2525.88	.58
.60	2119.46	2176.49	2233.90	2291.70	2349.90	2408.52	2467.58	2527.08	**.60**
.62	2120.60	2177.63	2235.05	2292.86	2351.07	2409.70	2468.76	2528.27	.62
.64	2121.74	2178.78	2236.20	2294.02	2352.24	2410.88	2469.95	2529.47	.64
.66	2122.87	2179.92	2237.35	2295.18	2353.41	2412.05	2471.13	2530.66	.66
.68	2124.01	2181.07	2238.51	2296.34	2354.58	2413.23	2472.32	2531.86	.68
.70	2125.15	2182.21	2239.66	2297.50	2355.74	2414.41	2473.51	2533.05	.70
.72	2126.29	2183.36	2240.81	2298.66	2356.91	2415.59	2474.69	2534.25	.72
.74	2127.42	2184.50	2241.97	2299.82	2358.08	2416.76	2475.88	2535.44	.74
.76	2128.56	2185.65	2243.12	2300.98	2359.25	2417.94	2477.07	2536.64	.76
.78	2129.70	2186.79	2244.27	2302.14	2360.42	2419.12	2478.25	2537.83	.78
.80	2130.84	2187.94	2245.43	2303.30	2361.59	2420.30	2479.44	2539.03	**.80**
.82	2131.98	2189.09	2246.58	2304.47	2362.76	2421.48	2480.63	2540.23	.82
.84	2133.11	2190.23	2247.73	2305.63	2363.93	2422.66	2481.82	2541.43	.84
.86	2134.25	2191.38	2248.89	2306.79	2365.10	2423.84	2483.00	2542.62	.86
.88	2135.39	2192.52	2250.04	2307.95	2366.27	2425.01	2484.19	2543.82	.88
.90	2136.53	2193.67	2251.20	2309.12	2367.44	2426.19	2485.38	2545.02	.90
.92	2137.67	2194.82	2252.35	2310.28	2368.61	2427.37	2486.57	2546.21	.92
.94	2138.81	2195.97	2253.50	2311.44	2369.78	2428.55	2487.76	2547.41	.94
.96	2139.95	2197.11	2254.66	2312.60	2370.96	2429.73	2488.95	2548.61	.96
.98	2141.09	2198.26	2255.81	2313.77	2372.13	2430.91	2490.13	2549.81	.98
1.00	2142.23	2199.41	2256.97	2314.93	2373.30	2432.09	2491.32	2551.00	**1.00**

TABLE II. — (*Continued*)

I	48°	49°	50°	51°	52°	53°	54°	55°	*I*
00	2551.00	2611.15	2671.78	2732.90	2794.54	2856.70	2919.40	2982.67	.00
.02	2552.20	2612.36	2672.99	2734.13	2795.77	2857.95	2920.66	2983.94	.02
.04	2553.40	2613.57	2674.21	2735.36	2797.01	2859.20	2921.92	2985.21	.04
.06	2554.60	2614.78	2675.43	2736.59	2798.25	2860.44	2923.18	2986.48	.06
.08	2555.80	2615.98	2676.65	2737.81	2799.49	2861.69	2924.44	2987.75	.08
.10	2557.00	2617.19	2677.86	2739.04	2800.73	2862.94	2925.70	2989.02	.10
.12	2558.20	2618.40	2679.09	2740.27	2801.97	2864.19	2926.96	2990.30	.12
.14	2559.40	2619.61	2680.31	2741.50	2803.21	2865.44	2928.23	2991.57	.14
.16	2560.60	2620.82	2681.53	2742.73	2804.45	2866.69	2929.49	2992.84	.16
.18	2561.80	2622.03	2682.74	2743.96	2805.69	2867.94	2930.75	2994.12	.18
.20	2563.00	2623.24	2683.96	2745.19	2806.93	2869.20	2932.01	2995.39	.20
22	2564.20	2624.45	2685.18	2746.42	2808.17	2870.45	2933.27	2996.66	.22
.24	2565.40	2625.66	2686.40	2747.65	2809.41	2871.70	2934.53	2997.94	.24
.26	2566.60	2626.87	2687.62	2748.88	2810.65	2872.95	2935.80	2999.21	.26
28	2567.80	2628.08	2688.84	2750.11	2811.89	2874.20	2937.06	3000.48	28
.30	2569.00	2629.29	2690.06	2751.34	2813.13	2875.45	2938.32	3001.76	.30
.32	2570.20	2630.50	2691.28	2752.57	2814.37	2876.70	2939.59	3003.03	.32
.34	2571.40	2631.71	2692.50	2753.80	2815.61	2877.96	2940.85	3004.31	.34
.36	2572.60	2632.92	2693.73	2755.03	2816.85	2879.21	2942.11	3005.58	.36
.38	2573.80	2634.13	2694.95	2756.26	2818.10	2880.46	2943.38	3006.86	.38
.40	2575.01	2635.34	2696.17	2757.49	2819.34	2881.71	2944.64	3008.13	.40
.42	2576.21	2636.56	2697.39	2758.73	2820.58	2882.97	2945.90	3009.41	.42
.44	2577.41	2637.77	2698.61	2759.96	2821.82	2884.22	2947.17	3010.68	.44
.46	2578.61	2638.99	2699.83	2761.19	2823.06	2885.47	2948.43	3011.96	.46
.48	2579.82	2640.19	2701.06	2762.42	2824.31	2886.73	2949.70	3013.24	.48
.50	2581.02	2641.40	2702.28	2763:65	2825.55	2887.98	2950.96	3014.51	.50
.52	2582.22	2642.62	2703.50	2764.89	2826.79	2889.24	2952.23	3015.79	.52
.54	2583.43	2643.83	2704.72	2766.12	2828.04	2890.49	2953.49	3017.07	.54
.56	2584.63	2645.04	2705.95	2767.35	2829.29	2891.74	2954.76	3018.35	.56
.58	2585.83	2646.26	2707.17	2768.59	2830.52	2893.00	2956.03	3019.62	.58
.60	2587.04	2647.47	2708.39	2769.82	2831.77	2894.26	2957.29	3030.90	.60
.62	2588.24	2648.68	2709.62	2771.05	2833.01	2895.51	2958.56	3022.18	.62
.64	2589.44	2649.90	2710.84	2772.29	2834.26	2896.77	2959.83	3023.46	.64
.66	2590.65	2651.11	2712.06	2773.52	2835.50	2898.02	2961.09	3024.74	.66
.68	2591.85	2652.33	2713.29	2774.76	2836.75	2899.28	2962.36	3026.02	.68
.70	2593.06	2653.54	2714.51	2775.99	2837.99	2900.53	2963.63	3027.29	.70
.72	2594.26	2654.76	2715.74	2777.23	2839.24	2901.79	2964.90	3028.57	.72
.74	2595.47	2655.97	2716.96	2778.46	2840.48	2903.05	2966.16	3029.85	.74
.76	2596.67	2657.18	2718.19	2779.70	2841.73	2904.30	2967.43	3031.13	.76
.78	2597.88	2658.40	2719.41	2780.93	2842.98	2905.56	2968.70	3032.41	.78
.80	2599.08	2659.62	2720.64	2782.17	2844.22	2906.82	2969.97	3033.69	.80
.82	2600.29	2660.83	2721.86	2783.41	2845.47	2908.07	2971.24	3034.97	.82
.84	2601.50	2662.05	2723.09	2784.64	2846.72	2909.33	2972.51	3036.25	.84
.86	2602.70	2663.26	2724.32	2785.88	2847.96	2910.59	2973.78	3037.54	.86
.88	2603.91	2664.48	2725.54	2787.11	2849.21	2911.85	2975.05	3038.82	.88
.90	2605.12	2665.69	2726.77	2788.35	2850.46	2913.11	2976.31	3040.10	.90
.92	2606.32	2666.91	2727.99	2789.59	2851.71	2914.37	2977.58	3041.38	.92
.94	2607.53	2668.13	2729.22	2790.82	2852.95	2915.63	2978.86	3042.66	.94
.96	2608.74	2669.34	2730.45	2792.06	2854.20	2916.88	2980.13	3043.94	.96
.98	2609.94	2670.56	2731.68	2793.30	2855.45	2918.14	2981.48	3045.23	.98
1.00	2611.15	2671.78	2732.90	2794.54	2856.70	2919.40	2982.67	3046.51	1.00

TABLE II. — (*Continued*)

I	56°	57°	58°	59°	60°	61°	62°	63°	*I*
.00	3046.51	3110.95	3176.00	3241.68	3308.01	3375.02	3442.72	3511.14	**.00**
.02	3047.79	3112.24	3177.30	3243.00	3309.35	3376.37	3444.08	3512.51	.02
.04	3049.07	3113.54	3178.61	3244.32	3310.38	3377.72	3445.44	3513.88	.04
.06	3050.36	3114.83	3179.92	3245.64	3312.02	3379.06	3446.81	3415.26	.06
.08	3051.64	3116.13	3181.23	3246.96	3313.35	3380.41	3448.17	3516.64	.08
.10	3052.92	3117.42	3182.54	3248.28	3314.69	3381.76	3449.53	3518.02	.10
.12	3054.21	3118.72	3183.85	3249.61	3316.02	3383.11	3450.89	3519.39	.12
.14	3055.49	3120.02	3185.15	3250.93	3317.36	3384.46	3452.26	3520.77	.14
.16	3056.78	3121.31	3186.46	3252.25	3318.69	3385.81	3453.62	3522.15	.16
.18	3058.06	3122.61	3187.77	3253.57	3320.03	3387.16	3454.98	3523.53	.18
.20	3059.35	3123.91	3189.08	3254.89	3321.36	3388.51	3456.35	3524.90	**.20**
.22	3060.63	3125.20	3190.39	3256.22	3322.70	3389.85	3457.71	3526.28	.22
.24	3061.92	3126.50	3191.70	3257.54	3324.03	3391.21	3459.07	3527.66	.24
.26	3063.20	3127.80	3193.01	3258.86	3325.37	3392.56	3460.44	3529.04	.26
.28	3064.49	3129.10	3194.32	3260.19	3326.71	3393.91	3461.80	3530.42	.28
.30	3065.78	3130.40	3195.63	3261.51	3328.05	3395.26	3463.17	3531.80	.30
.32	3067.06	3131.69	3196.95	3262.83	3329.38	3396.61	3464.53	3533.18	.32
.34	3068.35	3132.99	3198.26	3264.16	3330.72	3397.97	3465.90	3534.56	.34
.36	3069.64	3134.29	3199.57	3265.48	3332.06	3399.31	3467.27	3535.94	.36
.38	3070.92	3135.59	3200.88	3266.81	3333.40	3400.66	3468.63	3537.32	.38
.40	3072.21	3136.89	3202.19	3268.14	3334.74	3402.02	3470.00	3538.70	**.40**
.42	3073.50	3138.19	3203.51	3269.46	3336.08	3403.37	3471.37	3540.09	.42
.44	3074.79	3139.49	3204.82	3270.79	3337.41	3404.72	3472.73	3541.47	.44
.46	3076.08	3140.79	3206.13	3272.11	3338.75	3406.08	3474.10	3542.85	.46
.48	3077.36	3142.09	3207.44	3273.44	3340.09	3407.43	3475.47	3544.23	.48
.50	3078.65	3143.39	3208.76	3274.76	3341.43	3408.78	3476.84	3545.62	.50
.52	3079.94	3144.69	3210.07	3276.09	3342.77	3410.14	3478.20	3547.00	.52
.54	3081.23	3146.00	3211.39	3277.42	3344.11	3411.49	3479.57	3548.38	.54
.56	3082.52	3147.30	3212.70	3278.75	3345.46	3412.85	3480.94	3549.76	.56
.58	3083.81	3148.60	3214.01	3280.07	3346.80	3414.20	3482.31	3551.15	.58
.60	3085.10	3149.90	3215.33	3281.40	3348.14	3415.56	3483.68	3552.53	**.60**
.62	3086.39	3151.20	3216.64	3282.73	3349.48	3416.91	3485.05	3553.92	.62
.64	3087.68	3152.51	3217.96	3284.06	3350.82	3418.27	3486.42	3555.30	.64
.66	3088.97	3153.81	3219.27	3285.39	3352.16	3419.62	3487.79	3556.69	.66
.68	3090.26	3155.11	3220.59	3286.72	3353.51	3420.98	3489.16	3558.07	.68
.70	3091.55	3156.42	3221.91	3288.04	3354.85	3422.34	3490.53	3559.46	.70
.72	3092.84	3157.72	3223.22	3289.37	3356.19	3423.69	3491.90	3560.84	.72
.74	3094.13	3159.02	3224.54	3290.70	3357.53	3425.05	3493.27	3562.23	.74
.76	3095.43	3160.33	3225.86	3292.03	3358.88	3426.41	3494.65	3563.62	.76
.78	3096.72	3161.64	3227.17	3293.36	3360.22	3427.77	3496.02	3565.01	.78
.80	3098.01	3162.94	3228.49	3294.69	3361.57	3429.12	3497.39	3566.39	**.80**
.82	3099.30	3164.24	3229.81	3296.03	3362.91	3430.48	3498.77	3567.78	.82
.84	3100.60	3165.55	3231.13	3297.36	3364.26	3431.84	3500.14	3569.17	.84
.86	3101.89	3166.85	3232.45	3298.69	3365.60	3433.20	3501.51	3570.56	.86
.88	3103.18	3168.16	3233.76	3300.02	3366.94	3434.57	3502.89	3571.95	.88
.90	3104.48	3169.46	3235.08	3301.35	3368.29	3435.92	3504.26	3573.33	.90
.92	3105.77	3170.77	3236.40	3302.68	3369.64	3437.28	3505.63	3574.72	.92
.94	3107.06	3172.08	3237.72	3304.02	3370.98	3438.64	3507.01	3576.11	.94
.96	3108.36	3173.38	3239.04	3305.35	3372.33	3440.00	3508.38	3577.50	.96
.98	3109.65	3174.69	3240.36	3306.68	3373.67	3441.36	3509.76	3578.89	.98
1.00	3110.95	3176.00	3241.68	3308.01	3375.02	3442.72	3511.14	3580.28	**1.00**

TABLE II. — (*Continued*)

I	64°	65°	66°	67°	68°	69°	70°	71°	*I*
.00	3580.28	3650.19	3720.88	3792.37	3864.70	3937.88	4011.94	4086.92	**.00**
.02	3581.67	3651.60	3722.30	3793.81	3866.15	3939.35	4013.43	4088.43	.02
.04	3583.06	3653.00	3723.72	3795.25	3867.61	3940.82	4014.93	4089.94	.04
.06	3584.46	3654.41	3725.15	3796.69	3869.06	3942.30	4016.42	4091.45	.06
.08	3585.85	3655.82	3726.57	3798.13	3870.52	3943.77	4017.91	4092.96	.08
.10	3587.24	3657.22	3727.99	3799.57	3871.98	3945.25	4019.40	4094.47	.10
.12	3588.63	3658.63	3729.41	3801.01	3873.43	3946.72	4020.89	4095.98	.12
.14	3590.02	3660.04	3730.84	3802.45	3874.89	3948.19	4022.39	4097.49	.14
.16	3591.42	3661.45	3732.26	3803.89	3876.35	3949.67	4023.88	4099.00	.16
.18	3592.81	3662.86	3733.69	3805.33	3877.81	3951.15	4025.37	4100.51	.18
.20	3594.20	3664.26	3735.11	3806.77	3879.27	3952.62	4026.86	4102.03	**.20**
.22	3595.60	3665.67	3736.54	3808.21	3880.72	3954.10	4028.36	4103.54	.22
.24	3596.99	3667.08	3737.96	3809.65	3882.18	3955.57	4029.85	4105.05	.24
.26	3598.39	3668.49	3739.39	3811.10	3883.67	3957.05	4031.35	4106.57	.26
.28	3599.78	3669.88	3740.81	3812.54	3885.10	3958.53	4032.84	4108.08	.28
.30	3601.17	3671.31	3742.24	3813.98	3886.56	3960.00	4034.34	4109.59	.30
.32	3602.57	3672.72	3743.67	3815.42	3888.02	3961.48	4035.84	4111.11	.32
.34	3603.96	3674.13	3745.09	3816.87	3889.48	3962.96	4037.33	4112.62	.34
.36	3605.36	3675.55	3746.52	3818.31	3890.94	3964.44	4038.83	4114.14	.36
.38	3606.76	3676.96	3747.95	3819.76	3892.40	3965.92	4040.33	4115.65	.38
.40	3608.15	3678.37	3749.38	3821.20	3893.87	3967.40	4041.82	4117.17	**.40**
.42	3609.55	3679.78	3750.81	3822.65	3895.33	3968.88	4043.32	4118.69	.42
.44	3610.95	3681.20	3752.24	3824.09	3896.79	3970.36	4044.82	4120.20	.44
.46	3612.34	3682.61	3753.66	3825.54	3898.25	3971.84	4046.32	4121.72	.46
.48	3613.74	3684.02	3755.09	3826.98	3899.73	3973.32	4047.82	4123.24	.48
.50	3615.14	3685.43	3756.52	3828.43	3901.18	3974.80	4049.32	4124.76	.50
.52	3616.54	3686.85	3757.95	3829.88	3902.64	3976.28	4050.82	4126.28	.52
.54	3617.94	3688.26	3759.38	3831.32	3904.11	3977.76	4052.32	4127.80	.54
.56	3619.34	3689.68	3760.81	3832.77	3905.57	3979.24	4053.82	4129.31	.56
.58	3620.74	3691.09	3762.24	3834.22	3907.04	3980.73	4055.32	4130.83	.58
.60	3622.14	3692.51	3763.68	3835.67	3908.50	3982.21	4056.82	4132.35	**.60**
.62	3623.54	3693.92	3765.11	3837.12	3909.97	3983.69	4058.32	4133.87	.62
.64	3624.93	3695.34	3766.54	3838.56	3911.43	3985.18	4059.82	4135.40	.64
.66	3626.34	3696.76	3767.97	3840.01	3912.90	3986.66	4061.32	4136.92	.66
.68	3627.74	3698.17	3769.41	3841.46	3914.37	3988.15	4062.83	4138.44	.68
.70	3629.14	3699.59	3770.84	3842.91	3915.83	3989.63	4064.33	4139.96	.70
.72	3630.54	3701.01	3772.27	3844.36	3917.30	3991.12	4065.83	4141.48	.72
.74	3631.94	3702.42	3773.71	3845.81	3918.77	3992.60	4067.34	4143.00	.74
.76	3633.34	3703.84	3775.14	3847.26	3920.24	3994.09	4068.84	4144.53	.76
.78	3634.74	3705.26	3776.57	3848.71	3921.70	3995.57	4070.34	4146.05	.78
.80	3636.15	3706.68	3778.01	3850.17	3923.17	3997.06	4071.85	4148.57	**.80**
.82	3637.55	3708.10	3779.44	3851.62	3924.64	3998.55	4073.36	4149.10	.82
.84	3638.95	3709.52	3780.88	3853.07	3926.11	4000.03	4074.86	4150.62	.84
.86	3640.36	3710.93	3782.31	3854.52	3927.58	4001.52	4076.37	4152.15	.86
.88	3641.76	3712.35	3783.75	3855.97	3929.05	4003.01	4077.87	4153.67	.88
.90	3643.16	3713.77	3785.19	3857.43	3930.68	4004.50	4079.38	4155.20	.90
.92	3644.57	3715.19	3786.62	3858.88	3931.99	4005.99	4080.89	4156.73	.92
.94	3645.97	3716.61	3788.06	3860.33	3933.46	4007.48	4082.39	4158.25	.94
.96	3647.38	3718.04	3789.50	3861.79	3934.94	4008.96	4083.90	4159.78	.96
.98	3648.78	3719.46	3790.93	3863.24	3936.41	4010.45	4085.41	4161.31	.98
1.00	3650.19	3720.88	3792.37	3864.70	3937.88	4011.94	4086.92	4162.83	**1.00**

TABLE II. — (*Continued*)

I	72°	73°	74°	75°	76°	77°	78°	I
.00	4162.83	4239.72	4317.60	4396.52	4476.50	4557.56	4639.78	.00
.02	4164.36	4241.27	4319.17	4398.11	4478.10	4559.20	4641.44	.02
.04	4165.89	4242.81	4320.74	4399.69	4479.72	4560.84	4643.09	.04
.06	4167.42	4244.36	4322.31	4401.28	4481.33	4562.47	4644.75	.06
.08	4168.95	4245.91	4323.88	4402.87	4482.94	4564.10	4646.41	.08
.10	4170.48	4247.46	4325.45	4404.46	4484.55	4565.74	4648.06	.10
.12	4172.01	4249.01	4327.02	4406.06	4486.16	4567.37	4649.72	.12
.14	4173.54	4250.56	4328.59	4407.65	4487.78	4569.01	4651.38	.14
.16	4175.07	4252.11	4330.16	4409.24	4489.39	4570.65	4653.04	.16
.18	4176.60	4253.66	4331.73	4410.83	4491.01	4572.28	4654.70	.18
.20	4178.13	4255.21	4333.30	4412.42	4492.62	4573.92	4656.36	.20
.22	4179.66	4256.77	4334.87	4414.02	4494.23	4575.56	4658.02	.22
.24	4181.20	4258.32	4336.45	4415.63	4495.85	4577.19	4659.68	.24
.26	4182.73	4259.87	4338.02	4417.21	4497.47	4578.83	4661.34	.26
.28	4184.26	4261.42	4339.59	4418.80	4499.09	4580.47	4663.01	.28
.30	4185.80	4262.98	4340.97	4420.39	4500.70	4582.11	4664.67	.30
.32	4187.33	4264.53	4342.74	4421.99	4502.32	4583.75	4666.33	.32
.34	4188.87	4266.09	4344.32	4423.59	4503.94	4585.39	4668.00	.34
.36	4190.40	4267.64	4345.89	4425.18	4505.55	4587.03	4669.66	.36
.38	4191.93	4269.19	4347.47	4426.78	4507.17	4588.67	4671.32	.38
.40	4193.47	4270.85	4349.04	4428.38	4508.79	4590.31	4672.99	.40
.42	4195.01	4272.31	4350.62	4429.97	4510.41	4591.96	4674.65	.42
.44	4196.54	4273.86	4352.19	4431.57	4512.03	4593.60	4676.32	.44
.46	4198.08	4275.42	4353.77	4433.17	4513.65	4595.24	4677.99	.46
.48	4199.62	4276.98	4355.35	4434.77	4515.27	4596.89	4679.65	.48
.50	4201.15	4278.53	4356.93	4436.37	4516.89	4598.53	4681.32	.50
.52	4202.69	4280.09	4358.51	4437.97	4518.51	4600.18	4682.99	.52
.54	4204.23	4281.65	4360.08	4439.57	4520.14	4601.82	4684.66	.54
.56	4205.77	4283.21	4361.66	4441.17	4521.76	4603.47	4686.32	.56
.58	4207.31	4284.77	4363.24	4442.77	4523.38	4605.19	4687.99	.58
.60	4208.85	4286.33	4364.81	4444.37	4525.01	4606.76	4689.67	.60
.62	4210.39	4287.89	4366.40	4445.97	4526.63	4608.40	4691.33	.62
.64	4211.93	4289.45	4367.98	4447.58	4528.25	4610.05	4693.00	.64
.66	4213.47	4291.01	4369.56	4449.18	4529.88	4611.70	4694.68	.66
.68	4215.01	4292.57	4371.15	4450.78	4531.50	4613.35	4696.35	.68
.70	4216.55	4294.13	4372.73	4452.39	4533.13	4614.99	4698.02	.70
.72	4218.09	4295.69	4374.31	4453.99	4534.76	4616.64	4699.69	.72
.74	4219.63	4297.25	4375.90	4455.59	4536.38	4618.29	4701.37	.74
.76	4221.18	4298.82	4377.48	4457.20	4538.01	4619.94	4703.04	.76
.78	4222.72	4300.38	4379.06	4458.81	4539.64	4621.59	4704.71	.78
.80	4224.26	4301.94	4380.65	4460.41	4541.27	4623.24	4706.39	.80
.82	4225.81	4303.51	4382.23	4462.02	4542.89	4624.90	4708.06	.82
.84	4227.35	4305.07	4383.82	4463.62	4544.52	4626.55	4709.74	.84
.86	4228.90	4306.64	4385.40	4465.23	4546.15	4628.20	4711.41	.86
.88	4230.44	4308.20	4386.99	4466.84	4547.78	4629.85	4713.09	.88
.90	4231.98	4309.77	4388.58	4468.45	4549.41	4631.51	4714.77	.90
.92	4233.53	4311.33	4390.16	4470.05	4551.04	4633.16	4716.45	.92
.94	4235.08	4312.90	4391.75	4471.66	4552.67	4634.81	4718.12	.94
.96	4236.62	4314.46	4393.34	4473.27	4554.31	4636.47	4719.80	.96
.98	4238.17	4316.03	4394.93	4474.88	4555.94	4638.12	4721.48	.98
1.00	4239.72	4317.60	4396.52	4476.50	4557.56	4639.78	4723.16	1.00

TABLE II. — (*Continued*)

I	79°	80°	81°	82°	83°	84°	85°	*I*
.00	4723.16	4807.85	4893.58	4980.71	5069.17	5159.00	5250.26	.00
.02	4724.84	4809.45	4895.31	4982.47	5070.95	5160.80	5252.10	.02
.04	4726.52	4811.16	4897.04	4984.22	5072.73	5162.62	5253.94	.04
.06	4728.20	4812.86	4898.78	4985.98	5074.52	5164.43	5255.78	.06
.08	4729.88	4814.57	4900.51	4987.74	5076.30	5166.25	5257.62	.08
.10	4731.56	4816.27	4902.24	4989.49	5078.09	5168.06	5259.46	.10
.12	4733.25	4817.98	4903.97	4991.25	5079.87	5169.88	5261.30	.12
.14	4734.93	4819.69	4905.70	4993.01	5081.66	5171.69	5263.15	.14
.16	4736.61	4821.40	4907.44	4994.77	5083.45	5173.50	5264.99	.16
.18	4738.29	4823.10	4909.17	4996.53	5085.23	5175.32	5266.84	.18
.20	4739.98	4824.81	4910.90	4998.29	5087.02	5177.14	5268.68	.20
.22	4741.66	4826.52	4912.64	5000.05	5088.81	5178.95	5270.53	.22
.24	4743.35	4828.23	4914.37	5001.82	5090.60	5180.77	5272.38	.24
.26	4745.03	4829.94	4916.11	5003.58	5092.39	5182.59	5274.22	.26
.28	4746.72	4831.65	4917.83	5005.34	5094.18	5184.41	5276.07	.28
.30	4748.41	4833.36	4919.58	5007.10	5095.97	5186.23	5277.92	.30
.32	4750.09	4835.08	4921.32	5008.87	5097.76	5188.05	5279.77	.32
.34	4751.78	4836.79	4923.06	5010.63	5099.55	5189.87	5281.62	.34
.36	4753.47	4838.50	4924.80	5012.40	5101.34	5191.69	5283.47	.36
.38	4755.16	4840.22	4926.54	5014.16	5103.14	5193.51	5285.32	.38
.40	4756.85	4841.93	4928.28	5015.93	5104.93	5195.33	5287.17	.40
.42	4758.54	4843.64	4930.02	5017.70	5106.73	5197.15	5289.02	.42
.44	4760.23	4845.36	4931.76	5019.46	5108.52	5198.98	5290.87	.44
.46	4761.92	4847.08	4933.50	5021.23	5110.32	5200.80	5292.73	.46
.48	4763.61	4848.79	4935.24	5023.00	5112.11	5202.62	5294.58	.48
.50	4765.30	4850.51	4936.98	5024.77	5113.91	5204.45	5296.42	.50
.52	4766.99	4852.22	4938.73	5026.54	5115.70	5206.27	5298.29	.52
.54	4768.69	4853.94	4940.47	5028.31	5117.50	5208.10	5300.13	.54
.56	4770.38	4855.66	4942.21	5030.08	5119.30	5209.93	5302.00	.56
.58	4772.07	4857.38	4943.96	5031.85	5121.10	5211.75	5303.86	.58
.60	4773.76	4859.10	4945.70	5033.62	5122.90	5213.58	5305.71	.60
.62	4775.46	4860.82	4947.45	5035.39	5124.70	5215.41	5307.57	.62
.64	4777.15	4862.54	4949.19	5037.17	5126.50	5217.24	5309.43	.64
.66	4778.85	4864.26	4950.94	5038.94	5128.30	5219.07	5311.29	.66
.68	4780.55	4865.98	4952.68	5040.71	5130.10	5220.90	5313.15	.68
.70	4782.24	4867.70	4954.43	5042.49	5131.90	5222.73	5315.01	.70
.72	4783.94	4869.42	4956.18	5044.26	5133.70	5224.56	5316.87	.72
.74	4785.64	4871.14	4957.93	5046.04	5135.51	5226.39	5318.73	.74
.76	4787.33	4872.87	4959.68	5047.81	5137.31	5228.22	5320.59	.76
.78	4789.03	4874.59	4961.63	5049.59	5139.12	5230.06	5322.46	.78
.80	4790.73	4876.31	4963.18	5051.37	5140.92	5231.89	5324.32	.80
.82	4792.43	4878.04	4964.93	5053.14	5142.73	5233.72	5326.18	.82
.84	4794.13	4879.76	4966.68	5054.92	5144.53	5235.56	5328.05	.84
.86	4795.83	4881.49	4968.43	5056.70	5146.34	5237.39	5329.91	.86
.88	4797.53	4883.22	4970.18	5058.48	5148.15	5239.23	5331.78	.88
.90	4799.23	4884.94	4971.94	5060.26	5149.95	5241.07	5333.65	.90
.92	4800.93	4886.67	4973.69	5062.04	5151.76	5242.90	5335.51	.92
.94	4802.64	4888.40	4975.44	5063.82	5153.57	5244.74	5337.38	.94
.96	4804.34	4890.13	4977.20	5065.60	5155.38	5246.58	5339.25	.96
.98	4806.04	4891.85	4978.95	5067.38	5157.19	5248.42	5341.12	.98
1.00	4807.85	4893.58	4980.71	5069.17	5159.00	5250.26	5342.99	1.00

TABLE II. — (*Continued*)

I	86°	87°	88°	89°	90°	91°	92°	*I*
.00	5342.99	5437.24	5533.06	5630.51	5729.65	5830.53	5933.23	**.00**
.02	5344.85	5439.14	5534.99	5632.48	5731.65	5832.57	5935.30	.02
.04	5346.73	5441.04	5536.92	5634.44	5733.65	5834.61	5937.37	.04
.06	5348.60	5442.94	5538.86	5636.41	5735.65	5836.64	5939.45	.06
.08	5350.46	5444.84	5540.79	5638.38	5737.65	5838.68	5941.52	.08
.10	5352.34	5446.75	5542.73	5640.35	5739.66	5840.72	5943.60	.10
.12	5354.21	5448.65	5544.67	5642.32	5741.66	5842.76	5945.67	.12
.14	5356.09	5450.55	5546.60	5644.29	5743.67	5844.80	5947.75	.14
.16	5357.96	5452.46	5548.54	5646.26	5745.67	5846.84	5949.83	.16
.18	5359.84	5454.37	5550.48	5648.23	5747.68	5848.88	5951.91	.18
.20	5361.71	5456.27	5552.42	5650.20	5749.69	5850.93	5953.99	**.20**
.22	5363.59	5458.18	5554.36	5652.18	5751.69	5852.97	5956.07	.22
.24	5365.46	5460.09	5556.30	5654.15	5753.70	5855.01	5958.15	.24
.26	5367.34	5462.00	5558.24	5656.12	5755.71	5857.05	5960.23	.26
.28	5369.22	5463.91	5560.18	5658.10	5757.72	5859.10	5962.31	.28
.30	5371.10	5465.81	5562.12	5660.07	5759.73	5861.15	5964.40	.30
.32	5372.98	5467.72	5564.06	5662.05	5761.74	5863.20	5966.48	.32
.34	5374.86	5469.64	5566.01	5664.03	5763.75	5865.24	5968.56	.34
.36	5376.74	5471.55	5567.95	5666.00	5765.76	5867.29	5970.65	.36
.38	5378.62	5473.46	5569.90	5667.98	5767.78	5869.34	5972.74	.38
.40	5380.50	5475.37	5571.84	5669.96	5769.79	5871.38	5974.82	**.40**
.42	5382.38	5474.29	5573.79	5671.94	5771.80	5873.44	5976.91	.42
.44	5384.26	5479.20	5575.73	5673.92	5773.82	5875.49	5979.00	.44
.46	5386.15	5481.12	5577.68	5675.90	5775.84	5877.54	5981.09	.46
.48	5388.03	5483.03	5579.63	5677.88	5777.85	5879.60	5983.18	.48
.50	5389.92	5484.95	5581.58	5679.87	5779.87	5881.65	5985.27	.50
.52	5391.80	5486.86	5583.53	5681.85	5781.89	5883.71	5987.36	.52
.54	5393.69	5488.78	5585.48	5683.83	5783.91	5885.76	5989.46	.54
.56	5395.57	5490.70	5587.43	5685.82	5785.93	5887.82	5991.55	.56
.58	5397.46	5492.62	5589.38	5687.80	5787.95	5889.87	5993.64	.58
.60	5399.35	5494.54	5591.33	5689.79	5789.97	5891.93	5995.74	**.60**
.62	5401.24	5496.46	5593.29	5691.78	5791.99	5893.98	5997.83	.62
.64	5403.13	5498.38	5595.24	5693.76	5794.01	5896.05	5999.93	.64
.66	5405.02	5500.30	5597.19	5695.75	5796.03	5898.10	6002.02	.66
.68	5406.91	5502.22	5599.15	5697.74	5798.06	5900.16	6004.12	.68
.70	5408.80	5504.14	5601.10	5699.73	5800.08	5902.23	6006.22	.70
.72	5410.69	5506.07	5603.06	5701.72	5802.11	5904.29	6008.32	.72
.74	5412.58	5507.99	5605.01	5703.71	5804.13	5906.35	6010.42	.74
.76	5414.47	5509.92	5606.97	5705.70	5806.16	5908.41	6012.52	.76
.78	5416.37	5511.84	5608.93	5707.69	5808.19	5910.48	6014.62	.78
.80	5418.26	5513.77	5610.89	5709.68	5810.21	5912.54	6016.72	**.80**
.82	5420.16	5515.69	5612.85	5711.68	5812.24	5914.61	6018.83	.82
.84	5422.05	5517.62	5614.81	5713.67	5814.27	5916.67	6020.93	.84
.86	5423.95	5519.55	5616.77	5715.67	5816.30	5918.74	6023.04	.86
.88	5425.84	5521.48	5618.73	5717.66	5818.33	5920.81	6025.14	.88
.90	5427.74	5523.40	5620.69	5719.66	5820.37	5922.87	6027.25	.90
.92	5429.64	5525.33	5622.65	5721.65	5822.40	5924.94	6029.35	.92
.94	5431.54	5527.26	5624.62	5723.65	5824.43	5927.01	6031.46	.94
.96	5433.44	5529.19	5626.58	5725.65	5826.47	5929.08	6033.57	.96
.98	5435.34	5531.13	5628.55	5727.65	5828.50	5931.15	6035.68	.98
1.00	5437.24	5533.06	5630.51	5729.65	5830.53	5933.23	6037.79	**1.00**

TABLE II. — (*Continued*)

I	93°	94°	95°	96°	97°	98°	99°	I
.00	6037.79	6144.30	6252.82	6363.42	6476.19	6591.21	6708.56	.00
.02	6039.90	6146.45	6255.01	6365.66	6478.47	6593.53	6710.93	.02
.04	6042.01	6148.60	6257.20	6367.89	6480.75	6595.86	6713.30	.04
.06	6044.12	6150.75	6259.39	6370.13	6483.03	6598.18	6715.67	.06
.08	6046.25	6152.90	6261.59	6372.36	6485.31	6600.51	6718.05	.08
.10	6048.35	6155.06	6263.78	6374.60	6487.59	6602.84	6720.42	.10
.12	6050.47	6157.21	6265.98	6376.84	6489.87	6605.16	6722.80	.12
.14	6052.58	6159.37	6268.16	6379.08	6492.16	6607.49	6725.18	.14
.16	6054.70	6161.52	6270.37	6381.32	6494.44	6609.83	6727.56	.16
.18	6056.82	6163.68	6272.57	6383.56	6496.73	6612.16	6729.93	.18
.20	6058.96	6165.84	6274.77	6385.80	6499.01	6614.49	6732.32	.20
.22	6061.05	6168.00	6276.97	6388.04	6501.30	6616.82	6734.70	.22
.24	6063.17	6170.15	6279.17	6390.29	6503.59	6619.17	6737.08	.24
.26	6065.29	6172.32	6281.37	6392.53	6505.88	6621.49	6739.46	.26
.28	6067.42	6174.48	6283.57	6394.77	6508.17	6623.83	6741.85	.28
.30	6069.55	6176.64	6285.78	6397.02	6510.46	6626.16	6744.23	.30
.32	6071.66	6178.80	6287.98	6399.27	6512.75	6628.50	6746.62	.32
.34	6073.78	6180.96	6290.18	6401.52	6515.04	6630.84	6749.00	.34
.36	6075.91	6183.13	6292.39	6403.76	6517.33	6633.18	6751.39	.36
.38	6078.03	6185.29	6294.60	6406.01	6519.63	6635.52	6753.78	.38
.40	6080.16	6187.46	6296.80	6408.26	6521.92	6637.86	6756.17	.40
.42	6082.28	6189.63	6299.01	6410.52	6524.22	6640.21	6758.56	.42
.44	6084.41	6191.79	6301.22	6412.77	6526.62	6642.55	6760.96	.44
.46	6086.54	6193.96	6303.43	6415.02	6528.81	6644.90	6763.35	.46
.48	6088.67	6196.13	6305.64	6417.28	6531.11	6647.24	6765.74	.48
.50	6090.80	6198.30	6307.85	6419.53	6533.41	6649.59	6768.14	.50
.52	6092.93	6200.47	6310.07	6421.79	6535.71	6651.93	6770.53	.52
.54	6095.06	6202.64	6312.28	6424.04	6538.02	6654.28	6772.93	.54
.56	6097.19	6204.81	6314.49	6426.30	6540.32	6656.63	6775.33	.56
.58	6099.32	6206.99	6316.71	6428.56	6542.62	6658.98	6777.73	.58
.60	6101.46	6209.16	6318.92	6430.82	6544.93	6661.33	6780.12	.60
.62	6103.59	6211.34	6321.14	6433.08	6547.23	6663.69	6782.53	.62
.64	6105.73	6213.51	6323.36	6435.34	6549.54	6666.04	6784.93	.64
.66	6107.86	6215.69	6325.58	6437.60	6551.85	6668.39	6787.33	.66
.68	6110.00	6217.87	6327.80	6439.86	6554.15	6670.75	6789.73	.68
.70	6112.14	6220.04	6330.02	6442.13	6556.46	6673.10	6792.14	.70
.72	6114.28	6222.22	6332.24	6444.39	6558.77	6675.46	6794.55	.72
.74	6116.42	6224.40	6334.46	6446.66	6561.08	6677.82	6796.95	.74
.76	6118.55	6226.58	6336.68	6448.93	6563.39	6680.18	6799.36	.76
.78	6120.70	6228.77	6338.90	6451.19	6565.71	6682.54	6801.77	.78
.80	6122.84	6230.95	6341.13	6453.46	6568.02	6684.90	6804.18	.80
.82	6124.98	6233.13	6343.35	6455.73	6570.34	6687.26	6806.59	.82
.84	6127.12	6235.31	6345.58	6458.00	6572.65	6689.62	6809.00	.84
.86	6129.27	6237.50	6347.81	6460.27	6574.97	6691.99	6811.41	.86
.88	6131.42	6239.69	6350.04	6462.54	6577.29	6694.35	6813.83	.88
.90	6133.56	6241.87	6352.26	6464.81	6579.60	6696.72	6816.24	.90
.92	6135.70	6244.06	6354.49	6467.09	6581.92	6699.08	6818.66	.92
.94	6137.85	6246.25	6356.72	6469.36	6584.24	6701.45	6821.07	.94
.96	6140.00	6248.44	6358.96	6471.64	6586.56	6703.82	6823.49	.96
.98	6142.15	6250.63	6361.19	6473.91	6588.89	6706.19	6825.91	.98
1.00	6144.30	6252.82	6363.42	6476.19	6591.21	6708.56	6828.33	1.00

TABLE III. — Tangent Distance Corrections

$T_D = T_{1^\circ}/D +$ tabular correction

I \ D	2°	4°	6°	8°	10°	12°	14°	16°	18°	20°	D / I
1°	0.00	0.00	0.00	0.01	0.01	0.01	0.01	0.01	0.01	0.01	1°
2	.00	.00	.01	.01	.01	.02	.02	.02	.02	.03	2
4	.00	.01	.01	.02	.03	.03	.04	.04	.05	.05	4
6	.01	.01	.02	.03	.04	.05	.05	.06	.07	.08	6
8	.01	.02	.03	.04	.05	.06	.07	.08	.09	.10	8
10	0.01	0.02	0.04	0.05	0.06	0.08	0.09	0.10	0.11	0.13	10
12	.01	.03	.04	.06	.08	.09	.11	.12	.14	.15	12
14	.01	.03	.05	.07	.09	.11	.13	14	.16	.18	14
16	.02	.04	.06	.08	.10	.12	.14	.16	.18	.20	16
18	.02	.04	.07	.09	.11	.14	.16	.18	.21	.23	18
20	0.02	0.05	0.07	0.10	0.13	0.15	0.18	0.21	0.23	0.26	20
22	.02	.05	.08	.11	.14	.17	.20	.23	.25	.29	22
24	.02	.06	.09	.12	.15	.18	.22	.25	.28	.31	24
26	.03	.06	.10	.13	.17	.20	.24	.27	.30	.34	26
28	.03	.07	.11	.14	.18	.22	.25	.29	.33	.36	28
30	0.03	0.07	0.11	0.15	0.19	0.23	0.27	0.31	0.35	0.39	30
32	.03	.08	.12	.16	.21	.25	.29	.33	.38	.42	32
34	.03	.08	.13	.18	.22	.27	.31	.36	.40	.45	34
36	.04	.09	.14	.19	.23	.28	.33	.38	.43	.47	36
38	.04	.09	.15	.20	.25	.30	.35	.40	.45	.50	38
40	0.04	0.10	0.15	0.21	0.26	0.32	0.37	0.42	0.47	0.53	40
42	.04	.10	.16	.22	.28	.33	.39	.45	.50	.56	42
44	.04	.11	.17	.23	.29	.35	.41	.47	.53	.59	44
46	.05	.12	.18	.24	.31	.37	.43	.49	.56	.62	46
48	.05	.12	.19	.26	.32	.39	.45	.52	.59	.65	48
50	0.05	0.13	0.20	0.27	0.34	0.40	0.47	0.54	0.61	0.68	50
52	.05	.13	.21	.28	.35	.42	.50	.57	.64	.71	52
54	.06	.14	.22	.29	.37	.44	.52	.59	.67	.74	54
56	.06	.15	.23	.30	.38	.46	.54	.62	.70	.77	56
58	.06	.15	.24	.32	.40	.48	.56	.64	.73	.80	58
60	0.06	0.16	0.24	0.33	0.42	0.50	0.58	0.67	0.75	0.84	60
62	.07	.16	.25	.34	.43	.52	.61	.70	.79	.87	62
64	.07	.17	.27	.36	.45	.54	.64	.73	.82	.91	64
66	.07	.18	.28	.37	.47	.56	.66	.75	.85	.95	66
68	.07	.18	.29	.39	.49	.59	.69	.78	.88	.98	68
70	0.08	0.19	0.30	0.40	0.50	0.61	0.71	0.81	0.91	1.02	70
72	.08	.20	.31	.42	.52	.63	.74	.84	.95	1.06	72
74	.08	.21	.32	.43	.54	.65	.77	.87	.99	1.10	74
76	.09	.21	.33	.45	.56	.68	.79	.91	1.02	1.14	76
78	.09	.22	.34	.46	.58	.70	.82	.94	1.06	1.18	78
80	0.09	0.23	0.36	0.48	0.60	0.73	0.84	0.97	1.10	1.22	80
82	.09	.24	.37	.50	.63	.75	.88	1.01	1.14	1.27	82
84	.10	.25	.38	.52	.65	.78	.91	1.05	1.18	1.31	84
86	.10	.25	.40	.53	.67	.81	.95	1.08	1.22	1.36	86
88	.11	.26	.41	.55	.70	.84	.98	1.12	1.26	1.41	88
90	0.11	0.27	0.42	0.57	0.72	0.87	1.02	1.16	1.31	1.45	90
92	.11	.28	.44	.59	.75	.90	1.05	1.20	1.36	1.50	92
94	.12	.29	.46	.61	.77	.93	1.09	1.24	1.40	1.56	94
96	.12	.30	.47	.64	.80	.96	1.13	1.29	1.45	1.62	96
98	.13	.31	.49	.66	.83	1.00	1.17	1.34	1.51	1.68	98
100	0.13	0.33	0.51	0.68	0.86	1.03	1.21	1.38	1.56	1.74	100

TABLE IV. — External Distances for a 1° Curve

$E_D = E_{1^\circ}/D$ (approx.)

I	0°	10°	20°	30°	40°	50°	60°	70°	80°	90°
.0	.0	21.9	88.4	202.1	367.7	592.3	886.4	1265.0	1749.9	2373.3
.2	.0	22.8	90.2	04.9	71.6	97.5	93.1	73.5	60.9	87.5
.4	.0	23.7	92.0	07.7	75.5	602.7	99.8	82.1	71.9	2401.8
.6	.1	24.6	93.8	10.5	79.4	07.9	906.5	90.8	83.0	16.1
.8	.1	25.5	95.7	13.4	83.4	13.1	13.3	99.5	94.1	30.5
1.0	.2	26.5	97.6	216.2	387.4	618.4	920.1	1308.2	1805.3	2444.9
.2	.3	27.5	99.5	19.1	91.4	23.7	27.0	17.0	16.6	59.5
.4	.4	28.5	101.4	22.0	95.4	29.0	33.9	25.8	27.9	74.2
.6	.6	29.5	103.3	25.0	99.5	34.4	40.8	34.7	39.3	88.8
.8	.7	30.5	105.3	27.9	403.5	39.8	47.8	43.6	50.7	2503.6
2.0	.9	31.6	107.2	230.9	407.6	645.2	954.8	1352.6	1862.2	2518.5
.2	1.1	32.6	9.2	33.9	11.8	50.6	61.8	61.6	73.8	33.4
.4	1.3	33.7	11.2	36.9	15.9	56.1	68.8	70.6	85.4	48.5
.6	1.5	34.8	13.3	39.9	20.1	61.6	75.9	79.7	97.0	63.6
.8	1.7	35.9	15.3	43.0	24.3	67.1	83.1	88.9	1908.7	78.7
3.0	2.0	37.1	117.4	246.1	428.5	672.7	990.2	1398.0	1920.5	2594.0
.2	2.2	38.2	19.5	49.2	32.7	78.2	97.4	1407.3	32.4	2609.4
.4	2.5	39.4	21.6	52.3	37.0	83.9	1004.7	16.5	44.3	24.8
.6	2.8	40.6	23.7	55.4	41.3	89.5	12.0	25.9	56.3	40.3
.8	3.2	41.8	25.8	58.6	45.6	95.2	19.3	35.3	68.3	55.9
4.0	3.5	43.0	128.0	261.8	450.0	700.9	1026.6	1444.6	1980.4	2671.6
.2	3.9	44.3	30.2	65.0	54.3	06.6	34.0	54.1	92.5	87.4
.4	4.2	45.5	32.4	68.2	58.7	12.4	41.4	63.6	2004.7	2703.3
.6	4.6	46.8	34.6	71.5	63.2	18.2	48.9	73.2	17.0	19.2
.8	5.0	48.1	36.9	74.8	67.6	24.0	56.4	82.8	29.3	35.2
5.0	5.5	49.4	139.1	278.1	472.1	729.9	1063.9	1492.4	2041.7	2751.3
.2	5.9	50.8	41.4	81.4	76.6	35.7	71.5	1502.1	54.2	67.5
.4	6.4	52.1	43.7	84.7	81.1	41.6	79.1	11.8	66.7	83.8
.6	6.8	53.5	46.0	88.1	85.6	47.6	86.8	21.7	79.3	2800.1
.8	7.3	54.9	48.4	91.5	90.2	53.6	94.5	31.5	91.9	16.6
6.0	7.9	56.3	150.7	294.9	494.8	759.6	1102.2	1541.4	2104.6	2833.2
.2	8.4	57.7	53.1	98.3	99.4	65.6	09.9	51.3	17.4	49.8
.4	8.9	59.2	55.5	301.7	504.1	71.7	17.7	61.3	30.3	66.5
.6	9.5	60.6	57.9	05.2	08.8	77.8	25.6	71.3	43.2	83.4
.8	10.1	62.1	60.4	08.7	13.5	83.9	33.5	81.4	56.2	2900.3
7.0	10.7	63.6	162.8	312.2	518.2	790.1	1141.4	1591.6	2169.2	2917.3
.2	11.3	65.2	65.3	15.8	22.9	96.3	49.3	1601.8	82.4	34.4
.4	12.0	66.7	67.8	19.3	27.7	802.5	57.3	12.0	95.5	51.6
.6	12.6	68.3	70.3	22.9	32.5	08.8	65.4	22.3	2208.8	68.9
.8	13.3	69.8	72.8	26.5	37.4	15.2	73.4	32.6	22.1	86.3
8.0	14.0	71.4	175.4	330.1	542.2	821.4	1181.6	1643.0	2235.5	3003.8
.2	14.7	73.0	78.0	33.8	47.1	27.7	89.7	63.5	48.9	21.4
.4	15.4	74.7	80.6	37.5	52.0	34.1	97.9	64.0	62.5	39.1
.6	16.2	76.3	83.2	41.2	57.0	40.5	1206.1	74.5	76.1	56.8
.8	16.9	78.0	85.8	44.9	61.9	47.0	14.4	85.1	89.8	74.7
9.0	17.7	79.7	188.5	348.6	566.9	853.5	1222.7	1695.8	2303.5	3092.7
.2	18.5	81.4	91.2	52.4	72.0	60.0	31.1	1706.5	17.3	3110.8
.4	19.3	83.1	93.9	56.2	77.0	66.5	39.5	17.3	31.2	28.9
.6	20.2	84.8	96.6	60.0	82.1	73.1	48.0	28.1	45.1	47.2
.8	21.0	86.6	99.4	63.9	87.2	79.7	56.4	39.0	59.2	65.6
10.0	21.9	88.4	202.1	367.7	592.3	886.4	1265.0	1749.9	2373.3	3184.1
I	0°	10°	20°	30°	40°	50°	60°	70°	80°	90°

TABLE V. — Long Chords and Actual Arcs

Degree of curve	Actual arc, one station	2 Sta.	3 Sta.	4 Sta.	5 Sta.	6 Sta.	7 Sta.	8 Sta.	Degree of curve
0.2	100.000	200.0	300.0	400.0	500.0	600.0	700.0	800.0	**0.2**
.4	.000	00.0	00.0	00.0	00.0	00.0	699.9	799.9	.4
.6	.000	00.0	00.0	00.0	499.9	599.9	699.8	799.8	.6
.8	.001	00.0	00.0	00.0	99.9	99.8	99.7	99.6	.8
1.0	100.001	200.0	300.0	399.9	499.8	599.7	699.6	799.4	1.0
.2	.002	00.0	00.0	99.9	99.8	99.6	99.4	99.1	.2
.4	.002	00.0	299.9	99.9	99.7	99.5	99.2	98.8	.4
.6	.003	00.0	99.9	99.8	99.6	99.3	98.9	98.4	.6
.8	.004	00.0	99.9	99.8	99.5	99.1	98.6	97.9	.8
2.0	100.005	200.0	299.9	399.7	499.4	598.9	698.3	797.4	**2.0**
.2	.006	00.0	99.9	99.6	99.3	98.7	97.9	96.9	.2
.4	.007	00.0	99.8	99.6	99.1	98.5	97.5	96.3	.4
.6	.009	00.0	99.8	99.5	99.0	98.2	97.1	95.7	.6
.8	.010	199.9	99.8	99.4	98.8	97.9	96.7	95.0	.8
3.0	100.011	199.9	299.7	399.3	498.6	597.6	696.2	794.3	3.0
.2	.013	99.9	99.7	99.2	98.4	97.3	95.6	93.5	.2
.4	.015	99.9	99.6	99.1	98.2	96.9	95.1	92.6	.4
.6	.016	99.9	99.6	99.0	98.0	96.6	94.5	91.7	.6
.8	.018	99.9	99.6	98.9	97.8	96.2	93.9	90.8	.8
4.0	100.020	199.9	299.5	398.8	497.6	595.7	693.2	789.8	**4.0**
.2	.022	99.9	99.5	98.7	97.3	95.3	92.5	88.8	.2
.4	.025	99.9	99.4	98.5	97.1	94.9	91.8	87.7	.4
.6	.027	99.8	99.4	98.4	96.8	94.4	91.0	86.5	.6
.8	.029	99.8	99.3	98.2	96.5	93.9	90.2	85.3	.8
5.0	100.032	199.8	299.2	398.1	496.2	593.4	689.4	784.1	5.0
.2	.034	99.8	99.2	97.9	95.9	92.8	88.5	82.8	.2
.4	.037	99.8	99.1	97.8	95.6	92.3	87.6	81.5	.4
.6	.040	99.8	99.0	97.6	95.2	91.7	86.7	80.1	.6
.8	.043	99.7	99.0	97.4	94.9	91.1	85.7	78.7	.8
6.0	100.046	199.7	298.9	397.3	494.5	590.4	684.7	777.2	**6.0**
.2	.049	99.7	98.8	97.1	94.2	89.8	83.7	75.6	.2
.4	.052	99.7	98.8	96.9	93.8	89.1	82.7	74.0	.4
.6	.055	99.7	98.7	96.7	93.4	88.5	81.6	72.4	.6
.8	.059	99.6	98.6	96.5	93.0	87.7	80.4	70.7	.8
7.0	100.062	199.6	298.5	396.3	492.6	587.0	679.3	769.0	7.0
.2	.066	99.6	98.4	96.1	92.1	86.3	78.1	67.2	.2
.4	.070	99.6	98.3	95.8	91.7	85.5	76.9	65.4	.4
.6	.073	99.6	98.2	95.6	91.2	84.7	75.6	63.5	.6
.8	.077	99.5	98.1	95.4	90.8	83.9	74.3	61.6	.8
8.0	100.081	199.5	298.1	395.1	490.3	583.1	673.0	759.7	**8.0**
.2	.085	99.5	98.0	94.9	89.8	82.2	71.7	57.7	.2
.4	.090	99.5	97.9	94.6	89.3	81.4	70.3	55.6	.4
.6	.094	99.4	97.8	94.4	88.8	80.5	68.9	53.5	.6
.8	.098	99.4	97.6	94.1	88.3	79.6	67.4	51.4	.8
9.0	100.103	199.4	297.5	393.9	487.7	578.6	666.0	749.2	9.0
.2	.108	99.4	97.4	93.6	87.2	77.7	64.4	46.9	.2
.4	.112	99.3	97.3	93.3	86.6	76.7	62.9	44.6	.4
.6	.117	99.3	97.2	93.0	86.1	75.7	61.3	42.3	.6
.8	.122	99.3	97.1	92.7	85.5	74.7	59.7	39.9	.8
10.0	100.127	199.2	297.0	392.4	484.9	573.7	658.1	737.5	**10.0**
Degree	Actual arc	2 Sta.	3 Sta.	4 Sta.	5 Sta.	6 Sta.	7 Sta.	8 Sta.	Degree

TABLE V. — (*Continued*)

Degree of curve	Actual arc, one station	2 Sta.	3 Sta.	4 Sta.	5 Sta.	6 Sta.	7 Sta.	8 Sta.	Degree of curve
10.0	100.127	199.2	297.0	392.4	484.9	573.7	658.1	737.5	**10.0**
.2	.132	99.2	96.8	92.1	84.3	72.6	56.5	35.1	.2
.4	.137	99.2	96.7	91.8	83.7	71.6	54.8	32.5	.4
.6	.143	99.1	96.6	91.5	83.1	70.5	53.0	30.0	.6
.8	.148	99.1	96.5	91.2	82.4	69.4	51.3	27.4	.8
11.0	100.154	199.1	296.3	390.8	481.8	568.2	649.5	724.8	11.0
.2	.159	99.0	96.2	90.5	81.1	67.1	47.7	22.1	.2
.4	.165	99.0	96.1	90.2	80.4	65.9	45.8	19.4	.4
.6	.171	99.0	95.9	89.8	79.7	64.8	44.0	16.6	.6
.8	.177	98.9	95.8	89.5	79.0	63.5	42.1	13.8	.8
12.0	100.183	198.9	295.6	389.1	478.3	562.3	640.1	710.9	**12.0**
.2	.189	98.9	95.5	88.7	77.6	61.1	38.2	08.1	.2
.4	.195	98.8	95.3	88.4	76.9	59.8	36.2	05.1	.4
.6	.202	98.8	95.2	88.0	76.2	58.5	34.2	702.2	.6
.8	.208	98.8	95.0	87.6	75.4	57.2	32.1	699.2	.8
13.0	100.215	198.7	294.9	387.2	474.6	555.9	630.1	696.1	13.0
.2	.222	98.7	94.7	86.8	73.9	54.6	28.0	93.0	.2
.4	.228	98.6	94.6	86.5	73.1	53.2	25.8	89.9	.4
.6	.235	98.6	94.4	86.0	72.3	51.9	23.7	86.7	.6
.8	.242	98.5	94.2	85.6	71.5	50.5	21.5	83.5	.8
14.0	100.249	198.5	294.1	385.2	470.6	549.1	619.3	680.3	**14.0**
.2	.256	98.5	93.9	84.8	69.8	47.6	17.0	77.0	.2
.4	.264	98.4	93.7	84.4	69.0	46.2	14.8	73.7	.4
.6	.271	98.4	93.5	83.9	68.1	44.7	12.5	70.3	.6
.8	.279	98.3	93.4	83.5	67.3	43.2	10.2	66.9	.8
15.0	100.286	198.3	293.2	383.1	466.4	541.7	607.8	663.5	15.0
.2	.294	98.2	93.0	82.6	65.5	40.2	05.4	60.0	.2
.4	.302	98.2	92.8	82.2	64.6	38.7	03.0	56.5	.4
.6	.310	98.2	92.6	81.7	63.7	37.1	600.6	53.0	.6
.8	.318	98.1	92.4	81.2	62.8	35.6	598.2	49.4	.8
16.0	100.326	198.1	292.3	380.8	461.9	534.0	595.7	645.8	**16.0**
.2	.334	98.0	92.1	80.3	60.9	32.4	93.2	42.2	.2
.4	.342	98.0	91.9	79.8	60.0	30.7	90.7	38.5	.4
.6	.351	97.9	91.7	79.3	59.0	29.1	88.1	34.8	.6
.8	.359	97.9	91.5	78.8	58.0	27.5	85.5	31.1	.8
17.0	100.368	197.8	291.3	378.3	457.1	525.8	582.9	627.3	17.0
.2	.376	97.8	91.1	77.8	56.1	24.1	80.3	23.5	.2
.4	.385	97.7	90.8	77.3	55.1	22.4	77.7	19.6	.4
.6	.394	97.6	90.6	76.8	54.1	20.7	75.0	15.8	.6
.8	.403	97.6	90.4	76.3	53.0	18.9	72.3	11.9	.8
18.0	100.412	197.5	290.2	375.7	452.0	517.2	569.6	608.0	**18.0**
.2	.422	97.5	90.0	75.2	51.0	15.4	66.8	04.0	.2
.4	.431	97.4	89.8	74.7	49.9	13.6	64.1	600.0	.4
.6	.440	97.4	89.6	74.1	48.9	11.8	61.3	596.0	.6
.8	.450	97.3	89.3	73.6	47.8	10.0	58.5	92.0	.8
19.0	100.460	197.3	289.1	373.0	446.7	508.1	555.6	587.9	19.0
.2	.469	97.2	88.9	72.5	45.6	06.3	52.8	83.8	.2
.4	.479	97.1	88.6	71.9	44.5	04.4	49.9	79.7	.4
.6	.489	97.1	88.4	71.3	43.4	02.5	47.0	75.5	.6
.8	.499	97.0	88.2	70.7	42.3	500.6	44.1	71.3	.8
20.0	100.510	197.0	287.9	370.2	441.1	498.7	541.1	567.1	**20.0**
Degree	Actual arc	2 Sta.	3 Sta.	4 Sta.	5 Sta.	6 Sta.	7 Sta.	8 Sta.	Degree

TABLE VI. — MIDDLE ORDINATES

Degree of curve	1 Sta.	2 Sta.	3 Sta.	4 Sta.	5 Sta.	6 Sta.	7 Sta.	8 Sta.	Degree of curve
0.2	.04	.17	.39	.70	1.09	1.57	2.14	2.79	**0.2**
.4	.09	.35	.78	1.40	2.18	3.14	4.28	5.58	.4
.6	.13	.52	1.18	2.09	3.27	4.71	6.41	8.38	.6
.8	.17	.70	1.57	2.79	4.36	6.28	8.55	11.17	.8
1.0	.22	.87	1.96	3.49	5.45	7.85	10.69	13.96	1.0
.2	.26	1.05	2.36	4.19	6.54	9.42	12.82	16.75	.2
.4	.30	1.22	2.75	4.89	7.63	10.99	14.96	19.53	.4
.6	.35	1.40	3.14	5.58	8.72	12.56	17.09	22.32	.6
.8	.39	1.57	3.53	6.28	9.81	14.13	19.22	25.10	.8
2.0	.44	1.75	3.93	6.98	10.90	15.69	21.36	27.88	**2.0**
.2	.48	1.92	4.32	7.68	11.99	17.26	23.48	30.66	.2
.4	.52	2.09	4.71	8.37	13.08	18 83	25.61	33.43	.4
.6	.57	2.27	5.10	9.07	14.17	20.39	27.74	36.21	.6
.8	.61	2.44	5.50	9.77	15.25	21.95	29.86	38.98	.8
3.0	.65	2.62	5.89	10.46	16.34	23.52	31.98	41.74	3.0
.2	.70	2.79	6.28	11.16	17.43	25.08	34.10	44.50	.2
.4	.74	2.97	6.67	11.86	18.51	26.64	36.22	47.26	.4
.6	.78	3.14	7.06	12.55	19.60	28.20	38.34	50.01	.6
.8	.83	3.32	7.46	13.25	20.68	29.75	40.45	52.76	.8
4.0	.87	3.49	7.85	13.94	21.77	31.31	42.56	55.50	**4.0**
.2	.92	3.66	8.24	14.64	22.85	32.86	44.66	58.24	.2
.4	.96	3.84	8.63	15.33	23.93	34.41	46.77	60.97	.4
.6	1.00	4.01	9.02	16.03	25.01	35.96	48.87	63.69	.6
.8	1.05	4.19	9.42	16.72	26.09	37.51	50.96	66.42	.8
5.0	1.09	4.36	9.81	17.42	27.17	39.06	53.05	69.13	5.0
.2	1.14	4.54	10.20	18.11	28.25	40.60	55.14	71.84	.2
.4	1.18	4.71	10.59	18.80	29.33	42.15	57.23	74.54	.4
.6	1.22	4.89	10.98	19.49	30.40	43.69	59.31	77.23	.6
.8	1.27	5.06	11.37	20.19	31.48	45.22	61.38	79.92	.8
6.0	1.31	5.23	11.76	20.88	32.55	46.76	63.46	82.60	**6.0**
.2	1.35	5.41	12.15	21.57	33.63	48.29	65.52	85.27	.2
.4	1.40	5.58	12.54	22.26	34.70	49.82	67.58	87.93	.4
.6	1.44	5.76	12.93	22.95	35.77	51.35	69.64	90.59	.6
.8	1.48	5.93	13.32	23.64	36.84	52.88	71.70	93.23	.8
7.0	1.53	6.11	13.71	24.33	37.91	54.40	73.74	95.87	7.0
.2	1.57	6.28	14.10	25.02	38.97	55.92	75.79	98.50	.2
.4	1.62	6.45	14.49	25.71	40.04	57.44	77.82	101.12	.4
.6	1.66	6.63	14.88	26.39	41.10	58.95	79.85	103.73	.6
.8	1.70	6.80	15.27	27.08	42.17	60.46	81.88	106.33	.8
8.0	1.75	6.98	15.66	27.77	43.23	61.97	83.90	108.92	**8.0**
.2	1.79	7.15	16.05	28.45	44.29	63.47	85.92	111.50	.2
.4	1.83	7.32	16.44	29.14	45.35	64.97	87.92	114.06	.4
.6	1.88	7.50	16.83	29.82	46.40	66.47	89.92	116.62	.6
.8	1.92	7.67	17.22	30.51	47.46	67.97	91.92	119.17	.8
9.0	1.97	7.85	17.61	31.19	48.51	69.46	93.91	121.71	9.0
.2	2.00	8.02	18.00	31.87	49.56	70.95	95.89	124.23	.2
.4	2.05	8.19	18.38	32.56	50.61	72.43	97.87	126.75	.4
.6	2.10	8.37	18.77	33.24	51.66	73.91	99.83	129.25	.6
.8	2.14	8.54	19.16	33.92	52.71	75.39	101.80	131.74	.8
10.0	2.18	8.72	19.55	34.60	53.75	76.86	103.75	134.22	**10.0**
Degree	1 Sta.	2 Sta.	3 Sta.	4 Sta.	5 Sta.	6 Sta.	7 Sta.	8 Sta.	Degree

TABLE VI. — (*Continued*)

Degree of curve	1 Sta.	2 Sta.	3 Sta.	4 Sta.	5 Sta.	6 Sta.	7 Sta.	8 Sta.	Degree of curve
10.0	2.18	8.72	19.55	34.60	53.75	76.86	103.75	134.22	**10.0**
.2	2.23	8.89	19.94	35.28	54.79	78.33	105.70	136.68	.2
.4	2.27	9.06	20.32	35.96	55.83	79.79	107.64	139.14	.4
.6	2.31	9.24	20.71	36.63	56.87	81.25	109.57	141.58	.6
.8	2.36	9.41	21.10	37.31	57.91	82.71	111.49	144.00	.8
11.0	2.40	9.59	21.48	37.99	58.94	84.16	113.41	146.41	11.0
.2	2.44	9.76	21.87	38.66	59.98	85.61	115.32	148.81	.2
.4	2.49	9.93	22.25	39.34	61.01	87.05	117.21	151.20	.4
.6	2.53	10.11	22.64	40.01	62.04	88.49	119.11	153.57	.6
.8	2.58	10.28	23.03	40.68	63.06	89.92	120.99	155.93	.8
12.0	2.62	10.45	23.41	41.36	64.09	91.36	122.87	158.27	**12.0**
.2	2.66	10.63	23.80	42.03	65.11	92.78	124.73	160.59	.2
.4	2.71	10.80	24.18	42.70	66.13	94.20	126.59	162.91	.4
.6	2.75	10.97	24.57	43.37	67.14	95.62	128.43	165.21	.6
.8	2.80	11.15	24.95	44.03	68.16	97.03	130.27	167.49	.8
13.0	2.84	11.32	25.33	44.70	69.17	98.43	132.10	169.75	13.0
.2	2.88	11.49	25.72	45.37	70.18	99.83	133.92	172.01	.2
.4	2.93	11.67	26.10	46.03	71.19	101.23	135.73	174.24	.4
.6	2.97	11.84	26.48	46.70	72.19	102.62	137.53	176.46	.6
.8	3.01	12.01	26.87	47.36	73.20	104.00	139.33	178.67	.8
14.0	3.06	12.19	27.25	48.02	74.20	105.38	141.11	180.85	**14.0**
.2	3.10	12.36	27.63	48.69	75.20	106.76	142.88	183.02	.2
.4	3.15	12.53	28.01	49.35	76.19	108.12	144.64	185.17	.4
.6	3.19	12.71	28.40	50.01	77.18	109.49	146.40	187.31	.6
.8	3.23	12.88	28.78	50.66	78.17	110.85	148.14	189.43	.8
15.0	3.28	13.05	29.16	51.32	79.16	112.20	149.87	191.53	15.0
.2	3.32	13.23	29.54	51.98	80.14	113.54	151.59	193.62	.2
.4	3.36	13.40	29.92	52.63	81.12	114.88	153.30	195.68	.4
.6	3.41	13.57	30.30	53.29	82.10	116.22	155.00	197.73	.6
.8	3.45	13.74	30.68	53.94	83.08	117.55	156.69	199.76	.8
16.0	3.50	13.92	31.06	54.59	84.05	118.87	158.37	201.77	**16.0**
.2	3.54	14.09	31.44	55.24	85.02	120.19	160.03	203.77	.2
.4	3.58	14.26	31.82	55.89	85.99	121.50	161.69	205.74	.4
.6	3.63	14.44	32.20	56.54	86.95	122.80	163.33	207.70	.6
.8	3.67	14.61	32.57	57.19	87.91	124.10	164.96	209.64	.8
17.0	3.72	14.78	32.95	57.83	88.87	125.39	166.59	211.55	17.0
.2	3.76	14.95	33.33	58.48	89.83	126.68	168.20	213.46	.2
.4	3.80	15.13	33.71	59.12	90.78	127.96	169.79	215.33	.4
.6	3.85	15.30	34.08	59.76	91.73	129.23	171.38	217.20	.6
.8	3.89	15.47	34.46	60.40	92.67	130.49	172.95	219.03	.8
18.0	3.94	15.64	34.84	61.04	93.62	131.75	174.52	220.86	**18.0**
.2	3.98	15.82	35.21	61.68	94.55	133.01	176.07	222.65	.2
.4	4.02	15.99	35.59	62.32	95.49	134.25	177.60	224.43	.4
.6	4.07	16.16	35.96	62.96	96.42	135.49	179.13	226.20	.6
.8	4.11	16.33	36.34	63.59	97.35	136.72	180.64	227.93	.8
19.0	4.16	16.51	36.71	64.22	98.28	137.95	182.15	229.65	19.0
.2	4.20	16.68	37.09	64.85	99.20	139.17	183.64	231.35	.2
.4	4.24	16.85	37.46	65.48	100.12	140.38	185.11	233.03	.4
.6	4.29	17.02	37.83	66.11	101.03	141.58	186.57	234.69	.6
.8	4.33	17.19	38.20	66.74	101.95	142.78	188.02	236.33	.8
20.0	4.37	17.37	38.58	67.37	102.86	143.97	189.46	237.94	**20.0**
Degree	1 Sta.	2 Sta.	3 Sta.	4 Sta.	5 Sta.	6 Sta.	7 Sta.	8 Sta.	Degree

CHAPTER II

THE SPIRAL

THE railroad spiral is a curve of varying radius connecting a main or central curve with a tangent or connecting the two branches of a compound curve. If it is a true spiral its change in "degree" is proportionate to its length. Thus at the point of junction with the tangent (*T. S.* in Fig. 22) the degree is zero; at the junction with the main or central curve of degree D (*S. C.* in Fig. 22) it is D; at its mid-point it is $\frac{1}{2} D$ . . . etc. The radius is closely inversely as the length. Knowing the degree of the central curve the first quantity to determine is the length L, the second is Δ, the central angle consumed by the spiral. If these two can be conveniently chosen the other functions can be had from tables.

The length of the spiral is determined as follows: For curves of 6° or over on which track is canted 8 inches, $L = 240$ feet as a minimum. For curves flatter than 6° likely sometime to limit speed, $L = \frac{587}{\sqrt{D}}$ feet, D being the degree of the central curve. For minor curves not likely to limit speed, $L = \frac{2}{3} SE$ or $30\,E$ in feet, in which S is speed in miles per hour and E is the difference in elevation of the two rails in inches.

If the maximum allowable cant is 6 inches, $L = \frac{380}{\sqrt{D}}$ feet for curves flatter than 4.5° likely to limit speed. For curves of 4.5° and over the minimum length will be 180 feet.

For minor curves, $L = \frac{2}{3} SE$ or $30\,E$, as above.

It will be well to select lengths that are round numbers of feet not less than the required minimums and such that the resulting Δ may be whole degrees or a whole number of tenths of a degree divisible by 3. This is merely for convenience in computing.

$$\Delta = \frac{LD}{200}.$$

Notation: Referring to Fig. 22

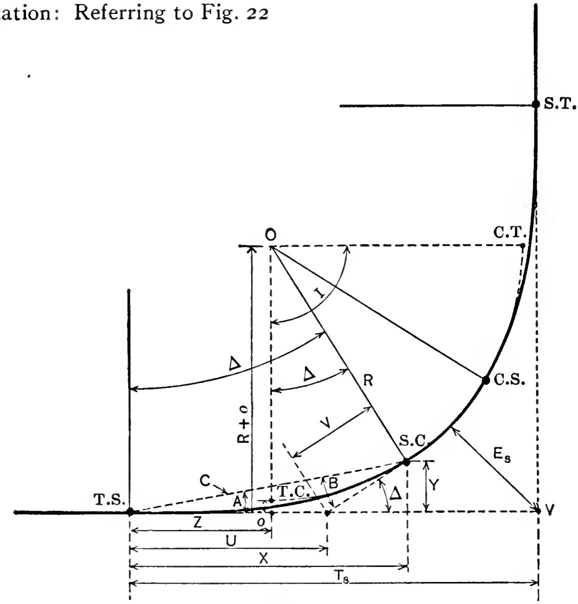

FIG. 22.

$T. S.$ = Tangent-Spiral. $S. C.$ = Spiral-Curve.
$C. S.$ = Curve-Spiral. $S. T.$ = Spiral-Tangent.
$T. C.$ = Tangent-Curve. $C. T.$ = Curve-Tangent.
Δ = central angle of the spiral.
A = deflection angle $T. S.$ to $S. C.$
B = deflection angle $S. C.$ to $T. S.$
C = the long chord of the spiral.
X = abscissa with $T. S.$ as origin.
Y = ordinate with $T. S.$ as origin.
U = spiral long tangent.
V = spiral short tangent.
o = curve offset.
Z = distance on tangent from $T. S.$ to $T. C.$ of the offset curve.
T_s = tangent distance of the spiraled curve.
E_s = external distance of the spiraled curve.
R = radius of central curve.

The Chord Spiral. — If the spiral be laid out by equal chords it is approximately true that the deflection angles from the tangent at the *T. S.* to the several chord points are as the squares of the chord numbers, and the final deflection A of the long chord is one-third the central angle Δ.

If the spiral be divided into N chords, the deflection angle for the first chord will closely approximate $\frac{\Delta}{3\,N^2}$ and the angles that the several chords (produced) will make with the tangent will be approximately 1, 7, 19, 37, 61, 91, 127, 169, 217, 271, etc., times $\frac{\Delta}{3\,N^2}$.

The chord spiral is a curve passing through the chord points of a series of equal chords for which the relations of the preceding paragraph are exactly true. It is not a curve of uniformly varying radius or degree, but differs from such a curve by an inappreciable amount.

The spiral may be divided into any number of chords. Tables for a division into ten chords have been devised by Mr. Jenks B. Jenkins for the American Railway Engineering Association, and have been approved as good practice by that association.

Table VIII gives values for the quantities noted below. Excepting o and Z the linear quantities vary as L and hence the tabular quantities are coefficients by which the L's of any given cases are to be multiplied to find the functions C, X, Y, U, and V. The use of the table to get o and Z will be evident from the table headings.

Referring to Fig. 22, the tabulated quantities are Δ, A, $\frac{C}{L}$, $\frac{X}{L}$, $\frac{Y}{L}$, $\frac{U}{L}$, $\frac{V}{L}$, coefficients for o and Z. The following formulas give these quantities:

$$\Delta = \frac{LD}{200},\ A = \tfrac{1}{3}\Delta - 0.000000825\,\Delta^3,\ \ B = \Delta - A.$$

$$\frac{C}{L} = \cos 0.3\,\Delta + 0.004 \operatorname{exsec} \tfrac{3}{4}\Delta \text{ (approx.)}.$$

$$X = C\cos A.$$

$$Y = C\sin A.$$

$$Z = X - R\sin\Delta.$$

$$U = C\frac{\sin B}{\sin\Delta}.$$

$$V = C\frac{\sin A}{\sin\Delta}.$$

$$o = Y - R\operatorname{vers}\Delta.$$

$$\text{Exactly, } X = \frac{L}{10}\left(\cos\frac{\Delta}{300} + \frac{7\,\Delta}{300} + \cos\frac{19\,\Delta}{300} + \cos\frac{37\,\Delta}{300} + \cos\frac{61\,\Delta}{300}\right.$$
$$\left. + \cos\frac{91\,\Delta}{300} + \cos\frac{127\,\Delta}{300} + \cos\frac{169\,\Delta}{300} + \cos\frac{217\,\Delta}{300} + \cos\frac{271\,\Delta}{300}\right).$$

$$\text{Exactly, } \quad Y = \frac{L}{10}\left(\sin\frac{\Delta}{300} + \sin\frac{7\,\Delta}{300} + \ldots \text{ etc.}\right).$$

$$\text{Exactly, } \quad \tan A = \frac{Y}{X}.$$

The following formulas give the tangent distance and external distance of the curve:

$$T_s = (R + o)\tan\tfrac{1}{2}I + Z$$
$$E_s = (R + o)\operatorname{exsec}\tfrac{1}{2}I + o.$$

The central δ subtended by any portion, l feet, of the spiral is the average "degree" of the portion multiplied by $\frac{l}{100}$. The average "degree" is the initial and final degree of the portion divided by 2. The degree at any point distant l feet from the $T.\,S.$ is $\frac{l}{L}D$. The degree at the end of any chord p (p being the number of the chord) is $\frac{p}{10}D$ for the 10-chord spiral or $\frac{p}{N}D$ for the N-chord spiral.

For precise computation of positions of points on line, A should be computed from $A = \frac{1}{3}\Delta - 0.000000825\,\Delta^3$ or taken from Table VIII, or Tables IX to XXIII. The deflection a_1 for the first chord is always $\frac{\Delta}{300}$ for the 10-chord spiral.

For field use the deflection from the $T.\,S.$ to any chord point should be taken as a_1 times the square of the number of the chord point to be located so long as δ does not exceed 15°. A may be taken as $1/3\,\Delta$ for $\Delta \leqq 15°$. When Δ is more than 15° one or more intermediate transit points should be used. Such points should be so chosen that the δ from the $T.\,S.$ to the first intermediate point shall not exceed 15°, and so that δ from any occupied point to the next transit point less the δ from the $T.\,S.$ to the occupied point shall not exceed 15°. With this procedure the deflections from the tangent at any intermediate point may be taken as in Table VII, which gives the coefficients by which a_1 is to be multiplied to give deflections to points both forward and back as indicated. This procedure is not exact but results in angular errors less than can be measured by the transit. It is probable that 90 or more per cent of the cases in practice will involve Δs of less than 10° and an error of 3 seconds or less than 0.001° if A is taken as $\frac{1}{3}\Delta$.

For $\Delta = 15°$ the error is 10 seconds or less than 0.003°. If it is desired to find the deflection from the *T. S.* to any point to which the δ exceeds 15° it may be done by finding the δ and then the corresponding A from Table VIII. If convenient spirals have been chosen, Tables IX to XXIII may be used.

To Select and Lay Out the Spiral. — Knowing I and D, determine L and Δ; from Table VIII find coefficients for and determine o and Z and substitute in the equation for T_s. Knowing the *P. I.* the station of the *T. S.* can be found. There are now four ways of locating the curve.

1. The curve may be run from the *T. S.* to the *S. C.* by deflection angles and chord measurements, using Table VII for multiples of a_1 and setting on intermediate points if necessary as advised in the preceding article. To lay out by 5 chords use the deflection coefficients for every second point computing a_1 as for 10 chords.

2. The tangent may be continued from the *T. S.* for Z feet, o laid off and the curve D run in for the full central angle I, using an offset back sight for the direction of the offset tangent, locating the *S. C.* at a distance corresponding to Δ, and which will be nearly $L - Z$, and the *C. S.* at a distance from the *S. C.* corresponding to $I - 2\,\Delta$, and offsetting o to the forward tangent and proceeding, locating the spirals later by deflection angles, or by offsets as in 4 below, when staking out for construction.

3. Measure U from the *T. S.*; establish a transit point, turn the angle Δ and measure V and establish the *S. C.*; run the spiral by deflections from either end; continue the central curve to the *C. S.*; lay out V and U to get the *S. T.* and run in the final spiral by deflections from either end.

4. Many times it will be sufficiently exact after running the central curve as in 2, to bisect the offset o for a point on the spiral and then set over such points as may be desired from tangent and curve respectively, making the offsets from the tangent half proportional to the cube of the distance from *T. S.* and from the curve half proportional to the cube of the distance from the *S. C.* Thus the quarter points would be offset 1/8 of $\frac{1}{2}\,o$ or $o/16$ from tangent and curve respectively.

Time may be saved if a spiral that can be found in one of the Tables IX to XXIII can be chosen. Thus if a 1.5-degree curve is to be connected and the speed to be considered is 90 miles an hour or less, Table X gives all required quantities for the necessary spiral which is 500 feet long. It may be laid out in ten chords of 50 feet each, for which deflection angles are found under the A column. If pluses are to be located they may be interpolated between the tabular values which are given for each 10 feet on the spiral. But if the speed considered is only 65 miles an hour Table XIII may be used, the length of the spiral being 200 feet. It may be laid out in 10 chords of 20 feet for which the deflection angles or coördinates are given in the table or it may be laid out by 5 chords of 40 feet. Pluses may be interpolated as indicated above. If the speed is 60 miles an hour, Table XIV may be used and the length of spiral will be found to be 150 feet. It may be laid out in 10 chords of 15 feet interpolating in the table, or better, by 5 chords of 30 feet, with quantities taken directly from the table. Thus each table is good for many different spiral lengths connecting curves of various degrees. Any table may be used in which the degree of the central curve can be found in the column headed D provided the speed for which the table is adapted is that for which the curve is to be spiraled or the track canted. Shorter spirals found in tables for slower maximum speed than that for which the track is canted may be used but are not recommended except where it is necessary materially to save cost of construction or to fit cramped situations in cities or on high embankments or in deep cuts when relining old track.

Spiraling a Compound Curve. — The length of spiral to connect the two branches of a compound curve may be found just as for a tangent and simple curve by substituting the difference of "degrees" $(D_1 - D_2)$ in the equation for length. It is also practically true that the deflections at the junction points with the two branches to the various chord points of the spiral are the same as for corresponding chord points of the spiral between tangent and simple curve of degree $(D_1 - D_2)$ if the deflections are considered as turned from equivalent chord points on the respective curves rather than from the tangent.

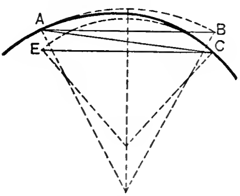

FIG. 23.

Thus in Fig. 23, the deflection from chord AB to chord AC of the spiral is $\frac{1}{3}\Delta$ (Δ being the central angle for spiral of length L connecting a tangent and $(D_1 - D_2)°$ curve) if arc $AB = L$, and from chord CE to chord CA it is the same. These relations are closely approximate. The deflection from the tangent at A is, if D_2 be the degree of the larger radius curve and D_1 of the shorter, $\frac{LD_2}{200} + \frac{1}{3}\Delta - C$, when $\Delta = \frac{(D_1 - D_2)\,L}{200}$ and C is the correction to be used when necessary or when Δ is more than 15°. Or the curve may be considered as part of a spiral from a tangent to the curve of degree D_2 and the deflection coefficients of Table VII may be used.

Illustrative Example. — A 4° curve is to connect with an 8° curve the offset coming at Sta. 464 of the 4° curve. $D_2 = 4°$; $D_1 = 8°$; $D_1 - D_2 = 4°$; $L = \dfrac{600}{\sqrt{D_1 - D_2}} = 300$. $\Delta = \dfrac{(D_1 + D_2)}{2} \times \dfrac{L}{100} = 18°$. For computing o and Z we use $D = D_1 - D_2 = 4°$, and $L = 300$, whence $\Delta = 6°$, and from the tables for $D = 4$, $L = 300$, and $\Delta = 6°$ we find $o = 2.62$ and $Z = 149.92$. Therefore $C. S.$ = Sta. 464 − 149.92 ft. = Sta. 462 + 50.08. If the 300 feet is part of a spiral connecting a tangent and an 8° curve and covers a difference of 4° in its length the whole spiral would be $L_8 = \dfrac{8\,L}{D_1 - D_2} = 2\,L = 600$ feet covering a Δ of 24°. Therefore Sta. 462 + 50.08 = $C. S.$ is the fifth chord point of the spiral. Since the central angle consumed by the spiral to be run is 18° and the central angle up to the fifth point of the 600-foot spiral is 6°, the difference is 12° or less than 15° and it will be proper to use Table VII with the transit at the fifth chord point. Hence the deflections to the several chord points are 16, 34, 54, 76, and 100 times a_1, which is $\dfrac{\Delta}{300} = 0.08°$ or:

Chord point	6	7	8	9	10
Deflection	1.28°	2.72°	4.32°	6.08°	8.00°

The chords are 60 feet and the deflections from tangent at A to the corresponding points on the 4° curve extended would be:

	1.20	2.40	3.60	4.80	6.00
The differences	0.08°	0.32°	0.72°	1.28°	2.00°

which would be the deflections from corresponding chord points on the D_1 curve, are the deflections for the chord points of a five-chord spiral of 300 feet connecting a tangent and 4° = $(D_1 - D_2)$ degree curve.

Setting up on the $S. C.$, the compounding point with the 8° curve, the deflection from the long chord of the spiral to the tangent is from Table VII, $125 \times a_1$ or 10°. It is also $\dfrac{LD_1}{200} - 2°$ or, stated otherwise, the angle between the long chord of $\dfrac{L}{100}$ stations of curve D_2 and the chord of the spiral is 2°, which is the deflection angle of a 300-foot spiral connecting a tangent and 4° = $(D_1 - D_2)$ degree curve.

Considering the whole spiraled curve, and referring to Fig. 24, in which R_1 is the shorter radius and R_2 is the longer radius, the compound curve is supposed connected first directly to the tangents. To introduce the spirals, the arc of R_1 must be thrown in along the line of common radius $PP_1 = o_1 \sec I_1$. The arc of R_2 must be thrown $PP_2 = o_2 \sec I_2$. $PP_1 - PP_2$ must equal o', the proper offset for the connecting spiral. Therefore determine L_2 to find o_2 and PP_2; to

PP_2 add o' previously found and find a trial value for $o_1 = \dfrac{PP_2 + o'}{\sec I_1}$; if found too small, o_2 or o' or both may be increased, which will necessitate increase in L_2 or L' or both; if found too large no harm will result unless in relining track the shift is too great. The tangent distances are increased by $o_2 \tan \Delta_2$ and $o_1 \tan \Delta_1$, respectively.

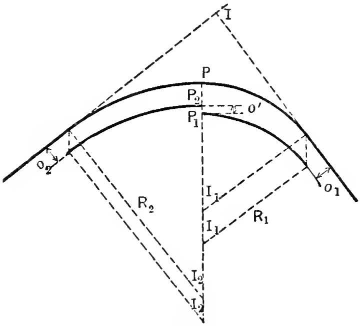

Fig. 24.

To lessen the movement of existing track the following procedure may be had: Conceive the larger radius curve moved outward along the common radius line, and the smaller radius curve moved inward, each by $\frac{1}{2} o'$, the proper offset for the chosen spiral; find new radii for the curves such that

$$R_2' = R_2 - \frac{\frac{1}{2} o' \cos I_2 + o_2}{\operatorname{vers} I_2}.$$

$$R_1' = R_1 - \frac{o_1 - \frac{1}{2} o' \cos I_1}{\operatorname{vers} I_1}.$$

Both tangent points will be moved toward the vertex by

$$t_2 = (R_2 - R_2' + \tfrac{1}{2} o') \sin I_2$$
$$t_1 = (R_1 - R_1' - \tfrac{1}{2} o') \sin I_1.$$

TABLE VII. — Coefficients of a_1 for Deflection Angles to Chord Points

Deflection angle to chord-point number	Transit at chord-point number										
	0 *T. S.*	1	2	3	4	5	6	7	8	9	10 *S. C.*
0 *T. S.*	0	2	8	18	32	50	72	98	128	162	200
1	1	0	5	14	27	44	65	90	119	152	189
2	4	4	0	8	20	36	56	80	108	140	176
3	9	10	7	0	11	26	45	68	95	126	161
4	16	18	16	10	0	14	32	54	80	110	144
5	25	28	27	22	13	0	17	38	63	92	125
6	36	40	40	36	28	16	0	20	44	72	104
7	49	54	55	52	45	34	19	0	23	50	81
8	64	70	72	70	64	54	40	22	0	26	56
9	81	88	91	90	85	76	63	46	25	0	29
10 *S. C.*	100	108	112	112	108	100	88	72	52	28	0

TABLE VIII. — General Functions — Ten-chord Spiral

Δ	A	$\frac{C}{L}$	$\frac{X}{L}$	$\frac{Y}{L}$	$\frac{U}{L}$	$\frac{V}{L}$	$o=mL-nD$		$Z=mL-nD$		Δ
							m	n	m	n	
0°.0	0°.000	1.00000	1.00000	.00000	.66667	.33333	.00000	.0000	.50000	.0000	0°.0
.1	.033	.00000	.00000	.00058	.66667	.33333	.00015	.0000	.50000	.0001	.1
.2	.067	.00000	.00000	.00116	.66667	.33333	.00029	.0000	.50000	.0003	.2
.3	.100	.00000	.00000	.00175	.66667	.33333	.00044	.0000	.50000	.0004	.3
.4	.133	.00000	.00000	.00233	.66667	.33333	.00058	.0000	.50000	.0005	.4
.5	.167	.00000	0.99999	.00291	.66667	.33334	.00073	.0000	.50000	.0006	.5
.6	.200	.00000	.99999	.00349	.66667	.33334	.00087	.0000	.50000	.0008	.6
.7	.233	.99999	.99999	.00407	.66667	.33334	.00102	.0000	.50000	.0009	.7
.8	.267	.99999	.99998	.00465	.66667	.33334	.00116	.0000	.50000	.0010	.8
.9	.300	.99999	.99998	.00524	.66668	.33334	.00131	.0000	.50000	.0011	.9
1.0	.333	.99999	.99997	.00582	.66668	.33334	.00145	.0000	.50000	.0013	1.0
.1	.367	.99998	.99996	.00640	.66668	.33335	.00160	.0000	.49999	.0014	.1
.2	.400	.99998	.99996	.00698	.66668	.33335	.00175	.0000	.49999	.0015	.2
.3	.433	.99998	.99995	.00756	.66668	.33335	.00189	.0000	.49999	.0017	.3
.4	.467	.99997	.99994	.00814	.66669	.33335	.00204	.0000	.49999	.0018	.4
.5	.500	.99997	.99993	.00873	.66669	.33336	.00218	.0000	.49999	.0019	.5
.6	.533	.99997	.99992	.00931	.66669	.33336	.00233	.0000	.49999	.0020	.6
.7	.567	.99996	.99991	.00989	.66670	.33336	.00247	.0000	.49999	.0022	.7
.8	.600	.99996	.99990	.01047	.66670	.33337	.00262	.0000	.49998	.0023	.8
.9	.633	.99995	.99989	.01105	.66671	.33337	.00276	.0000	.49998	.0024	.9
2.0	.667	.99995	.99988	.01163	.66671	.33337	.00291	.0000	.49998	.0025	2.0
.1	.700	.99994	.99987	.01222	.66671	.33338	.00305	.0000	.49998	.0027	.1
.2	.733	.99994	.99985	.01280	.66672	.33338	.00320	.0001	.49998	.0028	.2
.3	.767	.99993	.99984	.01338	.66672	.33338	.00335	.0001	.49997	.0029	.3
.4	.800	.99992	.99983	.01396	.66673	.33339	.00349	.0001	.49997	.0031	.4
.5	.833	.99992	.99981	.01454	.66673	.33339	.00364	.0001	.49997	.0032	.5
.6	.867	.99991	.99980	.01512	.66674	.33340	.00378	.0001	.49997	.0033	.6
.7	.900	.99990	.99978	.01571	.66674	.33340	.00393	.0001	.49996	.0034	.7
.8	.933	.99990	.99976	.01629	.66675	.33341	.00407	.0001	.49996	.0036	.8
.9	.967	.99989	.99975	.01687	.66676	.33342	.00422	.0001	.49996	.0037	.9
3.0	1.000	.99988	.99973	.01745	.66676	.33342	.00436	.0001	.49996	.0038	3.0
.1	1.033	.99987	.99971	.01803	.66677	.33343	.00451	.0001	.49995	.0039	.1
.2	1.067	.99986	.99969	.01861	.66678	.33343	.00465	.0001	.49995	.0041	.2
.3	1.100	.99985	.99967	.01919	.66678	.33344	.00480	.0001	.49995	.0042	.3
.4	1.133	.99985	.99965	.01978	.66679	.33345	.00494	.0001	.49994	.0043	.4
.5	1.167	.99984	.99963	.02036	.66680	.33345	.00509	.0001	.49994	.0045	.5
.6	1.200	.99983	.99961	.02094	.66681	.33346	.00524	.0001	.49994	.0046	.6
.7	1.233	.99982	.99959	.02152	.66681	.33347	.00538	.0002	.49993	.0047	.7
.8	1.267	.99981	.99956	.02210	.66682	.33347	.00553	.0002	.49993	.0048	.8
.9	1.300	.99980	.99954	.02268	.66683	.33348	.00567	.0002	.49993	.0050	.9
4.0	1.333	.99979	.99952	.02326	.66684	.33349	.00582	.0002	.49992	.0051	4.0
.1	1.367	.99978	.99949	.02384	.66685	.33350	.00596	.0002	.49992	.0052	.1
.2	1.400	.99976	.99947	.02443	.66686	.33351	.00611	.0002	.49991	.0053	.2
.3	1.433	.99975	.99944	.02501	.66686	.33351	.00625	.0002	.49991	.0055	.3
.4	1.467	.99974	.99941	.02559	.66687	.33352	.00640	.0002	.49991	.0056	.4
.5	1.500	.99973	.99939	.02617	.66688	.33353	.00654	.0002	.49990	.0057	.5
.6	1.533	.99972	.99936	.02675	.66689	.33354	.00669	.0002	.49990	.0059	.6
.7	1.567	.99970	.99933	.02733	.66690	.33355	.00683	.0002	.49989	.0060	.7
.8	1.600	.99969	.99930	.02791	.66691	.33356	.00698	.0003	.49989	.0061	.8
.9	1.633	.99968	.99927	.02849	.66692	.33357	.00713	.0003	.49988	.0062	.9
5.0	1.667	.99967	.99924	.02907	.66693	.33358	.00727	.0003	.49988	.0064	5.0

TABLE VIII. — (*Continued*)

Δ	A	$\frac{C}{L}$	$\frac{X}{L}$	$\frac{Y}{L}$	$\frac{U}{L}$	$\frac{V}{L}$	$o=mL-nD$		$Z=mL-nD$		Δ
							m	n	m	n	
5.0°	1.667°	.99967	.99924	.02907	.66693	.33358	.00727	.0003	.49988	.0064	5.0°
.1	1.700	.99965	.99921	.02965	.66695	.33359	.00742	.0003	.49987	.0065	.1
.2	1.733	.99964	.99918	.03023	.66696	.33360	.00756	.0003	.49987	.0066	.2
.3	1.767	.99962	.99915	.03082	.66697	.33361	.00771	.0003	.49986	.0067	.3
.4	1.800	.99961	.99912	.03140	.66698	.33362	.00785	.0003	.49986	.0069	.4
.5	1.833	.99960	.99908	.03198	.66699	.33363	.00800	.0003	.49985	.0070	.5
.6	1.867	.99958	.99905	.03256	.66700	.33364	.00814	.0003	.49985	.0071	.6
.7	1.900	.99957	.99902	.03314	.66702	.33365	.00829	.0004	.49984	.0073	.7
.8	1.933	.99955	.99898	.03372	.66703	.33366	.00843	.0004	.49984	.0074	.8
.9	1.967	.99953	.99895	.03430	.66704	.33367	.00858	.0004	.49983	.0075	.9
6.0	2.000	.99952	.99891	.03488	.66705	.33369	.00872	.0004	.49982	.0076	6.0
.1	2.033	.99950	.99887	.03546	.66707	.33370	.00887	.0004	.49982	.0078	.1
.2	2.067	.99949	.99884	.03604	.66708	.33371	.00901	.0004	.49981	.0079	.2
.3	2.100	.99947	.99880	.03662	.66709	.33372	.00916	.0004	.49981	.0080	.3
.4	2.133	.99945	.99876	.03720	.66711	.33373	.00930	.0005	.49980	.0081	.4
.5	2.167	.99944	.99872	.03778	.66712	.33375	.00945	.0005	.49979	.0083	.5
.6	2.200	.99942	.99868	.03836	.66713	.33376	.00959	.0005	.49979	.0084	.6
.7	2.233	.99940	.99864	.03894	.66715	.33377	.00974	.0005	.49978	.0085	.7
.8	2.267	.99938	.99860	.03952	.66716	.33379	.00989	.0005	.49977	.0086	.8
.9	2.300	.99936	.99856	.04010	.66718	.33380	.01003	.0005	.49977	.0088	.9
7.0	2.333	.99935	.99852	.04068	.66719	.33381	.01018	.0005	.49976	.0089	7.0
.1	2.367	.99933	.99847	.04126	.66721	.33383	.01032	.0006	.49975	.0090	.1
.2	2.400	.99931	.99843	.04184	.66722	.33384	.01047	.0006	.49975	.0091	.2
.3	2.433	.99929	.99839	.04242	.66724	.33385	.01061	.0006	.49974	.0093	.3
.4	2.467	.99927	.99834	.04300	.66725	.33387	.01076	.0006	.49973	.0094	.4
.5	2.500	.99925	.99830	.04358	.66727	.33388	.01090	.0006	.49972	.0095	.5
.6	2.533	.99923	.99825	.04416	.66729	.33390	.01105	.0006	.49972	.0097	.6
.7	2.567	.99921	.99821	.04474	.66730	.33391	.01119	.0007	.49971	.0098	.7
.8	2.600	.99919	.99816	.04532	.66732	.33393	.01134	.0007	.49970	.0099	.8
.9	2.633	.99917	.99811	.04590	.66734	.33394	.01148	.0007	.49969	.0100	.9
8.0	2.666	.99914	.99806	.04648	.66735	.33396	.01163	.0007	.49969	.0102	8.0
.1	2.699	.99912	.99801	.04706	.66737	.33398	.01177	.0007	.49968	.0103	.1
.2	2.733	.99910	.99797	.04764	.66739	.33399	.01192	.0007	.49967	.0104	.2
.3	2.766	.99908	.99792	.04822	.66741	.33401	.01206	.0008	.49966	.0105	.3
.4	2.799	.99906	.99786	.04880	.66742	.33402	.01221	.0008	.49965	.0107	.4
.5	2.833	.99903	.99781	.04937	.66744	.33404	.01235	.0008	.49965	.0108	.5
.6	2.866	.99901	.99776	.04995	.66746	.33406	.01250	.0008	.49964	.0109	.6
.7	2.899	.99899	.99771	.05053	.66748	.33407	.01264	.0008	.49963	.0110	.7
.8	2.933	.99897	.99766	.05111	.66750	.33409	.01279	.0009	.49962	.0112	.8
.9	2.966	.99894	.99760	.05169	.66752	.33411	.01293	.0009	.49961	.0113	.9
9.0	2.999	.99892	.99755	.05227	.66754	.33413	.01308	.0009	.49960	.0114	9.0
.1	3.033	.99889	.99749	.05285	.66756	.33414	.01322	.0009	.49959	.0116	.1
.2	3.066	.99887	.99744	.05343	.66758	.33416	.01337	.0009	.49959	.0117	.2
.3	3.099	.99884	.99738	.05400	.66760	.33418	.01351	.0010	.49958	.0118	.3
.4	3.133	.99882	.99733	.05458	.66762	.33420	.01366	.0010	.49957	.0119	.4
.5	3.166	.99879	.99727	.05516	.66764	.33422	.01381	.0010	.49956	.0120	.5
.6	3.199	.99877	.99721	.05574	.66766	.33424	.01395	.0010	.49955	.0122	.6
.7	3.232	.99874	.99715	.05632	.66768	.33425	.01410	.0010	.49954	.0123	.7
.8	3.266	.99872	.99709	.05690	.66770	.33427	.01424	.0011	.49953	.0124	.8
.9	3.299	.99869	.99704	.05747	.66772	.33429	.01439	.0011	.49952	.0126	.9
10.0	3.332	.99866	.99698	.05805	.66774	.33431	.01453	.0011	.49951	.0127	10.0

Δ	A	C/L	X/L	Y/L	U/L	V/L	o=mL−nD m	o=mL−nD n	Z=mL−nD m	Z=mL−nD n	Δ
°	°										°
10.0	3.332	.99866	.99698	.05805	.66774	.33431	.01453	.0011	.49951	.0127	**10.0**
.1	3.366	.99864	.99691	.05863	.66776	.33433	.01468	.0011	.49950	.0128	.1
.2	3.399	.99861	.99685	.05921	.66779	.33435	.01482	.0012	.49949	.0129	.2
.3	3.432	.99858	.99679	.05979	.66781	.33437	.01497	.0012	.49948	.0131	.3
.4	3.466	.99856	.99673	.06036	.66783	.33439	.01511	.0012	.49947	.0132	.4
.5	3.499	.99853	.99667	.06094	.66785	.33441	.01526	.0012	.49946	.0133	.5
.6	3.532	.99850	.99660	.06152	.66787	.33443	.01540	.0012	.49945	.0134	.6
.7	3.566	.99847	.99654	.06210	.66790	.33446	.01555	.0013	.49944	.0136	.7
.8	3.599	.99844	.99647	.06267	.66792	.33448	.01569	.0013	.49943	.0137	.8
.9	3.632	.99841	.99641	.06325	.66794	.33450	.01584	.0013	.49942	.0138	.9
11.0	3.666	.99838	.99634	.06383	.66797	.33452	.01598	.0013	.49941	.0139	**11.0**
.1	3.699	.99835	.99627	.06441	.66799	.33454	.01612	.0014	.49940	.0141	.1
.2	3.732	.99832	.99621	.06498	.66802	.33456	.01627	.0014	.49939	.0142	.2
.3	3.765	.99829	.99614	.06556	.66804	.33459	.01641	.0014	.49937	.0143	.3
.4	3.799	.99826	.99607	.06614	.66806	.33461	.01656	.0014	.49936	.0144	.4
.5	3.832	.99823	.99600	.06671	.66809	.33463	.01670	.0015	.49935	.0146	.5
.6	3.865	.99820	.99593	.06729	.66811	.33465	.01685	.0015	.49934	.0147	.6
.7	3.899	.99817	.99586	.06787	.66814	.33468	.01699	.0015	.49933	.0148	.7
.8	3.932	.99814	.99579	.06844	.66816	.33470	.01714	.0015	.49932	.0149	.8
.9	3.965	.99811	.99572	.06902	.66819	.33472	.01728	.0016	.49931	.0151	.9
12.0	3.999	.99808	.99565	.06960	.66822	.33475	.01743	.0016	.49929	.0152	**12.0**
.1	4.032	.99804	.99557	.07017	.66824	.33477	.01757	.0016	.49928	.0153	.1
.2	4.065	.99801	.99550	.07075	.66827	.33479	.01772	.0016	.49927	.0154	.2
.3	4.098	.99798	.99543	.07133	.66830	.33482	.01786	.0017	.49926	.0156	.3
.4	4.132	.99795	.99535	.07190	.66832	.33484	.01801	.0017	.49925	.0157	.4
.5	4.165	.99791	.99528	.07248	.66835	.33487	.01815	.0017	.49923	.0158	.5
.6	4.198	.99788	.99520	.07305	.66838	.33489	.01830	.0018	.49922	.0159	.6
.7	4.232	.99785	.99513	.07363	.66840	.33492	.01844	.0018	.49921	.0160	.7
.8	4.265	.99781	.99505	.07421	.66843	.33494	.01859	.0018	.49920	.0162	.8
.9	4.298	.99778	.99497	.07478	.66846	.33497	.01873	.0018	.49918	.0163	.9
13.0	4.331	.99774	.99489	.07536	.66849	.33499	.01888	.0019	.49917	.0164	**13.0**
.1	4.365	.99771	.99481	.07593	.66852	.33502	.01902	.0019	.49916	.0165	.1
.2	4.398	.99767	.99474	.07651	.66854	.33504	.01917	.0019	.49915	.0167	.2
.3	4.431	.99764	.99467	.07708	.66857	.33507	.01931	.0020	.49913	.0168	.3
.4	4.465	.99760	.99457	.07766	.66860	.33510	.01946	.0020	.49912	.0169	.4
.5	4.498	.99757	.99449	.07823	.66863	.33512	.01960	.0020	.49911	.0170	.5
.6	4.531	.99753	.99441	.07881	.66866	.33515	.01974	.0020	.49909	.0172	.6
.7	4.564	.99749	.99433	.07938	.66869	.33518	.01989	.0021	.49908	.0173	.7
.8	4.598	.99746	.99425	.07996	.66872	.33520	.02003	.0021	.49907	.0174	.8
.9	4.631	.99742	.99416	.08053	.66875	.33523	.02018	.0021	.49905	.0175	.9
14.0	4.664	.99738	.99408	.08111	.66878	.33526	.02032	.0022	.49904	.0177	**14.0**
.1	4.698	.99735	.99399	.08168	.66881	.33529	.02047	.0022	.49903	.0178	.1
.2	4.731	.99731	.99391	.08226	.66884	.33531	.02061	.0022	.49901	.0179	.2
.3	4.764	.99727	.99382	.08283	.66887	.33534	.02076	.0023	.49900	.0180	.3
.4	4.797	.99723	.99374	.08340	.66890	.33537	.02090	.0023	.49898	.0182	.4
.5	4.831	.99719	.99365	.08398	.66893	.33540	.02105	.0023	.49897	.0183	.5
.6	4.864	.99715	.99356	.08455	.66897	.33543	.02119	.0024	.49896	.0184	.6
.7	4.897	.99711	.99347	.08513	.66900	.33546	.02134	.0024	.49894	.0185	.7
.8	4.930	.99708	.99339	.08570	.66903	.33549	.02148	.0024	.49893	.0186	.8
.9	4.964	.99704	.99330	.08627	.66906	.33552	.02162	.0025	.49891	.0188	.9
15.0	4.997	.99700	.99321	.08685	.66909	.33555	.02177	.0025	.49890	.0189	**15.0**

TABLE VIII. — (*Continued*)

Δ	A	C/L	X/L	Y/L	U/L	V/L	o=mL−nD		Z=mL−nD		Δ
							m	n	m	n	
15.0°	4.997°	.99700	.99321	.08685	.66909	.33555	.02177	.0025	.49890	.0189	15.0°
.1	5.030	.99696	.99312	.08742	.66913	.33558	.02191	.0025	.49888	.0190	.1
.2	5.064	.99692	.99302	.08799	.66916	.33561	.02206	.0026	.49887	.0191	.2
.3	5.097	.99687	.99293	.08857	.66919	.33564	.02220	.0026	.49885	.0193	.3
.4	5.130	.99683	.99284	.08914	.66923	.33567	.02235	.0026	.49884	.0194	.4
.5	5.163	.99679	.99275	.08971	.66926	.33570	.02249	.0027	.49882	.0195	.5
.6	5.197	.99675	.99265	.09028	.66929	.33573	.02264	.0027	.49881	.0196	.6
.7	5.230	.99671	.99256	.09086	.66933	.33576	.02278	.0027	.49879	.0198	.7
.8	5.263	.99667	.99246	.09143	.66936	.33579	.02292	.0028	.49878	.0199	.8
.9	5.296	.99662	.99237	.09200	.66940	.33582	.02307	.0028	.49876	.0200	.9
16.0	5.330	.99658	.99227	.09257	.66943	.33585	.02321	.0028	.49875	.0201	16.0
.1	5.363	.99654	.99218	.09315	.66947	.33588	.02336	.0029	.49873	.0202	.1
.2	5.396	.99650	.99208	.09372	.66950	.33592	.02350	.0029	.49872	.0204	.2
.3	5.429	.99645	.99198	.09429	.66954	.33595	.02365	.0029	.49870	.0205	.3
.4	5.463	.99641	.99188	.09486	.66957	.33598	.02379	.0030	.49868	.0206	.4
.5	5.496	.99637	.99178	.09543	.66961	.33601	.02393	.0030	.49867	.0207	.5
.6	5.529	.99632	.99169	.09600	.66964	.33605	.02408	.0030	.49865	.0209	.6
.7	5.563	.99628	.99159	.09658	.66968	.33608	.02422	.0031	.49863	.0210	.7
.8	5.596	.99623	.99148	.09715	.66972	.33611	.02437	.0031	.49862	.0211	.8
.9	5.629	.99619	.99138	.09772	.66975	.33615	.02451	.0032	.49860	.0212	.9
17.0	5.662	.99614	.99128	.09829	.66979	.33618	.02466	.0032	.49859	.0213	17.0
.1	5.696	.99610	.99118	.09886	.66983	.33621	.02480	.0032	.49857	.0215	.1
.2	5.729	.99605	.99108	.09943	.66986	.33625	.02494	.0033	.49855	.0216	.2
.3	5.762	.99601	.99097	.10000	.66990	.33628	.02509	.0033	.49853	.0217	.3
.4	5.796	.99596	.99087	.10057	.66994	.33632	.02523	.0033	.49852	.0218	.4
.5	5.829	.99591	.99076	.10114	.66998	.33635	.02538	.0034	.49850	.0220	.5
.6	5.862	.99587	.99066	.10171	.67002	.33639	.02552	.0034	.49848	.0221	.6
.7	5.896	.99582	.99055	.10228	.67005	.33642	.02567	.0035	.49847	.0222	.7
.8	5.929	.99577	.99044	.10285	.67009	.33646	.02581	.0035	.49845	.0223	.8
.9	5.962	.99572	.99034	.10342	.67013	.33649	.02595	.0035	.49843	.0224	.9
18.0	5.995	.99568	.99023	.10399	.67017	.33653	.02610	.0036	.49841	.0226	18.0
.1	6.028	.99563	.99012	.10456	.67021	.33657	.02624	.0036	.49840	.0227	.1
.2	6.062	.99558	.99001	.10513	.67025	.33660	.02639	.0037	.49838	.0228	.2
.3	6.095	.99553	.98990	.10570	.67029	.33664	.02653	.0037	.49836	.0229	.3
.4	6.128	.99548	98979	.10627	.67033	.33667	.02667	.0037	.49834	.0230	.4
.5	6.161	.99543	.98968	.10684	.67037	.33671	.02682	.0038	.49833	.0232	.5
.6	6.194	.99538	.98957	.10741	.67041	.33675	.02696	.0038	.49831	.0233	.6
.7	6.228	.99533	.98946	.10798	.67045	.33679	.02711	.0039	.49829	.0234	.7
.8	6.261	.99528	.98935	.10855	.67049	.33682	.02725	.0039	.49827	.0235	.8
.9	6.294	.99523	.98923	.10912	.67053	.33686	.02739	.0039	.49825	.0236	.9
19.0	6.328	.99518	.98912	.10968	.67058	.33690	.02754	.0040	.49823	.0238	19.0
.1	6.361	.99513	.98901	.11025	.67062	.33694	.02768	.0040	.49821	.0239	.1
.2	6.394	.99508	.98889	.11082	.67066	.33697	.02783	.0041	.49820	.0240	.2
.3	6.427	.99503	.98878	.11139	.67070	.33701	.02797	.0041	.49818	.0241	.3
.4	6.461	.99498	.98866	.11196	.67074	.33705	.02811	.0041	.49816	.0242	.4
.5	6.494	.99493	.98854	.11252	.67079	.33709	.02826	.0042	.49814	.0244	.5
.6	6.527	.99487	.98843	.11309	.67083	.33713	.02840	.0042	.49812	.0245	.6
.7	6.560	.99482	.98831	.11366	.67087	.33717	.02854	.0043	.49810	.0246	.7
.8	6.594	.99477	.98819	.11423	.67092	.33721	.02869	.0043	.49808	.0247	.8
.9	6.627	.99472	.98807	.11479	.67096	.33725	.02883	.0044	.49806	.0248	.9
20.0	6.660	.99466	.98795	.11536	.67100	.33729	.02898	.0044	.49804	.0250	20.0

TABLE VIII. — (*Continued*)

Δ	A	$\frac{C}{L}$	$\frac{X}{L}$	$\frac{Y}{L}$	$\frac{U}{L}$	$\frac{V}{L}$	$o=mL-nD$		$Z=mL-nD$		Δ
							m	n	m	n	
20°.0	6°.660	.99466	.98795	.11536	.67100	.33729	.02898	.0044	.49804	.0250	**20°.0**
.1	6.693	.99461	.98783	.11593	.67105	.33733	.02912	.0044	.49802	.0251	.1
.2	6.727	.99456	.98771	.11649	.67109	.33737	.02926	.0045	.49800	.0252	.2
.3	6.759	.99450	.98759	.11706	.67114	.33741	.02941	.0045	.49798	.0253	.3
.4	6.793	.99445	.98747	.11763	.67118	.33745	.02955	.0046	.49796	.0254	.4
.5	6.826	.99439	.98734	.11819	.67123	.33749	.02969	.0046	.49794	.0256	.5
.6	6.859	.99434	.98722	.11876	.67127	.33753	.02984	.0047	.49792	.0257	.6
.7	6.892	.99428	.98710	.11932	.67132	.33757	.02998	.0047	.49790	.0258	.7
.8	6.926	.99423	.98697	.11989	.67136	.33762	.03013	.0048	.49788	.0259	.8
.9	6.959	.99417	.98685	.12046	.67141	.33766	.03027	.0048	.49786	.0260	.9
21.0	6.992	.99412	.98672	.12102	.67145	.33770	.03041	.0048	.49784	.0262	**21.0**
.1	7.026	.99406	.98660	.12159	.67150	.33774	.03056	.0049	.49782	.0263	.1
.2	7.059	.99400	.98647	.12215	.67155	.33778	.03070	.0049	.49780	.0264	.2
.3	7.092	.99395	.98634	.12272	.67159	.33783	.03084	.0050	.49778	.0265	.3
.4	7.125	.99389	.98622	.12328	.67164	.33787	.03099	.0050	.49776	.0266	.4
.5	7.158	.99383	.98609	.12385	.67169	.33791	.03113	.0051	.49774	.0267	.5
.6	7.192	.99378	.98596	.12441	.67173	.33796	.03127	.0051	.49772	.0269	.6
.7	7.225	.99372	.98583	.12497	.67178	.33800	.03142	.0052	.49770	.0270	.7
.8	7.258	.99366	.98570	.12554	.67183	.33804	.03156	.0052	.49768	.0271	.8
.9	7.291	.99360	.98557	.12610	.67188	.33809	.03170	.0053	.49765	.0272	.9
22.0	7.324	.99354	.98544	.12667	.67193	.33813	.03185	.0053	.49763	.0273	**22.0**
.1	7.358	.99349	.98531	.12723	.67197	.33818	.03199	.0054	.49761	.0275	.1
.2	7.391	.99343	.98517	.12779	.67202	.33822	.03213	.0054	.49759	.0276	.2
.3	7.424	.99337	.98504	.12836	.67207	.33827	.03228	.0055	.49757	.0277	.3
.4	7.458	.99331	.98491	.12892	.67212	.33831	.03242	.0055	.49755	.0278	.4
.5	7.491	.99325	.98477	.12948	.67217	.33836	.03256	.0056	.49752	.0279	.5
.6	7.524	.99319	.98464	.13005	.67222	.33840	.03271	.0056	.49750	.0281	.6
.7	7.557	.99313	.98450	.13061	.67227	.33845	.03285	.0057	.49748	.0282	.7
.8	7.590	.99307	.98437	.13117	.67232	.33849	.03299	.0057	.49746	.0283	.8
.9	7.623	.99301	.98423	.13173	.67237	.33854	.03314	.0058	.49744	.0284	.9
23.0	7.657	.99295	.98409	.13230	.67242	.33859	.03328	.0058	.49741	.0285	**23.0**
.1	7.690	.99288	.98396	.13286	.67247	.33863	.03342	.0059	.49739	.0286	.1
.2	7.723	.99282	.98382	.13342	.67252	.33868	.03357	.0059	.49737	.0288	.2
.3	7.756	.99276	.98368	.13398	.67258	.33873	.03371	.0060	.49735	.0289	.3
.4	7.789	.99270	.98354	.13454	.67263	.33877	.03385	.0060	.49732	.0290	.4
.5	7.822	.99264	.98340	.13510	.67268	.33882	.03400	.0061	.49730	.0291	.5
.6	7.856	.99257	.98326	.13567	.67273	.33887	.03414	.0061	.49728	.0292	.6
.7	7.889	.99251	.98312	.13623	.67278	.33892	.03428	.0062	.49725	.0293	.7
.8	7.922	.99245	.98298	.13679	.67284	.33896	.03443	.0062	.49723	.0295	.8
.9	7.955	.99238	.98283	.13735	.67289	.33901	.03457	.0063	.49721	.0296	.9
24.0	7.989	.99232	.98269	.13791	.67294	.33906	.03471	.0063	.49718	.0297	**24.0**
.1	8.022	.99226	.98255	.13847	.67300	.33911	.03485	.0064	.49716	.0298	.1
.2	8.055	.99219	.98240	.13903	.67305	.33916	.03500	.0064	.49714	.0299	.2
.3	8.088	.99213	.98226	.13959	.67310	.33921	.03514	.0065	.49711	.0300	.3
.4	8.121	.99206	.98211	.14015	.67316	.33926	.03528	.0065	.49709	.0302	.4
.5	8.154	.99200	.98197	.14071	.67321	.33931	.03543	.0066	.49707	.0303	.5
.6	8.188	.99193	.98182	.14127	.67327	.33936	.03557	.0066	.49704	.0304	.6
.7	8.221	.99187	.98167	.14183	.67332	.33941	.03571	.0067	.49702	.0305	.7
.8	8.254	.99180	.98153	.14239	.67338	.33946	.03585	.0067	.49699	.0306	.8
.9	8.287	.99174	.98138	.14295	.67343	.33951	.03600	.0068	.49697	.0307	.9
25.0	8.321	.99167	.98123	.14350	.67349	.33956	.03614	.0068	.49695	.0309	**25.0**

TABLE VIII. — (*Continued*)

Δ	A	C/L	X/L	Y/L	U/L	V/L	o=mL−nD m	o=mL−nD n	Z=mL−nD m	Z=mL−nD n	Δ
25°.0	8°.321	.99167	.98123	.14350	.67349	.33956	.03614	.0068	.49695	.0309	**25°.0**
.1	8.354	.99160	.98108	.14406	.67354	.33961	.03628	.0069	.49692	.0310	.1
.2	8.387	.99154	.98093	.14462	.67360	.33966	.03643	.0069	.49690	.0311	.2
.3	8.420	.99147	.98078	.14518	.67365	.33971	.03657	.0070	.49687	.0312	.3
.4	8.453	.99140	.98063	.14574	.67371	.33976	.03671	.0071	.49685	.0313	.4
.5	8.486	.99133	.98048	.14629	.67377	.33982	.03685	.0071	.49682	.0314	.5
.6	8.519	.99127	.98033	.14685	.67382	.33987	.03700	.0072	.49680	.0315	.6
.7	8.553	.99120	.98017	.14741	.67388	.33992	.03714	.0072	.49677	.0317	.7
.8	8.586	.99113	.98002	.14797	.67394	.33997	.03728	.0073	.49675	.0318	.8
.9	8.619	.99106	.97987	.14852	.67400	.34002	.03742	.0073	.49672	.0319	.9
26.0	8.652	.99099	.97971	.14908	.67405	.34008	.03757	.0074	.49670	.0320	**26.0**
.1	8.685	.99092	.97956	.14964	.67411	.34013	.03771	.0074	.49667	.0321	.1
.2	8.719	.99085	.97940	.15019	.67417	.34018	.03785	.0075	.49665	.0322	.2
.3	8.752	.99078	.97925	.15075	.67423	.34024	.03800	.0076	.49662	.0323	.3
.4	8.785	.99071	.97909	.15131	.67429	.34029	.03814	.0076	.49660	.0325	.4
.5	8.818	.99064	.97893	.15186	.67435	.34035	.03828	.0077	.49657	.0326	.5
.6	8.851	.99057	.97878	.15242	.67441	.34040	.03842	.0077	.49654	.0327	.6
.7	8.884	.99050	.97862	.15297	.67447	.34045	.03857	.0078	.49652	.0328	.7
.8	8.917	.99043	.97846	.15353	.67452	.34051	.03871	.0078	.49649	.0329	.8
.9	8.951	.99036	.97830	.15408	.67458	.34056	.03885	.0079	.49647	.0330	.9
27.0	8.984	.99029	.97814	.15464	.67465	.34062	.03899	.0080	.49644	.0331	**27.0**
.1	9.017	.99022	.97798	.15519	.67471	.34067	.03913	.0080	.49641	.0333	.1
.2	9.050	.99014	.97782	.15575	.67477	.34073	.03929	.0081	.49639	.0334	.2
.3	9.083	.99007	.97766	.15630	.67483	.34079	.03942	.0081	.49636	.0335	.3
.4	9.116	.99000	.97749	.15686	.67489	.34084	.03956	.0082	.49633	.0336	.4
.5	9.149	.98993	.97733	.15741	.67495	.34090	.03970	.0082	.49631	.0337	.5
.6	9.183	.98985	.97717	.15796	.67501	.34095	.03985	.0083	.49629	.0338	.6
.7	9.216	.98978	.97700	.15852	.67507	.34101	.03999	.0084	.49625	.0339	.7
.8	9.249	.98971	.97684	.15907	.67514	.34107	.04013	.0084	.49623	.0340	.8
.9	9.282	.98963	.97667	.15962	.67520	.34113	.04027	.0085	.49620	.0342	.9
28.0	9.315	.98956	.97651	.16018	.67526	.34118	.04041	.0085	.49617	.0343	**28.0**
.1	9.348	.98948	.97634	.16073	.67532	.34124	.04056	.0086	.49615	.0344	.1
.2	9.381	.98941	.97617	.16128	.67539	.34130	.04070	.0087	.49612	.0345	.2
.3	9.415	.98933	.97601	.16183	.67545	.34136	.04084	.0087	.49609	.0346	.3
.4	9.448	.98926	.97584	.16239	.67551	.34141	.04098	.0088	.49606	.0347	.4
.5	9.481	.98918	.97567	.16294	.67558	.34147	.04113	.0088	.49604	.0348	.5
.6	9.514	.98911	.97550	.16349	.67564	.34153	.04127	.0089	.49601	.0349	.6
.7	9.547	.98903	.97533	.16404	.67571	.34159	.04141	.0090	.49598	.0351	.7
.8	9.580	.98895	.97516	.16459	.67577	.34165	.04155	.0090	.49595	.0352	.8
.9	9.613	.98888	.97499	.16514	.67584	.34171	.04169	.0091	.49592	.0353	.9
29.0	9.647	.98880	.97482	.16569	.67590	.34177	.04184	.0092	.49590	.0354	**29.0**
.1	9.680	.98872	.97465	.16624	.67597	.34183	.04198	.0092	.49587	.0355	.1
.2	9.713	.98865	.97447	.16679	.67603	.34189	.04212	.0093	.49584	.0356	.2
.3	9.746	.98857	.97430	.16734	.67610	.34195	.04226	.0093	.49581	.0357	.3
.4	9.779	.98849	.97413	.16789	.67616	.34201	.04240	.0094	.49578	.0358	.4
.5	9.812	.98841	.97395	.16844	.67623	.34207	.04254	.0095	.49575	.0359	.5
.6	9.845	.98833	.97378	.16899	.67630	.34213	.04269	.0095	.49573	.0361	.6
.7	9.878	.98826	.97360	.16954	.67636	.34219	.04283	.0096	.49570	.0362	.7
.8	9.911	.98818	.97343	.17009	.67643	.34225	.04297	.0097	.49567	.0363	.8
.9	9.945	.98810	.97325	.17064	.67650	.34232	.04311	.0097	.49564	.0364	.9
30.0	9.978	.98802	.97307	.17119	.67657	.34238	.04325	.0098	.49561	.0365	**30.0**

Δ	A	C/L	X/L	Y/L	U/L	V/L	o=mL−nD m	o=mL−nD n	Z=mL−nD m	Z=mL−nD n	Δ
30°.0	9°.978	.98802	.97307	.17119	.67657	.34238	.04325	.0098	.49561	.0365	**30°.0**
.1	10.011	.98794	.97290	.17174	.67663	.34244	.04339	.0098	.49558	.0366	.1
.2	10.044	.98786	.97272	.17229	.67670	.34250	.04354	.0099	.49555	.0367	.2
.3	10.077	.98778	.97254	.17283	.67677	.34257	.04368	.0100	.49552	.0368	.3
.4	10.110	.98770	.97236	.17338	.67684	.34263	.04382	.0100	.49549	.0369	.4
.5	10.143	.98762	.97218	.17393	.67691	.34269	.04396	.0101	.49546	.0371	.5
.6	10.176	.98754	.97200	.17448	.67698	.34276	.04410	.0102	.49543	.0372	.6
.7	10.209	.98745	.97182	.17502	.67705	.34282	.04424	.0102	.49540	.0373	.7
.8	10.242	.98737	.97164	.17557	.67712	.34288	.04439	.0103	.49537	.0374	.8
.9	10.276	.98729	.97146	.17612	.67719	.34295	.04453	.0104	.49534	.0375	.9
31.0	10.309	.98721	.97127	.17666	.67726	.34301	.04467	.0104	.49531	.0376	**31.0**
.1	10.342	.98713	.97109	.17721	.67733	.34308	.04481	.0105	.49528	.0377	.1
.2	10.375	.98704	.97091	.17776	.67740	.34314	.04495	.0106	.49525	.0378	.2
.3	10.408	.98696	.97072	.17830	.67747	.34321	.04509	.0106	.49522	.0379	.3
.4	10.441	.98688	.97054	.17885	.67754	.34327	.04523	.0107	.49519	.0380	.4
.5	10.474	.98680	.97035	.17939	.67761	.34334	.04538	.0108	.49516	.0381	.5
.6	10.507	.98671	.97017	.17994	.67768	.34340	.04552	.0108	.49513	.0383	.6
.7	10.540	.98663	.96998	.18048	.67775	.34347	.04566	.0109	.49510	.0384	.7
.8	10.573	.98654	.96979	.18103	.67783	.34353	.04580	.0110	.49507	.0385	.8
.9	10.607	.98646	.96960	.18157	.67790	.34360	.04594	.0110	.49504	.0386	.9
32.0	10.640	.98637	.96942	.18212	.67797	.34367	.04608	.0111	.49501	.0387	**32.0**
.1	10.673	.98629	.96923	.18266	.67804	.34373	.04622	.0112	.49498	.0388	.1
.2	10.706	.98620	.96904	.18320	.67812	.34380	.04636	.0112	.49495	.0389	.2
.3	10.739	.98612	.96885	.18375	.67819	.34387	.04650	.0113	.49491	.0390	.3
.4	10.772	.98603	.96866	.18429	.67826	.34394	.04665	.0114	.49488	.0391	.4
.5	10.805	.98595	.96847	.18483	.67834	.34400	.04679	.0114	.49485	.0392	.5
.6	10.838	.98586	.96828	.18538	.67841	.34407	.04693	.0115	.49482	.0393	.6
.7	10.871	.98577	.96808	.18592	.67849	.34414	.04707	.0116	.49479	.0394	.7
.8	10.904	.98569	.96789	.18646	.67856	.34421	.04721	.0116	.49476	.0395	.8
.9	10.937	.98560	.96770	.18700	.67864	.34428	.04735	.0117	.49473	.0397	.9
33.0	10.970	.98551	.96750	.18754	.67871	.34435	.04749	.0118	.49469	.0398	**33.0**
.1	11.003	.98543	.96731	.18809	.67879	.34442	.04763	.0118	.49466	.0399	.1
.2	11.036	.98534	.96712	.18863	.67886	.34448	.04777	.0119	.49463	.0400	.2
.3	11.069	.98525	.96692	.18917	.67894	.34455	.04791	.0120	.49460	.0401	.3
.4	11.103	.98516	.96672	.18971	.67901	.34462	.04805	.0121	.49457	.0402	.4
.5	11.136	.98507	.96653	.19025	.67909	.34469	.04820	.0121	.49453	.0403	.5
.6	11.169	.98499	.96633	.19079	.67917	.34477	.04834	.0122	.49450	.0404	.6
.7	11.202	.98490	.96613	.19133	.67925	.34484	.04848	.0123	.49447	.0405	.7
.8	11.235	.98481	.96593	.19187	.67932	.34491	.04862	.0123	.49443	.0406	.8
.9	11.268	.98472	.96574	.19241	.67940	.34498	.04876	.0124	.49440	.0407	.9
34.0	11.301	.98463	.96554	.19295	.67948	.34505	.04890	.0125	.49437	.0408	**34.0**
.1	11.334	.98454	.96534	.19349	.67956	.34512	.04904	.0126	.49434	.0409	.1
.2	11.367	.98445	.96514	.19403	.67963	.34519	.04918	.0126	.49430	.0410	.2
.3	11.400	.98436	.96494	.19457	.67971	.34527	.04932	.0127	.49427	.0411	.3
.4	11.433	.98427	.96473	.19510	.67979	.34534	.04946	.0128	.49424	.0412	.4
.5	11.466	.98417	.96453	.19564	.67987	.34541	.04960	.0128	.49420	.0413	.5
.6	11.499	.98408	.96433	.19618	.67995	.34548	.04974	.0129	.49417	.0415	.6
.7	11.532	.98399	.96413	.19672	.68003	.34556	.04988	.0130	.49414	.0416	.7
.8	11.565	.98390	.96392	.19726	.68011	.34563	.05002	.0131	.49410	.0417	.8
.9	11.598	.98381	.96372	.19779	.68019	.34570	.05016	.0131	.49407	.0418	.9
35.0	11.631	.98371	.96351	.19833	.68027	.34578	.05030	.0132	.49404	.0419	**35.0**

Δ	A	C/L	X/L	Y/L	U/L	V/L	o=mL−nD		Z=mL−nD		Δ
							m	n	m	n	
35°.0	11°.631	.98371	.96351	.19833	.68027	.34578	.05030	.0132	.49404	.0419	**35°.0**
.1	11.664	.98362	.96331	.19887	.68035	.34585	.05044	.0133	.49400	.0420	.1
.2	11.698	.98353	.96310	.19940	.68043	.34593	.05058	.0133	.49397	.0421	.2
.3	11.731	.98344	.96290	.19994	.68051	.34600	.05072	.0134	.49393	.0422	.3
.4	11.764	.98334	.96269	.20047	.68059	.34608	.05086	.0135	.49390	.0423	.4
.5	11.797	.98325	.96248	.20101	.68068	.34615	.05100	.0136	.49387	.0424	.5
.6	11.830	.98315	.96227	.20155	.68076	.34623	.05115	.0136	.49383	.0425	.6
.7	11.863	.98306	.96207	.20208	.68084	.34630	.05129	.0137	.49380	.0426	.7
.8	11.896	.98297	.96186	.20262	.68092	.34638	.05143	.0138	.49376	.0427	.8
.9	11.929	.98287	.96165	.20315	.68101	.34645	.05157	.0139	.49373	.0428	.9
36.0	11.961	.98278	.96144	.20368	.68109	.34653	.05171	.0139	.49369	.0429	**36.0**
.1	11.994	.98268	.96123	.20422	.68117	.34661	.05185	.0140	.49366	.0430	.1
.2	12.027	.98259	.96102	.20475	.68126	.34668	.05199	.0141	.49362	.0431	.2
.3	12.061	.98249	.96080	.20529	.68134	.34676	.05213	.0142	.49359	.0432	.3
.4	12.094	.98239	.96059	.20582	.68142	.34684	.05227	.0142	.49355	.0433	.4
.5	12.127	.98230	.96038	.20635	.68151	.34692	.05241	.0143	.49352	.0434	.5
.6	12.159	.98220	.96017	.20689	.68159	.34699	.05255	.0144	.49348	.0435	.6
.7	12.192	.98210	.95995	.20742	.68168	.34707	.05269	.0145	.49345	.0436	.7
.8	12.226	.98201	.95974	.20795	.68176	.34715	.05282	.0145	.49341	.0437	.8
.9	12.259	.98191	.95952	.20848	.68185	.34723	.05296	.0146	.49338	.0438	.9
37.0	12.292	.98181	.95931	.20901	.68194	.34731	.05310	.0147	.49334	.0439	**37.0**
.1	12.324	.98171	.95909	.20955	.68202	.34739	.05324	.0148	.49330	.0440	.1
.2	12.358	.98162	.95887	.21008	.68211	.34747	.05338	.0149	.49327	.0441	.2
.3	12.391	.98152	.95866	.21061	.68219	.34754	.05352	.0149	.49323	.0442	.3
.4	12.424	.98142	.95844	.21114	.68228	.34762	.05366	.0150	.49320	.0443	.4
.5	12.456	.98132	.95822	.21167	.68237	.34770	.05380	.0151	.49316	.0444	.5
.6	12.489	.98122	.95800	.21220	.68246	.34779	.05394	.0152	.49312	.0445	.6
.7	12.523	.98112	.95778	.21273	.68254	.34787	.05408	.0152	.49309	.0446	.7
.8	12.556	.98102	.95756	.21326	.68263	.34795	.05422	.0153	.49305	.0447	.8
.9	12.588	.98092	.95734	.21379	.68272	.34803	.05436	.0154	.49302	.0448	.9
38.0	12.621	.98082	.95712	.21432	.68281	.34811	.05450	.0155	.49298	.0449	**38.0**
.1	12.654	.98072	.95690	.21485	.68290	.34819	.05464	.0156	.49294	.0450	.1
.2	12.687	.98062	.95668	.21537	.68299	.34827	.05478	.0156	.49291	.0451	.2
.3	12.720	.98052	.95646	.21590	.68307	.34835	.05492	.0157	.49287	.0452	.3
.4	12.753	.98042	.95623	.21643	.68316	.34844	.05506	.0158	.49283	.0453	.4
.5	12.786	.98032	.95601	.21696	.68325	.34852	.05520	.0159	.49279	.0454	.5
.6	12.819	.98022	.95578	.21749	.68334	.34860	.05534	.0159	.49276	.0455	.6
.7	12.852	.98011	.95556	.21801	.68343	.34869	.05548	.0160	.49272	.0456	.7
.8	12.885	.98001	.95533	.21854	.68353	.34877	.05561	.0161	.49268	.0457	.8
.8	12.918	.97991	.95511	.21907	.68362	.34885	.05575	.0162	.49265	.0458	.9
39.0	12.951	.97981	.95488	.21959	.68371	.34894	.05589	.0163	.49261	.0459	**39.0**
.1	12.984	.97970	.95466	.22012	.68380	.34902	.05603	.0163	.49257	.0460	.1
.2	13.017	.97960	.95443	.22065	.68389	.34911	.05617	.0164	.49253	.0461	.2
.3	13.050	.97950	.95420	.22117	.68398	.34919	.05631	.0165	.49250	.0462	.3
.4	13.083	.97939	.95397	.22170	.68408	.34928	.05645	.0166	.49246	.0463	.4
.5	13.116	.97929	.95374	.22222	.68417	.34936	.05659	.0167	.49242	.0464	.5
.6	13.149	.97919	.95351	.22275	.68426	.34945	.05673	.0168	.49238	.0465	.6
.7	13.182	.97908	.95328	.22327	.68435	.34953	.05687	.0168	.49234	.0466	.7
.8	13.215	.97898	.95305	.22379	.68445	.34962	.05701	.0169	.49231	.0467	.8
.9	13.247	.97887	.95282	.22432	.68454	.34970	.05714	.0170	.49227	.0468	.9
40.0	13.281	.97877	.95259	.22484	.68464	.34979	.05728	.0171	.49223	.0469	**40.0**

TABLE IX. — Spiral Functions for Change of 0.2° per 100 Feet Suitable for Speeds of 104 Miles an Hour or Less and Curves of 1° or Less

L	*D*	Δ	*A*	*Z*	*o*	*C*	*X*	*Y*	*U*	*V*
	°	°	°	′						
10	0.02	0.001	0.000	5.00	0.00	10.00	10.00	0.00	6.67	3.33
20	.04	.004	.001	10.00	.00	20.00	20.00	.00	13.33	6.67
30	.06	.009	.003	15.00	.00	30.00	30.00	.00	20.00	10.00
40	.08	.016	.005	20.00	.00	40.00	40.00	.00	26.67	13.33
50	.10	.025	.008	25.00	.00	50.00	50.00	.01	33.33	16.67
60	.12	.036	.012	30.00	.00	60.00	60.00	.01	40.00	20.00
70	.14	.049	.016	35.00	.00	70.00	70.00	.02	46.67	23.33
80	.16	.064	.021	40.00	.01	80.00	80.00	.03	53.33	26.67
90	.18	.081	.027	45.00	.01	90.00	90.00	.04	60.00	30.00
100	.20	.100	.033	50.00	.01	100.00	100.00	.06	66.67	33.33
10	.22	.121	.040	55.00	.02	10.00	10.00	.08	73.33	36.67
20	.24	.144	.048	60.00	.03	20.00	20.00	.10	80.00	40.00
30	.26	.169	.056	65.00	.03	30.00	30.00	.13	86.67	43.33
40	.28	.196	.065	70.00	.04	40.00	40.00	.16	93.33	46.67
50	.30	.225	.075	75.00	.05	50.00	50.00	.20	100.00	50.00
60	.32	.256	.085	80.00	.06	60.00	60.00	.24	06.67	53.33
70	.34	.289	.096	85.00	.07	70.00	70.00	.28	13.33	56.67
80	.36	.324	.108	90.00	.08	80.00	80.00	.34	20.00	60.00
90	.38	.361	.120	95.00	.10	90.00	90.00	.40	26.67	63.33
200	.40	.400	.133	100.00	.12	200.00	200.00	.47	133.33	66.67
10	.42	.441	.147	105.00	.13	10.00	10.00	.54	40.00	70.00
20	.44	.484	.161	110.00	.15	20.00	20.00	.62	46.67	73.33
30	.46	.529	.176	115.00	.18	30.00	30.00	.71	53.33	76.67
40	.48	.576	.192	120.00	.20	40.00	40.00	.80	60.00	80.00
50	.50	.625	.208	125.00	.23	50.00	50.00	.91	66.67	83.33
60	.52	.676	.225	130.00	.26	60.00	60.00	1.02	73.33	86.67
70	.54	.729	.243	135.00	.29	70.00	70.00	1.14	80.00	90.00
80	.56	.784	.261	140.00	.32	80.00	79.99	1.28	86.67	93.34
90	.58	.841	.280	145.00	.35	90.00	89.99	1.42	93.33	96.67
300	.60	.900	.300	150.00	.39	300.00	99.99	1.57	200.00	100.00
10	.62	.961	.320	155.00	.43	10.00	309.99	1.73	06.67	103.34
20	.64	1.024	.341	160.00	.48	20.00	19.99	1.91	13.33	106.67
30	.66	1.089	.363	165.00	.52	29.99	29.99	2.09	20.00	110.00
40	.68	1.156	.385	170.00	.57	39.99	39.99	2.29	26.67	113.34
50	.70	1.225	.408	175.00	.62	49.99	49.98	2.49	33.34	116.67
60	.72	1.296	.432	180.00	.68	59.99	59.98	2.71	40.01	120.01
70	.74	1.369	.456	185.00	.74	69.99	69.98	2.95	46.67	123.34
80	.76	1.444	.481	189.99	.80	79.99	79.98	3.19	53.34	126.67
90	.78	1.521	.507	194.99	.86	89.99	89.97	3.45	60.01	130.01
400	.80	1.600	.533	199.99	.93	99.99	99.97	3.72	266.68	133.34
10	.82	1.681	.560	204.99	1.00	409.98	409.96	4.01	73.35	136.68
20	.84	1.764	.588	209.99	1.08	19.98	19.96	4.31	80.02	140.01
30	.86	1.849	.618	214.99	1.16	29.98	29.96	4.63	86.68	143.35
40	.88	1.936	.645	219.99	1.24	39.98	39.95	4.96	93.35	146.68
50	.90	2.025	.675	224.99	1.33	49.98	49.94	5.30	300.02	150.02
60	.92	2.116	.705	229.99	1.42	59.97	59.94	5.66	06.69	153.35
70	.94	2.209	.736	234.99	1.51	69.97	69.93	6.04	13.36	156.69
80	.96	2.304	.768	239.98	1.61	79.97	79.92	6.43	20.03	160.02
90	.98	2.401	.800	244.98	1.71	89.96	89.91	6.84	26.70	163.36
500	1.00	2.500	.833	249.98	1.82	499.96	499.91	7.27	333.37	166.70

TABLE X. — SPIRAL FUNCTIONS FOR A CHANGE OF 0.3° PER 100 FEET. SUITABLE FOR SPEEDS OF 91 MILES AN HOUR OR LESS, OR CURVES OF 1.5° OR LESS

L	*D*	Δ	*A*	*Z*	*o*	*C*	*X*	*Y*	*U*	*V*
	°	°	°							
10	0.03	0.001	0.001	5.00	0.00	10.00	10.00	0.00	6.67	3.33
20	.06	.006	.002	10.00	.00	20.00	20.00	.00	13.33	6.67
30	.09	.013	.005	15.00	.00	30.00	30.00	.00	20.00	10.00
40	.12	.024	.008	20.00	.00	40.00	40.00	.00	26.67	13.33
50	.15	.037	.013	25.00	.00	50.00	50.00	.01	33.33	16.67
60	.18	.054	.018	30.00	.00	60.00	60.00	.02	40.00	20.00
70	.21	.073	.025	35.00	.01	70.00	70.00	.03	46.67	23.33
80	.24	.096	.032	40.00	.01	80.00	80.00	.04	53.33	26.67
90	.27	.121	.041	45.00	.02	90.00	90.00	.06	60.00	30.00
100	.30	.150	.050	50.00	.02	100.00	100.00	.09	66.67	33.33
10	.33	.181	.061	55.00	.03	110.00	110.00	.12	73.33	36.67
20	.36	.216	.072	60.00	.04	120.00	120.00	.15	80.00	40.00
30	.39	.253	.085	65.00	.05	130.00	130.00	.19	86.67	43.33
40	.42	.294	.098	70.00	.06	140.00	140.00	.24	93.33	46.67
50	.45	.337	.113	75.00	.07	150.00	150.00	.29	100.00	50.00
60	.48	.384	.128	80.00	.09	160.00	160.00	.36	106.67	53.33
70	.51	.433	.145	85.00	.11	170.00	170.00	.43	113.33	56.67
80	.54	.486	.162	90.00	.13	180.00	180.00	.51	120.00	60.00
90	.57	.541	.181	95.00	.15	190.00	190.00	.60	126.67	63.33
200	.60	.600	.200	100.00	.17	200.00	200.00	.70	133.33	66.67
10	.63	.661	.221	105.00	.20	210.00	210.00	.81	140.00	70.00
20	.66	.726	.242	110.00	.23	220.00	220.00	.93	146.67	73.33
30	.69	.793	.265	115.00	.27	230.00	230.00	1.06	153.33	76.67
40	.72	.864	.288	120.00	.30	240.00	240.00	1.21	160.00	80.00
50	.75	.937	.313	125.00	.34	250.00	250.00	1.36	166.67	83.34
60	.78	1.014	.338	130.00	.38	260.00	259.99	1.53	173.34	86.67
70	.81	1.093	.365	135.00	.43	269.99	269.99	1.72	180.00	90.00
80	.84	1.176	.392	140.00	.48	279.99	279.99	1.92	186.67	93.34
90	.87	1.261	.421	145.00	.53	289.99	289.99	2.13	193.34	96.67
300	.90	1.350	.450	150.00	.59	299.99	299.98	2.36	200.01	100.01
10	.93	1.441	.481	155.00	.65	309.99	309.98	2.60	206.67	103.34
20	.96	1.536	.512	160.00	.71	319.99	319.98	2.86	213.34	106.67
30	.99	1.633	.545	165.00	.79	329.99	329.97	3.14	220.01	110.01
40	1.02	1.734	.578	170.00	.86	339.99	339.97	3.43	226.68	113.34
50	1.05	1.837	.613	175.00	.93	349.99	349.96	3.74	233.35	116.68
60	1.08	1.944	.648	180.00	1.02	359.98	359.96	4.07	240.02	120.01
70	1.11	2.053	.685	184.99	1.11	369.98	369.95	4.42	246.68	123.35
80	1.14	2.166	.722	189.99	1.20	379.98	379.94	4.79	253.35	126.68
90	1.17	2.281	.761	194.98	1.29	389.97	389.94	5.18	260.02	130.02
400	1.20	2.400	.800	199.98	1.40	399.97	399.93	5.58	266.69	133.36
10	1.23	2.521	.841	204.98	1.50	409.96	409.92	6.01	273.36	136.69
20	1.26	2.646	.882	209.98	1.62	419.96	419.91	6.46	280.03	140.03
30	1.29	2.773	.925	214.98	1.74	429.96	429.90	6.94	286.70	143.37
40	1.32	2.904	.968	219.98	1.86	439.95	439.89	7.43	293.37	146.70
50	1.35	3.037	1.013	224.98	1.98	449.95	449.87	7.95	300.04	150.04
60	1.38	3.174	1.058	229.97	2.13	459.94	459.86	8.49	306.72	153.38
70	1.41	3.313	1.105	234.97	2.27	469.93	469.84	9.06	313.39	156.72
80	1.44	3.456	1.152	239.96	2.41	479.92	479.83	9.65	320.06	160.06
90	1.47	3.601	1.201	244.96	2.57	489.92	489.81	10.27	326.74	163.40
500	1.50	3.750	1.250	249.96	2.72	499.90	499.79	10.91	333.41	166.74

TABLE XI.—SPIRAL FUNCTIONS FOR A CHANGE OF 0.4° PER 100 FEET. SUITABLE FOR SPEEDS OF 83 MILES AN HOUR OR LESS, OR CURVES OF 2.0° OR LESS

L	*D*	Δ	*A*	*Z*	*o*	*C*	*X*	*Y*	*U*	*V*
	°	°	°							
10	0.04	0.002	0.001	5.00	0.00	10.00	10.00	0.00	6.67	3.33
20	.08	.008	.003	10.00	.00	20.00	20.00	.00	13.33	6.67
30	.12	.018	.006	15.00	.00	30.00	30.00	.00	20.00	10.00
40	.16	.032	.011	20.00	.00	40.00	40.00	.01	26.67	13.33
50	.20	.050	.016	25.00	.00	50.00	50.00	.02	33.33	16.67
60	.24	.072	.024	30.00	.01	60.00	60.00	.03	40.00	20.00
70	.28	.098	.033	35.00	.01	70.00	70.00	.04	46.67	23.33
80	.32	.128	.043	40.00	.01	80.00	80.00	.06	53.33	26.67
90	.36	.162	.054	45.00	.02	90.00	90.00	.08	60.00	30.00
100	.40	.200	.067	50.00	.03	100.00	100.00	.12	66.67	33.33
10	.44	.242	.081	55.00	.04	110.00	110.00	.16	73.33	36.67
20	.48	.288	.096	60.00	.05	120.00	120.00	.20	80.00	40.00
30	.52	.338	.113	65.00	.06	130.00	130.00	.26	86.67	43.33
40	.56	.392	.131	70.00	.08	140.00	140.00	.32	93.33	46.67
50	.60	.450	.150	75.00	.10	150.00	150.00	.39	100.00	50.00
60	.64	.512	.171	80.00	.12	160.00	160.00	.48	106.67	53.33
70	.68	.578	.193	85.00	.14	170.00	170.00	.57	113.33	56.67
80	.72	.648	.216	90.00	.17	180.00	180.00	.68	120.00	60.00
90	.76	.722	.241	95.00	.20	190.00	190.00	.80	126.67	63.33
200	.80	.800	.267	100.00	.23	200.00	200.00	.93	133.33	66.67
10	.84	.882	.294	105.00	.27	210.00	210.00	1.08	140.00	70.00
20	.88	.968	.323	110.00	.31	220.00	219.99	1.24	146.67	73.33
30	.92	1.058	.353	115.00	.35	230.00	229.99	1.41	153.34	76.67
40	.96	1.152	.384	120.00	.40	240.00	239.99	1.61	160.00	80.00
50	1.00	1.250	.417	125.00	.46	250.00	249.99	1.82	166.67	83.34
60	1.04	1.352	.451	130.00	.51	259.99	259.98	2.04	173.34	86.67
70	1.08	1.458	.486	135.00	.57	269.99	269.98	2.29	180.01	90.01
80	1.12	1.568	.523	140.00	.64	279.99	279.98	2.55	186.67	93.34
90	1.16	1.682	.561	144.99	.71	289.99	289.97	2.84	193.34	96.67
300	1.20	1.800	.600	149.99	.79	299.99	299.97	3.14	200.01	100.01
10	1.24	1.922	.641	154.99	.86	309.98	309.97	3.47	206.68	103.34
20	1.28	2.048	.683	159.99	.95	319.98	319.96	3.81	213.35	106.68
30	1.32	2.178	.726	164.99	1.05	329.98	329.95	4.18	220.02	110.02
40	1.36	2.312	.771	169.99	1.14	339.98	339.95	4.57	226.68	113.35
50	1.40	2.450	.817	174.98	1.25	349.97	349.94	4.99	233.36	116.69
60	1.44	2.592	.864	179.98	1.36	359.97	359.93	5.43	240.03	120.02
70	1.48	2.738	.913	184.98	1.48	369.96	369.91	5.89	246.69	123.36
80	1.52	2.888	.963	189.98	1.60	379.96	379.90	6.38	253.37	126.70
90	1.56	3.042	1.014	194.98	1.72	389.95	389.89	6.90	260.04	130.03
400	1.60	3.200	1.067	199.97	1.86	399.94	399.88	7.44	266.71	133.37
10	1.64	3.362	1.121	204.97	2.00	409.94	409.86	8.02	273.38	136.71
20	1.68	3.528	1.176	209.97	2.15	419.93	419.84	8.61	280.06	140.05
30	1.72	3.698	1.233	214.96	2.31	429.92	429.82	9.25	286.73	143.39
40	1.76	3.872	1.291	219.96	2.48	439.91	439.80	9.90	293.41	146.73
50	1.80	4.050	1.350	224.95	2.65	449.90	449.78	10.60	300.08	150.07
60	1.84	4.232	1.411	229.95	2.83	459.89	459.75	11.32	306.76	153.41
70	1.88	4.418	1.473	234.95	3.02	469.88	469.72	12.07	313.43	156.75
80	1.92	4.608	1.533	239.94	3.22	479.87	479.69	12.86	320.11	160.10
90	1.96	4.802	1.601	244.93	3.42	489.85	489.66	13.68	326.79	163.44
500	2.00	5.000	1.667	249.93	3.63	499.84	499.62	14.54	333.47	166.79

TABLE XII. — Spiral Functions for a Change of 0.5° per 100 Feet. Suitable for Speeds of 77 Miles an Hour or Less, or Curves of 2.0° or Less

L	*D*	Δ	*A*	*Z*	*o*	*C*	*X*	*Y*	*U*	*V*
	°	°	°							
10	0.05	0.002	0.001	5.00	0.00	10.00	10.00	0.00	6.67	3.33
20	.10	.010	.003	10.00	.00	20.00	20.00	.00	13.33	6.67
30	.15	.025	.008	15.00	.00	30.00	30.00	.00	20.00	10.00
40	.20	.040	.013	20.00	.00	40.00	40.00	.01	26.67	13.33
50	.25	.062	.021	25.00	.00	50.00	50.00	.02	33.33	16.67
60	.30	.090	.030	30.00	.01	60.00	60.00	.03	40.00	20.00
70	.35	.122	.041	35.00	.01	70.00	70.00	.05	46.67	23.33
80	.40	.160	.053	40.00	.02	80.00	80.00	.07	53.33	26.67
90	.45	.202	.067	45.00	.03	90.00	90.00	.11	60.00	30.00
100	.50	.250	.083	50.00	.04	100.00	100.00	.15	66.67	33.33
10	.55	.302	.101	55.00	.05	110.00	110.00	.19	73.33	36.67
20	.60	.360	.120	60.00	.06	120.00	120.00	.25	80.00	40.00
30	.65	.422	.141	65.00	.08	130.00	130.00	.32	86.67	43.33
40	.70	.490	.163	70.00	.10	140.00	140.00	.40	93.33	46.67
50	.75	.562	.187	75.00	.12	150.00	150.00	.49	100.00	50.00
60	.80	.640	.213	80.00	.15	160.00	160.00	.60	106.67	53.33
70	.85	.722	.241	85.00	.18	170.00	170.00	.71	113.33	56.67
80	.90	.810	.270	90.00	.21	180.00	180.00	.85	120.00	60.00
90	.95	.902	.301	95.00	.25	190.00	189.99	1.00	126.67	63.33
200	1.00	1.000	.333	100.00	.29	200.00	199.99	1.16	133.34	66.67
10	.05	1.102	.367	105.00	.34	210.00	209.99	1.35	140.00	70.00
20	.10	1.210	.403	110.00	.39	220.00	219.99	1.55	146.67	73.34
30	.15	1.322	.441	115.00	.44	230.00	229.99	1.77	153.34	76.67
40	.20	1.440	.480	120.00	.50	239.99	239.99	2.01	160.01	80.00
50	.25	1.562	.521	125.00	.57	249.99	249.98	2.27	166.67	83.34
60	.30	1.690	.563	129.99	.64	259.99	259.98	2.56	173.34	86.67
70	.35	1.822	.607	134.99	.72	269.99	269.97	2.86	180.01	90.01
80	.40	1.960	.653	139.99	.80	279.99	279.97	3.19	186.68	93.34
90	.45	2.102	.701	144.99	.88	289.98	289.96	3.55	193.35	96.68
300	1.50	2.250	.750	149.99	.98	299.98	299.96	3.93	200.02	100.01
10	.55	2.402	.801	154.99	1.08	309.98	309.95	4.33	206.69	103.35
20	.60	2.560	.853	159.98	1.19	319.97	319.94	4.76	213.36	106.69
30	.65	2.722	.907	164.98	1.31	329.97	329.93	5.23	220.02	110.02
40	.70	2.890	.963	169.98	1.43	339.96	339.92	5.72	226.70	113.36
50	.75	3.062	1.021	174.98	1.56	349.96	349.90	6.23	233.37	116.70
60	.80	3.240	1.080	179.97	1.70	359.95	359.88	6.78	240.04	120.03
70	.85	3.422	1.141	184.97	1.84	369.94	369.87	7.37	246.71	123.38
80	.90	3.610	1.203	189.97	2.00	379.94	379.85	7.98	253.39	126.71
90	.95	3.802	1.267	194.96	2.16	389.93	389.83	8.63	260.06	130.05
400	2.00	4.000	1.333	199.96	2.33	399.92	399.81	9.30	266.74	133.40

TABLE XIII. — SPIRAL FUNCTIONS FOR A CHANGE OF 0.75° PER 100 FEET. SUITABLE FOR SPEEDS OF 67 MILES AN HOUR OR LESS, OR CURVES OF 3.0° OR LESS

L	D	Δ	A	Z	o	C	X	Y	U	V
	°	°	°							
10	0.075	0.004	0.001	5.00	0.00	10.00	10.00	0.00	6.67	3.33
20	.150	.015	.005	10.00	.00	20.00	20.00	.00	13.33	6.67
30	.225	.034	.012	15.00	.00	30.00	30.00	.01	20.00	10.00
40	.300	.060	.020	20.00	.00	40.00	40.00	.01	26.67	13.33
50	.375	.094	.031	25.00	.01	50.00	50.00	.03	33.33	16.67
60	.450	.135	.045	30.00	.01	60.00	60.00	.05	40.00	20.00
70	.525	.184	.061	35.00	.02	70.00	70.00	.07	46.67	23.33
80	.600	.240	.080	40.00	.03	80.00	80.00	.11	53.33	26.67
90	.675	.304	.101	45.00	.04	90.00	90.00	.16	60.00	30.00
100	.750	.375	.125	50.00	.06	100.00	100.00	.22	66.67	33.33
10	.825	.454	.151	55.00	.07	110.00	110.00	.29	73.33	36.67
20	.900	.540	.180	60.00	.09	120.00	120.00	.38	80.00	40.00
30	.975	.634	.211	65.00	.12	130.00	130.00	.48	86.67	43.33
40	1.050	.735	.245	70.00	.15	140.00	140.00	.60	93.33	46.67
50	1.125	.844	.281	75.00	.18	150.00	150.00	.74	100.00	50.00
60	1.200	.960	.320	80.00	.22	160.00	160.00	.89	106.67	53.33
70	1.275	1.084	.361	85.00	.27	170.00	169.99	1.07	113.33	56.67
80	1.350	1.215	.405	90.00	.32	180.00	179.99	1.27	120.00	60.00
90	1.425	1.354	.451	95.00	.37	189.99	189.99	1.50	126.67	63.34
200	1.500	1.500	.500	100.00	.44	199.99	199.99	1.75	133.34	66.67
10	1.575	1.654	.551	104.99	.51	209.99	209.98	2.02	140.01	70.01
20	1.650	1.815	.605	109.99	.58.	219.99	219.98	2.32	146.67	73.34
30	1.725	1.984	.661	114.99	.66	229.99	229.97	2.65	153.34	76.68
40	1.800	2.160	.720	119.99	.73	239.99	239.97	3.02	160.01	80.01
50	1.875	2.344	.781	124.99	.85	249.98	249.96	3.41	166.68	83.34
60	1.950	2.535	.845	129.99	.96	259.98	259.95	3.84	173.35	86.68
70	2.025	2.734	.911	134.98	1.07	269.97	269.94	4.30	180.02	90.02
80	2.100	2.940	.980	139.98	1.20	279.97	279.93	4.79	186.69	93.36
90	2.175	3.154	1.051	144.98	1.33	289.96	289.91	5.32	193.37	96.69
300	2.250	3.375	1.125	149.97	1.47	299.96	299.90	5.86	200.04	100.03
10	2.325	3.604	1.201	154.97	1.63	309.95	309.88	6.50	206.71	103.37
20	2.400	3.840	1.280	159.97	1.79	319.94	319.86	7.15	213.38	106.71
30	2.475	4.084	1.361	164.96	1.96	329.93	329.83	7.84	220.06	110.04
40	2.550	4.335	1.445	169.96	2.14	339.92	339.81	8.57	226.73	113.39
50	2.625	4.594	1.531	174.95	2.34	349.90	349.78	9.35	233.41	116.74
60	2.700	4.860	1.620	179.94	2.54	359.88	359.74	10.17	240.09	120.09
70	2.775	5.134	1.711	184.93	2.76	369.87	369.70	11.04	246.77	123.43
80	2.850	5.415	1.805	189.93	2.99	379.85	379.67	11.97	253.45	126.78
90	2.925	5.704	1.901	194.92	3.24	389.83	389.62	12.93	260.14	130.12
400	3.000	6.000	2.000	199.91	3.49	399.81	399.56	13.95	266.82	138.34

TABLE XIV. — SPIRAL FUNCTIONS FOR A CHANGE OF 1.0° PER 100 FEET. SUITABLE FOR SPEEDS OF 61 MILES AN HOUR OR LESS, OR CURVES OF 4.0° OR LESS

L	*D*	Δ	*A*	*Z*	*o*	*C*	*X*	*Y*	*U*	*V*
	°	°	°							
10	0.10	0.005	0.002	5.00	0.00	10.00	10.00	.00	6.67	3.33
20	.20	.020	.007	10.00	.00	20.00	20.00	.00	13.33	6.66
30	.30	.045	.015	15.00	.00	30.00	30.00	.01	20.00	10.00
40	.40	.080	.027	20.00	.00	40.00	40.00	.02	26.67	13.33
50	.50	.125	.042	25.00	.01	50.00	50.00	.04	33.33	16.67
60	.60	.180	.060	30.00	.02	60.00	60.00	.06	40.00	20.00
70	.70	.245	.082	35.00	.03	70.00	70.00	.10	46.67	23.33
80	.80	.320	.107	40.00	.03	80.00	80.00	.15	53.33	26.67
90	.90	.405	.135	45.00	.05	90.00	90.00	.21	60.00	30.00
100	1.00	.500	.167	50.00	.07	100.00	100.00	.29	66.67	33.33
10	1.10	.605	.202	55.00	.10	110.00	110.00	.39	73.33	36.67
20	1.20	.720	.240	60.00	.13	120.00	120.00	.50	80.00	40.00
30	1.30	.845	.282	65.00	.16	130.00	130.00	.64	86.67	43.33
40	1.40	.980	.327	70.00	.20	140.00	140.00	.80	93.34	46.67
50	1.50	1.125	.375	75.00	.25	150.00	149.99	.98	100.00	50.00
60	1.60	1.280	.427	80.00	.30	160.00	159.99	1.19	106.67	53.34
70	1.70	1.445	.482	85.00	.36	169.99	169.99	1.43	113.34	56.67
80	1.80	1.620	.540	90.00	.42	179.99	179.99	1.70	120.00	60.00
90	1.90	1.805	.602	94.99	.50	189.99	189.98	1.99	126.67	63.34
200	2.00	2.000	.667	99.99	.58	199.99	199.98	2.33	133.34	66.67
10	2.10	2.205	.735	104.99	.67	209.99	209.97	2.69	140.01	70.01
20	2.20	2.420	.807	109.99	.77	219.98	219.96	3.10	146.68	73.35
30	2.30	2.645	.882	114.99	.89	229.98	229.95	3.54	153.35	76.68
40	2.40	2.880	.960	119.98	1.01	239.97	239.94	4.02	160.02	80.02
50	2.50	3.125	1.042	124.98	1.14	249.97	249.93	4.54	166.69	83.36
60	2.60	3.380	1.127	129.97	1.28	259.96	259.91	5.11	173.37	86.70
70	2.70	3.645	1.215	134.97	1.43	269.95	269.89	5.72	180.04	90.03
80	2.80	3.920	1.307	139.97	1.60	279.94	279.87	6.38	186.71	93.37
90	2.90	4.205	1.402	144.96	1.77	289.93	289.85	7.09	193.39	96.72
300	3.00	4.500	1.500	149.95	1.96	299.92	299.82	7.85	200.06	100.06
10	3.10	4.805	1.602	154.95	2.16	309.90	309.78	8.66	206.74	103.40
20	3.20	5.120	1.707	159.94	2.38	319.89	319.75	9.53	213.42	106.75
30	3.30	5.445	1.815	164.93	2.61	329.87	329.70	10.44	220.10	110.09
40	3.40	5.780	1.927	169.92	2.86	339.85	339.66	11.42	226.79	113.44
50	3.50	6.125	2.042	174.91	3.12	349.82	349.60	12.46	233.47	116.80
60	3.60	6.480	2.160	179.89	3.39	359.80	359.54	13.56	240.16	120.15
70	3.70	6.845	2.282	184.88	3.68	369.77	369.47	14.71	246.85	123.50
80	3.80	7.220	2.407	189.87	3.99	379.73	379.40	15.94	253.54	126.86
90	3.90	7.605	2.535	194.85	4.31	389.70	389.32	17.23	260.24	130.22
400	4.00	8.000	2.667	199.84	4.65	399.66	399.22	18.59	266.94	133.58

TABLE XV.—SPIRAL FUNCTIONS FOR A CHANGE OF $1\frac{1}{3}°$ PER 100 FEET. SUITABLE FOR A SPEED OF 55 MILES AN HOUR OR LESS, OR CURVES OF 4.0° OR LESS

L	*D*	Δ	*A*	*Z*	*o*	*C*	*X*	*Y*	*U*	*V*
	°	°	°							
10	0.133	0.007	0.002	5.00	0.00	10.00	10.00	0.00	6.67	3.33
20	.267	.027	.009	10.00	.00	20.00	20.00	.00	13.33	6.67
30	.400	.060	.020	15.00	.00	30.00	30.00	.01	20.00	10.00
40	.533	.107	.036	20.00	.01	40.00	40.00	.02	26.67	13.33
50	.667	.167	.056	25.00	.01	50.00	50.00	.05	33.33	16.67
60	.800	.240	.080	30.00	.02	60.00	60.00	.08	40.00	20.00
70	.933	.327	.109	35.00	.03	70.00	70.00	.13	46.67	23.33
80	1.067	.427	.142	40.00	.05	80.00	80.00	.20	53.33	26.67
90	1.200	.540	.180	45.00	.07	90.00	90.00	.28	60.00	30.00
100	1.333	.667	.222	50.00	.10	100.00	100.00	.39	66.67	33.33
10	1.467	.807	.269	55.00	.13	110.00	110.00	.52	73.33	36.67
10	1.600	.960	.320	60.00	.17	120.00	120.00	.67	80.00	40.00
30	1.733	1.127	.376	65.00	.21	130.00	129.99	.85	86.67	43.34
40	1.867	1.307	.436	70.00	.27	140.00	139.99	1.06	93.34	46.67
50	2.000	1.500	.500	74.99	.33	150.00	149.99	1.31	100.00	50.00
60	2.133	1.707	.569	79.99	.40	159.99	159.99	1.59	106.67	53.34
70	2.267	1.927	.642	84.99	.48	169.99	169.98	1.91	113.34	56.67
80	2.400	2.160	.720	89.99	.57	179.99	179.97	2.26	120.01	60.01
90	2.533	2.407	.802	94.99	.66	189.98	189.97	2.66	126.68	63.34
200	2.667	2.667	.889	99.98	.78	199.98	199.96	3.10	133.35	66.68
10	2.800	2.940	.980	104.98	.90	209.97	209.94	3.59	140.02	70.02
20	2.933	3.227	1.076	109.98	1.03	219.97	219.93	4.12	146.69	73.35
30	3.067	3.527	1.176	114.97	1.18	229.95	229.91	4.71	153.36	76.69
40	3.200	3.840	1.280	119.97	1.34	239.95	239.89	5.35	160.04	80.03
50	3.333	4.167	1.389	124.96	1.51	249.94	249.87	6.05	166.72	83.38
60	3.467	4.507	1.502	129.95	1.70	259.93	259.84	6.81	173.39	86.72
70	3.600	4.860	1.620	134.95	1.91	269.91	269.81	7.62	180.07	90.06
80	3.733	5.227	1.742	139.94	2.13	279.90	279.77	8.50	186.75	93.41
90	3.867	5.607	1.869	144.94	2.36	289.88	289.72	9.43	193.43	96.76
300	4.000	6.000	2.000	149.92	2.61	299.86	299.67	10.46	200.12	100.11

TABLE XVI. — Spiral Functions for a Change of 1.5° per 100 Feet. Suitable for Speeds of 53 Miles an Hour or Less, or Curves of 4.5° or Less

L	*D*	Δ	*A*	*Z*	*o*	*C*	*X*	*Y*	*U*	*V*
	°	°	°							
10	0.15	0.008	0.002	5.00	0.00	10.00	10.00	0.00	6.67	3.33
20	.30	.030	.010	10.00	.00	20.00	20.00	.00	13.33	6.67
30	.45	.068	.022	15.00	.00	30.00	30.00	.01	20.00	10.00
40	.60	.120	.040	20.00	.01	40.00	40.00	.03	26.67	13.33
50	.75	.188	.062	25.00	.01	50.00	50.00	.05	33.33	16.67
60	.90	.270	.090	30.00	.02	60.00	60.00	.09	40.00	20.00
70	1.05	.368	.122	35.00	.04	70.00	70.00	.15	46.67	23.33
80	1.20	.480	.160	40.00	.06	80.00	80.00	.22	53.33	26.67
90	1.35	.608	.202	45.00	.08	90.00	90.00	.32	60.00	30.00
100	1.50	.750	.250	50.00	.11	100.00	100.00	.44	66.67	33.33
10	1.65	.908	.302	55.00	.15	110.00	110.00	.58	73.33	36.67
20	1.80	1.080	.360	60.00	.19	120.00	120.00	.75	80.00	40.00
30	1.95	1.268	.422	65.00	.24	130.00	129.99	.96	86.67	43.34
40	2.10	1.470	.490	69.99	.30	140.00	139.99	1.20	93.34	46.67
50	2.25	1.688	.562	74.99	.37	149.99	149.99	1.47	100.00	50.00
60	2.40	1.920	.640	79.99	.45	159.99	159.98	1.79	106.67	53.34
70	2.55	2.168	.722	84.99	.54	169.99	169.97	2.14	113.34	56.67
80	2.70	2.430	.810	89.99	.64	179.99	179.97	2.54	120.01	60.01
90	2.85	2.708	.902	94.98	.75	189.98	189.96	2.99	126.68	63.35
200	3.00	3.000	1.000	99.98	.87	199.98	199.95	3.49	133.35	66.68
10	3.15	3.308	1.102	104.98	1.01	209.97	209.93	4.04	140.02	70.02
20	3.30	3.630	1.210	109.97	1.16	219.96	219.91	4.64	146.70	73.36
30	3.45	3.968	1.322	114.96	1.33	229.95	229.89	5.30	153.37	76.70
40	3.60	4.320	1.440	119.96	1.51	239.94	239.87	6.03	160.05	80.04
50	3.75	4.688	1.562	124.95	1.70	249.93	249.83	6.81	166.73	83.39
60	3.90	5.070	1.690	129.94	1.92	259.91	259.80	7.66	173.41	86.73
70	4.05	5.468	1.822	134.93	2.15	269.89	269.76	8.58	180.09	90.08
80	4.20	5.880	1.960	139.92	2.39	279.87	279.71	9.55	186.77	93.43
90	4.35	6.308	2.102	144.91	2.66	289.85	289.65	10.61	193.46	96.78
300	4.50	6.750	2.250	149.90	2.94	299.82	299.59	11.77	200.15	100.13

TABLE XVII. — SPIRAL FUNCTIONS FOR A CHANGE OF 2.0° PER 100 FEET. SUITABLE FOR A SPEED OF 48 MILES AN HOUR OR LESS, AND CURVES OF 6.0° OR LESS

L	*D*	Δ	*A*	*Z*	*o*	*C*	*X*	*Y*	*U*	*V*
	°	°	°							
10	0.20	0.010	0.003	5.00	0.00	10.00	10.00	0.00	6.97	3.33
20	.40	.040	.013	10.00	.00	20.00	20.00	.00	13.33	6.67
30	.60	.090	.030	15.00	.00	30.00	30.00	.02	20.00	10.00
40	.80	.160	.053	20.00	.01	40.00	40.00	.04	26.67	13.33
50	1.00	.250	.083	25.00	.02	50.00	50.00	.07	33.33	16.67
60	.20	.360	.120	30.00	.03	60.00	60.00	.13	40.00	20.00
70	.40	.490	.163	35.00	.05	70.00	70.00	.20	46.67	23.33
80	.60	.640	.213	40.00	.07	80.00	80.00	.30	53.33	26.67
90	.80	.810	.270	45.00	.11	90.00	90.00	.42	60.00	30.00
100	2.00	1.000	.333	50.00	.14	100.00	100.00	.58	66.67	33.33
10	.20	1.210	.403	55.00	.19	110.00	109.99	.77	73.33	36.67
20	.40	1.440	.480	59.99	.25	120.00	119.99	1.00	80.00	40.00
30	.60	1.690	.563	64.99	.34	129.99	129.99	1.28	86.67	43.34
40	.80	1.960	.653	69.99	.40	139.99	139.98	1.60	93.34	46.67
50	3.00	2.250	.750	74.99	.49	149.99	149.98	1.96	100.01	50.01
60	.20	2.560	.853	79.98	.60	159.99	159.97	2.38	106.68	53.34
70	.40	2.890	.963	84.98	.71	169.98	169.96	2.86	113.35	56.68
80	.60	3.240	1.080	89.98	.85	179.97	179.94	3.39	120.02	60.02
90	.80	3.610	1.203	94.97	1.00	189.97	189.93	3.99	126.69	63.36
200	4.00	4.000	1.333	99.96	1.16	199.96	199.90	4.65	133.37	66.70
10	.20	4.410	1.470	104.96	1.35	209.95	209.88	5.38	140.04	70.04
20	.40	4.840	1.613	109.95	1.55	219.93	219.84	6.19	146.72	73.38
30	.60	5.290	1.763	114.94	1.77	229.91	229.80	7.07	153.40	76.73
40	.80	5.760	1.920	119.93	2.01	239.89	239.76	8.03	160.09	80.08
50	5.00	6.250	2.083	124.91	2.27	249.87	249.70	9.08	166.77	83.43
60	.20	6.760	2.253	129.90	2.55	259.84	259.64	10.21	173.46	86.78
70	.40	7.290	2.430	134.88	2.86	269.81	269.57	11.44	180.15	90.14
80	.60	7.840	2.613	139.86	3.19	279.77	279.48	12.75	186.85	93.50
90	.80	8.410	2.802	144.84	3.54	289.73	289.38	14.17	193.55	96.87
300	6.00	9.000	2.999	149.81	3.92	299.68	299.26	15.68	200.26	100.24

TABLE XVIII. — SPIRAL FUNCTIONS FOR A CHANGE OF 2.5° PER 100 FEET. SUITABLE FOR SPEEDS OF 45 MILES AN HOUR OR LESS, AND CURVES OF 7.5° OR LESS

L	*D*	Δ	*A*	*Z*	*o*	*C*	*X*	*Y*	*U*	*V*
	°	°	°							
10	0.25	0.012	0.004	5.00	0.00	10.00	10.00	0.00	6.67	3.33
20	.50	.050	.017	10.00	.00	20.00	20.00	.01	13.33	6.67
30	.75	.112	.037	15.00	.00	30.00	30.00	.02	20.00	10.00
40	1.00	.200	.067	20.00	.01	40.00	40.00	.05	26.67	13.33
50	.25	.312	.104	25.00	.02	50.00	50.00	.09	33.33	16.67
60	.50	.450	.150	30.00	.04	60.00	60.00	.16	40.00	20.00
70	.75	.612	.204	35.00	.06	70.00	70.00	.21	46.67	23.33
80	2.00	.800	.267	40.00	.09	80.00	80.00	.37	53.33	26.67
90	.25	1.012	.337	45.00	.13	90.00	90.00	.53	60.00	30.00
100	.50	1.250	.417	50.00	.18	100.00	100.00	.73	66.67	33.34
10	.75	1.512	.504	54.99	.24	110.00	109.99	.97	73.34	36.67
20	3.00	1.800	.600	59.99	.31	120.00	119.99	1.26	80.00	40.00
30	.25	2.112	.704	64.99	.40	129.99	129.98	1.60	86.67	43.34
40	.50	2.450	.817	69.98	.50	139.99	139.97	2.00	93.34	46.67
50	.75	2.812	.937	74.98	.61	149.98	149.96	2.45	100.01	50.01
60	4.00	3.200	1.067	79.98	.74	159.98	159.95	2.98	106.68	53.35
70	.25	3.612	1.204	84.97	.89	169.97	169.93	3.57	113.36	56.69
80	.50	4.050	1.350	89.96	1.06	179.96	179.91	4.24	120.03	60.03
90	.75	4.512	1.504	94.95	1.25	189.95	189.88	4.99	126.71	63.37
200	5.00	5.000	1.667	99.94	1.45	199.93	199.85	5.81	133.39	66.72
10	.25	5.512	1.837	104.93	1.68	209.91	209.81	6.73	140.07	70.06
20	.50	6.050	2.017	109.92	1.93	219.89	219.76	7.74	146.76	73.41
30	.75	6.612	2.204	114.90	2.21	229.87	229.70	8.84	153.44	76.76
40	6.00	7.200	2.400	119.89	2.51	239.83	239.62	10.04	160.13	80.12
50	.25	7.812	2.604	124.86	2.84	249.80	249.54	11.35	166.83	83.48
60	.50	8.450	2.816	129.84	3.19	259.75	259.44	12.76	173.53	86.85
70	.75	9.112	3.036	134.81	3.57	269.70	269.32	14.29	180.24	90.22
80	7.00	9.800	3.266	139.78	3.98	279.64	279.19	15.93	186.96	93.60
90	.25	10.512	3.503	144.75	4.42	289.57	289.03	17.69	193.68	96.98
300	7.50	11.250	3.749	149.71	4.89	299.49	298.85	19.58	200.41	100.37

TABLE XIX. — SPIRAL FUNCTIONS FOR A CHANGE OF 3.0° PER 100 FEET. SUITABLE FOR SPEEDS OF 41 MILES AN HOUR OR LESS, AND CURVES OF 9.0° OR LESS

L	*D*	Δ	*A*	*Z*	*o*	*C*	*X*	*Y*	*U*	*V*
	°	°	°							
10	0.30	0.015	0.005	5.00	0.00	10.00	10.00	0.00	6.67	3.33
20	.60	.060	.020	10.00	.00	20.00	20.00	.01	13.33	6.67
30	.90	.135	.045	15.00	.01	30.00	30.00	.02	20.00	10.00
40	1.20	.240	.080	20.00	.01	40.00	40.00	.06	26.67	13.33
50	.50	.375	.125	25.00	.03	50.00	50.00	.11	33.33	16.67
60	.80	.540	.180	30.00	.05	60.00	60.00	.19	40.00	20.00
70	2.10	.735	.245	35.00	.07	70.00	70.00	.30	46.67	23.33
80	.40	.960	.320	40.00	.11	80.00	80.00	.45	53.34	26.67
90	.70	1.215	.405	45.00	.16	90.00	90.00	.64	60.00	30.00
100	3.00	1.500	.500	49.99	.22	100.00	99.99	.87	66.67	33.34
10	.30	1.815	.605	54.99	.29	109.99	109.99	1.16	73.34	36.67
20	.60	2.160	.720	59.99	.36	119.99	119.98	1.51	80.01	40.01
30	.90	2.535	.845	64.98	.48	129.99	129.98	1.92	86.67	43.34
40	4.20	2.940	.980	69.98	.60	139.98	139.96	2.39	93.35	46.68
50	.50	3.375	1.125	74.97	.74	149.98	149.95	2.94	100.02	50.02
60	.80	3.840	1.280	79.97	.89	159.97	159.93	3.57	106.69	53.36
70	5.10	4.335	1.445	84.96	1.07	169.96	169.90	4.28	113.37	56.70
80	.40	4.860	1.620	89.95	1.27	179.94	179.87	5.08	120.05	60.04
90	.70	5.415	1.805	94.93	1.49	189.92	189.83	5.98	126.73	63.39
200	6.00	6.000	2.000	99.92	1.74	199.90	199.78	6.98	133.41	66.74
10	.30	6.615	2.205	104.90	2.02	209.88	209.72	8.06	140.10	70.09
20	.60	7.260	2.420	109.88	2.32	219.85	219.65	9.26	146.79	73.45
30	.90	7.935	2.645	114.86	2.65	229.81	229.56	10.59	153.49	76.81
40	7.20	8.640	2.879	119.83	3.01	239.76	239.46	12.04	160.19	80.17
50	.50	9.375	3.124	124.80	3.40	249.71	249.34	13.60	166.90	83.55
60	.80	10.140	3.379	129.77	3.82	259.64	259.19	15.30	173.62	86.93
70	8.10	10.935	3.644	134.73	4.28	269.57	269.03	17.11	180.35	90.32
80	.40	11.760	3.919	139.69	4.77	279.48	278.83	19.08	187.08	93.71
90	.70	12.615	4.203	144.64	5.30	289.39	288.61	21.20	193.83	97.12
300	9.00	13.500	4.498	149.58	5.86	298.70	298.35	23.47	200.59	100.54

TABLE XX. — SPIRAL FUNCTIONS FOR A CHANGE OF 4.0° PER 100 FEET. SUITABLE FOR SPEEDS OF 35 MILES AN HOUR OR LESS, OR CURVES OF 10.0° OR LESS

L	*D*	Δ	*A*	*Z*	*o*	*C*	*X*	*Y*	*U*	*V*
	°	°	°							
10	0.40	0.020	0.007	5.00	0.00	10.00	10.00	0.00	6.67	3.33
20	.80	.080	.027	10.00	.00	20.00	20.00	.01	13.33	6.67
30	1.20	.180	.060	15.00	.01	30.00	30.00	.03	20.00	10.00
40	.60	.320	.107	20.00	.02	40.00	40.00	.07	26.67	13.33
50	2.00	.500	.167	25.00	.04	50.00	50.00	.15	33.33	16.67
60	.40	.720	.240	30.00	.06	60.00	60.00	.25	40.00	20.00
70	.80	.980	.327	35.00	.10	70.00	70.00	.40	46.67	23.33
80	3.20	1.280	.427	39.99	.15	80.00	80.00	.60	53.33	26.67
90	.60	1.620	.540	44.99	.21	90.00	89.99	.85	60.00	30.00
100	4.00	2.000	.667	49.99	.29	99.99	99.99	1.16	66.67	33.34
10	.40	2.420	.807	54.98	.39	109.99	109.98	1.55	73.33	36.67
20	.80	2.880	.960	59.98	.50	119.99	119.97	1.84	80.01	40.01
30	5.20	3.380	1.127	64.97	.64	129.98	129.95	2.56	86.68	43.35
40	.60	3.920	1.307	69.96	.80	139.97	139.93	3.19	93.36	46.69
50	6.00	4.500	1.500	74.95	.98	149.96	149.91	3.93	100.03	50.03
60	.40	5.120	1.707	79.94	1.19	159.94	159.87	4.76	106.71	53.37
70	.80	5.780	1.927	84.92	1.43	169.92	169.83	5.71	113.40	56.72
80	7.20	6.480	2.160	89.90	1.77	179.90	179.77	6.78	120.08	60.08
90	.60	7.220	2.407	94.88	1.99	189.87	189.70	7.97	126.77	63.43
200	8.00	8.000	2.667	99.86	2.32	199.83	199.61	9.30	133.47	66.79
10	.40	8.820	2.939	104.83	2.68	209.78	209.51	10.76	140.18	70.16
20	.80	9.680	3.222	109.79	3.09	219.72	219.38	12.38	146.89	73.54
30	9.20	10.580	3.526	114.75	3.52	229.66	229.22	14.11	153.61	76.92
40	.60	11.520	3.839	119.70	4.00	239.57	239.03	16.03	160.34	80.31
250	10.00	12.500	4.165	124.65	4.52	249.48	248.82	18.12	167.09	83.72

TABLE XXI. — SPIRAL FUNCTIONS FOR A CHANGE OF 5.0° PER 100 FEET. SUITABLE FOR SPEEDS OF 32 MILES AN HOUR OR LESS, OR CURVES OF 12.5° OR LESS

L	D	Δ	A	Z	o	C	X	Y	U	V
	°	°	°							
10	0.50	0.025	0.008	5.00	0.00	10.00	10.00	0.00	6.67	3.33
20	1.00	.100	.033	10.00	.00	20.00	20.00	.01	13.33	6.67
30	.50	.225	.075	15.00	.01	30.00	30.00	.04	20.00	10.00
40	2.00	.400	.133	20.00	.02	40.00	40.00	.09	26.67	13.33
50	.50	.625	.208	25.00	.05	50.00	50.00	.18	33.33	16.67
60	3.00	.900	.300	30.00	.08	60.00	60.00	.31	40.00	20.00
70	.50	1.225	.408	34.99	.13	70.00	70.00	.50	46.67	23.33
80	4.00	1.600	.533	39.99	.19	80.00	79.99	.74	53.34	26.67
90	.50	2.025	.675	44.99	.27	90.00	89.99	1.06	60.00	30.00
100	5.00	2.500	.833	49.98	.36	99.99	99.98	1.45	66.67	33.34
10	.50	3.025	1.008	54.97	.48	109.99	109.97	1.93	73.34	36.68
20	6.00	3.600	1.200	59.97	.63	119.98	119.95	2.51	80.02	40.02
30	.50	4.225	1.408	64.95	.80	129.97	129.93	3.19	86.69	43.36
40	7.00	4.900	1.633	69.94	1.00	139.96	139.90	3.99	93.37	46.70
50	.50	5.625	1.875	74.92	1.20	149.94	149.86	4.90	100.05	50.05
60	8.00	6.400	2.133	79.90	1.48	159.91	159.80	5.94	106.74	53.40
70	.50	7.225	2.408	84.88	1.78	169.88	169.73	7.13	113.43	56.75
80	9.00	8.100	2.699	89.85	2.11	179.84	179.64	8.46	120.13	60.12
90	.50	9.025	3.008	94.82	2.48	189.79	189.53	9.95	126.83	63.48
200	10.00	10.000	3.332	99.78	2.90	199.73	199.40	11.61	133.55	66.86
10	.50	11.025	3.674	104.73	3.35	209.66	209.23	13.41	140.27	70.25
20	11.00	12.100	4.032	109.67	3.82	219.57	219.04	15.42	147.01	73.65
30	.50	13.225	4.406	114.61	4.40	229.46	228.79	17.62	153.76	77.06
40	12.00	14.400	4.797	119.54	5.99	239.34	238.50	20.02	160.54	80.49
250	12.50	15.625	5.205	124.46	5.64	249.18	248.16	22.62	167.32	83.94

TABLE XXII.—SPIRAL FUNCTIONS FOR A CHANGE OF 7.5° PER 100 FEET. SUITABLE FOR A SPEED OF 26 MILES AN HOUR OR LESS, OR A CURVE OF 18.0° OR LESS

L	*D*	Δ	*A*	*Z*	*o*	*C*	*X*	*Y*	*U*	*V*
	°	°	°							
10	0.75	0.0375	0.012	5.00	0.00	10.00	10.00	0.00	6.67	3.33
20	1.50	.1500	.050	10.00	.00	20.00	20.00	.02	13.33	6.67
30	2.25	.3375	.113	15.00	.01	30.00	30.00	.06	20.00	10.00
40	3.00	.6000	.200	20.00	.03	40.00	40.00	.14	26.67	13.33
50	3.75	.9375	.313	25.00	.07	50.00	50.00	.27	33.33	16.67
60	4.50	1.3500	.450	29.99	.12	60.00	60.00	.47	40.00	20.00
70	5.25	1.8375	.613	34.99	.19	70.00	69.99	.75	46.67	23.34
80	6.00	2.4000	.800	39.98	.28	79.99	79.99	1.12	53.34	26.67
90	6.75	3.0375	1.013	44.97	.40	89.99	89.97	1.59	60.01	30.01
100	7.50	3.7500	1.250	49.96	.54	99.98	99.96	2.18	66.68	33.35
10	8.25	4.5375	1.513	54.94	.71	109.97	109.93	2.90	73.36	36.69
20	9.00	5.4000	1.800	59.92	.94	119.95	119.89	3.77	80.04	40.03
30	9.75	6.3375	2.113	64.90	1.19	129.93	129.84	4.78	86.72	43.38
40	10.50	7.3500	2.450	69.86	1.49	139.90	139.77	5.98	93.41	46.74
50	11.25	8.4375	2.812	74.83	1.83	149.86	149.68	7.35	100.11	50.10
60	12.00	9.6000	3.199	79.78	2.22	159.80	159.55	8.92	106.83	53.48
70	12.75	10.8375	3.612	84.73	2.66	169.73	169.40	10.67	113.55	56.86
80	13.50	12.1500	4.049	89.66	3.15	179.64	179.20	12.66	120.29	60.26
90	14.25	13.5375	4.511	94.59	3.51	189.54	188.95	14.89	127.04	63.68
200	15.00	15.0000	4.997	99.50	4.32	199.40	198.64	17.37	133.82	67.11
10	15.75	16.5375	5.509	104.40	4.99	209.23	208.27	19.86	140.62	70.57
20	16.50	18.1500	6.045	109.27	5.73	219.03	217.82	22.72	147.45	74.05
30	17.25	19.8375	6.607	114.13	6.54	228.79	227.28	25.91	154.31	77.56
240	18.00	21.6000	7.192	118.97	7.41	238.51	236.63	30.01	161.22	81.11

TABLE XXIII. — Spiral Functions for a Change of 10.0° per 100 Feet. Suitable for Speeds of 22 Miles an Hour or Less, or Curves of 25.0° or Less

L	*D*	Δ	*A*	*Z*	*o*	*C*	*X*	*Y*	*U*	*V*
	°	°	°							
10	1.00	0.050	0.017	5.00	0.00	10.00	10.00	0.00	6.67	3.33
20	2.00	.200	.067	10.00	.01	20.00	20.00	.02	13.33	6.67
30	3.00	.450	.150	15.00	.02	30.00	30.00	.08	20.00	10.00
40	4.00	.800	.267	20.00	.05	40.00	40.00	.19	26.67	13.33
50	5.00	1.250	.417	24.99	.09	50.00	50.00	.36	33.33	16.67
60	6.00	1.800	.600	29.98	.16	60.00	59.99	.63	40.00	20.00
70	7.00	2.450	.817	34.98	.25	69.99	69.99	.98	46.67	23.34
80	8.00	3.200	1.067	39.96	.37	79.99	79.97	1.49	53.34	26.67
90	9.00	4.050	1.350	44.95	.53	89.98	89.96	2.12	60.02	30.01
100	10.00	5.000	1.667	49.92	.72	99.97	99.92	2.91	66.69	33.36
10	11.00	6.050	2.017	54.89	.98	109.95	109.88	3.87	73.38	36.71
20	12.00	7.200	2.400	59.86	1.25	119.92	119.81	5.02	80.07	40.06
30	13.00	8.450	2.816	64.81	1.59	129.88	129.72	6.38	86.77	43.42
40	14.00	9.800	3.266	69.76	1.98	139.82	139.59	7.97	93.48	46.80
50	15.00	11.250	3.749	74.69	2.43	149.74	149.43	9.78	100.20	50.19
60	16.00	12.800	4.265	79.61	2.95	159.65	159.21	11.87	106.95	53.59
70	17.00	14.450	4.814	84.52	3.53	169.53	168.93	14.21	113.72	57.01
80	18.00	16.200	5.396	89.40	4.18	179.37	178.57	16.87	120.45	60.47
90	19.00	18.050	6.012	94.26	4.91	189.18	188.13	19.78	127.34	63.94
200	20.00	20.000	6.660	99.11	5.71	198.93	197.59	23.07	134.20	67.46
10	21.00	22.050	7.341	103.92	6.69	208.64	206.93	26.60	141.11	71.01
20	22.00	24.200	8.055	108.71	7.56	218.28	216.13	30.59	148.07	74.62
30	23.00	26.450	8.802	113.46	8.51	227.86	225.17	34.77	155.09	78.27
40	24.00	28.800	9.580	118.18	9.76	237.35	234.04	39.50	162.18	82.00
250	25.00	31.250	10.392	122.86	10.99	246.75	242.70	44.67	169.36	85.79

CHAPTER III

LOGARITHMS AND TRIGONOMETRIC FUNCTIONS

TABLE XXIV. — COMMON LOGARITHMS OF NUMBERS

USE OF THE TABLE OF LOGARITHMS

THE logarithm of a number is the exponent denoting the power to which some fixed base number must be raised to equal the number whose logarithm is considered. There are two base numbers in use, but almost all operations are performed by one system, known as Common Logarithms, in which the base is 10. The logarithm of 1 in any system is 0 because any number raised to the 0 power is 1. Thus $\frac{x^1}{x^1} = x^{1-1} = x^0 = 1$. The logarithm of 10 in the common system is 1; of 100, 2; of 1000, 3; etc., since $10^1 = 10$, $10^2 = 100$, $10^3 = 1000$, etc. Numbers between 1 and 10, 10 and 100, 100 and 1000, etc., will have fractional logarithms. Thus, the logarithm of 8 is 0.90309; of 13 is 1.11394; of 126 is 2.10037, etc., since $10^{0.90309} = 8$, $10^{1.11394} = 13$, $10^{2.10037} = 126$, etc. The fraction is called the *mantissa* and is always the same for the same sequence of figures and is incommensurable, being given to 3, 5, 6, 7, or 10 decimal places, according to the precision required. Thus log 1.263 = 0.10140; log 12.63 = 1.10140; and log 126.3 = 2.10140, all of 5 decimal places. The whole number, called the *characteristic*, varies. The characteristic is always 1 less than the number of digits to the left of the decimal point of the number whose logarithm is being found. In the tables only the mantissas are given. The whole number must be known by the computer from the number of digits in the number whose logarithm is wanted.

