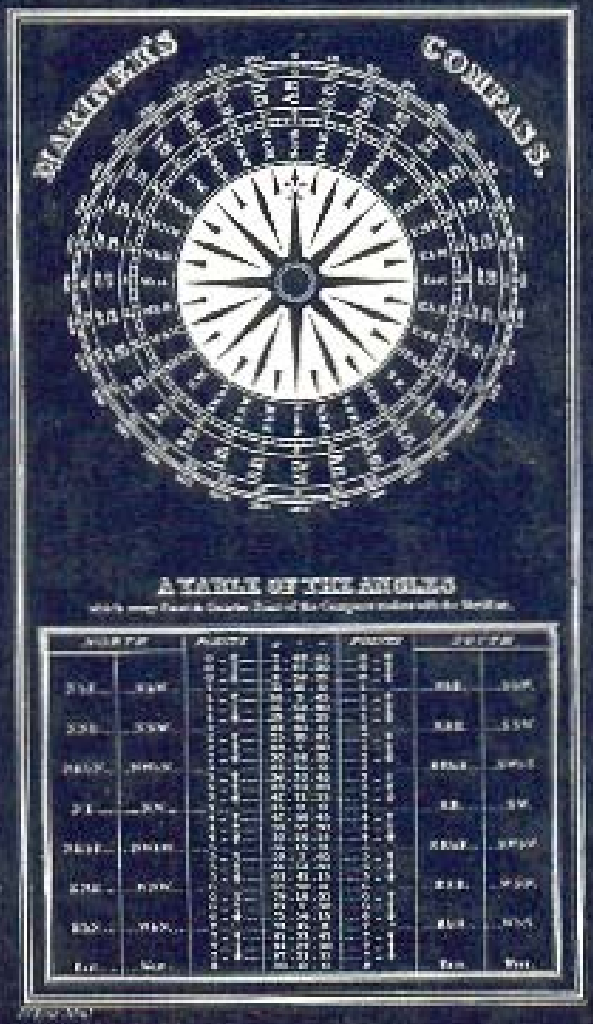
# NORIE'S NAUTICAL TABLES




Edited by
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Imray Laurie Norie & Wilson

# NORIE'S NAUTICAL TABLES

## WITH EXPLANATIONS OF THEIR USE

EDITED BY

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IMRAY LAURIE NORIE AND WILSON LTD

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# PREFACE

One hundred and eighty years of publication involving many new editions and reprints afford a searching test of the usefulness and value of any publication designed to meet the exacting requirements of navigators and the shipping industry. Since J. W. Norie published the first edition of his COMPLETE SET OF NAUTICAL TABLES AND EPITOME OF PRACTICAL NAVIGATION in 1803, the tables have undergone a continuing process of change to maintain their usefulness to the modern practical navigator.

During these years many changes to the tables have been necessary in both content and presentation to conform with changing techniques of navigation, but the aim of the editors has always been to have user friendly navigational tables which could be used quickly and easily under shipboard conditions. This has resulted in many changes to the tables aimed at removing much of the tedium of interpolation, so enabling the navigator to obtain the answers to navigational problems quickly with the minimum of probability of error. Certain tables and data are also included which are not readily available on board ship or are only used in the examination room, but the physical dimensions of the book impose strict limits on what can be included with the result that it is impossible to include all the tables the editor would wish.

In the present edition, the Star's Total Correction Table inside the back cover, the Moon's Total Correction Table and the extended Star's Total Correction Table have been redesigned to reduce interpolation to a minimum.

The editor wishes to thank all those who have suggested improvements to the tables, and will welcome any further helpful criticism which users of the Tables may care to make.

A. G. BLANCE
London 1991

# EXPLANATION AND USE OF THE TABLES

# I. COMPUTATION TABLES

## TRAVERSE TABLE

*(Pages 2 - 93)*

These Tables afford an easy and expeditious means of solving all problems that resolve themselves into the solution of right-angled plane triangles. They can thus be applied to all the forms of Sailings except Great Circle Sailing; but they are specially useful in resolving a Traverse. On this account they are called Traverse Tables, and the terms *Course*, *Distance*, *Difference of Latitude* and *Departure* are used as names of the different parts involved.

The Traverse Table has now been brought into line with the requirements of the modern compass notation by the inclusion, at the top and foot of each page, of the number of degrees of the new (0–360) circular system of reckoning, corresponding to the value printed at centre of title in conformity with the older quadrantal notation, the latter form being retained for its application to the solution of certain problems in the Sailings and for its utility in the conversion of Departure to Difference of Longitude and vice versa, as explained later in this article.

The figures denoting the number of degrees under the new arrangement are placed in the appropriate quadrants of a small diagrammatic symbol, representing the cardinal points of the compass, and in these positions they introduce the equivalents in the new notation corresponding to the number of degrees of the old system, shown at centre of titles, when pertaining to the respective quadrants. The arrangement will be better understood by reference to an example; thus, on page 58 –'28 DEGREES'

| | | | | |
|---|---|---|---|---|
| For old | N28°E | S28°E | S28°W | N28°W |
| Read new | ↑ 028° | ↑ 152° | 208° ↑ | 332° ↑ |

or vice versa, and, as examples of the reverse process, on page 38, but this time from the foot with caption '72 DEGREES'—

| | | | | |
|---|---|---|---|---|
| For new | ↑ 072° | ↑ 108° | 252° ↑ | 288° ↑ |
| Read old | N72°E | S72°E | S72°W | N72°W |

It will be observed that, in the new notation of the Traverse Table, the three-figure degrees corresponding to Easterly courses are placed in the symbol diagram towards the right-hand side of the page, in contradistinction to those for Westerly equivalents which are printed on the left.

The courses, in both the old and new notation, are displayed at the top and bottom of the pages, while the Distances are arranged in order in the columns marked Dist. The Difference of Latitude and Departure corresponding to any given Run on any given Course will be found in the columns marked D. Lat. and Dep., respectively, of the page for the given Course and opposite the given Distance. But it must most carefully be observed that when the required Course is found at the *top* of the page, the Difference of Latitude and Departure also are to be taken from the columns as named at the *top* of the page; and when the Course appears at the *foot* of the page, the relevant quantities too must be taken from the columns as named at the *foot* of the page.

When any of the given quantities (except the Course which is never to be changed) exceeds the limits of the tables, any aliquot part, as a half or a third, is to be taken, and the quantities found are to be doubled or trebled; that is, they are to be multiplied by the same figure as the given quantity was divided by. And since the Difference of Latitude and Departure corresponding to any given Course and Distance are to be found opposite the Distance on that page which contains the Course, it follows that if any two of the four parts be given, and these two be found in their proper places in the tables, the other two will be found in their respective places on the same page.

The following examples will illustrate the application of the tables to Plane Sailing:—

1 *Example:* Find the difference of latitude and departure made good by a ship in sailing 84 miles on a course 112°. (S68°E., Old Style).

Course 112° is found in the Table at foot of page 46. Opposite 84 in the Distance column on that page we get:—D. Lat. 31·5, Dep. 77·9.

The D. Lat. is named S and Departure E, because it is noted that 112° is shown in the South and East quadrant of the compass symbol.

2 *Example:* Find the course and distance made good by a ship whose difference of latitude was found to be 431 miles S, and departure 132′ W.

431 and 132 are not to be found alongside each other, but in the Table on page 37 we find 431·3 and 131·9, and these are sufficiently near to the desired value for all practical purposes. These give 197°, or 17° old style, as a course, and 451 as a distance. Hence—

Course S17° W, or 197°, and Distance 451 miles.

These tables may also, as has already been stated, be applied to solving problems in Parallel and Middle Latitude Sailings. In solving these problems the Course (old notation) at the *top* or *bottom* of page becomes the Latitude or Middle Latitude, the Distance column becomes a Diff. Longitude column, and the D. Lat. column becomes a Dep. column. To facilitate the taking out of these quantities the D. Long. and Dep. are bracketed together, and the words *D. Long.*, and *Dep.* are also printed in italics at the top of their respective columns when the Latitude or Middle Latitude, as course, is at the *top;* but at the bottom of their respective columns when Latitude or Middle Latitude, as course is at the *bottom.*

3 *Example:* In Latitude or Middle Latitude 47° the departure made good was 260′·5; required the difference of Longitude.

With 47° as course at the *bottom* of the page, look in the column with *Dep.* printed in italics at the *bottom*, just over the end of the bracket; and opposite to 260′·5 will be found 382 in the *D. Long.* column, which is the Difference of Longitude required. Page 89

4 *Example:* A ship, after sailing East 260′·5, had changed her Longitude 6° 22′. Required the parallel of Latitude on which she sailed.

6° 22′ equals 382′. Opposite 382 in *D. Long.* column is 260′·5 in *Dep.* column entered from the *bottom*, and the parallel on which she sailed is Lat. 47°. Page 89

## MERIDIONAL PARTS (For the Spheroid)

*( Pages 94 - 102)*

This table is used in resolving problems by *Mercator's Sailing* and in constructing charts on Mercator's projection. The meridional parts are to be taken out for the degrees answering to the given latitude at the *top* or *bottom*, and for the minutes at either *side* column. Thus, the meridional parts corresponding to the latitude 49° 57′ are 3451·88. Page 98

# LOGARITHMS

*(Pages 103 - 117)*

This table gives correct to five significant figures the mantissae (or fractional parts) of the common logarithms of numbers. The operator must decide for himself the integral or whole number part of the logarithm (called the characteristic) according to the position of the decimal point in the natural number.

The rules for determining the characteristic can be demonstrated by the following:

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| 10 000 | = | $10^4$ | ∴ | $\log_{10}$ | 10 000 | = | 4 |
| 1 000 | = | $10^3$ | ∴ | $\log_{10}$ | 1 000 | = | 3 |
| 100 | = | $10^2$ | ∴ | $\log_{10}$ | 100 | = | 2 |
| 10 | = | $10^1$ | ∴ | $\log_{10}$ | 10 | = | 1 |
| 1 | = | $10^0$ | ∴ | $\log_{10}$ | 1 | = | 0 |
| 0·1 | = | $10^{-1}$ | ∴ | $\log_{10}$ | 0·1 | = | −1 |
| 0·01 | = | $10^{-2}$ | ∴ | $\log_{10}$ | 0·01 | = | −2 |
| 0·001 | = | $10^{-3}$ | ∴ | $\log_{10}$ | 0·001 | = | −3 |
| 0·0001 | = | $10^{-4}$ | ∴ | $\log_{10}$ | 0·0001 | = | −4 |

The above, which may be extended infinitely in both directions, shows that the log. of, say, 342 must lie between 2 and 3. Similarly, the log. of 29·64 must be between 1 and 2. From the table it will be found that log. 342 = 2·53403 and log. 29·64 = 1·47188. These statements could be expressed as follows:— pg 107 pg 106

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$10^{2.53403} = 342$

$10^{1.47188} = 29{\cdot}64$

*For numbers greater than* 1 the rule for finding the characteristic is—The characteristic is the number which is 1 less than the number of figures before the decimal point. If there are five figures before the decimal point the characteristic is 4; if there is one figure before the decimal point the characteristic is 0, and so on. Thus:— pg 110

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log. 5378 = 3·73062

log. 537·8 = 2·73062

log. 53·78 = 1·73062

log. 5·378 = 0·73062

*For numbers less than* 1 the rule for finding the characteristic is—The negative characteristic of the log. of a number less than 1 is the number which is 1 more than the number of noughts between the decimal point and the first significant figure. Thus:—

log. 0·5378 = $\bar{1}$·73062

log. 0·05378 = $\bar{2}$·73062

log. 0·005378 = $\bar{3}$·73062

log. 0·0005378 = $\bar{4}$·73062

*Tabular logarithms* To avoid the negative characteristics, logarithms in tabular form are obtained by adding 10 to the characteristic.

*Example:* log 0·5378 = $\bar{1}$·73062 or in tabular form 9·73062

log 0·005378 = $\bar{3}$·73062 or in tabular form 7·73062

In the tables of logarithms of trigonometrical functions the characteristic is given in both forms at the top of each column of logarithms.

*Example:* log. sin. 5° 30′ = $\bar{2}$·98157 or 8·98157 — pg 140

log. cot. 5° 30′ = 1·01642 or 11·01642

PAGE 140

*Interpolation*

When the number whose logarithm is required consists of four significant figures or less the mantissa is taken from the main part of the table. Where there are five significant figures the difference for the fifth figure is obtained from the relevant section of the D column.

*Example:* log. 140·27 = 2·14675 + 21 = 2·14696 (page 103)

If the number consists of more than six significant figures the approximate logarithm can be found by simple proportion.

*Example:* log. 140·277 = 2·14675 (from main table) + 21 (from D column)
+ 2 (by simple proportion)
= 2·14698

*To find the number, N, whose log. is known.* If the number is required to four significant figures or less all that is necessary is to find the series of digits corresponding to the tabulated mantissa which is *nearest* to the one given. The characteristic of the log. will determine the position of the decimal point. Thus:—

Given log. N = 1·87109.
Nearest tabulated mantissa 87111 gives digits 7432. (pg 113)
The characteristic being 1, there are two figures before the decimal point.
The required number, N, is therefore 74·32.

**PAGE 113**

The following examples will serve to illustrate the procedure when more than four significant figures are required. Suppose the number, N, correct to five significant figures is required when log. N is known to be 2·27104.

*Example:* log. N = 2·27104
The next less tabulated mantissa ·27091 gives the digits 1866. (page 104)
But ·27104 − ·27091 = 13
∴ Entering the 180–189 section of the D column the fifth figure is 6 for a D value of 12 and by simple proportion the sixth figure is therefore 5.
∴ the digits of the number are 186665
The characteristic of the logarithm is 2.
∴ the number N is 186·665

## LOGS. of TRIG. FUNCTIONS

*(Pages 118 - 241)*

Whilst preserving the basic layout which has been a feature of '*Norie's*', and '*Norie's*' alone, since J. W. Norie produced the original edition, changes have been introduced which make the table a much more efficient instrument in conforming with the modern technique of astronomical navigation. For all angles from 0° to 90° the table is now completely *downward* reading and for that reason alone should be practically blunder-proof. In the main part of the table from 4° to 86° the log. functions of angles are tabulated for one minute intervals of the angles and proportional parts for fractions of one minute (from 0′·1 to 0′·9) are given. In the remainder of the table, where that system ceases to be practicable, log. functions are tabulated for intervals of 0′·1 or 0′·2 as necessary and differences between successive tabulations are given. This means that, except in special and rare cases, interpolation is reduced when taking out any log. function of an angle and there is no need to resort to the questionable practice of rounding off angles to the nearest minute in order to 'save trouble'. With this table it is no more of an effort to work accurately than it is to work roughly. How far a navigator is justified in working to tenths of a minute is a matter which can be argued about indefinitely,

but since the Nautical Almanac gives hour angles and declinations to tenths of a minute and a modern sextant with a decimal vernier enables readings to be taken to tenths of a minute as well, it would seem only logical to use navigation tables which, with the minimum of effort, provide for the same order of precision.

The characteristic of the logarithm is given at the top of each function's column in indicial form with the tabular form in brackets.

*Example:* log. sin. 5° 09′ = $\bar{2}$.95310 or 8·95310

Thus the navigator can use whichever form of characteristic is preferred though it must be appreciated that the two forms cannot be interchanged within a calculation.

Occasionally, it may be necessary to find the logs. of trigonometrical functions of angles greater than 90°. No difficulty should be experienced in such cases as the second, third and fourth quadrant equivalents of the first quadrant angles are plainly indicated. It should be noted, however, that the table is *upward* reading for angles between 90° and 180° and also for those between 270° and 360°, but *downward* reading for angles between 180° and 270°. In *all* cases, however, the name of the ratio being used appears at the *top* of the page. When applying proportional parts care should be taken to notice in which direction the log. function is increasing, i.e. upwards or downwards.

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| | | | | |
|---|---|---|---|---|
| log. sin. | 1° 38′·7 | = $\bar{2}$·(45754 + $\frac{86}{2}$) | = $\bar{2}$·45798 | or 8·45798 |
| log. tan. | 177° 57′·5 | = $\bar{2}$·(55240 − $\frac{70}{2}$) | = $\bar{2}$·55205 | or 8·55205 |
| log. cosec. | 26° 04′·4 | = 0·(35712 − 10) | = 0·35702 | or 10·35702 |
| log. sec. | 333° 25′·3 | = 0·(04852 − 2) | = 0·04850 | or 10·04850 |
| log. cos. | 138° 17′·6 | = $\bar{1}$·(87300 + 7) | = $\bar{1}$.87307 | or 9·87307 |
| log. sin. | 62° 19′·8 | = $\bar{1}$·(94720 + 5) | = $\bar{1}$.94725 | or 9·94725 |
| log. cot. | 117° 53′·0 | = | $\bar{1}$·72354 | or 9·72354 |
| log. cos. | 83° 15′·3 | = $\bar{1}$·(07018 − 32) | = $\bar{1}$.06986 | or 9·06986 |

To find the angle whose log. function is given is equally simple. For instance, to find $\theta$ when log. sin. $\theta$ = $\bar{1}$·66305 or 9·66305, notice that the next *less* tabulated log. sin. is $\bar{1}$·66295 or 9·66295 which gives the angle 27° 24′·0. The excess 10 gives an additional 0′·4. Hence, $\theta$ = 27° 24′·4.

In practice, the above processes will, of course, be performed mentally.

## HAVERSINES

*(Pages 242 - 348)*

To make the tables clearer and to make interpolation almost completely unnecessary the tables are presented as follows:—

1. The Log. Haversines are printed in bold type and the Natural Haversines in light type.
2. In the range 0° to 90° and 270° to 360° (the range most frequently used) haversines are tabulated at 0·2′ intervals and the proportional parts for 0·1′ are given at the foot of each page.
3. In the remainder of the table haversines are tabulated at 1·0′ intervals and the proportional parts for 0·2′ are given at the top of each column.
4. The characteristic of the logarithms is given at the top of each column in the negative index form together with the tabular form in brackets.

| ANGLE | LOG. HAVERSINE | NAT. HAV. |
|---|---|---|
| 15° 33′·0 | $\bar{2}$·26249 or 8·26249 | 0·01830 — pg 258 |
| 15° 33′·6 | $\bar{2}$·26304 or 8·26304 | 0·01832 — 〃 |
| 15° 33′·7 | $\bar{2}$·26313 or 8·26313 | 0·01832 — PAGE 258 |
| 344° 10′·0 | $\bar{2}$·27807 or 8·27807 | 0·01897 — |
| 344° 10′·4 | $\bar{2}$·27771 or 8·27771 | 0·01895 — 〃 |
| 344° 10′·5 | $\bar{2}$·27762 or 8·27762 | 0·01895 — 〃 |
| 95° 25′·0 | $\bar{1}$·73815 or 9·73815 | 0·54720 — pg 334 |
| 95° 25′·6 | $\bar{1}$·73822 or 9·73822 | 0·54729 — |
| 263° 37′·0 | $\bar{1}$·74475 or 9·74475 | 0·55559 — PAGE 334 |
| 263° 37′·8 | $\bar{1}$·74466 or 9·74466 | 0·55547 — |

*Derivation of Haversine Formulae:*

$$\text{Cos. A} = \frac{\text{cos. a} - \text{cos. b cos. c}}{\text{sin. b sin. c}}, \text{ (fundamental formula).}$$

$$\therefore 1 - \text{cos. A} = 1 - \frac{\text{cos. a} - \text{cos. b cos. c}}{\text{sin. b sin. c}}$$

$$\text{i.e. vers A} = \frac{\text{sin. b. sin. c} - \text{cos. a} + \text{cos. b cos. c}}{\text{sin. b sin. c}},$$

$$\therefore \text{cos. (b} \sim \text{c)} - \text{cos. a} = \text{sin. b sin. c vers. A,}$$
$$\text{or} \quad -\text{cos. a} = -\text{cos. (b} \sim \text{c)} + \text{sin. b sin. c vers. A.}$$

By adding unity to each side this becomes—

$$1 - \text{cos. a} = 1 - \text{cos. (b} \sim \text{c)} + \text{sin. b sin. c vers. A,}$$
$$\therefore \text{vers. a} = \text{vers. (b} \sim \text{c)} + \text{sin. b sin. c vers. A,}$$
$$\text{whence hav. a} = \text{hav. (b} \sim \text{c)} + \text{sin. b sin. c hav. A} \quad \ldots\ldots\ldots (1)$$

By transposing we obtain—

$$\text{hav. A} = [\text{hav. a} - \text{hav. (b} \sim \text{c)}] \text{ cosec. b cosec. c.} \quad \ldots\ldots (2)$$
$$\text{and hav. (b} \sim \text{c)} = \text{hav. a} - \text{hav. A sin. b sin. c.} \quad \ldots\ldots\ldots\ldots\ldots (3)$$

These three versions of the spherical haversine formula are frequently adapted for navigational purposes as follows.

(1) Hav. z = hav. (l ∼ d)* + hav. h cos. l cos. d.
(2) Hav. h = [hav. z − hav. (l ∼ d;*] sec. l sec. d.
(3) Hav. mer. zen. dist. = hav. z − hav. h cos. l cos. d.

where
- z = zenith distance,
- l = latitude,
- d = declination,
- h = hour angle.

* (l ∼ d) when l and d have the same name,
(l + d) when l and d have different names.

*Examples*

(1) Find zenith distance when h = 66° 49′·3, l = 31° 10′·2 N., d = 19° 24′·7 N.

Hav. z = hav. h cos. l cos. d + hav. (l ± d) .

| | | | |
|---|---|---|---|
| h .. | 66° 49′·3 | L. hav. $\bar{1}$·48173 or 9·48173 | |
| l .. | 31° 10′·2 | L. cos. $\bar{1}$·93228 or 9·93228 | |
| d .. | 19° 24′·7 | L. cos. $\bar{1}$·97458 or 9·97458 | |
| | | L. hav. $\bar{1}$·38859 or 9·38859 | N. hav. 0·24468 |
| (l ~ d) .. | 11° 45′·5 | ..... | N. hav. 0·01049 |
| z .. | 60° 40′·9 | ..... | N. hav. 0·25517 |

Calculated zenith distance = 60° 40′·9 and is used for comparing with the true zenith distance to find the intercept when establishing the position line by the Marc St. Hilaire or Intercept method.

(2) Find the hour angle when l = 41° 21′·6 N., d = 9° 34′·1 S., z = 63° 45′·8.

Hav. h = [hav. z − hav. (l ± d)] sec. l sec. d.

| | | | |
|---|---|---|---|
| z .. | 63° 45′·8 | N. hav. 0·27896 | |
| (l + d) .. | 50° 55′·7 | N. hav. 0·18485 | |
| | | N. hav. 0·09411 | L. hav. $\bar{2}$·97364 or 8·97364 |
| l .. | 41° 21′·6 | ..... | L. sec. 0·12461 or 10·12461 |
| d .. | 9° 34′·1 | ..... | L. sec. 0·00608 or 10·00608 |
| h .. | 41° 46′·9 | ..... | L. hav. $\bar{1}$·10433 or 9·10433 |

Hour angle = 41° 46′·9 if body is W. of the meridian, or hour angle = 318° 13′·1 if body is E. of the meridian, and is used for finding the computed longitude when establishing the position line by the "chronometer method".

(3) Find the mer. zen. dist. when h = 355° 57′·2, l = 48° 12′·5 N., d = 12° 13′·7 S., z = 60° 21′·6.

Hav. mer. zen. dist. = hav. z − hav. h cos. l cos. d.

| | | | |
|---|---|---|---|
| h .. | 355° 57′·2 | L. hav. $\bar{3}$·09571 or 7·09571 | |
| l .. | 48° 12′·5 | L. cos. $\bar{1}$·82375 or 9·82375 | |
| d .. | 12° 13′·7 | L. cos. $\bar{1}$·99003 or 9·99003 | |
| | | L. hav. $\bar{4}$·90949 or 6·90949 | N. hav. 0·00081 |
| z .. | 60° 21′·6 | ..... | N. hav. 0·25273 |
| mer. zen. dist. .. | 60° 15′·2 | ..... | N. hav. 0·25192 |

The mer. zen. dist., 60° 15′·2, when combined with the declination gives the latitude of the point where the position line (at right angles to the direction of the body) cuts the meridian of D.R. longitude used to compute h. This method of working an ex-meridian sight is, of course, an alternative to using ex-meridian tables.

*The haversine formulae and great circle sailing calculations*

Formula (1) is used to find the great circle distance from one point to another and formula (2) is used to find the initial and final courses. The vertex of the track and the latitude of the point where the track cuts any specified meridian can then be found by right angled spherical trigonometry.

*Example:* Find the great circle distance and the initial course on the track from A (17° 22′ N., 25° 28′ W.) to B (40° 08′ N., 73° 17′ W.).

*To find the great circle distance*

Hav. AB = hav. (PA ~ PB) + hav. P sin. PA sin. PB.

| | | | |
|---|---|---|---|
| P | .. 47° 49′·0 | L. hav. $\bar{1}$·21550 or 9·21550 | |
| PA | .. 72° 38′·0 | L. sin. $\bar{1}$·97974 or 9·97974 | |
| PB | .. 49° 52′·0 | L. sin. $\bar{1}$·88340 or 9·88340 | |
| | | L. hav. $\bar{1}$·07864 or 9·07864 | N. hav. 0·11985 |
| (PA ~ PB) | .. 22° 46′·0 | ..... | N. hav. 0·03896 |
| AB | .. 46° 58′·2 | ..... | N. hav. 0·15881 |

∴ Great circle distance = 2818·2 miles.

*To find the initial course*

Hav. A = [hav. PB − hav. (PA ~ AB)] cosec. PA cosec. AB.

| | | | | |
|---|---|---|---|---|
| PB | .. 49° 52′·0 | N. hav. 0·17772 | | |
| (PA ~ AB) | .. 25° 39′·8 | N. hav. 0·04932 | | |
| | | N. hav. 0·12840 | L. hav. | 1·10856 or 9·10856 |
| PA | .. 72° 38′·0 | ..... | L. cosec. | 0·02026 or 10·02026 |
| AB | .. 46° 58′·2 | ..... | L. cosec. | 0·13609 or 10·13609 |
| A | .. 50° 48′·5 | ..... | L. hav. | 1·26491 or 9·26491 |

∴ Initial course = N. 50° 48′·5 W. or 309° 11′·5.

# NATURAL FUNCTIONS OF ANGLES

(Pages 349-363)

In these tables, which are intended for use with simple pocket calculators, the natural trigonometric functions can be obtained to five decimal places.

*Examples*:

1. To find tan. 49° 38′:

| | |
|---|---|
| 1·17500 | (tan. 49° 36′) |
| +0·00138 | (2′ from difference table against 49°) |
| tan. 49° 38′ = 1·17638 | page (354) |

2. To find cos. 80° 27′:

| | |
|---|---|
| 0·16677 | (cos. 80° 24′) |
| −0·00086 | (3′ from difference table against 80°, subtracted) |
| cos. 80° 27′ = 0·16591 | |

3. To find sec. 76° 44′:

| | |
|---|---|
| 4·34689 | (sec. 76° 42′) |
| +0·01078 | (⅓[sec. 76° 42′–sec. 76° 48′]; difference must be obtained by this method because the mean differences are not sufficiently accurate) |
| Sec. 76° 44′ = 4·35767 | |

4. To convert 31° 46′ to radians:

| | |
|---|---|
| 31° = 0·54105 radians | |
| 46′ = 0·01338 radians | |
| 31° 46′ = 0·55443 radians | |

5. To convert 1·648 radians to degrees:

| | |
|---|---|
| 1 radian | = 57° 17·7′ |
| 0·648 radians | = 37° 07·7′ |
| 1·648 radians | = 94° 25·4′ |

(page 352) PAGE 352
(page 363) PAGE 363
(page 362) PAGE 362

## SQUARES AND CUBES OF NUMBERS

(Pages 364 - 367)

These tables will give squares and cubes of numbers to four significant figures.

*To obtain the square or cube of a number:*

(a) If the number is between 1 and 10 and consists of three significant figures (or less) the square or cube is taken from the main part of the tables, but if there are four significant figures the Mean Difference section is also used.

*Example:*

$2{\cdot}824^2$ = 7·952 (from main table) + 23 (from Mean Difference)
= 7·975

$7{\cdot}631^3$ = 58·22 (from main table) + 2 (from Mean Difference)
= 58·24

(b) All other numbers are converted into scientific notation and the square or cube obtained for the significant figures as before.

*Example:*

$463{\cdot}8^2 = (4{\cdot}638 \times 10^2)^2 = 21{\cdot}51 \times 10^4$
$= 2{\cdot}151 \times 10^5$ or 215 100

$0{\cdot}000\ 072\ 51^3 = (7{\cdot}251 \times 10^{-5})^3 = 381{\cdot}3 \times 10^{-15}$
$= 3{\cdot}813 \times 10^{-13}$ or 0·000 000 000 000 3813

# SQUARE AND CUBE ROOTS OF NUMBERS

(Pages 368 - 377)

These tables, which give the square and cube roots of numbers to four significant figures, are in the following form:

(a) Square roots of numbers between 1 and 10 and between 10 and 100.
(b) Cube roots of numbers between 1 and 10, between 10 and 100 and between 100 and 1000.

The following examples illustrate the method of obtaining square or cube roots using the tables:

| $\sqrt{839{\cdot}2}$ | $\sqrt{4523}$ | $\sqrt[3]{78\ 620\ 000}$ | $\sqrt[3]{0{\cdot}000\ 7247}$ |
|---|---|---|---|

1. *Change the number into scientific notation.*

| $= \sqrt{8{\cdot}392 \times 10^2}$ | $= \sqrt{4{\cdot}523 \times 10^3}$ | $= \sqrt[3]{7{\cdot}862 \times 10^7}$ | $= \sqrt[3]{7{\cdot}247 \times 10^{-4}}$ |
|---|---|---|---|

2. *Adjust the position of the decimal point to make the index of 10 exactly divisible by the root being found.*

| $= \sqrt{8{\cdot}392 \times 10^2}$ | $= \sqrt{45{\cdot}23 \times 10^2}$ | $= \sqrt[3]{78{\cdot}62 \times 10^6}$ | $= \sqrt[3]{724{\cdot}7 \times 10^{-6}}$ |
|---|---|---|---|

3. *Enter the tables shown below and extract the required root of the significant figures.*

| TABLE OF SQUARE ROOTS 1–10 | TABLE OF SQUARE ROOTS 10–100 | TABLE OF CUBE ROOTS 10–100 | TABLE OF CUBE ROOTS 100–1000 |
|---|---|---|---|
| $= 2{\cdot}897$ | $= 6{\cdot}725$ | $= 4{\cdot}284$ | $= 8{\cdot}982$ |

4. *Determine the square or cube root of the power of 10.*

| $\sqrt{10^2} = 10$ | $\sqrt{10^2} = 10$ | $\sqrt[3]{10^6} = 10^2$ | $\sqrt[3]{10^{-6}} = 10^{-2}$ |
|---|---|---|---|
| $\therefore \sqrt{839{\cdot}2}$ | $\therefore \sqrt{45{\cdot}23}$ | $\therefore \sqrt[3]{78\ 620\ 000}$ | $\therefore \sqrt[3]{0{\cdot}000\ 7247}$ |
| $= 2{\cdot}897 \times 10$ | $= 6{\cdot}725 \times 10$ | $= 4{\cdot}284 \times 10^2$ | $= 8{\cdot}982 \times 10^{-2}$ |
| or 28·97 | or 67·25 | or 428·4 | or 0·08982 |

Mean Difference columns are not required in the table of square roots of numbers between 5·5 and 9·9 nor in the tables of cube roots of numbers between 1·0 and 10·0 and between 55·0 and 100·0. When any of the above tables are being used to find the roots of numbers with four significant figures interpolation can be carried out mentally.

# II. TABLES FOR CELESTIAL NAVIGATION

## A, B & C AZIMUTH TABLES

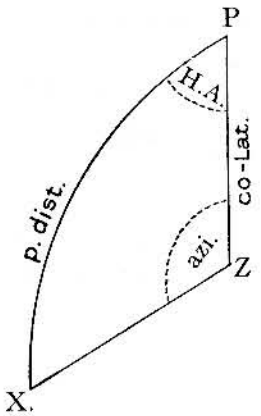
*(Pages 380 - 428)*

To conform with the method of presenting data in the Nautical Almanac the hour angles in Tables A and B are given in degrees and minutes of arc from 0° 15′ to 359° 45′.

If the H.A. is between 0° and 180° the body is west of the meridian and its hour angle will appear in the upper row of H.A.s at either the top or bottom of the page. If the H.A. is between 180° and 360° the body is east of the meridian and its hour angle will appear in the lower row.

The A, B and C values and the azimuth are derived by employing the well known formula which connects four adjacent parts of a spherical triangle. It can be shown, for instance, that in spherical triangle A B C:—

cot. a sin. b = cot. A sin. C + cos. b cos. C.
∴ cot. a sin. b − cos. C cos. b = sin. C cot. A.




The figure shows the astronomical triangle PZX with the four adjacent parts PX, P, PZ and Z representing, in that order, polar distance, hour angle, co-latitude and azimuth.

Applying the above formula to this particular case, we have:—

cot. PX sin. PZ − cos. P. cos. PZ = P. cot. Z.
Dividing by sin. P. sin. PZ, this becomes—

$$\frac{\text{cot. PX.}}{\text{sin. P}} \cdot \frac{\text{sin. PZ}}{\text{sin. PZ}} - \frac{\text{cos. P}}{\text{sin. P}} \cdot \frac{\text{cos. PZ}}{\text{sin. PZ}} = \frac{\text{sin. P}}{\text{sin. P}} \cdot \frac{\text{cot. Z}}{\text{sin. PZ}}$$

i.e. cot. PX cosec. P − cot. P cot. PZ = cot. Z cosec. PZ,
or tan. decl. cosec. H.A. − cot. H.A. tan. lat.
= cot. azi. sec. lat.

In the tables:—

cot. H.A. tan. lat. is tabulated as A, and tan. decl. cosec. H. A. is tabulated as B.
Hence (A ± B) cos. lat. = cot. azimuth.

(A ± B), referred to for convenience as 'C', forms the primary argument in Table C with lat. as the secondary argument. With these two arguments the azimuth is found.

As an example, consider the case where hour angle = 48°, lat. = 52° N., and decl. = 15° N.

| | | | | | |
|---|---|---|---|---|---|
| lat. | 52° 00′ N | L. tan. | 0·10719 | | |
| H.A. | 48° 00′ | L. cot. | 9.95444 | L. cosec. | 0·12893 |
| decl. | 15° 00′ N | + ..... | | + L. tan. | 9·42805 |
| | | Log. A | 0·06163 | Log. B | 9·55698 |
| | | ∴A = | 1·153 S. | B = | 0·361 N. |

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PAGE 395 (page 394-395)

(A is named opposite to lat.; B has the same name as decl.) (A ± B) = 'C' = 0·792 S. (Same name as A which is numerically greater than B.).

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| | | | |
|---|---|---|---|
| 'C' | 0·792 S. | Log. | 9·89873 |
| lat. | 52° 00′ N. | L. cos. | 9·78934 |
| Azi. | 64° 00′ | L. cot. | 9·68807 |

HA < 180°

If HA is between 0° and 180° — W

∴ Azimuth = S. 64° W. or 244°.

(The azimuth takes the names of the 'C' factor and hour angle.) (page 394-395)

Reference to the tables will show that for the above data A = 1·15 S. and B = 0·36 N. The combination of these is 0·79 S., which in Table C with lat. 52° gives azimuth S. 64°·2 W.

The rules for naming and combining A and B and for naming the azimuth are given on each page of the appropriate table. It is important that they should be applied correctly.

*Longitude Correction*

The quantity (A ± B) or 'C', besides being one of the arguments for finding the azimuth from table C, is also the 'longitude correction factor' or the error in longitude due to an error of 1′ of latitude. This can often be very useful to those accustomed to working sights by the longitude method.

A simple sketch showing the direction of the position line will at once make it clear which way the longitude correction should be applied. It will easily be apparent that when working a sight by the longitude method:—

(a) when the position line lies N.E./S.W. (body in N.W. or S.E. quadrant), if the assumed latitude is too far north the computed longitude will be too far east, and if the latitude is too far south the longitude will be too far west;

(b) when the position line lies N.W./S.E. (body in N.E. or S.W. quadrant) the reverse holds good.

*Example:* Suppose a sight worked with lat. 49° 06′ N. gives longitude 179° 46′·0 W. and azimuth S. 70°·5 E., the value of 'C' being 0·54. If the correct latitude turned out to be 49° 46′ N., i.e. 40′ error, the error in longitude would be 40 x 0′·54 or 21′·6. We should therefore have:—

| | |
|---|---|
| Computed long. | 179° 46′·0 W. |
| Correction | 21′·6 E. |
| Correct long. | 179° 24′·4 W. |

This is a case where the latitude being too far south, the computed longitude is too far west.

*Examples on the use of the tables*

In each of the following cases find the longitude correction factor and the true azimuth.

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*Example* 1: H.A. 310°, lat. 48° N., decl. 20° N.

From Table A with H.A. 310°, lat. 48° N., A = 0·93 S.
From Table B with H.A. 310°, decl. 20° N., B = 0·48 N.

Long. corr'n. factor = A − B = C = 0·45 S.

From Table C with C 0·45 S., lat. 48° N., T. Azi. = S. 73°·2 E.

A is named S. opposite to lat. because H.A. is *not* between 90° and 270°.
B is named N. because the decl. is N.
C = A − B as A and B have different names, and is named S. as the greater quantity is S.
The azimuth is named S. because C is S., and E. because H.A. is between 180° and 360°.

*Example* 2: H.A. 244°, lat. 41° S., decl. 5° S.

From Table A with H.A. 244°, lat. 41° S., A = 0·42 S.
From Table B with H.A. 244°, decl. 5° S., B = 0·10 S.

Long. corr'n. factor = A + B = C = 0·52 S.

From Table C with C 0·52 S., lat. 41° S., T. Azi. = S. 68°·6 E.

A is named S. same as lat. because H.A. is between 90° and 270°.
B is named S. because the decl. is S.
C = A + B as A and B have the same name (both S.).
The azimuth is named S. because C is S., and E. because H.A. is between 180° and 360°.

*Example* 3: H.A. 108°, lat. 61° N., decl. 20° N.

From Supplementary Table A with H.A. 108°, lat. 61° N., A = 0·59 N.
From Table B with H.A. 108°, decl. 20° N., B = 0·38 N.

Long. corr'n. factor = A + B = C = 0·97 N.

From Table C with C 0·97 N., lat. 61° N., T. Azi. = N. 64°·8 W.

A is named N. same as lat. because H.A. is between 90° and 270°.
B is named N. because the decl. is N.
C = A + B as A and B have the same name (both N.).
The azimuth is named N. because C is N., and W. because H.A. is between 0° and 180°.

*Use of ABC Tables for Great Circle Sailing*

These tables provide a ready means of finding the initial great circle course from one point to another. Suppose, for example, the initial course from P (49° 30′ N., 5° 00′ W.) to Q (46° 00′ N., 53° 00′ W.) is required. The procedure is simply to treat d. long. as hour angle, lat. of P. as latitude, and lat. of Q as declination. Thus:—

From Table A with H.A. 48°, lat. 49° 30′ N., A = 1·06 S.
From Table B with H.A. 48°, decl. 46° 00′ N., B = 1·39 N.

A − B = C = 0·33 N.

From Table C with C 0·33 N., lat. 49° 30′ N., T. Azi. = N. 77°·9 W.
i.e. Initial G.C. Course = N. 77°·9 W. or 282°·1.