To find the logarithm of a number look in the table for the mantissa and prefix the proper characteristic, determined from the number of digits to the left of the decimal point in the number in question. Thus, on page 76, line 27, we find the mantissa for the sequence 1263 in the fifth column to be 0.10140; then for 1.263 the log is 0.10140; for 12.63 and 126.3 as given above.

In the table the first three figures of a four-figure number appear in the first column, the fourth figure at the heads of the 10 numbered columns. The first two figures of the mantissa appear in the second column, the last three in the column under the fourth digit of the number whose logarithm is sought. If the first two figures change in going across the page, that fact is indicated by an asterisk; which, to economize space, stands for the first two figures of the second column in the *line below the asterisk.* Thus, the logarithm of 1445 (see p. 76) is 3.15987, while that of 1446 is 3.16017. For numbers of 3 figures or less, the mantissa is found in the column headed 0, since the mantissas for 1, 10, 100, or for 2, 20, 200, or for 15, 150, 1500, etc., are respectively the same.

The logarithm of a number of more than four figures is found as indicated in the following example: What is the log of 382.568? On page 81, line 33, columns 2 and 7, find log 382.5 to be 2.58263. Note that log 382.6 is 2.59274, a difference of 11 in the log for a difference of 1 in the last place of the sequence in the number. Assuming that the log increases in proportion to the number, the log of 382.568 may be said to be $\frac{68}{100}$ of 11 larger than log 382.5 since 382.568 is $\frac{68}{100}$ of 1 in the last place (the place of the 5) greater than 382.5. To facilitate this computation, a table of proportional parts is found alongside the log table. Thus, in the case just given, for a difference of 11 we find, from the table of proportional parts, that an increase of 0.6 of one in the last place of the number makes a difference in the log of 6.6, an increase of 0.08 in the number increases the log by 0.88, found by moving the decimal point 1 digit to the left in the tabular value for 0.8, so that an increase of 0.68 of 1 in the last place increases the log of 382.5 by 6.6 + 0.88, or 7.48; or, since we make the fifth figure the nearest whole number, we find log 382.568 = 2.58263 + 7 = 2.58270.

To find the number corresponding to a given logarithm we reverse the process. Thus, the number corresponding to the logarithm 2.58270 is found as follows: The next smaller mantissa is 0.58263 for the sequence 3825 and it is smaller than 0.58270 by 7. The difference for a whole unit in the last place is 11 and in the table of proportional parts under 11 find 6.6, corresponding to 0.6 of 1 in the last place of the number, as the next smaller difference to 7, leaving still a difference of 7 − 6.6 = 0.4 to be used, which, by moving the decimal point one digit to the left, is found to correspond most nearly to 0.04 of 1 in the last place of the number. Therefore, the whole number is 382.564. But we found that 2.58270 is the logarithm of 382.568. We see by this that this table cannot be depended on to give more than a sequence of 5 significant figures correctly. This is true of all tables of logarithms: that as many significant figures in sequence may be correctly determined as there are decimal places in the tabular mantissas. A 5-place table gives five significant figures, a 6-place table, six significant figures, etc.

To multiply a by b we add the logarithms of a and b, written log a and log b, and find the number corresponding to the sum.

To divide a by b, we subtract log b from log a and find the number corresponding to the difference.

It may often occur in computations that the fifth place in a resulting logarithm, found by adding two or more logarithms, may be in error by one unit, thus making the quantity determined certain to one less significant figure than the number of places in the logarithm.

To find the product a^2b^3. Find the logarithm of a and multiply it by 2; find the logarithm of b and multiply it by 3; add the two results for the logarithm of the product and find the corresponding number. Thus:

What is the product $1.2^2 \times 4.3^3$?

p. 76, line 21, col. 2, log 1.2 = 0.07918 × 2 = 0.15836
p. 82, line 31, col. 2, log 4.3 = 0.63347 × 3 = 1.90041
p. 76, line 15, col. 6 and 7 = 2.05877 = log 114.49. Ans.

This example, checked by a 7-place table, gives the same result to the fifth significant figure even though both logarithms were multiplied and then added.

The following example, worked by 5-place and 7-place logarithms, shows the uncertainty of the last figure in computations made by any set of tables, by showing the uncertainty of the fifth figure in the computations made with the 5-place tables. Required the product $1.65^2 \times 1.8^3$.

5-Place

$$\begin{aligned} \text{Log } 1.65 &= 0.21748 \times 2 = 0.43496 \\ \text{Log } 1.8 &= 0.25527 \times 3 = \underline{0.76581} \\ && 1.20077 = \log 15.877. \quad \text{Ans.} \end{aligned}$$

7-Place

$$\begin{aligned} \text{Log } 1.65 &= 0.2174839 \times 2 = 0.4349678 \\ \text{Log } 1.8 &= 0.2552725 \times 3 = \underline{0.7658175} \\ && 1.2007853 = \log 15.8776. \quad \text{Ans.} \end{aligned}$$

Thus 15.878 is nearer right than 15.877, although the error of the latter is only about 0.6 of one in the last place and the error of the former is about 0.4 of one in the last place. Greater differences can occur so that the fifth place is not certain within 1 unit.

Logarithms of fractions. The logarithm of $1 = \frac{10}{10} = 10^{1-1} = 10^0$ is 0.00000. Similarly the logarithm of $0.1 = \frac{1}{10} = 10^{0-1}$ is -1.00000; the logarithm of $\frac{1}{100}$ is -2; of $\frac{1}{1000}$ is -3; etc. Therefore, if the sequence is all fractional the characteristic is *minus* and with a numerical value expressed by the number of the place on the right of the decimal point in which the first significant figure appears. Thus the logarithm of 0.00126 is $-3 + 0.10037$, usually written $\bar{3}.10037$. The mantissa is not minus, only the characteristic is minus. This sometimes gives the beginner trouble, but need not if he remembers that the mantissa is always plus, while the characteristic is plus or minus according as the number corresponding is equal to or greater than 1 or is less than 1, and that in general the two must be treated separately. The following examples will make the use of the signs clear:

Required the product 43.0×0.43.

$$\begin{array}{lll} \text{Log } 43 & = 1.63347 & 1.63347 \\ \text{Log } 0.43 & = \underline{\bar{1}.63347} & \underline{0.63347 - 1} \\ \text{Log } 18.49 & = 1.26694 & 2.26694 - 1 = 1.26694 \end{array}$$

Required the product 43.0×0.43^2.

$$\begin{array}{ll} \text{Log } 43.0 & = 1.63347 \\ \text{Log } 0.43^2 & = \underline{\bar{1}.26694} \\ \text{Log } 7.951 & = 0.90041 \end{array} \qquad \begin{aligned} \text{Log } 0.43^2 &= \bar{1}.63347 \times 2 \\ &= \bar{2} + 1.26694 = \bar{1}.26694 \end{aligned}$$

Required the product $43.0 \times 0.43^{\frac{1}{2}}$.

$$\begin{array}{ll} \text{Log } 43.0 & = 1.63347 \\ \text{Log } 0.43^{\frac{1}{2}} & = \underline{\bar{1}.81674} \\ \text{Log } 28.207 & = 1.45021 \end{array}$$

Log $0.43^{\frac{1}{2}} = \bar{1}.63347 \div 2 = \bar{1}.816735$ found thus: Add 10 to the characteristic and subtract 10 before dividing by 2, getting $\frac{9.63347 - 10}{2} = 4.816735 - 5$, or $\bar{1}.816735$.

Instead of adding and subtracting 10 in the preceding example, only enough may be added and subtracted to make the negative characteristic divisible by the divisor. Thus: In the foregoing example add and subtract 1, getting $\frac{\bar{1}.63347 - 1 + 1}{2} = \frac{\bar{2} + 1.63347}{2} = \bar{1}.816735$, as before, without the necessity of considering the 4 and -5. If the 1/3 power has been required, the divisor would have been 3, and 2 should be added and subtracted getting $\frac{\bar{1}.63347 - 2 + 2}{3} = \frac{\bar{3} + 2.63347}{3}$ $= \bar{1}.877823 +$. This work need not be written out in full in an example, as the computer can see the figures mentally. Thus, he knows the characteristic will be $\bar{1}$ so he writes this down and then imagines a 2, or whatever number is to be added, at the left of the decimal and at once writes down the quotient after the $\bar{1}$. In handling very small numbers when the negative characteristic is large, it may be necessary to write out the operation to guard against error.

In making the tables, when the remainder after the fifth figure was more than 0.5, the fifth figure was increased by 1; when less than 0.5, the fifth figure was not changed.

When the computer is finding a logarithm, and the operation brings a 5 in the place following the last place of the table (as the sixth place when using the tables of this book) and the 5 is followed by ciphers, a good rule to adopt is to make the last place the nearest *even* number. Thus in getting log $0.43^{\frac{1}{3}}$ in the example above we add 5 in the sixth place. This rule will tend to balance inaccuracies in a long series of computations.

To divide 3.68×4.21 we find (page 81) log 3.68 = 0.56585
(page 82) log 4.21 = 0.62428

Now to subtract, we may add and subtract 10 from the log 3.68, getting

$$\begin{array}{r} 10.56585 - 10 \\ 0.62428 \\ \hline 9.94157 - 10 = \bar{1}.94157 \end{array}$$

or, we may add the arithmetical complement of log 4.21 instead of subtracting the log 4.21. That is, we may multiply by $\frac{1}{4.21}$ instead of dividing by 4.21. The logarithm of $\frac{1}{4.21}$ is 0.00000 − 0.62428, or $\bar{1}.37572$ and is called the arithmetical complement of the log 4.21. It is the logarithm of the reciprocal of 4.21. In a series of operations, where several factors are to be multiplied and the product divided by the product of several factors, the arithmetical complements of the divisor factors are used to avoid the double operation of two additions and one subtraction, since the arithmetical complements may be written down from the logs almost as readily as the logs themselves. Each digit of the mantissa of the log is subtracted from 9 except the last, which is subtracted from 10. The characteristic is negative and one greater than the characteristic of the log when the log characteristic is positive; and is positive and one less than the characteristic of the log if that characteristic is negative. Thus:

Log 8.364 is 0.92241; its complement is $\bar{1}.07759$
Log 83.64 is 1.92241; its complement is $\bar{2}.07759$

Log 836.4 is 2.92241; its complement is $\bar{3}.07759$
Log 0.8364 is $\bar{1}.92241$; its complement is 0.07759
Log 0.08364 is $\bar{2}.92241$; its complement is 1.07759

Instead of thinking of the characteristic by the rule above, the log may be subtracted from 10 instead of zero when a characteristic of 9 in the complement will correspond to $\bar{1}$; 8 to $\bar{2}$, etc. And the computer can as readily think of 9 as indicating that the first significant figure of the result is in the first or tenths' place of the decimal; 8, that it is in the second or hundredths' place, etc., and this will cause no confusion unless very large quantities are being dealt with, so that the 8 or 9 might sometimes be a positive characteristic not standing in the place of a $\bar{2}$ or $\bar{1}$; but this difficulty is not likely to arise in using 5- or 6-place tables, since such tables would not be used with such large numbers.

When the first figures are small. When the first three figures of a number of five or more places are between 100 and 110 inclusive use pages 94 and 95, which give 7-place logarithms for five digits directly.

N	L 0	1	2	3	4	5	6	7	8	9
100	00 000	043	087	130	173	217	260	303	346	389
101	432	475	518	561	604	647	689	732	775	817
102	860	903	945	988	*030	*072	*115	*157	*199	*242
103	01 284	326	368	410	452	494	536	578	620	662
104	703	745	787	828	870	912	953	995	*036	*078
105	02 119	160	202	243	284	325	366	407	449	490
106	531	572	612	653	694	735	776	816	857	898
107	938	979	*019	*060	*100	*141	*181	*222	*262	*302
108	03 342	383	423	463	503	543	583	623	663	703
109	743	782	822	862	902	941	981	*021	*060	*100
110	04 139	179	218	258	297	336	376	415	454	493
111	532	571	610	650	689	727	766	805	844	883
112	922	961	999	*038	*077	*115	*154	*192	*231	*269
113	05 308	346	385	423	461	500	538	576	614	652
114	690	729	767	805	843	881	918	956	994	*032
115	06 070	108	145	183	221	258	296	333	371	408
116	446	483	521	558	595	633	670	707	744	781
117	819	856	893	930	967	*004	*041	*078	*115	*151
118	07 188	225	262	298	335	372	408	445	482	518
119	555	591	628	664	700	737	773	809	846	882
120	918	954	990	*027	*063	*099	*135	*171	*207	*243
121	08 279	314	350	386	422	458	493	529	565	600
122	636	672	707	743	778	814	849	884	920	955
123	991	*026	*061	*096	*132	*167	*202	*237	*272	*307
124	09 342	377	412	447	482	517	552	587	621	656
125	691	726	760	795	830	864	899	934	968	*003
126	10 037	072	106	140	175	209	243	278	312	346
127	380	415	449	483	517	551	585	619	653	687
128	721	755	789	823	857	890	924	958	992	*025
129	11 059	093	126	160	193	227	261	294	327	361
130	394	428	461	494	528	561	594	628	661	694
131	727	760	793	826	860	893	926	959	992	*024
132	12 057	090	123	156	189	222	254	287	320	352
133	385	418	450	483	516	548	581	613	646	678
134	710	743	775	808	840	872	905	937	969	*001
135	13 033	066	098	130	162	194	226	258	290	322
136	354	386	418	450	481	513	545	577	609	640
137	672	704	735	767	799	830	862	893	925	956
138	988	*019	*051	*082	*114	*145	*176	*208	*239	*270
139	14 301	333	364	395	426	457	489	520	551	582
140	613	644	675	706	737	768	799	829	860	891
141	922	953	983	*014	*045	*076	*106	*137	*168	*198
142	15 229	259	290	320	351	381	412	442	473	503
143	534	564	594	625	655	685	715	746	776	806
144	836	866	897	927	957	987	*017	*047	*077	*107
145	16 137	167	197	227	256	286	316	346	376	406
146	435	465	495	524	554	584	613	643	673	702
147	732	761	791	820	850	879	909	938	967	997
148	17 026	056	085	114	143	173	202	231	260	289
149	319	348	377	406	435	464	493	522	551	580
150	17 609	863	667	696	725	754	782	811	840	869
N	L 0	1	2	3	4	5	6	7	8	9

P P

	44	43	42
1	4.4	4.3	4.2
2	8.8	8.6	8.4
3	13.2	12.9	12.6
4	17.6	17.2	16.8
5	22.0	21.5	21.0
6	26.4	25.8	25.2
7	30.8	30.1	29.4
8	35.2	34.4	33.6
9	39.6	38.7	37.8

	41	40	39
1	4.1	4.0	3.9
2	8.2	8.0	7.8
3	12.3	12.0	11.7
4	16.4	16.0	15.6
5	20.5	20.0	19.5
6	24.6	24.0	23.4
7	28.7	28.0	27.3
8	32.8	32.0	31.2
9	36.9	36.0	35.1

	38	37	36
1	3.8	3.7	3.6
2	7.6	7.4	7.2
3	11.4	11.1	10.8
4	15.2	14.8	14.4
5	19.0	18.5	18.0
6	22.8	22.2	21.6
7	26.6	25.9	25.2
8	30.4	29.6	28.8
9	34.2	33.3	32.4

	35	34	33
1	3.5	3.4	3.3
2	7.0	6.8	6.6
3	10.5	10.2	9.9
4	14.0	13.6	13.2
5	17.5	17.0	16.5
6	21.0	20.4	19.8
7	24.5	23.8	23.1
8	28.0	27.2	26.4
9	31.5	30.6	29.7

	32	31	30
1	3.2	3.1	3.0
2	6.4	6.2	6.0
3	9.6	9.3	9.0
4	12.8	12.4	12.0
5	16.0	15.5	15.0
6	19.2	18.6	18.0
7	22.4	21.7	21.0
8	25.6	24.8	24.0
9	28.8	27.9	27.0

P P

N	L 0	1	2	3	4	5	6	7	8	9
150	17 609	638	667	696	725	754	782	811	840	869
151	898	926	955	984	*013	*041	*070	*099	*127	*156
152	18 184	213	241	270	298	327	355	384	412	441
153	469	498	526	554	583	611	639	667	696	724
154	752	780	808	837	865	893	921	949	977	*005
155	19 033	061	089	117	145	173	201	229	257	285
156	312	340	368	396	424	451	479	507	535	562
157	590	618	645	673	700	728	756	783	811	838
158	866	893	921	948	976	*003	*030	*058	*085	*112
159	20 140	167	194	222	249	276	303	330	358	385
160	412	439	466	493	520	548	575	602	629	656
161	683	710	737	763	790	817	844	871	898	925
162	952	978	*005	*032	*059	*085	*112	*139	*165	*192
163	21 219	245	272	299	325	352	378	405	431	458
164	484	511	537	564	590	617	643	669	696	722
165	748	775	801	827	854	880	906	932	958	985
166	22 011	037	063	089	115	141	167	194	220	246
167	272	298	324	350	376	401	427	453	479	505
168	531	557	583	608	634	660	686	712	737	763
169	789	814	840	866	891	917	943	968	994	*019
170	23 045	070	096	121	147	172	198	223	249	274
171	300	325	350	376	401	426	452	477	502	528
172	553	578	603	629	654	679	704	729	754	779
173	805	830	855	880	905	930	955	980	*005	*030
174	24 055	080	105	130	155	180	204	229	254	279
175	304	329	353	378	403	428	452	477	502	527
176	551	576	601	625	650	674	699	724	748	773
177	797	822	846	871	895	920	944	969	993	*018
178	25 042	066	091	115	139	164	188	212	237	261
179	285	310	334	358	382	406	431	455	479	503
180	527	551	575	600	624	648	672	696	720	744
181	768	792	816	840	864	888	912	935	959	983
182	26 007	031	055	079	102	126	150	174	198	221
183	245	269	293	316	340	364	387	411	435	458
184	482	505	529	553	576	600	623	647	670	694
185	717	741	764	788	811	834	858	881	905	928
186	951	975	998	*021	*045	*068	*091	*114	*138	*161
187	27 184	207	231	254	277	300	323	346	370	393
188	416	439	462	485	508	531	554	577	600	623
189	646	669	692	715	738	761	784	807	830	852
190	875	898	921	944	967	989	*012	*035	*058	*081
191	28 103	126	149	171	194	217	240	262	285	307
192	330	353	375	398	421	443	466	488	511	533
193	556	578	601	623	646	668	691	713	735	758
194	780	803	825	847	870	892	914	937	959	981
195	29 003	026	048	070	092	115	137	159	181	203
196	226	248	270	292	314	336	358	380	403	425
197	447	469	491	513	535	557	579	601	623	645
198	667	688	710	732	754	776	798	820	842	863
199	885	907	929	951	973	994	*016	*038	*060	*081
200	30 103	125	146	168	190	211	233	255	276	298
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PP

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7	20.3	19.6
8	23.2	22.4
9	26.1	25.2

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3	8.1	7.8
4	10.8	10.4
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6	16.2	15.6
7	18.9	18.2
8	21.6	20.8
9	24.3	23.4

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2	5.0
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5	12.5
6	15.0
7	17.5
8	20.0
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	24	23
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2	4.8	4.6
3	7.2	6.9
4	9.6	9.2
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6	14.4	13.8
7	16.8	16.1
8	19.2	18.4
9	21.6	20.7

	22	21
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4	8.8	8.4
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9	19.8	18.9

PP

N	L 0	1	2	3	4	5	6	7	8	9
200	30 103	125	146	168	190	211	233	255	276	298
201	320	341	363	384	406	428	449	471	492	514
202	535	557	578	600	621	643	664	685	707	728
203	750	771	792	814	835	856	878	899	920	942
204	963	984	*006	*027	*048	*069	*091	*112	*133	*154
205	31 175	197	218	239	260	281	302	323	345	366
206	387	408	429	450	471	492	513	534	555	576
207	597	618	639	660	681	702	723	744	765	785
208	806	827	848	869	890	911	931	952	973	994
209	32 015	035	056	077	098	118	139	160	181	201
210	222	243	263	284	305	325	346	366	387	408
211	428	449	469	490	510	531	552	572	593	613
212	634	654	675	695	715	736	756	777	797	818
213	838	858	879	899	919	940	960	980	*001	*021
214	33 041	062	082	102	122	143	163	183	203	224
215	244	264	284	304	325	345	365	385	405	425
216	445	465	486	506	526	546	566	586	606	626
217	646	666	686	706	726	746	766	786	806	826
218	846	866	885	905	925	945	965	985	*005	*025
219	34 044	064	084	104	124	143	163	183	203	223
220	242	262	282	301	321	341	361	380	400	420
221	439	459	479	498	518	537	557	577	596	616
222	635	655	674	694	713	733	753	772	792	811
223	830	850	869	889	908	928	947	967	986	*005
224	35 025	044	064	083	102	122	141	160	180	199
225	218	238	257	276	295	315	334	353	372	392
226	411	430	449	468	488	507	526	545	564	583
227	603	622	641	660	679	698	717	736	755	774
228	793	813	832	851	870	889	908	927	946	965
229	984	*003	*021	*040	*059	*078	*097	*116	*135	*154
230	36 173	192	211	229	248	267	286	305	324	342
231	361	380	399	418	436	455	474	493	511	530
232	549	568	586	605	624	642	661	680	698	717
233	736	754	773	791	810	829	847	866	884	903
234	922	940	959	977	996	*014	*033	*051	*070	*088
235	37 107	125	144	162	181	199	218	236	254	273
236	291	310	328	346	365	383	401	420	438	457
237	475	493	511	530	548	566	585	603	621	639
238	658	676	694	712	731	749	767	785	803	822
239	840	858	876	894	912	931	949	967	985	*003
240	38 021	039	057	075	093	112	130	148	166	184
241	202	220	238	256	274	292	310	328	346	364
242	382	399	417	435	453	471	489	507	525	543
243	561	578	596	614	632	650	668	686	703	721
244	739	757	775	792	810	828	846	863	881	899
245	917	934	952	970	987	*005	*023	*041	*058	*076
246	39 094	111	129	146	164	182	199	217	235	252
247	270	287	305	322	340	358	375	393	410	428
248	445	463	480	498	515	533	550	568	585	602
249	620	637	655	672	690	707	724	742	759	777
250	39 794	811	829	846	863	881	898	915	933	950
N	L 0	1	2	3	4	5	6	7	8	9

P P

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8	17.6	16.8
9	19.8	18.9

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3	6.0
4	8.0
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6	12.0
7	14.0
8	16.0
9	18.0

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5	9.5
6	11.4
7	13.3
8	15.2
9	17.1

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2	3.6
3	5.4
4	7.2
5	9.0
6	10.8
7	12.6
8	14.4
9	16.2

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5	8.5
6	10.2
7	11.9
8	13.6
9	15.3

P P

N	L 0	1	2	3	4	5	6	7	8	9
250	39 794	811	829	846	863	881	898	915	933	950
251	967	985	*002	*019	*037	*054	*071	*088	*106	*123
252	40 140	157	175	192	209	226	243	261	278	295
253	312	329	346	364	381	398	415	432	449	466
254	483	500	518	535	552	569	586	603	620	637
255	654	671	688	705	722	739	756	773	790	807
256	824	841	858	875	892	909	926	943	960	976
257	993	*010	*027	*044	*061	*078	*095	*111	*128	*145
258	41 162	179	196	212	229	246	263	280	296	313
259	330	347	363	380	397	414	430	447	464	481
260	497	514	531	547	564	581	597	614	631	647
261	664	681	697	714	731	747	764	780	797	814
262	830	847	863	880	896	913	929	946	963	979
263	996	*012	*029	*045	*062	*078	*095	*111	*127	*144
264	42 160	177	193	210	226	243	259	275	292	308
265	325	341	357	374	390	406	423	439	455	472
266	488	504	521	537	553	570	586	602	619	635
267	651	667	684	700	716	732	749	765	781	797
268	813	830	846	862	878	894	911	927	943	959
269	975	991	*008	*024	*040	*056	*072	*088	*104	*120
270	43 136	152	169	185	201	217	233	249	265	281
271	297	313	329	345	361	377	393	409	425	441
272	457	473	489	505	521	537	553	569	584	600
273	616	632	648	664	680	696	712	727	743	759
274	775	791	807	823	838	854	870	886	902	917
275	933	949	965	981	996	*012	*028	*044	*059	*075
276	44 091	107	122	138	154	170	185	201	217	232
277	248	264	279	295	311	326	342	358	373	389
278	404	420	436	451	467	483	498	514	529	545
279	560	576	592	607	623	638	654	669	685	700
280	716	731	747	762	778	793	809	824	840	855
281	871	886	902	917	932	948	963	979	994	*010
282	45 025	040	056	071	086	102	117	133	148	163
283	179	194	209	225	240	255	271	286	301	317
284	332	347	362	378	393	408	423	439	454	469
285	484	500	515	530	545	561	576	591	606	621
286	637	652	667	682	697	712	728	743	758	773
287	788	803	818	834	849	864	879	894	909	924
288	939	954	969	984	*000	*015	*030	*045	*060	*075
289	46 090	105	120	135	150	165	180	195	210	225
290	240	255	270	285	300	315	330	345	359	374
291	389	404	419	434	449	464	479	494	509	523
292	538	553	568	583	598	613	627	642	657	672
293	687	702	716	731	746	761	776	790	805	820
294	835	850	864	879	894	909	923	938	953	967
295	982	997	*012	*026	*041	*056	*070	*085	*100	*114
296	47 129	144	159	173	188	202	217	232	246	261
297	276	290	305	319	334	349	363	378	392	407
298	422	436	451	465	480	494	509	524	538	553
299	567	582	596	611	625	640	654	669	683	698
300	47 712	727	741	756	770	784	799	813	828	842
N	L 0	1	2	3	4	5	6	7	8	9

P P

	18		**17**		**16**		**15**		**14**
1	1.8	1	1.7	1	1.6	1	1.5	1	1.4
2	3.6	2	3.4	2	3.2	2	3.0	2	2.8
3	5.4	3	5.1	3	4.8	3	4.5	3	4.2
4	7.2	4	6.8	4	6.4	4	6.0	4	5.6
5	9.0	5	8.5	5	8.0	5	7.5	5	7.0
6	10.8	6	10.2	6	9.6	6	9.0	6	8.4
7	12.6	7	11.9	7	11.2	7	10.5	7	9.8
8	14.4	8	13.6	8	12.8	8	12.0	8	11.2
9	16.2	9	15.3	9	14.4	9	13.5	9	12.6

P P

N	L 0	1	2	3	4	5	6	7	8	9
300	47 712	727	741	756	770	784	799	813	828	842
301	857	871	885	900	914	929	943	958	972	986
302	48 001	015	029	044	058	073	087	101	116	130
303	144	159	173	187	202	216	230	244	259	273
304	287	302	316	330	344	359	373	387	401	416
305	430	444	458	473	487	501	515	530	544	558
306	572	586	601	615	629	643	657	671	686	700
307	714	728	742	756	770	785	799	813	827	841
308	855	869	883	897	911	926	940	954	968	982
309	996	*010	*024	*038	*052	*066	*080	*094	*108	*122
310	49 136	150	164	178	192	206	220	234	248	262
311	276	290	304	318	332	346	360	374	388	402
312	415	429	443	457	471	485	499	513	527	541
313	554	568	582	596	610	624	638	651	665	679
314	693	707	721	734	748	762	776	790	803	817
315	831	845	859	872	886	900	914	927	941	955
316	969	982	996	*010	*024	*037	*051	*065	*079	*092
317	50 106	120	133	147	161	174	188	202	215	229
318	243	256	270	284	297	311	325	338	352	365
319	379	393	406	420	433	447	461	474	488	501
320	515	529	542	556	569	583	596	610	623	637
321	651	664	678	691	705	718	732	745	759	772
322	786	799	813	826	840	853	866	880	893	907
323	920	934	947	961	974	987	*001	*014	*028	*041
324	51 055	068	081	095	108	121	135	148	162	175
325	188	202	215	228	242	255	268	282	295	308
326	322	335	348	362	375	388	402	415	428	441
327	455	468	481	495	508	521	534	548	561	574
328	587	601	614	627	640	654	667	680	693	706
329	720	733	746	759	772	786	799	812	825	838
330	851	865	878	891	904	917	930	943	957	970
331	983	996	*009	*022	*035	*048	*061	*075	*088	*101
332	52 114	127	140	153	166	179	192	205	218	231
333	244	257	270	284	297	310	323	336	349	362
334	375	388	401	414	427	440	453	466	479	492
335	504	517	530	543	556	569	582	595	608	621
336	634	647	660	673	686	699	711	724	737	750
337	763	776	789	802	815	827	840	853	866	879
338	892	905	917	930	943	956	969	982	994	*007
339	53 020	033	046	058	071	084	097	110	122	135
340	148	161	173	186	199	212	224	237	250	263
341	275	288	301	314	326	339	352	364	377	390
342	403	415	428	441	453	466	479	491	504	517
343	529	542	555	567	580	593	605	618	631	643
344	656	668	681	694	706	719	732	744	757	769
345	782	794	807	820	832	845	857	870	882	895
346	908	920	933	945	958	970	983	995	*008	*020
347	54 033	045	058	070	083	095	108	120	133	145
348	158	170	183	195	208	220	233	245	258	270
349	283	295	307	320	332	345	357	370	382	394
350	54 407	419	432	444	456	469	481	494	506	518
N	L 0	1	2	3	4	5	6	7	8	9

P P

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9	13.5

	14
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5	7.0
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9	12.6

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6	7.8
7	9.1
8	10.4
9	11.7

	12
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6	7.2
7	8.4
8	9.6
9	10.8

P P

N	L 0	1	2	3	4	5	6	7	8	9
350	54 407	419	432	444	456	469	481	494	506	518
351	531	543	555	568	580	593	605	617	630	642
352	654	667	679	691	704	716	728	741	753	765
353	777	790	802	814	827	839	851	864	876	888
354	900	913	925	937	949	962	974	986	998	*011
355	55 023	035	047	060	072	084	096	108	121	133
356	145	157	169	182	194	206	218	230	242	255
357	267	279	291	303	315	328	340	352	364	376
358	388	400	413	425	437	449	461	473	485	497
359	509	522	534	546	558	570	582	594	606	618
360	630	642	654	666	678	691	703	715	727	739
361	751	763	775	787	799	811	823	835	847	859
362	871	883	895	907	919	931	943	955	967	979
363	991	*003	*015	*027	*038	*050	*062	*074	*086	*098
364	56 110	122	134	146	158	170	182	194	205	217
365	229	241	253	265	277	289	301	312	324	336
366	348	360	372	384	396	407	419	431	443	455
367	467	478	490	502	514	526	538	549	561	573
368	585	597	608	620	632	644	656	667	679	691
369	703	714	726	738	750	761	773	785	797	808
370	820	832	844	855	867	879	891	902	914	926
371	937	949	961	972	984	996	*008	*019	*031	*043
372	57 054	066	078	089	101	113	124	136	148	159
373	171	183	194	206	217	229	241	252	264	276
374	287	299	310	322	334	345	357	368	380	392
375	403	415	426	438	449	461	473	484	496	507
376	519	530	542	553	565	576	588	600	611	623
377	634	646	657	669	680	692	703	715	726	738
378	749	761	772	784	795	807	818	830	841	852
379	864	875	887	898	910	921	933	944	955	967
380	978	990	*001	*013	*024	*035	*047	*058	*070	*081
381	58 092	104	115	127	138	149	161	172	184	195
382	206	218	229	240	252	263	274	286	297	309
383	320	331	343	354	365	377	388	399	410	422
384	433	444	456	467	478	490	501	512	524	535
385	546	557	569	580	591	602	614	625	636	647
386	659	670	681	692	704	715	726	737	749	760
387	771	782	794	805	816	827	838	850	861	872
388	883	894	906	917	928	939	950	961	973	984
389	995	*006	*017	*028	*040	*051	*062	*073	*084	*095
390	59 106	118	129	140	151	162	173	184	195	207
391	218	229	240	251	262	273	284	295	306	318
392	329	340	351	362	373	384	395	406	417	428
393	439	450	461	472	483	494	506	517	528	539
394	550	561	572	583	594	605	616	627	638	649
395	660	671	682	693	704	715	726	737	748	759
396	770	780	791	802	813	824	835	846	857	868
397	879	890	901	912	923	934	945	956	966	977
398	988	999	*010	*021	*032	*043	*054	*065	*076	*086
399	60 097	108	119	130	141	152	163	173	184	195
400	60 206	217	228	239	249	260	271	282	293	304
N	L 0	1	2	3	4	5	6	7	8	9

P P

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6	7.8	7.2	6.6	6.0
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P P

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400	60 206	217	228	239	249	260	271	282	293	304
401	314	325	336	347	358	369	379	390	401	412
402	423	433	444	455	466	477	487	498	509	520
403	531	541	552	563	574	584	595	606	617	627
404	638	649	660	670	681	692	703	713	724	735
405	746	756	767	778	788	799	810	821	831	842
406	853	863	874	885	895	906	917	927	938	949
407	959	970	981	991	*002	*013	*023	*034	*045	*055
408	61 066	077	087	098	109	119	130	140	151	162
409	172	183	194	204	215	225	236	247	257	268
410	278	289	300	310	321	331	342	352	363	374
411	384	395	405	416	426	437	448	458	469	479
412	490	500	511	521	532	542	553	563	574	584
413	595	606	616	627	637	648	658	669	679	690
414	700	711	721	731	742	752	763	773	784	794
415	805	815	826	836	847	857	868	878	888	899
416	909	920	930	941	951	962	972	982	993	*003
417	62 014	024	034	045	055	066	076	086	097	107
418	118	128	138	149	159	170	180	190	201	211
419	221	232	242	252	263	273	284	294	304	315
420	325	335	346	356	366	377	387	397	408	418
421	428	439	449	459	469	480	490	500	511	521
422	531	542	552	562	572	583	593	603	613	624
423	634	644	655	665	675	685	696	706	716	726
424	737	747	757	767	778	788	798	808	818	829
425	839	849	859	870	880	890	900	910	921	931
426	941	951	961	972	982	992	*002	*012	*022	*033
427	63 043	053	063	073	083	094	104	114	124	134
428	144	155	165	175	185	195	205	215	225	236
429	246	256	266	276	286	296	306	317	327	337
430	347	357	367	377	387	397	407	417	428	438
431	448	458	468	478	488	498	508	518	528	538
432	548	558	568	579	589	599	609	619	629	639
433	649	659	669	679	689	699	709	719	729	739
434	749	759	769	779	789	799	809	819	829	839
435	849	859	869	879	889	899	909	919	929	939
436	949	959	969	979	988	998	*008	*018	*028	*038
437	64 048	058	068	078	088	098	108	118	128	137
438	147	157	167	177	187	197	207	217	227	237
439	246	256	266	276	286	296	306	316	326	335
440	345	355	365	375	385	395	404	414	424	434
441	444	454	464	473	483	493	503	513	523	532
442	542	552	562	572	582	591	601	611	621	631
443	640	650	660	670	680	689	699	709	719	729
444	738	748	758	768	777	787	797	807	816	826
445	836	846	856	865	875	885	895	904	914	924
446	933	943	953	963	972	982	992	*002	*011	*021
447	65 031	040	050	060	070	079	089	099	108	118
448	128	137	147	157	167	176	186	196	205	215
449	225	234	244	254	263	273	283	292	302	312
450	65 321	331	341	350	360	369	379	389	398	408
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P P

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P P

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450	65 321	331	341	350	360	369	379	389	398	408
451	418	427	437	447	456	466	475	485	495	504
452	514	523	533	543	552	562	571	581	591	600
453	610	619	629	639	648	658	667	677	686	696
454	706	715	725	734	744	753	763	772	782	792
455	801	811	820	830	839	849	858	868	877	887
456	896	906	916	925	935	944	954	963	973	982
457	992	*001	*011	*020	*030	*039	*049	*058	*068	*077
458	66 087	096	106	115	124	134	143	153	162	172
459	181	191	200	210	219	229	238	247	257	266
460	276	285	295	304	314	323	332	342	351	361
461	370	380	389	398	408	417	427	436	445	455
462	464	474	483	492	502	511	521	530	539	549
463	558	567	577	586	596	605	614	624	633	642
464	652	661	671	680	689	699	708	717	727	736
465	745	755	764	773	783	792	801	811	820	829
466	839	848	857	867	876	885	894	904	913	922
467	932	941	950	960	969	978	987	997	*006	*015
468	67 025	034	043	052	062	071	080	089	099	108
469	117	127	136	145	154	164	173	182	191	201
470	210	219	228	237	247	256	265	274	284	293
471	302	311	321	330	339	348	357	367	376	385
472	394	403	413	422	431	440	449	459	468	477
473	486	495	504	514	523	532	541	550	560	569
474	578	587	596	605	614	624	633	642	651	660
475	669	679	688	697	706	715	724	733	742	752
476	761	770	779	788	797	806	815	825	834	843
477	852	861	870	879	888	897	906	916	925	934
478	943	952	961	970	979	988	997	*006	*015	*024
479	68 034	043	052	061	070	079	088	097	106	115
480	124	133	142	151	160	169	178	187	196	205
481	215	224	233	242	251	260	269	278	287	296
482	305	314	323	332	341	350	359	368	377	386
483	395	404	413	422	431	440	449	458	467	476
484	485	494	502	511	520	529	538	547	556	565
485	574	583	592	601	610	619	628	637	646	655
486	664	673	681	690	699	708	717	726	735	744
487	753	762	771	780	789	797	806	815	824	833
488	842	851	860	869	878	886	895	904	913	922
489	931	940	949	958	966	975	984	993	*002	*011
490	69 020	028	037	046	055	064	073	082	090	099
491	108	117	126	135	144	152	161	170	179	188
492	197	205	214	223	232	241	249	258	267	276
493	285	294	302	311	320	329	338	346	355	364
494	373	381	390	399	408	417	425	434	443	452
495	461	469	478	487	496	504	513	522	531	539
496	548	557	566	574	583	592	601	609	618	627
497	636	644	653	662	671	679	688	697	705	714
498	723	732	740	749	758	767	775	784	793	801
499	810	819	827	836	845	854	862	871	880	888
500	69 897	906	914	923	932	940	949	958	966	975
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P P

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P P

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500	69 897	906	914	923	932	940	949	958	966	975
501	984	992	*001	*010	*018	*027	*036	*044	*053	*062
502	70 070	079	088	096	105	114	122	131	140	148
503	157	165	174	183	191	200	209	217	226	234
504	243	252	260	269	278	286	295	303	312	321
505	329	338	346	355	364	372	381	389	398	406
506	415	424	432	441	449	458	467	475	484	492
507	501	509	518	526	535	544	552	561	569	578
508	586	595	603	612	621	629	638	646	655	663
509	672	680	689	697	706	714	723	731	740	749
510	757	766	774	783	791	800	808	817	825	834
511	842	851	859	868	876	885	893	902	910	919
512	927	935	944	952	961	969	978	986	995	*003
513	71 012	020	029	037	046	054	063	071	079	088
514	096	105	113	122	130	139	147	155	164	172
515	181	189	198	206	214	223	231	240	248	257
516	265	273	282	290	299	307	315	324	332	341
517	349	357	366	374	383	391	399	408	416	425
518	433	441	450	458	466	475	483	492	500	508
519	517	525	533	542	550	559	567	575	584	592
520	600	609	617	625	634	642	650	659	667	675
521	684	692	700	709	717	725	734	742	750	759
522	767	775	784	792	800	809	817	825	834	842
523	850	858	867	875	883	892	900	908	917	925
524	933	941	950	958	966	975	983	991	999	*008
525	72 016	024	032	041	049	057	066	074	082	090
526	099	107	115	123	132	140	148	156	165	173
527	181	189	198	206	214	222	230	239	247	255
528	263	272	280	288	296	304	313	321	329	337
529	346	354	362	370	378	387	395	403	411	419
530	428	436	444	452	460	469	477	485	493	501
531	509	518	526	534	542	550	558	567	575	583
532	591	599	607	616	624	632	640	648	656	665
533	673	681	689	697	705	713	722	730	738	746
534	754	762	770	779	787	795	803	811	819	827
535	835	843	852	860	868	876	884	892	900	908
536	916	925	933	941	949	957	965	973	981	989
537	997	*006	*014	*022	*030	*038	*046	*054	*062	*070
538	73 078	086	094	102	111	119	127	135	143	151
539	159	167	175	183	191	199	207	215	223	231
540	239	247	255	263	272	280	288	296	304	312
541	320	328	336	344	352	360	368	376	384	392
542	400	408	416	424	432	440	448	456	464	472
543	480	488	496	504	512	520	528	536	544	552
544	560	568	576	584	592	600	608	616	624	632
545	640	648	656	664	672	679	687	695	703	711
546	719	727	735	743	751	759	767	775	783	791
547	799	807	815	823	830	838	846	854	862	870
548	878	886	894	902	910	918	926	933	941	949
549	957	965	973	981	989	997	*005	*013	*020	*028
550	74 036	044	052	060	068	076	084	092	099	107
N	L 0	1	2	3	4	5	6	7	8	9

P P

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P P

N	L 0	1	2	3	4	5	6	7	8	9
550	74 036	044	052	060	068	076	084	092	099	107
551	115	123	131	139	147	155	162	170	178	186
552	194	202	210	218	225	233	241	249	257	265
553	273	280	288	296	304	312	320	327	335	343
554	351	359	367	374	382	390	398	406	414	421
555	429	437	445	453	461	468	476	484	492	500
556	507	515	523	531	539	547	554	562	570	578
557	586	593	601	609	617	624	632	640	648	656
558	663	671	679	687	695	702	710	718	726	733
559	741	749	757	764	772	780	788	796	803	811
560	819	827	834	842	850	858	865	873	881	889
561	896	904	912	920	927	935	943	950	958	966
562	974	981	989	997	*005	*012	*020	*028	*035	*043
563	75 051	059	066	074	082	089	097	105	113	120
564	128	136	143	151	159	166	174	182	189	197
565	205	213	220	228	236	243	251	259	266	274
566	282	289	297	305	312	320	328	335	343	351
567	358	366	374	381	389	397	404	412	420	427
568	435	442	450	458	465	473	481	488	496	504
569	511	519	526	534	542	549	557	565	572	580
570	587	595	603	610	618	626	633	641	648	656
571	664	671	679	686	694	702	709	717	724	732
572	740	747	755	762	770	778	785	793	800	808
573	815	823	831	838	846	853	861	868	876	884
574	891	899	906	914	921	929	937	944	952	959
575	967	974	982	989	997	*005	*012	*020	*027	*035
576	76 042	050	057	065	072	080	087	095	103	110
577	118	125	133	140	148	155	163	170	178	185
578	193	200	208	215	223	230	238	245	253	260
579	268	275	283	290	298	305	313	320	328	335
580	343	350	358	365	373	380	388	395	403	410
581	418	425	433	440	448	455	462	470	477	485
582	492	500	507	515	522	530	537	545	552	559
583	567	574	582	589	597	604	612	619	626	634
584	641	649	656	664	671	678	686	693	701	708
585	716	723	730	738	745	753	760	768	775	782
586	790	797	805	812	819	827	834	842	849	856
587	864	871	879	886	893	901	908	916	923	930
588	938	945	953	960	967	975	982	989	997	*004
589	77 012	019	026	034	041	048	056	063	070	078
590	085	093	100	107	115	122	129	137	144	151
591	159	166	173	181	188	195	203	210	217	225
592	232	240	247	254	262	269	276	283	291	298
593	305	313	320	327	335	342	349	357	364	371
594	379	386	393	401	408	415	422	430	437	444
595	452	459	466	474	481	488	495	503	510	517
596	525	532	539	546	554	561	568	576	583	590
597	597	605	612	619	627	634	641	648	656	663
598	670	677	685	692	699	706	714	721	728	735
599	743	750	757	764	772	779	786	793	801	808
600	77 815	822	830	837	844	851	859	866	873	880
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P P

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600	77 815	822	830	837	844	851	859	866	873	880
601	887	895	902	909	916	924	931	938	945	952
602	960	967	974	981	988	996	*003	*010	*017	*025
603	78 032	039	046	053	061	068	075	082	089	097
604	104	111	118	125	132	140	147	154	161	168
605	176	183	190	197	204	211	219	226	233	240
606	247	254	262	269	276	283	290	297	305	312
607	319	326	333	340	347	355	362	369	376	383
608	390	398	405	412	419	426	433	440	447	455
609	462	469	476	483	490	497	504	512	519	526
610	533	540	547	554	561	569	576	583	590	597
611	604	611	618	625	633	640	647	654	661	668
612	675	682	689	696	704	711	718	725	732	739
613	746	753	760	767	774	781	789	796	803	810
614	817	824	831	838	845	852	859	866	873	880
615	888	895	902	909	916	923	930	937	944	951
616	958	965	972	979	986	993	*000	*007	*014	*021
617	79 029	036	043	050	057	064	071	078	085	092
618	099	106	113	120	127	134	141	148	155	162
619	169	176	183	190	197	204	211	218	225	232
620	239	246	253	260	267	274	281	288	295	302
621	309	316	323	330	337	344	351	358	365	372
622	379	386	393	400	407	414	421	428	435	442
623	449	456	463	470	477	484	491	498	505	511
624	518	525	532	539	546	553	560	567	574	581
625	588	595	602	609	616	623	630	637	644	650
626	657	664	671	678	685	692	699	706	713	720
627	727	734	741	748	754	761	768	775	782	789
628	796	803	810	817	824	831	837	844	851	858
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631	80 003	010	017	024	030	037	044	051	058	065
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634	209	216	223	229	236	243	250	257	264	271
635	277	284	291	298	305	312	318	325	332	339
636	346	353	359	366	373	380	387	393	400	407
637	414	421	428	434	441	448	455	462	468	475
638	482	489	496	502	509	516	523	530	536	543
639	550	557	564	570	577	584	591	598	604	611
640	618	625	632	638	645	652	659	665	672	679
641	686	693	699	706	713	720	726	733	740	747
642	754	760	767	774	781	787	794	801	808	814
643	821	828	835	841	848	855	862	868	875	882
644	889	895	902	909	916	922	929	936	943	949
645	956	963	969	976	983	990	996	*003	*010	*017
646	81 023	030	037	043	050	057	064	070	077	084
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648	158	164	171	178	184	191	198	204	211	218
649	224	231	238	245	251	258	265	271	278	285
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P P

N	L 0	1	2	3	4	5	6	7	8	9
650	81 291	298	305	311	318	325	331	338	345	351
651	358	365	371	378	385	391	398	405	411	418
652	425	431	438	445	451	458	465	471	478	485
653	491	498	505	511	518	525	531	538	544	551
654	558	564	571	578	584	591	598	604	611	617
655	624	631	637	644	651	657	664	671	677	684
656	690	697	704	710	717	723	730	737	743	750
657	757	763	770	776	783	790	796	803	809	816
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659	889	895	902	908	915	921	928	935	941	948
660	954	961	968	974	981	987	994	*000	*007	*014
661	82 020	027	033	040	046	053	060	066	073	079
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669	543	549	556	562	569	575	582	588	595	601
670	607	614	620	627	633	640	646	653	659	666
671	672	679	685	692	698	705	711	718	724	730
672	737	743	750	756	763	769	776	782	789	795
673	802	808	814	821	827	834	840	847	853	860
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676	995	*001	*008	*014	*020	*027	*033	*040	*046	*052
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681	315	321	327	334	340	347	353	359	366	372
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686	632	639	645	651	658	664	670	677	683	689
687	696	702	708	715	721	727	734	740	746	753
688	759	765	771	778	784	790	797	803	809	816
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697	323	330	336	342	348	354	361	367	373	379
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737	747	753	759	764	770	776	782	788	794	800
738	806	812	817	823	829	835	841	847	853	859
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740	923	929	935	941	947	953	958	964	970	976
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745	216	221	227	233	239	245	251	256	262	268
746	274	280	286	291	297	303	309	315	320	326
747	332	338	344	349	355	361	367	373	379	384
748	390	396	402	408	413	419	425	431	437	442
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750	87 506	512	518	523	529	535	541	547	552	558
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772	762	767	773	779	784	790	795	801	807	812
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789	708	713	719	724	730	735	741	746	752	757
790	763	768	774	779	785	790	796	801	807	812
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797	146	151	157	162	168	173	179	184	189	195
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934	97 035	039	044	049	053	058	063	067	072	077	4 1.6
935	081	086	090	095	100	104	109	114	118	123	5 2.0
936	128	132	137	142	146	151	155	160	165	169	6 2.4 7 2.8
937	174	179	183	188	192	197	202	206	211	216	8 3.2
938	220	225	230	234	239	243	248	253	257	262	9 3.6
939	267	271	276	280	285	290	294	299	304	308	
940	313	317	322	327	331	336	340	345	350	354	
941	359	364	368	373	377	382	387	391	396	400	
942	405	410	414	419	424	428	433	437	442	447	
943	451	456	460	465	470	474	479	483	488	493	
944	497	502	506	511	516	520	525	529	534	539	
945	543	548	552	557	562	566	571	575	580	585	
946	589	594	598	603	607	612	617	621	626	630	
947	635	640	644	649	653	658	663	667	672	676	
948	681	685	690	695	699	704	708	713	717	722	
949	727	731	736	740	745	749	754	759	763	768	
950	97 772	777	782	786	791	795	800	804	809	813	
N	L 0	1	2	3	4	5	6	7	8	9	P P

N	L 0	1	2	3	4	5	6	7	8	9
950	97 772	777	782	786	791	795	800	804	809	813
951	818	823	827	832	836	841	845	850	855	859
952	864	868	873	877	882	886	891	896	900	905
953	909	914	918	923	928	932	937	941	946	950
954	955	959	964	968	973	978	982	987	991	996
955	98 000	005	009	014	019	023	028	032	037	041
956	046	050	055	059	064	068	073	078	082	087
957	091	096	100	105	109	114	118	123	127	132
958	137	141	146	150	155	159	164	168	173	177
959	182	186	191	195	200	204	209	214	218	223
960	227	232	236	241	245	250	254	259	263	268
961	272	277	281	286	290	295	299	304	308	313
962	318	322	327	331	336	340	345	349	354	358
963	363	367	372	376	381	385	390	394	399	403
964	408	412	417	421	426	430	435	439	444	448
965	453	457	462	466	471	475	480	484	489	493
966	498	502	507	511	516	520	525	529	534	538
967	543	547	552	556	561	565	570	574	579	583
968	588	592	597	601	605	610	614	619	623	628
969	632	637	641	646	650	655	659	664	668	673
970	677	682	686	691	695	700	704	709	713	717
971	722	726	731	735	740	744	749	753	758	762
972	767	771	776	780	784	789	793	798	802	807
973	811	816	820	825	829	834	838	843	847	851
974	856	860	865	869	874	878	883	887	892	896
975	900	905	909	914	918	923	927	932	936	941
976	945	949	954	958	963	967	972	976	981	985
977	989	994	998	*003	*007	*012	*016	*021	*025	*029
978	99 034	038	043	047	052	056	061	065	069	074
979	078	083	087	092	096	100	105	109	114	118
980	123	127	131	136	140	145	149	154	158	162
981	167	171	176	180	185	189	193	198	202	207
982	211	216	220	224	229	233	238	242	247	251
983	255	260	264	269	273	277	282	286	291	295
984	300	304	308	313	317	322	326	330	335	339
985	344	348	352	357	361	366	370	374	379	383
986	388	392	396	401	405	410	414	419	423	427
987	432	436	441	445	449	454	458	463	467	471
988	476	480	484	489	493	498	502	506	511	515
989	520	524	528	533	537	542	546	550	555	559
990	564	568	572	577	581	585	590	594	599	603
991	607	612	616	621	625	629	634	638	642	647
992	651	656	660	664	669	673	677	682	686	691
993	695	699	704	708	712	717	721	726	730	734
994	739	743	747	752	756	760	765	769	774	778
995	782	787	791	795	800	804	808	813	817	822
996	826	830	835	839	843	848	852	856	861	865
997	870	874	878	883	887	891	896	900	904	909
998	913	917	922	926	930	935	939	944	948	952
999	957	961	965	970	974	978	983	987	991	996
1000	00 000	004	009	013	017	022	026	030	035	039
N	L 0	1	2	3	4	5	6	7	8	9

P P

	5
1	0.5
2	1.0
3	1.5
4	2.0
5	2.5
6	3.0
7	3.5
8	4.0
9	4.5

	4
1	0.4
2	0.8
3	1.2
4	1.6
5	2.0
6	2.4
7	2.8
8	3.2
9	3.6

N	L 0	1	2	3	4	5	6	7	8	9
1000	000 0000	0434	0869	1303	1737	2171	2605	3039	3473	3907
1001	4341	4775	5208	5642	6076	6510	6943	7377	7810	8244
1002	8677	9111	9544	9977	*0411	*0844	*1277	*1710	*2143	*2576
1003	001 3009	3442	3875	4308	4741	5174	5607	6039	6472	6905
1004	7337	7770	8202	8635	9067	9499	9932	*0364	*0796	*1228
1005	002 1661	2093	2525	2957	3389	3821	4253	4685	5116	5548
1006	5980	6411	6843	7275	7706	8138	8569	9001	9432	9863
1007	003 0295	0726	1157	1588	2019	2451	2882	3313	3744	4174
1008	4605	5036	5467	5898	6328	6759	7190	7620	8051	8481
1009	8912	9342	9772	*0203	*0633	*1063	*1493	*1924	*2354	*2784
1010	004 3214	3644	4074	4504	4933	5363	5793	6223	6652	7082
1011	7512	7941	8371	8800	9229	9659	*0088	*0517	*0947	*1376
1012	005 1805	2234	2663	3092	3521	3950	4379	4808	5237	5666
1013	6094	6523	6952	7380	7809	8238	8666	9094	9523	9951
1014	006 0380	0808	1236	1664	2092	2521	2949	3377	3805	4233
1015	4660	5088	5516	5944	6372	6799	7227	7655	8082	8510
1016	8937	9365	9792	*0219	*0647	*1074	*1501	*1928	*2355	*2782
1017	007 3210	3637	4064	4490	4917	5344	5771	6198	6624	7051
1018	7478	7904	8331	8757	9184	9610	*0037	*0463	*0889	*1316
1019	008 1742	2168	2594	3020	3446	3872	4298	4724	5150	5576
1020	6002	6427	6853	7279	7704	8130	8556	8981	9407	9832
1021	009 0257	0683	1108	1533	1959	2384	2809	3234	3659	4084
1022	4509	4934	5359	5784	6208	6633	7058	7483	7907	8332
1023	8756	9181	9605	*0030	*0454	*0878	*1303	*1727	*2151	*2575
1024	010 3000	3424	3848	4272	4696	5120	5544	5967	6391	6815
1025	7239	7662	8086	8510	8933	9357	9780	*0204	*0627	*1050
1026	011 1474	1897	2320	2743	3166	3590	4013	4436	4859	5282
1027	5704	6127	6550	6973	7396	7818	8241	8664	9086	9509
1028	9931	*0354	*0776	*1198	*1621	*2043	*2465	*2887	*3310	*3732
1029	012 4154	4576	4998	5420	5842	6264	6685	7107	7529	7951
1030	8372	8794	9215	9637	*0059	*0480	*0901	*1323	*1744	*2165
1031	013 2587	3008	3429	3850	4271	4692	5113	5534	5955	6376
1032	6797	7218	7639	8059	8480	8901	9321	9742	*0162	*0583
1033	014 1003	1424	1844	2264	2685	3105	3525	3945	4365	4785
1034	5205	5625	6045	6465	6885	7305	7725	8144	8564	8984
1035	9403	9823	*0243	*0662	*1082	*1501	*1920	*2340	*2759	*3178
1036	015 3598	4017	4436	4855	5274	5693	6112	6531	6950	7369
1037	7788	8206	8625	9044	9462	9881	*0300	*0718	*1137	*1555
1038	016 1974	2392	2810	3229	3647	4065	4483	4901	5319	5737
1039	6155	6573	6991	7409	7827	8245	8663	9080	9498	9916
1040	017 0333	0751	1168	1586	2003	2421	2838	3256	3673	4090
1041	4507	4924	5342	5759	6176	6593	7010	7427	7844	8260
1042	8677	9094	9511	9927	*0344	*0761	*1177	*1594	*2010	*2427
1043	018 2843	3259	3676	4092	4508	4925	5341	5757	6173	6589
1044	7005	7421	7837	8253	8669	9084	9500	9916	*0332	*0747
1045	019 1163	1578	1994	2410	2825	3240	3656	4071	4486	4902
1046	5317	5732	6147	6562	6977	7392	7807	8222	8637	9052
1047	9467	9882	*0296	*0711	*1126	*1540	*1955	*2369	*2784	*3198
1048	020 3613	4027	4442	4856	5270	5684	6099	6513	6927	7341
1049	7755	8169	8583	8997	9411	9824	*0238	*0652	*1066	*1479
1050	021 1893	2307	2720	3134	3547	3961	4374	4787	5201	5614
N	L 0	1	2	3	4	5	6	7	8	9

N	L 0	1	2	3	4	5	6	7	8	9
1050	021 1893	2307	2720	3134	3547	3961	4374	4787	5201	5614
1051	6027	6440	6854	7267	7680	8093	8506	8919	9332	9745
1052	022 0157	0570	0983	1396	1808	2221	2634	3046	3459	3871
1053	4284	4696	5109	5521	5933	6345	6758	7170	7582	7994
1054	8406	8818	9230	9642	*0054	*0466	*0878	*1289	*1701	*2113
1055	023 2525	2936	3348	3759	4171	4582	4994	5405	5817	6228
1056	6639	7050	7462	7873	8284	8695	9106	9517	9928	*0339
1057	024 0750	1161	1572	1982	2393	2804	3214	3625	4036	4446
1058	4857	5267	5678	6088	6498	6909	7319	7729	8139	8549
1059	8960	9370	9780	*0190	*0600	*1010	*1419	*1829	*2239	*2649
1060	025 3059	3468	3878	4288	4697	5107	5516	5926	6335	6744
1061	7154	7563	7972	8382	8791	9200	9609	*0018	*0427	*0836
1062	026 1245	1654	2063	2472	2881	3289	3698	4107	4515	4924
1063	5333	5741	6150	6558	6967	7375	7783	8192	8600	9008
1064	9416	9824	*0233	*0641	*1049	*1457	*1865	*2273	*2680	*3088
1065	027 3496	3904	4312	4719	5127	5535	5942	6350	6757	7165
1066	7572	7979	8387	8794	9201	9609	*0016	*0423	*0830	*1237
1067	028 1644	2051	2458	2865	3272	3679	4086	4492	4899	5306
1068	5713	6119	6526	6932	7339	7745	8152	8558	8964	9371
1069	9777	*0183	*0590	*0996	*1402	*1808	*2214	*2620	*3026	*3432
1070	029 3838	4244	4649	5055	5461	5867	6272	6678	7084	7489
1071	7895	8300	8706	9111	9516	9922	*0327	*0732	*1138	*1543
1072	030 1948	2353	2758	3163	3568	3973	4378	4783	5188	5592
1073	5997	6402	6807	7211	7616	8020	8425	8830	9234	9638
1074	031 0043	0447	0851	1256	1660	2064	2468	2872	3277	3681
1075	4085	4489	4893	5296	5700	6104	6508	6912	7315	7719
1076	8123	8526	8930	9333	9737	*0140	*0544	*0947	*1350	*1754
1077	032 2157	2560	2963	3367	3770	4173	4576	4979	5382	5785
1078	6188	6590	6993	7396	7799	8201	8604	9007	9409	9812
1079	033 0214	0617	1019	1422	1824	2226	2629	3031	3433	3835
1080	4238	4640	5042	5444	5846	6248	6650	7052	7453	7855
1081	8257	8659	9060	9462	9864	*0265	*0667	*1068	*1470	*1871
1082	034 2273	2674	3075	3477	3878	4279	4680	5081	5482	5884
1083	6285	6686	7087	7487	7888	8289	8690	9091	9491	9892
1084	035 0293	0693	1094	1495	1895	2296	2696	3096	3497	3897
1085	4297	4698	5098	5498	5898	6298	6698	7098	7498	7898
1086	8298	8698	9098	9498	9898	*0297	*0697	*1097	*1496	*1896
1087	036 2295	2695	3094	3494	3893	4293	4692	5091	5491	5890
1088	6289	6688	7087	7486	7885	8284	8683	9082	9481	9880
1089	037 0279	0678	1076	1475	1874	2272	2671	3070	3468	3867
1090	4265	4663	5062	5460	5858	6257	6655	7053	7451	7849
1091	8248	8646	9044	9442	9839	*0237	*0635	*1033	*1431	*1829
1092	038 2226	2624	3022	3419	3817	4214	4612	5009	5407	5804
1093	6202	6599	6996	7393	7791	8188	8585	8982	9379	9776
1094	039 0173	0570	0967	1364	1761	2158	2554	2951	3348	3745
1095	4141	4538	4934	5331	5727	6124	6520	6917	7313	7709
1096	8106	8502	8898	9294	9690	*0086	*0482	*0878	*1274	*1670
1097	040 2066	2462	2858	3254	3650	4045	4441	4837	5232	5628
1098	6023	6419	6814	7210	7605	8001	8396	8791	9187	9582
1099	9977	*0372	*0767	*1162	*1557	*1952	*2347	*2742	*3137	*3532
1100	041 3927	4322	4716	5111	5506	5900	6295	6690	7084	7479
N	L 0	1	2	3	4	5	6	7	8	9

TABLE XXV. — Logarithms of Sines, Tangents, Cosines, and Cotangents for Each 0.01° of the Quadrant

In this table whenever the trigonometric function is fractional, as it always is for sines and cosines, except when it is 1, the logarithms have been increased by 10 to avoid the negative characteristic. But where the function is greater than 1, as are cotangents and tangents for certain parts of the circle, the logarithm is given without the 10. Thus in the column headed *cot* at the *top* of the page the logarithms are unaugmented; in all other columns they are augmented. This must be remembered in working with them.

To find the square root of the sine of 26.32° we find on page 151, line 33, the log sin to be 9.64678, which must be divided by 2 to give the logarithm of the square root; the operation is performed thus:

$$\frac{2)9.64678 - 10}{4.82339 - 5} = \bar{1}.82339.$$

Whence $\sqrt{\sin 26.32°}$ = the number whose log is $\bar{1}.82339$ or 0.66587+. But to find the square root of the cotangent of 26.32°, page 151, line 33, we have 0.30569 ÷ 2 = 0.152845, which corresponds to the number 1.4218+.

The numbering of the pages. — On each page there will be found four-degree numbers which are to be used as follows: the upper left-hand figure is used with the headings at the tops of the columns and the fractions running down the left side of the page. The lower right-hand figure is used with the headings at the bottoms of the columns, and fractions running up the right-hand side of the page. The upper right-hand figure is used with headings at the tops of the columns and fractions running up the right-hand side of the page. The lower left-hand figure is used with headings at the bottom of the page and fractions running down the left-hand side of the page. Generally stated the figures are used with the headings and fractions nearest them.

Example. — See pages 163–164. The log sin of 32.4° is found in the 2nd column, page 163, 41st line, to be 9.72902, while the log sin of 122.4° is found in the 7th column of the same page and line to be 9.92651. The log sin of 147.4° is found in the 2nd column on page 164, 41st line from the bottom, to be 9.73140, while the log sin 57.4° is found in the 7th column of the same page and line to be 9.92555.

When the function or angle sought is not in the table, as when the log sin of 14.436° or the angle whose sine is 9.34220 is wanted, we must interpolate between the tabular quantities. Thus:

(*a*) Log sin 14.43° is found on page 127, line 44, to be 9.39654 with a tabular difference of 30 for a change of 0.01 given in the column headed *d*. Then the addition for 6 tenths of 0.01° is found by multiplying $30 \times 0.6 = 18$, and adding to 9.39654 giving 9.39672 as the required sine. When the quantities are less simple the proportional part given in the right-hand column of the page may be used. If the angle is 14.4362° the table of proportional parts is convenient even for the simple difference of 30. Thus, from the values in the right-hand column headed "30" we find 18 opposite 6; moving the decimal point one place to the left, we find 0.6 opposite 2; adding we get .000186, or .00019, to be added to the log sin 14.43° to give log sin 14.4362°. The figures are uncertain beyond five places and may be a fraction of one in error in the fifth place.

(*b*) For the angle whose log sine is 9.34220 we find on page 124 the next smaller log sin = 9.34212 = log sin 12.70°; the difference is $9.34220 - 9.34212 = 8$ in the last place. The tabular difference is 34. Looking in the column of proportional parts under 34 we find 6.8 next smaller number than 8 corresponding to 0.002 and leaving 1.2 unused; moving the decimal point one place to the left in the tabular quantities, the next smaller and nearest number is 1.02 opposite 3. Therefore the angle is 12.7023°. The last figure is uncertain.

For fractional angles near 0° *and* 90°, the differences are changing so rapidly that linear interpolation is not sufficiently exact. The right-hand columns of pages 99 to 104 show what to do. Thus to find the log sin 0.1246° we find (pages 76 and 99)

$$\begin{aligned} \text{Log. } 0.1246 &= \bar{1}.09552 \\ S &= \underline{1.75812} \\ & \quad\ 7.33740 \end{aligned}$$

To find log cos and log cot we find log sin and tangents of complementary angles. Thus, to get log cos 89.367°, we get log sin 0.633°. Conversely, to find the angle whose log sin is 7.33740, we refer to page 99, and find that the angle is between 0.12° and 0.13° and hence

$$\begin{aligned} S &= 1.75812 \\ \log \sin &= \underline{7.33740 - 10} \\ \text{(page 76) } \log 0.1246° &= 9.09552 - 10 = \bar{1}.09552. \end{aligned}$$

TABLE XXVI. — Logarithmic Versed Sines and External Secants for Each 0.02° of the Quadrant

The use of this table will be evident except the interpolation for small angles and for external secants for angles near 90°.

For small angles use the quantity V for versed sines and E for external secants as follows:

$$\text{Log vers } \alpha = 2 \log \alpha^\circ + V.$$
$$\text{Log exsec } \alpha = 2 \log \alpha^\circ + E.$$

Interpolate for V and E when necessary.

Example. — Required log vers 1.354°.

$$\begin{aligned} \text{Log } 1.354 &= 0.13162 \\ &\underline{2} \\ &0.26324 \\ V \text{ for } 1.36^\circ &= \underline{6.18270} \\ \text{Log vers } 1.354^\circ &= 6.44594. \end{aligned}$$

$$\text{Log } \alpha^\circ = \frac{\log \text{vers } \alpha - V}{2} = \frac{\log \text{exsec } \alpha - E}{2}.$$

For external secants near 90° the interpolation is as follows:

$$\text{Log exsec } A = \log \text{vers } A - \log \sin (90 - A).$$

	Sin	d.	Tan	d. c.	Cot	Cos	
00	....		....		....	....	100
01	6.24188		6.24188		3.75812	0.00000	99
02	6.54291	30103	6.54291	30103	3.45709	0.00000	98
03	6.71900	17609	6.71900	17609	3.28100	0.00000	97
04	6.84394	12494	6.84394	12494	3.15606	0.00000	96
05	6.94085	9691	6.94085	9691	3.05915	0.00000	95
06	7.02003	7918	7.02003	7918	2.97997	0.00000	94
07	7.08698	6695	7.08698	6695	2.91302	0.00000	93
08	7.14497	5799	7.14497	5799	2.85503	0.00000	92
09	7.19612	5115	7.19612	5115	2.80388	0.00000	91
10	7.24188	4576	7.24188	4576	2.75812	0.00000	90
11	7.28327	4139	7.28327	4139	2.71673	0.00000	89
12	7.32106	3779	7.32106	3779	2.67894	0.00000	88
13	7.35582	3476	7.35582	3476	2.64418	0.00000	87
14	7.38800	3218	7.38801	3219	2.61199	0.00000	86
15	7.41797	2997	7.41797	2996	2.58203	0.00000	85
16	7.44600	2803	7.44600	2803	2.55400	0.00000	84
17	7.47233	2633	7.47233	2633	2.52767	0.00000	83
18	7.49715	2482	7.49715	2482	2.50285	0.00000	82
19	7.52063	2348	7.52063	2348	2.47937	0.00000	81
20	7.54291	2228	7.54291	2228	2.45709	0.00000	80
21	7.56410	2119	7.56410	2119	2.43590	0.00000	79
22	7.58430	2020	7.58430	2020	2.41570	0.00000	78
23	7.60360	1930	7.60361	1931	2.39639	0.00000	77
24	7.62209	1849	7.62209	1848	2.37791	0.00000	76
25	7.63982	1773	7.63982	1773	2.36018	0.00000	75
26	7.65685	1703	7.65685	1703	2.34315	0.00000	74
27	7.67324	1639	7.67324	1639	2.32676	0.00000	73
28	7.68903	1579	7.68904	1580	2.31096	9.99999	72
29	7.70427	1524	7.70428	1524	2.29572	9.99999	71
30	7.71900	1473	7.71900	1472	2.28100	9.99999	70
31	7.73324	1424	7.73324	1424	2.26676	9.99999	69
32	7.74703	1379	7.74703	1379	2.25297	9.99999	68
33	7.76039	1336	7.76040	1337	2.23960	9.99999	67
34	7.77335	1296	7.77336	1296	2.22664	9.99999	66
35	7.78594	1259	7.78595	1259	2.21405	9.99999	65
36	7.79818	1224	7.79819	1224	2.20181	9.99999	64
37	7.81008	1190	7.81009	1190	2.18991	9.99999	63
38	7.82166	1158	7.82167	1158	2.17833	9.99999	62
39	7.83294	1128	7.83295	1128	2.16705	9.99999	61
40	7.84393	1099	7.84394	1099	2.15606	9.99999	60
41	7.85466	1073	7.85467	1073	2.14533	9.99999	59
42	7.86512	1046	7.86513	1046	2.13487	9.99999	58
43	7.87534	1022	7.87535	1022	2.12465	9.99999	57
44	7.88533	999	7.88534	999	2.11466	9.99999	56
45	7.89509	976	7.89510	976	2.10490	9.99999	55
46	7.90463	954	7.90464	954	2.09536	9.99999	54
47	7.91397	934	7.91398	934	2.08602	9.99999	53
48	7.92311	914	7.92313	915	2.07687	9.99998	52
49	7.93207	896	7.93208	895	2.06792	9.99998	51
50	7.94084	877	7.94086	878	2.05914	9.99998	50
	Cos	d.	Cot	d. c.	Tan	Sin	

S

°	1.758
.0	123
.1	123
.2	124
.3	125
.4	126
.5	128

To interpolate when angles are small:
$\log \sin \alpha = \log \alpha^\circ - S$; $\log \tan \alpha = \log \alpha^\circ - T$;
$\log \alpha^\circ = \log \sin \alpha + S = \log \tan \alpha + T$.
For cos and cot near 90° use sin and tan of complement.

T

°	1.758
.0	123
.1	122
.2	121
.3	119
.4	116
.5	112

90° 89°

	Sin	d.	Tan	d. c.	Cot	Cos	
50	7.94084	860	7.94086	860	2.05914	9.99998	**50**
51	7.94944	843	7.94946	843	2.05054	9.99998	49
52	7.95787	828	7.95789	828	2.04211	9.99998	48
53	7.96615	811	7.96617	811	2.03383	9.99998	47
54	7.97426	797	7.97428	797	2.02572	9.99998	46
55	7.98223	783	7.98225	783	2.01775	9.99998	45
56	7.99006	769	7.99008	769	2.00992	9.99998	44
57	7.99775	755	7.99777	755	2.00223	9.99998	43
58	8.00530	742	8.00532	742	1.99468	9.99998	42
59	8.01272	730	8.01274	730	1.98726	9.99998	41
60	8.02002	718	8.02004	718	1.97996	9.99998	**40**
61	8.02720	706	8.02722	707	1.97278	9.99998	39
62	8.03426	695	8.03429	695	1.96571	9.99997	38
63	8.04121	684	8.04124	684	1.95876	9.99997	37
64	8.04805	673	8.04808	673	1.95192	9.99997	36
65	8.05478	663	8.05481	663	1.94519	9.99997	35
66	8.06141	653	8.06144	653	1.93856	9.99997	34
67	8.06794	644	8.06797	644	1.93203	9.99997	33
68	8.07438	634	8.07441	634	1.92559	9.99997	32
69	8.08072	624	8.08075	625	1.91925	9.99997	31
70	8.08696	616	8.08700	616	1.91300	9.99997	**30**
71	8.09312	608	8.09316	607	1.90684	9.99997	29
72	8.09920	599	8.09923	599	1.90077	9.99997	28
73	8.10519	591	8.10522	591	1.89478	9.99996	27
74	8.11110	583	8.11113	583	1.88887	9.99996	26
75	8.11693	575	8.11696	576	1.88304	9.99996	25
76	8.12268	568	8.12272	567	1.87728	9.99996	24
77	8.12836	560	8.12839	561	1.87161	9.99996	23
78	8.13396	553	8.13400	553	1.86600	9.99996	22
79	8.13949	546	8.13953	547	1.86047	9.99996	21
80	8.14495	540	8.14500	539	1.85500	9.99996	**20**
81	8.15035	533	8.15039	533	1.84961	9.99996	19
82	8.15568	526	8.15572	527	1.84428	9.99996	18
83	8.16094	520	8.16099	520	1.83901	9.99995	17
84	8.16614	514	8.16619	514	1.83381	9.99995	16
85	8.17128	508	8.17133	508	1.82867	9.99995	15
86	8.17636	502	8.17641	502	1.82359	9.99995	14
87	8.18138	496	8.18143	496	1.81857	9.99995	13
88	8.18634	491	8.18639	491	1.81361	9.99995	12
89	8.19125	485	8.19130	486	1.80870	9.99995	11
90	8.19610	480	8.19616	480	1.80384	9.99995	**10**
91	8.20090	475	8.20096	474	1.79904	9.99995	09
92	8.20565	469	8.20570	470	1.79430	9.99994	08
93	8.21034	465	8.21040	464	1.78960	9.99994	07
94	8.21499	459	8.21504	460	1.78496	9.99994	06
95	8.21958	455	8.21964	455	1.78036	9.99994	05
96	8.22413	450	8.22419	450	1.77581	9.99994	04
97	8.22863	445	8.22869	446	1.77131	9.99994	03
98	8.23308	441	8.23315	441	1.76685	9.99994	02
99	8.23749	437	8.23756	436	1.76244	9.99994	01
100	8.24186		8.24192		1.75808	9.99993	**00**
	Cos	d.	Cot	d. c.	Tan	Sin	

S

°	1.758
.5	128
.6	131
.7	133
.8	137
.9	140
1.0	145

To interpolate when angles are small:
$\log \sin \alpha = \log \alpha^\circ - S$; $\log \tan \alpha = \log \alpha^\circ - T$;
$\log \alpha^\circ = \log \sin \alpha + S = \log \tan \alpha + T$.
For cos and cot near 90° use sin and tan of complement.

T

°	1.758
.5	112
.6	107
.7	101
8	094
9	087
1.0	079

	Sin	d.	Tan	d. c.	Cot	Cos	
00	8.24186	432	8.24192	432	1.75808	9.99993	100
01	8.24618	427	8.24624	428	1.75376	9.99993	99
02	8.25045	424	8.25052	424	1.74948	9.99993	98
03	8.25469	420	8.25476	420	1.74524	9.99993	97
04	8.25889	415	8.25896	416	1.74104	9.99993	96
05	8.26304	412	8.26312	411	1.73688	9.99993	95
06	8.26716	408	8.26723	408	1.73277	9.99993	94
07	8.27124	404	8.27131	404	1.72869	9.99992	93
08	8.27528	400	8.27535	401	1.72465	9.99992	92
09	8.27928	396	8.27936	396	1.72064	9.99992	91
10	8.28324	393	8.28332	393	1.71668	9.99992	90
11	8.28717	390	8.28725	390	1.71275	9.99992	89
12	8.29107	386	8.29115	386	1.70885	9.99992	88
13	8.29493	382	8.29501	383	1.70499	9.99992	87
14	8.29875	380	8.29884	379	1.70116	9.99991	86
15	8.30255	376	8.30263	376	1.69737	9.99991	85
16	8.30631	372	8.30639	373	1.69361	9.99991	84
17	8.31003	370	8.31012	370	1.68988	9.99991	83
18	8.31373	366	8.31382	367	1.68618	9.99991	82
19	8.31739	364	8.31749	363	1.68251	9.99991	81
20	8.32103	360	8.32112	361	1.67888	9.99990	80
21	8.32463	357	8.32473	357	1.67527	9.99990	79
22	8.32820	355	8.32830	355	1.67170	9.99990	78
23	8.33175	352	8.33185	352	1.66815	9.99990	77
24	8.33527	348	8.33537	349	1.66463	9.99990	76
25	8.33875	346	8.33886	346	1.66114	9.99990	75
26	8.34221	344	8.34232	343	1.65768	9.99989	74
27	8.34565	340	8.34575	341	1.65425	9.99989	73
28	8.34905	338	8.34916	338	1.65084	9.99989	72
29	8.35243	335	8.35254	336	1.64746	9.99989	71
30	8.35578	333	8.35590	332	1.64410	9.99989	70
31	8.35911	330	8.35922	331	1.64078	9.99989	69
32	8.36241	328	8.36253	328	1.63747	9.99988	68
33	8.36569	325	8.36581	325	1.63419	9.99988	67
34	8.36894	323	8.36906	323	1.63094	9.99988	66
35	8.37217	321	8.37229	321	1.62771	9.99988	65
36	8.37538	318	8.37550	318	1.62450	9.99988	64
37	8.37856	315	8.37868	316	1.62132	9.99988	63
38	8.38171	314	8.38184	314	1.61816	9.99987	62
39	8.38485	311	8.38498	311	1.61502	9.99987	61
40	8.38796	309	8.38809	309	1.61191	9.99987	60
41	8.39105	307	8.39118	307	1.60882	9.99987	59
42	8.39412	305	8.39425	305	1.60575	9.99987	58
43	8.39717	302	8.39730	303	1.60270	9.99986	57
44	8.40019	301	8.40033	301	1.59967	9.99986	56
45	8.40320	298	8.40334	298	1.59666	9.99986	55
46	8.40618	297	8.40632	297	1.59368	9.99986	54
47	8.40915	294	8.40929	295	1.59071	9.99986	53
48	8.41209	292	8.41224	292	1.58776	9.99986	52
49	8.41501	291	8.41516	291	1.58484	9.99985	51
50	8.41792		8.41807		1.58193	9.99985	50
	Cos	d.	Cot	d. c.	Tan	Sin	

S

°	1.758
1.0	145
.1	149
.2	154
.3	160
.4	166
.5	172

To interpolate when angles are small:
$\log \sin \alpha = \log \alpha° - S$; $\log \tan \alpha = \log \alpha° - T$;
$\log \alpha° = \log \sin \alpha + S = \log \tan \alpha + T$.
For cos and cot of angles near 90° use sin and tan of complement.

T

°	1.758
1.0	079
.1	069
.2	059
.3	048
.4	036
.5	023

	Sin	d.	Tan	d. c.	Cot	Cos	
50	8.41792	288	8.41807	288	1.58193	9.99985	**50**
51	8.42080	287	8.42095	287	1.57905	9.99985	**49**
52	8.42367	285	8.42382	285	1.57618	9.99985	**48**
53	8.42652	283	8.42667	283	1.57333	9.99985	**47**
54	8.42935	281	8.42950	282	1.57050	9.99984	**46**
55	8.43216	279	8.43232	279	1.56768	9.99984	**45**
56	8.43495	277	8.43511	278	1.56489	9.99984	**44**
57	8.43772	276	8.43789	275	1.56211	9.99984	**43**
58	8.44048	274	8.44064	275	1.55936	9.99983	**42**
59	8.44322	272	8.44339	272	1.55661	9.99983	**41**
60	8.44594	271	8.44611	271	1.55389	9.99983	**40**
61	8.44865	268	8.44882	269	1.55118	9.99983	**39**
62	8.45133	268	8.45151	267	1.54849	9.99983	**38**
63	8.45401	265	8.45418	266	1.54582	9.99982	**37**
64	8.45666	264	8.45684	264	1.54316	9.99982	**36**
65	8.45930	262	8.45948	263	1.54052	9.99982	**35**
66	8.46192	261	8.46211	261	1.53789	9.99982	**34**
67	8.46453	259	8.46472	259	1.53528	9.99982	**33**
68	8.46712	258	8.46731	258	1.53269	9.99981	**32**
69	8.46970	256	8.46989	256	1.53011	9.99981	**31**
70	8.47226	255	8.47245	255	1.52755	9.99981	**30**
71	8.47481	253	8.47500	254	1.52500	9.99981	**29**
72	8.47734	252	8.47754	252	1.52246	9.99980	**28**
73	8.47986	250	8.48006	250	1.51994	9.99980	**27**
74	8.48236	249	8.48256	249	1.51744	9.99980	**26**
75	8.48485	247	8.48505	248	1.51495	9.99980	**25**
76	8.48732	246	8.48753	246	1.51247	9.99980	**24**
77	8.48978	245	8.48999	245	1.51001	9.99979	**23**
78	8.49223	243	8.49244	243	1.50756	9.99979	**22**
79	8.49466	242	8.49487	242	1.50513	9.99979	**21**
80	8.49708	240	8.49729	241	1.50271	9.99979	**20**
81	8.49948	240	8.49970	239	1.50030	9.99978	**19**
82	8.50188	237	8.50209	239	1.49791	9.99978	**18**
83	8.50425	237	8.50448	236	1.49552	9.99978	**17**
84	8.50662	235	8.50684	236	1.49316	9.99978	**16**
85	8.50897	234	8.50920	234	1.49080	9.99977	**15**
86	8.51131	233	8.51154	233	1.48846	9.99977	**14**
87	8.51364	232	8.51387	232	1.48613	9.99977	**13**
88	8.51596	230	8.51619	231	1.48381	9.99977	**12**
89	8.51826	229	8.51850	229	1.48150	9.99976	**11**
90	8.52055	228	8.52079	228	1.47921	9.99976	**10**
91	8.52283	227	8.52307	227	1.47693	9.99976	**09**
92	8.52510	225	8.52534	226	1.47466	9.99976	**08**
93	8.52735	225	8.52760	225	1.47240	9.99975	**07**
94	8.52960	223	8.52985	223	1.47015	9.99975	**06**
95	8.53183	222	8.53208	222	1.46792	9.99975	**05**
96	8.53405	221	8.53430	221	1.46570	9.99975	**04**
97	8.53626	220	8.53651	221	1.46349	9.99974	**03**
98	8.53846	218	8.53872	219	1.46128	9.99974	**02**
99	8.54064	218	8.54091	217	1.45909	9.99974	**01**
100	8.54282		8.54308		1.45692	9.99974	**00**
	Cos	d.	Cot	d. c.	Tan	Sin	

S

°	1.758
1.5	172
.6	179
.7	186
.8	194
.9	202
2.0	211

To interpolate when angles are small:

$\log \sin \alpha = \log \alpha^\circ - S$; $\log \tan \alpha = \log \alpha^\circ - T$;

$\log \alpha^\circ = \log \sin \alpha + S = \log \tan \alpha + T$.

For cos and cot of angles near 90° use sin and tan of complement.

T

°	1.75
1.5	8023
.6	8010
.7	7995
.8	7980
.9	7963
2.0	7946

	Sin	d.	Tan	d. c.	Cot	Cos	
00	8.54282	216	8.54308	217	1.45692	9.99974	100
01	8.54498	216	8.54525	216	1.45475	9.99973	99
02	8.54714	214	8.54741	215	1.45259	9.99973	98
03	8.54928	214	8.54956	213	1.45044	9.99973	97
04	8.55142	212	8.55169	213	1.44831	9.99972	96
05	8.55354	211	8.55382	211	1.44618	9.99972	95
06	8.55565	210	8.55593	211	1.44407	9.99972	94
07	8.55775	210	8.55804	209	1.44196	9.99972	93
08	8.55985	208	8.56013	209	1.43987	9.99971	92
09	8.56193	207	8.56222	207	1.43778	9.99971	91
10	8.56400	206	8.56429	207	1.43571	9.99971	90
11	8.56606	205	8.56636	205	1.43364	9.99971	89
12	8.56811	205	8.56841	205	1.43159	9.99970	88
13	8.57016	203	8.57046	203	1.42954	9.99970	87
14	8.57219	202	8.57249	203	1.42751	9.99970	86
15	8.57421	202	8.57452	202	1.42548	9.99969	85
16	8.57623	200	8.57654	200	1.42346	9.99969	84
17	8.57823	200	8.57854	200	1.42146	9.99969	83
18	8.58023	199	8.58054	199	1.41946	9.99969	82
19	8.58222	197	8.58253	198	1.41747	9.99968	81
20	8.58419	197	8.58451	198	1.41549	9.99968	80
21	8.58616	196	8.58649	196	1.41351	9.99968	79
22	8.58812	195	8.58845	195	1.41155	9.99967	78
23	8.59007	194	8.59040	195	1.40960	9.99967	77
24	8.59201	194	8.59235	193	1.40765	9.99967	76
25	8.59395	192	8.59428	193	1.40572	9.99967	75
26	8.59587	192	8.59621	192	1.40379	9.99966	74
27	8.59779	191	8.59813	191	1.40187	9.99966	73
28	8.59970	190	8.60004	190	1.39996	9.99966	72
29	8.60160	189	8.60194	190	1.39806	9.99965	71
30	8.60349	188	8.60384	188	1.39616	9.99965	70
31	8.60537	188	8.60572	188	1.39428	9.99965	69
32	8.60725	186	8.60760	187	1.39240	9.99964	68
33	8.60911	186	8.60947	186	1.39053	9.99964	67
34	8.61097	185	8.61133	186	1.38867	9.99964	66
35	8.61282	185	8.61319	185	1.38681	9.99963	65
36	8.61467	183	8.61504	183	1.38496	9.99963	64
37	8.61650	183	8.61687	183	1.38313	9.99963	63
38	8.61833	182	8.61870	183	1.38130	9.99963	62
39	8.62015	181	8.62053	181	1.37947	9.99962	61
40	8.62196	181	8.62234	181	1.37766	9.99962	60
41	8.62377	179	8.62415	180	1.37585	9.99962	59
42	8.62556	179	8.62595	179	1.37405	9.99961	58
43	8.62735	179	8.62774	179	1.37226	9.99961	57
44	8.62914	177	8.62953	178	1.37047	9.99961	56
45	8.63091	177	8.63131	177	1.36869	9.99960	55
46	8.63268	176	8.63308	176	1.36692	9.99960	54
47	8.63444	175	8.63484	176	1.36516	9.99960	53
48	8.63619	175	8.63660	175	1.36340	9.99959	52
49	8.63794	174	8.63835	174	1.36165	9.99959	51
50	8.63968		8.64009		1.35991	9.99959	50
	Cos	d.	Cot	d. c.	Tan	Sin	

S

°	1.758
2.0	211
.1	220
.2	229
.3	239
.4	250
.5	260

To interpolate when angles are small:
log sin α = log α° − S; log tan α = log α° − T;
log α° = log sin α + S = log tan α + T.
For cos and cot of angles near 90° use sin and tan of complement.

T

°	1.757
2.0	946
.1	928
.2	909
.3	889
.4	869
.5	847

92° 87°

	Sin	d.	Tan	d. c.	Cot	Cos	
50	8.63968	173	8.64009	174	1.35991	9.99959	50
51	8.64141	173	8.64183	173	1.35817	9.99958	49
52	8.64314	172	8.64356	172	1.35644	9.99958	48
53	8.64486	171	8.64528	172	1.35472	9.99958	47
54	8.64657	170	8.64700	170	1.35300	9.99957	46
55	8.64827	170	8.64870	171	1.35130	9.99957	45
56	8.64997	169	8.65041	169	1.34959	9.99957	44
57	8.65166	169	8.65210	169	1.34790	9.99956	43
58	8.65335	168	8.65379	168	1.34621	9.99956	42
59	8.65503	167	8.65547	168	1.34453	9.99956	41
60	8.65670	167	8.65715	167	1.34285	9.99955	40
61	8.65837	166	8.65882	166	1.34118	9.99955	39
62	8.66003	165	8.66048	166	1.33952	9.99955	38
63	8.66168	165	8.66214	165	1.33786	9.99954	37
64	8.66333	164	8.66379	164	1.33621	9.99954	36
65	8.66497	163	8.66543	164	1.33457	9.99954	35
66	8.66660	163	8.66707	163	1.33293	9.99953	34
67	8.66823	162	8.66870	163	1.33130	9.99953	33
68	8.66985	162	8.67033	162	1.32967	9.99952	32
69	8.67147	161	8.67195	161	1.32805	9.99952	31
70	8.67308	160	8.67356	161	1.32644	9.99952	30
71	8.67468	160	8.67517	160	1.32483	9.99951	29
72	8.67628	160	8.67677	160	1.32323	9.99951	28
73	8.67788	158	8.67837	159	1.32163	9.99951	27
74	8.67946	158	8.67996	158	1.32004	9.99950	26
75	8.68104	158	8.68154	158	1.31846	9.99950	25
76	8.68262	157	8.68312	158	1.31688	9.99950	24
77	8.68419	156	8.68470	156	1.31530	9.99949	23
78	8.68575	156	8.68626	157	1.31374	9.99949	22
79	8.68731	155	8.68783	155	1.31217	9.99948	21
80	8.68886	155	8.68938	155	1.31062	9.99948	20
81	8.69041	154	8.69093	155	1.30907	9.99948	19
82	8.69195	154	8.69248	154	1.30752	9.99947	18
83	8.69349	153	8.69402	153	1.30598	9.99947	17
84	8.69502	152	8.69555	153	1.30445	9.99947	16
85	8.69654	152	8.69708	152	1.30292	9.99946	15
86	8.69806	152	8.69860	152	1.30140	9.99946	14
87	8.69958	151	8.70012	152	1.29988	9.99945	13
88	8.70109	150	8.70164	150	1.29836	9.99945	12
89	8.70259	150	8.70314	151	1.29686	9.99945	11
90	8.70409	149	8.70465	149	1.29535	9.99944	10
91	8.70558	149	8.70614	150	1.29386	9.99944	09
92	8.70707	149	8.70764	148	1.29236	9.99944	08
93	8.70856	147	8.70912	149	1.29088	9.99943	07
94	8.71003	148	8.71061	147	1.28939	9.99943	06
95	8.71151	147	8.71208	148	1.28792	9.99942	05
96	8.71298	146	8.71356	146	1.28644	9.99942	04
97	8.71444	146	8.71502	147	1.28498	9.99942	03
98	8.71590	145	8.71649	145	1.28351	9.99941	02
99	8.71735	145	8.71794	146	1.28206	9.99941	01
100	8.71880		8.71940		1.28060	9.99940	00
	Cos	d.	Cot	d. c.	Tan	Sin	

S

°	1.758
2.5	260
.6	272
.7	283
.8	296
.9	308
3.0	321

To interpolate when angles are small:
$\log \sin \alpha = \log \alpha° - S$; $\log \tan \alpha = \log \alpha° - T$;
$\log \alpha° = \log \sin \alpha + S = \log \tan \alpha + T$.
For cos and cot of angles near 90° use sin and tan of complement.

T

°	1.757
2.5	847
.6	824
.7	801
.8	777
.9	752
3.0	725

	Sin	d.	Tan	d.c.	Cot	Cos	
00	8.71880	144	8.71940	144	1.28060	9.99940	100
01	8.72024	144	8.72084	145	1.27916	9.99940	99
02	8.72168	144	8.72229	144	1.27771	9.99940	98
03	8.72312	143	8.72373	143	1.27627	9.99939	97
04	8.72455	142	8.72516	143	1.27484	9.99939	96
05	8.72597	142	8.72659	142	1.27341	9.99938	95
06	8.72739	142	8.72801	142	1.27199	9.99938	94
07	8.72881	141	8.72943	142	1.27057	9.99938	93
08	8.73022	141	8.73085	141	1.26915	9.99937	92
09	8.73163	140	8.73226	140	1.26774	9.99937	91
10	8.73303	139	8.73366	140	1.26634	9.99936	90
11	8.73442	140	8.73506	140	1.26494	9.99936	89
12	8.73582	139	8.73646	139	1.26354	9.99936	88
13	8.73721	138	8.73785	139	1.26215	9.99935	87
14	8.73859	138	8.73924	139	1.26076	9.99935	86
15	8.73997	137	8.74063	138	1.25937	9.99934	85
16	8.74134	138	8.74201	137	1.25799	9.99934	84
17	8.74272	136	8.74338	137	1.25662	9.99933	83
18	8.74408	136	8.74475	137	1.25525	9.99933	82
19	8.74544	136	8.74612	136	1.25388	9.99933	81
20	8.74680	136	8.74748	136	1.25252	9.99932	80
21	8.74816	134	8.74884	135	1.25116	9.99932	79
22	8.74950	135	8.75019	135	1.24981	9.99931	78
23	8.75085	134	8.75154	135	1.24846	9.99931	77
24	8.75219	134	8.75289	134	1.24711	9.99931	76
25	8.75353	133	8.75423	133	1.24577	9.99930	75
26	8.75486	133	8.75556	134	1.24444	9.99930	74
27	8.75619	132	8.75690	133	1.24310	9.99929	73
28	8.75751	132	8.75823	132	1.24177	9.99929	72
29	8.75883	132	8.75955	132	1.24045	9.99928	71
30	8.76015	131	8.76087	132	1.23913	9.99928	70
31	8.76146	131	8.76219	131	1.23781	9.99927	69
32	8.76277	131	8.76350	131	1.23650	9.99927	68
33	8.76408	130	8.76481	131	1.23519	9.99927	67
34	8.76538	129	8.76612	130	1.23388	9.99926	66
35	8.76667	130	8.76742	129	1.23258	9.99926	65
36	8.76797	129	8.76871	130	1.23129	9.99925	64
37	8.76926	128	8.77001	129	1.22999	9.99925	63
38	8.77054	128	8.77130	128	1.22870	9.99924	62
39	8.77182	128	8.77258	129	1.22742	9.99924	61
40	8.77310	128	8.77387	127	1.22613	9.99923	60
41	8.77438	127	8.77514	128	1.22486	9.99923	59
42	8.77565	126	8.77642	127	1.22358	9.99923	58
43	8.77691	126	8.77769	127	1.22231	9.99922	57
44	8.77817	126	8.77896	126	1.22104	9.99922	56
45	8.77943	126	8.78022	126	1.21978	9.99921	55
46	8.78069	125	8.78148	126	1.21852	9.99921	54
47	8.78194	125	8.78274	125	1.21726	9.99920	53
48	8.78319	124	8.78399	125	1.21601	9.99920	52
49	8.78443	125	8.78524	125	1.21476	9.99919	51
50	8.78568		8.78649		1.21351	9.99919	50
	Cos	d.	Cot	d. c.	Tan	Sin	

P. P.

	145	143	141	139	138	137	135	133	131	129	128	127	125	124
1	14.5	14.3	14.1	13.9	13.8	13.7	13.5	13.3	13.1	12.9	12.8	12.7	12.5	12.4
2	29.0	28.6	28.2	27.8	27.6	27.4	27.0	26.6	26.2	25.8	25.6	25.4	25.0	24.8
3	43.5	42.9	42.3	41.7	41.4	41.1	40.5	39.9	39.3	38.7	38.4	38.1	37.5	37.2
4	58.0	57.2	56.4	55.6	55.2	54.8	54.0	53.2	52.4	51.6	51.2	50.8	50.0	49.6
5	72.5	71.5	70.5	69.5	69.0	68.5	67.5	66.5	65.5	64.5	64.0	63.5	62.5	62.0
6	87.0	85.8	84.6	83.4	82.8	82.2	81.0	79.8	78.6	77.4	76.8	76.2	75.0	74.4
7	101.5	100.1	98.7	97.3	96.6	95.9	94.5	93.1	91.7	90.3	89.6	88.9	87.5	86.8
8	116.0	114.4	112.8	111.2	110.4	109.6	108.0	106.4	104.8	103.2	102.4	101.6	100.0	99.2
9	130.5	128.7	126.9	125.1	124.2	123.3	121.5	119.7	117.9	116.1	115.2	114.3	112.5	111.6

′	Sin	d.	Tan	d. c.	Cot	Cos	′
50	8.78568	123	8.78649	124	1.21351	9.99919	50
51	8.78691	124	8.78773	124	1.21227	9.99918	49
52	8.78815	123	8.78897	123	1.21103	9.99918	48
53	8.78938	122	8.79020	123	1.20980	9.99918	47
54	8.79060	123	8.79143	123	1.20857	9.99917	46
55	8.79183	122	8.79266	123	1.20734	9.99917	45
56	8.79305	121	8.79389	122	1.20611	9.99916	44
57	8.79426	122	8.79511	122	1.20489	9.99916	43
58	8.79548	121	8.79633	121	1.20367	9.99915	42
59	8.79669	120	8.79754	121	1.20246	9.99915	41
60	8.79789	121	8.79875	121	1.20125	9.99914	40
61	8.79910	120	8.79996	120	1.20004	9.99914	39
62	8.80030	119	8.80116	121	1.19884	9.99913	38
63	8.80149	120	8.80237	119	1.19763	9.99913	37
64	8.80269	119	8.80356	120	1.19644	9.99912	36
65	8.80388	118	8.80476	119	1.19524	9.99912	35
66	8.80506	119	8.80595	119	1.19405	9.99911	34
67	8.80625	118	8.80714	118	1.19286	9.99911	33
68	8.80743	117	8.80832	118	1.19168	9.99910	32
69	8.80860	118	8.80950	118	1.19050	9.99910	31
70	8.80978	117	8.81068	118	1.18932	9.99909	30
71	8.81095	117	8.81186	117	1.18814	9.99909	29
72	8.81212	116	8.81303	117	1.18697	9.99908	28
73	8.81328	116	8.81420	117	1.18580	9.99908	27
74	8.81444	116	8.81537	116	1.18463	9.99907	26
75	8.81560	115	8.81653	116	1.18347	9.99907	25
76	8.81675	116	8.81769	116	1.18231	9.99906	24
77	8.81791	114	8.81885	115	1.18115	9.99906	23
78	8.81905	115	8.82000	115	1.18000	0.99905	22
79	8.82020	114	8.82115	115	1.17885	9.99905	21
80	8.82134	114	8.82230	114	1.17770	9.99904	20
81	8.82248	114	8.82344	114	1.17656	9.99904	19
82	8.82362	113	8.82458	114	1.17542	9.99903	18
83	8.82475	113	8.82572	114	1.17428	9.99903	17
84	8.82588	113	8.82686	113	1.17314	9.99902	16
85	8.82701	113	8.82799	113	1.17201	9.99902	15
86	8.82814	112	8.82912	113	1.17088	9.99901	14
87	8.82926	112	8.83025	112	1.16975	9.99901	13
88	8.83038	111	8.83137	112	1.16863	9.99900	12
89	8.83149	112	8.83249	112	1.16751	9.99900	11
90	8.83261	111	8.83361	112	1.16639	9.99899	10
91	8.83372	110	8.83473	111	1.16527	9.99899	09
92	8.83482	111	8.83584	111	1.16416	9.99898	08
93	8.83593	110	8.83695	111	1.16305	9.99898	07
94	8.83703	110	8.83806	110	1.16194	9.99897	06
95	8.83813	110	8.83916	110	1.16084	9.99897	05
96	8.83923	109	8.84026	110	1.15974	9.99896	04
97	8.84032	109	8.84136	110	1.15864	9.99896	03
98	8.84141	109	8.84246	109	1.15754	9.99895	02
99	8.84250	108	8.84355	109	1.15645	9.99895	01
100	8.84358		8.84464		1.15536	9.99894	00
	Cos	d.	Cot	d. c.	Tan	Sin	

P. P.

	123	122	121	119	118	117	116	115	114	113	112	111	109	108
1	12.3	12.2	12.1	11.9	11.8	11.7	11.6	11.5	11.4	11.3	11.2	11.1	10.9	10.8
2	24.6	24.4	24.2	23.8	23.6	23.4	23.2	23.0	22.8	22.6	22.4	22.2	21.8	21.6
3	36.9	36.6	36.3	35.7	35.4	35.1	34.8	34.5	34.2	33.9	33.6	33.3	32.7	32.4
4	49.2	48.8	48.4	47.6	47.2	46.8	46.4	46.0	45.6	45.2	44.8	44.4	43.6	43.2
5	61.5	61.0	60.5	59.5	59.0	58.5	58.0	57.5	57.0	56.5	56.0	55.5	54.5	54.0
6	73.8	73.2	72.6	71.4	70.8	70.2	69.6	69.0	68.4	67.8	67.2	66.6	65.4	64.8
7	86.1	85.4	84.7	83.3	82.6	81.9	81.2	80.5	79.8	79.1	78.4	77.7	76.3	75.6
8	98.4	97.6	96.8	95.2	94.4	93.6	92.8	92.0	91.2	90.4	89.6	88.8	87.2	86.4
9	110.7	109.8	108.9	107.1	106.2	105.3	104.4	103.5	102.6	101.7	100.8	99.9	98.1	97.2

′	Sin	d.	Tan	d. c.	Cot	Cos	
00	8.84358	109	8.84464	109	1.15536	9.99894	100
01	8.84467	108	8.84573	109	1.15427	9.99894	99
02	8.84575	107	8.84682	108	1.15318	9.99893	98
03	8.84682	108	8.84790	108	1.15210	9.99892	97
04	8.84790	107	8.84898	108	1.15102	9.99892	96
05	8.84897	107	8.85006	107	1.14994	9.99891	95
06	8.85004	107	8.85113	107	1.14887	9.99891	94
07	8.85111	106	8.85220	107	1.14780	9.99890	93
08	8.85217	106	8.85327	107	1.14673	9.99890	92
09	8.85323	106	8.85434	106	1.14566	9.99889	91
10	8.85429	106	8.85540	106	1.14460	9.99889	90
11	8.85535	105	8.85646	106	1.14354	9.99888	89
12	8.85640	105	8.85752	106	1.14248	9.99888	88
13	8.85745	105	8.85858	105	1.14142	9.99887	87
14	8.85850	105	8.85963	106	1.14037	9.99887	86
15	8.85955	104	8.86069	104	1.13931	9.99886	85
16	8.86059	104	8.86173	105	1.13827	9.99885	84
17	8.86163	104	8.86278	105	1.13722	9.99885	83
18	8.86267	103	8.86383	104	1.13617	9.99884	82
19	8.86370	104	8.86487	104	1.13513	9.99884	81
20	8.86474	103	8.86591	103	1.13409	9.99883	80
21	8.86577	103	8.86694	104	1.13306	9.99883	79
22	8.86680	102	8.86798	103	1.13202	9.99882	78
23	8.86782	103	8.86901	103	1.13099	9.99882	77
24	8.86885	102	8.87004	102	1.12996	9.99881	76
25	8.86987	102	8.87106	103	1.12894	9.99880	75
26	8.87089	101	8.87209	102	1.12791	9.99880	74
27	8.87190	102	8.87311	102	1.12689	9.99879	73
28	8.87292	101	8.87413	102	1.12587	9.99879	72
29	8.87393	101	8.87515	101	1.12485	9.99878	71
30	8.87494	100	8.87616	101	1.12384	9.99878	70
31	8.87594	101	8.87717	102	1.12283	9.99877	69
32	8.87695	100	8.87819	100	1.12181	9.99876	68
33	8.87795	100	8.87919	101	1.12081	9.99876	67
34	8.87895	100	8.88020	100	1.11980	9.99875	66
35	8.87995	99	8.88120	100	1.11880	9.99875	65
36	8.88094	100	8.88220	100	1.11780	9.99874	64
37	8.88194	99	8.88320	100	1.11680	9.99874	63
38	8.88293	99	8.88420	99	1.11580	9.99873	62
39	8.88392	98	8.88519	99	1.11481	9.99872	61
40	8.88490	99	8.88618	99	1.11382	9.99872	60
41	8.88589	98	8.88717	99	1.11283	9.99871	59
42	8.88687	98	8.88816	99	1.11184	9.99871	58
43	8.88785	98	8.88915	98	1.11085	9.99870	57
44	8.88883	97	8.89013	98	1.10987	9.99869	56
45	8.88980	97	8.89111	98	1.10889	9.99869	55
46	8.89077	97	8.89209	98	1.10791	9.99868	54
47	8.89174	97	8.89307	97	1.10693	9.99868	53
48	8.89271	97	8.89404	97	1.10596	9.99867	52
49	8.89368	96	8.89501	97	1.10499	9.99867	51
50	8.89464		8.89598		1.10402	9.99866	50
	Cos	d.	Cot	d. c.	Tan	Sin	

P. P.

	109	108	107	106	105	104	103	102	101	100	99	98	97	96
1	10.9	10.8	10.7	10.6	10.5	10.4	10.3	10.2	10.1	10.0	9.9	9.8	9.7	9.6
2	21.8	21.6	21.4	21.2	21.0	20.8	20.6	20.4	20.2	20.0	19.8	19.6	19.4	19.2
3	32.7	32.4	32.1	31.8	31.5	31.2	30.9	30.6	30.3	30.0	29.7	29.4	29.1	28.8
4	43.6	43.2	42.8	42.4	42.0	41.6	41.2	40.8	40.4	40.0	39.6	39.2	38.8	38.4
5	54.5	54.0	53.5	53.0	52.5	52.0	51.5	51.0	50.5	50.0	49.5	49.0	48.5	48.0
6	65.4	64.8	64.2	63.6	63.0	62.4	61.8	61.2	60.6	60.0	59.4	58.8	58.2	57.6
7	76.3	75.6	74.9	74.2	73.5	72.8	72.1	71.4	70.7	70.0	69.3	68.6	67.9	67.2
8	87.2	86.4	85.6	84.8	84.0	83.2	82.4	81.0	80.8	80.0	79.2	78.4	77.6	76.8
9	98.1	97.2	96.3	95.4	94.5	93.6	92.7	91.8	90.9	90.0	89.1	88.2	87.3	86.4

	Sin	d.	Tan	d. c.	Cot	Cos	
50	8.89464	97	8.89598	97	1.10402	9.99866	50
51	8.89561	96	8.89695	97	1.10305	9.99865	49
52	8.89657	95	8.89792	96	1.10208	9.99865	48
53	8.89752	96	8.89888	96	1.10112	9.99864	47
54	8.89848	95	8.89984	96	1.10016	9.99864	46
55	8.89943	95	8.90080	96	1.09920	9.99863	45
56	8.90038	95	8.90176	96	1.09824	9.99862	44
57	8.90133	95	8.90272	95	1.09728	9.99862	43
58	8.90228	95	8.90367	95	1.09633	9.99861	42
59	8.90323	94	8.90462	95	1.09538	9.99860	41
60	8.90417	94	8.90557	95	1.09443	9.99860	40
61	8.90511	94	8.90652	94	1.09348	9.99859	39
62	8.90605	94	8.90746	95	1.09254	9.99859	38
63	8.90699	93	8.90841	94	1.09159	9.99858	37
64	8.90792	93	8.90935	94	1.09065	9.99857	36
65	8.90885	93	8.91029	93	1.08971	9.99857	35
66	8.90978	93	8.91122	94	1.08878	9.99856	34
67	8.91071	93	8.91216	93	1.08784	9.99856	33
68	8.91164	93	8.91309	93	1.08691	9.99855	32
69	8.91257	92	8.91402	93	1.08598	9.99854	31
70	8.91349	92	8.91495	93	1.08505	9.99854	30
71	8.91441	92	8.91588	92	1.08412	9.99853	29
72	8.91533	92	8.91680	93	1.08320	9.99852	28
73	8.91625	91	8.91773	92	1.08227	9.99852	27
74	8.91716	91	8.91865	92	1.08135	9.99851	26
75	8.91807	91	8.91957	92	1.08043	9.99851	25
76	8.91898	91	8.92049	91	1.07951	9.99850	24
77	8.91989	91	8.92140	91	1.07860	9.99849	23
78	8.92080	91	8.92231	92	1.07769	9.99849	22
79	8.92171	90	8.92323	91	1.07677	9.99848	21
80	8.92261	90	8.92414	90	1.07586	9.99847	20
81	8.92351	90	8.92504	91	1.07496	9.99847	19
82	8.92441	90	8.92595	90	1.07405	9.99846	18
83	8.92531	90	8.92685	91	1.07315	9.99846	17
84	8.92621	89	8.92776	90	1.07224	9.99845	16
85	8.92710	89	8.92866	90	1.07134	9.99844	15
86	8.92799	89	8.92956	89	1.07044	9.99844	14
87	8.92888	89	8.93045	90	1.06955	9.99843	13
88	8.92977	89	8.93135	89	1.06865	9.99842	12
89	8.93066	88	8.93224	89	1.06776	9.99842	11
90	8.93154	89	8.93313	89	1.06687	9.99841	10
91	8.93243	88	8.93402	89	1.06598	9.99840	09
92	8.93331	88	8.93491	89	1.06509	9.99840	08
93	8.93419	88	8.93580	88	1.06420	9.99839	07
94	8.93507	87	8.93668	88	1.06332	9.99838	06
95	8.93594	88	8.93756	89	1.06244	9.99838	05
96	8.93682	87	8.93845	87	1.06155	9.99837	04
97	8.93769	87	8.93932	88	1.06068	9.99836	03
98	8.93856	87	8.94020	88	1.05980	9.99836	02
99	8.93943	87	8.94108	87	1.05892	9.99835	01
100	8.94030		8.94195		1.05805	9.99834	00
	Cos	d.	Cot	d. c.	Tan	Sin	

P. P.

	97	96	95	94	93	92	91	90	89	88	87
1	9.7	9.6	9.5	9.4	9.3	9.2	9.1	9.0	8.9	8.8	8.7
2	19.4	19.2	19.0	18.8	18.6	18.4	18.2	18.0	17.8	17.6	17.4
3	29.1	28.8	28.5	28.2	27.9	27.6	27.3	27.0	26.7	26.4	26.1
4	38.8	38.4	38.0	37.6	37.2	36.8	36.4	36.0	35.6	35.2	34.8
5	48.5	48.0	47.5	47.0	46.5	46.0	45.5	45.0	44.5	44.0	43.5
6	58.2	57.6	57.0	56.4	55.8	55.2	54.6	54.0	53.4	52.8	52.2
7	67.9	67.2	66.5	65.8	65.1	64.4	63.7	63.0	62.3	61.6	60.9
8	77.6	76.8	76.0	75.2	74.4	73.6	72.8	72.0	71.2	70.4	69.6
9	87.3	86.4	85.5	84.6	83.7	82.8	81.9	81.0	80.1	79.2	78.3

P. P.

5° 174°

	Sin	d.	Tan	d. c.	Cot	Cos	
00	8.94030	86	8.94195	87	1.05805	9.99834	100
01	8.94116	87	8.94282	87	1.05718	9.99834	99
02	8.94203	86	8.94369	87	1.05631	9.99833	98
03	8.94289	86	8.94456	87	1.05544	9.99832	97
04	8.94375	86	8.94543	87	1.05457	9.99832	96
05	8.94461	85	8.94630	86	1.05370	9.99831	95
06	8.94546	86	8.94716	86	1.05284	9.99830	94
07	8.94632	85	8.94802	86	1.05198	9.99830	93
08	8.94717	85	8.94888	86	1.05112	9.99829	92
09	8.94802	85	8.94974	86	1.05026	9.99828	91
10	8.94887	85	8.95060	85	1.04940	9.99828	90
11	8.94972	85	8.95145	86	1.04855	9.99827	89
12	8.95057	84	8.95231	85	1.04769	9.99826	88
13	8.95141	85	8.95316	85	1.04684	9.99826	87
14	8.95226	84	8.95401	85	1.04599	9.99825	86
15	8.95310	84	8.95486	84	1.04514	9.99824	85
16	8.95394	84	8.95570	85	1.04430	9.99824	84
17	8.95478	84	8.95655	84	1.04345	9.99823	83
18	8.95562	83	8.95739	84	1.04261	9.99822	82
19	8.95645	83	8.95823	85	1.04177	9.99822	81
20	8.95728	84	8.95908	83	1.04092	9.99821	80
21	8.95812	83	8.95991	84	1.04009	9.99820	79
22	8.95895	83	8.96075	84	1.03925	9.99820	78
23	8.95978	82	8.96159	83	1.03841	9.99819	77
24	8.96060	83	8.96242	83	1.03758	9.99818	76
25	8.96143	82	8.96325	84	1.03675	9.99817	75
26	8.96225	83	8.96409	83	1.03591	9.99817	74
27	8.96308	82	8.96492	82	1.03508	9.99816	73
28	8.96390	82	8.96574	83	1.03426	9.99815	72
29	8.96472	81	8.96657	82	1.03343	9.99815	71
30	8.96553	82	8.96739	83	1.03261	9.99814	70
31	8.96635	81	8.96822	82	1.03178	9.99813	69
32	8.96716	82	8.96904	82	1.03096	9.99813	68
33	8.96798	81	8.96986	82	1.03014	9.99812	67
34	8.96879	81	8.97068	82	1.02932	9.99811	66
35	8.96960	81	8.97150	81	1.02850	9.99810	65
36	8.97041	81	8.97231	82	1.02769	9.99810	64
37	8.97122	80	8.97313	81	1.02687	9.99809	63
38	8.97202	81	8.97394	81	1.02606	9.99808	62
39	8.97283	80	8.97475	81	1.02525	9.99808	61
40	8.97363	80	8.97556	81	1.02444	9.99807	60
41	8.97443	80	8.97637	80	1.02363	9.99806	59
42	8.97523	80	8.97717	81	1.02283	9.99805	58
43	8.97603	79	8.97798	80	1.02202	9.99805	57
44	8.97682	80	8.97878	81	1.02122	9.99804	56
45	8.97762	79	8.97959	80	1.02041	9.99803	55
46	8.97841	79	8.98039	80	1.01961	9.99803	54
47	8.97920	80	8.98119	80	1.01881	9.99802	53
48	8.98000	78	8.98199	79	1.01801	9.99801	52
49	8.98078	79	8.98278	80	1.01722	9.99800	51
50	8.98157		8.98358		1.01642	9.99800	50
	Cos	d.	Cot	d. c.	Tan	Sin	

P. P.

	87	86
1	8.7	8.6
2	17.4	17.2
3	26.1	25.8
4	34.8	34.4
5	43.5	43.0
6	52.2	51.6
7	60.9	60.2
8	69.6	68.8
9	78.3	77.4

	85	84
1	8.5	8.4
2	17.0	16.8
3	25.5	25.2
4	34.0	33.6
5	42.5	42.0
6	51.0	50.4
7	59.5	58.8
8	68.0	67.2
9	76.5	75.6

	83
1	8.3
2	16.6
3	24.9
4	33.2
5	41.5
6	49.8
7	58.1
8	66.4
9	74.7

	82	81
1	8.2	8.1
2	16.4	16.2
3	24.6	24.3
4	32.8	32.4
5	41.0	40.5
6	49.2	48.6
7	57.4	56.7
8	65.6	64.8
9	73.8	72.9

	80
1	8.0
2	16.0
3	24.0
4	32.0
5	40.0
6	48.0
7	56.0
8	64.0
9	72.0

	79	78
1	7.9	7.8
2	15.8	15.6
3	23.7	23.4
4	31.6	31.2
5	39.5	39.0
6	47.4	46.8
7	55.3	54.6
8	63.2	62.4
9	71.1	70.2

P. P.

95° 84°

	Sin	d.	Tan	d. c.	Cot	Cos	
50	8.98157	79	8.98358	79	1.01642	9.99800	50
51	8.98236	78	8.98437	79	1.01563	9.99799	49
52	8.98314	79	8.98516	79	1.01484	9.99798	48
53	8.98393	78	8.98595	79	1.01405	9.99797	47
54	8.98471	78	8.98674	79	1.01326	9.99797	46
55	8.98549	78	8.98753	79	1.01247	9.99796	45
56	8.98627	78	8.98832	78	1.01168	9.99795	44
57	8.98705	77	8.98910	79	1.01090	9.99794	43
58	8.98782	78	8.98989	78	1.01011	9.99794	42
59	8.98860	77	8.99067	78	1.00933	9.99793	41
60	8.98937	78	8.99145	78	1.00855	9.99792	40
61	8.99015	77	8.99223	78	1.00777	9.99791	39
62	8.99092	77	8.99301	78	1.00699	9.99791	38
63	8.99169	76	8.99379	77	1.00621	9.99790	37
64	8.99245	77	8.99456	78	1.00544	9.99789	36
65	8.99322	77	8.99534	77	1.00466	9.99788	35
66	8.99399	76	8.99611	77	1.00389	9.99788	34
67	8.99475	76	8.99688	77	1.00312	9.99787	33
68	8.99551	77	8.99765	77	1.00235	9.99786	32
69	8.99628	76	8.99842	77	1.00158	9.99785	31
70	8.99704	75	8.99919	76	1.00081	9.99785	30
71	8.99779	76	8.99995	77	1.00005	9.99784	29
72	8.99855	76	9.00072	76	0.99928	9.99783	28
73	8.99931	75	9.00148	77	0.99852	9.99782	27
74	9.00006	76	9.00225	76	0.99775	9.99782	26
75	9.00082	75	9.00301	76	0.99699	9.99781	25
76	9.00157	75	9.00377	75	0.99623	9.99780	24
77	9.00232	75	9.00452	76	0.99548	9.99779	23
78	9.00307	75	9.00528	76	0.99472	9.99779	22
79	9.00382	74	9.00604	75	0.99396	9.99778	21
80	9.00456	75	9.00679	76	0.99321	9.99777	20
81	9.00531	74	9.00755	75	0.99245	9.99776	19
82	9.00605	75	9.00830	75	0.99170	9.99776	18
83	9.00680	74	9.00905	75	0.99095	9.99775	17
84	9.00754	74	9.00980	75	0.99020	9.99774	16
85	9.00828	74	9.01055	74	0.98945	9.99773	15
86	9.00902	74	9.01129	75	0.98871	9.99772	14
87	9.00976	73	9.01204	74	0.98796	9.99772	13
88	9.01049	74	9.01278	75	0.98722	9.99771	12
89	9.01123	73	9.01353	74	0.98647	9.99770	11
90	9.01196	73	9.01427	74	0.98573	9.99769	10
91	9.01269	74	9.01501	74	0.98499	9.99769	09
92	9.01343	73	9.01575	74	0.98425	9.99768	08
93	9.01416	73	9.01649	73	0.98351	9.99767	07
94	9.01489	72	9.01722	74	0.98278	9.99766	06
95	9.01561	73	9.01796	73	0.98204	9.99765	05
96	9.01634	73	9.01869	74	0.98131	9.99765	04
97	9.01707	72	9.01943	73	0.98057	9.99764	03
98	9.01779	72	9.02016	73	0.97984	9.99763	02
99	9.01851	72	9.02089	73	0.97911	9.99762	01
100	9.01923		9.02162		0.97838	9.99761	00
	Cos	d.	Cot	d. c.	Tan	Sin	

P. P.

	79	78
1	7.9	7.8
2	15.8	15.6
3	23.7	23.4
4	31.6	31.2
5	39.5	39.0
6	47.4	46.8
7	55.3	54.6
8	63.2	62.4
9	71.1	70.2

	77
1	7.7
2	15.4
3	23.1
4	30.8
5	38.5
6	46.2
7	53.9
8	61.6
9	69.3

	76
1	7.6
2	15.2
3	22.8
4	30.4
5	38.0
6	45.6
7	53.2
8	60.8
9	68.4

	75	74
1	7.5	7.4
2	15.0	14.8
3	22.5	22.2
4	30.0	29.6
5	37.5	37.0
6	45.0	44.4
7	52.5	51.8
8	60.0	59.2
9	67.5	66.6

	73
1	7.3
2	14.6
3	21.9
4	29.2
5	36.5
6	43.8
7	51.1
8	58.4
9	65.7

	72
1	7.2
2	14.4
3	21.6
4	28.8
5	36.0
6	43.2
7	50.4
8	57.6
9	64.8

P. P.

	Sin	d.	Tan	d. c.	Cot	Cos	
00	9.01923	73	9.02162	73	0.97838	9.99761	100
01	9.01996	71	9.02235	73	0.97765	9.99761	99
02	9.02067	72	9.02308	72	0.97692	9.99760	98
03	9.02139	72	9.02380	73	0.97620	9.99759	97
04	9.02211	72	9.02453	72	0.97547	9.99758	96
05	9.02283	71	9.02525	72	0.97475	9.99757	95
06	9.02354	71	9.02597	73	0.97403	9.99757	94
07	9.02425	72	9.02670	72	0.97330	9.99756	93
08	9.02497	71	9.02742	71	0.97258	9.99755	92
09	9.02568	71	9.02813	72	0.97187	9.99754	91
10	9.02639	71	9.02885	72	0.97115	9.99753	90
11	9.02710	70	9.02957	71	0.97043	9.99753	89
12	9.02780	71	9.03028	72	0.96972	9.99752	88
13	9.02851	70	9.03100	71	0.96900	9.99751	87
14	9.02921	71	9.03171	71	0.96829	9.99750	86
15	9.02992	70	9.03242	72	0.96758	9.99749	85
16	9.03062	70	9.03314	71	0.96686	9.99749	84
17	9.03132	70	9.03385	70	0.96615	9.99748	83
18	9.03202	70	9.03455	71	0.96545	9.99747	82
19	9.03272	70	9.03526	71	0.96474	9.99746	81
20	9.03342	70	9.03597	70	0.96403	9.99745	80
21	9.03412	69	9.03667	71	0.96333	9.99744	79
22	9.03481	70	9.03738	70	0.96262	9.99744	78
23	9.03551	69	9.03808	70	0.96192	9.99743	77
24	9.03620	70	9.03878	70	0.96122	9.99742	76
25	9.03690	69	9.03948	70	0.96052	9.99741	75
26	9.03759	69	9.04018	70	0.95982	9.99740	74
27	9.03828	69	9.04088	70	0.95912	9.99739	73
28	9.03897	69	9.04158	70	0.95842	9.99739	72
29	9.03966	68	9.04228	69	0.95772	9.99738	71
30	9.04034	69	9.04297	70	0.95703	9.99737	70
31	9.04103	68	9.04367	69	0.95633	9.99736	69
32	9.04171	69	9.04436	69	0.95564	9.99735	68
33	9.04240	68	9.04505	69	0.95495	9.99734	67
34	9.04308	68	9.04574	69	0.95426	9.99734	66
35	9.04376	68	9.04643	69	0.95357	9.99733	65
36	9.04444	68	9.04712	69	0.95288	9.99732	64
37	9.04512	68	9.04781	69	0.95219	9.99731	63
38	9.04580	68	9.04850	68	0.95150	9.99730	62
39	9.04648	67	9.04918	69	0.95082	9.99729	61
40	9.04715	68	9.04987	68	0.95013	9.99728	60
41	9.04783	67	9.05055	69	0.94945	9.99728	59
42	9.04850	68	9.05124	68	0.94876	9.99727	58
43	9.04918	67	9.05192	68	0.94808	9.99726	57
44	9.04985	67	9.05260	68	0.94740	9.99725	56
45	9.05052	67	9.05328	68	0.94672	9.99724	55
46	9.05119	67	9.05396	67	0.94604	9.99723	54
47	9.05186	67	9.05463	68	0.94537	9.99723	53
48	9.05253	66	9.05531	68	0.94469	9.99722	52
49	9.05319	67	9.05599	67	0.94401	9.99721	51
50	9.05386		9.05666		0.94334	9.99720	50
	Cos	d.	Cot	d. c.	Tan	Sin	

P. P.

	73	72	71	70	69	68	67	66
1	7.3	7.2	7.1	7.0	6.9	6.8	6.7	6.6
2	14.6	14.4	14.2	14.0	13.8	13.6	13.4	13.2
3	21.9	21.6	21.3	21.0	20.7	20.4	20.1	19.8
4	29.2	28.8	28.4	28.0	27.6	27.2	26.8	26.4
5	36.5	36.0	35.5	35.0	34.5	34.0	33.5	33.0
6	43.8	43.2	42.6	42.0	41.4	40.8	40.2	39.6
7	51.1	50.4	49.7	49.0	48.3	47.6	46.9	46.2
8	58.4	57.6	56.8	56.0	55.2	54.4	53.6	52.8
9	65.7	64.8	63.9	63.0	62.1	61.2	60.3	59.4

P. P.

	Sin	d.	Tan	d. c.	Cot	Cos	
50	9.05386	66	9.05666	67	0.94334	9.99720	50
51	9.05452	67	9.05733	68	0.94267	9.99719	49
52	9.05519	66	9.05801	67	0.94199	9.99718	48
53	9.05585	66	9.05868	67	0.94132	9.99717	47
54	9.05651	66	9.05935	67	0.94065	9.99716	46
55	9.05717	66	9.06002	66	0.93998	9.99716	45
56	9.05783	66	9.06068	67	0.93932	9.99715	44
57	9.05849	66	9.06135	67	0.93865	9.99714	43
58	9.05915	65	9.06202	66	0.93798	9.99713	42
59	9.05980	66	9.06268	67	0.93732	9.99712	41
60	9.06046	66	9.06335	66	0.93665	9.99711	40
61	9.06112	65	9.06401	66	0.93599	9.99710	39
62	9.06177	65	9.06467	67	0.93533	9.99709	38
63	9.06242	65	9.06534	66	0.93466	9.99709	37
64	9.06307	65	9.06600	66	0.93400	9.99708	36
65	9.06372	65	9.06666	65	0.93334	9.99707	35
66	9.06437	65	9.06731	66	0.93269	9.99706	34
67	9.06502	65	9.06797	66	0.93203	9.99705	33
68	9.06567	65	9.06863	65	0.93137	9.99704	32
69	9.06632	64	9.06928	66	0.93072	9.99703	31
70	9.06696	65	9.06994	65	0.93006	9.99702	30
71	9.06761	64	9.07059	65	0.92941	9.99701	29
72	9.06825	64	9.07124	66	0.92876	9.99701	28
73	9.06889	65	9.07190	65	0.92810	9.99700	27
74	9.06954	64	9.07255	65	0.92745	9.99699	26
75	9.07018	64	9.07320	65	0.92680	9.99698	25
76	9.07082	63	9.07385	64	0.92615	9.99697	24
77	9.07145	64	9.07449	65	0.92551	9.99696	23
78	9.07209	64	9.07514	65	0.92486	9.99695	22
79	9.07273	64	9.07579	64	0.92421	9.99694	21
80	9.07337	63	9.07643	65	0.92357	9.99693	20
81	9.07400	64	9.07708	64	0.92292	9.99693	19
82	9.07464	63	9.07772	64	0.92228	9.99692	18
83	9.07527	63	9.07836	64	0.92164	9.99691	17
84	9.07590	63	9.07900	64	0.92100	9.99690	16
85	9.07653	63	9.07964	64	0.92036	9.99689	15
86	9.07716	63	9.08028	64	0.91972	9.99688	14
87	9.07779	63	9.08092	64	0.91908	9.99687	13
88	9.07842	63	9.08156	64	0.91844	9.99686	12
89	9.07905	63	9.08220	63	0.91780	9.99685	11
90	9.07968	62	9.08283	64	0.91717	9.99684	10
91	9.08030	63	9.08347	63	0.91653	9.99683	09
92	9.08093	62	9.08410	64	0.91590	9.99682	08
93	9.08155	62	9.08474	63	0.91526	9.99682	07
94	9.08217	63	9.08537	63	0.91463	9.99681	06
95	9.08280	62	9.08600	63	0.91400	9.99680	05
96	9.08342	62	9.08663	63	0.91337	9.99679	04
97	9.08404	62	9.08726	63	0.91274	9.99678	03
98	9.08466	62	9.08789	63	0.91211	9.99677	02
99	9.08528	61	9.08852	62	0.91148	9.99676	01
100	9.08589		9.08914		0.91086	9.99675	00
	Cos	d.	Cot	d. c.	Tan	Sin	

P. P.

	68	67	66	65	64	63	62	61
1	6.8	6.7	6.6	6.5	6.4	6.3	6.2	6.1
2	13.6	13.4	13.2	13.0	12.8	12.6	12.4	12.2
3	20.4	20.1	19.8	19.5	19.2	18.9	18.6	18.3
4	27.2	26.8	26.4	26.0	25.6	25.2	24.8	24.4
5	34.0	33.5	33.0	32.5	32.0	31.5	31.0	30.5
6	40.8	40.2	39.6	39.0	38.4	37.8	37.2	36.6
7	47.6	46.9	46.2	45.5	44.8	44.1	43.4	42.7
8	54.4	53.6	52.8	52.0	51.2	50.4	49.6	48.8
9	61.2	60.3	59.4	58.5	57.6	56.7	55.8	54.9

P. P.

′	Sin	d.	Tan	d. c.	Cot	Cos	′
00	9.08589	62	9.08914	63	0.91086	9.99675	100
01	9.08651	62	9.08977	63	0.91023	9.99674	99
02	9.08713	61	9.09040	62	0.90960	9.99673	98
03	9.08774	62	9.09102	62	0.90898	9.99672	97
04	9.08836	61	9.09164	63	0.90836	9.99671	96
05	9.08897	61	9.09227	62	0.90773	9.99670	95
06	9.08958	61	9.09289	62	0.90711	9.99669	94
07	9.09019	61	9.09351	62	0.90649	9.99669	93
08	9.09080	61	9.09413	62	0.90587	9.99668	92
09	9.09141	61	9.09475	62	0.90525	9.99667	91
10	9.09202	61	9.09537	61	0.90463	9.99666	90
11	9.09263	61	9.09598	62	0.90402	9.99665	89
12	9.09324	61	9.09660	62	0.90340	9.99664	88
13	9.09385	60	9.09722	61	0.90278	9.99663	87
14	9.09445	61	9.09783	62	0.90217	9.99662	86
15	9.09506	60	9.09845	61	0.90155	9.99661	85
16	9.09566	60	9.09906	61	0.90094	9.99660	84
17	9.09626	60	9.09967	61	0.90033	9.99659	83
18	9.09686	61	9.10028	61	0.89972	9.99658	82
19	9.09747	60	9.10089	61	0.89911	9.99657	81
20	9.09807	60	9.10150	61	0.89850	9.99656	80
21	9.09867	59	9.10211	61	0.89789	9.99655	79
22	9.09926	60	9.10272	61	0.89728	9.99654	78
23	9.09986	60	9.10333	61	0.89667	9.99653	77
24	9.10046	60	9.10394	60	0.89606	9.99652	76
25	9.10106	59	9.10454	61	0.89546	9.99651	75
26	9.10165	60	9.10515	60	0.89485	9.99650	74
27	9.10225	59	9.10575	60	0.89425	9.99649	73
28	9.10284	59	9.10635	61	0.89365	9.99648	72
29	9.10343	59	9.10696	60	0.89304	9.99648	71
30	9.10402	60	9.10756	60	0.89244	9.99647	70
31	9.10462	59	9.10816	60	0.89184	9.99646	69
32	9.10521	59	9.10876	60	0.89124	9.99645	68
33	9.10580	58	9.10936	60	0.89064	9.99644	67
34	9.10638	59	9.10996	60	0.89004	9.99643	66
35	9.10697	59	9.11056	59	0.88944	9.99642	65
36	9.10756	59	9.11115	60	0.88885	9.99641	64
37	9.10815	58	9.11175	59	0.88825	9.99640	63
38	9.10873	59	9.11234	60	0.88766	9.99639	62
39	9.10932	58	9.11294	59	0.88706	9.99638	61
40	9.10990	58	9.11353	60	0.88647	9.99637	60
41	9.11048	59	9.11413	59	0.88587	9.99636	59
42	9.11107	58	9.11472	59	0.88528	9.99635	58
43	9.11165	58	9.11531	59	0.88469	9.99634	57
44	9.11223	58	9.11590	59	0.88410	9.99633	56
45	9.11281	58	9.11649	59	0.88351	9.99632	55
46	9.11339	58	9.11708	59	0.88292	9.99631	54
47	9.11397	57	9.11767	59	0.88233	9.99630	53
48	9.11454	58	9.11826	58	0.88174	9.99629	52
49	9.11512	58	9.11884	59	0.88116	9.99628	51
50	9.11570		9.11943		0.88057	9.99627	50
	Cos	d.	Cot	d. c.	Tan	Sin	

P. P.

	63	62	61	60	59	58
1	6.3	6.2	6.1	6.0	5.9	5.8
2	12.6	12.4	12.2	12.0	11.8	11.6
3	18.9	18.6	18.3	18.0	17.7	17.4
4	25.2	24.8	24.4	24.0	23.6	23.2
5	31.5	31.0	30.5	30.0	29.5	29.0
6	37.8	37.2	36.6	36.0	35.4	34.8
7	44.1	43.4	42.7	42.0	41.3	40.6
8	50.4	49.6	48.8	48.0	47.2	46.4
9	56.7	55.8	54.9	54.0	53.1	52.2

	Sin	d.	Tan	d. c.	Cot	Cos	
50	9.11570	57	9.11943	58	0.88057	9.99627	50
51	9.11627	58	9.12001	59	0.87999	9.99626	49
52	9.11685	57	9.12060	58	0.87940	9.99625	48
53	9.11742	57	9.12118	59	0.87882	9.99624	47
54	9.11799	58	9.12177	58	0.87823	9.99623	46
55	9.11857	57	9.12235	58	0.87765	9.99622	45
56	9.11914	57	9.12293	58	0.87707	9.99621	44
57	9.11971	57	9.12351	58	0.87649	9.99620	43
58	9.12028	57	9.12409	58	0.87591	9.99619	42
59	9.12085	57	9.12467	58	0.87533	9.99618	41
60	9.12142	56	9.12525	58	0.87475	9.99617	40
61	9.12198	57	9.12583	57	0.87417	9.99616	39
62	9.12255	57	9.12640	58	0.87360	9.99615	38
63	9.12312	56	9.12698	58	0.87302	9.99614	37
64	9.12368	57	9.12756	57	0.87244	9.99613	36
65	9.12425	56	9.12813	57	0.87187	9.99612	35
66	9.12481	56	9.12870	58	0.87130	9.99611	34
67	9.12537	57	9.12928	57	0.87072	9.99610	33
68	9.12594	56	9.12985	57	0.87015	9.99609	32
69	9.12650	56	9.13042	57	0.86958	9.99608	31
70	9.12706	56	9.13099	57	0.86901	9.99607	30
71	9.12762	56	9.13156	57	0.86844	9.99606	29
72	9.12818	56	9.13213	57	0.86787	9.99605	28
73	9.12874	56	9.13270	57	0.86730	9.99604	27
74	9.12930	55	9.13327	57	0.86673	9.99603	26
75	9.12985	56	9.13384	57	0.86616	9.99601	25
76	9.13041	56	9.13441	56	0.86559	9.99600	24
77	9.13097	55	9.13497	57	0.86503	9.99599	23
78	9.13152	56	9.13554	56	0.86446	9.99598	22
79	9.13208	55	9.13610	57	0.86390	9.99597	21
80	9.13263	55	9.13667	56	0.86333	9.99596	20
81	9.13318	55	9.13723	56	0.86277	9.99595	19
82	9.13373	56	9.13779	56	0.86221	9.99594	18
83	9.13429	55	9.13835	57	0.86165	9.99593	17
84	9.13484	55	9.13892	56	0.86108	9.99592	16
85	9.13539	55	9.13948	56	0.86052	9.99591	15
86	9.13594	55	9.14004	56	0.85996	9.99590	14
87	9.13649	54	9.14060	55	0.85940	9.99589	13
88	9.13703	55	9.14115	56	0.85885	9.99588	12
89	9.13758	55	9.14171	56	0.85829	9.99587	11
90	9.13813	54	9.14227	56	0.85773	9.99586	10
91	9.13867	55	9.14283	55	0.85717	9.99585	09
92	9.13922	54	9.14338	56	0.85662	9.99584	08
93	9.13976	55	9.14394	55	0.85606	9.99583	07
94	9.14031	54	9.14449	55	0.85551	9.99582	06
95	9.14085	54	9.14504	56	0.85496	9.99581	05
96	9.14139	54	9.14560	55	0.85440	9.99580	04
97	9.14193	55	9.14615	55	0.85385	9.99578	03
98	9.14248	54	9.14670	55	0.85330	9.99577	02
99	9.14302	54	9.14725	55	0.85275	9.99576	01
100	9.14356		9.14780		0.85220	9.99575	00
	Cos	d.	Cot	d. c.	Tan	Sin	

P. P.	59	58	57	56	55	54
1	5.9	5.8	5.7	5.6	5.5	5.4
2	11.8	11.6	11.4	11.2	11.0	10.8
3	17.7	17.4	17.1	16.8	16.5	16.2
4	23.6	23.2	22.8	22.4	22.0	21.6
5	29.5	29.0	28.5	28.0	27.5	27.0
6	35.4	34.8	34.2	33.6	33.0	32.4
7	41.3	40.6	39.9	39.2	38.5	37.8
8	47.2	46.4	45.6	44.8	44.0	43.2
9	53.1	52.2	51.3	50.4	49.5	48.6

	Sin	d.	Tan	d. c.	Cot	Cos	
00	9.14356	53	9.14780	55	0.85220	9.99575	100
01	9.14409	54	9.14835	55	0.85165	9.99574	99
02	9.14463	54	9.14890	55	0.85110	9.99573	98
03	9.14517	54	9.14945	55	0.85055	9.99572	97
04	9.14571	53	9.15000	54	0.85000	9.99571	96
05	9.14624	54	9.15054	55	0.84946	9.99570	95
06	9.14678	53	9.15109	55	0.84891	9.99569	94
07	9.14731	54	9.15164	54	0.84836	9.99568	93
08	9.14785	53	9.15218	55	0.84782	9.99567	92
09	9.14838	53	9.15273	54	0.84727	9.99566	91
10	9.14891	54	9.15327	54	0.84673	9.99565	90
11	9.14945	53	9.15381	54	0.84619	9.99563	89
12	9.14998	53	9.15435	55	0.84565	9.99562	88
13	9.15051	53	9.15490	54	0.84510	9.99561	87
14	9.15104	53	9.15544	54	0.84456	9.99560	86
15	9.15157	53	9.15598	54	0.84402	9.99559	85
16	9.15210	53	9.15652	54	0.84348	9.99558	84
17	9.15263	52	9.15706	54	0.84294	9.99557	83
18	9.15315	53	9.15760	53	0.84240	9.99556	82
19	9.15368	53	9.15813	54	0.84187	9.99555	81
20	9.15421	52	9.15867	54	0.84133	9.99554	80
21	9.15473	53	9.15921	53	0.84079	9.99553	79
22	9.15526	52	9.15974	54	0.84026	9.99552	78
23	9.15578	53	9.16028	53	0.83972	9.99550	77
24	9.15631	52	9.16081	54	0.83919	9.99549	76
25	9.15683	52	9.16135	53	0.83865	9.99548	75
26	9.15735	52	9.16188	53	0.83812	9.99547	74
27	9.15787	53	9.16241	54	0.83759	9.99546	73
28	9.15840	52	9.16295	53	0.83705	9.99545	72
29	9.15892	52	9.16348	53	0.83652	9.99544	71
30	9.15944	51	9.16401	53	0.83599	9.99543	70
31	9.15995	52	9.16454	53	0.83546	9.99542	69
32	9.16047	52	9.16507	53	0.83493	9.99540	68
33	9.16099	52	9.16560	53	0.83440	9.99539	67
34	9.16151	52	9.16613	52	0.83387	9.99538	66
35	9.16203	51	9.16665	53	0.83335	9.99537	65
36	9.16254	52	9.16718	53	0.83282	9.99536	64
37	9.16306	51	9.16771	52	0.83229	9.99535	63
38	9.16357	52	9.16823	53	0.83177	9.99534	62
39	9.16409	51	9.16876	52	0.83124	9.99533	61
40	9.16460	51	9.16928	53	0.83072	9.99532	60
41	9.16511	52	9.16981	52	0.83019	9.99530	59
42	9.16563	51	9.17033	52	0.82967	9.99529	58
43	9.16614	51	9.17085	53	0.82915	9.99528	57
44	9.16665	51	9.17138	52	0.82862	9.99527	56
45	9.16716	51	9.17190	52	0.82810	9.99526	55
46	9.16767	51	9.17242	52	0.82758	9.99525	54
47	9.16818	51	9.17294	52	0.82706	9.99524	53
48	9.16869	50	9.17346	52	0.82654	9.99523	52
49	9.16919	51	9.17398	52	0.82602	9.99521	51
50	9.16970		9.17450		0.82550	9.99520	50
	Cos	d.	Cot	d. c.	Tan	Sin	

P. P.

	55	54	53	52	51
1	5.5	5.4	5.3	5.2	5.1
2	11.0	10.8	10.6	10.4	10.2
3	16.5	16.2	15.9	15.6	15.3
4	22.0	21.6	21.2	20.8	20.4
5	27.5	27.0	26.5	26.0	25.5
6	33.0	32.4	31.8	31.2	30.6
7	38.5	37.8	37.1	36.4	35.7
8	44.0	43.2	42.4	41.6	40.8
9	49.5	48.6	47.7	46.8	45.9

P. P.

	Sin	d.	Tan	d. c.	Cot	Cos	
50	9.16970	51	9.17450	52	0.82550	9.99520	50
51	9.17021	51	9.17502	51	0.82498	9.99519	49
52	9.17072	50	9.17553	52	0.82447	9.99518	48
53	9.17122	51	9.17605	52	0.82395	9.99517	47
54	9.17173	50	9.17657	51	0.82343	9.99516	46
55	9.17223	50	9.17708	52	0.82292	9.99515	45
56	9.17273	51	9.17760	51	0.82240	9.99514	44
57	9.17324	50	9.17811	52	0.82189	9.99512	43
58	9.17374	50	9.17863	51	0.82137	9.99511	42
59	9.17424	50	9.17914	51	0.82086	9.99510	41
60	9.17474	50	9.17965	52	0.82035	9.99509	40
61	9.17524	51	9.18017	51	0.81983	9.99508	39
62	9.17575	49	9.18068	51	0.81932	9.99507	38
63	9.17624	50	9.18119	51	0.81881	9.99505	37
64	9.17674	50	9.18170	51	0.81830	9.99504	36
65	9.17724	50	9.18221	51	0.81779	9.99503	35
66	9.17774	50	9.18272	51	0.81728	9.99502	34
67	9.17824	49	9.18323	51	0.81677	9.99501	33
68	9.17873	50	9.18374	51	0.81626	9.99500	32
69	9.17923	50	9.18425	50	0.81575	9.99499	31
70	9.17973	49	9.18475	51	0.81525	9.99497	30
71	9.18022	50	9.18526	51	0.81474	9.99496	29
72	9.18072	49	9.18577	50	0.81423	9.99495	28
73	9.18121	49	9.18627	51	0.81373	9.99494	27
74	9.18170	50	9.18678	50	0.81322	9.99493	26
75	9.18220	49	9.18728	50	0.81272	9.99492	25
76	9.18269	49	9.18778	51	0.81222	9.99490	24
77	9.18318	49	9.18829	50	0.81171	9.99489	23
78	9.18367	49	9.18879	50	0.81121	9.99488	22
79	9.18416	49	9.18929	50	0.81071	9.99487	21
80	9.18465	49	9.18979	50	0.81021	9.99486	20
81	9.18514	49	9.19029	51	0.80971	9.99485	19
82	9.18563	49	9.19080	50	0.80920	9.99483	18
83	9.18612	49	9.19130	49	0.80870	9.99482	17
84	9.18661	48	9.19179	50	0.80821	9.99481	16
85	9.18709	49	9.19229	50	0.80771	9.99480	15
86	9.18758	48	9.19279	50	0.80721	9.99479	14
87	9.18806	49	9.19329	50	0.80671	9.99477	13
88	9.18855	49	9.19379	49	0.80621	9.99476	12
89	9.18904	48	9.19428	50	0.80572	9.99475	11
90	9.18952	48	9.19478	50	0.80522	9.99474	10
91	9.19000	49	9.19528	49	0.80472	9.99473	09
92	9.19049	48	9.19577	50	0.80423	9.99472	08
93	9.19097	48	9.19627	49	0.80373	9.99470	07
94	9.19145	48	9.19676	49	0.80324	9.99469	06
95	9.19193	48	9.19725	50	0.80275	9.99468	05
96	9.19241	48	9.19775	49	0.80225	9.99467	04
97	9.19289	48	9.19824	49	0.80176	9.99466	03
98	9.19337	48	9.19873	49	0.80127	9.99464	02
99	9.19385	48	9.19922	49	0.80078	9.99463	01
100	9.19433		9.19971		0.80029	9.99462	00
	Cos	d.	Cot	d. c.	Tan	Sin	

P. P.

	52	51	50	49	48
1	5.2	5.1	5.0	4.9	4.8
2	10.4	10.2	10.0	9.8	9.6
3	15.6	15.3	15.0	14.7	14.4
4	20.8	20.4	20.0	19.6	19.2
5	26.0	25.5	25.0	24.5	24.0
6	31.2	30.6	30.0	29.4	28.8
7	36.4	35.7	35.0	34.3	33.6
8	41.6	40.8	40.0	39.2	38.4
9	46.8	45.9	45.0	44.1	43.2

P. P.

	Sin	d.	Tan	d. c.	Cot	Cos	
00	9.19433	48	9.19971	49	0.80029	9.99462	100
01	9.19481	48	9.20020	49	0.79980	9.99461	99
02	9.19529	48	9.20069	49	0.79931	9.99460	98
03	9.19577	47	9.20118	49	0.79882	9.99458	97
04	9.19624	48	9.20167	49	0.79833	9.99457	96
05	9.19672	47	9.20216	49	0.79784	9.99456	95
06	9.19719	48	9.20265	48	0.79735	9.99455	94
07	9.19767	47	9.20313	49	0.79687	9.99454	93
08	9.19814	48	9.20362	49	0.79638	9.99452	92
09	9.19862	47	9.20411	48	0.79589	9.99451	91
10	9.19909	47	9.20459	49	0.79541	9.99450	90
11	9.19956	48	9.20508	48	0.79492	9.99449	89
12	9.20004	47	9.20556	49	0.79444	9.99447	88
13	9.20051	47	9.20605	48	0.79395	9.99446	87
14	9.20098	47	9.20653	48	0.79347	9.99445	86
15	9.20145	47	9.20701	49	0.79299	9.99444	85
16	9.20192	47	9.20750	48	0.79250	9.99443	84
17	9.20239	47	9.20798	48	0.79202	9.99441	83
18	9.20286	47	9.20846	48	0.79154	9.99440	82
19	9.20333	47	9.20894	48	0.79106	9.99439	81
20	9.20380	47	9.20942	48	0.79058	9.99438	80
21	9.20427	46	9.20990	48	0.79010	9.99436	79
22	9.20473	47	9.21038	48	0.78962	9.99435	78
23	9.20520	47	9.21086	48	0.78914	9.99434	77
24	9.20567	46	9.21134	48	0.78866	9.99433	76
25	9.20613	47	9.21182	47	0.78818	9.99432	75
26	9.20660	46	9.21229	48	0.78771	9.99430	74
27	9.20706	46	9.21277	48	0.78723	9.99429	73
28	9.20752	47	9.21325	47	0.78675	9.99428	72
29	9.20799	46	9.21372	48	0.78628	9.99427	71
30	9.20845	46	9.21420	47	0.78580	9.99425	70
31	9.20891	47	9.21467	48	0.78533	9.99424	69
32	9.20938	46	9.21515	47	0.78485	9.99423	68
33	9.20984	46	9.21562	48	0.78438	9.99422	67
34	9.21030	46	9.21610	47	0.78390	9.99420	66
35	9.21076	46	9.21657	47	0.78343	9.99419	65
36	9.21122	46	9.21704	47	0.78296	9.99418	64
37	9.21168	46	9.21751	47	0.78249	9.99417	63
38	9.21214	46	9.21798	48	0.78202	9.99415	62
39	9.21260	46	9.21846	47	0.78154	9.99414	61
40	9.21306	45	9.21893	47	0.78107	9.99413	60
41	9.21351	46	9.21940	47	0.78060	9.99412	59
42	9.21397	46	9.21987	47	0.78013	9.99410	58
43	9.21443	45	9.22034	46	0.77966	9.99409	57
44	9.21488	46	9.22080	47	0.77920	9.99408	56
45	9.21534	45	9.22127	47	0.77873	9.99407	55
46	9.21579	46	9.22174	47	0.77826	9.99405	54
47	9.21625	45	9.22221	46	0.77779	9.99404	53
48	9.21670	46	9.22267	47	0.77733	9.99403	52
49	9.21716	45	9.22314	47	0.77686	9.99402	51
50	9.21761		9.22361		0.77639	9.99400	50
	Cos	d.	Cot	d. c.	Tan	Sin	

P. P.

	49	48	47	46	45
1	4.9	4.8	4.7	4.6	4.5
2	9.8	9.6	9.4	9.2	9.0
3	14.7	14.4	14.1	13.8	13.5
4	19.6	19.2	18.8	18.4	18.0
5	24.5	24.0	23.5	23.0	22.5
6	29.4	28.8	28.2	27.6	27.0
7	34.3	33.6	32.9	32.2	31.5
8	39.2	38.4	37.6	36.8	36.0
9	44.1	43.2	42.3	41.4	40.5

P. P.

	Sin	d.	Tan	d. c.	Cot	Cos	
50	9.21761	45	9.22361	46	0.77639	9.99400	50
51	9.21806	45	9.22407	47	0.77593	9.99399	49
52	9.21851	46	9.22454	46	0.77546	9.99398	48
53	9.21897	45	9.22500	47	0.77500	9.99396	47
54	9.21942	45	9.22547	46	0.77453	9.99395	46
55	9.21987	45	9.22593	46	0.77407	9.99394	45
56	9.22032	45	9.22639	46	0.77361	9.99393	44
57	9.22077	45	9.22685	47	0.77315	9.99391	43
58	9.22122	45	9.22732	46	0.77268	9.99390	42
59	9.22167	44	9.22778	46	0.77222	9.99389	41
60	9.22211	45	9.22824	46	0.77176	9.99388	40
61	9.22256	45	9.22870	46	0.77130	9.99386	39
62	9.22301	45	9.22916	46	0.77084	9.99385	38
63	9.22346	44	9.22962	46	0.77038	9.99384	37
64	9.22390	45	9.23008	46	0.76992	9.99382	36
65	9.22435	45	9.23054	46	0.76946	9.99381	35
66	9.22480	44	9.23100	46	0.76900	9.99380	34
67	9.22524	44	9.23146	45	0.76854	9.99379	33
68	9.22568	45	9.23191	46	0.76809	9.99377	32
69	9.22613	44	9.23237	46	0.76763	9.99376	31
70	9.22657	45	9.23283	45	0.76717	9.99375	30
71	9.22702	44	9.23328	46	0.76672	9.99373	29
72	9.22746	44	9.23374	45	0.76626	9.99372	28
73	9.22790	44	9.23419	46	0.76581	9.99371	27
74	9.22834	44	9.23465	45	0.76535	9.99369	26
75	9.22878	44	9.23510	46	0.76490	9.99368	25
76	9.22922	45	9.23556	45	0.76444	9.99367	24
77	9.22967	44	9.23601	45	0.76399	9.99366	23
78	9.23011	43	9.23646	46	0.76354	9.99364	22
79	9.23054	44	9.23692	45	0.76308	9.99363	21
80	9.23098	44	9.23737	45	0.76263	9.99362	20
81	9.23142	44	9.23782	45	0.76218	9.99360	19
82	9.23186	44	9.23827	45	0.76173	9.99359	18
83	9.23230	44	9.23872	45	0.76128	9.99358	17
84	9.23274	43	9.23917	45	0.76083	9.99356	16
85	9.23317	44	9.23962	45	0.76038	9.99355	15
86	9.23361	43	9.24007	45	0.75993	9.99354	14
87	9.23404	44	9.24052	45	0.75948	9.99352	13
88	9.23448	43	9.24097	45	0.75903	9.99351	12
89	9.23491	44	9.24142	44	0.75858	9.99350	11
90	9.23535	43	9.24186	45	0.75814	9.99348	10
91	9.23578	44	9.24231	45	0.75769	9.99347	09
92	9.23622	43	9.24276	45	0.75724	9.99346	08
93	9.23665	43	9.24321	44	0.75679	9.99344	07
94	9.23708	44	9.24365	45	0.75635	9.99343	06
95	9.23752	43	9.24410	44	0.75590	9.99342	05
96	9.23795	43	9.24454	45	0.75546	9.99340	04
97	9.23838	43	9.24499	44	0.75501	9.99339	03
98	9.23881	43	9.24543	45	0.75457	9.99338	02
99	9.23924	43	9.24588	44	0.75412	9.99336	01
100	9.23967		9.24632		0.75368	9.99335	00
	Cos	d.	Cot	d. c.	Tan	Sin	

P. P.

	47	46	45	44	43
1	4.7	4.6	4.5	4.4	4.3
2	9.4	9.2	9.0	8.8	8.6
3	14.1	13.8	13.5	13.2	12.9
4	18.8	18.4	18.0	17.6	17.2
5	23.5	23.0	22.5	22.0	21.5
6	28.2	27.6	27.0	26.4	25.8
7	32.9	32.2	31.5	30.8	30.1
8	37.6	36.8	36.0	35.2	34.4
9	42.3	41.4	40.5	39.6	38.7

P. P.

	Sin	d.	Tan	d. c.	Cot	Cos	
00	9.23967	43	9.24632	44	0.75368	9.99335	100
01	9.24010	43	9.24676	44	0.75324	9.99334	99
02	9.24053	43	9.24720	45	0.75280	9.99332	98
03	9.24096	43	9.24765	44	0.75235	9.99331	97
04	9.24139	42	9.24809	44	0.75191	9.99330	96
05	9.24181	43	9.24853	44	0.75147	9.99328	95
06	9.24224	43	9.24897	44	0.75103	9.99327	94
07	9.24267	43	9.24941	44	0.75059	9.99326	93
08	9.24310	42	9.24985	44	0.75015	9.99324	92
09	9.24352	43	9.25029	44	0.74971	9.99323	91
10	9.24395	42	9.25073	44	0.74927	9.99322	90
11	9.24437	43	9.25117	44	0.74883	9.99320	89
12	9.24480	42	9.25161	44	0.74839	9.99319	88
13	9.24522	43	9.25205	43	0.74795	9.99318	87
14	9.24565	42	9.25248	44	0.74752	9.99316	86
15	9.24607	42	9.25292	44	0.74708	9.99315	85
16	9.24649	43	9.25336	43	0.74664	9.99314	84
17	9.24692	42	9.25379	44	0.74621	9.99312	83
18	9.24734	42	9.25423	43	0.74577	9.99311	82
19	9.24776	42	9.25466	44	0.74534	9.99310	81
20	9.24818	42	9.25510	43	0.74490	9.99308	80
21	9.24860	42	9.25553	44	0.74447	9.99307	79
22	9.24902	42	9.25597	43	0.74403	9.99305	78
23	9.24944	42	9.25640	44	0.74360	9.99304	77
24	9.24986	42	9.25684	43	0.74316	9.99303	76
25	9.25028	42	9.25727	43	0.74273	9.99301	75
26	9.25070	42	9.25770	43	0.74230	9.99300	74
27	9.25112	42	9.25813	44	0.74187	9.99299	73
28	9.25154	42	9.25857	43	0.74143	9.99297	72
29	9.25196	41	9.25900	43	0.74100	9.99296	71
30	9.25237	42	9.25943	43	0.74057	9.99294	70
31	9.25279	42	9.25986	43	0.74014	9.99293	69
32	9.25321	41	9.26029	43	0.73971	9.99292	68
33	9.25362	42	9.26072	43	0.73928	9.99290	67
34	9.25404	41	9.26115	43	0.73885	9.99289	66
35	9.25445	42	9.26158	43	0.73842	9.99288	65
36	9.25487	41	9.26201	42	0.73799	9.99286	64
37	9.25528	42	9.26243	43	0.73757	9.99285	63
38	9.25570	41	9.26286	43	0.73714	9.99283	62
39	9.25611	41	9.26329	43	0.73671	9.99282	61
40	9.25652	42	9.26372	42	0.73628	9.99281	60
41	9.25694	41	9.26414	43	0.73586	9.99279	59
42	9.25735	41	9.26457	43	0.73543	9.99278	58
43	9.25776	41	9.26500	42	0.73500	9.99276	57
44	9.25817	41	9.26542	43	0.73458	9.99275	56
45	9.25858	41	9.26585	42	0.73415	9.99274	55
46	9.25899	41	9.26627	43	0.73373	9.99272	54
47	9.25940	41	9.26670	42	0.73330	9.99271	53
48	9.25981	41	9.26712	42	0.73288	9.99269	52
49	9.26022	41	9.26754	43	0.73246	9.99268	51
50	9.26063		9.26797		0.73203	9.99267	50
	Cos	d.	Cot	d. c.	Tan	Sin	

P. P.

	44	43	42	41
1	4.4	4.3	4.2	4.1
2	8.8	8.6	8.4	8.2
3	13.2	12.9	12.6	12.3
4	17.6	17.2	16.8	16.4
5	22.0	21.5	21.0	20.5
6	26.4	25.8	25.2	24.6
7	30.8	30.1	29.4	28.7
8	35.2	34.4	33.6	32.8
9	39.6	38.7	37.8	36.9

P. P.

	Sin	d.	Tan	d. c.	Cot	Cos	
50	9.26063	41	9.26797	42	0.73203	9.99267	50
51	9.26104	41	9.26839	42	0.73161	9.99265	49
52	9.26145	41	9.26881	42	0.73119	9.99264	48
53	9.26186	41	9.26923	43	0.73077	9.99262	47
54	9.26227	40	9.26966	42	0.73034	9.99261	46
55	9.26267	41	9.27008	42	0.72992	9.99260	45
56	9.26308	41	9.27050	42	0.72950	9.99258	44
57	9.26349	40	9.27092	42	0.72908	9.99257	43
58	9.26389	41	9.27134	42	0.72866	9.99255	42
59	9.26430	40	9.27176	42	0.72824	9.99254	41
60	9.26470	41	9.27218	42	0.72782	9.99252	40
61	9.26511	40	9.27260	42	0.72740	9.99251	39
62	9.26551	41	9.27302	41	0.72698	9.99250	38
63	9.26592	40	9.27343	42	0.72657	9.99248	37
64	9.26632	40	9.27385	42	0.72615	9.99247	36
65	9.26672	41	9.27427	42	0.72573	9.99245	35
66	9.26713	40	9.27469	41	0.72531	9.99244	34
67	9.26753	40	9.27510	42	0.72490	9.99243	33
68	9.26793	40	9.27552	42	0.72448	9.99241	32
69	9.26833	40	9.27594	41	0.72406	9.99240	31
70	9.26873	40	9.27635	42	0.72365	9.99238	30
71	9.26913	41	9.27677	41	0.72323	9.99237	29
72	9.26954	40	9.27718	42	0.72282	9.99236	28
73	9.26994	40	9.27760	41	0.72240	9.99234	27
74	9.27034	39	9.27801	41	0.72199	9.99233	26
75	9.27073	40	9.27842	42	0.72158	9.99231	25
76	9.27113	40	9.27884	41	0.72116	9.99230	24
77	9.27153	40	9.27925	41	0.72075	9.99228	23
78	9.27193	40	9.27966	42	0.72034	9.99227	22
79	9.27233	40	9.28008	41	0.71992	9.99225	21
80	9.27273	39	9.28049	41	0.71951	9.99224	20
81	9.27312	40	9.28090	41	0.71910	9.99222	19
82	9.27352	40	9.28131	41	0.71869	9.99221	18
83	9.27392	39	9.28172	41	0.71828	9.99220	17
84	9.27431	40	9.28213	41	0.71787	9.99218	16
85	9.27471	39	9.28254	41	0.71746	9.99217	15
86	9.27510	40	9.28295	41	0.71705	9.99215	14
87	9.27550	39	9.28336	41	0.71664	9.99214	13
88	9.27589	40	9.28377	41	0.71623	9.99212	12
89	9.27629	39	9.28418	41	0.71582	9.99211	11
90	9.27668	39	9.28459	41	0.71541	9.99209	10
91	9.27707	40	9.28500	40	0.71500	9.99208	09
92	9.27747	39	9.28540	41	0.71460	9.99206	08
93	9.27786	39	9.28581	41	0.71419	9.99205	07
94	9.27825	39	9.28622	40	0.71378	9.99203	06
95	9.27864	40	9.28662	41	0.71338	9.99202	05
96	9.27904	39	9.28703	41	0.71297	9.99201	04
97	9.27943	39	9.28744	40	0.71256	9.99199	03
98	9.27982	39	9.28784	41	0.71216	9.99198	02
99	9.28021	39	9.28825	40	0.71175	9.99196	01
100	9.28060		9.28865		0.71135	9.99195	00
	Cos	d.	Cot	d. c.	Tan	Sin	

P. P.

	43	42	41	40
1	4.3	4.2	4.1	4.0
2	8.6	8.2	8.2	8.0
3	12.9	12.6	12.3	12.0
4	17.2	16.8	16.4	16.0
5	21.5	21.0	20.5	20.0
6	25.8	25.2	24.6	24.0
7	30.1	29.4	28.7	28.0
8	34.4	33.6	32.8	32.0
9	38.7	37.8	36.9	36.0

P. P.

′	Sin	d.	Tan	d. c.	Cot	Cos	′
00	9.28060	39	9.28865	41	0.71135	9.99195	100
01	9.28099	39	9.28906	40	0.71094	9.99193	99
02	9.28138	39	9.28946	40	0.71054	9.99192	98
03	9.28177	39	9.28986	41	0.71014	9.99190	97
04	9.28216	38	9.29027	40	0.70973	9.99189	96
05	9.28254	39	9.29067	40	0.70933	9.99187	95
06	9.28293	39	9.29107	41	0.70893	9.99186	94
07	9.28332	39	9.29148	40	0.70852	9.99184	93
08	9.28371	38	9.29188	40	0.70812	9.99183	92
09	9.28409	39	9.29228	40	0.70772	9.99181	91
10	9.28448	39	9.29268	40	0.70732	9.99180	90
11	9.28487	38	9.29308	40	0.70692	9.99178	89
12	9.28525	39	9.29348	40	0.70652	9.99177	88
13	9.28564	38	9.29388	40	0.70612	9.99175	87
14	9.28602	39	9.29428	40	0.70572	9.99174	86
15	9.28641	38	9.29468	40	0.70532	9.99172	85
16	9.28679	39	9.29508	40	0.70492	9.99171	84
17	9.28718	38	9.29548	40	0.70452	9.99169	83
18	9.28756	38	9.29588	40	0.70412	9.99168	82
19	9.28794	39	9.29628	40	0.70372	9.99166	81
20	9.28833	38	9.29668	39	0.70332	9.99165	80
21	9.28871	38	9.29707	40	0.70293	9.99163	79
22	9.28909	38	9.29747	40	0.70253	9.99162	78
23	9.28947	38	9.29787	40	0.70213	9.99160	77
24	9.28985	39	9.29827	39	0.70173	9.99159	76
25	9.29024	38	9.29866	40	0.70134	9.99157	75
26	9.29062	38	9.29906	39	0.70094	9.99156	74
27	9.29100	38	9.29945	40	0.70055	9.99154	73
28	9.29138	38	9.29985	39	0.70015	9.99153	72
29	9.29176	38	9.30024	40	0.69976	9.99151	71
30	9.29214	38	9.30064	39	0.69936	9.99150	70
31	9.29252	37	9.30103	40	0.69897	9.99148	69
32	9.29289	38	9.30143	39	0.69857	9.99147	68
33	9.29327	38	9.30182	39	0.69818	9.99145	67
34	9.29365	38	9.30221	40	0.69779	9.99144	66
35	9.29403	38	9.30261	39	0.69739	9.99142	65
36	9.29441	37	9.30300	39	0.69700	9.99141	64
37	9.29478	38	9.30339	39	0.69661	9.99139	63
38	9.29516	38	9.30378	40	0.69622	9.99138	62
39	9.29554	37	9.30418	39	0.69582	9.99136	61
40	9.29591	38	9.30457	39	0.69543	9.99135	60
41	9.29629	37	9.30496	39	0.69504	9.99133	59
42	9.29666	38	9.30535	39	0.69465	9.99132	58
43	9.29704	37	9.30574	39	0.69426	9.99130	57
44	9.29741	38	9.30613	39	0.69387	9.99128	56
45	9.29779	37	9.30652	39	0.69348	9.99127	55
46	9.29816	38	9.30691	39	0.69309	9.99125	54
47	9.29854	37	9.30730	39	0.69270	9.99124	53
48	9.29891	37	9.30769	38	0.69231	9.99122	52
49	9.29928	38	9.30807	39	0.69193	9.99121	51
50	9.29966		9.30846		0.69154	9.99119	50
	Cos	d.	Cot	d. c.	Tan	Sin	

P. P.

	41	40	39	38
1	4.1	4.0	3.9	3.8
2	8.2	8.0	7.8	7.6
3	12.3	12.0	11.7	11.4
4	16.4	16.0	15.6	15.2
5	20.5	20.0	19.5	19.0
6	24.6	24.0	23.4	22.8
7	28.7	28.0	27.3	26.6
8	32.8	32.0	31.2	30.4
9	36.9	36.0	35.1	34.2

	Sin	d.	Tan	d. c.	Cot	Cos	
50	9.29966	37	9.30846	39	0.69154	9.99119	50
51	9.30003	37	9.30885	39	0.69115	9.99118	49
52	9.30040	37	9.30924	39	0.69076	9.99116	48
53	9.30077	37	9.30963	38	0.69037	9.99115	47
54	9.30114	37	9.31001	39	0.68999	9.99113	46
55	9.30151	37	9.31040	38	0.68960	9.99112	45
56	9.30188	38	9.31078	39	0.68922	9.99110	44
57	9.30226	37	9.31117	39	0.68883	9.99108	43
58	9.30263	36	9.31156	38	0.68844	9.99107	42
59	9.30299	37	9.31194	39	0.68806	9.99105	41
60	9.30336	37	9.31233	38	0.68767	9.99104	40
61	9.30373	37	9.31271	39	0.68729	9.99102	39
62	9.30410	37	9.31310	38	0.68690	9.99101	38
63	9.30447	37	9.31348	38	0.68652	9.99099	37
64	9.30484	37	9.31386	39	0.68614	9.99098	36
65	9.30521	36	9.31425	38	0.68575	9.99096	35
66	9.30557	37	9.31463	38	0.68537	9.99094	34
67	9.30594	37	9.31501	39	0.68499	9.99093	33
68	9.30631	36	9.31540	38	0.68460	9.99091	32
69	9.30667	37	9.31578	38	0.68422	9.99090	31
70	9.30704	37	9.31616	38	0.68384	9.99088	30
71	9.30741	36	9.31654	38	0.68346	9.99087	29
72	9.30777	37	9.31692	38	0.68308	9.99085	28
73	9.30814	36	9.31730	38	0.68270	9.99083	27
74	9.30850	37	9.31768	38	0.68232	9.99082	26
75	9.30887	36	9.31806	38	0.68194	9.99080	25
76	9.30923	37	9.31844	38	0.68156	9.99079	24
77	9.30960	36	9.31882	38	0.68118	9.99077	23
78	9.30996	36	9.31920	38	0.68080	9.99076	22
79	9.31032	36	9.31958	38	0.68042	9.99074	21
80	9.31068	37	9.31996	38	0.68004	9.99072	20
81	9.31105	36	9.32034	38	0.67966	9.99071	19
82	9.31141	36	9.32072	38	0.67928	9.99069	18
83	9.31177	36	9.32110	37	0.67890	9.99068	17
84	9.31213	37	9.32147	38	0.67853	9.99066	16
85	9.31250	36	9.32185	38	0.67815	9.99064	15
86	9.31286	36	9.32223	37	0.67777	9.99063	14
87	9.31322	36	9.32260	38	0.67740	9.99061	13
88	9.31358	36	9.32298	38	0.67702	9.99060	12
89	9.31394	36	9.32336	37	0.67664	9.99058	11
90	9.31430	36	9.32373	38	0.67627	9.99056	10
91	9.31466	36	9.32411	37	0.67589	9.99055	09
92	9.31502	36	9.32448	38	0.67552	9.99053	08
93	9.31538	35	9.32486	37	0.67514	9.99052	07
94	9.31573	36	9.32523	38	0.67477	9.99050	06
95	9.31609	36	9.32561	37	0.67439	9.99048	05
96	9.31645	36	9.32598	38	0.67402	9.99047	04
97	9.31681	36	9.32636	37	0.67364	9.99045	03
98	9.31717	35	9.32673	37	0.67327	9.99044	02
99	9.31752	36	9.32710	37	0.67290	9.99042	01
100	9.31788		9.32747		0.67253	9.99040	00
	Cos	d.	Cot	d. c.	Tan	Sin	

P. P.

	38	37	36	35
1	3.8	3.7	3.6	3.5
2	7.6	7.4	7.2	7.0
3	11.4	11.1	10.8	10.5
4	15.2	14.8	14.4	14.0
5	19.0	18.5	18.0	17.5
6	22.8	22.2	21.6	21.0
7	26.6	25.9	25.2	24.5
8	30.4	29.6	28.8	28.0
9	34.2	33.3	32.4	31.5

P. P.

′	Sin	d.	Tan	d. c.	Cot	Cos	′
00	9.31788	36	9.32747	38	0.67253	9.99040	100
01	9.31824	35	9.32785	37	0.67215	9.99039	99
02	9.31859	36	9.32822	37	0.67178	9.99037	98
03	9.31895	35	9.32859	37	0.67141	9.99036	97
04	9.31930	36	9.32896	37	0.67104	9.99034	96
05	9.31966	35	9.32933	38	0.67067	9.99032	95
06	9.32001	36	9.32971	37	0.67029	9.99031	94
07	9.32037	35	9.33008	37	0.66992	9.99029	93
08	9.32072	36	9.33045	37	0.66955	9.99028	92
09	9.32108	35	9.33082	37	0.66918	9.99026	91
10	9.32143	35	9.33119	37	0.66881	9.99024	90
11	9.32178	36	9.33156	37	0.66844	9.99023	89
12	9.32214	35	9.33193	37	0.66807	9.99021	88
13	9.32249	35	9.33230	36	0.66770	9.99019	87
14	9.32284	35	9.33266	37	0.66734	9.99018	86
15	9.32319	36	9.33303	37	0.66697	9.99016	85
16	9.32355	35	9.33340	37	0.66660	9.99014	84
17	9.32390	35	9.33377	37	0.66623	9.99013	83
18	9.32425	35	9.33414	36	0.66586	9.99011	82
19	9.32460	35	9.33450	37	0.66550	9.99010	81
20	9.32495	35	9.33487	37	0.66513	9.99008	80
21	9.32530	35	9.33524	36	0.66476	9.99006	79
22	9.32565	35	9.33560	37	0.66440	9.99005	78
23	9.32600	35	9.33597	37	0.66403	9.99003	77
24	9.32635	35	9.33634	36	0.66366	9.99001	76
25	9.32670	35	9.33670	37	0.66330	9.99000	75
26	9.32705	35	9.33707	36	0.66293	9.98998	74
27	9.32740	35	9.33743	37	0.66257	9.98996	73
28	9.32775	34	9.33780	36	0.66220	9.98995	72
29	9.32809	35	9.33816	37	0.66184	9.98993	71
30	9.32844	35	9.33853	36	0.66147	9.98991	70
31	9.32879	35	9.33889	36	0.66111	9.98990	69
32	9.32914	34	9.33925	37	0.66075	9.98988	68
33	9.32948	35	9.33962	36	0.66038	9.98987	67
34	9.32983	35	9.33998	36	0.66002	9.98985	66
35	9.33018	34	9.34034	37	0.65966	9.98983	65
36	9.33052	35	9.34071	36	0.65929	9.98982	64
37	9.33087	34	9.34107	36	0.65893	9.98980	63
38	9.33121	35	9.34143	36	0.65857	9.98978	62
39	9.33156	34	9.34179	36	0.65821	9.98977	61
40	9.33190	35	9.34215	37	0.65785	9.98975	60
41	9.33225	34	9.34252	36	0.65748	9.98973	59
42	9.33259	35	9.34288	36	0.65712	9.98972	58
43	9.33294	34	9.34324	36	0.65676	9.98970	57
44	9.33328	34	9.34360	36	0.65640	9.98968	56
45	9.33362	35	9.34396	36	0.65604	9.98967	55
46	9.33397	34	9.34432	36	0.65568	9.98965	54
47	9.33431	34	9.34468	36	0.65532	9.98963	53
48	9.33465	34	9.34504	36	0.65496	9.98962	52
49	9.33499	35	9.34540	36	0.65460	9.98960	51
50	9.33534		9.34576		0.65424	9.98958	50
	Cos	d.	Cot	d. c.	Tan	Sin	

P. P.

	38	37	36	35
1	3.8	3.7	3.6	3.5
2	7.6	7.4	7.2	7.0
3	11.4	11.1	10.8	10.5
4	15.2	14.8	14.4	14.0
5	19.0	18.5	18.0	17.5
6	22.8	22.2	21.6	21.0
7	26.6	25.9	25.2	24.5
8	30.4	29.6	28.8	28.0
9	34.2	33.3	32.4	31.5

	Sin	d.	Tan	d. c.	Cot	Cos	
50	9.33534	34	9.34576	35	0.65424	9.98958	**50**
51	9.33568	34	9.34611	36	0.65389	9.98956	**49**
52	9.33602	34	9.34647	36	0.65353	9.98955	**48**
53	9.33636	34	9.34683	36	0.65317	9.98953	**47**
54	9.33670	34	9.34719	36	0.65281	9.98951	**46**
55	9.33704	34	9.34755	35	0.65245	9.98950	**45**
56	9.33738	34	9.34790	36	0.65210	9.98948	**44**
57	9.33772	34	9.34826	36	0.65174	9.98946	**43**
58	9.33806	34	9.34862	35	0.65138	9.98945	**42**
59	9.33840	34	9.34897	36	0.65103	9.98943	**41**
60	9.33874	34	9.34933	35	0.65067	9.98941	**40**
61	9.33908	34	9.34968	36	0.65032	9.98940	**39**
62	9.33942	34	9.35004	36	0.64996	9.98938	**38**
63	9.33976	34	9.35040	35	0.64960	9.98936	**37**
64	9.34010	33	9.35075	36	0.64925	9.98934	**36**
65	9.34043	34	9.35111	35	0.64889	9.98933	**35**
66	9.34077	34	9.35146	35	0.64854	9.98931	**34**
67	9.34111	34	9.35181	36	0.64819	9.98929	**33**
68	9.34145	33	9.35217	35	0.64783	9.98928	**32**
69	9.34178	34	9.35252	36	0.64748	9.98926	**31**
70	9.34212	34	9.35288	35	0.64712	9.98924	**30**
71	9.34246	33	9.35323	35	0.64677	9.98923	**29**
72	9.34279	34	9.35358	36	0.64642	9.98921	**28**
73	9.34313	33	9.35394	35	0.64606	9.98919	**27**
74	9.34346	34	9.35429	35	0.64571	9.98917	**26**
75	9.34380	33	9.35464	35	0.64536	9.98916	**25**
76	9.34413	34	9.35499	35	0.64501	9.98914	**24**
77	9.34447	33	9.35534	36	0.64466	9.98912	**23**
78	9.34480	34	9.35570	35	0.64430	9.98911	**22**
79	9.34514	33	9.35605	35	0.64395	9.98909	**21**
80	9.34547	33	9.35640	35	0.64360	9.98907	**20**
81	9.34580	34	9.35675	35	0.64325	9.98905	**19**
82	9.34614	33	9.35710	35	0.64290	9.98904	**18**
83	9.34647	33	9.35745	35	0.64255	9.98902	**17**
84	9.34680	33	9.35780	35	0.64220	9.98900	**16**
85	9.34713	34	9.35815	35	0.64185	9.98898	**15**
86	9.34747	33	9.35850	35	0.64150	9.98897	**14**
87	9.34780	33	9.35885	35	0.64115	9.98895	**13**
88	9.34813	33	9.35920	35	0.64080	9.98893	**12**
89	9.34846	33	9.35955	34	0.64045	9.98892	**11**
90	9.34879	33	9.35989	35	0.64011	9.98890	**10**
91	9.34912	33	9.36024	35	0.63976	9.98888	**09**
92	9.34945	33	9.36059	35	0.63941	9.98886	**08**
93	9.34978	33	9.36094	34	0.63906	9.98885	**07**
94	9.35011	33	9.36128	35	0.63872	9.98883	**06**
95	9.35044	33	9.36163	35	0.63837	9.98881	**05**
96	9.35077	33	9.36198	35	0.63802	9.98879	**04**
97	9.35110	33	9.36233	34	0.63767	9.98878	**03**
98	9.35143	33	9.36267	35	0.63733	9.98876	**02**
99	9.35176	33	9.36302	34	0.63698	9.98874	**01**
100	9.35209		9.36336		0.63664	9.98872	**00**
	Cos	d.	Cot	d. c.	Tan	Sin	

P. P.

	36	**35**	**34**	**33**
1	3.6	3.5	3.4	3.3
2	7.2	7.0	6.8	6.6
3	10.8	10.5	10.2	9.9
4	14.4	14.0	13.6	13.2
5	18.0	17.5	17.0	16.5
6	21.6	21.0	20.4	19.8
7	25.2	24.5	23.8	23.1
8	28.8	28.0	27.2	26.4
9	32.4	31.5	30.6	29.7

P. P.

′	Sin	d.	Tan	d. c.	Cot	Cos	′
00	9.35209	33	9.36336	35	0.63664	9.98872	100
01	9.35242	32	9.36371	35	0.63629	9.98871	99
02	9.35274	33	9.36406	34	0.63594	9.98869	98
03	9.35307	33	9.36440	35	0.63560	9.98867	97
04	9.35340	33	9.36475	34	0.63525	9.98865	96
05	9.35373	32	9.36509	34	0.63491	9.98864	95
06	9.35405	33	9.36543	35	0.63457	9.98862	94
07	9.35438	33	9.36578	34	0.63422	9.98860	93
08	9.35471	32	9.36612	35	0.63388	9.98858	92
09	9.35503	33	9.36647	34	0.63353	9.98857	91
10	9.35536	32	9.36681	34	0.63319	9.98855	90
11	9.35568	33	9.36715	35	0.63285	9.98853	89
12	9.35601	32	9.36750	34	0.63250	9.98851	88
13	9.35633	33	9.36784	34	0.63216	9.98850	87
14	9.35666	32	9.36818	34	0.63182	9.98848	86
15	9.35698	33	9.36852	35	0.63148	9.98846	85
16	9.35731	32	9.36887	34	0.63113	9.98844	84
17	9.35763	33	9.36921	34	0.63079	9.98842	83
18	9.35796	32	9.36955	34	0.63045	9.98841	82
19	9.35828	32	9.36989	34	0.63011	9.98839	81
20	9.35860	33	9.37023	34	0.62977	9.98837	80
21	9.35893	32	9.37057	34	0.62943	9.98835	79
22	9.35925	32	9.37091	34	0.62909	9.98834	78
23	9.35957	32	9.37125	34	0.62875	9.98832	77
24	9.35989	33	9.37159	34	0.62841	9.98830	76
25	9.36022	32	9.37193	34	0.62807	9.98828	75
26	9.36054	32	9.37227	34	0.62773	9.98826	74
27	9.36086	32	9.37261	34	0.62739	9.98825	73
28	9.36118	32	9.37295	34	0.62705	9.98823	72
29	9.36150	32	9.37329	34	0.62671	9.98821	71
30	9.36182	32	9.37363	34	0.62637	9.98819	70
31	9.36214	32	9.37397	34	0.62603	9.98817	69
32	9.36246	32	9.37431	33	0.62569	9.98816	68
33	9.36278	32	9.37464	34	0.62536	9.98814	67
34	9.36310	32	9.37498	34	0.62502	9.98812	66
35	9.36342	32	9.37532	34	0.62468	9.98810	65
36	9.36374	32	9.37566	33	0.62434	9.98808	64
37	9.36406	32	9.37599	34	0.62401	9.98807	63
38	9.36438	32	9.37633	34	0.62367	9.98805	62
39	9.36470	32	9.37667	33	0.62333	9.98803	61
40	9.36502	31	9.37700	34	0.62300	9.98801	60
41	9.36533	32	9.37734	34	0.62266	9.98799	59
42	9.36565	32	9.37768	33	0.62232	9.98798	58
43	9.36597	32	9.37801	34	0.62199	9.98796	57
44	9.36629	31	9.37835	33	0.62165	9.98794	56
45	9.36660	32	9.37868	34	0.62132	9.98792	55
46	9.36692	32	9.37902	33	0.62098	9.98790	54
47	9.36724	31	9.37935	34	0.62065	9.98789	53
48	9.36755	32	9.37969	33	0.62031	9.98787	52
49	9.36787	32	9.38002	33	0.61998	9.98785	51
50	9.36819		9.38035		0.61965	9.98783	50
	Cos	d.	Cot	d. c.	Tan	Sin	

P. P.

	35	34	33	32
1	3.5	3.4	3.3	3.2
2	7.0	6.8	6.6	6.4
3	10.5	10.2	9.9	9.6
4	14.0	13.6	13.2	12.8
5	17.5	17.0	16.5	16.0
6	21.0	20.4	19.8	19.2
7	24.5	23.8	23.1	22.4
8	28.0	27.2	26.4	25.6
9	31.5	30.6	29.7	28.8

P. P.

	Sin	d.	Tan	d. c.	Cot	Cos		P. P.
50	9.36819	31	9.38035	34	0.61965	9.98783	50	
51	9.36850	32	9.38069	33	0.61931	9.98781	49	
52	9.36882	31	9.38102	33	0.61898	9.98780	48	
53	9.36913	32	9.38135	34	0.61865	9.98778	47	**33**
54	9.36945	31	9.38169	33	0.61831	9.98776	46	1 | 3.3
55	9.36976	32	9.38202	33	0.61798	9.98774	45	2 | 6.6
56	9.37008	31	9.38235	34	0.61765	9.98772	44	3 | 9.9
57	9.37039	31	9.38269	33	0.61731	9.98770	43	4 | 13.2
58	9.37070	32	9.38302	33	0.61698	9.98769	42	5 | 16.5
59	9.37102	31	9.38335	33	0.61665	9.98767	41	6 | 19.8
60	9.37133	31	9.38368	33	0.61632	9.98765	40	7 | 23.1
61	9.37164	32	9.38401	33	0.61599	9.98763	39	8 | 26.4
62	9.37196	31	9.38434	34	0.61566	9.98761	38	9 | 29.7
63	9.37227	31	9.38468	33	0.61532	9.98759	37	
64	9.37258	31	9.38501	33	0.61499	9.98758	36	
65	9.37289	32	9.38534	33	0.61466	9.98756	35	**32**
66	9.37321	31	9.38567	33	0.61433	9.98754	34	1 | 3.2
67	9.37352	31	9.38600	33	0.61400	9.98752	33	2 | 6.4
68	9.37383	31	9.38633	33	0.61367	9.98750	32	3 | 9.6
69	9.37414	31	9.38666	33	0.61334	9.98748	31	4 | 12.8
70	9.37445	31	9.38699	33	0.61301	9.98746	30	5 | 16.0
71	9.37476	31	9.38732	33	0.61268	9.98745	29	6 | 19.2
72	9.37507	31	9.38765	32	0.61235	9.98743	28	7 | 22.4
73	9.37538	31	9.38797	33	0.61203	9.98741	27	8 | 25.6
74	9.37569	31	9.38830	33	0.61170	9.98739	26	9 | 28.8
75	9.37600	31	9.38863	33	0.61137	9.98737	25	
76	9.37631	31	9.38896	33	0.61104	9.98735	24	
77	9.37662	31	9.38929	33	0.61071	9.98734	23	**31**
78	9.37693	31	9.38962	32	0.61038	9.98732	22	1 | 3.1
79	9.37724	31	9.38994	33	0.61006	9.98730	21	2 | 6.2
80	9.37755	31	9.39027	33	0.60973	9.98728	20	3 | 9.3
81	9.37786	31	9.39060	32	0.60940	9.98726	19	4 | 12.4
82	9.37817	30	9.39092	33	0.60908	9.98724	18	5 | 15.5
83	9.37847	31	9.39125	33	0.60875	9.98722	17	6 | 18.6
84	9.37878	31	9.39158	32	0.60842	9.98720	16	7 | 21.7
85	9.37909	31	9.39190	33	0.60810	9.98719	15	8 | 24.8
86	9.37940	30	9.39223	33	0.60777	9.98717	14	9 | 27.9
87	9.37970	31	9.39256	32	0.60744	9.98715	13	
88	9.38001	31	9.39288	33	0.60712	9.98713	12	
89	9.38032	30	9.39321	32	0.60679	9.98711	11	**30**
90	9.38062	31	9.39353	33	0.60647	9.98709	10	1 | 3.0
91	9.38093	31	9.39386	32	0.60614	9.98707	09	2 | 6.0
92	9.38124	30	9.39418	33	0.60582	9.98705	08	3 | 9.0
93	9.38154	31	9.39451	32	0.60549	9.98704	07	4 | 12.0
94	9.38185	30	9.39483	32	0.60517	9.98702	06	5 | 15.0
95	9.38215	31	9.39515	33	0.60485	9.98700	05	6 | 18.0
96	9.38246	30	9.39548	32	0.60452	9.98698	04	7 | 21.0
97	9.38276	31	9.39580	32	0.60420	9.98696	03	8 | 24.0
98	9.38307	30	9.39612	33	0.60388	9.98694	02	9 | 27.0
99	9.38337	31	9.39645	32	0.60355	9.98692	01	
100	9.38368		9.39677		0.60323	9.98690	00	
	Cos	d.	Cot	d. c.	Tan	Sin		P. P.