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The final course, if required, may be obtained in a similar way by finding the initial course from Q to P and reversing it.

# AMPLITUDES and CORRECTIONS

*(Explanation with Table)*
*(Pages 429 - 431)*

## EX-MERIDIAN TABLE I

*(Pages 432 - 443)*

'A' is the change in the altitude of a body in seconds of arc during the minute of time immediately preceding or following meridian passage. It is tabulated for latitudes to 83° and declinations to 63°.

This table is in two sections:–

(i) Latitude and Declination SAME NAME. On page 432 - 435 there are bands in which the value of 'A' is omitted. This is because 'A' changes too rapidly for accurate interpolation to be possible, when the body is near the zenith.

(ii) Latitude and Declination DIFFERENT NAME. 'A' for Lower Transit observation is tabulated on the lower parts of pages 440 - 442 of this section and on page 443, although the latitude and declination are of the same name.

'A' is computed using the formula:–

$$A = \frac{1.9635 \times \cos \text{lat} \times \cos \text{dec}}{\sin (\text{lat} \pm \text{dec})}$$

In the denominator the latitude and declination are:–

(a) subtracted at Upper Transit if of the same name;
(b) added at Upper Transit if of different name;
(c) subtracted at Lower Transit.

## EX-MERIDIAN TABLE II

*(Pages 444 - 447)*

The Reduction is the product of 'A' from Table I and the square of the time in minutes that the body is East or West of the meridian. To obtain the True Meridian Altitude, the Reduction is added to the True Altitude of Upper Transit observations and subtracted from the True Altitude of Lower Transit observations of circumpolar bodies.

The table is entered with 'A' and the Local Hour Angle for Upper Transit observations or 'A' and (180 ~ LHA) for Lower Transit observations. If the interpolated value of 'A' from Table I is to one or two decimal places, the Reduction can be obtained to a corresponding accuracy by moving the decimal point the appropriate number of places as shown in the example below:

'A' = 2.45 ; Local Hour Angle = 354° 00′
From the column headed 354° 00′:–
Reduction for 2.0 = 19.2
0.4 = 3.84 (extract the value for 4″ and move the decimal point one place)
0.05 = 0.48 (extract the value for 5″ and move the decimal point two places)
Reduction for 2.45 = 23.52

*Example* 1: In D.R. Lat. 48° 13′ N., D.R. Long. 7° 20′ W., the True Altitude of the sun was 19° 52′. Sun's LHA 356° 00′. Declination 21° 39′ S. Determine the Position Line.

| *Table I* (Different Name) | *Table II* | | | |
|---|---|---|---|---|
| | LHA | 356° 00′ | T. Alt. | 19° 52′·0 S. |
| | | | Reduction | 5′·6 |
| Lat. 48° 13′ N. | | A = 1″·3 | T. Mer. Alt. | 19° 57′·6 S. |
| Decl. 21° 39′ S. | Red for. | 1″·0 = 4′·3 | T. Mer. Z. Dist. | 70° 02′·4 N. |
| A = 1″·3 | " " | ·3 = 1′·3 | Decl. | 21° 39′·0 S. |
| | | Reduction = 5′·6 | Lat. | 48° 23′·4 N. |
| | | | True Azimuth from Az. Tables | 176° |

(page 439) PAGE 439

PAGE 444 (page 444)

Position Line passes 086° and 266° through Lat. 48° 23′·4 N., Long. 7° 20′ W.

*Example* 2: D.R. Lat. 42° 12′ N., D.R. Long. 24° 32′ W., the True Altitude of Antares was 21° 28′. Star's LHA 357° 00′. Declination 26° 18′ ·0 S. Determine the Position Line.

| *Table I* (Different Name) | *Table II* | | | |
|---|---|---|---|---|
| | LHA | 357° 00′ | T. Alt. | 21° 28′·0 S. |
| | | A = 1″·4 | Reduction | 3′·4 |
| Lat. 42° 12′ N. | Red. for | 1″·0 = 2′·4 | T. Mer. Alt. | 21° 31′·4 S. |
| Decl. 26° 18′ S. | " " | ·4 = 0′·96 | T. Mer. Z. Dist. | 68° 28′·6 N. |
| A = 1″·4 | | Reduction = 3′·36 | Decl. | 26° 18′·0 S. |
| | | | Lat. | 42° 10′·6 N. |
| | | | True Azimuth from Az. Tables | 177° |

Position Line passes 087° and 267° through Lat. 42° 10′·6 N. Long. 24° 32′ W.

Although the latitude and declination of a circumpolar body are always of the same name, 'A' for Lower Transit observations is tabulated in the lower part of the "Latitude and Declination Different Name" section of Table 1.

When near its Lower Transit the Local Hour Angle is less than 180° when west of the meridian and more than 180° when east of it. The Hour Angle to use when entering Table II in this case is (180°~ LHA).

*Example* 3: D.R. Lat. 42° 10′ N., Long. 21° 30′ W., the True Altitude of Dubhe was 14° 20′. Star's LHA 176° 30′. Declination 62° 01′ N. Determine the Position Line.

| *Table I* (Same Name) | *Table II* | | | |
|---|---|---|---|---|
| | LHA | 176° 30′ | T. Alt. | 14° 20′·0 |
| | | = 3° 30′ | Reduction | −2′·3 |
| Lat. 42° 10′ N. | | A = 0″·7 | T. Mer. Alt. | 14° 17′·7 |
| Decl. 62° 01′ N. | Reduction | = 2′·29 | Polar Dist. | 27° 59′·0 |
| A = 0″·7 | For Lower Transit | −2′·3 | Lat. | 42° 16′·7 N. |
| | | | True Azimuth from Az. Tables | 358° |

Position Line passes 088° and 268° through Lat. 42° 16′·7 N., Long. 21° 30′ W.

*Example* 4: D.R. Lat. 50° 02′ S., D.R. Long. 67° 20′ W., the True Altitude of Achernar was 17° 20′. Star's LHA 184° 20′. Declination 57° 29′ S. Determine the Position Line.

| *Table I* (Same Name) | *Table II* | | | |
|---|---|---|---|---|
| | LHA | 184° 20′ | T. Alt. | 17° 20′·0 |
| | | = 4° 20′ | Reduction | −3′·5 |
| Lat. 50° 02′ S. | | A = 0″·7 | T. Mer. Alt. | 17° 16′·5 |
| | Reduction | = 3′·5 | Polar Dist. | 32° 31′·0 |
| Decl. 57° 29′ S. | For Lower Transit | −3′·5 | | |
| A = 0″·7 | | | Lat. | 49° 47′·5 S. |
| | | | True Azimuth from Az. Tables | 177·5° |

Position Line passes 087°·5 and 267°·5 through 49° 47′·5 S., Long. 67° 20′ W.

## EX-MERIDIAN TABLE III

*(Page 448)*

This Table contains a Second Correction, which, when the amount of the Main Correction is considerable, enables the process of Reduction to Meridian to be applied with advantage on much larger hour angles than could otherwise be the case.

*Example:* D.R. Lat. 31° 00′ N., D.R. Long. 124° 00′ W., the True Altitude of the Sun was 55° 01′. Sun's LHA 347° 30′. Declination 2° 00′ S. Determine the Position Line.

| *Table I* (Different Name) | *Table II* | | | |
|---|---|---|---|---|
| | LHA | 347° 30′ | T. Alt. | 55° 01′·0 S. |
| | | A = 3″·1 | 1st Correction | 2° 09′·2 + |
| Lat. 31° 00′ N. | Red. for | 3″·0 = 125′·0 | 2nd Correction | 3′·6 − |
| Decl. 2° 00′ S. | ,, ,, | ·1 = 4′·2 | | |
| A = 3″·1 | | | T. Mer. Alt. | 57° 06′·6 S. |
| | 1st Correction | = 129′·2 | T. Mer. Z. Dist. | 32° 53′·4 N. |
| | | | Decl. | 2° 00′·0 S. |
| Entering Table III with 129′ as First Correction and 56° as Altitude we have 3·6′ Subtractive for Second Correction. | | | Lat. | 30° 53′·4 N. |
| | | | True Azimuth from Az. Tables | 158° |

Position Line passes 068° and 248° through Lat. 30° 53′·4 N., Long. 124° 00′ W.

## EX-MERIDIAN TABLE IV

*(Page 448)*

This Table gives the limits of Hour Angle or Time before or after the time of the Meridian Passage when an Ex-Meridian observation can be taken. When the observation is taken within the time limit prescribed by this Table the Second Correction from Table III is negligible. The Table is entered with 'A' taken from Table I,

Given Lat. 37° N., Declination 18° N., find the limits of Hour Angle for taking an Ex-Meridian observation.

For Lat. 37° and Declination 18°, 'Same Name', Table I gives 4″·6 for 'A'. Entering Table IV with 4″·6 as 'A', the time limit abreast is found to be 24 minutes.

## CHANGE of HOUR ANGLE with ALTITUDE

*(Pages 449 - 450)*

**PAGE 448**

The formula used in calculating the values tabulated is:—

Change of H.A. (in mins.) due to 1′ change of Alt. = cosec. Az. sec. Lat.

The table gives in minutes of arc the error in hour angle resulting from an altitude 1′ in error. This is of particular value to those navigators who work their sights by the 'Longitude by Chronometer' method. It will be seen that the error is least in the case of a body on the prime vertical and that it increases as the azimuth decreases—very rapidly as the azimuth becomes very small. From the table the observer can readily find the least azimuth on which the altitude of a body should be observed in order that the resulting longitude may not exceed a chosen limit of error. Another use to which this table can be put is to find the correct longitude when a sight has been worked using an altitude in error by a known amount.

*Example* 1: In latitude 18° what should be the lowest value of azimuth in order that an error of 1′ in the altitude may not produce more than 2′ of error in the computed longitude?

Under lat. 18° and against azi. 32°, the error for 1′ of alt. is found to be 1′·98. Accordingly, the observation should be taken on a bearing greater than 32°.

(In lat. 36°, it will be seen, an azimuth of about 39° would constitute the limit. In lat. 63° the error would exceed 2′ even when the body was on the P.V.)

*Example* 2: A sight worked in lat. 54° by the 'Longitude Method' resulted in a deducted longitude of 64° 14′·5 W. and azimuth N. 65° E. Afterwards it was discovered that the sextant index error of 2′ 30″ off the arc had been applied the wrong way. Find the correct longitude.

Since the longitude is found by comparing the L.H.A. of the body with its G.H.A., it is evident that the error in the L.H.A. will be the error in the computed longitude. The index error of 2′·5, which should have been added, was subtracted, so that the altitude used was 5′ too small.

The table shows that in lat. 54°, when the azi. is 65°, the error in H.A. is 1′·88 per 1′ of alt. For 5′, therefore, the error will be 5 × 1′·88 = 9′·40.

As the real altitude was greater than the value used, the observer must be *nearer* to the body than his computed longitude would lead him to suppose. With an *easterly* azimuth this means that the *Westerly* L.H.A. should be greater, and therefore the observer's west longitude should be smaller. Hence:—

| | | |
|---|---|---|
| Computed long. ..... | 64° | 14′·5W. |
| Error ..... | | 9′·4 to subtract |
| Correct long. ..... | 64° | 05′·1W |

It will be appreciated that this is much quicker than re-working the sight.

## CHANGE OF ALTITUDE IN ONE MINUTE OF TIME

*(Pages 451 - 452)*



This Table contains the change in the altitude of a celestial body in minutes and tenths of arc in one minute of time. It is useful for finding the correction to be applied to the computed altitude of a heavenly body when the time of observation differs from that used in the computation of the altitude. When the star is East of the Meridian the correction from the Table is subtractive from the computed altitude if the time of observation is earlier than that used in the computation of the

altitude; it is additive if the time of observation is later. When the star is West of the meridian the correction is additive if the time of observation is before that used when computing the altitude, it is subtractive if the time of observation is after.

*Formula*

Change of altitude in one minute of time = 15′ Sin. Az. Cos. Lat.

The change in 6 seconds of time is found by shifting the decimal point one place to the left.

The change in 1 second of time is found by calling the quantities in the Table seconds instead of minutes.

*Example:* In Lat. 51° 30′ N. on the Meridian of Greenwich on October 26th, 1925 at 8 h. 0 m. p.m. the computed altitude of the star *Altair* was 37° 09′·2. Find the true altitude at 8 h. 10 m. p.m., the Az. being S.49° 37′ W. Opposite 52° in the Lat. Col. and under 50° in the Az. Col. is 7′·1 of arc which is the change of altitude in 1 min. of time, and 7′·1 × 10 minutes gives 71′ or 1° 11′, which is the correction to apply to the computed altitude.

(page 452)

| | | |
|---|---|---|
| Computed Alt. ..... | 37° | 09′·2 |
| Corr. to Subt. ..... | 1° | 11′·0 |
| True Alt. required ..... | 35° | 58′·2 |

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## DIP of the SEA HORIZON

(Page 453)

The tabulated values are derived from the formula—Dip (in minutes) = $1{\cdot}76\sqrt{h}$ where h = height of eye in metres. Thus, for example, when h = 30 m (98 ft), dip. = 9′·6.

Heights of eye are given in metres, ranging from 0·5 m to 50·0 m and also in the equivalent feet (1·5 ft to 164 ft).

## MONTHLY MEAN OF THE SUN'S SEMIDIAMETER AND SUN'S PARALLAX IN ALTITUDE

(Page 453)

Correction for parallax is to be taken out opposite the Sun's Altitude and is always *additive*.

*Example:* The sun's parallax corresponding to 51° of altitude is 0′·1.

## AUGMENTATION OF THE MOON'S SEMIDIAMETER

(Page 453)

## REDUCTION OF THE MOON'S PARALLAX

(Page 453)

## MEAN REFRACTION

*(Page 454)*

This table contains the Refraction of the heavenly bodies, in minutes and decimals at a mean state of the atmosphere, and corresponding to their apparent altitudes. This correction is always to be *subtracted* from the apparent altitude of the object.

*Example:* The mean refraction for the apparent altitude 10° 50′, is 4·′9.

*Caution:* For low altitudes all refraction tables are more or less inaccurate.

## ADDITIONAL REFRACTION CORRECTIONS

*(Page 454)*

The mean refraction values given in the Mean Refraction table are for an atmospheric pressure of 1,000 mb (29·5 in) and an air temperature of 10°C (50°F). If the atmospheric pressure or temperature differ from these values additional corrections must be applied to the apparent altitude. These corrections are contained in the tables 'Additional Refraction Corrections for Atmospheric Pressure' and 'Additional Refraction Corrections for Air Temperature'

*Example:* Find the true altitude of the sun when the observed altitude of the sun's lower limb was 6° 00′, height of eye 26 m (85 ft), atmospheric pressure 1020 mb (30·1 in), air temperature 0° C (32° F).

| | | |
|---|---|---|
| Observed altitude sun's lower limb | = | 6° 00′ |
| Total correction | = | 0°—01·5′ |
| True altitude | = | 5° 58·5′ |
| Correction for temperature | = | —0·4′ |
| Correction for pressure | = | —0·2′ |
| Corrected altitude | = | 5° 57·9′ |

If the altitude is greater than 5° 00′ the error due to applying these corrections to the true altitude can be ignored in practice.

N.B.—To convert barometer readings from mercury inches to millibars, or vice-versa, see page 499. To convert temperatures from Fahrenheit to Celsius, or vice-versa, see page 494 .

The adjustment of mean refraction as shown above is important only when the altitude is small. It should be borne in mind that on account of uncertain refraction position lines obtained from sights taken when the altitude of the body is less than 10° or so should not be relied upon implicitly. Moreover, due to the effect of atmospheric refraction on dip it is unwise to place too much reliance on sights taken, whatever the altitude, when there is cause for abnormal refraction to be suspected.

# CORRECTION of MOON'S MERIDIAN PASSAGE

*(Page 455)*

The correction obtained from this table is to be applied to the time of meridian passage given in the Nautical Almanac (i.e. the time of transit at Greenwich) in order to find the time of the local transit according to the observer's longitude.

$$\text{Correction} = \frac{D \times \text{longitude}}{360}$$ where D is the difference between the times of successive transits.

When the observer is in *East* longitude, D is the difference between the time of transit on the day of observation and the time of transit on the *preceding* day. When in *West* longitude it is the difference between the times on the day of observation and the *following* day.

*Example:* From Naut. Alm. L.M.T. of moon's upper transit at Greenwich is:—

| | h. | m. | |
|---|---|---|---|
| 1st July | 18 | 44 | |
| | | | diff. 48m. |
| 2nd July | 19 | 32 | |
| | | | diff. 53m. |
| 3rd July | 20 | 25 | |

Find G.M.T. of moon's upper transit on 2nd July (a) in longitude 156° E., (b) in longitude 63° W.

| | | July | h. | m. |
|---|---|---|---|---|
| (a) | L.M.T. of transit at Greenwich | 2 | 19 | 32 |
| | Corr'n. for D 48m., long. 156° E. | | | −20·8 |
| | L.M.T. of local transit | 2 | 19 | 11·2 |
| | East longitude in time units | | −10 | 24 |
| | G.M.T. of local transit (156° E.) | 2 | 8 | 47·2 |

| | | July | h. | m. |
|---|---|---|---|---|
| (b) | L.M.T. of transit at Greenwich | 2 | 19 | 32 |
| | Corr'n. for D 53m., long. 63° W. | | | +9·2 |
| | L.M.T. of local transit | 2 | 19 | 41·2 |
| | West longitude in time units | | +4 | 12 |
| | G.M.T. of local transit (63° W.) | 2 | 23 | 53·2 |

## SUN'S TOTAL CORRECTION

*(Pages 456–461 and Inside Front Cover)*

This is a combined table for the correction of both Lower Limb and Upper Limb altitudes of the Sun. To simplify interpolation for intermediate altitudes and heights of eye, the tabulation is based on columnar and linear correction differences of 0.2.

The corrections in the main table give the combined effect of dip, refraction, parallax in altitude and an assumed semi-diameter of 16.0. Subsidiary corrections at the foot of the table give the monthly variations of the semi-diameter from the assumed value of 16.0. The corrections and subsidiary corrections are added to or subtracted from the observed altitude as show in the table.

| *Example 1* | | | *Example 2* | | |
|---|---|---|---|---|---|
| Obs. Alt. Sun's L.L. | = | 24 57.2 | Obs. Alt. Sun's U.L. | = | 33 45.6 |
| Corrn. for obs. alt. 25 and H.E. 12.0m | = | + 8.0 | Corrn. for obs. alt. 34 and H.E. 19.7m | = | − 24.7 |
| | | + 0.1 | Subsidiary corrn. for June | = | + 0.2 |
| True Alt. of Sun's centre | = | 25 05.3 | True Alt. of Sun's centre | = | 33 20.7 |

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## STAR'S TOTAL CORRECTION

*(Pages 462–465 and Inside Back Cover)*

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This table corrects the combined effects of dip and refraction. To simplify interpolation for intermediate altitudes and heights of eye, the table is based on columnar and linear correction differences of 0′.2.

This table can also be used for the correction of observed altitudes of the planets, but in the case of Venus and Mars the small additional correction given in the Nautical Almanac for parallax and phase may be necessary. The size of these corrections vary with the date and the altitude of the planet.

## MOON'S TOTAL CORRECTION

*(Lower Limb – pages 466–478; Upper Limb – pages 479–491)*

This table corrects the combined effects of dip, atmospheric refraction, augmented semi-diameter and parallax in altitude. The dip component used in the main table is a constant 12′.3, therefore the subsidiary correction given at the foot of the pages must be added to the main correction. The argument for this subsidiary correction is the observer's height of eye.

No account has been taken of the reduction with latitude of the moon's horizontal parallax, but in general this is of no practical significance. In cases where a high degree of accuracy is required it will be necessary to apply the corrections separately together with the adjustment of the refraction correction for the prevailing atmospheric pressure and temperature.

The main corrections are ALWAYS added to both the lower limb and upper limb observed altitudes of the moon, the dip correction is then added and for upper limb observations 30′ must be subtracted from the result.



| Example 1 | | Example 2 | |
|---|---|---|---|
| Moon's Hor. Pax. (from N. Alm.) = 57′.5 | | Moon's Hor. Pax. (from N. Alm.) = 59′.0 | |
| Obs. Alt. moon's lower limb | = 38°47′.4 | Obs. Alt. moon's upper limb | = 69°36′.0 |
| Correction from main table | = + 47′.1 | Correction from main table | = + 22′.0 |
| Correction for height of eye 13.5m | = + 5′.8 | Correction for height of eye 33m | = + 2′.2 |
| True altitude of moon | = 39°40′.3 | | 70°00′.2 |
| | | | − 30′ |
| | | True altitude of moon | = 69°30′.2 |

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# III. TABLES FOR COASTAL NAVIGATION

## DAY'S RUN - AVERAGE SPEED TABLE

*(Pages 494–500)*

This table provides a rapid means of finding the average speed directly from the arguments 'steaming time' and 'distance run'. It will be appreciated that there is no necessity to convert minutes into decimals of a day, and that no logarithms or co-logarithms are required. Simple addition is all that is needed.

The scope of the table has been made wide enough to cover cases of high speed vessels (up to 40 knots or so) on easterly or westerly courses in high latitudes where change of longitude between one local noon and the next may amount to some 30°, or 2 hours of time.

Distances are tabulated as multiples of 100 miles. Increments of speed for multiples of 10 miles and multiples of 1 mile are obtained simply by shifting the decimal point one or two places to the left, respectively.

*Example:* Given steaming time 23 h. 29 m., distance 582 miles, find the average speed.

| Distance in miles | Speed in knots |
|---|---|
| 500 | 21·291 |
| 80* | 3·4066 |
| 2† | 0·08517 |
| 582 | 24·78277 |

That is, average speed correct to two places of decimals, which are generally considered sufficient, is 24·78 knots.

* Enter with 800 miles and shift decimal point 1 place to the left
† Enter with 200 miles and shift decimal point 2 places to the left

## RADAR RANGE TABLE

*(Page 501)*

## RADAR PLOTTER'S SPEED AND DISTANCE TABLE

*(Page 502)*

## MEASURED MILE SPEED TABLE

*(Pages 503–509)*

This table is arranged in 'critical table' form and gives speeds correct to the nearest hundredth of a knot without interpolation. If the time argument is an exact tabulated value, the speed immediately above it should be taken.

1. If the time recorded for the measured mile is 9 m. 16·2 s., the speed is 6·47 knots.
2. If the time is 4 m. 55·3 s., the speed is 12·19 knots.
3. If the time is 3 m. 52·3 s., the speed is 15·49 knots.
4. Suppose a ship on trials makes six runs over a measured mile, three against the tide and three with the tide, such that the timings by stop-watch are as follows:—

| | m. | s. |
|---|---|---|
| First run against tide | 3 | 28·8 |
| First run with tide | 3 | 18·4 |
| Second run against tide | 3 | 30·0 |
| Second run with tide | 3 | 17·8 |
| Third run against tide | 3 | 31·1 |
| Third run with tide | 3 | 16·7 |
| Then total time for 6 miles is | 20 | 22·8 |
| ∴Average time for 1 mile is | 3 | 23·8 |

*From the table the average speed for the six runs is* 17·66 *knots.*

Strictly speaking, the average speed should be computed by finding the 'mean of means', in which case the work would be arranged as follows.

| RUN | m. | s. | SPEED KNOTS | 1ST MEAN | 2ND MEAN | 3RD MEAN | 4TH MEAN | MEAN OF MEANS |
|---|---|---|---|---|---|---|---|---|
| 1st | 3 | 28·8 | 17·24 | | | | | |
| | | | | 17·690 | | | | |
| 2nd | 3 | 18·4 | 18·14 | | 17·6650 | | | |
| | | | | 17·640 | | 17·66000 | | |
| 3rd | 3 | 30·0 | 17·14 | | 17·6550 | | 17·655625 | |
| | | | | 17·670 | | 17·65125 | | 17·6528125 |
| 4th | 3 | 17·8 | 18·20 | | 17·6475 | | 17·650000 | |
| | | | | 17·625 | | 17·64875 | | |
| 5th | 3 | 31·1 | 17·05 | | 17·6500 | | | |
| | | | | 17·675 | | | | |
| 6th | 3 | 16·7 | 18·30 | | | | | |
| | | | 6) 106·07 | | 4) 70·6175 | | | |
| | | | 17·68 | | 17·6544 | | | |
| | | | *Ordinary mean speed* | | *Ordinary mean of second means** | | | *True mean speed* |

At speeds greater than about 19½ knots it will be noticed that in certain cases a change of a tenth of a second in the time will make a difference of more than one hundredth of a knot in the tabulated speed. For example, if the time for one mile is between 2 m. 38·7 s. and 2 m. 38·8 s. the speed, correct to two places of decimals, could be either 22·68 or 22·67 knots.

In very high speed vessels the recorded time for a measured mile may be so small as to be beyond the scope of the table. Even so, a reasonably accurate speed is easily obtained by entering the table with double the recorded time, and then doubling the speed so obtained. For instance, if a mile is run in 1 m. 55·2 s., enter with 3 m. 50·4 s. This gives 15·62 knots which is half the required speed of 31·24 knots (and this will be correct within 0·02 of a knot). By calculation the correct speed is actually 31·250 knots.

* This is usually regarded as being sufficiently accurate

Besides its orthodox use for speed trial purposes, the table will be found useful to navigators for other purposes.

For example, suppose it is decided to alter course after the ship has run 6 miles on a certain heading from a position line obtained at 1432, the speed of the ship being 11·75 knots. The table shows that at this speed the ship will run one mile in a little over 5 m. 6 s., or 6 miles in about 30½ minutes. Therefore, the course should be altered at 1502½.

In certain circumstances it might be considered convenient to plot the radar target of another vessel at regular intervals corresponding to one mile runs of one's own vessel. Suppose the speed to be 9·70 knots, which the table shows to correspond to a mile in about 6 m. 11 s. Then, if the stop-watch is started from zero at the time of the first observation, successive observations should be taken as nearly as practicable when the watch shows 6 m. 11 s., 12 m. 22 s., 18 m. 33s., 24 m. 44 s., and so on.

## DISTANCE BY VERTICAL ANGLE

*(Pages 510–515)*

This table gives the distance of an observer from objects of known height when the angle between base and the summit is known. The tables are for distances up to 7 miles so that the whole object from base to summit will be in view when the height of eye is more than 12 metres (39 feet) Observers whose height of eye is less than this must apply a correction for Dip if their distance from the object exceeds the distance of the sea horizon given for their height of eye in the table Distance of the Sea Horizon (page 486).

The distances given are from the position of the observer to a point at the base vertically below the summit, and it is to this point that the angle should be measured. In places where there is a big rise and fall of tide it would be necessary to make an allowance for the state of the tide, as heights are always given above Mean High Water Springs or Mean Higher High Water. In the case of light-vessels there is no allowance for the state of the tide, as the water plane is always at the same distance with reference to any part of the vessel.

*To find the Distance*

Measure the angle from summit to base and note the angle; then under the given height find the observed angle, and opposite the angle will be found the distance off in Miles in the *left* hand column.

*Example:* The vertical angle between the base and summit of a light-house situated 61 m (200 feet) above sea level was 0° 57′. Required the distance.

Under 61 m (200 ft) and opposite the given angle is 2·0 miles, the distance. (page 512)

*To find the Angle to place on the Sextant to pass at a given distance from a Point of Known Height*

Opposite the given distance and under the known height will be found the required angle to place on the sextant.

*Example:* Wishing to pass a point situated 150 m (492 ft) above sea level at a distance of 4 miles, required the angle to place on the sextant.

Opposite 4 miles in the distance column at the *side*, and under 150 m (492 ft) at the *top*, is 1° 10′, the angle required to place on the sextant.

## EXTREME RANGE TABLE

*(Pages 516–517)*

This table has been compiled for the purpose of determining the maximum distance at which an object may be seen at sea according to its elevation and that of the observer's eye. Heights are given in metres with their equivalents in feet.

The arguments with which the table is ordinarily entered are the height of the observer's eye and the height of the distant object which last, however, need not be a terrestrial one but may be the masthead of a vessel, or some other easily defined detail thereof, provided always that the height of the feature or object observed be definitely known. The arguments, too, can be made interchangeable, thus, should the lookout, stationed at the masthead at an elevation exceeding 30 metres observe a low-lying rock having a height of less than that amount, then the terms can be substituted for each other and the 'Height of Eye' can be sought in the 'Height of Object' column, and vice versa.

The tables are computed on the basis of normal atmospheric conditions, refraction and visibility, and, in the case of lights, the quantity taken out as 'Extreme Range' presupposes that the light possesses sufficient power to be discernible at such a distance. It must be remembered also that the heights of lights and shore objects are referred to Mean High Water Springs or Mean Higher Water therefore due allowance should be made when the time of observation does not approximate thereto, particularly if the elevation or distance should be small.

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*Example* 1: At what distance will a tower 60 m (197 ft) high be visible to an observer whose eye is elevated 20 m (66 ft) above the water?

Take 60 m (197 ft) as the 'Height of Object' in the marginal column and in the column under 20 m (66 ft) 'Height of Eye', at the top of the page, will be found the 25·6 miles distance.

*Example* 2: The officer of the watch, whose eye is elevated 16 m (52 ft) above the water, observes a shore light, with an elevation of 45 m (148 ft), just dipping. At what distance is the ship from the light?

In the column headed 16 m (52 ft) 'Height of Eye' and abreast of 45 m (148 ft) 'Height of Object' will be found the distance 22·4 miles.

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## DISTANCE of the SEA HORIZON

*(Page 518)*

The tabulations are derived from the formula—Distance of the sea horizon in nautical miles = $2{\cdot}095\ \sqrt{h}$, where h = height of eye in metres. Thus for example, when h = 50 m (164 ft) the distance of the sea horizon is 14·8 n. miles.

The following examples show how the table can be used.

*Example* 1: At what distance in good visibility should an observer whose height of eye is 16 m (52 ft) be able to sight a terrestrial object of height 170 m (558 ft)?

| | | |
|---|---|---|
| Distance of horizon for height | 16 m (52 ft) | = 8·4 miles |
| " " | 170 m (558 ft) | = 27·3 miles |
| | Sum | = 35·7 miles |

Hence, the object should be visible at a distance of 35·7 miles.

*Example* 2: The range of visibility of a light is stated on a chart to be 21 M. At what distance from the light will an observer be at the moment when the light has just dipped below the horizon if his height of eye is 50 feet?

| | | |
|---|---|---|
| Charted range, i.e. for 15 feet height of eye ..... | 21 | miles |
| Subtracting distance of horizon for height 15 feet ..... | 4·55 | » |
| Range of light at sea level ..... | 16·45 | » |
| Adding distance of horizon for height 50 feet ..... | 8·30 | » |
| Dipping distance, or maximum range to observer ..... | 24·75 | » |

N.B.—This method is applicable only in the case of a light of adequate power, and the accuracy of the result will probably be affected by the fact that the charted height of a light never includes a fraction of a mile. Abnormal refraction will also affect the accuracy of distances obtained by using this table.

## DIP OF THE SHORE HORIZON

*(Page 519)*

When the part of the horizon immediately under the sun is obstructed by land and the observer is near the shore the Dip for an observed altitude will be greater than that shown in the Dip of the Sea Horizon table. When correcting the altitude the dip should be taken from this table when obtaining the apparent altitude.

*Example:* The observed altitude of the sun's lower limb above the shore horizon (distance 1·6 miles) was 22° 30′, Height of Eye 12 m (39 ft).

| | | | |
|---|---|---|---|
| Observed altitude ..... | = | 22° 30′ | |
| Dip of Shore Horizon .... | = | −14·7′ | (H.E. = 12 m, distance = 1·6 miles) |
| ∴Apparent altitude ..... | = | 22° 15·3′ | |

If the refraction is believed to be abnormal the table should be used with caution.

The table can also be used to obtain the approximate range of a ship by measuring the angle between the ship's waterline and the sea horizon.

*Example:* The sextant angle between a ship's waterline and the sea horizon is 5·0′. Height of Eye = 25 m (82 ft).

| | | | |
|---|---|---|---|
| From dip of sea horizon table. | Dip ..... | = | 8·8′ |
| | Observed angle ..... | = | 5·0′ |
| ∴Dip of the ship's waterline ..... | | = | 14·8 |
| ∴From the dip of the shore horizon table, Range ..... | | = | 3·5 miles |

## CORRECTION REQUIRED TO CONVERT A RADIO GREAT CIRCLE BEARING TO MERCATORIAL BEARING

*(Page 520)*

# IV. PHYSICAL AND CONVERSION TABLES

## TO CONVERT ARC TO TIME AND TIME TO ARC

*(Pages 522–523)*

## HOURS AND MINUTES TO DECIMAL OF A DAY

*(Page 524)*

## ATMOSPHERIC PRESSURE CONVERSION TABLE

*(Page 525)*

## °FAHRENHEIT - °CELSIUS - °FAHRENHEIT

*(Page 526)*

## SI - BRITISH UNITS

*(Pages 527–528)*

## BRITISH GALLONS - U.S. GALLONS - LITRES

*(Pages 529–531)*

## NAUTICAL MILES, STATUTE MILES, KILOMETRES

*(Pages 532–534)*

## FATHOMS - METRES - FATHOMS

*(Page 535)*

## DECIMAL FRACTIONS OF A DEGREE

*(Page 536 and Inside Back Cover)*

# V. PORTS OF THE WORLD

## PORTS OF THE WORLD. LATITUDES AND LONGITUDES

*(Pages 538–595)*

This section is an alphabetical list of all the ports of the world used by commercial shipping, the positions given to the nearest minute of latitude and longitude being those of the port area, not the centre of the towns or cities. Every effort has been made to ensure that the names and positions given are correct by checking with charts and reliable official sources and publications.

The user should note the following points:-

1 The order of listing is strictly alphabetical and if two or more ports have the same name they are listed in the sub-order of their countries, alphabetically.

2 A port which has several commonly used names or whose name has been changed recently is entered under each name with the alternative names in brackets.

3 Ports whose names consist of two or more words are entered under each word.
e.g. Port Chalmers is entered under P as Port Chalmers and under C as Chalmers, Port.

4 To assist in locating a port its country is given in Anglicised form and where it is considered useful the name of the bay, island, river etc. on which it is sited is given in the form used in its country.