′	Sin	d.	Tan	d. c.	Cot	Cos	′
00	9.38368	30	9.39677	32	0.60323	9.98690	100
01	9.38398	30	9.39709	33	0.60291	9.98689	99
02	9.38428	31	9.39742	32	0.60258	9.98687	98
03	9.38459	30	9.39744	32	0.60226	9.98685	97
04	9.38489	30	9.39806	32	0.60194	9.98683	96
05	9.38519	31	9.39838	32	0.60162	9.98681	95
06	9.38550	30	9.39870	33	0.60130	9.98679	94
07	9.38580	30	9.39903	32	0.60097	9.98677	93
08	9.38610	30	9.39935	32	0.60065	9.98675	92
09	9.38640	30	9.39967	32	0.60033	9.98673	91
10	9.38670	31	9.39999	32	0.60001	9.98671	90
11	9.38701	30	9.40031	32	0.59969	9.98670	89
12	9.38731	30	9.40063	32	0.59937	9.98668	88
13	9.38761	30	9.40095	32	0.59905	9.98666	87
14	9.38791	30	9.40127	32	0.59873	9.98664	86
15	9.38821	30	9.40159	32	0.59841	9.98662	85
16	9.38851	30	9.40191	32	0.59809	9.98660	84
17	9.38881	30	9.40223	32	0.59777	9.98658	83
18	9.38911	30	9.40255	32	0.59745	9.98656	82
19	9.38941	30	9.40287	32	0.59713	9.98654	81
20	9.38971	30	9.40319	32	0.59681	9.98652	80
21	9.39001	30	9.40351	31	0.59649	9.98650	79
22	9.39031	30	9.40382	32	0.59618	9.98648	78
23	9.39061	30	9.40414	32	0.59586	9.98647	77
24	9.39091	30	9.40446	32	0.59554	9.98645	76
25	9.39121	29	9.40478	32	0.59522	9.98643	75
26	9.39150	30	9.40510	31	0.59490	9.98641	74
27	9.39180	30	9.40541	32	0.59459	9.98639	73
28	9.39210	30	9.40573	32	0.59427	9.98637	72
29	9.39240	30	9.40605	31	0.59395	9.98635	71
30	9.39270	29	9.40636	32	0.59364	9.98633	70
31	9.39299	30	9.40668	32	0.59332	9.98631	69
32	9.39329	30	9.40700	31	0.59300	9.98629	68
33	9.39359	29	9.40731	32	0.59269	9.98627	67
34	9.39388	30	9.40763	32	0.59237	9.98625	66
35	9.39418	30	9.40795	31	0.59205	9.98623	65
36	9.39448	29	9.40826	32	0.59174	9.98621	64
37	9.39477	30	9.40858	31	0.59142	9.98620	63
38	9.39507	29	9.40889	32	0.59111	9.98618	62
39	9.39536	30	9.40921	31	0.59079	9.98616	61
40	9.39566	29	9.40952	32	0.59048	9.98614	60
41	9.39595	30	9.40984	31	0.59016	9.98612	59
42	9.39625	29	9.41015	31	0.58985	9.98610	58
43	9.39654	30	9.41046	32	0.58954	9.98608	57
44	9.39684	29	9.41078	31	0.58922	9.98606	56
45	9.39713	30	9.41109	32	0.58891	9.98604	55
46	9.39743	29	9.41141	31	0.58859	9.98602	54
47	9.39772	29	9.41172	31	0.58828	9.98600	53
48	9.39801	30	9.41203	32	0.58797	9.98598	52
49	9.39831	29	9.41235	31	0.58765	9.98596	51
50	9.39860		9.41266		0.58734	9.98594	50
	Cos	d.	Cot	d. c.	Tan	Sin	

P. P.

	33	32	31	30
1	3.3	3.2	3.1	3.0
2	6.6	6.4	6.2	6.0
3	9.9	9.6	9.3	9.0
4	13.2	12.8	12.4	12.0
5	16.5	16.0	15.5	15.0
6	19.8	19.2	18.6	18.0
7	23.1	22.4	21.7	21.0
8	26.4	25.6	24.8	24.0
9	29.7	28.8	27.9	27.0

P. P.

	Sin	d.	Tan	d. c.	Cot	Cos	
50	9.39860	29	9.41266	31	0.58734	9.98594	50
51	9.39889	30	9.41297	31	0.58703	9.98592	49
52	9.39919	29	9.41328	32	0.58672	9.98590	48
53	9.39948	29	9.41360	31	0.58640	9.98588	47
54	9.39977	29	9.41391	31	0.58609	9.98586	46
55	9.40006	29	9.41422	31	0.58578	9.98584	45
56	9.40035	30	9.41453	31	0.58547	9.98582	44
57	9.40065	29	9.41484	31	0.58516	9.98580	43
58	9.40094	29	9.41515	31	0.58485	9.98578	42
59	9.40123	29	9.41546	32	0.58454	9.98576	41
60	9.40152	29	9.41578	31	0.58422	9.98574	40
61	9.40181	29	9.41609	31	0.58391	9.98573	39
62	9.40210	29	9.41640	31	0.58360	9.98571	38
63	9.40239	29	9.41671	31	0.58329	9.98569	37
64	9.40268	29	9.41702	31	0.58298	9.98567	36
65	9.40297	29	9.41733	31	0.58267	9.98565	35
66	9.40326	29	9.41764	31	0.58236	9.98563	34
67	9.40355	29	9.41795	30	0.58205	9.98561	33
68	9.40384	29	9.41825	31	0.58175	9.98559	32
69	9.40413	29	9.41856	31	0.58144	9.98557	31
70	9.40442	29	9.41887	31	0.58113	9.98555	30
71	9.40471	29	9.41918	31	0.58082	9.98553	29
72	9.40500	29	9.41949	31	0.58051	9.98551	28
73	9.40529	28	9.41980	31	0.58020	9.98549	27
74	9.40557	29	9.42011	30	0.57989	9.98547	26
75	9.40586	29	9.42041	31	0.57959	9.98545	25
76	9.40615	29	9.42072	31	0.57928	9.98543	24
77	9.40644	28	9.42103	31	0.57897	9.98541	23
78	9.40672	29	9.42134	30	0.57866	9.98539	22
79	9.40701	29	9.42164	31	0.57836	9.98537	21
80	9.40730	29	9.42195	31	0.57805	9.98535	20
81	9.40759	28	9.42226	30	0.57774	9.98533	19
82	9.40787	29	9.42256	31	0.57744	9.98531	18
83	9.40816	28	9.42287	31	0.57713	9.98529	17
84	9.40844	29	9.42318	30	0.57682	9.98527	16
85	9.40873	29	9.42348	31	0.57652	9.98525	15
86	9.40902	28	9.42379	31	0.57621	9.98523	14
87	9.40930	29	9.42410	30	0.57590	9.98521	13
88	9.40959	28	9.42440	31	0.57560	9.98519	12
89	9.40987	29	9.42471	30	0.57529	9.98517	11
90	9.41016	28	9.42501	31	0.57499	9.98515	10
91	9.41044	29	9.42532	30	0.57468	9.98513	09
92	9.41073	28	9.42562	31	0.57438	9.98511	08
93	9.41101	29	9.42593	30	0.57407	9.98509	07
94	9.41130	28	9.42623	30	0.57377	9.98507	06
95	9.41158	28	9.42653	31	0.57347	9.98505	05
96	9.41186	29	9.42684	30	0.57316	9.98502	04
97	9.41215	28	9.42714	31	0.57286	9.98500	03
98	9.41243	28	9.42745	30	0.57255	9.98498	02
99	9.41271	29	9.42775	30	0.57225	9.98496	01
100	9.41300		9.42805		0.57195	9.98494	00
	Cos	d.	Cot	d. c.	Tan	Sin	

P. P.

	31	30	29	28
1	3.1	3.0	2.9	2.8
2	6.2	6.0	5.8	5.6
3	9.3	9.0	8.7	8.4
4	12.4	12.0	11.6	11.2
5	15.5	15.0	14.5	14.0
6	18.6	18.0	17.4	16.8
7	21.7	21.0	20.3	19.6
8	24.8	24.0	23.2	22.4
9	27.9	27.0	26.1	25.2

P. P.

	Sin	d.	Tan	d. c.	Cot	Cos	
00	9.41300	28	9.42805	31	0.57195	9.98494	100
01	9.41328	28	9.42836	30	0.57164	9.98492	99
02	9.41356	28	9.42866	30	0.57134	9.98490	98
03	9.41384	29	9.42896	30	0.57104	9.98488	97
04	9.41413	28	9.42926	31	0.57074	9.98486	96
05	9.41441	28	9.42957	30	0.57043	9.98484	95
06	9.41469	28	9.42987	30	0.57013	9.98482	94
07	9.41497	28	9.43017	30	0.56983	9.98480	93
08	9.41525	28	9.43047	30	0.56953	9.98478	92
09	9.41553	29	9.43077	31	0.56923	9.98476	91
10	9.41582	28	9.43108	30	0.56892	9.98474	90
11	9.41610	28	9.43138	30	0.56862	9.98472	89
12	9.41638	28	9.43168	30	0.56832	9.98470	88
13	9.41666	28	9.43198	30	0.56802	9.98468	87
14	9.41694	28	9.43228	30	0.56772	9.98466	86
15	9.41722	28	9.43258	30	0.56742	9.98464	85
16	9.41750	28	9.43288	30	0.56712	9.98462	84
17	9.41778	28	9.43318	30	0.56682	9.98460	83
18	9.41806	28	9.43348	30	0.56652	9.98458	82
19	9.41834	27	9.43378	30	0.56622	9.98456	81
20	9.41861	28	9.43408	30	0.56592	9.98453	80
21	9.41889	28	9.43438	30	0.56562	9.98451	79
22	9.41917	28	9.43468	30	0.56532	9.98449	78
23	9.41945	28	9.43498	30	0.56502	9.98447	77
24	9.41973	28	9.43528	30	0.56472	9.98445	76
25	9.42001	28	9.43558	29	0.56442	9.98443	75
26	9.42029	27	9.43587	30	0.56413	9.98441	74
27	9.42056	28	9.43617	30	0.56383	9.98439	73
28	9.42084	28	9.43647	30	0.56353	9.98437	72
29	9.42112	28	9.43677	30	0.56323	9.98435	71
30	9.42140	27	9.43707	29	0.56293	9.98433	70
31	9.42167	28	9.43736	30	0.56264	9.98431	69
32	9.42195	28	9.43766	30	0.56234	9.98429	68
33	9.42223	27	9.43796	30	0.56204	9.98427	67
34	9.42250	28	9.43826	29	0.56174	9.98425	66
35	9.42278	27	9.43855	30	0.56145	9.98422	65
36	9.42305	28	9.43885	30	0.56115	9.98420	64
37	9.42333	28	9.43915	29	0.56085	9.98418	63
38	9.42361	27	9.43944	30	0.56056	9.98416	62
39	9.42388	28	9.43974	30	0.56026	9.98414	61
40	9.42416	27	9.44004	29	0.55996	9.98412	60
41	9.42443	28	9.44033	30	0.55967	9.98410	59
42	9.42471	27	9.44063	29	0.55937	9.98408	58
43	9.42498	28	9.44092	30	0.55908	9.98406	57
44	9.42526	27	9.44122	29	0.55878	9.98404	56
45	9.42553	27	9.44151	30	0.55849	9.98402	55
46	9.42580	28	9.44181	29	0.55819	9.98399	54
47	9.42608	27	9.44210	30	0.55790	9.98397	53
48	9.42635	28	9.44240	29	0.55760	9.98395	52
49	9.42663	27	9.44269	30	0.55731	9.98393	51
50	9.42690		9.44299		0.55701	9.98391	50
	Cos	d.	Cot	d. c.	Tan	Sin	

P. P.

31	
1	3.1
2	6.2
3	9.3
4	12.4
5	15.5
6	18.6
7	21 7
8	24.8
9	27.9

30	
1	3.0
2	6.0
3	9.0
4	12.0
5	15.0
6	18.0
7	21.0
8	24.0
9	27.0

29	
1	2.9
2	5.8
3	8.7
4	11.6
5	14.5
6	17.4
7	20.3
8	23.2
9	26.1

28	
1	2.8
2	5.6
3	8.4
4	11.2
5	14.0
6	16.8
7	19.6
8	22.4
9	25.2

P. P.

	Sin	d.	Tan	d. c.	Cot	Cos	
50	9.42690	27	9.44299	29	0.55701	9.98391	50
51	9.42717	28	9.44328	30	0.55672	9.98389	49
52	9.42745	27	9.44358	29	0.55642	9.98387	48
53	9.42772	27	9.44387	29	0.55613	9.98385	47
54	9.42799	27	9.44416	30	0.55584	9.98383	46
55	9.42826	28	9.44446	29	0.55554	9.98381	45
56	9.42854	27	9.44475	29	0.55525	9.98378	44
57	9.42881	27	9.44504	30	0.55496	9.98376	43
58	9.42908	27	9.44534	29	0.55466	9.98374	42
59	9.42935	27	9.44563	29	0.55437	9.98372	41
60	9.42962	27	9.44592	30	0.55408	9.98370	40
61	9.42989	28	9.44622	29	0.55378	9.98368	39
62	9.43017	27	9.44651	29	0.55349	9.98366	38
63	9.43044	27	9.44680	29	0.55320	9.98364	37
64	9.43071	27	9.44709	29	0.55291	9.98361	36
65	9.43098	27	9.44738	30	0.55262	9.98359	35
66	9.43125	27	9.44768	29	0.55232	9.98357	34
67	9.43152	27	9.44797	29	0.55203	9.98355	33
68	9.43179	27	9.44826	29	0.55174	9.98353	32
69	9.43206	27	9.44855	29	0.55145	9.98351	31
70	9.43233	27	9.44884	29	0.55116	9.98349	30
71	9.43260	27	9.44913	29	0.55087	9.98347	29
72	9.43287	27	9.44942	29	0.55058	9.98344	28
73	9.43314	27	9.44971	29	0.55029	9.98342	27
74	9.43341	26	9.45000	29	0.55000	9.98340	26
75	9.43367	27	9.45029	29	0.54971	9.98338	25
76	9.43394	27	9.45058	29	0.54942	9.98336	24
77	9.43421	27	9.45087	29	0.54913	9.98334	23
78	9.43448	27	9.45116	29	0.54884	9.98332	22
79	9.43475	27	9.45145	29	0.54855	9.98329	21
80	9.43502	26	9.45174	29	0.54826	9.98327	20
81	9.43528	27	9.45203	29	0.54797	9.98325	19
82	9.43555	27	9.45232	29	0.54768	9.98323	18
83	9.43582	27	9.45261	29	0.54739	9.98321	17
84	9.43609	26	9.45290	29	0.54710	9.98319	16
85	9.43635	27	9.45319	29	0.54681	9.98317	15
86	9.43662	27	9.45348	28	0.54652	9.98314	14
87	9.43689	26	9.45376	29	0.54624	9.98312	13
88	9.43715	27	9.45405	29	0.54595	9.98310	12
89	9.43742	27	9.45434	29	0.54566	9.98308	11
90	9.43769	26	9.45463	29	0.54537	9.98306	10
91	9.43795	27	9.45492	28	0.54508	9.98304	09
92	9.43822	26	9.45520	29	0.54480	9.98302	08
93	9.43848	27	9.45549	29	0.54451	9.98299	07
94	9.43875	26	9.45578	28	0.54422	9.98297	06
95	9.43901	27	9.45606	29	0.54394	9.98295	05
96	9.43928	26	9.45635	29	0.54365	9.98293	04
97	9.43954	27	9.45664	28	0.54336	9.98291	03
98	9.43981	26	9.45692	29	0.54308	9.98289	02
99	9.44007	27	9.45721	29	0.54279	9.98286	01
100	9.44034		9.45750		0.54250	9.98284	00
	Cos	d.	Cot	d. c.	Tan	Sin	

P. P.

	29	28	27	26
1	2.9	2.8	2.7	2.6
2	5.8	5.6	5.4	5.2
3	8.7	8.4	8.1	7.8
4	11.6	11.2	10.8	10.4
5	14.5	14.0	13.5	13.0
6	17.4	16.8	16.2	15.6
7	20.3	19.6	18.9	18.2
8	23.2	22.4	21.6	20.8
9	26.1	25.2	24.3	23.4

P. P.

′	Sin	d.	Tan	d. c.	Cot	Cos	
00	9.44034	26	9.45750	28	0.54250	9.98284	100
01	9.44060	27	9.45778	29	0.54222	9.98282	99
02	9.44087	26	9.45807	28	0.54193	9.98280	98
03	9.44113	26	9.45835	29	0.54165	9.98278	97
04	9.44139	27	9.45864	28	0.54136	9.98275	96
05	9.44166	26	9.45892	29	0.54108	9.98273	95
06	9.44192	26	9.45921	29	0.54079	9.98271	94
07	9.44218	27	9.45950	28	0.54050	9.98269	93
08	9.44245	26	9.45978	28	0.54022	9.98267	92
09	9.44271	26	9.46006	29	0.53994	9.98265	91
10	9.44297	27	9.46035	28	0.53965	9.98262	90
11	9.44324	26	9.46063	29	0.53937	9.98260	89
12	9.44350	26	9.46092	28	0.53908	9.98258	88
13	9.44376	26	9.46120	29	0.53880	9.98256	87
14	9.44402	26	9.46149	28	0.53851	9.98254	86
15	9.44428	27	9.46177	28	0.53823	9.98251	85
16	9.44455	26	9.46205	29	0.53795	9.98249	84
17	9.44481	26	9.46234	28	0.53766	9.98247	83
18	9.44507	26	9.46262	28	0.53738	9.98245	82
19	9.44533	26	9.46290	29	0.53710	9.98243	81
20	9.44559	26	9.46319	28	0.53681	9.98240	80
21	9.44585	26	9.46347	28	0.53653	9.98238	79
22	9.44611	26	9.46375	28	0.53625	9.98236	78
23	9.44637	26	9.46403	29	0.53597	9.98234	77
24	9.44663	26	9.46432	28	0.53568	9.98232	76
25	9.44689	26	9.46460	28	0.53540	9.98229	75
26	9.44715	26	9.46488	28	0.53512	9.98227	74
27	9.44741	26	9.46516	28	0.53484	9.98225	73
28	9.44767	26	9.46544	29	0.53456	9.98223	72
29	9.44793	26	9.46573	28	0.53427	9.98221	71
30	9.44819	26	9.46601	28	0.53399	9.98218	70
31	9.44845	26	9.46629	28	0.53371	9.98216	69
32	9.44871	26	9.46657	28	0.53343	9.98214	68
33	9.44897	26	9.46685	28	0.53315	9.98212	67
34	9.44923	25	9.46713	28	0.53287	9.98209	66
35	9.44948	26	9.46741	28	0.53259	9.98207	65
36	9.44974	26	9.46769	28	0.53231	9.98205	64
37	9.45000	26	9.46797	28	0.53203	9.98203	63
38	9.45026	26	9.46825	28	0.53175	9.98201	62
39	9.45052	25	9.46853	28	0.53147	9.98198	61
40	9.45077	26	9.46881	28	0.53119	9.98196	60
41	9.45103	26	9.46909	28	0.53091	9.98194	59
42	9.45129	26	9.46937	28	0.53063	9.98192	58
43	9.45155	25	9.46965	28	0.53035	9.98189	57
44	9.45180	26	9.46993	28	0.53007	9.98187	56
45	9.45206	26	9.47021	28	0.52979	9.98185	55
46	9.45232	25	9.47049	28	0.52951	9.98183	54
47	9.45257	26	9.47077	28	0.52923	9.98180	53
48	9.45283	26	9.47105	28	0.52895	9.98178	52
49	9.45309	25	9.47133	27	0.52867	9.98176	51
50	9.45334		9.47160		0.52840	9.98174	50
	Cos	d.	Cot	d. c.	Tan	Sin	

P. P.

	29	28	27	26
1	2.9	2.8	2.7	2.6
2	5.8	5.6	5.4	5.2
3	8.7	8.4	8.1	7.8
4	11.6	11.2	10.8	10.4
5	14.5	14.0	13.5	13.0
6	17.4	16.8	16.2	15.6
7	20.3	19.6	18.9	18.2
8	23.2	22.4	21.6	20.8
9	26.1	25.2	24.3	23.4

P. P.

	Sin	d.	Tan	d. c.	Cot	Cos	
50	9.45334	26	9.47160	28	0.52840	9.98174	50
51	9.45360	25	9.47188	28	0.52812	9.98171	49
52	9.45385	26	9.47216	28	0.52784	9.98169	48
53	9.45411	25	9.47244	28	0.52756	9.98167	47
54	9.45436	26	9.47272	27	0.52728	9.98165	46
55	9.45462	25	9.47299	28	0.52701	9.98162	45
56	9.45487	26	9.47327	28	0.52673	9.98160	44
57	9.45513	25	9.47355	28	0.52645	9.98158	43
58	9.45538	26	9.47383	27	0.52617	9.98156	42
59	9.45564	25	9.47410	28	0.52590	9.98153	41
60	9.45589	26	9.47438	28	0.52562	9.98151	40
61	9.45615	25	9.47466	27	0.52534	9.98149	39
62	9.45640	25	9.47493	28	0.52507	9.98147	38
63	9.45665	26	9.47521	28	0.52479	9.98144	37
64	9.45691	25	9.47549	27	0.52451	9.98142	36
65	9.45716	26	9.47576	28	0.52424	9.98140	35
66	9.45742	25	9.47604	28	0.52396	9.98138	34
67	9.45767	25	9.47632	27	0.52368	9.98135	33
68	9.45792	25	9.47659	28	0.52341	9.98133	32
69	9.45817	26	9.47687	27	0.52313	9.98131	31
70	9.45843	25	9.47714	28	0.52286	9.98129	30
71	9.45868	25	9.47742	27	0.52258	9.98126	29
72	9.45893	25	9.47769	28	0.52231	9.98124	28
73	9.45918	26	9.47797	27	0.52203	9.98122	27
74	9.45944	25	9.47824	28	0.52176	9.98119	26
75	9.45969	25	9.47852	27	0.52148	9.98117	25
76	9.45994	25	9.47879	28	0.52121	9.98115	24
77	9.46019	25	9.47907	27	0.52093	9.98113	23
78	9.46044	25	9.47934	27	0.52066	9.98110	22
79	9.46069	26	9.47961	28	0.52039	9.98108	21
80	9.46095	25	9.47989	27	0.52011	9.98106	20
81	9.46120	25	9.48016	28	0.51984	9.98103	19
82	9.46145	25	9.48044	27	0.51956	9.98101	18
83	9.46170	25	9.48071	27	0.51929	9.98099	17
84	9.46195	25	9.48098	28	0.51902	9.98097	16
85	9.46220	25	9.48126	27	0.51874	9.98094	15
86	9.46245	25	9.48153	27	0.51847	9.98092	14
87	9.46270	25	9.48180	28	0.51820	9.98090	13
88	9.46295	25	9.48208	27	0.51792	9.98087	12
89	9.46320	25	9.48235	27	0.51765	9.98085	11
90	9.46345	25	9.48262	27	0.51738	9.98083	10
91	9.46370	25	9.48289	28	0.51711	9.98080	09
92	9.46395	25	9.48317	27	0.51683	9.98078	08
93	9.46420	24	9.48344	27	0.51656	9.98076	07
94	9.46444	25	9.48371	27	0.51629	9.98074	06
95	9.46469	25	9.48398	27	0.51602	9.98071	05
96	9.46494	25	9.48425	28	0.51575	9.98069	04
97	9.46519	25	9.48453	27	0.51547	9.98067	03
98	9.46544	25	9.48480	27	0.51520	9.98064	02
99	9.46569	25	9.48507	27	0.51493	9.98062	01
100	9.46594		9.48534		0.51466	9.98060	00
	Cos	d.	Cot	d. c.	Tan	Sin	

P. P.

28	
1	2.8
2	5.6
3	8.4
4	11.2
5	14.0
6	16.8
7	19.6
8	22.4
9	25.2

27	
1	2.7
2	5.4
3	8.1
4	10.8
5	13.5
6	16.2
7	18.9
8	21.6
9	24.3

25	
1	2.5
2	5.0
3	7.5
4	10.0
5	12.5
6	15.0
7	17.5
8	20.0
9	22.5

24	
1	2.4
2	4.8
3	7.2
4	9.6
5	12.0
6	14.4
7	16.8
8	19.2
9	21.6

P. P.

	Sin	d.	Tan	d. c.	Cot	Cos	
00	9.46594	24	9.48534	27	0.51466	9.98060	100
01	9.46618	25	9.48561	27	0.51439	9.98057	99
02	9.46643	25	9.48588	27	0.51412	9.98055	98
03	9.46668	25	9.48615	27	0.51385	9.98053	97
04	9.46693	24	9.48642	27	0.51358	9.98050	96
05	9.46717	25	9.48669	27	0.51331	9.98048	95
06	9.46742	25	9.48696	27	0.51304	9.98046	94
07	9.46767	24	9.48723	27	0.51277	9.98043	93
08	9.46791	25	9.48750	27	0.51250	9.98041	92
09	9.46816	25	9.48777	27	0.51223	9.98039	91
10	9.46841	24	9.48804	27	0.51196	9.98036	90
11	9.46865	25	9.48831	27	0.51169	9.98034	89
12	9.46890	25	9.48858	27	0.51142	9.98032	88
13	9.46915	24	9.48885	27	0.51115	9.98029	87
14	9.46939	25	9.48912	27	0.51088	9.98027	86
15	9.46964	24	9.48939	27	0.51061	9.98025	85
16	9.46988	25	9.48966	27	0.51034	9.98022	84
17	9.47013	24	9.48993	27	0.51007	9.98020	83
18	9.47037	25	9.49020	26	0.50980	9.98018	82
19	9.47062	24	9.49046	27	0.50954	9.98015	81
20	9.47086	25	9.49073	27	0.50927	9.98013	80
21	9.47111	24	9.49100	27	0.50900	9.98011	79
22	9.47135	25	9.49127	27	0.50873	9.98008	78
23	9.47160	24	9.49154	27	0.50846	9.98006	77
24	9.47184	25	9.49181	26	0.50819	9.98004	76
25	9.47209	24	9.49207	27	0.50793	9.98001	75
26	9.47233	24	9.49234	27	0.50766	9.97999	74
27	9.47257	25	9.49261	27	0.50739	9.97997	73
28	9.47282	24	9.49288	26	0.50712	9.97994	72
29	9.47306	24	9.49314	27	0.50686	9.97992	71
30	9.47330	25	9.49341	27	0.50659	9.97989	70
31	9.47355	24	9.49368	26	0.50632	9.97987	69
32	9.47379	24	9.49394	27	0.50606	9.97985	68
33	9.47403	25	9.49421	27	0.50579	9.97982	67
34	9.47428	24	9.49448	26	0.50552	9.97980	66
35	9.47452	24	9.49474	27	0.50526	9.97978	65
36	9.47476	24	9.49501	27	0.50499	9.97975	64
37	9.47500	25	9.49528	26	0.50472	9.97973	63
38	9.47525	24	9.49554	27	0.50446	9.97971	62
39	9.47549	24	9.49581	26	0.50419	9.97968	61
40	9.47573	24	9.49607	27	0.50393	9.97966	60
41	9.47597	24	9.49634	26	0.50366	9.97963	59
42	9.47621	25	9.49660	27	0.50340	9.97961	58
43	9.47646	24	9.49687	26	0.50313	9.97959	57
44	9.47670	24	9.49713	27	0.50287	9.97956	56
45	9.47694	24	9.49740	26	0.50260	9.97954	55
46	9.47718	24	9.49766	27	0.50234	9.97951	54
47	9.47742	24	9.49793	26	0.50207	9.97949	53
48	9.47766	24	9.49819	27	0.50181	9.97947	52
49	9.47790	24	9.49846	26	0.50154	9.97944	51
50	9.47814		9.49872		0.50128	9.97942	50
	Cos	d.	Cot	d. c.	Tan	Sin	

P. P.

	27		26		25		24
1	2.7	1	2.6	1	2.5	1	2.4
2	5.4	2	5.2	2	5.0	2	4.8
3	8.1	3	7.8	3	7.5	3	7.2
4	10.8	4	10.4	4	10.0	4	9.6
5	13.5	5	13.0	5	12.5	5	12.0
6	16.2	6	15.6	6	15.0	6	14.4
7	18.9	7	18.2	7	17.5	7	16.8
8	21.6	8	20.8	8	20.0	8	19.2
9	24.3	9	23.4	9	22.5	9	21.6

P. P.

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	Sin	d.	Tan	d. c.	Cot	Cos	
50	9.47814	24	9.49872	27	0.50128	9.97942	**50**
51	9.47838	24	9.49899	26	0.50101	9.97940	49
52	9.47862	24	9.49925	26	0.50075	9.97937	48
53	9.47886	24	9.49951	27	0.50049	9.97935	47
54	9.47910	24	9.49978	26	0.50022	9.97932	46
55	9.47934	24	9.50004	27	0.49996	9.97930	45
56	9.47958	24	9.50031	26	0.49969	9.97928	44
57	9.47982	24	9.50057	26	0.49943	9.97925	43
58	9.48006	24	9.50083	27	0.49917	9.97923	42
59	9.48030	24	9.50110	26	0.49890	9.97920	41
60	9.48054	24	9.50136	26	0.49864	9.97918	**40**
61	9.48078	24	9.50162	26	0.49838	9.97916	39
62	9.48102	23	9.50188	27	0.49812	9.97913	38
63	9.48125	24	9.50215	26	0.49785	9.97911	37
64	9.48149	24	9.50241	26	0.49759	9.97908	36
65	9.48173	24	9.50267	26	0.49733	9.97906	35
66	9.48197	24	9.50293	27	0.49707	9.97904	34
67	9.48221	24	9.50320	26	0.49680	9.97901	33
68	9.48245	23	9.50346	26	0.49654	9.97899	32
69	9.48268	24	9.50372	26	0.49628	9.97896	31
70	9.48292	24	9.50398	26	0.49602	9.97894	**30**
71	9.48316	24	9.50424	27	0.49576	9.97891	29
72	9.48340	23	9.50451	26	0.49549	9.97889	28
73	9.48363	24	9.50477	26	0.49523	9.97887	27
74	9.48387	24	9.50503	26	0.49497	9.97884	26
75	9.48411	23	9.50529	26	0.49471	9.97882	25
76	9.48434	24	9.50555	26	0.49445	9.97879	24
77	9.48458	24	9.50581	26	0.49419	9.97877	23
78	9.48482	23	9.50607	26	0.49393	9.97874	22
79	9.48505	24	9.50633	26	0.49367	9.97872	21
80	9.48529	23	9.50659	26	0.49341	9.97870	**20**
81	9.48552	24	9.50685	26	0.49315	9.97867	19
82	9.48576	24	9.50711	26	0.49289	9.97865	18
83	9.48600	23	9.50737	26	0.49263	9.97862	17
84	9.48623	24	9.50763	26	0.49237	9.97860	16
85	9.48647	23	9.50789	26	0.49211	9.97857	15
86	9.48670	24	9.50815	26	0.49185	9.97855	14
87	9.48694	23	9.50841	26	0.49159	9.97853	13
88	9.48717	24	9.50867	26	0.49133	9.97850	12
89	9.48741	23	9.50893	26	0.49107	9.97848	11
90	9.48764	24	9.50919	26	0.49081	9.97845	**10**
91	9.48788	23	9.50945	26	0.49055	9.97843	09
92	9.48811	24	9.50971	26	0.49029	9.97840	08
93	9.48835	23	9.50997	26	0.49003	9.97838	07
94	9.48858	23	9.51023	25	0.48977	9.97835	06
95	9.48881	24	9.51048	26	0.48952	9.97833	05
96	9.48905	23	9.51074	26	0.48926	9.97830	04
97	9.48928	24	9.51100	26	0.48900	9.97828	03
98	9.48952	23	9.51126	26	0.48874	9.97826	02
99	9.48975	23	9.51152	26	0.48848	9.97823	01
100	9.48998		9.51178		0.48822	9.97821	**00**
	Cos	d.	Cot	d. c.	Tan	Sin	

P. P.

	27	26	24	23
1	2.7	2.6	2.4	2.3
2	5.4	5.2	4.8	4.6
3	8.1	7.8	7.2	6.9
4	10.8	10.4	9.6	9.2
5	13.5	13.0	12.0	11.5
6	16.2	15.6	14.4	13.8
7	18.9	18.2	16.8	16.1
8	21.6	20.8	19.2	18.4
9	24.3	23.4	21.6	20.7

	Sin	d.	Tan	d. c.	Cot	Cos	
00	9.48998	24	9.51178	25	0.48822	9.97821	100
01	9.49022	23	9.51203	26	0.48797	9.97818	99
02	9.49045	23	9.51229	26	0.48771	9.97816	98
03	9.49068	23	9.51255	26	0.48745	9.97813	97
04	9.49091	24	9.51281	25	0.48719	9.97811	96
05	9.49115	23	9.51306	26	0.48694	9.97808	95
06	9.49138	23	9.51332	26	0.48668	9.97806	94
07	9.49161	23	9.51358	26	0.48642	9.97803	93
08	9.49184	24	9.51384	25	0.48616	9.97801	92
09	9.49208	23	9.51409	26	0.48591	9.97798	91
10	9.49231	23	9.51435	26	0.48565	9.97796	90
11	9.49254	23	9.51461	25	0.48539	9.97793	89
12	9.49277	23	9.51486	26	0.48514	9.97791	88
13	9.49300	23	9.51512	25	0.48488	9.97788	87
14	9.49323	24	9.51537	26	0.48463	9.97786	86
15	9.49347	23	9.51563	26	0.48437	9.97784	85
16	9.49370	23	9.51589	25	0.48411	9.97781	84
17	9.49393	23	9.51614	26	0.48386	9.97779	83
18	9.49416	23	9.51640	25	0.48360	9.97776	82
19	9.49439	23	9.51665	26	0.48335	9.97774	81
20	9.49462	23	9.51691	26	0.48309	9.97771	80
21	9.49485	23	9.51717	25	0.48283	9.97769	79
22	9.49508	23	9.51742	26	0.48258	9.97766	78
23	9.49531	23	9.51768	25	0.48232	9.97764	77
24	9.49554	23	9.51793	26	0.48207	9.97761	76
25	9.49577	23	9.51819	25	0.48181	9.97759	75
26	9.49600	23	9.51844	26	0.48156	9.97756	74
27	9.49623	23	9.51870	25	0.48130	9.97754	73
28	9.49646	23	9.51895	25	0.48105	9.97751	72
29	9.49669	23	9.51920	26	0.48080	9.97749	71
30	9.49692	23	9.51946	25	0.48054	9.97746	70
31	9.49715	23	9.51971	26	0.48029	9.97744	69
32	9.49738	23	9.51997	25	0.48003	9.97741	68
33	9.49761	22	9.52022	25	0.47978	9.97739	67
34	9.49783	23	9.52047	26	0.47953	9.97736	66
35	9.49806	23	9.52073	25	0.47927	9.97734	65
36	9.49829	23	9.52098	26	0.47902	9.97731	64
37	9.49852	23	9.52124	25	0.47876	9.97729	63
38	9.49875	23	9.52149	25	0.47851	9.97726	62
39	9.49898	22	9.52174	26	0.47826	9.97723	61
40	9.49920	23	9.52200	25	0.47800	9.97721	60
41	9.49943	23	9.52225	25	0.47775	9.97718	59
42	9.49966	23	9.52250	25	0.47750	9.97716	58
43	9.49989	22	9.52275	26	0.47725	9.97713	57
44	9.50011	23	9.52301	25	0.47699	9.97711	56
45	9.50034	23	9.52326	25	0.47674	9.97708	55
46	9.50057	23	9.52351	25	0.47649	9.97706	54
47	9.50080	22	9.52376	26	0.47624	9.97703	53
48	9.50102	23	9.52402	25	0.47598	9.97701	52
49	9.50125	23	9.52427	25	0.47573	9.97698	51
50	9.50148		9.52452		0.47548	9.97696	50
	Cos	d.	Cot	d. c.	Tan	Sin	

P. P.

	26	25	24	23
1	2.6	2.5	2.4	2.3
2	5.2	5.0	4.8	4.6
3	7.8	7.5	7.2	6.9
4	10.4	10.0	9.6	9.2
5	13.0	12.5	12.0	11.5
6	15.6	15.0	14.4	13.8
7	18.2	17.5	16.8	16.1
8	20.8	20.0	19.2	18.4
9	23.4	22.5	21.6	20.7

	Sin	d.	Tan	d. c.	Cot	Cos	
50	9.50148	22	9.52452	25	0.47548	9.97696	50
51	9.50170	23	9.52477	25	0.47523	9.97693	49
52	9.50193	23	9.52502	26	0.47498	9.97691	48
53	9.50216	22	9.52528	25	0.47472	9.97688	47
54	9.50238	23	9.52553	25	0.47447	9.97686	46
55	9.50261	22	9.52578	25	0.47422	9.97683	45
56	9.50283	23	9.52603	25	0.47397	9.97680	44
57	9.50306	22	9.52628	25	0.47372	9.97678	43
58	9.50328	23	9.52653	25	0.47347	9.97675	42
59	9.50351	23	9.52678	25	0.47322	9.97673	41
60	9.50374	22	9.52703	25	0.47297	9.97670	40
61	9.50396	23	9.52728	25	0.47272	9.97668	39
62	9.50419	22	9.52753	25	0.47247	9.97665	38
63	9.50441	23	9.52778	26	0.47222	9.97663	37
64	9.50464	22	9.52804	25	0.47196	9.97660	36
65	9.50486	22	9.52829	25	0.47171	9.97657	35
66	9.50508	23	9.52854	25	0.47146	9.97655	34
67	9.50531	22	9.52879	25	0.47121	9.97652	33
68	9.50553	23	9.52904	25	0.47096	9.97650	32
69	9.50576	22	9.52929	24	0.47071	9.97647	31
70	9.50598	22	9.52953	25	0.47047	9.97645	30
71	9.50620	23	9.52978	25	0.47022	9.97642	29
72	9.50643	22	9.53003	25	0.46997	9.97640	28
73	9.50665	23	9.53028	25	0.46972	9.97637	27
74	9.50688	22	9.53053	25	0.46947	9.97634	26
75	9.50710	22	9.53078	25	0.46922	9.97632	25
76	9.50732	23	9.53103	25	0.46897	9.97629	24
77	9.50755	22	9.53128	25	0.46872	9.97627	23
78	9.50777	22	9.53153	25	0.46847	9.97624	22
79	9.50799	22	9.53178	24	0.46822	9.97621	21
80	9.50821	23	9.53202	25	0.46798	9.97619	20
81	9.50844	22	9.53227	25	0.46773	9.97616	19
82	9.50866	22	9.53252	25	0.46748	9.97614	18
83	9.50888	22	9.53277	25	0.46723	9.97611	17
84	9.50910	23	9.53302	25	0.46698	9.97609	16
85	9.50933	22	9.53327	24	0.46673	9.97606	15
86	9.50955	22	9.53351	25	0.46649	9.97603	14
87	9.50977	22	9.53376	25	0.46624	9.97601	13
88	9.50999	22	9.53401	25	0.46599	9.97598	12
89	9.51021	22	9.53426	24	0.46574	9.97596	11
90	9.51043	23	9.53450	25	0.46550	9.97593	10
91	9.51066	22	9.53475	25	0.46525	9.97590	09
92	9.51088	22	9.53500	25	0.46500	9.97588	08
93	9.51110	22	9.53525	24	0.46475	9.97585	07
94	9.51132	22	9.53549	25	0.46451	9.97583	06
95	9.51154	22	9.53574	25	0.46426	9.97580	05
96	9.51176	22	9.53599	24	0.46401	9.97577	04
97	9.51198	22	9.53623	25	0.46377	9.97575	03
98	9.51220	22	9.53648	25	0.46352	9.97572	02
99	9.51242	22	9.53673	24	0.46327	9.97570	01
100	9.51264		9.53697		0.46303	9.97567	00
	Cos	d.	Cot	d. c.	Tan	Sin	

P. P.

	25	24	23	22
1	2.5	2.4	2.3	2.2
2	5.0	4.8	4.6	4.4
3	7.5	7.2	6.9	6.6
4	10.0	9.6	9.2	8.8
5	12.5	12.0	11.5	11.0
6	15.0	14.4	13.8	13.2
7	17.5	16.8	16.1	15.4
8	20.0	19.2	18.4	17.6
9	22.5	21.6	20.7	19.8

P. P.

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	Sin	d.	Tan	d. c.	Cot	Cos	
00	9.51264	22	9.53697	25	0.46303	9.97567	100
01	9.51286	22	9.53722	24	0.46278	9.97564	99
02	9.51308	22	9.53746	25	0.46254	9.97562	98
03	9.51330	22	9.53771	25	0.46229	9.97559	97
04	9.51352	22	9.53796	24	0.46204	9.97557	96
05	9.51374	22	9.53820	25	0.46180	9.97554	95
06	9.51396	22	9.53845	24	0.46155	9.97551	94
07	9.51418	22	9.53869	25	0.46131	9.97549	93
08	9.51440	22	9.53894	24	0.46106	9.97546	92
09	9.51462	22	9.53918	25	0.46082	9.97543	91
10	9.51484	22	9.53943	24	0.46057	9.97541	90
11	9.51506	21	9.53967	25	0.46033	9.97538	89
12	9.51527	22	9.53992	24	0.46008	9.97536	88
13	9.51549	22	9.54016	25	0.45984	9.97533	87
14	9.51571	22	9.54041	24	0.45959	9.97530	86
15	9.51593	22	9.54065	25	0.45935	9.97528	85
16	9.51615	22	9.54090	24	0.45910	9.97525	84
17	9.51637	21	9.54114	25	0.45886	9.97522	83
18	9.51658	22	9.54139	24	0.45861	9.97520	82
19	9.51680	22	9.54163	24	0.45837	9.97517	81
20	9.51702	22	9.54187	25	0.45813	9.97515	80
21	9.51724	21	9.54212	24	0.45788	9.97512	79
22	9.51745	22	9.54236	25	0.45764	9.97509	78
23	9.51767	22	9.54261	24	0.45739	9.97507	77
24	9.51789	22	9.54285	24	0.45715	9.97504	76
25	9.51811	21	9.54309	25	0.45691	9.97501	75
26	9.51832	22	9.54334	24	0.45666	9.97499	74
27	9.51854	22	9.54358	24	0.45642	9.97496	73
28	9.51876	21	9.54382	25	0.45618	9.97493	72
29	9.51897	22	9.54407	24	0.45593	9.97491	71
30	9.51919	22	9.54431	24	0.45569	9.97488	70
31	9.51941	21	9.54455	25	0.45545	9.97485	69
32	9.51962	22	9.54480	24	0.45520	9.97483	68
33	9.51984	22	9.54504	24	0.45496	9.97480	67
34	9.52006	21	9.54528	24	0.45472	9.97477	66
35	9.52027	22	9.54552	25	0.45448	9.97475	65
36	9.52049	21	9.54577	24	0.45423	9.97472	64
37	9.52070	22	9.54601	24	0.45399	9.97469	63
38	9.52092	21	9.54625	24	0.45375	9.97467	62
39	9.52113	22	9.54649	24	0.45351	9.97464	61
40	9.52135	21	9.54673	25	0.45327	9.97461	60
41	9.52156	22	9.54698	24	0.45302	9.97459	59
42	9.52178	21	9.54722	24	0.45278	9.97456	58
43	9.52199	22	9.54746	24	0.45254	9.97453	57
44	9.52221	21	9.54770	24	0.45230	9.97451	56
45	9.52242	22	9.54794	24	0.45206	9.97448	55
46	9.52264	21	9.54818	25	0.45182	9.97445	54
47	9.52285	22	9.54843	24	0.45157	9.97443	53
48	9.52307	21	9.54867	24	0.45133	9.97440	52
49	9.52328	22	9.54891	24	0.45109	9.97437	51
50	9.52350		9.54915		0.45085	9.97435	50
	Cos	d.	Cot	d. c.	Tan	Sin	

P. P.

	25
1	2.5
2	5.0
3	7.5
4	10.0
5	12.5
6	15.0
7	17.5
8	20.0
9	22.5

	24
1	2.4
2	4.8
3	7.2
4	9.6
5	12.0
6	14.4
7	16.8
8	19.2
9	21.6

	22
1	2.2
2	4.4
3	6.6
4	8.8
5	11.0
6	13.2
7	15.4
8	17.6
9	19.8

	21
1	2.1
2	4.2
3	6.3
4	8.4
5	10.5
6	12.6
7	14.7
8	16.8
9	18.9

	Sin	d.	Tan	d. c.	Cot	Cos	
50	9.52350	21	9.54915	24	0.45085	9.97435	50
51	9.52371	21	9.54939	24	0.45061	9.97432	49
52	9.52392	22	9.54963	24	0.45037	9.97429	48
53	9.52414	21	9.54987	24	0.45013	9.97427	47
54	9.52435	21	9.55011	24	0.44989	9.97424	46
55	9.52456	22	9.55035	24	0.44965	9.97421	45
56	9.52478	21	9.55059	24	0.44941	9.97419	44
57	9.52499	21	9.55083	24	0.44917	9.97416	43
58	9.52520	22	9.55107	24	0.44893	9.97413	42
59	9.52542	21	9.55131	24	0.44869	9.97410	41
60	9.52563	21	9.55155	24	0.44845	9.97408	40
61	9.52584	22	9.55179	24	0.44821	9.97405	39
62	9.52606	21	9.55203	24	0.44797	9.97402	38
63	9.52627	21	9.55227	24	0.44773	9.97400	37
64	9.52648	21	9.55251	24	0.44749	9.97397	36
65	9.52669	21	9.55275	24	0.44725	9.97394	35
66	9.52690	22	9.55299	24	0.44701	9.97392	34
67	9.52712	21	9.55323	24	0.44677	9.97389	33
68	9.52733	21	9.55347	24	0.44653	9.97386	32
69	9.52754	21	9.55371	24	0.44629	9.97383	31
70	9.52775	21	9.55395	23	0.44605	9.97381	30
71	9.52796	22	9.55418	24	0.44582	9.97378	29
72	9.52818	21	9.55442	24	0.44558	9.97375	28
73	9.52839	21	9.55466	24	0.44534	9.97373	27
74	9.52860	21	9.55490	24	0.44510	9.97370	26
75	9.52881	21	9.55514	24	0.44486	9.97367	25
76	9.52902	21	9.55538	24	0.44462	9.97364	24
77	9.52923	21	9.55562	23	0.44438	9.97362	23
78	9.52944	21	9.55585	24	0.44415	9.97359	22
79	9.52965	21	9.55609	24	0.44391	9.97356	21
80	9.52986	21	9.55633	24	0.44367	9.97353	20
81	9.53007	21	9.55657	23	0.44343	9.97351	19
82	9.53028	21	9.55680	24	0.44320	9.97348	18
83	9.53049	22	9.55704	24	0.44296	9.97345	17
84	9.53071	21	9.55728	24	0.44272	9.97343	16
85	9.53092	20	9.55752	23	0.44248	9.97340	15
86	9.53112	21	9.55775	24	0.44225	9.97337	14
87	9.53133	21	9.55799	24	0.44201	9.97334	13
88	9.53154	21	9.55823	24	0.44177	9.97332	12
89	9.53175	21	9.55847	23	0.44153	9.97329	11
90	9.53196	21	9.55870	24	0.44130	9.97326	10
91	9.53217	21	9.55894	24	0.44106	9.97323	09
92	9.53238	21	9.55918	23	0.44082	9.97321	08
93	9.53259	21	9.55941	24	0.44059	9.97318	07
94	9.53280	21	9.55965	24	0.44035	9.97315	06
95	9.53301	21	9.55989	23	0.44011	9.97312	05
96	9.53322	21	9.56012	24	0.43988	9.97310	04
97	9.53343	20	9.56036	23	0.43964	9.97307	03
98	9.53363	21	9.56059	24	0.43941	9.97304	02
99	9.53384	21	9.56083	24	0.43917	9.97301	01
100	9.53405		9.56107		0.43893	9.97299	00
	Cos	d.	Cot	d. c.	Tan	Sin	

P. P.

	24
1	2.4
2	4.8
3	7.2
4	9.6
5	12.0
6	14.4
7	16.8
8	19.2
9	21.6

	23
1	2.3
2	4.6
3	6.9
4	9.2
5	11.5
6	13.8
7	16.1
8	18.4
9	20.7

	21
1	2.1
2	4.2
3	6.3
4	8.4
5	10.5
6	12.6
7	14.7
8	16.8
9	18.9

	20
1	2.0
2	4.0
3	6.0
4	8.0
5	10.0
6	12.0
7	14.0
8	16.0
9	18.0

P. P.

′	Sin	d.	Tan	d. c.	Cot	Cos	′
00	9.53405	21	9.56107	23	0.43893	9.97299	100
01	9.53426	21	9.56130	24	0.43870	9.97296	99
02	9.53447	21	9.56154	23	0.43846	9.97293	98
03	9.53468	20	9.56177	24	0.43823	9.97290	97
04	9.53488	21	9.56201	23	0.43799	9.97288	96
05	9.53509	21	9.56224	24	0.43776	9.97285	95
06	9.53530	21	9.56248	23	0.43752	9.97282	94
07	9.53551	20	9.56271	24	0.43729	9.97279	93
08	9.53571	21	9.56295	23	0.43705	9.97276	92
09	9.53592	21	9.56318	24	0.43682	9.97274	91
10	9.53613	21	9.56342	23	0.43658	9.97271	90
11	9.53634	20	9.56365	24	0.43635	9.97268	89
12	9.53654	21	9.56389	23	0.43611	9.97265	88
13	9.53675	21	9.56412	24	0.43588	9.97263	87
14	9.53696	20	9.56436	23	0.43564	9.97260	86
15	9.53716	21	9.56459	24	0.43541	9.97257	85
16	9.53737	21	9.56483	23	0.43517	9.97254	84
17	9.53758	20	9.56506	24	0.43494	9.97251	83
18	9.53778	21	9.56530	23	0.43470	9.97249	82
19	9.53799	20	9.56553	23	0.43447	9.97246	81
20	9.53819	21	9.56576	24	0.43424	9.97243	80
21	9.53840	21	9.56600	23	0.43400	9.97240	79
22	9.53861	20	9.56623	23	0.43377	9.97238	78
23	9.53881	21	9.56646	24	0.43354	9.97235	77
24	9.53902	20	9.56670	23	0.43330	9.97232	76
25	9.53922	21	9.56693	23	0.43307	9.97229	75
26	9.53943	20	9.56716	24	0.43284	9.97226	74
27	9.53963	21	9.56740	23	0.43260	9.97224	73
28	9.53984	20	9.56763	23	0.43237	9.97221	72
29	9.54004	21	9.56786	24	0.43214	9.97218	71
30	9.54025	20	9.56810	23	0.43190	9.97215	70
31	9.54045	21	9.56833	23	0.43167	9.97212	69
32	9.54066	20	9.56856	24	0.43144	9.97210	68
33	9.54086	21	9.56880	23	0.43120	9.97207	67
34	9.54107	20	9.56903	23	0.43097	9.97204	66
35	9.54127	21	9.56926	23	0.43074	9.97201	65
36	9.54148	20	9.56949	24	0.43051	9.97198	64
37	9.54168	20	9.56973	23	0.43027	9.97195	63
38	9.54188	21	9.56996	23	0.43004	9.97193	62
39	9.54209	20	9.57019	23	0.42981	9.97190	61
40	9.54229	21	9.57042	23	0.42958	9.97187	60
41	9.54250	20	9.57065	24	0.42935	9.97184	59
42	9.54270	20	9.57089	23	0.42911	9.97181	58
43	9.54290	21	9.57112	23	0.42888	9.97179	57
44	9.54311	20	9.57135	23	0.42865	9.97176	56
45	9.54331	20	9.57158	23	0.42842	9.97173	55
46	9.54351	21	9.57181	23	0.42819	9.97170	54
47	9.54372	20	9.57204	24	0.42796	9.97167	53
48	9.54392	20	9.57228	23	0.42772	9.97164	52
49	9.54412	21	9.57251	23	0.42749	9.97162	51
50	9.54433		9.57274		0.42726	9.97159	50
	Cos	d.	Cot	d. c.	Tan	Sin	

P. P.

24	
1	2.4
2	4.8
3	7.2
4	9.6
5	12.0
6	14.4
7	16.8
8	19.2
9	21.6

23	
1	2.3
2	4.6
3	6.9
4	9.2
5	11.5
6	13.8
7	16.1
8	18.4
9	20.7

21	
1	2.1
2	4.2
3	6.3
4	8.4
5	10.5
6	12.6
7	14.7
8	16.8
9	18.9

20	
1	2.0
2	4.0
3	6.0
4	8.0
5	10.0
6	12.0
7	14.0
8	16.0
9	18.0

P. P.

110°　　　　69°

	Sin	d.	Tan	d. c.	Cot	Cos	
50	9.54433	20	9.57274	23	0.42726	9.97159	50
51	9.54453	20	9.57297	23	0.42703	9.97156	49
52	9.54473	20	9.57320	23	0.42680	9.97153	48
53	9.54493	21	9.57343	23	0.42657	9.97150	47
54	9.54514	20	9.57366	23	0.42634	9.97147	46
55	9.54534	20	9.57389	23	0.42611	9.97145	45
56	9.54554	20	9.57412	23	0.42588	9.97142	44
57	9.54574	20	9.57435	23	0.42565	9.97139	43
58	9.54594	21	9.57458	23	0.42542	9.97136	42
59	9.54615	20	9.57481	23	0.42519	9.97133	41
60	9.54635	20	9.57504	23	0.42496	9.97130	40
61	9.54655	20	9.57527	23	0.42473	9.97127	39
62	9.54675	20	9.57550	23	0.42450	9.97125	38
63	9.54695	20	9.57573	23	0.42427	9.97122	37
64	9.54715	20	9.57596	23	0.42404	9.97119	36
65	9.54735	21	9.57619	23	0.42381	9.97116	35
66	9.54756	20	9.57642	23	0.42358	9.97113	34
67	9.54776	20	9.57665	23	0.42335	9.97110	33
68	9.54796	20	9.57688	23	0.42312	9.97108	32
69	9.54816	20	9.57711	23	0.42289	9.97105	31
70	9.54836	20	9.57734	23	0.42266	9.97102	30
71	9.54856	20	9.57757	23	0.42243	9.97099	29
72	9.54876	20	9.57780	23	0.42220	9.97096	28
73	9.54896	20	9.57803	23	0.42197	9.97093	27
74	9.54916	20	9.57826	23	0.42174	9.97090	26
75	9.54936	20	9.57849	22	0.42151	9.97087	25
76	9.54956	20	9.57871	23	0.42129	9.97085	24
77	9.54976	20	9.57894	23	0.42106	9.97082	23
78	9.54996	20	9.57917	23	0.42083	9.97079	22
79	9.55016	20	9.57940	23	0.42060	9.97076	21
80	9.55036	20	9.57963	23	0.42037	9.97073	20
81	9.55056	20	9.57986	23	0.42014	9.97070	19
82	9.55076	20	9.58009	22	0.41991	9.97067	18
83	9.55096	20	9.58031	23	0.41969	9.97064	17
84	9.55116	20	9.58054	23	0.41946	9.97062	16
85	9.55136	19	9.58077	23	0.41923	9.97059	15
86	9.55155	20	9.58100	22	0.41900	9.97056	14
87	9.55175	20	9.58122	23	0.41878	9.97053	13
88	9.55195	20	9.58145	23	0.41855	9.97050	12
89	9.55215	20	9.58168	23	0.41832	9.97047	11
90	9.55235	20	9.58191	22	0.41809	9.97044	10
91	9.55255	20	9.58213	23	0.41787	9.97041	09
92	9.55275	19	9.58236	23	0.41764	9.97038	08
93	9.55294	20	9.58259	23	0.41741	9.97036	07
94	9.55314	20	9.58282	22	0.41718	9.97033	06
95	9.55334	20	9.58304	23	0.41696	9.97030	05
96	9.55354	20	9.58327	23	0.41673	9.97027	04
97	9.55374	19	9.58350	22	0.41650	9.97024	03
98	9.55393	20	9.58372	23	0.41628	9.97021	02
99	9.55413	20	9.58395	23	0.41605	9.97018	01
100	9.55433		9.58418		0.41582	9.97015	00
	Cos	d.	Cot	d. c.	Tan	Sin	

P. P.

	23	22	20	19
1	2.3	2.2	2.0	1.9
2	4.6	4.4	4.0	3.8
3	6.9	6.6	6.0	5.7
4	9.2	8.8	8.0	7.6
5	11.5	11.0	10.0	9.5
6	13.8	13.2	12.0	11.4
7	16.1	15.4	14.0	13.3
8	18.4	17.6	16.0	15.2
9	20.7	19.8	18.0	17.1

P. P.

′	Sin	d.	Tan	d. c.	Cot	Cos	d.	′
00	9.55433	20	9.58418	22	0.41582	9.97015	3	100
01	9.55453	19	9.58440	23	0.41560	9.97012	3	99
02	9.55472	20	9.58463	23	0.41537	9.97009	3	98
03	9.55492	20	9.58486	22	0.41514	9.97006	2	97
04	9.55512	20	9.58508	23	0.41492	9.97004	3	96
05	9.55532	19	9.58531	23	0.41469	9.97001	3	95
06	9.55551	20	9.58554	22	0.41446	9.96998	3	94
07	9.55571	20	9.58576	23	0.41424	9.96995	3	93
08	9.55591	19	9.58599	22	0.41401	9.96992	3	92
09	9.55610	20	9.58621	23	0.41379	9.96989	3	91
10	9.55630	20	9.58644	22	0.41356	9.96986	3	90
11	9.55650	19	9.58666	23	0.41334	9.96983	3	89
12	9.55669	20	9.58689	23	0.41311	9.96980	3	88
13	9.55689	19	9.58712	22	0.41288	9.96977	3	87
14	9.55708	20	9.58734	23	0.41266	9.96974	3	86
15	9.55728	20	9.58757	22	0.41243	9.96971	3	85
16	9.55748	19	9.58779	23	0.41221	9.96968	3	84
17	9.55767	20	9.58802	22	0.41198	9.96965	2	83
18	9.55787	19	9.58824	23	0.41176	9.96963	3	82
19	9.55806	20	9.58847	22	0.41153	9.96960	3	81
20	9.55826	19	9.58869	23	0.41131	9.96957	3	80
21	9.55845	20	9.58892	22	0.41108	9.96954	3	79
22	9.55865	19	9.58914	23	0.41086	9.96951	3	78
23	9.55884	20	9.58937	22	0.41063	9.96948	3	77
24	9.55904	19	9.58959	22	0.41041	9.96945	3	76
25	9.55923	20	9.58981	23	0.41019	9.96942	3	75
26	9.55943	19	9.59004	22	0.40996	9.96939	3	74
27	9.55962	20	9.59026	23	0.40974	9.96936	3	73
28	9.55982	19	9.59049	22	0.40951	9.96933	3	72
29	9.56001	20	9.59071	23	0.40929	9.96930	3	71
30	9.56021	19	9.59094	22	0.40906	9.96927	3	70
31	9.56040	20	9.59116	22	0.40884	9.96924	3	69
32	9.56060	19	9.59138	23	0.40862	9.96921	3	68
33	9.56079	19	9.59161	22	0.40839	9.96918	3	67
34	9.56098	20	9.59183	22	0.40817	9.96915	3	66
35	9.56118	19	9.59205	23	0.40795	9.96912	3	65
36	9.56137	20	9.59228	22	0.40772	9.96909	3	64
37	9.56157	19	9.59250	22	0.40750	9.96906	2	63
38	9.56176	19	9.59272	23	0.40728	9.96904	3	62
39	9.56195	20	9.59295	22	0.40705	9.96901	3	61
40	9.56215	19	9.59317	22	0.40683	9.96898	3	60
41	9.56234	19	9.59339	23	0.40661	9.96895	3	59
42	9.56253	20	9.59362	22	0.40638	9.96892	3	58
43	9.56273	19	9.59384	22	0.40616	9.96889	3	57
44	9.56292	19	9.59406	23	0.40594	9.96886	3	56
45	9.56311	19	9.59429	22	0.40571	9.96883	3	55
46	9.56330	20	9.59451	22	0.40549	9.96880	3	54
47	9.56350	19	9.59473	22	0.40527	9.96877	3	53
48	9.56369	19	9.59495	23	0.40505	9.96874	3	52
49	9.56388	20	9.59518	22	0.40482	9.96871	3	51
50	9.56408		9.59540		0.40460	9.96868		50
	Cos	d.	Cot	d. c.	Tan	Sin	d.	

P. P.

	23	22	20	19	3
1	2.3	2.2	2.0	1.9	0.3
2	4.6	4.4	4.0	3.8	0.6
3	6.9	6.6	6.0	5.7	0.9
4	9.2	8.8	8.0	7.6	1.2
5	11.5	11.0	10.0	9.5	1.5
6	13.8	13.2	12.0	11.4	1.8
7	16.1	15.4	14.0	13.3	2.1
8	18.4	17.6	16.0	15.2	2.4
9	20.7	19.8	18.0	17.1	2.7

P. P.

	Sin	d.	Tan	d. c.	Cot	Cos	d.	
50	9.56408	19	9.59540	22	0.40460	9.96868	3	**50**
51	9.56427	19	9.59562	22	0.40438	9.96865	3	49
52	9.56446	19	9.59584	22	0.40416	9.96862	3	48
53	9.56465	19	9.59606	23	0.40394	9.96859	3	47
54	9.56484	20	9.59629	22	0.40371	9.96856	3	46
55	9.56504	19	9.59651	22	0.40349	9.96853	3	45
56	9.56523	19	9.59673	22	0.40327	9.96850	3	44
57	9.56542	19	9.59695	22	0.40305	9.96847	3	43
58	9.56561	19	9.59717	22	0.40283	9.96844	3	42
59	9.56580	19	9.59739	23	0.40261	9.96841	3	41
60	9.56599	20	9.59762	22	0.40238	9.96838	3	**40**
61	9.56619	19	9.59784	22	0.40216	9.96835	3	39
62	9.56638	19	9.59806	22	0.40194	9.96832	3	38
63	9.56657	19	9.59828	22	0.40172	9.96829	3	37
64	9.56676	19	9.59850	22	0.40150	9.96826	3	36
65	9.56695	19	9.59872	22	0.40128	9.96823	3	35
66	9.56714	19	9.59894	22	0.40106	9.96820	3	34
67	9.56733	19	9.59916	23	0.40084	9.96817	3	33
68	9.56752	19	9.59939	22	0.40061	9.96814	3	32
69	9.56771	19	9.59961	22	0.40039	9.96811	3	31
70	9.56790	19	9.59983	22	0.40017	9.96808	3	**30**
71	9.56809	20	9.60005	22	0.39995	9.96805	3	29
72	9.56829	19	9.60027	22	0.39973	9.96802	3	28
73	9.56848	19	9.60049	22	0.39951	9.96799	3	27
74	9.56867	19	9.60071	22	0.39929	9.96796	3	26
75	9.56886	19	9.60093	22	0.39907	9.96793	3	25
76	9.56905	19	9.60115	22	0.39885	9.96790	3	24
77	9.56924	19	9.60137	22	0.39863	9.96787	3	23
78	9.56943	18	9.60159	22	0.39841	9.96784	3	22
79	9.56961	19	9.60181	22	0.39819	9.96781	3	21
80	9.56980	19	9.60203	22	0.39797	9.96778	4	**20**
81	9.56999	19	9.60225	22	0.39775	9.96774	3	19
82	9.57018	19	9.60247	22	0.39753	9.96771	3	18
83	9.57037	19	9.60269	22	0.39731	9.96768	3	17
84	9.57056	19	9.60291	22	0.39709	9.96765	3	16
85	9.57075	19	9.60313	22	0.39687	9.96762	3	15
86	9.57094	19	9.60335	22	0.39665	9.96759	3	14
87	9.57113	19	9.60357	22	0.39643	9.96756	3	13
88	9.57132	19	9.60379	21	0.39621	9.96753	3	12
89	9.57151	18	9.60400	22	0.39600	9.96750	3	11
90	9.57169	19	9.60422	22	0.39578	9.96747	3	**10**
91	9.57188	19	9.60444	22	0.39556	9.96744	3	09
92	9.57207	19	9.60466	22	0.39534	9.96741	3	08
93	9.57226	19	9.60488	22	0.39512	9.96738	3	07
94	9.57245	19	9.60510	22	0.39490	9.96735	3	06
95	9.57264	18	9.60532	22	0.39468	9.96732	3	05
96	9.57282	19	9.60554	21	0.39446	9.96729	3	04
97	9.57301	19	9.60575	22	0.39425	9.96726	3	03
98	9.57320	19	9.60597	22	0.39403	9.96723	3	02
99	9.57339	19	9.60619	22	0.39381	9.96720	3	01
100	9.57358		9.60641		0.39359	9.96717		**00**
	Cos	d.	Cot	d. c.	Tan	Sin	d.	

P. P.

	22	21	19	18	4
1	2.2	2.1	1.9	1.8	0.4
2	4.4	4.2	3.8	3.6	0.8
3	6.6	6.3	5.7	5.4	1.2
4	8.8	8.4	7.6	7.2	1.6
5	11.0	10.5	9.5	9.0	2.0
6	13.2	12.6	11.4	10.8	2.4
7	15.4	14.7	13.3	12.6	2.8
8	17.6	16.8	15.2	14.4	3.2
9	19.8	18.9	17.1	16.2	3.6

P. P.

′	Sin	d.	Tan	d. c.	Cot	Cos	d.	′
00	9.57358	18	9.60641	22	0.39359	9.96717	3	100
01	9.57376	19	9.60663	22	0.39337	9.96714	4	99
02	9.57395	19	9.60685	21	0.39315	9.96710	3	98
03	9.57414	19	9.60706	22	0.39294	9.96707	3	97
04	9.57433	18	9.60728	22	0.39272	9.96704	3	96
05	9.57451	19	9.60750	22	0.39250	9.96701	3	95
06	9.57470	19	9.60772	22	0.39228	9.96698	3	94
07	9.57489	18	9.60794	21	0.39206	9.96695	3	93
08	9.57507	19	9.60815	22	0.39185	9.96692	3	92
09	9.57526	19	9.60837	22	0.39163	9.96689	3	91
10	9.57545	18	9.60859	22	0.39141	9.96686	3	90
11	9.57563	19	9.60881	21	0.39119	9.96683	3	89
12	9.57582	19	9.60902	22	0.39098	9.96680	3	88
13	9.57601	18	9.60924	22	0.39076	9.96677	3	87
14	9.57619	19	9.60946	21	0.39054	9.96674	4	86
15	9.57638	19	9.60967	22	0.39033	9.96670	3	85
16	9.57657	18	9.60989	22	0.39011	9.96667	3	84
17	9.57675	19	9.61011	22	0.38989	9.96664	3	83
18	9.57694	18	9.61033	21	0.38967	9.96661	3	82
19	9.57712	19	9.61054	22	0.38946	9.96658	3	81
20	9.57731	18	9.61076	22	0.38924	9.96655	3	80
21	9.57749	19	9.61098	21	0.38902	9.96652	3	79
22	9.57768	19	9.61119	22	0.38881	9.96649	3	78
23	9.57787	18	9.61141	21	0.38859	9.96646	3	77
24	9.57805	19	9.61162	22	0.38838	9.96643	3	76
25	9.57824	18	9.61184	22	0.38816	9.96640	4	75
26	9.57842	19	9.61206	21	0.38794	9.96636	3	74
27	9.57861	18	9.61227	22	0.38773	9.96633	3	73
28	9.57879	19	9.61249	22	0.38751	9.96630	3	72
29	9.57898	18	9.61271	21	0.38729	9.96627	3	71
30	9.57916	19	9.61292	22	0.38708	9.96624	3	70
31	9.57935	18	9.61314	21	0.38686	9.96621	3	69
32	9.57953	19	9.61335	22	0.38665	9.96618	3	68
33	9.57972	18	9.61357	21	0.38643	9.96615	3	67
34	9.57990	18	9.61378	22	0.38622	9.96612	4	66
35	9.58008	19	9.61400	22	0.38600	9.96608	3	65
36	9.58027	18	9.61422	21	0.38578	9.96605	3	64
37	9.58045	19	9.61443	22	0.38557	9.96602	3	63
38	9.58064	18	9.61465	21	0.38535	9.96599	3	62
39	9.58082	19	9.61486	22	0.38514	9.96596	3	61
40	9.58101	18	9.61508	21	0.38492	9.96593	3	60
41	9.58119	18	9.61529	22	0.38471	9.96590	3	59
42	9.58137	19	9.61551	21	0.38449	9.96587	4	58
43	9.58156	18	9.61572	22	0.38428	9.96583	3	57
44	9.58174	18	9.61594	21	0.38406	9.96580	3	56
45	9.58192	19	9.61615	22	0.38385	9.96577	3	55
46	9.58211	18	9.61637	21	0.38363	9.96574	3	54
47	9.58229	18	9.61658	22	0.38342	9.96571	3	53
48	9.58247	19	9.61680	21	0.38320	9.96568	3	52
49	9.58266	18	9.61701	21	0.38299	9.96565	3	51
50	9.58284		9.61722		0.38278	9.96562		50
	Cos	d.	Cot	d. c.	Tan	Sin	d.	

P. P.

	22	21	19	18	3
1	2.2	2.1	1.9	1.8	0.3
2	4.4	4.2	3.8	3.6	0.6
3	6.6	6.3	5.7	5.4	0.9
4	8.8	8.4	7.6	7.2	1.2
5	11.0	10.5	9.5	9.0	1.5
6	13.2	12.6	11.4	10.8	1.8
7	15.4	14.7	13.3	12.6	2.1
8	17.6	16.8	15.2	14.4	2.4
9	19.8	18.9	17.1	16.2	2.7

P. P.

	Sin	d.	Tan	d. c.	Cot	Cos	d.	
50	9.58284	18	9.61722	22	0.38278	9.96562	4	**50**
51	9.58302	19	9.61744	21	0.38256	9.96558	3	49
52	9.58321	18	9.61765	22	0.38235	9.96555	3	48
53	9.58339	18	9.61787	21	0.38213	9.96552	3	47
54	9.58357	18	9.61808	22	0.38192	9.96549	3	46
55	9.58375	19	9.61830	21	0.38170	9.96546	3	45
56	9.58394	18	9.61851	21	0.38149	9.96543	3	44
57	9.58412	18	9.61872	22	0.38128	9.96540	4	43
58	9.58430	18	9.61894	21	0.38106	9.96536	3	42
59	9.58448	19	9.61915	21	0.38085	9.96533	3	41
60	9.58467	18	9.61936	22	0.38064	9.96530	3	**40**
61	9.58485	18	9.61958	21	0.38042	9.96527	3	39
62	9.58503	18	9.61979	22	0.38021	9.96524	3	38
63	9.58521	18	9.62001	21	0.37999	9.96521	4	37
64	9.58539	18	9.62022	21	0.37978	9.96517	3	36
65	9.58557	19	9.62043	22	0.37957	9.96514	3	35
66	9.58576	18	9.62065	21	0.37935	9.96511	3	34
67	9.58594	18	9.62086	21	0.37914	9.96508	3	33
68	9.58612	18	9.62107	21	0.37893	9.96505	3	32
69	9.58630	18	9.62128	22	0.37872	9.96502	4	31
70	9.58648	18	9.62150	21	0.37850	9.96498	3	**30**
71	9.58666	18	9.62171	21	0.37829	9.96495	3	29
72	9.58684	18	9.62192	22	0.37808	9.96492	3	28
73	9.58702	19	9.62214	21	0.37786	9.96489	3	27
74	9.58721	18	9.62235	21	0.37765	9.96486	3	26
75	9.58739	18	9.62256	21	0.37744	9.96483	4	25
76	9.58757	18	9.62277	22	0.37723	9.96479	3	24
77	9.58775	18	9.62299	21	0.37701	9.96476	3	23
78	9.58793	18	9.62320	21	0.37680	9.96473	3	22
79	9.58811	18	9.62341	21	0.37659	9.96470	3	21
80	9.58829	18	9.62362	21	0.37638	9.96467	4	**20**
81	9.58847	18	9.62383	22	0.37617	9.96463	3	19
82	9.58865	18	9.62405	21	0.37595	9.96460	3	18
83	9.58883	18	9.62426	21	0.37574	9.96457	3	17
84	9.58901	18	9.62447	21	0.37553	9.96454	3	16
85	9.58919	18	9.62468	21	0.37532	9.96451	4	15
86	9.58937	18	9.62489	22	0.37511	9.96447	3	14
87	9.58955	18	9.62511	21	0.37489	9.96444	3	13
88	9.58973	18	9.62532	21	0.37468	9.96441	3	12
89	9.58991	18	9.62553	21	0.37447	9.96438	3	11
90	9.59009	18	9.62574	21	0.37426	9.96435	3	**10**
91	9.59027	18	9.62595	21	0.37405	9.96432	4	09
92	9.59045	18	9.62616	21	0.37384	9.96428	3	08
93	9.59063	18	9.62637	22	0.37363	9.96425	3	07
94	9.59081	17	9.62659	21	0.37341	9.96422	3	06
95	9.59098	18	9.62680	21	0.37320	9.96419	4	05
96	9.59116	18	9.62701	21	0.37299	9.96415	3	04
97	9.59134	18	9.62722	21	0.37278	9.96412	3	03
98	9.59152	18	9.62743	21	0.37257	9.96409	3	02
99	9.59170	18	9.62764	21	0.37236	9.96406	3	01
100	9.59188		9.62785		0.37215	9.96403		**00**
	Cos	d.	Cot	d. c.	Tan	Sin	d.	

P. P.

	22	21	18	17	4
1	2.2	2.1	1.8	1.7	0.4
2	4.4	4.2	3.6	3.4	0.8
3	6.6	6.3	5.4	5.1	1.2
4	8.8	8.4	7.2	6.8	1.6
5	11.0	10.5	9.0	8.5	2.0
6	13.2	12.6	10.8	10.2	2.4
7	15.4	14.7	12.6	11.9	2.8
8	17.6	16.8	14.4	13.6	3.2
9	19.8	18.9	16.2	15.3	3.6

P. P.

	Sin	d.	Tan	d. c.	Cot	Cos	d.	
00	9.59188	18	9.62785	21	0.37215	9.96403	4	**100**
01	9.59206	17	9.62806	21	0.37194	9.96399	3	99
02	9.59223	18	9.62827	21	0.37173	9.96396	3	98
03	9.59241	18	9.62848	21	0.37152	9.96393	3	97
04	9.59259	18	9.62869	21	0.37131	9.96390	3	96
05	9.59277	18	9.62890	22	0.37110	9.96387	4	95
06	9.59295	18	9.62912	21	0.37088	9.96383	3	94
07	9.59313	17	9.62933	21	0.37067	9.96380	3	93
08	9.59330	18	9.62954	21	0.37046	9.96377	3	92
09	9.59348	18	9.62975	21	0.37025	9.96374	4	91
10	9.59366	18	9.62996	21	0.37004	9.96370	3	**90**
11	9.59384	17	9.63017	21	0.36983	9.96367	3	89
12	9.59401	18	9.63038	21	0.36962	9.96364	3	88
13	9.59419	18	9.63059	21	0.36941	9.96361	4	87
14	9.59437	18	9.63080	21	0.36920	9.96357	3	86
15	9.59455	17	9.63101	20	0.36899	9.96354	3	85
16	9.59472	18	9.63121	21	0.36879	9.96351	3	84
17	9.59490	18	9.63142	21	0.36858	9.96348	4	83
18	9.59508	18	9.63163	21	0.36837	9.96344	3	82
19	9.59526	17	9.63184	21	0.36816	9.96341	3	81
20	9.59543	18	9.63205	21	0.36795	9.96338	3	**80**
21	9.59561	18	9.63226	21	0.36774	9.96335	4	79
22	9.59579	17	9.63247	21	0.36753	9.96331	3	78
23	9.59596	18	9.63268	21	0.36732	9.96328	3	77
24	9.59614	18	9.63289	21	0.36711	9.96325	3	76
25	9.59632	17	9.63310	21	0.36690	9.96322	4	75
26	9.59649	18	9.63331	21	0.36669	9.96318	3	74
27	9.59667	17	9.63352	21	0.36648	9.96315	3	73
28	9.59684	18	9.63373	20	0.36627	9.96312	3	72
29	9.59702	18	9.63393	21	0.36607	9.96309	4	71
30	9.59720	17	9.63414	21	0.36586	9.96305	3	**70**
31	9.59737	18	9.63435	21	0.36565	9.96302	3	69
32	9.59755	17	9.63456	21	0.36544	9.96299	-	68
33	9.59772	18	9.63477	21	0.36523	9.96296	4	67
34	9.59790	18	9.63498	21	0.36502	9.96292	3	66
35	9.59808	17	9.63519	20	0.36481	9.96289	3	65
36	9.59825	18	9.63539	21	0.36461	9.96286	4	64
37	9.59843	17	9.63560	21	0.36440	9.96282	3	63
38	9.59860	18	9.63581	21	0.36419	9.96279	3	62
39	9.59878	17	9.63602	21	0.36398	9.96276	3	61
40	9.59895	18	9.63623	20	0.36377	9.96273	4	**60**
41	9.59913	17	9.63643	21	0.36357	9.96269	3	59
42	9.59930	18	9.63664	21	0.36336	9.96266	3	58
43	9.59948	17	9.63685	21	0.36315	9.96263	3	57
44	9.59965	18	9.63706	20	0.36294	9.96260	4	56
45	9.59983	17	9.63726	21	0.36274	9.96256	3	55
46	9.60000	18	9.63747	21	0.36253	9.96253	3	54
47	9.60018	17	9.63768	21	0.36232	9.96250	4	53
48	9.60035	18	9.63789	20	0.36211	9.96246	3	52
49	9.60053	17	9.63809	21	0.36191	9.96243	3	51
50	9.60070		9.63830		0.36170	9.96240		**50**
	Cos	d.	Cot	d. c.	Tan	Sin	d.	

P. P.

	21	20	18	17	3
1	2.1	2.0	1.8	1.7	0.3
2	4.2	4.0	3.6	3.4	0.6
3	6.3	6.0	5.4	5.1	0.9
4	8.4	8.0	7.2	6.8	1.2
5	10.5	10.0	9.0	8.5	1.5
6	12.6	12.0	10.8	10.2	1.8
7	14.7	14.0	12.6	11.9	2.1
8	16.8	16.0	14.4	13.6	2.4
9	18.9	18.0	16.2	15.3	2.7

P. P.

	Sin	d.	Tan	d. c.	Cot	Cos	d.	
50	9.60070	17	9.63830	21	0.36170	9.96240	4	**50**
51	9.60087	18	9.63851	21	0.36149	9.96236	3	49
52	9.60105	17	9.63872	20	0.36128	9.96233	3	48
53	9.60122	18	9.63892	21	0.36108	9.96230	3	47
54	9.60140	17	9.63913	21	0.36087	9.96227	4	46
55	9.60157	17	9.63934	20	0.36066	9.96223	3	45
56	9.60174	18	9.63954	21	0.36046	9.96220	3	44
57	9.60192	17	9.63975	21	0.36025	9.96217	4	43
58	9.60209	18	9.63996	20	0.36004	9.96213	3	42
59	9.60227	17	9.64016	21	0.35984	9.96210	3	41
60	9.60244	17	9.64037	21	0.35963	9.96207	4	**40**
61	9.60261	18	9.64058	20	0.35942	9.96203	3	39
62	9.60279	17	9.64078	21	0.35922	9.96200	3	38
63	9.60296	17	9.64099	21	0.35901	9.96197	4	37
64	9.60313	18	9.64120	20	0.35880	9.96193	3	36
65	9.60331	17	9.64140	21	0.35860	9.96190	3	35
66	9.60348	17	9.64161	21	0.35839	9.96187	3	34
67	9.60365	17	9.64182	20	0.35818	9.96184	4	33
68	9.60382	18	9.64202	21	0.35798	9.96180	3	32
69	9.60400	17	9.64223	20	0.35777	9.96177	3	31
70	9.60417	17	9.64243	21	0.35757	9.96174	4	**30**
71	9.60434	17	9.64264	21	0.35736	9.96170	3	29
72	9.60451	18	9.64285	20	0.35715	9.96167	3	28
73	9.60469	17	9.64305	21	0.35695	9.96164	4	27
74	9.60486	17	9.64326	20	0.35674	9.96160	3	26
75	9.60503	17	9.64346	21	0.35654	9.96157	3	25
76	9.60520	18	9.64367	20	0.35633	9.96154	4	24
77	9.60538	17	9.64387	21	0.35613	9.96150	3	23
78	9.60555	17	9.64408	21	0.35592	9.96147	3	22
79	9.60572	17	9.64429	20	0.35571	9.96144	4	21
80	9.60589	17	9.64449	21	0.35551	9.96140	3	**20**
81	9.60606	18	9.64470	20	0.35530	9.96137	3	19
82	9.60624	17	9.64490	21	0.35510	9.96134	4	18
83	9.60641	17	9.64511	20	0.35489	9.96130	3	17
84	9.60658	17	9.64531	21	0.35469	9.96127	4	16
85	9.60675	17	9.64552	20	0.35448	9.96123	3	15
86	9.60692	17	9.64572	21	0.35428	9.96120	3	14
87	9.60709	17	9.64593	20	0.35407	9.96117	4	13
88	9.60726	18	9.64613	21	0.35387	9.96113	3	12
89	9.60744	17	9.64634	20	0.35366	9.96110	3	11
90	9.60761	17	9.64654	20	0.35346	9.96107	4	**10**
91	9.60778	17	9.64674	21	0.35326	9.96103	3	09
92	9.60795	17	9.64695	20	0.35305	9.96100	3	08
93	9.60812	17	9.64715	21	0.35285	9.96097	4	07
94	9.60829	17	9.64736	20	0.35264	9.96093	3	06
95	9.60846	17	9.64756	21	0.35244	9.96090	3	05
96	9.60863	17	9.64777	20	0.35223	9.96087	4	04
97	9.60880	17	9.64797	21	0.35203	9 96083	3	03
98	9.60897	17	9.64818	20	0.35182	9.96080	4	02
99	9.60914	17	9.64838	20	0.35162	9.96076	3	01
100	9.60931		9.64858		0.35142	9.96073		**00**
	Cos	d.	Cot	d. c.	Tan	Sin	d.	

P. P.

	21	20	18	17	4
1	2.1	2.0	1.8	1.7	0.4
2	4.2	4.0	3.6	3.4	0.8
3	6.3	6.0	5.4	5.1	1.2
4	8.4	8.0	7.2	6.8	1.6
5	10.5	10.0	9.0	8.5	2.0
6	12.6	12.0	10.8	10.2	2.4
7	14.7	14.0	12.6	11.9	2.8
8	16.8	16.0	14.4	13.6	3.2
9	18.9	18.0	16.2	15.3	3.6

′	Sin	d.	Tan	d. c.	Cot	Cos	d.	′
00	9.60931	17	9.64858	21	0.35142	9.96073	3	100
01	9.60948	17	9.64879	20	0.35121	9.96070	4	99
02	9.60965	17	9.64899	20	0.35101	9.96066	3	98
03	9.60982	17	9.64919	21	0.35081	9.96063	3	97
04	9.60999	17	9.64940	20	0.35060	9.96060	4	96
05	9.61016	17	9.64960	21	0.35040	9.96056	3	95
06	9.61033	17	9.64981	20	0.35019	9.96053	4	94
07	9.61050	17	9.65001	20	0.34999	9.96049	3	93
08	9.61067	17	9.65021	21	0.34979	9.96046	3	92
09	9.61084	17	9.65042	20	0.34958	9.96043	4	91
10	9.61101	17	9.65062	20	0.34938	9.96039	3	90
11	9.61118	17	9.65082	21	0.34918	9.96036	4	89
12	9.61135	17	9.65103	20	0.34897	9.96032	3	88
13	9.61152	17	9.65123	20	0.34877	9.96029	3	87
14	9.61169	17	9.65143	21	0.34857	9.96026	4	86
15	9.61186	17	9.65164	20	0.34836	9.96022	3	85
16	9.61203	17	9.65184	20	0.34816	9.96019	4	84
17	9.61220	16	9.65204	20	0.34796	9.96015	3	83
18	9.61236	17	9.65224	21	0.34776	9.96012	3	82
19	9.61253	17	9.65245	20	0.34755	9.96009	4	81
20	9.61270	17	9.65265	20	0.34735	9.96005	3	80
21	9.61287	17	9.65285	21	0.34715	9.96002	4	79
22	9.61304	17	9.65306	20	0.34694	9.95998	3	78
23	9.61321	17	9.65326	20	0.34674	9.95995	3	77
24	9.61338	16	9.65346	20	0.34654	9.95992	4	76
25	9.61354	17	9.65366	21	0.34634	9.95988	3	75
26	9.61371	17	9.65387	20	0.34613	9.95985	4	74
27	9.61388	17	9.65407	20	0.34593	9.95981	3	73
28	9.61405	17	9.65427	20	0.34573	9.95978	4	72
29	9.61422	16	9.65447	20	0.34553	9.95974	3	71
30	9.61438	17	9.65467	21	0.34533	9.95971	3	70
31	9.61455	17	9.65488	20	0.34512	9.95968	4	69
32	9.61472	17	9.65508	20	0.34492	9.95964	3	68
33	9.61489	17	9.65528	20	0.34472	9.95961	4	67
34	9.61506	16	9.65548	20	0.34452	9.95957	3	66
35	9.61522	17	9.65568	21	0.34432	9.95954	4	65
36	9.61539	17	9.65589	20	0.34411	9.95950	3	64
37	9.61556	17	9.65609	20	0.34391	9.95947	3	63
38	9.61573	16	9.65629	20	0.34371	9.95944	4	62
39	9.61589	17	9.65649	20	0.34351	9.95940	3	61
40	9.61606	17	9.65669	20	0.34331	9.95937	4	60
41	9.61623	16	9.65689	21	0.34311	9.95933	3	59
42	9.61639	17	9.65710	20	0.34290	9.95930	4	58
43	9.61656	17	9.65730	20	0.34270	9.95926	3	57
44	9.61673	16	9.65750	20	0.34250	9.95923	3	56
45	9.61689	17	9.65770	20	0.34230	9.95920	4	55
46	9.61706	17	9.65790	20	0.34210	9.95916	3	54
47	9.61723	16	9.65810	20	0.34190	9.95913	4	53
48	9.61739	17	9.65830	20	0.34170	9.95909	3	52
49	9.61756	17	9.65850	20	0.34150	9.95906	4	51
50	9.61773		9.65870		0.34130	9.95902		50
	Cos	d.	Cot	d. c.	Tan	Sin	d.	

P. P.

	21	20	17	16	3
1	2.1	2.0	1.7	1.6	0.3
2	4.2	4.0	3.4	3.2	0.6
3	6.3	6.0	5.1	4.8	0.9
4	8.4	8.0	6.8	6.4	1.2
5	10.5	10.0	8.5	8.0	1.5
6	12.6	12.0	10.2	9.6	1.8
7	14.7	14.0	11.9	11.2	2.1
8	16.8	16.0	13.6	12.8	2.4
9	18.9	18.0	15.3	14.4	2.7

P. P.

	Sin	d.	Tan	d. c.	Cot	Cos	d.	
50	9.61773	16	9.65870	20	0.34130	9.95902	3	**50**
51	9.61789	17	9.65890	21	0.34110	9.95899	4	49
52	9.61806	17	9.65911	20	0.34089	9.95895	3	48
53	9.61823	16	9.65931	20	0.34069	9.95892	4	47
54	9.61839	17	9.65951	20	0.34049	9.95888	3	46
55	9.61856	16	9.65971	20	0.34029	9.95885	3	45
56	9.61872	17	9.65991	20	0.34009	9.95882	4	44
57	9.61889	17	9.66011	20	0.33989	9.95878	3	43
58	9.61906	16	9.66031	20	0.33969	9.95875	4	42
59	9.61922	17	9.66051	20	0.33949	9.95871	3	41
60	9.61939	16	9.66071	20	0.33929	9.95868	4	**40**
61	9.61955	17	9.66091	20	0.33909	9.95864	3	39
62	9.61972	16	9.66111	20	0.33889	9.95861	4	38
63	9.61988	17	9.66131	20	0.33869	9.95857	3	37
64	9.62005	16	9.66151	20	0.33849	9.95854	4	36
65	9.62021	17	9.66171	20	0.33829	9.95850	3	35
66	9.62038	16	9.66191	20	0.33809	9.95847	4	34
67	9.62054	17	9.66211	20	0.33789	9.95843	3	33
68	9.62071	16	9.66231	20	0.33769	9.95840	4	32
69	9.62087	17	9.66251	20	0.33749	9.95836	3	31
70	9.62104	16	9.66271	20	0.33729	9.95833	4	**30**
71	9.62120	17	9.66291	20	0.33709	9.95829	3	29
72	9.62137	16	9.66311	20	0.33689	9.95826	4	28
73	9.62153	17	9.66331	20	0.33669	9.95822	3	27
74	9.62170	16	9.66351	20	0.33649	9.95819	4	26
75	9.62186	17	9.66371	20	0.33629	9.95815	3	25
76	9.62203	16	9.66391	20	0.33609	9.95812	4	24
77	9.62219	16	9.66411	19	0.33589	9.95808	3	23
78	9.62235	17	9.66430	20	0.33570	9.95805	4	22
79	9.62252	16	9.66450	20	0.33550	9.95801	3	21
80	9.62268	17	9.66470	20	0.33530	9.95798	4	**20**
81	9.62285	16	9.66490	20	0.33510	9.95794	3	19
82	9.62301	16	9.66510	20	0.33490	9.95791	4	18
83	9.62317	17	9.66530	20	0.33470	9.95787	3	17
84	9.62334	16	9.66550	20	0.33450	9.95784	4	16
85	9.62350	17	9.66570	20	0.33430	9.95780	3	15
86	9.62367	16	9.66590	19	0.33410	9.95777	4	14
87	9.62383	16	9.66609	20	0.33391	9.95773	3	13
88	9.62399	17	9.66629	20	0.33371	9.95770	4	12
89	9.62416	16	9.66649	20	0.33351	9.95766	3	11
90	9.62432	16	9.66669	20	0.33331	9.95763	4	**10**
91	9.62448	17	9.66689	20	0.33311	9.95759	3	09
92	9.62465	16	9.66709	20	0.33291	9.95756	4	08
93	9.62481	16	9.66729	19	0.33271	9.95752	3	07
94	9.62497	16	9.66748	20	0.33252	9.95749	4	06
95	9.62513	17	9.66768	20	0.33232	9.95745	3	05
96	9.62530	16	9.66788	20	0.33212	9.95742	4	04
97	9.62546	16	9.66808	20	0.33192	9.95738	3	03
98	9.62562	17	9.66828	19	0.33172	9.95735	4	02
99	9.62579	16	9.66847	20	0.33153	9.95731	3	01
100	9.62595		9.66867		0.33133	9.95728		**00**
	Cos	d.	Cot	d. c.	Tan	Sin	d.	

P. P.

	20	**19**	**17**	**16**	**4**
1	2.0	1.9	1.7	1.6	0.4
2	4.0	3.8	3.4	3.2	0.8
3	6.0	5.7	5.1	4.8	1.2
4	8.0	7.6	6.8	6.4	1.6
5	10.0	9.5	8.5	8.0	2.0
6	12.0	11.4	10.2	9.6	2.4
7	14.0	13.3	11.9	11.2	2.8
8	16.0	15.2	13.6	12.8	3.2
9	18.0	17.1	15.3	14.4	3.6

	Sin	d.	Tan	d. c.	Cot	Cos	d.	
00	9.62595	16	9.66867	20	0.33133	9.95728	4	100
01	9.62611	16	9.66887	20	0.33113	9.95724	4	99
02	9.62627	17	9.66907	20	0.33093	9.95720	3	98
03	9.62644	16	9.66927	19	0.33073	9.95717	4	97
04	9.62660	16	9.66946	20	0.33054	9.95713	3	96
05	9.62676	16	9.66966	20	0.33034	9.95710	4	95
06	9.62692	16	9.66986	20	0.33014	9.95706	3	94
07	9.62708	17	9.67006	19	0.32994	9.95703	4	93
08	9.62725	16	9.67025	20	0.32975	9.95699	3	92
09	9.62741	16	9.67045	20	0.32955	9.95696	4	91
10	9.62757	16	9.67065	20	0.32935	9.95692	3	90
11	9.62773	16	9.67085	19	0.32915	9.95689	4	89
12	9.62789	17	9.67104	20	0.32896	9.95685	4	88
13	9.62806	16	9.67124	20	0.32876	9.95681	3	87
14	9.62822	16	9.67144	19	0.32856	9.95678	4	86
15	9.62838	16	9.67163	20	0.32837	9.95674	3	85
16	9.62854	16	9.67183	20	0.32817	9.95671	4	84
17	9.62870	16	9.67203	20	0.32797	9.95667	3	83
18	9.62886	16	9.67223	19	0.32777	9.95664	4	82
19	9.62902	16	9.67242	20	0.32758	9.95660	3	81
20	9.62918	17	9.67262	20	0.32738	9.95657	4	80
21	9.62935	16	9.67282	19	0.32718	9.95653	4	79
22	9.62951	16	9.67301	20	0.32699	9.95649	3	78
23	9.62967	16	9.67321	20	0.32679	9.95646	4	77
24	9.62983	16	9.67341	19	0.32659	9.95642	3	76
25	9.62999	16	9.67360	20	0.32640	9.95639	4	75
26	9.63015	16	9.67380	19	0.32620	9.95635	3	74
27	9.63031	16	9.67399	20	0.32601	9.95632	4	73
28	9.63047	16	9.67419	20	0.32581	9.95628	4	72
29	9.63063	16	9.67439	19	0.32561	9.95624	3	71
30	9.63079	16	9.67458	20	0.32542	9.95621	4	70
31	9.63095	16	9.67478	20	0.32522	9.95617	3	69
32	9.63111	16	9.67498	19	0.32502	9.95614	4	68
33	9.63127	16	9.67517	20	0.32483	9.95610	4	67
34	9.63143	16	9.67537	19	0.32463	9.95606	3	66
35	9.63159	16	9.67556	20	0.32444	9.95603	4	65
36	9.63175	16	9.67576	20	0.32424	9.95599	3	64
37	9.63191	16	9.67596	19	0.32404	9.95596	4	63
38	9.63207	16	9.67615	20	0.32385	9.95592	4	62
39	9.63223	16	9.67635	19	0.32365	9.95588	3	61
40	9.63239	16	9.67654	20	0.32346	9.95585	4	60
41	9.63255	16	9.67674	19	0.32326	9.95581	3	59
42	9.63271	16	9.67693	20	0.32307	9.95578	4	58
43	9.63287	16	9.67713	19	0.32287	9.95574	4	57
44	9.63303	16	9.67732	20	0.32268	9.95570	3	56
45	9.63319	16	9.67752	20	0.32248	9.95567	4	55
46	9.63335	16	9.67772	19	0.32228	9.95563	3	54
47	9.63351	16	9.67791	20	0.32209	9.95560	4	53
48	9.63367	16	9.67811	19	0.32189	9.95556	4	52
49	9.63383	15	9.67830	20	0.32170	9.95552	3	51
50	9.63398		9.67850		0.32150	9.95549		50
	Cos	d.	Cot	d. c.	Tan	Sin	d.	

P. P.

	20	19	17	16	3
1	2.0	1.9	1.7	1.6	0.3
2	4.0	3.8	3.4	3.2	0.6
3	6.0	5.7	5.1	4.8	0.9
4	8.0	7.6	6.8	6.4	1.2
5	10.0	9.5	8.5	8.0	1.5
6	12.0	11.4	10.2	9.6	1.8
7	14.0	13.3	11.9	11.2	2.1
8	16.0	15.2	13.6	12.8	2.4
9	18.0	17.1	15.3	14.4	2.7

	Sin	d.	Tan	d. c.	Cot	Cos	d.	
50	9.63398	16	9.67850	19	0.32150	9.95549	4	50
51	9.63414	16	9.67869	20	0.32131	9.95545	3	49
52	9.63430	16	9.67889	19	0.32111	9.95542	4	48
53	9.63446	16	9.67908	20	0.32092	9.95538	4	47
54	9.63462	16	9.67928	19	0.32072	9.95534	3	46
55	9.63478	16	9.67947	20	0.32053	9.95531	4	45
56	9.63494	16	9.67967	19	0.32033	9.95527	4	44
57	9.63510	15	9.67986	19	0.32014	9.95523	3	43
58	9.63525	16	9.68005	20	0.31995	9.95520	4	42
59	9.63541	16	9.68025	19	0.31975	9.95516	3	41
60	9.63557	16	9.68044	20	0.31956	9.95513	4	40
61	9.63573	16	9.68064	19	0.31936	9.95509	4	39
62	9.63589	15	9.68083	20	0.31917	9.95505	3	38
63	9.63604	16	9.68103	19	0.31897	9.95502	4	37
64	9.63620	16	9.68122	20	0.31878	9.95498	4	36
65	9.63636	16	9.68142	19	0.31858	9.95494	3	35
66	9.63652	16	9.68161	19	0.31839	9.95491	4	34
67	9.63668	15	9.68180	20	0.31820	9.95487	4	33
68	9.63683	16	9.68200	19	0.31800	9.95483	3	32
69	9.63699	16	9.68219	20	0.31781	9.95480	4	31
70	9.63715	16	9.68239	19	0.31761	9.95476	3	30
71	9.63731	15	9.68258	19	0.31742	9.95473	4	29
72	9.63746	16	9.68277	20	0.31723	9.95469	4	28
73	9.63762	16	9.68297	19	0.31703	9.95465	3	27
74	9.63778	16	9.68316	20	0.31684	9.95462	4	26
75	9.63794	15	9.68336	19	0.31664	9.95458	4	25
76	9.63809	16	9.68355	19	0.31645	9.95454	3	24
77	9.63825	16	9.68374	20	0.31626	9.95451	4	23
78	9.63841	15	9.68394	19	0.31606	9.95447	4	22
79	9.63856	16	9.68413	19	0.31587	9.95443	3	21
80	9.63872	16	9.68432	20	0.31568	9.95440	4	20
81	9.63888	15	9.68452	19	0.31548	9.95436	4	19
82	9.63903	16	9.68471	19	0.31529	9.95432	3	18
83	9.63919	16	9.68490	20	0.31510	9.95429	4	17
84	9.63935	15	9.68510	19	0.31490	9.95425	4	16
85	9.63950	16	9.68529	19	0.31471	9.95421	3	15
86	9.63966	16	9.68548	20	0.31452	9.95418	4	14
87	9.63982	15	9.68568	19	0.31432	9.95414	4	13
88	9.63997	16	9.68587	19	0.31413	9.95410	3	12
89	9.64013	15	9.68606	20	0.31394	9.95407	4	11
90	9.64028	16	9.68626	19	0.31374	9.95403	4	10
91	9.64044	16	9.68645	19	0.31355	9.95399	3	09
92	9.64060	15	9.68664	19	0.31336	9.95396	4	08
93	9.64075	16	9.68683	20	0.31317	9.95392	4	07
94	9.64091	15	9.68703	19	0.31297	9.95388	4	06
95	9.64106	16	9.68722	19	0.31278	9.95384	3	05
96	9.64122	16	9.68741	19	0.31259	9.95381	4	04
97	9.64138	15	9.68760	20	0.31240	9.95377	4	03
98	9.64153	16	9.68780	19	0.31220	9.95373	4	02
99	9.64169	15	9.68799	19	0.31201	9.95369	3	01
100	9.64184		9.68818		0.31182	9.95366		00
	Cos	d.	Cot	d. c.	Tan	Sin	d.	

P. P.

	20	19	16	15	4
1	2.0	1.9	1.6	1.5	0.4
2	4.0	3.8	3.2	3.0	0.8
3	6.0	5.7	4.8	4.5	1.2
4	8.0	7.6	6.4	6.0	1.6
5	10.0	9.5	8.0	7.5	2.0
6	12.0	11.4	9.6	9.0	2.4
7	14.0	13.3	11.2	10.5	2.8
8	16.0	15.2	12.8	12.0	3.2
9	18.0	17.1	14.4	13.5	3.6

P. P.

	Sin	d.	Tan	d. c.	Cot	Cos	d.	
00	9.64184	16	9.68818	19	0.31182	9.95366	4	100
01	9.64200	15	9.68837	20	0.31163	9.95362	3	99
02	9.64215	16	9.68857	19	0.31143	9.95359	4	98
03	9.64231	15	9.68876	19	0.31124	9.95355	4	97
04	9.64246	16	9.68895	19	0.31105	9.95351	3	96
05	9.64262	15	9.68914	20	0.31086	9.95348	4	95
06	9.64277	16	9.68934	19	0.31066	9.95344	4	94
07	9.64293	15	9.68953	19	0.31047	9.95340	4	93
08	9.64308	16	9.68972	19	0.31028	9.95336	3	92
09	9.64324	15	9.68991	19	0.31009	9.95333	4	91
10	9.64339	16	9.69010	19	0.30990	9.95329	4	90
11	9.64355	15	9.69029	20	0.30971	9.95325	3	89
12	9.64370	16	9.69049	19	0.30951	9.95322	4	88
13	9.64386	15	9.69068	19	0.30932	9.95318	4	87
14	9.64401	16	9.69087	19	0.30913	9.95314	4	86
15	9.64417	15	9.69106	19	0.30894	9.95310	3	85
16	9.64432	15	9.69125	19	0.30875	9.95307	4	84
17	9.64447	16	9.69144	20	0.30856	9.95303	4	83
18	9.64463	15	9.69164	19	0.30836	9.95299	4	82
19	9.64478	16	9.69183	19	0.30817	9.95295	3	81
20	9.64494	15	9.69202	19	0.30798	9.95292	4	80
21	9.64509	15	9.69221	19	0.30779	9.95288	4	79
22	9.64524	16	9.69240	19	0.30760	9.95284	3	78
23	9.64540	15	9.69259	19	0.30741	9.95281	4	77
24	9.64555	16	9.69278	20	0.30722	9.95277	4	76
25	9.64571	15	9.69298	19	0.30702	9.95273	4	75
26	9.64586	15	9.69317	19	0.30683	9.95269	3	74
27	9.64601	16	9.69336	19	0.30664	9.95266	4	73
28	9.64617	15	9.69355	19	0.30645	9.95262	4	72
29	9.64632	15	9.69374	19	0.30626	9.95258	4	71
30	9.64647	16	9.69393	19	0.30607	9.95254	3	70
31	9.64663	15	9.69412	19	0.30588	9.95251	4	69
32	9.64678	15	9.69431	19	0.30569	9.95247	4	68
33	9.64693	16	9.69450	19	0.30550	9.95243	4	67
34	9.64709	15	9.69469	19	0.30531	9.95239	3	66
35	9.64724	15	9.69488	19	0.30512	9.95236	4	65
36	9.64739	16	9.69507	19	0.30493	9.95232	4	64
37	9.64755	15	9.69526	19	0.30474	9.95228	4	63
38	9.64770	15	9.69545	20	0.30455	9.95224	3	62
39	9.64785	15	9.69565	19	0.30435	9.95221	4	61
40	9.64800	16	9.69584	19	0.30416	9.95217	4	60
41	9.64816	15	9.69603	19	0.30397	9.95213	4	59
42	9.64831	15	9.69622	19	0.30378	9.95209	3	58
43	9.64846	15	9.69641	19	0.30359	9.95206	4	57
44	9.64861	16	9.69660	19	0.30340	9.95202	4	56
45	9.64877	15	9.69679	19	0.30321	9.95198	4	55
46	9.64892	15	9.69698	19	0.30302	9.95194	4	54
47	9.64907	15	9.69717	19	0.30283	9.95190	3	53
48	9.64922	16	9.69736	19	0.30264	9.95187	4	52
49	9.64938	15	9.69755	19	0.30245	9.95183	4	51
50	9.64953		9.69774		0.30226	9.95179		50
	Cos	d.	Cot	d. c.	Tan	Sin	d.	

P. P.

	20	19	16	15	3
1	2.0	1.9	1.6	1.5	0.3
2	4.0	3.8	3.2	3.0	0.6
3	6.0	5.7	4.8	4.5	0.9
4	8.0	7.6	6.4	6.0	1.2
5	10.0	9.5	8.0	7.5	1.5
6	12.0	11.4	9.6	9.0	1.8
7	14.0	13.3	11.2	10.5	2.1
8	16.0	15.2	12.8	12.0	2.4
9	18.0	17.1	14.4	13.5	2.7

	Sin	d.	Tan	d. c.	Cot	Cos	d.	
50	9.64953	15	9.69774	19	0.30226	9.95179	4	50
51	9.64968	15	9.69793	19	0.30207	9.95175	3	49
52	9.64983	15	9.69812	19	0.30188	9.95172	4	48
53	9.64998	16	9.69831	19	0.30169	9.95168	4	47
54	9.65014	15	9.69850	18	0.30150	9.95164	4	46
55	9.65029	15	9.69868	19	0.30132	9.95160	4	45
56	9.65044	15	9.69887	19	0.30113	9.95156	3	44
57	9.65059	15	9.69906	19	0.30094	9.95153	4	43
58	9.65074	15	9.69925	19	0.30075	9.95149	4	42
59	9.65089	15	9.69944	19	0.30056	9.95145	4	41
60	9.65104	16	9.69963	19	0.30037	9.95141	4	40
61	9.65120	15	9.69982	19	0.30018	9.95137	3	39
62	9.65135	15	9.70001	19	0.29999	9.95134	4	38
63	9.65150	15	9.70020	19	0.29980	9.95130	4	37
64	9.65165	15	9.70039	19	0.29961	9.95126	4	36
65	9.65180	15	9.70058	19	0.29942	9.95122	4	35
66	9.65195	15	9.70077	19	0.29923	9.95118	3	34
67	9.65210	15	9.70096	18	0.29904	9.95115	4	33
68	9.65225	15	9.70114	19	0.29886	9.95111	4	32
69	9.65240	15	9.70133	19	0.29867	9.95107	4	31
70	9.65255	16	9.70152	19	0.29848	9.95103	4	30
71	9.65271	15	9.70171	19	0.29829	9.95099	3	29
72	9.65286	15	9.70190	19	0.29810	9.95096	4	28
73	9.65301	15	9.70209	19	0.29791	9.95092	4	27
74	9.65316	15	9.70228	19	0.29772	9.95088	4	26
75	9.65331	15	9.70247	18	0.29753	9.95084	4	25
76	9.65346	15	9.70265	19	0.29735	9.95080	4	24
77	9.65361	15	9.70284	19	0.29716	9.95076	3	23
78	9.65376	15	9.70303	19	0.29697	9.95073	4	22
79	9.65391	15	9.70322	19	0.29678	9.95069	4	21
80	9.65406	15	9.70341	19	0.29659	9.95065	4	20
81	9.65421	15	9.70360	19	0.29640	9.95061	4	19
82	9.65436	15	9.70379	18	0.29621	9.95057	3	18
83	9.65451	15	9.70397	19	0.29603	9.95054	4	17
84	9.65466	15	9.70416	19	0.29584	9.95050	4	16
85	9.65481	15	9.70435	19	0.29565	9.95046	4	15
86	9.65496	15	9.70454	19	0.29546	9.95042	4	14
87	9.65511	15	9.70473	18	0.29527	9.95038	4	13
88	9.65526	15	9.70491	19	0.29509	9.95034	4	12
89	9.65541	15	9.70510	19	0.29490	9.95030	3	11
90	9.65556	15	9.70529	19	0.29471	9.95027	4	10
91	9.65571	14	9.70548	19	0.29452	9.95023	4	09
92	9.65585	15	9.70567	18	0.29433	9.95019	4	08
93	9.65600	15	9.70585	19	0.29415	9.95015	4	07
94	9.65615	15	9.70604	19	0.29396	9.95011	4	06
95	9.65630	15	9.70623	19	0.29377	9.95007	3	05
96	9.65645	15	9.70642	18	0.29358	9.95004	4	04
97	9.65660	15	9.70660	19	0.29340	9.95000	4	03
98	9.65675	15	9.70679	19	0.29321	9.94996	4	02
99	9.65690	15	9.70698	19	0.29302	9.94992	4	01
100	9.65705		9.70717		0.29283	9.94988		00
	Cos	d.	Cot	d. c.	Tan	Sin	d.	

P. P.

	19	18	15	14	4
1	1.9	1.8	1.5	1.4	0.4
2	3.8	3.6	3.0	2.8	0.8
3	5.7	5.4	4.5	4.2	1.2
4	7.6	7.2	6.0	5.6	1.6
5	9.5	9.0	7.5	7.0	2.0
6	11.4	10.8	9.0	8.4	2.4
7	13.3	12.6	10.5	9.8	2.8
8	15.2	14.4	12.0	11.2	3.2
9	17.1	16.2	13.5	12.6	3.6

P. P.

	Sin	d.	Tan	d. c.	Cot	Cos	d.	
00	9.65705	15	9.70717	18	0.29283	9.94988	4	**100**
01	9.65720	14	9.70735	19	0.29265	9.94984	4	99
02	9.65734	15	9.70754	19	0.29246	9.94980	4	98
03	9.65749	15	9.70773	19	0.29227	9.94976	3	97
04	9.65764	15	9.70792	18	0.29208	9.94973	4	96
05	9.65779	15	9.70810	19	0.29190	9.94969	4	95
06	9.65794	15	9.70829	19	0.29171	9.94965	4	94
07	9.65809	14	9.70848	18	0.29152	9.94961	4	93
08	9.65823	15	9.70866	19	0.29134	9.94957	4	92
09	9.65838	15	9.70885	19	0.29115	9.94953	4	91
10	9.65853	15	9.70904	18	0.29096	9.94949	3	**90**
11	9.65868	15	9.70922	19	0.29078	9.94946	4	89
12	9.65883	15	9.70941	19	0.29059	9.94942	4	88
13	9.65898	14	9.70960	18	0.29040	9.94938	4	87
14	9.65912	15	9.70978	19	0.29022	9.94934	4	86
15	9.65927	15	9.70997	19	0.29003	9.94930	4	85
16	9.65942	15	9.71016	18	0.28984	9.94926	4	84
17	9.65957	14	9.71034	19	0.28966	9.94922	4	83
18	9.65971	15	9.71053	19	0.28947	9.94918	4	82
19	9.65986	15	9.71072	18	0.28928	9.94914	3	81
20	9.66001	15	9.71090	19	0.28910	9.94911	4	**80**
21	9.66016	14	9.71109	19	0.28891	9.94907	4	79
22	9.66030	15	9.71128	18	0.28872	9.94903	4	78
23	9.66045	15	9.71146	19	0.28854	9.94899	4	77
24	9.66060	15	9.71165	19	0.28835	9.94895	4	76
25	9.66075	14	9.71184	18	0.28816	9.94891	4	75
26	9.66089	15	9.71202	19	0.28798	9.94887	4	74
27	9.66104	15	9.71221	18	0.28779	9.94883	4	73
28	9.66119	14	9.71239	19	0.28761	9.94879	4	72
29	9.66133	15	9.71258	19	0.28742	9.94875	4	71
30	9.66148	15	9.71277	18	0.28723	9.94871	3	**70**
31	9.66163	14	9.71295	19	0.28705	9.94868	4	69
32	9.66177	15	9.71314	18	0.28686	9.94864	4	68
33	9.66192	15	9.71332	19	0.28668	9.94860	4	67
34	9.66207	14	9.71351	19	0.28649	9.94856	4	66
35	9.66221	15	9.71370	18	0.28630	9.94852	4	65
36	9.66236	15	9.71388	19	0.28612	9.94848	4	64
37	9.66251	14	9.71407	18	0.28593	9.94844	4	63
38	9.66265	15	9.71425	19	0.28575	9.94840	4	62
39	9.66280	15	9.71444	18	0.28556	9.94836	4	61
40	9.66295	14	9.71462	19	0.28538	9.94832	4	**60**
41	9.66309	15	9.71481	18	0.28519	9.94828	4	59
42	9.66324	14	9.71499	19	0.28501	9.94824	4	58
43	9.66338	15	9.71518	19	0.28482	9.94820	3	57
44	9.66353	15	9.71537	18	0.28463	9.94817	4	56
45	9.66368	14	9.71555	19	0.28445	9.94813	4	55
46	9.66382	15	9.71574	18	0.28426	9.94809	4	54
47	9.66397	14	9.71592	19	0.28408	9.94805	4	53
48	9.66411	15	9.71611	18	0.28389	9.94801	4	52
49	9.66426	15	9.71629	19	0.28371	9.94797	4	51
50	9.66441		9.71648		0.28352	9.94793		**50**
	Cos	d.	Cot	d. c.	Tan	Sin	d.	

P. P.

	19	18	15	14	3
1	1.9	1.8	1.5	1.4	0.3
2	3.8	3.6	3.0	2.8	0.6
3	5.7	5.4	4.5	4.2	0.9
4	7.6	7.2	6.0	5.6	1.2
5	9.5	9.0	7.5	7.0	1.5
6	11.4	10.8	9.0	8.4	1.8
7	13.3	12.6	10.5	9.8	2.1
8	15.2	14.4	12.0	11.2	2.4
9	17.1	16.2	13.5	12.6	2.7

P. P.

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	Sin	d.	Tan	d. c.	Cot	Cos	d.	
50	9.66441	14	9.71648	18	0.28352	9.94793	4	**50**
51	9.66455	15	9.71666	19	0.28334	9.94789	4	49
52	9.66470	14	9.71685	18	0.28315	9.94785	4	48
53	9.66484	15	9.71703	19	0.28297	9.94781	4	47
54	9.66499	14	9.71722	18	0.28278	9.94777	4	46
55	9.66513	15	9.71740	19	0.28260	9.94773	4	45
56	9.66528	14	9.71759	18	0.28241	9.94769	4	44
57	9.66542	15	9.71777	19	0.28223	9.94765	4	43
58	9.66557	14	9.71796	18	0.28204	9.94761	4	42
59	9.66571	15	9.71814	19	0.28186	9.94757	4	41
60	9.66586	14	9.71833	18	0.28167	9.94753	4	**40**
61	9.66600	15	9.71851	18	0.28149	9.94749	4	39
62	9.66615	14	9.71869	19	0.28131	9.94745	4	38
63	9.66629	15	9.71888	18	0.28112	9.94741	4	37
64	9.66644	14	9.71906	19	0.28094	9.94737	3	36
65	9.66658	15	9.71925	18	0.28075	9.94734	4	35
66	9.66673	14	9.71943	19	0.28057	9.94730	4	34
67	9.66687	15	9.71962	18	0.28038	9.94726	4	33
68	9.66702	14	9.71980	18	0.28020	9.94722	4	32
69	9.66716	15	9.71998	19	0.28002	9.94718	4	31
70	9.66731	14	9.72017	18	0.27983	9.94714	4	**30**
71	9.66745	14	9.72035	19	0.27965	9.94710	4	29
72	9.66759	15	9.72054	18	0.27946	9.94706	4	28
73	9.66774	14	9.72072	19	0.27928	9.94702	4	27
74	9.66788	15	9.72091	18	0.27909	9.94698	4	26
75	9.66803	14	9.72109	18	0.27891	9.94694	4	25
76	9.66817	14	9.72127	19	0.27873	9.94690	4	24
77	9.66831	15	9.72146	18	0.27854	9.94686	4	23
78	9.66846	14	9.72164	18	0.27836	9.94682	4	22
79	9.66860	15	9.72182	19	0.27818	9.94678	4	21
80	9.66875	14	9.72201	18	0.27799	9.94674	4	**20**
81	9.66889	14	9.72219	19	0.27781	9.94670	4	19
82	9.66903	15	9.72238	18	0.27762	9.94666	4	18
83	9.66918	14	9.72256	18	0.27744	9.94662	4	17
84	9.66932	14	9.72274	19	0.27726	9.94658	4	16
85	9.66946	15	9.72293	18	0.27707	9.94654	4	15
86	9.66961	14	9.72311	18	0.27689	9.94650	4	14
87	9.66975	14	9.72329	19	0.27671	9.94646	4	13
88	9.66989	15	9.72348	18	0.27652	9.94642	4	12
89	9.67004	14	9.72366	18	0.27634	9.94638	4	11
90	9.67018	14	9.72384	19	0.27616	9.94634	4	**10**
91	9.67032	15	9.72403	18	0.27597	9.94630	4	09
92	9.67047	14	9.72421	18	0.27579	9.94626	4	08
93	9.67061	14	9.72439	19	0.27561	9.94622	4	07
94	9.67075	15	9.72458	18	0.27542	9.94618	4	06
95	9.67090	14	9.72476	18	0.27524	9.94614	4	05
96	9.67104	14	9.72494	19	0.27506	9.94610	4	04
97	9.67118	14	9.72513	18	0.27487	9.94606	4	03
98	9.67132	15	9.72531	18	0.27469	9.94602	4	02
99	9.67147	14	9.72549	18	0.27451	9.94598	5	01
100	9.67161		9.72567		0.27433	9.94593		**00**
	Cos	d.	Cot	d. c.	Tan	Sin	d.	

P. P.

	19	**18**	**15**	**14**	**4**
1	1.9	1.8	1.5	1.4	0.4
2	3.8	3.6	3.0	2.8	0.8
3	5.7	5.4	4.5	4.2	1.2
4	7.6	7.2	6.0	5.6	1.6
5	9.5	9.0	7.5	7.0	2.0
6	11.4	10.8	9.0	8.4	2.4
7	13.3	12.6	10.5	9.8	2.8
8	15.2	14.4	12.0	11.2	3.2
9	17.1	16.2	13.5	12.6	3.6

P. P.

	Sin	d.	Tan	d. c.	Cot	Cos	d.	
00	9.67161	14	9.72567	19	0.27433	9.94593	4	100
01	9.67175	14	9.72586	18	0.27414	9.94589	4	99
02	9.67189	15	9.72604	18	0.27396	9.94585	4	98
03	9.67204	14	9.72622	19	0.27378	9.94581	4	97
04	9.67218	14	9.72641	18	0.27359	9.94577	4	96
05	9.67232	14	9.72659	18	0.27341	9.94573	4	95
06	9.67246	15	9.72677	18	0.27323	9.94569	4	94
07	9.67261	14	9.72695	19	0.27305	9.94565	4	93
08	9.67275	14	9.72714	18	0.27286	9.94561	4	92
09	9.67289	14	9.72732	18	0.27268	9.94557	4	91
10	9.67303	14	9.72750	18	0.27250	9.94553	4	90
11	9.67317	15	9.72768	19	0.27232	9.94549	4	89
12	9.67332	14	9.72787	18	0.27213	9.94545	4	88
13	9.67346	14	9.72805	18	0.27195	9.94541	4	87
14	9.67360	14	9.72823	18	0.27177	9.94537	4	86
15	9.67374	14	9.72841	18	0.27159	9.94533	4	85
16	9.67388	14	9.72859	19	0.27141	9.94529	4	84
17	9.67402	15	9.72878	18	0.27122	9.94525	4	83
18	9.67417	14	9.72896	18	0.27104	9.94521	4	82
19	9.67431	14	9.72914	18	0.27086	9.94517	4	81
20	9.67445	14	9.72932	18	0.27068	9.94513	5	80
21	9.67459	14	9.72950	19	0.27050	9.94508	4	79
22	9.67473	14	9.72969	18	0.27031	9.94504	4	78
23	9.67487	14	9.72987	18	0.27013	9.94500	4	77
24	9.67501	14	9.73005	18	0.26995	9.94496	4	76
25	9.67515	15	9.73023	18	0.26977	9.94492	4	75
26	9.67530	14	9.73041	19	0.26959	9.94488	4	74
27	9.67544	14	9.73060	18	0.26940	9.94484	4	73
28	9.67558	14	9.73078	18	0.26922	9.94480	4	72
29	9.67572	14	9.73096	18	0.26904	9.94476	4	71
30	9.67586	14	9.73114	18	0.26886	9.94472	4	70
31	9.67600	14	9.73132	18	0.26868	9.94468	4	69
32	9.67614	14	9.73150	19	0.26850	9.94464	4	68
33	9.67628	14	9.73169	18	0.26831	9.94460	5	67
34	9.67642	14	9.73187	18	0.26813	9.94455	4	66
35	9.67656	14	9.73205	18	0.26795	9.94451	4	65
36	9.67670	14	9.73223	18	0.26777	9.94447	4	64
37	9.67684	14	9.73241	18	0.26759	9.94443	4	63
38	9.67698	14	9.73259	18	0.26741	9.94439	4	62
39	9.67712	14	9.73277	18	0.26723	9.94435	4	61
40	9.67726	14	9.73295	19	0.26705	9.94431	4	60
41	9.67740	14	9.73314	18	0.26686	9.94427	4	59
42	9.67754	14	9.73332	18	0.26668	9.94423	4	58
43	9.67768	14	9.73350	18	0.26650	9.94419	4	57
44	9.67782	14	9.73368	18	0.26632	9.94415	5	56
45	9.67796	14	9.73386	18	0.26614	9.94410	4	55
46	9.67810	14	9.73404	18	0.26596	9.94406	4	54
47	9.67824	14	9.73422	18	0.26578	9.94402	4	53
48	9.67838	14	9.73440	18	0.26560	9.94398	4	52
49	9.67852	14	9.73458	18	0.26542	9.94394	4	51
50	9.67866		9.73476		0.26524	9.94390		50
	Cos	d.	Cot	d. c.	Tan	Sin	d.	

P. P.

	19	18	15	14	4
1	1.9	1.8	1.5	1.4	0.4
2	3.8	3.6	3.0	2.8	0.8
3	5.7	5.4	4.5	4.2	1.2
4	7.6	7.2	6.0	5.6	1.6
5	9.5	9.0	7.5	7.0	2.0
6	11.4	10.8	9.0	8.4	2.4
7	13.3	12.6	10.5	9.8	2.8
8	15.2	14.4	12.0	11.2	3.2
9	17.1	16.2	13.5	12.6	3.6

P. P.

	Sin	d.	Tan	d. c.	Cot	Cos	d.	
50	9.67866	14	9.73476	19	0.26524	9.94390	4	50
51	9.67880	14	9.73495	18	0.26505	9.94386	4	49
52	9.67894	14	9.73513	18	0.26487	9.94382	5	48
53	9.67908	14	9.73531	18	0.26469	9.94377	4	47
54	9.67922	14	9.73549	18	0.26451	9.94373	4	46
55	9.67936	14	9.73567	18	0.26433	9.94369	4	45
56	9.67950	14	9.73585	18	0.26415	9.94365	4	44
57	9.67964	14	9.73603	18	0.26397	9.94361	4	43
58	9.67978	14	9.73621	18	0.26379	9.94357	4	42
59	9.67992	14	9.73639	18	0.26361	9.94353	4	41
60	9.68006	14	9.73657	18	0.26343	9.94349	5	40
61	9.68020	13	9.73675	18	0.26325	9.94344	4	39
62	9.68033	14	9.73693	18	0.26307	9.94340	4	38
63	9.68047	14	9.73711	18	0.26289	9.94336	4	37
64	9.68061	14	9.73729	18	0.26271	9.94332	4	36
65	9.68075	14	9.73747	18	0.26253	9.94328	4	35
66	9.68089	14	9.73765	18	0.26235	9.94324	4	34
67	9.68103	14	9.73783	18	0.26217	9.94320	5	33
68	9.68117	13	9.73801	18	0.26199	9.94315	4	32
69	9.68130	14	9.73819	18	0.26181	9.94311	4	31
70	9.68144	14	9.73837	18	0.26163	9.94307	4	30
71	9.68158	14	9.73855	18	0.26145	9.94303	4	29
72	9.68172	14	9.73873	18	0.26127	9.94299	4	28
73	9.68186	14	9.73891	18	0.26109	9.94295	4	27
74	9.68200	13	9.73909	18	0.26091	9.94291	5	26
75	9.68213	14	9.73927	18	0.26073	9.94286	4	25
76	9.68227	14	9.73945	18	0.26055	9.94282	4	24
77	9.68241	14	9.73963	18	0.26037	9.94278	4	23
78	9.68255	14	9.73981	18	0.26019	9.94274	4	22
79	9.68269	14	9.73999	18	0.26001	9.94270	4	21
80	9.68283	13	9.74017	18	0.25983	9.94266	5	20
81	9.68296	14	9.74035	18	0.25965	9.94261	4	19
82	9.68310	14	9.74053	18	0.25947	9.94257	4	18
83	9.68324	14	9.74071	18	0.25929	9.94253	4	17
84	9.68338	13	9.74089	18	0.25911	9.94249	4	16
85	9.68351	14	9.74107	18	0.25893	9.94245	4	15
86	9.68365	14	9.74125	17	0.25875	9.94241	5	14
87	9.68379	14	9.74142	18	0.25858	9.94236	4	13
88	9.68393	13	9.74160	18	0.25840	9.94232	4	12
89	9.68406	14	9.74178	18	0.25822	9.94228	4	11
90	9.68420	14	9.74196	18	0.25804	9.94224	4	10
91	9.68434	14	9.74214	18	0.25786	9.94220	5	09
92	9.68448	13	9.74232	18	0.25768	9.94215	4	08
93	9.68461	14	9.74250	18	0.25750	9.94211	4	07
94	9.68475	14	9.74268	18	0.25732	9.94207	4	06
95	9.68489	13	9.74286	18	0.25714	9.94203	4	05
96	9.68502	14	9.74304	18	0.25696	9.94199	4	04
97	9.68516	14	9.74322	17	0.25678	9.94195	5	03
98	9.68530	13	9.74339	18	0.25661	9.94190	4	02
99	9.68543	14	9.74357	18	0.25643	9.94186	4	01
100	9.68557		9.74375		0.25625	9.94182		00
	Cos	d.	Cot	d. c.	Tan	Sin	d.	

P. P.

18	
1	1.8
2	3.6
3	5.4
4	7.2
5	9.0
6	10.8
7	12.6
8	14.4
9	16.2

17	
1	1.7
2	3.4
3	5.1
4	6.8
5	8.5
6	10.2
7	11.9
8	13.6
9	15.3

14	
1	1.4
2	2.8
3	4.2
4	5.6
5	7.0
6	8.4
7	9.8
8	11.2
9	12.6

13	
1	1.3
2	2.6
3	3.9
4	5.2
5	6.5
6	7.8
7	9.1
8	10.4
9	11.7

5	
1	0.5
2	1.0
3	1.5
4	2.0
5	2.5
6	3.0
7	3.5
8	4.0
9	4.5

P. P.

′	Sin	d.	Tan	d. c.	Cot	Cos	d.	
00	9.68557	14	9.74375	18	0.25625	9.94182	4	100
01	9.68571	13	9.74393	18	0.25607	9.94178	4	99
02	9.68584	14	9.74411	18	0.25589	9.94174	5	98
03	9.68598	14	9.74429	18	0.25571	9.94169	4	97
04	9.68612	13	9.74447	18	0.25553	9.94165	4	96
05	9.68625	14	9.74465	17	0.25535	9.94161	4	95
06	9.68639	14	9.74482	18	0.25518	9.94157	5	94
07	9.68653	13	9.74500	18	0.25500	9.94152	4	93
08	9.68666	14	9.74518	18	0.25482	9.94148	4	92
09	9.68680	14	9.74536	18	0.25464	9.94144	4	91
10	9.68694	13	9.74554	18	0.25446	9.94140	4	90
11	9.68707	14	9.74572	17	0.25428	9.94136	5	89
12	9.68721	13	9.74589	18	0.25411	9.94131	4	88
13	9.68734	14	9.74607	18	0.25393	9.94127	4	87
14	9.68748	14	9.74625	18	0.25375	9.94123	4	86
15	9.68762	13	9.74643	18	0.25357	9.94119	5	85
16	9.68775	14	9.74661	18	0.25339	9.94114	4	84
17	9.68789	13	9.74679	17	0.25321	9.94110	4	83
18	9.68802	14	9.74696	18	0.25304	9.94106	4	82
19	9.68816	13	9.74714	18	0.25286	9.94102	4	81
20	9.68829	14	9.74732	18	0.25268	9.94098	5	80
21	9.68843	14	9.74750	18	0.25250	9.94093	4	79
22	9.68857	13	9.74768	17	0.25232	9.94089	4	78
23	9.68870	14	9.74785	18	0.25215	9.94085	4	77
24	9.68884	13	9.74803	18	0.25197	9.94081	5	76
25	9.68897	14	9.74821	18	0.25179	9.94076	4	75
26	9.68911	13	9.74839	17	0.25161	9.94072	4	74
27	9.68924	14	9.74856	18	0.25144	9.94068	4	73
28	9.68938	13	9.74874	18	0.25126	9.94064	5	72
29	9.68951	14	9.74892	18	0.25108	9.94059	4	71
30	9.68965	13	9.74910	17	0.25090	9.94055	4	70
31	9.68978	14	9.74927	18	0.25073	9.94051	4	69
32	9.68992	13	9.74945	18	0.25055	9.94047	5	68
33	9.69005	14	9.74963	18	0.25037	9.94042	4	67
34	9.69019	13	9.74981	17	0.25019	9.94038	4	66
35	9.69032	14	9.74998	18	0.25002	9.94034	4	65
36	9.69046	13	9.75016	18	0.24984	9.94030	5	64
37	9.69059	14	9.75034	18	0.24966	9.94025	4	63
38	9.69073	13	9.75052	17	0.24948	9.94021	4	62
39	9.69086	14	9.75069	18	0.24931	9.94017	5	61
40	9.69100	13	9.75087	18	0.24913	9.94012	4	60
41	9.69113	14	9.75105	18	0.24895	9.94008	4	59
42	9.69127	13	9.75123	17	0.24877	9.94004	4	58
43	9.69140	13	9.75140	18	0.24860	9.94000	5	57
44	9.69153	14	9.75158	18	0.24842	9.93995	4	56
45	9.69167	13	9.75176	17	0.24824	9.93991	4	55
46	9.69180	14	9.75193	18	0.24807	9.93987	4	54
47	9.69194	13	9.75211	18	0.24789	9.93983	5	53
48	9.69207	13	9.75229	18	0.24771	9.93978	4	52
49	9.69220	14	9.75247	17	0.24753	9.93974	4	51
50	9.69234		9.75264		0.24736	9.93970		50
	Cos	d.	Cot	d. c.	Tan	Sin	d.	

P. P.

	18	17	14	13	4
1	1.8	1.7	1.4	1.3	0.4
2	3.6	3.4	2.8	2.6	0.8
3	5.4	5.1	4.2	3.9	1.2
4	7.2	6.8	5.6	5.2	1.6
5	9.0	8.5	7.0	6.5	2.0
6	10.8	10.2	8.4	7.8	2.4
7	12.6	11.9	9.8	9.1	2.8
8	14.4	13.6	11.2	10.4	3.2
9	16.2	15.3	12.6	11.7	3.6

P. P.

	Sin	d.	Tan	d. c.	Cot	Cos	d.	
50	9.69234	13	9.75264	18	0.24736	9.93970	5	50
51	9.69247	14	9.75282	18	0.24718	9.93965	4	49
52	9.69261	13	9.75300	17	0.24700	9.93961	4	48
53	9.69274	13	9.75317	18	0.24683	9.93957	4	47
54	9.69287	14	9.75335	18	0.24665	9.93953	5	46
55	9.69301	13	9.75353	17	0.24647	9.93948	4	45
56	9.69314	14	9.75370	18	0.24630	9.93944	4	44
57	9.69328	13	9.75388	18	0.24612	9.93940	5	43
58	9.69341	13	9.75406	17	0.24594	9.93935	4	42
59	9.69354	14	9.75423	18	0.24577	9.93931	4	41
60	9.69368	13	9.75441	18	0.24559	9.93927	5	40
61	9.69381	13	9.75459	17	0.24541	9.93922	4	39
62	9.69394	14	9.75476	18	0.24524	9.93918	4	38
63	9.69408	13	9.75494	17	0.24506	9.93914	5	37
64	9.69421	13	9.75511	18	0.24489	9.93909	4	36
65	9.69434	14	9.75529	18	0.24471	9.93905	4	35
66	9.69448	13	9.75547	17	0.24453	9.93901	4	34
67	9.69461	13	9.75564	18	0.24436	9.93897	5	33
68	9.69474	13	9.75582	18	0.24418	9.93892	4	32
69	9.69487	14	9.75600	17	0.24400	9.93888	4	31
70	9.69501	13	9.75617	18	0.24383	9.93884	5	30
71	9.69514	13	9.75635	17	0.24365	9.93879	4	29
72	9.69527	14	9.75652	18	0.24348	9.93875	4	28
73	9.69541	13	9.75670	18	0.24330	9.93871	5	27
74	9.69554	13	9.75688	17	0.24312	9.93866	4	26
75	9.69567	13	9.75705	18	0.24295	9.93862	4	25
76	9.69580	14	9.75723	17	0.24277	9.93858	5	24
77	9.69594	13	9.75740	18	0.24260	9.93853	4	23
78	9.69607	13	9.75758	18	0.24242	9.93849	4	22
79	9.69620	13	9.75776	17	0.24224	9.93845	5	21
80	9.69633	14	9.75793	18	0.24207	9.93840	4	20
81	9.69647	13	9.75811	17	0.24189	9.93836	4	19
82	9.69660	13	9.75828	18	0.24172	9.93832	5	18
83	9.69673	13	9.75846	17	0.24154	9.93827	4	17
84	9.69686	13	9.75863	18	0.24137	9.93823	4	16
85	9.69699	14	9.75881	18	0.24119	9.93819	5	15
86	9.69713	13	9.75899	17	0.24101	9.93814	4	14
87	9.69726	13	9.75916	18	0.24084	9.93810	5	13
88	9.69739	13	9.75934	17	0.24066	9.93805	4	12
89	9.69752	13	9.75951	18	0.24049	9.93801	4	11
90	9.69765	14	9.75969	17	0.24031	9.93797	5	10
91	9.69779	13	9.75986	18	0.24014	9.93792	4	09
92	9.69792	13	9.76004	17	0.23996	9.93788	4	08
93	9.69805	13	9.76021	18	0.23979	9.93784	5	07
94	9.69818	13	9.76039	17	0.23961	9.93779	4	06
95	9.69831	13	9.76056	18	0.23944	9.93775	4	05
96	9.69844	14	9.76074	17	0.23926	9.93771	5	04
97	9.69858	13	9.76091	18	0.23909	9.93766	4	03
98	9.69871	13	9.76109	17	0.23891	9.93762	5	02
99	9.69884	13	9.76126	18	0.23874	9.93757	4	01
100	9.69897		9.76144		0.23856	9.93753		00
	Cos	d.	Cot	d. c.	Tan	Sin	d.	

P. P.

	18	17	14	13	5
1	1.8	1.7	1.4	1.3	0.5
2	3.6	3.4	2.8	2.6	1.0
3	5.4	5.1	4.2	3.9	1.5
4	7.2	6.8	5.6	5.2	2.0
5	9.0	8.5	7.0	6.5	2.5
6	10.8	10.2	8.4	7.8	3.0
7	12.6	11.9	9.8	9.1	3.5
8	14.4	13.6	11.2	10.4	4.0
9	16.2	15.3	12.6	11.7	4.5

	Sin	d.	Tan	d. c.	Cot	Cos	d.	
00	9.69897	13	9.76144	17	0.23856	9.93753	4	100
01	9.69910	13	9.76161	18	0.23839	9.93749	5	99
02	9.69923	13	9.76179	17	0.23821	9.93744	4	98
03	9.69936	13	9.76196	18	0.23804	9.93740	4	97
04	9.69949	14	9.76214	17	0.23786	9.93736	5	96
05	9.69963	13	9.76231	18	0.23769	9.93731	4	95
06	9.69976	13	9.76249	17	0.23751	9.93727	5	94
07	9.69989	13	9.76266	18	0.23734	9.93722	4	93
08	9.70002	13	9.76284	17	0.23716	9.93718	4	92
09	9.70015	13	9.76301	18	0.23699	9.93714	5	91
10	9.70028	13	9.76319	17	0.23681	9.93709	4	90
11	9.70041	13	9.76336	18	0.23664	9.93705	5	89
12	9.70054	13	9.76354	17	0.23646	9.93700	4	88
13	9.70067	13	9.76371	18	0.23629	9.93696	4	87
14	9.70080	13	9.76389	17	0.23611	9.93692	5	86
15	9.70093	13	9.76406	18	0.23594	9.93687	4	85
16	9.70106	13	9.76424	17	0.23576	9.93683	5	84
17	9.70119	13	9.76441	17	0.23559	9.93678	4	83
18	9.70132	13	9.76458	18	0.23542	9.93674	4	82
19	9.70145	14	9.76476	17	0.23524	9.93670	5	81
20	9.70159	13	9.76493	18	0.23507	9.93665	4	80
21	9.70172	13	9.76511	17	0.23489	9.93661	5	79
22	9.70185	13	9.76528	18	0.23472	9.93656	4	78
23	9.70198	13	9.76546	17	0.23454	9.93652	4	77
24	9.70211	13	9.76563	17	0.23437	9.93648	5	76
25	9.70224	13	9.76580	18	0.23420	9.93643	4	75
26	9.70237	13	9.76598	17	0.23402	9.93639	5	74
27	9.70250	13	9.76615	18	0.23385	9.93634	4	73
28	9.70263	13	9.76633	17	0.23367	9.93630	5	72
29	9.70276	12	9.76650	18	0.23350	9.93625	4	71
30	9.70288	13	9.76668	17	0.23332	9.93621	4	70
31	9.70301	13	9.76685	17	0.23315	9.93617	5	69
32	9.70314	13	9.76702	18	0.23298	9.93612	4	68
33	9.70327	13	9.76720	17	0.23280	9.93608	5	67
34	9.70340	13	9.76737	17	0.23263	9.93603	4	66
35	9.70353	13	9.76754	18	0.23246	9.93599	5	65
36	9.70366	13	9.76772	17	0.23228	9.93594	4	64
37	9.70379	13	9.76789	18	0.23211	9.93590	5	63
38	9.70392	13	9.76807	17	0.23193	9.93585	4	62
39	9.70405	13	9.76824	17	0.23176	9.93581	4	61
40	9.70418	13	9.76841	18	0.23159	9.93577	5	60
41	9.70431	13	9.76859	17	0.23141	9.93572	4	59
42	9.70444	13	9.76876	17	0.23124	9.93568	5	58
43	9.70457	13	9.76893	18	0.23107	9.93563	4	57
44	9.70470	12	9.76911	17	0.23089	9.93559	5	56
45	9.70482	13	9.76928	17	0.23072	9.93554	4	55
46	9.70495	13	9.76945	18	0.23055	9.93550	5	54
47	9.70508	13	9.76963	17	0.23037	9.93545	4	53
48	9.70521	13	9.76980	18	0.23020	9.93541	4	52
49	9.70534	13	9.76998	17	0.23002	9.93537	5	51
50	9.70547		9.77015		0.22985	9.93532		50
	Cos	d.	Cot	d. c.	Tan	Sin	d.	

P. P.

	18	17	14	13	4
1	1.8	1.7	1.4	1.3	0.4
2	3.6	3.4	2.8	2.6	0.8
3	5.4	5.1	4.2	3.9	1.2
4	7.2	6.8	5.6	5.2	1.6
5	9.0	8.5	7.0	6.5	2.0
6	10.8	10.2	8.4	7.8	2.4
7	12.6	11.9	9.8	9.1	2.8
8	14.4	13.6	11.2	10.4	3.2
9	16.2	15.3	12.6	11.7	3.6

P. P.

	Sin	d.	Tan	d. c.	Cot	Cos	d.	
50	9.70547	13	9.77015	17	0.22985	9.93532	4	50
51	9.70560	13	9.77032	18	0.22968	9.93528	5	49
52	9.70573	12	9.77050	17	0.22950	9.93523	4	48
53	9.70585	13	9.77067	17	0.22933	9.93519	5	47
54	9.70598	13	9.77084	17	0.22916	9.93514	4	46
55	9.70611	13	9.77101	18	0.22899	9.93510	5	45
56	9.70624	13	9.77119	17	0.22881	9.93505	4	44
57	9.70637	13	9.77136	17	0.22864	9.93501	5	43
58	9.70650	12	9.77153	18	0.22847	9.93496	4	42
59	9.70662	13	9.77171	17	0.22829	9.93492	5	41
60	9.70675	13	9.77188	17	0.22812	9.93487	4	40
61	9.70688	13	9.77205	18	0.22795	9.93483	5	39
62	9.70701	13	9.77223	17	0.22777	9.93478	4	38
63	9.70714	13	9.77240	17	0.22760	9.93474	5	37
64	9.70727	12	9.77257	17	0.22743	9.93469	4	36
65	9.70739	13	9.77274	18	0.22726	9.93465	5	35
66	9.70752	13	9.77292	17	0.22708	9.93460	4	34
67	9.70765	13	9.77309	17	0.22691	9.93456	5	33
68	9.70778	12	9.77326	18	0.22674	9.93451	4	32
69	9.70790	13	9.77344	17	0.22656	9.93447	5	31
70	9.70803	13	9.77361	17	0.22639	9.93442	4	30
71	9.70816	13	9.77378	17	0.22622	9.93438	5	29
72	9.70829	13	9.77395	18	0.22605	9.93433	4	28
73	9.70842	12	9.77413	17	0.22587	9.93429	5	27
74	9.70854	13	9.77430	17	0.22570	9.93424	4	26
75	9.70867	13	9.77447	17	0.22553	9.93420	5	25
76	9.70880	12	9.77464	18	0.22536	9.93415	4	24
77	9.70892	13	9.77482	17	0.22518	9.93411	5	23
78	9.70905	13	9.77499	17	0.22501	9.93406	4	22
79	9.70918	13	9.77516	17	0.22484	9.93402	5	21
80	9.70931	12	9.77533	18	0.22467	9.93397	4	20
81	9.70943	13	9.77551	17	0.22449	9.93393	5	19
82	9.70956	13	9.77568	17	0.22432	9.93388	4	18
83	9.70969	12	9.77585	17	0.22415	9.93384	5	17
84	9.70981	13	9.77602	17	0.22398	9.93379	4	16
85	9.70994	13	9.77619	18	0.22381	9.93375	5	15
86	9.71007	13	9.77637	17	0.22363	9.93370	4	14
87	9.71020	12	9.77654	17	0.22346	9.93366	5	13
88	9.71032	13	9.77671	17	0.22329	9.93361	4	12
89	9.71045	13	9.77688	18	0.22312	9.93357	5	11
90	9.71058	12	9.77706	17	0.22294	9.93352	5	10
91	9.71070	13	9.77723	17	0.22277	9.93347	4	09
92	9.71083	13	9.77740	17	0.22260	9.93343	5	08
93	9.71096	12	9.77757	17	0.22243	9.93338	4	07
94	9.71108	13	9.77774	17	0.22226	9.93334	5	06
95	9.71121	12	9.77791	18	0.22209	9.93329	4	05
96	9.71133	13	9.77809	17	0.22191	9.93325	5	04
97	9.71146	13	9.77826	17	0.22174	9.93320	4	03
98	9.71159	12	9.77843	17	0.22157	9.93316	5	02
99	9.71171	13	9.77860	17	0.22140	9.93311	4	01
100	9.71184		9.77877		0.22123	9.93307		00
	Cos	d.	Cot	d. c.	Tan	Sin	d.	

P. P.

	18	17	13	12	5
1	1.8	1.7	1.3	1.2	0.5
2	3.6	3.4	2.6	2.4	1.0
3	5.4	5.1	3.9	3.6	1.5
4	7.2	6.8	5.2	4.8	2.0
5	9.0	8.5	6.5	6.0	2.5
6	10.8	10.2	7.8	7.2	3.0
7	12.6	11.9	9.1	8.4	3.5
8	14.4	13.6	10.4	9.6	4.0
9	16.2	15.3	11.7	10.8	4.5

P. P.

	Sin	d.	Tan	d. c.	Cot	Cos	d.	
00	9.71184	13	9.77877	18	0.22123	9.93307	5	100
01	9.71197	12	9.77895	17	0.22105	9.93302	5	99
02	9.71209	13	9.77912	17	0.22088	9.93297	4	98
03	9.71222	12	9.77929	17	0.22071	9.93293	5	97
04	9.71234	13	9.77946	17	0.22054	9.93288	4	96
05	9.71247	13	9.77963	17	0.22037	9.93284	5	95
06	9.71260	12	9.77980	17	0.22020	9.93279	4	94
07	9.71272	13	9.77997	18	0.22003	9.93275	5	93
08	9.71285	12	9.78015	17	0.21985	9.93270	5	92
09	9.71297	13	9.78032	17	0.21968	9.93265	4	91
10	9.71310	12	9.78049	17	0.21951	9.93261	5	90
11	9.71322	13	9.78066	17	0.21934	9.93256	4	89
12	9.71335	13	9.78083	17	0.21917	9.93252	5	88
13	9.71348	12	9.78100	17	0.21900	9.93247	4	87
14	9.71360	13	9.78117	18	0.21883	9.93243	5	86
15	9.71373	12	9.78135	17	0.21865	9.93238	5	85
16	9.71385	13	9.78152	17	0.21848	9.93233	4	84
17	9.71398	12	9.78169	17	0.21831	9.93229	5	83
18	9.71410	13	9.78186	17	0.21814	9.93224	4	82
19	9.71423	12	9.78203	17	0.21797	9.93220	5	81
20	9.71435	13	9.78220	17	0.21780	9.93215	4	80
21	9.71448	12	9.78237	17	0.21763	9.93211	5	79
22	9.71460	13	9.78254	17	0.21746	9.93206	5	78
23	9.71473	12	9.78271	18	0.21729	9.93201	4	77
24	9.71485	13	9.78289	17	0.21711	9.93197	5	76
25	9.71498	12	9.78306	17	0.21694	9.93192	4	75
26	9.71510	13	9.78323	17	0.21677	9.93188	5	74
27	9.71523	12	9.78340	17	0.21660	9.93183	5	73
28	9.71535	13	9.78357	17	0.21643	9.93178	4	72
29	9.71548	12	9.78374	17	0.21626	9.93174	5	71
30	9.71560	13	9.78391	17	0.21609	9.93169	4	70
31	9.71573	12	9.78408	17	0.21592	9.93165	5	69
32	9.71585	13	9.78425	17	0.21575	9.93160	5	68
33	9.71598	12	9.78442	17	0.21558	9.93155	4	67
34	9.71610	12	9.78459	17	0.21541	9.93151	5	66
35	9.71622	13	9.78476	17	0.21524	9.93146	5	65
36	9.71635	12	9.78493	17	0.21507	9.93141	4	64
37	9.71647	13	9.78510	18	0.21490	9.93137	5	63
38	9.71660	12	9.78528	17	0.21472	9.93132	4	62
39	9.71672	13	9.78545	17	0.21455	9.93128	5	61
40	9.71685	12	9.78562	17	0.21438	9.93123	5	60
41	9.71697	12	9.78579	17	0.21421	9.93118	4	59
42	9.71709	13	9.78596	17	0.21404	9.93114	5	58
43	9.71722	12	9.78613	17	0.21387	9.93109	5	57
44	9.71734	13	9.78630	17	0.21370	9.93104	4	56
45	9.71747	12	9.78647	17	0.21353	9.93100	5	55
46	9.71759	12	9.78664	17	0.21336	9.93095	4	54
47	9.71771	13	9.78681	17	0.21319	9.93091	5	53
48	9.71784	12	9.78698	17	0.21302	9.93086	5	52
49	9.71796	13	9.78715	17	0.21285	9.93081	4	51
50	9.71809		9.78732		0.21268	9.93077		50
	Cos	d.	Cot	d. c.	Tan	Sin	d.	

P. P.

	18	17	13	12	4
1	1.8	1.7	1.3	1.2	0.4
2	3.6	3.4	2.6	2.4	0.8
3	5.4	5.1	3.9	3.6	1.2
4	7.2	6.8	5.2	4.8	1.6
5	9.0	8.5	6.5	6.0	2.0
6	10.8	10.2	7.8	7.2	2.4
7	12.6	11.9	9.1	8.4	2.8
8	14.4	13.6	10.4	9.6	3.2
9	16.2	15.3	11.7	10.8	3.6

P. P.

	Sin	d.	Tan	d. c.	Cot	Cos	d.	
50	9.71809	12	9.78732	17	0.21268	9.93077	5	**50**
51	9.71821	12	9.78749	17	0.21251	9.93072	5	49
52	9.71833	13	9.78766	17	0.21234	9.93067	4	48
53	9.71846	12	9.78783	17	0.21217	9.93063	5	47
54	9.71858	12	9.78800	17	0.21200	9.93058	5	46
55	9.71870	13	9.78817	17	0.21183	9.93053	4	45
56	9.71883	12	9.78834	17	0.21166	9.93049	5	44
57	9.71895	12	9.78851	17	0.21149	9.93044	5	43
58	9.71907	13	9.78868	17	0.21132	9.93039	4	42
59	9.71920	12	9.78885	17	0.21115	9.93035	5	41
60	9.71932	12	9.78902	17	0.21098	9.93030	5	**40**
61	9.71944	13	9.78919	17	0.21081	9.93025	4	39
62	9.71957	12	9.78936	17	0.21064	9.93021	5	38
63	9.71969	12	9.78953	17	0.21047	9.93016	5	37
64	9.71981	13	9.78970	17	0.21030	9.93011	4	36
65	9.71994	12	9.78987	17	0.21013	9.93007	5	35
66	9.72006	12	9.79004	17	0.20996	9.93002	5	34
67	9.72018	12	9.79021	17	0.20979	9.92997	4	33
68	9.72030	13	9.79038	17	0.20962	9.92993	5	32
69	9.72043	12	9.79055	17	0.20945	9.92988	5	31
70	9.72055	12	9.79072	17	0.20928	9.92983	4	**30**
71	9.72067	12	9.79089	17	0.20911	9.92979	5	29
72	9.72079	13	9.79106	16	0.20894	9.92974	5	28
73	9.72092	12	9.79122	17	0.20878	9.92969	4	27
74	9.72104	12	9.79139	17	0.20861	9.92965	5	26
75	9.72116	12	9.79156	17	0.20844	9.92960	5	25
76	9.72128	13	9.79173	17	0.20827	9.92955	4	24
77	9.72141	12	9.79190	17	0.20810	9.92951	5	23
78	9.72153	12	9.79207	17	0.20793	9.92946	5	22
79	9.72165	12	9.79224	17	0.20776	9.92941	5	21
80	9.72177	13	9.79241	17	0.20759	9.92936	4	**20**
81	9.72190	12	9.79258	17	0.20742	9.92932	5	19
82	9.72202	12	9.79275	17	0.20725	9.92927	5	18
83	9.72214	12	9.79292	17	0.20708	9.92922	4	17
84	9.72226	12	9.79309	17	0.20691	9.92918	5	16
85	9.72238	13	9.79326	17	0.20674	9.92913	5	15
86	9.72251	12	9.79343	16	0.20657	9.92908	5	14
87	9.72263	12	9.79359	17	0.20641	9.92903	4	13
88	9.72275	12	9.79376	17	0.20624	9.92899	5	12
89	9.72287	12	9.79393	17	0.20607	9.92894	5	11
90	9.72299	13	9.79410	17	0.20590	9.92889	4	**10**
91	9.72312	12	9.79427	17	0.20573	9.92885	5	09
92	9.72324	12	9.79444	17	0.20556	9.92880	5	08
93	9.72336	12	9.79461	17	0.20539	9.92875	5	07
94	9.72348	12	9.79478	17	0.20522	9.92870	4	06
95	9.72360	12	9.79495	16	0.20505	9.92866	5	05
96	9.72372	13	9.79511	17	0.20489	9.92861	5	04
97	9.72385	12	9.79528	17	0.20472	9.92856	4	03
98	9.72397	12	9.79545	17	0.20455	9.92852	5	02
99	9.72409	12	9.79562	17	0.20438	9.92847	5	01
100	9.72421		9.79579		0.20421	9.92842		**00**
	Cos	d.	Cot	d. c.	Tan	Sin	d.	

P. P.

	17	16	13	12	5
1	1.7	1.6	1.3	1.2	0.5
2	3.4	3.2	2.6	2.4	1.0
3	5.1	4.8	3.9	3.6	1.5
4	6.8	6.4	5.2	4.8	2.0
5	8.5	8.0	6.5	6.0	2.5
6	10.2	9.6	7.8	7.2	3.0
7	11.9	11.2	9.1	8.4	3.5
8	13.6	12.8	10.4	9.6	4.0
9	15.3	14.4	11.7	10.8	4.5

P. P.

	Sin	d.	Tan	d. c.	Cot	Cos	d.		
00	9.72421	12	9.79579	17	0.20421	9.92842	5	**100**	
01	9.72433	12	9.79596	17	0.20404	9.92837	4	99	
02	9.72445	12	9.79613	17	0.20387	9.92833	5	98	
03	9.72457	12	9.79630	16	0.20370	9.92828	5	97	
04	9.72469	13	9.79646	17	0.20354	9.92823	5	96	
05	9.72482	12	9.79663	17	0.20337	9.92818	4	95	
06	9.72494	12	9.79680	17	0.20320	9.92814	5	94	
07	9.72506	12	9.79697	17	0.20303	9.92809	5	93	
08	9.72518	12	9.79714	17	0.20286	9.92804	5	92	
09	9.72530	12	9.79731	16	0.20269	9.92799	4	91	
10	9.72542	12	9.79747	17	0.20253	9.92795	5	**90**	
11	9.72554	12	9.79764	17	0.20236	9.92790	5	89	
12	9.72566	12	9.79781	17	0.20219	9.92785	5	88	
13	9.72578	12	9.79798	17	0.20202	9.92780	4	87	
14	9.72590	12	9.79815	17	0.20185	9.92776	5	86	
15	9.72602	12	9.79832	16	0.20168	9.92771	5	85	
16	9.72614	13	9.79848	17	0.20152	9.92766	5	84	
17	9.72627	12	9.79865	17	0.20135	9.92761	5	83	
18	9.72639	12	9.79882	17	0.20118	9.92756	4	82	
19	9.72651	12	9.79899	17	0.20101	9.92752	5	81	
20	9.72663	12	9.79916	16	0.20084	9.92747	5	**80**	
21	9.72675	12	9.79932	17	0.20068	9.92742	5	79	
22	9.72687	12	9.79949	17	0.20051	9.92737	4	78	
23	9.72699	12	9.79966	17	0.20034	9.92733	5	77	
24	9.72711	12	9.79983	17	0.20017	9.92728	5	76	
25	9.72723	12	9.80000	16	0.20000	9.92723	5	75	
26	9.72735	12	9.80016	17	0.19984	9.92718	5	74	
27	9.72747	12	9.80033	17	0.19967	9.92713	4	73	
28	9.72759	12	9.80050	17	0.19950	9.92709	5	72	
29	9.72771	12	9.80067	17	0.19933	9.92704	5	71	
30	9.72783	12	9.80084	16	0.19916	9.92699	5	**70**	
31	9.72795	12	9.80100	17	0.19900	9.92694	4	69	
32	9.72807	12	9.80117	17	0.19883	9.92690	5	68	
33	9.72819	12	9.80134	17	0.19866	9.92685	5	67	
34	9.72831	12	9.80151	17	0.19849	9.92680	5	66	
35	9.72843	12	9.80168	16	0.19832	9.92675	5	65	
36	9.72855	12	9.80184	17	0.19816	9.92670	4	64	
37	9.72867	12	9.80201	17	0.19799	9.92666	5	63	
38	9.72879	11	9.80218	17	0.19782	9.92661	5	62	
39	9.72890	12	9.80235	16	0.19765	9.92656	5	61	
40	9.72902	12	9.80251	17	0.19749	9.92651	5	**60**	
41	9.72914	12	9.80268	17	0.19732	9.92646	5	59	
42	9.72926	12	9.80285	17	0.19715	9.92641	4	58	
43	9.72938	12	9.80302	16	0.19698	9.92637	5	57	
44	9.72950	12	9.80318	17	0.19682	9.92632	5	56	
45	9.72962	12	9.80335	17	0.19665	9.92627	5	55	
46	9.72974	12	9.80352	17	0.19648	9.92622	5	54	
47	9.72986	12	9.80369	16	0.19631	9.92617	4	53	
48	9.72998	12	9.80385	17	0.19615	9.92613	5	52	
49	9.73010	12	9.80402	17	0.19598	9.92608	5	51	
50	9.73022		9.80419		0.19581	9.92603		**50**	
	Cos	d.	Cot	d. c.	Tan	Sin	d.		

P. P.

	17	16	13	12	4
1	1.7	1.6	1.3	1.2	0.4
2	3.4	3.2	2.6	2.4	0.8
3	5.1	4.8	3.9	3.6	1.2
4	6.8	6.4	5.2	4.8	1.6
5	8.5	8.0	6.5	6.0	2.0
6	10.2	9.6	7.8	7.2	2.4
7	11.9	11.2	9.1	8.4	2.8
8	13.6	12.8	10.4	9.6	3.2
9	15.3	14.4	11.7	10.8	3.6

P. P.

	Sin	d.	Tan	d. c.	Cot	Cos	d.	
50	9.73022	12	9.80419	16	0.19581	9.92603	5	**50**
51	9.73034	11	9.80435	17	0.19565	9.92598	5	49
52	9.73045	12	9.80452	17	0.19548	9.92593	5	48
53	9.73057	12	9.80469	17	0.19531	9.92588	4	47
54	9.73069	12	9.80486	16	0.19514	9.92584	5	46
55	9.73081	12	9.80502	17	0.19498	9.92579	5	45
56	9.73093	12	9.80519	17	0.19481	9.92574	5	44
57	9.73105	12	9.80536	16	0.19464	9.92569	5	43
58	9.73117	12	9.80552	17	0.19448	9.92564	5	42
59	9.73129	11	9.80569	17	0.19431	9.92559	4	41
60	9.73140	12	9.80586	17	0.19414	9.92555	5	**40**
61	9.73152	12	9.80603	16	0.19397	9.92550	5	39
62	9.73164	12	9.80619	17	0.19381	9.92545	5	38
63	9.73176	12	9.80636	17	0.19364	9.92540	5	37
64	9.73188	12	9.80653	16	0.19347	9.92535	5	36
65	9.73200	11	9.80669	17	0.19331	9.92530	5	35
66	9.73211	12	9.80686	17	0.19314	9.92525	4	34
67	9.73223	12	9.80703	16	0.19297	9.92521	5	33
68	9.73235	12	9.80719	17	0.19281	9.92516	5	32
69	9.73247	12	9.80736	17	0.19264	9.92511	5	31
70	9.73259	12	9.80753	16	0.19247	9.92506	5	**30**
71	9.73271	11	9.80769	17	0.19231	9.92501	5	29
72	9.73282	12	9.80786	17	0.19214	9.92496	5	28
73	9.73294	12	9.80803	16	0.19197	9.92491	5	27
74	9.73306	12	9.80819	17	0.19181	9.92486	4	26
75	9.73318	11	9.80836	17	0.19164	9.92482	5	25
76	9.73329	12	9.80853	16	0.19147	9.92477	5	24
77	9.73341	12	9.80869	17	0.19131	9 92472	5	23
78	9.73353	12	9.80886	17	0.19114	9.92467	5	22
79	9.73365	12	9.80903	16	0.19097	9.92462	5	21
80	9.73377	11	9.80919	17	0.19081	9.92457	5	**20**
81	9.73388	12	9.80936	17	0.19064	9.92452	5	19
82	9.73400	12	9.80953	16	0.19047	9.92447	4	18
83	9.73412	12	9.80969	17	0.19031	9.92443	5	17
84	9.73424	11	9.80986	17	0.19014	9.92438	5	16
85	9.73435	12	9.81003	16	0.18997	9.92433	5	15
86	9.73447	12	9.81019	17	0.18981	9.92428	5	14
87	9.73459	11	9.81036	16	0.18964	9.92423	5	13
88	9.73470	12	9.81052	17	0.18948	9.92418	5	12
89	9.73482	12	9.81069	17	0.18931	9.92413	5	11
90	9.73494	12	9.81086	16	0.18914	9.92408	5	**10**
91	9.73506	11	9.81102	17	0.18898	9.92403	5	09
92	9.73517	12	9.81119	17	0.18881	9.92398	4	08
93	9.73529	12	9.81136	16	0.18864	9.92394	5	07
94	9.73541	11	9.81152	17	0.18848	9.92389	5	06
95	9.73552	12	9.81169	16	0.18831	9.92384	5	05
96	9.73564	12	9.81185	17	0.18815	9.92379	5	04
97	9.73576	12	9.81202	17	0.18798	9.92374	5	03
98	9.73588	11	9.81219	16	0.18781	9.92369	5	02
99	9.73599	12	9.81235	17	0.18765	9.92364	5	01
100	9.73611		9.81252		0.18748	9.92359		**00**
	Cos	d.	Cot	d. c.	Tan	Sin	d.	

P. P.

	17	**16**	**12**	**11**	**5**
1	1.7	1.6	1.2	1.1	0.5
2	3.4	3.2	2.4	2.2	1.0
3	5.1	4.8	3.6	3.3	1.5
4	6.8	6.4	4.8	4.4	2.0
5	8.5	8.0	6.0	5.5	2.5
6	10.2	9.6	7.2	6.6	3.0
7	11.9	11.2	8.4	7.7	3.5
8	13.6	12.8	9.6	8.8	4.0
9	15.3	14.4	10.8	9.9	4.5

′	Sin	d.	Tan	d. c.	Cot	Cos	d.	′
00	9.73611	12	9.81252	16	0.18748	9.92359	5	100
01	9.73623	11	9.81268	17	0.18732	9.92354	5	99
02	9.73634	12	9.81285	17	0.18715	9.92349	5	98
03	9.73646	12	9.81302	16	0.18698	9.92344	5	97
04	9.73658	11	9.81318	17	0.18682	9.92339	4	96
05	9.73669	12	9.81335	16	0.18665	9.92335	5	95
06	9.73681	11	9.81351	17	0.18649	9.92330	5	94
07	9.73692	12	9.81368	16	0.18632	9.92325	5	93
08	9.73704	12	9.81384	17	0.18616	9.92320	5	92
09	9.73716	11	9.81401	17	0.18599	9.92315	5	91
10	9.73727	12	9.81418	16	0.18582	9.92310	5	90
11	9.73739	12	9.81434	17	0.18566	9.92305	5	89
12	9.73751	11	9.81451	16	0.18549	9.92300	5	88
13	9.73762	12	9.81467	17	0.18533	9.92295	5	87
14	9.73774	11	9.81484	16	0.18516	9.92290	5	86
15	9.73785	12	9.81500	17	0.18500	9.92285	5	85
16	9.73797	12	9.81517	16	0.18483	9.92280	5	84
17	9.73809	11	9.81533	17	0.18467	9.92275	5	83
18	9.73820	12	9.81550	17	0.18450	9.92270	5	82
19	9.73832	11	9.81567	16	0.18433	9.92265	5	81
20	9.73843	12	9.81583	17	0.18417	9.92260	5	80
21	9.73855	12	9.81600	16	0.18400	9.92255	5	79
22	9.73867	11	9.81616	17	0.18384	9.92250	5	78
23	9.73878	12	9.81633	16	0.18367	9.92245	5	77
24	9.73890	11	9.81649	17	0.18351	9.92240	5	76
25	9.73901	12	9.81666	16	0.18334	9.92235	4	75
26	9.73913	11	9.81682	17	0.18318	9.92231	5	74
27	9.73924	12	9.81699	16	0.18301	9.92226	5	73
28	9.73936	11	9.81715	17	0.18285	9.92221	5	72
29	9.73947	12	9.81732	16	0.18268	9.92216	5	71
30	9.73959	12	9.81748	17	0.18252	9.92211	5	70
31	9.73971	11	9.81765	16	0.18235	9.92206	5	69
32	9.73982	12	9.81781	17	0.18219	9.92201	5	68
33	9.73994	11	9.81798	16	0.18202	9.92196	5	67
34	9.74005	12	9.81814	17	0.18186	9.92191	5	66
35	9.74017	11	9.81831	16	0.18169	9.92186	5	65
36	9.74028	12	9.81847	17	0.18153	9.92181	5	64
37	9.74040	11	9.81864	16	0.18136	9.92176	5	63
38	9.74051	12	9.81880	17	0.18120	9.92171	5	62
39	9.74063	11	9.81897	16	0.18103	9.92166	5	61
40	9.74074	12	9.81913	17	0.18087	9.92161	5	60
41	9.74086	11	9.81930	16	0.18070	9.92156	5	59
42	9.74097	12	9.81946	17	0.18054	9.92151	5	58
43	9.74109	11	9.81963	16	0.18037	9.92146	5	57
44	9.74120	12	9.81979	17	0.18021	9.92141	5	56
45	9.74132	11	9.81996	16	0.18004	9.92136	5	55
46	9.74143	12	9.82012	17	0.17988	9.92131	5	54
47	9.74155	11	9.82029	16	0.17971	9.92126	5	53
48	9.74166	11	9.82045	17	0.17955	9.92121	5	52
49	9.74177	12	9.82062	16	0.17938	9.92116	5	51
50	9.74189		9.82078		0.17922	9.92111		50
	Cos	d.	Cot	d. c.	Tan	Sin	d.	

P. P.

	17	16	12	11	5
1	1.7	1.6	1.2	1.1	0.5
2	3.4	3.2	2.4	2.2	1.0
3	5.1	4.8	3.6	3.3	1.5
4	6.8	6.4	4.8	4.4	2.0
5	8.5	8.0	6.0	5.5	2.5
6	10.2	9.6	7.2	6.6	3.0
7	11.9	11.2	8.4	7.7	3.5
8	13.6	12.8	9.6	8.8	4.0
9	15.3	14.4	10.8	9.9	4.5

	Sin	d.	Tan	d. c.	Cot	Cos	d.	
50	9.74189	11	9.82078	17	0.17922	9.92111	5	50
51	9.74200	12	9.82095	16	0.17905	9.92106	5	49
52	9.74212	11	9.82111	17	0.17889	9.92101	5	48
53	9.74223	12	9.82128	16	0.17872	9.92096	5	47
54	9.74235	11	9.82144	17	0.17856	9.92091	5	46
55	9.74246	12	9.82161	16	0.17839	9.92086	5	45
56	9.74258	11	9.82177	17	0.17823	9.92081	6	44
57	9.74269	11	9.82194	16	0.17806	9.92075	5	43
58	9.74280	12	9.82210	16	0.17790	9.92070	5	42
59	9.74292	11	9.82226	17	0.17774	9.92065	5	41
60	9.74303	12	9.82243	16	0.17757	9.92060	5	40
61	9.74315	11	9.82259	17	0.17741	9.92055	5	39
62	9.74326	11	9.82276	16	0.17724	9.92050	5	38
63	9.74337	12	9.82292	17	0.17708	9.92045	5	37
64	9.74349	11	9.82309	16	0.17691	9.92040	5	36
65	9.74360	12	9.82325	16	0.17675	9.92035	5	35
66	9.74372	11	9.82341	17	0.17659	9.92030	5	34
67	9.74383	11	9.82358	16	0.17642	9.92025	5	33
68	9.74394	12	9.82374	17	0.17626	9.92020	5	32
69	9.74406	11	9.82391	16	0.17609	9.92015	5	31
70	9.74417	11	9.82407	17	0.17593	9.92010	5	30
71	9.74428	12	9.82424	16	0.17576	9.92005	5	29
72	9.74440	11	9.82440	16	0.17560	9.92000	5	28
73	9.74451	12	9.82456	17	0.17544	9.91995	5	27
74	9.74463	11	9.82473	16	0.17527	9.91990	5	26
75	9.74474	11	9.82489	17	0.17511	9.91985	5	25
76	9.74485	12	9.82506	16	0.17494	9.91980	5	24
77	9.74497	11	9.82522	16	0.17478	9.91975	6	23
78	9.74508	11	9.82538	17	0.17462	9.91969	5	22
79	9.74519	12	9.82555	16	0.17445	9.91964	5	21
80	9.74531	11	9.82571	17	0.17429	9.91959	5	20
81	9.74542	11	9.82588	16	0.17412	9.91954	5	19
82	9.74553	12	9.82604	16	0.17396	9.91949	5	18
83	9.74565	11	9.82620	17	0.17380	9.91944	5	17
84	9.74576	11	9.82637	16	0.17363	9.91939	5	16
85	9.74587	11	9.82653	17	0.17347	9.91934	5	15
86	9.74598	12	9.82670	16	0.17330	9.91929	5	14
87	9.74610	11	9.82686	16	0.17314	9.91924	5	13
88	9.74621	11	9.82702	17	0.17298	9.91919	5	12
89	9.74632	12	9.82719	16	0.17281	9.91914	6	11
90	9.74644	11	9.82735	16	0.17265	9.91908	5	10
91	9.74655	11	9.82751	17	0.17249	9.91903	5	09
92	9.74666	11	9.82768	16	0.17232	9.91898	5	08
93	9.74677	12	9.82784	17	0.17216	9.91893	5	07
94	9.74689	11	9.82801	16	0.17199	9.91888	5	06
95	9.74700	11	9.82817	16	0.17163	9.91883	5	05
96	9.74711	11	9.82833	17	0.17167	9.91878	5	04
97	9.74722	12	9.82850	16	0.17150	9.91873	5	03
98	9.74734	11	9.82866	16	0.17134	9.91868	5	02
99	9.74745	11	9.82882	17	0.17118	9.91863	6	01
100	9.74756		9.82899		0.17101	9.91857		00
	Cos	d.	Cot	d. c.	Tan	Sin	d.	

P. P.

	17	16	12	11	6
1	1.7	1.6	1.2	1.1	0.6
2	3.4	3.2	2.4	2.2	1.2
3	5.1	4.8	3.6	3.3	1.8
4	6.8	6.4	4.8	4.4	2.4
5	8.5	8.0	6.0	5.5	3.0
6	10.2	9.6	7.2	6.6	3.6
7	11.9	11.2	8.4	7.7	4.2
8	13.6	12.8	9.6	8.8	4.8
9	15.3	14.4	10.8	9.9	5.4

P. P.

	Sin	d.	Tan	d. c.	Cot	Cos	d.	
00	9.74756	11	9.82899	16	0.17101	9.91857	5	**100**
01	9.74767	12	9.82915	16	0.17085	9.91852	5	99
02	9.74779	11	9.82931	17	0.17069	9.91847	5	98
03	9.74790	11	9.82948	16	0.17052	9.91842	5	97
04	9.74801	11	9.82964	16	0.17036	9.91837	5	96
05	9.74812	12	9.82980	17	0.17020	9.91832	5	95
06	9.74824	11	9.82997	16	0.17003	9.91827	5	94
07	9.74835	11	9.83013	16	0.16987	9.91822	6	93
08	9.74846	11	9.83029	17	0.16971	9.91816	5	92
09	9.74857	11	9.83046	16	0.16954	9.91811	5	91
10	9.74868	12	9.83062	16	0.16938	9.91806	5	**90**
11	9.74880	11	9.83078	17	0.16922	9.91801	5	89
12	9.74891	11	9.83095	16	0.16905	9.91796	5	88
13	9.74902	11	9.83111	16	0.16889	9.91791	5	87
14	9.74913	11	9.83127	17	0.16873	9.91786	5	86
15	9.74924	11	9.83144	16	0.16856	9.91781	6	85
16	9.74935	12	9.83160	16	0.16840	9.91775	5	84
17	9.74947	11	9.83176	17	0.16824	9.91770	5	83
18	9.74958	11	9.83193	16	0.16807	9.91765	5	82
19	9.74969	11	9.83209	16	0.16791	9.91760	5	81
20	9.74980	11	9.83225	17	0.16775	9.91755	5	**80**
21	9.74991	11	9.83242	16	0.16758	9.91750	6	79
22	9.75002	12	9.83258	16	0.16742	9.91744	5	78
23	9.75014	11	9.83274	16	0.16726	9.91739	5	77
24	9.75025	11	9.83290	17	0.16710	9.91734	5	76
25	9.75036	11	9.83307	16	0.16693	9.91729	5	75
26	9.75047	11	9.83323	16	0.16677	9.91724	5	74
27	9.75058	11	9.83339	17	0.16661	9.91719	5	73
28	9.75069	11	9.83356	16	0.16644	9.91714	6	72
29	9.75080	11	9.83372	16	0.16628	9.91708	5	71
30	9.75091	12	9.83388	17	0.16612	9.91703	5	**70**
31	9.75103	11	9.83405	16	0.16595	9.91698	5	69
32	9.75114	11	9.83421	16	0.16579	9.91693	5	68
33	9.75125	11	9.83437	16	0.16563	9.91688	6	67
34	9.75136	11	9.83453	17	0.16547	9.91682	5	66
35	9.75147	11	9.83470	16	0.16530	9.91677	5	65
36	9.75158	11	9.83486	16	0.16514	9.91672	5	64
37	9.75169	11	9.83502	16	0.16498	9.91667	5	63
38	9.75180	11	9.83518	17	0.16482	9.91662	5	62
39	9.75191	11	9.83535	16	0.16465	9.91657	6	61
40	9.75202	11	9.83551	16	0.16449	9.91651	5	**60**
41	9.75213	11	9.83567	16	0.16433	9.91646	5	59
42	9.75224	12	9.83583	17	0.16417	9.91641	5	58
43	9.75236	11	9.83600	16	0.16400	9.91636	5	57
44	9.75247	11	9.83616	16	0.16384	9.91631	6	56
45	9.75258	11	9.83632	16	0.16368	9.91625	5	55
46	9.75269	11	9.83648	17	0.16352	9.91620	5	54
47	9.75280	11	9.83665	16	0.16335	9.91615	5	53
48	9.75291	11	9.83681	16	0.16319	9.91610	5	52
49	9.75302	11	9.83697	16	0.16303	9.91605	6	51
50	9.75313		9.83713		0.16287	9.91599		**50**
	Cos	d.	Cot	d. c.	Tan	Sin	d.	

P. P.

17	
1	1.7
2	3.4
3	5.1
4	6.8
5	8.5
6	10.2
7	11.9
8	13.6
9	15.3

16	
1	1.6
2	3.2
3	4.8
4	6.4
5	8.0
6	9.6
7	11.2
8	12.8
9	14.4

12	
1	1.2
2	2.4
3	3.6
4	4.8
5	6.0
6	7.2
7	8.4
8	9.6
9	10.8

11	
1	1.1
2	2.2
3	3.3
4	4.4
5	5.5
6	6.6
7	7.7
8	8.8
9	9.9

5	
1	0.5
2	1.0
3	1.5
4	2.0
5	2.5
6	3.0
7	3.5
8	4.0
9	4.5

P. P.

	Sin	d.	Tan	d. c.	Cot	Cos	d.	
50	9.75313	11	9.83713	17	0.16287	9.91599	5	**50**
51	9.75324	11	9.83730	16	0.16270	9.91594	5	49
52	9.75335	11	9.83746	16	0.16254	9.91589	5	48
53	9.75346	11	9.83762	16	0.16238	9.91584	5	47
54	9.75357	11	9.83778	17	0.16222	9.91579	6	46
55	9.75368	11	9.83795	16	0.16205	9.91573	5	45
56	9.75379	11	9.83811	16	0.16189	9.91568	5	44
57	9.75390	11	9.83827	16	0.16173	9.91563	5	43
58	9.75401	11	9.83843	16	0.16157	9.91558	6	42
59	9.75412	11	9.83859	17	0.16141	9.91552	5	41
60	9.75423	11	9.83876	16	0.16124	9.91547	5	**40**
61	9.75434	11	9.83892	16	0.16108	9.91542	5	39
62	9.75445	11	9.83908	16	0.16092	9.91537	6	38
63	9.75456	11	9.83924	17	0.16076	9.91531	5	37
64	9.75467	11	9.83941	16	0.16059	9.91526	5	36
65	9.75478	11	9.83957	16	0.16043	9.91521	5	35
66	9.75489	11	9.83973	16	0.16027	9.91516	5	34
67	9.75500	11	9.83989	16	0.16011	9.91511	6	33
68	9.75511	11	9.84005	17	0.15995	9.91505	5	32
69	9.75522	11	9.84022	16	0.15978	9.91500	5	31
70	9.75533	11	9.84038	16	0.15962	9.91495	5	**30**
71	9.75544	10	9.84054	16	0.15946	9.91490	6	29
72	9.75554	11	9.84070	16	0.15930	9.91484	5	28
73	9.75565	11	9.84086	17	0.15914	9.91479	5	27
74	9.75576	11	9.84103	16	0.15897	9.91474	5	26
75	9.75587	11	9.84119	16	0.15881	9.91469	6	25
76	9.75598	11	9.84135	16	0.15865	9.91463	5	24
77	9.75609	11	9.84151	16	0.15849	9.91458	5	23
78	9.75620	11	9.84167	16	0.15833	9.91453	6	22
79	9.75631	11	9.84183	17	0.15817	9.91447	5	21
80	9.75642	11	9.84200	16	0.15800	9.91442	5	**20**
81	9.75653	11	9.84216	16	0.15784	9.91437	5	19
82	9.75664	11	9.84232	16	0.15768	9.91432	6	18
83	9.75675	10	9.84248	16	0.15752	9.91426	5	17
84	9.75685	11	9.84264	16	0.15736	9.91421	5	16
85	9.75696	11	9.84280	17	0.15720	9.91416	5	15
86	9.75707	11	9.84297	16	0.15703	9.91411	6	14
87	9.75718	11	9.84313	16	0.15687	9.91405	5	13
88	9.75729	11	9.84329	16	0.15671	9.91400	5	12
89	9.75740	11	9.84345	16	0.15655	9.91395	6	11
90	9.75751	11	9.84361	16	0.15639	9.91389	5	**10**
91	9.75762	10	9.84377	17	0.15623	9.91384	5	09
92	9.75772	11	9.84394	16	0.15606	9.91379	5	08
93	9.75783	11	9.84410	16	0.15590	9.91374	6	07
94	9.75794	11	9.84426	16	0.15574	9.91368	5	06
95	9.75805	11	9.84442	16	0.15558	9.91363	5	05
96	9.75816	11	9.84458	16	0.15542	9.91358	6	04
97	9.75827	10	9.84474	16	0.15526	9.91352	5	03
98	9.75837	11	9.84490	17	0.15510	9.91347	5	02
99	9.75848	11	9.84507	16	0.15493	9.91342	6	01
100	9.75859		9.84523		0.15477	9.91336		**00**
	Cos	d.	Cot	d. c.	Tan	Sin	d.	