5 Accents and diphthongs have been omitted.

# TRAVERSE TABLE

17 Degrees

343° / 197°

017° / 163°

1h 08m

17°

| D. Lon | Dep. | | D. Lon | Dep. | | D. Lon | Dep. | | D. Lon | Dep. | | D. Lon | Dep. | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Dist. | D. Lat. | Dep. | Dist. | D. Lat. | Dep. | Dist. | D. Lat. | Dep. | Dist. | D. Lat. | Dep. | Dist. | D. Lat. | Dep. |
| 301 | 287·8 | 88·0 | 361 | 345·2 | 105·5 | 421 | 402·6 | 123·1 | 481 | 460·0 | 140·6 | 541 | 517·4 | 158·2 |
| 302 | 288·8 | 88·3 | 362 | 346·2 | 105·8 | 422 | 403·6 | 123·4 | 482 | 460·9 | 140·9 | 542 | 518·3 | 158·5 |
| 303 | 289·8 | 88·6 | 363 | 347·1 | 106·1 | 423 | 404·5 | 123·7 | 483 | 461·9 | 141·2 | 543 | 519·3 | 158·8 |
| 304 | 290·7 | 88·9 | 364 | 348·1 | 106·4 | 424 | 405·5 | 124·0 | 484 | 462·9 | 141·5 | 544 | 520·2 | 159·1 |
| 305 | 291·7 | 89·2 | 365 | 349·1 | 106·7 | 425 | 406·4 | 124·3 | 485 | 463·8 | 141·8 | 545 | 521·2 | 159·3 |
| 306 | 292·6 | 89·5 | 366 | 350·0 | 107·0 | 426 | 407·4 | 124·6 | 486 | 464·8 | 142·1 | 546 | 522·1 | 159·6 |
| 307 | 293·6 | 89·8 | 367 | 351·0 | 107·3 | 427 | 408·3 | 124·8 | 487 | 465·7 | 142·4 | 547 | 523·1 | 159·9 |
| 308 | 294·5 | 90·1 | 368 | 351·9 | 107·6 | 428 | 409·3 | 125·1 | 488 | 466·7 | 142·7 | 548 | 524·1 | 160·2 |
| 309 | 295·5 | 90·3 | 369 | 352·9 | 107·9 | 429 | 410·3 | 125·4 | 489 | 467·6 | 143·0 | 549 | 525·0 | 160·5 |
| 310 | 296·5 | 90·6 | 370 | 353·8 | 108·2 | 430 | 411·2 | 125·7 | 490 | 468·6 | 143·3 | 550 | 526·0 | 160·8 |
| 311 | 297·4 | 90·9 | 371 | 354·8 | 108·5 | 431 | 412·2 | 126·0 | 491 | 469·5 | 143·6 | 551 | 526·9 | 161·1 |
| 312 | 298·4 | 91·2 | 372 | 355·7 | 108·8 | 432 | 413·1 | 126·3 | 492 | 470·5 | 143·8 | 552 | 527·9 | 161·4 |
| 313 | 299·3 | 91·5 | 373 | 356·7 | 109·1 | 433 | 414·1 | 126·6 | 493 | 471·5 | 144·1 | 553 | 528·8 | 161·7 |
| 314 | 300·3 | 91·8 | 374 | 357·7 | 109·3 | 434 | 415·0 | 126·9 | 494 | 472·4 | 144·4 | 554 | 529·8 | 162·0 |
| 315 | 301·2 | 92·1 | 375 | 358·6 | 109·6 | 435 | 416·0 | 127·2 | 495 | 473·4 | 144·7 | 555 | 530·7 | 162·3 |
| 316 | 302·2 | 92·4 | 376 | 359·6 | 109·9 | 436 | 416·9 | 127·5 | 496 | 474·3 | 145·0 | 556 | 531·7 | 162·6 |
| 317 | 303·1 | 92·7 | 377 | 360·5 | 110·2 | 437 | 417·9 | 127·8 | 497 | 475·3 | 145·3 | 557 | 532·7 | 162·9 |
| 318 | 304·1 | 93·0 | 378 | 361·5 | 110·5 | 438 | 418·9 | 128·1 | 498 | 476·2 | 145·6 | 558 | 533·6 | 163·1 |
| 319 | 305·1 | 93·3 | 379 | 362·4 | 110·8 | 439 | 419·8 | 128·4 | 499 | 477·2 | 145·9 | 559 | 534·6 | 163·4 |
| 320 | 306·0 | 93·6 | 380 | 363·4 | 111·1 | 440 | 420·8 | 128·6 | 500 | 478·2 | 146·2 | 560 | 535·5 | 163·7 |
| 321 | 307·0 | 93·9 | 381 | 364·4 | 111·4 | 441 | 421·7 | 128·9 | 501 | 479·1 | 146·5 | 561 | 536·5 | 164·0 |
| 322 | 307·9 | 94·1 | 382 | 365·3 | 111·7 | 442 | 422·7 | 129·2 | 502 | 480·1 | 146·8 | 562 | 537·4 | 164·3 |
| 323 | 308·9 | 94·4 | 383 | 366·3 | 112·0 | 443 | 423·6 | 129·5 | 503 | 481·0 | 147·1 | 563 | 538·4 | 164·6 |
| 324 | 309·8 | 94·7 | 384 | 367·2 | 112·3 | 444 | 424·6 | 129·8 | 504 | 482·0 | 147·4 | 564 | 539·4 | 164·9 |
| 325 | 310·8 | 95·0 | 385 | 368·2 | 112·6 | 445 | 425·6 | 130·1 | 505 | 482·9 | 147·6 | 565 | 540·3 | 165·2 |
| 326 | 311·8 | 95·3 | 386 | 369·1 | 112·9 | 446 | 426·5 | 130·4 | 506 | 483·9 | 147·9 | 566 | 541·3 | 165·5 |
| 327 | 312·7 | 95·6 | 387 | 370·1 | 113·1 | 447 | 427·5 | 130·7 | 507 | 484·8 | 148·2 | 567 | 542·2 | 165·8 |
| 328 | 313·6 | 95·9 | 388 | 371·0 | 113·4 | 448 | 428·4 | 131·0 | 508 | 485·8 | 148·5 | 568 | 543·2 | 166·1 |
| 329 | 314·6 | 96·2 | 389 | 372·0 | 113·7 | 449 | 429·4 | 131·3 | 509 | 486·8 | 148·8 | 569 | 544·1 | 166·4 |
| 330 | 315·5 | 96·5 | 390 | 373·0 | 114·0 | 450 | 430·3 | 131·6 | 510 | 487·7 | 149·1 | 570 | 545·1 | 166·7 |
| 331 | 316·5 | 96·8 | 391 | 373·9 | 114·3 | 451 | 431·3 | 131·9 | 511 | 488·7 | 149·4 | 571 | 546·1 | 166·9 |
| 332 | 317·5 | 97·1 | 392 | 374·9 | 114·6 | 452 | 432·2 | 132·2 | 512 | 489·6 | 149·7 | 572 | 547·0 | 167·2 |
| 333 | 318·4 | 97·4 | 393 | 375·8 | 114·9 | 453 | 433·2 | 132·4 | 513 | 490·6 | 150·0 | 573 | 548·0 | 167·5 |
| 334 | 319·4 | 97·7 | 394 | 376·8 | 115·2 | 454 | 434·2 | 132·7 | 514 | 491·5 | 150·3 | 574 | 548·9 | 167·8 |
| 335 | 320·4 | 97·9 | 395 | 377·7 | 115·5 | 455 | 435·1 | 133·0 | 515 | 492·5 | 150·6 | 575 | 549·9 | 168·1 |
| 336 | 321·3 | 98·2 | 396 | 378·7 | 115·8 | 456 | 436·1 | 133·3 | 516 | 493·5 | 150·9 | 576 | 550·8 | 168·4 |
| 337 | 322·3 | 98·5 | 397 | 379·7 | 116·1 | 457 | 437·0 | 133·6 | 517 | 494·4 | 151·2 | 577 | 551·8 | 168·7 |
| 338 | 323·2 | 98·8 | 398 | 380·6 | 116·4 | 458 | 438·0 | 133·9 | 518 | 495·4 | 151·4 | 578 | 552·7 | 169·0 |
| 339 | 324·2 | 99·1 | 399 | 381·6 | 116·7 | 459 | 438·9 | 134·2 | 519 | 496·3 | 151·7 | 579 | 553·7 | 169·3 |
| 340 | 325·1 | 99·4 | 400 | 382·5 | 116·9 | 460 | 439·9 | 134·5 | 520 | 497·3 | 152·0 | 580 | 554·7 | 169·6 |
| 341 | 326·1 | 99·7 | 401 | 383·5 | 117·2 | 461 | 440·9 | 134·8 | 521 | 498·2 | 152·3 | 581 | 555·6 | 169·9 |
| 342 | 327·1 | 100·0 | 402 | 384·4 | 117·5 | 462 | 441·8 | 135·1 | 522 | 499·2 | 152·6 | 582 | 556·6 | 170·2 |
| 343 | 328·0 | 100·3 | 403 | 385·4 | 117·8 | 463 | 442·8 | 135·4 | 523 | 500·1 | 152·9 | 583 | 557·5 | 170·5 |
| 344 | 329·0 | 100·6 | 404 | 386·3 | 118·1 | 464 | 443·7 | 135·7 | 524 | 501·1 | 153·2 | 584 | 558·5 | 170·7 |
| 345 | 329·9 | 100·9 | 405 | 387·3 | 118·4 | 465 | 444·7 | 136·0 | 525 | 502·1 | 153·5 | 585 | 559·4 | 171·0 |
| 346 | 330·8 | 101·2 | 406 | 388·3 | 118·7 | 466 | 445·6 | 136·2 | 526 | 503·0 | 153·8 | 586 | 560·4 | 171·3 |
| 347 | 331·8 | 101·5 | 407 | 389·2 | 119·0 | 467 | 446·6 | 136·5 | 527 | 504·0 | 154·1 | 587 | 561·4 | 171·6 |
| 348 | 332·8 | 101·7 | 408 | 390·2 | 119·3 | 468 | 447·6 | 136·8 | 528 | 504·9 | 154·4 | 588 | 562·3 | 171·9 |
| 349 | 333·8 | 102·0 | 409 | 391·1 | 119·6 | 469 | 448·5 | 137·1 | 529 | 505·9 | 154·7 | 589 | 563·3 | 172·2 |
| 350 | 334·7 | 102·3 | 410 | 392·1 | 119·9 | 470 | 449·5 | 137·4 | 530 | 506·8 | 155·0 | 590 | 564·2 | 172·5 |
| 351 | 335·7 | 102·6 | 411 | 393·0 | 120·2 | 471 | 450·4 | 137·7 | 531 | 507·8 | 155·2 | 591 | 565·2 | 172·8 |
| 352 | 336·6 | 102·9 | 412 | 394·0 | 120·5 | 472 | 451·4 | 138·0 | 532 | 508·8 | 155·5 | 592 | 566·1 | 173·1 |
| 353 | 337·6 | 103·2 | 413 | 394·9 | 120·7 | 473 | 452·3 | 138·3 | 533 | 509·7 | 155·8 | 593 | 567·1 | 173·4 |
| 354 | 338·5 | 103·5 | 414 | 395·9 | 121·0 | 474 | 453·3 | 138·6 | 534 | 510·7 | 156·1 | 594 | 568·0 | 173·7 |
| 355 | 339·5 | 103·8 | 415 | 396·8 | 121·3 | 475 | 454·2 | 138·9 | 535 | 511·6 | 156·4 | 595 | 569·0 | 174·0 |
| 356 | 340·4 | 104·1 | 416 | 397·8 | 121·6 | 476 | 455·2 | 139·2 | 536 | 512·6 | 156·7 | 596 | 570·0 | 174·3 |
| 357 | 341·4 | 104·4 | 417 | 398·7 | 121·9 | 477 | 456·2 | 139·5 | 537 | 513·5 | 157·0 | 597 | 570·9 | 174·5 |
| 358 | 342·4 | 104·7 | 418 | 399·7 | 122·2 | 478 | 457·1 | 139·8 | 538 | 514·5 | 157·3 | 598 | 571·9 | 174·8 |
| 359 | 343·3 | 105·0 | 419 | 400·7 | 122·5 | 479 | 458·1 | 140·0 | 539 | 515·4 | 157·6 | 599 | 572·8 | 175·1 |
| 360 | 344·3 | 105·3 | 420 | 401·6 | 122·8 | 480 | 459·0 | 140·3 | 540 | 516·4 | 157·9 | 600 | 573·8 | 175·4 |
| Dist. | Dep. | D. Lat. | Dist. | Dep. | D. Lat. | Dist. | Dep. | D. Lat. | Dist. | Dep. | D. Lat. | Dist. | Dep. | D. Lat. |
| D. Lon | | Dep. | D. Lon | | Dep. | D. Lon | | Dep. | D. Lon | | Dep. | D. Lon | | Dep. |

287° / 253°

73 Degrees

073° / 107°

4h 52m

73°

AÇIKLAMA SAYFASINA DÖNMEK IÇIN TIKLAYIN

# TRAVERSE TABLE

## 22 Degrees

22°

338° / 202°

022° / 158°

1h 28m

| D. Lon Dist. | Dep. D. Lat. | Dep. | D. Lon Dist. | Dep. D. Lat. | Dep. | D. Lon Dist. | Dep. D. Lat. | Dep. | D. Lon Dist. | Dep. D. Lat. | Dep. | D. Lon Dist. | Dep. D. Lat. | Dep. |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1 | 00·9 | 00·4 | 61 | 56·6 | 22·9 | 121 | 112·2 | 45·3 | 181 | 167·8 | 67·8 | 241 | 223·5 | 90·3 |
| 2 | 01·9 | 00·7 | 62 | 57·5 | 23·2 | 122 | 113·1 | 45·7 | 182 | 168·7 | 68·2 | 242 | 224·4 | 90·7 |
| 3 | 02·8 | 01·1 | 63 | 58·4 | 23·6 | 123 | 114·0 | 46·1 | 183 | 169·7 | 68·6 | 243 | 225·3 | 91·0 |
| 4 | 03·7 | 01·5 | 64 | 59·3 | 24·0 | 124 | 115·0 | 46·5 | 184 | 170·6 | 68·9 | 244 | 226·2 | 91·4 |
| 5 | 04·6 | 01·9 | 65 | 60·3 | 24·3 | 125 | 115·9 | 46·8 | 185 | 171·5 | 69·3 | 245 | 227·2 | 91·8 |
| 6 | 05·6 | 02·2 | 66 | 61·2 | 24·7 | 126 | 116·8 | 47·2 | 186 | 172·5 | 69·7 | 246 | 228·1 | 92·2 |
| 7 | 06·5 | 02·6 | 67 | 62·1 | 25·1 | 127 | 117·8 | 47·6 | 187 | 173·4 | 70·1 | 247 | 229·0 | 92·5 |
| 8 | 07·4 | 03·0 | 68 | 63·0 | 25·5 | 128 | 118·7 | 47·9 | 188 | 174·3 | 70·4 | 248 | 229·9 | 92·9 |
| 9 | 08·3 | 03·4 | 69 | 64·0 | 25·8 | 129 | 119·6 | 48·3 | 189 | 175·2 | 70·8 | 249 | 230·9 | 93·3 |
| 10 | 09·3 | 03·7 | 70 | 64·9 | 26·2 | 130 | 120·5 | 48·7 | 190 | 176·2 | 71·2 | 250 | 231·8 | 93·7 |
| 11 | 10·2 | 04·1 | 71 | 65·8 | 26·6 | 131 | 121·5 | 49·1 | 191 | 177·1 | 71·5 | 251 | 232·7 | 94·0 |
| 12 | 11·1 | 04·5 | 72 | 66·8 | 27·0 | 132 | 122·4 | 49·4 | 192 | 178·0 | 71·9 | 252 | 233·7 | 94·4 |
| 13 | 12·1 | 04·9 | 73 | 67·7 | 27·3 | 133 | 123·3 | 49·8 | 193 | 178·9 | 72·3 | 253 | 234·6 | 94·8 |
| 14 | 13·0 | 05·2 | 74 | 68·6 | 27·7 | 134 | 124·2 | 50·2 | 194 | 179·9 | 72·7 | 254 | 235·5 | 95·2 |
| 15 | 13·9 | 05·6 | 75 | 69·5 | 28·1 | 135 | 125·2 | 50·6 | 195 | 180·8 | 73·0 | 255 | 236·4 | 95·5 |
| 16 | 14·8 | 06·0 | 76 | 70·5 | 28·5 | 136 | 126·1 | 50·9 | 196 | 181·7 | 73·4 | 256 | 237·4 | 95·9 |
| 17 | 15·8 | 06·4 | 77 | 71·4 | 28·8 | 137 | 127·0 | 51·3 | 197 | 182·7 | 73·8 | 257 | 238·3 | 96·3 |
| 18 | 16·7 | 06·7 | 78 | 72·3 | 29·2 | 138 | 128·0 | 51·7 | 198 | 183·6 | 74·2 | 258 | 239·2 | 96·6 |
| 19 | 17·6 | 07·1 | 79 | 73·2 | 29·6 | 139 | 128·9 | 52·1 | 199 | 184·5 | 74·5 | 259 | 240·1 | 97·0 |
| 20 | 18·5 | 07·5 | 80 | 74·2 | 30·0 | 140 | 129·8 | 52·4 | 200 | 185·4 | 74·9 | 260 | 241·1 | 97·4 |
| 21 | 19·5 | 07·9 | 81 | 75·1 | 30·3 | 141 | 130·7 | 52·8 | 201 | 186·4 | 75·3 | 261 | 242·0 | 97·8 |
| 22 | 20·4 | 08·2 | 82 | 76·0 | 30·7 | 142 | 131·7 | 53·2 | 202 | 187·3 | 75·7 | 262 | 242·9 | 98·1 |
| 23 | 21·3 | 08·6 | 83 | 77·0 | 31·1 | 143 | 132·6 | 53·6 | 203 | 188·2 | 76·0 | 263 | 243·8 | 98·5 |
| 24 | 22·3 | 09·0 | 84 | 77·9 | 31·5 | 144 | 133·5 | 53·9 | 204 | 189·1 | 76·4 | 264 | 244·8 | 98·9 |
| 25 | 23·2 | 09·4 | 85 | 78·8 | 31·8 | 145 | 134·4 | 54·3 | 205 | 190·1 | 76·8 | 265 | 245·7 | 99·3 |
| 26 | 24·1 | 09·7 | 86 | 79·7 | 32·2 | 146 | 135·4 | 54·7 | 206 | 191·0 | 77·2 | 266 | 246·6 | 99·6 |
| 27 | 25·0 | 10·1 | 87 | 80·7 | 32·6 | 147 | 136·3 | 55·1 | 207 | 191·9 | 77·5 | 267 | 247·6 | 100·0 |
| 28 | 26·0 | 10·5 | 88 | 81·6 | 33·0 | 148 | 137·2 | 55·4 | 208 | 192·9 | 77·9 | 268 | 248·5 | 100·4 |
| 29 | 26·9 | 10·9 | 89 | 82·5 | 33·3 | 149 | 138·2 | 55·8 | 209 | 193·8 | 78·3 | 269 | 249·4 | 100·8 |
| 30 | 27·8 | 11·2 | 90 | 83·4 | 33·7 | 150 | 139·1 | 56·2 | 210 | 194·7 | 78·7 | 270 | 250·3 | 101·1 |
| 31 | 28·7 | 11·6 | 91 | 84·4 | 34·1 | 151 | 140·0 | 56·6 | 211 | 195·6 | 79·0 | 271 | 251·3 | 101·5 |
| 32 | 29·7 | 12·0 | 92 | 85·3 | 34·5 | 152 | 140·9 | 56·9 | 212 | 196·6 | 79·4 | 272 | 252·2 | 101·9 |
| 33 | 30·6 | 12·4 | 93 | 86·2 | 34·8 | 153 | 141·9 | 57·3 | 213 | 197·5 | 79·8 | 273 | 253·1 | 102·3 |
| 34 | 31·5 | 12·7 | 94 | 87·2 | 35·2 | 154 | 142·8 | 57·7 | 214 | 198·4 | 80·2 | 274 | 254·0 | 102·6 |
| 35 | 32·5 | 13·1 | 95 | 88·1 | 35·6 | 155 | 143·7 | 58·1 | 215 | 199·3 | 80·5 | 275 | 255·0 | 103·0 |
| 36 | 33·4 | 13·5 | 96 | 89·0 | 36·0 | 156 | 144·6 | 58·4 | 216 | 200·3 | 80·9 | 276 | 255·9 | 103·4 |
| 37 | 34·3 | 13·9 | 97 | 89·9 | 36·3 | 157 | 145·6 | 58·8 | 217 | 201·2 | 81·3 | 277 | 256·8 | 103·8 |
| 38 | 35·2 | 14·2 | 98 | 90·9 | 36·7 | 158 | 146·5 | 59·2 | 218 | 202·1 | 81·7 | 278 | 257·8 | 104·1 |
| 39 | 36·2 | 14·6 | 99 | 91·8 | 37·1 | 159 | 147·4 | 59·6 | 219 | 203·1 | 82·0 | 279 | 258·7 | 104·5 |
| 40 | 37·1 | 15·0 | 100 | 92·7 | 37·5 | 160 | 148·3 | 59·9 | 220 | 204·0 | 82·4 | 280 | 259·6 | 104·9 |
| 41 | 38·0 | 15·4 | 101 | 93·6 | 37·8 | 161 | 149·3 | 60·3 | 221 | 204·9 | 82·8 | 281 | 260·5 | 105·3 |
| 42 | 38·9 | 15·7 | 102 | 94·6 | 38·2 | 162 | 150·2 | 60·7 | 222 | 205·8 | 83·2 | 282 | 261·5 | 105·6 |
| 43 | 39·9 | 16·1 | 103 | 95·5 | 38·6 | 163 | 151·1 | 61·1 | 223 | 206·8 | 83·5 | 283 | 262·4 | 106·0 |
| 44 | 40·8 | 16·5 | 104 | 96·4 | 39·0 | 164 | 152·1 | 61·4 | 224 | 207·7 | 83·9 | 284 | 263·3 | 106·4 |
| 45 | 41·7 | 16·9 | 105 | 97·4 | 39·3 | 165 | 153·0 | 61·8 | 225 | 208·6 | 84·3 | 285 | 264·2 | 106·8 |
| 46 | 42·7 | 17·2 | 106 | 98·3 | 39·7 | 166 | 153·9 | 62·2 | 226 | 209·5 | 84·7 | 286 | 265·2 | 107·1 |
| 47 | 43·6 | 17·6 | 107 | 99·2 | 40·1 | 167 | 154·8 | 62·6 | 227 | 210·5 | 85·0 | 287 | 266·1 | 107·5 |
| 48 | 44·5 | 18·0 | 108 | 100·1 | 40·5 | 168 | 155·8 | 62·9 | 228 | 211·4 | 85·4 | 288 | 267·0 | 107·9 |
| 49 | 45·4 | 18·4 | 109 | 101·1 | 40·8 | 169 | 156·7 | 63·3 | 229 | 212·3 | 85·8 | 289 | 268·0 | 108·3 |
| 50 | 46·4 | 18·7 | 110 | 102·0 | 41·2 | 170 | 157·6 | 63·7 | 230 | 213·3 | 86·2 | 290 | 268·9 | 108·6 |
| 51 | 47·3 | 19·1 | 111 | 102·9 | 41·6 | 171 | 158·5 | 64·1 | 231 | 214·2 | 86·5 | 291 | 269·8 | 109·0 |
| 52 | 48·2 | 19·5 | 112 | 103·8 | 42·0 | 172 | 159·5 | 64·4 | 232 | 215·1 | 86·9 | 292 | 270·7 | 109·4 |
| 53 | 49·1 | 19·9 | 113 | 104·8 | 42·3 | 173 | 160·4 | 64·8 | 233 | 216·0 | 87·3 | 293 | 271·7 | 109·8 |
| 54 | 50·1 | 20·2 | 114 | 105·7 | 42·7 | 174 | 161·3 | 65·2 | 234 | 217·0 | 87·7 | 294 | 272·6 | 110·1 |
| 55 | 51·0 | 20·6 | 115 | 106·6 | 43·1 | 175 | 162·3 | 65·6 | 235 | 217·9 | 88·0 | 295 | 273·5 | 110·5 |
| 56 | 51·9 | 21·0 | 116 | 107·6 | 43·5 | 176 | 163·2 | 65·9 | 236 | 218·8 | 88·4 | 296 | 274·4 | 110·9 |
| 57 | 52·8 | 21·4 | 117 | 108·5 | 43·8 | 177 | 164·1 | 66·3 | 237 | 219·7 | 88·8 | 297 | 275·4 | 111·3 |
| 58 | 53·8 | 21·7 | 118 | 109·4 | 44·2 | 178 | 165·0 | 66·7 | 238 | 220·7 | 89·2 | 298 | 276·3 | 111·6 |
| 59 | 54·7 | 22·1 | 119 | 110·3 | 44·6 | 179 | 166·0 | 67·1 | 239 | 221·6 | 89·5 | 299 | 277·2 | 112·0 |
| 60 | 55·6 | 22·5 | 120 | 111·3 | 45·0 | 180 | 166·9 | 67·4 | 240 | 222·5 | 89·9 | 300 | 278·2 | 112·4 |

| Dist. | Dep. | D. Lat. | Dist. | Dep. | D. Lat. | Dist. | Dep. | D. Lat. | Dist. | Dep. | D. Lat. | Dist. | Dep. | D. Lat. |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| D. Lon | | Dep. | D. Lon | | Dep. | D. Lon | | Dep. | D. Lon | | Dep. | D. Lon | | Dep. |

68°

292° / 248°

68 Degrees

068° / 112°

4h 32m

# TRAVERSE TABLE

## 43 Degrees

317° / 223°

043° / 137°

2h 52m

43°

| D. Lon | Dep. | | D. Lon | Dep. | | D. Lon | Dep. | | D. Lon | Dep. | | D. Lon | Dep. | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Dist. | D. Lat. | Dep. | Dist. | D. Lat. | Dep. | Dist. | D. Lat. | Dep. | Dist. | D. Lat. | Dep. | Dist. | D. Lat. | Dep. |
| 301 | 220·1 | 205·3 | 361 | 264·0 | 246·2 | 421 | 307·9 | 287·1 | 481 | 351·8 | 328·0 | 541 | 395·7 | 369·0 |
| 302 | 220·9 | 206·0 | 362 | 264·8 | 246·9 | 422 | 308·6 | 287·8 | 482 | 352·5 | 328·7 | 542 | 396·4 | 369·6 |
| 303 | 221·6 | 206·6 | 363 | 265·5 | 247·6 | 423 | 309·4 | 288·5 | 483 | 353·2 | 329·4 | 543 | 397·1 | 370·3 |
| 304 | 222·3 | 207·3 | 364 | 266·2 | 248·2 | 424 | 310·1 | 289·2 | 484 | 354·0 | 330·1 | 544 | 397·9 | 371·0 |
| 305 | 223·1 | 208·0 | 365 | 266·9 | 248·9 | 425 | 310·8 | 289·8 | 485 | 354·7 | 330·8 | 545 | 398·6 | 371·7 |
| 306 | 223·8 | 208·7 | 366 | 267·7 | 249·6 | 426 | 311·6 | 290·5 | 486 | 355·4 | 331·5 | 546 | 399·3 | 372·4 |
| 307 | 224·5 | 209·4 | 367 | 268·4 | 250·3 | 427 | 312·3 | 291·2 | 487 | 356·2 | 332·1 | 547 | 400·1 | 373·1 |
| 308 | 225·3 | 210·1 | 368 | 269·1 | 251·0 | 428 | 313·0 | 291·9 | 488 | 356·9 | 332·8 | 548 | 400·8 | 373·7 |
| 309 | 226·0 | 210·7 | 369 | 269·9 | 251·7 | 429 | 313·8 | 292·6 | 489 | 357·6 | 333·5 | 549 | 401·5 | 374·4 |
| 310 | 226·7 | 211·4 | 370 | 270·6 | 252·3 | 430 | 314·5 | 293·3 | 490 | 358·4 | 334·2 | 550 | 402·2 | 375·1 |
| 311 | 227·5 | 212·1 | 371 | 271·3 | 253·0 | 431 | 315·2 | 293·9 | 491 | 359·1 | 334·9 | 551 | 403·0 | 375·8 |
| 312 | 228·2 | 212·8 | 372 | 272·1 | 253·7 | 432 | 315·9 | 294·6 | 492 | 359·8 | 335·5 | 552 | 403·7 | 376·5 |
| 313 | 228·9 | 213·5 | 373 | 272·8 | 254·4 | 433 | 316·7 | 295·3 | 493 | 360·6 | 336·2 | 553 | 404·4 | 377·1 |
| 314 | 229·6 | 214·1 | 374 | 273·5 | 255·1 | 434 | 317·4 | 296·0 | 494 | 361·3 | 336·9 | 554 | 405·2 | 377·8 |
| 315 | 230·4 | 214·8 | 375 | 274·3 | 255·7 | 435 | 318·1 | 296·7 | 495 | 362·0 | 337·6 | 555 | 405·9 | 378·5 |
| 316 | 231·1 | 215·5 | 376 | 275·0 | 256·4 | 436 | 318·9 | 297·4 | 496 | 362·8 | 338·3 | 556 | 406·6 | 379·2 |
| 317 | 231·8 | 216·2 | 377 | 275·7 | 257·1 | 437 | 319·6 | 298·0 | 497 | 363·5 | 339·0 | 557 | 407·4 | 379·9 |
| 318 | 232·6 | 216·9 | 378 | 276·5 | 257·8 | 438 | 320·3 | 298·7 | 498 | 364·2 | 339·6 | 558 | 408·1 | 380·6 |
| 319 | 233·3 | 217·6 | 379 | 277·2 | 258·5 | 439 | 321·1 | 299·4 | 499 | 364·9 | 340·3 | 559 | 408·8 | 381·2 |
| 320 | 234·0 | 218·2 | 380 | 277·9 | 259·2 | 440 | 321·8 | 300·1 | 500 | 365·7 | 341·0 | 560 | 409·6 | 381·9 |
| 321 | 234·8 | 218·9 | 381 | 278·6 | 259·8 | 441 | 322·5 | 300·8 | 501 | 366·4 | 341·7 | 561 | 410·3 | 382·6 |
| 322 | 235·5 | 219·6 | 382 | 279·4 | 260·5 | 442 | 323·3 | 301·4 | 502 | 367·1 | 342·4 | 562 | 411·0 | 383·3 |
| 323 | 236·2 | 220·3 | 383 | 280·1 | 261·2 | 443 | 324·0 | 302·1 | 503 | 367·9 | 343·0 | 563 | 411·8 | 384·0 |
| 324 | 237·0 | 221·0 | 384 | 280·8 | 261·9 | 444 | 324·7 | 302·8 | 504 | 368·6 | 343·7 | 564 | 412·5 | 384·6 |
| 325 | 237·7 | 221·6 | 385 | 281·6 | 262·6 | 445 | 325·5 | 303·5 | 505 | 369·3 | 344·4 | 565 | 413·2 | 385·3 |
| 326 | 238·4 | 222·3 | 386 | 282·3 | 263·3 | 446 | 326·2 | 304·2 | 506 | 370·1 | 345·1 | 566 | 413·9 | 386·0 |
| 327 | 239·2 | 223·0 | 387 | 283·0 | 263·9 | 447 | 326·9 | 304·9 | 507 | 370·8 | 345·8 | 567 | 414·7 | 386·7 |
| 328 | 239·9 | 223·7 | 388 | 283·8 | 264·6 | 448 | 327·6 | 305·5 | 508 | 371·5 | 346·5 | 568 | 415·4 | 387·4 |
| 329 | 240·6 | 224·4 | 389 | 284·5 | 265·3 | 449 | 328·4 | 306·2 | 509 | 372·3 | 347·1 | 569 | 416·1 | 388·1 |
| 330 | 241·3 | 225·1 | 390 | 285·2 | 266·0 | 450 | 329·1 | 306·9 | 510 | 373·0 | 347·8 | 570 | 416·9 | 388·7 |
| 331 | 242·1 | 225·7 | 391 | 286·0 | 266·7 | 451 | 329·9 | 307·6 | 511 | 373·7 | 348·5 | 571 | 417·6 | 389·4 |
| 332 | 242·8 | 226·4 | 392 | 286·7 | 267·3 | 452 | 330·6 | 308·3 | 512 | 374·5 | 349·2 | 572 | 418·3 | 390·1 |
| 333 | 243·5 | 227·1 | 393 | 287·4 | 268·0 | 453 | 331·3 | 308·9 | 513 | 375·2 | 349·9 | 573 | 419·1 | 390·8 |
| 334 | 244·3 | 227·8 | 394 | 288·2 | 268·7 | 454 | 332·0 | 309·6 | 514 | 375·9 | 350·5 | 574 | 419·8 | 391·5 |
| 335 | 245·0 | 228·5 | 395 | 288·9 | 269·4 | 455 | 332·8 | 310·3 | 515 | 376·6 | 351·2 | 575 | 420·5 | 392·1 |
| 336 | 245·7 | 229·2 | 396 | 289·6 | 270·1 | 456 | 333·5 | 311·0 | 516 | 377·4 | 351·9 | 576 | 421·3 | 392·8 |
| 337 | 246·5 | 229·8 | 397 | 290·3 | 270·8 | 457 | 334·2 | 311·7 | 517 | 378·1 | 352·6 | 577 | 422·0 | 393·5 |
| 338 | 247·2 | 230·5 | 398 | 291·1 | 271·4 | 458 | 335·0 | 312·4 | 518 | 378·8 | 353·3 | 578 | 422·7 | 394·2 |
| 339 | 247·9 | 231·2 | 399 | 291·8 | 272·1 | 459 | 335·7 | 313·0 | 519 | 379·6 | 354·0 | 579 | 423·5 | 394·9 |
| 340 | 248·7 | 231·9 | 400 | 292·5 | 272·8 | 460 | 336·4 | 313·7 | 520 | 380·3 | 354·6 | 580 | 424·2 | 395·6 |
| 341 | 249·4 | 232·6 | 401 | 293·3 | 273·5 | 461 | 337·2 | 314·4 | 521 | 381·0 | 355·3 | 581 | 424·9 | 396·2 |
| 342 | 250·1 | 233·2 | 402 | 294·0 | 274·2 | 462 | 337·9 | 315·1 | 522 | 381·8 | 356·0 | 582 | 425·6 | 396·9 |
| 343 | 250·9 | 233·9 | 403 | 294·7 | 274·8 | 463 | 338·6 | 315·8 | 523 | 382·5 | 356·7 | 583 | 426·4 | 397·6 |
| 344 | 251·6 | 234·6 | 404 | 295·5 | 275·5 | 464 | 339·3 | 316·4 | 524 | 383·2 | 357·4 | 584 | 427·1 | 398·3 |
| 345 | 252·3 | 235·3 | 405 | 296·2 | 276·2 | 465 | 340·1 | 317·1 | 525 | 384·0 | 358·0 | 585 | 427·8 | 399·0 |
| 346 | 253·0 | 236·0 | 406 | 296·9 | 276·9 | 466 | 340·8 | 317·8 | 526 | 384·7 | 358·7 | 586 | 428·6 | 399·7 |
| 347 | 253·8 | 236·7 | 407 | 297·7 | 277·6 | 467 | 341·5 | 318·5 | 527 | 385·4 | 359·4 | 587 | 429·3 | 400·3 |
| 348 | 254·5 | 237·3 | 408 | 298·4 | 278·3 | 468 | 342·3 | 319·2 | 528 | 386·2 | 360·1 | 588 | 430·0 | 401·0 |
| 349 | 255·2 | 238·0 | 409 | 299·1 | 278·9 | 469 | 343·0 | 319·9 | 529 | 386·9 | 360·8 | 589 | 430·8 | 401·7 |
| 350 | 256·0 | 238·7 | 410 | 299·9 | 279·6 | 470 | 343·7 | 320·5 | 530 | 387·6 | 361·5 | 590 | 431·5 | 402·4 |
| 351 | 256·7 | 239·4 | 411 | 300·6 | 280·3 | 471 | 344·5 | 321·2 | 531 | 388·3 | 362·1 | 591 | 432·2 | 403·1 |
| 352 | 257·4 | 240·1 | 412 | 301·3 | 281·0 | 472 | 345·2 | 321·9 | 532 | 389·1 | 362·8 | 592 | 433·0 | 403·7 |
| 353 | 258·2 | 240·7 | 413 | 302·0 | 281·7 | 473 | 345·9 | 322·6 | 533 | 389·8 | 363·5 | 593 | 433·7 | 404·4 |
| 354 | 258·9 | 241·4 | 414 | 302·8 | 282·3 | 474 | 346·7 | 323·3 | 534 | 390·5 | 364·2 | 594 | 434·4 | 405·1 |
| 355 | 259·6 | 242·1 | 415 | 303·5 | 283·0 | 475 | 347·4 | 323·9 | 535 | 391·3 | 364·9 | 595 | 435·2 | 405·8 |
| 356 | 260·4 | 242·8 | 416 | 304·3 | 283·7 | 476 | 348·1 | 324·6 | 536 | 392·0 | 365·6 | 596 | 435·9 | 406·5 |
| 357 | 261·1 | 243·5 | 417 | 305·0 | 284·4 | 477 | 348·9 | 325·3 | 537 | 392·7 | 366·2 | 597 | 436·6 | 407·2 |
| 358 | 261·8 | 244·2 | 418 | 305·7 | 285·1 | 478 | 349·6 | 326·0 | 538 | 393·5 | 366·9 | 598 | 437·3 | 407·8 |
| 359 | 262·6 | 244·8 | 419 | 306·4 | 285·8 | 479 | 350·3 | 326·7 | 539 | 394·2 | 367·6 | 599 | 438·1 | 408·5 |
| 360 | 263·3 | 245·5 | 420 | 307·2 | 286·4 | 480 | 351·0 | 327·4 | 540 | 394·9 | 368·3 | 600 | 438·8 | 409·2 |
| Dist. | Dep. | D. Lat. | Dist. | Dep. | D. Lat. | Dist. | Dep. | D. Lat. | Dist. | Dep. | D. Lat. | Dist. | Dep. | D. Lat. |
| D. Lon | | Dep. | D. Lon | | Dep. | D. Lon | | Dep. | D. Lon | | Dep. | D. Lon | | Dep. |

313° / 227°

47 Degrees

047° / 133°

3h 08m

47°

*Terrestrial Spheroid* **MERIDIONAL PARTS** *Compression* $\frac{1}{293.465}$

| M | 41° | 42° | 43° | 44° | 45° | 46° | 47° | 48° | 49° | 50° | M |
|---|---|---|---|---|---|---|---|---|---|---|---|
| 0 | 2686·24 | 2766·05 | 2847·13 | 2929·55 | 3013·38 | 3098·70 | 3185·59 | 3274·13 | 3364·41 | 3456·53 | 0 |
| 1 | 2687·56 | 2767·39 | 2848·49 | 2930·93 | 3014·79 | 3100·14 | 3187·05 | 3275·62 | 3365·93 | 3458·08 | 1 |
| 2 | 2688·88 | 2768·73 | 2849·85 | 2932·32 | 3016·20 | 3101·57 | 3188·51 | 3277·11 | 3367·45 | 3459·64 | 2 |
| 3 | 2690·20 | 2770·07 | 2851·22 | 2933·71 | 3017·61 | 3103·01 | 3189·97 | 3278·60 | 3368·97 | 3461·19 | 3 |
| 4 | 2691·52 | 2771·41 | 2852·58 | 2935·09 | 3019·02 | 3104·44 | 3191·44 | 3280·09 | 3370·49 | 3462·74 | 4 |
| 5 | 2692·84 | 2772·75 | 2853·94 | 2936·48 | 3020·43 | 3105·88 | 3192·90 | 3281·58 | 3372·01 | 3464·29 | 5 |
| 6 | 2694·16 | 2774·10 | 2855·31 | 2937·87 | 3021·85 | 3107·32 | 3194·36 | 3283·07 | 3373·54 | 3465·85 | 6 |
| 7 | 2695·49 | 2775·44 | 2856·67 | 2939·26 | 3023·26 | 3108·76 | 3195·83 | 3284·57 | 3375·06 | 3467·40 | 7 |
| 8 | 2696·81 | 2776·78 | 2858·04 | 2940·64 | 3024·67 | 3110·19 | 3197·29 | 3286·06 | 3376·58 | 3468·96 | 8 |
| 9 | 2698·13 | 2778·13 | 2859·40 | 2942·03 | 3026·08 | 3111·63 | 3198·76 | 3287·55 | 3378·11 | 3470·52 | 9 |
| 10 | 2699·45 | 2779·47 | 2860·77 | 2943·42 | 3027·50 | 3113·07 | 3200·23 | 3289·05 | 3379·63 | 3472·07 | 10 |
| 11 | 2700·78 | 2780·81 | 2862·14 | 2944·81 | 3028·91 | 3114·51 | 3201·69 | 3290·54 | 3381·16 | 3473·63 | 11 |
| 12 | 2702·10 | 2782·16 | 2863·50 | 2946·20 | 3030·32 | 3115·95 | 3203·16 | 3292·04 | 3382·68 | 3475·19 | 12 |
| 13 | 2703·42 | 2783·50 | 2864·87 | 2947·59 | 3031·74 | 3117·39 | 3204·63 | 3293·54 | 3384·21 | 3476·75 | 13 |
| 14 | 2704·75 | 2784·85 | 2866·24 | 2948·98 | 3033·15 | 3118·83 | 3206·10 | 3295·03 | 3385·73 | 3478·30 | 14 |
| 15 | 2706·07 | 2786·19 | 2867·60 | 2950·37 | 3034·57 | 3120·27 | 3207·56 | 3296·53 | 3387·26 | 3479·86 | 15 |
| 16 | 2707·40 | 2787·54 | 2868·97 | 2951·76 | 3035·99 | 3121·71 | 3209·03 | 3298·03 | 3388·79 | 3481·42 | 16 |
| 17 | 2708·72 | 2788·89 | 2870·34 | 2953·15 | 3037·40 | 3123·16 | 3210·50 | 3299·52 | 3390·32 | 3482·98 | 17 |
| 18 | 2710·05 | 2790·23 | 2871·71 | 2954·55 | 3038·82 | 3124·60 | 3211·97 | 3301·02 | 3391·85 | 3484·54 | 18 |
| 19 | 2711·38 | 2791·58 | 2873·08 | 2955·94 | 3040·23 | 3126·04 | 3213·44 | 3302·52 | 3393·38 | 3486·11 | 19 |
| 20 | 2712·70 | 2792·93 | 2874·45 | 2957·33 | 3041·65 | 3127·49 | 3214·91 | 3304·02 | 3394·91 | 3487·67 | 20 |
| 21 | 2714·03 | 2794·28 | 2875·82 | 2958·73 | 3043·07 | 3128·93 | 3216·38 | 3305·52 | 3396·44 | 3489·23 | 21 |
| 22 | 2715·36 | 2795·62 | 2877·19 | 2960·12 | 3044·49 | 3130·37 | 3217·86 | 3307·02 | 3397·97 | 3490·79 | 22 |
| 23 | 2716·68 | 2796·97 | 2878·56 | 2961·51 | 3045·91 | 3131·82 | 3219·33 | 3308·52 | 3399·50 | 3492·36 | 23 |
| 24 | 2718·01 | 2798·32 | 2879·93 | 2962·91 | 3047·33 | 3133·26 | 3220·80 | 3310·02 | 3401·03 | 3493·92 | 24 |
| 25 | 2719·34 | 2799·67 | 2881·30 | 2964·30 | 3048·75 | 3134·71 | 3222·27 | 3311·53 | 3402·56 | 3495·49 | 25 |
| 26 | 2720·67 | 2801·02 | 2882·67 | 2965·70 | 3050·17 | 3136·15 | 3223·75 | 3313·03 | 3404·10 | 3497·05 | 26 |
| 27 | 2722·00 | 2802·37 | 2884·05 | 2967·09 | 3051·59 | 3137·60 | 3225·22 | 3314·53 | 3405·63 | 3498·62 | 27 |
| 28 | 2723·33 | 2803·72 | 2885·42 | 2968·49 | 3053·01 | 3139·05 | 3226·69 | 3316·03 | 3407·16 | 3500·18 | 28 |
| 29 | 2724·66 | 2805·07 | 2886·79 | 2969·89 | 3054·43 | 3140·49 | 3228·17 | 3317·54 | 3408·70 | 3501·75 | 29 |
| 30 | 2725·99 | 2806·42 | 2888·17 | 2971·28 | 3055·85 | 3141·94 | 3229·64 | 3319·04 | 3410·23 | 3503·32 | 30 |
| 31 | 2727·32 | 2807·77 | 2889·54 | 2972·68 | 3057·27 | 3143·39 | 3231·12 | 3320·55 | 3411·77 | 3504·89 | 31 |
| 32 | 2728·65 | 2809·13 | 2890·91 | 2974·08 | 3058·70 | 3144·84 | 3232·60 | 3322·05 | 3413·30 | 3506·45 | 32 |
| 33 | 2729·98 | 2810·48 | 2892·29 | 2975·48 | 3060·12 | 3146·29 | 3234·07 | 3323·56 | 3414·84 | 3508·02 | 33 |
| 34 | 2731·31 | 2811·83 | 2893·66 | 2976·88 | 3061·54 | 3147·74 | 3235·55 | 3325·07 | 3416·38 | 3509·59 | 34 |
| 35 | 2732·64 | 2813·18 | 2895·04 | 2978·28 | 3062·97 | 3149·19 | 3237·03 | 3326·57 | 3417·92 | 3511·16 | 35 |
| 36 | 2733·97 | 2814·54 | 2896·42 | 2979·68 | 3064·39 | 3150·64 | 3238·51 | 3328·08 | 3419·45 | 3512·73 | 36 |
| 37 | 2735·31 | 2815·89 | 2897·79 | 2981·08 | 3065·81 | 3152·09 | 3239·98 | 3329·59 | 3420·99 | 3514·31 | 37 |
| 38 | 2736·64 | 2817·25 | 2899·17 | 2982·48 | 3067·24 | 3153·54 | 3241·46 | 3331·10 | 3422·53 | 3515·88 | 38 |
| 39 | 2737·97 | 2818·60 | 2900·54 | 2983·88 | 3068·66 | 3154·99 | 3242·94 | 3332·60 | 3424·07 | 3517·45 | 39 |
| 40 | 2739·30 | 2819·95 | 2901·92 | 2985·28 | 3070·09 | 3156·45 | 3244·42 | 3334·11 | 3425·61 | 3519·02 | 40 |
| 41 | 2740·64 | 2821·31 | 2903·30 | 2986·68 | 3071·52 | 3157·90 | 3245·90 | 3335·62 | 3427·15 | 3520·60 | 41 |
| 42 | 2741·97 | 2822·67 | 2904·68 | 2988·08 | 3072·94 | 3159·35 | 3247·38 | 3337·13 | 3428·70 | 3522·17 | 42 |
| 43 | 2743·31 | 2824·02 | 2906·06 | 2989·48 | 3074·37 | 3160·81 | 3248·87 | 3338·65 | 3430·24 | 3523·75 | 43 |
| 44 | 2744·64 | 2825·38 | 2907·43 | 2990·88 | 3075·80 | 3162·26 | 3250·35 | 3340·16 | 3431·78 | 3525·32 | 44 |
| 45 | 2745·98 | 2826·73 | 2908·81 | 2992·29 | 3077·23 | 3163·71 | 3251·83 | 3341·67 | 3433·32 | 3526·90 | 45 |
| 46 | 2747·31 | 2828·09 | 2910·19 | 2993·69 | 3078·66 | 3165·17 | 3253·31 | 3343·18 | 3434·87 | 3528·47 | 46 |
| 47 | 2748·65 | 2829·45 | 2911·57 | 2995·09 | 3080·09 | 3166·62 | 3254·80 | 3344·69 | 3436·41 | 3530·05 | 47 |
| 48 | 2749·98 | 2830·81 | 2912·95 | 2996·50 | 3081·52 | 3168·08 | 3256·28 | 3346·21 | 3437·95 | 3531·63 | 48 |
| 49 | 2751·32 | 2832·16 | 2914·33 | 2997·90 | 3082·95 | 3169·54 | 3257·77 | 3347·72 | 3439·50 | 3533·21 | 49 |
| 50 | 2752·66 | 2833·52 | 2915·72 | 2999·31 | 3084·38 | 3170·99 | 3259·25 | 3349·24 | 3441·05 | 3534·79 | 50 |
| 51 | 2754·00 | 2834·88 | 2917·10 | 3000·71 | 3085·81 | 3172·45 | 3260·74 | 3350·75 | 3442·59 | 3536·37 | 51 |
| 52 | 2755·33 | 2836·24 | 2918·48 | 3002·12 | 3087·24 | 3173·91 | 3262·22 | 3352·27 | 3444·14 | 3537·95 | 52 |
| 53 | 2756·67 | 2837·60 | 2919·86 | 3003·53 | 3088·67 | 3175·37 | 3263·71 | 3353·78 | 3445·69 | 3539·53 | 53 |
| 54 | 2758·01 | 2838·96 | 2921·24 | 3004·93 | 3090·10 | 3176·83 | 3265·20 | 3355·30 | 3447·23 | 3541·11 | 54 |
| 55 | 2759·35 | 2840·32 | 2922·63 | 3006·34 | 3091·53 | 3178·28 | 3266·68 | 3356·82 | 3448·78 | 3542·69 | 55 |
| 56 | 2760·69 | 2841·68 | 2924·01 | 3007·75 | 3092·97 | 3179·74 | 3268·17 | 3358·33 | 3450·33 | 3544·27 | 56 |
| 57 | 2762·03 | 2843·04 | 2925·39 | 3009·16 | 3094·40 | 3181·20 | 3269·66 | 3359·85 | 3451·88 | 3545·85 | 57 |
| 58 | 2763·37 | 2844·40 | 2926·78 | 3010·56 | 3095·83 | 3182·66 | 3271·15 | 3361·37 | 3453·43 | 3547·44 | 58 |
| 59 | 2764·71 | 2845·77 | 2928·16 | 3011·97 | 3097·27 | 3184·13 | 3272·64 | 3362·89 | 3454·98 | 3549·02 | 59 |
| 60 | 2766·05 | 2847·13 | 2929·55 | 3013·38 | 3098·70 | 3185·59 | 3274·13 | 3364·41 | 3456·53 | 3550·60 | 60 |
| M | 41° | 42° | 43° | 44° | 45° | 46° | 47° | 48° | 49° | 50° | M |