P. P.

	17	16	11	10	6
1	1.7	1.6	1.1	1.0	0.6
2	3.4	3.2	2.2	2.0	1.2
3	5.1	4.8	3.3	3.0	1.8
4	6.8	6.4	4.4	4.0	2.4
5	8.5	8.0	5.5	5.0	3.0
6	10.2	9.6	6.6	6.0	3.6
7	11.9	11.2	7.7	7.0	4.2
8	13.6	12.8	8.8	8.0	4.8
9	15.3	14.4	9.9	9.0	5.4

′	Sin	d.	Tan	d. c.	Cot	Cos	d.	′
00	9.75859	11	9.84523	16	0.15477	9.91336	5	100
01	9.75870	11	9.84539	16	0.15461	9.91331	5	99
02	9.75881	11	9.84555	16	0.15445	9.91326	5	98
03	9.75892	10	9.84571	16	0.15429	9.91321	6	97
04	9.75902	11	9.84587	16	0.15413	9.91315	5	96
05	9.75913	11	9.84603	16	0.15397	9.91310	5	95
06	9.75924	11	9.84619	17	0.15381	9.91305	6	94
07	9.75935	11	9.84636	16	0.15364	9.91299	5	93
08	9.75946	10	9.84652	16	0.15348	9.91294	5	92
09	9.75956	11	9.84668	16	0.15332	9.91289	6	91
10	9.75967	11	9.84684	16	0.15316	9.91283	5	90
11	9.75978	11	9.84700	16	0.15300	9.91278	5	89
12	9.75989	11	9.84716	16	0.15284	9.91273	6	88
13	9.76000	10	9.84732	16	0.15268	9.91267	5	87
14	9.76010	11	9.84748	16	0.15252	9.91262	5	86
15	9.76021	11	9.84764	17	0.15236	9.91257	6	85
16	9.76032	11	9.84781	16	0.15219	9.91251	5	84
17	9.76043	10	9.84797	16	0.15203	9.91246	5	83
18	9.76053	11	9.84813	16	0.15187	9.91241	6	82
19	9.76064	11	9.84829	16	0.15171	9.91235	5	81
20	9.76075	11	9.84845	16	0.15155	9.91230	5	80
21	9.76086	10	9.84861	16	0.15139	9.91225	6	79
22	9.76096	11	9.84877	16	0.15123	9.91219	5	78
23	9.76107	11	9.84893	16	0.15107	9.91214	5	77
24	9.76118	11	9.84909	16	0.15091	9.91209	6	76
25	9.76129	10	9.84925	16	0.15075	9.91203	5	75
26	9.76139	11	9.84941	17	0.15059	9.91198	6	74
27	9.76150	11	9.84958	16	0.15042	9.91192	5	73
28	9.76161	10	9.84974	16	0.15026	9.91187	5	72
29	9.76171	11	9.84990	16	0.15010	9.91182	6	71
30	9.76182	11	9.85006	16	0.14994	9.91176	5	70
31	9.76193	10	9.85022	16	0.14978	9.91171	5	69
32	9.76203	11	9.85038	16	0.14962	9.91166	6	68
33	9.76214	11	9.85054	16	0.14946	9.91160	5	67
34	9.76225	11	9.85070	16	0.14930	9.91155	6	66
35	9.76236	10	9.85086	16	0.14914	9.91149	5	65
36	9.76246	11	9.85102	16	0.14898	9.91144	5	64
37	9.76257	11	9.85118	16	0.14882	9.91139	6	63
38	9.76268	10	9.85134	16	0.14866	9.91133	5	62
39	9.76278	11	9.85150	16	0.14850	9.91128	5	61
40	9.76289	11	9.85166	16	0.14834	9.91123	6	60
41	9.76300	10	9.85182	16	0.14818	9.91117	5	59
42	9.76310	11	9.85198	17	0.14802	9.91112	6	58
43	9.76321	11	9.85215	16	0.14785	9.91106	5	57
44	9.76332	10	9.85231	16	0.14769	9.91101	5	56
45	9.76342	11	9.85247	16	0.14753	9.91096	6	55
46	9.76353	11	9.85263	16	0.14737	9.91090	5	54
47	9.76364	10	9.85279	16	0.14721	9.91085	6	53
48	9.76374	11	9.85295	16	0.14705	9.91079	5	52
49	9.76385	10	9.85311	16	0.14689	9.91074	5	51
50	9.76395		9.85327		0.14673	9.91069		50
	Cos	d.	Cot	d. c.	Tan	Sin	d.	′

P. P.

	17	16	11	10	5
1	1.7	1.6	1.1	1.0	0.5
2	3.4	3.2	2.2	2.0	1.0
3	5.1	4.8	3.3	3.0	1.5
4	6.8	6.4	4.4	4.0	2.0
5	8.5	8.0	5.5	5.0	2.5
6	10.2	9.6	6.6	6.0	3.0
7	11.9	11.2	7.7	7.0	3.5
8	13.6	12.8	8.8	8.0	4.0
9	15.3	14.4	9.9	9.0	4.5

	Sin	d.	Tan	d. c.	Cot	Cos	d.	
50	9.76395	11	9.85327	16	0.14673	9.91069	6	50
51	9.76406	11	9.85343	16	0.14657	9.91063	5	49
52	9.76417	10	9.85359	16	0.14641	9.91058	6	48
53	9.76427	11	9.85375	16	0.14625	9.91052	5	47
54	9.76438	10	9.85391	16	0.14609	9.91047	5	46
55	9.76448	11	9.85407	16	0.14593	9.91042	6	45
56	9.76459	11	9.85423	16	0.14577	9.91036	5	44
57	9.76470	10	9.85439	16	0.14561	9.91031	6	43
58	9.76480	11	9.85455	16	0.14545	9.91025	5	42
59	9.76491	10	9.85471	16	0.14529	9.91020	6	41
60	9.76501	11	9.85487	16	0.14513	9.91014	5	40
61	9.76512	11	9.85503	16	0.14497	9.91009	5	39
62	9.76523	10	9.85519	16	0.14481	9.91004	6	38
63	9.76533	11	9.85535	16	0.14465	9.90998	5	37
64	9.76544	10	9.85551	16	0.14449	9.90993	6	36
65	9.76554	11	9.85567	16	0.14433	9.90987	5	35
66	9.76565	10	9.85583	16	0.14417	9.90982	6	34
67	9.76575	11	9.85599	16	0.14401	9.90976	5	33
68	9.76586	11	9.85615	16	0.14385	9.90971	5	32
69	9.76597	10	9.85631	16	0.14369	9.90966	6	31
70	9.76607	11	9.85647	16	0.14353	9.90960	5	30
71	9.76618	10	9.85663	16	0.14337	9.90955	6	29
72	9.76628	11	9.85679	16	0.14321	9.90949	5	28
73	9.76639	10	9.85695	16	0.14305	9.90944	6	27
74	9.76649	11	9.85711	16	0.14289	9.90938	5	26
75	9.76660	10	9.85727	16	0.14273	9.90933	6	25
76	9.76670	11	9.85743	16	0.14257	9.90927	5	24
77	9.76681	10	9.85759	16	0.14241	9.90922	6	23
78	9.76691	11	9.85775	16	0.14225	9.90916	5	22
79	9.76702	10	9.85791	16	0.14209	9.90911	5	21
80	9.76712	11	9.85807	16	0.14193	9.90906	6	20
81	9.76723	10	9.85823	16	0.14177	9.90900	5	19
82	9.76733	11	9.85839	16	0.14161	9.90895	6	18
83	9.76744	10	9.85855	16	0.14145	9.90889	5	17
84	9.76754	11	9.85871	16	0.14129	9.90884	6	16
85	9.76765	10	9.85887	16	0.14113	9.90878	5	15
86	9.76775	11	9.85903	16	0.14097	9.90873	6	14
87	9.76786	10	9.85919	16	0.14081	9.90867	5	13
88	9.76796	11	9.85935	16	0.14065	9.90862	6	12
89	9.76807	10	9.85951	16	0.14049	9.90856	5	11
90	9.76817	11	9.85967	16	0.14033	9.90851	6	10
91	9.76828	10	9.85983	16	0.14017	9.90845	5	09
92	9.76838	11	9.85999	15	0.14001	9.90840	6	08
93	9.76849	10	9.86014	16	0.13986	9.90834	5	07
94	9.76859	11	9.86030	16	0.13970	9.90829	6	06
95	9.76870	10	9.86046	16	0.13954	9.90823	5	05
96	9.76880	11	9.86062	16	0.13938	9.90818	6	04
97	9.76891	10	9.86078	16	0.13922	9.90812	5	03
98	9.76901	10	9.86094	16	0.13906	9.90807	6	02
99	9.76911	11	9.86110	16	0.13890	9.90801	5	01
100	9.76922		9.86126		0.13874	9.90796		00
	Cos	d.	Cot	d. c.	Tan	Sin	d.	

P. P.

	16	15	11	10	6
1	1.6	1.5	1.1	1.0	0.6
2	3.2	3.0	2.2	2.0	1.2
3	4.8	4.5	3.3	3.0	1.8
4	6.4	6.0	4.4	4.0	2.4
5	8.0	7.5	5.5	5.0	3.0
6	9.6	9.0	6.6	6.0	3.6
7	11.2	10.5	7.7	7.0	4.2
8	12.8	12.0	8.8	8.0	4.8
9	14.4	13.5	9.9	9.0	5.4

P. P.

	Sin	d.	Tan	d. c.	Cot	Cos	d.	
00	9.76922	10	9.86126	16	0.13874	9.90796	6	100
01	9.76932	11	9.86142	16	0.13858	9.90790	5	99
02	9.76943	10	9.86158	16	0.13842	9.90785	6	98
03	9.76953	11	9.86174	16	0.13826	9.90779	5	97
04	9.76964	10	9.86190	16	0.13810	9.90774	6	96
05	9.76974	10	9.86206	16	0.13794	9.90768	5	95
06	9.76984	11	9.86222	16	0.13778	9.90763	6	94
07	9.76995	10	9.86238	16	0.13762	9.90757	5	93
08	9.77005	11	9.86254	15	0.13746	9.90752	6	92
09	9.77016	10	9.86269	16	0.13731	9.90746	5	91
10	9.77026	10	9.86285	16	0.13715	9.90741	6	90
11	9.77036	11	9.86301	16	0.13699	9.90735	5	89
12	9.77047	10	9.86317	16	0.13683	9.90730	6	88
13	9.77057	11	9.86333	16	0.13667	9.90724	6	87
14	9.77068	10	9.86349	16	0.13651	9.90718	5	86
15	9.77078	10	9.86365	16	0.13635	9.90713	6	85
16	9.77088	11	9.86381	16	0.13619	9.90707	5	84
17	9.77099	10	9.86397	16	0.13603	9.90702	6	83
18	9.77109	10	9.86413	16	0.13587	9.90696	5	82
19	9.77119	11	9.86429	16	0.13571	9.90691	6	81
20	9.77130	10	9.86445	15	0.13555	9.90685	5	80
21	9.77140	10	9.86460	16	0.13540	9.90680	6	79
22	9.77150	11	9.86476	16	0.13524	9.90674	5	78
23	9.77161	10	9.86492	16	0.13508	9.90669	6	77
24	9.77171	10	9.86508	16	0.13492	9.90663	6	76
25	9.77181	11	9.86524	16	0.13476	9.90657	5	75
26	9.77192	10	9.86540	16	0.13460	9.90652	6	74
27	9.77202	10	9.86556	16	0.13444	9.90646	5	73
28	9.77212	11	9.86572	16	0.13428	9.90641	6	72
29	9.77223	10	9.86588	15	0.13412	9.90635	5	71
30	9.77233	10	9.86603	16	0.13397	9.90630	6	70
31	9.77243	11	9.86619	16	0.13381	9.90624	6	69
32	9.77254	10	9.86635	16	0.13365	9.90618	5	68
33	9.77264	10	9.86651	16	0.13349	9.90613	6	67
34	9.77274	11	9.86667	16	0.13333	9.90607	5	66
35	9.77285	10	9.86683	16	0.13317	9.90602	6	65
36	9.77295	10	9.86699	16	0.13301	9.90596	5	64
37	9.77305	11	9.86715	16	0.13285	9.90591	6	63
38	9.77316	10	9.86731	15	0.13269	9.90585	6	62
39	9.77326	10	9.86746	16	0.13254	9.90579	5	61
40	9.77336	10	9.86762	16	0.13238	9.90574	6	60
41	9.77346	11	9.86778	16	0.13222	9.90568	5	59
42	9.77357	10	9.86794	16	0.13206	9.90563	6	58
43	9.77367	10	9.86810	16	0.13190	9.90557	6	57
44	9.77377	10	9.86826	16	0.13174	9.90551	5	56
45	9.77387	11	9.86842	15	0.13158	9.90546	6	55
46	9.77398	10	9.86857	16	0.13143	9.90540	5	54
47	9.77408	10	9.86873	16	0.13127	9.90535	6	53
48	9.77418	11	9.86889	16	0.13111	9.90529	6	52
49	9.77429	10	9.86905	16	0.13095	9.90523	5	51
50	9.77439		9.86921		0.13079	9.90518		50
	Cos	d.	Cot	d. c.	Tan	Sin	d.	

P. P.

	16	15	11	10	5
1	1.6	1.5	1.1	1.0	0.5
2	3.2	3.0	2.2	2.0	1.0
3	4.8	4.5	3.3	3.0	1.5
4	6.4	6.0	4.4	4.0	2.0
5	8.0	7.5	5.5	5.0	2.5
6	9.6	9.0	6.6	6.0	3.0
7	11.2	10.5	7.7	7.0	3.5
8	12.8	12.0	8.8	8.0	4.0
9	14.4	13.5	9.9	9.0	4.5

P. P.

	Sin	d.	Tan	d. c.	Cot	Cos	d.	
50	9.77439	10	9.86921	16	0.13079	9.90518	6	50
51	9.77449	10	9.86937	16	0.13063	9.90512	5	49
52	9.77459	10	9.86953	15	0.13047	9.90507	6	48
53	9.77469	11	9.86968	16	0.13032	9.90501	6	47
54	9.77480	10	9.86984	16	0.13016	9.90495	5	46
55	9.77490	10	9.87000	16	0.13000	9.90490	6	45
56	9.77500	10	9.87016	16	0.12984	9.90484	5	44
57	9.77510	11	9.87032	16	0.12968	9.90479	6	43
58	9.77521	10	9.87048	15	0.12952	9.90473	6	42
59	9.77531	10	9.87063	16	0.12937	9.90467	5	41
60	9.77541	10	9.87079	16	0.12921	9.90462	6	40
61	9.77551	10	9.87095	16	0.12905	9.90456	6	39
62	9.77561	11	9.87111	16	0.12889	9.90450	5	38
63	9.77572	10	9.87127	16	0.12873	9.90445	6	37
64	9.77582	10	9.87143	15	0.12857	9.90439	5	36
65	9.77592	10	9.87158	16	0.12842	9.90434	6	35
66	9.77602	10	9.87174	16	0.12826	9.90428	6	34
67	9.77612	11	9.87190	16	0.12810	9.90422	5	33
68	9.77623	10	9.87206	16	0.12794	9.90417	6	32
69	9.77633	10	9.87222	16	0.12778	9.90411	6	31
70	9.77643	10	9.87238	15	0.12762	9.90405	5	30
71	9.77653	10	9.87253	16	0.12747	9.90400	6	29
72	9.77663	10	9.87269	16	0.12731	9.90394	6	28
73	9.77673	11	9.87285	16	0.12715	9.90388	5	27
74	9.77684	10	9.87301	16	0.12699	9.90383	6	26
75	9.77694	10	9.87317	15	0.12683	9.90377	6	25
76	9.77704	10	9.87332	16	0.12668	9.90371	5	24
77	9.77714	10	9.87348	16	0.12652	9.90366	6	23
78	9.77724	10	9.87364	16	0.12636	9.90360	6	22
79	9.77734	10	9.87380	16	0.12620	9.90354	5	21
80	9.77744	11	9.87396	16	0.12604	9.90349	6	20
81	9.77755	10	9.87412	15	0.12588	9.90343	6	19
82	9.77765	10	9.87427	16	0.12573	9.90337	5	18
83	9.77775	10	9.87443	16	0.12557	9.90332	6	17
84	9.77785	10	9.87459	16	0.12541	9.90326	6	16
85	9.77795	10	9.87475	15	0.12525	9.90320	5	15
86	9.77805	10	9.87490	16	0.12510	9.90315	6	14
87	9.77815	10	9.87506	16	0.12494	9.90309	6	13
88	9.77825	10	9.87522	16	0.12478	9.90303	5	12
89	9.77835	11	9.87538	16	0.12462	9.90298	6	11
90	9.77846	10	9.87554	15	0.12446	9.90292	6	10
91	9.77856	10	9.87569	16	0.12431	9.90286	6	09
92	9.77866	10	9.87585	16	0.12415	9.90280	5	08
93	9.77876	10	9.87601	16	0.12399	9.90275	6	07
94	9.77886	10	9.87617	16	0.12383	9.90269	6	06
95	9.77896	10	9.87633	15	0.12367	9.90263	5	05
96	9.77906	10	9.87648	16	0.12352	9.90258	6	04
97	9.77916	10	9.87664	16	0.12336	9.90252	6	03
98	9.77926	10	9.87680	16	0.12320	9.90246	5	02
99	9.77936	10	9.87696	15	0.12304	9.90241	6	01
100	9.77946		9.87711		0.12289	9.90235		00
	Cos	d.	Cot	d. c.	Tan	Sin	d.	

P. P.

	16	15	11	10	6
1	1.6	1.5	1.1	1.0	0.6
2	3.2	3.0	2.2	2.0	1.2
3	4.8	4.5	3.3	3.0	1.8
4	6.4	6.0	4.4	4.0	2.4
5	8.0	7.5	5.5	5.0	3.0
6	9.6	9.0	6.6	6.0	3.6
7	11.2	10.5	7.7	7.0	4.2
8	12.8	12.0	8.8	8.0	4.8
9	14.4	13.5	9.9	9.0	5.4

′	Sin	d.	Tan	d. c.	Cot	Cos	d.	′
00	9.77946	10	9.87711	16	0.12289	9.90235	6	100
01	9.77956	10	9.87727	16	0.12273	9.90229	6	99
02	9.77966	10	9.87743	16	0.12257	9.90223	5	98
03	9.77976	11	9.87759	16	0.12241	9.90218	6	97
04	9.77987	10	9.87775	15	0.12225	9.90212	6	96
05	9.77997	10	9.87790	16	0.12210	9.90206	5	95
06	9.78007	10	9.87806	16	0.12194	9.90201	6	94
07	9.78017	10	9.87822	16	0.12178	9.90195	6	93
08	9.78027	10	9.87838	15	0.12162	9.90189	6	92
09	9.78037	10	9.87853	16	0.12147	9.90183	5	91
10	9.78047	10	9.87869	16	0.12131	9.90178	6	90
11	9.78057	10	9.87885	16	0.12115	9.90172	6	89
12	9.78067	10	9.87901	15	0.12099	9.90166	6	88
13	9.78077	10	9.87916	16	0.12084	9.90160	5	87
14	9.78087	10	9.87932	16	0.12068	9.90155	6	86
15	9.78097	10	9.87948	16	0.12052	9.90149	6	85
16	9.78107	10	9.87964	15	0.12036	9.90143	6	84
17	9.78117	10	9.87979	16	0.12021	9.90137	5	83
18	9.78127	10	9.87995	16	0.12005	9.90132	6	82
19	9.78137	10	9.88011	16	0.11989	9.90126	6	81
20	9.78147	10	9.88027	15	0.11973	9.90120	6	80
21	9.78157	10	9.88042	16	0.11958	9.90114	5	79
22	9.78167	10	9.88058	16	0.11942	9.90109	6	78
23	9.78177	10	9.88074	15	0.11926	9.90103	6	77
24	9.78187	10	9.88089	16	0.11911	9.90097	6	76
25	9.78197	10	9.88105	16	0.11895	9.90091	5	75
26	9.78207	10	9.88121	16	0.11879	9.90086	6	74
27	9.78217	10	9.88137	15	0.11863	9.90080	6	73
28	9.78227	9	9.88152	16	0.11848	9.90074	6	72
29	9.78236	10	9.88168	16	0.11832	9.90068	5	71
30	9.78246	10	9.88184	16	0.11816	9.90063	6	70
31	9.78256	10	9.88200	15	0.11800	9.90057	6	69
32	9.78266	10	9.88215	16	0.11785	9.90051	6	68
33	9.78276	10	9.88231	16	0.11769	9.90045	6	67
34	9.78286	10	9.88247	15	0.11753	9.90039	5	66
35	9.78296	10	9.88262	16	0.11738	9.90034	6	65
36	9.78306	10	9.88278	16	0.11722	9.90028	6	64
37	9.78316	10	9.88294	16	0.11706	9.90022	6	63
38	9.78326	10	9.88310	15	0.11690	9.90016	5	62
39	9.78336	10	9.88325	16	0.11675	9.90011	6	61
40	9.78346	10	9.88341	16	0.11659	9.90005	6	60
41	9.78356	10	9.88357	15	0.11643	9.89999	6	59
42	9.78366	9	9.88372	16	0.11628	9.89993	6	58
43	9.78375	10	9.88388	16	0.11612	9.89987	5	57
44	9.78385	10	9.88404	16	0.11596	9.89982	6	56
45	9.78395	10	9.88420	15	0.11580	9.89976	6	55
46	9.78405	10	9.88435	16	0.11565	9.89970	6	54
47	9.78415	10	9.88451	16	0.11549	9.89964	6	53
48	9.78425	10	9.88467	15	0.11533	9.89958	6	52
49	9.78435	10	9.88482	16	0.11518	9.89952	5	51
50	9.78445		9.88498		0.11502	9.89947		50
	Cos	d.	Cot	d. c.	Tan	Sin	d.	

P. P.

	16	15	11	9	5
1	1.6	1.5	1.1	0.9	0.5
2	3.2	3.0	2.2	1.8	1.0
3	4.8	4.5	3.3	2.7	1.5
4	6.4	6.0	4.4	3.6	2.0
5	8.0	7.5	5.5	4.5	2.5
6	9.6	9.0	6.6	5.4	3.0
7	11.2	10.5	7.7	6.3	3.5
8	12.8	12.0	8.8	7.2	4.0
9	14.4	13.5	9.9	8.1	4.5

	Sin	d.	Tan	d. c.	Cot	Cos	d.	
50	9.78445	10	9.88498	16	0.11502	9.89947	6	**50**
51	9.78455	9	9.88514	15	0.11486	9.89941	6	49
52	9.78464	10	9.88529	16	0.11471	9.89935	6	48
53	9.78474	10	9.88545	16	0 11455	9.89929	6	47
54	9.78484	10	9.88561	16	0.11439	9.89923	5	46
55	9.78494	10	9.88577	15	0.11423	9.89918	6	45
56	9.78504	10	9.88592	16	0.11408	9.89912	6	44
57	9.78514	10	9.88608	16	0.11392	9.89906	6	43
58	9.78524	9	9.88624	15	0.11376	9.89900	6	42
59	9.78533	10	9.88639	16	0.11361	9.89894	6	41
60	9.78543	10	9.88655	16	0.11345	9 89888	5	**40**
61	9.78553	10	9.88671	15	0.11329	9.89883	6	39
62	9.78563	10	9.88686	16	0.11314	9.89877	6	38
63	9.78573	10	9.88702	16	0.11298	9.89871	6	37
64	9.78583	9	9.88718	15	0.11282	9.89865	6	36
65	9.78592	10	9.88733	16	0.11267	9.89859	6	35
66	9.78602	10	9.88749	16	0.11251	9.89853	6	34
67	9.78612	10	9.88765	15	0.11235	9.89847	5	33
68	9.78622	10	9.88780	16	0.11220	9.89842	6	32
69	9.78632	10	9.88796	16	0.11204	9.89836	6	31
70	9.78642	9	9.88812	15	0.11188	9.89830	6	**30**
71	9.78651	10	9.88827	16	0.11173	9.89824	6	29
72	9.78661	10	9.88843	16	0.11157	9.89818	6	28
73	9.78671	10	9.88859	15	0.11141	9.89812	6	27
74	9.78681	10	9.88874	16	0.11126	9.89806	5	26
75	9.78691	9	9.88890	16	0.11110	9.89801	6	25
76	9.78700	10	9.88906	15	0.11094	9.89795	6	24
77	9.78710	10	9.88921	16	0.11079	9.89789	6	23
78	9.78720	10	9.88937	16	0.11063	9.89783	6	22
79	9.78730	9	9.88953	15	0.11047	9.89777	6	21
80	9.78739	10	9 88968	16	0.11032	9.89771	6	**20**
81	9.78749	10	9.88984	16	0.11016	9.89765	6	19
82	9.78759	10	9.89000	15	0.11000	9.89759	5	18
83	9.78769	10	9.89015	16	0.10985	9.89754	6	17
84	9.78779	9	9.89031	15	0.10969	9.89748	6	16
85	9.78788	10	9.89046	16	0.10954	9.89742	6	15
86	9.78798	10	9.89062	16	0.10938	9.89736	6	14
87	9.78808	10	9.89078	15	0.10922	9.89730	6	13
88	9.78818	9	9.89093	16	0.10907	9.89724	6	12
89	9.78827	10	9.89109	16	0.10891	9.89718	6	11
90	9.78837	10	9.89125	15	0.10875	9.89712	6	**10**
91	9.78847	9	9.89140	16	0.10860	9.89706	5	09
92	9.78856	10	9.89156	16	0.10844	9.89701	6	08
93	9.78866	10	9.89172	15	0.10828	9.89695	6	07
94	9.78876	10	9.89187	16	0.10813	9.89689	6	06
95	9.78886	9	9.89203	15	0.10797	9.89683	6	05
96	9.78895	10	9.89218	16	0.10782	9.89677	6	04
97	9.78905	10	9.89234	16	0.10766	9.89671	6	03
98	9.78915	9	9.89250	15	0.10750	9.89665	6	02
99	9.78924	10	9.89265	16	0.10735	9.89659	6	01
100	9.78934		9.89281		0.10719	9.89653		**00**
	Cos	d.	Cot	d. c.	Tan	Sin	d.	

P. P.

	16	15	10	9	6
1	1.6	1.5	1.0	0.9	0.6
2	3.2	3.0	2.0	1.8	1.2
3	4.8	4.5	3.0	2.7	1.8
4	6.4	6.0	4.0	3.6	2.4
5	8.0	7.5	5.0	4.5	3.0
6	9.6	9.0	6.0	5.4	3.6
7	11.2	10.5	7.0	6.3	4.2
8	12.8	12.0	8.0	7.2	4.8
9	14.4	13.5	9.0	8.1	5.4

	Sin	d.	Tan	d. c.	Cot	Cos	d.	
00	9.78934	10	9.89281	16	0.10719	9.89653	6	100
01	9.78944	10	9.89297	15	0.10703	9.89647	6	99
02	9.78954	9	9.89312	16	0.10688	9.89641	6	98
03	9.78963	10	9.89328	15	0.10672	9.89635	5	97
04	9.78973	10	9.89343	16	0.10657	9.89630	6	96
05	9.78983	9	9.89359	16	0.10641	9.89624	6	95
06	9.78992	10	9.89375	15	0.10625	9.89618	6	94
07	9.79002	10	9.89390	16	0.10610	9.89612	6	93
08	9.79012	9	9.89406	16	0.10594	9.89606	6	92
09	9.79021	10	9.89422	15	0.10578	9.89600	6	91
10	9.79031	10	9.89437	16	0.10563	9.89594	6	90
11	9.79041	9	9.89453	15	0.10547	9.89588	6	89
12	9.79050	10	9.89468	16	0.10532	9.89582	6	88
13	9.79060	10	9.89484	16	0.10516	9.89576	6	87
14	9.79070	9	9.89500	15	0.10500	9.89570	6	86
15	9.79079	10	9.89515	16	0.10485	9.89564	6	85
16	9.79089	10	9.89531	15	0.10469	9.89558	6	84
17	9.79099	9	9.89546	16	0.10454	9.89552	6	83
18	9.79108	10	9.89562	16	0.10438	9.89546	6	82
19	9.79118	10	9.89578	15	0.10422	9.89540	6	81
20	9.79128	9	9.89593	16	0.10407	9.89534	6	80
21	9.79137	10	9.89609	15	0.10391	9.89528	6	79
22	9.79147	9	9.89624	16	0.10376	9.89522	6	78
23	9.79156	10	9.89640	16	0.10360	9.89516	6	77
24	9.79166	10	9.89656	15	0.10344	9.89510	6	76
25	9.79176	9	9.89671	16	0.10329	9.89504	5	75
26	9.79185	10	9.89687	15	0.10313	9.89499	6	74
27	9.79195	9	9.89702	16	0.10298	9.89493	6	73
28	9.79204	10	9.89718	16	0.10282	9.89487	6	72
29	9.79214	10	9.89734	15	0.10266	9.89481	6	71
30	9.79224	9	9.89749	16	0.10251	9.89475	6	70
31	9.79233	10	9.89765	15	0.10235	9.89469	6	69
32	9.79243	9	9.89780	16	0.10220	9.89463	6	68
33	9.79252	10	9.89796	15	0.10204	9.89457	6	67
34	9.79262	10	9.89811	16	0.10189	9.89451	6	66
35	9.79272	9	9.89827	16	0.10173	9.89445	6	65
36	9.79281	10	9.89843	15	0.10157	9.89439	6	64
37	9.79291	9	9.89858	16	0.10142	9.89433	6	63
38	9.79300	10	9.89874	15	0.10126	9.89427	6	62
39	9.79310	9	9.89889	16	0.10111	9.89421	6	61
40	9.79319	10	9.89905	15	0.10095	9.89415	6	60
41	9.79329	10	9.89920	16	0.10080	9.89409	6	59
42	9.79339	9	9.89936	16	0.10064	9.89403	6	58
43	9.79348	10	9.89952	15	0.10048	9.89397	6	57
44	9.79358	9	9.89967	16	0.10033	9.89391	6	56
45	9.79367	10	9.89983	15	0.10017	9.89385	6	55
46	9.79377	9	9.89998	16	0.10002	9.89379	6	54
47	9.79386	10	9.90014	15	0.09986	9.89373	7	53
48	9.79396	9	9.90029	16	0.09971	9.89366	6	52
49	9.79405	10	9.90045	16	0.09955	9.89360	6	51
50	9.79415		9.90061		0.09939	9.89354		50
	Cos	d.	Cot	d. c.	Tan	Sin	d.	

P. P.

	16	15	10	9	6
1	1.6	1.5	1.0	0.9	0.6
2	3.2	3.0	2.0	1.8	1.2
3	4.8	4.5	3.0	2.7	1.8
4	6.4	6.0	4.0	3.6	2.4
5	8.0	7.5	5.0	4.5	3.0
6	9.6	9.0	6.0	5.4	3.6
7	11.2	10.5	7.0	6.3	4.2
8	12.8	12.0	8.0	7.2	4.8
9	14.4	13.5	9.0	8.1	5.4

P. P.

	Sin	d.	Tan	d. c.	Cot	Cos	d.	
50	9.79415	9	9.90061	15	0.09939	9.89354	6	50
51	9.79424	10	9.90076	16	0.09924	9.89348	6	49
52	9.79434	10	9.90092	15	0.09908	9.89342	6	48
53	9.79444	9	9.90107	16	0.09893	9.89336	6	47
54	9.79453	10	9.90123	15	0.09877	9.89330	6	46
55	9.79463	9	9.90138	16	0.09862	9.89324	6	45
56	9.79472	10	9.90154	15	0.09846	9.89318	6	44
57	9.79482	9	9.90169	16	0.09831	9.89312	6	43
58	9.79491	10	9.90185	15	0.09815	9.89306	6	42
59	9.79501	9	9.90200	16	0.09800	9.89300	6	41
60	9.79510	10	9.90216	16	0.09784	9.89294	6	40
61	9.79520	9	9.90232	15	0.09768	9.89288	6	39
62	9.79529	10	9.90247	16	0.09753	9.89282	6	38
63	9.79539	9	9.90263	15	0.09737	9.89276	6	37
64	9.79548	10	9.90278	16	0.09722	9.89270	6	36
65	9.79558	9	9.90294	15	0.09706	9.89264	6	35
66	9.79567	9	9.90309	16	0.09691	9.89258	6	34
67	9.79576	10	9.90325	15	0.09675	9.89252	6	33
68	9.79586	9	9.90340	16	0.09660	9.89246	7	32
69	9.79595	10	9.90356	15	0.09644	9.89239	6	31
70	9.79605	9	9.90371	16	0.09629	9.89233	6	30
71	9.79614	10	9.90387	16	0.09613	9.89227	6	29
72	9.79624	9	9.90403	15	0.09597	9.89221	6	28
73	9.79633	10	9.90418	16	0.09582	9.89215	6	27
74	9.79643	9	9.90434	15	0.09566	9.89209	6	26
75	9.79652	10	9.90449	16	0.09551	9.89203	6	25
76	9.79662	9	9.90465	15	0.09535	9.89197	6	24
77	9.79671	9	9.90480	16	0.09520	9.89191	6	23
78	9.79680	10	9.90496	15	0.09504	9.89185	6	22
79	9.79690	9	9.90511	16	0.09489	9.89179	6	21
80	9.79699	10	9.90527	15	0.09473	9.89173	7	20
81	9.79709	9	9.90542	16	0.09458	9.89166	6	19
82	9.79718	10	9.90558	15	0.09442	9.89160	6	18
83	9.79728	9	9.90573	16	0.09427	9.89154	6	17
84	9.79737	9	9.90589	15	0.09411	9.89148	6	16
85	9.79746	10	9.90604	16	0.09396	9.89142	6	15
86	9.79756	9	9.90620	15	0.09380	9.89136	6	14
87	9.79765	10	9.90635	16	0.09365	9.89130	6	13
88	9.79775	9	9.90651	15	0.09349	9.89124	6	12
89	9.79784	9	9.90666	16	0.09334	9.89118	6	11
90	9.79793	10	9.90682	15	0.09318	9.89112	7	10
91	9.79803	9	9.90697	16	0.09303	9.89105	6	09
92	9.79812	10	9.90713	15	0.09287	9.89099	6	08
93	9.79822	9	9.90728	16	0.09272	9.89093	6	07
94	9.79831	9	9.90744	15	0.09256	9.89087	6	06
95	9.79840	10	9.90759	16	0.09241	9.89081	6	05
96	9.79850	9	9.90775	15	0.09225	9.89075	6	04
97	9.79859	9	9.90790	16	0.09210	9.89069	6	03
98	9.79868	10	9.90806	15	0.09194	9.89063	7	02
99	9.79878	9	9.90821	16	0.09179	9.89056	6	01
100	9.79887		9.90837		0.09163	9.89050		00
	Cos	d.	Cot	d. c.	Tan	Sin	d.	

P. P.

	16	15	10	9	7
1	1.6	1.5	1.0	0.9	0.7
2	3.2	3.0	2.0	1.8	1.4
3	4.8	4.5	3.0	2.7	2.1
4	6.4	6.0	4.0	3.6	2.8
5	8.0	7.5	5.0	4.5	3.5
6	9.6	9.0	6.0	5.4	4.2
7	11.2	10.5	7.0	6.3	4.9
8	12.8	12.0	8.0	7.2	5.6
9	14.4	13.5	9.0	8.1	6.3

′	Sin	d.	Tan	d. c.	Cot	Cos	d.	′
00	9.79887	10	9.90837	15	0.09163	9.89050	6	100
01	9.79897	9	9.90852	16	0.09148	9.89044	6	99
02	9.79906	9	9.90868	15	0.09132	9.89038	6	98
03	9.79915	10	9.90883	16	0.09117	9.89032	6	97
04	9.79925	9	9.90899	15	0.09101	9.89026	6	96
05	9.79934	9	9.90914	16	0.09086	9.89020	7	95
06	9.79943	10	9.90930	15	0.09070	9.89013	6	94
07	9.79953	9	9.90945	16	0.09055	9.89007	6	93
08	9.79962	9	9.90961	15	0.09039	9.89001	6	92
09	9.79971	10	9.90976	16	0.09024	9.88995	6	91
10	9.79981	9	9.90992	15	0.09008	9.88989	6	90
11	9.79990	9	9.91007	16	0.08993	9.88983	7	89
12	9.79999	10	9.91023	15	0.08977	9.88976	6	88
13	9.80009	9	9.91038	16	0.08962	9.88970	6	87
14	9.80018	9	9.91054	15	0.08946	9.88964	6	86
15	9.80027	10	9.91069	16	0.08931	9.88958	6	85
16	9.80037	9	9.91085	15	0.08915	9.88952	6	84
17	9.80046	9	9.91100	16	0.08900	9.88946	7	83
18	9.80055	9	9.91116	15	0.08884	9.88939	6	82
19	9.80064	10	9.91131	16	0.08869	9.88933	6	81
20	9.80074	9	9.91147	15	0.08853	9.88927	6	80
21	9.80083	9	9.91162	16	0.08838	9.88921	6	79
22	9.80092	10	9.91178	15	0.08822	9.88915	6	78
23	9.80102	9	9.91193	16	0.08807	9.88909	7	77
24	9.80111	9	9.91209	15	0.08791	9.88902	6	76
25	9.80120	9	9.91224	15	0.08776	9.88896	6	75
26	9.80129	10	9.91239	16	0.08761	9.88890	6	74
27	9.80139	9	9.91255	15	0.08745	9.88884	6	73
28	9.80148	9	9.91270	16	0.08730	9.88878	7	72
29	9.80157	9	9.91286	15	0.08714	9.88871	6	71
30	9.80166	10	9.91301	16	0.08699	9.88865	6	70
31	9.80176	9	9.91317	15	0.08683	9.88859	6	69
32	9.80185	9	9.91332	16	0.08668	9.88853	6	68
33	9.80194	10	9.91348	15	0.08652	9.88847	7	67
34	9.80204	9	9.91363	16	0.08637	9.88840	6	66
35	9.80213	9	9.91379	15	0.08621	9.88834	6	65
36	9.80222	9	9.91394	16	0.08606	9.88828	6	64
37	9.80231	9	9.91410	15	0.08590	9.88822	7	63
38	9.80240	10	9.91425	16	0.08575	9.88815	6	62
39	9.80250	9	9.91441	15	0.08559	9.88809	6	61
40	9.80259	9	9.91456	15	0.08544	9.88803	6	60
41	9.80268	9	9.91471	16	0.08529	9.88797	6	59
42	9.80277	10	9.91487	15	0.08513	9.88791	7	58
43	9.80287	9	9.91502	16	0.08498	9.88784	6	57
44	9.80296	9	9.91518	15	0.08482	9.88778	6	56
45	9.80305	9	9.91533	16	0.08467	9.88772	6	55
46	9.80314	9	9.91549	15	0.08451	9.88766	7	54
47	9.80323	10	9.91564	16	0.08436	9.88759	6	53
48	9.80333	9	9.91580	15	0.08420	9.88753	6	52
49	9.80342	9	9.91595	15	0.08405	9.88747	6	51
50	9.80351		9.91610		0.08390	9.88741		50
	Cos	d.	Cot	d. c.	Tan	Sin	d.	

P. P.

	16	15	10	9	6
1	1.6	1.5	1.0	0.9	0.6
2	3.2	3.0	2.0	1.8	1.2
3	4.8	4.5	3.0	2.7	1.8
4	6.4	6.0	4.0	3.6	2.4
5	8.0	7.5	5.0	4.5	3.0
6	9.6	9.0	6.0	5.4	3.6
7	11.2	10.5	7.0	6.3	4.2
8	12.8	12.0	8.0	7.2	4.8
9	14.4	13.5	9.0	8.1	5.4

P. P.

129° 50°

	Sin	d.	Tan	d. c.	Cot	Cos	d.	
50	9.80351	9	9.91610	16	0.08390	9.88741	7	50
51	9.80360	9	9.91626	15	0.08374	9.88734	6	49
52	9.80369	10	9.91641	16	0.08359	9.88728	6	48
53	9.80379	9	9.91657	15	0.08343	9.88722	6	47
54	9.80388	9	9.91672	16	0.08328	9.88716	7	46
55	9.80397	9	9.91688	15	0.08312	9.88709	6	45
56	9.80406	9	9.91703	16	0.08297	9.88703	6	44
57	9.80415	10	9.91719	15	0.08281	9.88697	6	43
58	9.80425	9	9.91734	15	0.08266	9.88691	7	42
59	9.80434	9	9.91749	16	0.08251	9.88684	6	41
60	9.80443	9	9.91765	15	0.08235	9.88678	6	40
61	9.80452	9	9.91780	16	0.08220	9.88672	7	39
62	9.80461	9	9.91796	15	0.08204	9.88665	6	38
63	9.80470	9	9.91811	16	0.08189	9.88659	6	37
64	9.80479	10	9.91827	15	0.08173	9.88653	6	36
65	9.80489	9	9.91842	15	0.08158	9.88647	7	35
66	9.80498	9	9.91857	16	0.08143	9.88640	6	34
67	9.80507	9	9.91873	15	0.08127	9.88634	6	33
68	9.80516	9	9.91888	16	0.08112	9.88628	7	32
69	9.80525	9	9.91904	15	0.08096	9.88621	6	31
70	9.80534	9	9.91919	16	0.08081	9.88615	6	30
71	9.80543	10	9.91935	15	0.08065	9.88609	6	29
72	9.80553	9	9.91950	15	0.08050	9.88603	7	28
73	9.80562	9	9.91965	16	0.08035	9.88596	6	27
74	9.80571	9	9.91981	15	0.08019	9.88590	6	26
75	9.80580	9	9.91996	16	0.08004	9.88584	7	25
76	9.80589	9	9.92012	15	0.07988	9.88577	6	24
77	9.80598	9	9.92027	15	0.07973	9.88571	6	23
78	9.80607	9	9.92042	16	0.07958	9.88565	7	22
79	9.80616	9	9.92058	15	0.07942	9.88558	6	21
80	9.80625	10	9.92073	16	0.07927	9.88552	6	20
81	9.80635	9	9.92089	15	0.07911	9.88546	6	19
82	9.80644	9	9.92104	16	0.07896	9.88540	7	18
83	9.80653	9	9.92120	15	0.07880	9.88533	6	17
84	9.80662	9	9.92135	15	0.07865	9.88527	6	16
85	9.80671	9	9.92150	16	0.07850	9.88521	7	15
86	9.80680	9	9.92166	15	0.07834	9.88514	6	14
87	9.80689	9	9.92181	16	0.07819	9.88508	6	13
88	9.80698	9	9.92197	15	0.07803	9.88502	7	12
89	9.80707	9	9.92212	15	0.07788	9.88495	6	11
90	9.80716	9	9.92227	16	0.07773	9.88489	6	10
91	9.80725	9	9.92243	15	0.07757	9.88483	7	09
92	9.80734	9	9.92258	16	0.07742	9.88476	6	08
93	9.80743	9	9.92274	15	0.07726	9.88470	6	07
94	9.80752	10	9.92289	15	0.07711	9.88464	7	06
95	9.80762	9	9.92304	16	0.07696	9.88457	6	05
96	9.80771	9	9.92320	15	0.07680	9.88451	7	04
97	9.80790	9	9.92335	16	0.07665	9.88444	6	03
98	9.80789	9	9.92351	15	0.07649	9.88438	6	02
99	9.80798	9	9.92366	15	0.07634	9.88432	7	01
100	9.80807		9.92381		0.07619	9.88425		00
	Cos	d.	Cot	d. c.	Tan	Sin	d.	

P. P.

	16	15	10	9	7
1	1.6	1.5	1.0	0.9	0.7
2	3.2	3.0	2.0	1.8	1.4
3	4.8	4.5	3.0	2.7	2.1
4	6.4	6.0	4.0	3.6	2.8
5	8.0	7.5	5.0	4.5	3.5
6	9.6	9.0	6.0	5.4	4.2
7	11.2	10.5	7.0	6.3	4.9
8	12.8	12.0	8.0	7.2	5.6
9	14.4	13.5	9.0	8.1	6.3

P. P.

	Sin	d.	Tan	d. c.	Cot	Cos	d.	
00	9.80807	9	9.92381	16	0.07619	9.88425	6	**100**
01	9.80816	9	9.92397	15	0.07603	9.88419	6	99
02	9.80825	9	9.92412	16	0.07588	9.88413	7	98
03	9.80834	9	9.92428	15	0.07572	9.88406	6	97
04	9.80843	9	9.92443	15	0.07557	9.88400	6	96
05	9.80852	9	9.92458	16	0.07542	9.88394	7	95
06	9.80861	9	9.92474	15	0.07526	9.88387	6	94
07	9.80870	9	9.92489	15	0.07511	9.88381	7	93
08	9.80879	9	9.92504	16	0.07496	9.88374	6	92
09	9.80888	9	9.92520	15	0.07480	9.88368	6	91
10	9.80897	9	9.92535	16	0.07465	9.88362	7	**90**
11	9.80906	9	9.92551	15	0.07449	9.88355	6	89
12	9.80915	9	9.92566	15	0.07434	9.88349	6	88
13	9.80924	9	9.92581	16	0.07419	9.88343	7	87
14	9.80933	9	9.92597	15	0.07403	9.88336	6	86
15	9.80942	9	9.92612	16	0.07388	9.88330	7	85
16	9.80951	9	9.92628	15	0.07372	9.88323	6	84
17	9.80960	9	9.92643	15	0.07357	9.88317	6	83
18	9.80969	9	9.92658	16	0.07342	9.88311	7	82
19	9.80978	9	9.92674	15	0.07326	9.88304	6	81
20	9.80987	9	9.92689	15	0.07311	9.88298	7	**80**
21	9.80996	9	9.92704	16	0.07296	9.88291	6	79
22	9.81005	9	9.92720	15	0.07280	9.88285	6	78
23	9.81014	9	9.92735	16	0.07265	9.88279	7	77
24	9.81023	9	9.92751	15	0.07249	9.88272	6	76
25	9.81032	9	9.92766	15	0.07234	9.88266	7	75
26	9.81041	8	9.92781	16	0.07219	9.88259	6	74
27	9.81049	9	9.92797	15	0.07203	9.88253	7	73
28	9.81058	9	9.92812	15	0.07188	9.88246	6	72
29	9.81067	9	9.92827	16	0.07173	9.88240	6	71
30	9.81076	9	9.92843	15	0.07157	9.88234	7	**70**
31	9.81085	9	9.92858	15	0.07142	9.88227	6	69
32	9.81094	9	9.92873	16	0.07127	9.88221	7	68
33	9.81103	9	9.92889	15	0.07111	9.88214	6	67
34	9.81112	9	9.92904	16	0.07096	9.88208	7	66
35	9.81121	9	9.92920	15	0.07080	9.88201	6	65
36	9.81130	9	9.92935	15	0.07065	9.88195	6	64
37	9.81139	9	9.92950	16	0.07050	9.88189	7	63
38	9.81148	9	9.92966	15	0.07034	9.88182	6	62
39	9.81157	9	9.92981	15	0.07019	9.88176	7	61
40	9.81166	8	9.92996	16	0.07004	9.88169	6	**60**
41	9.81174	9	9.93012	15	0.06988	9.88163	7	59
42	9.81183	9	9.93027	15	0.06973	9.88156	6	58
43	9.81192	9	9.93042	16	0.06958	9.88150	7	57
44	9.81201	9	9.93058	15	0.06942	9.88143	6	56
45	9.81210	9	9.93073	15	0.06927	9.88137	7	55
46	9.81219	9	9.93088	16	0.06912	9.88130	6	54
47	9.81228	9	9.93104	15	0.06896	9.88124	7	53
48	9.81237	9	9.93119	16	0.06881	9.88117	6	52
49	9.81246	8	9.93135	15	0.06865	9.88111	6	51
50	9.81254		9.93150		0.06850	9.88105		**50**
	Cos	d.	Cot	d. c.	Tan	Sin	d.	

P. P.

16	
1	1.6
2	3.2
3	4.8
4	6.4
5	8.0
6	9.6
7	11.2
8	12.8
9	14.4

15	
1	1.5
2	3.0
3	4.5
4	6.0
5	7.5
6	9.0
7	10.5
8	12.0
9	13.5

9	
1	0.9
2	1.8
3	2.7
4	3.6
5	4.5
6	5.4
7	6.3
8	7.2
9	8.1

8	
1	0.8
2	1.6
3	2.4
4	3.2
5	4.0
6	4.8
7	5.6
8	6.4
9	7.2

7	
1	0.7
2	1.4
3	2.1
4	2.8
5	3.5
6	4.2
7	4.9
8	5.6
9	6.3

	Sin	d.	Tan	d. c.	Cot	Cos	d.	
50	9.81254	9	9.93150	15	0.06850	9.88105	7	50
51	9.81263	9	9.93165	16	0.06835	9.88098	6	49
52	9.81272	9	9.93181	15	0.06819	9.88092	7	48
53	9.81281	9	9.93196	15	0.06804	9.88085	6	47
54	9.81290	9	9.93211	16	0.06789	9.88079	7	46
55	9.81299	9	9.93227	15	0.06773	9.88072	6	45
56	9.81308	8	9.93242	15	0.06758	9.88066	7	44
57	9.81316	9	9.93257	16	0.06743	9.88059	6	43
58	9.81325	9	9.93273	15	0.06727	9.88053	7	42
59	9.81334	9	9.93288	15	0.06712	9.88046	6	41
60	9.81343	9	9.93303	16	0.06697	9.88040	7	40
61	9.81352	9	9.93319	15	0.06681	9.88033	6	39
62	9.81361	9	9.93334	15	0.06666	9.88027	7	38
63	9.81370	8	9.93349	16	0.06651	9.88020	6	37
64	9.81378	9	9.93365	15	0.06635	9.88014	7	36
65	9.81387	9	9.93380	15	0.06620	9.88007	6	35
66	9.81396	9	9.93395	16	0.06605	9.88001	7	34
67	9.81405	9	9.93411	15	0.06589	9.87994	6	33
68	9.81414	8	9.93426	15	0.06574	9.87988	7	32
69	9.81422	9	9.93441	16	0.06559	9.87981	6	31
70	9.81431	9	9.93457	15	0.06543	9.87975	7	30
71	9.81440	9	9.93472	15	0.06528	9.87968	6	29
72	9.81449	9	9.93487	16	0.06513	9.87962	7	28
73	9.81458	9	9.93503	15	0.06497	9.87955	6	27
74	9.81467	8	9.93518	15	0.06482	9.87949	7	26
75	9.81475	9	9.93533	16	0.06467	9.87942	7	25
76	9.81484	9	9.93549	15	0.06451	9.87935	6	24
77	9.81493	9	9.93564	15	0.06436	9.87929	7	23
78	9.81502	8	9.93579	16	0.06421	9.87922	6	22
79	9.81510	9	9.93595	15	0.06405	9.87916	7	21
80	9.81519	9	9 93610	15	0.06390	9.87909	6	20
81	9.81528	9	9.93625	16	0.06375	9.87903	7	19
82	9.81537	9	9.93641	15	0.06359	9.87896	6	18
83	9.81546	8	9.93656	15	0.06344	9.87890	7	17
84	9.81554	9	9.93671	16	0.06329	9.87883	6	16
85	9.81563	9	9.93687	15	0.06313	9.87877	7	15
86	9.81572	9	9.93702	15	0.06298	9.87870	7	14
87	9.81581	8	9.93717	16	0.06283	9.87863	6	13
88	9.81589	9	9.93733	15	0.06267	9.87857	7	12
89	9.81598	9	9.93748	15	0.06252	9.87850	6	11
90	9.81607	9	9.93763	15	0.06237	9.87844	7	10
91	9.81616	8	9.93778	16	0.06222	9.87837	6	09
92	9.81624	9	9.93794	15	0.06206	9.87831	7	08
93	9.81633	9	9.93809	15	0.06191	9.87824	7	07
94	9.81642	9	9.93824	16	0.06176	9.87817	6	06
95	9.81651	8	9.93840	15	0.06160	9.87811	7	05
96	9.81659	9	9.93855	15	0.06145	9.87804	6	04
97	9.81668	9	9.93870	16	0.06130	9.87798	7	03
98	9.81677	9	9.93886	15	0.06114	9.87791	6	02
99	9.81686	8	9.93901	15	0.06099	9.87785	7	01
100	9.81694		9.93916		0.06084	9.87778		00
	Cos	d.	Cot	d. c.	Tan	Sin	d.	

P. P.

	16	15	8	7	6
1	1.6	1.5	0.8	0.7	0.6
2	3.2	3.0	1.6	1.4	1.2
3	4.8	4.5	2.4	2.1	1.8
4	6.4	6.0	3.2	2.8	2.4
5	8.0	7.5	4.0	3.5	3.0
6	9.6	9.0	4.8	4.2	3.6
7	11.2	10.5	5.6	4.9	4.2
8	12.8	12.0	6.4	5.6	4.8
9	14.4	13.5	7.2	6.3	5.4

P. P.

41° **138°**

	Sin	d.	Tan	d. c.	Cot	Cos	d.	
00	9.81694	9	9.93916	16	0.06084	9.87778	7	**100**
01	9.81703	9	9.93932	15	0.06068	9.87771	6	99
02	9.81712	8	9.93947	15	0.06053	9.87765	7	98
03	9.81720	9	9.93962	16	0.06038	9.87758	6	97
04	9.81729	9	9.93978	15	0.06022	9.87752	7	96
05	9.81738	9	9.93993	15	0.06007	9.87745	7	95
06	9.81747	8	9.94008	15	0.05992	9.87738	6	94
07	9.81755	9	9.94023	16	0.05977	9.87732	7	93
08	9.81764	9	9.94039	15	0.05961	9.87725	6	92
09	9.81773	8	9.94054	15	0.05946	9.87719	7	91
10	9.81781	9	9.94069	16	0.05931	9.87712	7	**90**
11	9.81790	9	9.94085	15	0.05915	9.87705	6	89
12	9.81799	8	9.94100	15	0.05900	9.87699	7	88
13	9.81807	9	9.94115	16	0.05885	9.87692	6	87
14	9.81816	9	9.94131	15	0.05869	9.87686	7	86
15	9.81825	8	9.94146	15	0.05854	9.87679	7	85
16	9.81833	9	9.94161	15	0.05839	9.87672	6	84
17	9.81842	9	9.94176	16	0.05824	9.87666	7	83
18	9.81851	8	9.94192	15	0.05808	9.87659	7	82
19	9.81859	9	9.94207	15	0.05793	9.87652	6	81
20	9.81868	9	9.94222	16	0.05778	9.87646	7	**80**
21	9.81877	8	9.94238	15	0.05762	9.87639	7	79
22	9.81885	9	9.94253	15	0.05747	9.87632	6	78
23	9.81894	9	9.94268	16	0.05732	9.87626	7	77
24	9.81903	8	9.94284	15	0.05716	9.87619	6	76
25	9.81911	9	9.94299	15	0.05701	9.87613	7	75
26	9.81920	9	9.94314	15	0.05686	9.87606	7	74
27	9.81929	8	9.94329	16	0.05671	9.87599	6	73
28	9.81937	9	9.94345	15	0.05655	9.87593	7	72
29	9.81946	9	9.94360	15	0.05640	9.87586	7	71
30	9.81955	8	9.94375	16	0.05625	9.87579	6	**70**
31	9.81963	9	9.94391	15	0.05609	9.87573	7	69
32	9.81972	8	9.94406	15	0.05594	9.87566	7	68
33	9.81980	9	9.94421	15	0.05579	9.87559	6	67
34	9.81989	9	9.94436	16	0.05564	9.87553	7	66
35	9.81998	8	9.94452	15	0.05548	9.87546	7	65
36	9.82006	9	9.94467	15	0.05533	9.87539	6	64
37	9.82015	8	9.94482	16	0.05518	9.87533	7	63
38	9.82023	9	9.94498	15	0.05502	9.87526	7	62
39	9.82032	9	9.94513	15	0.05487	9.87519	6	61
40	9.82041	8	9.94528	15	0.05472	9.87513	7	**60**
41	9.82049	9	9.94543	16	0.05457	9.87506	7	59
42	9.82058	8	9.94559	15	0.05441	9.87499	7	58
43	9.82066	9	9.94574	15	0.05426	9.87492	6	57
44	9.82075	9	9.94589	15	0.05411	9.87486	7	56
45	9.82084	8	9.94604	16	0.05396	9.87479	7	55
46	9.82092	9	9.94620	15	0.05380	9.87472	6	54
47	9.82101	8	9.94635	15	0.05365	9.87466	7	53
48	9.82109	9	9.94650	16	0.05350	9.87459	7	52
49	9.82118	8	9.94666	15	0.05334	9.87452	6	51
50	9.82126		9.94681		0.05319	9.87446		**50**
	Cos	d.	Cot	d. c.	Tan	Sin	d.	

P. P.

	16	15	9	8	7
1	1.6	1.5	0.9	0.8	0.7
2	3.2	3.0	1.8	1.6	1.4
3	4.8	4.5	2.7	2.4	2.1
4	6.4	6.0	3.6	3.2	2.8
5	8.0	7.5	4.5	4.0	3.5
6	9.6	9.0	5.4	4.8	4.2
7	11.2	10.5	6.3	5.6	4.9
8	12.8	12.0	7.2	6.4	5.6
9	14.4	13.5	8.1	7.2	6.3

P. P.

131° **48°**

	Sin	d.	Tan	d. c.	Cot	Cos	d.	
50	9.82126	9	9.94681	15	0.05319	9.87446	7	**50**
51	9.82135	9	9.94696	15	0.05304	9.87439	7	49
52	9.82144	8	9.94711	16	0.05289	9.87432	7	48
53	9.82152	9	9.94727	15	0.05273	9.87425	6	47
54	9.82161	8	9.94742	15	0.05258	9.87419	7	46
55	9.82169	9	9.94757	15	0.05243	9.87412	7	45
56	9.82178	8	9.94772	16	0.05228	9.87405	6	44
57	9.82186	9	9.94788	15	0.05212	9.87399	7	43
58	9.82195	8	9.94803	15	0.05197	9.87392	7	42
59	9.82203	9	9.94818	16	0.05182	9.87385	7	41
60	9.82212	9	9.94834	15	0.05166	9.87378	6	**40**
61	9.82221	8	9.94849	15	0.05151	9.87372	7	39
62	9.82229	9	9.94864	15	0.05136	9.87365	7	38
63	9.82238	8	9.94879	16	0.05121	9.87358	7	37
64	9.82246	9	9.94895	15	0.05105	9.87351	6	36
65	9.82255	8	9.94910	15	0.05090	9.87345	7	35
66	9.82263	9	9.94925	15	0.05075	9.87338	7	34
67	9.82272	8	9.94940	16	0.05060	9.87331	6	33
68	9.82280	9	9.94956	15	0.05044	9.87325	7	32
69	9.82289	8	9.94971	15	0.05029	9.87318	7	31
70	9.82297	9	9.94986	15	0.05014	9.87311	7	**30**
71	9.82306	8	9.95001	16	0.04999	9.87304	6	29
72	9.82314	9	9.95017	15	0.04983	9.87298	7	28
73	9.82323	8	9.95032	15	0.04968	9.87291	7	27
74	9.82331	9	9.95047	15	0.04953	9.87284	7	26
75	9.82340	8	9.95062	16	0.04938	9.87277	7	25
76	9.82348	9	9.95078	15	0.04922	9.87270	6	24
77	9.82357	8	9.95093	15	0.04907	9.87264	7	23
78	9.82365	9	9.95108	16	0.04892	9.87257	7	22
79	9.82374	8	9.95124	15	0.04876	9.87250	7	21
80	9.82382	9	9.95139	15	0.04861	9.87243	6	**20**
81	9.82391	8	9.95154	15	0.04846	9.87237	7	19
82	9.82399	9	9.95169	16	0.04831	9.87230	7	18
83	9.82408	8	9.95185	15	0.04815	9.87223	7	17
84	9.82416	8	9.95200	15	0.04800	9.87216	7	16
85	9.82424	9	9.95215	15	0.04785	9.87209	6	15
86	9.82433	8	9.95230	16	0.04770	9.87203	7	14
87	9.82441	9	9.95246	15	0.04754	9.87196	7	13
88	9.82450	8	9.95261	15	0.04739	9.87189	7	12
89	9.82458	9	9.95276	15	0.04724	9.87182	7	11
90	9.82467	8	9.95291	16	0.04709	9.87175	6	**10**
91	9.82475	9	9.95307	15	0.04693	9.87169	7	09
92	9.82484	8	9.95322	15	0.04678	9.87162	7	08
93	9.82492	9	9.95337	15	0.04663	9.87155	7	07
94	9.82501	8	9.95352	16	0.04648	9.87148	7	06
95	9.82509	8	9.95368	15	0.04632	9.87141	6	05
96	9.82517	9	9.95383	15	0.04617	9.87135	7	04
97	9.82526	8	9.95398	15	0.04602	9.87128	7	03
98	9.82534	9	9.95413	16	0.04587	9.87121	7	02
99	9.82543	8	9.95429	15	0.04571	9.87114	7	01
100	9.82551		9.95444		0.04556	9.87107		**00**
	Cos	d.	Cot	d. c.	Tan	Sin	d.	

P. P.

	16	15	8	7	6
1	1.6	1.5	0.8	0.7	0.6
2	3.2	3.0	1.6	1.4	1.2
3	4.8	4.5	2.4	2.1	1.8
4	6.4	6.0	3.2	2.8	2.4
5	8.0	7.5	4.0	3.5	3.0
6	9.6	9.0	4.8	4.2	3.6
7	11.2	10.5	5.6	4.9	4.2
8	12.8	12.0	6.4	5.6	4.8
9	14.4	13.5	7.2	6.3	5.4

131°   48°

	Sin	d.	Tan	d. c.	Cot	Cos	d.	
00	9.82551		9.95444		0.04556	9.87107		100
01	9.82560	9	9.95459	15	0.04541	9.87101	6	99
02	9.82568	8	9.95474	15	0.04526	9.87094	7	98
03	9.82576	8	9.95489	15	0.04511	9.87087	7	97
04	9.82585	9	9.95505	16	0.04495	9.87080	7	96
05	9.82593	8	9.95520	15	0.04480	9.87073	7	95
06	9.82602	9	9.95535	15	0.04465	9.87066	7	94
07	9.82610	8	9.95550	15	0.04450	9.87060	6	93
08	9.82618	8	9.95566	16	0.04434	9.87053	7	92
09	9.82627	9	9.95581	15	0.04419	9.87046	7	91
10	9.82635	8	9.95596	15	0.04404	9.87039	7	90
11	9.82644	9	9.95611	15	0.04389	9.87032	7	89
12	9.82652	8	9.95627	16	0.04373	9.87025	7	88
13	9.82660	8	9.95642	15	0.04358	9.87018	7	87
14	9.82669	9	9.95657	15	0.04343	9.87012	6	86
15	9.82677	8	9.95672	15	0.04328	9.87005	7	85
16	9.82685	8	9.95688	16	0.04312	9.86998	7	84
17	9.82694	9	9.95703	15	0.04297	9.86991	7	83
18	9.82702	8	9.95718	15	0.04282	9.86984	7	82
19	9.82711	9	9.95733	15	0.04267	9.86977	7	81
20	9.82719	8	9.95748	15	0.04252	9.86970	7	80
21	9.82727	8	9.95764	16	0.04236	9.86963	7	79
22	9.82736	9	9.95779	15	0.04221	9.86957	6	78
23	9.82744	8	9.95794	15	0.04206	9.86950	7	77
24	9.82752	8	9.95809	15	0.04191	9.86943	7	76
25	9.82761	9	9.95825	16	0.04175	9.86936	7	75
26	9.82769	8	9.95840	15	0.04160	9.86929	7	74
27	9.82777	8	9.95855	15	0.04145	9.86922	7	73
28	9.82786	9	9.95870	15	0.04130	9.86915	7	72
29	9.82794	8	9.95886	16	0.04114	9.86908	7	71
30	9.82802	8	9.95901	15	0.04099	9.86902	6	70
31	9.82811	9	9.95916	15	0.04084	9.86895	7	69
32	9.82819	8	9.95931	15	0.04069	9.86888	7	68
33	9.82827	8	9.95946	15	0.04054	9.86881	7	67
34	9.82836	9	9.95962	16	0.04038	9.86874	7	66
35	9.82844	8	9.95977	15	0.04023	9.86867	7	65
36	9.82852	8	9.95992	15	0.04008	9.86860	7	64
37	9.82861	9	9.96007	15	0.03993	9.86853	7	63
38	9.82869	8	9.96023	16	0.03977	9.86846	7	62
39	9.82877	8	9.96038	15	0.03962	9.86839	7	61
40	9.82885	8	9.96053	15	0.03947	9.86832	7	60
41	9.82894	9	9.96068	15	0.03932	9.86826	6	59
42	9.82902	8	9.96083	15	0.03917	9.86819	7	58
43	9.82910	8	9.96099	16	0.03901	9.86812	7	57
44	9.82919	9	9.96114	15	0.03886	9.86805	7	56
45	9.82927	8	9.96129	15	0.03871	9.86798	7	55
46	9.82935	8	9.96144	15	0.03856	9.86791	7	54
47	9.82944	9	9.96160	16	0.03840	9.86784	7	53
48	9.82952	8	9.96175	15	0.03825	9.86777	7	52
49	9.82960	8	9.96190	15	0.03810	9.86770	7	51
50	9.82968	8	9.96205	15	0.03795	9.86763	7	50
	Cos	d.	Cot	d. c.	Tan	Sin	d.	

P. P.

	16	15	9	8	7
1	1.6	1.5	0.9	0.8	0.7
2	3.2	3.0	1.8	1.6	1.4
3	4.8	4.5	2.7	2.4	2.1
4	6.4	6.0	3.6	3.2	2.8
5	8.0	7.5	4.5	4.0	3.5
6	9.6	9.0	5.4	4.8	4.2
7	11.2	10.5	6.3	5.6	4.9
8	12.8	12.0	7.2	6.4	5.6
9	14.4	13.5	8.1	7.2	6.3

P. P.

	Sin	d.	Tan	d. c.	Cot	Cos	d.	
50	9.82968	9	9.96205	15	0.03795	9.86763	7	**50**
51	9.82977	8	9.96220	16	0.03780	9.86756	7	49
52	9.82985	8	9.96236	15	0.03764	9.86749	7	48
53	9.82993	8	9.96251	15	0.03749	9.86742	7	47
54	9.83001	9	9.96266	15	0.03734	9.86735	7	46
55	9.83010	8	9.96281	16	0.03719	9.86728	7	45
56	9.83018	8	9.96297	15	0.03703	9.86721	7	44
57	9.83026	8	9.96312	15	0.03688	9.86714	7	43
58	9.83034	9	9.96327	15	0.03673	9.86707	7	42
59	9.83043	8	9.96342	15	0.03658	9.86700	6	41
60	9.83051	8	9.96357	16	0.03643	9.86694	7	**40**
61	9.83059	8	9.96373	15	0.03627	9.86687	7	39
62	9.83067	9	9.96388	15	0.03612	9.86680	7	38
63	9.83076	8	9.96403	15	0.03597	9.86673	7	37
64	9.83084	8	9.96418	15	0.03582	9.86666	7	36
65	9.83092	8	9.96433	16	0.03567	9.86659	7	35
66	9.83100	9	9.96449	15	0.03551	9.86652	7	34
67	9.83109	8	9.96464	15	0.03536	9.86645	7	33
68	9.83117	8	9.96479	15	0.03521	9.86638	7	32
69	9.83125	8	9.96494	16	0.03506	9.86631	7	31
70	9.83133	8	9.96510	15	0.03490	9.86624	7	**30**
71	9.83141	9	9.96525	15	0.03475	9.86617	7	29
72	9.83150	8	9.96540	15	0.03460	9.86610	7	28
73	9.83158	8	9.96555	15	0.03445	9.86603	7	27
74	9.83166	8	9.96570	16	0.03430	9.86596	7	26
75	9.83174	8	9.96586	15	0.03414	9.86589	7	25
76	9.83182	9	9.96601	15	0.03399	9.86582	7	24
77	9.83191	8	9.96616	15	0.03384	9.86575	7	23
78	9.83199	8	9.96631	15	0.03369	9.86568	7	22
79	9.83207	8	9.96646	16	0.03354	9.86561	7	21
80	9.83215	8	9.96662	15	0.03338	9.86554	7	**20**
81	9.83223	9	9.96677	15	0.03323	9.86547	7	19
82	9.83232	8	9.96692	15	0.03308	9.86540	7	18
83	9.83240	8	9.96707	15	0.03293	9.86533	7	17
84	9.83248	8	9.96722	16	0.03278	9.86526	8	16
85	9.83256	8	9.96738	15	0.03262	9.86518	7	15
86	9.83264	8	9.96753	15	0.03247	9.86511	7	14
87	9.83272	9	9.96768	15	0.03232	9.86504	7	13
88	9.83281	8	9.96783	15	0.03217	9.86497	7	12
89	9.83289	8	9.96798	16	0.03202	9.86490	7	11
90	9.83297	8	9.96814	15	0.03186	9.86483	7	**10**
91	9.83305	8	9.96829	15	0.03171	9.86476	7	09
92	9.83313	8	9.96844	15	0.03156	9.86469	7	08
93	9.83321	9	9.96859	15	0.03141	9.86462	7	07
94	9.83330	8	9.96874	16	0.03126	9.86455	7	06
95	9.83338	8	9.96890	15	0.03110	9.86448	7	05
96	9.83346	8	9.96905	15	0.03095	9.86441	7	04
97	9.83354	8	9.96920	15	0.03080	9.86434	7	03
98	9.83362	8	9.96935	15	0.03065	9.86427	7	02
99	9.83370	8	9.96950	16	0.03050	9.86420	7	01
100	9.83378		9.96966		0.03034	9.86413		**00**
	Cos	d.	Cot	d. c.	Tan	Sin	d.	

P. P.

	16	15	9	8	7
1	1.6	1.5	0.9	0.8	0.7
2	3.2	3.0	1.8	1.6	1.4
3	4.8	4.5	2.7	2.4	2.1
4	6.4	6.0	3.6	3.2	2.8
5	8.0	7.5	4.5	4.0	3.5
6	9.6	9.0	5.4	4.8	4.2
7	11.2	10.5	6.3	5.6	4.9
8	12.8	12.0	7.2	6.4	5.6
9	14.4	13.5	8.1	7.2	6.3

P. P.

43° **136°**

′	Sin	d.	Tan	d. c.	Cot	Cos	d.	′
00	9.83378	8	9.96966	15	0.03034	9.86413	7	**100**
01	9.83386	9	9.96981	15	0.03019	9.86406	7	99
02	9.83395	8	9.96996	15	0.03004	9.86399	7	98
03	9.83403	8	9.97011	15	0.02989	9.86392	8	97
04	9.83411	8	9.97026	16	0.02974	9.86384	7	96
05	9.83419	8	9.97042	15	0.02958	9.86377	7	95
06	9.83427	8	9.97057	15	0.02943	9.86370	7	94
07	9.83435	8	9.97072	15	0.02928	9.86363	7	93
08	9.83443	8	9.97087	15	0.02913	9.86356	7	92
09	9.83451	8	9.97102	16	0.02898	9.86349	7	91
10	9.83459	9	9.97118	15	0.02882	9.86342	7	**90**
11	9.83468	8	9.97133	15	0.02867	9.86335	7	89
12	9.83476	8	9.97148	15	0.02852	9.86328	7	88
13	9.83484	8	9.97163	15	0.02837	9.86321	7	87
14	9.83492	8	9.97178	15	0.02822	9.86314	8	86
15	9.83500	8	9.97193	16	0.02807	9.86306	7	85
16	9.83508	8	9.97209	15	0.02791	9.86299	7	84
17	9.83516	8	9.97224	15	0.02776	9.86292	7	83
18	9.83524	8	9.97239	15	0.02761	9.86285	7	82
19	9.83532	8	9.97254	15	0.02746	9.86278	7	81
20	9.83540	8	9.97269	16	0.02731	9.86271	7	**80**
21	9.83548	8	9.97285	15	0.02715	9.86264	7	79
22	9.83556	9	9.97300	15	0.02700	9.86257	7	78
23	9.83565	8	9.97315	15	0.02685	9.86250	8	77
24	9.83573	8	9.97330	15	0.02670	9.86242	7	76
25	9.83581	8	9.97345	16	0.02655	9.86235	7	75
26	9.83589	8	9.97361	15	0.02639	9.86228	7	74
27	9.83597	8	9.97376	15	0.02624	9.86221	7	73
28	9.83605	8	9.97391	15	0.02609	9.86214	7	72
29	9.83613	8	9.97406	15	0.02594	9.86207	7	71
30	9.83621	8	9.97421	16	0.02579	9.86200	8	**70**
31	9.83629	8	9.97437	15	0.02563	9.86192	7	69
32	9.83637	8	9.97452	15	0.02548	9.86185	7	68
33	9.83645	8	9.97467	15	0.02533	9.86178	7	67
34	9.83653	8	9.97482	15	0.02518	9.86171	7	66
35	9.83661	8	9.97497	15	0.02503	9.86164	7	65
36	9.83669	8	9.97512	16	0.02488	9.86157	7	64
37	9.83677	8	9.97528	15	0.02472	9.86150	8	63
38	9.83685	8	9.97543	15	0.02457	9.86142	7	62
39	9.83693	8	9.97558	15	0.02442	9.86135	7	61
40	9.83701	8	9.97573	15	0.02427	9.86128	7	**60**
41	9.83709	8	9.97588	16	0.02412	9.86121	7	59
42	9.83717	8	9.97604	15	0.02396	9.86114	7	58
43	9.83725	8	9.97619	15	0.02381	9.86107	8	57
44	9.83733	8	9.97634	15	0.02366	9.86099	7	56
45	9.83741	8	9.97649	15	0.02351	9.86092	7	55
46	9.83749	8	9.97664	15	0.02336	9.86085	7	54
47	9.83757	8	9.97679	16	0.02321	9.86078	7	53
48	9.83765	8	9.97695	15	0.02305	9.86071	8	52
49	9.83773	8	9.97710	15	0.02290	9.86063	7	51
50	9.83781		9.97725		0.02275	9.86056		**50**
	Cos	d.	Cot	d. c.	Tan	Sin	d.	

P. P.

	16	15	9	8	7
1	1.6	1.5	0.9	0.8	0.7
2	3.2	3.0	1.8	1.6	1.4
3	4.8	4.5	2.7	2.4	2.1
4	6.4	6.0	3.6	3.2	2.8
5	8.0	7.5	4.5	4.0	3.5
6	9.6	9.0	5.4	4.8	4.2
7	11.2	10.5	6.3	5.6	4.9
8	12.8	12.0	7.2	6.4	5.6
9	14.4	13.5	8.1	7.2	6.3

P. P.

133° **46°**

	Sin	d.	Tan	d. c.	Cot	Cos	d.	
50	9.83781	8	9.97725	15	0.02275	9.86056	7	50
51	9.83789	8	9.97740	15	0.02260	9.86049	7	49
52	9.83797	8	9.97755	16	0.02245	9.86042	7	48
53	9.83805	8	9.97771	15	0.02229	9.86035	8	47
54	9.83813	8	9.97786	15	0.02214	9.86027	7	46
55	9.83821	8	9.97801	15	0.02199	9.86020	7	45
56	9.83829	8	9.97816	15	0.02184	9.86013	7	44
57	9.83837	8	9.97831	15	0.02169	9.86006	7	43
58	9.83845	8	9.97846	16	0.02154	9.85999	8	42
59	9.83853	8	9.97862	15	0.02138	9.85991	7	41
60	9.83861	8	9.97877	15	0.02123	9.85984	7	40
61	9.83869	8	9.97892	15	0.02108	9.85977	7	39
62	9.83877	8	9.97907	15	0.02093	9.85970	8	38
63	9.83885	8	9.97922	16	0.02078	9.85962	7	37
64	9.83893	8	9.97938	15	0.02062	9.85955	7	36
65	9.83901	8	9.97953	15	0.02047	9.85948	7	35
66	9.83909	8	9.97968	15	0.02032	9.85941	7	34
67	9.83917	8	9.97983	15	0.02017	9.85934	8	33
68	9.83925	7	9.97998	15	0.02002	9.85926	7	32
69	9.83932	8	9.98013	16	0.01987	9.85919	7	31
70	9.83940	8	9.98029	15	0.01971	9.85912	7	30
71	9.83948	8	9.98044	15	0.01956	9.85905	8	29
72	9.83956	8	9.98059	15	0.01941	9.85897	7	28
73	9.83964	8	9.98074	15	0.01926	9.85890	7	27
74	9.83972	8	9.98089	15	0.01911	9.85883	7	26
75	9.83980	8	9.98104	16	0.01896	9.85876	8	25
76	9.83988	8	9.98120	15	0.01880	9.85868	7	24
77	9.83996	8	9.98135	15	0.01865	9.85861	7	23
78	9.84004	8	9.98150	15	0.01850	9.85854	7	22
79	9.84012	8	9.98165	15	0.01835	9.85847	8	21
80	9.84020	7	9.98180	15	0.01820	9.85839	7	20
81	9.84027	8	9.98195	16	0.01805	9.85832	7	19
82	9.84035	8	9.98211	15	0.01789	9.85825	8	18
83	9.84043	8	9.98226	15	0.01774	9.85817	7	17
84	9.84051	8	9.98241	15	0.01759	9.85810	7	16
85	9.84059	8	9.98256	15	0.01744	9.85803	7	15
86	9.84067	8	9.98271	16	0.01729	9.85796	8	14
87	9.84075	8	9.98287	15	0.01713	9.85788	7	13
88	9.84083	8	9.98302	15	0.01698	9.85781	7	12
89	9.84091	7	9.98317	15	0.01683	9.85774	8	11
90	9.84098	8	9.98332	15	0.01668	9.85766	7	10
91	9.84106	8	9.98347	15	0.01653	9.85759	7	09
92	9.84114	8	9.98362	16	0.01638	9.85752	7	08
93	9.84122	8	9.98378	15	0.01622	9.85745	8	07
94	9.84130	8	9.98393	15	0.01607	9.85737	7	06
95	9.84138	8	9.98408	15	0.01592	9.85730	7	05
96	9.84146	8	9.98423	15	0.01577	9.85723	8	04
97	9.84154	7	9.98438	15	0.01562	9.85715	7	03
98	9.84161	8	9.98453	16	0.01547	9.85708	7	02
99	9.84169	8	9.98469	15	0.01531	9.85701	8	01
100	9.84177		9.98484		0.01516	9.85693		00
	Cos	d.	Cot	d. c.	Tan	Sin	d.	

P. P.

	16	15	8	7
1	1.6	1.5	0.8	0.7
2	3.2	3.0	1.6	1.4
3	4.8	4.5	2.4	2.1
4	6.4	6.0	3.2	2.8
5	8.0	7.5	4.0	3.5
6	9.6	9.0	4.8	4.2
7	11.2	10.5	5.6	4.9
8	12.8	12.0	6.4	5.6
9	14.4	13.5	7.2	6.3

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	Sin	d.	Tan	d. c.	Cot	Cos	d.	
00	9.84177	8	9.98484	15	0.01516	9.85693	7	**100**
01	9.84185	8	9.98499	15	0.01501	9.85686	7	99
02	9.84193	8	9.98514	15	0.01486	9.85679	8	98
03	9.84201	8	9.98529	15	0.01471	9.85671	7	97
04	9.84209	7	9.98544	16	0.01456	9.85664	7	96
05	9.84216	8	9.98560	15	0.01440	9.85657	8	95
06	9.84224	8	9.98575	15	0.01425	9.85649	7	94
07	9.84232	8	9.98590	15	0.01410	9.85642	7	93
08	9.84240	8	9.98605	15	0.01395	9.85635	8	92
09	9.84248	7	9.98620	15	0.01380	9.85627	7	91
10	9.84255	8	9.98635	16	0.01365	9.85620	7	**90**
11	9.84263	8	9.98651	15	0.01349	9.85613	8	89
12	9.84271	8	9.98666	15	0.01334	9.85605	7	88
13	9.84279	8	9.98681	15	0.01319	9.85598	7	87
14	9.84287	8	9.98696	15	0.01304	9.85591	8	86
15	9.84295	7	9.98711	15	0.01289	9.85583	7	85
16	9.84302	8	9.98726	16	0.01274	9.85576	7	84
17	9.84310	8	9.98742	15	0.01258	9.85569	8	83
18	9.84318	8	9.98757	15	0.01243	9.85561	7	82
19	9.84326	8	9.98772	15	0.01228	9.85554	7	81
20	9.84334	7	9.98787	15	0.01213	9.85547	8	**80**
21	9.84341	8	9.98802	15	0.01198	9.85539	7	79
22	9.84349	8	9.98817	16	0.01183	9.85532	8	78
23	9.84357	8	9.98833	15	0.01167	9.85524	7	77
24	9.84365	8	9.98848	15	0.01152	9.85517	7	76
25	9.84373	7	9.98863	15	0.01137	9.85510	8	75
26	9.84380	8	9.98878	15	0.01122	9.85502	7	74
27	9.84388	8	9.98893	15	0.01107	9.85495	8	73
28	9.84396	8	9.98908	16	0.01092	9.85487	7	72
29	9.84404	7	9.98924	15	0.01076	9.85480	7	71
30	9.84411	8	9.98939	15	0.01061	9.85473	8	**70**
31	9.84419	8	9.98954	15	0.01046	9.85465	7	69
32	9.84427	8	9.98969	15	0.01031	9.85458	8	68
33	9.84435	7	9.98984	15	0.01016	9.85450	7	67
34	9.84442	8	9.98999	16	0.01001	9.85443	7	66
35	9.84450	8	9.99015	15	0.00985	9.85436	8	65
36	9.84458	8	9.99030	15	0.00970	9.85428	7	64
37	9.84466	7	9.99045	15	0.00955	9.85421	8	63
38	9.84473	8	9.99060	15	0.00940	9.85413	7	62
39	9.84481	8	9.99075	15	0.00925	9.85406	7	61
40	9.84489	8	9.99090	16	0.00910	9.85399	8	**60**
41	9.84497	7	9.99106	15	0.00894	9.85391	7	59
42	9.84504	8	9.99121	15	0.00879	9.85384	8	58
43	9.84512	8	9.99136	15	0.00864	9.85376	7	57
44	9.84520	8	9.99151	15	0.00849	9.85369	8	56
45	9.84528	7	9.99166	15	0.00834	9.85361	7	55
46	9.84535	8	9.99181	15	0.00819	9.85354	7	54
47	9.84543	8	9.99196	16	0.00804	9.85347	8	53
48	9.84551	7	9.99212	15	0.00788	9.85339	7	52
49	9.84558	8	9.99227	15	0.00773	9.85332	8	51
50	9.84566		9.99242		0.00758	9.85324		**50**
	Cos	d.	Cot	d. c.	Tan	Sin	d.	

P. P.

	16	**15**	**8**	**7**
1	1.6	1.5	0.8	0.7
2	3.2	3.0	1.6	1.4
3	4.8	4.5	2.4	2.1
4	6.4	6.0	3.2	2.8
5	8.0	7.5	4.0	3.5
6	9.6	9.0	4.8	4.2
7	11.2	10.5	5.6	4.9
8	12.8	12.0	6.4	5.6
9	14.4	13.5	7.2	6.3

P. P.

	Sin	d.	Tan	d. c.	Cot	Cos	d.	
50	9.84566	8	9.99242	15	0.00758	9.85324	7	**50**
51	9.84574	8	9.99257	15	0.00743	9.85317	8	49
52	9.84582	7	9.99272	15	0.00728	9.85309	7	48
53	9.84589	8	9.99287	16	0.00713	9.85302	8	47
54	9.84597	8	9.99303	15	0.00697	9.85294	7	46
55	9.84605	7	9.99318	15	0.00682	9.85287	8	45
56	9.84612	8	9.99333	15	0.00667	9.85279	7	44
57	9.84620	8	9.99348	15	0.00652	9.85272	7	43
58	9.84628	7	9.99363	15	0.00637	9.85265	8	42
59	9.84635	8	9.99378	16	0.00622	9.85257	7	41
60	9.84643	8	9.99394	15	0.00606	9.85250	8	**40**
61	9.84651	8	9.99409	15	0.00591	9.85242	7	39
62	9.84659	7	9.99424	15	0.00576	9.85235	8	38
63	9.84666	8	9.99439	15	0.00561	9.85227	7	37
64	9.84674	8	9.99454	15	0.00546	9.85220	8	36
65	9.84682	7	9.99469	16	0.00531	9.85212	7	35
66	9.84689	8	9.99485	15	0.00515	9.85205	8	34
67	9.84697	8	9.99500	15	0.00500	9.85197	7	33
68	9.84705	7	9.99515	15	0.00485	9.85190	8	32
69	9.84712	8	9.99530	15	0.00470	9.85182	7	31
70	9.84720	8	9.99545	15	0.00455	9.85175	8	**30**
71	9.84728	7	9.99560	16	0.00440	9.85167	7	29
72	9.84735	8	9.99576	15	0.00424	9.85160	8	28
73	9.84743	8	9.99591	15	0.00409	9.85152	7	27
74	9.84751	7	9.99606	15	0.00394	9.85145	8	26
75	9.84758	8	9.99621	15	0.00379	9.85137	7	25
76	9.84766	7	9.99636	15	0.00364	9.85130	8	24
77	9.84773	8	9.99651	15	0.00349	9.85122	7	23
78	9.84781	8	9.99666	16	0.00334	9.85115	8	22
79	9.84789	7	9.99682	15	0.00318	9.85107	7	21
80	9.84796	8	9.99697	15	0.00303	9.85100	8	**20**
81	9.84804	8	9.99712	15	0.00288	9.85092	7	19
82	9.84812	7	9.99727	15	0.00273	9.85085	8	18
83	9.84819	8	9.99742	15	0.00258	9.85077	8	17
84	9.84827	8	9.99757	16	0.00243	9.85069	7	16
85	9.84835	7	9.99773	15	0.00227	9.85062	8	15
86	9.84842	8	9.99788	15	0.00212	9.85054	7	14
87	9.84850	7	9.99803	15	0.00197	9.85047	8	13
88	9.84857	8	9.99818	15	0.00182	9.85039	7	12
89	9.84865	8	9.99833	15	0.00167	9.85032	8	11
90	9.84873	7	9.99848	16	0.00152	9.85024	7	**10**
91	9.84880	8	9.99864	15	0.00136	9.85017	8	09
92	9.84888	7	9.99879	15	0.00121	9.85009	8	08
93	9.84895	8	9.99894	15	0.00106	9.85001	7	07
94	9.84903	8	9.99909	15	0.00091	9.84994	8	06
95	9.84911	7	9.99924	15	0.00076	9.84986	7	05
96	9.84918	8	9.99939	16	0.00061	9.84979	8	04
97	9.84926	7	9.99955	15	0.00045	9.84971	7	03
98	9.84933	8	9.99970	15	0.00030	9.84964	8	02
99	9.84941	8	9.99985	15	0.00015	9.84956	7	01
100	9.84949		10.00000		0.00000	9.84949		**00**
	Cos	d.	Cot	d. c.	Tan	Sin	d.	

P. P.

	16	15	8	7
1	1.6	1.5	0.8	0.7
2	3.2	3.0	1.6	1.4
3	4.8	4.5	2.4	2.1
4	6.4	6.0	3.2	2.8
5	8.0	7.5	4.0	3.5
6	9.6	9.0	4.8	4.2
7	11.2	10.5	5.6	4.9
8	12.8	12.0	6.4	5.6
9	14.4	13.5	7.2	6.3

P. P.

TABLE XXVI.—Logarithmic Versed Sines and External Secants

$\text{Log vs} = 2\log\alpha^\circ + V \quad \text{Log exsec} = 2\log\alpha^\circ + E$

Hundredths	0° Vers	0° V	0° E	0° Exsec	Hundredths	1° Vers	1° V	1° E	1° Exsec
		6.182					6.182		
00	Inf. neg.	725	725	Inf. neg.	00	6.18271	714	780	6.18278
02	2.78478	725	725	2.78478	02	.19991	713	782	.19998
04	3.38684	725	725	3.38684	04	.21678	713	785	.21685
06	.73903	725	725	.73903	06	.23332	712	787	.23339
08	.98890	725	725	.98890	08	.24956	712	789	.24964
10	4.18272	725	725	4.18272	10	6.26549	711	791	6.26557
12	.34109	725	726	.34109	12	.28115	711	794	.28123
14	.47498	725	726	.47498	14	.29652	711	797	.29661
16	.59096	724	726	.59096	16	.31163	710	799	.31172
18	.69327	724	727	.69327	18	.33461	709	801	.33470
20	4.78478	724	727	4.78479	20	6.34107	709	804	6.34116
22	.86757	724	727	.86757	22	.35543	708	807	.35553
24	.94315	724	728	.94315	24	.36955	708	810	.36965
26	5.01267	724	729	5.01268	26	.38345	707	812	.38356
28	.07704	724	729	.07705	28	.39713	707	815	.39724
30	5.13697	724	730	5.13697	30	6.41059	706	818	6.41070
32	.19302	724	731	.19303	32	.42385	706	821	.42397
34	.24568	723	731	.24569	34	.43691	705	824	.43703
36	.29533	723	732	.29534	36	.44977	704	827	.44989
38	.34229	723	733	.34230	38	.46246	704	830	.46259
40	5.38684	723	734	5.38685	40	6.47496	703	833	6.47509
42	.42922	723	735	.42923	42	.48728	703	836	.48741
44	.46962	722	735	.46964	44	.49943	702	839	.49957
46	.50824	722	736	.50825	46	.51141	701	842	.51155
48	.54521	722	737	.54522	48	.52322	700	845	.52336
50	5.58066	722	739	5.58068	50	6.53488	700	849	6.53503
52	.61473	722	740	.61475	52	.54639	699	852	.54654
54	.64751	721	740	.64753	54	.55774	699	855	.55790
56	.67910	721	742	.67912	56	.56895	698	859	.56911
58	.70958	721	743	.70960	58	.58001	697	863	.58018
60	5.73902	721	745	5.73904	60	6.59093	697	866	6.59110
62	.76750	720	746	.76753	62	.60173	696	870	.60190
64	.79508	720	747	.79511	64	.61238	695	873	.61256
66	.82181	720	749	.82184	66	.62291	694	877	.62309
68	.84774	720	750	.84777	68	.63331	694	881	.63350
70	5.87292	719	752	5.87295	70	6.64359	693	884	6.64378
72	.89738	719	753	.89742	72	.65375	692	888	.65395
74	.92118	719	755	.92122	74	.66379	692	892	.66399
76	.94435	718	756	.94438	76	.67372	691	896	.67392
78	.96691	718	758	.96695	78	.68353	690	900	.68374
80	5.98890	718	760	5.98894	80	6.69323	689	903	6.69345
82	6.01034	717	762	6.01039	82	.70383	688	907	.70405
84	.03128	717	764	.03132	84	.71232	687	911	.71254
86	.05171	717	766	.05176	86	.72171	686	915	.72194
88	.07168	716	767	.07173	88	.73100	686	919	.73123
90	6.09120	716	769	6.09125	90	6.74019	685	924	6.74043
92	.11029	715	772	.11035	92	.74929	684	928	.74953
94	.12897	715	774	.12903	94	.75829	683	932	.75854
96	.14726	715	776	.14732	96	.76718	682	936	.76743
98	.16517	714	778	.16523	98	.77601	681	941	.77627
100	6.18271	714	780	6.18278	100	6.78474	681	945	6.78500

TABLE XXVI.—Logarithmic Versed Sines and External Secants

$\text{Log vs} = 2 \log \alpha^\circ + V \qquad \text{Log exsec} = 2 \log \alpha^\circ + E$

Hundredths	2° Vers	2° V	2° E	2° Exsec	Hundredths	3° Vers	3° V	3° E	3° Exsec
		6.182					6.182	6.183	
00	6.78474	681	945	6.78501	00	7.13687	626	221	7.13746
02	.79338	680	950	.79365	02	.14264	624	228	.14324
04	.80194	679	954	.80221	04	.14837	623	234	.14898
06	.81041	678	958	.81069	06	.15406	621	241	.16468
08	.81880	677	963	.81909	08	.15972	620	248	.16035
10	6.82712	676	968	6.82741	10	7.16534	619	255	7.16598
12	.83535	675	973	.83565	12	.17093	618	261	.17157
14	.84350	674	978	.84381	14	.17648	616	268	.17713
16	.85158	673	982	.85189	16	.18199	614	275	.18265
18	.85959	672	987	.85990	18	.18747	613	283	.18814
20	6.86752	671	992	6.86784	20	7.19291	612	290	7.19359
22	.87538	670	997	.87570	22	.18832	610	296	.19901
24	.88317	669	*002	.88350	24	.20370	609	303	.20439
26	.89089	668	006	.89122	26	.20904	607	311	.20975
28	.89854	667	011	.89888	28	.21435	606	318	.21507
30	6.90612	666	016	6.90647	30	7.21963	605	325	7.22035
32	.91364	665	022	.91400	32	.22488	603	333	.22561
34	.92110	664	027	.92146	34	.23010	602	340	.23083
36	.92849	663	032	.92886	36	.23528	600	348	.23603
38	.93582	662	037	.93619	38	.24043	599	355	.24119
40	6.94308	661	042	6.94347	40	7.24556	597	362	7.24632
42	.95029	660	048	.95068	42	.25065	596	370	.25142
44	.95744	659	053	.95783	44	.25571	595	377	.25649
46	.96453	658	058	.96493	46	.26075	593	385	.26154
48	.97156	657	063	.97197	48	.26575	591	393	.26655
50	6.97854	656	069	6.97895	50	7.27073	590	400	7.27154
52	.98546	655	075	.98588	52	.27567	588	408	.27649
54	.99232	654	081	.99275	54	.28059	587	416	.28142
56	.99913	652	086	.99957	56	.28549	585	424	.28632
58	.00589	651	092	.00633	58	.29035	583	432	.29120
60	7.01260	650	098	7.01304	60	7.29519	582	440	7.29605
62	.01925	649	103	.01971	62	.30000	581	448	.30087
64	.02586	648	109	.02632	64	.30478	579	456	.30566
66	.03241	646	115	.03288	66	.30954	577	464	.31043
68	.03891	645	121	.03939	68	.31427	575	472	.31517
70	7.04537	644	127	7.04585	70	7.31898	574	480	7.31988
72	.05178	643	133	.05227	72	.32366	572	488	.32457
74	.05814	642	139	.05864	74	.32831	571	496	.32924
76	.06446	640	145	.06496	76	.33294	569	504	.33388
78	.07073	639	151	.07124	78	.33755	567	512	.33850
80	7.07695	638	157	7.07747	80	7.34213	566	521	7.34309
82	.08314	637	163	.08366	82	.34669	564	529	.34766
84	.08927	636	169	.08981	84	.35122	562	538	.35220
86	.09537	634	176	.09591	86	.35574	560	547	.35672
88	.10142	633	182	.10197	88	.36022	558	556	.36122
90	7.10743	632	189	7.10799	90	7.36469	557	564	7.36569
92	.11340	631	195	.11396	92	.36913	555	572	.37014
94	.11932	630	201	.11790	94	.37355	553	581	.37457
96	.12521	628	208	.12579	96	.37794	552	590	.37898
98	.13106	627	215	.13165	98	.38232	550	599	.38337
100	7.13687	626	221 *183	7.13746	100	7.38667	548	608	7.38773

Hundredths	4° Vers	Diff. .001	4° Exsec	Diff. .001	Hundredths	5° Vers.	Diff. .001	5° Exsec	Diff. .001
00	7.38667	21.65	7.38773	21.75	**00**	7.58039	17.30	7.58204	17.40
02	.39100	21.55	.39207	21.60	**02**	.58385	17.30	.58552	17.35
04	.39531	21.45	.39639	21.50	**04**	.58731	17.15	.58899	17.25
06	.39960	21.30	.40069	21.35	**06**	.59074	17.15	.59244	17.20
08	.40386	21.25	.40496	21.30	**08**	.59417	17.05	.59588	17.10
10	7.40811	21.10	7.40922	21.20	**10**	7.59758	17.00	7.59930	17.05
12	.41233	21.05	.41346	21.05	**12**	.60098	16.90	.60271	17.00
14	.41654	20.90	.41767	21.00	**14**	.60436	16.85	.60611	16.90
16	.42072	20.80	.42187	20.85	**16**	.60773	16.80	.60949	16.90
18	.42488	20.75	.42604	20.80	**18**	.61109	16.70	.61287	16.75
20	7.42903	20.60	7.43020	20.65	**20**	7.61443	16.70	7.61622	16.75
22	.43315	20.55	.43433	20.60	**22**	.61777	16.55	.61957	16.65
24	.43726	20.40	.43845	20.50	**24**	.62108	16.55	.62290	16.60
26	.44134	20.35	.44255	20.35	**26**	.62439	16.50	.62622	16.55
28	.44541	20.25	.44662	20.30	**28**	.62769	16.40	.62953	16.50
30	7.44946	20.15	7.45068	20.20	**30**	7.63097	16.35	7.63283	16.40
32	.45349	20.05	.45472	20.10	**32**	.63424	16.25	.63611	16.35
34	.45750	19.95	.45874	20.05	**34**	.63749	16.25	.63938	16.30
36	.46149	19.85	.46275	19.90	**36**	.64074	16.15	.64264	16.25
38	.46546	19.80	.46673	19.85	**38**	.64397	16.10	.64589	16.15
40	7.46942	19.65	7.47070	19.75	**40**	7.64719	16.05	7.64912	16.15
42	.47335	19.60	.47465	19.65	**42**	.65040	16.00	.65235	16.05
44	.47727	19.55	.47858	19.55	**44**	.65360	15.90	.65556	16.00
46	.48118	19.40	.48249	19.50	**46**	.65678	15.85	.65876	15.90
48	.48506	19.35	.48639	19.40	**48**	.65995	15.85	.66194	15.90
50	7.48893	19.25	7.49027	19.30	**50**	7.66312	15.75	7.66512	15.85
52	.49278	19.15	.49413	19.20	**52**	.66627	15.70	.66829	15.75
54	.49661	19.10	.49797	19.15	**54**	.66941	15.60	.67144	15.70
56	.50043	18.95	.50180	19.05	**56**	.67253	15.60	.67458	15.65
58	.50422	18.95	.50561	19.00	**58**	.67565	15.55	.67771	15.60
60	7.50801	18.80	7.50941	18.90	**60**	7.67876	15.45	7.68083	15.55
62	.51177	18.75	.51319	18.80	**62**	.68185	15.40	.68394	15.50
64	.51552	18.70	.51695	18.75	**64**	.68493	15.35	.68704	15 45
66	.51926	18.55	.52070	18.65	**66**	.68800	15.35	.69013	15.35
68	.52297	18.55	.52443	18.55	**68**	.69107	15.25	.69320	15.35
70	7.52668	18.40	7.52814	18.50	**70**	7.69412	15.20	7.69627	15.25
72	.53036	18.35	.53184	18.40	**72**	.69716	15.15	.69932	15.25
74	.53403	18.30	.53552	18.35	**74**	.70019	15.05	.70237	15.15
76	.53769	18.20	.53919	18.25	**76**	.70320	15.05	.70540	15.15
78	.54133	18.10	.54284	18.20	**78**	.70621	15.00	.70843	15.05
80	7.54495	18.05	7.54648	18.10	**80**	7.70921	14.95	7.71144	15.00
82	.54856	17.90	.55010	18.05	**82**	.71220	14.85	.71444	14.95
84	.55216	17.90	.55371	17.95	**84**	.71517	14.85	.71743	14.95
86	.55574	17.80	.55730	17.90	**86**	.71814	14.80	.72042	14.85
88	.55930	17.75	.56088	17.80	**88**	.72110	14.75	.72339	14.80
90	7.56285	17.70	7.56444	17.75	**90**	7.72405	14.65	7.72635	14.75
92	.56639	17.65	.56799	17.70	**92**	.72698	14.65	.72930	14.75
94	.56991	17.55	.57153	17.60	**94**	.72991	14.60	.73225	14.65
96	.57342	17.45	.57505	17.50	**96**	.73283	14.50	.73518	14.60
98	.57691	17.40	.57855	17.45	**98**	.73573	14.50	.73810	14.55
100	7.58039		7.58204		**100**	7.73863		7.74102	

Hundredths	6° Vers	Diff. .001	6° Exsec	Diff. .001
00	7.73863	14.45	7.74102	14.50
02	.74152	14.40	.74392	14.45
04	.74440	14.35	.74681	14.45
06	.74727	14.25	.74970	14.35
08	.75012	14.25	.75257	14.35
10	7.75297	14.20	7.75544	14.30
12	.75581	14.20	.75830	14.20
14	.75865	14.10	.76114	14.20
16	.76147	14.05	.76398	14.15
18	.76428	14.00	.76681	14.10
20	7.76708	14.00	7.76963	14.05
22	.76988	13.90	.77244	14.05
24	.77266	13.90	.77525	13.95
26	.77544	13.85	.77804	13.90
28	.77821	13.80	.78082	13.90
30	7.78097	13.75	7.78360	13.85
32	.78372	13.70	.78637	13.75
34	.78646	13.65	.78912	13.75
36	.78919	13.65	.79187	13.75
38	.79192	13.55	.79462	13.65
40	7.79463	13.55	7.79735	13.60
42	.79734	13.50	.80007	13.60
44	.80004	13.45	.80279	13.55
46	.80273	13.40	.80550	13.50
48	.80541	13.40	.80820	13.45
50	7.80809	13.30	7.81089	13.40
52	.81075	13.30	.81357	13.35
54	.81341	13.25	.81624	13.35
56	.81606	13.20	.81891	13.30
58	.81870	13.15	.82157	13.25
60	7.82133	13.15	7.82422	13.20
62	.82396	13.05	.82686	13.20
64	.82657	13.05	.82950	13.10
66	.82918	13.05	.83212	13.10
68	.83179	12.95	.83474	13.10
70	7.83438	12.95	7.83736	13.00
72	.83697	12.85	.83996	13.00
74	.83954	12.85	.84256	12.90
76	.84211	12.85	.84514	12.95
78	.84468	12.75	.84773	12.85
80	7.84723	12.75	7.85030	12.80
82	.84978	12.70	.85286	12.80
84	.85232	12.65	.85542	12.75
86	.85485	12.65	.85797	12.75
88	.85738	12.60	.86052	12.70
90	7.85990	12.55	7.86306	12.60
92	.86241	12.50	.86558	12.65
94	.86491	12.50	.86811	12.55
96	.86741	12.45	.87062	12.55
98	.86990	12.40	.87313	12.50
100	7.87238		7.87563	

Hundredths	7° Vers	Diff. .001	7° Exsec	Diff. .001
00	7.87238	12.40	7.87563	12.45
02	.87486	12.30	.87812	12.45
04	.87732	12.30	.88061	12.40
06	.87978	12.30	.88309	12.35
08	.88224	12.25	.88556	12.35
10	7.88469	12.20	7.88803	12.30
12	.88713	12.15	.89049	12.25
14	.88956	12.15	.89294	12.25
16	.89199	12.10	.89539	12.15
18	.89441	12.05	.89782	12.20
20	7.89682	12.00	7.90026	12.10
22	.89922	12.00	.90268	12.10
24	.90162	12.00	.90510	12.05
26	.90402	11.90	.90751	12.05
28	.90640	11.90	.90992	12.00
30	7.90878	11.90	7.91232	11.95
32	.91116	11.80	.91471	11.95
34	.91352	11.80	.91710	11.90
36	.91588	11.80	.91948	11.85
38	.91824	11.70	.92185	11.85
40	7.92058	11.75	7.92422	11.80
42	.92293	11.65	.92658	11.75
44	.92526	11.65	.92893	11.75
46	.92759	11.60	.93128	11.70
48	.92991	11.60	.93362	11.70
50	7.93223	11.55	7.93596	11.65
52	.93454	11.50	.93829	11.60
54	.93684	11.50	.94061	11.60
56	.93914	11.45	.94293	11.55
58	.94143	11.45	.94524	11.55
60	7.94372	11.35	7.94755	11.50
62	.94599	11.40	.94985	11.45
64	.94827	11.35	.95214	11.45
66	.95054	11.30	.95443	11.40
68	.95280	11.25	.95671	11.40
70	7.95505	11.25	7.95899	11.35
72	.95730	11.25	.96126	11.30
74	.95955	11.15	.96352	11.30
76	.96178	11.20	.96578	11.25
78	.96402	11.10	.96803	11.25
80	7.96624	11.10	7.97028	11.20
82	.96846	11.10	.97252	11.20
84	.97068	11.05	.97476	11.15
86	.97289	11.00	.97699	11.10
88	.97509	11.00	.97921	11.10
90	7.97729	10.95	7.98143	11.10
92	.97948	10.95	.98365	11.00
94	.98167	10.90	.98585	11.05
96	.98385	10.90	.98806	10.95
98	.98603	10.85	.99025	11.00
100	7.98820		7.99245	

TABLE XXVI. — (*Continued*)

Hundredths	8°				Hundredths	9°			
	Vers	Diff. .001	Exsec	Diff. .001		Vers	Diff. .001	Exsec	Diff. .001
00	7.98820	10.80	7.99245	10.90	**00**	8.09032	9.60	8.09570	9.70
02	.99036	10.80	.99463	10.90	**02**	.09224	9.60	.09764	9.65
04	.99252	10.80	.99681	10.90	**04**	.09416	9.60	.09959	9.60
06	.99468	10.75	.99899	10.85	**06**	.09608	9.55	.10153	9.65
08	.99683	10.70	8.00116	10.85	**08**	.09799	9.50	.10346	9.70
10	7.99897	10.70	8.00333	10.80	**10**	8.09989	9.55	8.10540	9.60
12	8.00111	10.65	.00549	10.75	**12**	.10180	9.50	.10732	9.65
14	.00324	10.65	.00764	10.75	**14**	.10370	9.45	.10925	9.55
16	.00537	10.60	.00979	10.70	**16**	.10559	9.45	.11116	9.60
18	.00749	10.60	.01193	10.70	**18**	.10748	9.45	.11308	9.55
20	8.00961	10.55	8.01407	10.70	**20**	8.10937	9.40	8.11499	9.55
22	.01172	10.55	.01621	10.65	**22**	.11125	9.40	.11690	9.50
24	.01383	10.50	.01834	10.60	**24**	.11313	9.35	.11880	9.50
26	.01593	10.50	.02046	10.60	**26**	.11500	9.35	.12070	9.45
28	.01803	10.45	.02258	10.55	**28**	.11687	9.35	.12259	9.45
30	8.02012	10.45	8.02469	10.55	**30**	8.11874	9.30	8.12448	9.45
32	.02221	10.40	.02680	10.55	**32**	.12060	9.30	.12637	9.40
34	.02429	10.40	.02891	10.50	**34**	.12246	9.25	.12825	9.40
36	.02637	10.35	.03101	10.45	**36**	.12431	9.25	.13013	9.40
38	.02844	10.35	.03310	10.45	**38**	.12616	9.25	.13201	9.35
40	8.03051	10.30	8.03519	10.40	**40**	8.12801	9.20	8.13388	9.30
42	.03257	10.25	.03727	10.40	**42**	.12985	9.20	.13574	9.35
44	.03462	10.30	.03935	10.40	**44**	.13169	9.15	.13761	9.30
46	.03668	10.20	.04143	10.35	**46**	.13352	9.15	.13947	9.25
48	.03872	10.25	.04350	10.30	**48**	.13535	9.15	.14132	9.25
50	8.04077	10.15	8.04556	10.30	**50**	8.13718	9.10	8.14317	9.25
52	.04280	10.20	.04762	10.20	**52**	.13900	9.10	.14502	9.25
54	.04484	10.10	.04968	10.25	**54**	.14082	9.05	.14687	9.20
56	.04686	10.15	.05173	10.25	**56**	.14263	9.05	.14871	9.15
58	.04889	10.10	.05378	10.20	**58**	.14444	9.05	.15054	9.20
60	8.05091	10.05	8.05582	10.15	**60**	8.14625	9.00	8.15238	9.10
62	.05292	10.05	.05785	10.20	**62**	.14805	9.00	.15420	9.15
64	.05493	10.00	.05989	10.10	**64**	.14985	9.00	.15603	9.10
66	.05693	10.00	.06191	10.15	**66**	.15165	8.95	.15785	9.10
68	.05893	10.00	.06394	10.05	**68**	.15344	8.95	.15967	9.05
70	8.06093	9.95	8.06595	10.10	**70**	8.15523	8.95	8.16148	9.10
72	.06292	9.95	.06797	10.05	**72**	.15702	8.90	.16330	9.00
74	.06491	9.90	.06998	10.00	**74**	.15880	8.85	.16510	9.05
76	.06689	9.85	.07198	10.00	**76**	.16057	8.90	.16691	9.00
78	.06886	9.90	.07398	10.00	**78**	.16235	8.85	.16871	8.95
80	8.07084	9.80	8.07598	9.95	**80**	8.16412	8.80	8.17050	8.95
82	.07280	9.85	.07797	9.95	**82**	.16588	8.85	.17229	8.95
84	.07477	9.80	.07996	9.90	**84**	.16765	8.80	.17408	8.95
86	.07673	9.75	.08194	9.90	**86**	.16941	8.75	.17587	8.90
88	.07868	9.75	.08392	9.85	**88**	.17116	8.75	.17765	8.90
90	8.08063	9.75	8.08589	9.85	**90**	8.17291	8.75	8.17943	8.85
92	.08258	9.70	.08786	9.85	**92**	.17466	8.75	.18120	8.90
94	.08452	9.70	.08983	9.80	**94**	.17641	8.70	.18298	8.80
96	.08646	9.65	.09179	9.75	**96**	.17815	8.70	.18474	8.85
98	.08839	9.65	.09374	9.80	**98**	.17989	8.65	.18651	8.80
100	8.09032		8.09570		**100**	8.18162		8.18827	

Hundredths	10°				Hundredths	11°			
	Vers	Diff. .001	Exsec	Diff. .001		Vers	Diff. .001	Exsec	Diff. .001
00	8.18162	8.65	8.18827	8.80	00	8.26418	7.85	8.27223	8.00
02	.18335	8.65	.19003	8.75	02	.26575	7.85	.27383	8.00
04	.18508	8.60	.19178	8.75	04	.26732	7.85	.27543	8.00
06	.18680	8.65	.19353	8.75	06	.26889	7.80	.27703	7.95
08	.18853	8.55	.19528	8.75	08	.27045	7.80	.27862	7.95
10	8.19024	8.60	8.19703	8.70	10	8.27201	7.80	8.28021	7.95
12	.19196	8.55	.19877	8.65	12	.27357	7.80	.28180	7.95
14	.19367	8.50	.20050	8.70	14	.27513	7.75	.28339	7.90
16	.19537	8.55	.20224	8.65	16	.27668	7.75	.28497	7.90
18	.19708	8.50	.20397	8.65	18	.27823	7.75	.28655	7.90
20	8.19878	8.45	8.20570	8.60	20	8.27978	7.70	8.28813	7.85
22	.20047	8.50	.20742	8.60	22	.28132	7.70	.28970	7.90
24	.20217	8.45	.20914	8.60	24	.28286	7.70	.29128	7.80
26	.20386	8.45	.21086	8.55	26	.28440	7.70	.29284	7.85
28	.20555	8.40	.21257	8.55	28	.28594	7.65	.29441	7.85
30	8.20723	8.40	8.21428	8.55	30	8.28747	7.65	8.29598	7.80
32	.20891	8.40	.21599	8.55	32	.28900	7.65	.29754	7.75
34	.21059	8.35	.21770	8.50	34	.29053	7.65	.29909	7.80
36	.21226	8.35	.21940	8.50	36	.29206	7.60	.30065	7.75
38	.21393	8.35	.22110	8.45	38	.29358	7.60	.30220	7.80
40	8.21560	8.30	8.22279	8.45	40	8.29510	7.60	8.30376	7.70
42	.21726	8.30	.22448	8.45	42	.29662	7.55	.30530	7.75
44	.21892	8.30	.22617	8.45	44	.29813	7.60	.30685	7.70
46	.22058	8.30	.22786	8.40	46	.29965	7.55	.30839	7.70
48	.22224	8.25	.22954	8.40	48	.30116	7.50	.30993	7.70
50	8.22389	8.25	8.23122	8.40	50	8.30266	7.55	8.31147	7.65
52	.22554	8.20	.23290	8.35	52	.30417	7.50	.31300	7.70
54	.22718	8.20	.23457	8.35	54	.30567	7.50	.31454	7.65
56	.22882	8.20	.23624	8.35	56	.30717	7.45	.31607	7.60
58	.23046	8.20	.23791	8.30	58	.30866	7.50	.31759	7.65
60	8.23210	8.15	8.23957	8.30	60	8.31016	7.45	8.31912	7.60
62	.23373	8.15	.24123	8.30	62	.31165	7.45	.32064	7.60
64	.23536	8.15	.24289	8.30	64	.31314	7.40	.32216	7.60
66	.23699	8.10	.24455	8.25	66	.31462	7.45	.32368	7.55
68	.23861	8.10	.24620	8.25	68	.31611	7.40	.32519	7.60
70	8.24023	8.10	8.24785	8.20	70	8.31759	7.40	8.32671	7.55
72	.24185	8.05	.24949	8.25	72	.31907	7.35	.32822	7.50
74	.24346	8.05	.25114	8.20	74	.32054	7.35	.32972	7.55
76	.24507	8.05	.25278	8.15	76	.32201	7.35	.33123	7.50
78	.24668	8.05	.25441	8.20	78	.32348	7.35	.33273	7.50
80	8.24829	8.00	8.25605	8.15	80	8.32495	7.35	8.33423	7.50
82	.24989	8.00	.25768	8.15	82	.32642	7.30	.33573	7.45
84	.25149	7.95	.25931	8.10	84	.32788	7.30	.33722	7.45
86	.25308	8.00	.26093	8.10	86	.32934	7.30	.33871	7.45
88	.25468	7.95	.26255	8.10	88	.33080	7.30	.34020	7.45
90	8.25627	7.90	8.26417	8.10	90	8.33226	7.25	8.34169	7.45
92	.25785	7.95	.26579	8.05	92	.33371	7.25	.34318	7.40
94	.25944	7.90	.26740	8.10	94	.33516	7.25	.34466	7.40
96	.26102	7.90	.26902	8.00	96	.33661	7.25	.34614	7.40
98	.26260	7.90	.27062	8.05	98	.33806	7.20	.34762	7.35
100	8.26418		8.27223		100	8.33950		8.34909	

TABLE XXVI. — (*Continued*)

Hundredths	12° Vers	Diff. .001	12° Exsec	Diff. .001	Hundredths	13° Vers	Diff. .001	13° Exsec	Diff. .001
00	8.33950	7.20	8.34909	7.40	**00**	8.40875	6.65	8.42002	6.85
02	.34094	7.20	.35057	7.35	**02**	.41008	6.60	.42139	6.80
04	.34238	7.20	.35204	7.35	**04**	.41140	6.65	.42275	6.80
06	.34382	7.15	.35351	7.30	**06**	.41273	6.60	.42391	6.80
08	.34525	7.15	.35497	7.35	**08**	.41405	6.60	.42547	6.80
10	8.34668	7.15	8.35644	7.30	**10**	8.41537	6.60	8.42683	6.75
12	.34811	7.15	.35790	7.30	**12**	.41669	6.60	.42818	6.75
14	.34954	7.10	.35936	7.30	**14**	.41801	6.60	.42953	6.75
16	.35096	7.10	.36082	7.25	**16**	.41933	6.55	.43088	6.75
18	.35238	7.10	.36227	7.25	**18**	.42064	6.55	.43223	6.75
20	8.35380	7.10	8.36372	7.25	**20**	8.42195	6.55	8.43358	6.70
22	.35522	7.10	.36517	7.25	**22**	.42326	6.55	.43492	6.75
24	.35664	7.05	.36662	7.25	**24**	.42457	6.50	.43627	6.70
26	.35805	7.05	.36807	7.20	**26**	.42587	6.55	.43761	6.70
28	.35946	7.05	.36951	7.20	**28**	.42718	6.50	.43895	6.65
30	8.36087	7.00	8.37095	7.20	**30**	8.42848	6.50	8.44028	6.70
32	.36227	7.05	.37239	7.20	**32**	.42978	6.45	.44162	6.65
34	.36368	7.00	.37383	7.15	**34**	.43107	6.50	.44295	6.65
36	.36508	7.00	.37526	7.15	**36**	.43237	6.45	.44428	6.65
38	.36648	6.95	.37669	7.15	**38**	.43366	6.45	.44561	6.65
40	8.36787	7.00	8.37812	7.15	**40**	8.43495	6.45	8.44694	6.65
42	.36927	6.95	.37955	7.15	**42**	.43624	6.45	.44827	6.60
44	.37066	6.95	.38098	7.10	**44**	.43753	6.45	.44959	6.60
46	.37205	6.95	.38240	7.10	**46**	.43882	6.40	.45091	6.60
48	.37344	6.90	.38382	7.10	**48**	.44010	6.40	.45223	6.60
50	8.37482	6.90	8.38524	7.10	**50**	8.44138	6.40	8.45355	6.60
52	.37620	6.95	.38666	7.05	**52**	.44266	6.40	.45487	6.55
54	.37759	6.85	.38807	7.05	**54**	.44394	6.40	.45618	6.55
56	.37896	6.90	.38948	7.05	**56**	.44522	6.35	.45749	6.55
58	.38034	6.85	.39089	7.05	**58**	.44649	6.35	.45880	6.55
60	8.38171	6.90	8.39230	7.05	**60**	8.44776	6.35	8.46011	6.55
62	.38309	6.85	.39371	7.00	**62**	.44903	6.35	.46142	6.55
64	.38446	6.80	.39511	7.00	**64**	.45030	6.35	.46273	6.50
66	.38582	6.85	.39651	7.00	**66**	.45157	6.30	.46403	6.50
68	.38719	6.80	.39791	7.00	**68**	.45283	6.35	.46533	6.50
70	8.38855	6.80	8.39931	7.00	**70**	8.45410	6.30	8.46663	6.50
72	.38991	6.80	.40071	6.95	**72**	.45536	6.30	.46793	6.50
74	.39127	6.80	.40210	6.95	**74**	.45662	6.25	.46923	6.45
76	.39263	6.80	.40349	6.95	**76**	.45787	6.30	.47052	6.45
78	.39399	6.75	.40488	6.95	**78**	.45913	6.25	.47181	6.45
80	8.39534	6.75	8.40627	6.90	**80**	8.46038	6.25	8.47310	6.45
82	.39669	6.75	.40765	6.90	**82**	.46163	6.25	.47439	6.45
84	.39804	6.70	.40903	6.95	**84**	.46288	6.25	.47568	6.40
86	.39938	6.75	.41042	6.85	**86**	.46413	6.25	.47696	6.45
88	.40073	6.70	.41179	6.90	**88**	.46538	6.20	.47825	6.40
90	8.40207	6.70	8.41317	6.90	**90**	8.46662	6.25	8.47953	6.40
92	.40341	6.70	.41455	6.85	**92**	.46787	6.20	.48081	6.40
94	.40475	6.65	.41592	6.85	**94**	.46911	6.20	.48209	6.40
96	.40608	6.70	.41729	6.85	**96**	.47035	6.15	.48337	6.35
98	.40742	6.65	.41866	6.80	**98**	.47158	6.20	.48464	6.35
100	8.40875		8.42002		**100**	8.47282		8.48591	

TABLE XXVI. — (*Continued*)

Hundredths	14° Vers	Diff. .001	14° Exsec	Diff. .001	Hundredths	15° Vers	Diff. .001	15° Exsec	Diff. .001
00	8.47282	6.15	8.48591	6.40	**00**	8.53243	5.75	8.54748	5.95
02	.47405	6.15	.48719	6.35	02	.53358	5.75	.54867	5.95
04	.47528	6.15	.48846	6.30	04	.53473	5.70	.54986	5.95
06	.47651	6.15	.48972	6.35	06	.53587	5.75	.55105	5.95
08	.47774	6.15	.49099	6.35	08	.53702	5.70	.55224	5.90
10	8.47897	6.10	8.49226	6.30	10	8.53816	5.75	8.55342	5.95
12	.48019	6.15	.49352	6.30	12	.53931	5.70	.55461	5.90
14	.48142	6.10	.49478	6.30	14	.54045	5.70	.55579	5.90
16	.48264	6.10	.49604	6.30	16	.54159	5.70	.55697	5.90
18	.48386	6.10	.49730	6.25	18	.54273	5.65	.55815	5.90
20	8.48508	6.05	8.49855	6.30	**20**	8.54386	5.70	8.55933	5.90
22	.48629	6.10	.49981	6.20	22	.54500	5.65	.56051	5.85
24	.48751	6.05	.50105	6.30	24	.54613	5.70	.56168	5.85
26	.48872	6.05	.50231	6.25	26	.54727	5.65	.56285	5.90
28	.48993	6.05	.50356	6.25	28	.54840	5.65	.56403	5.85
30	8.49114	6.05	8.50481	6.25	30	8.54953	5.60	8.56520	5.85
32	.49235	6.00	.50606	6.20	32	.55065	5.65	.56637	5.80
34	.49355	6.05	.50730	6.20	34	.55178	5.60	.56753	5.85
36	.49486	6.00	.50864	6.25	36	.55290	5.65	.56870	5.85
38	.49596	6.00	.50979	6.20	38	.55403	5.60	.56987	5.80
40	8.49716	6.00	8.51103	6.15	**40**	8.55515	5.60	8.57103	5.80
42	.49836	6.00	.51226	6.20	42	.55627	5.60	.57219	5.80
44	.49956	5.95	.51350	6.20	44	.55739	5.60	.57335	5.80
46	.50075	6.00	.51474	6.15	46	.55851	5.55	.57451	5.80
48	.50195	5.95	.51597	6.15	48	.55962	5.60	.57567	5.80
50	8.50314	5.95	8.51720	6.15	50	8.56074	5.55	8.57683	5.75
52	.50433	5.95	.51843	6.15	52	.56185	5.55	.57798	5.80
54	.50552	5.95	.51966	6.15	54	.56296	5.55	.57914	5.75
56	.50671	5.90	.52089	6.10	56	.56407	5.55	.58029	5.75
58	.50789	5.95	.52211	6.10	58	.56518	5.55	.58144	5.75
60	8.50908	5.90	8.52333	6.15	**60**	8.56629	5.55	8.58259	5.75
62	.51026	5.90	.52456	6.10	62	.56740	5.50	.58374	5.75
64	.51144	5.90	.52578	6.10	64	.56850	5.50	.58489	5.70
66	.51262	5.90	.52700	6.05	66	.56960	5.50	.58603	5.70
68	.51380	5.90	.52821	6.10	68	.57070	5.55	.58717	5.75
70	8.51498	5.85	8.52943	6.05	70	8.57181	5.45	8.58832	5.70
72	.51615	5.85	.53064	6.10	72	.57290	5.50	.58946	5.70
74	.51732	5.85	.53186	6.05	74	.57400	5.50	.59060	5.70
76	.51849	5.85	.53307	6.05	76	.57510	5.45	.59174	5.70
78	.51966	5.85	.53428	6.00	78	.57619	5.45	.59288	5.65
80	8.52083	5.85	8.53548	6.05	**80**	8.57728	5.50	8.59401	5.70
82	.52200	5.80	.53669	6.05	82	.57838	5.45	.59515	5.65
84	.52316	5.85	.53790	6.00	84	.57947	5.45	.59628	5.65
86	.52433	5.80	.53910	6.00	86	.58056	5.40	.59741	5.65
88	.52549	5.80	.54030	6.00	88	.58164	5.45	.59854	5.65
90	8.52665	5.80	8.54150	6.00	90	8.58273	5.40	8.59967	5.65
92	.52781	5.75	.54270	6.00	92	.58381	5.45	.60080	5.65
94	.52896	5.80	.54390	5.95	94	.58490	5.40	.60193	5.60
96	.53012	5.75	.54509	6.00	96	.58598	5.40	.60305	5.65
98	.53127	5.80	.54629	5.95	98	.58706	5.40	.60418	5.60
100	8.53243		8.54748		**100**	8.58814		8.60530	

TABLE XXVI. — (*Continued*)

Hun-dredths	16°				Hun-dredths	17°			
	Vers	Diff. .001	Exsec	Diff. .001		Vers	Diff. .001	Exsec	Diff. .001
00	8.58814	5.40	8.60530	5.60	**00**	8.64043	5.10	8.65984	5.30
02	.58922	5.40	.60642	5.60	**02**	.64145	5.05	.66090	5.30
04	.59030	5.35	.60754	5.60	**04**	.64246	5.05	.66196	5.25
06	.59137	5.35	.60866	5.60	**06**	.64347	5.05	.66301	5.30
08	.59244	5.40	.60978	5.55	**08**	.64448	5.05	.66407	5.30
10	8.59352	5.35	8.61089	5.60	**10**	8.64549	5.05	8.66513	5.25
12	.59459	5.35	.61201	5.55	**12**	.64650	5.05	.66618	5.25
14	.59566	5.35	.61312	5.60	**14**	.64751	5.00	.66723	5.30
16	.59673	5.30	.61424	5.55	**16**	.64851	5.00	.66829	5.25
18	.59779	5.35	.61535	5.55	**18**	.64951	5.05	.66934	5.25
20	8.59886	5.30	8.61646	5.50	**20**	8.65052	5.00	8.67039	5.25
22	.59992	5.35	.61756	5.55	**22**	.65152	5.00	.67144	5.20
24	.60099	5.30	.61867	5.55	**24**	.65252	5.00	.67248	5.25
26	.60205	5.30	.61978	5.50	**26**	.65352	5.00	.67353	5.25
28	.60311	5.30	.62088	5.55	**28**	.65452	4.95	.67458	5.20
30	8.60417	5.30	8.62199	5.50	**30**	8.65551	5.00	8.67562	5.20
32	.60523	5.25	.62309	5.50	**32**	.65651	5.00	.67666	5.25
34	.60628	5.30	.62419	5.50	**34**	.65751	4.95	.67771	5.20
36	.60734	5.25	.62529	5.50	**36**	.65850	4.95	.67875	5.20
38	.60839	5.30	.62639	5.45	**38**	.65949	4.95	.67979	5.20
40	8.60945	5.25	8.62748	5.50	**40**	8.66048	4.95	8.68083	5.15
42	.61050	5.25	.62858	5.50	**42**	.66147	4.95	.68186	5.20
44	.61155	5.25	.62968	5.45	**44**	.66246	4.95	.68290	5.20
46	.61260	5.20	.63077	5.45	**46**	.66345	4.95	.68393	5.20
48	.61364	5.25	.63786	5.45	**48**	.66444	4.90	.68497	5.15
50	8.61469	5.20	8.63295	5.45	**50**	8.66542	4.95	8.68600	5.15
52	.61573	5.25	.63404	5.45	**52**	.66641	4.90	.68703	5.20
54	.61678	5.20	.63513	5.45	**54**	.66739	4.90	.68807	5.15
56	.61782	5.20	.63622	5.40	**56**	.66837	4.90	.68910	5.10
58	.61886	5.20	.63730	5.45	**58**	.66935	4.90	.69012	5.15
60	8.61990	5.20	8.63839	5.40	**60**	8.67033	4.90	8.69115	5.15
62	.62094	5.20	.63947	5.45	**62**	.67131	4.90	.69218	5.15
64	.62198	5.15	.64056	5.40	**64**	.67229	4.90	.69321	5.10
66	.62301	5.20	.64164	5.40	**66**	.67327	4.85	.69423	5.10
68	.62405	5.15	.64272	5.40	**68**	.67424	4.85	.69525	5.15
70	8.62508	5.15	8.64380	5.35	**70**	8.67521	4.90	8.69628	5.10
72	.62611	5.15	.64487	5.40	**72**	.67619	4.85	.69730	5.10
74	.62714	5.15	.64595	5.40	**74**	.67716	4.85	.69832	5.10
76	.62817	5.15	.64703	5.35	**76**	.67813	4.85	.69934	5.10
78	.62920	5.15	.64810	5.35	**78**	.67910	4.85	.70036	5.05
80	8.63023	5.15	8.64917	5.35	**80**	8.68007	4.85	8.70137	5.10
82	.63126	5.10	.65024	5.40	**82**	.68104	4.80	.70239	5.05
84	.63228	5.10	.65132	5.30	**84**	.68200	4.85	.70340	5.10
86	.63330	5.15	.65238	5.35	**86**	.68297	4.80	.70442	5.05
88	.63433	5.10	.65345	5.35	**88**	.68393	4.85	.70543	5.05
90	8.63535	5.10	8.65452	5.35	**90**	8.68490	4.80	8.70644	5.05
92	.63637	5.10	.65559	5.30	**92**	.68586	4.80	.70745	5.05
94	.63739	5.05	.65665	5.30	**94**	.68682	4.80	.70846	5.05
96	.63840	5.10	.65771	5.35	**96**	.68778	4.80	.70947	5.05
98	.63942	5.05	.65878	5.30	**98**	.68874	4.75	.71048	5.05
100	8.64043		8.65984		**100**	8.68969		8.71149	

Hundredths	18° Vers	Diff. .001	18° Exsec	Diff. .001
00	8.68969	4.80	8.71149	5.00
02	.69065	4.80	.71249	5.05
04	.69161	4.75	.71350	5.00
06	.69256	4.75	.71450	5.05
08	.69351	4.80	.71551	5.00
10	8.69447	4.75	8.71651	5.00
12	.69542	4.75	.71751	5.00
14	.69637	4.75	.71851	5.00
16	.69732	4.75	.71951	5.00
18	.69827	4.70	.72051	4.95
20	8.69921	4.75	8.72150	5.00
22	.70016	4.70	.72250	4.95
24	.70110	4.75	.72349	5.00
26	.70205	4.70	.72449	4.95
28	.70299	4.70	.72548	4.95
30	8.70393	4.70	8.72647	4.95
32	.70487	4.70	.72746	4.95
34	.70581	4.70	.72845	4.95
36	.70675	4.70	.72944	4.95
38	.70769	4.65	.73043	4.95
40	8.70862	4.70	8.73142	4.90
42	.70956	4.65	.73240	4.95
44	.71049	4.70	.73339	4.90
46	.71143	4.65	.73437	4.90
48	.71236	4.65	.73535	4.95
50	8.71329	4.65	8.73634	4.90
52	.71422	4.65	.73732	4.90
54	.71515	4.65	.73830	4.90
56	.71608	4.65	.73928	4.85
58	.71701	4.60	.74025	4.90
60	8.71793	4.65	8.74123	4.90
62	.71886	4.60	.74221	4.85
64	.71978	4.65	.74318	4.90
66	.72071	4.60	.74416	4.85
68	.72163	4.60	.74513	4.85
70	8.72255	4.60	8.74610	4.85
72	.72347	4.60	.74707	4.85
74	.72439	4.60	.74804	4.85
76	.72531	4.55	.74901	4.85
78	.72622	4.60	.74998	4.85
80	8.72714	4.60	8.75095	4.85
82	.72806	4.55	.75192	4.80
84	.72897	4.55	.75288	4.85
86	.72988	4.60	.75385	4.80
88	.73080	4.55	.75481	4.85
90	8.73171	4.55	8.75578	4.80
92	.73262	4.55	.75674	4.80
94	.73353	4.50	.75770	4.80
96	.73443	4.55	.75866	4.80
98	.73534	4.55	.75962	4.80
100	8.73625		8.76058	

Hundredths	19° Vers	Diff. .001	19° Exsec	Diff. .001
00	8.73625	4.50	8.76058	4.80
02	.73715	4.55	.76154	4.75
04	.73806	4.50	.76249	4.80
06	.73896	4.50	.76345	4.75
08	.73986	4.55	.76440	4.80
10	8.74077	4.50	8.76536	4.75
12	.74167	4.50	.76631	4.75
14	.74257	4.45	.76726	4.75
16	.74346	4.50	.76821	4.75
18	.74436	4.50	.76916	4.75
20	8.74526	4.50	8.77011	4.75
22	.74616	4.45	.77106	4.75
24	.74705	4.45	.77201	4.75
26	.74794	4.50	.77296	4.70
28	.74884	4.45	.77390	4.75
30	8.74973	4.45	8.77485	4.70
32	.75062	4.45	.77579	4.75
34	.75151	4.45	.77674	4.70
36	.75240	4.45	.77768	4.70
38	.75329	4.40	.77862	4.70
40	8.75417	4.45	8.77956	4.70
42	.75506	4.45	.78050	4.70
44	.75595	4.40	.78144	4.70
46	.75683	4.45	.78238	4.65
48	.75772	4.40	.78331	4.70
50	8.75860	4.40	8.78425	4.70
52	.75948	4.40	.78519	4.65
54	.76036	4.40	.78612	4.70
56	.76124	4.40	.78706	4.65
58	.76212	4.40	.78799	4.65
60	8.76300	4.35	8.78892	4.65
62	.76387	4.40	.78985	4.65
64	.76475	4.40	.79078	4.65
66	.76563	4.35	.79171	4.65
68	.76650	4.35	.79264	4.65
70	8.76737	4.40	8.79357	4.60
72	.76825	4.35	.79449	4.65
74	.76912	4.35	.79542	4.65
76	.76999	4.35	.79635	4.60
78	.77086	4.35	.79727	4.60
80	8.77173	4.35	8.79819	4.65
82	.77260	4.30	.79912	4.60
84	.77346	4.35	.80004	4.60
86	.77433	4.35	.80096	4.60
88	.77520	4.30	.80188	4.60
90	8.77606	4.30	8.80280	4.60
92	.77692	4.35	.80372	4.60
94	.77779	4.30	.80464	4.55
96	.77865	4.30	.80555	4.60
98	.77951	4.30	.80647	4.55
100	8.78037		8.80738	

Hundredths	20° Vers	Diff. .001	20° Exsec	Diff. .001	Hundredths	21° Vers	Diff. .001	21° Exsec	Diff. .001
00	8.78037	4.30	8.80738	4.60	**00**	8.82230	4.05	8.85214	4.40
02	.78123	4.30	.80830	4.55	**02**	.82311	4.10	.85302	4.40
04	.78209	4.30	.80921	4.60	**04**	.82393	4.10	.85390	4.35
06	.78295	4.25	.81013	4.55	**06**	.82475	4.05	.85477	4.35
08	.78380	4.30	.81104	4.55	**08**	.82556	4.10	.85564	4.40
10	8.78466	4.25	8.81195	4.55	**10**	8.82638	4.05	8.85652	4.35
12	.78551	4.30	.81286	4.55	**12**	.82719	4.05	.85739	4.35
14	.78637	4.25	.81377	4.55	**14**	.82800	4.05	.85826	4.35
16	.78722	4.25	.81468	4.55	**16**	.82881	4.10	.85913	4.35
18	.78807	4.25	.81559	4.50	**18**	.82963	4.05	.86000	4.35
20	8.78892	4.25	8.81649	4.55	**20**	8.83044	4.05	8.86087	4.35
22	.78977	4.25	.81740	4.55	**22**	.83125	4.00	.86174	4.35
24	.79062	4.25	.81831	4.50	**24**	.83205	4.05	.86261	4.30
26	.79147	4.25	.81921	4.50	**26**	.83286	4.05	.86347	4.35
28	.79232	4.25	.82011	4.55	**28**	.83367	4.05	.86434	4.30
30	8.79317	4.25	8.82102	4.50	**30**	8.83448	4.00	8.86520	4.35
32	.79402	4.20	.82192	4.50	**32**	.83528	4.05	.86607	4.30
34	.79486	4.25	.82282	4.50	**34**	.83609	4.00	.86693	4.35
36	.79571	4.20	.82372	4.50	**36**	.83689	4.00	.86780	4.30
38	.79655	4.20	.82462	4.50	**38**	.83769	4.05	.86866	4.30
40	8.79739	4.20	8.82552	4.50	**40**	8.83850	4.00	8.86952	4.30
42	.79823	4.25	.82642	4.50	**42**	.83930	4.00	.87038	4.25
44	.79908	4.20	.82732	4.50	**44**	.84010	4.00	.87123	4.35
46	.79992	4.20	.82822	4.45	**46**	.84090	4.00	.87210	4.30
48	.80076	4.15	.82911	4.50	**48**	.84170	4.00	.87296	4.30
50	8.80159	4.20	8.83001	4.45	**50**	8.84250	4.00	8.87382	4.30
52	.80243	4.20	.83090	4.50	**52**	.84330	4.00	.87468	4.30
54	.80327	4.20	.83180	4.45	**54**	.84410	3.95	.87554	4.25
56	.80411	4.15	.83269	4.45	**56**	.84489	4.00	.87639	4.30
58	.80494	4.20	.83358	4.45	**58**	.84569	3.95	.87725	4.25
60	8.80578	4.15	8.83447	4.45	**60**	8.84648	4.00	8.87810	4.30
62	.80661	4.15	.83536	4.45	**62**	.84728	3.95	.87896	4.25
64	.80744	4.15	.83625	4.45	**64**	.84807	3.95	.87981	4.30
66	.80827	4.15	.83714	4.45	**66**	.84886	4.00	.88067	4.25
68	.80911	4.15	.83803	4.45	**68**	.84966	3.95	.88152	4.25
70	8.80994	4.15	8.83892	4.45	**70**	8.85045	3.95	8.88237	4.25
72	.81077	4.10	.83981	4.40	**72**	.85124	3.95	.88322	4.25
74	.81159	4.15	.84069	4.45	**74**	.85203	3.95	.88407	4.25
76	.81242	4.15	.84158	4.40	**76**	.85282	3.90	.88492	4.25
78	.81325	4.15	.84246	4.45	**78**	.85360	3.95	.88577	4.20
80	8.81408	4.10	8.84335	4.40	**80**	8.85439	3.95	8.88661	4.25
82	.81490	4.15	.84423	4.40	**82**	.85518	3.90	.88746	4.25
84	.81573	4.10	.84511	4.40	**84**	.85596	3.95	.88831	4.25
86	.81655	4.10	.84599	4.40	**86**	.85675	3.95	.88916	4.20
88	.81737	4.15	.84687	4.40	**88**	.85754	3.90	.89000	4.25
90	8.81820	4.10	8.84775	4.40	**90**	8.85832	3.90	8.89085	4.20
92	.81902	4.10	.84863	4.40	**92**	.85910	3.90	.89169	4.25
94	.81984	4.10	.84951	4.40	**94**	.85988	3.95	.89254	4.20
96	.82066	4.10	.85039	4.40	**96**	.86067	3.90	.89338	4.20
98	.82148	4.10	.85127	4.35	**98**	.86145	3.90	.89422	4.20
100	8.82230		8.85214		**100**	8.86223		8.89506	

Hundredths	22° Vers	Diff. .001	22° Exsec	Diff. .001	Hundredths	23° Vers	Diff. .001	23° Exsec	Diff. .001
00	8.86223	3.90	8.89506	4.20	**00**	8.90034	3.75	8.93631	4.05
02	.86301	3.90	.89590	4.20	**02**	.90109	3.70	.93712	4.05
04	.86379	3.85	.89674	4.20	**04**	.90183	3.70	.93793	4.05
06	.86456	3.90	.89758	4.20	**06**	.90257	3.75	.93874	4.05
08	.86534	3.90	.89842	4.20	**08**	.90332	3.70	.93955	4.00
10	8.86612	3.85	8.89926	4.20	**10**	8.90406	3.70	8.94035	4.05
12	.86689	3.90	.90010	4.15	**12**	.90480	3.70	.94116	4.05
14	.86767	3.85	.90093	4.20	**14**	.90554	3.70	.94197	4.00
16	.86844	3.90	.90177	4.20	**16**	.90628	3.70	.94277	4.05
18	.86922	3.85	.90261	4.15	**18**	.90702	3.70	.94358	4.00
20	8.86999	3.85	8.90344	4.15	**20**	8.90776	3.70	8.94438	4.00
22	.87076	3.85	.90427	4.20	**22**	.90850	3.65	.94518	4.05
24	.87153	3.90	.90511	4.15	**24**	.90923	3.70	.94599	4.00
26	.87231	3.85	.90594	4.15	**26**	.90997	3.70	.94679	4.00
28	.87308	3.85	.90677	4.20	**28**	.91071	3.65	.94759	4.00
30	8.87385	3.80	8.90761	4.15	**30**	8.91144	3.70	8.94839	4.00
32	.87461	3.85	.90844	4.15	**32**	.91218	3.65	.94919	4.00
34	.87538	3.85	.90927	4.15	**34**	.91291	3.65	.94999	4.00
36	.87615	3.85	.91010	4.15	**36**	.91365	3.65	.95079	4.00
38	.87692	3.80	.91093	4.10	**38**	.91448	3.65	.95169	3.95
40	8.87768	3.85	8.91175	4.15	**40**	8.91511	3.65	8.95238	4.00
42	.87845	3.80	.91258	4.15	**42**	.91584	3.65	.95318	4.00
44	.87921	3.85	.91341	4.10	**44**	.91657	3.65	.95398	4.00
46	.87998	3.80	.91423	4.15	**46**	.91730	3.65	.95478	3.95
48	.88074	3.80	.91506	4.15	**48**	.91803	3.65	.95557	4.00
50	8.88150	3.80	8.91589	4.10	**50**	8.91876	3.65	8.95637	3.95
52	.88226	3.80	.91671	4.10	**52**	.91949	3.65	.95716	3.95
54	.88302	3.80	.91753	4.15	**54**	.92022	3.65	.95795	4.00
56	.88378	3.80	.91836	4.10	**56**	.92095	3.60	.95875	3.95
58	.88454	3.80	.91918	4.10	**58**	.92167	3.65	.95954	3.95
60	8.88530	3.80	8.92000	4.10	**60**	8.92240	3.65	8.96033	3.95
62	.88606	3.80	.92082	4.15	**62**	.92313	3.60	.96112	4.00
64	.88682	3.80	.92165	4.10	**64**	.92385	3.60	.96192	3.95
66	.88758	3.75	.92247	4.05	**66**	.92457	3.65	.96271	3.95
68	.88833	3.80	.92328	4.10	**68**	.92530	3.60	.96350	3.90
70	8.88909	3.75	8.92410	4.10	**70**	8.92602	3.60	8.96428	3.95
72	.88984	3.80	.92492	4.10	**72**	.92674	3.60	.96507	3.95
74	.89060	3.75	.92574	4.10	**74**	.92746	3.60	.96586	3.95
76	.89135	3.75	.92656	4.05	**76**	.92818	3.65	.96665	3.95
78	.89210	3.80	.92737	4.10	**78**	.92891	3.55	.96744	3.90
80	8.89286	3.75	8.92819	4.05	**80**	8.92962	3.60	8.96822	3.95
82	.89361	3.75	.92900	4.10	**82**	.93034	3.60	.96901	3.90
84	.89436	3.75	.92982	4.05	**84**	.93106	3.60	.96979	3.95
86	.89511	3.75	.93063	4.10	**86**	.93178	3.60	.97058	3.90
88	.89586	3.75	.93145	4.05	**88**	.93250	3.55	.97136	3.95
90	8.89661	3.70	8.93226	4.05	**90**	8.93321	3.60	8.97215	3.90
92	.89735	3.75	.93307	4.05	**92**	.93393	3.60	.97293	3.90
94	.89810	3.75	.93388	4.05	**94**	.93465	3.55	.97371	3.95
96	.89885	3.75	.93469	4.05	**96**	.93536	3.55	.97450	3.90
98	.89960	3.70	.93550	4.05	**98**	.93607	3.60	.97528	3.90
100	8.90034		8.93631		**100**	8.93679		8.97606	

Hundredths	24° Vers	Diff. .001	24° Exsec	Diff. .001	Hundredths	25° Vers	Diff. .001	25° Exsec	Diff. .001
00	8.93679	3.55	8.97606	3.90	**00**	8.97170	3.45	9.01443	3.75
02	.93750	3.55	.97684	3.90	**02**	.97239	3.40	.01518	3.80
04	.93821	3.55	.97762	3.90	**04**	.97307	3.40	.01594	3.75
06	.93892	3.60	.97840	3.90	**06**	.97375	3.40	.01669	3.75
08	.93964	3.55	.97918	3.85	**08**	.97443	3.45	.01744	3.75
10	8.94035	3.55	8.97995	3.90	**10**	8.97512	3.40	9.01819	3.80
12	.94106	3.55	.98073	3.90	**12**	.97580	3.40	.01895	3.75
14	.94177	3.50	.98151	3.90	**14**	.97648	3.40	.01970	3.75
16	.94247	3.55	.98229	3.85	**16**	.97716	3.40	.02045	3.75
18	.94318	3.55	.98306	3.90	**18**	.97784	3.35	.02120	3.75
20	8.94389	3.55	8.98384	3.85	**20**	8.97851	3.40	9.02195	3.75
22	.94460	3.50	.98461	3.90	**22**	.97919	3.40	.02270	3.75
24	.94530	3.55	.98539	3.85	**24**	97987	3.40	.02345	3.70
26	.94601	3.50	.98616	3.85	**26**	.98055	3.35	.02419	3.75
28	.94671	3.55	.98693	3.90	**28**	.98122	3.40	.02494	3.75
30	8.94742	3.50	8.98771	3.85	**30**	8.98190	3.35	9.02569	3.75
32	.94812	3.50	.98848	3.85	**32**	.98257	3.40	.02644	3.70
34	.94882	3.55	.98925	3.85	**34**	.98325	3.35	.02718	3.75
36	.94953	3.50	.99002	3.85	**36**	.98392	3.35	.02793	3.70
38	.95023	3.50	.99079	3.85	**38**	.98459	3.40	.02867	3.75
40	8.95093	3.50	8.99156	3.85	**40**	8.98527	3.35	9.02942	3.70
42	.95163	3.50	.99233	3.85	**42**	.98594	3.35	.03016	3.75
44	.95233	3.50	.99310	3.85	**44**	.98661	3.35	.03091	3.70
46	.95303	3.50	.99387	3.85	**46**	.98728	3.35	.03165	3.70
48	.95373	3.50	.99464	3.85	**48**	.98795	3.35	.03239	3.75
50	8.95443	3.50	8.99541	3.80	**50**	8.98862	3.35	9.03314	3.70
52	.95513	3.45	.99617	3.85	**52**	.98929	3.35	.03388	3.70
54	.95582	3.50	.99694	3.85	**54**	.98996	3.35	.03462	3.70
56	.95652	3.50	.99771	3.80	**56**	.99063	3.35	.03536	3.70
58	.95722	3.45	.99847	3.85	**58**	.99130	3.35	.03610	3.70
60	8.95791	3.50	8.99924	3.80	**60**	8.99197	3.30	9.03684	3.70
62	.95861	3.45	9.00000	3.80	**62**	.99263	3.35	.03758	3.70
64	.95930	3.50	.00076	3.85	**64**	.99330	3.35	.03832	3.70
66	.96000	3.45	.00153	3.80	**66**	.99397	3.30	.03906	3.70
68	.96069	3.45	.00229	3.80	**68**	.99463	3.35	.03980	3.70
70	8.96138	3.45	9.00305	3.85	**70**	8.99530	3 30	9.04054	3.65
72	.96207	3.50	.00382	3.80	**72**	.99596	3.35	.04127	3.70
74	.96277	3.45	.00458	3.80	**74**	.99663	3.30	.04201	3.70
76	.96346	3.45	.00534	3.80	**76**	.99729	3.30	.04275	3.65
78	.96415	3.45	.00610	3.80	**78**	.99795	3.30	.04348	3.70
80	8.96484	3.45	9.00686	3.80	**80**	8.99861	3.35	9.04422	3.65
82	.96553	3.40	.00762	3.80	**82**	.99928	3.30	.04495	3.70
84	.96621	3.45	.00838	3.75	**84**	.99994	3.30	.04569	3.65
86	.96690	3.45	.00913	3.80	**86**	9.00060	3.30	.04642	3.65
88	.96759	3.45	.00989	3.80	**88**	.00126	3.30	.04715	3.70
90	8.96828	3.40	9.01065	3.80	**90**	9.00192	3.30	9.04789	3.65
92	.96896	3.45	.01141	3.75	**92**	.00258	3.25	.04862	3.65
94	.96965	3.40	.01216	3.80	**94**	.00323	3.30	.04935	3.65
96	.97033	3.45	.01292	3.75	**96**	.00389	3.30	.05008	3.70
98	.97102	3.40	.01367	3.80	**98**	.00455	3.30	.05082	3.65
100	8.97170		9.01443		**100**	9.00521		9.05155	

Hundredths	26° Vers	Diff. .001	26° Exsec	Diff. .001	Hundredths	27° Vers	Diff. .001	27° Exsec	Diff. .001
00	9.00521	3.25	9.05155	3.65	**00**	9.03740	3.15	9.08752	3.55
02	.00586	3.30	.05228	3.65	02	.03803	3.15	.08823	3.55
04	.00652	3.25	.05301	3.65	04	.03866	3.15	.08894	3.50
06	.00717	3.30	.05374	3.60	06	.03929	3.15	.08964	3.55
08	.00783	3.25	.05446	3.65	08	.03992	3.15	.09035	3.55
10	9.00848	3.30	9.05519	3.65	10	9.04055	3.15	9.09106	3.50
12	.00914	3.25	.05592	3.65	12	.04118	3.15	.09176	3.55
14	.00979	3.25	.05665	3.65	14	.04181	3.15	.09247	3.55
16	.01044	3.25	.05738	3.60	16	.04244	3.10	.09318	3.50
18	.01109	3.30	.05810	3.65	18	.04306	3.15	.09388	3.55
20	9.01175	3.25	9.05883	3.60	**20**	9.04369	3.15	9.09459	3.50
22	.01240	3.25	.05955	3.65	22	.04432	3.10	.09529	3.50
24	.01305	3.25	.06028	3.65	24	.04494	3.15	.09599	3.55
26	.01370	3.25	.06101	3.60	26	.04557	3.10	.09670	3.50
28	.01435	3.25	.06173	3.60	28	.04619	3.15	.09740	3.50
30	9.01500	3.25	9.06245	3.65	30	9.04682	3.10	9.09810	3.55
32	.01565	3.20	.06318	3.60	32	.04744	3.15	.09881	3.50
34	.01629	3.25	.06390	3.60	34	.04807	3.10	.09951	3.50
36	.01694	3.25	.06462	3.65	36	.04869	3.10	.10021	3.50
38	.01759	3.25	.06535	3.60	38	.04931	3.10	.10091	3.50
40	9.01824	3.20	9.06607	3.60	**40**	9.04993	3.10	9.10161	3.50
42	.01888	3.25	.06679	3.60	42	.05055	3.15	.10231	3.50
44	.01953	3.20	.06751	3.60	44	.05118	3.10	.10301	3.50
46	.02017	3.25	.06823	3.60	46	.05180	3.10	.10371	3.50
48	.02082	3.20	.06895	3.65	48	.05242	3.10	.10441	3.50
50	9.02146	3.20	9.06968	3.55	50	9.05304	3.10	9.10511	3.50
52	.02210	3.25	.07039	3.60	52	05366	3.05	.10581	3.45
54	.02275	3.20	.07111	3.60	54	.05427	3.10	.10650	3.50
56	.02339	3.20	.07183	3.55	56	.05489	3.10	.10720	3.50
58	.02403	3.20	.07254	3.60	58	.05551	3.10	.10790	3.50
60	9.02467	3.20	9.07326	3.60	**60**	9.05613	3.10	9.10860	3.45
62	.02531	3.25	.07398	3.55	62	.05675	3.05	.10929	3.50
64	.02596	3.20	.07469	3.60	64	.05736	3.10	.10999	3.45
66	.02660	3.15	.07541	3.60	66	.05798	3.05	.11068	3.50
68	.02723	3.20	.07613	3.55	68	.05859	3.10	.11138	3.45
70	9.02787	3.20	9.07684	3.60	70	9.05921	3.05	9.11207	3.50
72	.02851	3.20	.07756	3.55	72	.05982	3.10	.11277	3.45
74	.02915	3.20	.07827	3.55	74	.06044	3.05	.11346	3.45
76	.02979	3.20	.07898	3.60	76	.06105	3.05	.11415	3.50
78	.03043	3.15	.07970	3.55	78	.06166	3.10	.11485	3.45
80	9.03106	3.20	9.08041	3.55	**80**	9.06228	3.05	9.11554	3.45
82	.03170	3.15	.08112	3.60	82	.06289	3.05	.11623	3 45
84	.03233	3.20	.08184	3.55	84	.06350	3.05	.11692	3.50
86	.03297	3.15	.08255	3.55	86	.06411	3.05	.11762	3.45
88	.03360	3.20	.08326	3.55	88	.06472	3.05	.11831	3.45
90	9.03424	3.15	9.08397	3.55	90	9.06533	3.05	9.11900	3.45
92	.03487	3.15	.08468	3.55	92	.06594	3.05	.11969	3.45
94	.03550	3.20	.08539	3.55	94	.06655	3.05	.12038	3.45
96	.03614	3.15	.08610	3.55	96	.06716	3.05	.12107	3.45
98	.03677	3.15	.08681	3.55	98	.06777	3.05	.12176	3.45
100	9.03740		9.08752		**100**	9.06838		9.12245	

Hundredths	28° Vers	Diff. .001	28° Exsec	Diff. .001	Hundredths	29° Vers	Diff. .001	29° Exsec	Diff. .001
00	9.06838	3.05	9.12245	3.40	**00**	9.09823	2.95	9.15641	3.35
02	.06899	3.05	.12313	3.45	**02**	.09882	2.90	.15708	3.35
04	.06960	3.00	.12382	3.45	**04**	.09940	2.95	.15775	3.35
06	.07020	3.05	.12451	3.45	**06**	.09999	2.90	.15842	3.35
08	.07081	3.00	.12520	3.40	**08**	.10057	2.90	.15909	3.35
10	9.07141	3.05	9.12588	3 45	**10**	9 10115	2 95	9.15976	3 35
12	07202	3.05	12657	3.45	**12**	.10174	2.90	.16043	3.30
14	.07263	3.00	.12726	3.40	**14**	.10232	2.95	.16109	3.35
16	.07323	3.00	.12794	3.45	**16**	.10291	2.90	.16176	3.35
18	.07383	3.05	.12863	3.40	**18**	.10349	2.90	.16243	3.30
20	9.07444	3.00	9.12931	3.45	**20**	9.10407	2.90	9.16309	3.35
22	.07504	3.00	.13000	3.40	**22**	.10465	2.90	.16376	3.35
24	.07564	3.05	.13068	3.45	**24**	.10523	2.90	.16443	3.30
26	.07625	3.00	.13137	3.40	**26**	.10581	2.90	.16509	3.35
28	.07685	3.00	.13205	3.40	**28**	.10639	2.90	.16576	3.30
30	9.07745	3.00	9.13273	3.40	**30**	9.10697	2.90	9.16642	3.35
32	.07805	3.00	.13341	3.45	**32**	.10755	2.90	.16709	3.30
34	.07865	3.00	.13410	3.40	**34**	.10813	2.90	.16775	3.35
36	.07925	3.00	.13478	3.40	**36**	.10871	2.90	.16842	3.30
38	.07985	3.00	.13546	3.40	**38**	.10929	2.90	.16908	3.30
40	9.08045	3.00	9.13614	3.40	**40**	9.10987	2.90	9.16974	3.35
42	.08105	3.00	.13682	3.40	**42**	.11045	2.85	.17041	3.30
44	.08165	3.00	.13750	3.40	**44**	.11102	2.90	.17107	3.30
46	.08225	2.95	.13818	3.40	**46**	.11160	2.90	.17173	3.30
48	.08284	3.00	.13886	3.40	**48**	.11218	2.85	.17239	3.35
50	9.08344	3.00	9.13954	3.40	**50**	9.11275	2.90	9.17306	3.30
52	.08404	2.95	.14022	3.40	**52**	.11333	2.85	.17372	3.30
54	.08463	3.00	.14090	3.40	**54**	.11390	2.90	.17438	3.30
56	.08523	3.00	.14158	3.40	**56**	.11448	2.85	.17504	3.30
58	.08583	2.95	.14226	3.35	**58**	.11505	2.90	.17570	3.30
60	9.08642	2.95	9.14293	3.40	**60**	9.11563	2.85	9.17636	3.30
62	.08701	3.00	.14361	3.40	**62**	.11620	2.85	.17702	3.30
64	.08761	2.95	.14429	3.35	**64**	.11677	2.85	.17768	3.30
66	.08820	3.00	.14496	3.40	**66**	.11735	2.85	.17834	3.30
68	.08880	2.95	.14564	3.40	**68**	.11792	2.85	.17900	3.30
70	9.08939	2.95	9.14632	3.35	**70**	9.11849	2.85	9.17966	3.25
72	.08998	2.95	.14699	3.40	**72**	.11906	2.85	.18031	3.30
74	.09057	2.95	.14767	3.35	**74**	.11963	2.85	.18097	3.30
76	.09116	3.00	.14834	3.40	**76**	.12020	2.85	.18163	3.30
78	.09176	2.95	.14902	3.35	**78**	.12077	2.85	.18229	3.25
80	9.09235	2.95	9.14969	3.35	**80**	9.12134	2.85	9.18294	3.30
82	.09294	2.95	.15036	3.40	**82**	.12191	2.85	.18360	3.30
84	.09353	2.95	.15104	3.35	**84**	.12248	2.85	.18426	3.25
86	.09412	2.90	.15171	3.35	**86**	.12305	2.85	.18491	3.30
88	.09470	2.95	.15238	3.35	**88**	.12362	2.85	.18557	3.25
90	9.09529	2.95	9.15305	3.40	**90**	9.12419	2.85	9.18622	3.30
92	.09588	2.95	.15373	3.35	**92**	.12476	2.80	.18688	3.25
94	.09647	2.95	.15440	3.35	**94**	.12532	2.85	.18753	3.25
96	.09706	2.90	.15507	3.35	**96**	.12589	2.85	.18818	3.30
98	.09764	2.95	.15574	3.35	**98**	.12646	2.80	.18884	3.25
100	9.09823		9.15641		**100**	9.12702		9.18949	

TABLE XXVI. — (*Continued*)

Hundredths	30° Vers	Diff. .001	30° Exsec	Diff. .001	Hundredths	31° Vers	Diff. .001	31° Exsec	Diff. .001
00	9.12702	2.85	9.18949	3.25	**00**	9.15483	2.70	9.22176	3.20
02	.12759	2.80	.19014	3.30	02	.15537	2.75	.22240	3.20
04	.12815	2.85	.19080	3.25	04	.15592	2.75	.22304	3.15
06	.12872	2.80	.19145	3.25	06	.15647	2.70	.22367	3.20
08	.12928	2.85	.19210	3.25	08	.15701	2.75	.22431	3.20
10	9.12985	2.80	9.19275	3.30	10	9.15756	2.70	9.22495	3.15
12	.13041	2.80	.19341	3.25	12	.15810	2.75	.22558	3.20
14	.13097	2.80	.19406	3.25	14	.15865	2.70	.22622	3.15
16	.13154	2.80	.19471	3.25	16	.15919	2.70	.22685	3.20
18	.13210	2.80	.19536	3.25	18	.15973	2.75	.22749	3.15
20	9.13266	2.80	9.19601	3.25	**20**	9.16028	2.70	9.22812	3.20
22	.13322	2.80	.19666	3.25	22	.16082	2.70	.22876	3.15
24	.13378	2.80	.19731	3.25	24	.16136	2.70	.22939	3.20
26	.13434	2.80	.19796	3.25	26	.16190	2.70	.23003	3.15
28	.13490	2.80	.19861	3.25	28	.16244	2.75	.23066	3.15
30	9.13546	2.80	9.19926	3.20	30	9.16299	2.70	9.23129	3.20
32	.13602	2.80	.19990	3.25	32	.16353	2.70	.23193	3.15
34	.13658	2.80	.20055	3.25	34	.16407	2.70	.23256	3.15
36	.13714	2.80	.20120	3.25	36	.16461	2.70	.23319	3.20
38	.13770	2.80	.20185	3.20	38	.16515	2.70	.23383	3.15
40	9.13826	2.80	9.20249	3.25	**40**	9.16569	2.70	9.23446	3.15
42	.13882	2.75	.20314	3.25	42	.16623	2.65	.23509	3.15
44	.13937	2.80	.20379	3.20	44	.16676	2.70	.23572	3.15
46	.13993	2.80	.20443	3.25	46	.16730	2.70	.23635	3.15
48	.14049	2.75	.20508	3.20	48	.16784	2.70	.23698	3.15
50	9.14104	2.80	9.20572	3.25	50	9.16838	2.70	9.23761	3.15
52	.14160	2.80	.20637	3.20	52	.16892	2.65	.23824	3.15
54	.14216	2.75	.20701	3.25	54	.16945	2.70	.23887	3.15
56	.14271	2.80	.20766	3.20	56	.16999	2.70	.23950	3.15
58	.14327	2.75	.20830	3.25	58	.17053	2.65	.24013	3.15
60	9.14382	2.75	9.20895	3.20	**60**	9.17106	2.70	9.24076	3.15
62	.14437	2.80	.20959	3.20	62	.17160	2.65	.24139	3.15
64	.14493	2.75	.21023	3.25	64	.17213	2.70	.24202	3.15
66	.14548	2.75	.21088	3.20	66	.17267	2.65	.24265	3.15
68	.14603	2.80	.21152	3.20	68	.17320	2.70	.24328	3.10
70	9.14659	2.75	9.21216	3.20	70	9.17374	2.65	9.24390	3.15
72	.14714	2.75	.21280	3.25	72	.17427	2.65	.24453	3.15
74	.14769	2.75	.21345	3.20	74	.17480	2.70	.24516	3.10
76	.14824	2.75	.21409	3.20	76	.17534	2.65	.24578	3.15
78	.14879	2.75	.21473	3.20	78	.17587	2.65	.24641	3.15
80	9.14934	2.75	9.21537	3.20	**80**	9.17640	2.65	9.24704	3.10
82	.14989	2.75	.21601	3.20	82	.17693	2.70	.24766	3.15
84	.15044	2.75	.21665	3.20	84	.17747	2.65	.24829	3.10
86	.15099	2.75	.21729	3.20	86	.17800	2.65	.24891	3.15
88	.15154	2.75	.21793	3.20	88	.17853	2.65	.24954	3.15
90	9.15209	2.75	9.21857	3.20	90	9.17906	2.65	9.25017	3.10
92	.15264	2.75	.21921	3.20	92	.17959	2.65	.25079	3.10
94	.15319	2.70	.21985	3.20	94	.18012	2.65	.25141	3.15
96	.15373	2.75	.22049	3.15	96	.18065	2.65	.25204	3.10
98	.15428	2.75	.22112	3.20	98	.18118	2.65	.25266	3.15
100	9.15483		9.22176		**100**	9.18171		9.25329	

Hundredths	32° Vers	Diff. .001	32° Exsec	Diff. .001	Hundredths	33° Vers	Diff. .001	33° Exsec	Diff. .001
00	9.18171	2.60	9.25329	3.10	00	9.20771	2.60	9.28412	3.05
02	.18223	2.65	.25391	3.10	02	.20823	2 55	.28473	3.05
04	.18276	2.65	.25453	3.10	04	.20874	2.55	.28534	3.05
06	.18329	2.65	.25515	3.15	06	.20925	2.55	.28595	3.05
08	.18382	2.65	.25578	3.10	08	.20976	2.55	.28656	3.05
10	9.18435	2.60	9.25640	3.10	10	9.21027	2.55	9.28717	3.05
12	.18487	2.65	.25702	3.10	12	.21078	2.55	.28778	3.05
14	.18540	2.60	.25764	3.10	14	.21129	2.55	.28839	3.05
16	.18592	2.65	.25826	3.15	16	.21180	2.55	.28900	3.05
18	.18645	2.65	.25889	3.10	18	.21231	2.55	.28961	3.00
20	9.18698	2.60	9.25951	3.10	20	9.21282	2.50	9.29021	3.05
22	.18750	2.65	.26013	3.10	22	.21332	2.55	.29082	3.05
24	.18803	2.60	.26075	3.10	24	.21383	2.55	.29143	3.00
26	.18855	2.60	.26137	3.10	26	.21434	2.55	.29203	3.05
28	.18907	2.65	.26199	3.10	28	.21485	2.50	.29264	3.05
30	9.18960	2.60	9.26261	3.10	30	9.21535	2.55	9.29325	3.00
32	.19012	2.60	.26323	3.05	32	.21586	2.55	.29385	3.05
34	.19064	2.65	.26384	3.10	34	.21637	2.50	.29446	3.05
36	.19117	2.60	.26446	3.10	36	.21687	2.55	.29507	3.00
38	.19169	2.60	.26508	3.10	38	.21738	2.50	.29567	3.05
40	9.19221	2.60	9.26570	3.10	40	9.21788	2.55	9.29628	3.00
42	.19273	2.60	.26632	3.10	42	.21839	2.50	.29688	3.05
44	.19325	2.60	.26694	3.05	44	.21889	2.55	.29749	3.00
46	.19377	2.65	.26755	3.10	46	.21940	2.50	.29809	3.05
48	.19430	2.60	.26817	3.10	48	.21990	2.55	.29870	3.00
50	9.19482	2.60	9.26879	3.05	50	9.22041	2.50	9.29930	3.00
52	.19534	2.60	.26940	3.10	52	.22091	2.50	29990	3.05
54	.19586	2.55	.27002	3.10	54	.22141	2.55	.30051	3.00
56	.19637	2.60	.27064	3.05	56	.22192	2.50	.30111	3.00
58	.19689	2.60	.27125	3.10	58	.22242	2.50	.30171	3.05
60	9.19741	2.60	9.27187	3.05	60	9.22292	2.50	9.30232	3.00
62	.19793	2.60	.27248	3.10	62	.22342	2.50	.30292	3.00
64	.19845	2.60	.27310	3.05	64	.22392	2.50	.30352	3.00
66	.19897	2.55	.27371	3.10	66	.22442	2.55	.30412	3.05
68	.19948	2.60	.27433	3.05	68	.22493	2.50	.30473	3.00
70	9.20000	2 60	9.27494	3.05	70	9.22543	2.50	9.30533	3.00
72	.20052	2.55	.27555	3.10	72	.22593	2.50	.30593	3.00
74	.20103	2.55	.27617	3.05	74	.22643	2.50	.30653	3.00
76	.20155	2.55	.27678	3.05	76	.22693	2.50	.30713	3.00
78	.20206	2.60	.27739	3.10	78	.22743	2.50	.30773	3.00
80	9.20258	2.55	9.27801	3.05	80	9.22793	2.50	9.30833	3.00
82	.20309	2.60	.27862	3.05	82	.22843	2.45	.30893	3.00
84	.20361	2.55	.27923	3.05	84	.22892	2.50	.30953	3.00
86	.20412	2.60	.27984	3.10	86	.22942	2.50	.31013	3.00
88	.20464	2.55	.28046	3.05	88	.22992	2.50	.31073	3.00
90	9.20515	2.55	9.28107	3.05	90	9.23042	2.45	9.31133	3.00
92	.20566	2.60	.28168	3.05	92	.23091	2.50	.31193	3.00
94	.20618	2.55	.28229	3.05	94	.23141	2.50	.31253	3.00
96	.20669	2.55	.28290	3.05	96	.23191	2.45	.31313	3.00
98	.20720	2.55	.28351	3.05	98	.23240	2.50	.31373	3.00
100	9.20771		9.28412		100	9.23290		9.31433	

Hundredths	34° Vers	Diff. .001	34° Exsec	Diff. .001	Hundredths	35° Vers	Diff. .001	35° Exsec	Diff. .001
00	9.23290	2.50	9.31433	2.95	**00**	9.25731	2.40	9.34395	2.95
02	.23340	2.45	.31492	3.00	**02**	.25779	2.40	.34454	2.90
04	.23389	2.50	.31552	3.00	**04**	.25827	2.40	.34512	2.95
06	.23439	2.45	.31612	3.00	**06**	.25875	2.40	.34571	2.95
08	.23488	2.50	.31672	2.95	**08**	.25923	2.40	.34630	2.90
10	9.23538	2.45	9.31731	3.00	**10**	9.25971	2.40	9.34688	2.95
12	.23587	2.45	.31791	3.00	**12**	.26019	2.40	.34747	2 90
14	.23636	2.50	.31851	2.95	**14**	.26067	2.40	.34805	2.95
16	.23686	2.45	.31910	3.00	**16**	.26115	2.40	.34864	2.90
18	.23735	2.45	.31970	3.00	**18**	.26163	2.40	.34922	2.95
20	9.23784	2.50	9.32030	2.95	**20**	9.26211	2.35	9.34981	2.90
22	.23834	2.45	.32089	3.00	**22**	.26258	2.40	.35039	2.95
24	.23883	2.45	.32149	2.95	**24**	.26306	2.40	.35098	2.90
26	.23932	2.45	.32208	3.00	**26**	.26354	2.40	.35156	2.95
28	.23981	2.45	.32268	2.95	**28**	.26402	2.35	.35215	2.90
30	9.24030	2.45	9.32327	3.00	**30**	9.26449	2.40	9.35273	2.90
32	.24079	2.50	.32387	2.95	**32**	.26497	2.40	.35331	2.95
34	.24129	2.45	.32446	3.00	**34**	.26545	2.35	.35390	2.90
36	.24178	2.45	.32506	2.95	**36**	.26592	2.40	.35448	2.90
38	.24227	2.45	.32565	2.95	**38**	.26640	2.35	.35506	2.95
40	9.24276	2.45	9.32624	3.00	**40**	9.26687	2.40	9.35565	2.90
42	.24325	2.45	.32684	2.95	**42**	.26735	2.35	.35623	2.90
44	.24374	2.40	.32743	2.95	**44**	.26782	2.40	.35681	2.90
46	.24422	2.45	.32802	2.95	**46**	.26830	2.35	.35739	2.95
48	.24471	2.45	.32861	3.00	**48**	.26877	2.35	.35798	2.90
50	9.24520	2.45	9.32921	2.95	**50**	9.26924	2.40	9.35856	2.90
52	.24569	2.45	.32980	2.95	**52**	.26972	2.35	.35914	2.90
54	.24618	2.40	.33039	2.95	**54**	.27019	2.35	.35972	2.90
56	.24666	2.45	.33098	3.00	**56**	.27066	2.40	.36030	2.90
58	.24715	2.45	.33158	2.95	**58**	.27114	2.35	.36088	2.90
60	9.24764	2.45	9.33217	2.95	**60**	9.27161	2.35	9.36146	2.90
62	.24813	2.40	.33276	2.95	**62**	.27208	2.35	.36204	2.90
64	.24861	2.45	.33335	2.95	**64**	.27255	2.35	.36262	2.90
66	.24910	2.40	.33394	2.95	**66**	.27302	2.35	.36320	2.90
68	24958	2.45	.33453	2.95	**68**	.27349	2.35	.36378	2.90
70	9.25007	2.40	9.33512	2.95	**70**	9.27396	2.40	9.36436	2.90
72	.25055	2.45	.33571	2.95	**72**	.27444	2.35	.36494	2.90
74	.25104	2.40	.33630	2.95	**74**	.27491	2.35	.36552	2.90
76	.25152	2.45	.33689	2.95	**76**	.27538	2.35	.36610	2.90
78	.25201	2.40	.33748	2.95	**78**	.27585	2.35	.36668	2.90
80	9.25249	2.40	9.33807	2.95	**80**	9.27632	2.30	9.36726	2.90
82	.25297	2.45	.33866	2.95	**82**	.27678	2.35	.36784	2.90
84	.25346	2.40	.33925	2.95	**84**	.27725	2.35	.36842	2.90
86	.25394	2.40	.33984	2.90	**86**	.27772	2.35	.36900	2.85
88	.25442	2.45	.34042	2.95	**88**	.27819	2.35	.36957	2.90
90	9.25491	2.40	9.34101	2.95	**90**	9.27866	2.35	9.37015	2.90
92	.25539	2.40	.34160	2.95	**92**	.27913	2.30	.37073	2.90
94	.25587	2.40	.34219	2.90	**94**	.27959	2.35	.37131	2.85
96	.25635	2.40	.34277	2.95	**96**	.28006	2.35	.37188	2.90
98	.25683	2.40	.34336	2.95	**98**	.28053	2.30	.37246	2.90
100	9.25731		9.34395		**100**	9.28099		9.37304	

TABLE XXVI. — (*Continued*)

Hundredths	36° Vers	Diff. .001	36° Exsec	Diff. .001	Hundredths	37° Vers	Diff. .001	37° Exsec	Diff. .001
00	9.28099	2.35	9.37304	2.85	**00**	9.30398	2.30	9.40163	2.85
02	.28146	2.35	.37361	2.90	**02**	.30444	2.25	.40220	2.85
04	.28193	2.30	.37419	2.90	**04**	.30489	2.25	.40277	2.85
06	.28239	2.35	.37477	2.85	**06**	.30534	2.25	.40334	2.80
08	.28286	2.30	.37534	2.90	**08**	.30579	2.25	.40390	2.85
10	9.28332	2.35	9.37592	2.85	**10**	9.30624	2.30	9.40447	2.80
12	.28379	2.30	.37649	2.90	**12**	.30670	2.25	.40503	2.85
14	.28425	2.35	.37707	2.85	**14**	.30715	2.25	.40560	2.85
16	.28472	2.30	.37764	2.90	**16**	.30760	2.25	.40617	2.80
18	.28518	2.35	.37822	2.85	**18**	.30805	2.25	.40673	2.85
20	9.28565	2.30	9.37879	2.90	**20**	9.30850	2.25	9.40730	2.80
22	.28611	2.30	.37937	2.85	**22**	.30895	2.25	.40786	2.85
24	.28657	2.35	.37994	2.90	**24**	.30940	2.25	.40843	2.80
26	.28704	2.30	.38052	2.85	**26**	.30985	2.25	.40899	2.85
28	.28750	2.30	.38109	2.90	**28**	.31030	2.25	.40956	2.80
30	9.28796	2.30	9.38167	2.85	**30**	9.31075	2.25	9.41012	2.85
32	.28842	2.35	.38224	2.85	**32**	.31120	2.25	.41069	2.80
34	.28889	2.30	.38281	2.90	**34**	.31165	2.25	.41125	2.85
36	.28935	2.30	.38339	2.85	**36**	.31210	2.20	.41182	2.80
38	.28981	2.30	.38396	2.85	**38**	.31254	2.25	.41238	2.80
40	9.29027	2.30	9.38453	2.90	**40**	9.31299	2.25	9.41294	2.85
42	.29073	2.30	.38511	2.85	**42**	.31344	2.25	.41351	2.80
44	.29119	2.30	.38568	2.85	**44**	.31389	2.20	.41407	2.85
46	.29165	2.30	.38625	2.85	**46**	.31433	2.25	.41464	2.80
48	.29211	2.30	.38682	2.85	**48**	.31478	2.25	.41520	2.80
50	9.29257	2.30	9.38739	2.90	**50**	9.31523	2.20	9.41576	2.80
52	.29303	2.30	.38797	2.85	**52**	.31567	2.25	.41632	2.85
54	.29349	2.30	.38854	2.85	**54**	.31612	2.25	.41689	2.80
56	.29395	2.30	.38911	2.85	**56**	.31657	2.20	.41745	2.80
58	.29441	2.30	.38968	2.85	**58**	.31701	2.25	.41801	2.80
60	9.29487	2.30	9.39025	2.85	**60**	9.31746	2.20	9.41857	2.85
62	.29533	2.25	.39082	2.85	**62**	.31790	2.25	.41914	2.80
64	.29578	2.30	.39139	2.85	**64**	.31835	2.20	.41970	2.80
66	.29624	2.30	.39196	2.85	**66**	.31879	2.25	.42026	2.80
68	.29670	2.30	.39253	2.85	**68**	.31924	2.20	.42082	2.80
70	9.29716	2.25	9.39310	2.85	**70**	9.31968	2.25	9.42138	2.80
72	.29761	2.30	.39367	2.85	**72**	.32013	2.20	.42194	2.80
74	.29807	2.30	.39424	2.85	**74**	.32057	2.20	.42250	2.85
76	.29853	2.25	.39481	2.85	**76**	.32101	2.25	.42307	2.80
78	.29898	2.30	.39538	2.85	**78**	.32146	2.20	.42363	2.80
80	9.29944	2.25	9.39595	2.85	**80**	9.32190	2.20	9.42419	2.80
82	.29989	2.30	.39652	2.85	**82**	.32234	2.20	.42475	2.80
84	.30035	2.25	.39709	2.85	**84**	.32278	2.25	.42531	2.80
86	.30080	2.30	.39766	2.85	**86**	.32323	2.20	.42587	2.80
88	.30126	2.25	.39823	2.85	**88**	.32367	2.20	.42643	2.80
90	9.30171	2.30	9.39880	2.80	**90**	9.32411	2.20	9.42699	2.80
92	.30217	2.25	.39936	2.85	**92**	.32455	2.20	.42755	2.75
94	.30262	2.30	.39993	2.85	**94**	.32499	2.20	.42810	2.80
96	.30308	2.25	.40050	2.85	**96**	.32543	2.20	.42866	2.80
98	.30353	2.25	.40107	2.80	**98**	.32587	2.20	.42922	2.80
100	9.30398		9.40163		**100**	9.32631		9.42978	

Hundredths	38° Vers	Diff. .001	38° Exsec	Diff. .001	Hundredths	39° Vers	Diff. .001	39° Exsec	Diff. .001
00	9.32631	2.20	9.42978	2.80	**00**	9.34802	2.15	9.45752	2.75
02	.32675	2.20	.43034	2.80	**02**	.34845	2.15	.45807	2.75
04	.32719	2.20	.43090	2.80	**04**	.34888	2.10	.45862	2.75
06	.32763	2.20	.43146	2.80	**06**	.34930	2.15	.45917	2.75
08	.32807	2.20	.43202	2.75	**08**	.34973	2.15	.45972	2.75
10	9.32851	2.20	9.43257	2.80	**10**	9.35016	2.10	9.46027	2.75
12	.32895	2.20	.43313	2.80	**12**	.35058	2.15	.46082	2.75
14	.32939	2.20	.43369	2.80	**14**	.35101	2.15	.46137	2.75
16	.32983	2.20	.43425	2.75	**16**	.35144	2.10	.46192	2.75
18	.33027	2.15	.43480	2.80	**18**	.35186	2.15	.46247	2.75
20	9.33070	2.20	9.43536	2.80	**20**	9.35229	2.15	9.46302	2.75
22	.33114	2.20	.43592	2.75	**22**	.35272	2.10	.46357	2.75
24	.33158	2.20	.43647	2.80	**24**	.35314	2.15	.46412	2.75
26	.33202	2.15	.43703	2.80	**26**	.35357	2.10	.46467	2.75
28	.33245	2.20	.43759	2.75	**28**	.35399	2.15	.46522	2.70
30	9.33289	2.20	9.43814	2.80	**30**	9.35442	2.10	9.46576	2.75
32	.33333	2.15	.43870	2.80	**32**	.35484	2.10	.46631	2.75
34	.33376	2.20	.43926	2.75	**34**	.35526	2.15	.46686	2.75
36	.33420	2.15	.43981	2.80	**36**	.35569	2.10	.46741	2.75
38	.33463	2.20	.44037	2.75	**38**	.35611	2.15	.46796	2.75
40	9.33507	2.15	9.44092	2.80	**40**	9.35654	2.10	9.46851	2.70
42	.33550	2.20	.44148	2.75	**42**	.35696	2.10	.46905	2.75
44	.33594	2.15	.44203	2.80	**44**	.35738	2.10	.46960	2.75
46	.33637	2.20	.44259	2.75	**46**	.35780	2.15	.47015	2.75
48	.33681	2.15	.44314	2.80	**48**	.35823	2.10	.47070	2.70
50	9.33724	2.20	9.44370	2.75	**50**	9.35865	2.10	9.47124	2.75
52	.33768	2.15	.44425	2.80	**52**	.35907	2.10	.47179	2.75
54	.33811	2.15	.44481	2.75	**54**	.35949	2.10	.47234	2.70
56	.33854	2.20	.44536	2.80	**56**	.35991	2.15	.47288	2.75
58	.33898	2.15	.44592	2.75	**58**	.36034	2.10	.47343	2.75
60	9.33941	2.15	9.44647	2.75	**60**	9.36076	2.10	9.47398	2.70
62	.33984	2.20	.44702	2.80	**62**	.36118	2.10	.47452	2.75
64	.34028	2.15	.44758	2.75	**64**	.36160	2.10	.47507	2.75
66	.34071	2.15	.44813	2.75	**66**	.36202	2.10	.47562	2.70
68	.34114	2.15	.44868	2.80	**68**	.36244	2.10	.47616	2.75
70	9.34157	2.15	9.44924	2.75	**70**	9.36286	2.10	9.47671	2.70
72	.34200	2.20	.44979	2.75	**72**	.36328	2.10	.47725	2.75
74	.34244	2.15	.45034	2.80	**74**	.36370	2.10	.47780	2.70
76	.34287	2.15	.45090	2.75	**76**	.36412	2.10	.47834	2.75
78	.34330	2.15	.45145	2.75	**78**	.36454	2.10	.47889	2.75
80	9.34373	2.15	9.45200	2.75	**80**	9.36496	2.10	9.47944	2.70
82	.34416	2.15	.45255	2.80	**82**	.36538	2.05	.47998	2.75
84	.34459	2.15	.45311	2.75	**84**	.36579	2.10	.48053	2.70
86	.34502	2.15	.45366	2.75	**86**	.36621	2.10	.48107	2.70
88	.34545	2.15	.45421	2.75	**88**	.36663	2.10	.48161	2.75
90	9.34588	2.15	9.45476	2.75	**90**	9.36705	2.10	9.48216	2.70
92	.34631	2.15	.45481	2.75	**92**	.36747	2.05	.48270	2.75
94	.34674	2.10	.45586	2.80	**94**	.36788	2.10	.48325	2.70
96	.34716	2.15	.45642	2.75	**96**	.36830	2.10	.48379	2.70
98	.34759	2.15	.45697	2.75	**98**	.36872	2.05	.48433	2.75
100	9.34802		9.45752		**100**	9.36913		9.48488	

TABLE XXVI. — (*Continued*)

Hundredths	40° Vers	Diff. .001	40° Exsec	Diff. .001	Hundredths	41° Vers	Diff. .001	41° Exsec	Diff. .001
00	9.36913	2.10	9.48488	2.70	00	9.38968	2.05	9.51190	2.65
02	.36955	2.10	.48542	2.75	02	.39009	2.00	.51243	2.70
04	.36997	2.05	.48597	2.70	04	.39049	2.05	.51297	2.70
06	.37038	2.10	.48651	2.70	06	.39090	2.00	.51351	2.70
08	.37080	2.05	.48705	2.75	08	.39130	2.05	.51405	2.70
10	9.37121	2.10	9.48760	2.70	10	9.39171	2.00	9.51459	2.65
12	.37163	2.05	.48814	2.70	12	.39211	2.00	.51512	2.70
14	.37204	2.10	.48868	2.70	14	.39251	2.05	.51566	2.65
16	.37246	2.05	.48922	2.75	16	.39292	2.00	.51619	2.70
18	.37287	2.10	.48977	2.70	18	.39332	2.00	.51673	2.70
20	9.37329	2.05	.49031	2.70	20	9.39372	2.05	9.51727	2.65
22	.37370	2.10	.49085	2.70	22	.39413	2.00	.51780	2.70
24	.37412	2.05	.49149	2.75	24	.39453	2.00	.51834	2.65
26	.37453	2.05	.49194	2.70	26	.39493	2.05	.51887	2.70
28	.37494	2.10	.49248	2.70	28	.39534	2.00	.51941	2.70
30	9.37536	2.05	9.49302	2.70	30	9.39574	2.00	9.51995	2.65
32	.37577	2.05	.49356	2.70	32	.39614	2.00	.52048	2.70
34	.37618	2.05	.49410	2.75	34	.39654	2.00	.52102	2.65
36	.37659	2.10	.49465	2.70	36	.39694	2.05	.52155	2.70
38	.37701	2.05	.49519	2.70	38	.39735	2.00	.52209	2.65
40	9.37742	2.05	9.49573	2.70	40	9.39775	2.00	9.52262	2.70
42	.37783	2.05	.49627	2.70	42	.39815	2.00	.52316	2.65
44	.37824	2.05	.49681	2.70	44	.39855	2.00	.52369	2.70
46	.37865	2.05	.49735	2.70	46	.39895	2.00	.52423	2.65
48	.37906	2.10	.49789	2.70	48	.39935	2.00	.52476	2.65
50	9.37948	2.05	9.49843	2.70	50	9.39975	2.00	9.52529	2.70
52	.37989	2.05	.49897	2.70	52	.40015	2.00	.52583	2.65
54	.38030	2.05	.49951	2.70	54	.40055	2.00	.52636	2.70
56	.38071	2.05	.50005	2.70	56	.40095	2.00	.52690	2.65
58	.38112	2.05	.50059	2.70	58	.40135	2.00	.52743	2.65
60	9.38153	2.05	9.50113	2.70	60	9.40175	2.00	9.52796	2.70
62	.38194	2.05	.50167	2.70	62	.40215	2.00	.52850	2.65
64	.38235	2.05	.50221	2.70	64	.40255	1.95	.52903	2.65
66	.38276	2.05	.50275	2.70	66	.40294	2.00	.52956	2.70
68	.38317	2.00	.50329	2.70	68	.40334	2.00	.53010	2.65
70	9.38357	2.05	9.50383	2.70	70	9.40374	2.00	9.53063	2.65
72	.38398	2.05	.50437	2.70	72	.40414	2.00	.53116	2.70
74	.38439	2.05	.50491	2.65	74	.40454	1.95	.53170	2.65
76	.38480	2.05	.50544	2.70	76	.40493	2.00	.53223	2.65
78	.38521	2.05	.50598	2.70	78	.40533	2.00	.53276	2.70
80	9.38562	2.00	9.50652	2.70	80	9.40573	2.00	9.53330	2.65
82	.38602	2.05	.50706	2.70	82	.40613	1.95	.53383	2.65
84	.38643	2.05	.50760	2.70	84	.40652	2.00	.53436	2.65
86	.38684	2.00	.50814	2.65	86	.40692	1.95	.53489	2.65
88	.38724	2.05	.50867	2.70	88	.40731	2.00	.53542	2.70
90	9.38765	2.05	9.50921	2.70	90	9.40771	2.00	9.53596	2.65
92	.38806	2.00	.50975	2.70	92	.40811	1.95	.53649	2.65
94	.38846	2.05	.51029	2.70	94	.40850	2.00	.53702	2.65
96	.38887	2.05	.51083	2.65	96	.40890	1.95	.53755	2.65
98	.38928	2.00	.51136	2.70	98	.40929	2.00	.53808	2.65
100	9.38968		9.51190		100	9.40969		9.53861	