AÇIKLAMA SAYFASINA DÖNMEK IÇIN TIKLAYIN

# LOGARITHMS

**No. 1600——2199** **20412——34223**

| | 0 | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | | 5th fig. | D |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 160 | 20412 | 20439 | 20466 | 20493 | 20520 | 20548 | 20575 | 20602 | 20629 | 20656 | 160 | | |
| 161 | 20683 | 20710 | 20737 | 20763 | 20790 | 20817 | 20844 | 20871 | 20898 | 20925 | 161 | 1 | 3 |
| 162 | 20952 | 20978 | 21005 | 21032 | 21059 | 21085 | 21112 | 21139 | 21165 | 21192 | 162 | 2 | 5 |
| 163 | 21219 | 21245 | 21272 | 21299 | 21325 | 21352 | 21378 | 21405 | 21431 | 21458 | 163 | 3 | 8 |
| 164 | 21484 | 21511 | 21537 | 21564 | 21590 | 21617 | 21643 | 21669 | 21696 | 21722 | 164 | 4 | 11 |
| 165 | 21748 | 21775 | 21801 | 21827 | 21854 | 21880 | 21906 | 21932 | 21958 | 21985 | 165 | 5 | 13 |
| 166 | 22011 | 22037 | 22063 | 22089 | 22115 | 22141 | 22168 | 22194 | 22220 | 22246 | 166 | 6 | 16 |
| 167 | 22272 | 22298 | 22324 | 22350 | 22376 | 22402 | 22427 | 22453 | 22479 | 22505 | 167 | 7 | 18 |
| 168 | 22531 | 22557 | 22583 | 22608 | 22634 | 22660 | 22686 | 22712 | 22737 | 22763 | 168 | 8 | 21 |
| 169 | 22789 | 22814 | 22840 | 22866 | 22891 | 22917 | 22943 | 22968 | 22994 | 23019 | 169 | 9 | 24 |
| 170 | 23045 | 23070 | 23096 | 23122 | 23147 | 23172 | 23198 | 23223 | 23249 | 23274 | 170 | | |
| 171 | 23300 | 23325 | 23350 | 23376 | 23401 | 23426 | 23452 | 23477 | 23502 | 23528 | 171 | 1 | 2 |
| 172 | 23553 | 23578 | 23603 | 23629 | 23654 | 23679 | 23704 | 23729 | 23754 | 23780 | 172 | 2 | 5 |
| 173 | 23805 | 23830 | 23855 | 23880 | 23905 | 23930 | 23955 | 23980 | 24005 | 24030 | 173 | 3 | 7 |
| 174 | 24055 | 24080 | 24105 | 24130 | 24155 | 24180 | 24204 | 24229 | 24254 | 24279 | 174 | 4 | 10 |
| 175 | 24304 | 24329 | 24353 | 24378 | 24403 | 24428 | 24452 | 24477 | 24502 | 24527 | 175 | 5 | 12 |
| 176 | 24551 | 24576 | 24601 | 24625 | 24650 | 24675 | 24699 | 24724 | 24748 | 24773 | 176 | 6 | 15 |
| 177 | 24797 | 24822 | 24846 | 24871 | 24895 | 24920 | 24944 | 24969 | 24993 | 25018 | 177 | 7 | 17 |
| 178 | 25042 | 25066 | 25091 | 25115 | 25140 | 25164 | 25188 | 25213 | 25237 | 25261 | 178 | 8 | 20 |
| 179 | 25285 | 25310 | 25334 | 25358 | 25382 | 25406 | 25431 | 25455 | 25479 | 25503 | 179 | 9 | 22 |
| 180 | 25527 | 25551 | 25576 | 25600 | 25624 | 25648 | 25672 | 25696 | 25720 | 25744 | 180 | | |
| 181 | 25768 | 25792 | 25816 | 25840 | 25864 | 25888 | 25912 | 25936 | 25959 | 25983 | 181 | 1 | 2 |
| 182 | 26007 | 26031 | 26055 | 26079 | 26103 | 26126 | 26150 | 26174 | 26198 | 26221 | 182 | 2 | 5 |
| 183 | 26245 | 26269 | 26293 | 26316 | 26340 | 26364 | 26387 | 26411 | 26435 | 26458 | 183 | 3 | 7 |
| 184 | 26482 | 26505 | 26529 | 26553 | 26576 | 26600 | 26623 | 26647 | 26670 | 26694 | 184 | 4 | 9 |
| 185 | 26717 | 26741 | 26764 | 26788 | 26811 | 26834 | 26858 | 26881 | 26905 | 26928 | 185 | 5 | 12 |
| 186 | 26951 | 26975 | 26998 | 27021 | 27045 | 27068 | 27091 | 27114 | 27138 | 27161 | 186 | 6 | 14 |
| 187 | 27184 | 27207 | 27231 | 27254 | 27277 | 27300 | 27323 | 27346 | 27370 | 27393 | 187 | 7 | 16 |
| 188 | 27416 | 27439 | 27462 | 27485 | 27508 | 27531 | 27554 | 27577 | 27600 | 27623 | 188 | 8 | 19 |
| 189 | 27646 | 27669 | 27692 | 27715 | 27738 | 27761 | 27784 | 27807 | 27830 | 27853 | 189 | 9 | 21 |
| 190 | 27875 | 27898 | 27921 | 27944 | 27967 | 27990 | 28012 | 28035 | 28058 | 28081 | 190 | | |
| 191 | 28103 | 28126 | 28149 | 28172 | 28194 | 28217 | 28240 | 28262 | 28285 | 28308 | 191 | 1 | 2 |
| 192 | 28330 | 28353 | 28375 | 28398 | 28421 | 28443 | 28466 | 28488 | 28511 | 28533 | 192 | 2 | 4 |
| 193 | 28556 | 28578 | 28601 | 28623 | 28646 | 28668 | 28691 | 28713 | 28735 | 28758 | 193 | 3 | 7 |
| 194 | 28780 | 28803 | 28825 | 28847 | 28870 | 28892 | 28914 | 28937 | 28959 | 28981 | 194 | 4 | 9 |
| 195 | 29004 | 29026 | 29048 | 29070 | 29093 | 29115 | 29137 | 29159 | 29181 | 29203 | 195 | 5 | 11 |
| 196 | 29226 | 29248 | 29270 | 29292 | 29314 | 29336 | 29358 | 29380 | 29403 | 29425 | 196 | 6 | 13 |
| 197 | 29447 | 29469 | 29491 | 29513 | 29535 | 29557 | 29579 | 29601 | 29623 | 29645 | 197 | 7 | 16 |
| 198 | 29667 | 29688 | 29710 | 29732 | 29754 | 29776 | 29798 | 29820 | 29842 | 29864 | 198 | 8 | 18 |
| 199 | 29885 | 29907 | 29929 | 29951 | 29973 | 29994 | 30016 | 30038 | 30060 | 30081 | 199 | 9 | 20 |
| 200 | 30103 | 30125 | 30146 | 30168 | 30190 | 30211 | 30233 | 30255 | 30276 | 30298 | 200 | | |
| 201 | 30320 | 30341 | 30363 | 30384 | 30406 | 30428 | 30449 | 30471 | 30492 | 30514 | 201 | 1 | 2 |
| 202 | 30535 | 30557 | 30578 | 30600 | 30621 | 30643 | 30664 | 30685 | 30707 | 30728 | 202 | 2 | 4 |
| 203 | 30750 | 30771 | 30792 | 30814 | 30835 | 30856 | 30878 | 30899 | 30920 | 30942 | 203 | 3 | 6 |
| 204 | 30963 | 30984 | 31006 | 31027 | 31048 | 31069 | 31091 | 31112 | 31133 | 31154 | 204 | 4 | 8 |
| 205 | 31175 | 31197 | 31218 | 31239 | 31260 | 31281 | 31302 | 31323 | 31345 | 31366 | 205 | 5 | 11 |
| 206 | 31387 | 31408 | 31429 | 31450 | 31471 | 31492 | 31513 | 31534 | 31555 | 31576 | 206 | 6 | 13 |
| 207 | 31597 | 31618 | 31639 | 31660 | 31681 | 31702 | 31723 | 31744 | 31765 | 31785 | 207 | 7 | 15 |
| 208 | 31806 | 31827 | 31848 | 31869 | 31890 | 31911 | 31931 | 31952 | 31973 | 31994 | 208 | 8 | 17 |
| 209 | 32015 | 32035 | 32056 | 32077 | 32098 | 32118 | 32139 | 32160 | 32181 | 32201 | 209 | 9 | 19 |
| 210 | 32222 | 32243 | 32263 | 32284 | 32305 | 32325 | 32346 | 32367 | 32387 | 32408 | 210 | | |
| 211 | 32428 | 32449 | 32469 | 32490 | 32511 | 32531 | 32552 | 32572 | 32593 | 32613 | 211 | 1 | 2 |
| 212 | 32634 | 32654 | 32675 | 32695 | 32716 | 32736 | 32756 | 32777 | 32797 | 32818 | 212 | 2 | 4 |
| 213 | 32838 | 32858 | 32879 | 32899 | 32919 | 32940 | 32960 | 32981 | 33001 | 33021 | 213 | 3 | 6 |
| 214 | 33041 | 33062 | 33082 | 33102 | 33123 | 33143 | 33163 | 33183 | 33203 | 33224 | 214 | 4 | 8 |
| 215 | 33244 | 33264 | 33284 | 33304 | 33325 | 33345 | 33365 | 33385 | 33405 | 33425 | 215 | 5 | 10 |
| 216 | 33445 | 33466 | 33486 | 33506 | 33526 | 33546 | 33566 | 33586 | 33606 | 33626 | 216 | 6 | 12 |
| 217 | 33646 | 33666 | 33686 | 33706 | 33726 | 33746 | 33766 | 33786 | 33806 | 33826 | 217 | 7 | 14 |
| 218 | 33846 | 33866 | 33886 | 33905 | 33925 | 33945 | 33965 | 33985 | 34005 | 34025 | 218 | 8 | 16 |
| 219 | 34044 | 34064 | 34084 | 34104 | 34124 | 34144 | 34163 | 34183 | 34203 | 34223 | 219 | 9 | 18 |
| | 0 | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | | | |

# LOGARITHMS

No. 2800———3399 Log. 44716———53135

| | 0 | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | | 5th fig. | D |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 280 | 44716 | 44731 | 44747 | 44762 | 44778 | 44793 | 44809 | 44824 | 44840 | 44855 | 280 | | |
| 281 | 44871 | 44886 | 44902 | 44917 | 44932 | 44948 | 44963 | 44979 | 44994 | 45010 | 281 | 1 | 2 |
| 282 | 45025 | 45040 | 45056 | 45071 | 45087 | 45102 | 45117 | 45133 | 45148 | 45163 | 282 | 2 | 3 |
| 283 | 45179 | 45194 | 45209 | 45225 | 45240 | 45255 | 45271 | 45286 | 45301 | 45317 | 283 | 3 | 5 |
| 284 | 45332 | 45347 | 45362 | 45378 | 45393 | 45408 | 45424 | 45439 | 45454 | 45469 | 284 | 4 | 6 |
| 285 | 45485 | 45500 | 45515 | 45530 | 45545 | 45561 | 45576 | 45591 | 45606 | 45621 | 285 | 5 | 8 |
| 286 | 45637 | 45652 | 45667 | 45682 | 45697 | 45713 | 45728 | 45743 | 45758 | 45773 | 286 | 6 | 9 |
| 287 | 45788 | 45803 | 45818 | 45834 | 45849 | 45864 | 45879 | 45894 | 45909 | 45924 | 287 | 7 | 11 |
| 288 | 45939 | 45954 | 45969 | 45985 | 46000 | 46015 | 46030 | 46045 | 46060 | 46075 | 288 | 8 | 12 |
| 289 | 46090 | 46105 | 46120 | 46135 | 46150 | 46165 | 46180 | 46195 | 46210 | 46225 | 289 | 9 | 14 |
| 290 | 46240 | 46255 | 46270 | 46285 | 46300 | 46315 | 46330 | 46345 | 46359 | 46374 | 290 | | |
| 291 | 46389 | 46404 | 46419 | 46434 | 46449 | 46464 | 46479 | 46494 | 46509 | 46523 | 291 | 1 | 1 |
| 292 | 46538 | 46553 | 46568 | 46583 | 46598 | 46613 | 46627 | 46642 | 46657 | 46672 | 292 | 2 | 3 |
| 293 | 46687 | 46702 | 46716 | 46731 | 46746 | 46761 | 46776 | 46790 | 46805 | 46820 | 293 | 3 | 4 |
| 294 | 46835 | 46850 | 46864 | 46879 | 46894 | 46909 | 46923 | 46938 | 46953 | 46968 | 294 | 4 | 6 |
| 295 | 46982 | 46997 | 47012 | 47026 | 47041 | 47056 | 47070 | 47085 | 47100 | 47115 | 295 | 5 | 7 |
| 296 | 47129 | 47144 | 47159 | 47173 | 47188 | 47203 | 47217 | 47232 | 47246 | 47261 | 296 | 6 | 9 |
| 297 | 47276 | 47290 | 47305 | 47320 | 47334 | 47349 | 47363 | 47378 | 47393 | 47407 | 297 | 7 | 10 |
| 298 | 47422 | 47436 | 47451 | 47465 | 47480 | 47494 | 47509 | 47524 | 47538 | 47553 | 298 | 8 | 12 |
| 299 | 47567 | 47582 | 47596 | 47611 | 47625 | 47640 | 47654 | 47669 | 47683 | 47698 | 299 | 9 | 13 |
| 300 | 47712 | 47727 | 47741 | 47756 | 47770 | 47784 | 47799 | 47813 | 47828 | 47842 | 300 | | |
| 301 | 47857 | 47871 | 47886 | 47900 | 47914 | 47929 | 47943 | 47958 | 47972 | 47986 | 301 | 1 | 1 |
| 302 | 48001 | 48015 | 48029 | 48044 | 48058 | 48073 | 48087 | 48101 | 48116 | 48130 | 302 | 2 | 3 |
| 303 | 48144 | 48159 | 48173 | 48187 | 48202 | 48216 | 48230 | 48245 | 48259 | 48273 | 303 | 3 | 4 |
| 304 | 48287 | 48302 | 48316 | 48330 | 48345 | 48359 | 48373 | 48387 | 48402 | 48416 | 304 | 4 | 6 |
| 305 | 48430 | 48444 | 48458 | 48473 | 48487 | 48501 | 48515 | 48530 | 48544 | 48558 | 305 | 5 | 7 |
| 306 | 48572 | 48586 | 48601 | 48615 | 48629 | 48643 | 48657 | 48671 | 48686 | 48700 | 306 | 6 | 9 |
| 307 | 48714 | 48728 | 48742 | 48756 | 48770 | 48785 | 48799 | 48813 | 48827 | 48841 | 307 | 7 | 10 |
| 308 | 48855 | 48869 | 48883 | 48897 | 48911 | 48926 | 48940 | 48954 | 48968 | 48982 | 308 | 8 | 11 |
| 309 | 48996 | 49010 | 49024 | 49038 | 49052 | 49066 | 49080 | 49094 | 49108 | 49122 | 309 | 9 | 13 |
| 310 | 49136 | 49150 | 49164 | 49178 | 49192 | 49206 | 49220 | 49234 | 49248 | 49262 | 310 | | |
| 311 | 49276 | 49290 | 49304 | 49318 | 49332 | 49346 | 49360 | 49374 | 49388 | 49402 | 311 | 1 | 1 |
| 312 | 49416 | 49429 | 49443 | 49457 | 49471 | 49485 | 49499 | 49513 | 49527 | 49541 | 312 | 2 | 3 |
| 313 | 49554 | 49568 | 49582 | 49596 | 49610 | 49624 | 49638 | 49651 | 49665 | 49679 | 313 | 3 | 4 |
| 314 | 49693 | 49707 | 49721 | 49734 | 49748 | 49762 | 49776 | 49790 | 49804 | 49817 | 314 | 4 | 6 |
| 315 | 49831 | 49845 | 49859 | 49872 | 49886 | 49900 | 49914 | 49928 | 49941 | 49955 | 315 | 5 | 7 |
| 316 | 49969 | 49982 | 49996 | 50010 | 50024 | 50037 | 50051 | 50065 | 50079 | 50092 | 316 | 6 | 8 |
| 317 | 50106 | 50120 | 50133 | 50147 | 50161 | 50174 | 50188 | 50202 | 50215 | 50229 | 317 | 7 | 10 |
| 318 | 50243 | 50256 | 50270 | 50284 | 50297 | 50311 | 50325 | 50338 | 50352 | 50365 | 318 | 8 | 11 |
| 319 | 50379 | 50393 | 50406 | 50420 | 50434 | 50447 | 50461 | 50474 | 50488 | 50501 | 319 | 9 | 12 |
| 320 | 50515 | 50529 | 50542 | 50556 | 50569 | 50583 | 50596 | 50610 | 50623 | 50637 | 320 | | |
| 321 | 50651 | 50664 | 50678 | 50691 | 50705 | 50718 | 50732 | 50745 | 50759 | 50772 | 321 | 1 | 1 |
| 322 | 50786 | 50799 | 50813 | 50826 | 50840 | 50853 | 50866 | 50880 | 50893 | 50907 | 322 | 2 | 3 |
| 323 | 50920 | 50934 | 50947 | 50961 | 50974 | 50987 | 51001 | 51014 | 51028 | 51041 | 323 | 3 | 4 |
| 324 | 51055 | 51068 | 51081 | 51095 | 51108 | 51122 | 51135 | 51148 | 51162 | 51175 | 324 | 4 | 5 |
| 325 | 51188 | 51202 | 51215 | 51228 | 51242 | 51255 | 51268 | 51282 | 51295 | 51308 | 325 | 5 | 7 |
| 326 | 51322 | 51335 | 51348 | 51362 | 51375 | 51388 | 51402 | 51415 | 51428 | 51442 | 326 | 6 | 8 |
| 327 | 51455 | 51468 | 51481 | 51495 | 51508 | 51521 | 51534 | 51548 | 51561 | 51574 | 327 | 7 | 9 |
| 328 | 51587 | 51601 | 51614 | 51627 | 51640 | 51654 | 51667 | 51680 | 51693 | 51706 | 328 | 8 | 11 |
| 329 | 51720 | 51733 | 51746 | 51759 | 51772 | 51786 | 51799 | 51812 | 51825 | 51838 | 329 | 9 | 12 |
| 330 | 51851 | 51865 | 51878 | 51891 | 51904 | 51917 | 51930 | 51943 | 51957 | 51970 | 330 | | |
| 331 | 51983 | 51996 | 52009 | 52022 | 52035 | 52048 | 52061 | 52075 | 52088 | 52101 | 331 | 1 | 1 |
| 332 | 52114 | 52127 | 52140 | 52153 | 52166 | 52179 | 52192 | 52205 | 52218 | 52231 | 332 | 2 | 3 |
| 333 | 52244 | 52258 | 52271 | 52284 | 52297 | 52310 | 52323 | 52336 | 52349 | 52362 | 333 | 3 | 4 |
| 334 | 52375 | 52388 | 52401 | 52414 | 52427 | 52440 | 52453 | 52466 | 52479 | 52492 | 334 | 4 | 5 |
| 335 | 52505 | 52517 | 52530 | 52543 | 52556 | 52569 | 52582 | 52595 | 52608 | 52621 | 335 | 5 | 6 |
| 336 | 52634 | 52647 | 52660 | 52673 | 52686 | 52699 | 52711 | 52724 | 52737 | 52750 | 336 | 6 | 8 |
| 337 | 52763 | 52776 | 52789 | 52802 | 52815 | 52827 | 52840 | 52853 | 52866 | 52879 | 337 | 7 | 9 |
| 338 | 52892 | 52905 | 52917 | 52930 | 52943 | 52956 | 52969 | 52982 | 52994 | 53007 | 338 | 8 | 10 |
| 339 | 53020 | 53033 | 53046 | 53058 | 53071 | 53084 | 53097 | 53110 | 53122 | 53135 | 339 | 9 | 12 |
| | 0 | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | | | |

# LOGARITHMS

**No. 3400——3999** **Log. 53148——60195**

| | 0 | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | | 5th fig. | D |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 340 | 53148 | 53161 | 53173 | 53186 | 53199 | 53212 | 53225 | 53237 | 53250 | 53263 | 340 | | |
| 341 | 53275 | 53288 | 53301 | 53314 | 53326 | 53339 | 53352 | 53365 | 53377 | 53390 | 341 | 1 | 1 |
| 342 | 53403 | 53415 | 53428 | 53441 | 53453 | 53466 | 53479 | 53491 | 53504 | 53517 | 342 | 2 | 3 |
| 343 | 53529 | 53542 | 53555 | 53567 | 53580 | 53593 | 53605 | 53618 | 53631 | 53643 | 343 | 3 | 4 |
| 344 | 53656 | 53669 | 53681 | 53694 | 53706 | 53719 | 53732 | 53744 | 53757 | 53769 | 344 | 4 | 5 |
| 345 | 53782 | 53795 | 53807 | 53820 | 53832 | 53845 | 53857 | 53870 | 53883 | 53895 | 345 | 5 | 6 |
| 346 | 53908 | 53920 | 53933 | 53945 | 53958 | 53970 | 53983 | 53995 | 54008 | 54020 | 346 | 6 | 8 |
| 347 | 54033 | 54046 | 54058 | 54071 | 54083 | 54096 | 54108 | 54121 | 54133 | 54145 | 347 | 7 | 9 |
| 348 | 54158 | 54170 | 54183 | 54195 | 54208 | 54220 | 54233 | 54245 | 54258 | 54270 | 348 | 8 | 10 |
| 349 | 54283 | 54295 | 54307 | 54320 | 54332 | 54345 | 54357 | 54370 | 54382 | 54394 | 349 | 9 | 11 |
| 350 | 54407 | 54419 | 54432 | 54444 | 54456 | 54469 | 54481 | 54494 | 54506 | 54518 | 350 | | |
| 351 | 54531 | 54543 | 54555 | 54568 | 54580 | 54593 | 54605 | 54617 | 54630 | 54642 | 351 | 1 | 1 |
| 352 | 54654 | 54667 | 54679 | 54691 | 54704 | 54716 | 54728 | 54741 | 54753 | 54765 | 352 | 2 | 2 |
| 353 | 54778 | 54790 | 54802 | 54814 | 54827 | 54839 | 54851 | 54864 | 54876 | 54888 | 353 | 3 | 4 |
| 354 | 54900 | 54913 | 54925 | 54937 | 54949 | 54962 | 54974 | 54986 | 54998 | 55011 | 354 | 4 | 5 |
| 355 | 55023 | 55035 | 55047 | 55060 | 55072 | 55084 | 55096 | 55108 | 55121 | 55133 | 355 | 5 | 6 |
| 356 | 55145 | 55157 | 55169 | 55182 | 55194 | 55206 | 55218 | 55230 | 55243 | 55255 | 356 | 6 | 7 |
| 357 | 55267 | 55279 | 55291 | 55303 | 55315 | 55328 | 55340 | 55352 | 55364 | 55376 | 357 | 7 | 9 |
| 358 | 55388 | 55400 | 55413 | 55425 | 55437 | 55449 | 55461 | 55473 | 55485 | 55497 | 358 | 8 | 10 |
| 359 | 55509 | 55522 | 55534 | 55546 | 55558 | 55570 | 55582 | 55594 | 55606 | 55618 | 359 | 9 | 11 |
| 360 | 55630 | 55642 | 55654 | 55666 | 55679 | 55691 | 55703 | 55715 | 55727 | 55739 | 360 | | |
| 361 | 55751 | 55763 | 55775 | 55787 | 55799 | 55811 | 55823 | 55835 | 55847 | 55859 | 361 | 1 | 1 |
| 362 | 55871 | 55883 | 55895 | 55907 | 55919 | 55931 | 55943 | 55955 | 55967 | 55979 | 362 | 2 | 2 |
| 363 | 55991 | 56003 | 56015 | 56027 | 56039 | 56050 | 56062 | 56074 | 56086 | 56098 | 363 | 3 | 4 |
| 364 | 56110 | 56122 | 56134 | 56146 | 56158 | 56170 | 56182 | 56194 | 56206 | 56217 | 364 | 4 | 5 |
| 365 | 56229 | 56241 | 56253 | 56265 | 56277 | 56289 | 56301 | 56313 | 56324 | 56336 | 365 | 5 | 6 |
| 366 | 56348 | 56360 | 56372 | 56384 | 56396 | 56407 | 56419 | 56431 | 56443 | 56455 | 366 | 6 | 7 |
| 367 | 56467 | 56478 | 56490 | 56502 | 56514 | 56526 | 56538 | 56549 | 56561 | 56573 | 367 | 7 | 8 |
| 368 | 56585 | 56597 | 56608 | 56620 | 56632 | 56644 | 56656 | 56667 | 56679 | 56691 | 368 | 8 | 10 |
| 369 | 56703 | 56714 | 56726 | 56738 | 56750 | 56761 | 56773 | 56785 | 56797 | 56808 | 369 | 9 | 11 |
| 370 | 56820 | 56832 | 56844 | 56855 | 56867 | 56879 | 56891 | 56902 | 56914 | 56926 | 370 | | |
| 371 | 56937 | 56949 | 56961 | 56973 | 56984 | 56996 | 57008 | 57019 | 57031 | 57043 | 371 | 1 | 1 |
| 372 | 57054 | 57066 | 57078 | 57089 | 57101 | 57113 | 57124 | 57136 | 57148 | 57159 | 372 | 2 | 2 |
| 373 | 57171 | 57183 | 57194 | 57206 | 57217 | 57229 | 57241 | 57252 | 57264 | 57276 | 373 | 3 | 4 |
| 374 | 57287 | 57299 | 57310 | 57322 | 57334 | 57345 | 57357 | 57368 | 57380 | 57392 | 374 | 4 | 5 |
| 375 | 57403 | 57415 | 57426 | 57438 | 57449 | 57461 | 57473 | 57484 | 57496 | 57507 | 375 | 5 | 6 |
| 376 | 57519 | 57530 | 57542 | 57553 | 57565 | 57577 | 57588 | 57600 | 57611 | 57623 | 376 | 6 | 7 |
| 377 | 57634 | 57646 | 57657 | 57669 | 57680 | 57692 | 57703 | 57715 | 57726 | 57738 | 377 | 7 | 8 |
| 378 | 57749 | 57761 | 57772 | 57784 | 57795 | 57807 | 57818 | 57830 | 57841 | 57853 | 378 | 8 | 9 |
| 379 | 57864 | 57875 | 57887 | 57898 | 57910 | 57921 | 57933 | 57944 | 57956 | 57967 | 379 | 9 | 10 |
| 380 | 57978 | 57990 | 58001 | 58013 | 58024 | 58036 | 58047 | 58058 | 58070 | 58081 | 380 | | |
| 381 | 58093 | 58104 | 58115 | 58127 | 58138 | 58150 | 58161 | 58172 | 58184 | 58195 | 381 | 1 | 1 |
| 382 | 58206 | 58218 | 58229 | 58240 | 58252 | 58263 | 58275 | 58286 | 58297 | 58309 | 382 | 2 | 2 |
| 383 | 58320 | 58331 | 58343 | 58354 | 58365 | 58377 | 58388 | 58399 | 58411 | 58422 | 383 | 3 | 3 |
| 384 | 58433 | 58444 | 58456 | 58467 | 58478 | 58490 | 58501 | 58512 | 58524 | 58535 | 384 | 4 | 5 |
| 385 | 58546 | 58557 | 58569 | 58580 | 58591 | 58602 | 58614 | 58625 | 58636 | 58648 | 385 | 5 | 6 |
| 386 | 58659 | 58670 | 58681 | 58693 | 58704 | 58715 | 58726 | 58737 | 58749 | 58760 | 386 | 6 | 7 |
| 387 | 58771 | 58782 | 58794 | 58805 | 58816 | 58827 | 58838 | 58850 | 58861 | 58872 | 387 | 7 | 8 |
| 388 | 58883 | 58894 | 58906 | 58917 | 58928 | 58939 | 58950 | 58962 | 58973 | 58984 | 388 | 8 | 9 |
| 389 | 58995 | 59006 | 59017 | 59028 | 59040 | 59051 | 59062 | 59073 | 59084 | 59095 | 389 | 9 | 10 |
| 390 | 59107 | 59118 | 59129 | 59140 | 59151 | 59162 | 59173 | 59184 | 59196 | 59207 | 390 | | |
| 391 | 59218 | 59229 | 59240 | 59251 | 59262 | 59273 | 59284 | 59295 | 59306 | 59318 | 391 | 1 | 1 |
| 392 | 59329 | 59340 | 59351 | 59362 | 59373 | 59384 | 59395 | 59406 | 59417 | 59428 | 392 | 2 | 2 |
| 393 | 59439 | 59450 | 59461 | 59472 | 59483 | 59495 | 59506 | 59517 | 59528 | 59539 | 393 | 3 | 3 |
| 394 | 59550 | 59561 | 59572 | 59583 | 59594 | 59605 | 59616 | 59627 | 59638 | 59649 | 394 | 4 | 4 |
| 395 | 59660 | 59671 | 59682 | 59693 | 59704 | 59715 | 59726 | 59737 | 59748 | 59759 | 395 | 5 | 6 |
| 396 | 59770 | 59781 | 59791 | 59802 | 59813 | 59824 | 59835 | 59846 | 59857 | 59868 | 396 | 6 | 7 |
| 397 | 59879 | 59890 | 59901 | 59912 | 59923 | 59934 | 59945 | 59956 | 59967 | 59977 | 397 | 7 | 8 |
| 398 | 59988 | 59999 | 60010 | 60021 | 60032 | 60043 | 60054 | 60065 | 60076 | 60086 | 398 | 8 | 9 |
| 399 | 60097 | 60108 | 60119 | 60130 | 60141 | 60152 | 60163 | 60173 | 60184 | 60195 | 399 | 9 | 10 |
| | 0 | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | | | |

# LOGARITHMS

**No. 5200——5799** **Log. 71600——76335**

| | 0 | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | | 5th fig. | D |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 520 | 71600 | 71609 | 71617 | 71625 | 71634 | 71642 | 71650 | 71659 | 71667 | 71675 | 520 | | |
| 521 | 71684 | 71692 | 71700 | 71709 | 71717 | 71725 | 71734 | 71742 | 71750 | 71759 | 521 | 1 | 1 |
| 522 | 71767 | 71775 | 71784 | 71792 | 71800 | 71809 | 71817 | 71825 | 71834 | 71842 | 522 | 2 | 2 |
| 523 | 71850 | 71859 | 71867 | 71875 | 71883 | 71892 | 71900 | 71908 | 71917 | 71925 | 523 | 3 | 3 |
| 524 | 71933 | 71941 | 71950 | 71958 | 71966 | 71975 | 71983 | 71991 | 71999 | 72008 | 524 | 4 | 3 |
| 525 | 72016 | 72024 | 72033 | 72041 | 72049 | 72057 | 72066 | 72074 | 72082 | 72090 | 525 | 5 | 4 |
| 526 | 72099 | 72107 | 72115 | 72123 | 72132 | 72140 | 72148 | 72156 | 72165 | 72173 | 526 | 6 | 5 |
| 527 | 72181 | 72189 | 72198 | 72206 | 72214 | 72222 | 72231 | 72239 | 72247 | 72255 | 527 | 7 | 6 |
| 528 | 72263 | 72272 | 72280 | 72288 | 72296 | 72305 | 72313 | 72321 | 72329 | 72337 | 528 | 8 | 7 |
| 529 | 72346 | 72354 | 72362 | 72370 | 72378 | 72387 | 72395 | 72403 | 72411 | 72419 | 529 | 9 | 8 |
| 530 | 72428 | 72436 | 72444 | 72452 | 72460 | 72469 | 72477 | 72485 | 72493 | 72501 | 530 | | |
| 531 | 72510 | 72518 | 72526 | 72534 | 72542 | 72550 | 72559 | 72567 | 72575 | 72583 | 531 | 1 | 1 |
| 532 | 72591 | 72599 | 72608 | 72616 | 72624 | 72632 | 72640 | 72648 | 72656 | 72665 | 532 | 2 | 2 |
| 533 | 72673 | 72681 | 72689 | 72697 | 72705 | 72713 | 72722 | 72730 | 72738 | 72746 | 533 | 3 | 3 |
| 534 | 72754 | 72762 | 72770 | 72779 | 72787 | 72795 | 72803 | 72811 | 72819 | 72827 | 534 | 4 | 3 |
| 535 | 72835 | 72844 | 72852 | 72860 | 72868 | 72876 | 72884 | 72892 | 72900 | 72908 | 535 | 5 | 4 |
| 536 | 72917 | 72925 | 72933 | 72941 | 72949 | 72957 | 72965 | 72973 | 72981 | 72989 | 536 | 6 | 5 |
| 537 | 72997 | 73006 | 73014 | 73022 | 73030 | 73038 | 73046 | 73054 | 73062 | 73070 | 537 | 7 | 6 |
| 538 | 73078 | 73086 | 73094 | 73102 | 73111 | 73119 | 73127 | 73135 | 73143 | 73151 | 538 | 8 | 7 |
| 539 | 73159 | 73167 | 73175 | 73183 | 73191 | 73199 | 73207 | 73215 | 73223 | 73231 | 539 | 9 | 8 |
| 540 | 73239 | 73247 | 73256 | 73264 | 73272 | 73280 | 73288 | 73296 | 73304 | 73312 | 540 | | |
| 541 | 73320 | 73328 | 73336 | 73344 | 73352 | 73360 | 73368 | 73376 | 73384 | 73392 | 541 | 1 | 1 |
| 542 | 73400 | 73408 | 73416 | 73424 | 73432 | 73440 | 73448 | 73456 | 73464 | 73472 | 542 | 2 | 2 |
| 543 | 73480 | 73488 | 73496 | 73504 | 73512 | 73520 | 73528 | 73536 | 73544 | 73552 | 543 | 3 | 2 |
| 544 | 73560 | 73568 | 73576 | 73584 | 73592 | 73600 | 73608 | 73616 | 73624 | 73632 | 544 | 4 | 3 |
| 545 | 73640 | 73648 | 73656 | 73664 | 73672 | 73680 | 73687 | 73695 | 73703 | 73711 | 545 | 5 | 4 |
| 546 | 73719 | 73727 | 73735 | 73743 | 73751 | 73759 | 73767 | 73775 | 73783 | 73791 | 546 | 6 | 5 |
| 547 | 73799 | 73807 | 73815 | 73823 | 73831 | 73838 | 73846 | 73854 | 73862 | 73870 | 547 | 7 | 6 |
| 548 | 73878 | 73886 | 73894 | 73902 | 73910 | 73918 | 73926 | 73934 | 73941 | 73949 | 548 | 8 | 6 |
| 549 | 73957 | 73965 | 73973 | 73981 | 73989 | 73997 | 74005 | 74013 | 74021 | 74028 | 549 | 9 | 7 |
| 550 | 74036 | 74044 | 74052 | 74060 | 74068 | 74076 | 74084 | 74092 | 74099 | 74107 | 550 | | |
| 551 | 74115 | 74123 | 74131 | 74139 | 74147 | 74155 | 74162 | 74170 | 74178 | 74186 | 551 | 1 | 1 |
| 552 | 74194 | 74202 | 74210 | 74218 | 74225 | 74233 | 74241 | 74249 | 74257 | 74265 | 552 | 2 | 2 |
| 553 | 74273 | 74280 | 74288 | 74296 | 74304 | 74312 | 74320 | 74328 | 74335 | 74343 | 553 | 3 | 2 |
| 554 | 74351 | 74359 | 74367 | 74375 | 74382 | 74390 | 74398 | 74406 | 74414 | 74422 | 554 | 4 | 3 |
| 555 | 74429 | 74437 | 74445 | 74453 | 74461 | 74468 | 74476 | 74484 | 74492 | 74500 | 555 | 5 | 4 |
| 556 | 74508 | 74515 | 74523 | 74531 | 74539 | 74547 | 74554 | 74562 | 74570 | 74578 | 556 | 6 | 4 |
| 557 | 74586 | 74593 | 74601 | 74609 | 74617 | 74625 | 74632 | 74640 | 74648 | 74656 | 557 | 7 | 5 |
| 558 | 74663 | 74671 | 74679 | 74687 | 74695 | 74702 | 74710 | 74718 | 74726 | 74733 | 558 | 8 | 6 |
| 559 | 74741 | 74749 | 74757 | 74765 | 74772 | 74780 | 74788 | 74796 | 74803 | 74811 | 559 | 9 | 7 |
| 560 | 74819 | 74827 | 74834 | 74842 | 74850 | 74858 | 74865 | 74873 | 74881 | 74889 | 560 | | |
| 561 | 74896 | 74904 | 74912 | 74920 | 74927 | 74935 | 74943 | 74950 | 74958 | 74966 | 561 | 1 | 1 |
| 562 | 74974 | 74981 | 74989 | 74997 | 75005 | 75012 | 75020 | 75028 | 75035 | 75043 | 562 | 2 | 2 |
| 563 | 75051 | 75059 | 75066 | 75074 | 75082 | 75089 | 75097 | 75105 | 75113 | 75120 | 563 | 3 | 2 |
| 564 | 75128 | 75136 | 75143 | 75151 | 75159 | 75166 | 75174 | 75182 | 75190 | 75197 | 564 | 4 | 3 |
| 565 | 75205 | 75213 | 75220 | 75228 | 75236 | 75243 | 75251 | 75259 | 75266 | 75274 | 565 | 5 | 4 |
| 566 | 75282 | 75289 | 75297 | 75305 | 75312 | 75320 | 75328 | 75335 | 75343 | 75351 | 566 | 6 | 5 |
| 567 | 75358 | 75366 | 75374 | 75381 | 75389 | 75397 | 75404 | 75412 | 75420 | 75427 | 567 | 7 | 5 |
| 568 | 75435 | 75443 | 75450 | 75458 | 75465 | 75473 | 75481 | 75488 | 75496 | 75504 | 568 | 8 | 6 |
| 569 | 75511 | 75519 | 75527 | 75534 | 75542 | 75549 | 75557 | 75565 | 75572 | 75580 | 569 | 9 | 7 |
| 570 | 75588 | 75595 | 75603 | 75610 | 75618 | 75626 | 75633 | 75641 | 75648 | 75656 | 570 | | |
| 571 | 75664 | 75671 | 75679 | 75686 | 75694 | 75702 | 75709 | 75717 | 75724 | 75732 | 571 | 1 | 1 |
| 572 | 75740 | 75747 | 75755 | 75762 | 75770 | 75778 | 75785 | 75793 | 75800 | 75808 | 572 | 2 | 2 |
| 573 | 75816 | 75823 | 75831 | 75838 | 75846 | 75853 | 75861 | 75869 | 75876 | 75884 | 573 | 3 | 2 |
| 574 | 75891 | 75899 | 75906 | 75914 | 75921 | 75929 | 75937 | 75944 | 75952 | 75959 | 574 | 4 | 3 |
| 575 | 75967 | 75974 | 75982 | 75989 | 75997 | 76005 | 76012 | 76020 | 76027 | 76035 | 575 | 5 | 4 |
| 576 | 76042 | 76050 | 76057 | 76065 | 76072 | 76080 | 76088 | 76095 | 76103 | 76110 | 576 | 6 | 5 |
| 577 | 76118 | 76125 | 76133 | 76140 | 76148 | 76155 | 76163 | 76170 | 76178 | 76185 | 577 | 7 | 5 |
| 578 | 76193 | 76200 | 76208 | 76215 | 76223 | 76230 | 76238 | 76245 | 76253 | 76260 | 578 | 8 | 6 |
| 579 | 76268 | 76275 | 76283 | 76290 | 76298 | 76305 | 76313 | 76320 | 76328 | 76335 | 579 | 9 | 7 |
| | 0 | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | | | |

# LOGARITHMS

**No. 7000——7599** **Log. 84510——88076**

| | 0 | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | | 5th fig. | D |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 700 | 84510 | 84516 | 84522 | 84528 | 84535 | 84541 | 84547 | 84553 | 84559 | 84566 | 700 | | |
| 701 | 84572 | 84578 | 84584 | 84590 | 84597 | 84603 | 84609 | 84615 | 84621 | 84628 | 701 | 1 | 1 |
| 702 | 84634 | 84640 | 84646 | 84652 | 84658 | 84665 | 84671 | 84677 | 84683 | 84689 | 702 | 2 | 1 |
| 703 | 84696 | 84702 | 84708 | 84714 | 84720 | 84726 | 84733 | 84739 | 84745 | 84751 | 703 | 3 | 2 |
| 704 | 84757 | 84763 | 84770 | 84776 | 84782 | 84788 | 84794 | 84800 | 84807 | 84813 | 704 | 4 | 2 |
| 705 | 84819 | 84825 | 84831 | 84837 | 84844 | 84850 | 84856 | 84862 | 84868 | 84874 | 705 | 5 | 3 |
| 706 | 84881 | 84887 | 84893 | 84899 | 84905 | 84911 | 84917 | 84924 | 84930 | 84936 | 706 | 6 | 4 |
| 707 | 84942 | 84948 | 84954 | 84960 | 84967 | 84973 | 84979 | 84985 | 84991 | 84997 | 707 | 7 | 4 |
| 708 | 85003 | 85010 | 85016 | 85022 | 85028 | 85034 | 85040 | 85046 | 85052 | 85059 | 708 | 8 | 5 |
| 709 | 85065 | 85071 | 85077 | 85083 | 85089 | 85095 | 85101 | 85108 | 85114 | 85120 | 709 | 9 | 5 |
| 710 | 85126 | 85132 | 85138 | 85144 | 85150 | 85156 | 85163 | 85169 | 85175 | 85181 | 710 | | |
| 711 | 85187 | 85193 | 85199 | 85205 | 85211 | 85218 | 85224 | 85230 | 85236 | 85242 | 711 | 1 | 1 |
| 712 | 85248 | 85254 | 85260 | 85266 | 85272 | 85279 | 85285 | 85291 | 85297 | 85303 | 712 | 2 | 1 |
| 713 | 85309 | 85315 | 85321 | 85327 | 85333 | 85339 | 85346 | 85352 | 85358 | 85364 | 713 | 3 | 2 |
| 714 | 85370 | 85376 | 85382 | 85388 | 85394 | 85400 | 85406 | 85412 | 85419 | 85425 | 714 | 4 | 2 |
| 715 | 85431 | 85437 | 85443 | 85449 | 85455 | 85461 | 85467 | 85473 | 85479 | 85485 | 715 | 5 | 3 |
| 716 | 85491 | 85497 | 85503 | 85510 | 85516 | 85522 | 85528 | 85534 | 85540 | 85546 | 716 | 6 | 4 |
| 717 | 85552 | 85558 | 85564 | 85570 | 85576 | 85582 | 85588 | 85594 | 85600 | 85606 | 717 | 7 | 4 |
| 718 | 85612 | 85619 | 85625 | 85631 | 85637 | 85643 | 85649 | 85655 | 85661 | 85667 | 718 | 8 | 5 |
| 719 | 85673 | 85679 | 85685 | 85691 | 85697 | 85703 | 85709 | 85715 | 85721 | 85727 | 719 | 9 | 5 |
| 720 | 85733 | 85739 | 85745 | 85751 | 85757 | 85763 | 85769 | 85775 | 85782 | 85788 | 720 | | |
| 721 | 85794 | 85800 | 85806 | 85812 | 85818 | 85824 | 85830 | 85836 | 85842 | 85848 | 721 | 1 | 1 |
| 722 | 85854 | 85860 | 85866 | 85872 | 85878 | 85884 | 85890 | 85896 | 85902 | 85908 | 722 | 2 | 1 |
| 723 | 85914 | 85920 | 85926 | 85932 | 85938 | 85944 | 85950 | 85956 | 85962 | 85968 | 723 | 3 | 2 |
| 724 | 85974 | 85980 | 85986 | 85992 | 85998 | 86004 | 86010 | 86016 | 86022 | 86028 | 724 | 4 | 2 |
| 725 | 86034 | 86040 | 86046 | 86052 | 86058 | 86064 | 86070 | 86076 | 86082 | 86088 | 725 | 5 | 3 |
| 726 | 86094 | 86100 | 86106 | 86112 | 86118 | 86124 | 86130 | 86136 | 86142 | 86148 | 726 | 6 | 4 |
| 727 | 86153 | 86159 | 86165 | 86171 | 86177 | 86183 | 86189 | 86195 | 86201 | 86207 | 727 | 7 | 4 |
| 728 | 86213 | 86219 | 86225 | 86231 | 86237 | 86243 | 86249 | 86255 | 86261 | 86267 | 728 | 8 | 5 |
| 729 | 86273 | 86279 | 86285 | 86291 | 86297 | 86303 | 86309 | 86314 | 86320 | 86326 | 729 | 9 | 5 |
| 730 | 86332 | 86338 | 86344 | 86350 | 86356 | 86362 | 86368 | 86374 | 86380 | 86386 | 730 | | |
| 731 | 86392 | 86398 | 86404 | 86410 | 86416 | 86421 | 86427 | 86433 | 86439 | 86445 | 731 | 1 | 1 |
| 732 | 86451 | 36457 | 86463 | 86469 | 86475 | 86481 | 86487 | 86493 | 86499 | 86505 | 732 | 2 | 1 |
| 733 | 86510 | 86516 | 86522 | 86528 | 86534 | 86540 | 86546 | 86552 | 86558 | 86564 | 733 | 3 | 2 |
| 734 | 86570 | 86576 | 86581 | 86587 | 86593 | 86599 | 86605 | 86611 | 86617 | 86623 | 734 | 4 | 2 |
| 735 | 86629 | 86635 | 86641 | 86647 | 86652 | 86658 | 86664 | 86670 | 86676 | 86682 | 735 | 5 | 3 |
| 736 | 86688 | 86694 | 86700 | 86706 | 86711 | 86717 | 86723 | 86729 | 86735 | 86741 | 736 | 6 | 4 |
| 737 | 86747 | 86753 | 86759 | 86764 | 86770 | 86776 | 86782 | 86788 | 86794 | 86800 | 737 | 7 | 4 |
| 738 | 86806 | 86812 | 86817 | 86823 | 86829 | 86835 | 86841 | 86847 | 86853 | 86859 | 738 | 8 | 5 |
| 739 | 86864 | 86870 | 86876 | 86882 | 86888 | 86894 | 86900 | 86906 | 86911 | 86917 | 739 | 9 | 5 |
| 740 | 86923 | 86929 | 86935 | 86941 | 86947 | 86953 | 86958 | 86964 | 86970 | 86976 | 740 | | |
| 741 | 86982 | 86988 | 86994 | 86999 | 87005 | 87011 | 87017 | 87023 | 87029 | 87035 | 741 | 1 | 1 |
| 742 | 87040 | 87046 | 87052 | 87058 | 87064 | 87070 | 87076 | 87081 | 87087 | 87093 | 742 | 2 | 1 |
| 743 | 87099 | 87105 | 87111 | 87116 | 87122 | 87128 | 87134 | 87140 | 87146 | 87152 | 743 | 3 | 2 |
| 744 | 87157 | 87163 | 87169 | 87175 | 87181 | 87187 | 87192 | 87198 | 87204 | 87210 | 744 | 4 | 2 |
| 745 | 87216 | 87222 | 87227 | 87233 | 87239 | 87245 | 87251 | 87256 | 87262 | 87268 | 745 | 5 | 3 |
| 746 | 87274 | 87280 | 87286 | 87291 | 87297 | 87303 | 87309 | 87315 | 87320 | 87326 | 746 | 6 | 4 |
| 747 | 87332 | 87338 | 87344 | 87350 | 87355 | 87361 | 87367 | 87373 | 87379 | 87384 | 747 | 7 | 4 |
| 748 | 87390 | 87396 | 87402 | 87408 | 87413 | 87419 | 87425 | 87431 | 87437 | 87442 | 748 | 8 | 5 |
| 749 | 87448 | 87454 | 87460 | 87466 | 87471 | 87477 | 87483 | 87489 | 87495 | 87500 | 749 | 9 | 5 |
| 750 | 87506 | 87512 | 87518 | 87524 | 87529 | 87535 | 87541 | 87547 | 87552 | 87558 | 750 | | |
| 751 | 87564 | 87570 | 87576 | 87581 | 87587 | 87593 | 87599 | 87605 | 87610 | 87616 | 751 | 1 | 1 |
| 752 | 87622 | 87628 | 87633 | 87639 | 87645 | 87651 | 87656 | 87662 | 87668 | 87674 | 752 | 2 | 1 |
| 753 | 87680 | 87685 | 87691 | 87697 | 87703 | 87708 | 87714 | 87720 | 87726 | 87731 | 753 | 3 | 2 |
| 754 | 87737 | 87743 | 87749 | 87754 | 87760 | 87766 | 87772 | 87777 | 87783 | 87789 | 754 | 4 | 2 |
| 755 | 87795 | 87800 | 87806 | 87812 | 87818 | 87823 | 87829 | 87835 | 87841 | 87846 | 755 | 5 | 3 |
| 756 | 87852 | 87858 | 87864 | 87869 | 87875 | 87881 | 87887 | 87892 | 87898 | 87904 | 756 | 6 | 4 |
| 757 | 87910 | 87915 | 87921 | 87927 | 87933 | 87938 | 87944 | 87950 | 87956 | 87961 | 757 | 7 | 4 |
| 758 | 87967 | 87973 | 87978 | 87984 | 87990 | 87996 | 88001 | 88007 | 88013 | 88019 | 758 | 8 | 5 |
| 759 | 88024 | 88030 | 88036 | 88041 | 88047 | 88053 | 88059 | 88064 | 88070 | 88076 | 759 | 9 | 5 |
| | 0 | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | | | |

1° 181°

# LOGS. OF TRIG. FUNCTIONS

| ′ | Sine | Diff. | Cosec. | Tan. | Diff. | Cotan. | Secant | Diff. | Cosine | |
|---|---|---|---|---|---|---|---|---|---|---|
| 36·0 | $\bar{2}$.(8) 44594 | 90 | 1.(11) 55406 | $\bar{2}$.(8) 44611 | 90 | 1.(11) 55389 | 0.(10) 00017 | | $\bar{1}$.(9) 99983 | 24′ |
| ·2 | 44684 | 91 | 55316 | 44701 | 91 | 55299 | 00017 | | 99983 | |
| ·4 | 44775 | 90 | 55225 | 44792 | 90 | 55208 | 00017 | | 99983 | |
| ·6 | 44865 | 89 | 55135 | 44882 | 89 | 55118 | 00017 | | 99983 | |
| ·8 | 44954 | 90 | 55046 | 44971 | 90 | 55029 | 00017 | | 99983 | |
| 37·0 | 45044 | 90 | 54956 | 45061 | 90 | 54939 | 00017 | | 99983 | 23′ |
| ·2 | 45134 | 89 | 54866 | 45151 | 89 | 54849 | 00017 | | 99983 | |
| ·4 | 45223 | 89 | 54777 | 45240 | 90 | 54760 | 00017 | | 99983 | |
| ·6 | 45312 | 89 | 54688 | 45330 | 89 | 54670 | 00018 | | 99982 | |
| ·8 | 45401 | 88 | 54599 | 45419 | 88 | 54581 | 00018 | | 99982 | |
| 38·0 | 45489 | 89 | 54511 | 45507 | 89 | 54493 | 00018 | | 99982 | 22′ |
| ·2 | 45578 | 88 | 54422 | 45596 | 88 | 54404 | 00018 | | 99982 | |
| ·4 | 45666 | 88 | 54334 | 45684 | 88 | 54316 | 00018 | | 99982 | |
| ·6 | 45754 | 88 | 54246 | 45772 | 88 | 54228 | 00018 | | 99982 | |
| ·8 | 45842 | 88 | 54158 | 45860 | 88 | 54140 | 00018 | | 99982 | |
| 39·0 | 45930 | 88 | 54070 | 45948 | 88 | 54052 | 00018 | | 99982 | 21′ |
| ·2 | 46018 | 87 | 53982 | 46036 | 87 | 53964 | 00018 | | 99982 | |
| ·4 | 46105 | 88 | 53895 | 46123 | 88 | 53877 | 00018 | | 99982 | |
| ·6 | 46193 | 87 | 53807 | 46211 | 87 | 53789 | 00018 | | 99982 | |
| ·8 | 46280 | 86 | 53720 | 46298 | 87 | 53702 | 00018 | | 99982 | |
| 40·0 | 46366 | 87 | 53634 | 46385 | 86 | 53615 | 00018 | | 99982 | 20′ |
| ·2 | 46453 | 87 | 53547 | 46471 | 88 | 53529 | 00018 | | 99982 | |
| ·4 | 46540 | 86 | 53460 | 46559 | 86 | 53441 | 00019 | | 99981 | |
| ·6 | 46626 | 86 | 53374 | 46645 | 86 | 53355 | 00019 | | 99981 | |
| ·8 | 46712 | 86 | 53288 | 46731 | 86 | 53269 | 00019 | | 99981 | |
| 41·0 | 46799 | 86 | 53202 | 46817 | 86 | 53183 | 00019 | | 99981 | 19′ |
| ·2 | 46884 | 86 | 53116 | 46903 | 86 | 53097 | 00019 | | 99981 | |
| ·4 | 46970 | 86 | 53030 | 46989 | 86 | 53011 | 00019 | | 99981 | |
| ·6 | 47056 | 85 | 52944 | 47075 | 85 | 52925 | 00019 | | 99981 | |
| ·8 | 47141 | 85 | 52859 | 47160 | 85 | 52840 | 00019 | | 99981 | |
| 42·0 | 47226 | 85 | 52774 | 47245 | 85 | 52755 | 00019 | | 99981 | 18′ |
| 2 | 47311 | 85 | 52689 | 47330 | 85 | 52670 | 00019 | | 99981 | |
| 4 | 47396 | 85 | 52604 | 47415 | 85 | 52585 | 00019 | | 99981 | |
| ·6 | 47481 | 85 | 52519 | 47500 | 85 | 52500 | 00019 | | 99981 | |
| ·8 | 47566 | 84 | 52434 | 47585 | 84 | 52415 | 00019 | | 99981 | |
| 43·0 | 47650 | 84 | 52350 | 47669 | 85 | 52331 | 00019 | | 99981 | 17′ |
| ·2 | 47734 | 84 | 52266 | 47754 | 84 | 52246 | 00020 | | 99980 | |
| ·4 | 47818 | 84 | 52182 | 47838 | 84 | 52162 | 00020 | | 99980 | |
| ·6 | 47902 | 84 | 52098 | 47922 | 84 | 52078 | 00020 | | 99980 | |
| ·8 | 47986 | 83 | 52014 | 48006 | 83 | 51994 | 00020 | | 99980 | |
| 44·0 | 48069 | 84 | 51931 | 48089 | 84 | 51911 | 00020 | | 99980 | 16′ |
| ·2 | 48153 | 83 | 51847 | 48173 | 83 | 51827 | 00020 | | 99980 | |
| ·4 | 48236 | 83 | 51764 | 48256 | 83 | 51744 | 00020 | | 99980 | |
| ·6 | 48319 | 83 | 51681 | 48339 | 83 | 51661 | 00020 | | 99980 | |
| ·8 | 48402 | 83 | 51598 | 48422 | 83 | 51578 | 00020 | | 99980 | |
| 45·0 | 48485 | 82 | 51515 | 48505 | 82 | 51495 | 00020 | | 99980 | 15′ |
| ·2 | 48567 | 83 | 51433 | 48587 | 83 | 51413 | 00020 | | 99980 | |
| ·4 | 48650 | 82 | 51350 | 48670 | 83 | 51330 | 00020 | | 99980 | |
| ·6 | 48732 | 82 | 51268 | 48753 | 82 | 51247 | 00021 | | 99979 | |
| ·8 | 48814 | 82 | 51186 | 48835 | 82 | 51165 | 00021 | | 99979 | |
| 46·0 | 48896 | 82 | 51104 | 48917 | 82 | 51083 | 00021 | | 99979 | 14′ |
| ·2 | 48978 | 82 | 51022 | 48999 | 82 | 51001 | 00021 | | 99979 | |
| ·4 | 49060 | 81 | 50940 | 49081 | 81 | 50919 | 00021 | | 99979 | |
| ·6 | 49141 | 82 | 50859 | 49162 | 82 | 50838 | 00021 | | 99979 | |
| ·8 | 49223 | 81 | 50777 | 49244 | 81 | 50756 | 00021 | | 99979 | |
| 47·0 | 49304 | 81 | 50696 | 49325 | 81 | 50675 | 00021 | | 99979 | 13′ |
| ·2 | 49385 | 81 | 50615 | 49406 | 81 | 50594 | 00021 | | 99979 | |
| ·4 | 49466 | 81 | 50534 | 49487 | 81 | 50513 | 00021 | | 99979 | |
| ·6 | 49547 | 80 | 50453 | 49568 | 80 | 50432 | 00021 | | 99979 | |
| ·8 | 49627 | 81 | 50373 | 49648 | 81 | 50352 | 00021 | | 99979 | |
| 48·0 | 49708 | | 50292 | 49729 | | 50271 | 00021 | | 99979 | 12′ |

178° 358°

# 2° / 182° LOGS. OF TRIG. FUNCTIONS

| ′ | Sine | Diff. | Cosec. | Tan. | Diff. | Cotan. | Secant | Diff. | Cosine | |
|---|---|---|---|---|---|---|---|---|---|---|
| 00·0 | $\bar{2}$.(8) 54282 | | 1.(11) 45718 | $\bar{2}$.(8) 54308 | | 1.(11) 45692 | 0.(10) 00027 | | $\bar{1}$.(9) 99974 | 60′ |
| ·2 | 54354 | 72 | 45646 | 54381 | 73 | 45619 | 00027 | | 99973 | |
| ·4 | 54426 | 72 | 45574 | 54453 | 72 | 45547 | 00027 | | 99973 | |
| ·6 | 54498 | 72 | 45502 | 54525 | 72 | 45475 | 00027 | | 99973 | |
| ·8 | 54570 | 72 | 45430 | 54597 | 72 | 45403 | 00027 | | 99973 | |
| 01·0 | 54642 | 72 | 45358 | 54669 | 72 | 45331 | 00027 | | 99973 | 59′ |
| ·2 | 54714 | 72 | 45286 | 54741 | 72 | 45259 | 00027 | | 99973 | |
| ·4 | 54786 | 71 | 45214 | 54813 | 71 | 45187 | 00027 | | 99973 | |
| ·6 | 54857 | 71 | 45143 | 54884 | 71 | 45116 | 00027 | | 99973 | |
| ·8 | 54928 | 71 | 45072 | 54955 | 72 | 45045 | 00027 | | 99973 | |
| 02·0 | 55000 | 72 | 45001 | 55027 | 71 | 44973 | 00027 | | 99973 | 58′ |
| ·2 | 55071 | 71 | 44929 | 55098 | 72 | 44902 | 00027 | | 99973 | |
| ·4 | 55142 | 70 | 44858 | 55170 | 70 | 44830 | 00028 | | 99972 | |
| ·6 | 55212 | 71 | 44788 | 55240 | 71 | 44760 | 00028 | | 99972 | |
| ·8 | 55283 | 71 | 44717 | 55311 | 71 | 44689 | 00028 | | 99972 | |
| 03·0 | 55354 | 70 | 44646 | 55382 | 70 | 44618 | 00028 | | 99972 | 57′ |
| ·2 | 55424 | 71 | 44576 | 55452 | 71 | 44548 | 00028 | | 99972 | |
| ·4 | 55495 | 70 | 44505 | 55523 | 70 | 44477 | 00028 | | 99972 | |
| ·6 | 55565 | 70 | 44435 | 55593 | 70 | 44407 | 00028 | | 99972 | |
| ·8 | 55635 | 70 | 44365 | 55663 | 71 | 44337 | 00028 | | 99972 | |
| 04·0 | 55705 | 70 | 44295 | 55734 | 69 | 44266 | 00028 | | 99972 | 56′ |
| ·2 | 55775 | 70 | 44225 | 55803 | 70 | 44197 | 00028 | | 99972 | |
| ·4 | 55845 | 70 | 44155 | 55873 | 71 | 44127 | 00028 | | 99972 | |
| ·6 | 55915 | 69 | 44085 | 55944 | 69 | 44056 | 00029 | | 99971 | |
| ·8 | 55984 | 70 | 44016 | 56013 | 70 | 43987 | 00029 | | 99971 | |
| 05·0 | 56054 | 69 | 43946 | 56083 | 69 | 43917 | 00029 | | 99971 | 55′ |
| ·2 | 56123 | 70 | 43877 | 56152 | 70 | 43848 | 00029 | | 99971 | |
| ·4 | 56193 | 69 | 43807 | 56222 | 69 | 43778 | 00029 | | 99971 | |
| ·6 | 56262 | 69 | 43738 | 56291 | 69 | 43709 | 00029 | | 99971 | |
| ·8 | 56331 | 69 | 43669 | 56360 | 69 | 43640 | 00029 | | 99971 | |
| 06·0 | 56400 | 69 | 43600 | 56429 | 69 | 43571 | 00029 | | 99971 | 54′ |
| ·2 | 56469 | 69 | 43531 | 56498 | 69 | 43502 | 00029 | | 99971 | |
| ·4 | 56538 | 68 | 43462 | 56567 | 69 | 43433 | 00029 | | 99971 | |
| ·6 | 56606 | 69 | 43394 | 56636 | 69 | 43364 | 00030 | | 99970 | |
| ·8 | 56675 | 68 | 43325 | 56705 | 68 | 43295 | 00030 | | 99970 | |
| 07·0 | 56743 | 68 | 43257 | 56773 | 68 | 43227 | 00030 | | 99970 | 53′ |
| ·2 | 56811 | 69 | 43189 | 56841 | 69 | 43159 | 00030 | | 99970 | |
| ·4 | 56880 | 68 | 43120 | 56910 | 68 | 43090 | 00030 | | 99970 | |
| ·6 | 56948 | 68 | 43052 | 56978 | 68 | 43022 | 00030 | | 99970 | |
| ·8 | 57016 | 68 | 42984 | 57046 | 68 | 42954 | 00030 | | 99970 | |
| 08·0 | 57084 | 67 | 42916 | 57114 | 67 | 42886 | 00030 | | 99970 | 52′ |
| ·2 | 57151 | 68 | 42849 | 57181 | 68 | 42819 | 00030 | | 99970 | |
| ·4 | 57219 | 68 | 42781 | 57249 | 68 | 42751 | 00030 | | 99970 | |
| ·6 | 57287 | 67 | 42713 | 57317 | 68 | 42683 | 00030 | | 99970 | |
| ·8 | 57354 | 67 | 42646 | 57385 | 67 | 42615 | 00031 | | 99969 | |
| 09·0 | 57421 | 68 | 42579 | 57452 | 68 | 42548 | 00031 | | 99969 | 51′ |
| ·2 | 57489 | 67 | 42511 | 57520 | 67 | 42480 | 00031 | | 99969 | |
| ·4 | 57556 | 67 | 42444 | 57587 | 67 | 42413 | 00031 | | 99969 | |
| ·6 | 57623 | 67 | 42377 | 57654 | 67 | 42346 | 00031 | | 99969 | |
| ·8 | 57690 | 67 | 42310 | 57721 | 67 | 42279 | 00031 | | 99969 | |
| 10·0 | 57757 | 67 | 42243 | 57788 | 66 | 42212 | 00031 | | 99969 | 50′ |
| ·2 | 57823 | 67 | 42177 | 57854 | 67 | 42146 | 00031 | | 99969 | |
| ·4 | 57890 | 67 | 42110 | 57921 | 67 | 42079 | 00031 | | 99969 | |
| ·6 | 57957 | 66 | 42043 | 57988 | 66 | 42012 | 00031 | | 99969 | |
| ·8 | 58023 | 66 | 41977 | 58054 | 67 | 41946 | 00031 | | 99969 | |
| 11·0 | 58089 | 66 | 41911 | 58121 | 66 | 41879 | 00032 | | 99969 | 49′ |
| ·2 | 58155 | 67 | 41845 | 58187 | 67 | 41813 | 00032 | | 99968 | |
| ·4 | 58222 | 66 | 41778 | 58254 | 66 | 41746 | 00032 | | 99968 | |
| ·6 | 58288 | 65 | 41712 | 58320 | 65 | 41680 | 00032 | | 99968 | |
| ·8 | 58353 | 66 | 41647 | 58385 | 66 | 41615 | 00032 | | 99968 | |
| 12·0 | 58419 | | 41581 | 58451 | | 41549 | 00032 | | 99968 | 48′ |

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357°

# 5° / 185° LOGS. OF TRIG. FUNCTIONS

| ′ | Sine | Parts | Cosec. | Tan. | Parts | Cotan. | Secant | Parts | Cosine | |
|---|---|---|---|---|---|---|---|---|---|---|
| 00·0 | $\bar{2}$.(8) 94030 | ′ | 1.(11) 05970 | $\bar{2}$.(8) 94195 | ′ | 1.(11) 05805 | 0.(10) 00166 | | $\bar{1}$.(9) 99834 | 60′ |
| 01·0 | 94174 | ·1 14 | 05826 | 94340 | ·1 14 | 05660 | 00167 | | 99833 | |
| 02·0 | 94317 | ·2 28 | 05683 | 94485 | ·2 29 | 05515 | 00168 | | 99832 | |
| 03·0 | 94461 | ·3 43 | 05539 | 94630 | ·3 43 | 05371 | 00169 | | 99831 | |
| 04·0 | 94603 | ·4 57 | 05397 | 94773 | ·4 57 | 05227 | 00170 | | 99830 | |
| 05·0 | 94746 | ·5 71 | 05254 | 94917 | ·5 72 | 05083 | 00171 | | 99829 | 55′ |
| 06·0 | 94887 | ·6 85 | 05113 | 95060 | ·6 86 | 04940 | 00172 | | 99828 | |
| 07·0 | 95029 | ·7 99 | 04971 | 95202 | ·7 100 | 04798 | 00173 | | 99827 | |
| 08·0 | 95170 | ·8 114 | 04830 | 95344 | ·8 115 | 04656 | 00175 | | 99826 | |
| 09·0 | 95310 | ·9 128 | 04690 | 95486 | ·9 129 | 04514 | 00176 | | 99824 | |
| 10·0 | 95450 | ·1 14 | 04550 | 95627 | | 04373 | 00177 | | 99823 | 50′ |
| 11·0 | 95589 | ·2 28 | 04411 | 95767 | ·1 14 | 04233 | 00178 | | 99822 | |
| 12·0 | 95728 | ·3 41 | 04272 | 95908 | ·2 28 | 04093 | 00179 | | 99821 | |
| 13·0 | 95867 | ·4 55 | 04133 | 96047 | ·3 42 | 03953 | 00180 | | 99820 | |
| 14·0 | 96005 | ·5 69 | 03995 | 96187 | ·4 55 | 03813 | 00181 | | 99819 | |
| 15·0 | 96143 | ·6 83 | 03857 | 96326 | ·5 69<br>·6 83 | 03675 | 00183 | | 99817 | 45′ |
| 16·0 | 96280 | ·7 96 | 03720 | 96464 | ·7 97 | 03536 | 00184 | | 99816 | |
| 17·0 | 96417 | ·8 110 | 03583 | 96602 | ·8 111 | 03398 | 00185 | | 99815 | |
| 18·0 | 96553 | ·9 124 | 03447 | 96739 | ·9 125 | 03261 | 00186 | | 99814 | |
| 19·0 | 96689 | | 03311 | 96877 | | 03123 | 00187 | | 99813 | |
| 20·0 | 96825 | | 03175 | 97013 | | 02987 | 00188 | | 99812 | 40′ |
| 21·0 | 96960 | ·1 13 | 03040 | 97150 | ·1 13 | 02850 | 00190 | | 99810 | |
| 22·0 | 97095 | ·2 27 | 02905 | 97286 | ·2 27 | 02715 | 00191 | | 99809 | |
| 23·0 | 97229 | ·3 40 | 02771 | 97421 | ·3 40 | 02579 | 00192 | | 99808 | |
| 24·0 | 97363 | ·4 53 | 02637 | 97556 | ·4 54 | 02444 | 00193 | | 99807 | |
| 25·0 | 97496 | ·5 67 | 02504 | 97691 | ·5 67<br>·6 81 | 02309 | 00194 | | 99806 | 35′ |
| 26·0 | 97629 | ·6 80 | 02371 | 97825 | ·7 94 | 02175 | 00196 | | 99804 | |
| 27·0 | 97762 | ·7 93 | 02238 | 97959 | ·8 108 | 02041 | 00197 | | 99803 | |
| 28·0 | 97894 | ·8 107 | 02106 | 98092 | ·9 121 | 01908 | 00198 | | 99802 | |
| 29·0 | 98026 | ·9 120 | 01974 | 98225 | | 01775 | 00199 | | 99801 | |
| 30·0 | 98157 | | 01843 | 98358 | | 01642 | 00200 | | 99800 | 30′ |
| 31·0 | 98288 | ·1 13 | 01712 | 98490 | ·1 13 | 01510 | 00202 | | 99798 | |
| 32·0 | 98419 | ·2 26 | 01581 | 98622 | ·2 26 | 01378 | 00203 | | 99797 | |
| 33·0 | 98549 | ·3 39 | 01451 | 98753 | ·3 39 | 01247 | 00204 | | 99796 | |
| 34·0 | 98679 | ·4 52 | 01321 | 98884 | ·4 52 | 01116 | 00205 | | 99795 | |
| 35·0 | 98808 | ·5 65<br>·6 78 | 01192 | 99015 | ·5 65<br>·6 78 | 00985 | 00207 | | 99794 | 25′ |
| 36·0 | 98937 | ·7 91 | 01063 | 99145 | ·7 91 | 00855 | 00208 | | 99792 | |
| 37·0 | 99066 | ·8 103 | 00934 | 99275 | ·8 104 | 00725 | 00209 | | 99791 | |
| 38·0 | 99194 | ·9 116 | 00806 | 99405 | ·9 117 | 00596 | 00210 | | 99790 | |
| 39·0 | 99322 | | 00678 | 99534 | | 00466 | 00212 | | 99789 | |
| 40·0 | 99450 | | 00550 | 99662 | | 00338 | 00213 | | 99787 | 20′ |
| 41·0 | 99577 | ·1 13 | 00423 | 99791 | ·1 13 | 00209 | 00214 | | 99786 | |
| 42·0 | 99704 | ·2 25 | 00296 | 99919 | ·2 25 | 00081 | 00215 | | 99785 | |
| 43·0 | 99830 | ·3 38 | 00170 | $\bar{1}$.(9) 00047 | ·3 38 | 0.(10) 99954 | 00217 | | 99784 | |
| 44·0 | 99956 | ·4 50 | 00044 | 00174 | ·4 51 | 99826 | 00218 | | 99782 | |
| 45·0 | $\bar{1}$.(9) 00082 | ·5 63<br>·6 75 | 0.(10) 99918 | 00301 | ·5 63<br>·6 76 | 99700 | 00219 | | 99781 | 15′ |
| 46·0 | 00207 | ·7 88 | 99793 | 00427 | ·7 89 | 99573 | 00220 | | 99780 | |
| 47·0 | 00332 | ·8 100 | 99668 | 00553 | ·8 101 | 99447 | 00222 | | 99778 | |
| 48·0 | 00456 | ·9 113 | 99544 | 00679 | ·9 114 | 99321 | 00223 | | 99777 | |
| 49·0 | 00581 | | 99420 | 00805 | | 99195 | 00224 | | 99776 | |
| 50·0 | 00704 | | 99296 | 00930 | | 99070 | 00226 | | 99775 | 10′ |
| 51·0 | 00828 | ·1 12 | 99172 | 01055 | ·1 12 | 98945 | 00227 | | 99773 | |
| 52·0 | 00951 | ·2 24 | 99049 | 01179 | ·2 25 | 98821 | 00228 | | 99772 | |
| 53·0 | 01074 | ·3 37 | 98926 | 01303 | ·3 37 | 98697 | 00229 | | 99771 | |
| 54·0 | 01196 | ·4 49 | 98804 | 01427 | ·4 49 | 98573 | 00231 | | 99769 | |
| 55·0 | 01318 | ·5 61 | 98682 | 01550 | ·5 62 | 98450 | 00232 | | 99768 | 5′ |
| 56·0 | 01440 | ·6 73 | 98560 | 01673 | ·6 74 | 98327 | 00233 | | 99767 | |
| 57·0 | 01561 | ·7 85 | 98439 | 01796 | ·7 86 | 98204 | 00235 | | 99765 | |
| 58·0 | 01682 | ·8 98 | 98318 | 01918 | ·8 99 | 98082 | 00236 | | 99764 | |
| 59·0 | 01803 | ·9 110 | 98197 | 02040 | ·9 111 | 97960 | 00237 | | 99763 | |
| 60·0 | 01924 | | 98077 | 02162 | | 97838 | 00239 | | 99761 | 0′ |

174°
354°

AÇIKLAMA SAYFASINA DÖNMEK İÇIN TIKLAYIN

# 15° HAVERSINES

| ′ | .0 Log. | .0 Nat. | .2 Log. | .2 Nat. | .4 Log. | .4 Nat. | .6 Log. | .6 Nat. | .8 Log. | .8 Nat. | Log. | Nat. | ′ |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | $\bar{2}$.or(8.) | 0. | $\bar{2}$.or(8.) | 0. | $\bar{2}$.or(8.) | 0. | $\bar{2}$.or(8.) | 0. | $\bar{2}$.or(8.) | 0. | $\bar{2}$.or(8.) | 0. | |
| 00 | 23140 | 01704 | 23159 | 01704 | 23178 | 01705 | 23197 | 01706 | 23216 | 01707 | 23235 | 01707 | 59 |
| 01 | 23235 | 01707 | 23255 | 01708 | 23274 | 01709 | 23293 | 01710 | 23312 | 01710 | 23331 | 01711 | 58 |
| 02 | 23331 | 01711 | 23350 | 01712 | 23370 | 01713 | 23389 | 01713 | 23408 | 01714 | 23427 | 01715 | 57 |
| 03 | 23427 | 01715 | 23446 | 01716 | 23465 | 01717 | 23484 | 01717 | 23503 | 01718 | 23523 | 01719 | 56 |
| 04 | 23523 | 01719 | 23542 | 01720 | 23561 | 01720 | 23580 | 01721 | 23599 | 01722 | 23618 | 01723 | 55 |
| 05 | 23618 | 01723 | 23637 | 01723 | 23656 | 01724 | 23675 | 01725 | 23694 | 01726 | 23713 | 01726 | 54 |
| 06 | 23713 | 01726 | 23732 | 01727 | 23751 | 01728 | 23771 | 01729 | 23790 | 01729 | 23809 | 01730 | 53 |
| 07 | 23809 | 01730 | 23828 | 01731 | 23847 | 01732 | 23866 | 01732 | 23885 | 01733 | 23904 | 01734 | 52 |
| 08 | 23904 | 01734 | 23923 | 01735 | 23942 | 01735 | 23961 | 01736 | 23980 | 01737 | 23999 | 01738 | 51 |
| 09 | 23999 | 01738 | 24018 | 01739 | 24037 | 01739 | 24056 | 01740 | 24075 | 01741 | 24094 | 01742 | 50 |
| 10 | 24094 | 01742 | 24113 | 01742 | 24132 | 01743 | 24151 | 01744 | 24170 | 01745 | 24189 | 01745 | 49 |
| 11 | 24189 | 01745 | 24208 | 01746 | 24227 | 01747 | 24245 | 01748 | 24264 | 01748 | 24283 | 01749 | 48 |
| 12 | 24283 | 01749 | 24302 | 01750 | 24321 | 01751 | 24340 | 01751 | 24359 | 01752 | 24378 | 01753 | 47 |
| 13 | 24378 | 01753 | 24397 | 01754 | 24416 | 01755 | 24435 | 01755 | 24454 | 01756 | 24472 | 01757 | 46 |
| 14 | 24472 | 01757 | 24491 | 01758 | 24510 | 01758 | 24529 | 01759 | 24548 | 01760 | 24567 | 01761 | 45 |
| 15 | 24567 | 01761 | 24586 | 01761 | 24605 | 01762 | 24624 | 01763 | 24642 | 01764 | 24661 | 01764 | 44 |
| 16 | 24661 | 01764 | 24680 | 01765 | 24699 | 01766 | 24718 | 01767 | 24737 | 01768 | 24755 | 01768 | 43 |
| 17 | 24755 | 01768 | 24774 | 01769 | 24793 | 01770 | 24812 | 01771 | 24831 | 01771 | 24850 | 01772 | 42 |
| 18 | 24850 | 01772 | 24868 | 01773 | 24887 | 01774 | 24906 | 01774 | 24925 | 01775 | 24944 | 01776 | 41 |
| 19 | 24944 | 01776 | 24962 | 01777 | 24981 | 01777 | 25000 | 01778 | 25019 | 01779 | 25037 | 01780 | 40 |
| 20 | 25037 | 01780 | 25056 | 01781 | 25075 | 01781 | 25094 | 01782 | 25112 | 01783 | 25131 | 01784 | 39 |
| 21 | 25131 | 01784 | 25150 | 01784 | 25169 | 01785 | 25187 | 01786 | 25206 | 01787 | 25225 | 01788 | 38 |
| 22 | 25225 | 01788 | 25244 | 01788 | 25262 | 01789 | 25281 | 01790 | 25300 | 01791 | 25319 | 01791 | 37 |
| 23 | 25319 | 01791 | 25337 | 01792 | 25356 | 01793 | 25375 | 01794 | 25393 | 01794 | 25412 | 01795 | 36 |
| 24 | 25412 | 01795 | 25431 | 01796 | 25449 | 01797 | 25468 | 01798 | 25487 | 01798 | 25505 | 01799 | 35 |
| 25 | 25505 | 01799 | 25524 | 01800 | 25543 | 01801 | 25561 | 01801 | 25580 | 01802 | 25599 | 01803 | 34 |
| 26 | 25599 | 01803 | 25617 | 01804 | 25636 | 01805 | 25655 | 01805 | 25673 | 01806 | 25692 | 01807 | 33 |
| 27 | 25692 | 01807 | 25710 | 01808 | 25729 | 01808 | 25748 | 01809 | 25766 | 01810 | 25785 | 01811 | 32 |
| 28 | 25785 | 01811 | 25804 | 01811 | 25822 | 01812 | 25841 | 01813 | 25859 | 01814 | 25878 | 01815 | 31 |
| 29 | 25878 | 01815 | 25897 | 01815 | 25915 | 01816 | 25934 | 01817 | 25952 | 01818 | 25971 | 01818 | 30 |
| 30 | 25971 | 01818 | 25989 | 01819 | 26008 | 01820 | 26026 | 01821 | 26045 | 01822 | 26064 | 01822 | 29 |
| 31 | 26064 | 01822 | 26082 | 01823 | 26101 | 01824 | 26119 | 01825 | 26138 | 01825 | 26156 | 01826 | 28 |
| 32 | 26156 | 01826 | 26175 | 01827 | 26193 | 01828 | 26212 | 01829 | 26230 | 01829 | 26249 | 01830 | 27 |
| 33 | 26249 | 01830 | 26267 | 01831 | 26286 | 01832 | 26304 | 01832 | 26323 | 01833 | 26341 | 01834 | 26 |
| 34 | 26341 | 01834 | 26360 | 01835 | 26378 | 01836 | 26397 | 01836 | 26415 | 01837 | 26434 | 01838 | 25 |
| 35 | 26434 | 01838 | 26452 | 01839 | 26471 | 01840 | 26489 | 01840 | 26508 | 01841 | 26526 | 01842 | 24 |
| 36 | 26526 | 01842 | 26544 | 01843 | 26563 | 01843 | 26581 | 01844 | 26600 | 01845 | 26618 | 01846 | 23 |
| 37 | 26618 | 01846 | 26637 | 01847 | 26655 | 01847 | 26673 | 01848 | 26692 | 01849 | 26710 | 01850 | 22 |
| 38 | 26710 | 01850 | 26729 | 01850 | 26747 | 01851 | 26765 | 01852 | 26784 | 01853 | 26802 | 01854 | 21 |
| 39 | 26802 | 01854 | 26821 | 01854 | 26839 | 01855 | 26857 | 01856 | 26876 | 01857 | 26894 | 01858 | 20 |
| 40 | 26894 | 01858 | 26912 | 01858 | 26931 | 01859 | 26949 | 01860 | 26967 | 01861 | 26986 | 01861 | 19 |
| 41 | 26986 | 01861 | 27004 | 01862 | 27022 | 01863 | 27041 | 01864 | 27059 | 01865 | 27077 | 01865 | 18 |
| 42 | 27077 | 01865 | 27096 | 01866 | 27114 | 01867 | 27132 | 01868 | 27151 | 01869 | 27169 | 01869 | 17 |
| 43 | 27169 | 01869 | 27187 | 01870 | 27206 | 01871 | 27224 | 01872 | 27242 | 01873 | 27261 | 01873 | 16 |
| 44 | 27261 | 01873 | 27279 | 01874 | 27297 | 01875 | 27315 | 01876 | 27334 | 01876 | 27352 | 01877 | 15 |
| 45 | 27352 | 01877 | 27370 | 01878 | 27388 | 01879 | 27407 | 01880 | 27425 | 01880 | 27443 | 01881 | 14 |
| 46 | 27443 | 01881 | 27461 | 01882 | 27480 | 01883 | 27498 | 01884 | 27516 | 01884 | 27534 | 01885 | 13 |
| 47 | 27534 | 01885 | 27553 | 01886 | 27571 | 01887 | 27589 | 01888 | 27607 | 01888 | 27626 | 01889 | 12 |
| 48 | 27626 | 01889 | 27644 | 01890 | 27662 | 01891 | 27680 | 01891 | 27698 | 01892 | 27717 | 01893 | 11 |
| 49 | 27717 | 01893 | 27735 | 01894 | 27753 | 01895 | 27771 | 01895 | 27789 | 01896 | 27807 | 01897 | 10 |
| 50 | 27807 | 01897 | 27826 | 01898 | 27844 | 01899 | 27862 | 01899 | 27880 | 01900 | 27898 | 01901 | 09 |
| 51 | 27898 | 01901 | 27916 | 01902 | 27934 | 01903 | 27953 | 01903 | 27971 | 01904 | 27989 | 01905 | 08 |
| 52 | 27989 | 01905 | 28007 | 01906 | 28025 | 01907 | 28043 | 01907 | 28061 | 01908 | 28080 | 01909 | 07 |
| 53 | 28080 | 01909 | 28098 | 01910 | 28116 | 01911 | 28134 | 01911 | 28152 | 01912 | 28170 | 01913 | 06 |
| 54 | 28170 | 01913 | 28188 | 01914 | 28206 | 01915 | 28224 | 01915 | 28242 | 01916 | 28260 | 01917 | 05 |
| 55 | 28260 | 01917 | 28278 | 01918 | 28297 | 01919 | 28315 | 01919 | 28333 | 01920 | 28351 | 01921 | 04 |
| 56 | 28351 | 01921 | 28369 | 01922 | 28387 | 01923 | 28405 | 01923 | 28423 | 01924 | 28441 | 01925 | 03 |
| 57 | 28441 | 01925 | 28459 | 01926 | 28477 | 01927 | 28495 | 01927 | 28513 | 01928 | 28531 | 01929 | 02 |
| 58 | 28531 | 01929 | 28549 | 01930 | 28567 | 01931 | 28585 | 01931 | 28603 | 01932 | 28621 | 01933 | 01 |
| 59 | 28621 | 01933 | 28639 | 01934 | 28657 | 01935 | 28675 | 01935 | 28693 | 01936 | 28711 | 01937 | 00 |
| | | | .8 | | .6 | | .4 | | .2 | | .0 | | |

PARTS for 0′.1: LOGS 9 NATURALS negligible

AÇIKLAMA SAYFASINA DÖNMEK IÇIN TIKLAYIN

# HAVERSINES

| | 91° | | 92° | | 93° | | 94° | | 95° | | 96° | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | Log. | Nat. | Log. | Nat. | Log. | Nat. | Log. | Nat. | Log. | Nat. | Log. | Nat. | |
| Parts for 0'·2, etc. | ·2 2 ·2 3<br>·4 5 ·4 6<br>·6 7 ·6 9<br>·8 10 ·8 12 | | ·2 2 ·2 3<br>·4 5 ·4 6<br>·6 7 ·6 9<br>·8 10 ·8 12 | | ·2 2 ·2 3<br>·4 5 ·4 6<br>·6 7 ·6 9<br>·8 10 ·8 12 | | ·2 2 ·2 3<br>·4 5 ·4 6<br>·6 7 ·6 9<br>·8 9 ·8 12 | | ·2 2 ·2 3<br>·4 5 ·4 6<br>·6 7 ·6 9<br>·8 9 ·8 12 | | ·2 2 ·2 3<br>·4 5 ·4 5<br>·6 7 ·6 8<br>·8 9 ·8 12 | | Parts for 0'·2, etc. |
| ′ | $\overline{1}$.or(9.) | 0. | $\overline{1}$.or(9.) | 0. | $\overline{1}$.or(9.) | 0. | $\overline{1}$.or(9.) | 0. | $\overline{1}$.or(9.) | 0. | $\overline{1}$.or(9.) | 0. | ′ |
| 00 | 70648 | 50873 | 71387 | 51745 | 72112 | 52617 | 72825 | 53488 | 73526 | 54358 | 74215 | 55226 | 60 |
| 01 | 70661 | 50887 | 71399 | 51760 | 72124 | 52631 | 72837 | 53502 | 73538 | 54372 | 74226 | 55241 | 59 |
| 02 | 70673 | 50902 | 71411 | 51774 | 72136 | 52646 | 72849 | 53517 | 73549 | 54387 | 74237 | 55255 | 58 |
| 03 | 70686 | 50916 | 71423 | 51789 | 72148 | 52660 | 72861 | 53531 | 73561 | 54401 | 74249 | 55270 | 57 |
| 04 | 70698 | 50931 | 71436 | 51803 | 72160 | 52675 | 72873 | 53546 | 73572 | 54416 | 74260 | 55284 | 56 |
| 05 | 70710 | 50945 | 71448 | 51818 | 72172 | 52689 | 72884 | 53560 | 73584 | 54430 | 74272 | 55299 | 55 |
| 06 | 70723 | 50960 | 71460 | 51832 | 72184 | 52704 | 72896 | 53575 | 73596 | 54445 | 74283 | 55313 | 54 |
| 07 | 70735 | 50974 | 71472 | 51847 | 72196 | 52718 | 72908 | 53589 | 73607 | 54459 | 74294 | 55328 | 53 |
| 08 | 70748 | 50989 | 71484 | 51861 | 72208 | 52733 | 72920 | 53604 | 73619 | 54474 | 74306 | 55342 | 52 |
| 09 | 70760 | 51004 | 71496 | 51876 | 72220 | 52748 | 72931 | 53618 | 73630 | 54488 | 74317 | 55357 | 51 |
| 10 | 70772 | 51018 | 71509 | 51890 | 72232 | 52762 | 72943 | 53633 | 73642 | 54503 | 74328 | 55371 | 50 |
| 11 | 70785 | 51033 | 71521 | 51905 | 72244 | 52776 | 72955 | 53647 | 73653 | 54517 | 74340 | 55386 | 49 |
| 12 | 70797 | 51047 | 71533 | 51919 | 72256 | 52791 | 72967 | 53662 | 73665 | 54532 | 74351 | 55400 | 48 |
| 13 | 70809 | 51062 | 71545 | 51934 | 72268 | 52806 | 72978 | 53676 | 73676 | 54546 | 74362 | 55414 | 47 |
| 14 | 70822 | 51076 | 71557 | 51948 | 72280 | 52820 | 72990 | 53691 | 73688 | 54561 | 74374 | 55429 | 46 |
| 15 | 70834 | 51091 | 71569 | 51963 | 72292 | 52835 | 73002 | 53705 | 73699 | 54575 | 74385 | 55443 | 45 |
| 16 | 70847 | 51105 | 71582 | 51978 | 72304 | 52849 | 73014 | 53720 | 73711 | 54590 | 74396 | 55458 | 44 |
| 17 | 70859 | 51120 | 71594 | 51992 | 72316 | 52864 | 73025 | 53734 | 73722 | 54604 | 74408 | 55472 | 43 |
| 18 | 70871 | 51134 | 71606 | 52007 | 72328 | 52878 | 73037 | 53749 | 73734 | 54619 | 74419 | 55487 | 42 |
| 19 | 70884 | 51149 | 71618 | 52021 | 72340 | 52893 | 73049 | 53763 | 73746 | 54633 | 74430 | 55501 | 41 |
| 20 | 70896 | 51163 | 71630 | 52036 | 72352 | 52907 | 73060 | 53778 | 73757 | 54647 | 74442 | 55516 | 40 |
| 21 | 70908 | 51178 | 71642 | 52050 | 72363 | 52922 | 73072 | 53792 | 73769 | 54662 | 74453 | 55530 | 39 |
| 22 | 70921 | 51193 | 71654 | 52065 | 72375 | 52936 | 73084 | 53807 | 73780 | 54676 | 74464 | 55545 | 38 |
| 23 | 70933 | 51207 | 71666 | 52079 | 72387 | 52951 | 73096 | 53821 | 73792 | 54691 | 74475 | 55559 | 37 |
| 24 | 70945 | 51222 | 71679 | 52094 | 72399 | 52965 | 73107 | 53836 | 73803 | 54705 | 74487 | 55573 | 36 |
| 25 | 70958 | 51236 | 71691 | 52108 | 72411 | 52980 | 73119 | 53850 | 73815 | 54720 | 74498 | 55588 | 35 |
| 26 | 70970 | 51251 | 71703 | 52123 | 72423 | 52994 | 73131 | 53865 | 73826 | 54734 | 74509 | 55602 | 34 |
| 27 | 70982 | 51265 | 71715 | 52137 | 72435 | 53009 | 73142 | 53879 | 73838 | 54749 | 74521 | 55617 | 33 |
| 28 | 70995 | 51280 | 71727 | 52152 | 72447 | 53023 | 73154 | 53894 | 73849 | 54763 | 74532 | 55631 | 32 |
| 29 | 71007 | 51294 | 71739 | 52166 | 72459 | 53038 | 73166 | 53908 | 73860 | 54778 | 74543 | 55646 | 31 |
| 30 | 71019 | 51309 | 71751 | 52181 | 72471 | 53052 | 73177 | 53923 | 73872 | 54792 | 74554 | 55660 | 30 |
| 31 | 71032 | 51323 | 71763 | 52196 | 72482 | 53067 | 73189 | 53937 | 73883 | 54807 | 74566 | 55675 | 29 |
| 32 | 71044 | 51338 | 71775 | 52210 | 72494 | 53081 | 73201 | 53952 | 73895 | 54821 | 74577 | 55689 | 28 |
| 33 | 71056 | 51352 | 71787 | 52225 | 72506 | 53096 | 73212 | 53966 | 73906 | 54836 | 74588 | 55704 | 27 |
| 34 | 71068 | 51367 | 71800 | 52239 | 72518 | 53110 | 73224 | 53981 | 73918 | 54850 | 74600 | 55718 | 26 |
| 35 | 71081 | 51382 | 71812 | 52254 | 72530 | 53125 | 73236 | 53995 | 73929 | 54865 | 74611 | 55732 | 25 |
| 36 | 71093 | 51396 | 71824 | 52268 | 72542 | 53140 | 73247 | 54010 | 73941 | 54879 | 74622 | 55747 | 24 |
| 37 | 71105 | 51411 | 71836 | 52283 | 72554 | 53154 | 73259 | 54024 | 73952 | 54894 | 74633 | 55761 | 23 |
| 38 | 71118 | 51425 | 71848 | 52297 | 72565 | 53169 | 73271 | 54039 | 73964 | 54908 | 74645 | 55776 | 22 |
| 39 | 71130 | 51440 | 71860 | 52312 | 72577 | 53183 | 73282 | 54053 | 73975 | 54923 | 74656 | 55790 | 21 |
| 40 | 71142 | 51454 | 71872 | 52326 | 72589 | 53198 | 73294 | 54068 | 73987 | 54937 | 74667 | 55805 | 20 |
| 41 | 71154 | 51469 | 71884 | 52341 | 72601 | 53212 | 73306 | 54082 | 73998 | 54952 | 74678 | 55819 | 19 |
| 42 | 71167 | 51483 | 71896 | 52355 | 72613 | 53227 | 73317 | 54097 | 74009 | 54966 | 74690 | 55834 | 18 |
| 43 | 71179 | 51498 | 71908 | 52370 | 72625 | 53241 | 73329 | 54111 | 74021 | 54980 | 74701 | 55848 | 17 |
| 44 | 71191 | 51512 | 71920 | 52384 | 72637 | 53256 | 73341 | 54126 | 74032 | 54995 | 74712 | 55862 | 16 |
| 45 | 71203 | 51527 | 71932 | 52399 | 72648 | 53270 | 73352 | 54140 | 74044 | 55009 | 74723 | 55877 | 15 |
| 46 | 71216 | 51541 | 71944 | 52413 | 72660 | 53285 | 73364 | 54155 | 74055 | 55024 | 74734 | 55891 | 14 |
| 47 | 71228 | 51556 | 71956 | 52428 | 72672 | 53299 | 73375 | 54169 | 74067 | 55038 | 74746 | 55906 | 13 |
| 48 | 71240 | 51571 | 71968 | 52442 | 72684 | 53314 | 73387 | 54184 | 74078 | 55053 | 74757 | 55920 | 12 |
| 49 | 71252 | 51585 | 71980 | 52457 | 72696 | 53328 | 73399 | 54198 | 74089 | 55067 | 74768 | 55935 | 11 |
| 50 | 71265 | 51600 | 71992 | 52472 | 72708 | 53343 | 73410 | 54213 | 74101 | 55082 | 74779 | 55949 | 10 |
| 51 | 71277 | 51614 | 72004 | 52486 | 72719 | 53357 | 73422 | 54227 | 74112 | 55096 | 74791 | 55964 | 09 |
| 52 | 71289 | 51629 | 72016 | 52501 | 72731 | 53372 | 73433 | 54242 | 74124 | 55111 | 74802 | 55978 | 08 |
| 53 | 71301 | 51643 | 72028 | 52515 | 72743 | 53386 | 73445 | 54256 | 74135 | 55125 | 74813 | 55992 | 07 |
| 54 | 71314 | 51658 | 72040 | 52530 | 72755 | 53401 | 73457 | 54271 | 74146 | 55140 | 74824 | 56007 | 06 |
| 55 | 71326 | 51672 | 72052 | 52544 | 72767 | 53415 | 73468 | 54285 | 74158 | 55154 | 74835 | 56021 | 05 |
| 56 | 71338 | 51687 | 72064 | 52559 | 72778 | 53430 | 73480 | 54300 | 74169 | 55169 | 74846 | 56036 | 04 |
| 57 | 71350 | 51701 | 72076 | 52573 | 72790 | 53444 | 73491 | 54314 | 74181 | 55183 | 74858 | 56050 | 03 |
| 58 | 71362 | 51716 | 72088 | 52588 | 72802 | 53459 | 73503 | 54329 | 74192 | 55197 | 74869 | 56065 | 02 |
| 59 | 71375 | 51730 | 72100 | 52602 | 72814 | 53473 | 73515 | 54343 | 74203 | 55212 | 74880 | 56079 | 01 |
| 60 | 71387 | 51745 | 72112 | 52617 | 72825 | 53488 | 73526 | 54358 | 74215 | 55226 | 74891 | 56093 | 00 |
| | 268° | | 267° | | 266° | | 265° | | 264° | | 263° | | |

# NATURAL FUNCTIONS OF ANGLES

## NATURAL TANGENTS

| Degrees | 0′ | 6′ | 12′ | 18′ | 24′ | 30′ | 36′ | 42′ | 48′ | 54′ | Add Mean Differences 1′ | 2′ | 3′ | 4′ | 5′ |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **45** | 1·00000 | 00350 | 00701 | 01053 | 01406 | 01761 | 02117 | 02474 | 02832 | 03192 | 58 | 118 | 177 | 237 | 296 |
| 46 | ·03553 | 03915 | 04279 | 04644 | 05010 | 05378 | 05747 | 06117 | 06489 | 06862 | 61 | 123 | 184 | 245 | 307 |
| 47 | ·07237 | 07613 | 07990 | 08369 | 08749 | 09131 | 09514 | 09899 | 10285 | 10672 | 63 | 127 | 191 | 255 | 319 |
| 48 | ·11061 | 11452 | 11844 | 12238 | 12633 | 13029 | 13428 | 13828 | 14229 | 14632 | 66 | 132 | 199 | 265 | 331 |
| 49 | ·15037 | 15443 | 15851 | 16261 | 16672 | 17085 | 17500 | 17916 | 18334 | 18754 | 69 | 138 | 207 | 276 | 344 |
| **50** | 1·19175 | 19599 | 20024 | 20451 | 20879 | 21310 | 21742 | 22176 | 22612 | 23050 | 72 | 143 | 216 | 288 | 359 |
| 51 | ·23490 | 23931 | 24375 | 24820 | 25268 | 25717 | 26169 | 26622 | 27077 | 27535 | 75 | 150 | 225 | 300 | 375 |
| 52 | ·27994 | 28456 | 28919 | 29385 | 29853 | 30323 | 30795 | 31269 | 31745 | 32224 | 78 | 157 | 235 | 314 | 392 |
| 53 | ·32704 | 33187 | 33673 | 34160 | 34650 | 35142 | 35637 | 36134 | 36633 | 37134 | 82 | 164 | 247 | 329 | 411 |
| 54 | ·37638 | 38145 | 38653 | 39165 | 39679 | 40195 | 40714 | 41235 | 41759 | 42286 | 86 | 172 | 259 | 345 | 431 |
| **55** | 1·42815 | 43347 | 43881 | 44418 | 44958 | 45501 | 46046 | 46595 | 47146 | 47700 | 91 | 181 | 272 | 362 | 453 |
| 56 | ·48256 | 48816 | 49378 | 49944 | 50512 | 51084 | 51658 | 52235 | 52816 | 53400 | 95 | 191 | 286 | 382 | 477 |
| 57 | ·53987 | 54576 | 55170 | 55767 | 56366 | 56969 | 57575 | 58184 | 58797 | 59414 | 100 | 201 | 302 | 403 | 504 |
| 58 | ·60033 | 60657 | 61283 | 61914 | 62548 | 63185 | 63826 | 64471 | 65120 | 65772 | 106 | 213 | 319 | 426 | 533 |
| 59 | ·66428 | 67088 | 67752 | 68419 | 69091 | 69766 | 70446 | 71129 | 71817 | 72509 | 113 | 226 | 339 | 452 | 564 |
| **60** | 1·73205 | 1·73905 | 1·74610 | 1·75319 | 1·76032 | 1·76749 | 1·77471 | 1·78198 | 1·78929 | 1·79665 | 120 | 240 | 360 | 481 | 600 |
| 61 | 1·80405 | 1·81150 | 1·81900 | 1·82654 | 1·83413 | 1·84177 | 1·84946 | 185720 | 1·86500 | 1·87283 | 128 | 255 | 383 | 511 | 639 |
| 62 | 1·88073 | 1·88867 | 1·89667 | 1·90472 | 1·91282 | 1·92098 | 1·92920 | 1·93746 | 1·94579 | 1·95417 | 136 | 273 | 409 | 546 | 683 |
| 63 | 1·96261 | 1·97111 | 1·97967 | 1·98828 | 1·99695 | 2·00569 | 2·01449 | 2·02335 | 2·03227 | 2·04125 | 146 | 292 | 438 | 584 | 731 |
| 64 | 2·05030 | 2·05942 | 2·06860 | 2·07785 | 2·08716 | 2·09654 | 2·10600 | 2·11552 | 2·12511 | 2·13477 | 157 | 314 | 471 | 629 | 786 |
| **65** | 2·14451 | 2·15432 | 2·16420 | 2·17416 | 2·18419 | 2·19430 | 2·20449 | 2·21475 | 2·22510 | 2·23553 | 169 | 338 | 508 | 677 | 846 |
| 66 | 2·24604 | 2·25663 | 2·26730 | 2·27806 | 2·28891 | 2·29984 | 2·31086 | 2·32197 | 2·33317 | 2·34447 | 183 | 366 | 549 | 732 | 915 |
| 67 | 2·35585 | 2·36733 | 2·37891 | 2·39058 | 2·40235 | 2·41421 | 2·42618 | 2·43825 | 2·45043 | 2·46270 | 199 | 397 | 596 | 795 | 994 |
| 68 | 2·47509 | 2·48758 | 2·50018 | 2·51289 | 2·52571 | 2·53865 | 2·55170 | 2·56487 | 2·57815 | 2·59156 | | | | | |
| 69 | 2·60509 | 2·61874 | 2·63252 | 2·64642 | 2·66046 | 2·67462 | 2·68892 | 2·70335 | 2·71792 | 2·73263 | | | | | |
| **70** | 2·74748 | 2·76247 | 2·77761 | 2·79289 | 2·80833 | 2·82391 | 2·83965 | 2·85556 | 2·87161 | 2·88783 | | | | | |
| 71 | 2·90421 | 2·92076 | 2·93748 | 2·95437 | 2·97144 | 2·98868 | 3·00611 | 3·02372 | 3·04152 | 3·05950 | | | | | |
| 72 | 3·07768 | 3·09606 | 3·11464 | 3·13341 | 3·15240 | 3·17159 | 3·19100 | 3·21063 | 3·23048 | 3·25055 | | | | | |
| 73 | 3·27085 | 3·29139 | 3·31216 | 3·33317 | 3·35443 | 3·37594 | 3·39771 | 3·41973 | 3·44202 | 3·46458 | | | | | |
| 74 | 3·48741 | 3·51053 | 3·53393 | 3·55761 | 3·58160 | 3·60588 | 3·63048 | 3·65538 | 3·68061 | 3·70616 | | | | | |
| **75** | 3·73205 | 3·75828 | 3·78485 | 3·81177 | 3·83906 | 3·86671 | 3·89474 | 3·92316 | 3·95196 | 3·98117 | | | | | |
| 76 | 4·01078 | 4·04081 | 4·07127 | 4·10216 | 4·13350 | 4·16530 | 4·19756 | 4·23030 | 4·26352 | 4·29724 | | | | | |
| 77 | 4·33148 | 4·36623 | 4·40152 | 4·43735 | 4·47374 | 4·51071 | 4·54826 | 4·58641 | 4·62518 | 4·66458 | | | | | |
| 78 | 4·70463 | 4·74534 | 4·78673 | 4·82882 | 4·87162 | 4·91516 | 4·95945 | 5·00451 | 5·05037 | 5·09704 | | | | | |
| 79 | 5·14455 | 5·19293 | 5·24218 | 5·29235 | 5·34345 | 5·39552 | 5·44857 | 5·50264 | 5·55777 | 5·61397 | | | | | |
| **80** | 5·67128 | 5·72974 | 5·78938 | 5·85024 | 5·91236 | 5·97576 | 6·04051 | 6·10664 | 6·17419 | 6·24321 | | | | | |
| 81 | 6·31375 | 6·38587 | 6·45961 | 6·53503 | 6·61220 | 6·69116 | 6·77199 | 6·85475 | 6·93952 | 7·02637 | | | | | |
| 82 | 7·11537 | 7·20661 | 7·30018 | 7·39616 | 7·49465 | 7·59575 | 7·69957 | 7·80622 | 7·91582 | 8·02848 | | | | | |
| 83 | 8·14435 | 8·26356 | 8·38625 | 8·51259 | 8·64275 | 8·77689 | 8·91520 | 9·05789 | 9·20516 | 9·35724 | | | | | |
| 84 | 9·51436 | 9·6768 | 9·8448 | 10·019 | 10·199 | 10·385 | 10·579 | 10·780 | 10·988 | 11·205 | | | | | |
| **85** | 11·430 | 11·664 | 11·909 | 12·163 | 12·429 | 12·706 | 12·996 | 13·300 | 13·617 | 13·951 | | | | | |
| 86 | 14·301 | 14·669 | 15·056 | 15·464 | 15·895 | 16·350 | 16·832 | 17·343 | 17·886 | 18·464 | | | | | |
| 87 | 19·081 | 19·740 | 20·446 | 21·205 | 22·022 | 22·904 | 23·859 | 24·898 | 26·031 | 27·271 | | | | | |
| 88 | 28·636 | 30·145 | 31·821 | 33·694 | 35·801 | 38·188 | 40·917 | 44·066 | 47·740 | 52·081 | | | | | |
| 89 | 57·290 | 63·657 | 71·615 | 81·847 | 95·489 | 114·60 | 143·24 | 190·98 | 286·48 | 572·96 | | | | | |
| 90 | ∞ | | | | | | | | | | | | | | |

Mean differences no longer sufficiently accurate.

# NATURAL FUNCTIONS OF ANGLES

## NATURAL COSINES

| Degrees | 0′ | 6′ | 12′ | 18′ | 24′ | 30′ | 36′ | 42′ | 48′ | 54′ | Subtract Mean Differences 1′ | 2′ | 3′ | 4′ | 5′ |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **45** | 0·70711 | 70587 | 70463 | 70339 | 70215 | 70091 | 69966 | 69842 | 69717 | 69591 | 21 | 41 | 62 | 83 | 104 |
| 46 | ·69466 | 69340 | 69214 | 69088 | 68962 | 68835 | 68709 | 68582 | 68455 | 68327 | 21 | 42 | 63 | 84 | 106 |
| 47 | ·68200 | 68072 | 67944 | 67816 | 67688 | 67559 | 67430 | 67301 | 67172 | 67043 | 21 | 43 | 64 | 86 | 107 |
| 48 | ·66913 | 66783 | 66653 | 66523 | 66393 | 66262 | 66131 | 66000 | 65869 | 65738 | 22 | 44 | 65 | 87 | 109 |
| 49 | ·65606 | 65474 | 65342 | 65210 | 65077 | 64945 | 64812 | 64679 | 64546 | 64412 | 22 | 44 | 66 | 88 | 111 |
| **50** | 0·64279 | 64145 | 64011 | 63877 | 63742 | 63608 | 63473 | 63338 | 63203 | 63068 | 22 | 45 | 67 | 90 | 112 |
| 51 | ·62932 | 62796 | 62660 | 62524 | 62388 | 62251 | 62115 | 61978 | 61841 | 61704 | 23 | 45 | 68 | 91 | 114 |
| 52 | ·61566 | 61429 | 61291 | 61153 | 61015 | 60876 | 60738 | 60599 | 60460 | 60321 | 23 | 46 | 69 | 92 | 115 |
| 53 | ·60181 | 60042 | 59902 | 59763 | 59622 | 59482 | 59342 | 59201 | 59061 | 58920 | 23 | 47 | 70 | 94 | 117 |
| 54 | ·58779 | 58637 | 58496 | 58354 | 58212 | 58070 | 57928 | 57786 | 57643 | 57501 | 24 | 47 | 71 | 95 | 118 |
| **55** | 0·57358 | 57215 | 57071 | 56928 | 56784 | 56641 | 56497 | 56353 | 56208 | 56064 | 24 | 48 | 72 | 96 | 120 |
| 56 | ·55919 | 55775 | 55630 | 55484 | 55339 | 55194 | 55048 | 54902 | 54756 | 54610 | 24 | 49 | 73 | 97 | 121 |
| 57 | ·54464 | 54317 | 54171 | 54024 | 53877 | 53730 | 53583 | 53435 | 53288 | 53140 | 24 | 49 | 74 | 98 | 123 |
| 58 | ·52992 | 52844 | 52696 | 52547 | 52399 | 52250 | 52101 | 51952 | 51803 | 51653 | 25 | 50 | 74 | 99 | 124 |
| 59 | ·51504 | 51354 | 51204 | 51054 | 50904 | 50754 | 50603 | 50453 | 50302 | 50151 | 25 | 50 | 75 | 100 | 125 |
| **60** | 0·50000 | 49849 | 49697 | 49546 | 49394 | 49242 | 49090 | 48938 | 48786 | 48634 | 25 | 51 | 76 | 101 | 126 |
| 61 | ·48481 | 48328 | 48175 | 48022 | 47869 | 47716 | 47562 | 47409 | 47255 | 47101 | 26 | 51 | 77 | 102 | 128 |
| 62 | ·46947 | 46793 | 46639 | 46484 | 46330 | 46175 | 46020 | 45865 | 45710 | 45554 | 26 | 52 | 77 | 103 | 129 |
| 63 | ·45399 | 45243 | 45088 | 44932 | 44776 | 44620 | 44464 | 44307 | 44151 | 43994 | 26 | 52 | 78 | 104 | 130 |
| 64 | ·43837 | 43680 | 43523 | 43366 | 43209 | 43051 | 42894 | 42736 | 42578 | 42420 | 26 | 53 | 79 | 105 | 131 |
| **65** | 0·42262 | 42104 | 41945 | 41787 | 41628 | 41469 | 41310 | 41151 | 40992 | 40833 | 26 | 53 | 79 | 106 | 132 |
| 66 | ·40674 | 40514 | 40355 | 40195 | 40035 | 39875 | 39715 | 39555 | 39394 | 39234 | 27 | 53 | 80 | 107 | 133 |
| 67 | ·39073 | 38912 | 38752 | 38591 | 38430 | 38268 | 38107 | 37946 | 37784 | 37622 | 27 | 54 | 81 | 107 | 134 |
| 68 | ·37461 | 37299 | 37137 | 36975 | 36812 | 36650 | 36488 | 36325 | 36162 | 36000 | 27 | 54 | 81 | 108 | 135 |
| 69 | ·35837 | 35674 | 35511 | 35347 | 35184 | 35021 | 34857 | 34694 | 34530 | 34366 | 27 | 54 | 82 | 109 | 136 |
| **70** | 0·34202 | 34038 | 33874 | 33710 | 33545 | 33381 | 33216 | 33051 | 32887 | 32722 | 27 | 55 | 82 | 110 | 137 |
| 71 | ·32557 | 32392 | 32227 | 32061 | 31896 | 31730 | 31565 | 31399 | 31233 | 31068 | 28 | 55 | 83 | 110 | 138 |
| 72 | ·30902 | 30736 | 30570 | 30403 | 30237 | 30071 | 29904 | 29737 | 29571 | 29404 | 28 | 56 | 83 | 111 | 139 |
| 73 | ·29237 | 29070 | 28903 | 28736 | 28569 | 28402 | 28234 | 28067 | 27899 | 27731 | 28 | 56 | 84 | 112 | 139 |
| 74 | ·27564 | 27396 | 27228 | 27060 | 26892 | 26724 | 26556 | 26387 | 26219 | 26050 | 28 | 56 | 84 | 112 | 140 |
| **75** | 0·25882 | 25713 | 25545 | 25376 | 25207 | 25038 | 24869 | 24700 | 24531 | 24362 | 28 | 56 | 85 | 113 | 141 |
| 76 | ·24192 | 24023 | 23853 | 23684 | 23514 | 23345 | 23175 | 23005 | 22835 | 22665 | 28 | 57 | 85 | 113 | 141 |
| 77 | ·22495 | 22325 | 22155 | 21985 | 21814 | 21644 | 21474 | 21303 | 21132 | 20962 | 28 | 57 | 85 | 114 | 142 |
| 78 | ·20791 | 20620 | 20450 | 20279 | 20108 | 19937 | 19766 | 19595 | 19423 | 19252 | 29 | 57 | 86 | 114 | 143 |
| 79 | ·19081 | 18910 | 18738 | 18567 | 18395 | 18224 | 18052 | 17880 | 17708 | 17537 | 29 | 57 | 86 | 114 | 143 |
| **80** | 0·17365 | 17193 | 17021 | 16849 | 16677 | 16505 | 16333 | 16160 | 15988 | 15816 | 29 | 57 | 86 | 115 | 144 |
| 81 | ·15643 | 15471 | 15299 | 15126 | 14954 | 14781 | 14608 | 14436 | 14263 | 14090 | 29 | 58 | 86 | 115 | 144 |
| 82 | ·13917 | 13744 | 13572 | 13399 | 13226 | 13053 | 12880 | 12706 | 12533 | 12360 | 29 | 58 | 87 | 115 | 144 |
| 83 | ·12187 | 12014 | 11840 | 11667 | 11494 | 11320 | 11147 | 10973 | 10800 | 10626 | 29 | 58 | 87 | 116 | 145 |
| 84 | ·10453 | 10279 | 10106 | 09932 | 09758 | 09585 | 09411 | 09237 | 09063 | 08889 | 29 | 58 | 87 | 116 | 145 |
| **85** | 0·08716 | 08542 | 08368 | 08194 | 08020 | 07846 | 07672 | 07498 | 07324 | 07150 | 29 | 58 | 87 | 116 | 145 |
| 86 | ·06976 | 06802 | 06627 | 06453 | 06279 | 06105 | 05931 | 05756 | 05582 | 05408 | 29 | 58 | 87 | 116 | 145 |
| 87 | ·05234 | 05059 | 04885 | 04711 | 04536 | 04362 | 04188 | 04013 | 03839 | 03664 | 29 | 58 | 87 | 116 | 145 |
| 88 | ·03490 | 03316 | 03141 | 02967 | 02792 | 02618 | 02443 | 02269 | 02094 | 01920 | 29 | 58 | 87 | 117 | 145 |
| 89 | ·01745 | 01571 | 01396 | 01222 | 01047 | 00873 | 00698 | 00524 | 00349 | 00175 | 29 | 58 | 87 | 117 | 145 |
| 90 | ·00000 | | | | | | | | | | | | | | |