Hundredths	42° Vers	Diff. .001	42° Exsec	Diff. .001	Hundredths	43° Vers	Diff. .001	43° Exsec	Diff. .001
00	9.40969	1.95	9.53861	2.70	00	9.42918	1.95	9.56505	2.65
02	.41008	2.00	.53915	2.65	02	.42957	1.90	.56558	2.65
04	.41048	1.95	.53968	2.65	04	.42995	1.90	.56611	2.60
06	.41087	2.00	.54021	2.65	06	.43033	1.95	.56663	2.65
08	.41127	1.95	.54074	2.65	08	.43072	1.90	.56716	2.60
10	9.41166	1.95	9.54127	2.65	10	9.43110	1.95	9.56768	2.65
12	.41205	2.00	.54180	2.60	12	.43149	1.90	.56821	2.60
14	.41245	1.95	.54232	2.70	14	.43187	1.90	.56873	2.65
16	.41284	1.95	.54286	2.65	16	.43225	1.95	.56926	2.65
18	.41323	2.00	.54339	2.65	18	.43264	1.90	.56979	2.60
20	9.41363	1.95	9.54392	2.65	20	9.43302	1.90	9.57031	2.65
22	.41402	1.95	.54445	2.65	22	.43340	1.90	.57084	2.60
24	.41441	1.95	.54498	2.65	24	.43378	1.95	.57136	2.65
26	.41480	2.00	.54551	2.65	26	.43417	1.90	.57189	2.60
28	.41520	1.95	.54604	2.65	28	.43455	1.90	.57241	2.65
30	9.41559	1.95	9.54657	2.65	30	9.43493	1.90	9.57294	2.60
32	.41598	1.95	.54710	2.65	32	.43531	1.90	.57346	2.65
34	.41637	1.95	.54763	2.65	34	.43569	1.95	.57399	2.60
36	.41676	1.95	.54816	2.65	36	.43608	1.90	.57451	2.60
38	.41715	2.00	.54869	2.65	38	.43646	1.90	.57503	2.65
40	9.41755	1.95	9.54922	2.65	40	9.43684	1.90	9.57556	2.60
42	.41794	1.95	.54975	2.65	42	.43722	1.90	.57608	2.65
44	.41833	1.95	.55028	2.65	44	.43760	1.90	.57661	2.60
46	.41872	1.95	.55081	2.65	46	.43798	1.90	.57713	2.65
48	.41911	1.95	.55134	2.65	48	.43836	1.90	.57766	2.60
50	9.41950	1.95	9.55187	2.65	50	9.43874	1.90	9.57818	2.60
52	.41989	1.95	.55240	2.60	52	.43912	1.90	.57870	2.65
54	.42028	1.95	.55292	2.65	54	.43950	1.90	.57923	2.60
56	.42067	1.95	.55345	2.65	56	.43988	1.90	.57975	2.60
58	.42106	1.90	.55398	2.65	58	.44026	1.90	.58027	2.65
60	9.42144	1.95	9.55451	2.70	60	9.44064	1.90	9.58080	2.60
62	.42183	1.95	.55505	2.60	62	.44102	1.90	.58132	2.60
64	.42222	1.95	.55557	2.60	64	.44140	1.85	.58184	2.65
66	.42261	1.95	.55609	2.65	66	.44177	1.90	.58237	2.60
68	.42300	1.95	.55662	2.65	68	.44215	1.90	.58289	2.60
70	9.42339	1.90	9.55715	2.65	70	9.44253	1.90	9.58341	2.65
72	.42377	1.95	.55768	2.60	72	.44291	1.90	.58394	2.60
74	.42416	1.95	.55820	2.65	74	.44329	1.85	.58446	2.60
76	.42455	1.95	.55873	2.65	76	.44366	1.90	.58498	2.60
78	.42494	1.90	.55926	2.65	78	.44404	1.90	.58550	2.65
80	9.42532	1.95	9.55979	2.60	80	9.44442	1.90	9.58603	2.60
82	.42571	1.95	.56031	2.65	82	.44480	1.85	.58655	2.60
84	.42610	1.90	.56084	2.65	84	.44517	1.90	.58707	2.60
86	.42648	1.95	.56137	2.60	86	.44555	1.90	.58759	2.65
88	.42687	1.90	.56189	2.65	88	.44593	1.85	.58812	2.60
90	9.42725	1.90	9.56242	2.65	90	9.44630	1.90	9.58864	2.60
92	.42764	1.95	.56295	2.60	92	.44668	1.85	.58916	2.60
94	.42803	1.90	.56347	2.65	94	.44705	1.90	.58968	2.60
96	.42841	1.95	.56400	2.65	96	.44743	1.90	.59020	2.65
98	.42880	1.90	.56453	2.60	98	.44781	1.85	.59073	2.60
100	9.42918		9.56505		100	9.44818		9.59125	

TABLE XXVI. — (*Continued*)

Hundredths	44° Vers	Diff. .001	44° Exsec	Diff. .001	45° Vers	Diff. .001	45° Exsec	Diff. .001
00	9.44818	1.90	9.59125	2.60	9.46671	1.85	9.61722	2.60
02	.44856	1.85	.59177	2.60	.46708	1.80	.61774	2.60
04	.44893	1.90	.59229	2.60	.46744	1.85	.61826	2.60
06	.44931	1.85	.59281	2.60	.46781	1.80	.61878	2.55
08	.44968	1.85	.59333	2.60	.46817	1.85	.61929	2.60
10	9.45005	1.90	9.59385	2.60	9.46854	1.80	9.61981	2.60
12	.45043	1.85	.59437	2.65	.46890	1.85	.62033	2.60
14	.45080	1.90	.59490	2.60	.46927	1.80	.62085	2.55
16	.45118	1.85	.59542	2.60	.46963	1.85	.62136	2.60
18	.45155	1.85	.59594	2.60	.47000	1.80	.62188	2.60
20	9.45192	1.90	9.59646	2.60	9.47036	1.80	9.62240	2.55
22	.45230	1.85	.59698	2.60	.47072	1.85	.62291	2.60
24	.45267	1.85	.59750	2.60	.47109	1.80	.62343	2.60
26	.45304	1.90	.59802	2.60	.47145	1.85	.62395	2.55
28	.45342	1.85	.59854	2.60	.47182	1.80	.62446	2.60
30	9.45379	1.85	9.59906	2.60	9.47218	1.80	9.62498	2.60
32	.45416	1.85	.59958	2.60	.47254	1.85	.62550	2.55
34	.45453	1.85	.60010	2.60	.47291	1.80	.62601	2.60
36	.45490	1.90	.60062	2.60	.47327	1.80	.62653	2.60
38	.45528	1.85	.60114	2.60	.47363	1.80	.62705	2.55
40	9.45565	1.85	9.60166	2.60	9.47399	1.85	9.62756	2.60
42	.45602	1.85	.60218	2.60	.47436	1.80	.62808	2.55
44	.45639	1.85	.60270	2.60	.47472	1.80	.62859	2.60
46	.45676	1.85	.60322	2.60	.47508	1.80	.62911	2.60
48	.45713	1.85	.60374	2.60	.47544	1.80	.62963	2.55
50	9.45750	1.85	9.60426	2.60	9.47580	1.80	9.63014	2.60
52	.45787	1.85	.60478	2.60	.47616	1.85	.63066	2.55
54	.45824	1.85	.60530	2.60	.47653	1.80	.63117	2.60
56	.45861	1.85	.60582	2.60	.47689	1.80	.63169	2.55
58	.45898	1.85	.60634	2.60	.47725	1.80	.63220	2.60
60	9.45935	1.85	9.60686	2.60	9.47761	1.80	9.63272	2.55
62	.45972	1.85	.60738	2.60	.47797	1.80	.63323	2.60
64	.46009	1.85	.60790	2.55	.47833	1.80	.63375	2.60
66	.46046	1.85	.60841	2.60	.47869	1.80	.63427	2.55
68	.46083	1.85	.60893	2.60	.47905	1.80	.63478	2.60
70	9.46120	1.85	9.60945	2.60	9.47941	1.80	9.63530	2.55
72	.46157	1.85	.60997	2.60	.47977	1.80	.63581	2.60
74	.46194	1.80	.61049	2.60	.48013	1.80	.63633	2.55
76	.46230	1.85	.61101	2.60	.48049	1.80	.63684	2.60
78	.46267	1.85	.61153	2.55	.48085	1.80	.63736	2.55
80	9.46304	1.85	9.61204	2.60	9.48121	1.75	9.63787	2.60
82	.46341	1.85	.61256	2.60	.48156	1.80	.63839	2.55
84	.46378	1.80	.61308	2.60	.48192	1.80	.63890	2.55
86	.46414	1.85	.61360	2.60	.48228	1.80	.63941	2.60
88	.46451	1.85	.61412	2.60	.48264	1.80	.63993	2.55
90	9.46488	1.80	9.61464	2.55	9.48300	1.80	9.64044	2.60
92	.46524	1.85	.61515	2.60	.48336	1.75	.64096	2.55
94	.46561	1.85	.61567	2.60	.48371	1.80	.64147	2.60
96	.46598	1.80	.61619	2.60	.48407	1.80	.64199	2.55
98	.46634	1.85	.61671	2.55	.48443	1.80	.64250	2.55
100	9.46671		9.61722		9.48479		9.64301	

TABLE XXVI. — (*Continued*)

Hun-dredths	46° Vers	Diff. .001	46° Exsec	Diff. .001	Hun-dredths	47° Vers	Diff. .001	47° Exsec	Diff. .001
00	9.48479	1.75	9.64301	2.60	00	9.50243	1.75	9.66865	2.55
02	.48514	1.80	.64353	2.55	02	.50278	1.75	.66916	2.55
04	.48550	1.80	.64404	2.60	04	.50313	1.75	.66967	2.55
06	.48586	1.75	.64456	2.55	06	.50347	1.70	.67018	2.55
08	.48621	1.80	.64507	2.55	08	.50382	1.75	.67069	2.55
10	9.48657	1.80	9.64558	2.60	10	9.50417	1.75	9.67120	2.55
12	.48693	1.75	.64610	2.55	12	.50452	1.75	.67171	2.55
14	.48728	1.80	.64661	2.60	14	.50487	1.70	.67222	2.55
16	.48764	1.75	.64713	2.55	16	.50521	1.75	.67273	2.60
18	.48799	1.80	.64764	2.55	18	.50556	1.75	.67325	2.55
20	9.48835	1.75	9.64815	2.60	20	9.50591	1.70	9.67376	2.55
22	.48870	1.80	.64867	2.55	22	.50625	1.75	.67427	2.55
24	.48906	1.75	.64918	2.55	24	.50660	1.75	.67478	2.55
26	.48941	1.80	.64969	2.60	26	.50695	1.70	.67529	2.55
28	.48977	1.75	.65021	2.55	28	.50729	1.75	.67580	2.55
30	9.49012	1.80	9.65072	2.55	30	9.50764	1.75	9.67631	2.55
32	.49048	1.75	.65123	2.60	32	.50799	1.70	.67682	2.55
34	.49083	1.80	.65175	2.55	34	.50833	1.75	.67733	2.55
36	.49119	1.75	.65226	2.55	36	.50868	1.70	.67784	2.55
38	.49154	1.75	.65277	2.55	38	.50902	1.75	.67835	2.55
40	9.49189	1.80	9.65328	2.60	40	9.50937	1.70	9.67886	2.55
42	.49225	1.75	.65380	2.55	42	.50971	1.75	.67937	2.55
44	.49260	1.75	.65431	2.55	44	.51006	1.70	.67988	2.55
46	.49295	1.80	.65482	2.60	46	.51040	1.75	.68039	2.55
48	.49331	1.75	.65534	2.55	48	.51075	1.70	.68090	2.55
50	9.49366	1.75	9.65585	2.55	50	9.51109	1.75	9.68141	2.55
52	.49401	1.80	.65636	2.55	52	.51144	1.70	.68192	2.55
54	.49437	1.75	.65687	2.60	54	.51178	1.75	.68243	2.55
56	.49472	1.75	.65739	2.55	56	.51213	1.70	.68294	2.55
58	.49507	1.75	.65790	2.55	58	.51247	1.70	.68345	2.55
60	9.49542	1.75	9.65841	2.55	60	9.51281	1.75	9.68396	2.55
62	.49577	1.80	.65892	2.60	62	.51316	1.70	.68447	2.55
64	.49613	1.75	.65944	2.55	64	.51350	1.70	.68498	2.55
66	.49648	1.75	.65995	2.55	66	.51384	1.75	.68549	2.55
68	.49683	1.75	.66046	2.55	68	.51419	1.70	.68600	2.55
70	9.49718	1.75	9.66097	2.55	70	9.51453	1.70	9.68651	2.55
72	.49753	1.75	.66148	2.60	72	.51487	1.75	.68702	2.55
74	.49788	1.75	.66200	2.55	74	.51522	1.70	.68753	2.55
76	.49823	1.75	.66251	2.55	76	.51556	1.70	.68804	2.55
78	.49858	1.75	.66302	2.55	78	.51590	1.70	.68855	2.50
80	9.49893	1.75	9.66353	2.55	80	9.51624	1.75	9.68905	2.55
82	.49928	1.75	.66404	2.55	82	.51659	1.70	.68956	2.55
84	.49963	1.75	.66455	2.55	84	.51693	1.70	.69007	2.55
86	.49998	1.75	.66507	2.55	86	.51727	1.70	.69058	2.55
88	.50033	1.75	.66558	2.55	88	.51761	1.70	.69109	2.55
90	9.50068	1.75	9.66609	2.55	90	9.51795	1.70	9.69160	2.55
92	.50103	1.75	.66660	2.55	92	.51829	1.70	.69201	2.55
94	.50138	1.75	.66711	2.55	94	.51863	1.70	.69262	2.55
96	.50173	1.75	.66762	2.55	96	.51898	1.70	.69313	2.55
98	.50208	1.75	.66813	2.60	98	.51932	1.70	.69364	2.55
100	9.50243		9.66865		100	9.51966		9.69415	

Hundredths	48° Vers	Diff. .001	48° Exsec	Diff. .001	Hundredths	49° Vers	Diff. .001	49° Exsec	Diff. .001
00	9.51966	1.70	9.69415	2.50	00	9.53648	1.70	9.71954	2.55
02	.52000	1.70	.69465	2.55	02	.53682	1.65	.72005	2.50
04	.52034	1.70	.69516	2.55	04	.53715	1.65	.72055	2.55
06	.52068	1.70	.69567	2.55	06	.53748	1.65	.72106	2.55
08	.52102	1.70	.69618	2.55	08	.53781	1.70	.72157	2.55
10	9.52136	1.70	9.69669	2.55	10	9.53815	1.65	9.72208	2.50
12	.52170	1.70	.69720	2.55	12	.53848	1.65	.72258	2.55
14	.52204	1.70	.69771	2.55	14	.53881	1.65	.72309	2.55
16	.52238	1.65	.69822	2.50	16	.53914	1.65	.72360	2.50
18	.52271	1.70	.69872	2.55	18	.53947	1.65	.72410	2.55
20	9.52305	1.70	9.69923	2.55	20	9.53980	1.65	9.72461	2.55
22	.52339	1.70	.69974	2.55	22	.54013	1.65	.72512	2.50
24	.52373	1.70	.70025	2.55	24	.54046	1.70	.72562	2.55
26	.52407	1.70	.70076	2.55	26	.54080	1.65	.72613	2.55
28	.52441	1.70	.70127	2.50	28	.54113	1.65	.72664	2.50
30	9.52475	1.65	9.70177	2.55	30	9.54146	1.65	9.72714	2.55
32	.52508	1.70	.70228	2.55	32	.54179	1.65	.72765	2.55
34	.52542	1.70	.70279	2.55	34	.54212	1.65	.72816	2.50
36	.52576	1.70	.70330	2.55	36	.54245	1.65	.72866	2.55
38	.52610	1.65	.70381	2.50	38	.54278	1.65	.72917	2.55
40	9.52643	1.70	9.70431	2.55	40	9.54311	1.65	9.72968	2.50
42	.52677	1.70	.70482	2.55	42	.54344	1.65	.73018	2.55
44	.52711	1.70	.70533	2.55	44	.54377	1.60	.73069	2.55
46	.52745	1.65	.70584	2.55	46	.54409	1.65	.73120	2.50
48	.52778	1.70	.70635	2.50	48	.54442	1.65	.73170	2.55
50	9.52812	1.70	9.70685	2.55	50	9.54475	1.65	9.73221	2.50
52	.52846	1.65	.70736	2.55	52	.54508	1.65	.73271	2.50
54	.52879	1.70	.70787	2.55	54	.54541	1.65	.73321	2.55
56	.52913	1.65	.70838	2.55	56	.54574	1.65	.73372	2.55
58	.52946	1.70	.70889	2.50	58	.54607	1.60	.73423	2.55
60	9.52980	1.70	9.70939	2.55	60	9.54639	1.65	9.73474	2.50
62	.53014	1.65	.70990	2.55	62	.54672	1.65	.73524	2.55
64	.53047	1.70	.71041	2.55	64	.54705	1.65	.73575	2.55
66	.53081	1.65	.71092	2.50	66	.54738	1.65	.73626	2.50
68	.53114	1.70	.71142	2.55	68	.54771	1.60	.73676	2.55
70	9.53148	1.65	9.71193	2.55	70	9.54803	1.65	9.73727	2.55
72	.53181	1.70	.71244	2.55	72	.54836	1.65	.73778	2.50
74	.53215	1.65	.71295	2.50	74	.54869	1.60	.73828	2.55
76	.53248	1.70	.71345	2.55	76	.54901	1.65	.73879	2.50
78	.53282	1.65	.71396	2.55	78	.54934	1.65	.73929	2.55
80	9.53315	1.65	9.71447	2.55	80	9.54967	1.60	9.73980	2.55
82	.53348	1.70	.71498	2.50	82	.54999	1.65	.74031	2.50
84	.53382	1.65	.71548	2.55	84	.55032	1.65	.74081	2.55
86	.53415	1.70	.71599	2.55	86	.55065	1.60	.74132	2.50
88	.53449	1.65	.71650	2.50	88	.55097	1.65	.74182	2.55
90	9.53482	1.65	9.71700	2.55	90	9.55130	1.60	9.74233	2.55
92	.53515	1.70	.71751	2.55	92	.55162	1.65	.74284	2.50
94	.53549	1.65	.71802	2.55	94	.55195	1.65	.74334	2.55
96	.53582	1.65	.71853	2.50	96	.55228	1.60	.74385	2.50
98	.53615	1.65	.71903	2.55	98	.55260	1.65	.74435	2.55
100	9.53648		9.71954		100	9.55293		9.74486	

Hundredths	50° Vers	Diff. .001	50° Exsec	Diff. .001	Hundredths	51° Vers	Diff. .001	51° Exsec	Diff. .001
00	9.55293	1.60	9.74486	2.50	00	9.56900	1.60	9.77013	2.50
02	.55325	1.65	.74536	2.55	02	.56932	1.55	.77063	2.55
04	.55358	1.60	.74587	2.55	04	.56963	1.60	.77114	2.50
06	.55390	1.65	.74638	2.50	06	.56995	1.60	.77164	2.55
08	.55423	1.60	.74688	2.55	08	.57027	1.60	.77215	2.50
10	9.55455	1.60	9.74739	2.50	10	9.57059	1.55	9.77265	2.55
12	.55487	1.65	.74789	2.55	12	.57090	1.60	.77316	2.50
14	.55520	1.60	.74840	2.50	14	.57122	1.60	.77366	2.55
16	.55552	1.65	.74890	2.55	16	.57154	1.55	.77417	2.50
18	.55585	1.60	.74941	2.55	18	.57185	1.60	.77467	2.55
20	9.55617	1.60	9.74992	2.50	20	9.57217	1.60	9.77518	2.50
22	.55649	1.65	.75042	2.55	22	.57249	1.55	.77568	2.55
24	.55682	1.60	.75093	2.50	24	.57280	1.60	.77619	2.50
26	.55714	1.60	.75143	2.55	26	.57312	1.55	.77669	2.55
28	.55746	1.65	.75194	2.50	28	.57343	1.60	.77720	2.50
30	9.55779	1.60	9.75244	2.55	30	9.57375	1.60	9.77770	2.55
32	.55811	1.60	.75295	2.50	32	.57407	1.55	.77821	2.50
34	.55843	1.60	.75345	2.55	34	.57438	1.60	.77871	2.55
36	.55875	1.65	.75396	2.55	36	.57470	1.55	.77922	2.50
38	.55908	1.60	.75447	2.50	38	.57501	1.60	.77972	2.55
40	9.55940	1.60	9.75497	2.55	40	9.57533	1.55	9.78023	2.50
42	.55972	1.60	.75548	2.50	42	.57564	1.60	.78073	2.55
44	.56004	1.60	.75598	2.55	44	.57596	1.55	.78124	2.50
46	.56036	1.65	.75649	2.50	46	.57627	1.60	.78174	2.55
48	.56069	1.60	.75699	2.55	48	.57659	1.55	.78225	2.50
50	9.56101	1.60	9.75750	2.50	50	9.57690	1.55	9.78275	2.55
52	.56133	1.60	.75800	2.55	52	.57721	1.60	.78326	2.50
54	.56165	1.60	.75851	2.50	54	.57753	1.55	.78376	2.55
56	.56197	1.60	.75901	2.55	56	.57784	1.60	.78427	2.50
58	.56229	1.60	.75952	2.50	58	.57816	1.55	.78477	2.50
60	9.56261	1.60	9.76002	2.55	60	9.57847	1.55	9.78527	2.55
62	.56293	1.60	.76053	2.50	62	.57878	1.60	.78578	2.50
64	.56325	1.60	.76103	2.55	64	.57910	1.55	.78628	2.55
66	.56357	1.65	.76144	2.50	66	.57941	1.55	.78679	2.50
68	.56390	1.60	.76204	2.55	68	.57972	1.60	.78729	2.55
70	9.56422	1.60	9.76255	2.55	70	9.58004	1.55	9.78780	2.50
72	.56454	1.55	.76306	2.50	72	.58035	1.55	.78830	2.55
74	.56485	1.60	.76356	2.55	74	.58066	1.55	.78881	2.50
76	.56517	1.60	.76407	2.50	76	.58097	1.60	.78931	2.55
78	.56549	1.60	.76457	2.55	78	.58129	1.55	.78982	2.50
80	9.56581	1.60	9.76508	2.50	80	9.58160	1.55	9.79032	2.55
82	.56613	1.60	.76558	2.55	82	.58191	1.55	.79083	2.50
84	.56645	1.60	.76609	2.50	84	.58222	1.55	.79133	2.55
86	.56677	1.60	.76659	2.55	86	.58253	1.60	.79184	2.50
88	.56709	1.60	.76710	2.50	88	.58285	1.55	.79234	2.55
90	9.56741	1.60	9.76760	2.55	90	9.58316	1.55	9.79285	2.50
92	.56773	1.55	.76811	2.50	92	.58347	1.55	.79335	2.55
94	.56804	1.60	.76861	2.55	94	.58378	1.55	.79386	2.50
96	.56836	1 60	.76912	2.50	96	.58409	1.55	.79436	2.55
98	.56868	1.60	.76962	2.55	98	.58440	1.55	.79487	2.50
100	9.56900		9.77013		100	9.58471		9.79537	

Hundredths	52°				Hundredths	53°			
	Vers	Diff. .001	Exsec	Diff. .001		Vers	Diff. .001	Exsec	Diff. .001
00	9.58471	1.55	9.79537	2.55	**00**	9.60008	1.55	9.82062	2.55
02	.58502	1.60	.79588	2.50	**02**	.60039	1.50	.82113	2.50
04	.58534	1.55	.79638	2.55	**04**	.60069	1.55	.82163	2.55
06	.58565	1.55	.79689	2.50	**06**	.60100	1.50	.82214	2.50
08	.58596	1.55	.79739	2.55	**08**	.60130	1.50	.82264	2.55
10	9.58627	1.55	9.79790	2.50	**10**	9.60160	1.55	9.82315	2.50
12	.58658	1.55	.79840	2.55	**12**	.60191	1.50	.82365	2.55
14	.58689	1.55	.79891	2.50	**14**	.60221	1.50	.82416	2.50
16	.58720	1.55	.79941	2.55	**16**	.60251	1.55	.82466	2.55
18	.58751	1.55	.79992	2.50	**18**	.60282	1.50	.82517	2.55
20	9.58782	1.50	9.80042	2.55	**20**	9.60312	1.50	9.82568	2.50
22	.58812	1.55	.80093	2.50	**22**	.60342	1.50	.82618	2.55
24	.58843	1.55	.80143	2.55	**24**	.60372	1.55	.82669	2.50
26	.58874	1.55	.80194	2.50	**26**	.60403	1.50	.82719	2.55
28	.58905	1.55	.80244	2.55	**28**	.60433	1.50	.82770	2.50
30	9.58936	1.55	9.80295	2.50	**30**	9.60463	1.50	9.82820	2.55
32	.58967	1.55	.80345	2.50	**32**	.60493	1.50	.82871	2.50
34	.58998	1.55	.80395	2.55	**34**	.60523	1.55	.82921	2.55
36	.59029	1.50	.80446	2.50	**36**	.60554	1.50	.82972	2.50
38	.59059	1.55	.80496	2.55	**38**	.60584	1.50	.83022	2.55
40	9.59090	1.55	9.80547	2.50	**40**	9.60614	1.50	9.83073	2.50
42	.59121	1.55	.80597	2.55	**42**	.60644	1.50	.83123	2.55
44	.59152	1.55	.80648	2.50	**44**	.60674	1.50	.83174	2.55
46	.59183	1.50	.80698	2.55	**46**	.60704	1.50	.83225	2.50
48	.59213	1.55	.80749	2.50	**48**	.60734	1.50	.83275	2.55
50	9.59244	1.55	9.80799	2.55	**50**	9.60764	1.55	9.83326	2.50
52	.59275	1.55	.80850	2.50	**52**	.60795	1.50	.83376	2.55
54	.59306	1.50	.80900	2.50	**54**	.60825	1.50	.83427	2.50
56	.59336	1.55	.80950	2.55	**56**	.60855	1.50	.83477	2.55
58	.59367	1.55	.81001	2.55	**58**	.60885	1.50	.83528	2.55
60	9.59398	1.50	9.81052	2.50	**60**	9.60915	1.50	9.83579	2.50
62	.59428	1.55	.81102	2.55	**62**	.60945	1.50	.83629	2.55
64	.59459	1.55	.81153	2.50	**64**	.60975	1.50	.83680	2.50
66	.59490	1.50	.81203	2.55	**66**	.61005	1.50	.83730	2.55
68	.59520	1.55	.81254	2.50	**68**	.61035	1.50	.83781	2.50
70	9.59551	1.50	9.81304	2.55	**70**	9.61065	1.50	9.83831	2.55
72	.59581	1.55	.81355	2.50	**72**	.61095	1.45	.83882	2.55
74	.59612	1.55	.81405	2.55	**74**	.61124	1.50	.83933	2.50
76	.59643	1.50	.81456	2.55	**76**	.61154	1.50	.83983	2.55
78	.59673	1.55	.81507	2.50	**78**	.61184	1.50	.84034	2.50
80	9.59704	1.50	9.81557	2.55	**80**	9.61214	1.50	9.84084	2.55
82	.59734	1.55	.81608	2.50	**82**	.61244	1.50	.84135	2.55
84	.59765	1.50	.81658	2.55	**84**	.61274	1.50	.84186	2.50
86	.59795	1.55	.81709	2.50	**86**	.61304	1.50	.84236	2.55
88	.59826	1.50	.81759	2.55	**88**	.61334	1.45	.84287	2.50
90	9.59856	1.55	9.81810	2.50	**90**	9.61363	1.50	9.84337	2.55
92	.59887	1.50	.81860	2.55	**92**	.61393	1.50	.84388	2.55
94	.59917	1.55	.81911	2.50	**94**	.61423	1.50	.84439	2.50
96	.59948	1.50	.81961	2.55	**96**	.61453	1.50	.84489	2.55
98	.59978	1.50	.82012	2.50	**98**	.61483	1.45	.84540	2.50
100	9.60008		9.82062		**100**	9.61512		9.84590	

Hundredths	54° Vers	Diff. .001	54° Exsec	Diff. .001	Hundredths	55° Vers	Diff. .001	55° Exsec	Diff. .001
00	9.61512	1.50	9.84590	2.55	**00**	9.62984	1.45	9.87125	2.55
02	.61542	1.50	.84641	2.55	**02**	.63013	1.45	.87176	2.55
04	.61572	1.50	.84692	2.50	**04**	.63042	1.45	.87227	2.50
06	.61602	1.45	.84742	2.55	**06**	.63071	1.50	.87277	2.55
08	.61631	1.50	.84793	2.55	**08**	.63101	1.45	.87328	2.55
10	9.61661	1.50	9.84844	2.50	**10**	9.63130	1.45	9.87379	2.55
12	.61691	1.45	.84894	2.55	**12**	.63159	1.45	.87430	2.50
14	.61720	1.50	.84945	2.55	**14**	.63188	1.45	.87480	2.55
16	.61750	1.50	.84996	2.50	**16**	.63217	1.45	.87531	2.55
18	.61780	1.45	.85046	2.55	**18**	.63246	1.45	.87582	2.55
20	9.61809	1.50	9.85097	2.50	**20**	9.63275	1.45	9.87633	2.55
22	.61839	1.45	.85147	2.55	**22**	.63304	1.45	.87684	2.55
24	.61868	1.50	.85198	2.55	**24**	.63333	1.45	.87735	2.50
26	.61898	1.50	.85249	2.50	**26**	.63362	1.45	.87785	2.55
28	.61928	1.45	.85299	2.55	**28**	.63391	1.45	.87846	2.55
30	9.61957	1.50	9.85350	2.55	**30**	9.63420	1.40	9.87887	2.55
32	.61987	1.45	.85401	2.50	**32**	.63448	1.45	.87938	2.55
34	.62016	1.50	.85451	2.55	**34**	.63477	1.45	.87989	2.55
36	.62046	1.45	.85502	2.55	**36**	.63506	1.45	.88040	2.50
38	.62075	1.50	.85553	2.50	**38**	.63535	1.45	.88090	2.55
40	9.62105	1.45	9.85603	2.55	**40**	9.63564	1.45	9.88141	2.55
42	.62134	1.50	.85654	2.55	**42**	.63593	1.45	.88192	2.55
44	.62164	1.45	.85705	2.50	**44**	.63622	1.45	.88243	2.55
46	.62193	1.50	.85755	2.55	**46**	.63651	1.40	.88294	2.55
48	.62223	1.45	.85806	2.55	**48**	.63679	1.45	.88345	2.50
50	9.62252	1.50	9.85857	2.50	**50**	9.63708	1.45	9.88395	2.55
52	.62282	1.45	.85907	2.55	**52**	.63737	1.45	.88446	2.55
54	.62311	1.45	.85958	2.55	**54**	.63766	1.45	.88497	2.55
56	.62340	1.50	.86009	2.55	**56**	.63795	1.40	.88548	2.55
58	.62370	1.45	.86060	2.50	**58**	.63823	1.45	.88599	2.55
60	9.62399	1.50	9.86110	2.55	**60**	9.63852	1.45	9.88650	2.55
62	.62429	1.45	.86161	2.55	**62**	.63881	1.45	.88701	2.55
64	.62458	1.45	.86212	2.50	**64**	.63910	1.40	.88752	2.55
66	.62487	1.50	.86262	2.55	**66**	.63938	1.45	.88803	2.55
68	.62517	1.45	.86313	2.55	**68**	.63967	1.45	.88854	2.50
70	9.62546	1.45	9.86364	2.55	**70**	9.63996	1.45	9.88904	2.55
72	.62575	1.45	.86415	2.50	**72**	.64025	1.40	.88955	2.55
74	.62604	1.50	.86465	2.55	**74**	.64053	1.45	.89006	2.55
76	.62634	1.45	.86516	2.55	**76**	.64082	1.45	.89057	2.55
78	.62663	1.45	.86567	2.50	**78**	.64111	1.40	.89108	2.55
80	9.62692	1.50	9.86617	2.55	**80**	9.64139	1.45	9.89159	2.55
82	.62722	1.45	.86668	2.55	**82**	.64168	1.45	.89210	2.55
84	.62751	1.45	.86719	2.55	**84**	.64197	1.40	.89261	2.55
86	.62780	1.45	.86770	2.50	**86**	.64225	1.45	.89312	2.55
88	.62809	1.45	.86820	2.55	**88**	.64254	1.40	.89363	2.55
90	9.62838	1.50	9.86871	2.55	**90**	9.64282	1.45	9.89414	2.55
92	.62868	1.45	.86922	2.55	**92**	.64301	1.40	.89455	2.55
94	.62897	1.45	.86973	2.50	**94**	.64339	1.45	.89516	2.55
96	.62926	1.45	.87023	2.55	**96**	.64368	1.40	.89567	2.55
98	.62955	1.45	.87074	2.55	**98**	.64396	1.45	.89618	2.55
100	9.62984		9.87125		**100**	9.64425		9.89669	

TABLE XXVI. — (*Continued*)

Hundredths	56° Vers	Diff. .001	56° Exsec	Diff. .001	Hundredths	57° Vers	Diff. .001	57° Exsec	Diff. .001
00	9.64425	1.40	9.89669	2.55	**00**	9.65836	1.35	9.92225	2.55
02	.64453	1.45	.89720	2.55	**02**	.65863	1.40	.92276	2.55
04	.64482	1.40	.89771	2.55	**04**	.65891	1.40	.92327	2.60
06	.64510	1.45	.89822	2.55	**06**	.65919	1.40	.92379	2.55
08	.64539	1.40	.89873	2.55	**08**	.65947	1.40	.92430	2.55
10	9.64567	1.45	9.89924	2.55	**10**	9.65975	1.40	9.92481	2.55
12	.64596	1.40	.89975	2.55	**12**	.66003	1.40	.92532	2.55
14	.64624	1.45	.90026	2.55	**14**	.66031	1.40	.92584	2.60
16	.64653	1.40	.90077	2.55	**16**	.66059	1.35	.92635	2.55
18	.64681	1.40	.90128	2.55	**18**	.66086	1.40	.92686	2.60
20	9.64709	1.45	9.90179	2.55	**20**	9.66114	1.40	9.92738	2.55
22	.64738	1.40	.90230	2.55	**22**	.66142	1.40	.92789	2.55
24	.64766	1.40	.90281	2.55	**24**	.66170	1.40	.92840	2.60
26	.64794	1.45	.90332	2.55	**26**	.66198	1.35	.92892	2.55
28	.64823	1.40	.90383	2.55	**28**	.66225	1.40	.92943	2.55
30	9.64851	1.40	9.90434	2.55	**30**	9.66253	1.40	9.92994	2.60
32	.64880	1.40	.90485	2.55	**32**	.66281	1.40	.93046	2.55
34	.64908	1.40	.90536	2.55	**34**	.66309	1.35	.93097	2.60
36	.64936	1.40	.90587	2.55	**36**	.66336	1.40	.93149	2.55
38	.64964	1.45	.90638	2.55	**38**	.66364	1.40	.93200	2.55
40	9.64993	1.40	9.90689	2.60	**40**	9.66392	1.35	9.93251	2.60
42	.65021	1.40	.90741	2.55	**42**	.66419	1.40	.93303	2.55
44	.65049	1.40	.90792	2.55	**44**	.66447	1.40	.93354	2.55
46	.65077	1.45	.90843	2.55	**46**	.66475	1.35	.93405	2.60
48	.65106	1.40	.90894	2.55	**48**	.66502	1.40	.93457	2.55
50	9.65134	1.40	9.90945	2.55	**50**	9.66530	1.40	9.93508	2.60
52	.65162	1.40	.90996	2.55	**52**	.66558	1.35	.93560	2.55
54	.65190	1.40	.91047	2.55	**54**	.66585	1.40	.93611	2.60
56	.65218	1.45	.91098	2.55	**56**	.66613	1.35	.93663	2.55
58	.65247	1.40	.91149	2.60	**58**	.66640	1.40	.93714	2.60
60	9.65275	1.40	9.91201	2.55	**60**	9.66668	1.40	9.93766	2.55
62	.65303	1.40	.91252	2.55	**62**	.66696	1.35	.93817	2.60
64	.65331	1.40	.91303	2.55	**64**	.66723	1.40	.93869	2.55
66	.65359	1.40	.91354	2.55	**66**	.66751	1.35	.93920	2.55
68	.65387	1.40	.91405	2.55	**68**	.66778	1.40	.93971	2.60
70	9.65415	1.45	9.91456	2.60	**70**	9.66806	1.35	9.94023	2.55
72	.65444	1.40	.91508	2.55	**72**	.66833	1.40	.94074	2.60
74	.65472	1.40	.91559	2.55	**74**	.66861	1.35	.94126	2.55
76	.65500	1.40	.91610	2.55	**76**	.66888	1.40	.94177	2.60
78	.65528	1.40	.91661	2.55	**78**	.66916	1.35	.94229	2.60
80	9.65556	1.40	9.91712	2.60	**80**	9.66943	1.40	9.94281	2.55
82	.65584	1.40	.91764	2.55	**82**	.66971	1.35	.94332	2.60
84	.65612	1.40	.91815	2.55	**84**	.66998	1.40	.94384	2.55
86	.65640	1.40	.91866	2.55	**86**	.67026	1.35	.94435	2.60
88	.65668	1.40	.91917	2.55	**88**	.67053	1.35	.94487	2.55
90	9.65696	1.40	9.91968	2.60	**90**	9.67080	1.40	9.94538	2.60
92	.65724	1.40	.92020	2.55	**92**	.67108	1.35	.94590	2.55
94	.65752	1.40	.92071	2.55	**94**	.67135	1.40	.94641	2.60
96	.65780	1.40	.92122	2.55	**96**	.67163	1.35	.94693	2.60
98	.65808	1.40	.92173	2.60	**98**	.67190	1.35	.94745	2.55
100	9.65836		9.92225		**100**	9.67217		9.94796	

TABLE XXVI. — (*Continued*)

Hundredths	58° Vers	Diff. .001	58° Exsec	Diff. .001	Hundredths	59° Vers	Diff. .001	59° Exsec	Diff. .001
00	9.67217	1.40	9.94796	2.60	**00**	9.68571	1.35	9.97387	2.60
02	.67245	1.35	.94848	2.60	**02**	.68598	1.30	.97439	2.60
04	.67272	1.35	.94900	2.55	**04**	.68624	1.35	.97491	2.60
06	.67299	1.40	.94951	2.60	**06**	.68651	1.35	.97543	2.60
08	.67327	1.35	.95003	2.55	**08**	.68678	1.35	.97595	2.60
10	9.67354	1.35	9.95054	2.60	**10**	9.68705	1.30	9.97647	2.60
12	.67381	1.35	.95106	2.60	**12**	.68731	1.35	.97699	2.60
14	.67408	1.40	.95158	2.55	**14**	.68758	1.35	.97751	2.60
16	.67436	1.35	.95209	2.60	**16**	.68785	1.30	.97803	2.60
18	.67463	1.35	.95261	2.60	**18**	.68811	1.35	.97855	2.65
20	9.67490	1.35	9.95313	2.55	**20**	9.68838	1.35	9.97908	2.60
22	.67517	1.40	.95364	2.60	**22**	.68865	1.35	.97960	2.60
24	.67545	1.35	.95416	2.60	**24**	.68892	1.30	.98012	2.60
26	.67572	1.35	.95468	2.60	**26**	.68918	1.35	.98064	2.60
28	.67599	1.35	.95520	2.55	**28**	.68945	1.30	.98116	2.60
30	9.67626	1.35	9.95571	2.60	**30**	9.68971	1.35	9.98168	2.60
32	.67653	1.40	.95623	2.60	**32**	.68998	1.35	.98220	2.65
34	.67681	1.35	.95675	2.55	**34**	.69025	1.30	.98273	2.60
36	.67708	1.35	.95726	2.60	**36**	.69051	1.35	.98325	2.60
38	.67735	1.35	.95778	2.60	**38**	.69078	1.30	.98377	2.60
40	9.67762	1.35	9.95830	2.60	**40**	9.69104	1.35	9.98429	2.60
42	.67789	1.35	.95882	2.60	**42**	.69131	1.35	.98481	2.65
44	.67816	1.35	.95934	2.55	**44**	.69158	1.30	.98534	2.60
46	.67843	1.35	.95985	2.60	**46**	.69184	1.35	.98586	2.60
48	.67870	1.35	.96037	2.60	**48**	.69211	1.30	.98638	2.60
50	9.67897	1.40	9.96089	2.60	**50**	9.69237	1.35	9.98690	2.65
52	.67925	1.35	.96141	2.60	**52**	.69264	1.30	.98743	2.60
54	.67952	1.35	.96193	2.55	**54**	.69290	1.35	.98795	2.60
56	.67979	1.35	.96244	2.60	**56**	.69317	1.30	.98847	2.60
58	.68006	1.35	.96296	2.60	**58**	.69343	1.35	.98899	2.65
60	9.68033	1.35	9.96348	2.60	**60**	9.69370	1.30	9.98952	2.60
62	.68060	1.35	.96400	2.60	**62**	.69396	1.35	.99004	2.60
64	.68087	1.35	.96452	2.60	**64**	.69423	1.30	.99056	2.65
66	.68114	1.35	.96504	2.60	**66**	.69449	1.35	.99109	2.60
68	.68141	1.35	.96556	2.55	**68**	.69476	1.30	.99161	2.60
70	9.68168	1.35	9.96607	2.60	**70**	9.69502	1.30	9.99213	2.65
72	.68195	1.35	.96659	2.60	**72**	.69528	1.35	.99266	2.60
74	.68222	1.30	.96711	2.60	**74**	.69555	1.30	.99318	2.65
76	.68248	1.35	.96763	2.60	**76**	.69581	1.35	.99371	2.60
78	.68275	1.35	.96815	2.60	**78**	.69608	1.35	.99423	2.60
80	9.68302	1.35	9.96867	2.60	**80**	9.69634	1.30	9.99475	2.65
82	.68329	1.35	.96919	2.60	**82**	.69660	1.35	.99528	2.60
84	.68356	1.35	.96971	2.60	**84**	.69687	1.30	.99580	2.65
86	.68383	1.35	.97023	2.60	**86**	.69713	1.30	.99633	2.60
88	.68410	1.35	.97075	2.60	**88**	.69739	1.35	.99685	2.65
90	9.68437	1.30	9.97127	2.60	**90**	9.69766	1.30	9.99738	2.60
92	.68463	1.35	.97179	2.60	**92**	.69792	1.30	.99790	2.65
94	.68490	1.35	.97231	2.60	**94**	.69818	1.30	.99843	2.60
96	.68517	1.35	.97283	2.60	**96**	.69844	1.35	.99895	2.60
98	.68544	1.35	.97335	2.60	**98**	.69871	1.30	.99947	2.65
100	9.68571		9.97387		**100**	9.69897		0.00000	

Hundredths	60°				Hundredths	61°			
	Vers	Diff. .001	Exsec	Diff. .001		Vers	Diff. .001	Exsec	Diff. .001
00	9.69897	1.30	0.00000	2.65	**00**	9.71197	1.30	0.02640	2.65
02	.69923	1.30	.00053	2.60	**02**	.71223	1.25	.02693	2.65
04	.69949	1.35	.00105	2.65	**04**	.71248	1.30	.02746	2.65
06	.69976	1.30	.00158	2.60	**06**	.71274	1.30	.02799	2.65
08	.70002	1.30	.00210	2.65	**08**	.71300	1.25	.02852	2.65
10	9.70028	1.30	0.00263	2.60	**10**	9.71325	1.30	0.02905	2.65
12	.70054	1.35	.00315	2.65	**12**	.71351	1.30	.02958	2.70
14	.70081	1.30	.00368	2.60	**14**	.71377	1.25	.03012	2.65
16	.70107	1.30	.00420	2.65	**16**	.71402	1.30	.03065	2.65
18	.70133	1.30	.00473	2.65	**18**	.71428	1.30	.03118	2.65
20	9.70159	1.30	0.00526	2.60	**20**	9.71454	1.25	0.03171	2.65
22	.70185	1.30	.00578	2.65	**22**	.71479	1.30	.03224	2.70
24	.70211	1.30	.00631	2.65	**24**	.71505	1.25	.03278	2.65
26	.70237	1.35	.00684	2.60	**26**	.71530	1.30	.03331	2.65
28	.70264	1.30	.00736	2.65	**28**	.71556	1.30	.03384	2.65
30	9.70290	1.30	0.00789	2.65	**30**	9.71582	1.25	0.03437	2.70
32	.70316	1.30	.00842	2.65	**32**	.71607	1.30	.03491	2.65
34	.70342	1.30	.00894	2.65	**34**	.71633	1.25	.03544	2.65
36	.70368	1.30	.00947	2.65	**36**	.71658	1.30	.03597	2.65
38	.70394	1.30	.01000	2.60	**38**	.71684	1.25	.03651	2.65
40	9.70420	1.30	0.01052	2.65	**40**	9.71709	1.30	0.03704	2.65
42	.70446	1.30	.01105	2.65	**42**	.71735	1.25	.03757	2.70
44	.70472	1.30	.01158	2.65	**44**	.71760	1.30	.03811	2.65
46	.70498	1.30	.01211	2.60	**46**	.71786	1.25	.03864	2.65
48	.70524	1.30	.01263	2.65	**48**	.71811	1.30	.03917	2.70
50	9.70550	1.30	0.01316	2.65	**50**	9.71837	1.25	0.03971	2.65
52	.70576	1.30	.01369	2.65	**52**	.71862	1.30	.04024	2.70
54	.70602	1.30	.01422	2.65	**54**	.71888	1.25	.04078	2.65
56	.70628	1.30	.01475	2.65	**56**	.71913	1.30	.04131	2.65
58	.70654	1.30	.01528	2.60	**58**	.71939	1.25	.04184	2.70
60	9.70680	1.30	0.01580	2.65	**60**	9.71964	1.30	0.04238	2.65
62	.70706	1.30	.01633	2.65	**62**	.71990	1.25	.04291	2.70
64	.70732	1.30	.01686	2.65	**64**	.72015	1.30	.04345	2.65
66	.70758	1.30	.01739	2.65	**66**	.72041	1.25	.04398	2.70
68	.70784	1.30	.01792	2.65	**68**	.72066	1.25	.04452	2.65
70	9.70810	1.25	0.01845	2.65	**70**	9.72091	1.30	0.04505	2.70
72	.70835	1.30	.01898	2.65	**72**	.72117	1.25	.04559	2.65
74	.70861	1.30	.01951	2.65	**74**	.72142	1.25	.04612	2.70
76	.70887	1.30	.02004	2.60	**76**	.72167	1.30	.04666	2.70
78	.70913	1.30	.02056	2.65	**78**	.72193	1.25	.04720	2.65
80	9.70939	1.30	0.02109	2.65	**80**	9.72218	1.25	0.04773	2.70
82	.70965	1.30	.02162	2.65	**82**	.72243	1.30	.04827	2.65
84	.70991	1.25	.02215	2.65	**84**	.72269	1.25	.04880	2.70
86	.71016	1.30	.02268	2.65	**86**	.72294	1.25	.04934	2.70
88	.71042	1.30	.02321	2.65	**88**	.72319	1.30	.04988	2.65
90	9.71068	1.30	0.02374	2.65	**90**	9.72345	1.25	0.05041	2.70
92	71094	1.30	.02427	2.65	**92**	.72370	1.25	.05095	2.70
94	.71120	1.25	.02480	2.70	**94**	.72395	1.25	.05149	2.65
96	.71145	1.30	.02534	2.65	**96**	.72420	1.30	.05202	2.70
98	.71171	1.30	.02587	2.65	**98**	.72446	1.25	.05256	2.70
100	9.71197		0.02640		**100**	9.72771		0.05310	

TABLE XXVI. — (*Continued*)

Hundredths	62° Vers	Diff. .001	62° Exsec	Diff. .001	Hundredths	63° Vers	Diff. .001	63° Exsec	Diff. .001
00	9.72471	1.25	0.05310	2.70	00	9.73720	1.25	0.08015	2.75
02	.72496	1.25	.05364	2.65	02	.73745	1.20	.08070	2.70
04	.72521	1.30	.05417	2.70	04	.73769	1.25	.08124	2.75
06	.72547	1.25	.05471	2.70	06	.73794	1.25	.08179	2.70
08	.72572	1.25	.05525	2.70	08	.73819	1.25	.08233	2.75
10	9.72597	1.25	0.05579	2.70	10	9.73844	1.20	0.08288	2.75
12	.72622	1.25	.05633	2.65	12	.73868	1.25	.08343	2.70
14	.72647	1.25	.05686	2.70	14	.73893	1.25	.08397	2.75
16	.72672	1.30	.05740	2.70	16	.73918	1.20	.08452	2.70
18	.72698	1.25	.05794	2.70	18	.73942	1.25	.08506	2.75
20	9.72723	1.25	0.05848	2.70	20	9.73967	1.25	0.08561	2.75
22	.72748	1.25	.05902	2.70	22	.73992	1.20	.08616	2.70
24	.72773	1.25	.05956	2.70	24	.74016	1.25	.08670	2.75
26	.72798	1.25	.06010	2.70	26	.74031	1.20	.08715	2.75
28	.72823	1.25	.06064	2.70	28	.74065	1.25	.08780	2.75
30	9.72848	1.25	0.06118	2.70	30	9.74090	1.25	0.08835	2.70
32	.72873	1.25	.06172	2.70	32	.74115	1.20	.08889	2.75
34	.72898	1.25	.06226	2.70	34	.74139	1.25	.08944	2.75
36	.72923	1.25	.06280	2.70	36	.74164	1.20	.08999	2.75
38	.72948	1.25	.06334	2.70	38	.74188	1.25	.09054	2.70
40	9.72973	1.30	0.06388	2.70	40	9.74213	1.20	0.09108	2.75
42	.72999	1.25	.06442	2.70	42	.74237	1.25	.09163	2.75
44	.73024	1.25	.06496	2.70	44	.74262	1.20	.09218	2.75
46	.73049	1.25	.06550	2.70	46	.74286	1.25	.09273	2.75
48	.73074	1.25	.06604	2.70	48	.74311	1.20	.09328	2.75
50	9.73099	1.20	0.06658	2.70	50	9.74335	1.25	0.09383	2.75
52	.73123	1.25	.06712	2.70	52	.74360	1.20	.09438	2.75
54	.73148	1.25	.06766	2.70	54	.74384	1.25	.09493	2.75
56	.73173	1.25	.06820	2.70	56	.74409	1.20	.09548	2.70
58	.73198	1.25	.06874	2.75	58	.74433	1.25	.09602	2.75
60	9.73223	1.25	0.06929	2.70	60	9.74458	1.20	0.09657	2.75
62	.73248	1.25	.06983	2.70	62	.74482	1.25	.09712	2.75
64	.73273	1.25	.07037	2.70	64	.74507	1.20	.09767	2.80
66	.73298	1.25	.07091	2.75	66	.74531	1.25	.09823	2.75
68	.73323	1.25	.07146	2.70	68	.74556	1.20	.09878	2.75
70	9.73348	1.25	0.07200	2.70	70	9.74580	1.20	0.09933	2.75
72	.73373	1.25	.07254	2.75	72	.74604	1.25	.09988	2.75
74	.73398	1.20	.07308	2.70	74	.74629	1.20	.10043	2.75
76	.73422	1.25	.07363	2.70	76	.74653	1.25	.10098	2.75
78	.73447	1.25	.07417	2.70	78	.74678	1.20	.10153	2.75
80	9.73472	1.25	0.07471	2.75	80	9.74702	1.20	0.10208	2.75
82	.73497	1.25	.07526	2.70	82	.74726	1.25	.10263	2.80
84	.73522	1.25	.07580	2.70	84	.74751	1.20	.10319	2.75
86	.73547	1.20	.07634	2.75	86	.74775	1.20	.10374	2.75
88	.73571	1.25	.07689	2.70	88	.74799	1.25	.10429	2.75
90	9.73596	1.25	0.07743	2.75	90	9.74824	1.20	0.10484	2.80
92	.73621	1.25	.07798	2.70	92	.74848	1.20	.10540	2.75
94	.73646	1.25	.07852	2.70	94	.74872	1.20	.10595	2.75
96	.73671	1.20	.07906	2.75	96	.74896	1.25	.10650	2.75
98	.73695	1.25	.07961	2.70	98	.74921	1.20	.10705	2.80
100	9.73720		0.08015		100	9.74945		0.10761	

Hundredths	64° Vers	Diff. .001	Exsec	Diff. .001	Hundredths	65° Vers	Diff. .001	Exsec	Diff. .001
00	9.74945	1.20	0.10761	2.75	**00**	9.76146	1.20	0.13551	2.85
02	.74969	1.20	.10816	2.75	**02**	.76170	1.20	.13608	2.80
04	.74993	1.25	.10871	2.80	**04**	.76194	1.20	.13664	2.80
06	.75018	1.20	.10927	2.75	**06**	.76218	1.15	.13720	2.85
08	.75042	1.20	.10982	2.80	**08**	.76241	1.20	.13777	2.80
10	9.75066	1.20	0.11038	2.75	**10**	9.76265	1.20	0.13833	2.85
12	.75090	1.25	.11093	2.80	**12**	.76289	1.20	.13890	2.80
14	.75115	1.20	.11149	2.75	**14**	.76313	1.15	.13946	2.85
16	.75139	1.20	.11204	2.80	**16**	.76336	1.20	.14003	2.80
18	.75163	1.20	.11260	2.75	**18**	.76360	1.20	.14059	2.85
20	9.75187	1.20	0.11315	2.80	**20**	9.76384	1.20	0.14116	2.80
22	.75211	1.20	.11371	2.75	**22**	.76408	1.15	.14172	2.85
24	.75235	1.25	.11426	2.80	**24**	.76431	1.20	.14229	2.80
26	.75260	1.20	.11482	2.75	**26**	.76455	1.20	.14285	2.85
28	.75284	1.20	.11537	2.80	**28**	.76479	1.15	.14342	2.80
30	9.75308	1.20	0.11593	2.80	**30**	9.76502	1.20	0.14398	2.85
32	.75332	1.20	.11649	2.75	**32**	.76526	1.20	.14455	2.85
34	.75356	1.20	.11704	2.80	**34**	.76550	1.15	.14512	2.80
36	.75380	1.20	.11760	2.80	**36**	.76573	1.20	.14568	2.85
38	.75404	1.20	.11816	2.75	**38**	.76597	1.15	.14625	2.85
40	9.75428	1.20	0.11871	2.80	**40**	9.76620	1.20	0.14682	2.80
42	.75452	1.20	.11927	2.80	**42**	.76644	1.20	.14738	2.85
44	.75476	1.20	.11983	2.80	**44**	.76668	1.15	.14795	2.85
46	.75500	1.20	.12039	2.75	**46**	.76691	1.20	.14852	2.85
48	.75524	1.25	.12094	2.80	**48**	.76715	1.15	.14909	2.85
50	9.75549	1.20	0.12150	2.80	**50**	9.76738	1.20	0.14966	2.80
52	.75573	1.20	.12206	2.80	**52**	.76762	1.15	.15022	2.85
54	.75597	1.20	.12262	2.80	**54**	.76785	1.20	.15079	2.85
56	.75621	1.20	.12318	2.75	**56**	.76809	1.20	.15136	2.85
58	.75645	1.20	.12373	2.80	**58**	.76833	1.15	.15193	2.85
60	9.75669	1.15	0.12429	2.80	**60**	9.76856	1.20	0.15250	2.85
62	.75692	1.20	.12485	2.80	**62**	.76880	1.15	.15307	2.85
64	.75716	1.20	.12541	2.80	**64**	.76903	1.20	.15364	2.85
66	.75740	1.20	.12597	2.80	**66**	.76927	1.15	.15421	2.85
68	.75764	1.20	.12653	2.80	**68**	.76950	1.20	.15478	2.85
70	9.75788	1.20	0.12709	2.80	**70**	9.76974	1.15	0.15535	2.85
72	.75812	1.20	.12765	2.80	**72**	.76997	1.20	.15592	2.85
74	.75836	1.20	.12821	2.80	**74**	.77021	1.15	.15649	2.85
76	.75860	1.20	.12877	2.80	**76**	.77044	1.20	.15706	2.90
78	.75884	1.20	.12933	2.80	**78**	.77068	1.15	.15764	2.85
80	9.75908	1.20	0.12989	2.85	**80**	9.77091	1.15	0.15821	2.85
82	.75932	1.20	.13046	2.80	**82**	.77114	1.20	.15878	2.85
84	.75956	1.20	.13102	2.80	**84**	.77138	1.15	.15935	2.85
86	.75980	1.15	.13158	2.80	**86**	.77161	1.20	.15992	2.85
88	.76003	1.20	.13214	2.80	**88**	.77185	1.15	.16049	2.90
90	9.76027	1.20	0.13270	2.80	**90**	9.77208	1.15	0.16107	2.85
92	.76051	1.20	.13326	2.85	**92**	.77231	1.20	.16164	2.85
94	.76075	1.20	.13383	2.80	**94**	.77255	1.15	.16221	2.90
96	.76099	1.20	.13439	2.80	**96**	.77278	1.15	.16279	2.85
98	.76123	1.15	.13495	2.80	**98**	.77301	1.20	.16336	2.85
100	9.76146		0.13551		**100**	9.77325		0.16393	

TABLE XXVI. — (*Continued*)

Hundredths	66° Vers	Diff. .001	66° Exsec	Diff. .001	Hundredths	67° Vers	Diff. .001	67° Exsec	Diff. .001
00	9.77325	1.15	0.16393	2.90	00	9.78481	1.15	0.19293	2.95
02	.77348	1.15	.16451	2.85	02	.78504	1.15	.19352	2.90
04	.77371	1.20	.16508	2.90	04	.78527	1.15	.19410	2.95
06	.77395	1.15	.16566	2.85	06	.78550	1.10	.19469	2.95
08	.77418	1.15	.16623	2.90	08	.78572	1.15	.19528	2.95
10	9.77441	1.20	0.16681	2.85	10	9.78595	1.15	0.19587	2.90
12	.77465	1.15	.16738	2.90	12	.78618	1.15	.19645	2.95
14	.77488	1.15	.16796	2.85	14	.78641	1.15	.19704	2.95
16	.77511	1.15	.16853	2.90	16	.78664	1.15	.19763	2.95
18	.77534	1.20	.16911	2.90	18	.78687	1.15	.19822	2.95
20	9.77558	1.15	0.16969	2.85	20	9.78710	1.10	0.19881	2.90
22	.77581	1.15	.17026	2.90	22	.78732	1.15	.19939	2.95
24	.77604	1.15	.17084	2.90	24	.78755	1.15	.19998	2.95
26	.77627	1.20	.17142	2.85	26	.78778	1.15	.20057	2.95
28	.77651	1.10	.17199	2.90	28	.78801	1.10	.20116	2.95
30	9.77674	1.15	0.17257	2.90	30	9.78823	1.15	0.20175	2.95
32	.77697	1.15	.17315	2.85	32	.78846	1.15	.20234	2.95
34	.77720	1.20	.17372	2.90	34	.78869	1.15	.20293	2.95
36	.77744	1.15	.17430	2.90	36	.78892	1.15	.20352	3.00
38	.77767	1.15	.17488	2.90	38	.78915	1.10	.20412	2.95
40	9.77790	1.15	0.17546	2.90	40	9.78937	1.15	0.20471	2.95
42	.77813	1.15	.17604	2.90	42	.78960	1.15	.20530	2.95
44	.77836	1.15	.17662	2.90	44	.78983	1.10	.20589	2.95
46	.77859	1.15	.17720	2.90	46	.79005	1.15	.20648	3.00
48	.77882	1.20	.17778	2.90	48	.79028	1.15	.20708	2.95
50	9.77906	1.15	0.17836	2 90	50	9.79051	1.10	0.20767	2.95
52	.77929	1.15	.17894	2.90	52	.79073	1.15	.20826	2.95
54	.77952	1.15	.17952	2.90	54	.79096	1.15	.20885	3.00
56	.77975	1.15	.18010	2.90	56	.79119	1.10	.20945	2.95
58	.77998	1.15	.18068	2.90	58	.79141	1.15	.21004	3.00
60	9.78021	1.15	0.18126	2.90	60	9.79164	1.15	0.21064	2.95
62	.78044	1.15	.18184	2.90	62	.79187	1.15	.21123	3.00
64	.78067	1.15	.18242	2.90	64	.79209	1.15	.21183	2.95
66	.78090	1.15	.18300	2.90	66	.79232	1.15	.21242	3.00
68	.78113	1.15	.18358	2.95	68	.79255	1.10	.21302	2.95
70	9.78136	1.15	0.18417	2.90	70	9.79277	1.15	0.21361	3.00
72	.78159	1.15	.18475	2.90	72	.79300	1.10	.21421	2.95
74	.78182	1.15	.18533	2.95	74	.79322	1.15	.21480	3.00
76	.78205	1.15	.18592	2.90	76	.79345	1.15	.21540	3.00
78	.78228	1.15	.18650	2.90	78	.79368	1.10	.21600	2.95
80	9.78251	1.15	0.18708	2.95	80	9.79390	1.15	0.21659	3.00
82	.78274	1.15	.18767	2.90	82	.79413	1.10	.21719	3.00
84	.78297	1.15	.18825	2.90	84	.79435	1.15	.21779	3.00
86	.78320	1.15	.18883	2.95	86	.79458	1.10	.21839	2.95
88	.78343	1.15	.18942	2.90	88	.79480	1.15	.21898	3.00
90	9.78366	1.15	0.19000	2.95	90	9.79503	1.10	0.21958	3.00
92	.78389	1.15	.19059	2.90	92	.79525	1.15	.22018	3.00
94	.78412	1.15	.19117	2.95	94	.79548	1.10	.22078	3.00
96	.78435	1.15	.19176	2.90	96	.79570	1.15	.22138	3.00
98	.78458	1.15	.19234	2.95	98	.79593	1.10	.22198	3.00
100	9.78481		0.19293		100	9.79615		0.22258	

TABLE XXVI. — (*Continued*)

Hundredths	68° Vers	Diff. .001	68° Exsec	Diff. .001	Hundredths	69° Vers	Diff. .001	69° Exsec	Diff. .001
00	9.79615	1.15	0.22258	3.00	**00**	9.80729	1.10	0.25296	3.05
02	.79638	1.10	.22318	3.00	**02**	.80751	1.10	.25357	3.10
04	.79660	1.15	.22378	3.00	**04**	.80773	1.10	.25419	3.05
06	.79683	1.10	.22438	3.00	**06**	.80795	1.10	.25480	3.10
08	.79705	1.15	.22498	3.00	**08**	.80817	1.10	.25542	3.10
10	9.79728	1.10	0.22558	3.00	**10**	9.80839	1.10	0.25604	3.10
12	.79750	1.10	.22618	3.00	**12**	.80861	1.10	.25666	3.05
14	.79772	1.15	.22678	3.05	**14**	.80883	1.10	.25727	3.10
16	.79795	1.10	.22739	3.00	**16**	.80905	1.10	.25789	3.10
18	.79817	1.15	.22799	3.00	**18**	.80927	1.10	.25851	3.10
20	9.79840	1.10	0.22859	3.05	**20**	9.80949	1.10	0.25913	3.10
22	.79862	1.10	.22920	3.00	**22**	.80971	1.10	.25975	3.10
24	.79884	1.15	.22980	3.05	**24**	.80993	1.10	.26037	3.10
26	.79907	1.10	.23041	3.00	**26**	.81015	1.10	.26099	3.10
28	.79929	1.15	.23101	3.00	**28**	.81037	1.10	.26161	3.10
30	9.79952	1.10	0.23161	3.05	**30**	9.81059	1.05	0.26223	3.10
32	.79974	1.10	.23222	3.00	**32**	.81080	1.10	.26285	3.10
34	.79996	1.15	.23282	3.05	**34**	.81102	1.10	.26347	3.10
36	.80019	1.10	.23343	3.00	**36**	.81124	1.10	.26409	3.10
38	.80041	1.10	.23403	3.05	**38**	.81146	1.10	.26471	3.10
40	9.80063	1.10	0.23464	3.00	**40**	9.81168	1.10	0.26533	3.15
42	.80085	1.15	.23524	3.05	**42**	.81190	1.10	.26596	3.10
44	.80108	1.10	.23585	3.05	**44**	.81212	1.10	.26658	3.10
46	.80130	1.10	.23646	3.00	**46**	.81234	1.10	.26720	3.15
48	.80152	1.15	.23706	3.05	**48**	.81256	1.05	.26783	3.10
50	9.80175	1.10	0.23767	3.05	**50**	9.81277	1.10	0.26845	3.10
52	.80197	1.10	.23828	3.05	**52**	.81299	1.10	.26907	3.15
54	.80219	1.10	.23889	3.00	**54**	.81321	1.10	.26970	3.10
56	.80241	1.15	.23949	3.05	**56**	.81343	1.10	.27032	3.15
58	.80264	1.10	.24010	3.05	**58**	.81365	1.10	.27095	3.10
60	9.80286	1.10	0.24071	3.05	**60**	9.81387	1.05	0.27157	3.15
62	.80308	1.10	.24132	3.05	**62**	.81408	1.10	.27220	3.15
64	.80330	1.10	.24193	3.05	**64**	.81430	1.10	.27273	3.10
66	.80352	1.15	.24254	3.05	**66**	.81452	1.10	.27345	3.15
68	.80375	1.10	.24315	3.05	**68**	.81474	1.10	.27408	3.15
70	9.80397	1.10	0.24376	3.05	**70**	9.81496	1.05	0.27471	3.10
72	80419	1.10	.24437	3.05	**72**	.81517	1.10	.27533	3.15
74	.80441	1.10	.24498	3.05	**74**	.81539	1.10	.27596	3.15
76	.80463	1.10	.24559	3.10	**76**	.81561	1.10	.27659	3.15
78	.80485	1.15	.24621	3.05	**78**	.81583	1.05	.27722	3.15
80	9.80508	1.10	0.24682	3.05	**80**	9.81604	1.10	0.27785	3.15
82	.80530	1.10	.24743	3.05	**82**	.81626	1.10	.27848	3.15
84	.80552	1.10	.24804	3.10	**84**	.81648	1.10	.27911	3.15
86	.80574	1.10	.24866	3.05	**86**	.81670	1.05	.27974	3.15
88	.80596	1.10	.24927	3.05	**88**	.81691	1.10	.28037	3.15
90	9.80618	1.10	0.24988	3.10	**90**	9.81713	1.10	0.28100	3.15
92	.80640	1.10	.25050	3.05	**92**	.81735	1.05	.28163	3.15
94	.80662	1.10	.25111	3.10	**94**	.81756	1.10	.28226	3.20
96	.80684	1.15	.25173	3.05	**96**	.81778	1.10	.28290	3.15
98	.80707	1.10	.25234	3.10	**98**	.81800	1.05	.28353	3.15
100	9.80729		9.25296		**100**	9.81821		0.28416	

TABLE XXVI. — (*Continued*)

Hundredths	70° Vers	70° Diff. .001	70° Exsec	70° Diff. .001	Hundredths	71° Vers	71° Diff. .001	71° Exsec	71° Diff. .001
00	9.81821	1.10	0.28416	3.15	00	9.82894	1.05	0.31630	3.25
02	.81843	1.10	.28479	3.20	02	.82915	1.05	.31695	3.25
04	.81865	1.05	.28543	3.15	04	.82936	1.10	.31760	3.30
06	.81886	1.10	.28606	3.20	06	.82958	1.05	.31826	3.25
08	.81908	1.05	.28670	3.15	08	.82979	1.05	.31891	3.30
10	9.81929	1.10	0.28733	3.20	10	9.83000	1.05	0.31957	3.25
12	.81951	1.10	.28797	3.15	12	.83021	1.05	.32022	3.30
14	.81973	1.05	.28860	3.20	14	.83042	1.10	.32088	3.25
16	.81994	1.10	.28924	3.15	16	.83064	1.05	.32153	3.30
18	.82016	1.05	.28987	3.20	18	.83085	1.05	.32219	3.30
20	9.82037	1.05	0.29051	3.15	20	9.83106	1.05	0.32285	3.25
22	.82058	1.10	.29114	3.20	22	.83127	1.05	.32350	3.30
24	.82080	1.10	.29178	3.20	24	.83148	1.05	.32416	3.30
26	.82102	1.10	.29242	3.20	26	.83169	1.10	.32482	3.30
28	.82124	1.05	.29306	3.20	28	.83191	1.05	.32548	3.30
30	9.82145	1.10	0.29370	3.20	30	9.83212	1.05	0.32614	3.30
32	.82167	1.05	.29434	3.20	32	.83233	1.05	.32680	3.30
34	.82188	1.10	.29498	3.20	34	.83254	1.05	.32746	3.30
36	.82210	1.05	.29562	3.20	36	.83275	1.05	.32812	3.30
38	.82231	1.10	.29626	3.20	38	.83296	1.05	.32878	3.30
40	9.82253	1.05	0.29690	3.20	40	9.83317	1.05	0.32944	3.30
42	.82274	1.10	.29754	3.20	42	.83338	1.05	.33010	3.30
44	.82296	1.05	.29818	3.20	44	.83359	1.10	.33076	3.30
46	.82317	1.10	.29882	3.20	46	.83381	1.05	.33142	3.35
48	.82339	1.05	.29946	3.20	48	.83402	1.05	.33209	3.30
50	9.82360	1.05	0.30010	3.25	50	9.83423	1.05	0.33285	3.30
52	.82381	1.10	.30075	3.20	52	.83444	1.05	.33341	3.35
54	.82403	1.05	.30139	3.20	54	.83465	1.05	.33408	3.30
56	.82424	1.10	.30203	3.25	56	.83486	1.05	.33474	3.35
58	.82446	1.05	.30268	3.20	58	.83507	1.05	.33541	3.30
60	9.82467	1.10	0.30332	3.25	60	9.83528	1.05	0.33607	3.35
62	.82489	1.05	.30397	3.20	62	.83549	1.05	.33674	3.35
64	.82510	1.05	.30461	3.25	64	.83570	1.05	.33741	3.30
66	.82531	1.10	.30526	3.20	66	.83591	1.05	.33807	3.35
68	.82553	1.05	.30590	3.25	68	.83612	1.05	.33874	3.35
70	9.82574	1.05	0.30655	3.25	70	9.83633	1.05	0.33941	3.35
72	.82595	1.10	.30720	3.20	72	.83654	1.05	.34008	3.35
74	.82617	1.05	.30784	3.25	74	.83675	1.05	.34075	3.35
76	.82638	1.10	.30849	3.25	76	.83696	1.05	.34142	3.35
78	.82660	1.05	.30914	3.25	78	.83717	1.05	.34209	3.35
80	9.82681	1.05	0.30979	3.25	80	9.83738	1.05	0.34276	3.35
82	.82702	1.10	.31044	3.25	82	.83759	1.05	.34343	3.35
84	.82724	1.05	.31109	3.25	84	.83780	1.00	.34410	3.35
86	.82745	1.05	.31174	3.25	86	.83800	1.05	.34477	3.35
88	.82766	1.05	.31239	3.25	88	.83821	1.05	.34544	3.35
90	9.82787	1.10	0.31304	3.25	90	9.83842	1.05	0.34611	3.40
92	.82809	1.05	.31369	3.25	92	.83863	1.05	.34679	3.35
94	.82830	1.05	.31434	3.25	94	.83884	1.05	.34746	3.40
96	.82851	1.10	.31499	3.25	96	.83905	1.05	.34814	3.35
98	.82873	1.05	.31564	3.30	98	.83926	1.05	.34881	3.35
100	9.82894		0.31630		100	9.83947		0.34948	

TABLE XXVI. — (*Continued*)

Hundredths	72° Vers	Diff. .001	72° Exsec	Diff. .001	Hundredths	73° Vers	Diff. .001	73° Exsec	Diff. .001
00	9.83947	1.05	0.34948	3.40	00	9.84981	1.00	0.38387	3.50
02	.83968	1.00	.35016	3.40	02	.85001	1.00	.38457	3.50
04	.83988	1.05	.35084	3.35	04	.85021	1.05	.38527	3.50
06	.84009	1.05	.35151	3.40	06	.85042	1.00	.38597	3.55
08	.84030	1.05	.35219	3.40	08	.85062	1.05	.38668	3.50
10	9.84051	1.05	0.35287	3.35	10	9.85083	1.05	0.38738	3.55
12	.84072	1.05	.35354	3.40	12	.85104	1.00	.38809	3.50
14	.84093	1.00	.35422	3.40	14	.85124	1.00	.38879	3.50
16	.84113	1.05	.35490	3.40	16	.85144	1.05	.38949	3.55
18	.84134	1.05	.35558	3.40	18	.85165	1.00	.39020	3.50
20	9.84155	1.05	0.35626	3.40	20	9.85185	1.00	0.39090	3.55
22	.84176	1.05	.35694	3.40	22	.85205	1.05	.39161	3.55
24	.84197	1.00	.35762	3.40	24	.85226	1.00	.39232	3.55
26	.84217	1.05	.35830	3.45	26	.85246	1.05	.39303	3.50
28	.84238	1.05	.35899	3.40	28	.85267	1.00	.39373	3.55
30	9.84259	1.05	0.35967	3.40	30	9.85287	1.00	0.39444	3.55
32	.84280	1.00	.36035	3.40	32	.85307	1.05	.39515	3.55
34	.84300	1.05	.36103	3.45	34	.85328	1.00	.39586	3.55
36	.84321	1.05	.36172	3.40	36	.85348	1.00	.39667	3.55
38	.84342	1.05	.36240	3.45	38	.85368	1.05	.39728	3.60
40	9.84363	1.00	0.36309	3.40	40	9.85389	1.00	0.39800	3.55
42	.84383	1.05	.36377	3.45	42	.85409	1.00	.39871	3.55
44	.84404	1.05	.36446	3.40	44	.85429	1.05	.39942	3.55
46	.84425	1.00	.36514	3.45	46	.85450	1.00	.40013	3.60
48	.84445	1.05	.36583	3.45	48	.85470	1.00	.40085	3.55
50	9.84466	1.05	0.36652	3.45	50	9.85490	1.05	0.40156	3.60
52	.84487	1.00	.36721	3.40	52	.85511	1.00	.40228	3.55
54	.84507	1.05	.36789	3.45	54	.85531	1.00	.40299	3.60
56	.84528	1.05	.36858	3.45	56	.85551	1.05	.40371	3.60
58	.84549	1.00	.36927	3.45	58	.85572	1.00	.40443	3.55
60	9.84569	1.05	0.36996	3.45	60	9.85592	1.00	0.40514	3.60
62	.84590	1.05	.37065	3.45	62	.85612	1.00	.40586	3.60
64	.84611	1.00	.37134	3.50	64	.85632	1.05	.40658	3.60
66	.84631	1.05	.37204	3.45	66	.85653	1.00	.40730	3.60
68	.84652	1.00	.37273	3.45	68	.85673	1.00	.40802	3.60
70	9.84672	1.05	0.37342	3.45	70	9.85693	1.00	0.40874	3.60
72	.84693	1.05	.37411	3.50	72	.85713	1.00	.40946	3.60
74	.84714	1.00	.37481	3.45	74	.85733	1.05	.41018	3.60
76	.84734	1.05	.37550	3.45	76	.85754	1.00	.41090	3.65
78	.84755	1.00	.37619	3.50	78	.85774	1.00	.41163	3.60
80	9.84775	1.05	0.37689	3.50	80	9.85794	1.00	0.41235	3.60
82	.84796	1.00	.37759	3.45	82	.85814	1.00	.41307	3.65
84	.84816	1.05	.37828	3.50	84	.85834	1.05	.41380	3.60
86	.84837	1.00	.37898	3.50	86	.85855	1.00	.41452	3.65
88	.84857	1.05	.37968	3.45	88	.85875	1.00	.41525	3.65
90	9.84878	1.05	0.38037	3.50	90	9.85895	1.00	0.41598	3.60
92	.84899	1.00	.38107	3.50	92	.85915	1.00	.41670	3.65
94	.84919	1.05	.38177	3.50	94	.85935	1.00	.41743	3.65
96	.84940	1.00	.38247	3.50	96	.85955	1.00	.41816	3.65
98	.84960	1.05	.38317	3.50	98	.85975	1.05	.41889	3.65
100	9.84981		0.38387		100	9.85996		0.41962	

Hundredths	74° Vers	Diff. .001	74° Exsec	Diff. .001	Hundredths	75° Vers	Diff. .001	75° Exsec	Diff. .001
00	9.85996	1.00	0.41962	3.65	**00**	9.86992	1.00	0.45693	3.80
02	.86016	1.00	.42035	3.65	**02**	.87012	1.00	.45769	3.85
04	.86036	1.00	.42108	3.65	**04**	.87032	1.00	.45846	3.80
06	.86056	1.00	.42181	3.65	**06**	.87052	.95	.45922	3.85
08	.86076	1.00	.42254	3.70	**08**	.87071	1.00	.45999	3.80
10	9.86096	1.00	0.42328	3.65	**10**	9.87091	1.00	0.46075	3.85
12	.86116	1.00	.42401	3.65	**12**	.87111	1.00	.46152	3.80
14	.86136	1.00	.42474	3.70	**14**	.87131	.95	.46228	3.90
16	.86156	1.00	.42548	3.65	**16**	.87150	1.00	.46306	3.85
18	.86176	1.00	.42621	3.70	**18**	.87170	1.00	.46383	3.85
20	9.86196	1.00	0.42695	3.65	**20**	9.87190	.95	0.46460	3.85
22	.86216	1.00	.42768	3.70	**22**	.87209	1.00	.46537	3.85
24	.86236	1.05	.42842	3.70	**24**	.87229	1.00	.46614	3.85
26	.86257	1.00	.42916	3.70	**26**	.87249	.95	.46691	3.90
28	.86277	1.00	.42990	3.70	**28**	.87268	1.00	.46769	3.85
30	9.86297	1.00	0.43064	3.70	**30**	9.87288	1.00	0.46846	3.85
32	.86317	1.00	.43138	3.70	**32**	.87308	.95	.46923	3.90
34	.86337	1.00	.43212	3.70	**34**	.87327	1.00	.47001	3.90
36	.86357	1.00	.43286	3.70	**36**	.87347	1.00	.47079	3.85
38	.86377	1.00	.43360	3.70	**38**	.87367	.95	.47156	3.90
40	9.86397	1.00	0.43434	3.75	**40**	9.87386	1.00	0.47234	3.90
42	.86417	.95	.43509	3.70	**42**	.87406	.95	.47312	3.90
44	.86436	1.00	.43583	3.70	**44**	.87425	1.00	.47390	3.90
46	.86456	1.00	.43657	3.75	**46**	.87445	1.00	.47468	3.90
48	.86476	1.00	.43732	3.70	**48**	.87465	.95	.47546	3.90
50	9.86496	1.00	0.43806	3.75	**50**	9.87484	1.00	0.47624	3.90
52	.86516	1.00	.43881	3.75	**52**	.87504	.95	.47702	3.95
54	.86536	1.00	.43956	3.70	**54**	.87523	1.00	.47781	3.90
56	.86556	1.00	.44030	3.75	**56**	.87543	.95	.47859	3.95
58	.86576	1.00	.44105	3.75	**58**	.87562	1.00	.47938	3.90
60	9.86596	1.00	0.44180	3.75	**60**	9.87582	.95	0.48016	3.95
62	.86616	1.00	.44255	3.75	**62**	.87601	1.00	.48095	3.90
64	.86636	1.00	.44330	3.75	**64**	.87621	1.00	.48173	3.95
66	.86656	.95	.44405	3.80	**66**	.87641	.95	.48252	3.95
68	.86675	1.00	.44481	3.75	**68**	.87660	1.00	.48331	3.95
70	9.86695	1.00	0.44556	3.75	**70**	9.87680	.95	0.48410	3.95
72	.86715	1.00	.44631	3.75	**72**	.87699	1.00	.48489	3.95
74	.86735	1.00	.44706	3.80	**74**	.87719	.95	.48568	3.95
76	.86755	1.00	.44782	3.75	**76**	.87738	1.00	.48647	4.00
78	.86775	1.00	.44857	3.80	**78**	.87758	.95	.48727	3.95
80	9.86795	.95	0.44933	3.80	**80**	9.87777	.95	0.48806	3.95
82	.86814	1.00	.45009	3.75	**82**	.87796	1.00	.48885	4.00
84	.86834	1.00	.45084	3.80	**84**	.87716	.95	.48965	3.95
86	.86854	1.00	.45160	3.80	**86**	.87835	1.00	.49044	4.00
88	.86874	1.00	.45236	3.80	**88**	.87855	.95	.49124	4.00
90	9.86894	.95	0.45312	3.80	**90**	9.87874	1.00	0.49204	4.00
92	.86913	1.00	.45388	3.80	**92**	.87894	.95	.49284	4.00
94	.86933	1.00	.45464	3.80	**94**	.87913	1.00	.49364	4.00
96	.86953	1.00	.45540	3.85	**96**	.87933	.95	.49444	4.05
98	.86973	.95	.45617	3.80	**98**	.87952	.95	.49525	3.95
100	9.86992		0.45693		**100**	9.87971		0.49604	

TABLE XXVI. — (*Continued*)

Hundredths	76° Vers	Diff. .001	76° Exsec	Diff. .001	Hundredths	77° Vers	Diff. .001	77° Exsec	Diff. .001
00	9.87971	1.00	0.49604	4.00	00	9.88933	.95	0.53724	4.25
02	.87991	.95	.49684	4.00	02	.88952	.95	.53809	4.25
04	.88010	1.00	.49764	4.05	04	.88971	.95	.53894	4.25
06	.88030	.95	.49845	4.00	06	.88990	.95	.53979	4.25
08	.88049	.95	.49925	4.05	08	.89009	.95	.54064	4.25
10	9.88068	1.00	0.50006	4.05	10	9.89028	.95	0.54149	4.25
12	.88088	.95	.50087	4.00	12	.89047	.95	.54234	4.30
14	.88107	.95	.50167	4.05	14	.89066	.95	.54320	4.25
16	.88126	1.00	.50248	4.05	16	.89085	.95	.54405	4.30
18	.88146	.95	.50329	4.05	18	.89104	.95	.54491	4.25
20	9.88165	.95	0.50410	4.05	20	9.89123	.95	0.54576	4.30
22	.88184	1.00	.50491	4.05	22	.89142	.95	.54662	4.30
24	.88204	.95	.50572	4.10	24	.89161	.95	.54748	4.30
26	.88223	.95	.50654	4.05	26	.89180	.95	.54834	4.30
28	.88242	1.00	.50735	4.10	28	.89199	.95	.54920	4.30
30	9.88262	.95	0.50817	4.05	30	9.89218	.95	0.55006	4.30
32	.88281	.95	.50898	4.10	32	.89237	.95	.55092	4.35
34	.88300	1.00	.50980	4.05	34	.89256	.95	.55179	4.30
36	.88320	.95	.51061	4.10	36	.89275	.95	.55265	4.35
38	.88339	.95	.51143	4.10	38	.89294	.95	.55352	4.35
40	9.88358	.95	0.51225	4.10	40	9.89313	.95	0.55439	4.30
42	.88377	1.00	.51307	4.10	42	.89332	.95	.55525	4.35
44	.88397	.95	.51389	4.10	44	.89351	.90	.55612	4.35
46	.88416	.95	.51471	4.10	46	.89369	.95	.55699	4.35
48	.88435	.95	.51553	4.15	48	.89388	.95	.55786	4.40
50	9.88454	1.00	0.51636	4.10	50	9.89407	.95	0.55874	4.35
52	.88474	.95	.51718	4.15	52	.89426	.95	.55961	4.35
54	.88493	.95	.51801	4.10	54	.89445	.95	.56048	4.40
56	.88512	.95	.51883	4.15	56	.89464	.95	.56136	4.40
58	.88531	.95	.51966	4.15	58	.89483	.95	.56224	4.35
60	9.88550	1.00	0.52049	4.15	60	9.89502	.90	0.56311	4.40
62	.88570	.95	.52132	4.15	62	.89520	.95	.56399	4.40
64	.88589	.95	.52215	4.15	64	.89539	.95	.56487	4.40
66	.88608	.95	.52298	4.15	66	.89558	.95	.56575	4.40
68	.88627	.95	.52381	4.15	68	.89577	.95	.56663	4.45
70	9.88646	.95	0.52464	4.15	70	9.89596	.95	0.56752	4.40
72	.88665	1.00	.52547	4.20	72	.89615	.90	.56840	4.45
74	.88685	.95	.52631	4.15	74	.89633	.95	.56929	4.40
76	.88704	.95	.52714	4.20	76	.89652	.95	.57017	4.45
78	.88723	.95	.52798	4.20	78	.89671	.95	.57106	4.45
80	9.88742	.95	0.52882	4.20	80	9.89690	.95	0.57195	4.45
82	.88761	.95	.52966	4.15	82	.89709	.90	.57284	4.45
84	.88780	.95	.53049	4.20	84	.89727	.95	.57373	4.45
86	.88799	.95	.53133	4.25	86	.89746	.95	.57462	4.45
88	.88818	1.00	.53218	4.20	88	.89765	.95	.57551	4.50
90	9.88838	.95	0.53302	4.20	90	9.89784	.90	0.57641	4.45
92	.88857	.95	.53386	4.20	92	.89802	.95	.57730	4.50
94	.88876	.95	.53470	4.25	94	.89821	.95	.57820	4.50
96	.88895	.95	.53555	4.20	96	.89840	.95	.57910	4.45
98	.88914	.95	.53639	4.25	98	.89859	.90	.57999	4.50
100	9.88933		0.53724		100	9.89877		0.58089	

Hundredths	78° Vers	Diff. .001	78° Exsec	Diff. .001	Hundredths	79° Vers	Diff. .001	79° Exsec	Diff. .001
00	9.89877	.95	0.58089	4.55	**00**	9.90805	.90	0.62745	4.85
02	.89896	.95	.58180	4.50	**02**	.90823	.95	.62842	4.80
04	.89915	.90	.58270	4.50	**04**	.90842	.90	.62938	4.80
06	.89933	.95	.58360	4.55	**06**	.90860	.95	.63036	4.80
08	.89952	.95	.58451	4.50	**08**	.90879	.90	.63132	4.85
10	9.89971	.95	0.58541	4.55	**10**	9.90897	.90	0.63229	4.85
12	.89990	.90	.58632	4.55	**12**	.90915	.95	.63326	4.85
14	.90008	.95	.58723	4.55	**14**	.90934	.90	.63423	4.90
16	.90027	.95	.58814	4.55	**16**	.90952	.90	.63521	4.85
18	.90046	.90	.58905	4.55	**18**	.90970	.95	.63618	4.90
20	9.90064	.95	0.58996	4.55	**20**	9.90989	.90	0.63716	4.90
22	.90083	.95	.59087	4.55	**22**	.91007	.90	.63814	4.90
24	.90102	.90	.59178	4.60	**24**	.91025	.95	.63912	4.90
26	.90120	.95	.59270	4.60	**26**	.91044	.90	.64010	4.90
28	.90139	.90	.59362	4.55	**28**	.91062	.90	.64108	4.95
30	9.90157	.95	0.59453	4.60	**30**	9.91080	.95	0.64207	4.90
32	.90176	.95	.59545	4.60	**32**	.91099	.90	.64305	4.95
34	.90195	.90	.59637	4.60	**34**	.91117	.90	.64404	4.95
36	.90213	.95	.59729	4.65	**36**	.91135	.90	.64503	4.95
38	.90232	.90	.59822	4.60	**38**	.91153	.95	.64602	4.95
40	9.90250	.95	0.59914	4.65	**40**	9.91172	.90	0.64701	5.00
42	.90269	.95	.60007	4.60	**42**	.91190	.90	.64801	5.05
44	.90288	.90	.60099	4.65	**44**	.91218	.90	.64900	5.00
46	.90306	.90	.60192	4.60	**46**	.91226	.95	.65000	5.00
48	.90324	.95	.60284	4.70	**48**	.91245	.90	.65100	5.00
50	9.90343	.95	0.60378	4.65	**50**	9.91263	.90	0.65200	5.00
52	.90362	.90	.60471	4.65	**52**	.91281	.90	.65300	5.00
54	.90380	.95	.60564	4.70	**54**	.91299	.90	.65400	5.00
56	.90399	.90	.60658	4.65	**56**	.91317	.95	.65500	5.05
58	.90417	.95	.60751	4.70	**58**	.91336	.90	.65601	5.05
60	9.90436	.95	0.60845	4.65	**60**	9.91354	.90	0.65702	5.00
62	.90455	.90	.60938	4.70	**62**	.91372	.90	.65802	5.05
64	.90473	.95	.61032	4.70	**64**	.91390	.90	.65903	5.05
66	.90492	.90	.61126	4.75	**66**	.91408	.95	.66005	5.05
68	.90510	.95	.61221	4.70	**68**	.91427	.90	.66106	5.05
70	9.90529	.90	0.61315	4.70	**70**	9.91445	.90	0.66207	5.10
72	.90547	.90	.61409	4.75	**72**	.91463	.90	.66309	5.10
74	.90565	.95	.61504	4.75	**74**	.91481	.90	.66411	5.10
76	.90584	.90	.61599	4.70	**76**	.91499	.90	.66513	5.10
78	.90602	.95	.61693	4.75	**78**	.91517	.95	.66615	5.10
80	9.90621	.90	0.61788	4.75	**80**	9.91536	.90	0.66717	5.15
82	.90639	.95	.61883	4.80	**82**	.91554	.90	.66820	5.10
84	.90658	.90	.61979	4.75	**84**	.91572	.90	.66922	5.15
86	.90676	.95	.62074	4.75	**86**	.91590	.90	.67025	5.15
88	.90695	.90	.62169	4.80	**88**	.91608	.90	.67128	5.15
90	9.90713	.90	0.62265	4.80	**90**	9.91626	.90	0.67231	5.20
92	.90731	.95	.62361	4.80	**92**	.91644	.90	.67335	5.15
94	.90750	.90	.62457	4.80	**94**	.91662	.90	.67438	5.20
96	.90768	.95	.62543	4.80	**96**	.91680	.90	.67542	5.20
98	.90787	.90	.62649	4.80	**98**	.91698	.90	.67646	5.15
100	9.90805		0.62745		**100**	9.91716		0.67749	

TABLE XXVI. — (*Continued*)

Hundredths	80° Vers	Diff. .001	80° Exsec	Diff. .001	Hundredths	81° Vers	Diff. .001	81° Exsec	Diff. .001
00	9.91716	.95	0.67749	5.25	00	9.92612	.90	0.73179	5.65
02	.91735	.90	.67854	5.20	02	.92630	.85	.73292	5.70
04	.91753	.90	.67958	5.20	04	.92647	.90	.73406	5.70
06	.91771	.90	.68062	5.25	06	.92665	.90	.73520	5.70
08	.91789	.90	.68167	5.25	08	.92683	.90	.73634	5.75
10	9.91807	.90	0.68272	5.25	10	9.92701	.85	0.73749	5.70
12	.91825	.90	.68377	5.25	12	.92718	.90	.73863	5.75
14	.91843	.90	.68482	5.25	14	.92736	.90	.73978	5.75
16	.91861	.90	.68587	5.30	16	.92754	.85	.74093	5.75
18	.91879	.90	.68693	5.30	18	.92771	.90	.74208	5.80
20	9.91897	.90	0.68799	5.25	20	9.92789	.90	0.74324	5.80
22	.91915	.90	.68904	5.30	22	.92807	.85	.74440	5.80
24	.91933	.90	.69010	5.35	24	.92824	.90	.74556	5.85
26	.91951	.90	.69117	5.30	26	92842	.90	.74671	5.85
28	.91969	.90	.69223	5.35	28	.92860	.85	.74788	5.85
30	9.91987	.90	0.69330	5.30	30	9.92877	.90	0.74905	5.85
32	.92005	.90	.69436	5.35	32	.92895	.90	.75022	5.85
34	.92023	.90	.69543	5.35	34	.92913	.85	.75139	5.85
36	.92041	.90	.69650	5.40	36	.92930	.90	.75256	5.85
38	.92059	.90	.69758	5.35	38	.92948	.90	.75373	5.90
40	9.92077	.90	0.69865	5.40	40	9.92966	.85	0.75491	5.90
42	.92095	.90	.69973	5.35	42	.92983	.90	.75609	5.90
44	.92111	.95	.70080	5.45	44	.93001	.85	.75727	5.95
46	.92130	.90	.70189	5.40	46	.93018	.90	.75846	5.95
48	.92148	.90	.70297	5.40	48	.93036	.90	.75965	5.90
50	9.92166	.90	0.70405	5.45	50	9.93054	.85	0.76083	6.00
52	.92184	.90	.70514	5.45	52	.93071	.90	.76203	5.95
54	.92202	.90	.70623	5.45	54	.93089	.85	.76322	6.00
56	.92220	.90	.70732	5.45	56	.93106	.90	.76442	5.95
58	.92238	.90	.70841	5.45	58	.93124	.90	.76561	6.05
60	9.92256	.90	0.70950	5.50	60	9.93142	.85	0.76682	6.00
62	.92274	.85	.71060	5.45	62	.93159	.85	.76802	6.00
64	.92291	.90	.71169	5.50	64	.93176	.90	.76922	6.05
66	.92309	.90	.71279	5.50	66	.93194	.90	.77043	6.10
68	.92327	.90	.71389	5.55	68	.93212	.85	.77165	6.05
70	9.92345	.90	0.71500	5.50	70	9.93229	.90	0.77286	6.05
72	.92363	.90	.71610	5.55	72	.93247	.85	.77407	6.10
74	.92381	.85	.71721	5.55	74	.93264	.90	.77529	6.10
76	.92398	.90	.71832	5.55	76	.93282	.85	.77651	6.15
78	.92416	.90	.71943	5.55	78	.93299	.90	.77774	6.10
80	9.92434	.90	0.72054	5.60	80	9.93317	.85	0.77896	6.15
82	.92452	.90	.72166	5.60	82	.93334	.90	.78019	6.15
84	.92470	.85	.72278	5.55	84	.93352	.85	.78142	6.15
86	.92487	.90	.72389	5.65	86	.93369	.90	.78265	6.20
88	.92505	.90	.72502	5.60	88	.93387	.85	.78389	6.20
90	9.92523	.90	0.72614	5.60	90	9.93404	.90	0.78513	6.20
92	.92541	.90	.72726	5.65	92	.93422	.85	.78637	6.20
94	.92559	.85	.72839	5.65	94	.93439	.90	.78761	6.25
96	.92576	.90	.72952	5.65	96	.93457	.85	.78886	6.25
98	.92594	.90	.73065	5.70	98	.93474	.90	.79011	6.25
100	9.92612		0.73179		100	9.93492		0.79136	

TABLE XXVI. — (*Continued*)

Hundredths	82° Vers	Diff. .001	82° Exsec	Diff. .001	Hundredths	83° Vers	Diff. .001	83° Exsec	Diff. .001
00	9.93492	.85	0.79136	6.25	**00**	9.94356	.85	0.85766	7.05
02	.93509	.85	.79261	6.30	**02**	.94373	.85	.85907	7.05
04	.93526	.90	.79387	6.30	**04**	.94390	.85	.86048	7.10
06	.93544	.85	.79513	6.35	**06**	.94407	.85	.86190	7.10
08	.93561	.90	.79640	6.30	**08**	.94424	.90	.86332	7.10
10	9.93579	.85	0.79766	6.35	**10**	9.94442	.85	0.86474	7.10
12	.93596	.90	.79893	6.35	**12**	.94459	.85	.86616	7.15
14	.93614	.85	.80020	6.35	**14**	.94476	.85	.86759	7.20
16	.93631	.85	.80147	6.40	**16**	.94493	.85	.86903	7.15
18	.93648	.90	.80275	6.40	**18**	.94510	.85	.87046	7.20
20	9.93666	.85	0.80403	6.40	**20**	9.94527	.85	0.87190	7.25
22	.93683	.85	.80531	6.40	**22**	.94544	.85	.87335	7.25
24	.93700	.90	.80659	6.45	**24**	.94561	.85	.87470	7.25
26	.93718	.85	.80788	6.45	**26**	.94578	.85	.87625	7.25
28	.93735	.85	.80917	6.45	**28**	.94595	.85	.87770	7.30
30	9.93752	.90	0.81046	6.50	**30**	9.94612	.85	0.87916	7.30
32	.93770	.85	.81176	6.50	**32**	.94629	.85	.88062	7.35
34	.93787	.85	.81306	6.50	**34**	.94646	.85	.88209	7.35
36	.93804	.90	.81436	6.55	**36**	.94663	.85	.88356	7.40
38	.93822	.85	.81567	6.50	**38**	.94680	.85	.88504	7.35
40	9.93839	.85	0.81697	6.60	**40**	9.94697	.85	0.88651	7.45
42	.93856	.90	.81829	6.55	**42**	.94714	.85	.88800	7.40
44	.93874	.85	.81960	6.60	**44**	.94731	.85	.88948	7.45
46	.93891	.85	.82092	6.60	**46**	.94748	.85	.89097	7.50
48	.93908	.90	.82224	6.60	**48**	.94765	.85	.89247	7.50
50	9.93926	.85	0.82356	6.60	**50**	9.94782	.85	0.89397	7.50
52	.93943	.85	.82488	6.65	**52**	.94799	.85	.89547	7.50
54	.93960	.85	.82621	6.70	**54**	.94816	.85	.89697	7.55
56	.93977	.90	.82755	6.65	**56**	.94833	.85	.89848	7.60
58	.93995	.85	.82888	6.70	**58**	.94850	.85	.90000	7.60
60	9.94012	.85	0.83022	6.70	**60**	9.94867	.85	0.90152	7.60
62	.94029	.90	.83156	6.70	**62**	.94884	.85	.90304	7.65
64	.94047	.85	.83290	6.75	**64**	.94901	.85	.90457	7.65
66	.94064	.85	.83425	6.75	**66**	.94918	.85	.90610	7.70
68	.94081	.85	.83560	6.80	**68**	.94935	.85	.90764	7.70
70	9.94098	.85	0.83696	6.85	**70**	9.94952	.85	0.90918	7.70
72	.94115	.90	.83831	6.85	**72**	.94969	.85	.91072	7.75
74	.94133	.85	.83968	6.80	**74**	.94986	.85	.91227	7.80
76	.94150	.85	.84104	6.85	**76**	.95003	.85	.91383	7.75
78	.94167	.85	.84241	6.85	**78**	.95020	.85	.91538	7.80
80	9.94184	.85	0.84378	6.85	**80**	9.95037	.80	0.91694	7.85
82	.94201	.90	.84515	6.90	**82**	.95053	.85	.91851	7.85
84	.94219	.85	.84653	6.90	**84**	.95070	.85	.92008	7.90
86	.94236	.85	.84791	6.90	**86**	.95087	.85	.92166	7.90
88	.94253	.85	.84929	6.95	**88**	.95104	.85	.92324	7.90
90	9.94270	.85	0.85068	6.95	**90**	9.95121	.85	0.92482	7.95
92	.94287	.85	.85207	6.95	**92**	.95138	.85	.92641	8.00
94	.94304	.90	.85346	7.00	**94**	.95155	.80	.92801	8.00
96	.94322	.85	.85486	7.00	**96**	.95171	.85	.92961	8.00
98	.94339	.85	.85626	7.00	**98**	.95188	.85	.93121	8.05
100	9.94356		0.85766		**100**	9.95205		0.93282	

Hundredths	84°				Hundredths	85°			
	Vers	Diff. .001	Exsec	Diff. .001		Vers	Diff. .001	Exsec	Diff. .001
00	9.95205	.85	0.93282	8.05	00	9.96040	.80	1.02010	9.50
02	.95222	.85	.93443	8.10	02	.96056	.85	.02200	9.55
04	.95239	.85	.93605	8.10	04	.96073	.80	.02391	9.60
06	.95256	.80	.93767	8.15	06	.96089	.85	.02583	9.60
08	.95272	.85	.93930	8.15	08	.96106	.80	.02775	9.65
10	9.95289	.85	0.94093	8.20	10	9.96122	.85	1.02968	9.70
12	.95306	.85	.94257	8.20	12	.96139	.80	.03162	9.70
14	.95323	.85	.94421	8.25	14	.96155	.85	.03356	9.75
16	.95340	.80	.94586	8.25	16	.96172	.80	.03551	9.80
18	.95356	.85	.94751	8.30	18	.96188	.85	.03747	9.85
20	9.95373	.85	0.94917	8.30	20	9 96205	.80	1.03944	9.85
22	.95390	.85	.95183	8.35	22	.96221	.85	.04141	9.90
24	.95407	.85	.95250	8.35	24	.96238	.80	.04339	9.95
26	.95424	.80	.95417	8.40	26	.96254	.85	.04538	10.00
28	.95440	.85	.95585	8.45	28	.96271	.80	.04738	10.00
30	9.95457	.85	0.95754	8.40	30	9.96287	.85	1.04938	10.10
32	.95474	.85	.95922	8.50	32	.96304	.80	.05140	10.10
34	.95491	.80	.96092	8.50	34	.96320	.85	.05342	10.10
36	.95507	.85	.96262	8.50	36	.96337	.80	.05544	10.20
38	.95524	.85	.96432	8.55	38	.96353	.80	.05748	10.25
40	9.95541	.80	0.96603	8.60	40	9.96369	.85	1.05953	10.25
42	.95557	.85	.96775	8.60	42	.96386	.80	.06158	10.30
44	.95574	.85	.96947	8.65	44	.96402	.85	.06364	10.35
46	.95591	.85	.97120	8.65	46	.96419	.80	.06571	10.40
48	.95608	.80	.97293	8.70	48	.96435	.80	.06779	10.40
50	9.95624	.85	0.97467	8.70	50	9.96451	.85	1.06987	10.50
52	.95641	.85	.97641	8.75	52	.96468	.80	.07197	10.50
54	.95658	.80	.97816	8.80	54	.96484	.85	.07407	10.55
56	.95674	.85	.97992	8.80	56	.96501	.80	.07618	10.60
58	.95691	.85	.98168	8.85	58	.96517	.80	.07830	10.65
60	9.95708	.80	0.98345	8.85	60	9.96533	.85	1.08043	10.70
62	.95724	.85	.98522	8.90	62	.96550	.80	.08257	10.75
64	.95741	.85	.98700	8.95	64	.96566	.80	.08472	10.75
66	.95758	.80	.98879	8.95	66	.96582	.85	.08687	10.85
68	.95774	.85	.99058	8.95	68	.96599	.80	.08904	10.85
70	9.95791	.80	0.99237	9.05	70	9.96615	.85	1.09121	10.95
72	.95807	.85	.99418	9.05	72	.96632	.80	.09340	10.95
74	.95824	.85	.99599	9.05	74	.96648	.80	.09559	11.00
76	.95841	.80	.99780	9.15	76	.96664	.80	.09779	11.05
78	.95857	.85	.99963	9.15	78	.96680	.85	.10000	11.15
80	9.95874	.85	1.00146	9.15	80	9.96697	.80	1.10223	11.15
82	.95891	.80	.00329	9.20	82	.96713	.80	.10446	11.25
84	.95907	.85	.00513	9.25	84	.96729	.85	.10671	11.25
86	.95924	.80	.00698	9.25	86	.96746	.80	.10896	11.30
88	.95940	.85	.00883	9.30	88	.96762	.80	.11122	11.35
90	9.95957	.80	1.01069	9.35	90	9.96778	.85	1.11349	11.45
92	.95973	.85	.01256	9.40	92	.96795	.80	.11578	11.45
94	.95990	.85	.01444	9.45	94	.96811	.80	.11807	11.55
96	.96007	.80	.01633	9.40	96	.96827	.80	.12038	11.55
98	.96023	.85	.01821	9.45	98	.96843	.85	.12269	11.60
100	9.96040		1.02010		100	9.96860		1.12501	

TABLE XXVI. — (*Continued*)

Hundredths	86°				Hundredths	87°			
	Vers	Diff. .001	Exsec	Diff. .001		Vers	Diff. .001	Exsec	Diff. .001
00	9.96860	.80	1.12501	11.70	00	9.97665	.80	1.25785	15.35
02	.96876	.80	.12735	11.70	02	.97681	.80	.26092	15.40
04	.96892	.80	.12969	11.80	04	.97697	.80	.26400	15.50
06	.96908	.85	.13205	11.85	06	.97713	.80	.26710	15.60
08	.96925	.80	.13442	11.90	08	.97729	.80	.27022	15.70
10	9.96941	.80	1.13680	11.95	10	9.97745	.80	1.27336	15.80
12	.96957	.80	.13919	12.05	12	.97761	.80	.27652	15.95
14	.96973	.85	.14160	12.05	14	.97777	.80	.27971	16.00
16	.96990	.80	.14401	12.15	16	.97793	.80	.28291	16.15
18	.97006	.80	.14644	12.20	18	.97809	.80	.28614	16.25
20	9.97022	.80	1.14888	12.25	20	9.97825	.80	1.28939	16.35
22	.97038	.80	.15133	12.30	22	.97841	.80	.29266	16.45
24	.97054	.85	.15379	12.35	24	.97857	.80	.29595	16.55
26	.97071	.80	.15626	12.45	26	.97873	.80	.29926	16.70
28	.97087	.80	.15875	12.50	28	.97889	.75	.30260	16.80
30	9.97103	.80	1.16125	12.55	30	9.97904	.80	1.30596	16.95
32	.97119	.80	.16376	12.65	32	.97920	.80	.30935	17.05
34	.97135	.80	.16619	12.70	34	.97936	.80	.31276	17.15
36	.97151	.85	.16883	12.75	36	.97952	.80	.31619	17.30
38	.97168	.80	.17138	12.80	38	.97968	.80	.31965	17.45
40	9.97184	.80	1.17394	12.90	40	9.97984	.80	1.32314	17.55
42	.97200	.80	.17652	12.90	42	.98000	.80	.32665	17.65
44	.97216	.80	.17910	13.10	44	.98016	.75	.33018	17.85
46	.97232	.80	.18172	13.10	46	.98031	.80	.33375	17.90
48	.97248	.80	.18434	13.15	48	.98047	.80	.33733	18.10
50	9.97264	.80	1.18697	13.20	50	9.98063	.80	1.34095	18.25
52	.97280	.85	.18961	13.35	52	.98079	.80	.34460	18.35
54	.97297	.80	.19228	13.35	54	.98095	.80	.34827	18.50
56	.97313	.80	.19495	13.45	56	.98111	.75	.35197	18.65
58	.97329	.80	.19764	13.55	58	.98126	.80	.35570	18.80
60	9.97345	.80	1.20035	13.60	60	9.98142	.80	1.35946	18.95
62	.97361	.80	.20307	13.65	62	.98158	.80	.36325	19.10
64	.97377	.80	.20580	13.75	64	.98174	.80	.36707	19.25
66	.97393	.80	.20855	13.85	66	.98190	.75	.37092	19.45
68	.97409	.80	.21132	13.90	68	.98205	.80	.37481	19.55
70	9.97425	.80	1.21410	14.00	70	9.98221	.80	1.37872	19.75
72	.97441	.80	.21690	14.05	72	.98237	.80	.38267	19.90
74	.97457	.80	.21971	14.15	74	.98253	.75	.38665	20.10
76	.97473	.80	.22254	14.25	76	.98268	.80	.39067	20.25
78	.97489	.80	.22539	14.30	78	.98284	.80	.39472	20.45
80	9.97505	.80	1.22825	14.40	80	9.98300	.80	1.39881	20.60
82	.97521	.80	.23113	14.50	82	.98316	.75	.40293	20.80
84	.97537	.80	.23403	14.60	84	.98331	.80	.40709	20.95
86	.97553	.80	.23695	14.65	86	.98347	.80	.41128	21.20
88	.97569	.80	.23988	14.75	88	.98363	.80	.41552	21.35
90	9.97585	.80	1.24283	14.85	90	9.98379	.75	1.41979	21.55
92	.97601	.80	.24580	14.90	92	.98394	.80	.42410	21.75
94	.97617	.80	.24878	14.95	94	.98410	.80	.42845	21.95
96	.97633	.80	.25179	15.10	96	.98426	.80	.43284	22.20
98	.97649	.80	.25481	15.20	98	.98442	.75	.43728	22.35
100	9.97665		1.25785		100	9.98457		1.44175	

Hundredths	88° Vers	Diff. .001	88° Exsec	Diff. .001	Hundredths	89° Vers	Diff. .001	89° Exsec	Diff. .001
00	9.98457	.80	1.44175	22.60	00	9.99235	.80	1.75050	44.65
02	.98473	.80	.44627	22.85	02	.99251	.75	.75943	45.50
04	.98489	.75	.45084	23.05	04	.99266	.80	.76853	46.50
06	.98504	.80	.45545	23.25	06	.99282	.75	.77783	47.45
08	.98520	.80	.46010	23.55	08	.99297	.75	.78732	48.50
10	9.98536	.75	1.46481	23.75	10	9.99312	.80	1.79702	49.60
12	.98551	.80	.46956	24.00	12	.99328	.75	.80694	50.65
14	.98567	.80	.47436	24.25	14	.99343	.80	.81707	51.85
16	.98583	.75	.47921	24.50	16	.99359	.75	.82744	53.10
18	.98598	.80	.48411	24.75	18	.99374	.75	.83806	54.40
20	9.98614	.80	1.48906	25.05	20	9.99389	.80	1.84894	55.75
22	.98630	.75	.49407	25.30	22	.99405	.75	.86009	57.15
24	.98645	.80	.49913	25.60	24	.99420	.75	.87152	58.70
26	.98661	.75	.50425	25.85	26	.99435	.80	.88326	60.15
28	.98676	.80	.50942	26.20	28	.99451	.75	.89531	61.95
30	9.98692	.80	1.51466	26.45	30	9.99466	.75	1.90770	63.70
32	.98708	.75	.51995	26.80	32	.99481	.80	.92044	65.60
34	.98723	.80	.52531	27.10	34	.99497	.75	.93356	67.55
36	.98739	.80	.53073	27.40	36	.99512	.75	.94707	69.70
38	.98755	.75	.53621	27.75	38	.99527	.80	.96101	72.00
40	9.98770	.80	1.54176	28.10	40	9.99543	.75	1.97541	74.35
42	.98786	.75	.54738	28.40	42	.99558	.75	.99028	77.00
44	.98801	.80	.55306	28.80	44	.99573	.80	2.00568	79.70
46	.98817	.75	.55882	29.15	46	.99589	.75	.02162	82.75
48	.98832	.80	.56465	29.55	48	.99604	.75	.03817	85.90
50	9.98848	.80	1.57056	29.90	50	9.99619	.80	2.05535	89.40
52	.98864	.75	.57654	30.35	52	.99635	.75	.07323	93.20
54	.98879	.80	.58261	30.70	54	.99650	.75	.09187	97.30
56	.98895	.75	.58875	31.15	56	.99665	.75	.11133	101.75
58	.98910	.80	.59498	31.60	58	.99680	.80	.13168	106.70
60	9.98926	.75	1.60130	32.00	60	9.99696	.75	2.15302	112.15
62	.98941	.80	.60770	32.45	62	.99711	.75	.17545	118.20
64	.98957	.75	.61419	32.95	64	.99726	.80	.19909	124.85
66	.98972	.80	.62078	33.45	66	.99742	.75	.22406	132.40
68	.98988	.75	.62747	33.90	68	.99757	.75	.25054	140.90
70	9.99003	.80	1.63425	34.45	70	9.99772	.75	2.27872	150.60
72	.99019	.75	.64114	34.95	72	.99787	.75	.30884	161.70
74	.99034	.80	.64813	35.50	74	.99802	.80	.34118	174.55
76	.99050	.75	.65523	36.10	76	.99818	.75	.37609	189.70
78	.99065	.80	.66245	36.65	78	.99833	.75	.41403	207.70
80	9.99081	.75	1.66978	37.25	80	9.99848	.75	2.45557	229.55
82	.99096	.80	.67723	37.90	82	.99863	.80	.50148	256.55
84	.99112	.75	.68481	38.55	84	.99879	.75	.55279	290.70
86	.99127	.80	.69252	39.20	86	.99894	.75	.61093	335.50
88	.99143	.75	.70036	39.90	88	.99909	.75	.67803	396.65
90	9.99158	.80	1.70834	40.60	90	9.99924	.75	2.75736	485.45
92	.99174	.75	.71646	41.35	92	.99939	.75	.85443	625.45
94	.99189	.75	.72473	42.15	94	.99954	.80	.97952	881.20
96	.99204	.80	.73316	42.90	96	.99970	.75	3.15576	1505.90
98	.99220	.75	.74174	43.80	98	.99985	.75	.45694	
100	9.99235		1.75050		100	0.00000		∞	

TABLE XXVII. — NATURAL SINES, TANGENTS, COTANGENTS AND COSINES

Deg.	Sin	d.	Tan	d.	Cotan	d.	Cosin	d.	
0.0	0.0000	17	0.0000	17	inf.	....	1.0000	0	90.0
1	0.0017	18	0.0017	18	572.9572	....	1.0000	0	9
2	0.0035	17	0.0035	17	286.4777	....	1.0000	0	8
3	0.0052	18	0.0052	18	190.9842	....	1.0000	0	7
4	0.0070	17	0.0070	17	143.2371	....	1.0000	0	6
5	0.0087	18	0.0087	18	114.5887	....	1.0000	1	5
6	0.0105	17	0.0105	17	95.4895	....	0.9999	0	4
7	0.0122	18	0.0122	18	81.8470	....	0.9999	0	3
8	0.0140	17	0.0140	17	71.6151	....	0.9999	0	2
9	0.0157	18	0.0157	18	63.6567	....	0.9999	1	1
1.0	0.0175	17	0.0175	17	57.2900	....	0.9998	0	89.0
1	0.0192	17	0.0192	17	52.0807	....	0.9998	0	9
2	0.0209	18	0.0209	18	47.7395	....	0.9998	1	8
3	0.0227	17	0.0227	17	44.0661	....	0.9997	0	7
4	0.0244	18	0.0244	18	40.9174	....	0.9997	0	6
5	0.0262	17	0.0262	17	38.1885	....	0.9997	1	5
6	0.0279	18	0.0279	18	35.8006	....	0.9996	0	4
7	0.0297	17	0.0297	17	33.6935	....	0.9996	1	3
8	0.0314	18	0.0314	18	31.8205	....	0.9995	0	2
9	0.0332	17	0.0332	17	30.1446	....	0.9995	1	1
2.0	0.0349	17	0.0349	18	28.6363	....	0.9994	1	88.0
1	0.0366	18	0.0367	17	27.2715	....	0.9993	0	9
2	0.0384	17	0.0384	18	26.0307	....	0.9993	1	8
3	0.0401	18	0.0402	17	24.8978	....	0.9992	1	7
4	0.0419	17	0.0419	18	23.8593	9555	0.9991	1	6
5	0.0436	18	0.0437	17	22.9038	8821	0.9990	0	5
6	0.0454	17	0.0454	18	22.0217	8168	0.9990	1	4
7	0.0471	17	0.0472	17	21.2049	7584	0.9989	1	3
8	0.0488	18	0.0489	18	20.4465	7062	0.9988	1	2
9	0.0506	17	0.0507	17	19.7403	6592	0.9987	1	1
3.0	0.0523	18	0.0524	18	19.0811	6166	0.9986	1	87.0
1	0.0541	17	0.0542	17	18.4645	5782	0.9985	1	9
2	0.0558	18	0.0559	18	17.8863	5431	0.9984	1	8
3	0.0576	17	0.0577	17	17.3432	5113	0.9983	1	7
4	0.0593	17	0.0594	18	16.8319	4820	0.9982	1	6
5	0.0610	18	0.0612	17	16.3499	4554	0.0981	1	5
6	0.0628	17	0.0629	18	15.8945	4307	0.9980	1	4
7	0.0645	18	0.0647	17	15.4638	4081	0.9979	1	3
8	0.0663	17	0.0664	18	15.0557	3872	0.9978	1	2
9	0.0680	18	0.0682	17	14.6685	3678	0.9977	1	1
4.0	0.0698	17	0.0699	18	14.3007	3500	0.9976	2	86.0
1	0.0715	17	0.0717	17	13.9507	3333	0.9974	1	9
2	0.0732	18	0.0734	18	13.6174	3178	0.9973	1	8
3	0.0750	17	0.0752	17	13.2996	3034	0.9972	1	7
4	0.0767	18	0.0769	18	12.9962	2900	0.9971	2	6
5	0.0785	17	0.0787	18	12.7062	2774	0.9969	1	5
6	0.0802	17	0.0805	17	12.4288	2656	0.0968	2	4
7	0.0819	18	0.0822	18	12.1632	2545	0.9966	1	3
8	0.0837	17	0.0840	17	11.9087	2442	0.9965	2	2
9	0.0854	18	0.0857	18	11.6645	2344	0.9963	1	1
5.0	0.0872		0.0875		11.4301		0.9962		85.0
	Cosin	d.	Cotan	d.	Tan	d.	Sin	d.	Deg.

P. P.

	18
1	1.8
2	3.6
3	5.4
4	7.2
5	9.0
6	10.8
7	12.6
8	14.4
9	16.2

	17
1	1.7
2	3.4
3	5.1
4	6.8
5	8.5
6	10.2
7	11.9
8	13.6
9	15.3

Deg.	Sin	d.	Tan	d.	Cotan	d.	Cosin	d.	
5.0	0.0872	17	0.0875	17	11.4301	2253	0.9962	2	**85.0**
1	0.0889	17	0.0892	18	11.2048	2166	0.9960	1	9
2	0.0906	18	0.0910	18	10.9882	2085	0.9959	2	8
3	0.0924	17	0.0928	17	10.7797	2008	0.9957	1	7
4	0.0941	17	0.0945	18	10.5789	1935	0.9956	2	6
5	0.0958	18	0.0963	18	10.3854	1866	0.9954	2	5
6	0.0976	17	0.0981	17	10.1988	1801	0.9952	1	4
7	0.0993	18	0.0998	18	10.0187	1739	0.9951	2	3
8	0.1011	17	0.1016	17	9.8448	1680	0.9949	2	2
9	0.1028	17	0.1033	18	9.6768	1624	0.9947	2	1
6.0	0.1045	18	0.1051	18	9.5144	1572	0.9945	2	**84.0**
1	0.1063	17	0.1069	17	9.3572	1520	0.9943	1	9
2	0.1080	17	0.1086	18	9.2052	1473	0.9942	2	8
3	0.1097	18	0.1104	18	9.0579	1427	0.9940	2	7
4	0.1115	17	0.1122	17	8.9152	1383	0.9938	2	6
5	0.1132	17	0.1139	18	8.7769	1342	0.9936	2	5
6	0.1149	18	0.1157	18	8.6427	1301	0.9934	2	4
7	0.1167	17	0.1175	17	8.5126	1263	0.9932	2	3
8	0.1184	17	0.1192	18	8.3863	1227	0.9930	2	2
9	0.1201	18	0.1210	18	8.2636	1193	0.9928	3	1
7.0	0.1219	17	0.1228	18	8.1443	1158	0.9925	2	**83.0**
1	0.1236	17	0.1246	17	8.0285	1127	0.9923	2	9
2	0.1253	18	0.1263	18	7.9158	1096	0.9921	2	8
3	0.1271	17	0.1281	18	7.8062	1066	0.9919	2	7
4	0.1288	17	0.1299	18	7.6996	1038	0.9917	3	6
5	0.1305	18	0.1317	17	7.5958	1011	0.9914	2	5
6	0.1323	17	0.1334	18	7.4947	985	0.9912	2	4
7	0.1340	17	0.1352	18	7.3962	960	0.9910	3	3
8	0.1357	17	0.1370	18	7.3002	936	0.9907	2	2
9	0.1374	18	0.1388	17	7.2066	912	0.9905	2	1
8.0	0.1392	17	0.1405	18	7.1154	890	0.9903	3	**82.0**
1	0.1409	17	0.1423	18	7.0264	869	0.9900	2	9
2	0.1426	18	0.1441	18	6.9395	847	0.9898	3	8
3	0.1444	17	0.1459	18	6.8548	828	0.9895	2	7
4	0.1461	17	0.1477	18	6.7720	808	0.9893	3	6
5	0.1478	17	0.1495	17	6.6912	790	0.9890	2	5
6	0.1495	18	0.1512	18	6.6122	772	0.9888	3	4
7	0.1513	17	0.1530	18	6.5350	754	0.9885	3	3
8	0.1530	17	0.1548	18	6.4596	737	0.9882	2	2
9	0.1547	17	0.1566	18	6.3859	721	0.9880	3	1
9.0	0.1564	18	0.1584	18	6.3138	706	0.9877	3	**81.0**
1	0.1582	17	0.1602	18	6.2432	690	0.9874	3	9
2	0.1599	17	0.1620	18	6.1742	676	0.9871	2	8
3	0.1616	17	0.1638	17	6.1066	661	0.9869	3	7
4	0.1633	17	0.1655	18	6.0405	647	0.9866	3	6
5	0.1650	18	0.1673	18	5.9758	634	0.9863	3	5
6	0.1668	17	0.1691	18	5.9124	622	0.9860	3	4
7	0.1685	17	0.1709	18	5.8502	608	0.9857	3	3
8	0.1702	17	0.1727	18	5.7894	597	0.9854	3	2
9	0.1719	17	0.1745	18	5.7297	584	0.9851	3	1
10.0	0.1736		0.1763		5.6713		0.9848		**80.0**
	Cosin	d.	Cotan	d.	Tan	d.	Sin	d.	Deg.

P. P.

	18
1	1.8
2	3.6
3	5.4
4	7.2
5	9.0
6	10.8
7	12.6
8	14.4
9	16.2

	17
1	1.7
2	3.4
3	5.1
4	6.8
5	8.5
6	10.2
7	11.9
8	13.6
9	15.3

Deg.	Sin	d.	Tan	d.	Cotan	d.	Cosin	d.	
10.0	0.1736	18	0.1763	18	5.6713	573	0.9848	3	**80.0**
1	0.1754	17	0.1781	18	5.6140	562	0.9845	3	9
2	0.1771	17	0.1799	18	5.5578	552	0.9842	3	8
3	0.1788	17	0.1817	18	5.5026	540	0.9839	3	7
4	0.1805	17	0.1835	18	5.4486	531	0.9836	3	6
5	0.1822	18	0.1853	18	5.3955	520	0.9833	4	5
6	0.1840	17	0.1871	19	5.3435	511	0.9829	3	4
7	0.1857	17	0.1890	18	5.2924	502	0.9826	3	3
8	0.1874	17	0.1908	18	5.2422	493	0.9823	3	2
9	0.1891	17	0.1926	18	5.1929	483	0.9820	4	1
11.0	0.1908	17	0.1944	18	5.1446	476	0.9816	3	**79.0**
1	0.1925	17	0.1962	18	5.0970	466	0.9813	3	9
2	0.1942	17	0.1980	18	5.0504	459	0.9810	4	8
3	0.1959	18	0.1998	18	5.0045	451	0.9806	3	7
4	0.1977	17	0.2016	19	4.9594	442	0.9803	4	6
5	0.1994	17	0.2035	18	4.9152	436	0.9799	3	5
6	0.2011	17	0.2053	18	4.8716	428	0.9796	4	4
7	0.2028	17	0.2071	18	4.8288	421	0.9792	3	3
8	0.2045	17	0.2089	18	4.7867	414	0.9789	4	2
9	0.2062	17	0.2107	19	4.7453	407	0.9785	4	1
12.0	0.2079	17	0.2126	18	4.7046	400	0.9781	3	**78.0**
1	0.2096	17	0.2144	18	4.6646	394	0.9778	4	9
2	0.2113	17	0.2162	18	4.6252	388	0.9774	4	8
3	0.2130	17	0.2180	19	4.5864	381	0.9770	3	7
4	0.2147	17	0.2199	18	4.5483	376	0.9767	4	6
5	0.2164	17	0.2217	18	4.5107	370	0.9763	4	5
6	0.2181	17	0.2235	19	4.4737	364	0.9759	4	4
7	0.2198	17	0.2254	18	4.4373	358	0.9755	4	3
8	0.2215	18	0.2272	18	4.4015	353	0.9751	3	2
9	0.2233	17	0.2290	19	4.3662	347	0.9748	4	1
13.0	0.2250	17	0.2309	18	4.3315	343	0.9744	4	**77.0**
1	0.2267	17	0.2327	18	4.2972	337	0.9740	4	9
2	0.2284	16	0.2345	19	4.2635	332	0.9736	4	8
3	0.2300	17	0.2364	18	4.2303	327	0.9732	4	7
4	0.2317	17	0.2382	19	4.1976	323	0.9728	4	6
5	0.2334	17	0.2401	18	4.1653	318	0.9724	4	5
6	0.2351	17	0.2419	19	4.1335	313	0.9720	5	4
7	0.2368	17	0.2438	18	4.1022	309	0.9715	4	3
8	0.2385	17	0.2456	19	4.0713	305	0.9711	4	2
9	0.2402	17	0.2475	18	4.0408	300	0.9707	4	1
14.0	0.2419	17	0.2493	19	4.0108	296	0.9703	4	**76.0**
1	0.2436	17	0.2512	18	3.9812	292	0.9699	5	9
2	0.2453	17	0.2530	19	3.9520	288	0.9694	4	8
3	0.2470	17	0.2549	19	3.9232	285	0.9690	4	7
4	0.2487	17	0.2568	18	3.8947	280	0.9686	5	6
5	0.2504	17	0.2586	19	3.8667	276	0.9681	4	5
6	0.2521	17	0.2605	18	3.8391	273	0.9677	4	4
7	0.2538	16	0.2623	19	3.8118	270	0.9673	5	3
8	0.2554	17	0.2642	19	3.7848	265	0.9668	4	2
9	0.2571	17	0.2661	18	3.7583	262	0.9664	5	1
15.0	0.2588		0.2679		3.7321		0.9659		**75.0**
	Cosin	d.	Cotan	d.	Tan	d.	Sin	d.	Deg.

P. P.

	19	**18**	**17**
1	1.9	1.8	1.7
2	3.8	3.6	3.4
3	5.7	5.4	5.1
4	7.6	7.2	6.8
5	9.5	9.0	8.5
6	11.4	10.8	10.2
7	13.3	12.6	11.9
8	15.2	14.4	13.6
9	17.1	16.2	15.3

TABLE XXVII. — (*Continued*)

Deg.	Sin	d.	Tan	d.	Cotan	d.	Cosin	d.	
15.0	0.2588	17	0.2679	19	3.7321	259	0.9659	4	**75.0**
1	0.2605	17	0.2698	19	3.7062	256	0.9655	5	9
2	0.2622	17	0.2717	19	3.6806	252	0.9650	4	8
3	0.2639	17	0.2736	18	3.6554	249	0.9646	5	7
4	0.2656	16	0.2754	19	3.6305	246	0.9641	5	6
5	0.2672	17	0.2773	19	3.6059	243	0.9636	4	5
6	0.2689	17	0.2792	19	3.5816	240	0.9632	5	4
7	0.2706	17	0.2811	19	3.5576	237	0.9627	5	3
8	0.2723	17	0.2830	19	3.5339	234	0.9622	5	2
9	0.2740	16	0.2849	18	3.5105	231	0.9617	4	1
16.0	0.2756	17	0.2867	19	3.4874	228	0.9613	5	**74.0**
1	0.2773	17	0.2886	19	3.4646	226	0.9608	5	9
2	0.2790	17	0.2905	19	3.4420	223	0.9603	5	8
3	0.2807	16	0.2924	19	3.4197	220	0.9598	5	7
4	0.2823	17	0.2943	19	3.3977	218	0.9593	5	6
5	0.2840	17	0.2962	19	3.3759	215	0.9588	5	5
6	0.2857	17	0.2981	19	3.3544	212	0.9583	5	4
7	0.2874	16	0.3000	19	3.3332	210	0.9578	5	3
8	0.2890	17	0.3019	19	3.3122	208	0.9573	5	2
9	0.2907	17	0.3038	19	3.2914	205	0.9568	5	1
17.0	0.2924	16	0.3057	19	3.2709	203	0.9563	5	**73.0**
1	0.2940	17	0.3076	20	3.2506	201	0.9558	5	9
2	0.2957	17	0.3096	19	3.2305	199	0.9553	5	8
3	0.2974	16	0.3115	19	3.2106	196	0.9548	6	7
4	0.2990	17	0.3134	19	3.1910	194	0.9542	5	6
5	0.3007	17	0.3153	19	3.1716	192	0.9537	5	5
6	0.3024	16	0.3172	19	3.1524	190	0.9532	5	4
7	0.3040	17	0.3191	20	3.1334	188	0.9527	6	3
8	0.3057	17	0.3211	19	3.1146	185	0.9521	5	2
9	0.3074	16	0.3230	19	3.0961	184	0.9516	5	1
18.0	0.3090	17	0.3249	20	3.0777	182	0.9511	6	**72.0**
1	0.3107	16	0.3269	19	3.0595	180	0.9505	5	9
2	0.3123	17	0.3288	19	3.0415	178	0.9500	6	8
3	0.3140	16	0.3307	20	3.0237	176	0.9494	5	7
4	0.3156	17	0.3327	19	3.0061	174	0.9489	6	6
5	0.3173	17	0.3346	19	2.9887	173	0.9483	5	5
6	0.3190	16	0.3365	20	2.9714	170	0.9478	6	4
7	0.3206	17	0.3385	19	2.9544	169	0.9472	6	3
8	0.3223	16	0.3404	20	2.9375	167	0.9466	5	2
9	0.3239	17	0.3424	19	2.9208	166	0.9461	6	1
19.0	0.3256	16	0.3443	20	2.9042	164	0.9455	6	**71.0**
1	0.3272	17	0.3463	19	2.8878	162	0.9449	5	9
2	0.3289	16	0.3482	20	2.8716	160	0.9444	6	8
3	0.3305	17	0.3502	20	2.8556	159	0.9438	6	7
4	0.3322	16	0.3522	19	2.8397	158	0.9432	6	6
5	0.3338	17	0.3541	20	2.8239	156	0.9426	5	5
6	0.3355	16	0.3561	20	2.8083	154	0.9421	6	4
7	0.3371	16	0.3581	19	2.7929	153	0.9415	6	3
8	0.3387	17	0.3600	20	2.7776	151	0.9409	6	2
9	0.3404	16	0.3620	20	2.7625	150	0.9403	6	1
20.0	0.3420		0.3640		2.7475		0.9397		**70.0**
	Cosin	d.	Cotan	d.	Tan	d.	Sin	d.	Deg.

P. P.

	19
1	1.9
2	3.8
3	5.7
4	7.6
5	9.5
6	11.4
7	13.3
8	15.2
9	17.1

	18
1	1.8
2	3.6
3	5.4
4	7.2
5	9.0
6	10.8
7	12.6
8	14.4
9	16.2

	17
1	1.7
2	3.4
3	5.1
4	6.8
5	8.5
6	10.2
7	11.9
8	13.6
9	15.3

	16
1	1.6
2	3.2
3	4.8
4	6.4
5	8.0
6	9.6
7	11.2
8	12.8
9	14.4

Deg.	Sin	d.	Tan	d.	Cotan	d.	Cosin	d.	
20.0	0.3420	17	0.3640	19	2.7475	149	0.9397	6	**70.0**
1	0.3437	16	0.3659	20	2.7326	147	0.9391	6	9
2	0.3453	16	0.3679	20	2.7179	145	0.9385	6	8
3	0.3469	17	0.3699	20	2.7034	145	0.9379	6	7
4	0.3486	16	0.3719	20	2.6889	143	0.9373	6	6
5	0.3502	16	0.3739	20	2.6746	141	0.9367	6	5
6	0.3518	17	0.3759	20	2.6605	141	0.9361	7	4
7	0.3535	16	0.3779	20	2.6464	139	0.9354	6	3
8	0.3551	16	0.3799	20	2.6325	138	0.9348	6	2
9	0.3567	17	0.3819	20	2.6187	136	0.9342	6	1
21.0	0.3584	16	0.3839	20	2.6051	135	0.9336	6	**69.0**
1	0.3600	16	0.3859	20	2.5916	134	0.9330	7	9
2	0.3616	17	0.3879	20	2.5782	133	0.9323	6	8
3	0.3633	16	0.3899	20	2.5649	132	0.9317	6	7
4	0.3649	16	0.3919	20	2.5517	131	0.9311	7	6
5	0.3665	16	0.3939	20	2.5386	129	0.9304	6	5
6	0.3681	16	0.3959	20	2.5257	128	0.9298	7	4
7	0.3697	17	0.3979	21	2.5129	127	0.9291	6	3
8	0.3714	16	0.4000	20	2.5002	126	0.9285	7	2
9	0.3730	16	0.4020	20	2.4876	125	0.9278	6	1
22.0	0.3746	16	0.4040	21	2.4751	124	0.9272	7	**68.0**
1	0.3762	16	0.4061	20	2.4627	123	0.9265	6	9
2	0.3778	17	0.4081	20	2.4504	121	0.9259	7	8
3	0.3795	16	0.4101	21	2.4383	121	0.9252	7	7
4	0.3811	16	0.4122	20	2.4262	120	0.9245	6	6
5	0.3827	16	0.4142	21	2.4142	119	0.9239	7	5
6	0.3843	16	0.4163	20	2.4023	117	0.9232	7	4
7	0.3859	16	0.4183	21	2.3906	117	0.9225	6	3
8	0.3875	16	0.4204	20	2.3789	116	0.9219	7	2
9	0.3891	16	0.4224	21	2.3673	114	0.9212	7	1
23.0	0.3907	16	0.4245	20	2.3559	114	0.9205	7	**67.0**
1	0.3923	16	0.4265	21	2.3445	113	0.9198	7	9
2	0.3939	16	0.4286	21	2.3332	112	0.9191	7	8
3	0.3955	16	0.4307	20	2.3220	111	0.9184	6	7
4	0.3971	16	0.4327	21	2.3109	111	0.9178	7	6
5	0.3987	16	0.4348	21	2.2998	109	0.9171	7	5
6	0.4003	16	0.4369	21	2.2889	108	0.9164	7	4
7	0.4019	16	0.4390	21	2.2781	108	0.9157	7	3
8	0.4035	16	0.4411	20	2.2673	107	0.9150	7	2
9	0.4051	16	0.4431	21	2.2566	106	0.9143	8	1
24.0	0.4067	16	0.4452	21	2.2460	105	0.9135	7	**66.0**
1	0.4083	16	0.4473	21	2.2355	104	0.9128	7	9
2	0.4099	16	0.4494	21	2.2251	103	0.9121	7	8
3	0.4115	16	0.4515	21	2.2148	103	0.9114	7	7
4	0.4131	16	0.4536	21	2.2045	102	0.9107	7	6
5	0.4147	16	0.4557	21	2.1943	101	0.9100	8	5
6	0.4163	16	0.4578	21	2.1842	100	0.9092	7	4
7	0.4179	16	0.4599	22	2.1742	100	0.9085	7	3
8	0.4195	15	0.4621	21	2.1642	99	0.9078	8	2
9	0.4210	16	0.4642	21	2.1543	98	0.9070	7	1
25.0	0.4226		0.4663		2.1445		0.9063		**65.0**
	Cosin	d.	Cotan	d.	Tan	d.	Sin	d.	Deg.

P. P.

	22	**21**	**17**	**16**
1	2.2	2.1	1.7	1.6
2	4.4	4.2	3.4	3.2
3	6.6	6.3	5.1	4.8
4	8.8	8.4	6.8	6.4
5	11.0	10.5	8.5	8.0
6	13.2	12.6	10.2	9.6
7	15.4	14.7	11.9	11.2
8	17.6	16.8	13.6	12.8
9	19.8	18.9	15.3	14.4

Deg.	Sin	d.	Tan	d.	Cotan	d.	Cosin	d.	
25.0	0.4226	16	0.4663	21	2.1445	97	0.9063	7	**65.0**
1	0.4242	16	0.4684	22	2.1348	97	0.9056	8	9
2	0.4258	16	0.4706	21	2.1251	96	0.9048	7	8
3	0.4274	15	0.4727	21	2.1155	95	0.9041	8	7
4	0.4289	16	0.4748	22	2.1060	95	0.9033	7	6
5	0.4305	16	0.4770	21	2.0965	93	0.9026	8	5
6	0.4321	16	0.4791	22	2.0872	94	0.9018	7	4
7	0.4337	15	0.4813	21	2.0778	92	0.9011	8	3
8	0.4352	16	0.4834	22	2.0686	92	0.9003	7	2
9	0.4368	16	0.4856	21	2.0594	91	0.8996	8	1
26.0	0.4384	15	0.4877	22	2.0503	90	0.8988	8	**64.0**
1	0.4399	16	0.4899	22	2.0413	90	0.8980	7	9
2	0.4415	16	0.4921	21	2.0323	90	0.8973	8	8
3	0.4431	15	0.4942	22	2.0233	88	0.8965	8	7
4	0.4446	16	0.4964	22	2.0145	88	0.8957	8	6
5	0.4462	16	0.4986	22	2.0057	87	0.8949	7	5
6	0.4478	15	0.5008	21	1.9970	87	0.8942	8	4
7	0.4493	16	0.5029	22	1.9883	86	0.8934	8	3
8	0.4509	15	0.5051	22	1.9797	86	0.8926	8	2
9	0.4524	16	0.5073	22	1.9711	85	0.8918	8	1
27.0	0.4540	15	0.5095	22	1.9626	84	0.8910	8	**63.0**
1	0.4555	16	0.5117	22	1.9542	84	0.8902	8	9
2	0.4571	15	0.5139	22	1.9458	83	0.8894	8	8
3	0.4586	16	0.5161	23	1.9375	83	0.8886	8	7
4	0.4602	15	0.5184	22	1.9292	82	0.8878	8	6
5	0.4617	16	0.5206	22	1.9210	82	0.8870	8	5
6	0.4633	15	0.5228	22	1.9128	81	0.8862	8	4
7	0.4648	16	0.5250	22	1.9047	80	0.8854	8	3
8	0.4664	15	0.5272	23	1.8967	80	0.8846	8	2
9	0.4679	16	0.5295	22	1.8887	80	0.8838	9	1
28.0	0.4695	15	0.5317	23	1.8807	79	0.8829	8	**62.0**
1	0.4710	16	0.5340	22	1.8728	78	0.8821	8	9
2	0.4726	15	0.5362	22	1.8650	78	0.8813	8	8
3	0.4741	15	0.5384	23	1.8572	77	0.8805	9	7
4	0.4756	16	0.5407	23	1.8495	77	0.8796	8	6
5	0.4772	15	0.5430	22	1.8418	77	0.8788	8	5
6	0.4787	15	0.5452	23	1.8341	76	0.8780	9	4
7	0.4802	16	0.5475	23	1.8265	75	0.8771	8	3
8	0.4818	15	0.5498	22	1.8190	75	0.8763	8	2
9	0.4833	15	0.5520	23	1.8115	75	0.8755	9	1
29.0	0.4848	15	0.5543	23	1.8040	74	0.8746	8	**61.0**
1	0.4863	16	0.5566	23	1.7966	73	0.8738	9	9
2	0.4879	15	0.5589	23	1.7893	73	0.8729	8	8
3	0.4894	15	0.5612	23	1.7820	73	0.8721	9	7
4	0.4909	15	0.5635	23	1.7747	72	0.8712	8	6
5	0.4924	15	0.5658	23	1.7675	72	0.8704	9	5
6	0.4939	16	0.5681	23	1.7603	71	0.8695	9	4
7	0.4955	15	0.5704	23	1.7532	71	0.8686	8	3
8	0.4970	15	0.5727	23	1.7461	70	0.8678	9	2
9	0.4985	15	0.5750	24	1.7391	70	0.8669	9	1
30.0	0.5000		0.5774		1.7321		0.8660		**60.0**
	Cosin	d.	Cotan	d.	Tan	d.	Sin	d.	Deg.

P. P.

	23		**22**		**16**		**15**
1	2.3	1	2.2	1	1.6	1	1.5
2	4.6	2	4.4	2	3.2	2	3.0
3	6.9	3	6.6	3	4.8	3	4.5
4	9.2	4	8.8	4	6.4	4	6.0
5	11.5	5	11.0	5	8.0	5	7.5
6	13.8	6	13.2	6	9.6	6	9.0
7	16.1	7	15.4	7	11.2	7	10.5
8	18.4	8	17.6	8	12.8	8	12.0
9	20.7	9	19.8	9	14.4	9	13.5

Deg.	Sin	d.	Tan	d.	Cotan	d.	Cosin	d.	
30.0	0.5000	15	0.5774	23	1.7321	70	0.8660	8	**60.0**
1	0.5015	15	0.5797	23	1.7251	69	0.8652	9	9
2	0.5030	15	0.5820	24	1.7182	69	0.8643	9	8
3	0.5045	15	0.5844	23	1.7113	68	0.8634	9	7
4	0.5060	15	0.5867	23	1.7045	68	0.8625	9	6
5	0.5075	15	0.5890	24	1.6977	68	0.8616	9	5
6	0.5090	15	0.5914	24	1.6909	67	0.8607	8	4
7	0.5105	15	0.5938	23	1.6842	67	0.8599	9	3
8	0.5120	15	0.5961	24	1.6775	66	0.8590	9	2
9	0.5135	15	0.5985	24	1.6709	66	0.8581	9	1
31.0	0.5150	15	0.6009	23	1.6643	66	0.8572	9	**59.0**
1	0.5165	15	0.6032	24	1.6577	65	0.8563	9	9
2	0.5180	15	0.6056	24	1.6512	65	0.8554	9	8
3	0.5195	15	0.6080	24	1.6447	64	0.8545	9	7
4	0.5210	15	0.6104	24	1.6383	64	0.8536	10	6
5	0.5225	15	0.6128	24	1.6319	64	0.8526	9	5
6	0.5240	15	0.6152	24	1.6255	64	0.8517	9	4
7	0.5255	15	0.6176	24	1.6191	63	0.8508	9	3
8	0.5270	14	0.6200	24	1.6128	62	0.8499	9	2
9	0.5284	15	0.6224	25	1.6066	63	0.8490	10	1
32.0	0.5299	15	0.6249	24	1.6003	62	0.8480	9	**58.0**
1	0.5314	15	0.6273	24	1.5941	61	0.8471	9	9
2	0.5329	15	0.6297	25	1.5880	62	0.8462	9	8
3	0.5344	14	0.6322	24	1.5818	61	0.8453	10	7
4	0.5358	15	0.6346	25	1.5757	60	0.8443	9	6
5	0.5373	15	0.6371	24	1.5697	60	0.8434	9	5
6	0.5388	14	0.6395	25	1.5637	60	0.8425	10	4
7	0.5402	15	0.6420	25	1.5577	60	0.8415	9	3
8	0.5417	15	0.6445	24	1.5517	59	0.8406	10	2
9	0.5432	14	0.6469	25	1.5458	59	0.8396	9	1
33.0	0.5446	15	0.6494	25	1.5399	59	0.8387	10	**57.0**
1	0.5461	15	0.6519	25	1.5340	58	0.8377	9	9
2	0.5476	14	0.6544	25	1.5282	58	0.8368	10	8
3	0.5490	15	0.6569	25	1.5224	58	0.8358	10	7
4	0.5505	14	0.6594	25	1.5166	58	0.8348	9	6
5	0.5519	15	0.6619	25	1.5108	57	0.8339	10	5
6	0.5534	14	0.6644	25	1.5051	57	0.8329	9	4
7	0.5548	15	0.6669	25	1.4994	56	0.8320	10	3
8	0.5563	14	0.6694	26	1.4938	56	0.8310	10	2
9	0.5577	15	0.6720	25	1.4882	56	0.8300	10	1
34.0	0.5592	14	0.6745	26	1.4826	56	0.8290	9	**56.0**
1	0.5606	15	0.6771	25	1.4770	55	0.8281	10	9
2	0.5621	14	0.6796	26	1.4715	56	0.8271	10	8
3	0.5635	15	0.6822	25	1.4659	54	0.8261	10	7
4	0.5650	14	0.6847	26	1.4605	55	0.8251	10	6
5	0.5664	14	0.6873	26	1.4550	54	0.8241	10	5
6	0.5678	15	0.6899	25	1.4496	54	0.8231	10	4
7	0.5693	14	0.6924	26	1.4442	54	0.8221	10	3
8	0.5707	14	0.6950	26	1.4388	53	0.8211	9	2
9	0.5721	15	0.6976	26	1.4335	54	0.8202	10	1
35.0	0.5736		0.7002		1.4281		0.8192		**55.0**
	Cosin	d.	Cotan	d.	Tan	d.	Sin	d.	Deg.

P. P.

	24
1	2.4
2	4.8
3	7.2
4	9.6
5	12.0
6	14.4
7	16.8
8	19.2
9	21.6

	25
1	2.5
2	5.0
3	7.5
4	10.0
5	12.5
6	15.0
7	17.5
8	20.0
9	22.5

	26
1	2.6
2	5.2
3	7.8
4	10.4
5	13.0
6	15.6
7	18.2
8	20.8
9	23.4

	15
1	1.5
2	3.0
3	4.5
4	6.0
5	7.5
6	9.0
7	10.5
8	12.0
9	13.5

	14
1	1.4
2	2.8
3	4.2
4	5.6
5	7.0
6	8.4
7	9.8
8	11.2
9	12.6

Deg.	Sin	d.	Tan	d.	Cotan	d.	Cosin	d.	
35.0	0.5736	14	0.7002	26	1.4281	52	0.8192	11	**55.0**
1	0.5750	14	0.7028	26	1.4229	53	0.8181	10	9
2	0.5764	15	0.7054	26	1.4176	52	0.8171	10	8
3	0.5779	14	0.7080	27	1.4124	53	0.8161	10	7
4	0.5793	14	0.7107	26	1.4071	52	0.8151	10	6
5	0.5807	14	0.7133	26	1.4019	51	0.8141	10	5
6	0.5821	14	0.7159	27	1.3968	52	0.8131	10	4
7	0.5835	15	0.7186	26	1.3916	51	0.8121	10	3
8	0.5850	14	0.7212	27	1.3865	51	0.8111	11	2
9	0.5864	14	0.7239	26	1.3814	50	0.8100	10	1
36.0	0.5878	14	0.7265	27	1.3764	51	0.8090	10	**54.0**
1	0.5892	14	0.7292	27	1.3713	50	0.8080	10	9
2	0.5906	14	0.7319	27	1.3663	50	0.8070	11	8
3	0.5920	14	0.7346	27	1.3613	49	0.8059	10	7
4	0.5934	14	0.7373	27	1.3564	50	0.8049	10	6
5	0.5948	14	0.7400	27	1.3514	49	0.8039	11	5
6	0.5962	14	0.7427	27	1.3465	49	0.8028	10	4
7	0.5976	14	0.7454	27	1.3416	49	0.8018	11	3
8	0.5990	14	0.7481	27	1.3367	48	0.8007	10	2
9	0.6004	14	0.7508	28	1.3319	49	0.7997	11	1
37.0	0.6018	14	0.7536	27	1.3270	48	0.7986	10	**53.0**
1	0.6032	14	0.7563	27	1.3222	47	0.7976	11	9
2	0.6046	14	0.7590	28	1.3175	48	0.7965	10	8
3	0.6060	14	0.7618	28	1.3127	48	0.7955	11	7
4	0.6074	14	0.7646	27	1.3079	47	0.7944	10	6
5	0.6088	13	0.7673	28	1.3032	47	0.7934	11	5
6	0.6101	14	0.7701	28	1.2985	47	0.7923	11	4
7	0.6115	14	0.7729	28	1.2938	46	0.7912	10	3
8	0.6129	14	0.7757	28	1.2892	46	0.7902	11	2
9	0.6143	14	0.7785	28	1.2846	47	0.7891	11	1
38.0	0.6157	13	0.7813	28	1.2799	46	0.7880	11	**52.0**
1	0.6170	14	0.7841	28	1.2753	45	0.7869	10	9
2	0.6184	14	0.7869	29	1.2708	46	0.7859	11	8
3	0.6198	13	0.7898	28	1.2662	45	0.7848	11	7
4	0.6211	14	0.7926	28	1.2617	45	0.7837	11	6
5	0.6225	14	0.7954	29	1.2572	45	0.7826	11	5
6	0.6239	13	0.7983	29	1.2527	45	0.7815	11	4
7	0.6252	14	0.8012	28	1.2482	45	0.7804	11	3
8	0.6266	14	0.8040	29	1.2437	44	0.7793	11	2
9	0.6280	13	0.8069	29	1.2393	44	0.7782	11	1
39.0	0.6293	14	0.8098	29	1.2349	44	0.7771	11	**51.0**
1	0.6307	13	0.8127	29	1.2305	44	0.7760	11	9
2	0.6320	14	0.8156	29	1.2261	43	0.7749	11	8
3	0.6334	13	0.8185	29	1.2218	44	0.7738	11	7
4	0.6347	14	0.8214	29	1.2174	43	0.7727	11	6
5	0.6361	13	0.8243	30	1.2131	43	0.7716	11	5
6	0.6374	14	0.8273	29	1.2088	43	0.7705	11	4
7	0.6388	13	0.8302	30	1.2045	43	0.7694	11	3
8	0.6401	13	0.8332	29	1.2002	42	0.7683	11	2
9	0.6414	14	0.8361	30	1.1960	42	0.7672	12	1
40.0	0.6428		0.8391		1.1918		0.7660		**50.0**
	Cosin	d.	Cotan	d.	Tan	d.	Sin	d.	Deg.

P. P.

	27
1	2.7
2	5.4
3	8.1
4	10.8
5	13.5
6	16.2
7	18.9
8	21.6
9	24.3

	28
1	2.8
2	5.6
3	8.4
4	11.2
5	14.0
6	16.8
7	19.6
8	22.4
9	25.2

	29
1	2.9
2	5.8
3	8.7
4	11.6
5	14.5
6	17.4
7	20.3
8	23.2
9	26.1

	14
1	1.4
2	2.8
3	4.2
4	5.6
5	7.0
6	8.4
7	9.8
8	11.2
9	12.6

	13
1	1.3
2	2.6
3	3.9
4	5.2
5	6.5
6	7.8
7	9.1
8	10.4
9	11.7

Deg.	Sin	d.	Tan	d.	Cotan	d.	Cosin	d.	
40.0	0.6428	13	0.8391	30	1.1918	43	0.7660	11	**50.0**
1	0.6441	14	0.8421	30	1.1875	42	0.7649	11	9
2	0.6455	13	0.8451	30	1.1833	41	0.7638	11	8
3	0.6468	13	0.8481	30	1.1792	42	0.7627	12	7
4	0.6481	13	0.8511	30	1.1750	42	0.7615	11	6
5	0.6494	14	0.8541	30	1.1708	41	0.7604	11	5
6	0.6508	13	0.8571	30	1.1667	41	0.7593	12	4
7	0.6521	13	0.8601	31	1.1626	41	0.7581	11	3
8	0.6534	13	0.8632	30	1.1585	41	0.7570	11	2
9	0.6547	14	0.8662	31	1.1544	40	0.7559	12	1
41.0	0.6561	13	0.8693	31	1.1504	41	0.7547	11	**49.0**
1	0.6574	13	0.8724	30	1.1463	40	0.7536	12	9
2	0.6587	13	0.8754	31	1.1423	40	0.7524	11	8
3	0.6600	13	0.8785	31	1.1383	40	0.7513	12	7
4	0.6613	13	0.8816	31	1.1343	40	0.7501	11	6
5	0.6626	13	0.8847	31	1.1303	40	0.7490	12	5
6	0.6639	13	0.8878	32	1.1263	39	0.7478	12	4
7	0.6652	13	0.8910	31	1.1224	40	0.7466	11	3
8	0.6665	13	0.8941	31	1.1184	39	0.7455	12	2
9	0.6678	13	0.8972	32	1.1145	39	0.7443	12	1
42.0	0.6691	13	0.9004	32	1.1106	39	0.7431	11	**48.0**
1	0.6704	13	0.9036	31	1.1067	39	0.7420	12	9
2	0.6717	13	0.9067	32	1.1028	38	0.7408	12	8
3	0.6730	13	0.9099	32	1.0990	39	0.7396	11	7
4	0.6743	13	0.9131	32	1.0951	38	0.7385	12	6
5	0.6756	13	0.9163	32	1.0913	38	0.7373	12	5
6	0.6769	13	0.9195	33	1.0875	38	0.7361	12	4
7	0.6782	12	0.9228	32	1.0837	38	0.7349	12	3
8	0.6794	13	0.9260	33	1.0799	38	0.7337	12	2
9	0.6807	13	0.9293	32	1.0761	37	0.7325	11	1
43.0	0.6820	13	0.9325	33	1.0724	38	0.7314	12	**47.0**
1	0.6833	12	0.9358	33	1.0686	37	0.7302	12	9
2	0.6845	13	0.9391	33	1.0649	37	0.7290	12	8
3	0.6858	13	0.9424	33	1.0612	37	0.7278	12	7
4	0.6871	13	0.9457	33	1.0575	37	0.7266	12	6
5	0.6884	12	0.9490	33	1.0538	37	0.7254	12	5
6	0.6896	13	0.9523	33	1.0501	37	0.7242	12	4
7	0.6909	12	0.9556	34	1.0464	36	0.7230	12	3
8	0.6921	13	0.9590	33	1.0428	36	0.7218	12	2
9	0.6934	13	0.9623	34	1.0392	37	0.7206	13	1
44.0	0.6947	12	0.9657	34	1.0355	36	0.7193	12	**46.0**
1	0.6959	13	0.9691	34	1.0319	36	0.7181	12	9
2	0.6972	12	0.9725	34	1.0283	36	0.7169	12	8
3	0.6984	13	0.9759	34	1.0247	35	0.7157	12	7
4	0.6997	12	0.9793	34	1.0212	36	0.7145	12	6
5	0.7009	13	0.9827	34	1.0176	35	0.7133	13	5
6	0.7022	12	0.9861	35	1.0141	36	0.7120	12	4
7	0.7034	12	0.9896	34	1.0105	35	0.7108	12	3
8	0.7046	13	0.9930	35	1.0070	35	0.7096	13	2
9	0.7059	12	0.9965	35	1.0035	35	0.7083	12	1
45.0	0.7071		1.0000		1.0000		0.7071		**45.0**
	Cosin	d.	Cotan	d.	Tan	d.	Sin	d.	Deg.

P. P.

	31	32	33	34	13
1	3.1	3.2	3.3	3.4	1.3
2	6.2	6.4	6.6	6.8	2.6
3	9.3	9.6	9.9	10.2	3.9
4	12.4	12.8	13.2	13.6	5.2
5	15.5	16.0	16.5	17.0	6.5
6	18.6	19.2	19.8	20.4	7.8
7	21.7	22.4	23.1	23.8	9.1
8	24.8	25.6	26.4	27.2	10.4
9	27.9	28.8	29.7	30.6	11.7

TABLE XXVIII. — NATURAL VERSED SINES AND EXTERNAL SECANTS

Angle	Vers	Exsec	Angle	Vers	Exsec	Angle	Vers	Exsec	Angle	Vers	Exsec
0.0	.0000	.0000	**5.0**	.0038	.0038	**10.0**	.0152	.0154	**15.0**	.0341	.0353
.1	.0000	.0000	.1	.0040	.0040	.1	.0155	.0157	.1	.0345	.0358
.2	.0000	.0000	.2	.0041	.0041	.2	.0158	.0161	.2	.0350	.0363
.3	.0000	.0000	.3	.0043	.0043	.3	.0161	.0164	.3	.0354	.0367
.4	.0000	0000	.4	.0044	.0045	.4	.0164	.0167	.4	.0359	.0372
.5	.0000	.0000	.5	.0046	.0046	.5	.0167	.0170	.5	.0364	.0377
.6	.0001	.0001	.6	.0048	.0048	.6	.0171	.0174	.6	.0368	.0382
.7	.0001	.0001	.7	.0049	.0050	.7	.0174	.0177	.7	.0373	.0388
.8	.0001	.0001	.8	.0051	.0051	.8	.0177	.0180	.8	.0378	.0393
.9	.0001	.0001	.9	.0053	.0053	.9	.0180	.0184	.9	.0383	.0398
1.0	.0002	.0002	**6.0**	.0055	.0055	**11.0**	.0184	.0187	**16.0**	.0387	.0403
.1	.0002	.0002	.1	.0057	.0057	.1	.0187	.0191	.1	.0392	.0408
.2	.0002	.0002	.2	.0058	.0059	.2	.0190	.0194	.2	.0397	.0413
.3	.0003	.0003	.3	.0060	.0061	.3	.0194	.0198	.3	.0402	.0419
.4	.0003	.0003	.4	.0062	.0063	.4	.0197	.0201	.4	.0407	.0424
.5	.0003	.0003	.5	.0064	.0065	.5	.0201	.0205	.5	.0412	.0429
.6	.0004	.0004	.6	.0066	.0067	.6	.0204	.0209	.6	.0417	.0435
.7	.0004	.0004	.7	.0068	.0069	.7	.0208	.0212	.7	.0422	.0440
.8	.0005	.0005	.8	.0070	.0071	.8	.0211	.0216	.8	.0427	.0446
.9	.0005	.0005	.9	.0072	.0073	.9	.0215	.0220	.9	.0432	.0451
2.0	.0006	.0006	**7.0**	.0075	.0075	**12.0**	.0219	.0223	**17.0**	.0437	.0457
.1	.0007	.0007	.1	.0077	.0077	.1	.0222	.0227	.1	.0442	.0463
.2	.0007	.0007	.2	.0079	.0079	.2	.0226	.0231	.2	.0447	.0468
.3	.0008	.0008	.3	.0081	.0082	.3	.0230	.0235	.3	.0452	.0474
.4	.0009	.0009	.4	.0083	.0084	.4	.0233	.0239	.4	.0458	.0480
.5	.0010	.0010	.5	.0086	.0086	.5	.0237	.0243	.5	.0463	.0485
.6	.0010	.0010	.6	.0088	.0089	.6	.0241	.0247	.6	.0468	.0491
.7	.0011	.0011	.7	.0090	.0091	.7	.0245	.0251	.7	.0473	.0497
.8	.0012	.0012	.8	.0093	.0093	.8	.0249	.0255	.8	.0479	.0503
.9	.0013	.0013	.9	.0095	.0096	.9	.0252	.0259	.9	.0484	.0509
3.0	.0014	.0014	**8.0**	.0097	.0098	**13.0**	.0256	.0263	**18.0**	.0489	.0515
.1	.0015	.0015	.1	.0100	.0101	.1	.0260	.0267	.1	.0495	.0521
.2	.0016	.0016	.2	.0102	.0103	.2	.0264	.0271	.2	.0500	.0527
.3	.0017	.0017	.3	.0105	.0106	.3	.0268	.0276	.3	.0506	.0533
.4	.0018	.0018	.4	.0107	.0108	.4	.0272	.0280	.4	.0511	.0539
.5	.0019	.0019	.5	.0110	.0111	.5	.0276	.0284	.5	.0517	.0545
.6	.0020	.0020	.6	.0112	.0114	.6	.0280	.0288	.6	.0522	.0551
.7	.0021	.0021	.7	.0115	.0116	.7	.0285	.0293	.7	.0528	.0557
.8	.0022	.0022	.8	.0118	.0119	.8	.0289	.0297	.8	.0534	.0564
.9	.0023	.0023	.9	.0120	.0122	.9	.0293	.0302	.9	.0539	.0570
4.0	.0024	.0024	**9.0**	.0123	.0125	**14.0**	.0297	.0306	**19.0**	.0545	.0576
.1	.0026	.0026	.1	.0126	.0127	.1	.0301	.0311	.1	.0551	.0583
.2	.0027	.0027	.2	.0129	.0130	.2	.0306	.0315	.2	.0556	.0589
.3	.0028	.0028	.3	.0131	.0133	.3	.0310	.0320	.3	.0562	.0595
.4	.0030	.0030	.4	.0134	.0136	.4	.0314	.0324	.4	.0568	.0602
.5	.0031	.0031	.5	.0137	.0139	.5	.0319	.0329	.5	.0574	.0608
.6	.0032	.0032	.6	.0140	.0142	.6	.0323	.0334	.6	.0579	.0615
.7	.0034	.0034	.7	.0143	.0145	.7	.0327	.0338	.7	.0585	.0622
.8	.0035	.0035	.8	.0146	.0148	.8	.0332	.0343	.8	.0591	.0628
.9	.0037	.0037	.9	.0149	.0151	.9	.0336	.0348	.9	.0597	.0635
5.0	.0038	.0038	**10.0**	.0152	.0154	**15.0**	.0341	.0353	**20.0**	.0603	.0642

TABLE XXVIII. — Natural Versed Sines and External Secants

Angle	Vers	Exsec	Angle	Vers	Exsec	Angle	Vers	Exsec	Angle	Vers	Exsec
20.0	.0603	.0642	**25.0**	.0937	.1034	**30.0**	.1340	.1547	**35.0**	.1808	.2208
.1	.0609	.0649	.1	.0944	.1043	.1	.1348	.1559	.1	.1819	.2223
.2	.0615	.0655	.2	.0952	.1052	.2	.1357	.1570	.2	.1829	.2238
.3	.0621	.0662	.3	.0959	.1061	.3	.1366	.1582	.3	.1839	.2253
.4	.0627	.0669	.4	.0967	.1070	.4	.1375	.1594	.4	.1849	.2268
.5	.0633	.0676	.5	.0974	.1079	.5	.1384	.1606	.5	.1859	.2283
.6	.0639	.0683	.6	.0982	.1089	.6	.1393	.1618	.6	.1869	.2299
.7	.0646	.0690	.7	.0989	.1098	.7	.1401	.1630	.7	.1879	.2314
.8	.0651	.0697	.8	.0997	.1107	.8	.1410	.1642	.8	1889	.2329
.9	.0658	.0704	.9	.1004	.1117	.9	.1419	.1654	.9	.1900	.2345
21.0	.0664	.0711	**26.0**	.1012	.1126	**31.0**	.1428	.1666	**36.0**	.1910	.2361
.1	.0670	.0719	.1	.1020	.1135	.1	.1437	.1679	.1	.1920	.2376
.2	.0677	.0726	.2	.1027	.1145	.2	.1446	.1691	.2	.1930	.2392
.3	.0683	.0733	.3	.1035	.1155	.3	.1455	.1703	.3	.1941	.2408
.4	.0689	.0740	.4	.1043	.1164	.4	.1464	.1716	.4	.1951	.2424
.5	.0696	.0748	.5	.1051	.1174	.5	.1474	.1728	.5	.1961	.2440
.6	.0702	.0755	.6	.1058	.1184	.6	.1483	.1741	.6	.1972	.2456
.7	.0709	.0763	.7	.1066	.1194	.7	.1492	.1753	.7	.1982	.2472
.8	.0715	.0770	.8	.1074	.1203	.8	.1501	1766	.8	.1993	.2489
.9	.0722	.0778	.9	.1082	.1213	.9	.1510	.1779	.9	.2003	.2505
22.0	.0728	.0785	**27.0**	.1090	.1223	**32.0**	.1520	.1792	**37.0**	.2014	.2521
.1	.0735	.0793	.1	.1098	.1233	.1	.1529	.1805	.1	.2024	.2538
.2	.0741	.0801	.2	.1106	.1243	.2	.1538	.1818	.2	.2035	.2554
.3	.0748	.0808	.3	.1114	.1253	.3	.1547	.1831	.3	.2045	.2571
.4	.0755	.0816	.4	.1122	.1264	.4	.1557	.1844	.4	.2056	.2588
.5	.0761	.0824	.5	.1130	.1274	.5	.1566	.1857	.5	.2066	.2605
.6	.0768	.0832	.6	.1138	.1284	.6	.1575	.1870	.6	.2077	.2622
.7	.0775	.0840	.7	.1146	.1294	.7	.1585	.1883	.7	.2088	.2639
.8	.0781	.0848	.8	.1154	.1305	.8	.1594	.1897	.8	.2098	.2656
.9	.0788	.0856	.9	.1162	.1315	.9	.1604	.1910	.9	.2109	.2673
23.0	.0795	.0864	**28.0**	.1171	.1326	**33.0**	.1613	.1924	**38.0**	.2120	.2690
.1	.0802	.0872	.1	.1179	.1336	.1	.1623	.1937	.1	.2131	.2708
.2	.0809	.0880	.2	.1187	.1347	.2	.1632	.1951	.2	.2141	.2725
.3	.0816	.0888	.3	.1195	.1357	.3	.1642	.1964	.3	.2152	.2742
.4	.0822	.0896	.4	.1204	.1368	.4	.1652	.1978	.4	.2163	.2760
.5	.0829	.0904	.5	.1212	.1379	.5	.1661	.1992	.5	.2174	.2778
.6	.0836	.0913	.6	.1220	.1390	.6	.1671	.2006	.6	.2185	.2796
.7	.0843	.0921	.7	.1229	.1401	.7	.1680	.2020	.7	.2196	.2813
.8	.0850	.0929	.8	.1237	.1412	.8	.1690	.2034	.8	.2207	.2831
.9	.0857	.0938	.9	.1245	.1423	.9	.1700	.2048	.9	.2218	.2849
24.0	.0865	.0946	**29.0**	.1254	.1434	**34.0**	.1710	.2062	**39.0**	.2229	.2868
.1	.0872	.0955	.1	.1262	.1445	.1	.1719	.2076	.1	.2240	.2886
.2	.0879	.0963	.2	.1271	.1456	.2	.1729	.2091	.2	.2251	.2904
.3	.0886	.0972	.3	.1279	.1467	.3	.1739	.2105	.3	.2262	.2923
.4	.0893	.0981	.4	.1288	.1478	.4	.1749	.2120	.4	.2273	.2941
.5	.0900	.0989	.5	.1296	.1490	.5	.1759	.2134	.5	.2284	.2960
.6	.0908	.0998	.6	.1305	.1501	.6	.1769	.2149	.6	.2295	.2978
.7	.0915	.1007	.7	.1314	.1512	.7	.1779	.2163	.7	.2306	.2997
.8	.0922	.1016	.8	.1322	.1524	.8	.1789	.2178	.8	.2317	.3016
.9	.0930	.1025	.9	.1331	.1535	.9	.1798	.2193	.9	.2328	.3035
25.0	.0937	.1034	**30.0**	.1340	.1547	**35.0**	.1808	.2208	**40.0**	.2340	.3054

TABLE XXVIII. — Natural Versed Sines and External Secants

Angle	Vers	Exsec	Angle	Vers	Exsec	Angle	Vers	Exsec	Angle	Vers	Exsec
40.0	.2340	.3054	**45.0**	.2929	.4142	**50.0**	.3572	.5557	**55.0**	.4264	.7434
.1	.2351	.3073	.1	.2941	.4167	.1	.3586	.5590	.1	.4279	.7478
.2	.2362	.3093	.2	.2954	.4192	.2	.3599	.5622	.2	.4293	.7522
.3	.2373	.3102	.3	.2966	.4217	.3	.3612	.5655	.3	.4307	.7566
.4	.2385	.3131	.4	.2978	.4242	.4	.3626	.5688	.4	.4322	.7610
.5	.2396	.3151	.5	.2991	.4267	.5	.3639	.5721	.5	.4336	.7655
.6	.2407	.3171	.6	.3003	.4293	.6	.3653	.5755	.6	.4350	.7700
.7	.2419	.3190	.7	.3016	.4318	.7	.3666	.5788	.7	.4365	.7745
.8	.2430	.3210	.8	.3028	.4344	.8	.3680	.5822	.8	.4379	.7791
.9	.2441	.3230	.9	.3041	.4370	.9	.3693	.5856	.9	.4394	.7837
41.0	.2453	.3251	**46.0**	.3053	.4396	**51.0**	.3707	.5890	**56.0**	.4408	.7883
.1	.2464	.3270	.1	.3066	.4422	.1	.3720	.5925	.1	.4423	.7929
.2	.2476	.3291	.2	.3079	.4448	.2	.3734	.5959	.2	.4437	.7976
.3	.2487	.3311	.3	.3091	.4474	.3	.3748	.5994	.3	.4452	.8022
.4	.2499	.3331	.4	.3104	.4501	.4	.3761	.6029	.4	.4466	.8070
.5	.2510	.3352	.5	.3116	.4527	.5	.3775	.6064	.5	.4481	.8118
.6	.2522	.3373	.6	.3129	.4554	.6	.3789	.6099	.6	.4495	.8166
.7	.2534	.3393	.7	.3142	.4581	.7	.3802	.6135	.7	.4510	.8214
.8	.2545	.3414	.8	.3155	.4608	.8	.3816	.6171	.8	.4524	.8263
.9	.2557	.3435	.9	.3167	.4635	.9	.3830	.6207	.9	.4539	.8312
42.0	.2569	.3456	**47.0**	.3180	.4663	**52.0**	.3843	.6243	**57.0**	.4554	.8361
.1	.2580	.3478	.1	.3193	.4690	.1	.3857	.6279	.1	.4568	.8410
.2	.2592	.3499	.2	.3206	.4718	.2	.3871	.6316	.2	.4583	.8460
.3	.2604	.3520	.3	.3218	.4746	.3	.3885	.6353	.3	.4598	.8510
.4	.2615	.3542	.4	.3231	.4774	.4	.3899	.6390	.4	.4612	.8561
.5	.2627	.3563	.5	.3244	.4802	.5	.3912	.6427	.5	.4627	.8612
.6	.2639	.3585	.6	.3257	.4830	.6	.3926	.6464	.6	.4642	.8663
.7	.2651	.3607	.7	.3270	.4859	.7	.3940	.6502	.7	.4656	.8714
.8	.2663	.3629	.8	.3283	.4887	.8	.3954	.6540	.8	.4671	.8766
.9	.2675	.3651	.9	.3296	.4916	.9	.3968	.6578	.9	.4686	.8818
43.0	.2686	.3673	**48.0**	.3309	.4945	**53.0**	.3982	.6616	**58.0**	.4701	.8871
.1	.2698	.3696	.1	.3322	.4974	.1	.3996	.6655	.1	.4716	.8924
.2	.2710	.3718	.2	.3335	.5003	.2	.4010	.6694	.2	.4730	.8977
.3	.2722	.3741	.3	.3348	.5032	.3	.4024	.6733	.3	.4745	.9031
.4	.2734	.3763	.4	.3361	.5062	.4	.4038	.6772	.4	.4760	.9084
.5	.2746	.3786	.5	.3374	.5092	.5	.4052	.6812	.5	.4775	.9139
.6	.2758	.3809	.6	.3387	.5121	.6	.4066	.6852	.6	.4790	.9194
.7	.2770	.3832	.7	.3400	.5151	.7	.4080	.6892	.7	.4805	.9249
.8	.2782	.3855	.8	.3413	.5182	.8	.4094	.6942	.8	.4820	.9304
.9	.2794	.3878	.9	.3426	.5212	.9	.4108	.6972	.9	.4835	.9360
44.0	.2807	.3902	**49.0**	.3439	.5243	**54.0**	.4122	.7013	**59.0**	.4850	.9416
.1	.2819	.3925	.1	.3453	.5273	.1	.4136	.7054	.1	.4865	.9473
.2	.2831	.3949	.2	.3466	.5304	.2	.4150	.7095	.2	.4880	.9530
.3	.2843	.3972	.3	.3479	.5335	.3	.4165	.7137	.3	.4895	.9587
.4	.2855	.3996	.4	.3492	.5366	.4	.4179	.7179	.4	.4910	.9645
.5	.2868	.4020	.5	.3506	.5398	.5	.4193	.7221	.5	.4925	.9703
.6	.2880	.4044	.6	.3519	.5429	.6	.4207	.7263	.6	.4940	.9762
.7	.2892	.4069	.7	.3532	.5461	.7	.4221	.7305	.7	.4955	.9821
.8	.2904	.4093	.8	.3545	.5493	.8	.4236	.7348	.8	.4970	.9880
.9	.2917	.4118	.9	.3559	.5525	.9	.4250	.7391	.9	.4985	.9940
45.0	.2929	.4142	**50.0**	.3572	.5557	**55.0**	.4264	.7434	**60.0**	.5000	1.0000

TABLE XXVIII. — NATURAL VERSED SINES AND EXTERNAL SECANTS

Angle	Vers	Exsec	Angle	Vers	Exsec	Angle	Vers	Exsec
60.0	.5000	1.0000	**65.0**	.5774	1.3662	**70.0**	.6580	1.9238
.1	.5015	.0061	.1	.5790	.3751	.1	.6596	.9379
.2	.5030	.0122	.2	.5805	.3841	.2	.6613	.9521
.3	.5045	.0183	.3	.5821	.3931	.3	.6629	.9665
.4	.5061	.0245	.4	.5837	.4022	.4	.6645	.9811
.5	.5076	1.0308	.5	.5853	1.4114	.5	.6662	1.9957
.6	.5091	.0371	.6	.5869	.4207	.6	.6678	2.0106
.7	.5106	.0434	.7	.5885	.4300	.7	.6695	.0256
.8	.5121	.0498	.8	.5901	.4395	.8	.6711	.0406
.9	.5137	.0562	.9	.5917	.4490	.9	.6728	.0561
61.0	.5152	1.0627	**66.0**	.5933	.4586	**71.0**	.6744	2.0716
.1	.5167	.0692	.1	.5949	.4683	.1	.6761	.0872
.2	.5182	.0757	.2	.5965	.4780	.2	.6777	.1030
.3	.5198	.0824	.3	.5981	.4879	.3	.6794	.1190
.4	.5213	.0890	.4	.5997	.4978	.4	.6810	.1352
.5	.5228	1.0957	.5	.6013	1.5078	.5	.6827	2.1515
.6	.5244	.1025	.6	.6029	.5180	.6	.6844	.1681
.7	.5259	.1093	.7	.6045	.5282	.7	.6860	.1848
.8	.5274	.1162	.8	.6061	.5384	.8	.6877	.2017
.9	.5290	.1231	.9	.6077	.5488	.9	.6893	.2188
62.0	.5305	.1301	**67.0**	.6093	1.5593	**72.0**	.6910	2.2361
.1	.5321	.1371	.1	.6109	.5699	.1	.6926	.2535
.2	.5336	.1441	.2	.6125	.5805	.2	.6943	.2712
.3	.5352	.1513	.3	.6141	.5913	.3	.6960	.2891
.4	.5367	.1584	.4	.6157	.6022	4	.6976	.3072
.5	.5383	1.1657	.5	.6173	1.6131	.5	.6993	2.3255
.6	.5398	.1730	.6	.6189	.6242	.6	.7010	.3440
.7	.5414	.1803	.7	.6205	.6354	.7	.7026	.3628
.8	.5429	.1877	.8	.6222	.6466	.8	.7043	.3817
.9	.5445	.1952	.9	.6238	.6580	.9	.7060	.4009
63.0	.5460	1.2027	**68.0**	.6254	1.6695	**73.0**	.7076	2.4203
.1	.5476	.2103	.1	.6270	.6811	.1	.7093	.4399
.2	.5491	.2179	.2	.6286	.6927	.2	.7110	.4598
.3	.5507	.2256	.3	.6303	.7046	.3	.7126	.4789
.4	.5522	.2333	.4	.6319	.7165	.4	.7143	.5003
.5	.5538	1.2412	.5	.6335	1.7285	.5	.7160	2.5209
.6	.5554	.2490	.6	.6351	.7407	.6	.7177	.5418
.7	.5569	.2570	.7	.6367	.7529	.7	.7193	.5629
.8	.5585	.2650	.8	.6384	.7653	.8	.7210	.5843
.9	.5601	.2730	.9	.6400	.7778	.9	.7227	.6060
64.0	.5616	1.2812	**69.0**	.6416	.7904	**74.0**	.7244	2.6280
.1	.5632	.2894	.1	.6433	.8032	.1	.7260	.6502
.2	.5648	.2976	.2	.6449	.8161	.2	.7277	.6728
.3	.5663	.3060	.3	.6465	.8291	.3	.7294	.6955
.4	.5679	.3144	.4	.6482	.8422	.4	.7311	.7186
.5	.5695	1.3228	.5	.6498	1.8554	.5	.7328	2.7420
.6	.5711	.3314	.6	.6514	.8688	.6	.7344	.7657
.7	.5726	.3400	.7	.6531	.8824	.7	.7361	.7897
.8	.5742	.3486	.8	.6547	.8960	.8	.7378	.8140
.9	.5758	.3574	.9	.6563	.9099	.9	.7395	.8387
65.0	.5774	1.3662	**70.0**	.6580	1.9238	**75.0**	.7412	2.8637

TABLE XXVIII. — NATURAL VERSED SINES AND EXTERNAL SECANTS

Angle	Vers	Exsec	Angle	Vers	Exsec	Angle	Vers	Exsec
75.0	.7412	2.8637	**80.0**	.8264	4.7588	**85.0**	.9128	10.4737
.1	.7429	.8890	.1	.8281	.8164	.1	.9146	.7073
.2	.7446	.9147	.2	.8298	.8751	.2	.9163	.9506
.3	.7462	.9408	.3	.8315	.9351	.3	.9181	11.2043
.4	.7479	.9672	.4	.8332	.9963	.4	.9198	.4690
.5	.7496	2.9939	.5	.8350	5.0589	.5	.9215	11.7455
.6	.7513	3.0211	.6	.8367	.1227	.6	.9233	12.0346
.7	.7530	.0486	.7	.8384	.1880	.7	.9250	.3371
.8	.7547	.0765	.8	.8401	.2546	.8	.9268	.6541
.9	.7564	.1048	.9	.8418	.3228	.9	.9285	.9865
76.0	.7581	3.1336	**81.0**	.8436	5.3925	**86.0**	.9302	13.3356
.1	.7598	.1627	.1	.8453	.4637	.1	.9320	.7026
.2	.7615	.1923	.2	.8470	.5366	.2	.9337	14.0889
.3	.7632	.2223	.3	.8487	.6111	.3	.9355	.4961
.4	.7649	.2527	.4	.8505	.6874	.4	.9372	.9260
.5	.7666	3.2837	.5	.8522	5.7655	.5	.9390	15.3804
.6	.7683	.3150	.6	.8539	.8454	.6	.9407	.8616
.7	.7700	.3469	.7	.8556	.9273	.7	.9424	16.3720
.8	.7716	.3792	.8	.8574	6.0112	.8	.9442	.9142
.9	.7733	.4121	.9	.8591	.0972	.9	.9459	17.4915
77.0	.7750	3.4454	**82.0**	.8608	6.1853	**87.0**	.9477	18.1073
.1	.7767	.4793	.1	.8626	.2757	.1	.9494	.7656
.2	.7785	.5137	.2	.8643	.3684	.2	.9512	19.4709
.3	.7802	.5486	.3	.8660	.4635	.3	.9529	20.2285
.4	.7819	.5841	.4	.8677	.5611	.4	.9546	21.0444
.5	.7836	3.6202	.5	.8695	6.6613	.5	.9564	21.9256
.6	.7853	.6569	.6	.8712	.7642	.6	.9581	22.8802
.7	.7870	.6942	.7	.8729	.8700	.7	.9599	23.9179
.8	.7887	.7320	.8	.8747	.9787	.8	.9616	25.0499
.9	.7904	.7706	.9	.8764	7.0905	.9	.9634	26.2898
78.0	.7921	3.8097	**83.0**	.8781	7.2055	**88.0**	.9651	27.6537
.1	.7938	.8496	.1	.8799	.3238	.1	.9668	29.1612
.2	.7955	.8901	.2	.8816	.4457	.2	.9686	30.8362
.3	.7972	.9313	.3	.8833	.5711	.3	.9703	32.7083
.4	.7989	.9732	.4	.8851	.7004	.4	.9721	34.8145
.5	.8006	4.0159	.5	.8868	7.8337	.5	.9738	37.2016
.6	.8023	.0593	.6	.8885	.9711	.6	.9756	39.9296
.7	.8041	.1034	.7	.8903	8.1129	.7	.9773	43.0775
.8	.8058	.1484	.8	.8920	.2593	.8	.9791	46.7500
.9	.8075	.1942	.9	.8937	.4105	.9	.9808	51.0903
79.0	.8092	4.2408	**84.0**	.8955	8.5668	**89.0**	.9825	56.2987
.1	.8109	.2883	.1	.8972	.7283	.1	.9843	62.6646
.2	.8126	.3367	.2	.8989	.8955	.2	.9860	70.6221
.3	.8143	.3860	.3	.9007	9.0685	.3	.9878	80.8532
.4	.8160	.4362	.4	.9024	.2477	.4	.9895	94.4947
.5	.8178	4.4874	.5	.9042	9.4334	.5	.9913	113.5930
.6	.8195	.5396	.6	.9059	.6261	.6	.9930	142.2406
.7	.8212	.5928	.7	.9076	.8260	.7	.9948	189.9868
.8	.8229	.6470	.8	.9094	10.0336	.8	.9965	285.4795
.9	.8246	.7023	.9	.9111	.2493	.9	.9983	571.9581
80.0	.8264	4.7588	**85.0**	.9128	10.4737	**90.0**	1.0000	∞

TABLE XXIX

Seconds in decimals of a degree											
Sec.	Degree	Sec.	Degree	Sec.	Degree	Sec.	Degree	Sec.	Degree	Sec.	Degree
1	0.00028	11	0.00306	21	0.00584	31	0.00862	41	0.01139	51	0.01417
2	0.00056	12	0.00334	22	0.00612	32	0.00890	42	0.01167	52	0.01445
3	0.00083	13	0.00361	23	0.00639	33	0.00917	43	0.01195	53	0.01473
4	0.00111	14	0.00389	24	0.00667	34	0.00945	44	0.01222	54	0.01500
5	0.00139	15	0.00417	25	0.00695	35	0.00973	45	0.01250	55	0.01528
6	0.00167	16	0.00445	26	0.00723	36	0.01000	46	0.01278	56	0.01556
7	0.00195	17	0.00473	27	0.00751	37	0.01028	47	0.01306	57	0.01584
8	0.00222	18	0.00500	28	0.00778	38	0.01056	48	0.01334	58	0.01612
9	0.00250	19	0.00528	29	0.00806	39	0.01083	49	0.01361	59	0.01639
10	0.00278	20	0.00556	30	0.00834	40	0.01111	50	0.01389	60	0.01667

TABLE XXX

Minutes in decimals of a degree											
Min.	Degree	Min.	Degree	Min.	Degree	Min.	Degree	Min.	Degree	Min.	Degree
1	0.01667	11	0.18333	21	0.35000	31	0.51667	41	0.68333	51	0.85000
2	0.03333	12	0.20000	22	0.36667	32	0.53333	42	0.70000	52	0.86667
3	0.05000	13	0.21667	23	0.38333	33	0.55000	43	0.71667	53	0.88333
4	0.06667	14	0.23333	24	0.40000	34	0.56667	44	0.73333	54	0.90000
5	0.08333	15	0.25000	25	0.41667	35	0.58333	45	0.75000	55	0.91667
6	0.10000	16	0.26667	26	0.43333	36	0.60000	46	0.76667	56	0.93333
7	0.11667	17	0.28333	27	0.45000	37	0.61667	47	0.78333	57	0.95000
8	0.13333	18	0.30000	28	0.46667	38	0.63333	48	0.80000	58	0.96667
9	0.15000	19	0.31667	29	0.48333	39	0.65000	49	0.81667	59	0.98333
10	0.16667	20	0.33333	30	0.50000	40	0.66667	50	0.83333	60	1.00000

From Roberts' "Track Formulæ and Tables."

CHAPTER IV

LOCATION THEORIES AND TABLES

For problems relating to improvements of existing lines exact data and volumes of discussion of methods will be available. The methods here suggested are for use in locating new lines for which precise data respecting motive power, business, or expense are indeterminate. Most of the problems will relate to saving in operation of freight trains. A single locomotive may be assumed, since in the solution of problems the results will be practically the same relatively for any probable differences in locomotives. It must be remembered that not all of the trains will be affected by probable changes in ruling grades; the engineer must use his judgment in determining what trains will be affected. All trains must be considered in estimating the cost of distance, rise and fall, and curvature. The formulas given in what follows are based on the full discussion of the subjects in the author's "Elements of Railroad Engineering."

Tractive Effort. — For approximate computations the tractive effort of a locomotive may be assumed to be

$$T_b = \frac{146\,H}{S} \text{ pounds,}$$

or

$$T_c = \frac{Pd^2L}{D} \text{ pounds,}$$

or

$$T_a = \frac{W}{4.25} \text{ pounds if } W \text{ is pounds,}$$

in which H is the square feet of heating surface.

S is the speed in miles per hour.
P is the mean effective pressure in the cylinders.
d is the diameter of the piston.
L is the length of the stroke.
D is the diameter of the drive wheels.
W is the weight on the drive wheels.