# RADIANS TO DEGREES

| Radians | ·000 | ·002 | ·004 | ·006 | ·008 |
|---|---|---|---|---|---|
| | ° ′ | ° ′ | ° ′ | ° ′ | ° ′ |
| ·50 | 28 38·9 | 28 45·7 | 28 52·6 | 28 59·5 | 29 06·4 |
| ·51 | 29 13·3 | 29 20·1 | 29 27·0 | 29 33·9 | 29 40·8 |
| ·52 | 29 47·6 | 29 54·5 | 30 01·4 | 30 08·3 | 30 15·1 |
| ·53 | 30 22·0 | 30 28·9 | 30 35·8 | 30 42·6 | 30 49·5 |
| ·54 | 30 56·4 | 31 03·3 | 31 10·1 | 31 17·0 | 31 23·9 |
| ·55 | 31 30·8 | 31 37·6 | 31 44·5 | 31 51·4 | 31 58·3 |
| ·56 | 32 05·1 | 32 12·0 | 32 18·9 | 32 25·8 | 32 32·6 |
| ·57 | 32 39·5 | 32 46·4 | 32 53·3 | 33 00·1 | 33 07·0 |
| ·58 | 33 13·9 | 33 20·8 | 33 27·6 | 33 34·5 | 33 41·4 |
| ·59 | 33 48·3 | 33 55·1 | 34 02·0 | 34 08·9 | 34 15·8 |
| ·60 | 34 22·6 | 34 29·5 | 34 36·4 | 34 43·3 | 34 50·2 |
| ·61 | 34 57·0 | 35 03·9 | 35 10·8 | 35 17·7 | 35 24·5 |
| ·62 | 35 31·4 | 35 38·3 | 35 45·2 | 35 52·0 | 35 58·9 |
| ·63 | 36 05·8 | 36 12·7 | 36 19·5 | 36 26·4 | 36 33·3 |
| ·64 | 36 40·2 | 36 47·0 | 36 53·9 | 37 00·8 | 37 07·7 |
| ·65 | 37 14·5 | 37 21·4 | 37 28·3 | 37 35·2 | 37 42·0 |
| ·66 | 37 48·9 | 37 55·8 | 38 02·7 | 38 09·5 | 38 16·4 |
| ·67 | 38 23·3 | 38 30·2 | 38 37·0 | 38 43·9 | 38 50·8 |
| ·68 | 38 57·7 | 39 04·5 | 39 11·4 | 39 18·3 | 39 25·2 |
| ·69 | 39 32·0 | 39 38·9 | 39 45·8 | 39 52·7 | 39 59·5 |
| ·70 | 40 06·4 | 40 13·3 | 40 20·2 | 40 27·0 | 40 33·9 |
| ·71 | 40 40·8 | 40 47·7 | 40 54·6 | 41 01·4 | 41 08·3 |
| ·72 | 41 15·2 | 41 22·1 | 41 28·9 | 41 35·8 | 41 42·7 |
| ·73 | 41 49·6 | 41 56·4 | 42 03·3 | 42 10·2 | 42 17·1 |
| ·74 | 42 23·9 | 42 30·8 | 42 37·7 | 42 44·6 | 42 51·4 |
| ·75 | 42 58·3 | 43 05·2 | 43 12·1 | 43 18·9 | 43 25·8 |
| ·76 | 43 32·7 | 43 39·6 | 43 46·4 | 43 53·3 | 44 00·2 |
| ·77 | 44 07·1 | 44 13·9 | 44 20·8 | 44 27·7 | 44 34·6 |
| ·78 | 44 41·4 | 44 48·3 | 44 55·2 | 45 02·1 | 45 08·9 |
| ·79 | 45 15·8 | 45 22·7 | 45 29·6 | 45 36·4 | 45 43·3 |
| ·80 | 45 50·2 | 45 57·1 | 46 03·9 | 46 10·8 | 46 17·7 |
| ·81 | 46 24·6 | 46 31·5 | 46 38·3 | 46 45·2 | 46 52·1 |
| ·82 | 46 59·0 | 47 05·8 | 47 12·7 | 47 19·6 | 47 26·5 |
| ·83 | 47 33·3 | 47 40·2 | 47 47·1 | 47 54·0 | 48 00·8 |
| ·84 | 48 07·7 | 48 14·6 | 48 21·5 | 48 28·3 | 48 35·2 |
| ·85 | 48 42·1 | 48 49·0 | 48 55·8 | 49 02·7 | 49 09·6 |
| ·86 | 49 16·5 | 49 23·3 | 49 30·2 | 49 37·1 | 49 44·0 |
| ·87 | 49 50·8 | 49 57·7 | 50 04·6 | 50 11·5 | 50 18·3 |
| ·88 | 50 25·2 | 50 32·1 | 50 39·0 | 50 45·8 | 50 52·7 |
| ·89 | 50 59·6 | 51 06·5 | 51 13·3 | 51 20·2 | 51 27·1 |
| ·90 | 51 34·0 | 51 40·8 | 51 47·7 | 51 54·6 | 52 01·5 |
| ·91 | 52 08·3 | 52 15·2 | 52 22·1 | 52 29·0 | 52 35·9 |
| ·92 | 52 42·7 | 52 49·6 | 52 56·5 | 53 03·4 | 53 10·2 |
| ·93 | 53 17·1 | 53 24·0 | 53 30·9 | 53 37·7 | 53 44·6 |
| ·94 | 53 51·5 | 53 58·4 | 54 05·2 | 54 12·1 | 54 19·0 |
| ·95 | 54 25·9 | 54 32·7 | 54 39·6 | 54 46·5 | 54 53·4 |
| ·96 | 55 00·2 | 55 07·1 | 55 14·0 | 55 20·9 | 55 27·7 |
| ·97 | 55 34·6 | 55 41·5 | 55 48·4 | 55 55·2 | 56 02·1 |
| ·98 | 56 09·0 | 56 15·9 | 56 22·7 | 56 29·6 | 56 36·5 |
| ·99 | 56 43·4 | 56 50·2 | 56 57·1 | 57 04·0 | 57 10·9 |
| 1·00 | 57 17·7 | | | | |

## DEGREES TO RADIANS

| Degrees | 0 | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 |
|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | Radians | | | | | |
| 0 | 0·00000 | 0·01745 | 0·03491 | 0·05236 | 0·06981 | 0·08727 | 0·10472 | 0·12217 | 0·13963 | 0·15708 |
| 10 | ·17453 | ·19199 | ·20944 | ·22689 | ·24435 | ·26180 | ·27925 | ·29671 | ·31416 | ·33161 |
| 20 | ·34907 | ·36652 | ·38397 | ·40143 | ·41888 | ·43633 | ·45379 | ·47124 | ·48869 | ·50615 |
| 30 | ·52360 | ·54105 | ·55851 | ·57596 | ·59341 | ·61087 | ·62832 | ·64577 | ·66323 | ·68068 |
| 40 | ·69813 | ·71558 | ·73304 | ·75049 | ·76794 | ·78540 | ·80285 | ·82030 | ·83776 | ·85521 |
| 50 | 0·87266 | 0·89012 | 0·90757 | 0·92502 | 0·94248 | 0·95993 | 0·97738 | 0·99484 | 1·01229 | 1·02974 |
| 60 | 1·04720 | 1·06465 | 1·08210 | 1·09956 | 1·11701 | 1·13446 | 1·15192 | 1·16937 | 1·18682 | 1·20428 |
| 70 | ·22173 | ·23918 | ·25664 | ·27409 | ·29154 | ·30900 | ·32645 | ·34390 | ·36136 | ·37881 |
| 80 | ·39626 | ·41372 | ·43117 | ·44862 | ·46608 | ·48353 | ·50098 | ·51844 | ·53589 | ·55334 |
| 90 | ·57080 | | | | | | | | | |

## MINUTES OF ARC TO RADIANS

| Minutes | 0 | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 |
|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | Radians | | | | | |
| 0 | 0·00000 | 0·00029 | 0·00058 | 0·00087 | 0·00116 | 0·00145 | 0·00175 | 0·00204 | 0·00233 | 0·00262 |
| 10 | ·00291 | ·00320 | ·00349 | ·00378 | ·00407 | ·00436 | ·00465 | ·00495 | ·00524 | ·00553 |
| 20 | ·00582 | ·00611 | ·00640 | ·00669 | ·00698 | ·00727 | ·00756 | ·00785 | ·00814 | ·00844 |
| 30 | ·00873 | ·00902 | ·00931 | ·00960 | ·00989 | ·01018 | ·01047 | ·01076 | ·01105 | ·01134 |
| 40 | ·01164 | ·01193 | ·01222 | ·01251 | ·01280 | ·01309 | ·01338 | ·01367 | ·01396 | ·01425 |
| 50 | ·01454 | ·01484 | ·01513 | ·01542 | ·01571 | ·01600 | ·01629 | ·01658 | ·01687 | ·01716 |
| 60 | ·01745 | | | | | | | | | |

AÇIKLAMA SAYFASINA DÖNMEK IÇIN TIKLAYINIZ

# TABLE A HOUR ANGLE

| Lat. ° | 45° | 46° | 47° | 48° | 49° | 50° | 51° | 52° | 53° | 54° | 55° | 56° | 57° | 58° | 59° | 60° | Lat. ° |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | 315° | 314° | 313° | 312° | 311° | 310° | 309° | 308° | 307° | 306° | 305° | 304° | 303° | 302° | 301° | 300° | |
| 0 | ·00 | ·00 | ·00 | ·00 | ·00 | ·00 | ·00 | ·00 | ·00 | ·00 | ·00 | ·00 | ·00 | ·00 | ·00 | ·00 | 0 |
| 1 | ·02 | ·02 | ·02 | ·02 | ·02 | ·01 | ·01 | ·01 | ·01 | ·01 | ·01 | ·01 | ·01 | ·01 | ·01 | ·01 | 1 |
| 2 | ·03 | ·03 | ·03 | ·03 | ·03 | ·03 | ·03 | ·03 | ·03 | ·03 | ·02 | ·02 | ·02 | ·02 | ·02 | ·02 | 2 |
| 3 | ·05 | ·05 | ·05 | ·05 | ·05 | ·04 | ·04 | ·04 | ·04 | ·04 | ·04 | ·04 | ·03 | ·03 | ·03 | ·03 | 3 |
| 4 | ·07 | ·07 | ·07 | ·06 | ·06 | ·06 | ·06 | ·05 | ·05 | ·05 | ·05 | ·05 | ·05 | ·04 | ·04 | ·04 | 4 |
| 5 | ·09 | ·08 | ·08 | ·08 | ·08 | ·07 | ·07 | ·07 | ·07 | ·06 | ·06 | ·06 | ·06 | ·05 | ·05 | ·05 | 5 |
| 6 | ·11 | ·10 | ·10 | ·09 | ·09 | ·09 | ·09 | ·08 | ·08 | ·08 | ·07 | ·07 | ·07 | ·07 | ·06 | ·06 | 6 |
| 7 | ·12 | ·12 | ·11 | ·11 | ·11 | ·10 | ·10 | ·10 | ·09 | ·09 | ·09 | ·08 | ·08 | ·08 | ·07 | ·07 | 7 |
| 8 | ·14 | ·14 | ·13 | ·13 | ·12 | ·12 | ·11 | ·11 | ·11 | ·10 | ·10 | ·09 | ·09 | ·09 | ·08 | ·08 | 8 |
| 9 | ·16 | ·15 | ·15 | ·14 | ·14 | ·13 | ·13 | ·12 | ·12 | ·12 | ·11 | ·11 | ·10 | ·10 | ·10 | ·09 | 9 |
| 10 | ·18 | ·17 | ·16 | ·16 | ·15 | ·15 | ·14 | ·14 | ·13 | ·13 | ·12 | ·12 | ·11 | ·11 | ·11 | ·10 | 10 |
| 11 | ·19 | ·19 | ·18 | ·18 | ·17 | ·16 | ·16 | ·15 | ·15 | ·14 | ·14 | ·13 | ·13 | ·12 | ·12 | ·11 | 11 |
| 12 | ·21 | ·21 | ·20 | ·19 | ·18 | ·18 | ·17 | ·17 | ·16 | ·15 | ·15 | ·14 | ·14 | ·13 | ·13 | ·12 | 12 |
| 13 | ·23 | ·22 | ·22 | ·21 | ·20 | ·19 | ·19 | ·18 | ·17 | ·17 | ·16 | ·16 | ·15 | ·14 | ·14 | ·13 | 13 |
| 14 | ·25 | ·24 | ·23 | ·22 | ·22 | ·21 | ·20 | ·19 | ·19 | ·18 | ·17 | ·17 | ·16 | ·16 | ·15 | ·14 | 14 |
| 15 | ·27 | ·26 | ·25 | ·24 | ·23 | ·22 | ·22 | ·21 | ·20 | ·19 | ·19 | ·18 | ·17 | ·17 | ·16 | ·15 | 15 |
| 16 | ·29 | ·28 | ·27 | ·26 | ·25 | ·24 | ·23 | ·22 | ·22 | ·21 | ·20 | ·19 | ·19 | ·18 | ·17 | ·17 | 16 |
| 17 | ·31 | ·30 | ·29 | ·28 | ·27 | ·26 | ·25 | ·24 | ·23 | ·22 | ·21 | ·21 | ·20 | ·19 | ·18 | ·18 | 17 |
| 18 | ·32 | ·31 | ·30 | ·29 | ·28 | ·27 | ·26 | ·25 | ·24 | ·24 | ·23 | ·22 | ·21 | ·20 | ·20 | ·19 | 18 |
| 19 | ·34 | ·33 | ·32 | ·31 | ·30 | ·29 | ·28 | ·27 | ·26 | ·25 | ·24 | ·23 | ·22 | ·22 | ·21 | ·20 | 19 |
| 20 | ·36 | ·35 | ·34 | ·33 | ·32 | ·31 | ·29 | ·28 | ·27 | ·26 | ·25 | ·25 | ·24 | ·23 | ·22 | ·21 | 20 |
| 21 | ·38 | ·37 | ·36 | ·35 | ·33 | ·32 | ·31 | ·30 | ·29 | ·28 | ·27 | ·26 | ·25 | ·24 | ·23 | ·22 | 21 |
| 22 | ·40 | ·39 | ·38 | ·36 | ·35 | ·34 | ·33 | ·32 | ·30 | ·29 | ·28 | ·27 | ·26 | ·25 | ·24 | ·23 | 22 |
| 23 | ·42 | ·41 | ·40 | ·38 | ·37 | ·36 | ·34 | ·33 | ·32 | ·31 | ·30 | ·29 | ·28 | ·27 | ·26 | ·25 | 23 |
| 24 | ·45 | ·43 | ·42 | ·40 | ·39 | ·37 | ·36 | ·35 | ·34 | ·32 | ·31 | ·30 | ·29 | ·28 | ·27 | ·26 | 24 |
| 25 | ·47 | ·45 | ·44 | ·42 | ·41 | ·39 | ·38 | ·36 | ·35 | ·34 | ·33 | ·31 | ·30 | ·29 | ·28 | ·27 | 25 |
| 26 | ·49 | ·47 | ·46 | ·44 | ·42 | ·41 | ·39 | ·38 | ·37 | ·35 | ·34 | ·33 | ·32 | ·30 | ·29 | ·28 | 26 |
| 27 | ·51 | ·49 | ·48 | ·46 | ·44 | ·43 | ·41 | ·40 | ·38 | ·37 | ·36 | ·34 | ·33 | ·32 | ·31 | ·29 | 27 |
| 28 | ·53 | ·51 | ·50 | ·48 | ·46 | ·45 | ·43 | ·42 | ·40 | ·39 | ·37 | ·36 | ·35 | ·33 | ·32 | ·31 | 28 |
| 29 | ·55 | ·54 | ·52 | ·50 | ·48 | ·47 | ·45 | ·43 | ·42 | ·40 | ·39 | ·37 | ·36 | ·35 | ·33 | ·32 | 29 |
| 30 | ·58 | ·56 | ·54 | ·52 | ·50 | ·48 | ·47 | ·45 | ·44 | ·42 | ·40 | ·39 | ·37 | ·36 | ·35 | ·33 | 30 |
| 31 | ·60 | ·58 | ·56 | ·54 | ·52 | ·50 | ·49 | ·47 | ·45 | ·44 | ·42 | ·40 | ·39 | ·38 | ·36 | ·35 | 31 |
| 32 | ·62 | ·60 | ·58 | ·56 | ·54 | ·52 | ·51 | ·49 | ·47 | ·45 | ·44 | ·42 | ·41 | ·39 | ·38 | ·36 | 32 |
| 33 | ·65 | ·63 | ·61 | ·58 | ·56 | ·55 | ·53 | ·51 | ·49 | ·47 | ·45 | ·44 | ·42 | ·41 | ·39 | ·37 | 33 |
| 34 | ·67 | ·65 | ·63 | ·61 | ·59 | ·57 | ·55 | ·53 | ·51 | ·49 | ·47 | ·46 | ·44 | ·42 | ·41 | ·39 | 34 |
| 35 | ·70 | ·68 | ·65 | ·63 | ·61 | ·59 | ·57 | ·55 | ·53 | ·51 | ·49 | ·47 | ·45 | ·44 | ·42 | ·40 | 35 |
| 36 | ·73 | ·70 | ·68 | ·65 | ·63 | ·61 | ·59 | ·57 | ·55 | ·53 | ·51 | ·49 | ·47 | ·45 | ·44 | ·42 | 36 |
| 37 | ·75 | ·73 | ·70 | ·68 | ·66 | ·63 | ·61 | ·59 | ·57 | ·55 | ·53 | ·51 | ·49 | ·47 | ·45 | ·44 | 37 |
| 38 | ·78 | ·75 | ·73 | ·70 | ·68 | ·66 | ·63 | ·61 | ·59 | ·57 | ·55 | ·53 | ·51 | ·49 | ·47 | ·45 | 38 |
| 39 | ·81 | ·78 | ·76 | ·73 | ·70 | ·68 | ·66 | ·63 | ·61 | ·59 | ·57 | ·55 | ·53 | ·51 | ·49 | ·47 | 39 |
| 40 | ·84 | ·81 | ·78 | ·76 | ·73 | ·70 | ·68 | ·66 | ·63 | ·61 | ·59 | ·57 | ·55 | ·52 | ·50 | ·48 | 40 |
| 41 | ·87 | ·84 | ·81 | ·78 | ·76 | ·73 | ·70 | ·68 | ·66 | ·63 | ·61 | ·59 | ·56 | ·54 | ·52 | ·50 | 41 |
| 42 | ·90 | ·87 | ·84 | ·81 | ·78 | ·76 | ·73 | ·70 | ·68 | ·65 | ·63 | ·61 | ·58 | ·56 | ·54 | ·52 | 42 |
| 43 | ·93 | ·90 | ·87 | ·84 | ·81 | ·78 | ·76 | ·73 | ·70 | ·68 | ·65 | ·63 | ·61 | ·58 | ·56 | ·54 | 43 |
| 44 | ·97 | ·93 | ·90 | ·87 | ·84 | ·81 | ·78 | ·75 | ·73 | ·70 | ·68 | ·65 | ·63 | ·60 | ·58 | ·56 | 44 |
| 45 | 1·00 | ·97 | ·93 | ·90 | ·87 | ·84 | ·81 | ·78 | ·75 | ·73 | ·70 | ·68 | ·65 | ·63 | ·60 | ·58 | 45 |
| 46 | 1·04 | 1·00 | ·97 | ·93 | ·90 | ·87 | ·84 | ·81 | ·78 | ·75 | ·73 | ·70 | ·67 | ·65 | ·62 | ·60 | 46 |
| 47 | 1·07 | 1·04 | 1·00 | ·97 | ·93 | ·90 | ·87 | ·84 | ·81 | ·78 | ·75 | ·72 | ·70 | ·67 | ·64 | ·62 | 47 |
| 48 | 1·11 | 1·07 | 1·04 | 1·00 | ·97 | ·93 | ·90 | ·87 | ·84 | ·81 | ·78 | ·75 | ·72 | ·69 | ·67 | ·64 | 48 |
| 49 | 1·15 | 1·11 | 1·07 | 1·04 | 1·00 | ·97 | ·93 | ·90 | ·87 | ·84 | ·81 | ·78 | ·75 | ·72 | ·69 | ·66 | 49 |
| 50 | 1·19 | 1 15 | 1·11 | 1·07 | 1·04 | 1·00 | ·97 | ·93 | ·90 | ·87 | ·83 | ·80 | ·77 | ·75 | ·72 | ·69 | 50 |
| 51 | 1·23 | 1·19 | 1·15 | 1·11 | 1·07 | 1·04 | 1·00 | ·97 | ·93 | ·90 | ·86 | ·83 | ·80 | ·77 | ·74 | 71 | 51 |
| 52 | 1·28 | 1·24 | 1·19 | 1·15 | 1·11 | 1·07 | 1·04 | 1·00 | ·96 | ·93 | ·90 | ·86 | ·83 | ·80 | ·77 | ·74 | 52 |
| 53 | 1·33 | 1·28 | 1·24 | 1·19 | 1·15 | 1·11 | 1·07 | 1·04 | 1·00 | ·96 | ·93 | ·90 | ·86 | ·83 | ·80 | ·77 | 53 |
| 54 | 1·38 | 1·33 | 1·28 | 1·24 | 1·20 | 1·15 | 1·11 | 1·08 | 1·04 | 1·00 | ·96 | ·93 | ·89 | ·86 | ·83 | ·79 | 54 |
| 55 | 1·43 | 1·38 | 1·33 | 1·29 | 1·24 | 1·20 | 1·16 | 1·12 | 1·08 | 1·04 | 1·00 | ·96 | ·93 | ·89 | ·86 | ·82 | 55 |
| 56 | 1·48 | 1·43 | 1·38 | 1·34 | 1·29 | 1·24 | 1·20 | 1·16 | 1·12 | 1·08 | 1·04 | 1·00 | ·96 | ·93 | ·89 | ·86 | 56 |
| 57 | 1·54 | 1·49 | 1·44 | 1·39 | 1·34 | 1·29 | 1·25 | 1·20 | 1·16 | 1·12 | 1·08 | 1·04 | 1·00 | ·96 | ·93 | ·89 | 57 |
| 58 | 1·60 | 1·55 | 1·49 | 1·44 | 1·39 | 1·34 | 1·30 | 1·25 | 1·21 | 1·16 | 1·12 | 1·08 | 1·04 | 1·00 | ·96 | ·92 | 58 |
| 59 | 1·66 | 1·61 | 1·55 | 1·50 | 1·45 | 1·40 | 1·35 | 1·30 | 1·25 | 1·21 | 1·17 | 1·12 | 1·08 | 1·04 | 1·00 | ·96 | 59 |
| 60 | 1·73 | 1·67 | 1·62 | 1·56 | 1·51 | 1·45 | 1·40 | 1·35 | 1·31 | 1·26 | 1·21 | 1·17 | 1·12 | 1·08 | 1·04 | 1·00 | 60 |
| Lat. | 135° | 134° | 133° | 132° | 131° | 130° | 129° | 128° | 127° | 126° | 125° | 124° | 123° | 122° | 121° | 120° | Lat. |
| | 225° | 226° | 227° | 228° | 229° | 230° | 231° | 232° | 233° | 234° | 235° | 236° | 237° | 238° | 239° | 240° | |

HOUR ANGLE

A

A - Named opposite to Latitude, **except** when **Hour Angle** is between 90° and 270°

A - Named opposite to Latitude, **except** when **Hour Angle** is between 90° and 270°

# TABLE B HOUR ANGLE

| Dec. ° | 45° | 46° | 47° | 48° | 49° | 50° | 51° | 52° | 53° | 54° | 55° | 56° | 57° | 58° | 59° | 60° | Dec. ° |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | 315° | 314° | 313° | 312° | 311° | 310° | 309° | 308° | 307° | 306° | 305° | 304° | 303° | 302° | 301° | 300° | |
| 0 | ·00 | ·00 | ·00 | ·00 | ·00 | ·00 | ·00 | ·00 | ·00 | ·00 | ·00 | ·00 | ·00 | ·00 | ·00 | ·00 | 0 |
| 1 | ·02 | ·02 | ·02 | ·02 | ·02 | ·02 | ·02 | ·02 | ·02 | ·02 | ·02 | ·02 | ·02 | ·02 | ·02 | ·02 | 1 |
| 2 | ·05 | ·05 | ·05 | ·05 | ·05 | ·05 | ·04 | ·04 | ·04 | ·04 | ·04 | ·04 | ·04 | ·04 | ·04 | ·04 | 2 |
| 3 | ·07 | ·07 | ·07 | ·07 | ·07 | ·07 | ·07 | ·07 | ·07 | ·06 | ·06 | ·06 | ·06 | ·06 | ·06 | ·06 | 3 |
| 4 | ·10 | ·10 | ·10 | ·09 | ·09 | ·09 | ·09 | ·09 | ·09 | ·09 | ·09 | ·08 | ·08 | ·08 | ·08 | ·08 | 4 |
| 5 | ·12 | ·12 | ·12 | ·12 | ·12 | ·11 | ·11 | ·11 | ·11 | ·11 | ·11 | ·11 | ·10 | ·10 | ·10 | ·10 | 5 |
| 6 | ·15 | ·15 | ·14 | ·14 | ·14 | ·14 | ·14 | ·13 | ·13 | ·13 | ·13 | ·13 | ·13 | ·12 | ·12 | ·12 | 6 |
| 7 | ·17 | ·17 | ·17 | ·17 | ·16 | ·16 | ·16 | ·16 | ·15 | ·15 | ·15 | ·15 | ·15 | ·14 | ·14 | ·14 | 7 |
| 8 | ·20 | ·20 | ·19 | ·19 | ·19 | ·18 | ·18 | ·18 | ·18 | ·17 | ·17 | ·17 | ·17 | ·17 | ·16 | ·16 | 8 |
| 9 | ·22 | ·22 | ·22 | ·21 | ·21 | ·21 | ·20 | ·20 | ·20 | ·20 | ·19 | ·19 | ·19 | ·19 | ·18 | ·18 | 9 |
| 10 | ·25 | ·25 | ·24 | ·24 | ·23 | ·23 | ·23 | ·22 | ·22 | ·22 | ·22 | ·21 | ·21 | ·21 | ·21 | ·20 | 10 |
| 11 | ·27 | ·27 | ·27 | ·26 | ·26 | ·25 | ·25 | ·25 | ·24 | ·24 | ·24 | ·23 | ·23 | ·23 | ·23 | ·22 | 11 |
| 12 | ·30 | ·30 | ·29 | ·29 | ·28 | ·28 | ·27 | ·27 | ·27 | ·26 | ·26 | ·26 | ·25 | ·25 | ·25 | ·25 | 12 |
| 13 | ·33 | ·32 | ·32 | ·31 | ·31 | ·30 | ·30 | ·29 | ·29 | ·29 | ·28 | ·28 | ·28 | ·27 | ·27 | ·27 | 13 |
| 14 | ·35 | ·35 | ·34 | ·34 | ·33 | ·33 | ·32 | ·32 | ·31 | ·31 | ·30 | ·30 | ·30 | ·29 | ·29 | ·29 | 14 |
| 15 | ·38 | ·37 | ·37 | ·36 | ·36 | ·35 | ·34 | ·34 | ·34 | ·33 | ·33 | ·32 | ·32 | ·32 | ·31 | ·31 | 15 |
| 16 | ·41 | ·40 | ·39 | ·39 | ·38 | ·37 | ·37 | ·36 | ·36 | ·35 | ·35 | ·35 | ·34 | ·34 | ·33 | ·33 | 16 |
| 17 | ·43 | ·43 | ·42 | ·41 | ·41 | ·40 | ·39 | ·39 | ·38 | ·38 | ·37 | ·37 | ·36 | ·36 | ·36 | ·35 | 17 |
| 18 | ·46 | ·45 | ·44 | ·44 | ·43 | ·42 | ·42 | ·41 | ·41 | ·40 | ·40 | ·39 | ·39 | ·38 | ·38 | ·38 | 18 |
| 19 | ·49 | ·48 | ·47 | ·46 | ·46 | ·45 | ·44 | ·44 | ·43 | ·43 | ·42 | ·42 | ·41 | ·41 | ·40 | ·40 | 19 |
| 20 | ·51 | ·51 | ·50 | ·49 | ·48 | ·48 | ·47 | ·46 | ·46 | ·45 | ·44 | ·44 | ·43 | ·43 | ·42 | ·42 | 20 |
| 21 | ·54 | ·53 | ·52 | ·52 | ·51 | ·50 | ·49 | ·49 | ·48 | ·47 | ·47 | ·46 | ·46 | ·45 | ·45 | ·44 | 21 |
| 22 | ·57 | ·56 | ·55 | ·54 | ·54 | ·53 | ·52 | ·51 | ·51 | ·50 | ·49 | ·49 | ·48 | ·48 | ·47 | ·47 | 22 |
| 23 | ·60 | ·59 | ·58 | ·57 | ·56 | ·55 | ·55 | ·54 | ·53 | ·52 | ·52 | ·51 | ·51 | ·50 | ·50 | ·49 | 23 |
| 24 | ·63 | ·62 | ·61 | ·60 | ·59 | ·58 | ·57 | ·57 | ·56 | ·55 | ·54 | ·54 | ·53 | ·53 | ·52 | ·51 | 24 |
| 25 | ·66 | ·65 | ·64 | ·63 | ·62 | ·61 | ·60 | ·59 | ·58 | ·58 | ·57 | ·56 | ·56 | ·55 | ·54 | ·54 | 25 |
| 26 | ·69 | ·68 | ·67 | ·66 | ·65 | ·64 | ·63 | ·62 | ·61 | ·60 | ·60 | ·59 | ·58 | ·58 | ·57 | ·56 | 26 |
| 27 | ·72 | ·71 | ·70 | ·69 | ·68 | ·67 | ·66 | ·65 | ·64 | ·63 | ·62 | ·61 | ·61 | ·60 | ·59 | ·59 | 27 |
| 28 | ·75 | ·74 | ·73 | ·72 | ·70 | ·69 | ·68 | ·67 | ·67 | ·66 | ·65 | ·64 | ·63 | ·63 | ·62 | ·61 | 28 |
| 29 | ·78 | ·77 | ·76 | ·75 | ·73 | ·72 | ·71 | ·70 | ·69 | ·69 | ·68 | ·67 | ·66 | ·65 | ·65 | ·64 | 29 |
| 30 | ·82 | ·80 | ·79 | ·78 | ·76 | ·75 | ·74 | ·73 | ·72 | ·71 | ·70 | ·70 | ·69 | ·68 | ·67 | ·67 | 30 |
| 31 | ·85 | ·84 | ·82 | ·81 | ·80 | ·78 | ·77 | ·76 | ·75 | ·74 | ·73 | ·72 | ·72 | ·71 | ·70 | ·69 | 31 |
| 32 | ·88 | ·87 | ·85 | ·84 | ·83 | ·82 | ·80 | ·79 | ·78 | ·77 | ·76 | ·75 | ·75 | ·74 | ·73 | ·72 | 32 |
| 33 | ·92 | ·90 | ·89 | ·87 | ·86 | ·85 | ·84 | ·82 | ·81 | ·80 | ·79 | ·78 | ·77 | ·77 | ·76 | ·75 | 33 |
| 34 | ·96 | ·94 | ·92 | ·91 | ·89 | ·88 | ·87 | ·86 | ·84 | ·83 | ·82 | ·81 | ·80 | ·80 | ·79 | ·78 | 34 |
| 35 | ·99 | ·97 | ·96 | ·94 | ·93 | ·91 | ·90 | ·89 | ·88 | ·87 | ·85 | ·84 | ·83 | ·83 | ·82 | ·81 | 35 |
| 36 | 1·03 | 1·01 | ·99 | ·98 | ·96 | ·95 | ·93 | ·92 | ·91 | ·90 | ·89 | ·88 | ·87 | ·86 | ·85 | ·84 | 36 |
| 37 | 1·07 | 1·05 | 1·03 | 1·01 | 1·00 | ·98 | ·97 | ·96 | ·94 | ·93 | ·92 | ·91 | ·90 | ·89 | ·88 | ·87 | 37 |
| 38 | 1·11 | 1·09 | 1·07 | 1·05 | 1·04 | 1·02 | 1·00 | ·99 | ·98 | ·97 | ·95 | ·94 | ·93 | ·92 | ·91 | ·90 | 38 |
| 39 | 1·15 | 1·13 | 1·11 | 1·09 | 1·07 | 1·06 | 1·04 | 1·03 | 1·01 | 1·00 | ·99 | ·98 | ·97 | ·95 | ·94 | ·94 | 39 |
| 40 | 1·19 | 1·17 | 1·15 | 1·13 | 1·11 | 1·10 | 1·08 | 1·06 | 1·05 | 1·04 | 1·02 | 1·01 | 1·00 | ·99 | ·98 | ·97 | 40 |
| 41 | 1·23 | 1·21 | 1·19 | 1·17 | 1·15 | 1·13 | 1·12 | 1·10 | 1·09 | 1·07 | 1·06 | 1·05 | 1·04 | 1·03 | 1·01 | 1·00 | 41 |
| 42 | 1·28 | 1·25 | 1·23 | 1·21 | 1·19 | 1·18 | 1·16 | 1·14 | 1·13 | 1·11 | 1·10 | 1·09 | 1·07 | 1·06 | 1·05 | 1·04 | 42 |
| 43 | 1·32 | 1·30 | 1·28 | 1·25 | 1·24 | 1·22 | 1·20 | 1·18 | 1·17 | 1·15 | 1·14 | 1·12 | 1·11 | 1·10 | 1·09 | 1·08 | 43 |
| 44 | 1·37 | 1·34 | 1·32 | 1·30 | 1·28 | 1·26 | 1·24 | 1·23 | 1·21 | 1·19 | 1·18 | 1·16 | 1·15 | 1·14 | 1·13 | 1·12 | 44 |
| 45 | 1·41 | 1·39 | 1·37 | 1·35 | 1·33 | 1·31 | 1·29 | 1·27 | 1·25 | 1·24 | 1·22 | 1·21 | 1·19 | 1·18 | 1·17 | 1·15 | 45 |
| 46 | 1·47 | 1·44 | 1·42 | 1·39 | 1·37 | 1·35 | 1·33 | 1·31 | 1·30 | 1·28 | 1·26 | 1·25 | 1·23 | 1·22 | 1·21 | 1·20 | 46 |
| 47 | 1·52 | 1·49 | 1·47 | 1·44 | 1·42 | 1·40 | 1·38 | 1·36 | 1·34 | 1·33 | 1·31 | 1·29 | 1·28 | 1·26 | 1·25 | 1·24 | 47 |
| 48 | 1·57 | 1·54 | 1·52 | 1·49 | 1·47 | 1·45 | 1·43 | 1·41 | 1·39 | 1·37 | 1·36 | 1·34 | 1·32 | 1·31 | 1·30 | 1·28 | 48 |
| 49 | 1·63 | 1·60 | 1·57 | 1·55 | 1·52 | 1·50 | 1·48 | 1·46 | 1·44 | 1·42 | 1·40 | 1·39 | 1·37 | 1·36 | 1·34 | 1·33 | 49 |
| 50 | 1·69 | 1·66 | 1·63 | 1·60 | 1·58 | 1·56 | 1·53 | 1·51 | 1·49 | 1·47 | 1·45 | 1·44 | 1·42 | 1·41 | 1·39 | 1·38 | 50 |
| 51 | 1·75 | 1·72 | 1·69 | 1·66 | 1·64 | 1·61 | 1·59 | 1·57 | 1·55 | 1·53 | 1·51 | 1·49 | 1·47 | 1·46 | 1·44 | 1·43 | 51 |
| 52 | 1·81 | 1·78 | 1·75 | 1·72 | 1·70 | 1·67 | 1·65 | 1·62 | 1·60 | 1·58 | 1·56 | 1·54 | 1·53 | 1·51 | 1·49 | 1·48 | 52 |
| 53 | 1·88 | 1·84 | 1·81 | 1·79 | 1·76 | 1·73 | 1·71 | 1·68 | 1·66 | 1·64 | 1·62 | 1·60 | 1·58 | 1·56 | 1·55 | 1·53 | 53 |
| 54 | 1·95 | 1·91 | 1·88 | 1·85 | 1·82 | 1·80 | 1·77 | 1·75 | 1·72 | 1·70 | 1·68 | 1·66 | 1·64 | 1·62 | 1·61 | 1·59 | 54 |
| 55 | 2·02 | 1·99 | 1·95 | 1·92 | 1·89 | 1·86 | 1·84 | 1·81 | 1·79 | 1·77 | 1·74 | 1·72 | 1·70 | 1·68 | 1·67 | 1·65 | 55 |
| 56 | 2·10 | 2·06 | 2·03 | 2·00 | 1·96 | 1·94 | 1·91 | 1·88 | 1·86 | 1·83 | 1·81 | 1·79 | 1·77 | 1·75 | 1·73 | 1·71 | 56 |
| 57 | 2·18 | 2·14 | 2·11 | 2·07 | 2·04 | 2·01 | 1·98 | 1·95 | 1·93 | 1·90 | 1·88 | 1·86 | 1·84 | 1·82 | 1·80 | 1·78 | 57 |
| 58 | 2·27 | 2·22 | 2·19 | 2·15 | 2·12 | 2·09 | 2·06 | 2·03 | 2·00 | 1·98 | 1·95 | 1·93 | 1·91 | 1·89 | 1·87 | 1·85 | 58 |
| 59 | 2·36 | 2·31 | 2·28 | 2·24 | 2·21 | 2·17 | 2·14 | 2·11 | 2·08 | 2·06 | 2·03 | 2·01 | 1·98 | 1·96 | 1·94 | 1·92 | 59 |
| 60 | 2·45 | 2·41 | 2·37 | 2·33 | 2·29 | 2·26 | 2·23 | 2·20 | 2·17 | 2·14 | 2·11 | 2·09 | 2·07 | 2·04 | 2·02 | 2·00 | 60 |
| Dec. | 135° | 134° | 133° | 132° | 131° | 130° | 129° | 128° | 127° | 126° | 125° | 124° | 123° | 122° | 121° | 120° | Dec. |
| | 225° | 226° | 227° | 228° | 229° | 230° | 231° | 232° | 233° | 234° | 235° | 236° | 237° | 238° | 239° | 240° | |