T_b is to be used for speeds above that for which $T_b = T_c$ when P is 85 per cent of the working boiler pressure, and is known as the boiler tractive effort; T_a is used only in case it is less than T_c for $P = 85$ per cent of the boiler pressure. It is the tractive effort of adhesion and all that the locomotive can exert under normal conditions regardless of the values of T_b and T_c. T_c is called the cylinder tractive effort. T_a has been known to be as high as $\frac{W}{3}$, with sand on the track, and it is probably as low as $\frac{W}{5}$ under unfavorable conditions of track. Theoretic values of T_b for a particular consolidation locomotive are tabulated in Table XXXIII.

Resistance. — Resistance to motion on a straight level track varies with speed and weight per car of train; it may be taken from Table XXXII. Grade resistance or acceleration is given by $R_g = 20\,r$, in which R_g is resistance in pounds per ton and r is the rate per cent of grade expressed as a whole or mixed number; thus for a 2 per cent grade r is 2.0, etc. Curve resistance in pounds per ton varies with the degree of curve, somewhat with speed, being less as the speed is greater, and with the rigid wheel base of the car or locomotive. It may be averaged for a train at

$$R_c = 0.4 + 0.35\,D,$$

in which R_c is curve resistance in pounds per ton and D is the degree of curve. This is an empirical equation that does not vanish when D is 0 as it should to be mathematically correct. Ruling grades or others likely ever to become ruling because of the curves on them should be reduced or "compensated" in rate per cent through all curves as follows: For 1° curves reduce 0.04 per cent; for curves from 2° to 4° reduce 0.03 D per cent; for curves of 5° and over reduce 0.025 D per cent. Greater reductions will do no harm unless they make a steeper ruling grade necessary.

To Find the Maximum Load a Locomotive can Haul on a Given Grade at a Given Speed. — From Table XXXII find the train resistance for an assumed or known car weight at the given speed; add the grade resistance $= 20\,r$, and divide the tractive effort for the given speed by the sum; subtract the weight of engine and tender. The values for a particular consolidation engine are tabulated in Table XXXIV.

Pusher Grade.— To find the grade up which two similar locomotives can haul the load that one can haul on a given grade. If X be the rate of grade sought,

$$X = \frac{\dfrac{1.9\,T}{W + 2\,E} - R_t}{20},$$

in which R_t is train resistance in pounds per ton, T is the tractive effort of one locomotive, W is the weight of the train and E the weight of one locomotive and tender both in tons. If there are to be three locomotives the corresponding pusher grade is

$$X = \frac{\dfrac{2.85\,T}{W + 3\,E} - R_t}{20}.$$

To Find the Length of Up Grade Required to Reduce the Speed from S_1 to S_2 Miles an Hour for a Given Locomotive and Train. — This is the so-called momentum or velocity grade problem and finds the length of grade steeper than the ruling grade that can still be operated if a sufficient velocity of approach may be had.

Let r be the rate of the grade steeper than that for which the locomotive is loaded. Find the tractive effort for the average speed; add the weight of the train and locomotive for gross load W in tons; find the train resistance R_t for the train at the average speed; find the quantity

$$V = \frac{1}{20}\left(\frac{T}{W} - R_t\right);$$

find the velocity heads for the speeds S_1 and S_2 from Table XXXI, then

$$L \text{ stations} = \frac{\text{difference in velocity heads}}{r - V};$$

V is the virtual grade, or grade that the locomotive can work at the given speed with the given load. If the steep grade differs only a little from the ruling grade for the given S_2, the result is inaccurate but errs on the safe side, giving a grade somewhat shorter than true theory indicates.

Grades for Unbalanced Traffic. — If traffic is pretty certain to be permanently unbalanced with respect to direction of haul the grade against the lighter traffic may be steeper than that against the heavier traffic if economy of construction will result. The same number of engines and cars must go both ways, hence the lighter traffic trains will have a higher resistance per ton because the average car weight will be less. Having the ruling grade against the heavy traffic determined, the corresponding grade for a traffic in the opposite direction is found as follows:

Find the load that the assumed or known locomotive can haul behind the tender at a speed of about ten miles an hour on the ruling grade against the heavy traffic, using an assumed or known car weight to determine train resistance. If there is much variation in the traffic subtract the weight of the cars (taken at about 18 tons per car for preliminary purposes) from the load, reduce the remaining live or freight load by the assumed percentage of unbalancing, add the car weights and get the new total load and average car weight. Find the train resistance for the new car weight. If R_t be that resistance, T the tractive effort of the locomotive, E the weight of engine and tender and L the load behind the tender, then the grade, G, against the lighter traffic may be

$$G = \frac{1}{20}\left(\frac{T}{L+E} - R_t\right).$$

The caboose or way car has not been considered. For a greater degree of precision than such problems generally warrant its weight should be included with the engine weight E.

Elements for Estimating. — 1. *Distance.* — To estimate the cost of operating extra distance or the saving due to reducing distance assume a probable average train mile cost and assume a number of trains per day over the distance under consideration. All trains going both ways are to be included. Then if C be the train mile cost in dollars, M the miles of extra distance under consideration, and N the number of daily trains, the annual cost of operating the M miles, or the annual saving by omitting M miles, is given approximately by

$$K = 156\, C \cdot M \cdot N$$

for moderate changes in distance.

The limit of justifiable expenditure to reduce the distance in miles is $\frac{K}{r}$, where r is the going rate of interest which should be taken somewhat higher than the nominal rate specified in the company's bonds. In the formula it should be used as a decimal, thus 8 per cent = 0.08. For large changes in long lines the coefficient may be increased up to, say, 315 for a change involving the addition of a whole division.

The average train mile cost for the United States is not far from \$1.55 in 1914. The figures for the year have not been computed at this writing. The cost has been increasing for a number of years, but recent economies have checked this increase somewhat. In 1908 the average cost was about \$1.47. The Interstate Commerce Commission divides the country into three great districts for reporting savings and expenses, the Eastern, Southern, and Western. The Eastern district comprises that portion of the country bounded on the west by the northern and western shores of Lake Michigan to Chicago, thence by a line to Peoria, thence to East St. Louis, thence down the Mississippi River to the mouth of the Ohio River; and on the south by the Ohio River from its mouth to Parkersburg, West Virginia, thence by a line to the southwestern corner of Maryland, thence by the Potomac River to its mouth. The Southern district comprises the territory south of the Eastern district and east of the Mississippi River. The Western district includes the remainder of the United States, exclusive of Alaska and insular possessions.

The Commission also divides the railroads into three classes:

I. Roads with annual gross operating revenues of $1,000,000 or more.

II. Roads with annual gross operating revenues of $100,000 or more but less than $1,000,000.

III. Roads with annual gross operating revenues of less than $100,000.

Average train mile costs for the three classes in the three districts may be taken for purposes of estimating as follows (1914):

District	Class I	Class II	Class III
Eastern	$1.60	$1.19	$1.02
Southern	1.38	1.15	1.10
Western	1.59	1.52	1.45

2. *Rise and Fall.* — Rise and fall between any two points is the total vertical feet of rising grade with its corresponding vertical feet of fall. If the two points are at different levels it requires a round trip to realize the rise and fall due to this difference. In calculating the cost of rise and fall as between two lines, only the cost of the difference in rise and fall is of consequence and hence the following rule is satisfactory though inaccurate for a train going one way.

To find the rise and fall between two points add all vertical feet of rising grades and all vertical feet of falling grades and divide by two.

Three classes of rise and fall are recognized:

Class A. Rise and fall of small amounts on light grades apparently not felt by the locomotive, requiring no apparent change in effort, only varying the speed a little.

Class B. Rise and fall requiring the full power of the locomotive in the ascent, the shutting off of steam in the descent, but no use of brakes.

Class C. Rise and fall requiring the whole power of the locomotive in the ascent and the use of brakes and sometimes of sand on the descent.

If C be the train mile cost, N the number of daily trains (all trains both ways) and f the number of feet of rise and fall, the annual cost for operation may be estimated as follows — the result being in dollars.

Class A. $K_1 = 0.25\ f \cdot C \cdot N.$
Class B. $K_1 = 1.2\ f \cdot C \cdot N.$
Class C. $K_1 = f \cdot C \cdot N \times$ the factor of the following table.

Grade..........	0.4 and under	0.5	0.67	1.0	1.5	2.0	2.5	3.0	3.5	4.0
Cost factor......	2.4	2.9	3.6	4.2	4.6	4.8	4.9	5.0	5.05	5.1

The limit of justifiable expenditure to reduce the rise and fall by f feet is $\frac{K_1}{r}$, where r is the going rate of interest which should be somewhat larger than the rate of the company's bonds, and in the formula is to be expressed as a decimal, *i.e.*, 8 per cent = 0.08.

3. *Curvature.* — If C be the train mile cost and N the number of daily trains (all trains both ways) the annual operating cost saved by eliminating D degrees of curvature is found as follows, the result being in dollars:

$$K_2 = DC\,(0.11\,N + 2.55),$$

and the limit of justifiable expenditure to eliminate $D°$ of curvature is $\frac{K_2}{r}$, in which r is the going rate of interest expressed as a decimal and should be somewhat larger than that carried by the company's bonds.

4. *Ruling Grade.* — This is the most important of the four elements of location. The value of reducing the ruling grade from one rate to another is found by finding the saving in train miles due to the larger loads possible on the lighter grades and is assumed to be approximately proportional to the reduction in number of train miles. The ruling grade determines the weight of train for the whole operating division on which the grade occurs. The relative number of trains on two different ruling grades are assumed to be inversely as the loads behind the tender. To find the load behind the tender see page 259. If W be the train weight for ruling grade g and W' be the train weight for ruling grade g' and if N' be the number of daily trains one way to do a

given business on g', the number of trains to do the same business on g will be

$$N = \frac{W'}{W} N'.$$

If g' is steeper than g, the saving in daily trains one way will be $N' - N$, and the total train miles saved will be $2 (N' - N) L$, L being the length of the division in miles. Having found this, substitute in the following formula for annual saving due to reduction in ruling grade from g' to g, C being the train mile cost on g'.

$$K_3 = 730\, LC\left(0.43\,(N' - N) - \frac{W - W'}{10\, W'}\, N\right).$$

The N's of the foregoing discussion include only those full weight trains affected by the change. If the grade reduction is obtained at the expense of distance the extra distance should be figured against the improvement considering all trains to be run on the g grade and a train mile cost somewhat larger than C, say $\left(1 + \frac{W}{20\, W'}\right) C$, which supposes that about half the total trains may be affected. Precision is impossible. If rise and fall is reduced by the change the reduction should be credited to the change considering all trains for the g' grade at a train mile cost of C.

Table XXXV gives the relative number of trains for a consolidation locomotive for various grades. To use it for a reduction from an 0.8 per cent grade to a 0.6 per cent grade, there being 10 daily trains on the 0.8 per cent grade, divide the tabular quantity under 12 miles opposite 0.8 by that opposite 0.6 and multiply by 10. In any problem the maximum hauling capacity would probably be considered and hence the lower speeds. For fast freights slightly higher speeds may be considered. The limit of justifiable expenditure to reduce the ruling grade of the division from g' to g is $\frac{K_3}{r}$, in which r is the going interest rate expressed as a decimal and should be somewhat larger than the nominal rate carried by the company's bonds.

Cost of Pusher Service. — When helper engines must be maintained at intermediate points on a line the annual cost in dollars may be estimated as follows if the helpers can be kept busy:

$$K_4 = 155 \cdot N \cdot M,$$

in which N is the number of trains helped daily and M is the length of the pusher incline in miles. If the helper engine is not kept busy, say, making 100 miles a day, the part of 100 miles not run may be estimated to cost half as much per mile as the miles that are run.

TABLE XXXI. — VELOCITY HEADS IN FEET FOR SPEED IN MILES PER HOUR

Formula: $h = 0.035\ s^2$

Speed	0.0	0.1	0.2	0.3	0.4	0.5	0.6	0.7	0.8	0.9
0	0.00	0.00	0.00	0.00	0.01	0.01	0.01	0.02	0.02	0.03
1	0.03	0.04	0.05	0.06	0.07	0.08	0.09	0.10	0.11	0.13
2	0.14	0.15	0.17	0.19	0.20	0.22	0.24	0.26	0.27	0.29
3	0.31	0.34	0.36	0.38	0.40	0.43	0.45	0.48	0.51	0.53
4	0.56	0.59	0.62	0.65	0.68	0.71	0.74	0.77	0.81	0.84
5	0.87	0.91	0.95	0.98	1.02	1.06	1.10	1.14	1.18	1.22
6	1.26	1.30	1.35	1.39	1.43	1.48	1.52	1.57	1.62	1.67
7	1.72	1.76	1.81	1.87	1.92	1.97	2.02	2.08	2.13	2.18
8	2.24	2.30	2.35	2.41	2.47	2.53	2.59	2.65	2.71	2.77
9	2.84	2.90	2.96	3.03	3.09	3.16	3.23	3.29	3.36	3.43
10	3.50	3.57	3.64	3.71	3.79	3.86	3.93	4.01	4.08	4.16
11	4.24	4.31	4.39	4.47	4.55	4.63	4.71	4.79	4.87	4.96
12	5.04	5.12	5.21	5.29	5.38	5.47	5.56	5.65	5.73	5.82
13	5.91	6.01	6.10	6.19	6.28	6.38	6.47	6.57	6.66	6.76
14	6.86	6.96	7.06	7.16	7.26	7.36	7.46	7.56	7.67	7.77
15	7.87	7.98	8.09	8.19	8.30	8.41	8.52	8.63	8.74	8.85
16	8.96	9.07	9.18	9.30	9.41	9.53	9.64	9.76	9.88	10.00
17	10.11	10.23	10.35	10.47	10.60	10.72	10.84	10.97	11.09	11.21
18	11.34	11.47	11.59	11.72	11.85	11.98	12.11	12.24	12.37	12.50
19	12.64	12.77	12.90	13.04	13.17	13.31	13.45	13.58	13.72	13.86
20	14.00	14.14	14.28	14.42	14.57	14.71	14.85	15.00	15.14	15.29
21	15.44	15.58	15.73	15.88	16.03	16.18	16.33	16.48	16.63	16.79
22	16.94	17.10	17.25	17.41	17.56	17.72	17.88	18.03	18.19	18.35
23	18.52	18.68	18.84	19.00	19.17	19.33	19.50	19.66	19.82	19.99
24	20.16	20.33	20.50	20.67	20.84	21.01	21.18	21.35	21.53	21.70
25	21.88	22.05	22.22	22.40	22.58	22.76	22.94	23.12	23.30	23.48
26	23.66	23.84	24.03	24.21	24.40	24.58	24.77	24.95	25.14	25.33
27	25.52	25.70	25.90	26.09	26.28	26.47	26.66	26.86	27.05	27.25
28	27.44	27.64	27.83	28.03	28.23	28.43	28.63	28.83	29.03	29.23
29	29.44	29.64	29.84	30.05	30.25	30.46	30.67	30.88	31.08	31.29
30	31.50	31.71	31.92	32.13	32.35	32.56	32.78	32.98	33.20	33.42
31	33.64	33.85	34.07	34.29	34.51	34.73	34.96	35.18	35.40	35.62
32	35.84	36.06	36.29	36.52	36.74	36.97	37.19	37.42	37.65	37.88
33	38.11	38.34	38.58	38.81	39.05	39.27	39.51	39.75	39.98	40.22
34	40.46	40.70	40.94	41.18	41.42	41.66	41.90	42.14	42.38	42.63
35	42.87	43.12	43.37	43.61	43.86	44.11	44.36	44.61	44.86	45.11
36	45.36	45.61	45.87	46.12	46.38	46.63	46.88	47.14	47.40	47.66
37	47.91	48.18	48.43	48.70	48.96	49.22	49.48	49.74	50.01	50.28
38	50.54	50.81	51.08	51.34	51.61	51.88	52.16	52.42	52.69	52.96
39	53.24	53.51	53.78	54.06	54.34	54.61	54.89	55.17	55.44	55.72
	0.0	1.0	2.0	3.0	4.0	5.0	6.0	7.0	8.0	9.0
40	56.00	58.84	61.74	64.72	67.76	70.88	74.06	77.32	80.64	84.03
50	87.50	91.03	94.64	98.31	102.06	105.77	109.75	113.72	117.74	121.83
60	126.00	130.23	134.54	138.92	143.36	147.87	152.45	157.11	161.84	166.63
70	171.50	176.45	181.44	186.52	191.65	196.88	202.16	207.52	212.94	218.42
80	224.00	229.60	235.33	241.10	246.95	257.88	258.84	264.91	271.04	277.22
90	283.50	289.82	296.23	302.70	309.25	315.86	322.55	329.31	336.15	343.05
100	350.00									

Note. — For the table the theoretical heads have been increased 4.63 per cent to allow for the energy of the rotating wheels.

TABLE XXXII. — Train Resistance at Different Speeds and for Trains of Various Average Car Weights

Speed, miles per hour	Train resistance, pounds per ton *													Speed, miles per hour
	15 tons	20 tons	25 tons	30 tons	35 tons	40 tons	45 tons	50 tons	55 tons	60 tons	65 tons	70 tons	75 tons	
5	7.6	6.8	6.0	5.4	4.8	4.4	4.0	3.7	3.5	3.3	3.2	3.1	3.0	5
6	7.7	6.9	6.1	5.5	4.9	4.4	4.1	3.8	3.5	3.3	3.2	3.1	3.0	6
7	7.8	7.0	6.2	5.5	5.0	4.5	4.1	3.8	3.6	3.4	3.2	3.1	3.1	7
8	8.0	7.1	6.3	5.6	5.0	4.6	4.2	3.9	3.6	3.4	3.3	3.2	3.1	8
9	8.1	7.2	6.4	5.7	5.1	4.6	4.2	3.9	3.6	3.4	3.3	3.2	3.1	9
10	8.2	7.3	6.5	5.8	5.2	4.7	4.3	4.0	3.7	3.5	3.3	3.2	3.2	10
11	8.3	7.4	6.6	5.9	5.3	4.8	4.3	4.0	3.7	3.5	3.4	3.3	3.2	11
12	8.4	7.5	6.7	6.0	5.4	4.8	4.4	4.0	3.8	3.6	3.4	3.3	3.3	12
13	8.6	7.6	6.8	6.1	5.5	4.9	4.5	4.1	3.8	3.6	3.5	3.4	3.3	13
14	8.7	7.8	6.9	6.2	5.5	5.0	4.5	4.2	3.9	3.7	3.5	3.4	3.4	14
15	8.8	7.9	7.0	6.3	5.6	5.1	4.6	4.2	3.9	3.7	3.6	3.5	3.4	15
16	9.0	8.0	7.1	6.4	5.7	5.1	4.7	4.3	4.0	3.8	3.6	3.5	3.5	16
17	9.1	8.1	7.2	6.5	5.8	5.2	4.8	4.4	4.1	3.9	3.7	3.6	3.5	17
18	9.3	8.3	7.4	6.6	5.9	5.3	4.8	4.5	4.1	3.9	3.7	3.7	3.6	18
19	9.4	8.4	7.5	6.7	6.0	5.4	4.9	4.5	4.2	4.0	3.8	3.7	3.6	19
20	9.6	8.5	7.6	6.8	6.1	5.5	5.0	4.6	4.3	4.0	3.9	3.8	3.7	20
21	9.7	8.7	7.7	6.9	6.2	5.6	5.1	4.7	4.3	4.1	3.9	3.9	3.8	21
22	9.9	8.8	7.9	7.0	6.3	5.7	5.2	4.8	4.4	4.2	4.0	3.9	3.8	22
23	10.0	9.0	8.0	7.1	6.4	5.8	5.3	4.9	4.5	4.3	4.1	4.0	3.9	23
24	10.2	9.1	8.1	7.3	6.6	5.9	5.4	4.9	4.6	4.3	4.2	4.1	4.0	24
25	10.4	9.3	8.3	7.4	6.7	6.0	5.5	5.0	4.7	4.4	4.2	4.1	4.0	25
26	10.5	9.4	8.4	7.5	6.8	6.1	5.6	5.1	4.8	4.5	4.3	4.2	4.1	26
27	10.7	9.6	8.5	7.7	6.9	6.2	5.7	5.2	4.8	4.6	4.4	4.3	4.2	27
28	10.9	9.7	8.7	7.8	7.0	6.3	5.8	5.3	4.9	4.7	4.5	4.4	4.3	28
29	11.1	9.9	8.8	7.9	7.1	6.5	5.9	5.4	5.0	4.8	4.6	4.5	4.4	29
30	11.3	10.0	9.0	8.0	7.3	6.6	6.0	5.5	5.1	4.9	4.7	4.5	4.5	30
31	11.4	10.2	9.1	8.2	7.4	6.7	6.1	5.6	5.2	5.0	4.8	4.6	4.5	31
32	11.6	10.4	9.3	8.3	7.5	6.8	6.2	5.8	5.3	5.0	4.9	4.7	4.6	32
33	11.8	10.5	9.4	8.5	7.6	7.0	6.3	5.9	5.4	5.2	5.0	4.8	4.7	33
34	12.0	10.7	9.6	8.6	7.8	7.1	6.5	6.0	5.5	5.3	5.1	4.9	4.8	34
35	12.3	10.9	9.7	8.8	7.9	7.2	6.6	6.1	5.7	5.4	5.2	5.0	4.9	35
36	12.5	11.1	9.9	8.9	8.0	7.4	6.7	6.2	5.8	5.5	5.3	5.1	5.0	36
37	12.7	11.2	10.0	9.0	8.2	7.5	6.9	6.4	5.9	5.6	5.4	5.2	5.1	37
38	12.9	11.4	10.2	9.2	8.3	7.6	7.0	6.5	6.0	5.7	5.5	5.3	5.2	38
39	13.1	11.6	10.4	9.4	8.5	7.8	7.1	6.6	6.2	5.8	5.6	5.4	5.3	39
40	13.4	11.8	10.6	9.5	8.6	7.9	7.3	6.8	6.3	6.0	5.7	5.6	5.5	40

* Column headings indicate the average car weights.

This table from experiments of Professor Edward C. Schmidt of the University of Illinois. See Transactions of the American Society of Mechanical Engineers for 1910.

TABLE XXXIII

Tractive Effort in Pounds of the Consolidation Locomotive, Having the Characteristics Given Below, for Different Speeds. Nearest 50 Pounds

Speed	0.0	10.0	20.0	30.0
0.0	50,000 pounds	50,000	28,000	18,650
0.5		50,000	27,350	18,350
1.0		50,000	26,700	18,050
1.5		48,700	26,050	17,800
2.0		46,700	25,450	17,500
2.5		44,800	24,900	17,250
3.0		43,100	24,350	16,950
3.5		41,500	23,850	16,700
4.0		40,000	23,350	16,500
4.5		38,650	22,850	16,250
5.0		37,350	22,400	16,000
5.5		36,150	21,950	15,800
6.0		35,000	21,550	15,550
6.5		33,950	21,150	15,350
7.0		32,950	20,750	15,150
7.5		32,000	20,350	14,950
8.0		31,100	20,000	14,750
8.5		30,300	19,650	14,550
9.0		29,500	19,300	14,350
9.5		28,750	19,000	14,200

Consolidation locomotive.
Weight on drivers: 210,000 pounds.
Weight of engine and tender: 400,000 pounds.
Cylinders: 28″ diam. by 32″ stroke.
Heating surface: 3837 sq. ft.
Diameter drive wheels: 63″.
Boiler working pressure: 163 pounds.

For this locomotive:

T_c = 55,174 pounds (say 55,000 pounds);
T_a = 49,412 pounds (say 50,000 pounds);
T_b = 50,000 pounds at 11.2 mi./hr., and as T_a limits the effort, this will be taken as constant and equal to 50,000 pounds at speeds below 11 mi./hr.

TABLE XXXIV

NET LOADS IN TONS OF 2000 POUNDS BEHIND THE TENDER OF THE CONSOLIDATION LOCOMOTIVE OF TABLE XXXIII, ON GIVEN GRADES AT GIVEN SPEEDS

Grade \ Speed	Under 11 mi	15	20	25	30	35	40
0.00	11430	7918	5400	3873	2908	2224	1718
.05	9234	6468	4467	3246	2464	1905	1487
.10	7736	5458	3800	2787	2131	1660	1305
.15	6650	4714	3300	2435	1872	1467	1159
.20	5825	4142	2911	2158	1665	1310	1039
.25	5177	3690	2600	1934	1495	1179	938
.30	4655	3323	2346	1748	1354	1070	853
.35	4225	3019	2134	1592	1235	977	779
.40	3866	2764	1954	1459	1132	896	715
.45	3560	2546	1800	1345	1043	826	659
.50	3297	2358	1667	1245	966	764	609
.55	3068	2194	1550	1158	897	709	565
.60	2868	2050	1447	1080	836	660	525
.65	2691	1922	1356	1011	782	616	490
.70	2533	1808	1274	949	733	577	457
.75	2391	1706	1200	893	688	541	428
.80	2263	1613	1133	842	648	508	401
.85	2148	1529	1073	795	611	478	376
.90	2042	1453	1017	753	577	450	353
.95	1946	1382	967	714	546	425	332
1.00	1858	1318	920	678	517	401	313
.05	1776	1259	877	645	491	380	295
.10	1702	1204	837	615	466	359	278
.15	1632	1153	800	586	443	341	262
.20	1567	1106	765	559	422	323	247
.25	1507	1062	733	534	402	306	233
.30	1450	1020	703	511	383	291	220
.35	1398	982	675	489	365	276	208
.40	1348	946	649	469	348	262	197
.45	1302	911	624	449	333	249	186
.50	1258	879	600	431	318	237	175
.55	1217	849	578	414	304	226	166
.60	1178	820	557	397	291	214	156
.65	1141	793	537	382	278	204	147
.70	1106	768	518	367	266	194	139
.75	1072	743	500	353	255	185	131
.80	1041	720	483	340	244	176	123
.85	1011	698	467	327	234	167	116
.90	982	677	451	315	224	159	109
.95	955	657	436	303	214	151	102
2.00	929	637	422	292	205	143	96

The average car weight for this table is 45 tons.

TABLE XXXV. — RELATIVE NUMBER OF TRAINS TO DO THE SAME BUSINESS TONNAGE ON DIFFERENT GRADES, FOR DIFFERENT SPEEDS. COMPUTED FROM TABLE XXXIV

Grade \ Speed	Under 11 mi.	15	20	25	30	35	40
0.00	0.34	0.49	0.72	1.00	1.33	1.74	2.25
0.05	0.42	0.60	0.87	1.19	1.57	2.03	2.60
0.10	0.50	0.71	1.02	1.39	1.81	2.33	2.96
0.15	0.58	0.82	1.17	1.59	2.07	2.64	3.34
0.20	0.66	0.93	1.33	1.79	2.32	2.95	3.72
0.25	0.75	1.05	1.49	2.00	2.59	3.29	4.12
0.30	0.83	1.16	1.65	2.21	2.86	3.61	4.53
0.35	0.92	1.28	1.81	2.43	3.13	3.96	4.96
0.40	1.00	1.40	1.98	2.65	3.42	4.31	5.41
0.45	1.09	1.52	2.15	2.87	3.71	4.68	5.87
0.50	1.17	1.64	2.32	3.11	4.00	5.06	6.35
0.55	1.26	1.76	2.49	3.34	4.31	5.45	6.84
0.60	1.35	1.89	2.67	3.58	4.62	5.86	7.36
0.65	1.44	2.01	2.85	3.82	4.94	6.28	7.89
0.70	1.53	2.14	3.03	4.07	5.27	6.70	8.46
0.75	1.62	2.27	3.22	4.33	5.62	7.15	9.03
0.80	1.71	2.40	3.41	4.59	5.97	7.61	9.64
0.85	1.80	2.53	3.60	4.86	6.33	8.09	10.28
0.90	1.89	2.66	3.80	5.13	6.70	8.59	10.95
0.95	1.99	2.80	4.00	5.41	7.08	9.10	11.64
1.00	2.08	2.93	4.20	5.70	7.48	9.64	12.35
1.05	2.18	3.07	4.41	5.99	7.87	10.17	13.10
1.10	2.27	3.21	4.62	6.29	8.30	10.77	13.91
1.15	2.37	3.35	4.83	6.60	8.73	11.34	14.76
1.20	2.47	3.50	5.05	6.92	9.16	11.97	15.65
1.25	2.57	3.64	5.27	7.24	9.62	12.63	16.59
1.30	2.67	3.79	5.50	7.57	10.09	13.29	17.57
1.35	2.77	3.94	5.73	7.91	10.59	14.01	18.59
1.40	2.87	4.09	5.96	8.24	11.11	14.76	19.63
1.45	2.97	4.24	6.20	8.61	11.61	15.53	20.79
1.50	3.07	4.40	6.44	8.97	12.16	16.31	22.09
1.55	3.18	4.55	6.69	9.34	12.72	17.11	23.29
1.60	3.28	4.71	6.94	9.74	13.29	18.07	24.78
1.65	3.39	4.87	7.20	10.12	13.91	18.95	26.30
1.70	3.50	5.03	7.46	10.53	14.53	19.93	27.82
1.75	3.61	5.20	7.73	10.95	15.16	20.90	29.51
1.80	3.71	5.37	8.00	11.37	15.84	21.97	31.43
1.85	3.82	5.54	8.28	11.82	16.52	23.15	33.33
1.90	3.94	5.71	8.57	12.27	17.26	24.32	35.47
1.95	4.05	5.88	8.87	12.76	18.07	25.60	37.90
2.00	4.16	6.07	9.16	13.24	18.86	27.04	40.27

TABLE XXXVI. — PUSHER GRADES

The tabular quantities are pusher grades for the through grades indicated at the side and top of table. Computed for the Consolidation Engine of Table XXXIII.

Through grade	0.0	0.1	0.2	0.3	0.4	0.5	0.6	0.7	0.8	0.9
0.0	0.187	0.369	0.548	0.725	0.899	1.070	1.238	1.404	1.569	1.730
1.0	1.889	2.045	2.200	2.353	2.502	2.650	2.796	2.939	3.082	3.222
2.0	3.359	.....	.....	.....	.....	.....	.....	.....	.....	.....

TABLE XXXVII. — Grades and Grade Angles

Feet per station	Feet per mile	Inclination, deg.	Feet per station	Feet per mile	Inclination, deg.	Feet per station	Feet per mile	Inclination, deg.	Feet per station	Feet per mile	Inclination, deg.
00	.000	.000	50	26.400	.286	1.00	52.800	.573	1.50	79.200	.859
01	.528	.006	51	26.928	.292	1.01	53.328	.579	1.51	79.728	.865
02	1.056	.011	52	27.456	.298	1.02	53.856	.584	1.52	80.256	.871
03	1.584	.017	53	27.984	.304	1.03	54.384	.590	1.53	80.784	.877
04	2.112	.023	54	28.512	.309	1.04	54.912	.596	1.54	81.312	.882
05	2.640	.029	55	29.040	.315	1.05	55.440	.601	1.55	81.840	.888
06	3.168	.034	56	29.568	.321	1.06	55.968	.607	1.56	82.368	.894
07	3.696	.040	57	30.096	.327	1.07	56.496	.613	1.57	82.896	.899
08	4.224	.046	58	30.624	.332	1.08	57.024	.619	1.58	83.424	.905
09	4.752	.052	59	31.152	.338	1.09	57.552	.624	1.59	83.952	.911
10	5.280	.057	60	31.680	.344	1.10	58.080	.630	1.60	84.480	.917
11	5.808	.063	61	32.208	.349	1.11	58.608	.636	1.61	85.008	.922
12	6.336	.069	62	32.736	.355	1.12	59.136	.642	1.62	85.536	.928
13	6.864	.074	63	33.264	.361	1.13	59.664	.648	1.63	86.064	.934
14	7.392	.080	64	33.792	.367	1.14	60.192	.653	1.64	86.592	.939
15	7.920	.086	65	34.320	.372	1.15	60.720	.659	1.65	87.120	.945
16	8.448	.092	66	34.848	.378	1.16	61.248	.665	1.66	87.648	.951
17	8.976	.098	67	35.376	.384	1.17	61.776	.670	1.67	88.176	.957
18	9.504	.103	68	35.904	.390	1.18	62.304	.676	1.68	88.704	.962
19	10.032	.109	69	36.432	.395	1.19	62.832	.682	1.69	89.232	.968
20	10.560	.115	70	36.960	.401	1.20	63.360	.688	1.70	89.760	.974
21	11.088	.120	71	37.488	.407	1.21	63.888	.693	1.71	90.288	.980
22	11.616	.126	72	38.016	.412	1.22	64.416	.699	1.72	90.816	.985
23	12.144	.132	73	38.544	.418	1.23	64.944	.705	1.73	91.344	.991
24	12.672	.138	74	39.072	.424	1.24	65.472	.710	1.74	91.872	.997
25	13.200	.143	75	39.600	.430	1.25	66.000	.716	1.75	92.400	1.002
26	13.728	.149	76	40.128	.436	1.26	66.528	.722	1.76	92.928	1.008
27	14.256	.155	77	40.656	.441	1.27	67.056	.728	1.77	93.456	1.014
28	14.784	.160	78	41.184	.447	1.28	67.584	.733	1.78	93.984	1.020
29	15.312	.166	79	41.712	.452	1.29	68.112	.739	1.79	94.512	1.026
30	15.840	.172	80	42.240	.458	1.30	68.640	.745	1.80	95.040	1.031
31	16.368	.178	81	42.768	.464	1.31	69.168	.751	1.81	95.568	1.037
32	16.896	.183	82	43.296	.470	1.32	69.696	.756	1.82	96.096	1.043
33	17.424	.189	83	43.824	.476	1.33	70.224	.762	1.83	96.624	1.048
34	17.952	.195	84	44.352	.481	1.34	70.752	.768	1.84	97.152	1.054
35	18.480	.200	85	44.880	.487	1.35	71.280	.773	1.85	97.680	1.060
36	19.008	.206	86	45.408	.493	1.36	71.808	.779	1.86	98.208	1.066
37	19.536	.212	87	45.936	.498	1.37	72.336	.785	1.87	98.736	1.071
38	20.064	.218	88	46.464	.504	1.38	72.864	.791	1.88	99.264	1.077
39	20.592	.223	89	46.992	.510	1.39	73.392	.796	1.89	99.792	1.083
40	21.120	.229	90	47.520	.516	1.40	73.920	.802	1.90	100.320	1.089
41	21.648	.235	91	48.048	.521	1.41	74.448	.808	1.91	100.848	1.094
42	22.176	.240	92	48.576	.527	1.42	74.976	.814	1.92	101.376	1.100
43	22.704	.246	93	49.104	.533	1.43	75.504	.819	1.93	101.904	1.106
44	23.232	.252	94	49.632	.539	1.44	76.032	.825	1.94	102.432	1.111
45	23.760	.258	95	50.160	.544	1.45	76.560	.831	1.95	102.960	1.117
46	24.288	.264	96	50.688	.550	1.46	77.088	.836	1.96	103.488	1.123
47	24.816	.269	97	51.216	.556	1.47	77.616	.842	1.97	104.016	1.129
48	25.344	.275	98	51.744	.561	1.48	78.144	.848	1.98	104.544	1.134
49	25.872	.281	99	52.272	.567	1.49	78.672	.854	1.99	105.072	1.140
50	26.400	.286	1.00	52.800	.573	1.50	79.200	.859	2.00	105.600	1.146

CHAPTER V

ESTIMATING AND CONSTRUCTION TABLES

TABLE XXXVIII

Relative prices in place that can be paid for articles for the same purpose lasting N and N' years. The article lasting N years is assumed to cost $1.00 or one unit. Interest 4 per cent.

Example. — If a lasts 10 years and costs 50 cents, there may be paid for b lasting 7 years $50 \times 0.74 = 37$ cents.

N' \ N	5	6	7	8	9	10	11	12	13	14	N / N'	Amount $1.00 at comp'd int.
5	1.00	0.85	0.74	0.66	0.60	0.55	0.51	0.47	0.45	0.42	5	1.21665
6	1.18	1.00	0.87	0.78	0.70	0.65	0.60	0.56	0.52	0.50	6	1.26532
7	1.35	1.14	1.00	0.89	0.81	0.74	0.69	0.64	0.60	0.57	7	1.31593
8	1.51	1.28	1.12	1.00	0.91	0.83	0.77	0.72	0.67	0.64	8	1.36857
9	1.67	1.42	1.24	1.10	1.00	0.92	0.85	0.79	0.74	0.70	9	1.42331
10	1.82	1.55	1.35	1.20	1.09	1.00	0.93	0.86	0.81	0.77	10	1.48024
11	1.97	1.67	1.46	1.30	1.18	1.08	1.00	0.93	0.88	0.83	11	1.53945
12	2.11	1.79	1.56	1.39	1.26	1.16	1.07	1.00	0.94	0.89	12	1.60103
13	2.43	1.90	1.66	1.48	1.34	1.23	1.14	1.06	1.00	0.95	13	1.66507
14	2.37	2.01	1.76	1.57	1.42	1.30	1.21	1.13	1.06	1.00	14	1.73167
15	2.50	2.12	1.85	1.65	1.50	1.37	1.27	1.18	1.11	1.05	15	1.80094
16	2.62	2.22	1.94	1.73	1.57	1.44	1.33	1.24	1.17	1.10	16	1.87297
17	2.73	2.32	2.03	1.81	1.64	1.50	1.39	1.30	1.22	1.15	17	1.94790
18	2.84	2.41	2.11	1.88	1.70	1.56	1.44	1.35	1.27	1.20	18	2.02581
19	2.95	2.50	2.19	1.95	1.77	1.62	1.50	1.40	1.32	1.24	19	2.10685
20	3.05	2.59	2.26	2.02	1.83	1.68	1.55	1.45	1.36	1.29	20	2.19112
21	3.15	2.68	2.34	2.08	1.89	1.73	1.60	1.49	1.40	1.33	21	2.27876
22	3.25	2.76	2.41	2.15	1.94	1.78	1.65	1.54	1.45	1.37	22	2.36991
23	3.34	2.83	2.48	2.21	2.00	1.83	1.70	1.58	1.49	1.41	23	2.46471
24	3.42	2.91	2.54	2.26	2.05	1.88	1.74	1.62	1.53	1.44	24	2.56330
25	3.51	2.98	2.60	2.32	2.10	1.93	1.78	1.66	1.56	1.48	25	2.66583

TABLE XXXVIII.—(*Continued*)

N' \ N	15	16	17	18	19	20	21	22	23	24	25	N / N'
5	0.40	0.38	0.37	0.35	0.34	0.33	0.32	0.31	0.30	0.29	0.28	5
6	0.47	0.45	0.43	0.41	0.40	0.39	0.37	0.36	0.35	0.34	0.34	6
7	0.54	0.52	0.49	0.47	0.46	0.44	0.43	0.42	0.40	0.39	0.38	7
8	0.61	0.58	0.55	0.53	0.51	0.50	0.48	0.47	0.45	0.44	0.43	8
9	0.67	0.64	0.61	0.59	0.57	0.55	0.53	0.51	0.50	0.49	0.48	9
10	0.73	0.70	0.67	0.64	0.62	0.60	0.58	0.56	0.55	0.53	0.52	10
11	0.79	0.75	0.72	0.69	0.67	0.64	0.62	0.61	0.59	0.57	0.56	11
12	0.84	0.81	0.77	0.74	0.71	0.69	0.67	0.65	0.63	0.62	0.60	12
13	0.90	0.86	0.82	0.79	0.76	0.73	0.71	0.69	0.67	0.65	0.64	13
14	0.95	0.91	0.87	0.83	0.80	0.78	0.75	0.73	0.71	0.69	0.68	14
15	**1.00**	0.95	0.91	0.88	0.85	0.82	0.79	0.77	0.75	0.73	0.71	15
16	1.05	**1.00**	0.96	0.92	0.89	0.86	0.83	0.81	0.78	0.76	0.75	16
17	1.09	1.04	**1.00**	0.96	0.93	0.90	0.87	0.84	0.82	0.80	0.78	17
18	1.14	1.09	1.04	**1.00**	0.96	0.93	0.90	0.88	0.85	0.83	0.81	18
19	1.18	1.13	1.08	1.04	**1.00**	0.97	0.94	0.91	0.88	0.86	0.84	19
20	1.22	1.17	1.12	1.07	1.03	**1.00**	0.97	0.94	0.91	0.89	0.87	20
21	1.26	1.20	1.15	1.11	1.07	1.03	**1.00**	0.97	0.94	0.92	0.90	21
22	1.30	1.24	1.19	1.14	1.10	1.06	1.03	**1.00**	0.97	0.95	0.92	22
23	1.34	1.27	1.22	1.17	1.13	1.09	1.06	1.03	**1.00**	0.97	0.95	23
24	1.37	1.31	1.25	1.20	1.16	1.12	1.08	1.06	1.03	**1.00**	0.98	24
25	1.41	1.34	1.28	1.23	1.19	1.15	1.11	1.08	1.05	1.02	**1.00**	25

TABLE XXXIX

Relative prices in place that can be paid for articles for the same purpose lasting N and N' years. The article lasting N years is assumed to cost $1.00 or one unit. Interest 5 per cent.

Example. — If a lasts 10 years and costs 60 cents, there may be paid for b lasting 12 years, 60 × 1.15 = 79 cents.

N' \ N	5	6	7	8	9	10	11	12	13	14	N / N'	Amount $1.00 at comp'd int.
5	**1.00**	0.85	0.75	0.67	0.61	0.56	0.52	0.49	0.46	0.44	5	1.27628
6	1.17	**1.00**	0.88	0.79	0.71	0.66	0.61	0.57	0.54	0.51	6	1.34009
7	1.34	1.14	**1.00**	0.90	0.81	0.75	0.70	0.65	0.62	0.58	7	1.40710
8	1.49	1.27	1.12	**1.00**	0.91	0.84	0.78	0.73	0.69	0.65	8	1.47745
9	1.64	1.40	1.23	1.10	**1.00**	0.92	0.86	0.80	0.76	0.72	9	1.55132
10	1.78	1.52	1.33	1.19	1.09	**1.00**	0.93	0.87	0.82	0.78	10	1.62889
11	1.92	1.64	1.44	1.29	1.17	1.08	**1.00**	0.94	0.88	0.84	11	1.71034
12	2.05	1.75	1.53	1.37	1.25	1.15	1.07	**1.00**	0.94	0.90	12	1.79585
13	2.17	1.85	1.62	1.45	1.32	1.22	1.13	1.06	**1.00**	0.95	13	1.88564
14	2.29	1.95	1.71	1.53	1.39	1.28	1.19	1.12	1.05	**1.00**	14	1.97993
15	2.40	2.04	1.79	1.61	1.46	1.34	1.25	1.17	1.10	1.05	15	2.07892
16	2.50	2.14	1.87	1.68	1.52	1.40	1.30	1.22	1.15	1.09	16	2.18287
17	2.60	2.22	1.95	1.74	1.59	1.46	1.36	1.27	1.20	1.14	17	2.29202
18	2.70	2.30	2.02	1.81	1.64	1.51	1.41	1.32	1.24	1.18	18	2.40662
19	2.79	2.38	2.09	1.87	1.70	1.56	1.45	1.36	1.29	1.22	19	2.52695
20	2.88	2.46	2.15	1.93	1.75	1.61	1.50	1.41	1.33	1.25	20	2.65330
21	2.96	2.53	2.22	1.98	1.80	1.66	1.54	1.45	1.36	1.29	21	2.78596
22	3.04	2.59	2.27	2.04	1.85	1.70	1.58	1.49	1.40	1.33	22	2.92526
23	3.12	2.66	2.33	2.09	1.90	1.75	1.62	1.52	1.44	1.36	23	3.07152
24	3.19	2.72	2.38	2.13	1.94	1.79	1.66	1.56	1.47	1.39	24	3.22510
25	3.26	2.78	2.44	2.18	1.98	1.83	1.70	1.59	1.50	1.42	25	3.38635

TABLE XXXIX. — (*Continued*)

N' \ N	15	16	17	18	19	20	21	22	23	24	25	N / N'
5	0.42	0.40	0.38	0.37	0.36	0.35	0.34	0.33	0.32	0.31	0.31	5
6	0.49	0.47	0.45	0.43	0.42	0.41	0.40	0.39	0.38	0.37	0.36	6
7	0.56	0.53	0.51	0.49	0.48	0.46	0.45	0.44	0.43	0.42	0.41	7
8	0.62	0.60	0.57	0.55	0.53	0.52	0.50	0.49	0.48	0.47	0.46	8
9	0.68	0.66	0.63	0.61	0.59	0.57	0.55	0.54	0.53	0.52	0.50	9
10	0.74	0.71	0.68	0.66	0.64	0.62	0.60	0.59	0.57	0.56	0.55	10
11	0.80	0.77	0.74	0.71	0.69	0.67	0.65	0.63	0.62	0.60	0.59	11
12	0.85	0.82	0.79	0.76	0.73	0.71	0.69	0.67	0.66	0.64	0.63	12
13	0.90	0.87	0.83	0.80	0.78	0.75	0.73	0.71	0.70	0.68	0.67	13
14	0.95	0.91	0.88	0.85	0.82	0.79	0.77	0.75	0.73	0.72	0.70	14
15	**1.00**	0.96	0.92	0.89	0.86	0.83	0.81	0.79	0.77	0.75	0.74	15
16	1.04	**1.00**	0.96	0.93	0.90	0.87	0.85	0.82	0.80	0.79	0.77	16
17	1.09	1.04	**1.00**	0.96	0.93	0.90	0.88	0.86	0.84	0.82	0.80	17
18	1.13	1.08	1.04	**1.00**	0.97	0.94	0.91	0.89	0.87	0.85	0.83	18
19	1.16	1.12	1.07	1.03	**1.00**	0.97	0.94	0.92	0.90	0.88	0.86	19
20	1.20	1.15	1.11	1.07	1.03	**1.00**	0.97	0.95	0.92	0.90	0.88	20
21	1.24	1.18	1.14	1.10	1.06	1.03	**1.00**	0.97	0.95	0.93	0.91	21
22	1.27	1.21	1.17	1.13	1.09	1.06	1.03	**1.00**	0.98	0.95	0.93	22
23	1.30	1.24	1.20	1.15	1.12	1.08	1.05	1.02	**1.00**	0.98	0.96	23
24	1.33	1.27	1.22	1.18	1.14	1.11	1.08	1.05	1.02	**1.00**	0.98	24
25	1.36	1.30	1.25	1.21	1.17	1.13	1.10	1.07	1.04	1.02	**1.00**	25

Volumes of Triangular Prisms. — Table XL. In railroad earth-work the volume of a given length of cut or fill is given by the average end area method as $l \times \frac{A_1 + A_2}{2}$ in which l is the length, usually 100 feet, and A_1 and A_2 are the cross-section areas at the two ends. This is equivalent to $\frac{l}{2} A_1 + \frac{l}{2} A_2$ and Table XL is made on this basis with 100 for l. Hence the volumes are for 50-foot lengths and are to be used twice, once on one side of a station section for the part of the station

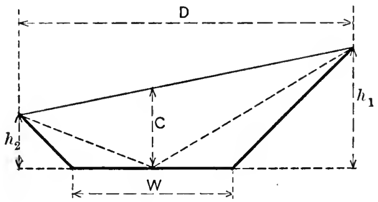


FIG. 25.

volume on that side, and once on the other side as part of the station volume on that side.

The commonest formula for the cross-section area of a 3-level section is $A = \frac{c}{2} D + \frac{w}{4} (h_1 + h_2)$. This is equivalent to the area of two triangles of bases c and $\frac{w}{2}$ and altitudes D and $h_1 + h_2$ or it may be taken as three triangles of bases D and $\frac{w}{2}$ and altitudes c, h_1 and h_2.

Whence the volume in cubic yards for a 50-foot length is

$$V_{50} = 50 \frac{c}{2 \times 27} D + 50 \frac{w}{4 \times 27} (h_1 + h_2)$$

$$= \frac{25}{27} cD + \frac{25}{27} \frac{w}{2} (h_1 + h_2).$$

D is the sum of the slope stake distances. The table is made to give the quantity $\frac{25}{27} \cdot x \cdot y$, in which x is the base or altitude and y is the altitude or base of the triangular base or end of a triangular prism.

In using the table for such work the x numbers at the side of the page should be used for heights c and $\frac{w}{2}$ and the y numbers at the top for D and $h_1 + h_2$. The quantities are given for only whole numbers of y

from 1 to 9 inclusive, but are given to hundredths so that for $y = 50$ or 70, etc., ten times the tabular values for 5 or 7, etc., are taken and for $y = 0.5$ and 0.7, etc., one-tenth the tabular values for 5 and 7 are taken.

Example. — The cross-section notes of two stations show

Sta.	L	C	R
762	$\frac{-3.6}{13.6}$	-4.2	$\frac{-5.3}{15.3}$
763	$\frac{-4.8}{14.8}$	-5.7	$\frac{-6.4}{16.4}$

the minus sign indicating a cut. The volume between stations 762 and 763 is had from the tables as follows:

For 762. $D = 13.6 + 15.3 = 28.9$, done mentally,

$$c = 4.2,$$

$$w = 20, \quad \frac{w}{2} = 10,$$

$$h_1 + h_2 = 8.9.$$

From Table XL opposite $x = 4.2$ under 2 take $10 \times 7.78 = 77.8$
under 8 $1 \times 31.11 = 31.11$
under 9 $\frac{1}{10} \times 35.00 = 3.5$

$\frac{w}{2} = 10 \therefore$ opposite $x = 10.0$ under 8 take $1 \times 74.00 = 74.00$
under 9 $\frac{1}{10} \times 83.33 = 8.33$
Total 194.8 = 194.8

For 763. $D = 14.8 + 16.4 = 31.2$.

$$c = 5.7,$$

$$w = 20, \quad \frac{w}{2} = 10,$$

$$h_1 + h_2 = 11.2.$$

Opposite $x = 5.7$ take $10 \times 15.83 = 158.3$
$1 \times 5.28 = 5.3$
$\frac{1}{10} \times 10.56 = 1.1$

$$\frac{w}{2} = 10.$$

$\therefore$ opposite $x = 10$ take $10 \times 9.72 = 97.2$
$1 \times 9.72 = 9.7$
$\frac{1}{10} \times 19.44 = 1.9$
Total 273.5 273.5
Total for sta. 468.3

If the length between two sections is 50 feet, take $\frac{1}{2}$ the result from the tables; if 40 feet, take $\frac{4}{10}$ the result, and so on. For a single right prism of any length take that portion of the tabular quantity that the length is of 50.

Prismoidal Correction. — Table XLI. To get the volume of a station of earthwork by the prismoidal formula, get it by the average end area method and subtract the prismoidal correction. That is, get the volume from Table XL, and subtract the correction of Table XLI. The correction is for full stations of 100 feet; for shorter lengths use proportional parts of the tabular quantities. The arguments of the table $C_1 - C_0$ and $D_1 - D_0$ are the differences in center heights and total widths respectively of the two end sections.

Level Section Volumes. — Table XLII. This table is used only in preliminary estimates and gives the volumes in cubic yards for 100-foot lengths for varying center heights. Its use will be evident.

TABLE XL. — Volumes of Triangular Prisms 50 Feet in Length

X \ Y	1	2	3	4	5	6	7	8	9	Y / X
.1	.09	.19	.28	.37	.46	.56	.65	.74	.83	.1
.2	.19	.37	.56	.74	.93	1.11	1.30	1.48	1.67	.2
.3	.28	.56	.83	1.11	1.39	1.67	1.94	2.22	2.50	.3
.4	.37	.74	1.11	1.48	1.85	2.22	2.59	2.96	3.33	.4
.5	.46	.93	1.39	1.85	2.31	2.78	3.24	3.70	4.17	.5
.6	.56	1.11	1.67	2.22	2.78	3.33	3.89	4.44	5.00	.6
.7	.65	1.30	1.94	2.59	3.24	3.89	4.54	5.19	5.83	.7
.8	.74	1.48	2.22	2.96	3.70	4.44	5.19	5.93	6.67	.8
.9	.83	1.67	2.50	3.33	4.17	5.00	5.83	6.67	7.50	.9
1.0	.93	1.85	2.78	3.70	4.63	5.56	6.48	7.41	8.33	**1.0**
.1	1.02	2.04	3.06	4.07	5.09	6.11	7.13	8.15	9.17	.1
.2	1.11	2.22	3.33	4.44	5.56	6.67	7.78	8.89	10.00	.2
.3	1.20	2.41	3.61	4.81	6.02	7.22	8.43	9.63	10.83	.3
.4	1.30	2.59	3.89	5.19	6.48	7.78	9.07	10.37	11.67	.4
.5	1.39	2.78	4.17	5.56	6.94	8.33	9.72	11.11	12.50	.5
.6	1.48	2.96	4.44	5.93	7.41	8.89	10.37	11.85	13.33	.6
.7	1.57	3.15	4.72	6.30	7.87	9.44	11.02	12.59	14.17	.7
.8	1.67	3.33	5.00	6.67	8.33	10.00	11.67	13.33	15.00	.8
.9	1.76	3.52	5.28	7.04	8.80	10.56	12.31	14.07	15.83	.9
2.0	1.85	3.70	5.56	7.41	9.26	11.11	12.96	14.81	16.67	**2.0**
.1	1.94	3.89	5.83	7.78	9.72	11.67	13.61	15.56	17.50	.1
.2	2.04	4.07	6.11	8.15	10.19	12.22	14.26	16.30	18.33	.2
.3	2.13	4.26	6.39	8.52	10.65	12.78	14.91	17.04	19.17	.3
.4	2.22	4.44	6.67	8.89	11.11	13.33	15.56	17.78	20.00	.4
.5	2.31	4.63	6.94	9.26	11.57	13.89	16.20	18.52	20.83	.5
.6	2.41	4.81	7.22	9.63	12.04	14.44	16.85	19.26	21.67	.6
.7	2.50	5.00	7.50	10.00	12.50	15.00	17.50	20.00	22.50	.7
.8	2.59	5.19	7.78	10.37	12.96	15.56	18.15	20.74	23.33	.8
.9	2.69	5.37	8.06	10.74	13.43	16.11	18.80	21.48	24.17	.9
3.0	2.78	5.56	8.33	11.11	13.89	16.67	19.44	22.22	25.00	**3.0**
.1	2.87	5.74	8.61	11.48	14.35	17.22	20.09	22.96	25.83	.1
.2	2.96	5.93	8.89	11.85	14.81	17.78	20.74	23.70	26.67	.2
.3	3.06	6.11	9.17	12.22	15.28	18.33	21.39	24.44	27.50	.3
.4	3.15	6.30	9.44	12.59	15.74	18.89	22.04	25.19	28.33	.4
.5	3.24	6.48	9.72	12.96	16.20	19.44	22.69	25.93	29.17	.5
.6	3.33	6.67	10.00	13.33	16.67	20.00	23.33	26.67	30.00	.6
.7	3.43	6.85	10.28	13.70	17.13	20.56	23.98	27.41	30.83	.7
.8	3.52	7.04	10.56	14.07	17.59	21.11	24.63	28.15	31.67	.8
.9	3.61	7.22	10.83	14.44	18.06	21.67	25.28	28.89	32.50	.9
4.0	3.70	7.41	11.11	14.81	18.52	22.22	25.93	29.63	33.33	**4.0**
.1	3.80	7.59	11.39	15.19	18.98	22.78	26.57	30.37	34.17	.1
.2	3.89	7.78	11.67	15.56	19.44	23.33	27.22	31.11	35.00	.2
.3	3.98	7.96	11.94	15.93	19.91	23.89	27.87	31.85	35.83	.3
4	4.07	8.15	12.22	16.30	20.37	24.44	28.52	32.59	36.67	.4
.5	4.17	8.33	12.50	16.67	20.83	25.00	29.17	33.33	37.50	.5
.6	4.26	8.52	12.78	17.04	21.30	25.56	29.81	34.07	38.33	.6
.7	4.35	8.70	13.06	17.41	21.76	26.11	30.46	34.81	39.17	.7
.8	4.44	8.89	13.33	17.78	22.22	26.67	31.11	35.56	40.00	.8
.9	4.54	9.07	13.61	18.15	22.69	27.22	31.76	36.30	40.83	.9
5.0	4.63	9.26	13.89	18.52	23.15	27.78	32.41	37.04	41.67	**5.0**

TABLE XL. — (*Continued*)

X \ Y	1	2	3	4	5	6	7	8	9	Y / X
5.1	4.72	9.44	14.17	18.89	23.61	28.33	33.06	37.78	42.50	**5.1**
.2	4.81	9.63	14.44	19.26	24.07	28.89	33.70	38.52	43.33	**.2**
.3	4.91	9.81	14.72	19.63	24.54	29.44	34.35	39.26	44.17	**.3**
.4	5.00	10.00	15.00	20.00	25.00	30.00	35.00	40.00	45.00	**.4**
.5	5.09	10.19	15.28	20.37	25.46	30.56	35.65	40.74	45.83	**.5**
.6	5.19	10.37	15.56	20.74	25.93	31.11	36.30	41.48	46.67	**.6**
.7	5.28	10.56	15.83	21.11	26.39	31.67	36.94	42.22	47.50	**.7**
.8	5.37	10.74	16.11	21.48	26.85	32.22	37.59	42.96	48.33	**.8**
.9	5.46	10.93	16.39	21.85	27.31	32.78	38.24	43.70	49.17	**.9**
6.0	5.56	11.11	16.67	22.22	27.78	33.33	38.89	44.44	50.00	**6.0**
.1	5.65	11.30	16.94	22.59	28.24	33.89	39.54	45.19	50.83	**.1**
.2	5.74	11.48	17.22	22.96	28.70	34.44	40.19	45.93	51.67	**.2**
.3	5.83	11.67	17.50	23.33	29.17	35.00	40.83	46.67	52.50	**.3**
.4	5.93	11.85	17.78	23.70	29.63	35.56	41.48	47.41	53.33	**.4**
.5	6.02	12.04	18.06	24.07	30.09	36.11	42.13	48.15	54.17	**.5**
.6	6.11	12.22	18.33	24.44	30.56	36.67	42.78	48.89	55.00	**.6**
.7	6.20	12.41	18.61	24.81	31.02	37.22	43.43	49.63	55.83	**.7**
.8	6.30	12.59	18.89	25.19	31.48	37.78	44.07	50.37	56.67	**.8**
.9	6.39	12.78	19.17	25.56	31.94	38.33	44.72	51.11	57.50	**.9**
7.0	6.48	12.96	19.44	25.93	32.41	38.89	45.37	51.85	58.33	**7.0**
.1	6.57	13.15	19.72	26.30	32.87	39.44	46.02	52.59	59.17	**.1**
.2	6.67	13.33	20.00	26.67	33.33	40.00	46.67	53.33	60.00	**.2**
.3	6.76	13.52	20.28	27.04	33.80	40.56	47.31	54.07	60.83	**.3**
.4	6.85	13.70	20.56	27.41	34.26	41.11	47.96	54.81	61.67	**.4**
.5	6.94	13.89	20.83	27.78	34.72	41.67	48.61	55.56	62.50	**.5**
.6	7.04	14.07	21.11	28.15	35.19	42.22	49.26	56.30	63.33	**.6**
.7	7.13	14.26	21.39	28.52	35.65	42.78	49.91	57.04	64.17	**.7**
.8	7.22	14.44	21.67	28.89	36.11	43.33	50.56	57.78	65.00	**.8**
.9	7.31	14.63	21.94	29.26	36.57	43.89	51.20	58.52	65.83	**.9**
8.0	7.41	14.81	22.22	29.63	37.04	44.44	51.85	59.26	66.67	**8.0**
.1	7.50	15.00	22.50	30.00	37.50	45.00	52.50	60.00	67.50	**.1**
.2	7.59	15.19	22.78	30.37	37.96	45.56	53.15	60.74	68.33	**.2**
.3	7.69	15.37	23.06	30.74	38.43	46.11	53.80	61.48	69.17	**.3**
.4	7.78	15.56	23.33	31.11	38.89	46.67	54.44	62.22	70.00	**.4**
.5	7.87	15.74	23.61	31.48	39.35	47.22	55.09	62.96	70.83	**.5**
.6	7.96	15.93	23.89	31.85	39.81	47.78	55.74	63.70	71.67	**.6**
.7	8.06	16.11	24.17	32.22	40.28	48.33	56.39	64.44	72.50	**.7**
.8	8.15	16.30	24.44	32.59	40.74	48.89	57.04	65.19	73.33	**.8**
.9	8.24	16.48	24.72	32.96	41.20	49.44	57.69	65.93	74.17	**.9**
9.0	8.33	16.67	25.00	33.33	41.67	50.00	58.33	66.67	75.00	**9.0**
.1	8.43	16.85	25.28	33.70	42.13	50.56	58.98	67.41	75.83	**.1**
.2	8.52	17.04	25.56	34.07	42.59	51.11	59.63	68.15	76.67	**.2**
.3	8.61	17.22	25.83	34.44	43.06	51.67	60.28	68.89	77.50	**.3**
.4	8.70	17.41	26.11	34.81	43.52	52.22	60.93	69.63	78.33	**.4**
.5	8.80	17.59	26.39	35.19	43.98	52.78	61.57	70.37	79.17	**.5**
.6	8.89	17.78	26.67	35.56	44.44	53.33	62.22	71.11	80.00	**.6**
.7	8.98	17.96	26.94	35.93	44.91	53.89	62.87	71.85	80.83	**.7**
.8	9.07	18.15	27.22	36.30	45.37	54.44	63.52	72.59	81.67	**.8**
.9	9.17	18.33	27.50	36.67	45.83	55.00	64.17	73.33	82.50	**.9**
10.0	9.26	18.52	27.78	37.04	46.30	55.56	64.81	74.07	83.33	**10.0**

Y / X	1	2	3	4	5	6	7	8	9	Y / X
10.1	9.35	18.70	28.06	37.41	46.76	56.11	65.46	74.81	84.17	**10.1**
.2	9.44	18.89	28.33	37.78	47.22	56.67	66.11	75.56	85.00	.2
.3	9.54	19.07	28.61	38.15	47.69	57.22	66.76	76.30	85.83	.3
.4	9.63	19.26	28.89	38.52	48.15	57.78	67.41	77.04	86.67	.4
.5	9.72	19.44	29.17	38.89	48.61	58.33	68.06	77.78	87.50	.5
.6	9.81	19.63	29.44	39.26	49.07	58.89	68.70	78.52	88.33	.6
.7	9.91	19.81	29.72	39.63	49.54	59.44	69.35	79.26	89.17	.7
.8	10.00	20.00	30.00	40.00	50.00	60.00	70.00	80.00	90.00	.8
.9	10.09	20.19	30.28	40.37	50.46	60.56	70.65	80.74	90.83	.9
11.0	10.19	20.37	30.56	40.74	50.93	61.11	71.30	81.48	91.67	**11.0**
.1	10.28	20.56	30.83	41.11	51.39	61.67	71.94	82.22	92.50	.1
.2	10.37	20.74	31.11	41.48	51.85	62.22	72.59	82.96	93.33	.2
.3	10.46	20.93	31.39	41.85	52.31	62.78	73.24	83.70	94.17	.3
.4	10.56	21.11	31.67	42.22	52.78	63.33	73.89	84.44	95.00	.4
.5	10.65	21.30	31.94	42.59	53.24	63.89	74.54	85.19	95.83	.5
.6	10.74	21.48	32.22	42.96	53.70	64.44	75.19	85.93	96.67	.6
.7	10.83	21.67	32.50	43.33	54.17	65.00	75.83	86.67	97.50	.7
.8	10.93	21.85	32.78	43.70	54.63	65.56	76.48	87.41	98.33	.8
.9	11.02	22.04	33.06	44.07	55.09	66.11	77.13	88.15	99.17	.9
12.0	11.11	22.22	33.33	44.44	55.56	66.67	77.78	88.89	100.00	**12.0**
.1	11.20	22.41	33.61	44.81	56.02	67.22	78.43	89.63	100.83	.1
.2	11.30	22.59	33.89	45.19	56.48	67.78	79.07	90.37	101.67	.2
.3	11.39	22.78	34.17	45.56	56.94	68.33	79.72	91.11	102.50	.3
.4	11.48	22.96	34.44	45.93	57.41	68.89	80.37	91.85	103.33	.4
.5	11.57	23.15	34.72	46.30	57.87	69.44	81.02	92.59	104.17	.5
.6	11.67	23.33	35.00	46.67	58.33	70.00	81.67	93.33	105.00	.6
.7	11.76	23.52	35.28	47.04	58.80	70.56	82.31	94.07	105.83	.7
.8	11.85	23.70	35.56	47.41	59.26	71.11	82.96	94.81	106.67	.8
.9	11.94	23.89	35.83	47.78	59.72	71.67	83.61	95.56	107.50	.9
13.0	12.04	24.07	36.11	48.15	60.19	72.22	84.26	96.30	108.33	**13.0**
.1	12.13	24.26	36.39	48.52	60.65	72.78	84.91	97.04	109.17	.1
.2	12.22	24.44	36.67	48.89	61.11	73.33	85.56	97.78	110.00	.2
.3	12.31	24.63	36.94	49.26	61.57	73.89	86.20	98.52	110.83	.3
.4	12.41	24.81	37.22	49.63	62.04	74.44	86.85	99.26	111.67	.4
.5	12.50	25.00	37.50	50.00	62.50	75.00	87.50	100.00	112.50	.5
.6	12.59	25.19	37.78	50.37	62.96	75.56	88.15	100.74	113.33	.6
.7	12.69	25.37	38.06	50.74	63.43	76.11	88.80	101.48	114.17	.7
.8	12.78	25.56	38.33	51.11	63.89	76.67	89.44	102.22	115.00	.8
.9	12.87	25.74	38.61	51.48	64.35	77.22	90.09	102.96	115.83	.9
14.0	12.96	25.93	38.89	51.85	64.81	77.78	90.74	103.70	116.67	**14.0**
.1	13.06	26.11	39.17	52.22	65.28	78.32	91.39	104.44	117.50	.1
.2	13.15	26.30	39.44	52.59	65.74	78.89	92.04	105.19	118.33	.2
.3	13.24	26.48	39.72	52.96	66.20	79.44	92.69	105.93	119.17	.3
.4	13.33	26.67	40.00	53.33	66.67	80.00	93.33	106.67	120.00	.4
.5	13.43	26.85	40.28	53.70	67.13	80.56	93.98	107.41	120.83	.5
.6	13.52	27.04	40.56	54.07	67.59	81.11	94.63	108.15	121.67	.6
.7	13.61	27.22	40.83	54.44	68.06	81.67	95.28	108.89	122.50	.7
.8	13.70	27.41	41.11	54.81	68.52	82.22	95.93	109.63	123.33	.8
.9	13.80	27.59	41.39	55.19	68.98	82.78	96.57	110.37	124.17	.9
15.0	13.89	27.78	41.67	55.56	69.44	83.33	97.22	111.11	125.00	**15.0**

TABLE XL. — (*Continued*)

Y / X	1	2	3	4	5	6	7	8	9	Y / X
15.1	13.98	27.96	41.94	55.93	69.91	83.89	97.87	111.85	125.83	**15.1**
.2	14.07	28.15	42.22	56.30	70.37	84.44	98.52	112.59	126.67	.2
.3	14.17	28.33	42.50	56.67	70.83	85.00	99.17	113.33	127.50	.3
.4	14.26	28.52	42.78	57.04	71.30	85.56	99.81	114.07	128.33	.4
.5	14.35	28.70	43.06	57.41	71.76	86.11	100.46	114.81	129.17	.5
.6	14.44	28.89	43.33	57.78	72.22	86.67	101.11	115.56	130.00	.6
.7	14.54	29.07	43.61	58.15	72.69	87.22	101.76	116.30	130.83	.7
.8	14.63	29.26	43.89	58.52	73.15	87.78	102.41	117.04	131.67	.8
.9	14.72	29.44	44.17	58.89	73.61	88.33	103.06	117.78	132.50	.9
16.0	14.81	29.63	44.44	59.26	74.07	88.89	103.70	118.52	133.33	**16.0**
.1	14.91	29.81	44.72	59.63	74.54	89.44	104.35	119.26	134.17	.1
.2	15.00	30.00	45.00	60.00	75.00	90.00	105.00	120.00	135.00	.2
.3	15.09	30.19	45.28	60.37	75.46	90.56	105.65	120.74	135.83	.3
.4	15.19	30.37	45.56	60.74	75.93	91.11	106.30	121.48	136.67	.4
.5	15.28	30.56	45.83	61.11	76.39	91.67	106.94	122.22	137.50	.5
.6	15.37	30.74	46.11	61.48	76.85	92.22	107.59	122.96	138.33	.6
.7	15.46	30.93	46.39	61.85	77.31	92.78	108.24	123.70	139.17	.7
.8	15.56	31.11	46.67	62.22	77.78	93.33	108.89	124.44	140.00	.8
.9	15.65	31.30	46.94	62.59	78.24	93.89	109.54	125.19	140.83	.9
17.0	15.74	31.48	47.22	62.96	78.70	94.44	110.19	125.93	141.67	**17.0**
.1	15.83	31.67	47.50	63.33	79.17	95.00	110.83	126.67	142.50	.1
.2	15.93	31.85	47.78	63.70	79.63	95.56	111.48	127.41	143.33	.2
.3	16.02	32.04	48.06	64.07	80.09	96.11	112.13	128.15	144.17	.3
.4	16.11	32.22	48.33	64.44	80.56	96.67	112.78	128.89	145.00	.4
.5	16.20	32.41	48.61	64.81	81.02	97.22	113.43	129.63	145.83	.5
.6	16.30	32.59	48.89	65.19	81.48	97.78	114.07	130.37	146.67	.6
.7	16.39	32.78	49.17	65.56	81.94	98.33	114.72	131.11	147.50	.7
.8	16.48	32.96	49.44	65.93	82.41	98.89	115.37	131.85	148.33	.8
.9	16.57	33.15	49.72	66.30	82.87	99.44	116.02	132.59	149.17	.9
18.0	16.67	33.33	50.00	66.67	83.33	100.00	116.67	133.33	150.00	**18.0**
.1	16.76	33.52	50.28	67.04	83.80	100.56	117.31	134.07	150.83	.1
.2	16.85	33.70	50.56	67.41	84.26	101.11	117.96	134.81	151.67	.2
.3	16.94	33.89	50.83	67.78	84.72	101.67	118.61	135.56	152.50	.3
.4	17.04	34.07	51.11	68.15	85.19	102.22	119.26	136.30	153.33	.4
.5	17.13	34.26	51.39	68.52	85.65	102.78	119.91	137.04	154.17	.5
.6	17.22	34.44	51.67	68.89	86.11	103.33	120.56	137.78	155.00	.6
.7	17.31	34.63	51.94	69.26	86.57	103.89	121.20	138.52	155.83	.7
.8	17.41	34.81	52.22	69.63	87.04	104.44	121.85	139.26	156.67	.8
.9	17.50	35.00	52.50	70.00	87.50	105.00	122.50	140.00	157.50	.9
19.0	17.59	35.19	52.78	70.37	87.96	105.56	123.15	140.74	158.33	**19.0**
.1	17.69	35.37	53.06	70.74	88.43	106.11	123.80	141.48	159.17	.1
.2	17.78	35.56	53.33	71.11	88.89	106.67	124.44	142.22	160.00	.2
.3	17.87	35.74	53.61	71.48	89.35	107.22	125.09	142.96	160.83	.3
.4	17.96	35.93	53.89	71.85	89.81	107.78	125.74	143.70	161.67	.4
.5	18.06	36.11	54.17	72.22	90.28	108.33	126.39	144.44	162.50	.5
.6	18.15	36.30	54.44	72.59	90.74	108.89	127.04	145.19	163.33	.6
.7	18.24	36.48	54.72	72.96	91.20	109.44	127.69	145.93	164.17	.7
.8	18.33	36.67	55.00	73.33	91.67	110.00	128.33	146.67	165.00	.8
.9	18.43	36.85	55.28	73.70	92.13	110.56	128.98	147.41	165.83	.9
20.0	18.52	37.04	55.56	74.07	92.59	111.11	129.63	148.15	166.67	**20.0**

X \ Y	1	2	3	4	5	6	7	8	9	Y / X
20.1	18.61	37.22	55.83	74.44	93.06	111.67	130.28	148.89	167.50	**20.1**
.2	18.70	37.41	56.11	74.81	93.52	112.22	130.93	149.63	168.33	.2
.3	18.80	37.59	56.39	75.19	93.98	112.78	131.57	150.37	169.17	.3
.4	18.89	37.78	56.67	75.56	94.44	113.33	132.22	151.11	170.00	.4
.5	18.98	37.96	56.94	75.93	94.91	113.89	132.87	151.85	170.83	.5
.6	19.07	38.15	57.22	76.30	95.37	114.44	133.52	152.59	171.67	.6
.7	19.17	38.33	57.50	76.67	95.83	115.00	134.17	153.33	172.50	.7
.8	19.26	38.52	57.78	77.04	96.30	115.56	134.81	154.07	173.33	.8
.9	19.35	38.70	58.06	77.41	96.76	116.11	135.46	154.81	174.17	.9
21.0	19.44	38.89	58.33	77.78	97.22	116.67	136.11	155.56	175.00	**21.0**
.1	19.54	39.07	58.61	78.15	97.69	117.22	136.76	156.30	175.83	.1
.2	19.63	39.26	58.89	78.52	98.15	117.78	137.41	157.04	176.67	.2
.3	19.72	39.44	59.17	78.89	98.61	118.33	138.06	157.78	177.50	.3
.4	19.81	39.63	59.44	79.26	99.07	118.89	138.70	158.52	178.33	.4
.5	19.91	39.81	59.72	79.63	99.54	119.44	139.35	159.26	179.17	.5
.6	20.00	40.00	60.00	80.00	100.00	120.00	140.00	160.00	180.00	.6
.7	20.09	40.19	60.28	80.37	100.46	120.56	140.65	160.74	180.83	.7
.8	20.19	40.37	60.56	80.74	100.93	121.11	141.30	161.48	181.67	.8
.9	20.28	40.56	60.83	81.11	101.39	121.67	141.94	162.22	182.50	.9
22.0	20.37	40.74	61.11	81.48	101.85	122.22	142.59	162.96	183.33	**22.0**
.1	20.46	40.93	61.39	81.85	102.31	122.78	143.24	163.70	184.17	.1
.2	20.56	41.11	61.67	82.22	102.78	123.33	143.89	164.44	185.00	.2
.3	20.65	41.30	61.94	82.59	103.24	123.89	144.54	165.19	185.83	.3
.4	20.74	41.48	62.22	82.96	103.70	124.44	145.19	165.93	186.67	.4
.5	20.83	41.67	62.50	83.33	104.17	125.00	145.83	166.67	187.50	.5
.6	20.93	41.85	62.78	83.70	104.63	125.56	146.48	167.41	188.33	.6
.7	21.02	42.04	63.06	84.07	105.09	126.11	147.13	168.15	189.17	.7
.8	21.11	42.22	63.33	84.44	105.56	126.67	147.78	168.89	190.00	.8
.9	21.20	42.41	63.61	84.81	106.02	127.22	148.43	169.63	190.83	.9
23.0	21.30	42.59	63.89	85.19	106.48	127.78	149.07	170.37	191.67	**23.0**
.1	21.39	42.78	64.17	85.56	106.94	128.33	149.72	171.11	192.50	.1
.2	21.48	42.96	64.44	85.93	107.41	128.89	150.37	171.85	193.33	.2
.3	21.57	43.15	64.72	86.30	107.87	129.44	151.02	172.59	194.17	.3
.4	21.67	43.33	65.00	86.67	108.33	130.00	151.67	173.33	195.00	.4
.5	21.76	43.52	65.28	87.04	108.80	130.56	152.31	174.07	195.83	.5
.6	21.85	43.70	65.56	87.41	109.26	131.11	152.96	174.81	196.67	.6
.7	21.94	43.89	65.83	87.78	109.72	131.67	153.61	175.56	197.50	.7
.8	22.04	44.07	66.11	88.15	110.19	132.22	154.26	176.30	198.33	.8
.9	22.13	44.26	66.39	88.52	110.65	132.78	154.91	177.04	199.17	.9
24.0	22.22	44.44	66.67	88.89	111.11	133.33	155.56	177.78	200.00	**24.0**
.1	22.31	44.63	66.94	89.26	111.57	133.89	156.20	178.52	200.83	.1
.2	22.41	44.81	67.22	89.63	112.04	134.44	156.85	179.26	201.67	.2
.3	22.50	45.00	67.50	90.00	112.50	135.00	157.50	180.00	202.50	.3
.4	22.59	45.19	67.78	90.37	112.96	135.56	158.15	180.74	203.33	.4
.5	22.69	45.37	68.06	90.74	113.43	136.11	158.80	181.48	204.17	.5
.6	22.78	45.56	68.33	91.11	113.89	136.67	159.44	182.22	205.00	.6
.7	22.87	45.74	68.61	91.48	114.35	137.22	160.09	182.96	205.83	.7
.8	22.96	45.93	68.89	91.85	114.81	137.78	160.74	183.70	206.67	.8
.9	23.06	46.11	69.17	92.22	115.28	138.33	161.39	184.44	207.50	.9
25.0	23.15	46.30	69.44	92.59	115.74	138.89	162.04	185.19	208.33	**25.0**

X \ Y	1	2	3	4	5	6	7	8	9	Y / X
25.1	23.24	46.48	69.72	92.96	116.20	139.44	162.69	185.93	209.17	**25.1**
.2	23.33	46.67	70.00	93.33	116.67	140.00	163.33	186.67	210.00	.2
.3	23.43	46.85	70.28	93.70	117.13	140.56	163.98	187.41	210.83	.3
.4	23.52	47.04	70.56	94.07	117.59	141.11	164.63	188.15	211.67	.4
.5	23.61	47.22	70.83	94.44	118.06	141.67	165.28	188.89	212.50	.5
.6	23.70	47.41	71.11	94.81	118.52	142.22	165.93	189.63	213.33	.6
.7	23.80	47.59	71.39	95.19	118.98	142.78	166.57	190.37	214.17	.7
.8	23.89	47.78	71.67	95.56	119.44	143.33	167.22	191.11	215.00	.8
.9	23.98	47.96	71.99	95.93	119.91	143.89	167.87	191.85	215.83	.9
26.0	24.07	48.15	72.22	96.30	120.37	144.44	168.52	192.59	216.67	**26.0**
.1	24.17	48.33	72.50	96.67	120.83	145.00	169.17	193.33	217.50	.1
.2	24.26	48.52	72.78	97.04	121.30	145.56	169.81	194.07	218.33	.2
.3	24.35	48.70	73.06	97.41	121.76	146.11	170.46	194.81	219.17	.3
.4	24.44	48.89	73.33	97.78	122.22	146.67	171.11	195.56	220.00	.4
.5	24.54	49.07	73.61	98.15	122.69	147.22	171.76	196.30	220.83	.5
.6	24.63	49.26	73.89	98.52	123.15	147.78	172.41	197.04	221.67	.6
.7	24.72	49.44	74.17	98.89	123.61	148.33	173.06	197.78	222.50	.7
.8	24.81	49.63	74.44	99.26	124.07	148.89	173.70	198.52	223.33	.8
.9	24.91	49.81	74.72	99.63	124.54	149.44	174.35	199.26	224.17	.9
27.0	25.00	50.00	75.00	100.00	125.00	150.00	175.00	200.00	225.00	**27.0**
.1	25.09	50.19	75.28	100.37	125.46	150.56	175.65	200.74	225.83	.1
.2	25.19	50.37	75.56	100.74	125.93	151.11	176.30	201.48	226.67	.2
.3	25.28	50.56	75.83	101.11	126.39	151.67	176.94	202.22	227.50	.3
.4	25.37	50.74	76.11	101.48	126.85	152.22	177.59	202.96	228.33	.4
.5	25.46	50.93	76.39	101.85	127.31	152.78	178.24	203.70	229.17	.5
.6	25.56	51.11	76.67	102.22	127.78	153.33	178.89	204.44	230.00	.6
.7	25.65	51.30	76.94	102.59	128.24	153.89	179.54	205.19	230.83	.7
.8	25.74	51.48	77.22	102.96	128.70	154.44	180.19	205.93	231.67	.8
.9	25.83	51.67	77.50	103.33	129.17	155.00	180.83	206.67	232.50	.9
28.0	25.93	51.85	77.78	103.70	129.63	155.56	181.48	207.41	233.33	**28.0**
.1	26.02	52.04	78.06	104.07	130.09	156.11	182.13	208.15	234.17	.1
.2	26.11	52.22	78.33	104.44	130.56	156.67	182.78	208.89	235.00	.2
.3	26.20	52.41	78.61	104.81	131.02	157.22	183.43	209.63	235.83	.3
.4	26.30	52.59	78.89	105.19	131.48	157.78	184.07	210.37	236.67	.4
.5	26.39	52.78	79.17	105.56	131.94	158.33	184.72	211.11	237.50	.5
.6	26.48	52.96	79.44	105.93	132.41	158.89	185.37	211.85	238.33	.6
.7	26.57	53.15	79.72	106.30	132.87	159.44	186.02	212.59	239.17	.7
.8	26.67	53.33	80.00	106.67	133.33	160.00	186.67	213.33	240.00	.8
.9	26.76	53.52	80.28	107.04	133.80	160.56	187.31	214.07	240.83	.9
29.0	26.85	53.70	80.56	107.41	134.26	161.11	187.96	214.81	241.67	**29.0**
.1	26.94	53.89	80.83	107.78	134.72	161.67	188.61	215.56	242.50	.1
.2	27.04	54.07	81.11	108.15	135.19	162.22	189.26	216.30	243.33	.2
.3	27.13	54.26	81.39	108.52	135.65	162.78	189.91	217.04	244.17	.3
.4	27.22	54.44	81.67	108.89	136.11	163.33	190.56	217.78	245.00	.4
.5	27.31	54.63	81.94	109.26	136.57	163.89	191.20	218.52	245.83	.5
.6	27.41	54.81	82.22	109.63	137.04	164.44	191.85	219.26	246.67	.6
.7	27.50	55.00	82.50	110.00	137.50	165.00	192.50	220.00	247.50	.7
.8	27.59	55.19	82.78	110.37	137.96	165.56	193.15	220.74	248.33	.8
.9	27.69	55.37	83.06	110.74	138.43	166.11	193.80	221.48	249.17	.9
30.0	27.78	55.56	83.33	111.11	138.89	166.67	194.44	222.22	250.00	**30.0**

Y / X	1	2	3	4	5	6	7	8	9	Y / X
30.1	27.87	55.74	83.61	111.48	139.35	167.22	195.09	222.96	250.83	**30.1**
.2	27.96	55.93	83.89	111.85	139.81	167.78	195.74	223.70	251.67	.2
.3	28.06	56.11	84.17	112.22	140.28	168.33	196.39	224.44	252.50	.3
.4	28.15	56.30	84.44	112.59	140.74	168.89	197.04	225.19	253.33	.4
.5	28.24	56.48	84.72	112.96	141.20	169.44	197.69	225.93	254.17	.5
.6	28.33	56.67	85.00	113.33	141.67	170.00	198.33	226.67	255.00	.6
.7	28.43	56.85	85.28	113.70	142.13	170.56	198.98	227.41	255.83	.7
.8	28.52	57.04	85.56	114.07	142.59	171.11	199.63	228.15	256.67	.8
.9	28.61	57.22	85.83	114.44	143.06	171.67	200.28	228.89	257.50	.9
31.0	28.70	57.41	86.11	114.81	143.52	172.22	200.93	229.63	258.33	**31.0**
.1	28.80	57.59	86.39	115.19	143.98	172.78	201.57	230.37	259.17	.1
.2	28.89	57.78	86.67	115.56	144.44	173.33	202.22	231.11	260.00	.2
.3	28.98	57.96	86.94	115.93	144.91	173.89	202.87	231.85	260.83	.3
.4	29.07	58.15	87.22	116.30	145.37	174.44	203.52	232.59	261.67	.4
.5	29.17	58.33	87.50	116.67	145.83	175.00	204.17	233.33	262.50	.5
.6	29.26	58.52	87.78	117.04	146.30	175.56	204.81	234.07	263.33	.6
.7	29.35	58.70	88.06	117.41	146.76	176.11	205.46	234.81	264.17	.7
.8	29.44	58.89	88.33	117.78	147.22	176.67	206.11	235.56	265.00	.8
.9	29.54	59.07	88.61	118.15	147.69	177.22	206.76	236.30	265.83	.9
32.0	29.63	59.26	88.89	118.52	148.15	177.78	207.41	237.04	266.67	**32.0**
.1	29.72	59.44	89.17	118.89	148.61	178.33	208.06	237.78	267.50	.1
.2	29.81	59.63	89.44	119.26	149.07	178.89	208.70	238.52	268.33	.2
.3	29.91	59.81	89.72	119.63	149.54	179.44	209.35	239.26	269.17	.3
.4	30.00	60.00	90.00	120.00	150.00	180.00	210.00	240.00	270.00	.4
.5	30.09	60.19	90.28	120.37	150.46	180.56	210.65	240.74	270.83	.5
.6	30.19	60.37	90.56	120.74	150.93	181.11	211.30	241.48	271.67	.6
.7	30.28	60.56	90.83	121.11	151.39	181.67	211.94	242.22	272.50	.7
.8	30.37	60.74	91.11	121.48	151.85	182.22	212.59	242.96	273.33	.8
.9	30.46	60.93	91.39	121.85	152.31	182.78	213.24	243.70	274.17	.9
33.0	30.56	61.11	91.67	122.22	152.78	183.33	213.89	244.44	275.00	**33.0**
.1	30.65	61.30	91.94	122.59	153.24	183.89	214.54	245.19	275.83	.1
.2	30.74	61.48	92.22	122.96	153.70	184.44	215.19	245.93	276.67	.2
.3	30.83	61.67	92.50	123.33	154.17	185.00	215.83	246.67	277.50	.3
.4	30.93	61.85	92.78	123.70	154.63	185.56	216.48	247.41	278.33	.4
.5	31.02	62.04	93.06	124.07	155.09	186.11	217.13	248.15	279.17	.5
.6	31.11	62.22	93.33	124.44	155.56	186.67	217.78	248.89	280.00	.6
.7	31.20	62.41	93.61	124.81	156.02	187.22	218.43	249.63	280.83	.7
.8	31.30	62.59	93.89	125.19	156.48	187.78	219.07	250.37	281.67	.8
.9	31.39	62.78	94.17	125.56	156.94	188.33	219.72	251.11	282.50	.9
34.0	31.48	62.96	94.44	125.93	157.41	188.89	220.37	251.85	283.33	**34.0**
.1	31.57	63.15	94.72	126.30	157.87	189.44	221.02	252.59	284.17	.1
.2	31.67	63.33	95.00	126.67	158.33	190.00	221.67	253.33	285.00	.2
.3	31.76	63.52	95.28	127.04	158.80	190.56	222.31	254.07	285.83	.3
.4	31.85	63.70	95.56	127.41	159.26	191.11	222.96	254.81	286.67	.4
.5	31.94	63.89	95.83	127.78	159.72	191.67	223.61	255.56	287.50	.5
.6	32.04	64.07	96.11	128.15	160.19	192.22	224.26	256.30	288.33	.6
.7	32.13	64.26	96.39	128.52	160.65	192.78	224.91	257.04	289.17	.7
.8	32.22	64.44	96.67	128.89	161.11	193.33	225.56	257.78	290.00	.8
.9	32.31	64.63	96.94	129.26	161.57	193.89	226.20	258.52	290.83	.9
35.0	32.41	64.81	97.22	129.63	162.04	194.44	226.85	259.26	291.67	**35.0**

TABLE XL. — (*Continued*)

Y / X	1	2	3	4	5	6	7	8	9	Y / X
35.1	32.50	65.00	97.50	130.00	162.50	195.00	227.50	260.00	292.50	**35.1**
.2	32.59	65.19	97.78	130.37	162.96	195.56	228.15	260.74	293.33	.2
.3	32.69	65.37	98.06	130.74	163.43	196.11	228.80	261.48	294.17	.3
.4	32.78	65.56	98.33	131.11	163.89	196.67	229.44	262.22	295.00	.4
.5	32.87	65.74	98.61	131.48	164.35	197.22	230.09	262.96	295.83	.5
.6	32.96	65.93	98.89	131.85	164.81	197.78	230.74	263.70	296.67	.6
.7	33.06	66.11	99.17	132.22	165.28	198.33	231.39	264.44	297.50	.7
.8	33.15	66.30	99.44	132.59	165.74	198.89	232.04	265.19	298.33	.8
.9	33.24	66.48	99.72	132.96	166.20	199.44	232.69	265.93	299.17	.9
36.0	33.33	66.67	100.00	133.33	166.67	200.00	233.33	266.67	300.00	**36.0**
.1	33.43	66.85	100.28	133.70	167.13	200.56	233.98	267.41	300.83	.1
.2	33.52	67.04	100.56	134.07	167.59	201.11	234.63	268.15	301.67	.2
.3	33.61	67.22	100.83	134.44	168.06	201.67	235.28	268.89	302.50	.3
.4	33.70	67.41	101.11	134.81	168.52	202.22	235.93	269.63	303.33	.4
.5	33.80	67.59	101.39	135.19	168.98	202.78	236.57	270.37	304.17	.5
.6	33.89	67.78	101.67	135.56	169.44	203.33	237.22	271.11	305.00	.6
.7	33.98	67.96	101.94	135.93	169.91	203.89	237.87	271.85	305.83	.7
.8	34.07	68.15	102.22	136.30	170.37	204.44	238.52	272.59	306.67	.8
.9	34.17	68.33	102.50	136.67	170.83	205.00	239.17	273.33	307.50	.9
37.0	34.26	68.52	102.78	137.04	171.30	205.56	239.81	274.07	308.33	**37.0**
.1	34.35	68.70	103.06	137.41	171.76	206.11	240.46	274.81	309.17	.1
.2	34.44	68.89	103.33	137.78	172.22	206.67	241.11	275.56	310.00	.2
.3	34.54	69.07	103.61	138.15	172.69	207.22	241.76	276.30	310.83	.3
.4	34.63	69.26	103.89	138.52	173.15	207.78	242.41	277.04	311.67	.4
.5	34.72	69.44	104.17	138.89	173.61	208.33	243.06	277.78	312.50	.5
.6	34.81	69.63	104.44	139.26	174.07	208.89	243.70	278.52	313.33	.6
7	34.91	69.81	104.72	139.63	174.54	209.44	244.35	279.26	314.17	.7
.8	35.00	70.00	105.00	140.00	175.00	210.00	245.00	280.00	315.00	.8
.9	35.09	70.19	105.28	140.37	175.46	210.56	245.65	280.74	315.83	.9
38.0	35.19	70.37	105.56	140.74	175.93	211.11	246.30	281.48	316.67	**38.0**
.1	35.28	70.56	105.83	141.11	176.39	211.67	246.94	282.22	317.50	.1
.2	35.37	70.74	106.11	141.48	176.85	212.22	247.59	282.96	318.33	.2
.3	35.46	70.93	106.39	141.85	177.31	212.78	248.24	283.70	319.17	.3
.4	35.56	71.11	106.67	142.22	177.78	213.33	248.89	284.44	320.00	.4
.5	35.65	71.30	106.94	142.59	178.24	213.89	249.54	285.19	320.83	.5
.6	35.74	71.48	107.22	142.96	178.70	214.44	250.19	285.93	321.67	.6
.7	35.83	71.67	107.50	143.33	179.17	215.00	250.83	286.67	322.50	.7
.8	35.93	71.85	107.78	143.70	179.63	215.56	251.48	287.41	323.33	.8
.9	36.02	72.04	108.06	144.07	180.09	216.11	252.13	288.15	324.17	.9
39.0	36.11	72.22	108.33	144.44	180.56	216.67	252.78	288.89	325.00	**39.0**
.1	36.20	72.41	108.61	144.81	181.02	217.22	253.43	289.63	325.83	.1
.2	36.30	72.59	108.89	145.19	181.48	217.78	254.07	290.37	326.67	.2
.3	36.39	72.78	109.17	145.56	181.94	218.33	254.72	291.11	327.50	.3
.4	36.48	72.96	109.44	145.93	182.41	218.89	255.37	291.85	328.33	.4
.5	36.57	73.15	109.72	146.30	182.87	219.44	256.02	292.59	329.17	.5
.6	36.67	73.33	110.00	146.67	183.33	220.00	256.67	293.33	330.00	.6
.7	36.76	73.52	110.28	147.04	183.80	220.56	257.31	294.07	330.83	.7
.8	36.85	73.70	110.56	147.41	184.26	221.11	257.96	294.81	331.67	.8
.9	36.94	73.89	110.83	147.78	184.72	221.67	258.61	295.56	332.50	.9
40.0	37.04	74.07	111.11	148.15	185.19	222.22	259.26	296.30	333.33	**40.0**

TABLE XLI

Prismoidal Corrections to be subtracted from average end area volumes 100 feet long. $D - D_1$ = difference in total width; $C - C_1$ = difference in center height. Corrections in cubic yards.

$C-C_1$ \ $D-D_1$	1	2	3	4	5	6	7	8	9	$D-D_1$ / $C-C_1$
.2	0.06	0.12	0.19	0.25	0.31	0.37	0.43	0.49	0.56	.2
.4	0.12	0.25	0.37	0.49	0.62	0.74	0.86	0.99	1.11	.4
.6	0.19	0.37	0.56	0.74	0.93	1.11	1.30	1.48	1.67	.6
.8	0.25	0.49	0.74	0.99	1.23	1.48	1.73	1.98	2.22	.8
1.0	0.31	0.62	0.93	1.23	1.54	1.85	2.16	2.47	2.78	1.0
.2	0.37	0.74	1.11	1.48	1.85	2.22	2.59	2.96	3.33	.2
.4	0.43	0.86	1.30	1.73	2.16	2.59	3.02	3.46	3.89	.4
.6	0.49	0.99	1.48	1.98	2.47	2.96	3.46	3.95	4.44	.6
.8	0.56	1.11	1.67	2.22	2.78	3.33	3.89	4.44	5.00	.8
2.0	0.62	1.23	1.85	2.47	3.09	3.70	4.32	4.94	5.56	**2.0**
.2	0.68	1.36	2.04	2.72	3.40	4.07	4.75	5.43	6.11	.2
.4	0.74	1.48	2.22	2.96	3.70	4.44	5.19	5.93	6.67	.4
.6	0.80	1.60	2.41	3.21	4.01	4.81	5.62	6.42	7.22	.6
.8	0.86	1.73	2.59	3.46	4.32	5.19	6.05	6.91	7.78	.8
3.0	0.93	1.85	2.78	3.70	4.63	5.56	6.48	7.41	8.33	3.0
.2	0.99	1.98	2.96	3.95	4.94	5.93	6.91	7.90	8.89	.2
.4	1.05	2.10	3.15	4.20	5.25	6.30	7.35	8.40	9.44	.4
.6	1.11	2.22	3.33	4.44	5.56	6.67	7.78	8.89	10.00	.6
.8	1.17	2.35	3.52	4.69	5.86	7.04	8.21	9.38	10.56	.8
4.0	1.23	2.47	3.70	4.94	6.17	7.41	8.64	9.88	11.11	**4.0**
.2	1.30	2.59	3.89	5.19	6.48	7.78	9.07	10.37	11.67	.2
.4	1.36	2.72	4.07	5.43	6.79	8.15	9.51	10.86	12.22	.4
.6	1.42	2.84	4.26	5.68	7.10	8.52	9.94	11.36	12.78	.6
.8	1.48	2.96	4.44	5.93	7.41	8.89	10.37	11.85	13.33	.8
5.0	1.54	3.09	4.63	6.17	7.72	9.26	10.80	12.35	13.89	5.0
.2	1.60	3.21	4.81	6.42	8.02	9.63	11.23	12.84	14.44	.2
.4	1.67	3.33	5.00	6.67	8.33	10.00	11.67	13.33	15.00	.4
.6	1.73	3.46	5.19	6.91	8.64	10.37	12.10	13.83	15.56	.6
.8	1.79	3.58	5.37	7.16	8.95	10.74	12.53	14.32	16.11	.8
6.0	1.85	3.70	5.56	7.41	9.26	11.11	12.96	14.81	16.67	**6.0**
.2	1.91	3.83	5.74	7.65	9.57	11.48	13.40	15.31	17.22	.2
.4	1.98	3.95	5.93	7.90	9.88	11.85	13.83	15.80	17.78	.4
.6	2.04	4.07	6.11	8.15	10.19	12.22	14.26	16.30	18.33	.6
.8	2.10	4.20	6.30	8.40	10.49	12.59	14.69	16.79	18.89	.8
7.0	2.16	4.32	6.48	8.64	10.80	12.96	15.12	17.28	19.44	7.0
.2	2.22	4.44	6.67	8.89	11.11	13.33	15.56	17.78	20.00	.2
.4	2.28	4.57	6.85	9.14	11.42	13.70	15.99	18.27	20.56	.4
.6	2.35	4.69	7.04	9.38	11.73	14.07	16.42	18.77	21.11	.6
.8	2.41	4.81	7.22	9.63	12.04	14.44	16.85	19.26	21.67	.8
8.0	2.47	4.94	7.41	9.88	12.35	14.81	17.28	19.75	22.22	**8.0**
.2	2.53	5.06	7.59	10.12	12.65	15.19	17.72	20.25	22.78	.2
.4	2.59	5.19	7.78	10.37	12.96	15.56	18.15	20.74	23.33	.4
.6	2.65	5.31	7.96	10.62	13.27	15.93	18.58	21.23	23.89	.6
.8	2.72	5.43	8.15	10.86	13.58	16.30	19.01	21.73	24.44	.8
9.0	2.78	5.56	8.33	11.11	13.89	16.67	19.44	22.22	25.00	9.0
.2	2.84	5.68	8.52	11.36	14.20	17.04	19.88	22.72	25.56	.2
.4	2.90	5.80	8.70	11.60	14.51	17.41	20.31	23.21	26.11	.4
.6	2.96	5.93	8.89	11.85	14.81	17.78	20.74	23.70	26.67	.6
.8	3.02	6.05	9.07	12.10	15.12	18.15	21.17	24.20	27.22	.8
10.0	3.09	6.17	9.26	12.35	15.43	18.52	21.60	24.69	27.78	**10.0**

TABLE XLI. — (*Continued*)

$D-D_1$ / $C-C_1$	1	2	3	4	5	6	7	8	9	$D-D_1$ / $C-C_1$
10.2	3.15	6.30	9.44	12.59	15.74	18.89	22.04	25.19	28.33	**10.2**
.4	3.21	6.42	9.63	12.84	16.05	19.26	22.47	25.68	28.89	.4
.6	3.27	6.54	9.81	13.09	16.36	19.63	22.90	26.17	29.44	.6
.8	3.33	6.67	10.00	13.33	16.67	20.00	23.33	26.67	30.00	.8
11.0	3.40	6.79	10.19	13.58	16.98	20.37	23.77	27.16	30.56	**11.0**
.2	3.46	6.91	10.37	13.83	17.28	20.74	24.20	27.65	31.11	.2
.4	3.52	7.04	10.56	14.07	17.59	21.11	24.63	28.15	31.67	.4
.6	3.58	7.16	10.74	14.32	17.90	21.48	25.06	28.64	32.22	.6
.8	3.64	7.28	10.93	14.57	18.21	21.85	25.49	29.14	32.78	.8
12.0	3.70	7.41	11.11	14.81	18.52	22.22	25.93	29.63	33.33	**12.0**
.2	3.77	7.53	11.30	15.06	18.83	22.59	26.36	30.12	33.89	.2
.4	3.83	7.65	11.48	15.31	19.14	22.96	26.79	30.62	34.44	.4
.6	3.89	7.78	11.67	15.56	19.44	23.33	27.22	31.11	35.00	.6
.8	3.95	7.90	11.85	15.80	19.75	23.70	27.65	31.60	35.56	.8
13.0	4.01	8.02	12.04	16.05	20.06	24.07	28.09	32.10	36.11	**13.0**
.2	4.07	8.15	12.22	16.30	20.37	24.44	28.52	32.59	36.67	.2
.4	4.14	8.27	12.41	16.54	20.68	24.81	28.95	33.09	37.22	.4
.6	4.20	8.40	12.59	16.79	20.99	25.19	29.38	33.58	37.78	.6
.8	4.26	8.52	12.78	17.04	21.30	25.56	29.81	34.07	38.33	.8
14.0	4.32	8.64	12.96	17.28	21.60	25.93	30.25	34.57	38.89	**14.0**
.2	4.38	8.77	13.15	17.53	21.91	26.30	30.68	35.06	39.44	.2
.4	4.44	8.89	13.33	17.78	22.22	26.67	31.11	35.56	40.00	.4
.6	4.51	9.01	13.52	18.02	22.53	27.04	31.54	36.05	40.56	.6
.8	4.57	9.14	13.70	18.27	22.84	27.41	31.98	36.54	41.11	.8
15.0	4.63	9.26	13.89	18.52	23.15	27.78	32.41	37.04	41.67	**15.0**
.2	4.69	9.38	14.07	18.77	23.46	28.15	32.84	37.53	42.22	.2
.4	4.75	9.51	14.26	19.01	23.77	28.52	33.27	38.02	42.78	.4
.6	4.81	9.63	14.44	19.26	24.07	28.89	33.70	38.52	43.33	.6
.8	4.88	9.75	14.63	19.51	24.38	29.26	34.14	39.01	43.89	.8
16.0	4.94	9.88	14.81	19.75	24.69	29.63	34.57	39.51	44.44	**16.0**
.2	5.00	10.00	15.00	20.00	25.00	30.00	35.00	40.00	45.00	.2
.4	5.06	10.12	15.19	20.25	25.31	30.37	35.43	40.49	45.56	.4
.6	5.12	10.25	15.37	20.49	25.62	30.74	35.86	40.99	46.11	.6
.8	5.19	10.37	15.56	20.74	25.93	31.11	36.30	41.48	46.67	.8
17.0	5.25	10.49	15.74	20.99	26.23	31.48	36.73	41.98	47.22	**17.0**
.2	5.31	10.62	15.93	21.23	26.54	31.85	37.16	42.47	47.78	.2
.4	5.37	10.74	16.11	21.48	26.85	32.22	37.59	42.96	48.33	.4
.6	5.43	10.86	16.30	21.73	27.16	32.59	38.02	43.46	48.89	.6
.8	5.49	10.99	16.48	21.98	27.47	32.96	38.46	43.95	49.44	.8
18.0	5.56	11.11	16.67	22.22	27.78	33.33	38.89	44.44	50.00	**18.0**
.2	5.62	11.23	16.85	22.47	28.09	33.70	39.32	44.94	50.56	.2
.4	5.68	11.36	17.04	22.72	28.40	34.07	39.75	45.43	51.11	.4
.6	5.74	11.48	17.22	22.96	28.70	34.44	40.19	45.93	51.67	.6
.8	5.80	11.60	17.41	23.21	29.01	34.81	40.62	46.42	52.22	.8
19.0	5.86	11.73	17.59	23.46	29.32	35.19	41.05	46.91	52.78	**19.0**
.2	5.93	11.85	17.78	23.70	29.63	35.56	41.48	47.41	53.33	.2
.4	5.99	11.98	17.96	23.95	29.94	35.93	41.91	47.90	53.89	.4
.6	6.05	12.10	18.15	24.20	30.25	36.30	42.35	48.40	54.44	.6
.8	6.11	12.22	18.33	24.44	30.56	36.67	42.78	48.89	55.00	.8
20.0	6.17	12.35	18.52	24.69	30.86	37.04	43.21	49.38	55.56	**20.0**

TABLE XLII. — Level Section Volumes

100 feet long. Roadbed 14 feet. Slope $1\frac{1}{2} : 1$.

Center height	0.0	0.1	0.2	0.3	0.4	0.5	0.6	0.7	0.8	0.9	Center height
0	....	5	11	16	22	27	33	39	45	51	0
1	57	64	70	77	83	90	97	104	111	119	1
2	126	133	141	149	156	164	172	181	189	197	2
3	206	214	223	232	241	250	259	268	277	287	3
4	296	306	316	326	336	346	356	366	377	387	4
5	398	409	420	431	442	453	465	476	488	499	5
6	511	523	535	547	559	572	584	597	609	622	6
7	635	648	661	675	688	701	715	729	742	756	7
8	770	785	799	813	828	842	857	872	887	902	8
9	917	932	947	963	978	994	1010	1026	1042	1058	9
10	1074	1090	1107	1123	1140	1157	1174	1191	1208	1225	10
11	1243	1260	1278	1295	1313	1331	1349	1367	1385	1404	11
12	1422	1441	1459	1478	1497	1516	1535	1555	1574	1593	12
13	1613	1633	1652	1672	1692	1713	1733	1753	1774	1794	13
14	1815	1836	1857	1878	1899	1920	1941	1963	1984	2006	14
15	2028	2050	2072	2094	2116	2138	2161	2183	2206	2229	15
16	2252	2275	2298	2321	2345	2368	2392	2415	2439	2463	16
17	2487	2511	2535	2560	2584	2609	2633	2658	2683	2708	17
18	2733	2759	2784	2809	2835	2861	2886	2912	2938	2965	18
19	2991	3017	3044	3070	3097	3124	3151	3178	3205	3232	19
Center height	**0.0**	**1.0**	**2.0**	**3.0**	**4.0**	**5.0**	**6.0**	**7.0**	**8.0**	**9.0**	**Center height**
20	3259	3539	3830	4131	4444	4769	5104	5450	5807	6176	20
30	6556	6946	7348	7761	8185	8620	9067	9524	9993	10472	30
40	10963	11465	11978	12502	13037	13583	14141	14709	15289	25880	40

TABLE XLIII. — Level Section Volumes

100 feet long. Roadbed 16 feet. Slope $1\frac{1}{2} : 1$.

Center height	0.0	0.1	0.2	0.3	0.4	0.5	0.6	0.7	0.8	0.9	Center height
0	....	6	12	18	25	31	38	44	51	58	0
1	65	72	79	86	94	101	109	117	125	133	1
2	141	149	157	166	174	183	192	201	209	219	2
3	228	237	247	256	266	275	285	295	305	316	3
4	326	336	347	358	368	379	390	401	412	424	4
5	435	447	458	470	482	494	506	518	531	543	5
6	556	568	581	594	607	620	633	646	660	673	6
7	687	701	715	729	743	757	771	786	800	815	7
8	830	845	859	875	890	905	921	936	952	967	8
9	983	999	1015	1032	1048	1064	1081	1098	1114	1131	9
10	1148	1165	1182	1200	1217	1235	1252	1270	1288	1306	10
11	1324	1342	1361	1379	1398	1416	1435	1454	1473	1492	11
12	1511	1530	1550	1569	1589	1609	1629	1649	1669	1689	12
13	1709	1730	1750	1771	1792	1813	1833	1855	1876	1897	13
14	1919	1940	1962	1983	2005	2027	2049	2072	2094	2116	14
15	2139	2162	2184	2207	2230	2253	2276	2300	2323	2347	15
16	2370	2394	2418	2442	2466	2490	2515	2539	2564	2588	16
17	2613	2638	2663	2688	2713	2738	2764	2789	2815	2841	17
18	2867	2893	2919	2945	2971	2998	3024	3051	3078	3105	18
19	3131	3159	3186	3213	3241	3268	3296	3323	3351	3379	19
Center height	**0.0**	**1.0**	**2.0**	**3.0**	**4.0**	**5.0**	**6.0**	**7.0**	**8.0**	**9.0**	**Center height**
20	3407	3694	3993	4302	4622	4954	5296	5650	6015	6391	20
30	6778	7176	7585	8006	8437	8880	9333	9798	10274	10761	30
40	11259	11769	12289	12820	13363	13917	14481	15057	15644	16243	40

TABLE XLIV. — Level Section Volumes

100 feet long. Roadbed 20 feet. Slope $1\frac{1}{2} : 1$.

Center height	0.0	0.1	0.2	0.3	0.4	0.5	0.6	0.7	0.8	0.9	Center height
0	....	7	15	23	31	38	46	55	63	71	0
1	80	88	97	106	115	124	133	142	151	161	1
2	170	180	190	200	210	220	230	240	251	262	2
3	272	283	294	305	316	327	339	350	362	373	3
4	385	397	409	421	433	446	458	471	484	496	4
5	509	522	535	549	562	575	589	603	617	630	5
6	644	659	673	687	702	716	731	746	761	776	6
7	791	806	821	837	852	868	884	900	916	932	7
8	948	964	981	998	1014	1031	1048	1065	1082	1099	8
9	1117	1134	1152	1169	1187	1205	1223	1241	1259	1278	9
10	1296	1315	1334	1352	1371	1390	1409	1429	1448	1461	10
11	1487	1507	1527	1546	1566	1587	1607	1627	1648	1668	11
12	1689	1710	1731	1752	1773	1794	1815	1837	1858	1880	12
13	1902	1924	1946	1968	1990	2012	2035	2058	2080	2103	13
14	2126	2149	2172	2195	2219	2242	2266	2289	2313	2337	14
15	2361	2385	2409	2435	2458	2483	2508	2532	2557	2582	15
16	2607	2633	2658	2683	2709	2735	2761	2786	2812	2839	16
17	2865	2891	2918	2944	2971	2998	3025	3052	3079	3106	17
18	3133	3161	3188	3216	3244	3272	3300	3328	3356	3384	18
19	3413	3442	3470	3499	3528	3557	3586	3615	3645	3674	19
Center height	**0.0**	**1.0**	**2.0**	**3.0**	**4.0**	**5.0**	**6.0**	**7.0**	**8.0**	**9.0**	**Center height**
20	3704	4006	4319	4643	4979	5324	5681	6050	6430	6820	20
30	7222	7635	8059	8494	8941	9398	9867	10346	10837	11339	30
40	11852	12376	12911	13457	14015	14583	15163	15754	16356	16969	40

TABLE XLV. — Level Section Volumes

100 feet long. Roadbed 20 feet. Slope $1 : 1$.

Center height	0.0	0.1	0.2	0.3	0.4	0.5	0.6	0.7	0.8	0.9	Center height
0	....	7	15	23	30	38	46	54	62	70	0
1	78	86	94	103	111	114	128	137	145	154	1
2	163	172	181	190	199	208	218	227	236	246	2
3	256	265	275	285	295	305	315	325	335	345	3
4	356	366	376	387	398	408	419	430	441	452	4
5	463	474	485	497	508	519	531	543	554	566	5
6	578	590	602	614	626	638	650	663	675	687	6
7	700	713	725	738	751	764	777	790	803	816	7
8	830	843	856	870	884	897	911	925	939	953	8
9	967	981	995	1009	1024	1038	1052	1067	1082	1096	9
10	1111	1126	1141	1156	1171	1186	1201	1217	1232	1247	10
11	1263	1279	1294	1310	1326	1342	1358	1374	1390	1406	11
12	1422	1439	1455	1471	1488	1505	1521	1538	1555	1572	12
13	1589	1606	1623	1640	1658	1675	1692	1710	1728	1745	13
14	1763	1781	1799	1817	1835	1853	1871	1889	1908	1926	14
15	1944	1963	1982	2000	2019	2038	2057	2076	2095	2114	15
16	2133	2153	2172	2191	2211	2231	2250	2270	2290	2310	16
17	2330	2350	2370	2390	2410	2431	2451	2471	2492	2513	17
18	2533	2554	2575	2596	2617	2638	2659	2680	2702	2723	18
19	2744	2766	2788	2809	2831	2853	2875	2897	2919	2941	19
Center height	**0.0**	**1.0**	**2.0**	**3.0**	**4.0**	**5.0**	**6.0**	**7.0**	**8.0**	**9.0**	**Center height**
20	2963	3189	3422	3663	3991	4167	4430	4700	4978	5263	20
30	5556	5856	6163	6478	6800	7130	7467	7811	8163	8522	30
40	8889	9263	9644	10033	10430	10833	11244	11663	12089	12522	40

TABLE XLVI. — Level Section Volumes

100 feet long. Roadbed 24 feet. Slope $1\frac{1}{2} : 1$.

Center height	0.0	0.1	0.2	0.3	0.4	0.5	0.6	0.7	0.8	0.9	Center height
0	....	9	18	27	36	46	55	65	75	85	0
1	94	105	115	125	135	146	156	167	178	189	1
2	200	211	222	234	245	257	269	280	292	304	2
3	317	329	341	354	366	379	392	405	418	431	3
4	444	458	471	485	499	512	526	540	555	569	4
5	583	598	612	627	642	657	672	687	702	718	5
6	733	749	765	780	796	812	829	845	861	878	6
7	894	911	928	945	962	979	996	1014	1031	1049	7
8	1067	1085	1102	1121	1139	1157	1175	1194	1212	1231	8
9	1250	1269	1288	1307	1326	1346	1365	1385	1405	1425	9
10	1444	1465	1485	1505	1525	1546	1566	1587	1608	1629	10
11	1650	1671	1692	1714	1735	1757	1779	1800	1822	1845	11
12	1867	1889	1911	1934	1956	1979	2002	2025	2048	2071	12
13	2094	2118	2141	2165	2189	2213	2236	2261	2285	2309	13
14	2333	2358	2382	2407	2432	2457	2482	2507	2532	2558	14
15	2583	2609	2635	2661	2686	2713	2739	2765	2791	2818	15
16	2844	2871	2898	2925	2952	2979	3006	3034	3061	3089	16
17	3117	3145	3172	3201	3229	3257	3285	3314	3342	3371	17
18	3400	3429	3458	3487	3516	3546	3575	3605	3635	3665	18
19	3694	3725	3755	3785	3815	3846	3876	3907	3938	3969	19
Center height	**0.0**	**1.0**	**2.0**	**3.0**	**4.0**	**5.0**	**6.0**	**7.0**	**8.0**	**9.0**	**Center height**
20	4000	4317	4644	4983	5333	5694	6067	6450	6844	7250	20
30	7667	8094	8533	8983	9444	9917	10400	10894	11400	11917	30
40	12444	12983	13533	14094	14667	15250	15844	16450	17067	17694	40

TABLE XLVII. — Level Section Volumes

100 feet long. Roadbed 24 feet. Slope $1 : 1$.

Center height	0.0	0.1	0.2	0.3	0.4	0.5	0.6	0.7	0.8	0.9	Center height
0	....	9	18	27	36	45	55	64	74	83	0
1	93	102	112	122	132	142	152	162	172	182	1
2	193	203	214	224	235	245	256	267	278	289	2
3	300	311	322	334	345	356	368	380	391	403	3
4	415	427	439	451	463	475	487	500	510	524	4
5	537	550	562	575	588	601	614	627	640	653	5
6	667	680	694	707	721	734	748	762	756	790	6
7	804	818	832	846	861	875	890	904	919	933	7
8	948	963	978	993	1008	1023	1038	1054	1069	1084	8
9	1100	1116	1131	1147	1163	1179	1195	1211	1226	1243	9
10	1259	1276	1292	1308	1325	1342	1358	1375	1392	1409	10
11	1426	1443	1460	1477	1495	1512	1530	1547	1565	1582	11
12	1600	1618	1636	1654	1672	1690	1708	1726	1745	1763	12
13	1782	1800	1819	1837	1856	1875	1894	1913	1932	1951	13
14	1970	1990	2009	2028	2048	2068	2087	2107	2127	2147	14
15	2167	2187	2207	2227	2247	2268	2288	2308	2329	2350	15
16	2370	2391	2412	2433	2454	2475	2496	2517	2539	2560	16
17	2582	2603	2625	2646	2668	2690	2712	2734	2756	2778	17
18	2800	2822	2845	2867	2889	2912	2935	2957	2980	3003	18
19	3026	3049	3072	3095	3118	3142	3165	3188	3212	3236	19
Center height	**0.0**	**1.0**	**2.0**	**3.0**	**4.0**	**5.0**	**6.0**	**7.0**	**8.0**	**9.0**	**Center height**
20	3259	3500	3748	4004	4267	4537	4815	5100	5393	5692	20
30	6000	6315	6637	6967	7304	7648	8000	8359	8726	9100	30
40	9481	9870	10267	10670	11081	11500	11926	12359	12800	13248	40

TABLE XLVIII. — Level Section Volumes

100 feet long. Roadbed 26 feet. Slope $1\frac{1}{2} : 1$.

Center height	0.0	0.1	0.2	0.3	0.4	0.5	0.6	0.7	0.8	0.9	Center height
0	....	10	19	29	39	50	60	70	81	91	0
1	102	113	124	135	146	157	168	180	191	203	1
2	215	227	239	251	263	275	288	301	313	326	2
3	339	352	365	378	392	405	419	432	446	460	3
4	474	488	502	517	531	546	561	575	590	605	4
5	620	636	651	666	682	698	713	729	745	762	5
6	778	794	811	827	844	861	878	895	912	929	6
7	946	964	981	999	1017	1035	1053	1071	1089	1107	7
8	1126	1144	1163	1182	1201	1220	1239	1258	1278	1297	8
9	1317	1333	1356	1376	1396	1416	1436	1457	1477	1498	9
10	1519	1539	1560	1581	1602	1624	1645	1666	1688	1710	10
11	1731	1753	1775	1798	1820	1842	1865	1887	1910	1933	11
12	1956	1979	2002	2025	2048	2072	2095	2119	2143	2167	12
13	2191	2215	2239	2263	2288	2312	2337	2362	2387	2412	13
14	2437	2462	2488	2513	2539	2564	2590	2616	2642	2668	14
15	2694	2721	2747	2774	2800	2827	2854	2881	2908	2936	15
16	2963	2990	3018	3046	3073	3101	3129	3158	3186	3214	16
17	3243	3271	3300	3329	3358	3387	3416	3445	3474	3504	17
18	3533	3563	3593	3623	3653	3683	3713	3743	3774	3804	18
19	3835	3866	3897	3928	3959	3990	4022	4053	4085	4116	19
Center height	**0.0**	**1.0**	**2.0**	**3.0**	**4.0**	**5.0**	**6.0**	**7.0**	**8.0**	**9.0**	**Center height**
20	4148	4472	4807	5154	5511	5880	6259	6650	7052	7465	20
30	7889	8324	8770	9228	9696	10176	10667	11168	11681	12205	30
40	12741	13287	13844	14413	14992	15583	16185	16798	17422	18057	40

TABLE XLIX. — Level Section Volumes

100 feet long. Roadbed 26 feet. Slope $1 : 1$.

Center height	0.0	0.1	0.2	0.3	0.4	0.5	0.6	0.7	0.8	0.9	Center height
0	....	10	19	29	39	49	59	69	79	90	0
1	100	110	121	131	142	153	164	174	185	196	1
2	207	219	230	241	252	264	275	287	299	310	2
3	322	334	346	358	370	382	395	407	419	432	3
4	444	457	470	483	495	508	521	534	548	561	4
5	574	587	601	614	628	642	655	669	683	697	5
6	711	725	739	754	768	782	797	811	826	841	6
7	856	870	885	900	915	931	946	961	976	992	7
8	1007	1023	1039	1054	1070	1086	1102	1118	1134	1150	8
9	1167	1183	1199	1216	1232	1249	1266	1283	1299	1316	9
10	1333	1350	1368	1385	1402	1419	1437	1454	1472	1490	10
11	1507	1525	1543	1561	1579	1597	1615	1634	1652	1670	11
12	1689	1707	1726	1745	1764	1782	1801	1820	1839	1859	12
13	1878	1897	1916	1936	1955	1975	1995	2014	2034	2054	13
14	2074	2094	2114	2134	2155	2175	2195	2216	2236	2257	14
15	2278	2299	2319	2340	2361	2382	2404	2425	2446	2467	15
16	2489	2510	2532	2554	2575	2597	2619	2641	2663	2685	16
17	2707	2730	2752	2774	2797	2819	2842	2865	2888	2910	17
18	2933	2956	2979	3003	3026	3049	3072	3096	3119	3143	18
19	3167	3190	3214	3238	3262	3286	3310	3334	3359	3383	19
Center height	**0.0**	**1.0**	**2.0**	**3.0**	**4.0**	**5.0**	**6.0**	**7.0**	**8.0**	**9.0**	**Center height**
20	3407	3656	3911	4174	4444	4722	5007	5300	5600	5907	20
30	6222	6544	6874	7211	7556	7907	8267	8633	9007	9389	30
40	9778	10174	10578	10989	11407	11833	12267	12707	13156	13611	40

TABLE L. — Level Section Volumes

100 feet long. Roadbed 28 feet. Slope $1\frac{1}{2}:1$.

Center height	0.0	0.1	0.2	0.3	0.4	0.5	0.6	0.7	0.8	0.9	Center height
0	....	10	21	32	42	53	64	75	86	98	0
1	109	121	132	144	156	168	180	192	205	217	1
2	230	242	255	268	281	294	307	320	334	348	2
3	361	375	389	403	417	431	445	460	474	489	3
4	504	519	534	549	564	579	595	610	626	642	4
5	656	673	690	706	722	738	755	772	788	805	5
6	822	839	856	874	891	909	926	944	962	980	6
7	998	1016	1035	1053	1072	1090	1109	1128	1147	1166	7
8	1185	1204	1224	1243	1263	1283	1303	1322	1343	1363	8
9	1383	1403	1424	1445	1465	1486	1507	1528	1549	1571	9
10	1592	1614	1635	1657	1679	1701	1723	1745	1767	1790	10
11	1812	1835	1858	1881	1904	1927	1950	1973	1997	2020	11
12	2044	2068	2092	2116	2140	2164	2189	2213	2238	2262	12
13	2287	2312	2337	2362	2387	2413	2438	2464	2489	2515	13
14	2541	2567	2593	2619	2645	2672	2698	2725	2752	2779	14
15	2806	2833	2860	2887	2915	2942	2970	2997	3025	3053	15
16	3081	3109	3138	3166	3195	3223	3252	3281	3310	3339	16
17	3368	3397	3427	3456	3486	3516	3546	3576	3606	3636	17
18	3667	3697	3728	3758	3789	3820	3851	3882	3913	3944	18
19	3976	4007	4039	4070	4102	4134	4166	4198	4231	4263	19

Center height	0.0	1.0	2.0	3.0	4.0	5.0	6.0	7.0	8.0	9.0	Center height
20	4296	4627	4970	5324	5689	6065	6451	6850	7259	7680	20
30	8111	8554	9007	9472	9948	10435	10933	11443	11963	12494	30
40	13037	13591	14156	14731	15318	15917	16526	17146	17778	18420	40

TABLE LI. — Level Section Volumes

100 feet long. Roadbed 28 feet. Slope $1:1$

Center height	0.0	0.1	0.2	0.3	0.4	0.5	0.6	0.7	0.8	0.9	Center height
0	....	10	21	31	42	53	64	74	85	96	0
1	107	119	130	141	152	164	175	167	199	210	1
2	222	234	246	258	270	282	295	307	319	332	2
3	344	357	370	383	395	408	421	434	448	461	3
4	474	487	501	514	528	542	555	569	583	597	4
5	611	625	639	654	668	682	697	711	726	741	5
6	656	770	785	800	816	831	846	861	876	892	6
7	908	923	939	954	970	986	1002	1018	1034	1050	7
8	1067	1083	1099	1116	1132	1149	1166	1182	1199	1216	8
9	1233	1250	1267	1285	1302	1319	1337	1354	1372	1390	9
10	1407	1425	1443	1461	1479	1497	1515	1534	1552	1570	10
11	1589	1607	1626	1645	1664	1682	1701	1720	1739	1759	11
12	1778	1797	1816	1836	1855	1875	1895	1914	1934	1954	12
13	1974	1994	2014	2034	2055	2075	2095	2116	2136	2157	13
14	2178	2199	2219	2240	2261	2282	2304	2325	2346	2367	14
15	2389	2410	2432	2454	2475	2497	2519	2541	2563	2585	15
16	2607	2630	2652	2674	2697	2719	2742	2765	2788	2810	16
17	2833	2856	2879	2903	2926	2949	2972	2996	3019	3043	17
18	3067	3090	3114	3138	3162	3186	3210	3234	3259	3283	18
19	3307	3332	3356	3381	3406	3431	3455	3480	3505	3530	19

Center height	0.0	1.0	2.0	3.0	4.0	5.0	6.0	7.0	8.0	9.0	Center height
20	3556	3811	4074	4344	4622	4907	5200	5500	5807	6122	20
30	6444	6774	7111	7456	7807	8167	8533	8907	9289	9678	30
40	10074	10478	10889	11307	11733	12167	12607	13056	13511	13974	40

TABLE LII. — Level Section Volumes

100 feet long. Roadbed 30 feet. Slope $1\frac{1}{2} : 1$.

Center height	0.0	0.1	0.2	0.3	0.4	0.5	0.6	0.7	0.8	0.9	Center height
0	....	11	22	34	45	57	69	80	92	104	0
1	117	129	141	154	166	179	192	205	218	231	1
2	244	258	271	285	299	312	326	340	355	369	2
3	383	398	412	427	442	457	472	487	502	518	3
4	533	549	565	580	596	612	629	645	661	678	4
5	694	711	728	745	762	779	796	814	831	849	5
6	867	884	902	920	939	957	975	994	1012	1031	6
7	1050	1069	1088	1107	1126	1146	1165	1185	1205	1224	7
8	1244	1264	1285	1305	1325	1346	1366	1387	1408	1429	8
9	1450	1471	1492	1514	1535	1557	1579	1600	1622	1644	9
10	1667	1689	1711	1734	1756	1779	1802	1825	1848	1871	10
11	1894	1918	1941	1965	1981	2012	2036	2060	2085	2109	11
12	2133	2158	2182	2207	2232	2257	2282	2307	2332	2358	12
13	2383	2409	2435	2460	2486	2512	2539	2565	2591	2618	13
14	2644	2671	2698	2725	2752	2779	2806	2834	2861	2889	14
15	2917	2944	2972	3000	3029	3057	3085	3114	3142	3171	15
16	3200	3229	3258	3287	3316	3346	3375	3405	3435	3464	16
17	3494	3525	3555	3585	3615	3646	3676	3707	3738	3769	17
18	3800	3831	3862	3894	3925	3957	3989	4020	4052	4084	18
19	4117	4149	4181	4214	4246	4279	4312	4345	4378	4411	19
Center height	**0.0**	**1.0**	**2.0**	**3.0**	**4.0**	**5.0**	**6.0**	**7.0**	**8.0**	**9.0**	**Center height**
20	4444	4783	5133	5494	5867	6250	6644	7050	7467	7894	20
30	8333	8783	9244	9717	10200	10694	11200	11717	12244	12783	30
40	13333	13894	14467	15050	15644	16250	16867	17494	18133	18783	40

TABLE LIII. — Level Section Volumes

100 feet long. Roadbed 30 feet. Slope 1 : 1.

Center height	0.0	0.1	0.2	0.3	0.4	0.5	0.6	0.7	0.8	0.9	Center height
0	....	11	22	34	45	56	68	80	91	103	0
1	115	127	139	151	163	175	187	200	212	224	1
2	237	250	262	275	288	301	314	327	340	353	2
3	367	380	393	407	421	434	448	462	476	490	3
4	504	518	532	546	561	575	589	604	619	633	4
5	648	663	678	693	708	723	738	754	769	784	5
6	800	816	831	847	863	879	895	911	927	943	6
7	959	976	992	1008	1025	1042	1058	1075	1092	1109	7
8	1126	1143	1160	1177	1195	1212	1229	1247	1265	1282	8
9	1300	1318	1336	1354	1372	1390	1408	1426	1445	1463	9
10	1481	1500	1519	1537	1556	1575	1594	1613	1632	1651	10
11	1670	1690	1709	1728	1748	1768	1787	1807	1827	1847	11
12	1867	1887	1907	1927	1947	1968	1988	2008	2029	2050	12
13	2070	2091	2112	2133	2154	2175	2196	2217	2239	2260	13
14	2281	2303	2325	2346	2368	2390	2412	2434	2456	2478	14
15	2500	2522	2545	2567	2589	2612	2635	2657	2680	2703	15
16	2726	2749	2772	2795	2818	2842	2865	2888	2912	2936	16
17	2959	2983	3007	3031	3055	3079	3103	3127	3151	3176	17
18	3200	3224	3249	3274	3298	3323	3348	3373	3399	3423	18
19	3448	3473	3499	3524	3549	3575	3601	3626	3652	3678	19
Center height	**0.0**	**1.0**	**2.0**	**3.0**	**4.0**	**5.0**	**6.0**	**7.0**	**8.0**	**9.0**	**Center height**
20	3704	3967	4237	4515	4800	5093	5393	5700	6015	6337	20
30	6667	7004	7348	7700	8059	8426	8800	9181	9570	9967	30
40	10370	10781	11200	11626	12059	12500	12948	13404	13867	14337	40

TABLE LIV. — Level Section Volumes

100 feet long. Roadbed 32 feet. Slope $1\frac{1}{2} : 1$.

Center height	0.0	0.1	0.2	0.3	0.4	0.5	0.6	0.7	0.8	0.9	Center height
0	....	12	24	36	48	61	73	86	98	111	0
1	124	137	150	163	177	190	204	218	231	245	1
2	259	273	288	302	316	331	346	360	375	390	2
3	406	421	436	452	467	483	499	515	531	547	3
4	563	579	596	612	629	646	663	680	697	714	4
5	731	749	767	784	802	820	838	856	874	893	5
6	911	930	948	967	986	1005	1024	1043	1063	1082	6
7	1102	1122	1141	1161	1181	1201	1222	1242	1262	1283	7
8	1304	1324	1345	1366	1388	1409	1430	1452	1473	1495	8
9	1517	1539	1561	1583	1605	1627	1650	1672	1695	1718	9
10	1741	1764	1787	1810	1833	1857	1881	1904	1928	1952	10
11	1976	2000	2024	2049	2073	2099	2122	2147	2172	2197	11
12	2222	2247	2273	2298	2324	2350	2375	2401	2427	2453	12
13	2480	2506	2532	2559	2586	2612	2639	2666	2694	2721	13
14	2748	2776	2803	2831	2859	2887	2915	2943	2971	2999	14
15	3028	3056	3085	3114	3143	3172	3201	3230	3259	3289	15
16	3319	3348	3378	3408	3438	3468	3498	3529	3559	3590	16
17	3620	3651	3682	3713	3744	3775	3807	3888	3870	3902	17
18	3933	3965	3997	4029	4062	4094	4126	4159	4192	4224	18
19	4257	4290	4324	4357	4390	4424	4457	4491	4525	4559	19
Center height	**0.0**	**1.0**	**2.0**	**3.0**	**4.0**	**5.0**	**6.0**	**7.0**	**8.0**	**9.0**	**Center height**
20	4593	4939	5296	5665	6044	6435	6837	7250	7674	8109	20
30	8556	9013	9482	9962	10452	10954	11467	11991	12526	13072	30
40	13630	14198	14778	15369	15970	16583	17207	17843	18489	19146	40

TABLE LV. — Level Section Volumes

100 feet long. Roadbed 32 feet. Slope $1 : 1$.

Center height	0.0	0.1	0.2	0.3	0.4	0.5	0.6	0.7	0.8	0.9	Center height
0	....	12	24	36	48	60	72	85	97	110	0
1	122	135	148	160	173	186	199	212	225	239	1
2	252	265	279	292	306	319	333	347	361	375	2
3	389	403	417	431	446	460	475	489	504	519	3
4	533	548	563	578	593	608	624	639	654	670	4
5	685	701	716	732	748	764	780	796	812	828	5
6	844	861	877	894	910	927	944	960	977	994	6
7	1011	1028	1045	1063	1080	1097	1115	1132	1150	1167	7
8	1185	1203	1221	1239	1257	1275	1293	1311	1330	1348	8
9	1367	1385	1404	1423	1441	1460	1479	1498	1517	1536	9
10	1556	1575	1594	1614	1633	1653	1672	1692	1712	1732	10
11	1752	1772	1792	1812	1832	1853	1873	1894	1914	1935	11
12	1956	1976	1997	2018	2039	2060	2081	2103	2124	2145	12
13	2167	2188	2210	2231	2253	2275	2297	2319	2341	2363	13
14	2385	2407	2430	2452	2475	2497	2520	2543	2565	2588	14
15	2611	2634	2657	2680	2704	2727	2750	2774	2797	2831	15
16	2844	2868	2892	2916	2940	2964	2988	3012	3036	3061	16
17	3085	3110	3134	3159	3184	3208	3233	3258	3283	3308	17
18	3333	3359	3384	3409	3435	3460	3486	3511	3537	3563	18
19	3589	3615	3641	3667	3693	3719	3746	3772	3799	3825	19
Center height	**0.0**	**1.0**	**2.0**	**3.0**	**4.0**	**5.0**	**6.0**	**7.0**	**8.0**	**9.0**	**Center height**
20	3852	4122	4400	4685	4978	5278	5585	5900	6222	6552	20
30	6889	7233	7585	7944	8311	8685	9067	9456	9852	10256	30
40	10667	11085	11511	11944	12385	12833	13289	13752	14222	14700	40

TABLE LVI. — LEVEL SECTION VOLUMES

100 feet long. Roadbed 20 feet. Slope $\frac{1}{4}$: 1.

Center height	0.0	0.1	0.2	0.3	0.4	0.5	0.6	0.7	0.8	0.9	Center height
0	....	7	15	22	30	37	45	52	60	67	0
1	75	83	90	98	106	113	121	129	136	144	1
2	152	160	167	175	183	191	199	207	214	223	2
3	231	238	246	254	263	271	279	287	295	303	3
4	311	319	327	336	344	352	360	369	377	385	4
5	394	402	410	419	427	435	444	452	461	469	5
6	478	486	495	503	512	521	529	538	546	555	6
7	564	573	581	590	599	608	616	625	634	643	7
8	652	661	670	679	688	696	706	714	724	733	8
9	742	751	760	769	778	787	796	806	815	824	9
10	833	843	852	861	870	880	889	899	908	917	10
11	927	936	946	955	965	974	984	993	1003	1013	11
12	1022	1032	1042	1051	1061	1071	1080	1090	1100	1110	12
13	1119	1129	1139	1149	1159	1169	1179	1189	1199	1209	13
14	1219	1229	1239	1249	1259	1269	1279	1289	1299	1309	14
15	1319	1330	1340	1350	1360	1371	1381	1391	1402	1412	15
16	1422	1433	1443	1453	1464	1474	1485	1495	1506	1516	16
17	1527	1537	1548	1559	1569	1580	1591	1601	1612	1623	17
18	1633	1644	1655	1666	1676	1687	1698	1709	1720	1731	18
19	1742	1753	1764	1774	1785	1796	1808	1819	1830	1841	19

Center height	0.0	1.0	2.0	3.0	4.0	5.0	6.0	7.0	8.0	9.0	Center height
20	1852	1964	2078	2194	2311	2431	2552	2675	2800	2927	20
30	3056	3186	3319	3453	3589	3727	3867	4008	4152	4297	30
40	4444	4593	4744	4897	5052	5208	5367	5527	5689	5853	40

TABLE LVII. — LEVEL SECTION VOLUMES

100 feet long. Roadbed 24 feet. Slope $\frac{1}{4}$: 1.

Center height	0.0	0.1	0.2	0.3	0.4	0.5	0.6	0.7	0.8	0.9	Center height
0	....	9	18	27	36	45	54	63	72	81	0
1	90	99	108	117	126	135	145	154	163	172	1
2	181	191	200	209	219	228	237	247	256	266	2
3	275	284	294	303	313	322	332	342	351	361	3
4	370	380	390	399	409	419	428	438	448	458	4
5	468	477	487	497	507	517	527	537	547	557	5
6	567	577	587	597	607	617	627	637	647	657	6
7	668	678	688	698	708	719	729	739	750	760	7
8	770	781	791	802	812	822	833	843	854	864	8
9	875	886	896	907	917	928	939	949	960	971	9
10	981	992	1003	1014	1025	1035	1046	1057	1068	1079	10
11	1090	1101	1112	1123	1134	1145	1156	1167	1178	1189	11
12	1200	1211	1222	1233	1245	1256	1267	1278	1289	1301	12
13	1312	1323	1335	1346	1357	1369	1380	1392	1403	1414	13
14	1426	1437	1449	1460	1472	1484	1495	1507	1518	1530	14
15	1542	1553	1565	1577	1588	1600	1612	1624	1636	1647	15
16	1659	1671	1683	1695	1707	1719	1731	1743	1755	1767	16
17	1779	1791	1803	1815	1827	1839	1851	1863	1876	1888	17
18	1900	1912	1924	1937	1949	1961	1974	1986	1998	2011	18
19	2023	2036	2048	2060	2073	2085	2098	2110	2123	2136	19

Center height	0.0	1.0	2.0	3.0	4.0	5.0	6.0	7.0	8.0	9.0	Center height
20	2148	2275	2404	2534	2667	2801	2937	3075	3215	3356	20
30	3500	3645	3793	3942	4093	4245	4400	4556	4715	4875	30
40	5037	5201	5367	5534	5704	5875	6048	6223	6400	6579	40

TABLE LVIII. — Middle Ordinates for Curving Rails

Ordinate given in inches

From Roberts' "Track Formulæ and Tables."

Degree of curve	Length of rails in feet											
	10	12	14	16	18	20	22	24	26	28	30	33
0.5°	...	...	....	....	....	....	....	....	....	1/8	1/8	1/8
1°	...	...	....	....	....	....	....	1/8	1/8	1/8	1/4	1/4
1.5°	...	...	....	....	1/8	1/8	1/8	1/8	1/4	1/4	3/8	3/8
2°	...	...	1/8	1/8	1/8	1/8	1/4	1/4	3/8	3/8	3/8	5/8
2.5°	...	...	1/8	1/8	1/4	1/4	1/4	3/8	3/8	1/2	1/2	3/4
3°	...	1/8	1/8	1/8	1/4	1/4	3/8	1/2	1/2	5/8	5/8	7/8
3.5°	...	1/8	1/8	1/4	1/4	3/8	3/8	1/2	5/8	3/4	7/8	1
4°	1/8	1/8	1/8	1/4	3/8	3/8	1/2	5/8	3/4	7/8	1	1 1/8
4.5°	1/8	1/8	1/4	1/4	3/8	1/2	1/2	5/8	3/4	7/8	1	1 1/4
5°	1/8	1/8	1/4	3/8	3/8	1/2	5/8	3/4	7/8	1	1 1/8	1 3/8
5.5°	1/8	1/4	1/4	3/8	1/2	5/8	3/4	7/8	1	1 1/8	1 1/4	1 5/8
6°	1/8	1/4	3/8	3/8	1/2	5/8	3/4	7/8	1 1/8	1 1/4	1 3/8	1 3/4
6.5°	1/8	1/4	3/8	1/2	1/2	3/4	7/8	1	1 1/8	1 3/8	1 1/2	1 7/8
7°	1/8	1/4	3/8	1/2	5/8	3/4	7/8	1	1 1/4	1 1/2	1 5/8	2
7.5°	1/8	1/4	3/8	1/2	5/8	3/4	1	1 1/8	1 3/8	1 1/2	1 3/4	2 1/8
8°	1/4	1/4	3/8	1/2	3/4	7/8	1	1 1/4	1 3/8	1 5/8	1 7/8	2 1/4
8.5°	1/4	3/8	3/8	5/8	3/4	7/8	1 1/8	1 1/4	1 1/2	1 3/4	2	2 3/8
9°	1/4	3/8	1/2	5/8	3/4	7/8	1 1/8	1 3/8	1 5/8	1 7/8	2 1/8	2 1/2
9.5°	1/4	3/8	1/2	5/8	3/4	1	1 1/4	1 3/8	1 3/4	2	2 1/4	2 3/4
10°	1/4	3/8	1/2	5/8	7/8	1	1 1/4	1 1/2	1 3/4	2	2 3/8	2 7/8
10.5°	1/4	3/8	5/8	3/4	7/8	1 1/8	1 3/8	1 5/8	1 7/8	2 1/8	2 1/2	3
11°	1/4	3/8	5/8	3/4	1	1 1/8	1 3/8	1 5/8	2	2 1/4	2 5/8	3 1/8
11.5°	3/8	1/2	5/8	3/4	1	1 1/4	1 1/2	1 3/4	2 1/8	2 3/8	2 3/4	3 1/4
12°	3/8	1/2	5/8	3/4	1	1 1/4	1 1/2	1 7/8	2 1/8	2 1/2	2 7/8	3 3/8
12.5°	3/8	1/2	5/8	7/8	1 1/8	1 3/8	1 5/8	2	2 1/4	2 5/8	3	3 5/8
13°	3/8	1/2	5/8	7/8	1 1/8	1 3/8	1 5/8	2	2 1/4	2 5/8	3	3 3/4
13.5°	3/8	1/2	3/4	1	1 1/4	1 1/2	1 3/4	2 1/8	2 3/8	2 3/4	3 1/8	3 7/8
14°	3/8	1/2	3/4	1	1 1/4	1 1/2	1 3/4	2 1/8	2 1/2	2 7/8	3 1/4	4
14.5°	3/8	5/8	3/4	1	1 1/4	1 5/8	1 7/8	2 1/4	2 5/8	3	3 3/8	4 1/8
15°	3/8	5/8	3/4	1	1 1/4	1 5/8	1 7/8	2 1/4	2 5/8	3 1/8	3 1/2	4 1/4
15.5°	3/8	5/8	7/8	1 1/8	1 3/8	1 5/8	2	2 3/8	2 7/8	3 1/4	3 5/8	4 3/8
16°	3/8	5/8	7/8	1 1/8	1 3/8	1 5/8	2	2 3/8	2 7/8	3 1/4	3 3/4	4 5/8

TABLE LVIIIa. — Gage on Curves

Degree of curve	Gage	Degree of curve	Gage
8° and under	4′ 8 1/2″	15°–16°	4′ 9″
9°–10°	4′ 8 5/8″	17°–18°	4′ 9 1/8″
11°–12°	4′ 8 3/4″	19°–20°	4′ 9 1/4″
13°–14°	4′ 8 7/8″	....	....

CANTING THE TRACK

Using the gage for the base, if R = radius, S = speed in miles per hour and e is the difference in level of the two rails in feet,

$$e = \frac{4.708}{\sqrt{1 + 223.5 \frac{R^2}{S^4}}}.$$

Using gage plus one rail head which the author recommends for use with the common track level,

$$e = \frac{4.9}{\sqrt{1 + 223.5 \frac{R^2}{S^4}}}.$$

The corresponding approximate formulas are $e = \frac{0.3149\ S^2}{R}$ and $e = \frac{0.3278\ S^2}{R}$. In inches $E = 0.00066\ S^2D$ and $E = 0.000686\ S^2D$.

The formula of the American Railway Engineering Association for difference of level measured at the gage lines is

$$E = 0.00066\ S^2D,$$

but the author recommends $E = 0.000686\ S^2D$. Both formulas are tabulated in Tables LIX and LIXa.

TABLE LIX

Difference of level *in inches* of the two rails of a standard gage track on curves of various degrees for various speeds.

Formula: $E = 0.00066\,S^2D$

(Nearest $\frac{1}{8}$ inch)

Degree of curve	Speed in miles per hour													Degree of curve
	10	15	20	25	30	35	40	45	50	55	60	65	70	
1	—	1/8	1/4	3/8	5/8	3/4	1 1/8	1 3/8	1 5/8	2	2 3/8	2 3/4	3 1/4	1
2	1/8	3/8	1/2	7/8	1 1/8	1 5/8	2 1/8	2 5/8	3 1/4	4	4 3/4	5 1/2	6 1/2	2
3	1/4	1/2	3/4	1 1/4	1 3/4	2 3/8	3 1/8	4	4 7/8	6	7 1/8	8 3/8	9 3/4	3
4	1/4	5/8	1	1 5/8	2 3/8	3 1/4	4 1/4	5 3/8	6 5/8	8	9 1/2	....	...	4
5	3/8	3/4	1 1/4	2	3	4	5 1/4	6 5/8	8 1/4	...	...	...	...	5
6	3/8	1	1 5/8	2 1/2	3 1/2	4 7/8	6 1/4	8	...	...	...	...	...	6
7	1/2	1 1/8	1 7/8	2 7/8	4 1/8	5 5/8	7 3/8	...	...	...	...	...	...	7
8	1/2	1 1/4	2 1/8	3 1/4	4 3/4	6 1/2	8 3/8	...	...	...	...	...	...	8
9	5/8	1 3/8	2 3/8	3 3/4	5 3/8	7 1/4	...	...	...	...	...	...	...	9
10	3/4	1 1/2	2 5/8	4 1/8	5 7/8	8 1/8	...	...	...	...	...	...	...	10
11	3/4	1 3/4	2 7/8	4 1/2	6 1/2	8 7/8	...	...	...	...	...	...	...	11
12	7/8	1 7/8	3 1/8	4 7/8	7 1/8	...	...	...	...	...	...	...	...	12
13	7/8	2	3 3/8	5 3/8	7 3/4	...	...	...	...	...	...	...	...	13
14	1	2 1/8	3 5/8	5 3/4	8 3/8	...	...	...	...	...	...	...	...	14
15	1	2 1/4	3 7/8	6 1/4	8 7/8	...	...	...	...	...	...	...	...	15
16	1 1/8	2 1/2	4 1/4	6 5/8	...	...	...	...	...	...	...	...	...	16
17	1 1/4	2 5/8	4 1/2	7	...	...	...	...	...	...	...	...	...	17
18	1 1/4	2 3/4	4 3/4	7 1/2	...	...	...	...	...	...	...	...	...	18
19	1 3/8	2 7/8	5	7 3/4	...	...	...	...	...	...	...	...	...	19
20	1 3/8	3	5 1/4	8 1/8	...	...	...	...	...	...	...	...	...	20

TABLE LIXa

From Formula $E = 0.000686\,S^2D$

(Nearest $\frac{1}{16}$ inch)

Degree of curve	Speed in miles per hour													Degree of curve
	10	15	20	25	30	35	40	45	50	55	60	65	70	
0.5	1/16	1/16	1/8	3/16	5/16	7/16	9/16	11/16	7/8	1 1/16	1 1/4	1 7/16	1 11/16	0.5
1	1/16	1/8	1/4	7/16	5/8	13/16	1 1/16	1 3/8	1 11/16	2 1/16	2 1/2	2 7/8	3 3/8	1
2	1/8	5/16	9/16	7/8	1 1/4	1 11/16	2 3/16	2 3/4	3 7/16	4 1/8	4 15/16	5 13/16	6 3/4	2
3	3/16	7/16	13/16	1 5/16	1 7/8	2 1/2	3 5/16	4 1/8	5 1/8	6 3/16	7 3/8	8 11/16	...	3
4	1/4	5/8	1 1/16	1 11/16	2 1/2	3 3/8	4 3/8	5 9/16	6 13/16	...	...	...	...	4
5	3/8	3/4	1 3/8	2 1/8	3 1/16	4 3/16	5 7/16	6 7/8	...	...	...	...	...	5
6	7/16	15/16	1 5/8	2 9/16	3 11/16	5.0	6 9/16	..	...	...	...	...	...	6
7	1/2	1 1/16	1 15/16	3.0	4 5/16	5 13/16	7 5/8	..	...	...	...	...	...	7
8	9/16	1 1/4	2 3/16	3 3/8	4 7/8	6 9/16	...	..	...	...	...	...	...	8
9	5/8	1 3/8	2 1/2	3 13/16	5 1/2	7 1/2	...	..	...	...	...	...	...	9
10	11/16	1 9/16	2 3/4	4 1/4	6 1/8	...	...	..	...	...	...	...	...	10
11	3/4	1 11/16	3.0	4 11/16	6 3/4	...	...	..	...	...	...	...	...	11
12	13/16	1 7/8	3 5/16	5 1/8	7 5/16	...	...	..	...	...	...	...	...	12
14	15/16	2 3/16	3 13/16	5 15/16	...	...	...	..	...	...	...	...	...	14
16	1 1/16	2 1/2	4 3/8	6 13/16	...	...	...	..	...	...	...	...	...	16
18	1 1/4	2 3/4	4 15/16	7 5/8	...	...	...	..	...	...	...	...	...	18
20	1 3/8	3 1/16	5 7/16	...	...	...	...	..	...	...	...	...	...	20

TABLE LX

From Roberts' "Track Formulæ and Tables."

Wt. one yd.	One ton lays	Lgth. rail	Wt. of 1 rail	Material per mile of track							Material per 100 linear feet of track							Lgth. of angle bars	Wt. in lbs. of 1 pair angle bars	Track bolts	
				Rail	Ties	Spk.	Angle bars		Track bolts		Rail	Ties	Spk.	Angle bars		Track bolts				Size	No. in keg
Lbs.	Lin. ft.	Ft.	Tons	Tons	No.	Kgs.	No. prs.	Tons	No.	Kgs.	Tons	No.	Kgs.	No. prs.	Tons	No.	Kgs.				
110	30.5	30	0.491	172.86	3168	33.8	358	15.90	2148	21.1	3.274	60.0	0.64	6.780	0.301	40.68	0.399	34″	99.5	1×4¾″	102
110	30.5	33	0.540	172.86	3200	34.1	328	14.57	1968	19.3	3.274	60.6	0.65	6.215	0.276	37.29	0.366	34″	99.5	1×4¾″	102
100	33.6	30	0.446	157.14	3168	33.8	358	13.90	2148	14.5	2.976	60.0	0.64	6.780	0.263	40.68	0.275	34″	87.0	⅞×4½″	148
100	33.6	33	0.491	157.14	3200	34.1	328	12.74	1968	13.2	2.976	60.6	0.65	6.215	0.241	37.29	0.252	34″	87.0	⅞×4½″	148
90	37.3	30	0.402	141.43	3168	33.8	358	11.83	2148	14.0	2.678	60.0	0.64	6.780	0.224	40.68	0.266	34″	74.0	⅞×4¼″	153
90	37.3	33	0.442	141.43	3200	34.1	328	10.83	1968	12.8	2.678	60.6	0.65	6.215	0.205	37.29	0.244	34″	74.0	⅞×4¼″	153
85	39.5	30	0.379	133.57	3168	33.8	358	10.88	2148	14.0	2.530	60.0	0.64	6.780	0.206	40.68	0.266	34″	68.1	⅞×4¼″	153
85	39.5	33	0.417	133.57	3200	34.1	328	9.93	1968	12.8	2.530	60.6	0.65	6.215	0.144	37.29	0.244	34″	68.1	⅞×4¼″	153
80	42.0	30	0.357	125.71	3168	33.8	358	10.08	2148	14.0	2.381	60.0	0.64	6.780	0.191	40.68	0.266	34″	63.1	⅞×4¼″	153
80	42.0	33	0.393	125.71	3200	34.1	328	9.24	1968	12.8	2.381	60.6	0.65	6.215	0.180	37.29	0.244	34″	63.1	⅞×4¼″	153
75	44.8	30	0.335	117.86	3168	33.8	358	9.35	2148	9.6	2.232	60.0	0.64	6.780	0.177	40.68	0.181	34″	58.5	¾×4⅛″	225
75	44.8	33	0.368	117.86	3200	34.1	328	8.57	1968	8.7	2.232	60.6	0.65	6.215	0.162	37.29	0.166	34″	58.5	¾×4⅛″	225
72	41.7	30	0.321	113.14	3168	33.8	358	8.63	2148	9.6	2.143	60.0	0.64	6.780	0.163	40.68	0.181	34″	54.0	¾×4⅛″	225
70	48.0	30	0.312	110.00	3168	33.8	358	8.73	2148	9.6	2.083	60.0	0.64	6.780	0.165	40.68	0.181	34″	54.6	¾×4⅛″	225
67	50.2	30	0.299	105.29	3168	38.8	358	6.04	1432	6.4	1.994	60.0	0.64	6.780	0.114	27.12	0.121	24″	37.8	¾×4⅛″	225
66	50.9	30	0.295	103.71	3168	38.8	358	5.43	1432	6.4	1.964	60.0	0.64	6.780	0.163	27.12	0.121	24″	34.0	¾×4⅛″	225
65	51.7	30	0.290	102.14	3168	33.8	358	5.69	1432	6.4	1.933	60.0	0.64	6.780	0.108	27.12	0.121	24″	35.6	¾×4⅛″	225
61½	54.6	30	0.275	96.64	3168	33.8	358	5.18	1432	6.4	1.830	60.0	0.64	6.780	0.101	27.12	0.121	24″	32.4	¾×4⅛″	225
60	56.0	30	0.268	94.29	3168	33.8	358	5.18	1432	5.8	1.786	60.0	0.64	6.780	0.101	27.12	0.110	24″	32.4	¾×3½″	247
58¼	57.7	30	0.260	91.54	3168	33.8	358	5.43	1432	5.8	1.734	60.0	0.64	6.780	0.103	27.12	0.110	24″	34.0	¾×3½″	247
56	60.0	30	0.250	88.00	3168	33.8	358	5.43	1432	5.8	1.667	60.0	0.64	6.780	0.103	27.12	0.110	24″	34.0	¾×3½″	247
54	62.2	30	0.241	84.86	3168	33.8	358	4.62	1432	5.8	1.607	60.0	0.64	6.780	0.087	27.12	0.110	24″	28.9	¾×3½″	247
52	64.6	30	0.232	81.71	3168	33.8	358	4.35	1432	5.8	1.548	60.0	0.64	6.780	0.082	27.12	0.110	24″	27.2	¾×3½″	247
50	67.2	30	0.223	78.57	3168	33.8	358	4.08	1432	5.8	1.488	60.0	0.64	6.780	0.077	27.12	0.110	24″	25.5	¾×3½″	247

Note. — Data for angle bars and track bolts computed on basis of using 10 per cent of 24′, 26′ and 28′ rails with 30′ rails and 10 per cent of 24′, 26′, 28′ and 30′ rails with 33′ rails. The data computed on basis of using 18 ties per 30′ rail and 20 ties per 33′ rail. Spike 375 to keg of 200 pounds. One ton = 2240 pounds.

TABLE LXI

Conversion of linear feet of 100 ft. wide right-of-way into acres

From Roberts' "Track Formulæ and Tables."

Acres	Lin. ft. R. of W.	Acres	Lin. ft. R. of W.	Acres	Lin. ft. R. of W.	Acres	Lin. ft. R. of W.
1.0	435.6	11.0	4791.6	21.0	9147.6	31.0	13503.6
2.0	871.2	12.0	5227.2	22.0	9583.2	32.0	13939.2
3.0	1306.8	13.0	5662.8	23.0	10018.8	33.0	14374.8
4.0	1742.4	14.0	6098.4	24.0	10454.4	34.0	14810.4
5.0	2178.0	15.0	6534.0	25.0	10890.0	35.0	15246.0
6.0	2613.6	16.0	6969.6	26.0	11325.6	36.0	15681.6
7.0	3049.2	17.0	7405.2	27.0	11761.2	37.0	16117.2
8.0	3484.8	18.0	7840.8	28.0	12196.8	38.0	16552.8
9.0	3920.4	19.0	8276.4	29.0	12632.4	39.0	16988.4
10.0	4356.0	20.0	8712.0	30.0	13068.0	40.0	17424.0

Acres	Lin. ft.	Acres	Lin. ft.	Acres	Lin. ft.	Acres	Lin. ft.	Acres	Lin. ft.
	2.2		89.3		176.4		263.5		350.7
0.01		0.21		0.41		0.61		0.81	
	6.5		93.7		180.8		267.9		355.0
0.02		0.22		0.42		0.62		0.82	
	10.9		98.0		185.1		272.3		359.4
0.03		0.23		0.43		0.63		0.83	
	15.2		102.4		189.5		276.6		363.7
0.04		0.24		0.44		0.64		0.84	
	19.6		106.7		193.8		281.0		368.1
0.05		0.25		0.45		0.65		0.85	
	24.0		111.1		198.2		285.3		372.4
0.06		0.26		0.46		0.66		0.86	
	28.3		115.4		202.6		289.7		376.8
0.07		0.27		0.47		0.67		0.87	
	32.7		119.8		206.9		294.0		381.2
0.08		0.28		0.48		0.68		0.88	
	37.0		124.1		211.3		298.4		385.5
0.09		0.29		0.49		0.69		0.89	
	41.4		128.5		215.6		302.7		389.9
0.10		0.30		0.50		0.70		0.90	
	45.7		132.9		220.0		307.1		394.2
0.11		0.31		0.51		0.71		0.91	
	50.1		137.2		224.3		311.5		398.6
0.12		0.32		0.52		0.72		0.92	
	54.5		141.6		228.7		315.8		402.9
0.13		0.33		0.53		0.73		0.93	
	58.8		145.9		233.0		320.2		407.3
0.14		0.34		0.54		0.74		0.94	
	63.2		150.3		237.4		324.5		411.6
0.15		0.35		0.55		0.75		0.95	
	67.5		154.6		241.8		328.9		416.0
0.16		0.36		0.56		0.76		0.96	
	71.9		159.0		246.1		333.2		420.4
0.17		0.37		0.57		0.77		0.97	
	76.2		163.4		250.5		337.6		424.7
0.18		0.38		0.58		0.78		0.98	
	80.6		167.7		254.8		341.9		429.1
0.19		0.39		0.59		0.79		0.99	
	84.9		172.1		259.2		346.3		433.4
0.20		0.40		0.60		0.80		1.00	
	89.3		176.4		263.5		350.7		437.8

TABLE LXII. — Drainage Areas

$$\text{Sq. ft. opening} = C\sqrt[4]{(\text{drainage area, in acres})^3}$$

From Roberts' "Track Formulæ and Tables."

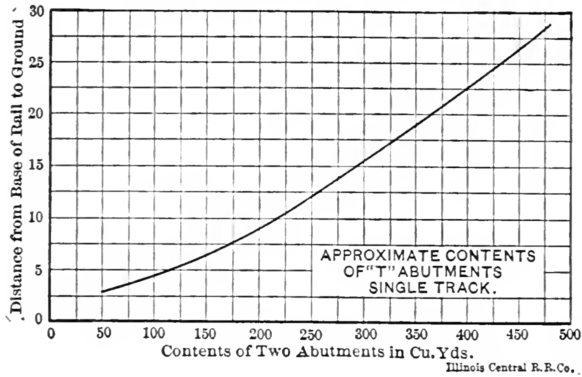
Acres drained	Steep slopes $C = 1$	Moderately steep slopes $C = 2/3$	Rolling land $C = 1/3$	Flat farm lands $C = 1/5$
	Sq. ft. opening required			
10	5.6	2.7	1.9	1.1
20	9.5	6.3	3.2	1.9
30	12.8	8.5	4.3	2.6
40	15.9	10.6	5.3	3.2
50	18.8	12.5	6.3	3.8
60	21.5	14.3	7.2	4.3
70	24.2	16.1	8.1	4.8
80	26.7	17.8	8.9	5.3
90	29.2	19.5	9.7	5.8
100	31.6	21.1	10.5	6.3
150	42.9	28.6	14.3	8.6
160	44.9	29.9	15.0	9.0
200	53.2	35.5	17.7	10.6
240	60.9	40.6	20.3	12.2
300	72.1	48.1	24.0	14.4
320	75.9	50.6	25.3	15.2
400	89.4	59.6	29.8	17.9
480	102.5	68.3	34.2	20.5
500	105.7	70.5	35.2	21.1
560	115.1	76.7	38.4	23.0
600	121.2	80.8	40.4	24.2
640	127.2	84.8	42.4	25.4
800	150.4	100.3	50.1	30.1
1000	177.8	118.5	59.3	35.6
2000	299.0	199.3	99.7	59.8
2500	353.5	235.7	117.8	70.7
3600	464.8	309.9	154.9	93.0
5000	594.6	396.4	198.2	118.9
6000	681.7	454.5	227.2	136.3
7000	765.3	510.2	255.1	153.1
8000	845.9	563.9	282.0	169.2
9000	924.4	616.3	308.1	184.9
10 000	1000.0	666.7	333.3	200.0

I. C. R.R. Co., 1906. Extended, 1909, by S. S. R.

TABLE LXIII

From Roberts' "Track Formulæ and Tables."

CURVES OF CONTENTS OF ABUTMENTS



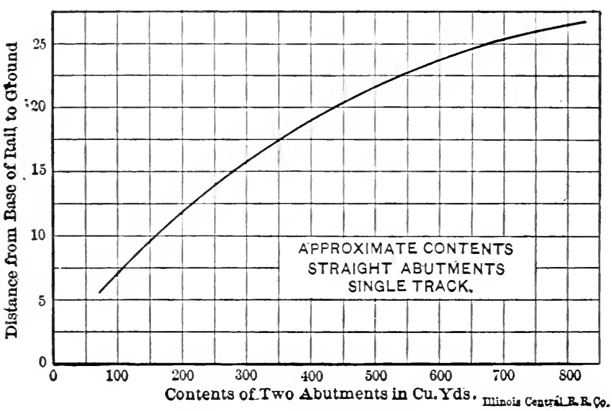


TABLE LXIV. — Cost Curves Timber Trestles

From Roberts' "Track Formulæ and Tables."

Unit Prices.

Material in Place.

Creosoted Material:	
Caps	\$55.00 per M. Ft. B.M.
Stringers	55.00 per M. Ft. B.M.
Other material	43.00 per M. Ft. B.M.
Piles	0.37 per linear foot.
Untreated Material:	
Caps	\$42.00 per M. Ft. B.M.
Stringers	42.00 per M. Ft. B.M.
Other Material	30.00 per M. Ft. B.M.
Piles	0.24 per M. Ft. B.M.
Iron	0.05 per pound.

To the cost of the trestle obtained from the following curves by multiplying the cost per foot by the length, *add* for single track:

\$25.00 for two bulkheads in all cases.

0.70 per linear foot for ties and ballast for ballast floors only.

For double track add:

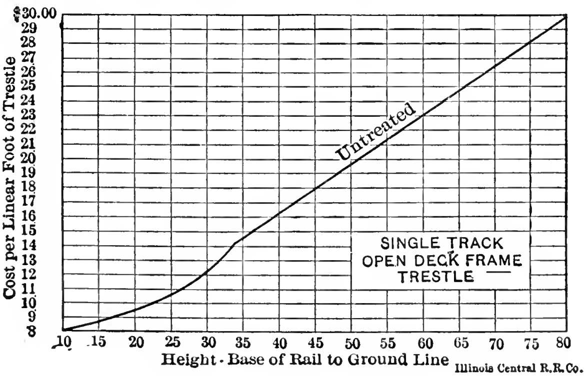
\$50.00 for two bulkheads in all cases.

1.40 per linear foot for ties and ballast for ballast floors only.

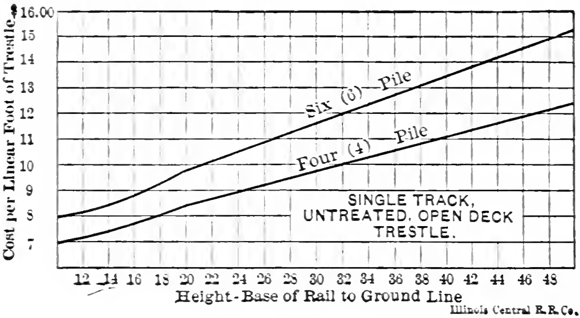
Creosoted open deck trestles have piles, caps and braces creosoted.

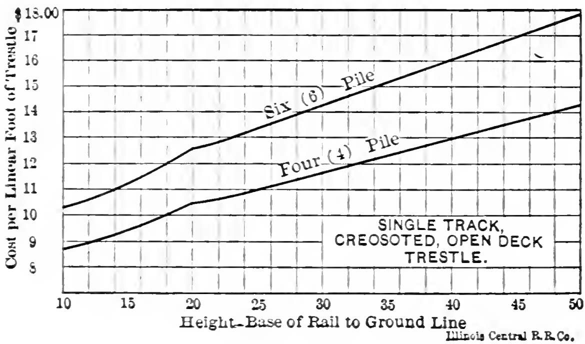
Ballast floor trestles have all material creosoted.

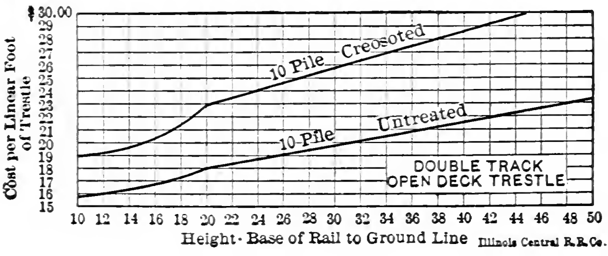
The cost per linear foot given by the following curves does *not* include longitudinal bracing. This should be figured separately for each trestle as the conditions at the opening may require.



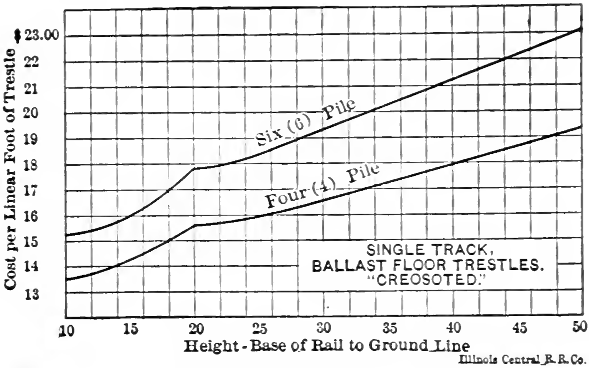
COST CURVES TIMBER TRESTLES — (*Continued*)







COST CURVES TIMBER TRESTLES — (*Continued*)



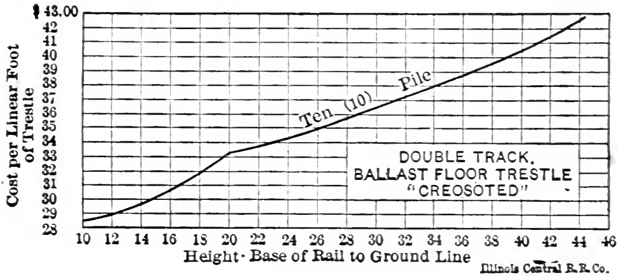


TABLE LXV. — PRELIMINARY CULVERT ESTIMATES AND BRIDGE WEIGHTS

Diameter, inches	Iron pipe			Concrete arch			
	Area, sq. ft.	Weight, lbs. per lin. ft.	Cu. yds. masonry, two ends	Dimensions, feet	Area, sq. ft.	Cu. yds. per ft. length	Cu. yds., two ends
12	0.79	72.5	4.0	2× 2	3.5	0.57	8.0*
16	1.40	107.8	5.0	3× 4	10.9	1.06	26.1*
18	1.77	127.7	5.7	4× 6	22.0	1.63	60.9*
20	2.18	165.7	6.5	6× 6	30.4	3.10	42.5†
24	3.14	200.6	7.8	8× 8	54.4	3.99	76.2†
30	4.91	290.2	10.8	10×10	85.4	5.57	109.0†
36	7.07	391.6	13.2	12×12	123.3	6.89	168.4†
42	9.62	512.2	17.8	15×15	193.2	8.81	278.5†
48	12.57	665.2	22.3	20×18	306.2	12.08	499.0†

* Square end walls. † Thirty-degree wing walls.

Bridge Weights*

W = weight of steel in pounds. l = span in feet for truss bridges and length overall for girder bridges.

Plate Girders:

Deck plate girder	$W = 12\,l^2 + 150\,l$
Through plate girder, iron floor system	$W = 12\,l^2 + 500\,l$
Through plate girder, large ties on shelf or flange angles	$W = 9\frac{1}{4}\,l^2 + 150\,l$
Through plate girder, solid iron floor	$W = 12\,l^2 + 800\,l$

Riveted Lattice Bridges:

Deck bridge, cross-ties on top chord	$W = 7\,l^2 + 200\,l$
Through bridge, iron floor system	$W = 7\,l^2 + 300\,l$

Pin Connected Bridges:

Deck span, cross-ties on top chord	$W = 5\,l^2 + 250\,l$
Deck span, iron floor system	$W = 5\,l^2 + 475\,l$
Through span, iron floor system	$W = 7\,l^2 + 650\,l$

TABLE LXVI. — Preliminary Ballast Estimates

Ties 6″ × 8″ × 8′.

18 ties to a 33-ft. rail.

Tabular quantities are in cubic yards per mile.

Depth under tie in inches	Gravel 3″ above tie at center slope 2–1		Broken stone level with top of ties 1 ft. outside slopes 1½–1	
	Single track	Double track 14′ C. to C.	Single track	Double track 14′ C. to C.
6	1400	4159	1965	4418
8	1737	4952	2396	5306
10	2095	5767	2845	6210
12	2476	6603	3309	7131

* From "Modern Framed Structures" by Johnson, Bryan and Turneaure.

CHAPTER VI

TURNOUTS AND CROSSOVERS

Let F = frog angle.
S = switch angle.
f = toe length of frog from theoretic point.
T = heel spread of switch.
t = point thickness of switch rail.
t' = point thickness of actual frog point.
N = number of frog.

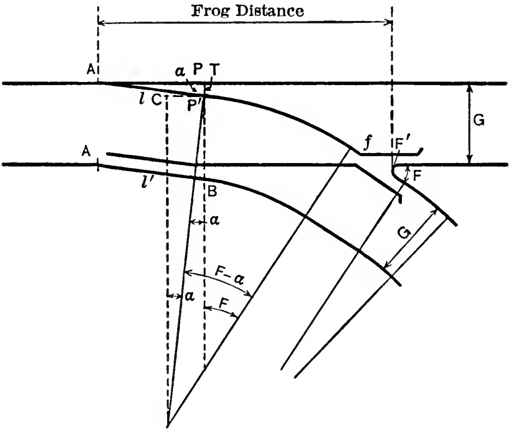


FIG. 26.

l = length of switch rail.
R = radius of turnout curve.
G = gage of track.

$$N = \tfrac{1}{2}\cot\tfrac{1}{2}F, \quad \sin S = \frac{T-t}{1}.$$

$$\text{Frog distance} = 1 + [G - (T + f\sin F)]\cot\tfrac{1}{2}(F+S) + f\cos F + t'N$$

$$R + \tfrac{1}{2}G = \frac{G - (T + f\sin F)}{2\sin\frac{1}{2}(F-S)\sin\frac{1}{2}(F+S)}.$$

Values for F, R, frog distance, S, and other quantities for varying values of N and l are given in Tables XLVII and XLVIII, and for spring rail frogs in Table XLIX.

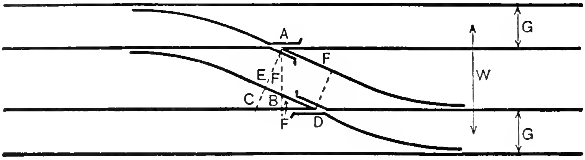


FIG. 27.

$$BD = (W - G)\cot F - \frac{G}{\sin F},$$

$$ED = \frac{W - G}{\sin F} - G\cot F.$$

Total length = $BD + 2 \times$ frog distance to theoretic point.

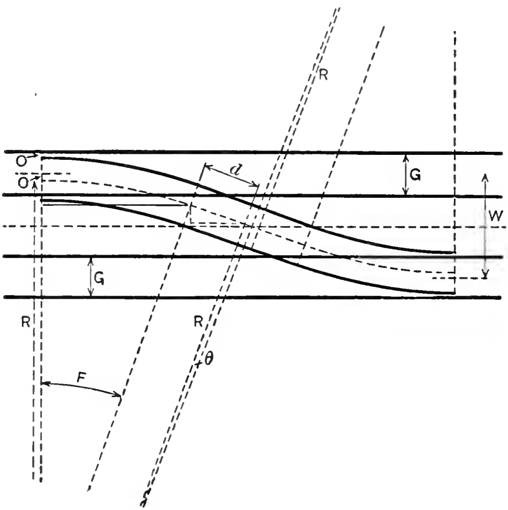


FIG. 28.

$$O = T - (R + \tfrac{1}{2}G)\text{ vers } S,$$

$$\text{Vers }(F + \theta) = \frac{\frac{W}{2} - d\sin F - O}{R},$$

$$\theta = (F + \theta) - F,$$
$$p = l - (R + \tfrac{1}{2} G) \sin S,$$
$$L = \text{length of crossover} = 2 \left\{ R \sin (F + \theta) + d \cos F \mp p \right\}.$$

Distance between frogs $= L - 2 \times$ frog distance.

Length of connecting rail $= 2\, R \dfrac{\theta}{57 \cdot 3}$.

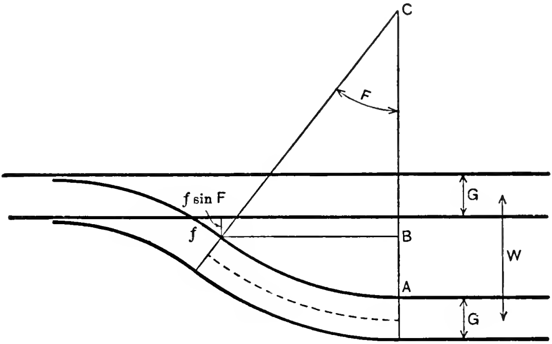


FIG. 29.

$$R = \frac{W - G - f' \sin F}{\text{vers } F} + \tfrac{1}{2} G.$$

Curve length is $R \dfrac{F}{57 \cdot 3}$.

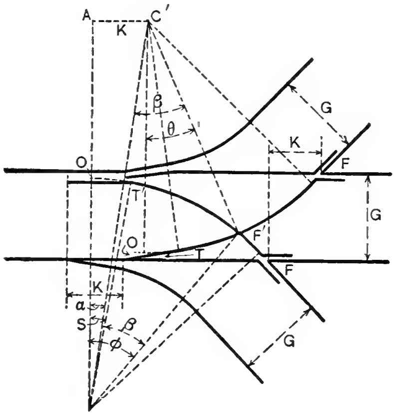


FIG. 30

K and the elements for both turnouts with equal frog angles F are known. To find F'' and the crotch frog distance.

$$O = T - (R + \tfrac{1}{2} G) \text{ vers } S,$$

$$AC = 2(R + O),$$

$$\frac{K}{AC} = \tan \alpha, \qquad CC' = \frac{K}{\sin \alpha} \quad \text{or} \quad \frac{AC}{\cos \alpha},$$

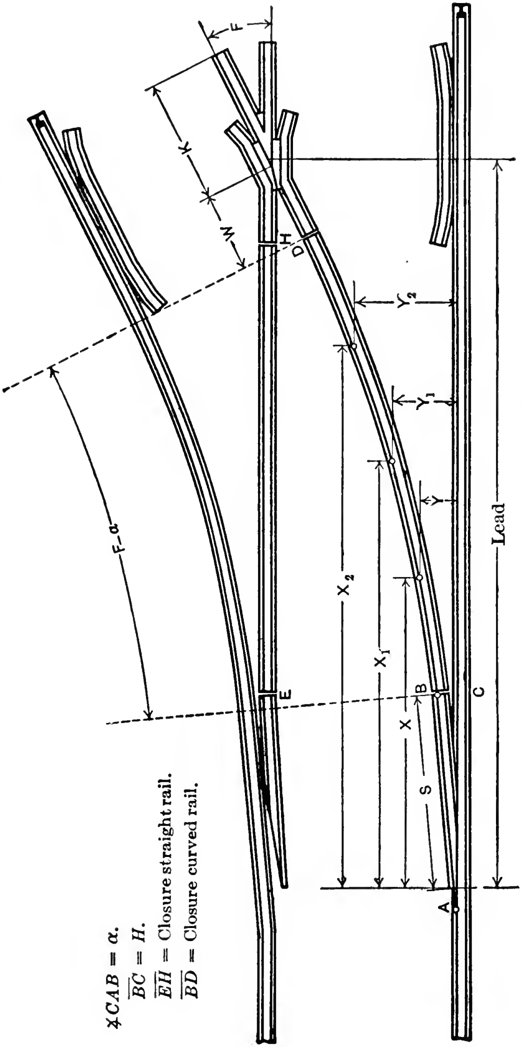
$$\frac{AC}{2(R + \frac{1}{2} G)} = \cos \beta, \qquad F'' = 2\beta,$$

$$\phi = \alpha + \beta,$$

$$\theta = \beta - \alpha.$$

Crotch frog distance from first point is

$$L = (R + \tfrac{1}{2} G)(\sin \phi - \sin S) + l + \frac{N''}{32}.$$



$\measuredangle CAB = \alpha$.
$\overline{BC} = H$.
$\overline{EH}$ = Closure straight rail.
$\overline{BD}$ = Closure curved rail.

Fig. 31.—Tables LXVII, LXVIII, LXIX.
(From Roberts' "Track Formulæ and Tables.")

TABLE LXVII. — PROPERTIES OF FROGS AND SWITCHES AND THEORETICAL SWITCH LEADS

In all cases gage is considered 4 ft. $8\frac{1}{2}$ in.

Properties of frogs. Thickness of all frog points 0½″											Properties of switches for all switches. Thickness of point =0¼″ and heel distance=H=6¼″			Theoretical leads				
N = frog number	F = frog angle	W = length theoretical point to toe		K = length theoretical point to heel		Total length		Spread at toe	Spread at heel	S = length of switch rail		a = switch angle	R = radius of center line	D = degree of lead curve	Distance point of switch rail to theoretical point of frog	Closure straight rail	Closure curved rail
I	II	III		IV		V		VI	VII	VIII		IX	X	XI	XII	XIII	XIV
	Degrees	Ft.	In.	Ft.	In.	Ft.	In.	Feet	Feet	Ft.	In.	Degrees	Feet	Degrees	Feet	Feet	Feet
4	14.250	3	2	5	4	8	6	0.79	1.32	11	0	2.605	112.26	52.899	37.05	22.88	23.29
5	11.421	3	7	6	5	10	0	0.71	1.28	11	0	2.605	183.22	31.673	42.77	28.19	28.55
6	9.527	4	0	7	0	11	0	0.66	1.16	11	0	2.605	273.95	21.033	48.11	33.11	33.38
7	8.171	4	5	8	1	12	6	0.63	1.15	16	6	1.736	364.88	15.789	61.94	41.02	41.24
8	7.153	4	9	8	9	13	6	0.59	1.09	16	6	1.736	488.71	11.744	67.47	46.22	46.42
9	6.360	6	0	10	0	16	0	0.67	1.11	16	6	1.736	616.27	9.308	72.24	49.74	49.92
9½	6.026	6	0	10	0	16	0	0.63	1.05	16	6	1.736	699.97	8.192	74.90	52.40	52.58
10	5.725	6	0	10	6	16	6	0.60	1.05	16	6	1.736	790.25	7.255	77.51	55.01	55.17
11	5.205	6	0	11	6	17	6	0.54	1.05	22	0	1.302	940.21	6.097	92.06	64.06	64.20
12	4.772	6	5	12	1	18	6	0.53	1.01	22	0	1.302	1136.34	5.044	97.25	68.83	68.96
15	3.818	7	8	14	10	22	6	0.51	0.99	33	0	0.868	1744.38	3.284	133.02	92.36	92.46
16	3.580	8	0	16	0	24	0	0.50	1.00	33	0	0.868	2005.98	2.857	135.95	94.95	95.05
18	3.182	8	10	17	8	26	6	0.49	0.98	33	0	0.868	2587.66	2.214	146.38	104.54	104.61
20	2.864	9	8	19	4	29	0	0.48	0.97	33	0	0.868	3262.98	1.756	156.35	113.68	113.76
24	2.387	11	4	23	2	34	6	0.47	0.97	33	0	0.868	4932.77	1.162	175.09	130.66	130.77

TABLE LXVIII. — Practical Switch Leads

In all cases gage is considered 4 ft. $8\frac{1}{2}$ in.

Practical leads														
N = frog number	R_1 = radius of center line	D_1 = degree of lead curve	Rectangular coördinates to the quarter and center points on gage side of curved rail, referred to point of switch rail as origin						T_s = tangent adjacent to switch rail	T_f = tangent adjacent to toe of frog	L' = distance actual point of switch rail to theoretical point of frog	*Lead* = distance actual point of switch rail to actual point of frog	Closure for straight rail	Closure for curved rail
			X	X_1	X_2	Y	Y_1	Y_2						
I	XV	XVI	XVII	XVIII	XIX	XX	XXI	XXII	XXIII	XXIV	XXV	XXVI	XXVII	XXVIII
	Feet	Degrees	Feet	Feet	Feet	Feet	Feet	Feet	Feet	Feet	Feet	Feet		
4	110.69	53.707	17.74	23.44	29.75	0.97	1.67	2.79	1.03	0.00	37.77	37.94	1-23.60	1-24
5	174.34	33.333	17.78	24.54	31.27	0.95	1.61	2.62	0.00	0.82	42.26	42.47	1-27.68	1-28
6	265.39	21.718	19.07	27.13	35.15	1.01	1.74	2.72	0.00	0.66	47.73	47.98	1-32.73	1-33
7	362.08	15.875	26.72	36.93	47.11	0.97	1.71	2.74	0.00	0.19	61.81	62.10	1-13.89 1-27	1-14.11 1-27
8	487.48	11.774	28.37	39.91	51.45	1.02	1.78	2.91	0.30	0.00	67.65	67.98	1-16.40 1-30	1-16.60 1-30
9	605.18	9.478	28.75	40.98	53.19	1.02	1.76	2.75	0.00	0.57	71.91	72.28	1-16.41 1-33	1-16.59 1-33
9½	695.45	8.246	30.31	43.35	56.37	1.06	1.82	2.83	0.76	0.00	75.32	75.71	1-25.82 1.27	1-26 1-27
10	790.25	7.255	30.28	44.05	57.81	1.06	1.84	2.85	0.00	0.00	77.51	77.93	1-27 1-28	1-27.17 1-28
11	922.65	6.213	40.74	56.47	72.19	1.08	1.84	2.87	2.99	0.00	93.85	94.31	1-32.85 1-33	2-33
12	1098.73	5.216	43.99	60.65	77.28	1.15	1.90	2.91	5.33	0.00	100.30	100.80	1-23.88 2-24	3-24
15	1744.38	3.284	55.49	77.95	100.41	1.01	1.78	2.85	0.00	0.00	132.66	133.28	2-33 1-25.9	2-33 1-26
16	1993.24	2.883	58.16	81.76	105.35	1.04	1.82	2.87	1.56	0.00	136.90	137.57	1-29.90 2-33	1-30 2-33
18	2546.31	2.242	58.73	84.46	110.10	1.04	1.82	2.86	0.00	1.08	145.76	146.51	1-25.93 3-26	4-26
20	3257.26	1.759	61.84	90.21	118.59	1.08	1.88	2.93	0.44	0.00	156.59	157.42	1-26.92 2-27 1-33	3-27 1-33
24	4886.16	1.173	67.82	100.21	132.59	1.27	1.97	3.00	2.43	0.00	176.22	177.22	1-32.89 3-33	4-33

TABLE LXIX. — Table of Switch Leads for Spring Frogs

Thickness of switch rail at point and bluntness of point of frog not considered.

Frog number, N	Frog angle, F	Distance point to toe, W	Distance point to heel, K	Length of switch rail, S	Heel distance, H	Switch angle, a	Gage, G	Theoretical leads: Length in feet, L	Theoretical leads: Degree of curve, D	Practical leads: Length in feet	Practical leads: Degree of curve	Practical leads: Rails required	Frog number, N
6	9.533°	7′ 0″	8′ 0″	10′ 0″ 12′ 0″	5″ 5″	2.388° 1.990°	4′ 8½″ 4′ 8½″	46.89 49.94	24.083° 24.583°	47.00	24.150°	2-30	6
7	8.167°	7′ 0″	8′ 0″	10′ 0″ 12′ 0″ 15′ 0″	5″ 5″ 5″	2.388° 1.990° 1.592°	4′ 8½″ 4′ 8½″ 4′ 8½″	52.61 56.02 60.55	16.283° 16.750° 17.133°	56.00	16.750°	2-27 2-10	7
8	7.150°	7′ 0″	8′ 0″	12′ 0″ 15′ 0″	5″ 5″	1.990° 1.592°	4′ 8½″ 4′ 8½″	61.73 66.68	12.100° 12.533°	67.00	12.600°	2-30 2-15	8
9	6.367°	7′ 0″	8′ 0″	15′ 0″	5″	1.592°	4′ 8½″	72.48	9.467°	73.00	9.533°	2-27 2-26	9
9½	6.033°	7′ 0″	8′ 0″	15′ 0″ 16′ 6″	5″ 5″	1.592° 1.448°	4′ 8½″ 4′ 8½″	75.31 77.84	8.333° 8.450°	77.50	8.583°	2-30 2-24	9½
10	5.733°	7′ 0″	8′ 0″	15′ 0″ 16′ 6″	5″ 5″	1.592° 1.448°	4′ 8½″ 4′ 8½″	78.07 80.70	7.383° 7.500°	80.50	7.500°	2-33 2-27	10
12	4.767°	7′ 0″	8′ 0″	16′ 6″ 18′ 0″	5″ 5″	1.448° 1.326°	4′ 8½″ 4′ 8½″	91.81 94.67	4.867° 4.933°	97.00	5.083°	2-30 2-27 2-15	12
15	3.817°	7′ 0″	8′ 0″	18′ 0″ 20′ 0″	5″ 5″	1.326° 1.194°	4′ 8½″ 4′ 8½″	109.91 114.14	2.950° 3.033°	114.50	3.033°	2-33 4-27	15

From Roberts' "Track Formulæ and Tables."

CHAPTER VII

AZIMUTH, LATITUDE, AND TIME

Meridian Determinations. 1. *By an Observation on Polaris at Elongation.* — Find the time of elongation from Table LXXI. Just before the time of elongation set the transit over a point and with the alidade clamped turn the telescope on the star, clamp the limb and follow the star with the slow motion till it seems to stop traveling east or west as the case may be. Plunge the telescope and range out a stake in line. If the observer is quick he may transit the telescope and take a second observation with the telescope reversed before the star moves in azimuth appreciably. Compute the azimuth of the star at elongation from the formula

$$\text{Sin } Z = \frac{\text{sin pole distance}}{\text{cos latitude}}.$$

The pole distance is found in Table LXX. The latitude may be taken to the nearest minute from a good map or determined as in the next article. Next morning set again over the transit point and from the established line set off Z and range out the meridian.

2. *By an Observation on Polaris at Any Time.* — This is not so good as the preceding method but is often more convenient and sufficiently precise for practically all field purposes.

Set the transit over a point and at any instant set the intersection of the wires on the star by clamps and slow motions. Range out a line in the azimuth plane of the star. Compute the azimuth of this line from the equation

$$\text{Sin } \tfrac{1}{2} Z = \pm \sqrt{\frac{\sin (s - a) \sin (s - l)}{\sin a \sin l}},$$

in which $s = \frac{1}{2}(d + a + l)$, d being the pole distance, a the co-altitude, and l the co-latitude.

Since there are two equal azimuth angles — one east, the other west — for any given altitude, and four positions of the star that will give the same Z angle — two east and two west of the meridian — the observer must know from the observed motion of the star in which quadrant of its apparent revolution the star is, or he may know from the times of observation and culmination, the latter taken from Table LXXI.

3. *By Equal Altitudes of a Star.* — In the southern hemisphere or elsewhere when not convenient to use Polaris, use equal altitudes of any star that may be observed on both sides of the meridian at reasonable altitudes of between 20° and 40°.

Select a star; set up the instrument over a fixed point; clamp one horizontal motion, and with the other and the vertical motion of the telescope bring the intersection of the wires approximately on the star; clamp both motions; set the vertical circle to read a whole minute or 0.01° such that the star is approaching the horizontal wire; follow with the azimuth motion so that when the star is on the horizontal wire it shall be also on the vertical wire, *i.e.*, at the intersection of the wires. Plunge the telescope and range out a stake some distance ahead. Repeat once or twice at intervals of from ten to twenty minutes and range out other points, numbering the points 1, 2, 3, etc. Set the vertical circle to read the last measured altitude and wait till the star again reaches it when an exact setting is made and a stake ranged out; set at the next altitude and repeat the operation until as many stakes are set on one side of the meridian as on the other, numbering them 3, 2, 1. The extra stakes are for checks on the work. In the morning bisect the angles 1-instrument-1, 2-instrument-2, etc., and set points which should coincide but may not. If they do not coincide set a point to average them unless there is enough variation to indicate an error. To average them select the most east or west of the middle points as an origin and measure the distance to each of the other middle points, add and divide by the number of middle points. The result is the distance of the average point from the origin. Use this and the instrument point to define the meridian. The times should be at least from one and one-half to two hours either side of the meridian. A star reaching culmination early in the night should be chosen. Approximate north and south will be known by the needle or the daytime position of the sun.

4. *By a Transit Observation on the Sun.* — Measure the altitude of the sun and its azimuth from any fixed line at the same instant; substitute the altitude, the latitude of the place determined from a good map to the nearest minute or by one of the methods of the next article, and the declination of the sun (explained later) in the formula,

$$\sin \tfrac{1}{2} Z = \pm \sqrt{\frac{\sin (s' - \phi) \sin (s' - h)}{\cos \phi \cos h}},$$

in which Z is the azimuth of the sun measured from the meridian, ϕ is the latitude, h is the altitude, and $s' = \frac{1}{2}(90 - \delta + \phi + h)$, δ being the declination taken with its proper sign, + when north and − when south. The difference between Z and the observed azimuth from the fixed line gives the azimuth of that line from which the meridian may be run out.

To make the observation, set the transit over a point at least one and one-half hours before or after noon and as long after sunrise or before sunset, and use any fixed distant point for zero azimuth. Use a piece of colored or smoked glass in the eyepiece cap or before the object glass, and bring the cross wires tangent to the sun's disc, approximately by hand motion of the alidade and telescope and clamps and precisely by both slow motions together; read the vertical circle and the azimuth. Subtract the refraction correction of Table LXX for the measured altitude from the vertical circle reading.

If the horizontal wire has been made tangent to the lower limb (edge) of the sun, add the sun's semi-diameter, 16^m or 0.26667°, to the corrected vertical circle reading; if the upper limb has been observed subtract the semi-diameter. The result is the correct altitude of the sun at the instant of observation. The sun's semi-diameter is not exactly 16^m but varies during the year and may be had from the Nautical Almanac mentioned later if greater precision is desired.

The measured azimuth from the reference line is increased or diminished according as the edge nearest or farthest from the reference line is observed, by $16' \times \sec h$ or $0.27° \sec h$. If the observer is satisfied to quarter the sun's image with the cross wires no semi-diameter correction is required either for altitude or azimuth.

Explanation of Astronomical Terms. — Celestial bodies are located on the celestial sphere by coördinates corresponding to latitude and longitude of the terrestrial sphere. The celestial equator is a circle cut from the celestial sphere by the terrestrial equatorial plane extended, and angular distances north or south of the celestial equator are called declinations, corresponding to terrestrial latitude. An arbitrary meridian of the celestial sphere is chosen as the reference for what is called right ascension, corresponding to longitude. Right ascension is not used in the methods of this chapter.

The declination of the sun changes constantly. The Nautical Almanac or American Ephemeris, published by the Government annually, gives the hourly change. Several instrument makers distribute gratis in pocket form reprints of that part of the Nautical Almanac relating to the sun and useful to surveyors. Every surveyor should have one of these reprints.

To determine the declination at a given place and hour on a given day the approximate Greenwich time of the observation must be known. In North America if standard time is carried by the observer, he will know what meridian time he carries and hence how many hours slow he is of Greenwich time; Eastern time is 5 hours, Central time 6 hours, Mountain time 7 hours, and Pacific time 8 hours slow of Greenwich time. The Almanac gives the coördinates of the sun for Greenwich apparent and mean noon, and some reprints give the coördinates for one and some for the other.

Noon. — The sun does not appear to move at a uniform rate around the earth. Apparent noon is the instant the sun appears to cross the meridian. Mean noon is the instant that an imaginary sun, moving at a uniform rate and making the same number of revolutions in a year as the real sun, appears to cross the meridian. Mean time is time according to the mean sun and is what is carried by clocks and watches. The difference between apparent and mean time is called the equation of time and is found in the Nautical Almanac and reprints. It is sometimes to be added and sometimes subtracted to convert one time into the other. The sign to be used is given with the equation.

Assuming standard time at any place where central time is used, 9 o'clock in the morning, being 3 hours before noon, would be $(6 - 3)$ hours $= 3$ hours after noon at Greenwich, and the declination of the table for a given day must be corrected for 3 hours change. In the table $-$ means south and $+$ north. If the change is marked $-$ the sun is going south, and north or $+$ declination is decreasing, while south or $-$ declination is increasing.

If local mean time is carried by the observer he must know his approximate longitude and must convert this into time, $15°$ to the hour, to find the difference between Greenwich and local time. In either case if his reprint gives the position of the sun for apparent noon, he must apply the equation of time to his mean time to find the local or standard apparent time.

The positions of heavenly bodies are figured from the center of the earth. With a body as near as the sun this gives rise to a correction to altitudes measured at the surface known as the correction for parallax. It is but a few seconds and is neglected in this discussion. The methods of this chapter are such as are suited to field instruments reading to minutes or 0.01 of a degree and many refinements necessary in astronomical work are omitted.

Latitude. 1. *By Polaris.* — The altitude of the north pole equals the latitude of the place of observation. Measure the altitude of Polaris at upper or lower culmination, subtract the refraction correction found in Table LXX. Add or subtract the pole distance of the star as found in Table LXX, according as lower or upper culmination is observed. The result is the latitude.

TABLE LXX. — POLAR DISTANCE OF POLARIS

For January 1 of years named

1915	1918	1921	1924	1927	1930	1933	1936	1939	1942
1.149°	1.133°	1.118°	1.102°	1.087°	1.071°	1.056°	1.041°	1.026°	1.011°

$$\text{Sin of azimuth at elongation} = \frac{\text{sin polar distance}}{\text{cosine latitude}}.$$

Latitude = altitude of Polaris at culmination ± polar distance − refraction correction given below.

Latitude or altitude	Correction	Latitude or altitude	Correction
20°	0.043°	50°	0.013°
30°	0.027°	60°	0.009°
40°			

To observe, set up a little before the time of culmination found in Table LXXI; set the horizontal wire on the star and follow with the slow motions till the star's motion seems to be wholly in azimuth and not at all in altitude. Read the vertical angle.

2. *By a Noon Observation of the Sun.*— Measure the altitude of the sun when at its highest point; subtract the refraction correction of Table LXX for the altitude found; subtract the sun's declination if north or add if south; the result is the co-latitude.

To observe set up the transit a little before noon; set the horizontal wire on the upper or lower limb (edge) of the sun's disc and keep it there as the sun rises and until it has ceased to rise and its motion seems to be wholly in azimuth; read the vertical circle very carefully and subtract or add the sun's semi-diameter according as the upper or lower limb was observed. Colored or smoked glass must be used, preferably in the eyepiece cap rather than before the object glass, but either may answer. The sun's semi-diameter is an average of 16 minutes or

0.26667°. It varies during the year and may be had from the Nautical Almanac or makers' reprint (see previous article) if desired to greater precision.

TABLE LXXI*

Approximate local mean times (counting from noon 24 hours) of the elongations and culminations of polaris in the year 1915 for latitude 40° N.; longitude 6^{H} W. from Greenwich.

Date	East elongation		West elongation		Upper culmination		Lower culmination	
	h.	m.	h.	m.	h.	m.	h.	m.
Jan. 1	0	52.1	12	42.1	6	47.1	18	45.2
15	23	53.0	11	46.8	5	51.8	17	49.9
Feb. 1	22	45.9	10	39.7	4	44.7	16	42.8
15	21	50.6	9	44.2	3	49.4	15	47.5
Mar. 1	20	55.4	8	49.2	2	54.2	14	52.3
15	20	00.2	7	54.0	1	59.0	13	57.1
Apr. 1	18	53.3	6	47.1	0	52.1	12	50.2
15	17	58.1	5	51.9	23	43.1	11	55.0
May 1	16	55.3	4	49.1	22	50.3	10	52.2
15	16	00.4	3	54.2	21	55.4	9	57.3
June 1	14	53.8	2	47.6	20	48.8	8	50.7
15	13	58.9	1	52.7	19	53.9	7	55.8
July 1	12	56.3	0	50.1	18	51.3	6	53.2
15	12	01.5	23	51.5	17	56.5	5	58.4
Aug. 1	10	55.0	22	45.0	16	50.0	4	51.9
15	10	00.1	21	50.1	15	55.1	3	57.0
Sept. 1	8	53.5	20	43.5	14	48.5	2	50.4
15	7	58.6	19	48.6	13	53.6	1	55.5
Oct. 1	6	55.8	18	45.8	12	50.8	0	52.7
15	6	00.8	17	50.8	11	55.8	23	53.9
Nov. 1	4	54.0	16	44.0	10	49.0	22	47.1
15	3	58.9	15	48.9	9	53.9	21	52.0
Dec. 1	2	55.8	14	45.8	8	50.8	20	48.9
15	2	00.6	13	50.6	7	55.6	19	53.7

* From data furnished by the U. S. Coast and Geodetic Survey.

Approximate Determination of Time. 1. *To Find the Error of a Watch.* — The observation for azimuth on the sun may be utilized. The instant of the observation should be noted on the watch. Then

$$\sin t = \frac{\sin Z \cos h}{\cos \delta},$$

in which t is the hour angle in degrees before or after apparent local noon. Reduce t to hours by dividing by 15 and find the apparent local time; apply the equation of time for the day from the Nautical Almanac, and the result is mean local time. The longitude of the place must in general be had from a map, if possible to the nearest minute. The difference between local longitude and the standard meridian whose time is carried reduced to time is applied to the determined mean local time to get the mean standard time. The difference between this and the observed time of the observation is the error of the watch. If the watch carries local time, longitude is needed only to compute change in declination and need not be so precisely determined.

To refer to any calendar day other than the first and fifteenth of each month, subtract 3.94^m for every day between it and the preceding tabular day, or add 3.94^m for every day between it and the succeeding tabular day.

To find the times for the tabular dates after 1915, to the tabular value add 1.36^m for each year after 1915 less 3.9^m for each leap year. In any leap year deduction for that year is not made until March 1.

To find the time of western elongation for Jan. 18, 1919:

For January 15, 1915, western elongation, tabular time is $11^h\ 46.8^m$. $1919 - 1915 = 4$; $4 \times 1.36 = 5.4$. One leap year has intervened, and, therefore, $5.4 - 3.9 = 1.5^m$ to be added. $11^h\ 46.8^m + 1.5^m = 11^h\ 48.3^m$ for January 15, 1919. For January 18 subtract $38 - 15 = 3 \times 3 \times 3.94^m = 11.8^m$ getting $11^h\ 36.5^m$.

To refer to any other than the tabular latitude between the limits of 25° and 50° north *add* to the time of west elongation 0.13^m for every degree south of latitude 40°, and *subtract* from the time of west elongation 0.18^m for every degree north of 40°. Reverse these signs for corrections to the times of east elongation. For latitudes as high as 60° diminish the times of *west* elongation and increase the times of *east* elongation by 0.23^m for every degree north of latitude 40°.

To refer to other longitudes, add 0.16^m for each hour east of 6 hours and subtract 0.16^m for each hour west of 6 hours.

TABLE LXXII

Length of 0.01° of latitude and 0.01° of longitude to the nearest whole foot

Latitude	Length 0.01° latitude	Length 0.01° longitude	Latitude	Length 0.01° latitude	Length 0.01° longitude
°			°		
1	3628	3652	31	3637	3133
2	3628	3650	32	3638	3100
3	3628	3647	33	3638	3066
4	3628	3643	34	3639	3031
5	3628	3638	35	3640	2995
6	3628	3632	36	3641	2958
7	3628	3625	37	3641	2920
8	3628	3617	38	3641	2882
9	3628	3608	39	3642	2842
10	3629	3597	40	3643	2802
11	3629	3586	41	3643	2761
12	3629	3573	42	3644	2719
13	3629	3559	43	3645	2675
14	3630	3545	44	3646	2632
15	3630	3529	45	3646	2587
16	3631	3512	46	3647	2542
17	3631	3494	47	3647	2495
18	3631	3475	48	3648	2449
19	3631	3455	49	3649	2401
20	3632	3433	50	3649	2353
21	3632	3411	51	3650	2303
22	3633	3388	52	3650	2254
23	3633	3364	53	3651	2203
24	3634	3338	54	3652	2152
25	3634	3312	55	3652	2099
26	3635	3285	56	3653	2047
27	3635	3256	57	3653	1994
28	3635	3227	58	3654	1940
29	3636	3197	59	3655	1886
30	3637	3166	60	3655	1831

TABLE LXXIII. — CONVERGENCE OF MERIDIANS

Latitude	Angular convergence per mile, degrees	Distance for convergence of 0.01°, feet	Latitude	Angular convergence per mile, degrees	Distance for convergence of 0.01°, feet
°			°		
1	0.000	209,240	31	0.009	6084
2	.001	104,588	32	.009	5851
3	.001	69,690	33	.009	5629
4	.001	52,231	34	.010	5420
5	.001	41,747	35	.010	5222
6	.002	34,750	36	.010	5032
7	.002	29,747	37	.011	4852
8	.002	26,002	38	.011	4681
9	.002	23,062	39	.012	4516
10	.003	20,715	40	.012	4359
11	.003	18,792	41	.013	4208
12	.003	17,185	42	.013	4062
13	.003	15,823	43	.013	3922
14	.004	14,651	44	.014	3788
15	.004	13,634	45	.014	3658
16	.004	12,740	46	.015	3533
17	.004	11,950	47	.015	3412
18	.005	11,244	48	.016	3295
19	.005	10,611	49	.017	3181
20	.005	10,039	50	.017	3071
21	.006	9,518	51	.018	2964
22	.006	9,044	52	.018	2860
23	.006	8,609	53	.019	2758
24	.006	8,208	54	.020	2660
25	.007	7,837	55	.021	2563
26	.007	7,493	56	.021	2469
27	.007	7,173	57	.022	2377
28	.008	6,874	58	.023	2288
29	.008	6,594	59	.024	2200
30	.008	6,331	60	.025	2114

CHAPTER VIII

TABLES FOR METRIC CURVES

METRIC curves are used in Latin-American countries. The "degree" is the angle subtended by a chord of 20 meters. Practically all usually tabulated curve functions may be converted from feet values in tables for curves used in the United States to meter values for metric curves by dividing by five.

The more commonly used functions have been tabulated in the three following tables. The tabular values are in meters.

TABLE LXXIV. — RADII, TANGENT OFFSETS AND MIDDLE ORDINATES FOR METRIC CURVES

Degree = angle subtended by chord of 20 meters

Deg., D	Radius, R	Logarithm, log R	Tan. off., t	Mid. ord., m	Deg., D	Radius, R	Logarithm, log R	Tan. off., t	Mid. ord., m
0.0	∞	∞	.000	.000	**10.0**	114.74	2.05970	1.743	.437
.2	5729.57	3.75812	.035	.009	.2	112.49	2.05113	1.778	.445
.4	2864.80	3.45709	.070	.017	.4	110.34	2.04272	1.813	.454
.6	1909.87	3.28100	.105	.026	.6	108.26	2.03447	1.847	.463
.8	1432.41	3.15607	.140	.035	.8	106.26	2.02637	1 882	.472
1.0	1145.93	3.05916	.175	.044	11.0	104.33	2.01843	1.917	.480
.2	954.95	2.97998	.209	.052	.2	102.48	2.01063	1.952	.489
.4	818.53	2.91304	.244	.061	.4	100.68	2.00296	1.986	.498
.6	716.22	2.85505	.279	.070	.6	98.95	1.99544	2.021	.507
.8	636.65	2.80390	.314	.079	.8	97.28	1.98804	2.056	.515
2.0	572.99	2.75814	.349	.087	**12.0**	95.67	1.98077	2.091	.524
.2	520.90	2.71676	.384	.096	.2	94.11	1.97361	2.125	.533
.4	477.50	2.67897	.419	.105	.4	92.59	1.96658	2.160	.542
.6	440.77	2.64422	.454	.113	.6	91.13	1.95966	2.195	.550
.8	409.30	2.61204	.489	.122	.8	89.71	1.95285	2.229	.559
3.0	382.02	2.58208	.524	.131	13.0	88.34	1.94614	2.264	.568
.2	358.15	2.55406	.558	.140	.2	87.00	1.93954	2.299	.577
.4	337.08	2.52774	.593	.148	.4	85.71	1.93304	2.333	.585
.6	318.36	2.50292	.628	.157	.6	84.46	1.92663	2.368	.594
.8	301.61	2.47945	.663	.166	.8	83.24	1.92032	2.403	.603
4.0	286.54	2.45718	.698	.175	**14.0**	82.06	1.91411	2.437	.612
.2	272.90	2.43600	.733	.183	.2	80.91	1.90798	2.472	.620
.4	260.50	2.41581	.768	.192	.4	79.79	1.90193	2.507	.629
.6	249.18	2.39651	.803	.201	.6	78.70	1.89598	2.541	.638
.8	238.80	2.37804	.838	.209	.8	77.64	1.89010	2.576	.647
5.0	229.26	2.36032	.872	.218	15.0	76.61	1.88430	2.611	.655
.2	220.44	2.34330	.907	.227	.2	75.61	1.87858	2.645	.664
.4	212.29	2.32692	.942	.236	.4	74.63	1.87294	2.680	.673
.6	204.71	2.31114	.977	.244	.6	73.68	1.86737	2.714	.682
.8	197.66	2.29591	1.012	.253	.8	72.76	1.86187	2.749	.690
6.0	191.07	2.28120	1.047	.262	**16.0**	71.85	1.85644	2.783	.699
.2	184.92	2.26697	1.082	.271	.2	70.97	1.85109	2.818	.708
.4	179.14	2.25320	1.116	.279	.4	70.11	1.84579	2.853	.717
.6	173.72	2.23985	1.151	.288	.6	69.27	1.84056	2.887	.726
.8	168.62	2.22690	1.186	.297	.8	68.45	1.83540	2.922	.734
7.0	163.80	2.21432	1.221	.306	17.0	67.65	1.83030	2.956	.743
.2	159.26	2.20211	1.256	.314	.2	66.87	1.82526	2.991	.752
.4	154.96	2.19022	1.291	.323	.4	66.11	1.82027	3.025	.761
.6	150.89	2.17866	1.325	.332	.6	65.37	1.81535	3.060	.769
.8	147.03	2.16739	1.360	.340	.8	64.64	1.81048	3.094	.778
8.0	143.36	2.15642	1.395	.349	**18.0**	63.92	1.80567	3.129	.787
.2	139.87	2.14571	1.430	.358	.2	63.23	1.80091	3.163	.796
.4	136.54	2.13526	1.465	.367	.4	62.55	1.79620	3.198	.805
.6	133.37	2.12506	1.500	.375	.6	61.88	1.79155	3.232	.813
.8	130.35	2.11510	1.534	.384	.8	61.23	1.78694	3.267	.822
9.0	127.45	2.10536	1.569	.393	19.0	60.59	1.78239	3.301	.831
.2	124.69	2.09583	1.604	.402	.2	59.96	1.77789	3.335	.840
.4	122.04	2.08651	1.639	.410	.4	59.35	1.77343	3.370	.849
.6	119.51	2.07739	1.674	.419	.6	58.75	1.76902	3.404	.857
.8	117.07	2.06846	1.708	.428	.8	58.16	1.76465	3.439	.866
10.0	114.74	2.05970	1.743	.437	**20.0**	57.59	1.76033	3.473	.875

TABLE LXXV. — METRIC CURVES

Degree of curve	Actual arc, one station	Long chords							Degree of curve
		2 Sta.	3 Sta.	4 Sta.	5 Sta.	6 Sta.	7 Sta.	8 Sta.	
0.2	20.000 m.	40.00	60.00	80.00	100.00	120.00	139.99	159.99	**0.2**
.4	.000	0.00	0.00	0.00	0.00	119.99	9.98	9.98	.4
.6	.000	0.00	0.00	79.99	99.99	9.98	9.97	9.95	.6
.8	.000	0.00	0.00	9.99	9.98	9.97	9.95	9.92	.8
1.0	20.000	40.00	59.99	79.99	99.97	119.95	139.92	159.87	1.0
.2	.000	0.00	9.99	9.98	9.96	9.92	9.88	9.82	.2
.4	.000	0.00	9.99	9.97	9.94	9.90	9.83	9.75	.4
.6	.001	0.00	9.98	9.96	9.92	9.86	9.78	9.67	.6
.8	.001	0.00	9.98	9.95	9.90	9.83	9.72	9.59	.8
2.0	20.001	39.99	59.97	79.94	99.88	119.78	139.66	159.49	**2.0**
.2	.001	9.99	9.97	9.93	9.85	9.74	9.59	9.38	.2
.4	.001	9.99	9.96	9.91	9.82	9.69	9.51	9.26	.4
.6	.002	9.99	9.96	9.90	9.80	9.64	9.42	9.14	.6
.8	.002	9.99	9.95	9.88	9.76	9.58	9.33	9.00	.8
3.0	20.002	39.99	59.94	79.86	99.73	119.52	139.23	158.85	3.0
.2	.003	9.98	9.94	9.84	9.69	9.45	9.13	8.69	.2
.4	.003	9.98	9.93	9.82	9.65	9.39	9.02	8.53	.4
.6	.003	9.98	9.92	9.80	9.60	9.31	8.90	8.35	.6
.8	.004	9.98	9.91	9.78	9.56	9.23	8.77	8.16	.8
4.0	20.004	39.98	59.90	79.76	99.51	119.15	138.64	157.96	**4.0**
.2	.004	9.97	9.89	9.73	9.46	9.06	8.50	7.75	.2
.4	.005	9.97	9.88	9.71	9.41	8.97	8.36	7.54	.4
.6	.005	9.97	9.87	9.68	9.36	8.87	8.20	7.30	.6
.8	.006	9.97	9.86	9.65	9.30	8.78	8.04	7.07	.8
5.0	20.006	39.96	59.85	79.62	99.24	118.67	137.88	156.82	5.0
.2	.007	9.96	9.84	9.59	9.18	8.56	7.71	6.56	.2
.4	.007	9.96	9.82	9.56	9.12	8.45	7.52	6.29	.4
.6	.008	9.95	9.81	9.52	9.05	8.34	7.34	6.02	.6
.8	.009	9.95	9.80	9.49	8.98	8.21	7.15	5.73	.8
6.0	20.009	39.94	59.78	79.45	98.91	118.09	136.95	155.43	**6.0**
.2	.010	9.94	9.77	9.41	8.83	7.96	6.74	5.12	.2
.4	.010	9.94	9.75	9.38	8.76	7.83	6.53	4.81	.4
.6	.011	9.93	9.74	9.34	8.68	7.69	6.31	4.48	.6
.8	.012	9.93	9.72	9.30	8.60	7.55	6.09	4.15	.8
7.0	20.012	39.92	59.70	79.26	98.51	117.40	135.86	153.80	7.0
.2	.013	9.92	9.69	9.21	8.43	7.25	5.62	3.45	.2
.4	.014	9.92	9.67	9.17	8.34	7.10	5.37	3.08	.4
.6	.015	9.91	9.65	9.12	8.25	6.94	5.12	2.71	.6
.8	.015	9.91	9.63	9.08	8.16	6.78	4.87	2.32	.8
8.0	20.016	39.90	59.61	79.03	98.06	116.62	134.60	151.94	**8.0**
.2	.017	9.90	9.59	8.98	7.96	6.45	4.33	1.53	.2
.4	.018	9.89	9.57	8.93	7.86	6.27	4.06	1.12	.4
.6	.019	9.89	9.55	8.88	7.76	6.09	3.77	0.70	.6
.8	.020	9.88	9.53	8.83	7.66	5.91	3.49	0.27	.8
9.0	20.021	39.88	59.51	78.77	97.55	115.73	133.19	149.83	9.0
.2	.022	9.87	9.49	8.72	7.44	5.54	2.89	9.38	.2
.4	.022	9.87	9.46	8.66	7.33	5.34	2.58	8.93	.4
.6	.023	9.86	9.44	8.60	7.21	5.15	2.27	8.46	.6
.8	.024	9.85	9.42	8.55	7.10	4.94	1.95	7.99	.8
10.0	20.025	39.85	59.39	78.48	96.98	114.74	131.62	147.50	**10.0**
Degree	Actual arc	2 Sta.	3 Sta.	4 Sta.	5 Sta.	6 Sta.	7 Sta.	8 Sta.	Degree

TABLE LXXV. — (*Continued*)

Degree of curve	Actual arc, one station	Long chords							Degree of curve
		2 Sta.	3 Sta.	4 Sta.	5 Sta.	6 Sta.	7 Sta.	8 Sta.	
10.0	20.025 m.	39.85	59.39	78.48	96.98	114.74	131.62	147.50	**10.0**
.2	.026	9.84	9.37	8.42	6.86	4.53	1.29	7.01	.2
.4	.027	9.84	9.34	8.36	6.74	4.31	0.95	6.51	.4
.6	.029	9.83	9.32	8.30	6.61	4.10	0.61	6.00	.6
.8	.030	9.82	9.29	8.23	6.48	3.87	0.25	5.48	.8
11.0	20.031	39.82	59.27	78.17	96.35	113.65	129.90	144.95	11.0
.2	.032	9.81	9.24	8.10	6.22	3.42	9.54	4.42	.2
.4	.033	9.80	9.21	8.03	6.08	3.19	9.17	3.87	.4
.6	.034	9.80	9.18	7.97	5.95	2.95	8.80	3.32	.6
.8	.035	9.79	9.15	7.90	5.81	2.71	8.42	2.76	.8
12.0	20.037	39.78	59.13	77.82	95.67	112.47	128.03	142.19	**12.0**
.2	.038	9.77	9.10	7.75	5.52	2.21	7.64	1.61	.2
.4	.039	9.77	9.07	7.68	5.38	1.96	7.24	1.03	.4
.6	.040	9.76	9.04	7.60	5.23	1.71	6.84	0.43	.6
.8	.042	9.75	9.01	7.53	5.08	1.45	6.43	139.83	.8
13.0	20.043	39.74	58.98	77.45	94.93	111.18	126.01	139.22	13.0
.2	.044	9.73	8.94	7.37	4.77	0.92	5.59	8.60	.2
.4	.046	9.73	8.91	7.29	4.61	0.65	5.17	7.98	.4
.6	.047	9.72	8.88	7.21	4.45	0.37	4.73	7.34	.6
.8	.048	9.71	8.85	7.13	4.29	0.09	4.30	6.70	.8
14.0	20.050	39.70	58.81	77.05	94.13	109.81	123.86	136.05	**14.0**
.2	.051	9.69	8.78	6.96	3.96	9.53	3.41	5.40	.2
.4	.053	9.68	8.74	6.88	3.80	9.23	2.95	4.73	.4
.6	.054	9.68	8.71	6.79	3.63	8.95	2.50	4.06	.6
.8	.056	9.67	8.67	6.70	3.45	8.65	2.03	3.38	.8
15.0	20.057	39.66	58.64	76.61	93.28	108.35	121.56	132.70	15.0
.2	.059	9.65	8.60	6.52	3.10	8.04	1.09	2.00	.2
.4	.060	9.64	8.56	6.43	2.92	7.74	0.61	1.30	.4
.6	.062	9.63	8.53	6.34	2.74	7.43	0.12	0.60	.6
.8	.064	9.62	8.49	6.25	2.56	7.11	119.63	129.88	.8
16.0	20.065	39.61	58.45	76.15	92.37	106.79	119.14	129.16	**16.0**
.2	.067	9.60	8.41	6.06	2.18	6.48	8.64	8.44	.2
.4	.068	9.59	8.37	5.96	1.99	6.15	8.13	7.70	.4
.6	.070	9.58	8.33	5.86	1.80	5.82	7.62	6.96	.6
.8	.072	9.57	8.29	5.76	1.61	5.49	7.11	6.21	.8
17.0	20.074	39.56	58.25	75.66	91.41	105.16	116.59	125.46	17.0
.2	.075	9.55	8.21	5.56	1.22	4.82	6.06	4.70	.2
.4	.077	9.54	8.17	5.46	1.01	4.47	5.53	3.93	.4
.6	.079	9.53	8.13	5.36	0.81	4.13	5.00	3.16	.6
.8	.081	9.52	8.08	5.25	0.61	3.78	4.46	2.38	.8
18.0	20.082	39.51	58.04	75.15	90.40	103.43	113.91	121.59	**18.0**
.2	.084	9.50	8.00	5.04	0.19	3.08	3.36	0.80	.2
.4	.086	9.48	7.95	4.93	89.98	2.72	2.81	0.00	.4
.6	.088	9.47	7.91	4.83	9.77	2.36	2.26	119.20	.6
.8	.090	9.46	7.87	4.71	9.56	1.99	1.69	8.39	.8
19.0	20.092	39.45	57.82	74.60	89.34	101.63	111.13	117.58	19.0
.2	.094	9.44	7.78	4.49	9.12	1.26	0.56	6.76	.2
.4	.096	9.43	7.73	4.38	8.90	0.88	109.98	5.93	.4
.6	.098	9.42	7.68	4.27	8.68	0.51	9.40	5.10	.6
.8	.100	9.40	7.64	4.15	8.46	0.13	8.82	4.27	.8
20.0	20.102	39.39	57.59	74.03	88.23	99.74	108.23	113.43	**20.0**
Degree	Actual arc	2 Sta.	3 Sta.	4 Sta.	5 Sta.	6 Sta.	7 Sta.	8 Sta.	Degree

Degree of curve	Middle ordinates								Degree of curve
	1 Sta.	2 Sta.	3 Sta.	4 Sta.	5 Sta.	6 Sta.	7 Sta.	8 Sta.	
0.2	.009	.035	.079	.140	.218	.314	.428	.558	**0.2**
.4	.017	.070	.157	.279	.436	.628	.855	1.117	.4
.6	.026	.105	.236	.419	.654	.942	1.283	1.675	.6
.8	.035	.140	.314	.558	.873	1.256	1.710	2.233	.8
1.0	.044	.175	.393	.698	1.091	1.570	2.137	2.791	1.0
.2	.052	.209	.471	.838	1.309	1.884	2.565	3.349	.2
.4	.061	.244	.550	.977	1.527	2.198	2.992	3.907	.4
.6	.070	.279	.624	1.117	1.745	2.512	3.418	4.464	.6
.8	.079	.314	.707	1.256	1.963	2.825	3.845	5.020	.8
2.0	.087	.349	.785	1.396	2.180	3.139	4.271	5.576	**2.0**
.2	.096	.384	.864	1.535	2.398	3.452	4.697	6.132	.2
.4	.105	.419	.942	1.675	2.616	3.765	5.122	6.687	.4
.6	.113	.454	1.021	1.814	2.833	4.078	5.548	7.241	.6
.8	.122	.489	1.099	1.953	3.051	4.391	5.973	7.795	.8
3.0	.131	.524	1.178	2.093	3.268	4.703	6.397	8.348	3.0
.2	.140	.558	1.256	2.232	3.485	5.015	6.821	8.900	.2
.4	.148	.593	1.335	2.371	3.703	5.327	7.244	9.451	.4
.6	.157	.628	1.413	2.510	3.920	5.639	7.667	10.002	.6
.8	.166	.663	1.491	2.650	4.136	5.950	8.090	10.551	.8
4.0	.175	.698	1.570	2.789	4.353	6.262	8.511	11.100	**4.0**
.2	.183	.733	1.648	2.928	4.570	6.572	8.933	11.647	.2
.4	.192	.768	1.726	3.067	4.786	6.883	9.353	12.194	.4
.6	.201	.803	1.805	3.205	5.002	7.193	9.773	12.739	.6
.8	.209	.838	1.883	3.344	5.218	7.502	10.192	13.283	.8
5.0	.218	.872	1.961	3.483	5.434	7.812	10.611	13.826	5.0
.2	.227	.907	2.040	3.622	5.650	8.121	11.028	14.367	.2
.4	.236	.942	2.118	3.760	5.865	8.429	11.445	14.907	.4
.6	.244	.977	2.196	3.899	6.081	8.737	11.862	15.446	.6
.8	.253	1.012	2.274	4.037	6.296	9.045	12.277	15.983	.8
6.0	.262	1.047	2.352	4.175	6.511	9.352	12.691	16.519	**6.0**
.2	.271	1.082	2.431	4.314	6.725	9.658	13.104	17.053	.2
.4	.279	1.116	2.509	4.452	6.940	9.965	13.517	17.586	.4
.6	.288	1.151	2.587	4.590	7.154	10.270	13.929	18.117	.6
.8	.297	1.186	2.665	4.728	7.368	10.575	14.339	18.646	.8
7.0	.306	1.221	2.743	4.866	7.581	10.880	14.749	19.174	7.0
.2	.314	1.256	2.821	5.003	7.795	11.184	15.157	19.700	.2
.4	.323	1.291	2.899	5.141	8.008	11.487	15.565	20.223	.4
.6	.332	1.325	2.977	5.279	8.221	11.790	15.971	20.745	.6
.8	.340	1.360	3.055	5.416	8.433	12.092	16.376	21.265	.8
8.0	.349	1.395	3.133	5.553	8.645	12.394	16.780	21.783	**8.0**
.2	.358	1.430	3.211	5.691	8.857	12.695	17.183	22.299	.2
.4	.367	1.465	3.288	5.828	9.069	12.995	17.584	22.813	.4
.6	.375	1.500	3.366	5.965	9.280	13.294	17.985	23.325	.6
.8	.384	1.534	3.444	6.101	9.491	13.594	18.384	23.834	.8
9.0	.393	1.569	3.522	6.238	9.702	13.892	18.782	24.342	9.0
.2	.402	1.604	3.599	6.375	9.912	14.189	19.178	24.847	.2
.4	.410	1.639	3.677	6.511	10.122	14.486	19.573	25.350	.4
.6	.419	1.674	3.754	6.647	10.332	14.782	19.967	25.850	.6
.8	.428	1.708	3.832	6.784	10.541	15.078	20.359	26.348	.8
10.0	.437	1.743	3.910	6.919	10.750	15.372	20.750	26.843	**10.0**
Degree	1 Sta.	2 Sta.	3 Sta.	4 Sta.	5 Sta.	6 Sta.	7 Sta.	8 Sta.	Degree

TABLE LXXVI. — (*Continued*)

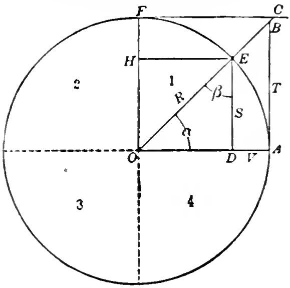
Degree of curve	Middle ordinates 1 Sta.	2 Sta.	3 Sta.	4 Sta.	5 Sta.	6 Sta.	7 Sta.	8 Sta.	Degree of curve
10.0	.437	1.743	3.910	6.919	10.750	15.372	20.750	26.843	**10.0**
.2	.445	1.778	3.987	7.055	10.958	15.666	21.139	27.336	.2
.4	.454	1.813	4.065	7.191	11.167	15.959	21.527	27.827	.4
.6	.463	1.847	4.142	7.327	11.374	16.251	21.913	28.315	.6
.8	.472	1.882	4.219	7.462	11.582	16.542	22.298	28.800	.8
11.0	.480	1.917	4.297	7.597	11.789	16.832	22.681	29.282	11.0
.2	.489	1.952	4.374	7.732	11.995	17.122	23.063	29.762	.2
.4	.498	1.986	4.451	7.867	12.201	17.410	23.443	30.239	.4
.6	.507	2.021	4.539	8.002	12.407	17.698	23.821	30.714	.6
.8	.515	2.056	4.605	8.137	12.612	17.985	24.198	31.185	.8
12.0	.524	2.091	4.682	8.271	12.817	18.271	24.573	31.654	**12.0**
.2	.533	2.125	4.759	8.405	13.021	18.556	24.946	32.119	.2
.4	.542	2.160	4.836	8.539	13.225	18.840	25.317	32.582	.4
.6	.550	2.195	4.913	8.673	13.429	19.123	25.687	33.041	.6
.8	.559	2.229	4.990	8.807	13.632	19.405	26.055	33.498	.8
13.0	.568	2.264	5.067	8.940	13.834	19.686	26.421	33.951	13.0
.2	.577	2.299	5.144	9.074	14.036	19.966	26.785	34.402	.2
.4	.585	2.333	5.220	9.207	14.238	20.245	27.147	34.849	.4
.6	.594	2.368	5.297	9.339	14.439	20.523	27.507	35.292	.6
.8	.603	2.403	5.374	9.472	14.639	20.800	27.866	35.733	.8
14.0	.612	2.437	5.450	9.605	14.839	21.076	28.222	36.171	**14.0**
.2	.620	2.472	5.527	9.737	15.039	21.351	28.576	36.604	.2
.4	.629	2.507	5.603	9.870	15.238	21.625	28.929	37.035	.4
.6	.638	2.541	5.679	10.001	15.437	21.897	29.279	37.462	.6
.8	.647	2.576	5.756	10.133	15.634	22.169	29.628	37.886	.8
15.0	.655	2.611	5.832	10.264	15.832	22.439	29.974	38.306	15.0
.2	.664	2.645	5.908	10.395	16.028	22.709	30.318	38.723	.2
.4	.673	2.680	5.984	10.526	16.225	22.977	30.660	39.137	.4
.6	.682	2.704	6.060	10.657	16.421	23.244	31.000	39.546	.6
.8	.690	2.749	6.136	10.788	16.616	23.509	31.338	39.952	.8
16.0	.699	2.783	6.212	10.918	16.810	23.774	31.673	40.355	**16.0**
.2	.708	2.818	6.288	11.048	17.005	24.037	32.007	40.753	.2
.4	.717	2.853	6.364	11.178	17.198	24.299	32.338	41.148	.4
.6	.726	2.887	6.439	11.308	17.390	24.560	32.667	41.540	.6
.8	.734	2.922	6.515	11.437	17.583	24.820	32.993	41.927	.8
17.0	.743	2.956	6.591	11.566	17.774	25.078	33.317	42.311	17.0
.2	.752	2.991	6.666	11.696	17.966	25.335	33.639	42.691	.2
.4	.761	3.025	6.741	11.824	18.156	25.591	33.959	43.067	.4
.6	.769	3.060	6.817	11.953	18.346	25.846	34.276	43.439	.6
.8	.778	3.094	6.892	12.081	18.534	26.099	34.591	43.807	.8
18.0	.787	3.129	6.967	12.208	18.723	26.351	34.903	44.171	**18.0**
.2	.796	3.163	7.043	12.336	18.911	26.601	35.213	44.531	.2
.4	.805	3.198	7.117	12.464	19.098	26.850	35.521	44.887	.4
.6	.813	3.232	7.193	12.593	19.285	27.098	35.826	45.239	.6
.8	.822	3.266	7.267	12.717	19.470	27.345	36.129	45.587	.8
19.0	.831	3.301	7.342	12.844	19.656	27.590	36.429	45.931	19.0
.2	.840	3.335	7.417	12.971	19.840	27.833	36.727	46.271	.2
.4	.849	3.370	7.492	13.097	20.024	28.076	37.022	46.606	.4
.6	.857	3.404	7.566	13.222	20.207	28.316	37.314	46.938	.6
.8	.866	3.439	7.641	13.348	20.389	28.556	37.604	47.265	.8
20.0	.875	3.473	7.715	13.473	20.571	28.794	37.892	47.588	**20.0**
Degree	1 Sta.	2 Sta.	3 Sta.	4 Sta.	5 Sta.	6 Sta.	7 Sta.	8 Sta.	Degree

CHAPTER IX

MISCELLANEOUS TABLES

TABLE LXXVII. — Trigonometric Formulas, Circular Measure, etc.

Trigonometric Functions and Formulas. Solution of Triangles



By definition, if $R = 1$,

ED = sine α.
OD = cosine α.
DA = versed sine α.
HF = coversed sine α.
BA = tangent α.
FC = cotangent α.
OB = secant α.
OC = cosecant α.

If R is other than 1, it follows from the above definitions and the proportionality of similar figures, that

1. $ED = R \sin \alpha.$
2. $OD = R \cos \alpha.$
3. $DA = R \operatorname{versin} \alpha.$
4. $HF = R \operatorname{coversin} \alpha.$
5. $BA = R \tan \alpha.$
6. $FC = R \cot \alpha.$
7. $OB = R \sec \alpha.$
8. $OC = R \operatorname{cosec} \alpha.$

from which also in *any right triangle* of angles α and β, if o be the side *opposite* the angle α, a the side *adjacent* thereto, and h the hypotenuse,

9. $\sin \alpha = \frac{o}{h} = \cos \beta.$

10. $\cos \alpha = \frac{a}{h} = \sin \beta.$

11. $\tan \alpha = \frac{o}{a} = \cot \beta.$

12. $\cot \alpha = \frac{a}{o} = \tan \beta.$

13. $\sec \alpha = \frac{h}{a} = \operatorname{cosec} \beta.$

14. $\operatorname{cosec} \alpha = \frac{h}{o} = \sec \beta.$

15. $\operatorname{vers} \alpha = \frac{h - a}{h} = \operatorname{covers} \beta.$

16. $\operatorname{covers} \alpha = \frac{h - o}{h} = \operatorname{vers} \beta.$

Hence,

17. $$\begin{cases} o = h \sin \alpha = h \cos \beta. \\ h = \dfrac{o}{\sin \alpha} = \dfrac{o}{\cos \beta}. \end{cases}$$

18. $$\begin{cases} a = h \cos \alpha = h \sin \beta. \\ h = \dfrac{a}{\cos \alpha} = \dfrac{a}{\sin \beta}. \end{cases}$$

19. $$\begin{cases} o = a \tan \alpha = a \cot \beta. \\ a = \dfrac{o}{\tan \alpha} = \dfrac{o}{\cot \beta}. \end{cases}$$

20. $$\begin{cases} a = o \cot \alpha = o \tan \beta. \\ o = \dfrac{a}{\cot \alpha} = \dfrac{a}{\tan \beta}. \end{cases}$$

21. $$\begin{cases} h = a \sec \alpha = a \operatorname{cosec} \beta. \\ a = \dfrac{h}{\sec \alpha} = \dfrac{h}{\operatorname{cosec} \beta}. \end{cases}$$

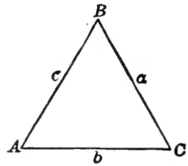
22. $$\begin{cases} h = o \operatorname{cosec} \alpha = o \sec \beta. \\ o = \dfrac{h}{\operatorname{cosec} \alpha} = \dfrac{h}{\sec \beta}. \end{cases}$$

23. $o = \sqrt{h^2 - a^2} = \sqrt{(h+a)(h-a)}.$

24. $a = \sqrt{h^2 - o^2} = \sqrt{(h+o)(h-o)}.$

25. $h = \sqrt{o^2 + a^2}.$

26. Area $= \dfrac{oa}{2}.$



Oblique triangles may be solved by some one of the following formulas:

GIVEN	SOUGHT	FORMULAS
27. $A, B, a,$	$C, b, c,$	$C = 180° - (A + B), b = \frac{a}{\sin A} \sin B,$ $c = \frac{a}{\sin A} \sin (A + B).$
28. $A, a, b,$	$B, C, c,$	$\sin B = \frac{\sin A}{a} b,\ C = 180° - (A + B),$ $c = \frac{a}{\sin A} \sin C.$
29. $C, a, b,$	$\frac{1}{2}(A + B),$	$\frac{1}{2}(A + B) = 90° - \frac{1}{2} C.$
30. $C, a, b,$	$\frac{1}{2}(A - B),$	$\tan \frac{1}{2}(A - B) = \frac{a - b}{a + b} \tan \frac{1}{2}(A + B).$
31. $C, a, b,$	$A, B,$	$\begin{cases} A = \frac{1}{2}(A + B) + \frac{1}{2}(A - B); \\ B = \frac{1}{2}(A + B) - \frac{1}{2}(A - B). \end{cases}$
32. $C, a, b,$	$c,$	$c = (a + b) \frac{\cos \frac{1}{2}(A + B)}{\cos \frac{1}{2}(A - B)}$ $= (a - b) \frac{\sin \frac{1}{2}(A + B)}{\sin \frac{1}{2}(A - B)}.$
33. $C, a, b,$	Area,	Area $= \frac{1}{2} ab \sin C.$
34. $a, b, c,$	$A,$	If $s = \frac{1}{2}(a + b + c),$ $\sin \frac{1}{2} A = \sqrt{\frac{(s - b)(s - c)}{bc}},$ $\cos \frac{1}{2} A = \sqrt{\frac{s(s - a)}{bc}},$ $\tan \frac{1}{2} A = \sqrt{\frac{(s - b)(s - c)}{s(s - a)}},$ $\sin A = \frac{2\sqrt{(s - a)(s - b)(s - c)}}{bc},$ $\text{vers} A = \frac{2(s - b)(s - c)}{bc}.$
35. $a, b, c,$	Area,	Area $= \sqrt{s(s - a)(s - b)(s - c)}.$
36. $A, B, C, a,$	Area,	Area $= \frac{a^2 \sin B \sin C}{2 \sin A}.$

From the definitions of the trigonometric functions, the geometrical properties of right triangles and in some cases algebraic transformations, it may be shown that if A is any angle and B any other angle,

37. $\sin^2 A + \cos^2 A = 1.$

38. $$\sin A = \frac{1}{\operatorname{cosec} A} = \sqrt{1 - \cos^2 A} = \tan A \cos A$$
$$= 2 \sin \tfrac{1}{2} A \cos \tfrac{1}{2} A = \operatorname{vers} A \cot \tfrac{1}{2} A$$
$$= \sqrt{\tfrac{1}{2} \operatorname{vers} 2A} = \sqrt{\tfrac{1}{2}(1 - \cos 2A)}.$$

39. $$\cos A = \frac{1}{\sec A} = \sqrt{1 - \sin^2 A} = \cot A \sin A$$
$$= 1 - \operatorname{vers} A = 2\cos^2 \tfrac{1}{2} A - 1 = 1 - 2 \sin^2 \tfrac{1}{2} A$$
$$= \cos^2 \tfrac{1}{2} A - \sin^2 \tfrac{1}{2} A = \sqrt{\tfrac{1}{2} + \tfrac{1}{2} \cos 2A}.$$

40. $$\tan A = \frac{\sin A}{\cos A} = \frac{1}{\cot A} = \sqrt{\sec^2 A - 1}$$
$$= \sqrt{\frac{1}{\cos^2 A} - 1} = \frac{\sqrt{1 - \cos^2 A}}{\cos A} = \frac{\sin 2A}{1 + \cos 2A}$$
$$= \frac{1 - \cos 2A}{\sin 2A} = \frac{\operatorname{vers} 2A}{\sin 2A} = \cot \tfrac{1}{2} A (\sec A - 1).$$

41. $$\cot A = \frac{\cos A}{\sin A} = \frac{1}{\tan A} = \sqrt{\operatorname{cosec}^2 A - 1}$$
$$= \frac{\sin 2A}{1 - \cos 2A} = \frac{\sin 2A}{\operatorname{vers} 2A} = \frac{1 + \cos 2A}{\sin 2A} = \frac{\tan \frac{1}{2} A}{\sec A - 1}.$$

42. $\operatorname{vers} A = 1 - \cos A = \sin A \tan \tfrac{1}{2} A = 2 \sin^2 \tfrac{1}{2} A = \cos A (\sec A - 1).$

43. $\sin (A \pm B) = \sin A \cos B \pm \sin B \cos A.$

44. $\cos (A \pm B) = \cos A \cos B \mp \sin A \sin B.$

45. $$\sin \tfrac{1}{2} A = \sqrt{\frac{1 - \cos A}{2}} = \sqrt{\frac{\operatorname{vers} A}{2}}.$$

46. $\sin 2A = 2 \sin A \cos A.$

47. $$\cos \tfrac{1}{2} A = \sqrt{\frac{1 + \cos A}{2}}.$$

48. $\cos 2A = 2 \cos^2 A - 1 = \cos^2 A - \sin^2 A = 1 - 2 \sin^2 A.$

49. $$\tan \tfrac{1}{2} A = \frac{\tan A}{1 + \sec A} = \operatorname{cosec} A - \cot A = \frac{1 - \cos A}{\sin A} = \sqrt{\frac{1 - \cos A}{1 + \cos A}}.$$

50. $$\tan 2A = \frac{2 \tan A}{1 - \tan^2 A}.$$

51. $$\cot \tfrac{1}{2} A = \frac{\sin A}{\operatorname{vers} A} = \frac{1 + \cos A}{\sin A} = \frac{1}{\operatorname{cosec} A - \cot A}.$$

52. $$\cot 2A = \frac{\cot^2 A - 1}{2 \cot A}.$$

53. $\text{vers}\frac{1}{2}A = \dfrac{\frac{1}{2}\text{vers}\,A}{1 + \sqrt{1 - \frac{1}{2}\text{vers}\,A}} = \dfrac{1 - \cos A}{2 + \sqrt{2\,(1 + \cos A)}}.$

54. $\text{vers}\,2A = 2\sin^2 A.$

55. $\sin A + \sin B = 2\sin\frac{1}{2}(A + B)\cos\frac{1}{2}(A - B).$

56. $\sin A - \sin B = 2\cos\frac{1}{2}(A + B)\sin\frac{1}{2}(A - B).$

57. $\cos A + \cos B = 2\cos\frac{1}{2}(A + B)\cos\frac{1}{2}(A - B).$

58. $\cos B - \cos A = 2\sin\frac{1}{2}(A + B)\sin\frac{1}{2}(A - B).$

59. $\sin^2 A - \sin^2 B = \cos^2 B - \cos^2 A = \sin(A + B)\sin(A - B).$

60. $\cos^2 A - \sin^2 B = \cos(A + B)\cos(A - B).$

61. $\tan A + \tan B = \dfrac{\sin(A + B)}{\cos A \cos B}.$

62. $\tan A - \tan B = \dfrac{\sin(A - B)}{\cos A \cos B}.$

Length of Circular Arcs to Radius 1

Deg.	Length	Deg.	Length	Deg.	Length	Deg.	Length	Deg.	Length
10	0.1745329	50	0.8726646	90	1.5707963	130	2.2689280	170	2.9670597
20	0.3490659	60	1.0471976	100	1.7453293	140	2.4434610	180	3.1415927
30	0.5235988	70	1.2217305	110	1.9198622	150	2.6179939	190	3.3161256
40	0.6981317	80	1.3962634	120	2.0943951	160	2.7925268	200	3.4906585

$\pi = 3.14159$ $\log \pi = 0.497150$

Degrees in arc of length equal to radius, 57.295780.

Degrees in arc of length equal to π, 180.

Circumference $= 2\pi r =$ 360°.

Area $= \pi r^2.$

If l = length of circular arc
d = number of degrees in same
r = radius of same
c = chord of same
m = middle ordinate

$$d = \frac{l}{r}\cdot\frac{180^\circ}{\pi} = \frac{l}{r}\,57.3^\circ \text{ approx.}$$

$$r = \frac{l}{d}\cdot\frac{180^\circ}{\pi} = \frac{l}{d}\,57.3^\circ \text{ approx.}$$

$$l = \frac{d}{180}\pi r = \frac{d}{57.3^\circ}r \text{ approx.}$$

Area of sector $= \frac{1}{2}lr.$

Area of sector $= \dfrac{d}{360}\pi r^2.$

Approx. area of segment $= \frac{2}{3}cm.$

$$\frac{1}{\pi} = 0.31831.$$

Volume of sphere $= \frac{4}{3}\pi r^3.$

Square feet in 1 acre = 43,560.

Cubic feet in 1 cubic meter = 35.3145.

TABLE LXXVIII. — Stadia Functions

Differences of elevation for 100 feet rod reading

Deg.	0	1	2	3	4	5	6	7	8	9	Deg.
.00	0.00	1.74	3.49	5.23	6.96	8.68	10.40	12.10	13.78	15.45	.00
.05	0.09	1.83	3.57	5.31	7.05	8.77	10.48	12.18	13.87	15.53	.05
.1	0.17	1.92	3.66	5.40	7.13	8.85	10.57	12.26	13.95	15.62	.1
.15	0.26	2.01	3.75	5.49	7.22	8.94	10.65	12.35	14.03	15.70	.15
.2	0.35	2.09	3.84	5.57	7.30	9.03	10.74	12.43	14.12	15.78	.2
.25	0.42	2.18	3.92	5.66	7.39	9.11	10.82	12.52	14.20	15.87	.25
.3	0.52	2.27	4.01	5.75	7.48	9.20	10.91	12.60	14.28	15.95	.3
.35	0.61	2.36	4.10	5.83	7.56	9.28	10.99	12.69	14.37	16.03	.35
.4	0.70	2.44	4.18	5.92	7.65	9.37	11.08	12.77	14.45	16.11	.4
.45	0.79	2.53	4.27	6.01	7.73	9.46	11.16	12.86	14.54	16.20	.45
.5	0.87	2.62	4.36	6.09	7.82	9.54	11.25	12.94	14.62	16.28	.5
.55	0.96	2.70	4.44	6.18	7.91	9.63	11.33	13.03	14.70	16.36	.55
.6	1.05	2.79	4.53	6.27	7.99	9.71	11.42	13.11	14.79	16.44	.6
.65	1.13	2.88	4.62	6.35	8.08	9.80	11.50	13.19	14.87	16.52	.65
.7	1.22	2.97	4.71	6.44	8.17	9.88	11.59	13.28	14.95	16.61	.7
.75	1.31	3.05	4.79	6.53	8.25	9.97	11.67	13.36	15.04	16.69	.75
.8	1.40	3.14	4.88	6.61	8.34	10.05	11.76	13.45	15.12	16.77	.8
.85	1.48	3.23	4.97	6.70	8.42	10.14	11.84	13.53	15.20	16.86	.85
.9	1.57	3.31	5.05	6.79	8.51	10.22	11.93	13.61	15.28	16.94	.9
.95	1.66	3.40	5.14	6.87	8.60	10.31	12.01	13.70	15.37	17.02	.95
1.00	1.74	3.49	5.23	6.96	8.68	10.40	12.10	13.78	15.45	17.10	1.00

Corrections to rod readings for horizontal distance

Rod	0°	1°	2°	3°	4°	5°	6°	7°	8°	9°	Rod
100	0.0	0.0	0.1	0.3	0.5	0.8	1.1	1.5	1.9	2.5	100
200	0.0	0.1	0.2	0.5	1.0	1.5	2.2	3.0	3.9	4.9	200
300	0.0	0.1	0.4	0.8	1.5	2.3	3.3	4.5	5.8	7.4	300
400	0.0	0.1	0.5	1.1	2.0	3.0	4.4	6.0	7.8	9.8	400
500	0.0	0.2	0.6	1.4	2.5	3.8	5.5	7.5	9.7	12.3	500
600	0.0	0.2	0.7	1.6	2.9	4.6	6.5	8.9	11.6	14.7	600
700	0.0	0.2	0.8	1.9	3.4	5.3	7.6	10.4	13.6	17.2	700
800	0.0	0.2	1.0	2.2	3.9	6.1	8.7	11.9	15.5	19.6	800
900	0.0	0.3	1.1	2.4	4.4	6.8	9.8	13.4	17.5	22.1	900
1000	0.0	0.3	1.2	2.7	4.9	7.6	10.9	14.9	19.4	24.5	1000

TABLE LXXVIII. — (*Continued*)

Deg.	10	11	12	13	14	15	16	17	18	19	Deg.
.00	17.10	18.73	20.34	21.92	23.47	25.00	26.50	27.96	29.39	30.78	.00
.05	17.18	18.81	20.42	22.00	23.55	25.08	26.57	28.03	29.46	30.85	.05
.1	17.26	18.89	20.50	22.08	23.63	25.15	26.64	28.10	29.53	30.92	.1
.15	17.35	18.97	20.58	22.15	23.70	25.23	26.72	28.18	29.60	30.99	.15
.2	17.43	19.05	20.66	22.23	23.78	25.30	26.79	28.25	29.67	31.06	.2
.25	17.51	19.13	20.73	22.31	23.86	25.38	26.87	28.32	29.74	31.13	.25
.3	17.59	19.21	20.81	22.39	23.93	25.45	26.94	28.39	29.81	31.19	.3
.35	17.67	19.30	20.89	22.47	24.01	25.53	27.01	28.46	29.88	31.26	.35
.4	17.76	19.38	20.97	22.54	24.09	25.60	27.09	28.54	29.95	31.33	.4
.45	17.84	19.46	21.05	22.62	24.16	25.68	27.16	28.61	30.02	31.40	.45
.5	17.92	19.54	21.13	22.70	24.24	25.75	27.23	28.68	30.09	31.47	.5
.55	18.00	19.62	21.21	22.78	24.32	25.83	27.31	28.75	30.16	31.53	.55
.6	18.08	19.70	21.29	22.85	24.39	25.90	27.38	28.82	30.23	31.60	.6
.65	18.16	19.78	21.37	22.93	24.47	25.98	27.45	28.89	30.30	31.67	.65
.7	18.24	19.86	21.45	23.01	24.55	26.05	27.52	28.96	30.37	31.74	.7
.75	18.33	19.94	21.53	23.09	24.62	26.13	27.60	29.04	30.44	31.80	.75
.8	18.41	20.02	21.60	23.16	24.70	26.20	27.67	29.11	30.51	31.87	.8
.85	18.49	20.10	21.68	23.24	24.77	26.27	27.74	29.18	30.58	31.94	.85
.9	18.57	20.18	21.76	23.32	24.85	26.35	27.81	29.25	30.65	32.01	.9
.95	18.65	20.26	21.84	23.40	24.92	26.42	27.89	29.32	30.71	32.07	.95
1.00	18.73	20.34	21.92	23.47	25.00	26.50	27.96	29.39	30.78	32.14	1.00

Corrections to rod readings for horizontal distance

Rod	10°	11°	12°	13°	14°	15°	16°	17°	18°	19°	Rod
100	3.0	3.6	4.3	5.1	5.9	6.7	7.6	8.5	9.5	10.6	100
200	6.0	7.3	8.6	10.1	11.7	13.4	15.2	17.1	19.1	21.2	200
300	9.1	10.9	13.0	15.2	17.6	20.1	22.8	25.6	28.6	31.8	300
400	12.1	14.6	17.3	20.2	23.4	26.8	30.4	34.2	38.2	42.4	400
500	15.1	18.2	21.6	25.3	29.3	33.5	38.0	42.7	47.7	53.0	500
600	18.1	21.8	25.9	30.4	35.1	40.2	45.6	51.3	57.3	63.6	600
700	21.1	25.5	30.2	35.4	41.0	46.9	53.2	59.8	66.8	74.2	700
800	24.2	29.1	34.6	40.5	46.8	53.6	60.8	68.4	76.4	84.8	800
900	27.2	32.8	38.9	45.5	52.7	60.3	68.4	76.9	85.9	95.4	900
1000	30.2	36.4	43.2	50.6	58.5	67.0	76.0	85.5	95.5	106.0	1000

TABLE LXXVIII. — (*Continued*)

Deg.	20	21	22	23	24	25	26	27	28	29	Deg.
.00	32.14	33.46	34.73	35.97	37.16	38.30	39.40	40.45	41.45	42.40	.00
.05	32.21	33.52	34.80	36.03	37.22	38.36	39.45	40.50	41.50	42.45	.05
.1	32.27	33.59	34.86	36.09	37.27	38.41	39.51	40.55	41.55	42.49	.1
.15	32.34	33.65	34.92	36.15	37.33	38.47	39.56	40.60	41.60	42.54	.15
.2	32.41	33.72	34.98	36.21	37.39	38.53	39.61	40.66	41.65	42.59	.2
.25	32.47	33.78	35.05	36.27	37.45	38.58	39.67	40.71	41.69	42.63	.25
.3	32.54	33.84	35.11	36.33	37.51	38.64	39.72	40.76	41.74	42.68	.3
.35	32.61	33.91	35.17	36.39	37.56	38.69	39.77	40.81	41.79	42.72	.35
.4	32.67	33.97	35.23	36.45	37.62	38.75	39.83	40.86	41.84	42.77	.4
.45	32.74	34.04	35.29	36.51	37.68	38.80	39.88	40.91	41.89	42.81	.45
.5	32.80	34.10	35.36	36.57	37.74	38.86	39.93	40.96	41.93	42.86	.5
.55	32.87	34.16	35.42	36.63	37.79	38.91	39.98	41.01	41.98	42.90	.55
.6	32.93	34.23	35.48	36.69	37.85	38.97	40.04	41.06	42.03	42.95	.6
.65	33.00	34.29	35.54	36.75	37.91	39.02	40.09	41.11	42.08	42.99	.65
.7	33.07	34.35	35.60	36.80	37.96	39.08	40.14	41.16	42.12	43.04	.7
.75	33.13	34.42	35.66	36.86	38.02	39.13	40.19	41.21	42.17	43.08	.75
.8	33.20	34.48	35.72	36.92	38.08	39.18	40.24	41.26	42.22	43.13	.8
.85	33.26	34.54	35.78	36.98	38.13	39.24	40.30	41.31	42.26	43.17	.85
.9	33.33	34.61	35.85	37.04	38.19	39.29	40.35	41.35	42.31	43.21	.9
.95	33.39	34.67	35.91	37.10	38.25	39.35	40.40	41.40	42.36	43.26	.95
1.00	33.46	34.73	35.97	37.16	38.30	39.40	40.45	41.45	42.40	43.30	1.00

Corrections to rod readings for horizontal distance

Rod	20°	21°	22°	23°	24°	25°	26°	27°	28°	29°	Rod
100	11.7	12.8	14.0	15.3	16.5	17.9	19.2	20.6	22.0	23.5	100
200	23.4	25.7	28.1	30.5	33.1	35.7	38.4	41.2	44.1	47.0	200
300	35.1	38.5	42.1	45.8	49.6	53.6	57.7	61.8	66.1	70.5	300
400	46.8	51.4	56.1	61.1	66.2	71.4	76.9	82.4	88.2	94.0	400
500	58.5	64.2	70.2	76.4	82.7	89.3	96.1	103.1	110.2	117.5	500
600	70.2	77.0	84.2	91.6	99.2	107.2	115.3	123.7	132.2	141.0	600
700	81.9	89.9	98.2	106.9	115.8	125.0	134.5	144.3	154.3	164.5	700
800	93.6	102.7	112.2	122.2	132.3	142.9	153.8	164.9	176.3	188.0	800
900	105.3	115.6	126.3	137.4	148.9	160.7	173.0	185.5	198.4	211.5	900
1000	117.0	128.4	140.3	152.7	165.4	178.6	192.2	206.1	220.4	235.0	1000

TABLE LXXIX. — Barometric Elevations

Giving altitudes above arbitrary sea level (barometer reading 30 inches) for various barometer readings B.

To determine difference of elevation of two points having barometer readings B and B_1, take from the table the altitudes corresponding to B and B_1, and correct *their difference* by Table LXXX. The corrected difference is the quantity required.

B	A	Diff. for 0.01	B	A	Diff. for 0.01	B	A	Diff. for 0.01
Inches	Feet	Feet	Inches	Feet	Feet	Inches	Feet	Feet
11.0	27,336	−24.6	14.0	20,765	−19.5	17.0	15,476	−16.0
11.1	27,090	24.4	14.1	20,570	19.3	17.1	15,316	15.9
11.2	26,846	24.2	14.2	20,377	19.1	17.2	15,157	15.8
11.3	26,604	24.0	14.3	20,186	18.9	17.3	14,999	15.7
11.4	26,364	23.8	14.4	19,997	18.8	17.4	14,842	15.6
11.5	26,126	23.6	14.5	19,809	18.6	17.5	14,686	15.5
11.6	25,890	23.4	14.6	19,623	18.6	17.6	14,531	15.4
11.7	25,656	23.2	14.7	19,437	18.5	17.7	14,377	15.4
11.8	25,424	23.0	14.8	19,252	18.4	17.8	14,223	15.3
11.9	25,194	22.8	14.9	19,068	18.2	17.9	14,070	15.2
12.0	24,966	22.6	15.0	18,886	18.1	18.0	13,918	15.1
12.1	24,740	22.4	15.1	18,705	18.0	18.1	13,767	15.0
12.2	24,516	22.2	15.2	18,525	17.9	18.2	13,617	14.9
12.3	24,294	22.1	15.3	18,346	17.8	18.3	13,468	14.9
12.4	24,073	21.9	15.4	18,168	17.6	18.4	13,319	14.7
12.5	23,854	21.7	15.5	17,992	17.5	18.5	13,172	14.7
12.6	23,637	21.6	15.6	17,817	17.4	18.6	13,025	14.6
12.7	23,421	21.4	15.7	17,643	17.3	18.7	12,879	14.6
12.8	23,207	21.2	15.8	17,470	17.2	18.8	12,733	14.4
12.9	22,995	21.0	15.9	17,298	17.1	18.9	12,589	14.4
13.0	22,785	20.9	16.0	17,127	16.9	19.0	12,445	14.3
13.1	22,576	20.8	16.1	16,958	16.9	19.1	12,302	14.2
13.2	22,368	20.6	16.2	16,789	16.8	19.2	12,160	14.2
13.3	22,162	20.4	16.3	16,621	16.7	19.3	12,018	14.1
13.4	21,958	20.1	16.4	16,454	16.6	19.4	11,877	14.0
13.5	21,757	20.0	16.5	16,288	16.4	19.5	11,737	13.9
13.6	21,557	19.9	16.6	16,124	16.3	19.6	11,598	13.9
13.7	21,358	19.8	16.7	15,961	16.3	19.7	11,459	13.8
13.8	21,160	19.8	16.8	15,798	16.2	19.8	11,321	13.7
13.9	20,962	−19.7	16.9	15,636	−16.0	19.9	11,184	−13.7
14.0	20,765		17.0	15,476		20.0	11,047	

Taken from Appendix 10, "U. S. Coast and Geodetic Survey Report" for 1881.

TABLE LXXIX. — (*Continued*)

B	*A*	Diff. for 0.01	*B*	*A*	Diff. for 0.01	*B*	*A*	Diff. for 0.01
Inches	Feet	Feet	Inches	Feet	Feet	Inches	Feet	Feet
20.0	11,047	−13.6	23.7	6,423	−11.5	27.4	2,470	−9.9
20.1	10,911	13.5	23.8	6,308	11.4	27.5	2,371	9.9
20.2	10,776	13.4	23.9	6,194	11.4	27.6	2,272	9.9
20.3	10,642	13.4	24.0	6,080	11.3	27.7	2,173	9.8
20.4	10,508	13.3	24.1	5,967	11.3	27.8	2,075	9.8
20.5	10,375	13.3	24.2	5,854	11.3	27.9	1,977	9.7
20.6	10,242	13.2	24.3	5,741	11.2	28.0	1,880	9.7
20.7	10,110	13.1	24.4	5,629	11.1	28.1	1,783	9.7
20.8	9,979	13.1	24.5	5,518	11.1	28.2	1,686	9.7
20.9	9,848	13.0	24.6	5,407	11.1	28.3	1,589	9.6
21.0	9,718	12.9	24.7	5,296	11.0	28.4	1,493	9.6
21.1	9,589	12.9	24.8	5,186	10.9	28.5	1,397	9.5
21.2	9,460	12.8	24.9	5,077	10.9	28.6	1,302	9.5
21.3	9,332	12.8	25.0	4,968	10.9	28.7	1,207	9.5
21.4	9,204	12.7	25.1	4,859	10.8	28.8	1,112	9.4
21.5	9,077	12.6	25.2	4,751	10.8	28.9	1,018	9.4
21.6	8,951	12.6	25.3	4,643	10.8	29.0	924	9.4
21.7	8,825	12.5	25.4	4,535	10.7	29.1	830	9.4
21.8	8,700	12.5	25.5	4,428	10.7	29.2	736	9 3
21.9	8,575	12.4	25.6	4,321	10.6	29.3	643	9.3
22.0	8,451	12.4	25.7	4,215	10.6	29.4	550	9.2
22.1	8,327	12.3	25.8	4,109	10.5	29.5	458	9.2
22.2	8,204	12.2	25.9	4,004	10.5	29.6	366	9.2
22.3	8,082	12.2	26.0	3,899	10.5	29.7	274	9.2
22.4	7,960	12.2	26.1	3,794	10.4	29.8	182	9.1
22.5	7,838	12.1	26.2	3,690	10.4	29.9	91	9.1
22.6	7,717	12.0	26.3	3,586	10.3	30.0	00	9.1
22.7	7,597	12.0	26.4	3,483	10.3	30.1	−91	9.0
22.8	7,477	11.9	26.5	3,380	10.3	30.2	181	9.0
22.9	7,358	11.9	26.6	3,277	10.2	30.3	271	9.0
23.0	7,239	11.8	26.7	3,175	10.2	30.4	361	9.0
23.1	7,121	11.7	26.8	3,073	10.1	30.5	451	8.9
23.2	7,004	11.7	26.9	2,972	10.1	30.6	540	8.9
23.3	6,887	11.7	27.0	2,871	10.1	30.7	629	8.8
23.4	6,770	11.6	27.1	2,770	10.0	30.8	717	8.8
23.5	6,654	11.6	27.2	2,670	10.0	30.9	805	−8.8
23.6	6,538	−11.5	27.3	2,570	−10.0	31.0	−893	
23.7	6,423		27.4	2,470				

TABLE LXXX. — Correction Coefficient for Temperature and Hygrometric Conditions

This correction is used when no hygrometric observations have been made. To the difference in altitude found in Table LXXIX for the given barometer readings is added algebraically the product of that difference and the correction below given, according to the formula, diff. alt. = (diff. by Table LXXIX) $(1 + c)$.

Sum O. T.[1]	Corr. coeff.	Sum O. T.	Corr. Coeff.	Sum O. T.	Corr. coeff.
0°	−0.1024	70°	−0.0273	140°	+0.0471
10	−0.0915	80	−0.0166	150	+0.0575
20	−0.0806	90	−0.0058	160	+0.0677
30	−0.0698	100	+0.0049	170	+0.0779
40	−0.0592	110	+0.0156	180	+0.0879
50	−0.0486	120	+0.0262	....	....
60	−0.0380	130	+0.0368	....	....

[1] Computed from Tables I and IV, Appendix 10, "U. S. Coast Survey Report" for 1881.

TABLE LXXXI.[1] — Volume in cubic feet per second discharging over a thin plate weir one foot in length without end contractions[2] according to Francis' Formula $Q = 3.33\ L \sqrt{H^3}$.

Head, H, in ft.	Cu. ft. per sec.	Head, H, in ft.	Cu. ft. per sec.	Head, H, in ft.	Cu. ft. per sec.	Head, H, in ft.	Cu. ft. per sec.	Head, H, in ft.	Cu. ft. per sec.
.01	0.003	.51	1.213	1.01	3.380	1.51	6.179	2.01	9.489
.02	0.009	.52	1.249	1.02	3.430	1.52	6.240	2.02	9.560
.03	0.017	.53	1.285	1.03	3.481	1.53	6.302	2.03	9.631
.04	0.027	.54	1.321	1.04	3.532	1.54	6.364	2.04	9.703
.05	0.037	.55	1.358	1.05	3.583	1.55	6.426	2.05	9.774
.06	0.049	.56	1.395	1.06	3.634	1.56	6.488	2.06	9.846
.07	0.062	.57	1.433	1.07	3.686	1.57	6.551	2.07	9.917
.08	0.075	.58	1.471	1.08	3.737	1.58	6.613	2.08	9.989
.09	0.090	.59	1.509	1.09	3.790	1.59	6.676	2.09	10.062
.10	0.105	.60	1.548	1.10	3.842	1.60	6.739	2.10	10.134
.11	0.121	.61	1.586	1.11	3.894	1.61	6.803	2.11	10.206
.12	0.138	.62	1.626	1.12	3.947	1.62	6.866	2.12	10.279
.13	0.156	.63	1.665	1.13	4.000	1.63	6.930	2.13	10.352
.14	0.174	.64	1.705	1.14	4.053	1.64	6.994	2.14	10.425
.15	0.193	.65	1.745	1.15	4.107	1.65	7.058	2.15	10.498
.16	0.213	.66	1.786	1.16	4.160	1.66	7.122	2.16	10.571
.17	0.233	.67	1.826	1.17	4.214	1.67	7.187	2.17	10.645
.18	0.254	.68	1.867	1.18	4.268	1.68	7.251	2.18	10.718
.19	0.276	.69	1.909	1.19	4.323	1.69	7.316	2.19	10.792
.20	0.298	.70	1.950	1.20	4.377	1.70	7.381	2.20	10.866
.21	0.320	.71	1.992	1.21	4.432	1.71	7.446	2.21	10.940
.22	0.344	.72	2.034	1.22	4.487	1.72	7.512	2.22	11.015
.23	0.367	.73	2.077	1.23	4.543	1.73	7.577	2.23	11.089
.24	0.392	.74	2.120	1.24	4.598	1.74	7.643	2.24	11.164
.25	0.416	.75	2.163	1.25	4.654	1.75	7.709	2.25	11.239
.26	0.441	.76	2.206	1.26	4.710	1.76	7.775	2.26	11.314
.27	0.467	.77	2.250	1.27	4.766	1.77	7.842	2.27	11.389
.28	0.493	.78	2.294	1.28	4.822	1.78	7.908	2.28	11.464
.29	0.520	.79	2.338	1.29	4.879	1.79	7.975	2.29	11.540
.30	0.547	.80	2.383	1.30	4.936	1.80	8.042	2.30	11.615
.31	0.575	.81	2.428	1.31	4.993	1.81	8.109	2.31	11.691
.32	0.603	.82	2.473	1.32	5.050	1.82	8.176	2.32	11.767
.33	0.631	.83	2.518	1.33	5.108	1.83	8.244	2.33	11.843
.34	0.660	.84	2.564	1.34	5.165	1.84	8.311	2.34	11.920
.35	0.690	.85	2.610	1.35	5.223	1.85	8.379	2.35	11.996
.36	0.719	.86	2.656	1.36	5.281	1.86	8.447	2.36	12.073
.37	0.749	.87	2.702	1.37	5.340	1.87	8.515	2.37	12.150
.38	0.780	.88	2.749	1.38	5.398	1.88	8.584	2.38	12.227
.39	0.811	.89	2.796	1.39	5.457	1.89	8.652	2.39	12.304
.40	0.842	.90	2.843	1.40	5.516	1.90	8.721	2.40	12.381
.41	0.874	.91	2.891	1.41	5.575	1.91	8.790	2.41	12.459
.42	0.906	.92	2.939	1.42	5.635	1.92	8.859	2.42	12.536
.43	0.939	.93	2.987	1.43	5.694	1.93	8.929	2.43	12.614
.44	0.972	.94	3.035	1.44	5.754	1.94	8.998	2.44	12.692
.45	1.005	.95	3.083	1.45	5.814	1.95	9.068	2.45	12.770
.46	1.039	.96	3.132	1.46	5.875	1.96	9.138	2.46	12.848
.47	1.073	.97	3.181	1.47	5.935	1.97	9.208	2.47	12.927
.48	1.107	.98	3.231	1.48	5.996	1.98	9.278	2.48	13.005
.49	1.142	.99	3.280	1.49	6.057	1.99	9.348	2.49	13.084
.50	1.177	1.00	3.330	1.50	6.118	2.00	9.419	2.50	13.163

[1] From Trautwine's Engineers' Pocketbook.

[2] The table values are not seriously in error when there are end contractions provided L is at least 10 H. The original formula was limited to heads, H, between ½ foot and 2 feet. The tabular values are probably not seriously in error for the range given. For any weir of length L feet multiply the tabular values by L.

TABLE LXXXII

Feet to Meters

Feet	0 Meters	1 Meters	2 Meters	3 Meters	4 Meters	5 Meters	6 Meters	7 Meters	8 Meters	9 Meters
0	0.000	0.305	0.610	0.914	1.219	1.524	1.829	2.134	2.438	2.743
10	3.048	3.353	3.658	3.962	4.267	4.572	4.877	5.182	5.486	5.791
20	6.036	6.401	6.706	7.010	7.315	7.620	7.925	8.229	8.534	8.839
30	9.144	9.449	9.753	10.058	10.363	10.668	10.972	11.277	11.582	11.887
40	12.192	12.496	12.801	13.106	13.411	13.716	14.020	14.325	14.630	14.935
50	15.239	15.544	15.849	16.154	16.459	16.763	17.068	17.373	17.678	17.983
60	18.287	18.592	18.897	19.202	19.507	19.811	20.116	20.421	20.726	21.031
70	21.335	21.640	21.945	22.250	22.555	22.859	23.164	23.469	23.774	24.079
80	24.383	24.688	24.993	25.298	25.602	25.907	26.212	26.517	26.822	27.126
90	27.431	27.736	28.041	28.346	28.651	28.955	29.260	29.565	29.870	30.174
100	30.479	30.784	31.089	31.394	31.698	32.003	32.308	32.613	32.918	33.222

Meters to Feet

Meters	0 Feet	1 Feet	2 Feet	3 Feet	4 Feet	5 Feet	6 Feet	7 Feet	8 Feet	9 Feet
0	0.00	3.28	6.56	9.84	13.12	16.40	19.69	22.97	26.25	29.53
10	32.81	36.09	39.37	42.65	45.93	49.21	52.49	55.78	59.06	62.34
20	65.62	68.90	72.18	75.46	78.74	82.02	85.30	88.58	91.87	95.15
30	98.43	101.71	104.99	108.27	111.55	114.83	118.11	121.39	124.67	127.96
40	131.24	134.52	137.80	141.08	144.36	147.64	150.92	154.20	157.48	160.76
50	164.04	167.33	170.61	173.89	177.17	180.45	183.73	187.01	190.29	193.57
60	196.85	200.13	203.42	206.70	209.98	213.26	216.54	219.82	223.10	226.38
70	229.66	232.94	236.22	239.51	242.79	246.07	249.35	252.63	255.91	259.19
80	262.47	265.75	269.03	272.31	275.60	278.88	282.16	285.44	288.72	292.00
90	295.28	298.56	391.84	305.12	308.40	311.69	314.97	318.25	321.53	324.81
100	328.09	331.37	334.65	337.93	341.21	344.49	347.78	351.06	354.34	357.62

1 statute mile = 1.6093 kilometers.
1 kilometer = 0.6214 statute mile.

CHAPTER X

ADJUSTMENT OF INSTRUMENTS

The Transit. — The adjustments in order are:

I. Axis of plate bubbles perpendicular to vertical axis of instrument.

II. Line of sight perpendicular to and presumably coincident with horizontal axis of telescope.

1. Parallax.
2. Vertical wire perpendicular to horizontal axis of telescope.
3. Intersection of wires to axis of telescope.
4. Objective slide coincident with axis of telescope.
5. Line of sight perpendicular to horizontal axis of telescope.
6. Eyepiece to center.

III. Horizontal axis of telescope truly horizontal (Standard).

IV. Axis of telescope bubble parallel to line of sight.

V. Error of vernier of vertical circle.

To test for and make the adjustments:

I. Set up; turn the alidade through 180°; if the plate bubbles depart from the centers of their tubes, bring them halfway back with the adjusting pin, and relevel. Repeat test and adjustment until complete.

II. 1. Carefully focus the eyepiece on the wires until they are sharp and there is no apparent motion over an object sighted as the eye is moved a little sidewise or up and down.

2. Sight a minute distant point and note whether the vertical wire remains on the point as the telescope is slightly revolved on its horizontal axis. If not, loosen two adjacent capstan screws carrying the wire ring, and turn the ring slightly until by further trial the adjustment is complete.

3. Construct a pair of Y standards of wood, as two notches cut in opposite sides of a box, that will support the telescope near the two ends after it has been removed from the standards. Remove the telescope and place it in the Y's; direct the line of sight to any minute distant point and revolve the telescope in the Y's 180°; notice if the intersection of the wires remains on the point; if not, bring the wires halfway back to the point by opposite capstan screws, moving first

one set and then the other. Repeat the test and adjustment until complete. This adjustment is not often made but should be made if careful leveling is to be done with the transit.

4. Not all object slides are adjustable. If the slide may be adjusted, its adjustment may be tested by making a test for 3 on a very near object; if an error appears, the slide may be moved by moving the ring carrying it. The ring is often concealed by a band around the telescope. After adjusting the slide a test should be made again for 3, and both tests and adjustments repeated until complete.

5. Set up; sight a minute distant point, or set a pin some 200 to 400 feet away; transit the telescope and find a distant point in the line of sight or set a pin some 200 to 400 feet away; revolve in azimuth and sight the first point; transit and see whether the line of sight falls on the second point; if not, move the vertical wire one-fourth the apparent distance toward the second point; repeat the test and adjustment until complete. The same first point may be retained but new second points must be found or set for each test.

6. If the wires seem to be to one side of the field of view, the eyepiece is not centered. This need not cause error in work. To correct the condition, if the eyepiece is adjustable, move the ring carrying it between the eye end and the wire ring until the wires appear to be in the center of the field.

III. (*a*) Hang a plumb line from a high point not far from the transit, turn the line of sight on the line near its top and plunge the telescope downward, noting if the intersection of the wires follows the line; if not, raise or lower one end of the horizontal axis until the required condition is met.

(*b*) Sight a nearby high point, say, on a building, plunge the telescope and set a point near the level of the instrument or lower; reverse in azimuth, transit, and sight the high point; plunge again and note whether the line of sight cuts the first lower point set; if not, raise or lower one end of the horizontal axis until the required condition is met. A new lower point will be needed for each test.

IV. Adjust as described for the Y level, II 1 (*b*).

V. After making IV, with the transit carefully leveled, bring the telescope bubble to the center of its tube and note the reading of the vertical arc vernier. If it is not zero, either move the vernier till it does read zero or note the error as an index error to be applied to all vertical angle readings. Care must be taken to note whether the error is such as to diminish or increase angles of elevation; angles of depression will be affected in the opposite way.

The Y Level. — The adjustments are:

I. Line of sight coincident with axis of telescope.

1. Parallax.
2. Horizontal wire perpendicular to vertical axis of instrument.
3. Intersection of wires to axis of telescope.
4. Objective slide coincident with axis of telescope.
5. Eyepiece to center.

II. Bubble axis parallel to line of sight.

1. Vertical adjustment.
2. Lateral adjustment.

III. Y adjustment — bubble axis perpendicular to vertical axis of level.

To Make the Adjustment:

I. 1. Set up; focus the eyepiece on the wires until they appear sharp and there is no apparent motion over the field as the eye is moved a little sidewise or vertically.

2. Sight a distant point near one end of the horizontal wire; turn the telescope a little on the vertical axis and note if the point remains covered by the wire from one end to the other; if not, loosen two adjacent screws carrying the wire ring and turn the ring until by trial the required condition is met.

3. Loosen the clips over the Y's and sight a distant point, clamping the azimuth motion; revolve the telescope in the Y's upside down, and note whether the intersection of the wires remains on the point; if not, move the wire ring first sidewise and then vertically about half the apparent error until the intersection of the wires will remain on a point through a complete revolution of the telescope.

4. If the object slide is adjustable, perform the same test on a very near point and adjust the object slide. The ring carrying the object slide when it is adjustable is likely to be concealed beneath a band around the telescope between the object focusing screw and the wire adjusting screws.

5. When the instrument is adjusted the wires may appear to be out of the center of the field of view; if so, the eyepiece is out of center and may be centered by moving the ring between the eye end and the wire ring until the wires appear to center the field.

II. 1 (*a*) Set up carefully, loosen the clips over the Y's, remove the telescope and replace it end for end; if the bubble does not return to the center of the tube bring it halfway back by the bubble adjusting screws, relevel, and test and adjust again, until the required condition is met. A better method is the following:

(*b*) Set up midway between two stakes about 200 feet apart; read a rod on the two stakes and get their difference of elevation; set up beyond one of the stakes about $\frac{1}{10}$ the distance between them; read the rod on the near stake, apply the difference in level and add a correction for curvature, = 0.001 ft. for 220 feet, for a trial reading on the distant stake; read the rod on the distant stake and if the reading is not the same as the trial reading, move the target up or down $\frac{11}{10}$ of the apparent error according as the instrument is pointing low or high; set the line of sight on the target and bring the bubble to the center by its adjusting screws. Without moving the instrument make another complete test on near and far rod and continue until the required condition is met. If the level is set outside one stake one-fourth of the distance between the stakes the apparent error will be multiplied by $\frac{5}{4}$ instead of $\frac{11}{10}$, and similarly for other proportions.

2. With the level set up and the clips loose, turn the telescope a little in the Y's and note whether the bubble remains centered; if not, adjust it by the lateral adjusting screws at one end until it will so remain when the telescope is turned from side to side.

III. Set up and level with particular care over one set of leveling screws; turn on the vertical axis 180° and note whether the bubble remains in the center of the tube; if not, bring it halfway back by raising or lowering one Y by the capstan nuts through which its stem passes; relevel and repeat until the required condition is met.

The Dumpy Level. — The adjustments are:

I. Bubble axis perpendicular to vertical axis of level.

II. Line of sight parallel to bubble axis.

1. Parallax.
2. Horizontal wire perpendicular to vertical axis of instrument.
3. Line of sight.

The adjustments are made as follows:

I. Set up with telescope leveled with particular care over one set of screws; reverse in azimuth and note whether the bubble remains in the center of its tube; if not, bring it halfway back by the bubble adjusting screws; relevel and repeat until the condition is met.

II. 1 and 2 are made as for the Y level.

3 is made as for Y level II 1 (*b*), adjusting the wires to the bubble rather than the bubble to the wires; *i.e.*, centering the bubble and moving the horizontal wire to the computed correct reading on the distant rod.

CHAPTER XI

SEXAGESIMAL TRIGONOMETRIC FUNCTIONS

TABLE LXXXIII.—Logarithmic Sines, Cosines, Tangents, and Cotangents for Each Minute of Arc

To interpolate when the angles are less than 3°, the quantities S and T as found in the 5th and 6th columns of the first three pages are used as follows:

$$\text{Log sine}\ \alpha = \text{Log}\ \alpha' - S,$$
$$\text{Log tangent}\ \alpha = \text{Log}\ \alpha' - T,$$
$$\text{Log}\ \alpha' = \text{Log sine}\ \alpha + S = \text{Log tangent}\ \alpha + T.$$

For cosine and cotangent of angles near 90° use the sine and tangent of the complements.

′	′	L Sin	d	S	T	L Tan	c d	L Cot	L Cos	
0	**0**	——		——	——	——		——	0.00 000	**60**
1	1	6.46 373	30103	3.53 627	3.53 627	6.46 373	30103	3.53 627	0.00 000	59
2	2	6.76 476	17609	3.53 627	3.53 627	6.76 476	17609	3.23 524	0.00 000	58
3	3	6.94 085	12494	3.53 627	3.53 627	6.94 085	12494	3.05 915	0.00 000	57
4	4	7.06 579	9691	3.53 627	3.53 627	7.06 579	9691	2.93 421	0.00 000	56
5	5	7.16 270	7918	3.53 627	3.53 627	7.16 270	7918	2.83 730	0.00 000	55
6	6	7.24 188	6694	3.53 627	3.53 627	7.24 188	6694	2.75 812	0.00 000	54
7	7	7.30 882	5800	3.53 627	3.53 627	7.30 882	5800	2.69 118	0.00 000	53
8	8	7.36 682	5115	3.53 627	3.53 627	7.36 682	5115	2.63 318	0.00 000	52
9	9	7.41 797	4576	3.53 627	3.53 627	7.41 797	4576	2.58 203	0.00 000	51
10	**10**	7.46 373	4139	3.53 627	3.53 627	7.46 373	4139	2.53 627	0.00 000	**50**
11	11	7.50 512	3779	3.53 627	3.53 627	7.50 512	3779	2.49 488	0.00 000	49
12	12	7.54 291	3476	3.53 627	3.53 627	7.54 291	3476	2.45 709	0.00 000	48
13	13	7.57 767	3218	3.53 627	3.53 627	7.57 767	3219	2.42 233	0.00 000	47
14	14	7.60 985	2997	3.53 628	3.53 627	7.60 986	2996	2.39 014	0.00 000	46
15	15	7.63 982	2802	3.53 628	3.53 627	7.63 982	2803	2.36 018	0.00 000	45
16	16	7.66 784	2633	3.53 628	3.53 627	7.66 785	2633	2.33 215	0.00 000	44
17	17	7.69 417	2483	3.53 628	3.53 627	7.69 418	2482	2.30 582	9.99 999	43
18	18	7.71 900	2348	3.53 628	3.53 627	7.71 900	2348	2.28 100	9.99 999	42
19	19	7.74 248	2227	3.53 628	3.53 627	7.74 248	2228	2.25 752	9.99 999	41
20	**20**	7.76 475	2119	3.53 628	3.53 627	7.76 476	2119	2.23 524	9.99 999	**40**
21	21	7.78 594	2021	3.53 628	3.53 627	7.78 595	2020	2.21 405	9.99 999	39
22	22	7.80 615	1930	3.53 628	3.53 627	7.80 615	1931	2.19 385	9.99 999	38
23	23	7.82 545	1848	3.53 628	3.53 627	7.82 546	1848	2.17 454	9.99 999	37
24	24	7.84 393	1773	3.53 628	3.53 627	7.84 394	1773	2.15 606	9.99 999	36
25	25	7.86 166	1704	3.53 628	3.53 627	7.86 167	1704	2.13 833	9.99 999	35
26	26	7.87 870	1639	3.53 628	3.53 627	7.87 871	1639	2.12 129	9.99 999	34
27	27	7.89 509	1579	3.53 628	3.53 626	7.89 510	1579	2.10 490	9.99 999	33
28	28	7.91 088	1524	3.53 628	3.53 626	7.91 089	1524	2.08 911	9.99 999	32
29	29	7.92 612	1472	3.53 628	3.53 626	7.92 613	1473	2.07 387	9.99 998	31
30	**30**	7.94 084	1424	3.53 628	3.53 626	7.94 086	1424	2.05 914	9.99 998	**30**
31	31	7.95 508	1379	3.53 628	3.53 626	7.95 510	1379	2.04 490	9.99 998	29
32	32	7.96 887	1336	3.53 628	3.53 626	7.96 889	1336	2.03 111	9.99 998	28
33	33	7.98 223	1297	3.53 628	3.53 626	7.98 225	1297	2.01 775	9.99 998	27
34	34	7.99 520	1259	3.53 628	3.53 626	7.99 522	1259	2.00 478	9.99 998	26
35	35	8.00 779	1223	3.53 628	3.53 626	8.00 781	1223	1.99 219	9.99 998	25
36	36	8.02 002	1190	3.53 628	3.53 626	8.02 004	1190	1.97 996	9.99 998	24
37	37	8.03 192	1158	3.53 628	3.53 626	8.03 194	1159	1.96 806	9.99 997	23
38	38	8.04 350	1128	3.53 628	3.53 626	8.04 353	1128	1.95 647	9.99 997	22
39	39	8.05 478	1100	3.53 628	3.53 626	8.05 481	1100	1.94 519	9.99 997	21
40	**40**	8.06 578	1072	3.53 628	3.53 625	8.06 581	1072	1.93 419	9.99 997	**20**
41	41	8.07 650	1046	3.53 628	3.53 625	8.07 653	1047	1.92 347	9.99 997	19
42	42	8.08 696	1022	3.53 628	3.53 625	8.08 700	1022	1.91 300	9.99 997	18
43	43	8.09 718	999	3.53 629	3.53 625	8.09 722	998	1.90 278	9.99 997	17
44	44	8.10 717	976	3.53 629	3.53 625	8.10 720	976	1.89 280	9.99 996	16
45	45	8.11 693	954	3.53 629	3.53 625	8.11 696	955	1.88 304	9.99 996	15
46	46	8.12 647	934	3.53 629	3.53 625	8.12 651	934	1.87 349	9.99 996	14
47	47	8.13 581	914	3.53 629	3.53 625	8.13 585	915	1.86 415	9.99 996	13
48	48	8.14 495	896	3.53 629	3.53 625	8.14 500	895	1.85 500	9.99 996	12
49	49	8.15 391	877	3.53 629	3.53 624	8.15 395	878	1.84 605	9.99 996	11
50	**50**	8.16 268	860	3.53 629	3.53 624	8.16 273	860	1.83 727	9.99 995	**10**
51	51	8.17 128	843	3.53 629	3.53 624	8.17 133	843	1.82 867	9.99 995	9
52	52	8.17 971	827	3.53 629	3.53 624	8.17 976	828	1.82 024	9.99 995	8
53	53	8.18 798	812	3.53 629	3.53 624	8.18 804	812	1.81 196	9.99 995	7
54	54	8.19 610	797	3.53 629	3.53 624	8.19 616	797	1.80 384	9.99 995	6
55	55	8.20 407	782	3.53 629	3.53 624	8.20 413	782	1.79 587	9.99 994	5
56	56	8.21 189	769	3.53 629	3.53 624	8.21 195	769	1.78 805	9.99 994	4
57	57	8.21 958	755	3.53 629	3.53 623	8.21 964	756	1.78 036	9.99 994	3
58	58	8.22 713	743	3.53 629	3.53 623	8.22 720	742	1.77 280	9.99 994	2
59	59	8.23 456	730	3.53 630	3.53 623	8.23 462	730	1.76 538	9.99 994	1
60	**60**	8.24 186		3.53 630	3.53 623	8.24 192		1.75 808	9.99 993	**0**
		L Cos	d			L Cot	c d	L Tan	L Sin	′

′	′	L Sin	d	S	T	L Tan	c d	L Cot	L Cos	
60	0	8.24 186	717	3.53 630	3.53 623	8.24 192	718	1.75 808	9.99 993	60
61	1	8.24 903	706	3.53 630	3.53 623	8.24 910	706	1.75 090	9.99 993	59
62	2	8.25 609	695	3.53 630	3.53 623	8.25 616	696	1.74 384	9.99 993	58
63	3	8.26 304	684	3.53 630	3.53 623	8.26 312	684	1.73 688	9.99 993	57
64	4	8.26 988	673	3.53 630	3.53 622	8.26 996	673	1.73 004	9.99 992	56
65	5	8.27 661	663	3.53 630	3.53 622	8.27 669	663	1.72 331	9.99 992	55
66	6	8.28 324	653	3.53 630	3.53 622	8.28 332	654	1.71 668	9.99 992	54
67	7	8.28 977	644	3.53 630	3.53 622	8.28 986	643	1.71 014	9.99 992	53
68	8	8.29 621	634	3.53 630	3.53 622	8.29 629	634	1.70 371	9.99 992	52
69	9	8.30 255	624	3.53 630	3.53 622	8.30 263	625	1.69 737	9.99 991	51
70	10	8.30 879	616	3.53 630	3.53 621	8.30 888	617	1.69 112	9.99 991	50
71	11	8.31 495	608	3.53 630	3.53 621	8.31 505	607	1.68 495	9.99 991	49
72	12	8.32 103	599	3.53 631	3.53 621	8.32 112	599	1.67 888	9.99 990	48
73	13	8.32 702	590	3.53 631	3.53 621	8.32 711	591	1.67 289	9.99 990	47
74	14	8.33 292	583	3.53 631	3.53 621	8.33 302	584	1.66 698	9.99 990	46
75	15	8.33 875	575	3.53 631	3.53 620	8.33 886	575	1.66 114	9.99 990	45
76	16	8.34 450	568	3.53 631	3.53 620	8.34 461	568	1.65 539	9.99 989	44
77	17	8.35 018	560	3.53 631	3.53 620	8.35 029	561	1.64 971	9.99 989	43
78	18	8.35 578	553	3.53 631	3.53 620	8.35 590	553	1.64 410	9.99 989	42
79	19	8.36 131	547	3.53 631	3.53 620	8.36 143	546	1.63 857	9.99 989	41
80	20	8.36 678	539	3.53 631	3.53 620	8.36 689	540	1.63 311	9.99 988	40
81	21	8.37 217	533	3.53 631	3.53 619	8.37 229	533	1.62 771	9.99 988	39
82	22	8.37 750	526	3.53 632	3.53 619	8.37 762	527	1.62 238	9.99 988	38
83	23	8.38 276	520	3.53 632	3.53 619	8.38 289	520	1.61 711	9.99 987	37
84	24	8.38 796	514	3.53 632	3.53 619	8.38 809	514	1.61 191	9.99 987	36
85	25	8.39 310	508	3.53 632	3.53 619	8.39 323	509	1.60 677	9.99 987	35
86	26	8.39 818	502	3.53 632	3.53 618	8.39 832	502	1.60 168	9.99 986	34
87	27	8.40 320	496	3.53 632	3.53 618	8.40 334	496	1.59 666	9.99 986	33
88	28	8.40 816	491	3.53 632	3.53 618	8.40 830	491	1.59 170	9.99 986	32
89	29	8.41 307	485	3.53 632	3.53 618	8.41 321	486	1.58 679	9.99 985	31
90	30	8.41 792	480	3.53 632	3.53 617	8.41 807	480	1.58 193	9.99 985	30
91	31	8.42 272	474	3.53 632	3.53 617	8.42 287	475	1.57 713	9.99 985	29
92	32	8.42 746	470	3.53 633	3 53 617	8.42 762	470	1.57 238	9.99 984	28
93	33	8.43 216	464	3.53 633	3.53 617	8.43 232	464	1.56 768	9.99 984	27
94	34	8.43 680	459	3.53 633	3.53 617	8.43 696	460	1.56 304	9.99 984	26
95	35	8.44 139	455	3.53 633	3.53 616	8.44 156	455	1.55 844	9.99 983	25
96	36	8.44 594	450	3.53 633	3.53 616	8.44 611	450	1.55 389	9.99 983	24
97	37	8.45 044	445	3.53 633	3.53 616	8.45 061	446	1.54 939	9.99 983	23
98	38	8.45 489	441	3.53 633	3.53 616	8.45 507	441	1.54 493	9.99 982	22
99	39	8.45 930	436	3.53 633	3.53 615	8.45 948	437	1.54 052	9.99 982	21
100	40	8.46 366	433	3.53 634	3.53 615	8.46 385	432	1.53 615	9.99 982	20
101	41	8.46 799	427	3.53 634	3.53 615	8.46 817	428	1.53 183	9.99 981	19
102	42	8.47 226	424	3.53 634	3.53 615	8.47 245	424	1.52 755	9.99 981	18
103	43	8.47 650	419	3.53 634	3.53 614	8.47 669	420	1.52 331	9.99 981	17
104	44	8.48 069	416	3.53 634	3.53 614	8.48 089	416	1.51 911	9.99 980	16
105	45	8.48 485	411	3.53 634	3.53 614	8.48 505	412	1.51 495	9.99 980	15
106	46	8.48 896	408	3.53 634	3.53 614	8.48 917	408	1.51 083	9.99 979	14
107	47	8.49 304	404	3.53 634	3.53 613	8.49 325	404	1.50 675	9.99 979	13
108	48	8.49 708	400	3.53 635	3.53 613	8.49 729	401	1.50 271	9.99 979	12
109	49	8.50 108	396	3.53 635	3.53 613	8.50 130	397	1.49 870	9.99 978	11
110	50	8.50 504	393	3.53 635	3.53 613	8.50 527	393	1.49 473	9.99 978	10
111	51	8.50 897	390	3.53 635	3.53 612	8.50 920	390	1.49 080	9.99 977	9
112	52	8.51 287	386	3.53 635	3.53 612	8.51 310	386	1.48 690	9.99 977	8
113	53	8.51 673	382	3.53 635	3.53 612	8.51 696	383	1.48 304	9.99 977	7
114	54	8.52 055	379	3.53 635	3.53 611	8.52 079	380	1.47 921	9.99 976	6
115	55	8.52 434	376	3.53 635	3.53 611	8.52 459	376	1.47 541	9.99 976	5
116	56	8.52 810	373	3.53 636	3.53 611	8.52 835	373	1.47 165	9.99 975	4
117	57	8.53 183	369	3.53 636	3.53 611	8.53 208	370	1.46 792	9.99 975	3
118	58	8.53 552	367	3.53 636	3.53 610	8.53 578	367	1.46 422	9.99 974	2
119	59	8.53 919	363	3.53 636	3.53 610	8.53 945	363	1.46 055	9.99 974	1
120	60	8.54 282		3.53 636	3.53 610	8.54 308		1.45 692	9.99 974	0
		L Cos	d			L Cot	c d	L Tan	L Sin	′

″	′	L Sin	d	S	T	L Tan	c d	L Cot	L Cos	
120	0	8.54 282	360	3.53 636	3.53 610	8.54 308	361	1.45 692	9.99 974	60
121	1	8.54 642	357	3.53 636	3.53 609	8.54 669	358	1.45 331	9.99 973	59
122	2	8.54 999	355	3.53 637	3.53 609	8.55 027	355	1.44 973	9.99 973	58
123	3	8.55 354	351	3.53 637	3.53 609	8.55 382	352	1.44 618	9.99 972	57
124	4	8.55 705	349	3.53 637	3.53 609	8.55 734	349	1.44 266	9.99 972	56
125	5	8.56 054	346	3.53 637	3.53 608	8.56 083	346	1.43 917	9.99 971	55
126	6	8.56 400	343	3.53 637	3.53 608	8.56 429	344	1.43 571	9.99 971	54
127	7	8.56 743	341	3.53 637	3.53 608	8.56 773	341	1.43 227	9.99 970	53
128	8	8.57 084	337	3.53 637	3.53 607	8.57 114	338	1.42 886	9.99 970	52
129	9	8.57 421	336	3.53 638	3.53 607	8.57 452	336	1.42 548	9.99 969	51
130	10	8.57 757	332	3.53 638	3.53 607	8.57 788	333	1.42 212	9.99 969	50
131	11	8.58 089	330	3.53 638	3.53 606	8.58 121	330	1.41 879	9.99 968	49
132	12	8.58 419	328	3.53 638	3.53 606	8.58 451	328	1.41 549	9.99 968	48
133	13	8.58 747	325	3.53 638	3.53 606	8.58 779	326	1.41 221	9.99 967	47
134	14	8.59 072	323	3.53 638	3.53 605	8.59 105	323	1.40 895	9.99 967	46
135	15	8.59 395	320	3.53 639	3.53 605	8.59 428	321	1.40 572	9.99 967	45
136	16	8.59 715	318	3.53 639	3.53 605	8.59 749	319	1.40 251	9.99 966	44
137	17	8.60 033	316	3.53 639	3.53 604	8.60 068	316	1.39 932	9.99 966	43
138	18	8.60 349	313	3.53 639	3.53 604	8.60 384	314	1.39 616	9.99 965	42
139	19	8.60 662	311	3.53 639	3.53 604	8.60 698	311	1.39 302	9.99 964	41
140	20	8.60 973	309	3.53 639	3.53 603	8.61 009	310	1.38 991	9.99 964	40
141	21	8.61 282	307	3.53 640	3.53 603	8.61 319	307	1.38 681	9.99 963	39
142	22	8.61 589	305	3.53 640	3.53 603	8.61 626	305	1.38 374	9.99 963	38
143	23	8.61 894	302	3.53 640	3.53 602	8.61 931	303	1.38 069	9.99 962	37
144	24	8.62 196	301	3.53 640	3.53 602	8.62 234	301	1.37 766	9.99 962	36
145	25	8.62 497	298	3.53 640	3.53 602	8.62 535	299	1.37 465	9.99 961	35
146	26	8.62 795	296	3.53 640	3.53 601	8.62 834	297	1.37 166	9.99 961	34
147	27	8.63 091	294	3.53 641	3.53 601	8.63 131	295	1.36 869	9.99 960	33
148	28	8.63 385	293	3.53 641	3.53 601	8.63 426	292	1.36 574	9.99 960	32
149	29	8.63 678	290	3.53 641	3.53 600	8.63 718	291	1.36 282	9.99 959	31
150	30	8.63 968	288	3.53 641	3.53 600	8.64 009	289	1.35 991	9.99 959	30
151	31	8.64 256	287	3.53 641	3.53 599	8.64 298	287	1.35 702	9.99 958	29
152	32	8.64 543	284	3.53 642	3.53 599	8.64 585	285	1.35 415	9.99 958	28
153	33	8.64 827	283	3.53 642	3.53 599	8.64 870	284	1.35 130	9.99 957	27
154	34	8.65 110	281	3.53 642	3.53 598	8.65 154	281	1.34 846	9.99 956	26
155	35	8.65 391	279	3.53 642	3.53 598	8.65 435	280	1.34 565	9.99 956	25
156	36	8.65 670	277	3.53 642	3.53 598	8.65 715	278	1.34 285	9.99 955	24
157	37	8.65 947	276	3.53 642	3.53 597	8.65 993	276	1.34 007	9.99 955	23
158	38	8.66 223	274	3.53 643	3.53 597	8.66 269	274	1.33 731	9.99 954	22
159	39	8.66 497	272	3.53 643	3.53 596	8.66 543	273	1.33 457	9.99 954	21
160	40	8.66 769	270	3.53 643	3.53 596	8.66 816	271	1.33 184	9.99 953	20
161	41	8.67 039	269	3.53 643	3.53 596	8.67 087	269	1.32 913	9.99 952	19
162	42	8.67 308	267	3.53 643	3.53 595	8.67 356	268	1.32 644	9.99 952	18
163	43	8.67 575	266	3.53 644	3.53 595	8.67 624	266	1.32 376	9.99 951	17
164	44	8.67 841	263	3.53 644	3.53 594	8.67 890	264	1.32 110	9.99 951	16
165	45	8.68 104	263	3.53 644	3.53 594	8.68 154	263	1.31 846	9.99 950	15
166	46	8.68 367	260	3.53 644	3.53 594	8.68 417	261	1.31 583	9.99 949	14
167	47	8.68 627	259	3.53 644	3.53 593	8.68 678	260	1.31 322	9.99 949	13
168	48	8.68 886	258	3.53 645	3.53 593	8.68 938	258	1.31 062	9.99 948	12
169	49	8.69 144	256	3.53 645	3.53 592	8.69 196	257	1.30 804	9.99 948	11
170	50	8.69 400	254	3.53 645	3.53 592	8.69 453	255	1.30 547	9.99 947	10
171	51	8.69 654	253	3.53 645	3.53 592	8.69 708	254	1.30 292	9.99 946	9
172	52	8.69 907	252	3.53 646	3.53 591	8.69 962	252	1.30 038	9.99 946	8
173	53	8.70 159	250	3.53 646	3.53 591	8.70 214	251	1.29 786	9.99 945	7
174	54	8.70 409	249	3.53 646	3.53 590	8.70 465	249	1.29 535	9.99 944	6
175	55	8.70 658	247	3.53 646	3.53 590	8.70 714	248	1.29 286	9.99 944	5
176	56	8.70 905	246	3.53 646	3.53 589	8.70 962	246	1.29 038	9.99 943	4
177	57	8.71 151	244	3.53 647	3.53 589	8.71 208	245	1.28 792	9.99 942	3
178	58	8.71 395	243	3.53 647	3.53 589	8.71 453	244	1.28 547	9.99 942	2
179	59	8.71 638	242	3.53 647	3.53 588	8.71 697	243	1.28 303	9.99 941	1
180	60	8.71 880		3.53 647	3.53 588	8.71 940		1.28 060	9.99 940	0
		L Cos	d			L Cot	c d	L Tan	L Sin	′

′	L Sin	d	L Tan	c d	L Cot	L Cos	
0	8.71 880	240	8.71 940	241	1.28 060	9.99 940	**60**
1	8.72 120	239	8.72 181	239	1.27 819	9.99 940	59
2	8.72 359	238	8.72 420	239	1.27 580	9.99 939	58
3	8.72 597	237	8.72 659	237	1.27 341	9.99 938	57
4	8.72 834	235	8.72 896	236	1.27 104	9.99 938	56
5	8.73 069	234	8.73 132	234	1.26 868	9.99 937	55
6	8.73 303	232	8.73 366	234	1.26 634	9.99 936	54
7	8.73 535	232	8.73 600	232	1.26 400	9.99 936	53
8	8.73 767	230	8.73 832	231	1.26 168	9.99 935	52
9	8.73 997	229	8.74 063	229	1.25 937	9.99 934	51
10	8.74 226	228	8.74 292	229	1.25 708	9.99 934	**50**
11	8.74 454	226	8.74 521	227	1.25 479	9.99 933	49
12	8.74 680	226	8.74 748	226	1.25 252	9.99 932	48
13	8.74 906	224	8.74 974	225	1.25 026	9.99 932	47
14	8.75 130	223	8.75 199	224	1.24 801	9.99 931	46
15	8.75 353	222	8.75 423	222	1.24 577	9.99 930	45
16	8.75 575	220	8.75 645	222	1.24 355	9.99 929	44
17	8.75 795	220	8.75 867	220	1.24 133	9.99 929	43
18	8.76 015	219	8.76 087	219	1.23 913	9.99 928	42
19	8.76 234	217	8.76 306	219	1.23 694	9.99 927	41
20	8.76 451	216	8.76 525	217	1.23 475	9.99 926	**40**
21	8.76 667	216	8.76 742	216	1.23 258	9.99 926	39
22	8.76 883	214	8.76 958	215	1.23 042	9.99 925	38
23	8.77 097	213	8.77 173	214	1.22 827	9.99 924	37
24	8.77 310	212	8.77 387	213	1.22 613	9.99 923	36
25	8.77 522	211	8.77 600	211	1.22 400	9.99 923	35
26	8.77 733	210	8.77 811	211	1.22 189	9.99 922	34
27	8.77 943	209	8.78 022	210	1.21 978	9.99 921	33
28	8.78 152	208	8.78 232	209	1.21 768	9.99 920	32
29	8.78 360	208	8.78 441	208	1.21 559	9.99 920	31
30	8.78 568	206	8.78 649	206	1.21 351	9.99 919	**30**
31	8.78 774	205	8.78 855	206	1.21 145	9.99 918	29
32	8.78 979	204	8.79 061	205	1.20 939	9.99 917	28
33	8.79 183	203	8.79 266	204	1.20 734	9.99 917	27
34	8.79 386	202	8.79 470	203	1.20 530	9.99 916	26
35	8.79 588	201	8.79 673	202	1.20 327	9.99 915	25
36	8.79 789	201	8.79 875	201	1.20 125	9.99 914	24
37	8.79 990	199	8.80 076	201	1.19 924	9.99 913	23
38	8.80 189	199	8.80 277	199	1.19 723	9.99 913	22
39	8.80 388	197	8.80 476	198	1.19 524	9.99 912	21
40	8.80 585	197	8.80 674	198	1.19 326	9.99 911	**20**
41	8.80 782	196	8.80 872	196	1.19 128	9.99 910	19
42	8.80 978	195	8.81 068	196	1.18 932	9.99 909	18
43	8.81 173	194	8.81 264	195	1.18 736	9.99 909	17
44	8.81 367	193	8.81 459	194	1.18 541	9.99 908	16
45	8.81 560	192	8.81 653	193	1.18 347	9.99 907	15
46	8.81 752	192	8.81 846	192	1.18 154	9.99 906	14
47	8.81 944	190	8.82 038	192	1.17 962	9.99 905	13
48	8.82 134	190	8.82 230	190	1.17 770	9.99 904	12
49	8.82 324	189	8.82 420	190	1.17 580	9.99 904	11
50	8.82 513	188	8.82 610	189	1.17 390	9.99 903	**10**
51	8.82 701	187	8.82 799	188	1.17 201	9.99 902	9
52	8.82 888	187	8.82 987	188	1.17 013	9.99 901	8
53	8.83 075	186	8.83 175	186	1.16 825	9.99 900	7
54	8.83 261	185	8.83 361	186	1.16 639	9.99 899	6
55	8.83 446	184	8.83 547	185	1.16 453	9.99 898	5
56	8.83 630	183	8.83 732	184	1.16 268	9.99 898	4
57	8.83 813	183	8.83 916	184	1.16 084	9.99 897	3
58	8.83 996	181	8.84 100	182	1.15 900	9.99 896	2
59	8.84 177	181	8.84 282	182	1.15 718	9.99 895	1
60	8.84 358		8.84 464		1.15 536	9.99 894	**0**
	L Cos	d	L Cot	c d	L Tan	L Sin	′

P P

	241	**239**	**237**	**236**	**234**
1	24.1	23.9	23.7	23.6	23.4
2	48.2	47.8	47.4	47.2	46.8
3	72.3	71.7	71.1	70.8	70.2
4	96.4	95.6	94.8	94.4	93.6
5	120.5	119.5	118.5	118.0	117.0
6	144.6	143.4	142.2	141.6	140.4
7	168.7	167.3	165.9	165.2	163.8
8	192.8	191.2	189.6	188.8	187.2
9	216.9	215.1	213.3	212.4	210.6

	232	**231**	**229**	**227**	**226**
1	23.2	23.1	22.9	22.7	22.6
2	46.4	46.2	45.8	45.4	45.2
3	69.6	69.3	68.7	68.1	67.8
4	92.8	92.4	91.6	90.8	90.4
5	116.0	115.5	114.5	113.5	113.0
6	139.2	138.6	137.4	136.2	135.6
7	162.4	161.7	160.3	158.9	158.2
8	185.6	184.8	183.2	181.6	180.8
9	208.8	207.9	206.1	204.3	203.4

	224	**222**	**220**	**219**	**217**
1	22.4	22.2	22.0	21.9	21.7
2	44.8	44.4	44.0	43.8	43.4
3	67.2	66.6	66.0	65.7	65.1
4	89.6	88.8	88.0	87.6	86.8
5	112.0	111.0	110.0	109.5	108.5
6	134.4	133.2	132.0	131.4	130.2
7	156.8	155.4	154.0	153.3	151.9
8	179.2	177.6	176.0	175.2	173.6
9	201.6	199.8	198.0	197.1	195.3

	216	**214**	**213**	**211**	**209**
1	21.6	21.4	21.3	21.1	20.9
2	43.2	42.8	42.6	42.2	41.8
3	64.8	64.2	63.9	63.3	62.7
4	86.4	85.6	85.2	84.4	83.6
5	108.0	107.0	106.5	105.5	104.5
6	129.6	128.4	127.8	126.6	125.4
7	151.2	149.8	149.1	147.7	146.3
8	172.8	171.2	170.4	168.8	167.2
9	194.4	192.6	191.7	189.9	188.1

	208	**206**	**203**	**201**	**199**
1	20.8	20.6	20.3	20.1	19.9
2	41.6	41.2	40.6	40.2	39.8
3	62.4	61.8	60.9	60.3	59.7
4	83.2	82.4	81.2	80.4	79.6
5	104.0	103.0	101.5	100.5	99.5
6	124.8	123.6	121.8	120.6	119.4
7	145.6	144.2	142.1	140.7	139.3
8	166.4	164.8	162.4	160.8	159.2
9	187.2	185.4	182.7	180.9	179.1

	198	**196**	**194**	**192**	**190**
1	19.8	19.6	19.4	19.2	19.0
2	39.6	39.2	38.8	38.4	38.0
3	59.4	58.8	58.2	57.6	57.0
4	79.2	78.4	77.6	76.8	76.0
5	99.0	98.0	97.0	96.0	95.0
6	118.8	117.6	116.4	115.2	114.0
7	138.6	137.2	135.8	134.4	133.0
8	158.4	156.8	155.2	153.6	152.0
9	178.2	176.4	174.6	172.8	171.0

	188	**186**	**184**	**182**	**181**
1	18.8	18.6	18.4	18.2	18.1
2	37.6	37.2	36.8	36.4	36.2
3	56.4	55.8	55.2	54.6	54.3
4	75.2	74.4	73.6	72.8	72.4
5	94.0	93.0	92.0	91.0	90.5
6	112.8	111.6	110.4	109.2	108.6
7	131.6	130.2	128.8	127.4	126.7
8	150.4	148.8	147.2	145.6	144.8
9	169.2	167.4	165.6	163.8	162.9

P P

′	L Sin	d	L Tan	c d	L Cot	L Cos	
0	8.84 358	181	8.84 464	182	1.15 536	9.99 894	**60**
1	8.84 539	179	8.84 646	180	1.15 354	9.99 893	59
2	8.84 718	179	8.84 826	180	1.15 174	9.99 892	58
3	8.84 897	178	8.85 006	179	1.14 994	9.99 891	57
4	8.85 075	177	8.85 185	178	1.14 815	9.99 891	56
5	8.85 252	177	8.85 363	177	1.14 637	9.99 890	55
6	8.85 429	176	8.85 540	177	1.14 460	9.99 889	54
7	8.85 605	175	8.85 717	176	1.14 283	9.99 888	53
8	8.85 780	175	8.85 893	176	1.14 107	9.99 887	52
9	8.85 955	173	8.86 069	174	1.13 931	9.99 886	51
10	8.86 128	173	8.86 243	174	1.13 757	9.99 885	**50**
11	8.86 301	173	8.86 417	174	1.13 583	9.99 884	49
12	8.86 474	171	8.86 591	172	1.13 409	9.99 883	48
13	8.86 645	171	8.86 763	172	1.13 237	9.99 882	47
14	8.86 816	171	8.86 935	171	1.13 065	9.99 881	46
15	8.86 987	169	8.87 106	171	1.12 894	9.99 880	45
16	8.87 156	169	8.87 277	170	1.12 723	9.99 879	44
17	8.87 325	169	8.87 447	169	1.12 553	9.99 879	43
18	8.87 494	167	8.87 616	169	1.12 384	9.99 878	42
19	8.87 661	168	8.87 785	168	1.12 215	9.99 877	41
20	8.87 829	166	8.87 953	167	1.12 047	9.99 876	**40**
21	8.87 995	166	8.88 120	167	1.11 880	9.99 875	39
22	8.88 161	165	8.88 287	166	1.11 713	9.99 874	38
23	8.88 326	164	8.88 453	165	1.11 547	9.99 873	37
24	8.88 490	164	8.88 618	165	1.11 382	9.99 872	36
25	8.88 654	163	8.88 783	165	1.11 217	9.99 871	35
26	8.88 817	163	8.88 948	163	1.11 052	9.99 870	34
27	8.88 980	162	8.89 111	163	1.10 889	9.99 869	33
28	8.89 142	162	8.89 274	163	1.10 726	9.99 868	32
29	8.89 304	160	8.89 437	161	1.10 563	9.99 867	31
30	8.89 464	161	8.89 598	162	1.10 402	9.99 866	**30**
31	8.89 625	159	8.89 760	160	1.10 240	9.99 865	29
32	8.89 784	159	8.89 920	160	1.10 080	9.99 864	28
33	8.89 943	159	8.90 080	160	1.09 920	9.99 863	27
34	8.90 102	158	8.90 240	159	1.09 760	9.99 862	26
35	8.90 260	157	8.90 399	158	1.09 601	9.99 861	25
36	8.90 417	157	8.90 557	158	1.09 443	9.99 860	24
37	8.90 574	156	8.90 715	157	1.09 285	9.99 859	23
38	8.90 730	155	8.90 872	157	1.09 128	9.99 858	22
39	8.90 885	155	8.91 029	156	1.08 971	9.99 857	21
40	8.91 040	155	8.91 185	155	1.08 815	9.99 856	**20**
41	8.91 195	154	8.91 340	155	1.08 660	9.99 855	19
42	8.91 349	153	8.91 495	155	1.08 505	9.99 854	18
43	8.91 502	153	8.91 650	153	1.08 350	9.99 853	17
44	8.91 655	152	8.91 803	154	1.08 197	9.99 852	16
45	8.91 807	152	8.91 957	153	1.08 043	9.99 851	15
46	8.91 959	151	8.92 110	152	1.07 890	9.99 850	14
47	8.92 110	151	8.92 262	152	1.07 738	9.99 848	13
48	8.92 261	150	8.92 414	151	1.07 586	9.99 847	12
49	8.92 411	150	8.92 565	151	1.07 435	9.99 846	11
50	8.92 561	149	8.92 716	150	1.07 284	9.99 845	**10**
51	8.92 710	149	8.92 866	150	1.07 134	9.99 844	9
52	8.92 859	148	8.93 016	149	1.06 984	9.99 843	8
53	8.93 007	147	8.93 165	148	1.06 835	9.99 842	7
54	8.93 154	147	8.93 313	149	1.06 687	9.99 841	6
55	8.93 301	147	8.93 462	147	1.06 538	9.99 840	5
56	8.93 448	146	8.93 609	147	1.06 391	9.99 839	4
57	8.93 594	146	8.93 756	147	1.06 244	9.99 838	3
58	8.93 740	145	8.93 903	146	1.06 097	9.99 837	2
59	8.93 885	145	8.94 049	146	1.05 951	9.99 836	1
60	8.94 030		8.94 195		1.05 805	9.99 834	**0**
	L Cos	d	L Cot	c d	L Tan	L Sin	′

P P

	182	**181**	**180**	**179**	**178**
1	18.2	18.1	18.0	17.9	17.8
2	36.4	36.2	36.0	35.8	35.6
3	54.6	54.3	54.0	53.7	53.4
4	72.8	72.4	72.0	71.6	71.2
5	91.0	90.5	90.0	89.5	89.0
6	109.2	108.6	108.0	107.4	106.8
7	127.4	126.7	126.0	125.3	124.6
8	145.6	144.8	144.0	143.2	142.4
9	163.8	162.9	162.0	161.1	160.2
	177	**176**	**175**	**174**	**173**
1	17.7	17.6	17.5	17.4	17.3
2	35.4	35.2	35.0	34.8	34.6
3	53.1	52.8	52.5	52.2	51.9
4	70.8	70.4	70.0	69.6	69.2
5	88.5	88.0	87.5	87.0	86.5
6	106.2	105.6	105.0	104.4	103.8
7	123.9	123.2	122.5	121.8	121.1
8	141.6	140.8	140.0	139.2	138.4
9	159.3	158.4	157.5	156.6	155.7
	172	**171**	**170**	**169**	**168**
1	17.2	17.1	17.0	16.9	16.8
2	34.4	34.2	34.0	33.8	33.6
3	51.6	51.3	51.0	50.7	50.4
4	68.8	68.4	68.0	67.6	67.2
5	86.0	85.5	85.0	84.5	84.0
6	103.2	102.6	102.0	101.4	100.8
7	120.4	119.7	119.0	118.3	117.6
8	137.6	136.8	136.0	135.2	134.4
9	154.8	153.9	153.0	152.1	151.2
	167	**166**	**165**	**164**	**163**
1	16.7	16.6	16.5	16.4	16.3
2	33.4	33.2	33.0	32.8	32.6
3	50.1	49.8	49.5	49.2	48.9
4	66.8	66.4	66.0	65.6	65.2
5	83.5	83.0	82.5	82.0	81.5
6	100.2	99.6	99.0	98.4	97.8
7	116.9	116.2	115.5	114.8	114.1
8	133.6	132.8	132.0	131.2	130.4
9	150.3	149.4	148.5	147.6	146.7
	162	**161**	**160**	**159**	**158**
1	16.2	16.1	16.0	15.9	15.8
2	32.4	32.2	32.0	31.8	31.6
3	48.6	48.3	48.0	47.7	47.4
4	64.8	64.4	64.0	63.6	63.2
5	81.0	80.5	80.0	79.5	79.0
6	97.2	96.6	96.0	95.4	94.8
7	113.4	112.7	112.0	111.3	110.6
8	129.6	128.8	128.0	127.2	126.4
9	145.8	144.9	144.0	143.1	142.2
	157	**156**	**155**	**154**	**153**
1	15.7	15.6	15.5	15.4	15.3
2	31.4	31.2	31.0	30.8	30.6
3	47.1	46.8	46.5	46.2	45.9
4	62.8	62.4	62.0	61.6	61.2
5	78.5	78.0	77.5	77.0	76.5
6	94.2	93.6	93.0	92.4	91.8
7	109.9	109.2	108.5	107.8	107.1
8	125.6	124.8	124.0	123.2	122.4
9	141.3	140.4	139.5	138.6	137.7
	152	**151**	**150**	**149**	**148**
1	15.2	15.1	15.0	14.9	14.8
2	30.4	30.2	30.0	29.8	29.6
3	45.6	45.3	45.0	44.7	44.4
4	60.8	60.4	60.0	59.6	59.2
5	76.0	75.5	75.0	74.5	74.0
6	91.2	90.6	90.0	89.4	88.8
7	106.4	105.7	105.0	104.3	103.6
8	121.6	120.8	120.0	119.2	118.4
9	136.8	135.9	135.0	134.1	133.2

P P

′	L Sin	d	L Tan	c d	L Cot	L Cos	
0	8.94 030	144	8.94 195	145	1.05 805	9.99 834	**60**
1	8.94 174	143	8.94 340	145	1.05 660	9.99 833	59
2	8.94 317	144	8.94 485	145	1.05 515	9.99 832	58
3	8.94 461	142	8.94 630	143	1.05 370	9.99 831	57
4	8.94 603	143	8.94 773	144	1.05 227	9.99 830	56
5	8.94 746	141	8.94 917	143	1.05 083	9.99 829	55
6	8.94 887	142	8.95 060	142	1.04 940	9.99 828	54
7	8.95 029	141	8.95 202	142	1.04 798	9.99 827	53
8	8.95 170	140	8.95 344	142	1.04 656	9.99 825	52
9	8.95 310	140	8.95 486	141	1.04 514	9.99 824	51
10	8.95 450	139	8.95 627	140	1.04 373	9.99 823	**50**
11	8.95 589	139	8.95 767	141	1.04 233	9.99 822	49
12	8.95 728	139	8.95 908	139	1.04 092	9.99 821	48
13	8.95 867	138	8.96 047	140	1.03 953	9.99 820	47
14	8.96 005	138	8.96 187	138	1.03 813	9.99 819	46
15	8.96 143	137	8.96 325	139	1.03 675	9.99 817	45
16	8.96 280	137	8.96 464	138	1.03 536	9.99 816	44
17	8.96 417	136	8.96 602	137	1.03 398	9.99 815	43
18	8.96 553	136	8.96 739	138	1.03 261	9.99 814	42
19	8.96 689	136	8.96 877	136	1.03 123	9.99 813	41
20	8.96 825	135	8.97 013	137	1.02 987	9.99 812	**40**
21	8.96 960	135	8.97 150	135	1.02 850	9.99 810	39
22	8.97 095	134	8.97 285	136	1.02 715	9.99 809	38
23	8.97 229	134	8.97 421	135	1.02 579	9.99 808	37
24	8.97 363	133	8.97 556	135	1.02 444	9.99 807	36
25	8.97 496	133	8.97 691	134	1.02 309	9.99 806	35
26	8.97 629	133	8.97 825	134	1.02 175	9.99 804	34
27	8.97 762	132	8.97 959	133	1.02 041	9.99 803	33
28	8.97 894	132	8.98 092	133	1.01 908	9.99 802	32
29	8.98 026	131	8.98 225	133	1.01 775	9.99 801	31
30	8.98 157	131	8.98 358	132	1.01 642	9.99 800	**30**
31	8.98 288	131	8.98 490	132	1.01 510	9.99 798	29
32	8.98 419	130	8.98 622	131	1.01 378	9.99 797	28
33	8.98 549	130	8.98 753	131	1.01 247	9.99 796	27
34	8.98 679	129	8.98 884	131	1.01 116	9.99 795	26
35	8.98 808	129	8.99 015	130	1.00 985	9.99 793	25
36	8.98 937	129	8.99 145	130	1.00 855	9.99 792	24
37	8.99 066	128	8.99 275	130	1.00 725	9.99 791	23
38	8.99 194	128	8.99 405	129	1.00 595	9.99 790	22
39	8.99 322	128	8.99 534	128	1.00 466	9.99 788	21
40	8.99 450	127	8.99 662	129	1.00 338	9.99 787	**20**
41	8.99 577	127	8.99 791	128	1.00 209	9.99 786	19
42	8.99 704	126	8.99 919	127	1.00 081	9.99 785	18
43	8.99 830	126	9.00 046	128	0.99 954	9.99 783	17
44	8.99 956	126	9.00 174	127	0.99 826	9.99 782	16
45	9.00 082	125	9.00 301	126	0.99 699	9.99 781	15
46	9.00 207	125	9.00 427	126	0.99 573	9.99 780	14
47	9.00 332	124	9.00 553	126	0.99 447	9.99 778	13
48	9.00 456	125	9.00 679	126	0.99 321	9.99 777	12
49	9.00 581	123	9.00 805	125	0.99 195	9.99 776	11
50	9.00 704	124	9.00 930	125	0.99 070	9.99 775	**10**
51	9.00 828	123	9.01 055	124	0.98 945	9.99 773	9
52	9.00 951	123	9.01 179	124	0.98 821	9.99 772	8
53	9.01 074	122	9.01 303	124	0.98 697	9.99 771	7
54	9.01 196	122	9.01 427	123	0.98 573	9.99 769	6
55	9.01 318	122	9.01 550	123	0.98 450	9.99 768	5
56	9.01 440	121	9.01 673	123	0.98 327	9.99 767	4
57	9.01 561	121	9.01 796	122	0.98 204	9.99 765	3
58	9.01 682	121	9.01 918	122	0.98 082	9.99 764	2
59	9.01 803	120	9.02 040	122	0.97 960	9.99 763	1
60	9.01 923		9.02 162		0.97 838	9.99 761	**0**
	L Cos	d	L Cot	c d	L Tan	L Sin	′

P P

	147	**146**	**145**	**144**
1	14.7	14.6	14.5	14.4
2	29.4	29.2	29.0	28.8
3	44.1	43.8	43.5	43.2
4	58.8	58.4	58.0	57.6
5	73.5	73.0	72.5	72.0
6	88.2	87.6	87.0	86.4
7	102.9	102.2	101.5	100.8
8	117.6	116.8	116.0	115.2
9	132.3	131.4	130.5	129.6
	143	**142**	**141**	**140**
1	14.3	14.2	14.1	14.0
2	28.6	28.4	28.2	28.0
3	42.9	42.6	42.3	42.0
4	57.2	56.8	56.4	56.0
5	71.5	71.0	70.5	70.0
6	85.8	85.2	84.6	84.0
7	100.1	99.4	98.7	98.0
8	114.4	113.6	112.8	112.0
9	128.7	127.8	126.9	126.0
	139	**138**	**137**	**136**
1	13.9	13.8	13.7	13.6
2	27.8	27.6	27.4	27.2
3	41.7	41.4	41.1	40.8
4	55.6	55.2	54.8	54.4
5	69.5	69.0	68.5	68.0
6	83.4	82.8	82.2	81.6
7	97.3	96.6	95.9	95.2
8	111.2	110.4	109.6	108.8
9	125.1	124.2	123.3	122.4
	135	**134**	**133**	**132**
1	13.5	13.4	13.3	13.2
2	27.0	26.8	26.6	26.4
3	40.5	40.2	39.9	39.6
4	54.0	53.6	53.2	52.8
5	67.5	67.0	66.5	66.0
6	81.0	80.4	79.8	79.2
7	94.5	93.8	93.1	92.4
8	108.0	107.2	106.4	105.6
9	121.5	120.6	119.7	118.8
	131	**130**	**129**	**128**
1	13.1	13.0	12.9	12.8
2	26.2	26.0	25.8	25.6
3	39.3	39.0	38.7	38.4
4	52.4	52.0	51.6	51.2
5	65.5	65.0	64.5	64.0
6	78.6	78.0	77.4	76.8
7	91.7	91.0	90.3	89.6
8	104.8	104.0	103.2	102.4
9	117.9	117.0	116.1	115.2
	127	**126**	**125**	**124**
1	12.7	12.6	12.5	12.4
2	25.4	25.2	25.0	24.8
3	38.1	37.8	37.5	37.2
4	50.8	50.4	50.0	49.6
5	63.5	63.0	62.5	62.0
6	76.2	75.6	75.0	74.4
7	88.9	88.2	87.5	86.8
8	101.6	100.8	100.0	99.2
9	114.3	113.4	112.5	111.6
	123	**122**	**121**	**120**
1	12.3	12.2	12.1	12.0
2	24.6	24.4	24.2	24.0
3	36.9	36.6	36.3	36.0
4	49.2	48.8	48.4	48.0
5	61.5	61.0	60.5	60.0
6	73.8	73.2	72.6	72.0
7	86.1	85.4	84.7	84.0
8	98.4	97.6	96.8	96.0
9	110.7	109.8	108.9	108.0

P P

′	L Sin	d	L Tan	c d	L Cot	L Cos	
0	9.01 923	120	9.02 162	121	0.97 838	9.99 761	**60**
1	9.02 043	120	9.02 283	121	0.97 717	9.99 760	59
2	9.02 163	120	9.02 404	121	0.97 596	9.99 759	58
3	9.02 283	119	9.02 525	120	0.97 475	9.99 757	57
4	9.02 402	118	9.02 645	121	0.97 355	9.99 756	56
5	9.02 520	119	9.02 766	119	0.97 234	9.99 755	55
6	9.02 639	118	9.02 885	120	0.97 115	9.99 753	54
7	9.02 757	117	9.03 005	119	0.96 995	9.99 752	53
8	9.02 874	118	9.03 124	118	0.96 876	9.99 751	52
9	9.02 992	117	9.03 242	119	0.96 758	9.99 749	51
10	9.03 109	117	9.03 361	118	0.96 639	9.99 748	**50**
11	9.03 226	116	9.03 479	118	0.96 521	9.99 747	49
12	9.03 342	116	9.03 597	117	0.96 403	9.99 745	48
13	9.03 458	116	9.03 714	118	0.96 286	9.99 744	47
14	9.03 574	116	9.03 832	116	0.96 168	9.99 742	46
15	9.03 690	115	9.03 948	117	0.96 052	9.99 741	45
16	9.03 805	115	9.04 065	116	0.95 935	9.99 740	44
17	9.03 920	114	9.04 181	116	0.95 819	9.99 738	43
18	9.04 034	115	9.04 297	116	0.95 703	9.99 737	42
19	9.04 149	113	9.04 413	115	0.95 587	9.99 736	41
20	9.04 262	114	9.04 528	115	0.95 472	9.99 734	**40**
21	9.04 376	114	9.04 643	115	0.95 357	9.99 733	39
22	9.04 490	113	9.04 758	115	0.95 242	9.99 731	38
23	9.04 603	112	9.04 873	114	0.95 127	9.99 730	37
24	9.04 715	113	9.04 987	114	0.95 013	9.99 728	36
25	9.04 828	112	9.05 101	113	0.94 899	9.99 727	35
26	9.04 940	112	9.05 214	114	0.94 786	9.99 726	34
27	9.05 052	112	9.05 328	113	0.94 672	9.99 724	33
28	9.05 164	111	9.05 441	112	0.94 559	9.99 723	32
29	9.05 275	111	9.05 553	113	0.94 447	9.99 721	31
30	9.05 386	111	9.05 666	112	0.94 334	9.99 720	**30**
31	9.05 497	110	9.05 778	112	0.94 222	9.99 718	29
32	9.05 607	110	9.05 890	112	0.94 110	9.99 717	28
33	9.05 717	110	9.06 002	111	0.93 998	9.99 716	27
34	9.05 827	110	9.06 113	111	0.93 887	9.99 714	26
35	9.05 937	109	9.06 224	111	0.93 776	9.99 713	25
36	9.06 046	109	9.06 335	110	0.93 665	9.99 711	24
37	9.06 155	109	9.06 445	111	0.93 555	9.99 710	23
38	9.06 264	108	9.06 556	110	0.93 444	9.99 708	22
39	9.06 372	109	9.06 666	109	0.93 334	9.99 707	21
40	9.06 481	108	9.06 775	110	0.93 225	9.99 705	**20**
41	9.06 589	107	9.06 885	109	0.93 115	9.99 704	19
42	9.06 696	108	9.06 994	109	0.93 006	9.99 702	18
43	9.06 804	107	9.07 103	108	0.92 897	9.99 701	17
44	9.06 911	107	9.07 211	109	0.92 789	9.99 699	16
45	9.07 018	106	9.07 320	108	0.92 680	9.99 698	15
46	9.07 124	107	9.07 428	108	0.92 572	9.99 696	14
47	9.07 231	106	9.07 536	107	0.92 464	9.99 695	13
48	9.07 337	105	9.07 643	108	0.92 357	9.99 693	12
49	9.07 442	106	9.07 751	107	0.92 249	9.99 692	11
50	9.07 548	105	9.07 858	106	0.92 142	9.99 690	**10**
51	9.07 653	105	9.07 964	107	0.92 036	9.99 689	9
52	9.07 758	105	9.08 071	106	0.91 929	9.99 687	8
53	9.07 863	105	9.08 177	106	0.91 823	9.99 686	7
54	9.07 968	104	9.08 283	106	0.91 717	9.99 684	6
55	9.08 072	104	9.08 389	106	0.91 611	9.99 683	5
56	9.08 176	104	9.08 495	105	0.91 505	9.99 681	4
57	9.08 280	103	9.08 600	105	0.91 400	9.99 680	3
58	9.08 383	103	9.08 705	105	0.91 295	9.99 678	2
59	9.08 486	103	9.08 810	104	0.91 190	9.99 677	1
60	9.08 589		9.08 914		0.91 086	9.99 675	**0**
	L Cos	d	L Cot	c d	L Tan	L Sin	′

P P

	121	**120**	**119**	**118**
1	12.1	12.0	11.9	11.8
2	24.2	24.0	23.8	23.6
3	36.3	36.0	35.7	35.4
4	48.4	48.0	47.6	47.2
5	60.5	60.0	59.5	59.0
6	72.6	72.0	71.4	70.8
7	84.7	84.0	83.3	82.6
8	96.8	96.0	95.2	94.4
9	108.9	108.0	107.1	106.2

	117	**116**	**115**	**114**
1	11.7	11.6	11.5	11.4
2	23.4	23.2	23.0	22.8
3	35.1	34.8	34.5	34.2
4	46.8	46.4	46.0	45.6
5	58.5	58.0	57.5	57.0
6	70.2	69.6	69.0	68.4
7	81.9	81.2	80.5	79.8
8	93.6	92.8	92.0	91.2
9	105.3	104.4	103.5	102.6

	113	**112**	**111**	**110**
1	11.3	11.2	11.1	11.0
2	22.6	22.4	22.2	22.0
3	33.9	33.6	33.3	33.0
4	45.2	44.8	44.4	44.0
5	56.5	56.0	55.5	55.0
6	67.8	67.2	66.6	66.0
7	79.1	78.4	77.7	77.0
8	90.4	89.6	88.8	88.0
9	101.7	100.8	99.9	99.0

	109	**108**	**107**	**106**
1	10.9	10.8	10.7	10.6
2	21.8	21.6	21.4	21.2
3	32.7	32.4	32.1	31.8
4	43.6	43.2	42.8	42.4
5	54.5	54.0	53.5	53.0
6	65.4	64.8	64.2	63.6
7	76.3	75.6	74.9	74.2
8	87.2	86.4	85.6	84.8
9	98.1	97.2	96.3	95.4

	105	**104**	**103**
1	10.5	10.4	10.3
2	21.0	20.8	20.6
3	31.5	31.2	30.9
4	42.0	41.6	41.2
5	52.5	52.0	51.5
6	63.0	62.4	61.8
7	73.5	72.8	72.1
8	84.0	83.2	82.4
9	94.5	93.6	92.7

P P

′	L Sin	d	L Tan	c d	L Cot	L Cos	
0	9.08 589	103	9.08 914	105	0.91 086	9.99 675	**60**
1	9.08 692	103	9.09 019	104	0.90 981	9.99 674	59
2	9.08 795	102	9.09 123	104	0.90 877	9.99 672	58
3	9.08 897	102	9.09 227	103	0.90 773	9.99 670	57
4	9.08 999	102	9.09 330	104	0.90 670	9.99 669	56
5	9.09 101	101	9.09 434	103	0.90 566	9.99 667	55
6	9.09 202	102	9.09 537	103	0.90 463	9.99 666	54
7	9.09 304	101	9.09 640	102	0.90 360	9.99 664	53
8	9.09 405	101	9.09 742	103	0.90 258	9.99 663	52
9	9.09 506	100	9.09 845	102	0.90 155	9.99 661	51
10	9.09 606	101	9.09 947	102	0.90 053	9.99 659	**50**
11	9.09 707	100	9.10 049	101	0.89 951	9.99 658	49
12	9.09 807	100	9.10 150	102	0.89 850	9.99 656	48
13	9.09 907	99	9.10 252	101	0.89 748	9.99 655	47
14	9.10 006	100	9.10 353	101	0.89 647	9.99 653	46
15	9.10 106	99	9.10 454	101	0.89 546	9.99 651	45
16	9.10 205	99	9.10 555	101	0.89 445	9.99 650	44
17	9.10 304	98	9.10 656	100	0.89 344	9.99 648	43
18	9.10 402	99	9.10 756	100	0.89 244	9.99 647	42
19	9.10 501	98	9.10 856	100	0.89 144	9.99 645	41
20	9.10 599	98	9.10 956	100	0.89 044	9.99 643	**40**
21	9.10 697	98	9.11 056	99	0.88 944	9.99 642	39
22	9.10 795	98	9.11 155	99	0.88 845	9.99 640	38
23	9.10 893	97	9.11 254	99	0.88 746	9.99 638	37
24	9.10 990	97	9.11 353	99	0.88 647	9.99 637	36
25	9.11 087	97	9.11 452	99	0.88 548	9.99 635	35
26	9.11 184	97	9.11 551	98	0.88 449	9.99 633	34
27	9.11 281	96	9.11 649	98	0.88 351	9.99 632	33
28	9.11 377	97	9.11 747	98	0.88 253	9.99 630	32
29	9.11 474	96	9.11 845	98	0.88 155	9.99 629	31
30	9.11 570	96	9.11 943	97	0.88 057	9.99 627	**30**
31	9.11 666	95	9.12 040	98	0.87 960	9.99 625	29
32	9.11 761	96	9.12 138	97	0.87 862	9.99 624	28
33	9.11 857	95	9.12 235	97	0.87 765	9.99 622	27
34	9.11 952	95	9.12 332	96	0.87 668	9.99 620	26
35	9.12 047	95	9.12 428	97	0.87 572	9.99 618	25
36	9.12 142	94	9.12 525	96	0.87 475	9.99 617	24
37	9.12 236	95	9.12 621	96	0.87 379	9.99 615	23
38	9.12 331	94	9.12 717	96	0.87 283	9.99 613	22
39	9.12 425	94	9.12 813	96	0.87 187	9.99 612	21
40	9.12 519	93	9.12 909	95	0.87 091	9.99 610	**20**
41	9.12 612	94	9.13 004	95	0.86 996	9.99 608	19
42	9.12 706	93	9.13 099	95	0.86 901	9.99 607	18
43	9.12 799	93	9.13 194	95	0.86 806	9.99 605	17
44	9.12 892	93	9.13 289	95	0.86 711	9.99 603	16
45	9.12 985	93	9.13 384	94	0.86 616	9.99 601	15
46	9.13 078	93	9.13 478	95	0.86 522	9.99 600	14
47	9.13 171	92	9.13 573	94	0.86 427	9.99 598	13
48	9.13 263	92	9.13 667	94	0.86 333	9.99 596	12
49	9.13 355	92	9.13 761	93	0.86 239	9.99 595	11
50	9.13 447	92	9.13 854	94	0.86 146	9.99 593	**10**
51	9.13 539	91	9.13 948	93	0.86 052	9.99 591	9
52	9.13 630	92	9.14 041	93	0.85 959	9.99 589	8
53	9.13 722	91	9.14 134	93	0.85 866	9.99 588	7
54	9.13 813	91	9.14 227	93	0.85 773	9.99 586	6
55	9.13 904	90	9.14 320	92	0.85 680	9.99 584	5
56	9.13 994	91	9.14 412	92	0.85 588	9.99 582	4
57	9.14 085	90	9.14 504	93	0.85 496	9.99 581	3
58	9.14 175	91	9.14 597	91	0.85 403	9.99 579	2
59	9.14 266	90	9.14 688	92	0.85 312	9.99 577	1
60	9.14 356		9.14 780		0.85 220	9.99 575	**0**
	L Cos	d	L Cot	c d	L Tan	L Sin	′

P P

	105	**104**	**103**
1	10.5	10.4	10.3
2	21.0	20.8	20.6
3	31.5	31.2	30.9
4	42.0	41.6	41.2
5	52.5	52.0	51.5
6	63.0	62.4	61.8
7	73.5	72.8	72.1
8	84.0	83.2	82.4
9	94.5	93.6	92.7

	102	**101**	**99**
1	10.2	10.1	9.9
2	20.4	20.2	19.8
3	30.6	30.3	29.7
4	40.8	40.4	39.6
5	51.0	50.5	49.5
6	61.2	60.6	59.4
7	71.4	70.7	69.3
8	81.6	80.8	79.2
9	91.8	90.9	89.1

	98	**97**	**96**
1	9.8	9.7	9.6
2	19.6	19.4	19.2
3	29.4	29.1	28.8
4	39.2	38.8	38.4
5	49.0	48.5	48.0
6	58.8	58.2	57.6
7	68.6	67.9	67.2
8	78.4	77.6	76.8
9	88.2	87.3	86.4

	95	**94**	**93**
1	9.5	9.4	9.3
2	19.0	18.8	18.6
3	28.5	28.2	27.9
4	38.0	37.6	37.2
5	47.5	47.0	46.5
6	57.0	56.4	55.8
7	66.5	65.8	65.1
8	76.0	75.2	74.4
9	85.5	84.6	83.7

	92	**91**	**90**
1	9.2	9.1	9.0
2	18.4	18.2	18.0
3	27.6	27.3	27.0
4	36.8	36.4	36.0
5	46.0	45.5	45.0
6	55.2	54.6	54.0
7	64.4	63.7	63.0
8	73.6	72.8	72.0
9	82.8	81.9	81.0

P P

′	L Sin	d	L Tan	c d	L Cot	L Cos	
0	9.14 356	89	9.14 780	92	0.85 220	9.99 575	**60**
1	9.14 445	90	9.14 872	91	0.85 128	9.99 574	59
2	9.14 535	89	9.14 963	91	0.85 037	9.99 572	58
3	9.14 624	90	9.15 054	91	0.84 946	9.99 570	57
4	9.14 714	89	9.15 145	91	0.84 855	9.99 568	56
5	9.14 803	88	9.15 236	91	0.84 764	9.99 566	55
6	9.14 891	89	9.15 327	90	0.84 673	9.99 565	54
7	9.14 980	89	9.15 417	91	0.84 583	9.99 563	53
8	9.15 069	88	9.15 508	90	0.84 492	9.99 561	52
9	9.15 157	88	9.15 598	90	0.84 402	9.99 559	51
10	9.15 245	88	9.15 688	89	0.84 312	9.99 557	**50**
11	9.15 333	88	9.15 777	90	0.84 223	9.99 556	49
12	9.15 421	87	9.15 867	89	0.84 133	9.99 554	48
13	9.15 508	88	9.15 956	90	0.84 044	9.99 552	47
14	9.15 596	87	9.16 046	89	0.83 954	9.99 550	46
15	9.15 683	87	9.16 135	89	0.83 865	9.99 548	45
16	9.15 770	87	9.16 224	88	0.83 776	9.99 546	44
17	9.15 857	87	9.16 312	89	0.83 688	9.99 545	43
18	9.15 944	86	9.16 401	88	0.83 599	9.99 543	42
19	9.16 030	86	9.16 489	88	0.83 511	9.99 541	41
20	9.16 116	87	9.16 577	88	0.83 423	9.99 539	**40**
21	9.16 203	86	9.16 665	88	0.83 335	9.99 537	39
22	9.16 289	85	9.16 753	88	0.83 247	9.99 535	38
23	9.16 374	86	9.16 841	87	0.83 159	9.99 533	37
24	9.16 460	85	9.16 928	88	0.83 072	9.99 532	36
25	9.16 545	86	9.17 016	87	0.82 984	9.99 530	35
26	9.16 631	85	9.17 103	87	0.82 897	9.99 528	34
27	9.16 716	85	9.17 190	87	0.82 810	9.99 526	33
28	9.16 801	85	9.17 277	86	0.82 723	9.99 524	32
29	9.16 886	84	9.17 363	87	0.82 637	9.99 522	31
30	9.16 970	85	9.17 450	86	0.82 550	9.99 520	**30**
31	9.17 055	84	9.17 536	86	0.82 464	9.99 518	29
32	9.17 139	84	9.17 622	86	0.82 378	9.99 517	28
33	9.17 223	84	9.17 708	86	0.82 292	9.99 515	27
34	9.17 307	84	9.17 794	86	0.82 206	9.99 513	26
35	9.17 391	83	9.17 880	85	0.82 120	9.99 511	25
36	9.17 474	84	9.17 965	86	0.82 035	9.99 509	24
37	9.17 558	83	9.18 051	85	0.81 949	9.99 507	23
38	9.17 641	83	9.18 136	85	0.81 864	9.99 505	22
39	9.17 724	83	9.18 221	85	0.81 779	9.99 503	21
40	9.17 807	83	9.18 306	85	0.81 694	9.99 501	**20**
41	9.17 890	83	9.18 391	84	0.81 609	9.99 499	19
42	9.17 973	82	9.18 475	85	0.81 525	9.99 497	18
43	9.18 055	82	9.18 560	84	0.81 440	9.99 495	17
44	9.18 137	83	9.18 644	84	0.81 356	9.99 494	16
45	9.18 220	82	9.18 728	84	0.81 272	9.99 492	15
46	9.18 302	81	9.18 812	84	0.81 188	9.99 490	14
47	9.18 383	82	9.18 896	83	0.81 104	9.99 488	13
48	9.18 465	82	9.18 979	84	0.81 021	9.99 486	12
49	9.18 547	81	9.19 063	83	0.80 937	9.99 484	11
50	9.18 628	81	9.19 146	83	0.80 854	9.99 482	**10**
51	9.18 709	81	9.19 229	83	0.80 771	9.99 480	9
52	9.18 790	81	9.19 312	83	0.80 688	9.99 478	8
53	9.18 871	81	9.19 395	83	0.80 605	9.99 476	7
54	9.18 952	81	9.19 478	83	0.80 522	9.99 474	6
55	9.19 033	80	9.19 561	82	0.80 439	9.99 472	5
56	9.19 113	80	9.19 643	82	0.80 357	9.99 470	4
57	9.19 193	80	9.19 725	82	0.80 275	9.99 468	3
58	9.19 273	80	9.19 807	82	0.80 193	9.99 466	2
59	9.19 353	80	9.19 889	82	0.80 111	9.99 464	1
60	9.19 433		9.19 971		0.80 029	9.99 462	**0**
	L Cos	d	L Cot	c d	L Tan	L Sin	′

P P

	92	91	90
1	9.2	9.1	9.0
2	18.4	18.2	18.0
3	27.6	27.3	27.0
4	36.8	36.4	36.0
5	46.0	45.5	45.0
6	55.2	54.6	54.0
7	64.4	63.7	63.0
8	73.6	72.8	72.0
9	82.8	81.9	81.0

	89	88
1	8.9	8.8
2	17.8	17.6
3	26.7	26.4
4	35.6	35.2
5	44.5	44.0
6	53.4	52.8
7	62.3	61.6
8	71.2	70.4
9	80.1	79.2

	87	86	85
1	8.7	8.6	8.5
2	17.4	17.2	17.0
3	26.1	25.8	25.5
4	34.8	34.4	34.0
5	43.5	43.0	42.5
6	52.2	51.6	51.0
7	60.9	60.2	59.5
8	69.6	68.8	68.0
9	78.3	77.4	76.5

	84	83
1	8.4	8.3
2	16.8	16.6
3	25.2	24.9
4	33.6	33.2
5	42.0	41.5
6	50.4	49.8
7	58.8	58.1
8	67.2	66.4
9	75.6	74.7

	82	81	80
1	8.2	8.1	8.0
2	16.4	16.2	16.0
3	24.6	24.3	24.0
4	32.8	32.4	32.0
5	41.0	40.5	40.0
6	49.2	48.6	48.0
7	57.4	56.7	56.0
8	65.6	64.8	64.0
9	73.8	72.6	72.0

P P

′	L Sin	d	L Tan	c d	L Cot	L Cos	
0	9.19 433	80	9.19 971	82	0.80 029	9.99 462	**60**
1	9.19 513	79	9.20 053	81	0.79 947	9.99 460	59
2	9.19 592	80	9.20 134	82	0.79 866	9.99 458	58
3	9.19 672	79	9.20 216	81	0.79 784	9.99 456	57
4	9.19 751	79	9.20 297	81	0.79 703	9.99 454	56
5	9.19 830	79	9.20 378	81	0.79 622	9.99 452	55
6	9.19 909	79	9.20 459	81	0.79 541	9.99 450	54
7	9.19 988	79	9.20 540	81	0.79 460	9.99 448	53
8	9.20 067	78	9.20 621	80	0.79 379	9.99 446	52
9	9.20 145	78	9.20 701	81	0.79 299	9.99 444	51
10	9.20 223	79	9.20 782	80	0.79 218	9.99 442	**50**
11	9.20 302	78	9.20 862	80	0.79 138	9.99 440	49
12	9.20 380	78	9.20 942	80	0.79 058	9.99 438	48
13	9.20 458	77	9.21 022	80	0.78 978	9.99 436	47
14	9.20 535	78	9.21 102	80	0.78 898	9.99 434	46
15	9.20 613	78	9.21 182	79	0.78 818	9.99 432	45
16	9.20 691	77	9.21 261	80	0.78 739	9.99 429	44
17	9.20 768	77	9.21 341	79	0.78 659	9.99 427	43
18	9.20 845	77	9.21 420	79	0.78 580	9.99 425	42
19	9.20 922	77	9.21 499	79	0.78 501	9.99 423	41
20	9.20 999	77	9.21 578	79	0.78 422	9.99 421	**40**
21	9.21 076	77	9.21 657	79	0.78 343	9.99 419	39
22	9.21 153	76	9.21 736	78	0.78 264	9.99 417	38
23	9.21 229	77	9.21 814	79	0.78 186	9.99 415	37
24	9.21 306	76	9.21 893	78	0.78 107	9.99 413	36
25	9.21 382	76	9.21 971	78	0.78 029	9.99 411	35
26	9.21 458	76	9.22 049	78	0.77 951	9.99 409	34
27	9.21 534	76	9.22 127	78	0.77 873	9.99 407	33
28	9.21 610	75	9.22 205	78	0.77 795	9.99 404	32
29	9.21 685	76	9.22 283	78	0.77 717	9.99 402	31
30	9.21 761	75	9.22 361	77	0.77 639	9.99 400	**30**
31	9.21 836	76	9.22 438	78	0.77 562	9.99 398	29
32	9.21 912	75	9.22 516	77	0.77 484	9.99 396	28
33	9.21 987	75	9.22 593	77	0.77 407	9.99 394	27
34	9.22 062	75	9.22 670	77	0.77 330	9.99 392	26
35	9.22 137	74	9.22 747	77	0.77 253	9.99 390	25
36	9.22 211	75	9.22 824	77	0.77 176	9.99 388	24
37	9.22 286	75	9.22 901	76	0.77 099	9.99 385	23
38	9.22 361	74	9.22 977	77	0.77 023	9.99 383	22
39	9.22 435	74	9.23 054	76	0.76 946	9.99 381	21
40	9.22 509	74	9.23 130	76	0.76 870	9.99 379	**20**
41	9.22 583	74	9.23 206	77	0.76 794	9.99 377	19
42	9.22 657	74	9.23 283	76	0.76 717	9.99 375	18
43	9.22 731	74	9.23 359	76	0.76 641	9.99 372	17
44	9.22 805	73	9.23 435	75	0.76 565	9.99 370	16
45	9.22 878	74	9.23 510	76	0.76 490	9.99 368	15
46	9.22 952	73	9.23 586	75	0.76 414	9.99 366	14
47	9.23 025	73	9.23 661	76	0.76 339	9.99 364	13
48	9.23 098	73	9.23 737	75	0.76 263	9.99 362	12
49	9.23 171	73	9.23 812	75	0.76 188	9.99 359	11
50	9.23 244	73	9.23 887	75	0.76 113	9.99 357	**10**
51	9.23 317	73	9.23 962	75	0.76 038	9.99 355	9
52	9.23 390	72	9.24 037	75	0.75 963	9.99 353	8
53	9.23 462	73	9.24 112	74	0.75 888	9.99 351	7
54	9.23 535	72	9.24 186	75	0.75 814	9.99 348	6
55	9.23 607	72	9.24 261	74	0.75 739	9.99 346	5
56	9.23 679	73	9.24 335	75	0.75 665	9.99 344	4
57	9.23 752	71	9.24 410	74	0.75 590	9.99 342	3
58	9.23 823	72	9.24 484	74	0.75 516	9.99 340	2
59	9.23 895	72	9.24 558	74	0.75 442	9.99 337	1
60	9.23 967		9.24 632		0.75 368	9.99 335	**0**
	L Cos	d	L Cot	c d	L Tan	L Sin	′

P P

	82	81	80
1	8.2	8.1	8.0
2	16.4	16.2	16.0
3	24.6	24.3	24.0
4	32.8	32.4	32.0
5	41.0	40.5	40.0
6	49.2	48.6	48.0
7	57.4	56.7	56.0
8	65.6	64.8	64.0
9	73.8	72.9	72.0

	79	78	77
1	7.9	7.8	7.7
2	15.8	15.6	15.4
3	23.7	23.4	23.1
4	31.6	31.2	30.8
5	39.5	39.0	38.5
6	47.4	46.8	46.2
7	55.3	54.6	53.9
8	63.2	62.4	61.6
9	71.1	70.2	69.3

	76	75	74
1	7.6	7.5	7.4
2	15.2	15.0	14.8
3	22.8	22.5	22.2
4	30.4	30.0	29.6
5	38.0	37.5	37.0
6	45.6	45.0	44.4
7	53.2	52.5	51.8
8	60.8	60.0	59.2
9	68.4	67.5	66.6

	73	72	71
1	7.3	7.2	7.1
2	14.6	14.4	14.2
3	21.9	21.6	21.3
4	29.2	28.8	28.4
5	36.5	36.0	35.5
6	43.8	43.2	42.6
7	51.1	50.4	49.7
8	58.4	57.6	56.8
9	65.7	64.8	63.9

P P

′	L Sin	d	L Tan	c d	L Cot	L Cos	d	
0	9.23 967	72	9.24 632	74	0.75 368	9.99 335	2	**60**
1	9.24 039	71	9.24 706	73	0.75 294	9.99 333	2	59
2	9.24 110	71	9.24 779	74	0.75 221	9.99 331	3	58
3	9.24 181	72	9.24 853	73	0.75 147	9.99 328	2	57
4	9.24 253	71	9.24 926	74	0.75 074	9.99 326	2	56
5	9.24 324	71	9.25 000	73	0.75 000	9.99 324	2	55
6	9.24 395	71	9.25 073	73	0.74 927	9.99 322	3	54
7	9.24 466	70	9.25 146	73	0.74 854	9.99 319	2	53
8	9.24 536	71	9.25 219	73	0.74 781	9.99 317	2	52
9	9.24 607	70	9.25 292	73	0.74 708	9.99 315	2	51
10	9.24 677	71	9.25 365	72	0.74 635	9.99 313	3	**50**
11	9.24 748	70	9.25 437	73	0.74 563	9.99 310	2	49
12	9.24 818	70	9.25 510	72	0.74 490	9.99 308	2	48
13	9.24 888	70	9.25 582	73	0.74 418	9.99 306	2	47
14	9.24 958	70	9.25 655	72	0.74 345	9.99 304	3	46
15	9.25 028	70	9.25 727	72	0.74 273	9.99 301	2	45
16	9.25 098	70	9.25 799	72	0.74 201	9.99 299	2	44
17	9.25 168	69	9.25 871	72	0.74 129	9.99 297	3	43
18	9.25 237	70	9.25 943	72	0.74 057	9.99 294	2	42
19	9.25 307	69	9.26 015	71	0.73 985	9.99 292	2	41
20	9.25 376	69	9.26 086	72	0.73 914	9.99 290	2	**40**
21	9.25 445	69	9.26 158	71	0.73 842	9.99 288	3	39
22	9.25 514	69	9.26 229	72	0.73 771	9.99 285	2	38
23	9.25 583	69	9.26 301	71	0.73 699	9.99 283	2	37
24	9.25 652	69	9.26 372	71	0.73 628	9.99 281	3	36
25	9.25 721	69	9.26 443	71	0.73 557	9.99 278	2	35
26	9.25 790	68	9.26 514	71	0.73 486	9.99 276	2	34
27	9.25 858	69	9.26 585	70	0.73 415	9.99 274	3	33
28	9.25 927	68	9.26 655	71	0.73 345	9.99 271	2	32
29	9.25 995	68	9.26 726	71	0.73 274	9.99 269	2	31
30	9.26 063	68	9.26 797	70	0.73 203	9.99 267	3	**30**
31	9.26 131	68	9.26 867	70	0.73 133	9.99 264	2	29
32	9.26 199	68	9.26 937	71	0.73 063	9.99 262	2	28
33	9.26 267	68	9.27 008	70	0.72 992	9.99 260	3	27
34	9.26 335	68	9.27 078	70	0.72 922	9.99 257	2	26
35	9.26 403	67	9.27 148	70	0.72 852	9.99 255	3	25
36	9.26 470	68	9.27 218	70	0.72 782	9.99 252	2	24
37	9.26 538	67	9.27 288	69	0.72 712	9.99 250	2	23
38	9.26 605	67	9.27 357	70	0.72 643	9.99 248	3	22
39	9.26 672	67	9.27 427	69	0.72 573	9.99 245	2	21
40	9.26 739	67	9.27 496	70	0.72 504	9.99 243	2	**20**
41	9.26 806	67	9.27 566	69	0.72 434	9.99 241	3	19
42	9.26 873	67	9.27 635	69	0.72 365	9.99 238	2	18
43	9.26 940	67	9.27 704	69	0.72 296	9.99 236	3	17
44	9.27 007	66	9.27 773	69	0.72 227	9.99 233	2	16
45	9.27 073	67	9.27 842	69	0.72 158	9.99 231	2	15
46	9.27 140	66	9.27 911	69	0.72 089	9.99 229	3	14
47	9.27 206	67	9.27 980	69	0.72 020	9.99 226	2	13
48	9.27 273	66	9.28 049	68	0.71 951	9.99 224	3	12
49	9.27 339	66	9.28 117	69	0.71 883	9.99 221	2	11
50	9.27 405	66	9.28 186	68	0.71 814	9.99 219	2	**10**
51	9.27 471	66	9.28 254	69	0.71 746	9.99 217	3	9
52	9.27 537	65	9.28 323	68	0.71 677	9.99 214	2	8
53	9.27 602	66	9.28 391	68	0.71 609	9.99 212	3	7
54	9.27 668	66	9.28 459	68	0.71 541	9.99 209	2	6
55	9.27 734	65	9.28 527	68	0.71 473	9.99 207	3	5
56	9.27 799	65	9.28 595	67	0.71 405	9.99 204	2	4
57	9.27 864	66	9.28 662	68	0.71 338	9.99 202	2	3
58	9.27 930	65	9.28 730	68	0.71 270	9.99 200	3	2
59	9.27 995	65	9.28 798	67	0.71 202	9.99 197	2	1
60	9.28 060		9.28 865		0.71 135	9.99 195		**0**
	L Cos	d	L Cot	c d	L Tan	L Sin	d	′

P P

	74	73	72
1	7.4	7.3	7.2
2	14.8	14.6	14.4
3	22.2	21.9	21.6
4	29.6	29.2	28.8
5	37.0	36.5	36.0
6	44.4	43.8	43.2
7	51.8	51.1	50.4
8	59.2	58.4	57.6
9	66.6	65.7	64.8

	71	70	69
1	7.1	7.0	6.9
2	14.2	14.0	13.8
3	21.3	21.0	20.7
4	28.4	28.0	27.6
5	35.5	35.0	34.5
6	42.6	42.0	41.4
7	49.7	49.0	48.3
8	56.8	56.0	55.2
9	63.9	63.0	62.1

	68	67	66
1	6.8	6.7	6.6
2	13.6	13.4	13.2
3	20.4	20.1	19.8
4	27.2	26.8	26.4
5	34.0	33.5	33.0
6	40.8	40.2	39.6
7	47.6	46.9	46.2
8	54.4	53.6	52.8
9	61.2	60.3	59.4

	65	3
1	6.5	0.3
2	13.0	0.6
3	19.5	0.9
4	26.0	1.2
5	32.5	1.5
6	39.0	1.8
7	45.5	2.1
8	52.0	2.4
9	58.5	2.7

P P

′	L Sin	d	L Tan	c d	L Cot	L Cos	d	
0	9.28 060	65	9.28 865	68	0.71 135	9.99 195	3	**60**
1	9.28 125	65	9.28 933	67	0.71 067	9.99 192	2	59
2	9.28 190	64	9.29 000	67	0.71 000	9.99 190	3	58
3	9.28 254	65	9.29 067	67	0.70 933	9.99 187	2	57
4	9.28 319	65	9.29 134	67	0.70 866	9.99 185	3	56
5	9.28 384	64	9.29 201	67	0.70 799	9.99 182	2	55
6	9.28 448	64	9.29 268	67	0.70 732	9.99 180	3	54
7	9.28 512	65	9.29 335	67	0.70 665	9.99 177	2	53
8	9.28 577	64	9.29 402	66	0.70 598	9.99 175	3	52
9	9.28 641	64	9.29 468	67	0.70 532	9.99 172	2	51
10	9.28 705	64	9.29 535	66	0.70 465	9.99 170	3	**50**
11	9.28 769	64	9.29 601	67	0.70 399	9.99 167	2	49
12	9.28 833	63	9.29 668	66	0.70 332	9.99 165	3	48
13	9.28 896	64	9.29 734	66	0.70 266	9.99 162	2	47
14	9.28 960	64	9.29 800	66	0.70 200	9.99 160	3	46
15	9.29 024	63	9.29 866	66	0.70 134	9.99 157	2	45
16	9.29 087	63	9.29 932	66	0.70 068	9.99 155	3	44
17	9.29 150	64	9.29 998	66	0.70 002	9.99 152	2	43
18	9.29 214	63	9.30 064	66	0.69 936	9.99 150	3	42
19	9.29 277	63	9.30 130	65	0.69 870	9.99 147	2	41
20	9.29 340	63	9.30 195	66	0.69 805	9.99 145	3	**40**
21	9.29 403	63	9.30 261	65	0.69 739	9.99 142	2	39
22	9.29 466	63	9.30 326	65	0.69 674	9.99 140	3	38
23	9.29 529	62	9.30 391	66	0.69 609	9.99 137	2	37
24	9.29 591	63	9.30 457	65	0.69 543	9.99 135	3	36
25	9.29 654	62	9.30 522	65	0.69 478	9.99 132	2	35
26	9.29 716	63	9.30 587	65	0.69 413	9.99 130	3	34
27	9.29 779	62	9.30 652	65	0.69 348	9.99 127	3	33
28	9.29 841	62	9.30 717	65	0.69 283	9.99 124	2	32
29	9.29 903	63	9.30 782	64	0.69 218	9.99 122	3	31
30	9.29 966	62	9.30 846	65	0.69 154	9.99 119	2	**30**
31	9.30 028	62	9.30 911	64	0.69 089	9.99 117	3	29
32	9.30 090	61	9.30 975	65	0.69 025	9.99 114	2	28
33	9.30 151	62	9.31 040	64	0.68 960	9.99 112	3	27
34	9.30 213	62	9.31 104	64	0.68 896	9.99 109	3	26
35	9.30 275	61	9.31 168	65	0.68 832	9.99 106	2	25
36	9.30 336	62	9.31 233	64	0.68 767	9.99 104	3	24
37	9.30 398	61	9.31 297	64	0.68 703	9.99 101	2	23
38	9.30 459	62	9.31 361	64	0.68 639	9.99 099	3	22
39	9.30 521	61	9.31 425	64	0.68 575	9.99 096	3	21
40	9.30 582	61	9.31 489	63	0.68 511	9.99 093	2	**20**
41	9.30 643	61	9.31 552	64	0.68 448	9.99 091	3	19
42	9.30 704	61	9.31 616	63	0.68 384	9.99 088	2	18
43	9.30 765	61	9.31 679	64	0.68 321	9.99 086	3	17
44	9.30 826	61	9.31 743	63	0.68 257	9.99 083	3	16
45	9.30 887	60	9.31 806	64	0.68 194	9.99 080	2	15
46	9.30 947	61	9.31 870	63	0.68 130	9.99 078	3	14
47	9.31 008	60	9.31 933	63	0.68 067	9.99 075	3	13
48	9.31 068	61	9.31 996	63	0.68 004	9.99 072	2	12
49	9.31 129	60	9.32 059	63	0.67 941	9.99 070	3	11
50	9.31 189	61	9.32 122	63	0.67 878	9.99 067	3	**10**
51	9.31 250	60	9.32 185	63	0.67 815	9.99 064	2	9
52	9.31 310	60	9.32 248	63	0.67 752	9.99 062	3	8
53	9.31 370	60	9.32 311	62	0.67 689	9.99 059	3	7
54	9.31 430	60	9.32 373	63	0.67 627	9.99 056	2	6
55	9.31 490	59	9.32 436	62	0.67 564	9.99 054	3	5
56	9.31 549	60	9.32 498	63	0.67 502	9.99 051	3	4
57	9.31 609	60	9.32 561	62	0.67 439	9.99 048	2	3
58	9.31 669	59	9.32 623	62	0.67 377	9.99 046	3	2
59	9.31 728	60	9.32 685	62	0.67 315	9.99 043	3	1
60	9.31 788		9.32 747		0.67 253	9.99 040		**0**
	L Cos	d	L Cot	c d	L Tan	L Sin	d	′

P P

	68	**67**	**66**
1	6.8	6.7	6.6
2	13.6	13.4	13.2
3	20.4	20.1	19.8
4	27.2	26.8	26.4
5	34.0	33.5	33.0
6	40.8	40.2	39.6
7	47.6	46.9	46.2
8	54.4	53.6	52.8
9	61.2	60.3	59.4

	65	**64**	**63**
1	6.5	6.4	6.3
2	13.0	12.8	12.6
3	19.5	19.2	18.9
4	26.0	25.6	25.2
5	32.5	32.0	31.5
6	39.0	38.4	37.8
7	45.5	44.8	44.1
8	52.0	51.2	50.4
9	58.5	57.6	56.7

	62	**61**	**60**
1	6.2	6.1	6.0
2	12.4	12.2	12.0
3	18.6	18.3	18.0
4	24.8	24.4	24.0
5	31.0	30.5	30.0
6	37.2	36.6	36.0
7	43.4	42.7	42.0
8	49.6	48.8	48.0
9	55.8	54.9	54.0

	59	**3**
1	5.9	0.3
2	11.8	0.6
3	17.7	0.9
4	23.6	1.2
5	29.5	1.5
6	35.4	1.8
7	41.3	2.1
8	47.2	2.4
9	53.1	2.7

P P

′	L Sin	d	L Tan	c d	L Cot	L Cos	d	
0	9.31 788	59	9.32 747	63	0.67 253	9.99 040	2	**60**
1	9.31 847	60	9.32 810	62	0.67 190	9.99 038	3	59
2	9.31 907	59	9.32 872	61	0.67 128	9.99 035	3	58
3	9.31 966	59	9.32 933	62	0.67 067	9.99 032	2	57
4	9.32 025	59	9.32 995	62	0.67 005	9.99 030	3	56
5	9.32 084	59	9.33 057	62	0.66 943	9.99 027	3	55
6	9.32 143	59	9.33 119	61	0.66 881	9.99 024	2	54
7	9.32 202	59	9.33 180	62	0.66 820	9.99 022	3	53
8	9.32 261	58	9.33 242	61	0.66 758	9.99 019	3	52
9	9.32 319	59	9.33 303	62	0.66 697	9.99 016	3	51
10	9.32 378	59	9.33 365	61	0.66 635	9.99 013	2	**50**
11	9.32 437	58	9.33 426	61	0.66 574	9.99 011	3	49
12	9.32 495	58	9.33 487	61	0.66 513	9.99 008	3	48
13	9.32 553	59	9.33 548	61	0.66 452	9.99 005	3	47
14	9.32 612	58	9.33 609	61	0.66 391	9.99 002	2	46
15	9.32 670	58	9.33 670	61	0.66 330	9.99 000	3	45
16	9.32 728	58	9.33 731	61	0.66 269	9.98 997	3	44
17	9.32 786	58	9.33 792	61	0.66 208	9.98 994	3	43
18	9.32 844	58	9.33 853	60	0.66 147	9.98 991	2	42
19	9.32 902	58	9.33 913	61	0.66 087	9.98 989	3	41
20	9.32 960	58	9.33 974	60	0.66 026	9.98 986	3	**40**
21	9.33 018	57	9.34 034	61	0.65 966	9.98 983	3	39
22	9.33 075	58	9.34 095	60	0.65 905	9.98 980	2	38
23	9.33 133	57	9.34 155	60	0.65 845	9.98 978	3	37
24	9.33 190	58	9.34 215	61	0.65 785	9.98 975	3	36
25	9.33 248	57	9.34 276	60	0.65 724	9.98 972	3	35
26	9.33 305	57	9.34 336	60	0.65 664	9.98 969	2	34
27	9.33 362	58	9.34 396	60	0.65 604	9.98 967	3	33
28	9.33 420	57	9.34 456	60	0.65 544	9.98 964	3	32
29	9.33 477	57	9.34 516	60	0.65 484	9.98 961	3	31
30	9.33 534	57	9.34 576	59	0.65 424	9.98 958	3	**30**
31	9.33 591	56	9.34 635	60	0.65 365	9.98 955	2	29
32	9.33 647	57	9.34 695	60	0.65 305	9.98 953	3	28
33	9.33 704	57	9.34 755	59	0.65 245	9.98 950	3	27
34	9.33 761	57	9.34 814	60	0.65 186	9.98 947	3	26
35	9.33 818	56	9.34 874	59	0.65 126	9.98 944	3	25
36	9.33 874	57	9.34 933	59	0.65 067	9.98 941	3	24
37	9.33 931	56	9.34 992	59	0.65 008	9.98 938	2	23
38	9.33 987	56	9.35 051	60	0.64 949	9.98 936	3	22
39	9.34 043	57	9.35 111	59	0.64 889	9.98 933	3	21
40	9.34 100	56	9.35 170	59	0.64 830	9.98 930	3	**20**
41	9.34 156	56	9.35 229	59	0.64 771	9.98 927	3	19
42	9.34 212	56	9.35 288	59	0.64 712	9.98 924	3	18
43	9.34 268	56	9.35 347	58	0.64 653	9.98 921	2	17
44	9.34 324	56	9.35 405	59	0.64 595	9.98 919	3	16
45	9.34 380	56	9.35 464	59	0.64 536	9.98 916	3	15
46	9.34 436	55	9.35 523	58	0.64 477	9.98 913	3	14
47	9.34 491	56	9.35 581	59	0.64 419	9.98 910	3	13
48	9.34 547	55	9.35 640	58	0.64 360	9.98 907	3	12
49	9.34 602	56	9.35 698	59	0.64 302	9.98 904	3	11
50	9.34 658	55	9.35 757	58	0.64 243	9.98 901	3	**10**
51	9.34 713	56	9.35 815	58	0.64 185	9.98 898	2	9
52	9.34 769	55	9.35 873	58	0.64 127	9.98 896	3	8
53	9.34 824	55	9.35 931	58	0.64 069	9.98 893	3	7
54	9.34 879	55	9.35 989	58	0.64 011	9.98 890	3	6
55	9.34 934	55	9.36 047	58	0.63 953	9.98 887	3	5
56	9.34 989	55	9.36 105	58	0.63 895	9.98 884	3	4
57	9.35 044	55	9.36 163	58	0.63 837	9.98 881	3	3
58	9.35 099	55	9.36 221	58	0.63 779	9.98 878	3	2
59	9.35 154	55	9.36 279	57	0.63 721	9.98 875	3	1
60	9.35 209		9.36 336		0.63 664	9.98 872		**0**
	L Cos	d	L Cot	c d	L Tan	L Sin	d	′

P P

	63	62	61
1	6.3	6.2	6.1
2	12.6	12.4	12.2
3	18.9	18.6	18.3
4	25.2	24.8	24.4
5	31.5	31.0	30.5
6	37.8	37.2	36.6
7	44.1	43.4	42.7
8	50.4	49.6	48.8
9	56.7	55.8	54.9

	60	59
1	6.0	5.9
2	12.0	11.8
3	18.0	17.7
4	24.0	23.6
5	30.0	29.5
6	36.0	35.4
7	42.0	41.3
8	48.0	47.2
9	54.0	53.1

	58	57
1	5.8	5.7
2	11.6	11.4
3	17.4	17.1
4	23.2	22.8
5	29.0	28.5
6	34.8	34.2
7	40.6	39.9
8	46.4	45.6
9	52.2	51.3

	56	55	3
1	5.6	5.5	0.3
2	11.2	11.0	0.6
3	16.8	16.5	0.9
4	22.4	22.0	1.2
5	28.0	27.5	1.5
6	33.6	33.0	1.8
7	39.2	38.5	2.1
8	44.8	44.0	2.4
9	50.4	49.5	2.7

P P

′	L Sin	d	L Tan	c d	L Cot	L Cos	d	
0	9.35 209	54	9.36 336	58	0.63 664	9.98 872	3	**60**
1	9.35 263	55	9.36 394	58	0.63 606	9.98 869	2	59
2	9.35 318	55	9.36 452	57	0.63 548	9.98 867	3	58
3	9.35 373	54	9.36 509	57	0.63 491	9.98 864	3	57
4	9.35 427	54	9.36 566	58	0.63 434	9.98 861	3	56
5	9.35 481	55	9.36 624	57	0.63 376	9.98 858	3	55
6	9.35 536	54	9.36 681	57	0.63 319	9.98 855	3	54
7	9.35 590	54	9.36 738	57	0.63 262	9.98 852	3	53
8	9.35 644	54	9.36 795	57	0.63 205	9.98 849	3	52
9	9.35 698	54	9.36 852	57	0.63 148	9.98 846	3	51
10	9.35 752	54	9.36 909	57	0.63 091	9.98 843	3	**50**
11	9.35 806	54	9.36 966	57	0.63 034	9.98 840	3	49
12	9.35 860	54	9.37 023	57	0.62 977	9.98 837	3	48
13	9.35 914	54	9.37 080	57	0.62 920	9.98 834	3	47
14	9.35 968	54	9.37 137	56	0.62 863	9.98 831	3	46
15	9.36 022	53	9.37 193	57	0.62 807	9.98 828	3	45
16	9.36 075	54	9.37 250	56	0.62 750	9.98 825	3	44
17	9.36 129	53	9.37 306	57	0.62 694	9.98 822	3	43
18	9.36 182	54	9.37 363	56	0.62 637	9.98 819	3	42
19	9.36 236	53	9.37 419	57	0.62 581	9.98 816	3	41
20	9.36 289	53	9.37 476	56	0.62 524	9.98 813	3	**40**
21	9.36 342	53	9.37 532	56	0.62 468	9.98 810	3	39
22	9.36 395	54	9.37 588	56	0.62 412	9.98 807	3	38
23	9.36 449	53	9.37 644	56	0.62 356	9.98 804	3	37
24	9.36 502	53	9.37 700	56	0.62 300	9.98 801	3	36
25	9.36 555	53	9.37 756	56	0.62 244	9.98 798	3	35
26	9.36 608	52	9.37 812	56	0.62 188	9.98 795	3	34
27	9.36 660	53	9.37 868	56	0.62 132	9.98 792	3	33
28	9.36 713	53	9.37 924	56	0.62 076	9.98 789	3	32
29	9.36 766	53	9.37 980	55	0.62 020	9.98 786	3	31
30	9.36 819	52	9.38 035	56	0.61 965	9.98 783	3	**30**
31	9.36 871	53	9.38 091	56	0.61 909	9.98 780	3	29
32	9.36 924	52	9.38 147	55	0.61 853	9.98 777	3	28
33	9.36 976	52	9.38 202	55	0.61 798	9.98 774	3	27
34	9.37 028	53	9.38 257	56	0.61 743	9.98 771	3	26
35	9.37 081	52	9.38 313	55	0.61 687	9.98 768	3	25
36	9.37 133	52	9.38 368	55	0.61 632	9.98 765	3	24
37	9.37 185	52	9.38 423	56	0.61 577	9.98 762	3	23
38	9.37 237	52	9.38 479	55	0.61 521	9.98 759	3	22
39	9.37 289	52	9.38 534	55	0.61 466	9.98 756	3	21
40	9.37 341	52	9.38 589	55	0.61 411	9.98 753	3	**20**
41	9.37 393	52	9.38 644	55	0.61 356	9.98 750	4	19
42	9.37 445	52	9.38 699	55	0.61 301	9.98 746	3	18
43	9.37 497	52	9.38 754	54	0.61 246	9.98 743	3	17
44	9.37 549	51	9.38 808	55	0.61 192	9.98 740	3	16
45	9.37 600	52	9.38 863	55	0.61 137	9.98 737	3	15
46	9.37 652	51	9.38 918	54	0.61 082	9.98 734	3	14
47	9.37 703	52	9.38 972	55	0.61 028	9.98 731	3	13
48	9.37 755	51	9.39 027	55	0.60 973	9.98 728	3	12
49	9.37 806	52	9.39 082	54	0.60 918	9.98 725	3	11
50	9.37 858	51	9.39 136	54	0.60 864	9.98 722	3	**10**
51	9.37 909	51	9.39 190	55	0.60 810	9.98 719	4	9
52	9.37 960	51	9.39 245	54	0.60 755	9.98 715	3	8
53	9.38 011	51	9.39 299	54	0.60 701	9.98 712	3	7
54	9.38 062	51	9.39 353	54	0.60 647	9.98 709	3	6
55	9.38 113	51	9.39 407	54	0.60 593	9.98 706	3	5
56	9.38 164	51	9.39 461	54	0.60 539	9.98 703	3	4
57	9.38 215	51	9.39 515	54	0.60 485	9.98 700	3	3
58	9.38 266	51	9.39 569	54	0.60 431	9.98 697	3	2
59	9.38 317	51	9.39 623	54	0.60 377	9.98 694	4	1
60	9.38 368		9.39 677		0.60 323	9.98 690		**0**
	L Cos	d	L Cot	c d	L Tan	L Sin	d	′

P P

	58	**57**	**56**
1	5.8	5.7	5.6
2	11.6	11.4	11.2
3	17.4	17.1	16.8
4	23.2	22.8	22.4
5	29.0	28.5	28.0
6	34.8	34.2	33.6
7	40.6	39.9	39.2
8	46.4	45.6	44.8
9	52.2	51.3	50.4

	55	**54**	**53**
1	5.5	5.4	5.3
2	11.0	10.8	10.6
3	16.5	16.2	15.9
4	22.0	21.6	21.2
5	27.5	27.0	26.5
6	33.0	32.4	31.8
7	38.5	37.8	37.1
8	44.0	43.2	42.4
9	49.5	48.6	47.7

	52	**51**
1	5.2	5.1
2	10.4	10.2
3	15.6	15.3
4	20.8	20.4
5	26.0	25.5
6	31.2	30.6
7	36.4	35.7
8	41.6	40.8
9	46.8	45.9

	4	**3**
1	0.4	0.3
2	0.8	0.6
3	1.2	0.9
4	1.6	1.2
5	2.0	1.5
6	2.4	1.8
7	2.8	2.1
8	3.2	2.4
9	3.6	2.7

P P

′	L Sin	d	L Tan	c d	L Cot	L Cos	d	
0	9.38 368	50	9.39 677	54	0.60 323	9.98 690	3	**60**
1	9.38 418	51	9.39 731	54	0.60 269	9.98 687	3	59
2	9.38 469	50	9.39 785	53	0.60 215	9.98 684	3	58
3	9.38 519	51	9.39 838	54	0.60 162	9.98 681	3	57
4	9.38 570	50	9.39 892	53	0.60 108	9.98 678	3	56
5	9.38 620	50	9.39 945	54	0.60 055	9.98 675	4	55
6	9.38 670	51	9.39 999	53	0.60 001	9.98 671	3	54
7	9.38 721	50	9.40 052	54	0.59 948	9.98 668	3	53
8	9.38 771	50	9.40 106	53	0.59 894	9.98 665	3	52
9	9.38 821	50	9.40 159	53	0.59 841	9.98 662	3	51
10	9.38 871	50	9.40 212	54	0.59 788	9.98 659	3	**50**
11	9.38 921	50	9.40 266	53	0.59 734	9.98 656	4	49
12	9.38 971	50	9.40 319	53	0.59 681	9.98 652	3	48
13	9.39 021	50	9.40 372	53	0.59 628	9.98 649	3	47
14	9.39 071	50	9.40 425	53	0.59 575	9.98 646	3	46
15	9.39 121	49	9.40 478	53	0.59 522	9.98 643	3	45
16	9.39 170	50	9.40 531	53	0.59 469	9.98 640	4	44
17	9.39 220	50	9.40 584	52	0.59 416	9.98 636	3	43
18	9.39 270	49	9.40 636	53	0.59 364	9.98 633	3	42
19	9.39 319	50	9.40 689	53	0.59 311	9.98 630	3	41
20	9.39 369	49	9.40 742	53	0.59 258	9.98 627	4	**40**
21	9.39 418	49	9.40 795	52	0.59 205	9.98 623	3	39
22	9.39 467	50	9.40 847	53	0.59 153	9.98 620	3	38
23	9.39 517	49	9.40 900	52	0.59 100	9.98 617	3	37
24	9.39 566	49	9.40 952	53	0.59 048	9.98 614	4	36
25	9.39 615	49	9.41 005	52	0.58 995	9.98 610	3	35
26	9.39 664	49	9.41 057	52	0.58 943	9.98 607	3	34
27	9.39 713	49	9.41 109	52	0.58 891	9.98 604	3	33
28	9.39 762	49	9.41 161	53	0.58 839	9.98 601	4	32
29	9.39 811	49	9.41 214	52	0.58 786	9.98 597	3	31
30	9.39 860	49	9.41 266	52	0.58 734	9.98 594	3	**30**
31	9.39 909	49	9.41 318	52	0.58 682	9.98 591	3	29
32	9.39 958	48	9.41 370	52	0.58 630	9.98 588	4	28
33	9.40 006	49	9.41 422	52	0.58 578	9.98 584	3	27
34	9.40 055	48	9.41 474	52	0.58 526	9.98 581	3	26
35	9.40 103	49	9.41 526	52	0.58 474	9.98 578	4	25
36	9.40 152	48	9.41 578	51	0.58 422	9.98 574	3	24
37	9.40 200	49	9.41 629	52	0.58 371	9.98 571	3	23
38	9.40 249	48	9.41 681	52	0.58 319	9.98 568	3	22
39	9.40 297	49	9.41 733	51	0.58 267	9.98 565	4	21
40	9.40 346	48	9.41 784	52	0.58 216	9.98 561	3	**20**
41	9.40 394	48	9.41 836	51	0.58 164	9.98 558	3	19
42	9.40 442	48	9.41 887	52	0.58 113	9.98 555	4	18
43	9.40 490	48	9.41 939	51	0.58 061	9.98 551	3	17
44	9.40 538	48	9.41 990	51	0.58 010	9.98 548	3	16
45	9.40 586	48	9.42 041	52	0.57 959	9.98 545	4	15
46	9.40 634	48	9.42 093	51	0.57 907	9.98 541	3	14
47	9.40 682	48	9.42 144	51	0.57 856	9.98 538	3	13
48	9.40 730	48	9.42 195	51	0.57 805	9.98 535	4	12
49	9.40 778	47	9.42 246	51	0.57 754	9.98 531	3	11
50	9.40 825	48	9.42 297	51	0.57 703	9.98 528	3	**10**
51	9.40 873	48	9.42 348	51	0.57 652	9.98 525	4	9
52	9.40 921	47	9.42 399	51	0.57 601	9.98 521	3	8
53	9.40 968	48	9.42 450	51	0.57 550	9.98 518	3	7
54	9.41 016	47	9.42 501	51	0.57 499	9.98 515	4	6
55	9.41 063	48	9.42 552	51	0.57 448	9.98 511	3	5
56	9.41 111	47	9.42 603	50	0.57 397	9.98 508	3	4
57	9.41 158	47	9.42 653	51	0.57 347	9.98 505	4	3
58	9.41 205	47	9.42 704	51	0.57 296	9.98 501	3	2
59	9.41 252	48	9.42 755	50	0.57 245	9.98 498	4	1
60	9.41 300		9.42 805		0.57 195	9.98 494		**0**
	L Cos	d	L Cot	c d	L Tan	L Sin	d	′

P P

	54	**53**
1	5.4	5.3
2	10.8	10.6
3	16.2	15.9
4	21.6	21.2
5	27.0	26.5
6	32.4	31.8
7	37.8	37.1
8	43.2	42.4
9	48.6	47.7

	52	**51**	**50**
1	5.2	5.1	5.0
2	10.4	10.2	10.0
3	15.6	15.3	15.0
4	20.8	20.4	20.0
5	26.0	25.5	25.0
6	31.2	30.6	30.0
7	36.4	35.7	35.0
8	41.6	40.8	40.0
9	46.8	45.9	45.0

	49	**48**	**47**
1	4.9	4.8	4.7
2	9.8	9.6	9.4
3	14.7	14.4	14.1
4	19.6	19.2	18.8
5	24.5	24.0	23.5
6	29.4	28.8	28.2
7	34.3	33.6	32.9
8	39.2	38.4	37.6
9	44.1	43.2	42.3

	4	**3**
1	0.4	0.3
2	0.8	0.6
3	1.2	0.9
4	1.6	1.2
5	2.0	1.5
6	2.4	1.8
7	2.8	2.1
8	3.2	2.4
9	3.6	2.7

P P

′	L Sin	d	L Tan	c d	L Cot	L Cos	d	
0	9.41 300		9.42 805		0.57 195	9.98 494		**60**
1	9.41 347	47	9.42 856	51	0.57 144	9.98 491	3	59
2	9.41 394	47	9.42 906	50	0.57 094	9.98 488	3	58
3	9.41 441	47	9.42 957	51	0.57 043	9.98 484	4	57
4	9.41 488	47	9.43 007	50	0.56 993	9.98 481	3	56
5	9.41 535	47	9.43 057	50	0.56 943	9.98 477	4	55
6	9.41 582	47	9.43 108	51	0.56 892	9.98 474	3	54
7	9.41 628	46	9.43 158	50	0.56 842	9.98 471	3	53
8	9.41 675	47	9.43 208	50	0.56 792	9.98 467	4	52
9	9.41 722	47	9.43 258	50	0.56 742	9.98 464	3	51
10	9.41 768	46	9.43 308	50	0.56 692	9.98 460	4	**50**
11	9.41 815	47	9.43 358	50	0.56 642	9.98 457	3	49
12	9.41 861	46	9.43 408	50	0.56 592	9.98 453	4	48
13	9.41 908	47	9.43 458	50	0.56 542	9.98 450	3	47
14	9.41 954	46	9.43 508	50	0.56 492	9.98 447	3	46
15	9.42 001	47	9.43 558	50	0.56 442	9.98 443	4	45
16	9.42 047	46	9.43 607	49	0.56 393	9.98 440	3	44
17	9.42 093	46	9.43 657	50	0.56 343	9.98 436	4	43
18	9.42 140	47	9.43 707	50	0.56 293	9.98 433	3	42
19	9.42 186	46	9.43 756	49	0.56 244	9.98 429	4	41
20	9.42 232	46	9.43 806	50	0.56 194	9.98 426	3	**40**
21	9.42 278	46	9.43 855	49	0.56 145	9.98 422	4	39
22	9.42 324	46	9.43 905	50	0.56 095	9.98 419	3	38
23	9.42 370	46	9.43 954	49	0.56 046	9.98 415	4	37
24	9.42 416	46	9.44 004	50	0.55 996	9.98 412	3	36
25	9.42 461	45	9.44 053	49	0.55 947	9.98 409	3	35
26	9.42 507	46	9.44 102	49	0.55 898	9.98 405	4	34
27	9.42 553	46	9.44 151	49	0.55 849	9.98 402	3	33
28	9.42 599	46	9.44 201	50	0.55 799	9.98 398	4	32
29	9.42 644	45	9.44 250	49	0.55 750	9.98 395	3	31
30	9.42 690	46	9.44 299	49	0.55 701	9.98 391	4	**30**
31	9.42 735	45	9.44 348	49	0.55 652	9.98 388	3	29
32	9.42 781	46	9.44 397	49	0.55 603	9.98 384	4	28
33	9.42 826	45	9.44 446	49	0.55 554	9.98 381	3	27
34	9.42 872	46	9.44 495	49	0.55 505	9.98 377	4	26
35	9.42 917	45	9.44 544	49	0.55 456	9.98 373	4	25
36	9.42 962	45	9.44 592	48	0.55 408	9.98 370	3	24
37	9.43 008	46	9.44 641	49	0.55 359	9.98 366	4	23
38	9.43 053	45	9.44 690	49	0.55 310	9.98 363	3	22
39	9.43 098	45	9.44 738	48	0.55 262	9.98 359	4	21
40	9.43 143	45	9.44 787	49	0.55 213	9.98 356	3	**20**
41	9.43 188	45	9.44 836	49	0.55 164	9.98 352	4	19
42	9.43 233	45	9.44 884	48	0.55 116	9.98 349	3	18
43	9.43 278	45	9.44 933	49	0.55 067	9.98 345	4	17
44	9.43 323	45	9.44 981	48	0.55 019	9.98 342	3	16
45	9.43 367	44	9.45 029	48	0.54 971	9.98 338	4	15
46	9.43 412	45	9.45 078	49	0.54 922	9.98 334	4	14
47	9.43 457	45	9.45 126	48	0.54 874	9.98 331	3	13
48	9.43 502	45	9.45 174	48	0.54 826	9.98 327	4	12
49	9.43 546	44	9.45 222	48	0.54 778	9.98 324	3	11
50	9.43 591	45	9.45 271	49	0.54 729	9.98 320	4	**10**
51	9.43 635	44	9.45 319	48	0.54 681	9.98 317	3	9
52	9.43 680	45	9.45 367	48	0.54 633	9.98 313	4	8
53	9.43 724	44	9.45 415	48	0.54 585	9.98 309	4	7
54	9.43 769	45	9.45 463	48	0.54 537	9.98 306	3	6
55	9.43 813	44	9.45 511	48	0.54 489	9.98 302	4	5
56	9.43 857	44	9.45 559	48	0.54 441	9.98 299	3	4
57	9.43 901	44	9.45 606	47	0.54 394	9.98 295	4	3
58	9.43 946	45	9.45 654	48	0.54 346	9.98 291	4	2
59	9.43 990	44	9.45 702	48	0.54 298	9.98 288	3	1
60	9.44 034	44	9.45 750	48	0.54 250	9.98 284	4	**0**
	L Cos	d	L Cot	c d	L Tan	L Sin	d	′

P P

	51	**50**	**49**
1	5.1	5.0	4.9
2	10.2	10.0	9.8
3	15.3	15.0	14.7
4	20.4	20.0	19.6
5	25.5	25.0	24.5
6	30.6	30.0	29.4
7	35.7	35.0	34.3
8	40.8	40.0	39.2
9	45.9	45.0	44.1

	48	**47**	**46**
1	4.8	4.7	4.6
2	9.6	9.4	9.2
3	14.4	14.1	13.8
4	19.2	18.8	18.4
5	24.0	23.5	23.0
6	28.8	28.2	27.6
7	33.6	32.9	32.2
8	38.4	37.6	36.8
9	43.2	42.3	41.4

	45	**44**
1	4.5	4.4
2	9.0	8.8
3	13.5	13.2
4	18.0	17.6
5	22.5	22.0
6	27.0	26.4
7	31.5	30.8
8	36.0	35.2
9	40.5	39.6

	4	**3**
1	0.4	0.3
2	0.8	0.6
3	1.2	0.9
4	1.6	1.2
5	2.0	1.5
6	2.4	1.8
7	2.8	2.1
8	3.2	2.4
9	3.6	2.7

P P

′	L Sin	d	L Tan	c d	L Cot	L Cos	d	
0	9.44 034	44	9.45 750	47	0.54 205	9.98 284	3	**60**
1	9.44 078	44	9.45 797	48	0.54 203	9.98 281	4	59
2	9.44 122	44	9.45 845	47	0.54 155	9.98 277	4	58
3	9.44 166	44	9.45 892	48	0.54 108	9.98 273	3	57
4	9.44 210	43	9.45 940	47	0.54 060	9.98 270	4	56
5	9.44 253	44	9.45 987	48	0.54 013	9.98 266	4	55
6	9.44 297	44	9.46 035	47	0.53 965	9.98 262	3	54
7	9.44 341	44	9.46 082	48	0.53 918	9.98 259	4	53
8	9.44 385	43	9.46 130	47	0.53 870	9.98 255	4	52
9	9.44 428	44	9.46 177	47	0.53 823	9.98 251	3	51
10	9.44 472	44	9.46 224	47	0.53 776	9.98 248	4	**50**
11	9.44 516	43	9.46 271	48	0.53 729	9.98 244	4	49
12	9.44 559	43	9.46 319	47	0.53 681	9.98 240	3	48
13	9.44 602	44	9.46 366	47	0.53 634	9.98 237	4	47
14	9.44 646	43	9.46 413	47	0.53 587	9.98 233	4	46
15	9.44 689	44	9.46 460	47	0.53 540	9.98 229	3	45
16	9.44 733	43	9.46 507	47	0.53 493	9.98 226	4	44
17	9.44 776	43	9.46 554	47	0.53 446	9.98 222	4	43
18	9.44 819	43	9.46 601	47	0.53 399	9.98 218	3	42
19	9.44 862	43	9.46 648	46	0.53 352	9.98 215	4	41
20	9.44 905	43	9.46 694	47	0.53 306	9.98 211	4	**40**
21	9.44 948	44	9.46 741	47	0.53 259	9.98 207	3	39
22	9.44 992	43	9.46 788	47	0.53 212	9.98 204	4	38
23	9.45 035	42	9.46 835	46	0.53 165	9.98 200	4	37
24	9.45 077	43	9.46 881	47	0.53 119	9.98 196	4	36
25	9.45 120	43	9.46 928	47	0.53 072	9.98 192	3	35
26	9.45 163	43	9.46 975	46	0.53 025	9.98 189	4	34
27	9.45 206	43	9.47 021	47	0.52 979	9.98 185	4	33
28	9.45 249	43	9.47 068	46	0.52 932	9.98 181	4	32
29	9.45 292	42	9.47 114	46	0.52 886	9.98 177	3	31
30	9.45 334	43	9.47 160	47	0.52 840	9.98 174	4	**30**
31	9.45 377	42	9.47 207	46	0.52 793	9.98 170	4	29
32	9.45 419	43	9.47 253	46	0.52 747	9.98 166	4	28
33	9.45 462	42	9.47 299	47	0.52 701	9.98 162	3	27
34	9.45 504	43	9.47 346	46	0.52 654	9.98 159	4	26
35	9.45 547	42	9.47 392	46	0.52 608	9.98 155	4	25
36	9.45 589	43	9.47 438	46	0.52 562	9.98 151	4	24
37	9.45 632	42	9.47 484	46	0.52 516	9.98 147	3	23
38	9.45 674	42	9.47 530	46	0.52 470	9.98 144	4	22
39	9.45 716	42	9.47 576	46	0.52 424	9.98 140	4	21
40	9.45 758	43	9.47 622	46	0.52 378	9.98 136	4	**20**
41	9.45 801	42	9.47 668	46	0.52 332	9.98 132	3	19
42	9.45 843	42	9.47 714	46	0.52 286	9.98 129	4	18
43	9.45 885	42	9.47 760	46	0.52 240	9.98 125	4	17
44	9.45 927	42	9.47 806	46	0.52 194	9.98 121	4	16
45	9.45 969	42	9.47 852	45	0.52 148	9.98 117	4	15
46	9.46 011	42	9.47 897	46	0.52 103	9.98 113	3	14
47	9.46 053	42	9.47 943	46	0.52 057	9.98 110	4	13
48	9.46 095	41	9.47 989	46	0.52 011	9.98 106	4	12
49	9.46 136	42	9.48 035	45	0.51 965	9.98 102	4	11
50	9.46 178	42	9.48 080	46	0.51 920	9.98 098	4	**10**
51	9.46 220	42	9.48 126	45	0.51 874	9.98 094	4	9
52	9.46 262	41	9.48 171	46	0.51 829	9.98 090	3	8
53	9.46 303	42	9.48 217	45	0.51 783	9.98 087	4	7
54	9.46 345	41	9.48 262	45	0.51 738	9.98 083	4	6
55	9.46 386	42	9.48 307	46	0.51 693	9.98 079	4	5
56	9.46 428	41	9.48 353	45	0.51 647	9.98 075	4	4
57	9.46 469	42	9.48 398	45	0.51 602	9.98 071	4	3
58	9.46 511	41	9.48 443	46	0.51 557	9.98 067	4	2
59	9.46 552	42	9.48 489	45	0.51 511	9.98 063	3	1
60	9.46 594		9.48 534		0.51 466	9.98 060		**0**
	L Cos	d	L Cot	c d	L Tan	L Sin	d	′

P P

	48	47	46
1	4.8	4.7	4.6
2	9.6	9.4	9.2
3	14.4	14.1	13.8
4	19.2	18.8	18.4
5	24.0	23.5	23.0
6	28.8	28.2	27.6
7	33.6	32.9	32.2
8	38.4	37.6	36.8
9	43.2	42.3	41.4

	45	44	43
1	4.5	4.4	4.3
2	9.0	8.8	8.6
3	13.5	13.2	12.9
4	18.0	17.6	17.2
5	22.5	22.0	21.5
6	27.0	26.4	25.8
7	31.5	30.8	30.1
8	36.0	35.2	34.4
9	40.5	39.6	38.7

	42	41
1	4.2	4.1
2	8.4	8.2
3	12.6	12.3
4	16.8	16.4
5	21.0	20.5
6	25.2	24.6
7	29.4	28.7
8	33.6	32.8
9	37.8	36.9

	4	3
1	0.4	0.3
2	0.8	0.6
3	1.2	0.9
4	1.6	1.2
5	2.0	1.5
6	2.4	1.8
7	2.8	2.1
8	3.2	2.4
9	3.6	2.7

P P

′	L Sin	d	L Tan	c d	L Cot	L Cos	d	′
0	9.46 594	41	9.48 534	45	0.51 466	9.98 060	4	**60**
1	9.46 635	41	9.48 579	45	0.51 421	9.98 056	4	59
2	9.46 676	41	9.48 624	45	0.51 376	9.98 052	4	58
3	9.46 717	41	9.48 669	45	0.51 331	9.98 048	4	57
4	9.46 758	42	9.48 714	45	0.51 286	9.98 044	4	56
5	9.46 800	41	9.48 759	45	0.51 241	9.98 040	4	55
6	9.46 841	41	9.48 804	45	0.51 196	9.98 036	4	54
7	9.46 882	41	9.48 849	45	0.51 151	9.98 032	3	53
8	9.46 923	41	9.48 894	45	0.51 106	9.98 029	4	52
9	9.46 964	41	9.48 939	45	0.51 061	9.98 025	4	51
10	9.47 005	40	9.48 984	45	0.51 016	9.98 021	4	**50**
11	9.47 045	41	9.49 029	44	0.50 971	9.98 017	4	49
12	9.47 086	41	9.49 073	45	0.50 927	9.98 013	4	48
13	9.47 127	41	9.49 118	45	0.50 882	9.98 009	4	47
14	9.47 168	41	9.49 163	44	0.50 837	9.98 005	4	46
15	9.47 209	40	9.49 207	45	0.50 793	9.98 001	4	45
16	9.47 249	41	9.49 252	44	0.50 748	9.97 997	4	44
17	9.47 290	40	9.49 296	45	0.50 704	9.97 993	4	43
18	9.47 330	41	9.49 341	44	0.50 659	9.97 989	3	42
19	9.47 371	40	9.49 385	45	0.50 615	9.97 986	4	41
20	9.47 411	41	9.49 430	44	0.50 570	9.97 982	4	**40**
21	9.47 452	40	9.49 474	45	0.50 526	9.97 978	4	39
22	9.47 492	41	9.49 519	44	0.50 481	9.97 974	4	38
23	9.47 533	40	9.49 563	44	0.50 437	9.97 970	4	37
24	9.47 573	40	9.49 607	45	0.50 393	9.97 966	4	36
25	9.47 613	41	9.49 652	44	0.50 348	9.97 962	4	35
26	9.47 654	40	9.49 696	44	0.50 304	9.97 958	4	34
27	9.47 694	40	9.49 740	44	0.50 260	9.97 954	4	33
28	9.47 734	40	9.49 784	44	0.50 216	9.97 950	4	32
29	9.47 774	40	9.49 828	44	0.50 172	9.97 946	4	31
30	9.47 814	40	9.49 872	44	0.50 128	9.97 942	4	**30**
31	9.47 854	40	9.49 916	44	0.50 084	9.97 938	4	29
32	9.47 894	40	9.49 960	44	0.50 040	9.97 934	4	28
33	9.47 934	40	9.50 004	44	0.49 996	9.97 930	4	27
34	9.47 974	40	9.50 048	44	0.49 952	9.97 926	4	26
35	9.48 014	40	9.50 092	44	0.49 908	9.97 922	4	25
36	9.48 054	40	9.50 136	44	0.49 864	9.97 918	4	24
37	9.48 094	39	9.50 180	43	0.49 820	9.97 914	4	23
38	9.48 133	40	9.50 223	44	0.49 777	9.97 910	4	22
39	9.48 173	40	9.50 267	44	0.49 733	9.97 906	4	21
40	9.48 213	39	9.50 311	44	0.49 689	9.97 902	4	**20**
41	9.48 252	40	9.50 355	43	0.49 645	9.97 898	4	19
42	9.48 292	40	9.50 398	44	0.49 602	9.97 894	4	18
43	9.48 332	39	9.50 442	43	0.49 558	9.97 890	4	17
44	9.48 371	40	9.50 485	44	0.49 515	9.97 886	4	16
45	9.48 411	39	9.50 529	43	0.49 471	9.97 882	4	15
46	9.48 450	40	9.50 572	44	0.49 428	9.97 878	4	14
47	9.48 490	39	9.50 616	43	0.49 384	9.97 874	4	13
48	9.48 529	39	9.50 659	44	0.49 341	9.97 870	4	12
49	9.48 568	39	9.50 703	43	0.49 297	9.97 866	5	11
50	9.48 607	40	9.50 746	43	0.49 254	9.97 861	4	**10**
51	9.48 647	39	9.50 789	44	0.49 211	9.97 857	4	9
52	9.48 686	39	9.50 833	43	0.49 167	9.97 853	4	8
53	9.48 725	39	9.50 876	43	0.49 124	9.97 849	4	7
54	9.48 764	39	9.50 919	43	0.49 081	9.97 845	4	6
55	9.48 803	39	9.50 962	43	0.49 038	9.97 841	4	5
56	9.48 842	39	9.51 005	43	0.48 995	9.97 837	4	4
57	9.48 881	39	9.51 048	44	0.48 952	9.97 833	4	3
58	9.48 920	39	9.51 092	43	0.48 908	9.97 829	4	2
59	9.48 959	39	9.51 135	43	0.48 865	9.97 825	4	1
60	9.48 998		9.51 178		0.48 822	9.97 821		**0**
′	L Cos	d	L Cot	c d	L Tan	L Sin	d	′

P P

	45	**44**	**43**
1	4.5	4.4	4.3
2	9.0	8.8	8.6
3	13.5	13.2	12.9
4	18.0	17.6	17.2
5	22.5	22.0	21.5
6	27.0	26.4	25.8
7	31.5	30.8	30.1
8	36.0	35.2	34.4
9	40.5	39.6	38.7

	42	**41**	**40**
1	4.2	4.1	4.0
2	8.4	8.2	8.0
3	12.6	12.3	12.0
4	16.8	16.4	16.0
5	21.0	20.5	20.0
6	25.2	24.6	24.0
7	29.4	28.7	28.0
8	33.6	32.8	32.0
9	37.8	36.9	36.0

	39	**5**	**4**	**3**
1	3.9	0.5	0.4	0.3
2	7.8	1.0	0.8	0.6
3	11.7	1.5	1.2	0.9
4	15.6	2.0	1.6	1.2
5	19.5	2.5	2.0	1.5
6	23.4	3.0	2.4	1.8
7	27.3	3.5	2.8	2.1
8	31.2	4.0	3.2	2.4
9	35.1	4.5	3.6	2.7

P P

′	L Sin	d	L Tan	cd	L Cot	L Cos	d	′
0	9.48 998	39	9.51 178	43	0.48 822	9.97 821	4	**60**
1	9.49 037	39	9.51 221	43	0.48 779	9.97 817	5	59
2	9.49 076	39	9.51 264	42	0.48 736	9.97 812	4	58
3	9.49 115	38	9.51 306	43	0.48 694	9.97 808	4	57
4	9.49 153	39	9.51 349	43	0.48 651	9.97 804	4	56
5	9.49 192	39	9.51 392	43	0.48 608	9.97 800	4	55
6	9.49 231	38	9.51 435	43	0.48 565	9.97 796	4	54
7	9.49 269	39	9.51 478	42	0.48 522	9.97 792	4	53
8	9.49 308	39	9.51 520	43	0.48 480	9.97 788	4	52
9	9.49 347	38	9.51 563	43	0.48 437	9.97 784	5	51
10	9.49 385	39	9.51 606	42	0.48 394	9.97 779	4	**50**
11	9.49 424	38	9.51 648	43	0.48 352	9.97 775	4	49
12	9.49 462	38	9.51 691	43	0.48 309	9.97 771	4	48
13	9.49 500	39	9.51 734	42	0.48 266	9.97 767	4	47
14	9.49 539	38	9.51 776	43	0.48 224	9.97 763	4	46
15	9.49 577	38	9.51 819	42	0.48 181	9.97 759	5	45
16	9.49 615	39	9.51 861	42	0.48 139	9.97 754	4	44
17	9.49 654	38	9.51 903	43	0.48 097	9.97 750	4	43
18	9.49 692	38	9.51 946	42	0.48 054	9.97 746	4	42
19	9.49 730	38	9.51 988	43	0.48 012	9.97 742	4	41
20	9.49 768	38	9.52 031	42	0.47 969	9.97 738	4	**40**
21	9.49 806	38	9.52 073	42	0.47 927	9.97 734	5	39
22	9.49 844	38	9.52 115	42	0.47 885	9.97 729	4	38
23	9.49 882	38	9.52 157	43	0.47 843	9.97 725	4	37
24	9.49 920	38	9.52 200	42	0.47 800	9.97 721	4	36
25	9.49 958	38	9.52 242	42	0.47 758	9.97 717	4	35
26	9.49 996	38	9.52 284	42	0.47 716	9.97 713	5	34
27	9.50 034	38	9.52 326	42	0.47 674	9.97 708	4	33
28	9.50 072	38	9.52 368	42	0.47 632	9.97 704	4	32
29	9.50 110	38	9.52 410	42	0.47 590	9.97 700	4	31
30	9.50 148	37	9.52 452	42	0.47 548	9.97 696	5	**30**
31	9.50 185	38	9.52 494	42	0.47 506	9.97 691	4	29
32	9.50 223	38	9.52 536	42	0.47 464	9.97 687	4	28
33	9.50 261	37	9.52 578	42	0.47 422	9.97 683	4	27
34	9.50 298	38	9.52 620	41	0.47 380	9.97 679	5	26
35	9.50 336	38	9.52 661	42	0.47 339	9.97 674	4	25
36	9.50 374	37	9.52 703	42	0.47 297	9.97 670	4	24
37	9.50 411	38	9.52 745	42	0.47 255	9.97 666	4	23
38	9.50 449	37	9.52 787	42	0.47 213	9.97 662	5	22
39	9.50 486	37	9.52 829	41	0.47 171	9.97 657	4	21
40	9.50 523	38	9.52 870	42	0.47 130	9.97 653	4	**20**
41	9.50 561	37	9.52 912	41	0.47 088	9.97 649	4	19
42	9.50 598	37	9.52 953	42	0.47 047	9.97 645	5	18
43	9.50 635	38	9.52 995	42	0.47 005	9.97 640	4	17
44	9.50 673	37	9.53 037	41	0.46 963	9.97 636	4	16
45	9.50 710	37	9.53 078	42	0.46 922	9.97 632	4	15
46	9.50 747	37	9.53 120	41	0.46 880	9.97 628	5	14
47	9.50 784	37	9.53 161	41	0.46 839	9.97 623	4	13
48	9.50 821	37	9.53 202	42	0.46 798	9.97 619	4	12
49	9.50 858	38	9.53 244	41	0.46 756	9.97 615	5	11
50	9.50 896	37	9.53 285	42	0.46 715	9.97 610	4	**10**
51	9.50 933	37	9.53 327	41	0.46 673	9.97 606	4	9
52	9.50 970	37	9.53 368	41	0.46 632	9.97 602	5	8
53	9.51 007	36	9.53 409	41	0.46 591	9.97 597	4	7
54	9.51 043	37	9.53 450	42	0.46 550	9.97 593	4	6
55	9.51 080	37	9.53 492	41	0.46 508	9.97 589	5	5
56	9.51 117	37	9.53 533	41	0.46 467	9.97 584	4	4
57	9.51 154	37	9.53 574	41	0.46 426	9.97 580	4	3
58	9.51 191	36	9.53 615	41	0.46 385	9.97 576	5	2
59	9.51 227	37	9.53 656	41	0.46 344	9.97 571	4	1
60	9.51 264		9.53 697		0.46 303	9.97 567		**0**
	L Cos	d	L Cot	cd	L Tan	L Sin	d	′

P P

	43	42	41
1	4.3	4.2	4.1
2	8.6	8.4	8.2
3	12.9	12.6	12.3
4	17.2	16.8	16.4
5	21.5	21.0	20.5
6	25.8	25.2	24.6
7	30.1	29.4	28.7
8	34.4	33.6	32.8
9	38.7	37.8	36.9

	39	38	37
1	3.9	3.8	3.7
2	7.8	7.6	7.4
3	11.7	11.4	11.1
4	15.6	15.2	14.8
5	19.5	19.0	18.5
6	23.4	22.8	22.2
7	27.3	26.6	25.9
8	31.2	30.4	29.6
9	35.1	34.2	33.3

	36	5	4
1	3.6	0.5	0.4
2	7.2	1.0	0.8
3	10.8	1.5	1.2
4	14.4	2.0	1.6
5	18.0	2.5	2.0
6	21.6	3.0	2.4
7	25.2	3.5	2.8
8	28.8	4.0	3.2
9	32.4	4.5	3.6

P P

19° **160°**

′	L Sin	d	L Tan	c d	L Cot	L Cos	d	
0	9.51 264	37	9.53 697	41	0.46 303	9.97 567	4	**60**
1	9.51 301	37	9.53 738	41	0.46 262	9.97 563	5	59
2	9.51 338	36	9.53 779	41	0.46 221	9.97 558	4	58
3	9.51 374	37	9.53 820	41	0.46 180	9.97 554	4	57
4	9.51 411	36	9.53 861	41	0.46 139	9.97 550	5	56
5	9.51 447	37	9.53 902	41	0.46 098	9.97 545	4	55
6	9.51 484	36	9.53 943	41	0.46 057	9.97 541	5	54
7	9.51 520	37	9.53 984	41	0.46 016	9.97 536	4	53
8	9.51 557	36	9.54 025	40	0.45 975	9.97 532	4	52
9	9.51 593	36	9.54 065	41	0.45 935	9.97 528	5	51
10	9.51 629	37	9.54 106	41	0.45 894	9.97 523	4	**50**
11	9.51 666	36	9.54 147	40	0.45 853	9.97 519	4	49
12	9.51 702	36	9.54 187	41	0.45 813	9.97 515	5	48
13	9.51 738	36	9.54 228	41	0.45 772	9.97 510	4	47
14	9.51 774	37	9.54 269	40	0.45 731	9.97 506	5	46
15	9.51 811	36	9.54 309	41	0.45 691	9.97 501	4	45
16	9.51 847	36	9.54 350	40	0.45 650	9.97 497	5	44
17	9.51 883	36	9.54 390	41	0.45 610	9.97 492	4	43
18	9.51 919	36	9.54 431	40	0.45 569	9.97 488	4	42
19	9.51 955	36	9.54 471	41	0.45 529	9.97 484	5	41
20	9.51 991	36	9.54 512	40	0.45 488	9.97 479	4	**40**
21	9.52 027	36	9.54 552	41	0.45 448	9.97 475	5	39
22	9.52 063	36	9.54 593	40	0.45 407	9.97 470	4	38
23	9.52 099	36	9.54 633	40	0.45 367	9.97 466	5	37
24	9.52 135	36	9.54 673	41	0.45 327	9.97 461	4	36
25	9.52 171	36	9.54 714	40	0.45 286	9.97 457	4	35
26	9.52 207	35	9.54 754	40	0.45 246	9.97 453	5	34
27	9.52 242	36	9.54 794	41	0.45 206	9.97 448	4	33
28	9.52 278	36	9.54 835	40	0.45 165	9.97 444	5	32
29	9.52 314	36	9.54 875	40	0.45 125	9.97 439	4	31
30	9.52 350	35	9.54 915	40	0.45 085	9.97 435	5	**30**
31	9.52 385	36	9.54 955	40	0.45 045	9.97 430	4	29
32	9.52 421	35	9.54 995	40	0.45 005	9.97 426	5	28
33	9.52 456	36	9.55 035	40	0.44 965	9.97 421	4	27
34	9.52 492	35	9.55 075	40	0.44 925	9.97 417	5	26
35	9.52 527	36	9.55 115	40	0.44 885	9.97 412	4	25
36	9.52 563	35	9.55 155	40	0.44 845	9.97 408	5	24
37	9.52 598	36	9.55 195	40	0.44 805	9.97 403	4	23
38	9.52 634	35	9.55 235	40	0.44 765	9.97 399	5	22
39	9.52 669	36	9.55 275	40	0.44 725	9.97 394	4	21
40	9.52 705	35	9.55 315	40	0.44 685	9.97 390	5	**20**
41	9.52 740	35	9.55 355	40	0.44 645	9.97 385	4	19
42	9.52 775	36	9.55 395	39	0.44 605	9.97 381	5	18
43	9.52 811	35	9.55 434	40	0.44 566	9.97 376	4	17
44	9.52 846	35	9.55 474	40	0.44 526	9.97 372	5	16
45	9.52 881	35	9.55 514	40	0.44 486	9.97 367	4	15
46	9.52 916	35	9.55 554	39	0.44 446	9.97 363	5	14
47	9.52 951	35	9.55 593	40	0.44 407	9.97 358	5	13
48	9.52 986	35	9.55 633	40	0.44 367	9.97 353	4	12
49	9.53 021	35	9.55 673	39	0.44 327	9.97 349	5	11
50	9.53 056	36	9.55 712	40	0.44 288	9.97 344	4	**10**
51	9.53 092	34	9.55 752	39	0.44 248	9.97 340	5	9
52	9.53 126	35	9.55 791	40	0.44 209	9.97 335	4	8
53	9.53 161	35	9.55 831	39	0.44 169	9.97 331	5	7
54	9.53 196	35	9.55 870	40	0.44 130	9.97 326	4	6
55	9.53 231	35	9.55 910	39	0.44 090	9.97 322	5	5
56	9.53 266	35	9.55 949	40	0.44 051	9.97 317	5	4
57	9.53 301	35	9.55 989	39	0.44 011	9.97 312	4	3
58	9.53 336	34	9.56 028	39	0.43 972	9.97 308	5	2
59	9.53 370	35	9.56 067	40	0.43 933	9.97 303	4	1
60	9.53 405		9.56 107		0.43 893	9.97 299		**0**
	L Cos	d	L Cot	c d	L Tan	L Sin	d	′

P P

	41	**40**	**39**
1	4.1	4.0	3.9
2	8.2	8.0	7.8
3	12.3	12.0	11.7
4	16.4	16.0	15.6
5	20.5	20.0	19.5
6	24.6	24.0	23.4
7	28.7	28.0	27.3
8	32.8	32.0	31.2
9	36.9	36.0	35.1

	37	**36**	**35**
1	3.7	3.6	3.5
2	7.4	7.2	7.0
3	11.1	10.8	10.5
4	14.8	14.4	14.0
5	18.5	18.0	17.5
6	22.2	21.6	21.0
7	25.9	25.2	24.5
8	29.6	28.8	28.0
9	33.3	32.4	31.5

	34	**5**	**4**
1	3.4	0.5	0.4
2	6.8	1.0	0.8
3	10.2	1.5	1.2
4	13.6	2.0	1.6
5	17.0	2.5	2.0
6	20.4	3.0	2.4
7	23.8	3.5	2.8
8	27.2	4.0	3.2
9	30.6	4.5	3.6

P P

109° **70°**

′	L Sin	d	L Tan	c d	L Cot	L Cos	d	
0	9.53 405	35	9.56 107	39	0.43 893	9.97 299	5	**60**
1	9.53 440	35	9.56 146	39	0.43 854	9.97 294	5	59
2	9.53 475	34	9.56 185	39	0.43 815	9.97 289	4	58
3	9.53 509	35	9.56 224	40	0.43 776	9.97 285	5	57
4	9.53 544	34	9.56 264	39	0.43 736	9.97 280	4	56
5	9.53 578	35	9.56 303	39	0.43 697	9.97 276	5	55
6	9.53 613	34	9.56 342	39	0.43 658	9.97 271	5	54
7	9.53 647	35	9.56 381	39	0.43 619	9.97 266	4	53
8	9.53 682	34	9.56 420	39	0.43 580	9.97 262	5	52
9	9.53 716	35	9.56 459	39	0.43 541	9.97 257	5	51
10	9.53 751	34	9.56 498	39	0.43 502	9.97 252	4	**50**
11	9.53 785	34	9.56 537	39	0.43 463	9.97 248	5	49
12	9.53 819	35	9.56 576	39	0.43 424	9.97 243	5	48
13	9.53 854	34	9.56 615	39	0.43 385	9.97 238	4	47
14	9.53 888	34	9.56 654	39	0.43 346	9.97 234	5	46
15	9.53 922	35	9.56 693	39	0.43 307	9.97 229	5	45
16	9.53 957	34	9.56 732	39	0.43 268	9.97 224	4	44
17	9.53 991	34	9.56 771	39	0.43 229	9.97 220	5	43
18	9.54 025	34	9.56 810	39	0.43 190	9.97 215	5	42
19	9.54 059	34	9.56 849	38	0.43 151	9.97 210	4	41
20	9.54 093	34	9.56 887	39	0.43 113	9.97 206	5	**40**
21	9.54 127	34	9.56 926	39	0.43 074	9.97 201	5	39
22	9.54 161	34	9.56 965	39	0.43 035	9.97 196	4	38
23	9.54 195	34	9.57 004	38	0.42 996	9.97 192	5	37
24	9.54 229	34	9.57 042	39	0.42 958	9.97 187	5	36
25	9.54 263	34	9.57 081	39	0.42 919	9.97 182	4	35
26	9.54 297	34	9.57 120	38	0.42 880	9.97 178	5	34
27	9.54 331	34	9.57 158	39	0.42 842	9.97 173	5	33
28	9.54 365	34	9.57 197	38	0.42 803	9.97 168	5	32
29	9.54 399	34	9.57 235	39	0.42 765	9.97 163	4	31
30	9.54 433	33	9.57 274	38	0.42 726	9.97 159	5	**30**
31	9.54 466	34	9.57 312	39	0.42 688	9.97 154	5	29
32	9.54 500	34	9.57 351	38	0.42 649	9.97 149	4	28
33	9.54 534	33	9.57 389	39	0.42 611	9.97 145	5	27
34	9.54 567	34	9.57 428	38	0.42 572	9.97 140	5	26
35	9.54 601	34	9.57 466	38	0.42 534	9.97 135	5	25
36	9.54 635	33	9.57 504	39	0.42 496	9.97 130	4	24
37	9.54 668	34	9.57 543	38	0.42 457	9.97 126	5	23
38	9.54 702	33	9.57 581	38	0.42 419	9.97 121	5	22
39	9.54 735	34	9.57 619	39	0.42 381	9.97 116	5	21
40	9.54 769	33	9.57 658	38	0.42 342	9.97 111	4	**20**
41	9.54 802	34	9.57 696	38	0.42 304	9.97 107	5	19
42	9.54 836	33	9.57 734	38	0.42 266	9.97 102	5	18
43	9.54 869	34	9.57 772	38	0.42 228	9.97 097	5	17
44	9.54 903	33	9.57 810	39	0.42 190	9.97 092	5	16
45	9.54 936	33	9.57 849	38	0.42 151	9.97 087	4	15
46	9.54 969	34	9.57 887	38	0.42 113	9.97 083	5	14
47	9.55 003	33	9.57 925	38	0.42 075	9.97 078	5	13
48	9.55 036	33	9.57 963	38	0.42 037	9.97 073	5	12
49	9.55 069	33	9.58 001	38	0.41 999	9.97 068	5	11
50	9.55 102	34	9.58 039	38	0.41 961	9.97 063	4	**10**
51	9.55 136	33	9.58 077	38	0.41 923	9.97 059	5	9
52	9.55 169	33	9.58 115	38	0.41 885	9.97 054	5	8
53	9.55 202	33	9.58 153	38	0.41 847	9.97 049	5	7
54	9.55 235	33	9.58 191	38	0.41 809	9.97 044	5	6
55	9.55 268	33	9.58 229	38	0.41 771	9.97 039	4	5
56	9.55 301	33	9.58 267	37	0.41 733	9.97 035	5	4
57	9.55 334	33	9.58 304	38	0.41 696	9.97 030	5	3
58	9.55 367	33	9.58 342	38	0.41 658	9.97 025	5	2
59	9.55 400	33	9.58 380	38	0.41 620	9.97 020	5	1
60	9.55 433		9.58 418		0.41 582	9.97 015		**0**
	L Cos	d	L Cot	c d	L Tan	L Sin	d	′

P P

	40	**39**	**38**
1	4.0	3.9	3.8
2	8.0	7.8	7.6
3	12.0	11.7	11.4
4	16.0	15.6	15.2
5	20.0	19.5	19.0
6	24.0	23.4	22.8
7	28.0	27.3	26.6
8	32.0	31.2	30.4
9	36.0	35.1	34.2

	37	**35**	**34**
1	3.7	3.5	3.4
2	7.4	7.0	6.8
3	11.1	10.5	10.2
4	14.8	14.0	13.6
5	18.5	17.5	17.0
6	22.2	21.0	20.4
7	25.9	24.5	23.8
8	29.6	28.0	27.2
9	33.3	31.5	30.6

	33	**5**	**4**
1	3.3	0.5	0.4
2	6.6	1.0	0.8
3	9.9	1.5	1.2
4	13.2	2.0	1.6
5	16.5	2.5	2.0
6	19.8	3.0	2.4
7	23.1	3.5	2.8
8	26.4	4.0	3.2
9	29.7	4.5	3.6

P P

′	L Sin	d	L Tan	c d	L Cot	L Cos	d	
0	9.55 433	33	9.58 418	37	0.41 582	9.97 015	5	60
1	9.55 466	33	9.58 455	38	0.41 545	9.97 010	5	59
2	9.55 499	33	9.58 493	38	0.41 507	9.97 005	4	58
3	9.55 532	32	9.58 531	38	0.41 469	9.97 001	5	57
4	9.55 564	33	9.58 569	37	0.41 431	9.96 996	5	56
5	9.55 597	33	9.58 606	38	0.41 394	9.96 991	5	55
6	9.55 630	33	9.58 644	37	0.41 356	9.96 986	5	54
7	9.55 663	32	9.58 681	38	0.41 319	9.96 981	5	53
8	9.55 695	33	9.58 719	38	0.41 281	9.96 976	5	52
9	9.55 728	33	9.58 757	37	0.41 243	9.96 971	5	51
10	9.55 761	32	9.58 794	38	0.41 206	9.96 966	4	50
11	9.55 793	33	9.58 832	37	0.41 168	9.96 962	5	49
12	9.55 826	32	9.58 869	38	0.41 131	9.96 957	5	48
13	9.55 858	33	9.58 907	37	0.41 093	9.96 952	5	47
14	9.55 891	32	9.58 944	37	0.41 056	9.96 947	5	46
15	9.55 923	33	9.58 981	38	0.41 019	9.96 942	5	45
16	9.55 956	32	9.59 019	37	0.40 981	9.96 937	5	44
17	9.55 988	33	9.59 056	38	0.40 944	9.96 932	5	43
18	9.56 021	32	9.59 094	37	0.40 906	9.96 927	5	42
19	9.56 053	32	9.59 131	37	0.40 869	9.96 922	5	41
20	9.56 085	33	9.59 168	37	0.40 832	9.96 917	5	40
21	9.56 118	32	9.59 205	38	0.40 795	9.96 912	5	39
22	9.56 150	32	9.59 243	37	0.40 757	9.96 907	4	38
23	9.56 182	33	9.59 280	37	0.40 720	9.96 903	5	37
24	9.56 215	32	9.59 317	37	0.40 683	9.96 898	5	36
25	9.56 247	32	9.59 354	37	0.40 646	9.96 893	5	35
26	9.56 279	32	9.59 391	38	0.40 609	9.96 888	5	34
27	9.56 311	32	9.59 429	37	0.40 571	9.96 883	5	33
28	9.56 343	32	9.59 466	37	0.40 534	9.96 878	5	32
29	9.56 375	33	9.59 503	37	0.40 497	9.96 873	5	31
30	9.56 408	32	9.59 540	37	0.40 460	9.96 868	5	30
31	9.56 440	32	9.59 577	37	0.40 423	9.96 863	5	29
32	9.56 472	32	9.59 614	37	0.40 386	9.96 858	5	28
33	9.56 504	32	9.59 651	37	0.40 349	9.96 853	5	27
34	9.56 536	32	9.59 688	37	0.40 312	9.96 848	5	26
35	9.56 568	31	9.59 725	37	0.40 275	9.96 843	5	25
36	9.56 599	32	9.59 762	37	0.40 238	9.96 838	5	24
37	9.56 631	32	9.59 799	36	0.40 201	9.96 833	5	23
38	9.56 663	32	9.59 835	37	0.40 165	9.96 828	5	22
39	9.56 695	32	9.59 872	37	0.40 128	9.96 823	5	21
40	9.56 727	32	9.59 909	37	0.40 091	9.96 818	5	20
41	9.56 759	31	9.59 946	37	0.40 054	9.96 813	5	19
42	9.56 790	32	9.59 983	36	0.40 017	9.96 808	5	18
43	9.56 822	32	9.60 019	37	0.39 981	9.96 803	5	17
44	9.56 854	32	9.60 056	37	0.39 944	9.96 798	5	16
45	9.56 886	31	9.60 093	37	0.39 907	9.96 793	5	15
46	9.56 917	32	9.60 130	36	0.39 870	9.96 788	5	14
47	9.56 949	31	9.60 166	37	0.39 834	9.96 783	5	13
48	9.56 980	32	9.60 203	37	0.39 797	9.96 778	6	12
49	9.57 012	32	9.60 240	36	0.39 760	9.96 772	5	11
50	9.57 044	31	9.60 276	37	0.39 724	9.96 767	5	10
51	9.57 075	32	9.60 313	36	0.39 687	9.96 762	5	9
52	9.57 107	31	9.60 349	37	0.39 651	9.96 757	5	8
53	9.57 138	31	9.60 386	36	0.39 614	9.96 752	5	7
54	9.57 169	32	9.60 422	37	0.39 578	9.96 747	5	6
55	9.57 201	31	9.60 459	36	0.39 541	9.96 742	5	5
56	9.57 232	32	9.60 495	37	0.39 505	9.96 737	5	4
57	9.57 264	31	9.60 532	36	0.39 468	9.96 732	5	3
58	9.57 295	31	9.60 568	37	0.39 432	9.96 727	5	2
59	9.57 326	32	9.60 605	36	0.39 395	9.96 722	5	1
60	9.57 358		9.60 641		0.39 359	9.96 717		0
	L Cos	d	L Cot	c d	L Tan	L Sin	d	′

P P

	38	37	36
1	3.8	3.7	3.6
2	7.6	7.4	7.2
3	11.4	11.1	10.8
4	15.2	14.8	14.4
5	19.0	18.5	18.0
6	22.8	22.2	21.6
7	26.6	25.9	25.2
8	30.4	29.6	28.8
9	34.2	33.3	32.4

	33	32	31
1	3.3	3.2	3.1
2	6.6	6.4	6.2
3	9.9	9.6	9.3
4	13.2	12.8	12.4
5	16.5	16.0	15.5
6	19.8	19.2	18.6
7	23.1	22.4	21.7
8	26.4	25.6	24.8
9	29.7	28.8	27.9

	6	5	4
1	0.6	0.5	0.4
2	1.2	1.0	0.8
3	1.8	1.5	1.2
4	2.4	2.0	1.6
5	3.0	2.5	2.0
6	3.6	3.0	2.4
7	4.2	3.5	2.8
8	4.8	4.0	3.2
9	5.4	4.5	3.6

P P

′	L Sin	d	L Tan	cd	L Cot	L Cos	d	′
0	9.57 358	31	9.60 641	36	0.39 359	9.96 717	6	**60**
1	9.57 389	31	9.60 677	37	0.39 323	9.96 711	5	59
2	9.57 420	31	9.60 714	36	0.39 286	9.96 706	5	58
3	9.57 451	31	9.60 750	36	0.39 250	9.96 701	5	57
4	9.57 482	32	9.60 786	37	0.39 214	9.96 696	5	56
5	9.57 514	31	9.60 823	36	0.39 177	9.96 691	5	55
6	9.57 545	31	9.60 859	36	0.39 141	9.96 686	5	54
7	9.57 576	31	9.60 895	36	0.39 105	9.96 681	5	53
8	9.57 607	31	9.60 931	36	0.39 069	9.96 676	6	52
9	9.57 638	31	9.60 967	37	0.39 033	9.96 670	5	51
10	9.57 669	31	9.61 004	36	0.38 996	9.96 665	5	**50**
11	9.57 700	31	9.61 040	36	0.38 960	9.96 660	5	49
12	9.57 731	31	9.61 076	36	0.38 924	9.96 655	5	48
13	9.57 762	31	9.61 112	36	0.38 888	9.96 650	5	47
14	9.57 793	31	9.61 148	36	0.38 852	9.96 645	5	46
15	9.57 824	31	9.61 184	36	0.38 816	9.96 640	6	45
16	9.57 855	30	9.61 220	36	0.38 780	9.96 634	5	44
17	9.57 885	31	9.61 256	36	0.38 744	9.96 629	5	43
18	9.57 916	31	9.61 292	36	0.38 708	9.96 624	5	42
19	9.57 947	31	9.61 328	36	0.38 672	9.96 619	5	41
20	9.57 978	30	9.61 364	36	0.38 636	9.96 614	6	**40**
21	9.58 008	31	9.61 400	36	0.38 600	9.96 608	5	39
22	9.58 039	31	9.61 436	36	0.38 564	9.96 603	5	38
23	9.58 070	31	9.61 472	36	0.38 528	9.96 598	5	37
24	9.58 101	30	9.61 508	36	0.38 492	9.96 593	5	36
25	9.58 131	31	9.61 544	35	0.38 456	9.96 588	6	35
26	9.58 162	30	9.61 579	36	0.38 421	9.96 582	5	34
27	9.58 192	31	9.61 615	36	0.38 385	9.96 577	5	33
28	9.58 223	30	9.61 651	36	0.38 349	9.96 572	5	32
29	9.58 253	31	9.61 687	35	0.38 313	9.96 567	5	31
30	9.58 284	30	9.61 722	36	0.38 278	9.96 562	6	**30**
31	9.58 314	31	9.61 758	36	0.38 242	9.96 556	5	29
32	9.58 345	30	9.61 794	36	0.38 206	9.96 551	5	28
33	9.58 375	31	9.61 830	35	0.38 170	9.96 546	5	27
34	9.58 406	30	9.61 865	36	0.38 135	9.96 541	6	26
35	9.58 436	31	9.61 901	35	0.38 099	9.96 535	5	25
36	9.58 467	30	9.61 936	36	0.38 064	9.96 530	5	24
37	9.58 497	30	9.61 972	36	0.38 028	9.96 525	5	23
38	9.58 527	30	9.62 008	35	0.37 992	9.96 520	6	22
39	9.58 557	31	9.62 043	36	0.37 957	9.96 514	5	21
40	9.58 588	30	9.62 079	35	0.37 921	9.96 509	5	**20**
41	9.58 618	30	9.62 114	36	0.37 886	9.96 504	6	19
42	9.58 648	30	9.62 150	35	0.37 850	9.96 498	5	18
43	9.58 678	31	9.62 185	36	0.37 815	9.96 493	5	17
44	9.58 709	30	9.62 221	35	0.37 779	9.96 488	5	16
45	9.58 739	30	9.62 256	36	0.37 744	9.96 483	6	15
46	9.58 769	30	9.62 292	35	0.37 708	9.96 477	5	14
47	9.58 799	30	9.62 327	35	0.37 673	9.96 472	5	13
48	9.58 829	30	9.62 362	36	0.37 638	9.96 467	6	12
49	9.58 859	30	9.62 398	35	0.37 602	9.96 461	5	11
50	9.58 889	30	9.62 433	35	0.37 567	9.96 456	5	**10**
51	9.58 919	30	9.62 468	36	0.37 532	9.96 451	6	9
52	9.58 949	30	9.62 504	35	0.37 496	9.96 445	5	8
53	9.58 979	30	9.62 539	35	0.37 461	9.96 440	5	7
54	9.59 009	30	9.62 574	35	0.37 426	9.96 435	6	6
55	9.59 039	30	9.62 609	36	0.37 391	9.96 429	5	5
56	9.59 069	29	9.62 645	35	0.37 355	9.96 424	5	4
57	9.59 098	30	9.62 680	35	0.37 320	9.96 419	6	3
58	9.59 128	30	9.62 715	35	0.37 285	9.96 413	5	2
59	9.59 158	30	9.62 750	35	0.37 250	9.96 408	5	1
60	9.59 188		9.62 785		0.37 215	9.96 403		**0**
	L Cos	d	L Cot	cd	L Tan	L Sin	d	′

P P

	37	**36**	**35**
1	3.7	3.6	3.5
2	7.4	7.2	7.0
3	11.1	10.8	10.5
4	14.8	14.4	14.0
5	18.5	18.0	17.5
6	22.2	21.6	21.0
7	25.9	25.2	24.5
8	29.6	28.8	28.0
9	33.3	32.4	31.5

	32	**31**	**30**
1	3.2	3.1	3.0
2	6.4	6.2	6.0
3	9.6	9.3	9.0
4	12.8	12.4	12.0
5	16.0	15.5	15.0
6	19.2	18.6	18.0
7	22.4	21.7	21.0
8	25.6	24.8	24.0
9	28.8	27.9	27.0

	29	**6**	**5**
1	2.9	0.6	0.5
2	5.8	1.2	1.0
3	8.7	1.8	1.5
4	11.6	2.4	2.0
5	14.5	3.0	2.5
6	17.4	3.6	3.0
7	20.3	4.2	3.5
8	23.2	4.8	4.0
9	26.1	5.4	4.5

P P

′	L Sin	d	L Tan	c d	L Cot	L Cos	d	
0	9.59 188	30	9.62 785	35	0.37 215	9.96 403	6	**60**
1	9.59 218	29	9.62 820	35	0.37 180	9.96 397	5	59
2	9.59 247	30	9.62 855	35	0.37 145	9.96 392	5	58
3	9.59 277	30	9.62 890	36	0.37 110	9.96 387	6	57
4	9.59 307	29	9.62 926	35	0.37 074	9.96 381	5	56
5	9.59 336	30	9.62 961	35	0.37 039	9.96 376	6	55
6	9.59 366	30	9.62 996	35	0.37 004	9.96 370	5	54
7	9.59 396	29	9.63 031	35	0.36 969	9.96 365	5	53
8	9.59 425	30	9.63 066	35	0.36 934	9.96 360	6	52
9	9.59 455	29	9.63 101	34	0.36 899	9.96 354	5	51
10	9.59 484	30	9.63 135	35	0.36 865	9.96 349	6	**50**
11	9.59 514	29	9.63 170	35	0.36 830	9.96 343	5	49
12	9.59 543	30	9.63 205	35	0.36 795	9.96 338	5	48
13	9.59 573	29	9.63 240	35	0.36 760	9.96 333	6	47
14	9.59 602	30	9.63 275	35	0.36 725	9.96 327	5	46
15	9.59 632	29	9.63 310	35	0.36 690	9.96 322	6	45
16	9.59 661	29	9.63 345	34	0.36 655	9.96 316	5	44
17	9.59 690	30	9.63 379	35	0.36 621	9.96 311	6	43
18	9.59 720	29	9.63 414	35	0.36 586	9.96 305	5	42
19	9.59 749	29	9.63 449	35	0.36 551	9.96 300	6	41
20	9.59 778	30	9.63 484	35	0.36 516	9.96 294	5	**40**
21	9.59 808	29	9.63 519	34	0.36 481	9.96 289	5	39
22	9.59 837	29	9.63 553	35	0.36 447	9.96 284	6	38
23	9.59 866	29	9.63 588	35	0.36 412	9.96 278	5	37
24	9.59 895	29	9.63 623	34	0.36 377	9.96 273	6	36
25	9.59 924	30	9.63 657	35	0.36 343	9.96 267	5	35
26	9.59 954	29	9.63 692	34	0.36 308	9.96 262	6	34
27	9.59 983	29	9.63 726	35	0.36 274	9.96 256	5	33
28	9.60 012	29	9.63 761	35	0.36 239	9.96 251	6	32
29	9.60 041	29	9.63 796	34	0.36 204	9.96 245	5	31
30	9.60 070	29	9.63 830	35	0.36 170	9.96 240	6	**30**
31	9.60 099	29	9.63 865	34	0.36 135	9.96 234	5	29
32	9.60 128	29	9.63 899	35	0.36 101	9.96 229	6	28
33	9.60 157	29	9.63 934	34	0.36 066	9.96 223	5	27
34	9.60 186	29	9.63 968	35	0.36 032	9.96 218	6	26
35	9.60 215	29	9.64 003	34	0.35 997	9.96 212	5	25
36	9.60 244	29	9.64 037	35	0.35 963	9.96 207	6	24
37	9.60 273	29	9.64 072	34	0.35 928	9.96 201	5	23
38	9.60 302	29	9.64 106	34	0.35 894	9.96 196	6	22
39	9.60 331	28	9.64 140	35	0.35 860	9.96 190	5	21
40	9.60 359	29	9.64 175	34	0.35 825	9.96 185	6	**20**
41	9.60 388	29	9.64 209	34	0.35 791	9.96 179	5	19
42	9.60 417	29	9.64 243	35	0.35 757	9.96 174	6	18
43	9.60 446	28	9.64 278	34	0.35 722	9.96 168	6	17
44	9.60 474	29	9.64 312	34	0.35 688	9.96 162	5	16
45	9.60 503	29	9.64 346	35	0.35 654	9.96 157	6	15
46	9.60 532	29	9.64 381	34	0.35 619	9.96 151	5	14
47	9.60 561	28	9.64 415	34	0.35 585	9.96 146	6	13
48	9.60 589	29	9.64 449	34	0.35 551	9.96 140	5	12
49	9.60 618	28	9.64 483	34	0.35 517	9.96 135	6	11
50	9.60 646	29	9.64 517	35	0.35 483	9.96 129	6	**10**
51	9.60 675	29	9.64 552	34	0.35 448	9.96 123	5	9
52	9.60 704	28	9.64 586	34	0.35 414	9.96 118	6	8
53	9.60 732	29	9.64 620	34	0.35 380	9.96 112	5	7
54	9.60 761	28	9.64 654	34	0.35 346	9.96 107	6	6
55	9.60 789	29	9.64 688	34	0.35 312	9.96 101	6	5
56	9.60 818	28	9.64 722	34	0.35 278	9.96 095	5	4
57	9.60 846	29	9.64 756	34	0.35 244	9.96 090	6	3
58	9.60 875	28	9.64 790	34	0.35 210	9.96 084	5	2
59	9.60 903	28	9.64 824	34	0.35 176	9.96 079	6	1
60	9.60 931		9.64 858		0.35 142	9.96 073		**0**
	L Cos	d	L Cot	c d	L Tan	L Sin	d	′

P P

	36	35	34
1	3.6	3.5	3.4
2	7.2	7.0	6.8
3	10.8	10.5	10.2
4	14.4	14.0	13.6
5	18.0	17.5	17.0
6	21.6	21.0	20.4
7	25.2	24.5	23.8
8	28.8	28.0	27.2
9	32.4	31.5	30.6

	30	29	28
1	3.0	2.9	2.8
2	6.0	5.8	5.6
3	9.0	8.7	8.4
4	12.0	11.6	11.2
5	15.0	14.5	14.0
6	18.0	17.4	16.8
7	21.0	20.3	19.6
8	24.0	23.2	22.4
9	27.0	26.1	25.2

	6	5
1	0.6	0.5
2	1.2	1.0
3	1.8	1.5
4	2.4	2.0
5	3.0	2.5
6	3.6	3.0
7	4.2	3.5
8	4.8	4.0
9	5.4	4.5

P P

′	L Sin	d	L Tan	c d	L Cot	L Cos	d	
0	9.60 931		9.64 858		0.35 142	9.96 073		**60**
1	9.60 960	29	9.64 892	34	0.35 108	9.96 067	6	59
2	9.60 988	28	9.64 926	34	0.35 074	9.96 062	5	58
3	9.61 016	28	9.64 960	34	0.35 040	9.96 056	6	57
4	9.61 045	29	9.64 994	34	0.35 006	9.96 050	6	56
5	9.61 073	28	9.65 028	34	0.34 972	9.96 045	5	55
6	9.61 101	28	9.65 062	34	0.34 938	9.96 039	6	54
7	9.61 129	28	9.65 096	34	0.34 904	9.96 034	5	53
8	9.61 158	29	9.65 130	34	0.34 870	9.96 028	6	52
9	9.61 186	28	9.65 164	34	0.34 836	9.96 022	6	51
10	9.61 214	28	9.65 197	33	0.34 803	9.96 017	5	**50**
11	9.61 242	28	9.65 231	34	0.34 769	9.96 011	6	49
12	9.61 270	28	9.65 265	34	0.34 735	9.96 005	6	48
13	9.61 298	28	9.65 299	34	0.34 701	9.96 000	5	47
14	9.61 326	28	9.65 333	34	0.34 667	9.95 994	6	46
15	9.61 354	28	9.65 366	33	0.34 634	9.95 988	6	45
16	9.61 382	28	9.65 400	34	0.34 600	9.95 982	6	44
17	9.61 411	29	9.65 434	34	0.34 566	9.95 977	5	43
18	9.61 438	27	9.65 467	33	0.34 533	9.95 971	6	42
19	9.61 466	28	9.65 501	34	0.34 499	9.95 965	6	41
20	9.61 494	28	9.65 535	34	0.34 465	9.95 960	5	**40**
21	9.61 522	28	9.65 568	33	0.34 432	9.95 954	6	39
22	9.61 550	28	9.65 602	34	0.34 398	9.95 948	6	38
23	9.61 578	28	9.65 636	34	0.34 364	9.95 942	6	37
24	9.61 606	28	9.65 669	33	0.34 331	9.95 937	5	36
25	9.61 634	28	9.65 703	34	0.34 297	9.95 931	6	35
26	9.61 662	28	9.65 736	33	0.34 264	9.95 925	6	34
27	9.61 689	27	9.65 770	34	0.34 230	9.95 920	5	33
28	9.61 717	28	9.65 803	33	0.34 197	9.95 914	6	32
29	9.61 745	28	9.65 837	34	0.34 163	9.95 908	6	31
30	9.61 773	28	9.65 870	33	0.34 130	9.95 902	6	**30**
31	9.61 800	27	9.65 904	34	0.34 096	9.95 897	5	29
32	9.61 828	28	9.65 937	33	0.34 063	9.95 891	6	28
33	9.61 856	28	9.65 971	34	0.34 029	9.95 885	6	27
34	9.61 883	27	9.66 004	33	0.33 996	9.95 879	6	26
35	9.61 911	28	9.66 038	34	0.33 962	9.95 873	6	25
36	9.61 939	28	9.66 071	33	0.33 929	9.95 868	5	24
37	9.61 966	27	9.66 104	33	0.33 896	9.95 862	6	23
38	9.61 994	28	9.66 138	34	0.33 862	9.95 856	6	22
39	9.62 021	27	9.66 171	33	0.33 829	9.95 850	6	21
40	9.62 049	28	9.66 204	33	0.33 796	9.95 844	6	**20**
41	9.62 076	27	9.66 238	34	0.33 762	9.95 839	5	19
42	9.62 104	28	9.66 271	33	0.33 729	9.95 833	6	18
43	9.62 131	27	9.66 304	33	0.33 696	9.95 827	6	17
44	9.62 159	28	9.66 337	33	0.33 663	9.95 821	6	16
45	9.62 186	27	9.66 371	34	0.33 629	9.95 815	6	15
46	9.62 214	28	9.66 404	33	0.33 596	9.95 810	5	14
47	9.62 241	27	9.66 437	33	0.33 563	9.95 804	6	13
48	9.62 268	27	9.66 470	33	0.33 530	9.95 798	6	12
49	9.62 296	28	9.66 503	33	0.33 497	9.95 792	6	11
50	9.62 323	27	9.66 537	34	0.33 463	9.95 786	6	**10**
51	9.62 350	27	9.66 570	33	0.33 430	9.95 780	6	9
52	9.62 377	27	9.66 603	33	0.33 397	9.95 775	5	8
53	9.62 405	28	9.66 636	33	0.33 364	9.95 769	6	7
54	9.62 432	27	9.66 669	33	0.33 331	9.95 763	6	6
55	9.62 459	27	9.66 702	33	0.33 298	9.95 757	6	5
56	9.62 486	27	9.66 735	33	0.33 265	9.95 751	6	4
57	9.62 513	27	9.66 768	33	0.33 232	9.95 745	6	3
58	9.62 541	28	9.66 801	33	0.33 199	9.95 739	6	2
59	9.62 568	27	9.66 834	33	0.33 166	9.95 733	6	1
60	9.62 595	27	9.66 867	33	0.33 133	9.95 728	5	**0**
	L Cos	d	L Cot	c d	L Tan	L Sin	d	′

P P

	34	33
1	3.4	3.3
2	6.8	6.6
3	10.2	9.9
4	13.6	13.2
5	17.0	16.5
6	20.4	19.8
7	23.8	23.1
8	27.2	26.4
9	30.6	29.7

	29	28	27
1	2.9	2.8	2.7
2	5.8	5.6	5.4
3	8.7	8.4	8.1
4	11.6	11.2	10.8
5	14.5	14.0	13.5
6	17.4	16.8	16.2
7	20.3	19.6	18.9
8	23.2	22.4	21.6
9	26.1	25.2	24.3

	6	5
1	0.6	0.5
2	1.2	1.0
3	1.8	1.5
4	2.4	2.0
5	3.0	2.5
6	3.6	3.0
7	4.2	3.5
8	4.8	4.0
9	5.4	4.5

P P

′	L Sin	d	L Tan	c d	L Cot	L Cos	d	
0	9.62 595	27	9.66 867	33	0.33 133	9.95 728	6	**60**
1	9.62 622	27	9.66 900	33	0.33 100	9.95 722	6	59
2	9.62 649	27	9.66 933	33	0.33 067	9.95 716	6	58
3	9.62 676	27	9.66 966	33	0.33 034	9.95 710	6	57
4	9.62 703	27	9.66 999	33	0.33 001	9.95 704	6	56
5	9.62 730	27	9.67 032	33	0.32 968	9.95 698	6	55
6	9.62 757	27	9.67 065	33	0.32 935	9.95 692	6	54
7	9.62 784	27	9.67 098	33	0.32 902	9.95 686	6	53
8	9.62 811	27	9.67 131	32	0.32 869	9.95 680	6	52
9	9.62 838	27	9.67 163	33	0.32 837	9.95 674	6	51
10	9.62 865	27	9.67 196	33	0.32 804	9.95 668	5	**50**
11	9.62 892	26	9.67 229	33	0.32 771	9.95 663	6	49
12	9.62 918	27	9.67 262	33	0.32 738	9.95 657	6	48
13	9.62 945	27	9.67 295	32	0.32 705	9.95 651	6	47
14	9.62 972	27	9.67 327	33	0.32 673	9.95 645	6	46
15	9.62 999	27	9.67 360	33	0.32 640	9.95 639	6	45
16	9.63 026	26	9.67 393	33	0.32 607	9.95 633	6	44
17	9.63 052	27	9.67 426	32	0.32 574	9.95 627	6	43
18	9.63 079	27	9.67 458	33	0.32 542	9.95 621	6	42
19	9.63 106	27	9.67 491	33	0.32 509	9.95 615	6	41
20	9.63 133	26	9.67 524	32	0.32 476	9.95 609	6	**40**
21	9.63 159	27	9.67 556	33	0.32 444	9.95 603	6	39
22	9.63 186	27	9.67 589	33	0.32 411	9.95 597	6	38
23	9.63 213	26	9.67 622	32	0.32 378	9.95 591	6	37
24	9.63 239	27	9.67 654	33	0.32 346	9.95 585	6	36
25	9.63 266	26	9.67 687	32	0.32 313	9.95 579	6	35
26	9.63 292	27	9.67 719	33	0.32 281	9.95 573	6	34
27	9.63 319	26	9.67 752	33	0.32 248	9.95 567	6	33
28	9.63 345	27	9.67 785	32	0.32 215	9.95 561	6	32
29	9.63 372	26	9.67 817	33	0.32 183	9.95 555	6	31
30	9.63 398	27	9.67 850	32	0.32 150	9.95 549	6	**30**
31	9.63 425	26	9.67 882	33	0.32 118	9.95 543	6	29
32	9.63 451	27	9.67 915	32	0.32 085	9.95 537	6	28
33	9.63 478	26	9.67 947	33	0.32 053	9.95 531	6	27
34	9.63 504	27	9.67 980	32	0.32 020	9.95 525	6	26
35	9.63 531	26	9.68 012	32	0.31 988	9.95 519	6	25
36	9.63 557	26	9.68 044	33	0.31 956	9.95 513	6	24
37	9.63 583	27	9.68 077	32	0.31 923	9.95 507	7	23
38	9.63 610	26	9.68 109	33	0.31 891	9.95 500	6	22
39	9.63 636	26	9.68 142	32	0.31 858	9.95 494	6	21
40	9.63 662	27	9.68 174	32	0.31 826	9.95 488	6	**20**
41	9.63 689	26	9.68 206	33	0.31 794	9.95 482	6	19
42	9.63 715	26	9.68 239	32	0.31 761	9.95 476	6	18
43	9.63 741	26	9.68 271	32	0.31 729	9.95 470	6	17
44	9.63 767	27	9.68 303	33	0.31 697	9.95 464	6	16
45	9.63 794	26	9.68 336	32	0.31 664	9.95 458	6	15
46	9.63 820	26	9.68 368	32	0.31 632	9.95 452	6	14
47	9.63 846	26	9.68 400	32	0.31 600	9.95 446	6	13
48	9.63 872	26	9.68 432	33	0.31 568	9.95 440	6	12
49	9.63 898	26	9.68 465	32	0.31 535	9.95 434	7	11
50	9.63 924	26	9.68 497	32	0.31 503	9.95 427	6	**10**
51	9.63 950	26	9.68 529	32	0.31 471	9.95 421	6	9
52	9.63 976	26	9.68 561	32	0.31 439	9.95 415	6	8
53	9.64 002	26	9.68 593	33	0.31 407	9.95 409	6	7
54	9.64 028	26	9.68 626	32	0.31 374	9.95 403	6	6
55	9.64 054	26	9.68 658	32	0.31 342	9.95 397	6	5
56	9.64 080	26	9.68 690	32	0.31 310	9.95 391	7	4
57	9.64 106	26	9.68 722	32	0.31 278	9.95 384	6	3
58	9.64 132	26	9.68 754	32	0.31 246	9.95 378	6	2
59	9.64 158	26	9.68 786	32	0.31 214	9.95 372	6	1
60	9.64 184		9.68 818		0.31 182	9.95 366		**0**
	L Cos	d	L Cot	c d	L Tan	L Sin	d	′

P P

	33	32
1	3.3	3.2
2	6.6	6.4
3	9.9	9.6
4	13.2	12.8
5	16.5	16.0
6	19.8	19.2
7	23.1	22.4
8	26.4	25.6
9	29.7	28.8

	27	26
1	2.7	2.6
2	5.4	5.2
3	8.1	7.8
4	10.8	10.4
5	13.5	13.0
6	16.2	15.6
7	18.9	18.2
8	21.6	20.8
9	24.3	23.4

	7	6	5
1	0.7	0.6	0.5
2	1.4	1.2	1.0
3	2.1	1.8	1.5
4	2.8	2.4	2.0
5	3.5	3.0	2.5
6	4.2	3.6	3.0
7	4.9	4.2	3.5
8	5.6	4.8	4.0
9	6.3	5.4	4.5

P P

′	L Sin	d	L Tan	c d	L Cot	L Cos	d	
0	9.64 184	26	9.68 818	32	0.31 182	9.95 366	6	60
1	9.64 210	26	9.68 850	32	0.31 150	9.95 360	6	59
2	9.64 236	26	9.68 882	32	0.31 118	9.95 354	6	58
3	9.64 262	26	9.68 914	32	0.31 086	9.95 348	7	57
4	9.64 288	25	9.68 946	32	0.31 054	9.95 341	6	56
5	9.64 313	26	9.68 978	32	0.31 022	9.95 335	6	55
6	9.64 339	26	9.69 010	32	0.30 990	9.95 329	6	54
7	9.64 365	26	9.69 042	32	0.30 958	9.95 323	6	53
8	9.64 391	26	9.69 074	32	0.30 926	9.95 317	7	52
9	9.64 417	25	9.69 106	32	0.30 894	9.95 310	6	51
10	9.64 442	26	9.69 138	32	0.30 862	9.95 304	6	50
11	9.64 468	26	9.69 170	32	0.30 830	9.95 298	6	49
12	9.64 494	25	9.69 202	32	0.30 798	9.95 292	6	48
13	9.64 519	26	9.69 234	32	0.30 766	9.95 286	7	47
14	9.64 545	26	9.69 266	32	0.30 734	9.95 279	6	46
15	9.64 571	25	9.69 298	31	0.30 702	9.95 273	6	45
16	9.64 596	26	9.69 329	32	0.30 671	9.95 267	6	44
17	9.64 622	25	9.69 361	32	0.30 639	9.95 261	7	43
18	9.64 647	26	9.69 393	32	0.30 607	9.95 254	6	42
19	9.64 673	25	9.69 425	32	0.30 575	9.95 248	6	41
20	9.64 698	26	9.69 457	31	0.30 543	9.95 242	6	40
21	9.64 724	25	9.69 488	32	0.30 512	9.95 236	7	39
22	9.64 749	26	9.69 520	32	0.30 480	9.95 229	6	38
23	9.64 775	25	9.69 552	32	0.30 448	9.95 223	6	37
24	9.64 800	26	9.69 584	31	0.30 416	9.95 217	6	36
25	9.64 826	25	9.69 615	32	0.30 385	9.95 211	7	35
26	9.64 851	26	9.69 647	32	0.30 353	9.95 204	6	34
27	9.64 877	25	9.69 679	31	0.30 321	9.95 198	6	33
28	9.64 902	25	9.69 710	32	0.30 290	9.95 192	7	32
29	9.64 927	26	9.69 742	32	0.30 258	9.95 185	6	31
30	9.64 953	25	9.69 774	31	0.30 226	9.95 179	6	30
31	9.64 978	25	9.69 805	32	0.30 195	9.95 173	6	29
32	9.65 003	26	9.69 837	31	0.30 163	9.95 167	7	28
33	9.65 029	25	9.69 868	32	0.30 132	9.95 160	6	27
34	9.65 054	25	9.69 900	32	0.30 100	9.95 154	6	26
35	9.65 079	25	9.69 932	31	0.30 068	9.95 148	7	25
36	9.65 104	26	9.69 963	32	0.30 037	9.95 141	6	24
37	9.65 130	25	9.69 995	31	0.30 005	9.95 135	6	23
38	9.65 155	25	9.70 026	32	0.29 974	9.95 129	7	22
39	9.65 180	25	9.70 058	31	0.29 942	9.95 122	6	21
40	9.65 205	25	9.70 089	32	0.29 911	9.95 116	6	20
41	9.65 230	25	9.70 121	31	0.29 879	9.95 110	7	19
42	9.65 255	26	9.70 152	32	0.29 848	9.95 103	6	18
43	9.65 281	25	9.70 184	31	0.29 816	9.95 097	7	17
44	9.65 306	25	9.70 215	32	0.29 785	9.95 090	6	16
45	9.65 331	25	9.70 247	31	0.29 753	9.95 084	6	15
46	9.65 356	25	9.70 278	31	0.29 722	9.95 078	7	14
47	9.65 381	25	9.70 309	32	0.29 691	9.95 071	6	13
48	9.65 406	25	9.70 341	31	0.29 659	9.95 065	6	12
49	9.65 431	25	9.70 372	32	0.29 628	9.95 059	7	11
50	9.65 456	25	9.70 404	31	0.29 596	9.95 052	6	10
51	9.65 481	25	9.70 435	31	0.29 565	9.95 046	7	9
52	9.65 506	25	9.70 466	32	0.29 534	9.95 039	6	8
53	9.65 531	25	9.70 498	31	0.29 502	9.95 033	6	7
54	9.65 556	24	9.70 529	31	0.29 471	9.95 027	7	6
55	9.65 580	25	9.70 560	32	0.29 440	9.95 020	6	5
56	9.65 605	25	9.70 592	31	0.29 408	9.95 014	7	4
57	9.65 630	25	9.70 623	31	0.29 377	9.95 007	6	3
58	9.65 655	25	9.70 654	31	0.29 346	9.95 001	6	2
59	9.65 680	25	9.70 685	32	0.29 315	9.94 995	7	1
60	9.65 705		9.70 717		0.29 283	9.94 988		0
	L Cos	d	L Cot	c d	L Tan	L Sin	d	′

P P

	32	31
1	3.2	3.1
2	6.4	6.2
3	9.6	9.3
4	12.8	12.4
5	16.0	15.5
6	19.2	18.6
7	22.4	21.7
8	25.6	24.8
9	28.8	27.9

	26	25	24
1	2.6	2.5	2.4
2	5.2	5.0	4.8
3	7.8	7.5	7.2
4	10.4	10.0	9.6
5	13.0	12.5	12.0
6	15.6	15.0	14.4
7	18.2	17.5	16.8
8	20.8	20.0	19.2
9	23.4	22.5	21.6

	7	6
1	0.7	0.6
2	1.4	1.2
3	2.1	1.8
4	2.8	2.4
5	3.5	3.0
6	4.2	3.6
7	4.9	4.2
8	5.6	4.8
9	6.3	5.4

P P

′	L Sin	d	L Tan	c d	L Cot	L Cos	d	
0	9.65 705	24	9.70 717	31	0.29 283	9.94 988	6	**60**
1	9.65 729	25	9.70 748	31	0.29 252	9.94 982	7	59
2	9.65 754	25	9.70 779	31	0.29 221	9.94 975	6	58
3	9.65 779	25	9.70 810	31	0.29 190	9.94 969	7	57
4	9.65 804	24	9.70 841	32	0.29 159	9.94 962	6	56
5	9.65 828	25	9.70 873	31	0.29 127	9.94 956	7	55
6	9.65 853	25	9.70 904	31	0.29 096	9.94 949	6	54
7	9.65 878	24	9.70 935	31	0.29 065	9.94 943	7	53
8	9.65 902	25	9.70 966	31	0.29 034	9.94 936	6	52
9	9.65 927	25	9.70 997	31	0.29 003	9.94 930	7	51
10	9.65 952	24	9.71 028	31	0.28 972	9.94 923	6	**50**
11	9.65 976	25	9.71 059	31	0.28 941	9.94 917	6	49
12	9.66 001	24	9.71 090	31	0.28 910	9.94 911	7	48
13	9.66 025	25	9.71 121	32	0.28 879	9.94 904	6	47
14	9.66 050	25	9.71 153	31	0.28 847	9.94 898	7	46
15	9.66 075	24	9.71 184	31	0.28 816	9.94 891	6	45
16	9.66 099	25	9.71 215	31	0.28 785	9.94 885	7	44
17	9.66 124	24	9.71 246	31	0.28 754	9.94 878	7	43
18	9.66 148	25	9.71 277	31	0.28 723	9.94 871	6	42
19	9.66 173	24	9.71 308	31	0.28 692	9.94 865	7	41
20	9.66 197	24	9.71 339	31	0.28 661	9.94 858	6	**40**
21	9.66 221	25	9.71 370	31	0.28 630	9.94 852	7	39
22	9.66 246	24	9.71 401	30	0.28 599	9.94 845	6	38
23	9.66 270	25	9.71 431	31	0.28 569	9.94 839	7	37
24	9.66 295	24	9.71 462	31	0.28 538	9.94 832	6	36
25	9.66 319	24	9.71 493	31	0.28 507	9.94 826	7	35
26	9.66 343	25	9.71 524	31	0.28 476	9.94 819	6	34
27	9.66 368	24	9.71 555	31	0.28 445	9.94 813	7	33
28	9.66 392	24	9.71 586	31	0.28 414	9.94 806	7	32
29	9.66 416	25	9.71 617	31	0.28 383	9.94 799	6	31
30	9.66 441	24	9.71 648	31	0.28 352	9.94 793	7	**30**
31	9.66 465	24	9.71 679	30	0.28 321	9.94 786	6	29
32	9.66 489	24	9.71 709	31	0.28 291	9.94 780	7	28
33	9.66 513	24	9.71 740	31	0.28 260	9.94 773	6	27
34	9.66 537	25	9.71 771	31	0.28 229	9.94 767	7	26
35	9.66 562	24	9.71 802	31	0.28 198	9.94 760	7	25
36	9.66 586	24	9.71 833	30	0.28 167	9.94 753	6	24
37	9.66 610	24	9.71 863	31	0.28 137	9.94 747	7	23
38	9.66 634	24	9.71 894	31	0.28 106	9.94 740	6	22
39	9.66 658	24	9.71 925	30	0.28 075	9.94 734	7	21
40	9.66 682	24	9.71 955	31	0.28 045	9.94 727	7	**20**
41	9.66 706	25	9.71 986	31	0.28 014	9.94 720	6	19
42	9.66 731	24	9.72 017	31	0.27 983	9.94 714	7	18
43	9.66 755	24	9.72 048	30	0.27 952	9.94 707	7	17
44	9.66 779	24	9.72 078	31	0.27 922	9.94 700	6	16
45	9.66 803	24	9.72 109	31	0.27 891	9.94 694	7	15
46	9.66 827	24	9.72 140	30	0.27 860	9.94 687	7	14
47	9.66 851	24	9.72 170	31	0.27 830	9.94 680	6	13
48	9.66 875	24	9.72 201	30	0.27 799	9.94 674	7	12
49	9.66 899	23	9.72 231	31	0.27 769	9.94 667	7	11
50	9.66 922	24	9.72 262	31	0.27 738	9.94 660	6	**10**
51	9.66 946	24	9.72 293	30	0.27 707	9.94 654	7	9
52	9.66 970	24	9.72 323	31	0.27 677	9.94 647	7	8
53	9.66 994	24	9.72 354	30	0.27 646	9.94 640	6	7
54	9.67 018	24	9.72 384	31	0.27 616	9.94 634	7	6
55	9.67 042	24	9.72 415	30	0.27 585	9.94 627	7	5
56	9.67 066	24	9.72 445	31	0.27 555	9.94 620	6	4
57	9.67 090	23	9.72 476	30	0.27 524	9.94 614	7	3
58	9.67 113	24	9.72 506	31	0.27 494	9.94 607	7	2
59	9.67 137	24	9.72 537	30	0.27 463	9.94 600	7	1
60	9.67 161		9.72 567		0.24 433	9.94 593		**0**
	L Cos	d	L Cot	c d	L Tan	L Sin	d	′

P P

	32	31	30
1	3.2	3.1	3.0
2	6.4	6.2	6.0
3	9.6	9.3	9.0
4	12.8	12.4	12.0
5	16.0	15.5	15.0
6	19.2	18.6	18.0
7	22.4	21.7	21.0
8	25.6	24.8	24.0
9	28.8	27.9	27.0

	25	24	23
1	2.5	2.4	2.3
2	5.0	4.8	4.6
3	7.5	7.2	6.9
4	10.0	9.6	9.2
5	12.5	12.0	11.5
6	15.0	14.4	13.8
7	17.5	16.8	16.1
8	20.0	19.2	18.4
9	22.5	21.6	20.7

	7	6
1	0.7	0.6
2	1.4	1.2
3	2.1	1.8
4	2.8	2.4
5	3.5	3.0
6	4.2	3.6
7	4.9	4.2
8	5.6	4.8
9	6.3	5.4

P P

′	L Sin	d	L Tan	c d	L Cot	L Cos	d	
0	9.67 161	24	9.72 567	31	0.27 433	9.94 593	6	**60**
1	9.67 185	23	9.72 598	30	0.27 402	9.94 587	7	59
2	9.67 208	24	9.72 628	31	0.27 372	9.94 580	7	58
3	9.67 232	24	9.72 659	30	0.27 341	9.94 573	6	57
4	9.67 256	24	9.72 689	31	0.27 311	9.94 567	7	56
5	9.67 280	23	9.72 720	30	0.27 280	9.94 560	7	55
6	9.67 303	24	9.72 750	30	0.27 250	9.94 553	7	54
7	9.67 327	23	9.72 780	31	0.27 220	9.94 546	6	53
8	9.67 350	24	9.72 811	30	0.27 189	9.94 540	7	52
9	9.67 374	24	9.72 841	31	0.27 159	9.94 533	7	51
10	9.67 398	23	9.72 872	30	0.27 128	9.94 526	7	**50**
11	9.67 421	24	9.72 902	30	0.27 098	9.94 519	6	49
12	9.67 445	23	9.72 932	31	0.27 068	9.94 513	7	48
13	9.67 468	24	9.72 963	30	0.27 037	9.94 506	7	47
14	9.67 492	23	9.72 993	30	0.27 007	9.94 499	7	46
15	9.67 515	24	9.73 023	31	0.26 977	9.94 492	7	45
16	9.67 539	23	9.73 054	30	0.26 946	9.94 485	6	44
17	9.67 562	24	9.73 084	30	0.26 916	9.94 479	7	43
18	9.67 586	23	9.73 114	30	0.26 886	9.94 472	7	42
19	9.67 609	24	9.73 144	31	0.26 856	9.94 465	7	41
20	9.67 633	23	9.73 175	30	0.26 825	9.94 458	7	**40**
21	9.67 656	24	9.73 205	30	0.26 795	9.94 451	6	39
22	9.67 680	23	9.73 235	30	0.26 765	9.94 445	7	38
23	9.67 703	23	9.73 265	30	0.26 735	9.94 438	7	37
24	9.67 726	24	9.73 295	31	0.26 705	9.94 431	7	36
25	9.67 750	23	9.73 326	30	0.26 674	9.94 424	7	35
26	9.67 773	23	9.73 356	30	0.26 644	9.94 417	7	34
27	9.67 796	24	9.73 386	30	0.26 614	9.94 410	6	33
28	9.67 820	23	9.73 416	30	0.26 584	9.94 404	7	32
29	9.67 843	23	9.73 446	30	0.26 554	9.94 397	7	31
30	9.67 866	24	9.73 476	31	0.26 524	9.94 390	7	**30**
31	9.67 890	23	9.73 507	30	0.26 493	9.94 383	7	29
32	9.67 913	23	9.73 537	30	0.26 463	9.94 376	7	28
33	9.67 936	23	9.73 567	30	0.26 433	9.94 369	7	27
34	9.67 959	23	9.73 597	30	0.26 403	9.94 362	7	26
35	9.67 982	24	9.73 627	30	0.26 373	9.94 355	6	25
36	9.68 006	23	9.73 657	30	0.26 343	9.94 349	7	24
37	9.68 029	23	9.73 687	30	0.26 313	9.94 342	7	23
38	9.68 052	23	9.73 717	30	0.26 283	9.94 335	7	22
39	9.68 075	23	9.73 747	30	0.26 253	9.94 328	7	21
40	9.68 098	23	9.73 777	30	0.26 223	9.94 321	7	**20**
41	9.68 121	23	9.73 807	30	0.26 193	9.94 314	7	19
42	9.68 144	23	9.73 837	30	0.26 163	9.94 307	7	18
43	9.68 167	23	9.73 867	30	0.26 133	9.94 300	7	17
44	9.68 190	23	9.73 897	30	0.26 103	9.94 293	7	16
45	9.68 213	24	9.73 927	30	0.26 073	9.94 286	7	15
46	9.68 237	23	9.73 957	30	0.26 043	9.94 279	6	14
47	9.68 260	23	9.73 987	30	0.26 013	9.94 273	7	13
48	9.68 283	22	9.74 017	30	0.25 983	9.94 266	7	12
49	9.68 305	23	9.74 047	30	0.25 953	9.94 259	7	11
50	9.68 328	23	9.74 077	30	0.25 923	9.94 252	7	**10**
51	9.68 351	23	9.74 107	30	0.25 893	9.94 245	7	9
52	9.68 374	23	9.74 137	29	0.25 863	9.94 238	7	8
53	9.68 397	23	9.74 166	30	0.25 834	9.94 231	7	7
54	9.68 420	23	9.74 196	30	0.25 804	9.94 224	7	6
55	9.68 443	23	9.74 226	30	0.25 774	9.94 217	7	5
56	9.68 466	23	9.74 256	30	0.25 744	9.94 210	7	4
57	9.68 489	23	9.74 286	30	0.25 714	9.94 203	7	3
58	9.68 512	22	9.74 316	29	0.25 684	9.94 196	7	2
59	9.68 534	23	9.74 345	30	0.25 655	9.94 189	7	1
60	9.68 557		9.74 375		0.25 625	9.94 182		**0**
	L Cos	d	L Cot	c d	L Tan	L Sin	d	′

P P

	31	30	29
1	3.1	3.0	2.9
2	6.2	6.0	5.8
3	9.3	9.0	8.7
4	12.4	12.0	11.6
5	15.5	15.0	14.5
6	18.6	18.0	17.4
7	21.7	21.0	20.3
8	24.8	24.0	23.2
9	27.9	27.0	26.1

	24	23	22
1	2.4	2.3	2.2
2	4.8	4.6	4.4
3	7.2	6.9	6.6
4	9.6	9.2	8.8
5	12.0	11.5	11.0
6	14.4	13.8	13.2
7	16.8	16.1	15.4
8	19.2	18.4	17.6
9	21.6	20.7	19.8

	7	6
1	0.7	0.6
2	1.4	1.2
3	2.1	1.8
4	2.8	2.4
5	3.5	3.0
6	4.2	3.6
7	4.9	4.2
8	5.6	4.8
9	6.3	5.4

P P

′	L Sin	d	L Tan	c d	L Cot	L Cos	d	
0	9.68 557	23	9.74 375	30	0.25 625	9.94 182	7	60
1	9.68 580	23	9.74 405	30	0.25 595	9.94 175	7	59
2	9.68 603	22	9.74 435	30	0.25 565	9.94 168	7	58
3	9.68 625	23	9.74 465	29	0.25 535	9.94 161	7	57
4	9.68 648	23	9.74 494	30	0.25 506	9.94 154	7	56
5	9.68 671	23	9.74 524	30	0.25 476	9.94 147	7	55
6	9.68 694	22	9.74 554	29	0.25 446	9.94 140	7	54
7	9.68 716	23	9.74 583	30	0.25 417	9.94 133	7	53
8	9.68 739	23	9.74 613	30	0.25 387	9.94 126	7	52
9	9.68 762	22	9.74 643	30	0.25 357	9.94 119	7	51
10	9.68 784	23	9.74 673	29	0.25 327	9.94 112	7	50
11	9.68 807	22	9.74 702	30	0.25 298	9.94 105	7	49
12	9.68 829	23	9.74 732	30	0.25 268	9.94 098	8	48
13	9.68 852	23	9.74 762	29	0.25 238	9.94 090	7	47
14	9.68 875	22	9.74 791	30	0.25 209	9.94 083	7	46
15	9.68 897	23	9.74 821	30	0.25 179	9.94 076	7	45
16	9.68 920	22	9.74 851	29	0.25 149	9.94 069	7	44
17	9.68 942	23	9.74 880	30	0.25 120	9.94 062	7	43
18	9.68 965	22	9.74 910	29	0.25 090	9.94 055	7	42
19	9.68 987	23	9.74 939	30	0.25 061	9.94 048	7	41
20	9.69 010	22	9.74 969	29	0.25 031	9.94 041	7	40
21	9.69 032	23	9.74 998	30	0.25 002	9.94 034	7	39
22	9.69 055	22	9.75 028	30	0.24 972	9.94 027	7	38
23	9.69 077	23	9.75 058	29	0.24 942	9.94 020	8	37
24	9.69 100	22	9.75 087	30	0.24 913	9.94 012	7	36
25	9.69 122	22	9.75 117	29	0.24 883	9.94 005	7	35
26	9.69 144	23	9.75 146	30	0.24 854	9.93 998	7	34
27	9.69 167	22	9.75 176	29	0.24 824	9.93 991	7	33
28	9.69 189	23	9.75 205	30	0.24 795	9.93 984	7	32
29	9.69 212	22	9.75 235	29	0.24 765	9.93 977	7	31
30	9.69 234	22	9.75 264	30	0.24 736	9.93 970	7	30
31	9.69 256	23	9.75 294	29	0.24 706	9.93 963	8	29
32	9.69 279	22	9.75 323	30	0.24 677	9.93 955	7	28
33	9.69 301	22	9.75 353	29	0.24 647	9.93 948	7	27
34	9.69 323	22	9.75 382	29	0.24 618	9.93 941	7	26
35	9.69 345	23	9.75 411	30	0.24 589	9.93 934	7	25
36	9.69 368	22	9.75 441	29	0.24 559	9.93 927	7	24
37	9.69 390	22	9.75 470	30	0.24 530	9.93 920	8	23
38	9.69 412	22	9.75 500	29	0.24 500	9.93 912	7	22
39	9.69 434	22	9.75 529	29	0.24 471	9.93 905	7	21
40	9.69 456	23	9.75 558	30	0.24 442	9.93 898	7	20
41	9.69 479	22	9.75 588	29	0.24 412	9.93 891	7	19
42	9.69 501	22	9.75 617	30	0.24 383	9.93 884	8	18
43	9.69 523	22	9.75 647	29	0.24 353	9.93 876	7	17
44	9.69 545	22	9.75 676	29	0.24 324	9.93 869	7	16
45	9.69 567	22	9.75 705	30	0.24 295	9.93 862	7	15
46	9.69 589	22	9.75 735	29	0.24 265	9.93 855	8	14
47	9.69 611	22	9.75 764	29	0.24 236	9.93 847	7	13
48	9.69 633	22	9.75 793	29	0.24 207	9.93 840	7	12
49	9.69 655	22	9.75 822	30	0.24 178	9.93 833	7	11
50	9.69 677	22	9.75 852	29	0.24 148	9.93 826	7	10
51	9.69 699	22	9.75 881	29	0.24 119	9.93 819	8	9
52	9.69 721	22	9.75 910	29	0.24 090	9.93 811	7	8
53	9.69 743	22	9.75 939	30	0.24 061	9.93 804	7	7
54	9.69 765	22	9.75 969	29	0.24 031	9.93 797	8	6
55	9.69 787	22	9.75 998	29	0.24 002	9.93 789	7	5
56	9.69 809	22	9.76 027	29	0.23 973	9.93 782	7	4
57	9.69 831	22	9.76 056	30	0.23 944	9.93 775	7	3
58	9.69 853	22	9.76 086	29	0.23 914	9.93 768	8	2
59	9.69 875	22	9.76 115	29	0.23 885	9.93 760	7	1
60	9.69 897		9.76 144		0.23 856	9.93 753		0
	L Cos	d	L Cot	c d	L Tan	L Sin	d	′

P P

	30	29	23
1	3.0	2.9	2.3
2	6.0	5.8	4.6
3	9.0	8.7	6.9
4	12.0	11.6	9.2
5	15.0	14.5	11.5
6	18.0	17.4	13.8
7	21.0	20.3	16.1
8	24.0	23.2	18.4
9	27.0	26.1	20.7

	22	8	7
1	2.2	0.8	0.7
2	4.4	1.6	1.4
3	6.6	2.4	2.1
4	8.8	3.2	2.8
5	11.0	4.0	3.5
6	13.2	4.8	4.2
7	15.4	5.6	4.9
8	17.6	6.4	5.6
9	19.8	7.2	6.3

P P

′	L Sin	d	L Tan	c d	L Cot	L Cos	d	
0	9.69 897	22	9.76 144	29	0.23 856	9.93 753	7	**60**
1	9.69 919	22	9.76 173	29	0.23 827	9.93 746	8	59
2	9.69 941	22	9.76 202	29	0.23 798	9.93 738	7	58
3	9.69 963	21	9.76 231	30	0.23 769	9.93 731	7	57
4	9.69 984	22	9.76 261	29	0.23 739	9.93 724	7	56
5	9.70 006	22	9.76 290	29	0.23 710	9.93 717	8	55
6	9.70 028	22	9.76 319	29	0.23 681	9.93 709	7	54
7	9.70 050	22	9.76 348	29	0.23 652	9.93 702	7	53
8	9.70 072	21	9.76 377	29	0.23 623	9.93 695	8	52
9	9.70 093	22	9.76 406	29	0.23 594	9.93 687	7	51
10	9.70 115	22	9.76 435	29	0.23 565	9.93 680	7	**50**
11	9.70 137	22	9.76 464	29	0.23 536	9.93 673	8	49
12	9.70 159	21	9.76 493	29	0.23 507	9.93 665	7	48
13	9.70 180	22	9.76 522	29	0.23 478	9.93 658	8	47
14	9.70 202	22	9.76 551	29	0.23 449	9.93 650	7	46
15	9.70 224	21	9.76 580	29	0.23 420	9.93 643	7	45
16	9.70 245	22	9.76 609	30	0.23 391	9.93 636	8	44
17	9.70 267	21	9.76 639	29	0.23 361	9.93 628	7	43
18	9.70 288	22	9.76 668	29	0.23 332	9.93 621	7	42
19	9.70 310	22	9.76 697	28	0.23 303	9.93 614	8	41
20	9.70 332	21	9.76 725	29	0.23 275	9.93 606	7	**40**
21	9.70 353	22	9.76 754	29	0.23 246	9.93 599	8	39
22	9.70 375	21	9.76 783	29	0.23 217	9.93 591	7	38
23	9.70 396	22	9.76 812	29	0.23 188	9.93 584	7	37
24	9.70 418	21	9.76 841	29	0.23 159	9.93 577	8	36
25	9.70 439	22	9.76 870	29	0.23 130	9.93 569	7	35
26	9.70 461	21	9.76 899	29	0.23 101	9.93 562	8	34
27	9.70 482	22	9.76 928	29	0.23 072	9.93 554	7	33
28	9.70 504	21	9.76 957	29	0.23 043	9.93 547	8	32
29	9.70 525	22	9.76 986	29	0.23 014	9.93 539	7	31
30	9.70 547	21	9.77 015	29	0.22 985	9.93 532	7	**30**
31	9.70 568	22	9.77 044	29	0.22 956	9.93 525	8	29
32	9.70 590	21	9.77 073	28	0.22 927	9.93 517	7	28
33	9.70 611	22	9.77 101	29	0.22 899	9.93 510	8	27
34	9.70 633	21	9.77 130	29	0.22 870	9.93 502	7	26
35	9.70 654	21	9.77 159	29	0.22 841	9.93 495	8	25
36	9.70 675	22	9.77 188	29	0.22 812	9.93 487	7	24
37	9.70 697	21	9.77 217	29	0.22 783	9.93 480	8	23
38	9.70 718	21	9.77 246	28	0.22 754	9.93 472	7	22
39	9.70 739	22	9.77 274	29	0.22 726	9.93 465	8	21
40	9.70 761	21	9.77 303	29	0.22 697	9.93 457	7	**20**
41	9.70 782	21	9.77 332	29	0.22 668	9.93 450	8	19
42	9.70 803	21	9.77 361	29	0.22 639	9.93 442	7	18
43	9.70 824	22	9.77 390	28	0.22 610	9.93 435	8	17
44	9.70 846	21	9.77 418	29	0.22 582	9.93 427	7	16
45	9.70 867	21	9.77 447	29	0.22 553	9.93 420	8	15
46	9.70 888	21	9.77 476	29	0.22 524	9.93 412	7	14
47	9.70 909	22	9.77 505	28	0.22 495	9.93 405	8	13
48	9.70 931	21	9.77 533	29	0.22 467	9.93 397	7	12
49	9.70 952	21	9.77 562	29	0.22 438	9.93 390	8	11
50	9.70 973	21	9.77 591	28	0.22 409	9.93 382	7	**10**
51	9.70 994	21	9.77 619	29	0.22 381	9.93 375	8	9
52	9.71 015	21	9.77 648	29	0.22 352	9.93 367	7	8
53	9.71 036	22	9.77 677	29	0.22 323	9.93 360	8	7
54	9.71 058	21	9.77 706	28	0.22 294	9.93 352	8	6
55	9.71 079	21	9.77 734	29	0.22 266	9.93 344	7	5
56	9.71 100	21	9.77 763	28	0.22 237	9.93 337	8	4
57	9.71 121	21	9.77 791	29	0.22 209	9.93 329	7	3
58	9.71 142	21	9.77 820	29	0.22 180	9.93 322	8	2
59	9.71 163	21	9.77 849	28	0.22 151	9.93 314	7	1
60	9.71 184		9.77 877		0.22 123	9.93 307		**0**
	L Cos	d	L Cot	c d	L Tan	L Sin	d	′

P P

	30	29	28
1	3.0	2.9	2.8
2	6.0	5.8	5.6
3	9.0	8.7	8.4
4	12.0	11.6	11.2
5	15.0	14.5	14.0
6	18.0	17.4	16.8
7	21.0	20.3	19.6
8	24.0	23.2	22.4
9	27.0	26.1	25.2

	22	21
1	2.2	2.1
2	4.4	4.2
3	6.6	6.3
4	8.8	8.4
5	11.0	10.5
6	13.2	12.6
7	15.4	14.7
8	17.6	16.8
9	19.8	18.9

	8	7
1	0.8	0.7
2	1.6	1.4
3	2.4	2.1
4	3.2	2.8
5	4.0	3.5
6	4.8	4.2
7	5.6	4.9
8	6.4	5.6
9	7.2	6.3

P P

′	L Sin	d	L Tan	c d	L Cot	L Cos	d	
0	9.71 184	21	9.77 877	29	0.22 123	9.93 307	8	**60**
1	9.71 205	21	9.77 906	29	0.22 094	9.93 299	8	59
2	9.71 226	21	9.77 935	28	0.22 065	9.93 291	7	58
3	9.71 247	21	9.77 963	29	0.22 037	9.93 284	8	57
4	9.71 268	21	9.77 992	28	0.22 008	9.93 276	7	56
5	9.71 289	21	9.78 020	29	0.21 980	9.93 269	8	55
6	9.71 310	21	9.78 049	28	0.21 951	9.93 261	8	54
7	9.71 331	21	9.78 077	29	0.21 923	9.93 253	7	53
8	9.71 352	21	9.78 106	29	0.21 894	9.93 246	8	52
9	9.71 373	20	9.78 135	28	0.21 865	9.93 238	8	51
10	9.71 393	21	9.78 163	29	0.21 837	9.93 230	7	**50**
11	9.71 414	21	9.78 192	28	0.21 808	9.93 223	8	49
12	9.71 435	21	9.78 220	29	0.21 780	9.93 215	8	48
13	9.71 456	21	9.78 249	28	0.21 751	9.93 207	7	47
14	9.71 477	21	9.78 277	29	0.21 723	9.93 200	8	46
15	9.71 498	21	9.78 306	28	0.21 694	9.93 192	8	45
16	9.71 519	20	9.78 334	29	0.21 666	9.93 184	7	44
17	9.71 539	21	9.78 363	28	0.21 637	9.93 177	8	43
18	9.71 560	21	9.78 391	28	0.21 609	9.93 169	8	42
19	9.71 58[illegible]	21	9.78 419	29	0.21 581	9.93 161	7	41
20	9.71 602	20	9.78 448	28	0.21 552	9.93 154	8	**40**
21	9.71 622	21	9.78 476	29	0.21 524	9.93 146	8	39
22	9.71 643	21	9.78 505	28	0.21 495	9.93 138	7	38
23	9.71 664	21	9.78 533	29	0.21 467	9.93 131	8	37
24	9.71 685	20	9.78 562	28	0.21 438	9.93 123	8	36
25	9.71 705	21	9.78 590	28	0.21 410	9.93 115	7	35
26	9.71 726	21	9.78 618	29	0.21 382	9.93 108	8	34
27	9.71 747	20	9.78 647	28	0.21 353	9.93 100	8	33
28	9.71 767	21	9.78 675	29	0.21 325	9.93 092	8	32
29	9.71 788	21	9.78 704	28	0.21 296	9.93 084	7	31
30	9.71 809	20	9.78 732	28	0.21 268	9.93 077	8	**30**
31	9.71 829	21	9.78 760	29	0.21 240	9.93 069	8	29
32	9.71 850	20	9.78 789	28	0.21 211	9.93 061	8	28
33	9.71 870	21	9.78 817	28	0.21 183	9.93 053	7	27
34	9.71 891	20	9.78 845	29	0.21 155	9.93 046	8	26
35	9.71 911	21	9.78 874	28	0.21 126	9.93 038	8	25
36	9.71 932	20	9.78 902	28	0.21 098	9.93 030	8	24
37	9.71 952	21	9.78 930	29	0.21 070	9.93 022	8	23
38	9.71 973	21	9.78 959	28	0.21 041	9.93 014	7	22
39	9.71 994	20	9.78 987	28	0.21 013	9.93 007	8	21
40	9.72 014	20	9.79 015	28	0.20 985	9.92 999	8	**20**
41	9.72 034	21	9.79 043	29	0.20 957	9.92 991	8	19
42	9.72 055	20	9.79 072	28	0.20 928	9.92 983	7	18
43	9.72 075	21	9.79 100	28	0.20 900	9.92 976	8	17
44	9.72 096	20	9.79 128	28	0.20 872	9.92 968	8	16
45	9.72 116	21	9.79 156	29	0.20 844	9.92 960	8	15
46	9.72 137	20	9.79 185	28	0.20 815	9.92 952	8	14
47	9.72 157	20	9.79 213	28	0.20 787	9.92 944	8	13
48	9.72 177	21	9.79 241	28	0.20 759	9.92 936	7	12
49	9.72 198	20	9.79 269	28	0.20 731	9.92 929	8	11
50	9.72 218	20	9.79 297	29	0.20 703	9.92 921	8	**10**
51	9.72 238	21	9.79 326	28	0.20 674	9.92 913	8	9
52	9.72 259	20	9.79 354	28	0.20 646	9.92 905	8	8
53	9.72 279	20	9.79 382	28	0.20 618	9.92 897	8	7
54	9.72 299	21	9.79 410	28	0.20 590	9.92 889	8	6
55	9.72 320	20	9.79 438	28	0.20 562	9.92 881	7	5
56	9.72 340	20	9.79 466	29	0.20 534	9.92 874	8	4
57	9.72 360	21	9.79 495	28	0.20 505	9.92 866	8	3
58	9.72 381	20	9.79 523	28	0.20 477	9.92 858	8	2
59	9.72 401	20	9.79 551	28	0.20 449	9.92 850	8	1
60	9.72 421		9.79 579		0.20 421	9.92 842		**0**
	L Cos	d	L Cot	c d	L Tan	L Sin	d	′

P P

	29	28
1	2.9	2.8
2	5.8	5.6
3	8.7	8.4
4	11.6	11.2
5	14.5	14.0
6	17.4	16.8
7	20.3	19.6
8	23.2	22.4
9	26.1	25.2

	21	20
1	2.1	2.0
2	4.2	4.0
3	6.3	6.0
4	8.4	8.0
5	10.5	10.0
6	12.6	12.0
7	14.7	14.0
8	16.8	16.0
9	18.9	18.0

	8	7
1	0.8	0.7
2	1.6	1.4
3	2.4	2.1
4	3.2	2.8
5	4.0	3.5
6	4.8	4.2
7	5.6	4.9
8	6.4	5.6
9	7.2	6.3

P P

′	L Sin	d	L Tan	c d	L Cot	L Cos	d	
0	9.72 421	20	9.79 579	28	0.20 421	9.92 842	8	60
1	9.72 441	20	9.79 607	28	0.20 393	9.92 834	8	59
2	9.72 461	21	9.79 635	28	0.20 365	9.92 826	8	58
3	9.72 482	20	9.79 663	28	0.20 337	9.92 818	8	57
4	9.72 502	20	9.79 691	28	0.20 309	9.92 810	7	56
5	9.72 522	20	9.79 719	28	0.20 281	9.92 803	8	55
6	9.72 542	20	9.79 747	29	0.20 253	9.92 795	8	54
7	9.72 562	20	9.79 776	28	0.20 224	9.92 787	8	53
8	9.72 582	20	9.79 804	28	0.20 196	9.92 779	8	52
9	9.72 602	20	9.79 832	28	0.20 168	9.92 771	8	51
10	9.72 622	21	9.79 860	28	0.20 140	9.92 763	8	50
11	9.72 643	20	9.79 888	28	0.20 112	9.92 755	8	49
12	9.72 663	20	9.79 916	28	0.20 084	9.92 747	8	48
13	9.72 683	20	9.79 944	28	0.20 056	9.92 739	8	47
14	9.72 703	20	9.79 972	28	0.20 028	9.92 731	8	46
15	9.72 723	20	9.80 000	28	0.20 000	9.92 723	8	45
16	9.72 743	20	9.80 028	28	0.19 972	9.92 715	8	44
17	9.72 763	20	9.80 056	28	0.19 944	9.92 707	8	43
18	9.72 783	20	9.80 084	28	0.19 916	9.92 699	8	42
19	9.72 803	20	9.80 112	28	0.19 888	9.92 691	8	41
20	9.72 823	20	9.80 140	28	0.19 860	9.92 683	8	40
21	9.72 843	20	9.80 168	27	0.19 832	9.92 675	8	39
22	9.72 863	20	9.80 195	28	0.19 805	9.92 667	8	38
23	9.72 883	19	9.80 223	28	0.19 777	9.92 659	8	37
24	9.72 902	20	9.80 251	28	0.19 749	9.92 651	8	36
25	9.72 922	20	9.80 279	28	0.19 721	9.92 643	8	35
26	9.72 942	20	9.80 307	28	0.19 693	9.92 635	8	34
27	9.72 962	20	9.80 335	28	0.19 665	9.92 627	8	33
28	9.72 982	20	9.80 363	28	0.19 637	9.92 619	8	32
29	9.73 002	20	9.80 391	28	0.19 609	9.92 611	8	31
30	9.73 022	19	9.80 419	28	0.19 581	9.92 603	8	30
31	9.73 041	20	9.80 447	27	0.19 553	9.92 595	8	29
32	9.73 061	20	9.80 474	28	0.19 526	9.92 587	8	28
33	9.73 081	20	9.80 502	28	0.19 498	9.92 579	8	27
34	9.73 101	20	9.80 530	28	0.19 470	9.92 571	8	26
35	9.73 121	19	9.80 558	28	0.19 442	9.92 563	8	25
36	9.73 140	20	9.80 586	28	0.19 414	9.92 555	9	24
37	9.73 160	20	9.80 614	28	0.19 386	9.92 546	8	23
38	9.73 180	20	9.80 642	27	0.19 358	9.92 538	8	22
39	9.73 200	19	9.80 669	28	0.19 331	9.92 530	8	21
40	9.73 219	20	9.80 697	28	0.19 303	9.92 522	8	20
41	9.73 239	20	9.80 725	28	0.19 275	9.92 514	8	19
42	9.73 259	19	9.80 753	28	0.19 247	9.92 506	8	18
43	9.73 278	20	9.80 781	27	0.19 219	9.92 498	8	17
44	9.73 298	20	9.80 808	28	0.19 192	9.92 490	8	16
45	9.73 318	19	9.80 836	28	0.19 164	9.92 482	9	15
46	9.73 337	20	9.80 864	28	0.19 136	9.92 473	8	14
47	9.73 357	20	9.80 892	27	0.19 108	9.92 465	8	13
48	9.73 377	19	9.80 919	28	0.19 081	9.92 457	8	12
49	9.73 396	20	9.80 947	28	0.19 053	9.92 449	8	11
50	9.73 416	19	9.80 975	28	0.19 025	9.92 441	8	10
51	9.73 435	20	9.81 003	27	0.18 997	9.92 433	8	9
52	9.73 455	19	9.81 030	28	0.18 970	9.92 425	9	8
53	9.73 474	20	9.81 058	28	0.18 942	9.92 416	8	7
54	9.73 494	19	9.81 086	27	0.18 914	9.92 408	8	6
55	9.73 513	20	9.81 113	28	0.18 887	9.92 400	8	5
56	9.73 533	19	9.81 141	28	0.18 859	9.92 392	8	4
57	9.73 552	20	9.81 169	27	0.18 831	9.92 384	8	3
58	9.73 572	19	9.81 196	28	0.18 804	9.92 376	9	2
59	9.73 591	20	9.81 224	28	0.18 776	9.92 367	8	1
60	9.73 611		9.81 252		0.18 748	9.92 359		0
	L Cos	d	L Cot	c d	L Tan	L Sin	d	′

P P

	29	28	27
1	2.9	2.8	2.7
2	5.8	5.6	5.4
3	8.7	8.4	8.1
4	11.6	11.2	10.8
5	14.5	14.0	13.5
6	17.4	16.8	16.2
7	20.3	19.6	18.9
8	23.2	22.4	21.6
9	26.1	25.2	24.3

	21	20	19
1	2.1	2.0	1.9
2	4.2	4.0	3.8
3	6.3	6.0	5.7
4	8.4	8.0	7.6
5	10.5	10.0	9.5
6	12.6	12.0	11.4
7	14.7	14.0	13.3
8	16.8	16.0	15.2
9	18.9	18.0	17.1

	9	8	7
1	0.9	0.8	0.7
2	1.8	1.6	1.4
3	2.7	2.4	2.1
4	3.6	3.2	2.8
5	4.5	4.0	3.5
6	5.4	4.8	4.2
7	6.3	5.6	4.9
8	7.2	6.4	5.6
9	8.1	7.2	6.3

P P

′	L Sin	d	L Tan	c d	L Cot	L Cos	d	
0	9.73 611	19	9.81 252	27	0.18 748	9.92 359	8	**60**
1	9.73 630	20	9.81 279	28	0.18 721	9.92 351	8	59
2	9.73 650	19	9.81 307	28	0.18 693	9.92 343	8	58
3	9.73 669	20	9.81 335	27	0.18 665	9.92 335	9	57
4	9.73 689	19	9.81 362	28	0.18 638	9.92 326	8	56
5	9.73 708	19	9.81 390	28	0.18 610	9.92 318	8	55
6	9.73 727	20	9.81 418	27	0.18 582	9.92 310	8	54
7	9.73 747	19	9.81 445	28	0.18 555	9.92 302	9	53
8	9.73 766	19	9.81 473	27	0.18 527	9.92 293	8	52
9	9.73 785	20	9.81 500	28	0.18 500	9.92 285	8	51
10	9.73 805	19	9.81 528	28	0.18 472	9.92 277	8	**50**
11	9.73 824	19	9.81 556	27	0.18 444	9.92 269	9	49
12	9.73 843	20	9.81 583	28	0.18 417	9.92 260	8	48
13	9.73 863	19	9.81 611	27	0.18 389	9.92 252	8	47
14	9.73 882	19	9.81 638	28	0.18 362	9.92 244	9	46
15	9.73 901	20	9.81 666	27	0.18 334	9.92 235	8	45
16	9.73 921	19	9.81 693	28	0.18 307	9.92 227	8	44
17	9.73 940	19	9.81 721	27	0.18 279	9.92 219	8	43
18	9.73 959	19	9.81 748	28	0.18 252	9.92 211	9	42
19	9.73 978	19	9.81 776	27	0.18 224	9.92 202	8	41
20	9.73 997	20	9.81 803	28	0.18 197	9.92 194	8	**40**
21	9.74 017	19	9.81 831	27	0.18 169	9.92 186	9	39
22	9.74 036	19	9.81 858	28	0.18 142	9.92 177	8	38
23	9.74 055	19	9.81 886	27	0.18 114	9.92 169	8	37
24	9.74 074	19	9.81 913	28	0.18 087	9.92 161	9	36
25	9.74 093	20	9.81 941	27	0.18 059	9.92 152	8	35
26	9.74 113	19	9.81 968	28	0.18 032	9.92 144	8	34
27	9.74 132	19	9.81 996	27	0.18 004	9.92 136	9	33
28	9.74 151	19	9.82 023	28	0.17 977	9.92 127	8	32
29	9.74 170	19	9.82 051	27	0.17 949	9.92 119	8	31
30	9.74 189	19	9.82 078	28	0.17 922	9.92 111	9	**30**
31	9.74 208	19	9.82 106	27	0.17 894	9.92 102	8	29
32	9.74 227	19	9.82 133	28	0.17 867	9.92 094	8	28
33	9.74 246	19	9.82 161	27	0.17 839	9.92 086	9	27
34	9.74 265	19	9.82 188	27	0.17 812	9.92 077	8	26
35	9.74 284	19	9.82 215	28	0.17 785	9.92 069	9	25
36	9.74 303	19	9.82 243	27	0.17 757	9.92 060	8	24
37	9.74 322	19	9.82 270	28	0.17 730	9.92 052	8	23
38	9.74 341	19	9.82 298	27	0.17 702	9.92 044	9	22
39	9.74 360	19	9.82 325	27	0.17 675	9.92 035	8	21
40	9.74 379	19	9.82 352	28	0.17 648	9.92 027	9	**20**
41	9.74 398	19	9.82 380	27	0.17 620	9.92 018	8	19
42	9.74 417	19	9.82 407	28	0.17 593	9.92 010	8	18
43	9.74 436	19	9.82 435	27	0.17 565	9.92 002	9	17
44	9.74 455	19	9.82 462	27	0.17 538	9.91 993	8	16
45	9.74 474	19	9.82 489	28	0.17 511	9.91 985	9	15
46	9.74 493	19	9.82 517	27	0.17 483	9.91 976	8	14
47	9.74 512	19	9.82 544	27	0.17 456	9.91 968	9	13
48	9.74 531	18	9.82 571	28	0.17 429	9.91 959	8	12
49	9.74 549	19	9.82 599	27	0.17 401	9.91 951	9	11
50	9.74 568	19	9.82 626	27	0.17 374	9.91 942	8	**10**
51	9.74 587	19	9.82 653	28	0.17 347	9.91 934	9	9
52	9.74 606	19	9.82 681	27	0.17 319	9.91 925	8	8
53	9.74 625	19	9.82 708	27	0.17 292	9.91 917	9	7
54	9.74 644	18	9.82 735	27	0.17 265	9.91 908	8	6
55	9.74 662	19	9.82 762	28	0.17 238	9.91 900	9	5
56	9.74 681	19	9.82 790	27	0.17 210	9.91 891	8	4
57	9.74 700	19	9.82 817	27	0.17 183	9.91 883	9	3
58	9.74 719	18	9.82 844	27	0.17 156	9.91 874	8	2
59	9.74 737	19	9.82 871	28	0.17 129	9.91 866	9	1
60	9.74 756		9.82 899		0.17 101	9.91 857		**0**
	L Cos	d	L Cot	c d	L Tan	L Sin	d	′

P P

	28	**27**
1	2.8	2.7
2	5.6	5.4
3	8.4	8.1
4	11.2	10.8
5	14.0	13.5
6	16.8	16.2
7	19.6	18.9
8	22.4	21.6
9	25.2	24.3

	20	**19**	**18**
1	2.0	1.9	1.8
2	4.0	3.8	3.6
3	6.0	5.7	5.4
4	8.0	7.6	7.2
5	10.0	9.5	9.0
6	12.0	11.4	10.8
7	14.0	13.3	12.6
8	16.0	15.2	14.4
9	18.0	17.1	16.2

	9	**8**
1	0.9	0.8
2	1.8	1.6
3	2.7	2.4
4	3.6	3.2
5	4.5	4.0
6	5.4	4.8
7	6.3	5.6
8	7.2	6.4
9	8.1	7.2

P P

′	L Sin	d	L Tan	c d	L Cot	L Cos	d	′
0	9.74 756	19	9.82 899	27	0.17 101	9.91 857	8	**60**
1	9.74 775	19	9.82 926	27	0.17 074	9.91 849	9	59
2	9.74 794	18	9.82 953	27	0.17 047	9.91 840	8	58
3	9.74 812	19	9.82 980	28	0.17 020	9.91 832	9	57
4	9.74 831	19	9.83 008	27	0.16 992	9.91 823	8	56
5	9.74 850	18	9.83 035	27	0.16 965	9.91 815	9	55
6	9.74 868	19	9.83 062	27	0.16 938	9.91 806	8	54
7	9.74 887	19	9.83 089	28	0.16 911	9.91 798	9	53
8	9.74 906	18	9.83 117	27	0.16 883	9.91 789	8	52
9	9.74 924	19	9.83 144	27	0.16 856	9.91 781	9	51
10	9.74 943	18	9.83 171	27	0.16 829	9.91 772	9	**50**
11	9.74 961	19	9.83 198	27	0.16 802	9.91 763	8	49
12	9.74 980	19	9.83 225	27	0.16 775	9.91 755	9	48
13	9.74 999	18	9.83 252	28	0.16 748	9.91 746	8	47
14	9.75 017	19	9.83 280	27	0.16 720	9.91 738	9	46
15	9.75 036	18	9.83 307	27	0.16 693	9.91 729	9	45
16	9.75 054	19	9.83 334	27	0.16 666	9.91 720	8	44
17	9.75 073	18	9.83 361	27	0.16 639	9.91 712	9	43
18	9.75 091	19	9.83 388	27	0.16 612	9.91 703	8	42
19	9.75 110	18	9.83 415	27	0.16 585	9.91 695	9	41
20	9.75 128	19	9.83 442	28	0.16 558	9.91 686	9	**40**
21	9.75 147	18	9.83 470	27	0.16 530	9.91 677	8	39
22	9.75 165	19	9.83 497	27	0.16 503	9.91 669	9	38
23	9.75 184	18	9.83 524	27	0.16 476	9.91 660	9	37
24	9.75 202	19	9.83 551	27	0.16 449	9.91 651	8	36
25	9.75 221	18	9.83 578	27	0.16 422	9.91 643	9	35
26	9.75 239	19	9.83 605	27	0.16 395	9.91 634	9	34
27	9.75 258	18	9.83 632	27	0.16 368	9.91 625	8	33
28	9.75 276	18	9.83 659	27	0.16 341	9.91 617	9	32
29	9.75 294	19	9.83 686	27	0.16 314	9.91 608	9	31
30	9.75 313	18	9.83 713	27	0.16 287	9.91 599	8	**30**
31	9.75 331	19	9.83 740	28	0.16 260	9.91 591	9	29
32	9.75 350	18	9.83 768	27	0.16 232	9.91 582	9	28
33	9.75 368	18	9.83 795	27	0.16 205	9.91 573	8	27
34	9.75 386	19	9.83 822	27	0.16 178	9.91 565	9	26
35	9.75 405	18	9.83 849	27	0.16 151	9.91 556	9	25
36	9.75 423	18	9.83 876	27	0.16 124	9.91 547	9	24
37	9.75 441	18	9.83 903	27	0.16 097	9.91 538	8	23
38	9.75 459	19	9.83 930	27	0.16 070	9.91 530	9	22
39	9.75 478	18	9.83 957	27	0.16 043	9.91 521	9	21
40	9.75 496	18	9.83 984	27	0.16 016	9.91 512	8	**20**
41	9.75 514	19	9.84 011	27	0.15 989	9.91 504	9	19
42	9.75 533	18	9.84 038	27	0.15 962	9.91 495	9	18
43	9.75 551	18	9.84 065	27	0.15 935	9.91 486	9	17
44	9.75 569	18	9.84 092	27	0.15 908	9.91 477	8	16
45	9.75 587	18	9.84 119	27	0.15 881	9.91 469	9	15
46	9.75 605	19	9.84 146	27	0.15 854	9.91 460	9	14
47	9.75 624	18	9.84 173	27	0.15 827	9.91 451	9	13
48	9.75 642	18	9.84 200	27	0.15 800	9.91 442	9	12
49	9.75 660	18	9.84 227	27	0.15 773	9.91 433	8	11
50	9.75 678	18	9.84 254	26	0.15 746	9.91 425	9	**10**
51	9.75 696	18	9.84 280	27	0.15 720	9.91 416	9	9
52	9.75 714	19	9.84 307	27	0.15 693	9.91 407	9	8
53	9.75 733	18	9.84 334	27	0.15 666	9.91 398	9	7
54	9.75 751	18	9.84 361	27	0.15 639	9.91 389	8	6
55	9.75 769	18	9.84 388	27	0.15 612	9.91 381	9	5
56	9.75 787	18	9.84 415	27	0.15 585	9.91 372	9	4
57	9.75 805	18	9.84 442	27	0.15 558	9.91 363	9	3
58	9.75 823	18	9.84 469	27	0.15 531	9.91 354	9	2
59	9.75 841	18	9.84 496	27	0.15 504	9.91 345	9	1
60	9.75 859		9.84 523		0.15 477	9.91 336		**0**
	L Cos	d	L Cot	c d	L Tan	L Sin	d	′

P P

	28	27	26
1	2.8	2.7	2.6
2	5.6	5.4	5.2
3	8.4	8.1	7.8
4	11.2	10.8	10.4
5	14.0	13.5	13.0
6	16.8	16.2	15.6
7	19.6	18.9	18.2
8	22.4	21.6	20.8
9	25.2	24.3	23.4

	19	18
1	1.9	1.8
2	3.8	3.6
3	5.7	5.4
4	7.6	7.2
5	9.5	9.0
6	11.4	10.8
7	13.3	12.6
8	15.2	14.4
9	17.1	16.2

	9	8
1	0.9	0.8
2	1.8	1.6
3	2.7	2.4
4	3.6	3.2
5	4.5	4.0
6	5.4	4.8
7	6.3	5.6
8	7.2	6.4
9	8.1	7.2

P P

′	L Sin	d	L Tan	c d	L Cot	L Cos	d	
0	9.75 859	18	9.84 523	27	0.15 477	9.91 336	8	**60**
1	9.75 877	18	9.84 550	26	0.15 450	9.91 328	9	59
2	9.75 895	18	9.84 576	27	0.15 424	9.91 319	9	58
3	9.75 913	18	9.84 603	27	0.15 397	9.91 310	9	57
4	9.75 931	18	9.84 630	27	0.15 370	9.91 301	9	56
5	9.75 949	18	9.84 657	27	0.15 343	9.91 292	9	55
6	9.75 967	18	9.84 684	27	0.15 316	9.91 283	9	54
7	9.75 985	18	9.84 711	27	0.15 289	9.91 274	8	53
8	9.76 003	18	9.84 738	26	0.15 262	9.91 266	9	52
9	9.76 021	18	9.84 764	27	0.15 236	9.91 257	9	51
10	9.76 039	18	9.84 791	27	0.15 209	9.91 248	9	**50**
11	9.76 057	18	9.84 818	27	0.15 182	9.91 239	9	49
12	9.76 075	18	9.84 845	27	0.15 155	9.91 230	9	48
13	9.76 093	18	9.84 872	27	0.15 128	9.91 221	9	47
14	9.76 111	18	9.84 899	26	0.15 101	9.91 212	9	46
15	9.76 129	17	9.84 925	27	0.15 075	9.91 203	9	45
16	9.76 146	18	9.84 952	27	0.15 048	9.91 194	9	44
17	9.76 164	18	9.84 979	27	0.15 021	9.91 185	9	43
18	9.76 182	18	9.85 006	27	0.14 994	9.91 176	9	42
19	9.76 200	18	9.85 033	26	0.14 967	9.91 167	9	41
20	9.76 218	18	9.85 059	27	0.14 941	9.91 158	9	**40**
21	9.76 236	17	9.85 086	27	0.14 914	9.91 149	8	39
22	9.76 253	18	9.85 113	27	0.14 887	9.91 141	9	38
23	9.76 271	18	9.85 140	26	0.14 860	9.91 132	9	37
24	9.76 289	18	9.85 166	27	0.14 834	9.91 123	9	36
25	9.76 307	17	9.85 193	27	0.14 807	9.91 114	9	35
26	9.76 324	18	9.85 220	27	0.14 780	9.91 105	9	34
27	9.76 342	18	9.85 247	26	0.14 753	9.91 096	9	33
28	9.76 360	18	9.85 273	27	0.14 727	9.91 087	9	32
29	9.76 378	17	9.85 300	27	0.14 700	9.91 078	9	31
30	9.76 395	18	9.85 327	27	0.14 673	9.91 069	9	**30**
31	9.76 413	18	9.85 354	26	0.14 646	9.91 060	9	29
32	9.76 431	17	9.85 380	27	0.14 620	9.91 051	9	28
33	9.76 448	18	9.85 407	27	0.14 593	9.91 042	9	27
34	9.76 466	18	9.85 434	26	0.14 566	9.91 033	10	26
35	9.76 484	17	9.85 460	27	0.14 540	9.91 023	9	25
36	9.76 501	18	9.85 487	27	0.14 513	9.91 014	9	24
37	9.76 519	18	9.85 514	26	0.14 486	9.91 005	9	23
38	9.76 537	17	9.85 540	27	0.14 460	9.90 996	9	22
39	9.76 554	18	9.85 567	27	0.14 433	9.90 987	9	21
40	9.76 572	18	9.85 594	26	0.14 406	9.90 978	9	**20**
41	9.76 590	17	9.85 620	27	0.14 380	9.90 969	9	19
42	9.76 607	18	9.85 647	27	0.14 353	9.90 960	9	18
43	9.76 625	17	9.85 674	26	0.14 326	9.90 951	9	17
44	9.76 642	18	9.85 700	27	0.14 300	9.90 942	9	16
45	9.76 660	17	9.85 727	27	0.14 273	9.90 933	9	15
46	9.76 677	18	9.85 754	26	0.14 246	9.90 924	9	14
47	9.76 695	17	9.85 780	27	0.14 220	9.90 915	9	13
48	9.76 712	18	9.85 807	27	0.14 193	9.90 906	10	12
49	9.76 730	17	9.85 834	26	0.14 166	9.90 896	9	11
50	9.76 747	18	9.85 860	27	0.14 140	9.90 887	9	**10**
51	9.76 765	17	9.85 887	26	0.14 113	9.90 878	9	9
52	9.76 782	18	9.85 913	27	0.14 087	9.90 869	9	8
53	9.76 800	17	9.85 940	27	0.14 060	9.90 860	9	7
54	9.76 817	18	9.85 967	26	0.14 033	9.90 851	9	6
55	9.76 835	17	9.85 993	27	0.14 007	9.90 842	10	5
56	9.76 852	18	9.86 020	26	0.13 980	9.90 832	9	4
57	9.76 870	17	9.86 046	27	0.13 954	9.90 823	9	3
58	9.76 887	17	9.86 073	27	0.13 927	9.90 814	9	2
59	9.76 904	18	9.86 100	26	0.13 900	9.90 805	9	1
60	9.76 922		9.86 126		0.13 874	9.90 796		**0**
	L Cos	d	L Cot	c d	L Tan	L Sin	d	′

P P

	27	26
1	2.7	2.6
2	5.4	5.2
3	8.1	7.8
4	10.8	10.4
5	13.5	13.0
6	16.2	15.6
7	18.9	18.2
8	21.6	20.8
9	24.3	23.4

	18	17
1	1.8	1.7
2	3.6	3.4
3	5.4	5.1
4	7.2	6.8
5	9.0	8.5
6	10.8	10.2
7	12.6	11.9
8	14.4	13.6
9	16.2	15.3

	10	9	8
1	1.0	0.9	0.8
2	2.0	1.8	1.6
3	3.0	2.7	2.4
4	4.0	3.6	3.2
5	5.0	4.5	4.0
6	6.0	5.4	4.8
7	7.0	6.3	5.6
8	8.0	7.2	6.4
9	9.0	8.1	7.2

P P

′	L Sin	d	L Tan	c d	L Cot	L Cos	d	′
0	9.76 922	17	9.86 126	27	0.13 874	9.90 796	9	**60**
1	9.76 939	18	9.86 153	26	0.13 847	9.90 787	10	59
2	9.76 957	17	9.86 179	27	0.13 821	9.90 777	9	58
3	9.76 974	17	9.86 206	26	0.13 794	9.90 768	9	57
4	9.76 991	18	9.86 232	27	0.13 768	9.90 759	9	56
5	9.77 009	17	9.86 259	26	0.13 741	9.90 750	9	55
6	9.77 026	17	9.86 285	27	0.13 715	9.90 741	10	54
7	9.77 043	18	9.86 312	26	0.13 688	9.90 731	9	53
8	9.77 061	17	9.86 338	27	0.13 662	9.90 722	9	52
9	9.77 078	17	9.86 365	27	0.13 635	9.90 713	9	51
10	9.77 095	17	9.86 392	26	0.13 608	9.90 704	10	**50**
11	9.77 112	18	9.86 418	27	0.13 582	9.90 694	9	49
12	9.77 130	17	9.86 445	26	0.13 555	9.90 685	9	48
13	9.77 147	17	9.86 471	27	0.13 529	9.90 676	9	47
14	9.77 164	17	9.86 498	26	0.13 502	9.90 667	10	46
15	9.77 181	18	9.86 524	27	0.13 476	9.90 657	9	45
16	9.77 199	17	9.86 551	26	0.13 449	9.90 648	9	44
17	9.77 216	17	9.86 577	26	0.13 423	9.90 639	9	43
18	9.77 233	17	9.86 603	27	0.13 397	9.90 630	10	42
19	9.77 250	18	9.86 630	26	0.13 370	9.90 620	9	41
20	9.77 268	17	9.86 656	27	0.13 344	9.90 611	9	**40**
21	9.77 285	17	9.86 683	26	0.13 317	9.90 602	10	39
22	9.77 302	17	9.86 709	27	0.13 291	9.90 592	9	38
23	9.77 319	17	9.86 736	26	0.13 264	9.90 583	9	37
24	9.77 336	17	9.86 762	27	0.13 238	9.90 574	9	36
25	9.77 353	17	9.86 789	26	0.13 211	9.90 565	10	35
26	9.77 370	17	9.86 815	27	0.13 185	9.90 555	9	34
27	9.77 387	18	9.86 842	26	0.13 158	9.90 546	9	33
28	9.77 405	17	9.86 868	26	0.13 132	9.90 537	10	32
29	9.77 422	17	9.86 894	27	0.13 106	9.90 527	9	31
30	9.77 439	17	9.86 921	26	0.13 079	9.90 518	9	**30**
31	9.77 456	17	9.86 947	27	0.13 053	9.90 509	10	29
32	9.77 473	17	9.86 974	26	0.13 026	9.90 499	9	28
33	9.77 490	17	9.87 000	27	0.13 000	9.90 490	10	27
34	9.77 507	17	9.87 027	26	0.12 973	9.90 480	9	26
35	9.77 524	17	9.87 053	26	0.12 947	9.90 471	9	25
36	9.77 541	17	9.87 079	27	0.12 921	9.90 462	10	24
37	9.77 558	17	9.87 106	26	0.12 894	9.90 452	9	23
38	9.77 575	17	9.87 132	26	0.12 868	9.90 443	9	22
39	9.77 592	17	9.87 158	27	0.12 842	9.90 434	10	21
40	9.77 609	17	9.87 185	26	0.12 815	9.90 424	9	**20**
41	9.77 626	17	9.87 211	27	0.12 789	9.90 415	10	19
42	9.77 643	17	9.87 238	26	0.12 762	9.90 405	9	18
43	9.77 660	17	9.87 264	26	0.12 736	9.90 396	10	17
44	9.77 677	17	9.87 290	27	0.12 710	9.90 386	9	16
45	9.77 694	17	9.87 317	26	0.12 683	9.90 377	9	15
46	9.77 711	17	9.87 343	26	0.12 657	9.90 368	10	14
47	9.77 728	16	9.87 369	27	0.12 631	9.90 358	9	13
48	9.77 744	17	9.87 396	26	0.12 604	9.90 349	10	12
49	9.77 761	17	9.87 422	26	0.12 578	9.90 339	9	11
50	9.77 778	17	9.87 448	27	0.12 552	9.90 330	10	**10**
51	9.77 795	17	9.87 475	26	0.12 525	9.90 320	9	9
52	9.77 812	17	9.87 501	26	0.12 499	9.90 311	10	8
53	9.77 829	17	9.87 527	27	0.12 473	9.90 301	9	7
54	9.77 846	16	9.87 554	26	0.12 446	9.90 292	10	6
55	9.77 862	17	9.87 580	26	0.12 420	9.90 282	9	5
56	9.77 879	17	9.87 606	27	0.12 394	9.90 273	10	4
57	9.77 896	17	9.87 633	26	0.12 367	9.90 263	9	3
58	9.77 913	17	9.87 659	26	0.12 341	9.90 254	10	2
59	9.77 930	16	9.87 685	26	0.12 315	9.90 244	9	1
60	9.77 946		9.87 711		0.12 289	9.90 235		**0**
	L Cos	d	L Cot	c d	L Tan	L Sin	d	′

P P

	27	26
1	2.7	2.6
2	5.4	5.2
3	8.1	7.8
4	10.8	10.4
5	13.5	13.0
6	16.2	15.6
7	18.9	18.2
8	21.6	20.8
9	24.3	23.4

	18	17	16
1	1.8	1.7	1.6
2	3.6	3.4	3.2
3	5.4	5.1	4.8
4	7.2	6.8	6.4
5	9.0	8.5	8.0
6	10.8	10.2	9.6
7	12.6	11.9	11.2
8	14.4	13.6	12.8
9	16.2	15.3	14.4

	10	9
1	1.0	0.9
2	2.0	1.8
3	3.0	2.7
4	4.0	3.6
5	5.0	4.5
6	6.0	5.4
7	7.0	6.3
8	8.0	7.2
9	9.0	8.1

P P

′	L Sin	d	L Tan	c d	L Cot	L Cos	d	
0	9.77 946	17	9.87 711	27	0.12 289	9.90 235	10	**60**
1	9.77 963	17	9.87 738	26	0.12 262	9.90 225	9	59
2	9.77 980	17	9.87 764	26	0.12 236	9.90 216	10	58
3	9.77 997	16	9.87 790	27	0.12 210	9.90 206	9	57
4	9.78 013	17	9.87 817	26	0.12 183	9.90 197	10	56
5	9.78 030	17	9.87 843	26	0.12 157	9.90 187	9	55
6	9.78 047	16	9.87 869	26	0.12 131	9.90 178	10	54
7	9.78 063	17	9.87 895	27	0.12 105	9.90 168	9	53
8	9.78 080	17	9.87 922	26	0.12 078	9.90 159	10	52
9	9.78 097	16	9.87 948	26	0.12 052	9.90 149	10	51
10	9.78 113	17	9.87 974	26	0.12 026	9.90 139	9	**50**
11	9.78 130	17	9.88 000	27	0.12 000	9.90 130	10	49
12	9.78 147	16	9.88 027	26	0.11 973	9.90 120	9	48
13	9.78 163	17	9.88 053	26	0.11 947	9.90 111	10	47
14	9.78 180	17	9.88 079	26	0.11 921	9.90 101	10	46
15	9.78 197	16	9.88 105	26	0.11 895	9.90 091	9	45
16	9.78 213	17	9.88 131	27	0.11 869	9.90 082	10	44
17	9.78 230	16	9.88 158	26	0.11 842	9.90 072	9	43
18	9.78 246	17	9.88 184	26	0.11 816	9.90 063	10	42
19	9.78 263	17	9.88 210	26	0.11 790	9.90 053	10	41
20	9.78 280	16	9.88 236	26	0.11 764	9.90 043	9	**40**
21	9.78 296	17	9.88 262	27	0.11 738	9.90 034	10	39
22	9.78 313	16	9.88 289	26	0.11 711	9.90 024	10	38
23	9.78 329	17	9.88 315	26	0.11 685	9.90 014	9	37
24	9.78 346	16	9.88 341	26	0.11 659	9.90 005	10	36
25	9.78 362	17	9.88 367	26	0.11 633	9.89 995	10	35
26	9.78 379	16	9.88 393	27	0.11 607	9.89 985	9	34
27	9.78 395	17	9.88 420	26	0.11 580	9.89 976	10	33
28	9.78 412	16	9.88 446	26	0.11 554	9.89 966	10	32
29	9.78 428	17	9.88 472	26	0.11 528	9.89 956	9	31
30	9.78 445	16	9.88 498	26	0.11 502	9.89 947	10	**30**
31	9.78 461	17	9.88 524	26	0.11 476	9.89 937	10	29
32	9.78 478	16	9.88 550	27	0.11 450	9.89 927	9	28
33	9.78 494	16	9.88 577	26	0.11 423	9.89 918	10	27
34	9.78 510	17	9.88 603	26	0.11 397	9.89 908	10	26
35	9.78 527	16	9.88 629	26	0.11 371	9.89 898	10	25
36	9.78 543	17	9.88 655	26	0.11 345	9.89 888	9	24
37	9.78 560	16	9.88 681	26	0.11 319	9.89 879	10	23
38	9.78 576	16	9.88 707	26	0.11 293	9.89 869	10	22
39	9.78 592	17	9.88 733	26	0.11 267	9.89 859	10	21
40	9.78 609	16	9.88 759	27	0.11 241	9.89 849	9	**20**
41	9.78 625	17	9.88 786	26	0.11 214	9.89 840	10	19
42	9.78 642	16	9.88 812	26	0.11 188	9.89 830	10	18
43	9.78 658	16	9.88 838	26	0.11 162	9.89 820	10	17
44	9.78 674	17	9.88 864	26	0.11 136	9.89 810	9	16
45	9.78 691	16	9.88 890	26	0.11 110	9.89 801	10	15
46	9.78 707	16	9.88 916	26	0.11 084	9.89 791	10	14
47	9.78 723	16	9.88 942	26	0.11 058	9.89 781	10	13
48	9.78 739	17	9.88 968	26	0.11 032	9.89 771	10	12
49	9.78 756	16	9.88 994	26	0.11 006	9.89 761	9	11
50	9.78 772	16	9.89 020	26	0.10 980	9.89 752	10	**10**
51	9.78 788	17	9.89 046	27	0.10 954	9.89 742	10	9
52	9.78 805	16	9.89 073	26	0.10 927	9.89 732	10	8
53	9.78 821	16	9.89 099	26	0.10 901	9.89 722	10	7
54	9.78 837	16	9.89 125	26	0.10 875	9.89 712	10	6
55	9.78 853	16	9.89 151	26	0.10 849	9.89 702	9	5
56	9.78 869	17	9.89 177	26	0.10 823	9.89 693	10	4
57	9.78 886	16	9.89 203	26	0.10 797	9.89 683	10	3
58	9.78 902	16	9.89 229	26	0.10 771	9.89 673	10	2
59	9.78 918	16	9.89 255	26	0.10 745	9.89 663	10	1
60	9.78 934		9.89 281		0.10 719	9.89 653		**0**
	L Cos	d	L Cot	c d	L Tan	L Sin	d	′

P P

	27	26
1	2.7	2.6
2	5.4	5.2
3	8.1	7.8
4	10.8	10.4
5	13.5	13.0
6	16.2	15.6
7	18.9	18.2
8	21.6	20.8
9	24.3	23.4

	17	16
1	1.7	1.6
2	3.4	3.2
3	5.1	4.8
4	6.8	6.4
5	8.5	8.0
6	10.2	9.6
7	11.9	11.2
8	13.6	12.8
9	15.3	14.4

	10	9
1	1.0	0.9
2	2.0	1.8
3	3.0	2.7
4	4.0	3.6
5	5.0	4.5
6	6.0	5.4
7	7.0	6.3
8	8.0	7.2
9	9.0	8.1

P P

′	L Sin	d	L Tan	c d	L Cot	L Cos	d	
0	9.78 934	16	9.89 281	26	0.10 719	9.89 653	10	**60**
1	9.78 950	17	9.89 307	26	0.10 693	9.89 643	10	59
2	9.78 967	16	9.89 333	26	0.10 667	9.89 633	9	58
3	9.78 983	16	9.89 359	26	0.10 641	9.89 624	10	57
4	9.78 999	16	9.89 385	26	0.10 615	9.89 614	10	56
5	9.79 015	16	9.89 411	26	0.10 589	9.89 604	10	55
6	9.79 031	16	9.89 437	26	0.10 563	9.89 594	10	54
7	9.79 047	16	9.89 463	26	0.10 537	9.89 584	10	53
8	9.79 063	16	9.89 489	26	0.10 511	9.89 574	10	52
9	9.79 079	16	9.89 515	26	0.10 485	9.89 564	10	51
10	9.79 095	16	9.89 541	26	0.10 459	9.89 554	10	**50**
11	9.79 111	17	9.89 567	26	0.10 433	9.89 544	10	49
12	9.79 128	16	9.89 593	26	0.10 407	9.89 534	10	48
13	9.79 144	16	9.89 619	26	0.10 381	9.89 524	10	47
14	9.79 160	16	9.89 645	26	0.10 355	9.89 514	10	46
15	9.79 176	16	9.89 671	26	0.10 329	9.89 504	9	45
16	9.79 192	16	9.89 697	26	0.10 303	9.89 495	10	44
17	9.79 208	16	9.89 723	26	0.10 277	9.89 485	10	43
18	9.79 224	16	9.89 749	26	0.10 251	9.89 475	10	42
19	9.79 240	16	9.89 775	26	0.10 225	9.89 465	10	41
20	9.79 256	16	9.89 801	26	0.10 199	9.89 455	10	**40**
21	9.79 272	16	9.89 827	26	0.10 173	9.89 445	10	39
22	9.79 288	16	9.89 853	26	0.10 147	9.89 435	10	38
23	9.79 304	15	9.89 879	26	0.10 121	9.89 425	10	37
24	9.79 319	16	9.89 905	26	0.10 095	9.89 415	10	36
25	9.79 335	16	9.89 931	26	0.10 069	9.89 405	10	35
26	9.79 351	16	9.89 957	26	0.10 043	9.89 395	10	34
27	9.79 367	16	9.89 983	26	0.10 017	9.89 385	10	33
28	9.79 383	16	9.90 009	26	0.09 991	9.89 375	11	32
29	9.79 399	16	9.90 035	26	0.09 965	9.89 364	10	31
30	9.79 415	16	9.90 061	25	0.09 939	9.89 354	10	**30**
31	9.79 431	16	9.90 086	26	0.09 914	9.89 344	10	29
32	9.79 447	16	9.90 112	26	0.09 888	9.89 334	10	28
33	9.79 463	15	9.90 138	26	0.09 862	9.89 324	10	27
34	9.79 478	16	9.90 164	26	0.09 836	9.89 314	10	26
35	9.79 494	16	9.90 190	26	0.09 810	9.89 304	10	25
36	9.79 510	16	9.90 216	26	0.09 784	9.89 294	10	24
37	9.79 526	16	9.90 242	26	0.09 758	9.89 284	10	23
38	9.79 542	16	9.90 268	26	0.09 732	9.89 274	10	22
39	9.79 558	15	9.90 294	26	0.09 706	9.89 264	10	21
40	9.79 573	16	9.90 320	26	0.09 680	9.89 254	10	**20**
41	9.79 589	16	9.90 346	25	0.09 654	9.89 244	11	19
42	9.79 605	16	9.90 371	26	0.09 629	9.89 233	10	18
43	9.79 621	15	9.90 397	26	0.09 603	9.89 223	10	17
44	9.79 636	16	9.90 423	26	0.09 577	9.89 213	10	16
45	9.79 652	16	9.90 449	26	0.09 551	9.89 203	10	15
46	9.79 668	16	9.90 475	26	0.09 525	9.89 193	10	14
47	9.79 684	15	9.90 501	26	0.09 499	9.89 183	10	13
48	9.79 699	16	9.90 527	26	0.09 473	9.89 173	11	12
49	9.79 715	16	9.90 553	25	0.09 447	9.89 162	10	11
50	9.79 731	15	9.90 578	26	0.09 422	9.89 152	10	**10**
51	9.79 746	16	9.90 604	26	0.09 396	9.89 142	10	9
52	9.79 762	16	9.90 630	26	0.09 370	9.89 132	10	8
53	9.79 778	15	9.90 656	26	0.09 344	9.89 122	10	7
54	9.79 793	16	9.90 682	26	0.09 318	9.89 112	11	6
55	9.79 809	16	9.90 708	26	0.09 292	9.89 101	10	5
56	9.79 825	15	9.90 734	25	0.09 266	9.89 091	10	4
57	9.79 840	16	9.90 759	26	0.09 241	9.89 081	10	3
58	9.79 856	16	9.90 785	26	0.09 215	9.89 071	11	2
59	9.79 872	15	9.90 811	26	0.09 189	9.89 060	10	1
60	9.79 887		9.90 837		0.09 163	9.89 050		**0**
	L Cos	d	L Cot	c d	L Tan	L Sin	d	′

P P

	26	**25**
1	2.6	2.5
2	5.2	5.0
3	7.8	7.5
4	10.4	10.0
5	13.0	12.5
6	15.6	15.0
7	18.2	17.5
8	20.8	20.0
9	23.4	22.5

	17	**16**	**15**
1	1.7	1.6	1.5
2	3.4	3.2	3.0
3	5.1	4.8	4.5
4	6.8	6.4	6.0
5	8.5	8.0	7.5
6	10.2	9.6	9.0
7	11.9	11.2	10.5
8	13.6	12.8	12.0
9	15.3	14.4	13.5

	11	**10**	**9**
1	1.1	1.0	0.9
2	2.2	2.0	1.8
3	3.3	3.0	2.7
4	4.4	4.0	3.6
5	5.5	5.0	4.5
6	6.6	6.0	5.4
7	7.7	7.0	6.3
8	8.8	8.0	7.2
9	9.9	9.0	8.1

P P

′	L Sin	d	L Tan	c d	L Cot	L Cos	d	
0	9.79 887	16	9.90 837	26	0.09 163	9.89 050	10	**60**
1	9.79 903	15	9.90 863	26	0.09 137	9.89 040	10	59
2	9.79 918	16	9.90 889	25	0.09 111	9.89 030	10	58
3	9.79 934	16	9.90 914	26	0.09 086	9.89 020	11	57
4	9.79 950	15	9.90 940	26	0.09 060	9.89 009	10	56
5	9.79 965	16	9.90 966	26	0.09 034	9.88 999	10	55
6	9.79 981	15	9.90 992	26	0.09 008	9.88 989	11	54
7	9.79 996	16	9.91 018	25	0.08 982	9.88 978	10	53
8	9.80 012	15	9.91 043	26	0.08 957	9.88 968	10	52
9	9.80 027	16	9.91 069	26	0.08 931	9.88 958	10	51
10	9.80 043	15	9.91 095	26	0.08 905	9.88 948	11	**50**
11	9.80 058	16	9.91 121	26	0.08 879	9.88 937	10	49
12	9.80 074	15	9.91 147	25	0.08 853	9.88 927	10	48
13	9.80 089	16	9.91 172	26	0.08 828	9.88 917	11	47
14	9.80 105	15	9.91 198	26	0.08 802	9.88 906	10	46
15	9.80 120	16	9.91 224	26	0.08 776	9.88 896	10	45
16	9.80 136	15	9.91 250	26	0.08 750	9.88 886	11	44
17	9.80 151	15	9.91 276	25	0.08 724	9.88 875	10	43
18	9.80 166	16	9.91 301	26	0.08 699	9.88 865	10	42
19	9.80 182	15	9.91 327	26	0.08 673	9.88 855	11	41
20	9.80 197	16	9.91 353	26	0.08 647	9.88 844	10	**40**
21	9.80 213	15	9.91 379	25	0.08 621	9.88 834	10	39
22	9.80 228	16	9.91 404	26	0.08 596	9.88 824	11	38
23	9.80 244	15	9.91 430	26	0.08 570	9.88 813	10	37
24	9.80 259	15	9.91 456	26	0.08 544	9.88 803	10	36
25	9.80 274	16	9.91 482	25	0.08 518	9.88 793	11	35
26	9.80 290	15	9.91 507	26	0.08 493	9.88 782	10	34
27	9.80 305	15	9.91 533	26	0.08 467	9.88 772	11	33
28	9.80 320	16	9.91 559	26	0.08 441	9.88 761	10	32
29	9.80 336	15	9.91 585	25	0.08 415	9.88 751	10	31
30	9.80 351	15	9.91 610	26	0.08 390	9.88 741	11	**30**
31	9.80 366	16	9.91 636	26	0.08 364	9.88 730	10	29
32	9.80 382	15	9.91 662	26	0.08 338	9.88 720	11	28
33	9.80 397	15	9.91 688	25	0.08 312	9.88 709	10	27
34	9.80 412	16	9.91 713	26	0.08 287	9.88 699	11	26
35	9.80 428	15	9.91 739	26	0.08 261	9.88 688	10	25
36	9.80 443	15	9.91 765	26	0.08 235	9.88 678	10	24
37	9.80 458	15	9.91 791	25	0.08 209	9.88 668	11	23
38	9.80 473	16	9.91 816	26	0.08 184	9.88 657	10	22
39	9.80 489	15	9.91 842	26	0.08 158	9.88 647	11	21
40	9.80 504	15	9.91 868	25	0.08 132	9.88 636	10	**20**
41	9.80 519	15	9.91 893	26	0.08 107	9.88 626	11	19
42	9.80 534	16	9.91 919	26	0.08 081	9.88 615	10	18
43	9.80 550	15	9.91 945	26	0.08 055	9.88 605	11	17
44	9.80 565	15	9.91 971	25	0.08 029	9.88 594	10	16
45	9.80 580	15	9.91 996	26	0.08 004	9.88 584	11	15
46	9.80 595	15	9.92 022	26	0.07 978	9.88 573	10	14
47	9.80 610	15	9.92 048	25	0.07 952	9.88 563	11	13
48	9.80 625	16	9.92 073	26	0.07 927	9.88 552	10	12
49	9.80 641	15	9.92 099	26	0.07 901	9.88 542	11	11
50	9.80 656	15	9.92 125	25	0.07 875	9.88 531	10	**10**
51	9.80 671	15	9.92 150	26	0.07 850	9.88 521	11	9
52	9.80 686	15	9.92 176	26	0.07 824	9.88 510	11	8
53	9.80 701	15	9.92 202	25	0.07 798	9.88 499	10	7
54	9.80 716	15	9.92 227	26	0.07 773	9.88 489	11	6
55	9.80 731	15	9.92 253	26	0.07 747	9.88 478	10	5
56	9.80 746	16	9.92 279	25	0.07 721	9.88 468	11	4
57	9.80 762	15	9.92 304	26	0.07 696	9.88 457	10	3
58	9.80 777	15	9.92 330	26	0.07 670	9.88 447	11	2
59	9.80 792	15	9.92 356	25	0.07 644	9.88 436	11	1
60	9.80 807		9.92 381		0.07 619	9.88 425		**0**
	L Cos	d	L Cot	c d	L Tan	L Sin	d	′

P P

	26	25
1	2.6	2.5
2	5.2	5.0
3	7.8	7.5
4	10.4	10.0
5	13.0	12.5
6	15.6	15.0
7	18.2	17.5
8	20.8	20.0
9	23.4	22.5

	16	15
1	1.6	1.5
2	3.2	3.0
3	4.8	4.5
4	6.4	6.0
5	8.0	7.5
6	9.6	9.0
7	11.2	10.5
8	12.8	12.0
9	14.4	13.5

	11	10
1	1.1	1.0
2	2.2	2.0
3	3.3	3.0
4	4.4	4.0
5	5.5	5.0
6	6.6	6.0
7	7.7	7.0
8	8.8	8.0
9	9.9	9.0

P P

′	L Sin	d	L Tan	c d	L Cot	L Cos	d	
0	9.80 807	15	9.92 381	26	0.07 619	9.88 425	10	**60**
1	9.80 822	15	9.92 407	26	0.07 593	9.88 415	11	59
2	9.80 837	15	9.92 433	25	0.07 567	9.88 404	10	58
3	9.80 852	15	9.92 458	26	0.07 542	9.88 394	11	57
4	9.80 867	15	9.92 484	26	0.07 516	9.88 383	11	56
5	9.80 882	15	9.92 510	25	0.07 490	9.88 372	10	55
6	9.80 897	15	9.92 535	26	0.07 465	9.88 362	11	54
7	9.80 912	15	9.92 561	26	0.07 439	9.88 351	11	53
8	9.80 927	15	9.92 587	25	0.07 413	9.88 340	10	52
9	9.80 942	15	9.92 612	26	0.07 388	9.88 330	11	51
10	9.80 957	15	9.92 638	25	0.07 362	9.88 319	11	**50**
11	9.80 972	15	9.92 663	26	0.07 337	9.88 308	10	49
12	9.80 987	15	9.92 689	26	0.07 311	9.88 298	11	48
13	9.81 002	15	9.92 715	25	0.07 285	9.88 287	11	47
14	9.81 017	15	9.92 740	26	0.07 260	9.88 276	10	46
15	9.81 032	15	9.92 766	26	0.07 234	9.88 266	11	45
16	9.81 047	14	9.92 792	25	0.07 208	9.88 255	11	44
17	9.81 061	15	9.92 817	26	0.07 183	9.88 244	10	43
18	9.81 076	15	9.92 843	25	0.07 157	9.88 234	11	42
19	9.81 091	15	9.92 868	26	0.07 132	9.88 223	11	41
20	9.81 106	15	9.92 894	26	0.07 106	9.88 212	11	**40**
21	9.81 121	15	9.92 920	25	0.07 080	9.88 201	10	39
22	9.81 136	15	9.92 945	26	0.07 055	9.88 191	11	38
23	9.81 151	15	9.92 971	25	0.07 029	9.88 180	11	37
24	9.81 166	14	9.92 996	26	0.07 004	9.88 169	11	36
25	9.81 180	15	9.93 022	26	0.06 978	9.88 158	10	35
26	9.81 195	15	9.93 048	25	0.06 952	9.88 148	11	34
27	9.81 210	15	9.93 073	26	0.06 927	9.88 137	11	33
28	9.81 225	15	9.93 099	25	0.06 901	9.88 126	11	32
29	9.81 240	14	9.93 124	26	0.06 876	9.88 115	10	31
30	9.81 254	15	9.93 150	25	0.06 850	9.88 105	11	**30**
31	9.81 269	15	9.93 175	26	0.06 825	9.88 094	11	29
32	9.81 284	15	9.93 201	26	0.06 799	9.88 083	11	28
33	9.81 299	15	9.93 227	25	0.06 773	9.88 072	11	27
34	9.81 314	14	9.93 252	26	0.06 748	9.88 061	10	26
35	9.81 328	15	9.93 278	25	0.06 722	9.88 051	11	25
36	9.81 343	15	9.93 303	26	0.06 697	9.88 040	11	24
37	9.81 358	14	9.93 329	25	0.06 671	9.88 029	11	23
38	9.81 372	15	9.93 354	26	0.06 646	9.88 018	11	22
39	9.81 387	15	9.93 380	26	0.06 620	9.88 007	11	21
40	9.81 402	15	9.93 406	25	0.06 594	9.87 996	11	**20**
41	9.81 417	14	9.93 431	26	0.06 569	9.87 985	10	19
42	9.81 431	15	9.93 457	25	0.06 543	9.87 975	11	18
43	9.81 446	15	9.93 482	26	0.06 518	9.87 964	11	17
44	9.81 461	14	9.93 508	25	0.06 492	9.87 953	11	16
45	9.81 475	15	9.93 533	26	0.06 467	9.87 942	11	15
46	9.81 490	15	9.93 559	25	0.06 441	9.87 931	11	14
47	9.81 505	14	9.93 584	26	0.06 416	9.87 920	11	13
48	9.81 519	15	9.93 610	26	0.06 390	9.87 909	11	12
49	9.81 534	15	9.93 636	25	0.06 364	9.87 898	11	11
50	9.81 549	14	9.93 661	26	0.06 339	9.87 887	10	**10**
51	9.81 563	15	9.93 687	25	0.06 313	9.87 877	11	9
52	9.81 578	14	9.93 712	26	0.06 288	9.87 866	11	8
53	9.81 592	15	9.93 738	25	0.06 262	9.87 855	11	7
54	9.81 607	15	9.93 763	26	0.06 237	9.87 844	11	6
55	9.81 622	14	9.93 789	25	0.06 211	9.87 833	11	5
56	9.81 636	15	9.93 814	26	0.06 186	9.87 822	11	4
57	9.81 651	14	9.93 840	25	0.06 160	9.87 811	11	3
58	9.81 665	15	9.93 865	26	0.06 135	9.87 800	11	2
59	9.81 680	14	9.93 891	25	0.06 109	9.87 789	11	1
60	9.81 694		9.93 916		0.06 084	9.87 778		**0**
	L Cos	d	L Cot	c d	L Tan	L Sin	d	′

P P

	26	25
1	2.6	2.5
2	5.2	5.0
3	7.8	7.5
4	10.4	10.0
5	13.0	12.5
6	15.6	15.0
7	18.2	17.5
8	20.8	20.0
9	23.4	22.5

	15	14
1	1.5	1.4
2	3.0	2.8
3	4.5	4.2
4	6.0	5.6
5	7.5	7.0
6	9.0	8.4
7	10.5	9.8
8	12.0	11.2
9	13.5	12.6

	11	10
1	1.1	1.0
2	2.2	2.0
3	3.3	3.0
4	4.4	4.0
5	5.5	5.0
6	6.6	6.0
7	7.7	7.0
8	8.8	8.0
9	9.9	9.0

P P

′	L Sin	d	L Tan	c d	L Cot	L Cos	d	
0	9.81 694	15	9.93 916	26	0.06 084	9.87 778	11	**60**
1	9.81 709	14	9.93 942	25	0.06 058	9.87 767	11	59
2	9.81 723	15	9.93 967	26	0.06 033	9.87 756	11	58
3	9.81 738	14	9.93 993	25	0.06 007	9.87 745	11	57
4	9.81 752	15	9.94 018	26	0.05 982	9.87 734	11	56
5	9.81 767	14	9.94 044	25	0.05 956	9.87 723	11	55
6	9.81 781	15	9.94 069	26	0.05 931	9.87 712	11	54
7	9.81 796	14	9.94 095	25	0.05 905	9.87 701	11	53
8	9.81 810	15	9.94 120	26	0.05 880	9.87 690	11	52
9	9.81 825	14	9.94 146	25	0.05 854	9.87 679	11	51
10	9.81 839	15	9.94 171	26	0.05 829	9.87 668	11	**50**
11	9.81 854	14	9.94 197	25	0.05 803	9.87 657	11	49
12	9.81 868	14	9.94 222	26	0.05 778	9.87 646	11	48
13	9.81 882	15	9.94 248	25	0.05 752	9.87 635	11	47
14	9.81 897	14	9.94 273	26	0.05 727	9.87 624	11	46
15	9.81 911	15	9.94 299	25	0.05 701	9.87 613	12	45
16	9.81 926	14	9.94 324	26	0.05 676	9.87 601	11	44
17	9.81 940	15	9.94 350	25	0.05 650	9.87 590	11	43
18	9.81 955	14	9.94 375	26	0.05 625	9.87 579	11	42
19	9.81 969	14	9.94 401	25	0.05 599	9.87 568	11	41
20	9.81 983	15	9.94 426	26	0.05 574	9.87 557	11	**40**
21	9.81 998	14	9.94 452	25	0.05 548	9.87 546	11	39
22	9.82 012	14	9.94 477	26	0.05 523	9.87 535	11	38
23	9.82 026	15	9.94 503	25	0.05 497	9.87 524	11	37
24	9.82 041	14	9.94 528	26	0.05 472	9.87 513	12	36
25	9.82 055	14	9.94 554	25	0.05 446	9.87 501	11	35
26	9.82 069	15	9.94 579	25	0.05 421	9.87 490	11	34
27	9.82 084	14	9.94 604	26	0.05 396	9.87 479	11	33
28	9.82 098	14	9.94 630	25	0.05 370	9.87 468	11	32
29	9.82 112	14	9.94 655	26	0.05 345	9.87 457	11	31
30	9.82 126	15	9.94 681	25	0.05 319	9.87 446	12	**30**
31	9.82 141	14	9.94 706	26	0.05 294	9.87 434	11	29
32	9.82 155	14	9.94 732	25	0.05 268	9.87 423	11	28
33	9.82 169	15	9.94 757	26	0.05 243	9.87 412	11	27
34	9.82 184	14	9.94 783	25	0.05 217	9.87 401	11	26
35	9.82 198	14	9.94 808	26	0.05 192	9.87 390	12	25
36	9.82 212	14	9.94 834	25	0.05 166	9.87 378	11	24
37	9.82 226	14	9.94 859	25	0.05 141	9.87 367	11	23
38	9.82 240	15	9.94 884	26	0.05 116	9.87 356	11	22
39	9.82 255	14	9.94 910	25	0.05 090	9.87 345	11	21
40	9.82 269	14	9.94 935	26	0.05 065	9.87 334	12	**20**
41	9.82 283	14	9.94 961	25	0.05 039	9.87 322	11	19
42	9.82 297	14	9.94 986	26	0.05 014	9.87 311	11	18
43	9.82 311	15	9.95 012	25	0.04 988	9.87 300	12	17
44	9.82 326	14	9.95 037	25	0.04 963	9.87 288	11	16
45	9.82 340	14	9.95 062	26	0.04 938	9.87 277	11	15
46	9.82 354	14	9.95 088	25	0.04 912	9.87 266	11	14
47	9.82 368	14	9.95 113	26	0.04 887	9.87 255	12	13
48	9.82 382	14	9.95 139	25	0.04 861	9.87 243	11	12
49	9.82 396	14	9.95 164	26	0.04 836	9.87 232	11	11
50	9.82 410	14	9.95 190	25	0.04 810	9.87 221	12	**10**
51	9.82 424	15	9.95 215	25	0.04 785	9.87 209	11	9
52	9.82 439	14	9.95 240	26	0.04 760	9.87 198	11	8
53	9.82 453	14	9.95 266	25	0.04 734	9.87 187	12	7
54	9.82 467	14	9.95 291	26	0.04 709	9.87 175	11	6
55	9.82 481	14	9.95 317	25	0.04 683	9.87 164	11	5
56	9.82 495	14	9.95 342	26	0.04 658	9.87 153	12	4
57	9.82 509	14	9.95 368	25	0.04 632	9.87 141	11	3
58	9.82 523	14	9.95 393	25	0.04 607	9.87 130	11	2
59	9.82 537	14	9.95 418	26	0.04 582	9.87 119	12	1
60	9.82 551		9.95 444		0.04 556	9.87 107		**0**
	L Cos	d	L Cot	c d	L Tan	L Sin	d	′

P P

	26	25
1	2.6	2.5
2	5.2	5.0
3	7.8	7.5
4	10.4	10.0
5	13.0	12.5
6	15.6	15.0
7	18.2	17.5
8	20.8	20.0
9	23.4	22.5

	15	14
1	1.5	1.4
2	3.0	2.8
3	4.5	4.2
4	6.0	5.6
5	7.5	7.0
6	9.0	8.4
7	10.5	9.8
8	12.0	11.2
9	13.5	12.6

	12	11
1	1.2	1.1
2	2.4	2.2
3	3.6	3.3
4	4.8	4.4
5	6.0	5.5
6	7.2	6.6
7	8.4	7.7
8	9.6	8.8
9	10.8	9.9

P P

′	L Sin	d	L Tan	c d	L Cot	L Cos	d	
0	9.82 551	14	9.95 444	25	0.04 556	9.87 107	11	**60**
1	9.82 565	14	9.95 469	26	0.04 531	9.87 096	11	59
2	9.82 579	14	9.95 495	25	0.04 505	9.87 085	12	58
3	9.82 593	14	9.95 520	25	0.04 480	9.87 073	11	57
4	9.82 607	14	9.95 545	26	0.04 455	9.87 062	12	56
5	9.82 621	14	9.95 571	25	0.04 429	9.87 050	11	55
6	9.82 635	14	9.95 596	26	0.04 404	9.87 039	11	54
7	9.82 649	14	9.95 622	25	0.04 378	9.87 028	12	53
8	9.82 663	14	9.95 647	25	0.04 353	9.87 016	11	52
9	9.82 677	14	9.95 672	26	0.04 328	9.87 005	12	51
10	9.82 691	14	9.95 698	25	0.04 302	9.86 993	11	**50**
11	9.82 705	14	9.95 723	25	0.04 277	9.86 982	12	49
12	9.82 719	14	9.95 748	26	0.04 252	9.86 970	11	48
13	9.82 733	14	9.95 774	25	0.04 226	9.86 959	12	47
14	9.82 747	14	9.95 799	26	0.04 201	9.86 947	11	46
15	9.82 761	14	9.95 825	25	0.04 175	9.86 936	12	45
16	9.82 775	13	9.95 850	25	0.04 150	9.86 924	11	44
17	9.82 788	14	9.95 875	26	0.04 125	9.86 913	11	43
18	9.82 802	14	9.95 901	25	0.04 099	9.86 902	12	42
19	9.82 816	14	9.95 926	26	0.04 074	9.86 890	11	41
20	9.82 830	14	9.95 952	25	0.04 048	9.86 879	12	**40**
21	9.82 844	14	9.95 977	25	0.04 023	9.86 867	12	39
22	9.82 858	14	9.96 002	26	0.03 998	9.86 855	11	38
23	9.82 872	13	9.96 028	25	0.03 972	9.86 844	12	37
24	9.82 885	14	9.96 053	25	0.03 947	9.86 832	11	36
25	9.82 899	14	9.96 078	26	0.03 922	9.86 821	12	35
26	9.82 913	14	9.96 104	25	0.03 896	9.86 809	11	34
27	9.82 927	14	9.96 129	26	0.03 871	9.86 798	12	33
28	9.82 941	14	9.96 155	25	0.03 845	9.86 786	11	32
29	9.82 955	13	9.96 180	25	0.03 820	9.86 775	12	31
30	9.82 968	14	9.96 205	26	0.03 795	9.86 763	11	**30**
31	9.82 982	14	9.96 231	25	0.03 769	9.86 752	12	29
32	9.82 996	14	9.96 256	25	0.03 744	9.86 740	12	28
33	9.83 010	13	9.96 281	26	0.03 719	9.86 728	11	27
34	9.83 023	14	9.96 307	25	0.03 693	9.86 717	12	26
35	9.83 037	14	9.96 332	25	0.03 668	9.86 705	11	25
36	9.83 051	14	9.96 357	26	0.03 643	9.86 694	12	24
37	9.83 065	13	9.96 383	25	0.03 617	9.86 682	12	23
38	9.83 078	14	9.96 408	25	0.03 592	9.86 670	11	22
39	9.83 092	14	9.96 433	26	0.03 567	9.86 659	12	21
40	9.83 106	14	9.96 459	25	0.03 541	9.86 647	12	**20**
41	9.83 120	13	9.96 484	26	0.03 516	9.86 635	11	19
42	9.83 133	14	9.96 510	25	0.03 490	9.86 624	12	18
43	9.83 147	14	9.96 535	25	0.03 465	9.86 612	12	17
44	9.83 161	13	9.96 560	26	0.03 440	9.86 600	11	16
45	9.83 174	14	9.96 586	25	0.03 414	9.86 589	12	15
46	9.83 188	14	9.96 611	25	0.03 389	9.86 577	12	14
47	9.83 202	13	9.96 636	26	0.03 364	9.86 565	11	13
48	9.83 215	14	9.96 662	25	0.03 338	9.86 554	12	12
49	9.83 229	13	9.96 687	25	0.03 313	9.86 542	12	11
50	9.83 242	14	9.96 712	26	0.03 288	9.86 530	12	**10**
51	9.83 256	14	9.96 738	25	0.03 262	9.86 518	11	9
52	9.83 270	13	9.96 763	25	0.03 237	9.86 507	12	8
53	9.83 283	14	9.96 788	26	0.03 212	9.86 495	12	7
54	9.83 297	13	9.96 814	25	0.03 186	9.86 483	11	6
55	9.83 310	14	9.96 839	25	0.03 161	9.86 472	12	5
56	9.83 324	14	9.96 864	26	0.03 136	9.86 460	12	4
57	9.83 338	13	9.96 890	25	0.03 110	9.86 448	12	3
58	9.83 351	14	9.96 915	25	0.03 085	9.86 436	11	2
59	9.83 365	13	9.96 940	26	0.03 060	9.86 425	12	1
60	9.83 378		9.96 966		0.03 034	9.86 413		**0**
	L Cos	d	L Cot	c d	L Tan	L Sin	d	′

P P

	26	25
1	2.6	2.5
2	5.2	5.0
3	7.8	7.5
4	10.4	10.0
5	13.0	12.5
6	15.6	15.0
7	18.2	17.5
8	20.8	20.0
9	23.4	22.5

	14	13
1	1.4	1.3
2	2.8	2.6
3	4.2	3.9
4	5.6	5.2
5	7.0	6.5
6	8.4	7.8
7	9.8	9.1
8	11.2	10.4
9	12.6	11.7

	12	11
1	1.2	1.1
2	2.4	2.2
3	3.6	3.3
4	4.8	4.4
5	6.0	5.5
6	7.2	6.6
7	8.4	7.7
8	9.6	8.8
9	10.8	9.9

P P

′	L Sin	d	L Tan	c d	L Cot	L Cos	d	
0	9.83 378	14	9.96 966	25	0.03 034	9.86 413	12	**60**
1	9.83 392	13	9.96 991	25	0.03 009	9.86 401	12	59
2	9.83 405	14	9.97 016	26	0.02 984	9.86 389	12	58
3	9.83 419	13	9.97 042	25	0.02 958	9.86 377	11	57
4	9.83 432	14	9.97 067	25	0.02 933	9.86 366	12	56
5	9.83 446	13	9.97 092	26	0.02 908	9.86 354	12	55
6	9.83 459	14	9.97 118	25	0.02 882	9.86 342	12	54
7	9.83 473	13	9.97 143	25	0.02 857	9.86 330	12	53
8	9.83 486	14	9.97 168	25	0.02 832	9.86 318	12	52
9	9.83 500	13	9.97 193	26	0.02 807	9.86 306	11	51
10	9.83 513	14	9.97 219	25	0.02 781	9.86 295	12	**50**
11	9.83 527	13	9.97 244	25	0.02 756	9.86 283	12	49
12	9.83 540	14	9.97 269	26	0.02 731	9.86 271	12	48
13	9.83 554	13	9.97 295	25	0.02 705	9.86 259	12	47
14	9.83 567	14	9.97 320	25	0.02 680	9.86 247	12	46
15	9.83 581	13	9.97 345	26	0.02 655	9.86 235	12	45
16	9.83 594	14	9.97 371	25	0.02 629	9.86 223	12	44
17	9.83 608	13	9.97 396	25	0.02 604	9.86 211	11	43
18	9.83 621	13	9.97 421	26	0.02 579	9.86 200	12	42
19	9.83 634	14	9.97 447	25	0.02 553	9.86 188	12	41
20	9.83 648	13	9.97 472	25	0.02 528	9.86 176	12	**40**
21	9.83 661	13	9.97 497	26	0.02 503	9.86 164	12	39
22	9.83 674	14	9.97 523	25	0.02 477	9.86 152	12	38
23	9.83 688	13	9.97 548	25	0.02 452	9.86 140	12	37
24	9.83 701	14	9.97 573	25	0.02 427	9.86 128	12	36
25	9.83 715	13	9.97 598	26	0.02 402	9.86 116	12	35
26	9.83 728	13	9.97 624	25	0.02 376	9.86 104	12	34
27	9.83 741	14	9.97 649	25	0.02 351	9.86 092	12	33
28	9.83 755	13	9.97 674	26	0.02 326	9.86 080	12	32
29	9.83 768	13	9.97 700	25	0.02 300	9.86 068	12	31
30	9.83 781	14	9.97 725	25	0.02 275	9.86 056	12	**30**
31	9.83 795	13	9.97 750	26	0.02 250	9.86 044	12	29
32	9.83 808	13	9.97 776	25	0.02 224	9.86 032	12	28
33	9.83 821	13	9.97 801	25	0.02 199	9.86 020	12	27
34	9.83 834	14	9.97 826	25	0.02 174	9.86 008	12	26
35	9.83 848	13	9.97 851	26	0.02 149	9.85 996	12	25
36	9.83 861	13	9.97 877	25	0.02 123	9.85 984	12	24
37	9.83 874	13	9.97 902	25	0.02 098	9.85 972	12	23
38	9.83 887	14	9.97 927	26	0.02 073	9.85 960	12	22
39	9.83 901	13	9.97 953	25	0.02 047	9.85 948	12	21
40	9.83 914	13	9.97 978	25	0.02 022	9.85 936	12	**20**
41	9.83 927	13	9.98 003	26	0.01 997	9.85 924	12	19
42	9.83 940	14	9.98 029	25	0.01 971	9.85 912	12	18
43	9.83 954	13	9.98 054	25	0.01 946	9.85 900	12	17
44	9.83 967	13	9.98 079	25	0.01 921	9.85 888	12	16
45	9.83 980	13	9.98 104	26	0.01 896	9.85 876	12	15
46	9.83 993	13	9.98 130	25	0.01 870	9.85 864	13	14
47	9.84 006	14	9.98 155	25	0.01 845	9.85 851	12	13
48	9.84 020	13	9.98 180	26	0.01 820	9.85 839	12	12
49	9.84 033	13	9.98 206	25	0.01 794	9.85 827	12	11
50	9.84 046	13	9.98 231	25	0.01 769	9.85 815	12	**10**
51	9.84 059	13	9.98 256	25	0.01 744	9.85 803	12	9
52	9.84 072	13	9.98 281	26	0.01 719	9.85 791	12	8
53	9.84 085	13	9.98 307	25	0.01 693	9.85 779	13	7
54	9.84 098	14	9.98 332	25	0.01 668	9.85 766	12	6
55	9.84 112	13	9.98 357	26	0.01 643	9.85 754	12	5
56	9.84 125	13	9.98 383	25	0.01 617	9.85 742	12	4
57	9.84 138	13	9.98 408	25	0.01 592	9.85 730	12	3
58	9.84 151	13	9.98 433	25	0.01 567	9.85 718	12	2
59	9.84 164	13	9.98 458	26	0.01 542	9.85 706	13	1
60	9.84 177		9.98 484		0.01 516	9.85 693		**0**
	L Cos	d	L Cot	c d	L Tan	L Sin	d	′

P P

	26	**25**
1	2.6	2.5
2	5.2	5.0
3	7.8	7.5
4	10.4	10.0
5	13.0	12.5
6	15.6	15.0
7	18.2	17.5
8	20.8	20.0
9	23.4	22.5

	14	**13**
1	1.4	1.3
2	2.8	2.6
3	4.2	3.9
4	5.6	5.2
5	7.0	6.5
6	8.4	7.8
7	9.8	9.1
8	11.2	10.4
9	12.6	11.7

	12	**11**
1	1.2	1.1
2	2.4	2.2
3	3.6	3.3
4	4.8	4.4
5	6.0	5.5
6	7.2	6.6
7	8.4	7.7
8	9.6	8.8
9	10.8	9.9

P P

44° **135°**

′	L Sin	d	L Tan	c d	L Cot	L Cos	d	′
0	9.84 177	13	9.98 484	25	0.01 516	9.85 693	12	**60**
1	9.84 190	13	9.98 509	25	0.01 491	9.85 681	12	59
2	9.84 203	13	9.98 534	26	0.01 466	9.85 669	12	58
3	9.84 216	13	9.98 560	25	0.01 440	9.85 657	12	57
4	9.84 229	13	9.98 585	25	0.01 415	9.85 645	13	56
5	9.84 242	13	9.98 610	25	0.01 390	9.85 632	12	55
6	9.84 255	14	9.98 635	26	0.01 365	9.85 620	12	54
7	9.84 269	13	9.98 661	25	0.01 339	9.85 608	12	53
8	9.84 282	13	9.98 686	25	0.01 314	9.85 596	13	52
9	9.84 295	13	9.98 711	26	0.01 289	9.85 583	12	51
10	9.84 308	13	9.98 737	25	0.01 263	9.85 571	12	**50**
11	9.84 321	13	9.98 762	25	0.01 238	9.85 559	12	49
12	9.84 334	13	9.98 787	25	0.01 213	9.85 547	13	48
13	9.84 347	13	9.98 812	26	0.01 188	9.85 534	12	47
14	9.84 360	13	9.98 838	25	0.01 162	9.85 522	12	46
15	9.84 373	12	9.98 863	25	0.01 137	9.85 510	13	45
16	9.84 385	13	9.98 888	25	0.01 112	9.85 497	12	44
17	9.84 398	13	9.98 913	26	0.01 087	9.85 485	12	43
18	9.84 411	13	9.98 939	25	0.01 061	9.85 473	13	42
19	9.84 424	13	9.98 964	25	0.01 036	9.85 460	12	41
20	9.84 437	13	9.98 989	26	0.01 011	9.85 448	12	**40**
21	9.84 450	13	9.99 015	25	0.00 985	9.85 436	13	39
22	9.84 463	13	9.99 040	25	0.00 960	9.85 423	12	38
23	9.84 476	13	9.99 065	25	0.00 935	9.85 411	12	37
24	9.84 489	13	9.99 090	26	0.00 910	9.85 399	13	36
25	9.84 502	13	9.99 116	25	0.00 884	9.85 386	12	35
26	9.84 515	13	9.99 141	25	0.00 859	9.85 374	13	34
27	9.84 528	12	9.99 166	25	0.00 834	9.85 361	12	33
28	9.84 540	13	9.99 191	26	0.00 809	9.85 349	12	32
29	9.84 553	13	9.99 217	25	0.00 783	9.85 337	13	31
30	9.84 566	13	9.99 242	25	0.00 758	9.85 324	12	**30**
31	9.84 579	13	9.99 267	26	0.00 733	9.85 312	13	29
32	9.84 592	13	9.99 293	25	0.00 707	9.85 299	12	28
33	9.84 605	13	9.99 318	25	0.00 682	9.85 287	13	27
34	9.84 618	12	9.99 343	25	0.00 657	9.85 274	12	26
35	9.84 630	13	9.99 368	26	0.00 632	9.85 262	12	25
36	9.84 643	13	9.99 394	25	0.00 606	9.85 250	13	24
37	9.84 656	13	9.99 419	25	0.00 581	9.85 237	12	23
38	9.84 669	13	9.99 444	25	0.00 556	9.85 225	13	22
39	9.84 682	12	9.99 469	26	0.00 531	9.85 212	12	21
40	9.84 694	13	9.99 495	25	0.00 505	9.85 200	13	**20**
41	9.84 707	13	9.99 520	25	0.00 480	9.85 187	12	19
42	9.84 720	13	9.99 545	25	0.00 455	9.85 175	13	18
43	9.84 733	12	9.99 570	26	0.00 430	9.85 162	12	17
44	9.84 745	13	9.99 596	25	0.00 404	9.85 150	13	16
45	9.84 758	13	9.99 621	25	0.00 379	9.85 137	12	15
46	9.84 771	13	9.99 646	26	0.00 354	9.85 125	13	14
47	9.84 784	12	9.99 672	25	0.00 328	9.85 112	12	13
48	9.84 796	13	9.99 697	25	0.00 303	9.85 100	13	12
49	9.84 809	13	9.99 722	25	0.00 278	9.85 087	13	11
50	9.84 822	13	9.99 747	26	0.00 253	9.85 074	12	**10**
51	9.84 835	12	9.99 773	25	0.00 227	9.85 062	13	9
52	9.84 847	13	9.99 798	25	0.00 202	9.85 049	12	8
53	9.84 860	13	9.99 823	25	0.00 177	9.85 037	13	7
54	9.84 873	12	9.99 848	26	0.00 152	9.85 024	12	6
55	9.84 885	13	9.99 874	25	0.00 126	9.85 012	13	5
56	9.84 898	13	9.99 899	25	0.00 101	9.84 999	13	4
57	9.84 911	12	9.99 924	25	0.00 076	9.84 986	12	3
58	9.84 923	13	9.99 949	26	0.00 051	9.84 974	13	2
59	9.84 936	13	9.99 975	25	0.00 025	9.84 961	12	1
60	9.84 949		0.00 000		0.00 000	9.84 949		**0**
	L Cos	d	L Cot	c d	L Tan	L Sin	d	′

P P

	26	25	14
1	2.6	2.5	1.4
2	5.2	5.0	2.8
3	7.8	7.5	4.2
4	10.4	10.0	5.6
5	13.0	12.5	7.0
6	15.6	15.0	8.4
7	18.2	17.5	9.8
8	20.8	20.0	11.2
9	23.4	22.5	12.6

	13	12
1	1.3	1.2
2	2.6	2.4
3	3.9	3.6
4	5.2	4.8
5	6.5	6.0
6	7.8	7.2
7	9.1	8.4
8	10.4	9.6
9	11.7	10.8

P P

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