HOUR ANGLE

B - Always named the **same** as Declination

B - Always named the **same** as Declination

B

# TABLE C

| A ± B = | ·30′ | ·31′ | ·32′ | ·33′ | ·34′ | ·35′ | A. & B. CORRECTION. ·36′ | ·37′ | ·38′ | ·39′ | ·40′ | ·41′ | ·42′ | ·43′ | ·44′ | ·45′ = A ± B |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Lat.° | AZIMUTHS ° | ° | ° | ° | ° | ° | ° | ° | ° | ° | ° | ° | ° | ° | ° | ° |
| 0 | 73·3 | 72·8 | 72·3 | 71·7 | 71·2 | 70·7 | 70·2 | 69·7 | 69·2 | 68·7 | 68·2 | 67·7 | 67·2 | 66·7 | 66·3 | 65·8 |
| 5 | 73·4 | 72·8 | 72·3 | 71·8 | 71·3 | 70·8 | 70·3 | 69·8 | 69·3 | 68·8 | 68·3 | 67·8 | 67·3 | 66·8 | 66·4 | 65·9 |
| 10 | 73·5 | 73·0 | 72·5 | 72·0 | 71·5 | 71·0 | 70·5 | 70·0 | 69·5 | 69·0 | 68·5 | 68·0 | 67·5 | 67·0 | 66·6 | 66·1 |
| 14 | 73·7 | 73·2 | 72·7 | 72·2 | 71·7 | 71·2 | 70·7 | 70·2 | 69·7 | 69·3 | 68·8 | 68·3 | 67·8 | 67·4 | 66·9 | 66·4 |
| 18 | 74·1 | 73·6 | 73·1 | 72·6 | 72·1 | 71·6 | 71·1 | 70·6 | 70·1 | 69·6 | 69·2 | 68·7 | 68·2 | 67·8 | 67·3 | 66·8 |
| 20 | 74·3 | 73·8 | 73·3 | 72·8 | 72·3 | 71·8 | 71·3 | 70·8 | 70·3 | 69·9 | 69·4 | 68·9 | 68·5 | 68·0 | 67·5 | 67·1 |
| 22 | 74·5 | 74·0 | 73·5 | 73·0 | 72·5 | 72·0 | 71·5 | 71·1 | 70·6 | 70·1 | 69·7 | 69·2 | 68·7 | 68·3 | 67·8 | 67·4 |
| 24 | 74·7 | 74·2 | 73·7 | 73·2 | 72·7 | 72·3 | 71·8 | 71·3 | 70·9 | 70·4 | 69·9 | 69·5 | 69·0 | 68·6 | 68·1 | 67·7 |
| 26 | 74·9 | 74·4 | 74·0 | 73·5 | 73·0 | 72·5 | 72·1 | 71·6 | 71·1 | 70·7 | 70·2 | 69·8 | 69·3 | 68·9 | 68·4 | 68·0 |
| 28 | 75·2 | 74·7 | 74·2 | 73·8 | 73·3 | 72·8 | 72·4 | 71·9 | 71·5 | 71·0 | 70·5 | 70·1 | 69·7 | 69·2 | 68·8 | 68·3 |
| 30 | 75·4 | 75·0 | 74·5 | 74·1 | 73·6 | 73·1 | 72·7 | 72·2 | 71·8 | 71·3 | 70·9 | 70·5 | 70·0 | 69·6 | 69·1 | 68·7 |
| 31 | 75·6 | 75·1 | 74·7 | 74·2 | 73·8 | 73·3 | 72·9 | 72·4 | 72·0 | 71·5 | 71·1 | 70·6 | 70·2 | 69·8 | 69·3 | 68·9 |
| 32 | 75·7 | 75·3 | 74·8 | 74·4 | 73·9 | 73·5 | 73·0 | 72·6 | 72·1 | 71·7 | 71·3 | 70·8 | 70·4 | 70·0 | 69·5 | 69·1 |
| 33 | 75·9 | 75·4 | 75·0 | 74·5 | 74·1 | 73·6 | 73·2 | 72·8 | 72·3 | 71·9 | 71·5 | 71·0 | 70·6 | 70·2 | 69·7 | 69·3 |
| 34 | 76·0 | 75·6 | 75·1 | 74·7 | 74·3 | 73·8 | 73·4 | 72·9 | 72·5 | 72·1 | 71·7 | 71·2 | 70·8 | 70·4 | 70·0 | 69·5 |
| 35 | 76·2 | 75·8 | 75·3 | 74·9 | 74·4 | 74·0 | 73·6 | 73·1 | 72·7 | 72·3 | 71·9 | 71·4 | 71·0 | 70·6 | 70·2 | 69·8 |
| 36 | 76·4 | 75·9 | 75·5 | 75·1 | 74·6 | 74·2 | 73·8 | 73·3 | 72·9 | 72·5 | 72·1 | 71·6 | 71·2 | 70·8 | 70·4 | 70·0 |
| 37 | 76·5 | 76·1 | 75·7 | 75·2 | 74·8 | 74·4 | 74·0 | 73·5 | 73·1 | 72·7 | 72·3 | 71·9 | 71·5 | 71·0 | 70·6 | 70·2 |
| 38 | 76·7 | 76·3 | 75·8 | 75·4 | 75·0 | 74·6 | 74·2 | 73·7 | 73·3 | 72·9 | 72·5 | 72·1 | 71·7 | 71·3 | 70·9 | 70·5 |
| 39 | 76·9 | 76·5 | 76·0 | 75·6 | 75·2 | 74·8 | 74·4 | 74·0 | 73·5 | 73·1 | 72·7 | 72·3 | 71·9 | 71·5 | 71·1 | 70·7 |
| 40 | 77·1 | 76·6 | 76·2 | 75·8 | 75·4 | 75·0 | 74·6 | 74·2 | 73·8 | 73·4 | 73·0 | 72·6 | 72·2 | 71·8 | 71·4 | 71·0 |
| 41 | 77·2 | 76·8 | 76·4 | 76·0 | 75·6 | 75·2 | 74·8 | 74·4 | 74·0 | 73·6 | 73·2 | 72·8 | 72·4 | 72·0 | 71·6 | 71·2 |
| 42 | 77·4 | 77·0 | 76·6 | 76·2 | 75·8 | 75·4 | 75·0 | 74·6 | 74·2 | 73·8 | 73·4 | 73·1 | 72·7 | 72·3 | 71·9 | 71·5 |
| 43 | 77·6 | 77·2 | 76·8 | 76·4 | 76·0 | 75·6 | 75·2 | 74·9 | 74·5 | 74·1 | 73·7 | 73·3 | 72·9 | 72·5 | 72·2 | 71·8 |
| 44 | 77·8 | 77·4 | 77·0 | 76·6 | 76·3 | 75·9 | 75·5 | 75·1 | 74·7 | 74·3 | 73·9 | 73·6 | 73·2 | 72·8 | 72·4 | 72·1 |
| 45 | 78·0 | 77·6 | 77·3 | 76·9 | 76·5 | 76·1 | 75·7 | 75·3 | 75·0 | 74·6 | 74·2 | 73·8 | 73·5 | 73·1 | 72·7 | 72·3 |
| 46 | 78·2 | 77·8 | 77·5 | 77·1 | 76·7 | 76·3 | 76·0 | 75·6 | 75·2 | 74·8 | 74·5 | 74·1 | 73·7 | 73·4 | 73·0 | 72·6 |
| 47 | 78·4 | 78·1 | 77·7 | 77·3 | 76·9 | 76·6 | 76·2 | 75·8 | 75·5 | 75·1 | 74·7 | 74·4 | 74·0 | 73·7 | 73·3 | 72·9 |
| 48 | 78·6 | 78·3 | 77·9 | 77·5 | 77·2 | 76·8 | 76·5 | 76·1 | 75·7 | 75·4 | 75·0 | 74·7 | 74·3 | 73·9 | 73·6 | 73·2 |
| 49 | 78·9 | 78·5 | 78·1 | 77·8 | 77·4 | 77·1 | 76·7 | 76·4 | 76·0 | 75·6 | 75·3 | 74·9 | 74·6 | 74·2 | 73·9 | 73·6 |
| 50 | 79·1 | 78·7 | 78·4 | 78·0 | 77·7 | 77·3 | 77·0 | 76·6 | 76·3 | 75·9 | 75·6 | 75·2 | 74·9 | 74·5 | 74·2 | 73·9 |
| 51 | 79·3 | 79·0 | 78·6 | 78·3 | 77·9 | 77·6 | 77·2 | 76·9 | 76·6 | 76·2 | 75·9 | 75·5 | 75·2 | 74·9 | 74·5 | 74·2 |
| 52 | 79·5 | 79·2 | 78·9 | 78·5 | 78·2 | 77·8 | 77·5 | 77·2 | 76·8 | 76·5 | 76·2 | 75·8 | 75·5 | 75·2 | 74·8 | 74·5 |
| 53 | 79·8 | 79·4 | 79·1 | 78·8 | 78·4 | 78·1 | 77·8 | 77·4 | 77·1 | 76·8 | 76·5 | 76·1 | 75·8 | 75·5 | 75·2 | 74·8 |
| 54 | 80·0 | 79·7 | 79·3 | 79·0 | 78·7 | 78·4 | 78·1 | 77·7 | 77·4 | 77·1 | 76·8 | 76·5 | 76·1 | 75·8 | 75·5 | 75·2 |
| 55 | 80·2 | 79·9 | 79·6 | 79·3 | 79·0 | 78·6 | 78·3 | 78·0 | 77·7 | 77·4 | 77·1 | 76·8 | 76·5 | 76·1 | 75·8 | 75·5 |
| 56 | 80·5 | 80·2 | 79·9 | 79·5 | 79·2 | 78·9 | 78·6 | 78·3 | 78·0 | 77·7 | 77·4 | 77·1 | 76·8 | 76·5 | 76·2 | 75·9 |
| 57 | 80·7 | 80·4 | 80·1 | 79·8 | 79·5 | 79·2 | 78·9 | 78·6 | 78·3 | 78·0 | 77·7 | 77·4 | 77·1 | 76·8 | 76·5 | 76·2 |
| 58 | 81·0 | 80·7 | 80·4 | 80·1 | 79·8 | 79·5 | 79·2 | 78·9 | 78·6 | 78·3 | 78·0 | 77·7 | 77·5 | 77·2 | 76·9 | 76·6 |
| 59 | 81·2 | 80·9 | 80·6 | 80·4 | 80·1 | 79·8 | 79·5 | 79·2 | 78·9 | 78·6 | 78·4 | 78·1 | 77·8 | 77·5 | 77·2 | 77·0 |
| 60 | 81·5 | 81·2 | 80·9 | 80·6 | 80·4 | 80·1 | 79·8 | 79·5 | 79·2 | 79·0 | 78·7 | 78·4 | 78·1 | 77·9 | 77·6 | 77·3 |
| 61 | 81·7 | 81·5 | 81·2 | 80·9 | 80·6 | 80·4 | 80·1 | 79·8 | 79·6 | 79·3 | 79·0 | 78·8 | 78·5 | 78·2 | 78·0 | 77·7 |
| 62 | 82·0 | 81·7 | 81·5 | 81·2 | 80·9 | 80·7 | 80·4 | 80·1 | 79·9 | 79·6 | 79·4 | 79·1 | 78·8 | 78·6 | 78·3 | 78·1 |
| 63 | 82·2 | 82·0 | 81·7 | 81·5 | 81·2 | 81·0 | 80·7 | 80·5 | 80·2 | 80·0 | 79·7 | 79·5 | 79·2 | 79·0 | 78·7 | 78·5 |
| 64 | 82·5 | 82·3 | 82·0 | 81·8 | 81·5 | 81·3 | 81·0 | 80·8 | 80·5 | 80·3 | 80·1 | 79·8 | 79·6 | 79·3 | 79·1 | 78·8 |
| 65 | 82·8 | 82·5 | 82·3 | 82·1 | 81·8 | 81·6 | 81·3 | 81·1 | 80·9 | 80·6 | 80·4 | 80·2 | 79·9 | 79·7 | 79·5 | 79·2 |
| 66 | 83·0 | 82·8 | 82·6 | 82·4 | 82·1 | 81·9 | 81·7 | 81·4 | 81·2 | 81·0 | 80·8 | 80·5 | 80·3 | 80·1 | 79·9 | 79·6 |
| 67 | 83·3 | 83·1 | 82·9 | 82·7 | 82·4 | 82·2 | 82·0 | 81·8 | 81·6 | 81·3 | 81·1 | 80·9 | 80·7 | 80·5 | 80·2 | 80·0 |
| 68 | 83·6 | 83·4 | 83·2 | 83·0 | 82·7 | 82·5 | 82·3 | 82·1 | 81·9 | 81·7 | 81·5 | 81·3 | 81·1 | 80·8 | 80·6 | 80·4 |
| Lat. | | | | | | | | | | | | | | | | |
| A ± B = | ·30′ | ·31′ | ·32′ | ·33′ | ·34′ | ·35′ | ·36′ | ·37′ | ·38′ | ·39′ | ·40′ | ·41′ | ·42′ | ·43′ | ·44′ | ·45′ = A ± B |

A & B take **S**ame Names Sum, (add). } RULE TO FIND C CORRECTION { A & B take **D**ifferent names Difference (Sub.)

**C** CORRECTION, (A ± B) is named the same as the greater of these quantities.

**AZIMUTH** takes combined names of **C** Correction and Hour Angle

**C**

AÇIKLAMA SAYFASINA DÖNMEK IÇIN TIKLAYINIZ

# TABLE C

| A ± B = | ·60′ | ·62′ | ·64′ | ·66′ | ·68′ | ·70′ | A & B CORRECTION. ·72′ | ·74′ | ·76′ | ·78′ | ·80′ | ·82′ | ·84′ | ·86′ | ·88′ | ·90′ = A ± B |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Lat. ° | AZIMUTHS ° | ° | ° | ° | ° | ° | ° | ° | ° | ° | ° | ° | ° | ° | ° | ° Lat. ° |
| 0 | 59·0 | 58·2 | 57·4 | 56·6 | 55·8 | 55·0 | 54·2 | 53·5 | 52·8 | 52·0 | 51·3 | 50·6 | 50·0 | 49·3 | 48·7 | 48·0 0 |
| 5 | 59·1 | 58·3 | 57·5 | 56·7 | 55·9 | 55·1 | 54·3 | 53·6 | 52·9 | 52·2 | 51·5 | 50·8 | 50·1 | 49·4 | 48·8 | 48·1 5 |
| 10 | 59·4 | 58·6 | 57·8 | 57·0 | 56·2 | 55·4 | 54·7 | 53·9 | 53·2 | 52·5 | 51·8 | 51·1 | 50·4 | 49·7 | 49·1 | 48·4 10 |
| 14 | 59·8 | 59·0 | 58·2 | 57·4 | 56·6 | 55·8 | 55·1 | 54·3 | 53·6 | 52·9 | 52·2 | 51·5 | 50·8 | 50·2 | 49·5 | 48·9 14 |
| 18 | 60·3 | 59·5 | 58·7 | 57·9 | 57·1 | 56·3 | 55·6 | 54·9 | 54·1 | 53·4 | 52·7 | 52·1 | 51·4 | 50·7 | 50·1 | 49·4 18 |
| 20 | 60·6 | 59·8 | 59·0 | 58·2 | 57·4 | 56·7 | 55·9 | 55·2 | 54·5 | 53·8 | 53·1 | 52·4 | 51·7 | 51·1 | 50·4 | 49·8 20 |
| 22 | 60·9 | 60·1 | 59·3 | 58·5 | 57·8 | 57·0 | 56·3 | 55·5 | 54·8 | 54·1 | 53·4 | 52·8 | 52·1 | 51·4 | 50·8 | 50·2 22 |
| 24 | 61·3 | 60·5 | 59·7 | 58·9 | 58·2 | 57·4 | 56·7 | 55·9 | 55·2 | 54·5 | 53·8 | 53·2 | 52·5 | 51·8 | 51·2 | 50·6 24 |
| 26 | 61·7 | 60 9 | 60·1 | 59·3 | 58·6 | 57·8 | 57·1 | 56·4 | 55·7 | 55·0 | 54·3 | 53·6 | 52·9 | 52·3 | 51·7 | 51·0 26 |
| 28 | 62·1 | 61·3 | 60·5 | 59·8 | 59·0 | 58·3 | 57·6 | 56·8 | 56·1 | 55·4 | 54·8 | 54·1 | 53·4 | 52·8 | 52·2 | 51·5 28 |
| 30 | 62·5 | 61·8 | 61·0 | 60·2 | 59·5 | 58·8 | 58·1 | 57·3 | 56·6 | 56·0 | 55·3 | 54·6 | 54·0 | 53·3 | 52·7 | 52·1 30 |
| 31 | 62·8 | 62·0 | 61·3 | 60·5 | 59·8 | 59·0 | 58·3 | 57·6 | 56·9 | 56·2 | 55·6 | 54·9 | 54·2 | 53·6 | 53·0 | 52·4 31 |
| 32 | 63·0 | 62·3 | 61·5 | 60·8 | 60·0 | 59·3 | 58·6 | 57·9 | 57·2 | 56·5 | 55·8 | 55·2 | 54·5 | 53·9 | 53·3 | 52·7 32 |
| 33 | 63·3 | 62·5 | 61·8 | 61·0 | 60·3 | 59·6 | 58·9 | 58·2 | 57·5 | 56·8 | 56·1 | 55·5 | 54·8 | 54·2 | 53·6 | 53·0 33 |
| 34 | 63·6 | 62·8 | 62·1 | 61·3 | 60·6 | 59·9 | 59·2 | 58·5 | 57·8 | 57·1 | 56·4 | 55·8 | 55·1 | 54·5 | 53·9 | 53·3 34 |
| 35 | 63·8 | 63·1 | 62·3 | 61·6 | 60·9 | 60·2 | 59·5 | 58·8 | 58·1 | 57·4 | 56·8 | 56·1 | 55·5 | 54·8 | 54·2 | 53·6 35 |
| 36 | 64·1 | 63·4 | 62·6 | 61·9 | 61·2 | 60·5 | 59·8 | 59·1 | 58·4 | 57·7 | 57·1 | 56·4 | 55·8 | 55·2 | 54·6 | 53·9 36 |
| 37 | 64·4 | 63·7 | 62·9 | 62·2 | 61·5 | 60·8 | 60·1 | 59·4 | 58·7 | 58·1 | 57·4 | 56·8 | 56·1 | 55·5 | 54·9 | 54·3 37 |
| 38 | 64·7 | 54·0 | 63·2 | 62·5 | 61·8 | 61·1 | 60·4 | 59·8 | 59·1 | 58·4 | 57·8 | 57·1 | 56·5 | 55·9 | 55·3 | 54·7 38 |
| 39 | 65·0 | 64·3 | 63·6 | 62·8 | 62·1 | 61·5 | 60·8 | 60·1 | 59·4 | 58·8 | 58·1 | 57·5 | 56·9 | 56·2 | 55·6 | 55·0 39 |
| 40 | 65·3 | 64·6 | 63·9 | 63·2 | 62·5 | 61·8 | 61·1 | 60·5 | 59·8 | 59·1 | 58·5 | 57·9 | 57·2 | 56·6 | 56·0 | 55·4 40 |
| 41 | 65·6 | 64·9 | 64·2 | 63·5 | 62·8 | 62·2 | 61·5 | 60·8 | 60·2 | 59·5 | 58·9 | 58·2 | 57·6 | 57·0 | 56·4 | 55·8 41 |
| 42 | 66·0 | 65·3 | 64·6 | 63·9 | 63·2 | 62·5 | 61·9 | 61·2 | 60·5 | 59·9 | 59·3 | 58·6 | 58·0 | 57·4 | 56·8 | 56·2 42 |
| 43 | 66·3 | 65·6 | 64·9 | 64·2 | 63·6 | 62·9 | 62·2 | 61·6 | 60·9 | 60·3 | 59·7 | 59·0 | 58·4 | 57·8 | 57·2 | 56·6 43 |
| 44 | 66·7 | 66·0 | 65·3 | 64·6 | 63·9 | 63·3 | 62·6 | 62·0 | 61·3 | 60·7 | 60·1 | 59·5 | 58·9 | 58·3 | 57·7 | 57·1 44 |
| 45 | 67·0 | 66·3 | 65·7 | 65·0 | 64·3 | 63·7 | 63·0 | 62·4 | 61·7 | 61·1 | 60·5 | 59·9 | 59·3 | 58·7 | 58·1 | 57·6 45 |
| 46 | 67·4 | 66·7 | 66·0 | 65·4 | 64·7 | 64·1 | 63·4 | 62·8 | 62·2 | 61·5 | 60·9 | 60·3 | 59·7 | 59·1 | 58·6 | 58·0 46 |
| 47 | 67·7 | 67·1 | 66·4 | 65·8 | 65·1 | 64·5 | 63·8 | 63·2 | 62·6 | 62·0 | 61·4 | 60·8 | 60·2 | 59·6 | 59·0 | 58·5 47 |
| 48 | 68·1 | 67·5 | 66·8 | 66·2 | 65·5 | 64·9 | 64·3 | 63·7 | 63·0 | 62·4 | 61·8 | 61·2 | 60·7 | 60·1 | 59·5 | 58·9 48 |
| 49 | 68·5 | 67·9 | 67·2 | 66·6 | 66·0 | 65·3 | 64·7 | 64·1 | 63·5 | 62·9 | 62·3 | 61·7 | 61·1 | 60·6 | 60·0 | 59·4 49 |
| 50 | 68·9 | 68·3 | 67·6 | 67·0 | 66·4 | 65·8 | 65·2 | 64·6 | 64·0 | 63·4 | 62·8 | 62·2 | 61·6 | 61·1 | 60·5 | 60·0 50 |
| 51 | 69·3 | 68·7 | 68·1 | 67·4 | 66·8 | 66·2 | 65·6 | 65·0 | 64·4 | 63·9 | 63·3 | 62·7 | 62·1 | 61·6 | 61·0 | 60·5 51 |
| 52 | 69·7 | 69·1 | 68·5 | 67·9 | 67·3 | 66·7 | 66·1 | 65·5 | 64·9 | 64·4 | 63·8 | 63·2 | 62·7 | 62·1 | 61·6 | 61·0 52 |
| 53 | 70·1 | 69·5 | 68·9 | 68·3 | 67·7 | 67·2 | 66·6 | 66·0 | 65·4 | 64·9 | 64·3 | 63·7 | 63·2 | 62·6 | 62·1 | 61·6 53 |
| 54 | 70·6 | 70·0 | 69·4 | 68·8 | 68·2 | 67·6 | 67·1 | 66·5 | 65·9 | 65·4 | 64·8 | 64·3 | 63·7 | 63·2 | 62·6 | 62·1 54 |
| 55 | 71·0 | 70·4 | 69·8 | 69·3 | 68·7 | 68·1 | 67·6 | 67·0 | 66·4 | 65·9 | 65·4 | 64·8 | 64·3 | 63·7 | 63·2 | 62·7 55 |
| 56 | 71·5 | 70·9 | 70·3 | 69·7 | 69·2 | 68·6 | 68·1 | 67·5 | 67·0 | 66·4 | 65·9 | 65·4 | 64·9 | 64·3 | 63·8 | 63·3 56 |
| 57 | 71·9 | 71·3 | 70·8 | 70·2 | 69·7 | 69·1 | 68·6 | 68·0 | 67·5 | 67·0 | 66·5 | 65·9 | 65·4 | 64·9 | 64·4 | 63·9 57 |
| 58 | 72·4 | 71·8 | 71·3 | 70·7 | 70·2 | 69·6 | 69·1 | 68·6 | 68·1 | 67·5 | 67·0 | 66·5 | 66·0 | 65·5 | 65·0 | 64·5 58 |
| 59 | 72·8 | 72·3 | 71·8 | 71·2 | 70·7 | 70·2 | 69·7 | 69·1 | 68·6 | 68·1 | 67·6 | 67·1 | 66·6 | 66·1 | 65·6 | 65·1 59 |
| 60 | 73·3 | 72·8 | 72·3 | 71·7 | 71·2 | 70·7 | 70·2 | 69·7 | 69·2 | 68·7 | 68·2 | 67·7 | 67·2 | 66·7 | 66·3 | 65·8 60 |
| 61 | 73·8 | 73·3 | 72·8 | 72·3 | 71·8 | 71·3 | 70·8 | 70·3 | 69·8 | 69·3 | 68·8 | 68·3 | 67·8 | 67·4 | 66·9 | 66·4 61 |
| 62 | 74·3 | 73·8 | 73·3 | 72·8 | 72·3 | 71·8 | 71·3 | 70·8 | 70·4 | 69·9 | 69·4 | 68·9 | 68·5 | 68·0 | 67·6 | 67·1 62 |
| 63 | 74·8 | 74·3 | 73·8 | 73·3 | 72·8 | 72·4 | 71·9 | 71·4 | 71·0 | 70·5 | 70·0 | 69·6 | 69·1 | 68·7 | 68·2 | 67·8 63 |
| 64 | 75·3 | 74·8 | 74·3 | 73·9 | 73·4 | 72·9 | 72·5 | 72·0 | 71·6 | 71·1 | 70·7 | 70·2 | 69·8 | 69·3 | 68·9 | 68·5 64 |
| 65 | 75·8 | 75·3 | 74·9 | 74·4 | 74·0 | 73·5 | 73·1 | 72·6 | 72·2 | 71·8 | 71·3 | 70·9 | 70·5 | 70·0 | 69·6 | 69·2 65 |
| 66 | 76·3 | 75·8 | 75·4 | 75·0 | 74·5 | 74·1 | 73·7 | 73·2 | 72·8 | 72·4 | 72·0 | 71·6 | 71·1 | 70·7 | 70·3 | 69·9 66 |
| 67 | 76·8 | 76·4 | 76·0 | 75·5 | 75·1 | 74·7 | 74·3 | 73·9 | 73·5 | 73·1 | 72·6 | 72·2 | 71·8 | 71·4 | 71·0 | 70·6 67 |
| 68 | 77·3 | 76·9 | 76·5 | 76·1 | 75·7 | 75·3 | 74·9 | 74·5 | 74·1 | 73·7 | 73·3 | 72·9 | 72·5 | 72·1 | 71·8 | 71·4 68 |
| Lat. | | | | | | | | | | | | | | | | Lat. |
| A ± B = | ·60′ | ·62′ | ·64′ | ·66′ | ·68′ | ·70′ | ·72′ | ·74′ | ·76′ | ·78′ | ·80′ | ·82′ | ·84′ | ·86′ | ·88′ | ·90′ = A ± B |

A & B take Same Names (add) } RULE TO FIND C CORRECTION { A & B take Different names (Sub.)

**C** CORRECTION, (A ± B) is named the same as the greater of these quantities.

**AZIMUTH** takes combined names of **C** Correction and Hour Angle

C

COMPASS ERROR BY AMPLITUDE



# TRUE AMPLITUDES

| Lat. | Declination | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| | 25½° | 26° | 26½° | 27° | 27½° | 28° | 28½° | 29° |
| ° | ° | ° | ° | ° | ° | ° | ° | ° |
| 2 | 25·5 | 26·0 | 26·5 | 27·0 | 27·5 | 28·0 | 28·5 | 29·0 |
| 4 | 25·6 | 26·1 | 26·6 | 27·1 | 27·6 | 28·1 | 28·6 | 29·1 |
| 6 | 25·7 | 26·2 | 26·7 | 27·2 | 27·7 | 28·2 | 28·7 | 29·2 |
| 8 | 25·8 | 26·3 | 26·8 | 27·3 | 27·8 | 28·3 | 28·8 | 29·3 |
| 10 | 25·9 | 26·4 | 26·9 | 27·5 | 28·0 | 28·5 | 29·0 | 29·5 |
| 12 | 26·1 | 26·6 | 27·1 | 27·7 | 28·2 | 28·7 | 29·2 | 29·7 |
| 14 | 26·3 | 26·9 | 27·4 | 27·9 | 28·4 | 28·9 | 29·5 | 30·0 |
| 16 | 26·6 | 27·1 | 27·7 | 28·2 | 28·7 | 29·2 | 29·8 | 30·3 |
| 18 | 26·9 | 27·5 | 28·0 | 28·5 | 29·0 | 29·6 | 30·1 | 30·7 |
| 20 | 27·3 | 27·8 | 28·3 | 28·9 | 29·4 | 30·0 | 30·5 | 31·1 |
| 22 | 27·7 | 28·2 | 28·8 | 29·3 | 29·9 | 30·4 | 31·0 | 31·5 |
| 24 | 28·1 | 28·7 | 29·2 | 29·8 | 30·4 | 30·9 | 31·5 | 32·1 |
| 26 | 28·6 | 29·2 | 29·8 | 30·3 | 30·9 | 31·5 | 32·1 | 32·6 |
| 28 | 29·2 | 29·8 | 30·4 | 30·9 | 31·5 | 32·1 | 32·7 | 33·3 |
| 30 | 29·8 | 30·4 | 31·0 | 31·6 | 32·2 | 32·8 | 33·4 | 34·1 |
| 31 | 30·1 | 30·8 | 31·4 | 32·0 | 32·6 | 33·2 | 33·8 | 34·5 |
| 32 | 30·5 | 31·1 | 31·7 | 32·4 | 33·0 | 33·6 | 34·2 | 34·9 |
| 33 | 30·9 | 31·5 | 32·1 | 32·8 | 33·4 | 34·0 | 34·7 | 35·3 |
| 34 | 31·3 | 31·9 | 32·6 | 33·2 | 33·8 | 34·5 | 35·1 | 35·8 |
| 35 | 31·7 | 32·4 | 33·0 | 33·7 | 34·3 | 35·0 | 35·6 | 36·3 |
| 36 | 32·2 | 32·8 | 33·5 | 34·1 | 34·8 | 35·5 | 36·1 | 36·8 |
| 37 | 32·6 | 33·3 | 34·0 | 34·6 | 35·3 | 36·0 | 36·7 | 37·4 |
| 38 | 33·1 | 33·8 | 34·5 | 35·2 | 35·9 | 36·6 | 37·3 | 38·0 |
| 39 | 33·6 | 34·3 | 35·0 | 35·8 | 36·5 | 37·2 | 37·9 | 38·6 |
| 40 | 34·2 | 34·9 | 35·6 | 36·4 | 37·1 | 37·8 | 38·5 | 39·3 |
| 41 | 34·8 | 35·5 | 36·2 | 37·0 | 37·7 | 38·5 | 39·2 | 40·0 |
| 42 | 35·4 | 36·2 | 36·9 | 37·7 | 38·4 | 39·2 | 39·9 | 40·7 |
| 43 | 36·1 | 36·8 | 37·6 | 38·4 | 39·2 | 39·9 | 40·7 | 41·5 |
| 44 | 36·8 | 37·5 | 38·3 | 39·2 | 39·9 | 40·7 | 41·6 | 42·4 |
| 45 | 37·5 | 38·3 | 39·1 | 39·9 | 40·8 | 41·6 | 42·4 | 43·3 |
| 46 | 38·3 | 39·1 | 40·0 | 40·8 | 41·7 | 42·5 | 43·4 | 44·3 |
| 47 | 39·1 | 40·0 | 40·9 | 41·7 | 42·6 | 43·5 | 44·4 | 45·3 |
| 48 | 40·0 | 40·9 | 41·8 | 42·7 | 43·6 | 44·5 | 45·5 | 46·4 |
| 49 | 41·0 | 41·9 | 42·9 | 43·8 | 44·7 | 45·7 | 46·7 | 47·7 |
| 50 | 42·0 | 43·0 | 44·0 | 44·9 | 45·9 | 46·9 | 47·9 | 49·0 |
| 50½ | 42·6 | 43·6 | 44·5 | 45·5 | 46·5 | 47·6 | 48·6 | 49·7 |
| 51 | 43·2 | 44·2 | 45·2 | 46·2 | 47·2 | 48·2 | 49·3 | 50·4 |
| 51½ | 43·8 | 44·8 | 45·8 | 46·8 | 47·9 | 49·0 | 50·0 | 51·2 |
| 52 | 44·4 | 45·4 | 46·4 | 47·5 | 48·6 | 49·7 | 50·8 | 52·0 |
| 52½ | 45·0 | 46·0 | 47·1 | 48·2 | 49·3 | 50·5 | 51·6 | 52·8 |
| 53 | 45·7 | 46·7 | 47·9 | 49·0 | 50·1 | 51·3 | 52·5 | 53·7 |
| 53½ | 46·4 | 47·5 | 48·6 | 49·8 | 50·9 | 52·1 | 53·3 | 54·6 |
| 54 | 47·1 | 48·2 | 49·4 | 50·6 | 51·8 | 53·0 | 54·3 | 55·6 |
| 54½ | 47·8 | 49·0 | 50·2 | 51·4 | 52·7 | 53·9 | 55·3 | 56·6 |
| 55 | 48·6 | 49·8 | 51·1 | 52·3 | 53·6 | 54·9 | 56·3 | 57·7 |
| 55½ | 49·5 | 50·7 | 52·0 | 53·3 | 54·6 | 56·0 | 57·4 | 58·9 |
| 56 | 50·3 | 51·6 | 52·9 | 54·3 | 55·7 | 57·1 | 58·6 | 60·1 |
| 56½ | 51·3 | 52·6 | 53·9 | 55·4 | 56·8 | 58·3 | 59·8 | 61·4 |
| 57 | 52·2 | 53·6 | 55·0 | 56·5 | 58·0 | 59·6 | 61·2 | 62·9 |
| 57½ | 53·2 | 54·7 | 56·1 | 57·7 | 59·2 | 60·7 | 62·6 | 65·0 |
| 58 | 54·3 | 55·8 | 57·4 | 58·9 | 60·6 | 62·4 | 64·2 | 66·2 |
| 58½ | 55·5 | 57·0 | 58·6 | 60·3 | 62·1 | 64·0 | 66·0 | 68·1 |
| 59 | 56·7 | 58·3 | 60·0 | 61·8 | 63·7 | 65·7 | 67·9 | 70·3 |
| 59½ | 58·0 | 59·7 | 61·5 | 63·4 | 65·5 | 67·7 | 70·1 | 72·8 |
| 60 | 59·4 | 61·2 | 63·2 | 65·2 | 67·4 | 69·9 | 72·6 | 75·8 |
| 60½ | 61·0 | 62·9 | 65·0 | 67·2 | 69·7 | 72·4 | 75·7 | 79·9 |
| 61 | 62·6 | 64·7 | 67·0 | 69·4 | 72·3 | 75·5 | 79·8 | 90·0 |
| 61½ | 64·5 | 66·7 | 69·3 | 72·1 | 75·4 | 79·7 | 90·0 | — |
| 62 | 66·2 | 69·0 | 71·9 | 75·2 | 79·6 | 90·0 | — | — |
| 62½ | 68·8 | 71·7 | 75·1 | 79·5 | 90·0 | — | — | — |

# Amplitude Corrections

| Lat. | Declination | | | | | |
|---|---|---|---|---|---|---|
| | 0° | 5° | 10° | 15° | 20° | 25° |
| ° | ° | ° | ° | ° | ° | ° |
| 0 | 0·0 | 0·0 | 0·0 | 0·0 | 0·0 | 0·0 |
| 5 | 0·1 | 0·1 | 0·1 | 0·1 | 0·1 | 0·1 |
| 10 | 0·1 | 0·1 | 0·1 | 0·1 | 0·1 | 0·1 |
| 15 | 0·2 | 0·2 | 0·2 | 0·2 | 0·2 | 0·2 |
| 20 | 0·2 | 0·2 | 0·2 | 0·2 | 0·2 | 0·3 |
| 25 | 0·3 | 0·3 | 0·3 | 0·3 | 0·3 | 0·3 |
| 30 | 0·4 | 0·4 | 0·4 | 0·4 | 0·4 | 0·4 |
| 35 | 0·4 | 0·5 | 0·5 | 0·5 | 0·5 | 0·5 |
| 40 | 0·5 | 0·6 | 0·6 | 0·6 | 0·6 | 0·7 |
| 42 | 0·6 | 0·6 | 0·6 | 0·6 | 0·7 | 0·7 |
| 44 | 0·6 | 0·6 | 0·7 | 0·7 | 0·7 | 0·7 |
| 46 | 0·7 | 0·7 | 0·7 | 0·7 | 0·8 | 0·8 |
| 48 | 0·7 | 0·8 | 0·8 | 0·8 | 0·9 | 0·9 |
| 50 | 0·8 | 0·8 | 0·8 | 0·9 | 0·9 | 1·0 |
| 52 | 0·8 | 0·9 | 0·9 | 0·9 | 1·0 | 1·1 |
| 54 | 0·9 | 0·9 | 1·0 | 1·0 | 1·1 | 1·3 |
| 56 | 0·9 | 0·9 | 1·0 | 1·0 | 1·2 | 1·5 |
| 58 | 1·0 | 1·0 | 1·1 | 1·2 | 1·3 | 1·7 |
| 60 | 1·1 | 1·2 | 1·2 | 1·3 | 1·5 | 2·1 |
| 62 | 1·2 | 1·2 | 1·3 | 1·4 | 1·8 | 2·9 |

## COMPASS ERROR BY AMPLITUDE

The true amplitudes given in the main table are calculated for the instant when the true altitude of the body is precisely 0° 00′. In the case of the sun (owing to the effects of dip, refraction and parallax) the lower limb at this instant will appear to be approximately half a diameter above the visible horizon. If the compass bearing is taken at that moment there will be no need to apply any correction.

However, should the bearing be observed when the sun's centre appears to be in the visible horizon, the correction obtained from the subsidiary table should be applied by being added to the observed azimuth reckoned from the elevated pole as shown in the example below. (Lat. 62° N., decl. 20° S.).

| | |
|---|---|
| Obs'd. Azi. | S. 41°·5 E. |
| From elev. pole | N. 138°·5 E. |
| Corr'n. | + 1°·8 |
| Sum | N. 140°·3 E. |
| Corr'd. obs'd. Amp. | E. 50°·3 S. |
| T. Amp. from table | E. 46°·8 S. |
| Comp. Error | 3°·5 W. |

Observations of rising or setting stars and planets are seldom practicable but, if obtained, should be treated in the same way as those of the sun's centre.

In the case of the moon that body will be approximately one-third of a degree below the horizon at the moment when its true altitude is 0° 00′. If observed when its centre appears in the visible horizon, two-thirds of the correction from the subsidiary table should be subtracted from the observed azimuth reckoned from the elevated pole.

# EX-MERIDIAN TABLE I

## Latitude and Declination DIFFERENT NAME

Change of Altitude in one minute from Meridian Passage = A

| Lat. ° | DECLINATION | | | | | | | | | | | | | | | | Lat. ° |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | 15° | 16° | 17° | 18° | 19° | 20° | 21° | 22° | 23° | 24° | 25° | 26° | 27° | 28° | 29° | 30° | |
| | " | " | " | " | " | " | " | " | " | " | " | " | " | " | " | " | |
| 0 | 7.3 | 6.8 | 6.4 | 6.0 | 5.7 | 5.4 | 5.1 | 4.9 | 4.6 | 4.4 | 4.2 | 4.0 | 3.9 | 3.7 | 3.5 | 3.4 | 0 |
| 1 | 6.9 | 6.5 | 6.1 | 5.7 | 5.4 | 5.1 | 4.9 | 4.7 | 4.4 | 4.2 | 4.1 | 3.9 | 3.7 | 3.6 | 3.4 | 3.3 | 1 |
| 2 | 6.5 | 6.1 | 5.8 | 5.5 | 5.2 | 4.9 | 4.7 | 4.5 | 4.3 | 4.1 | 3.9 | 3.8 | 3.6 | 3.5 | 3.3 | 3.2 | 2 |
| 3 | 6.1 | 5.8 | 5.5 | 5.2 | 4.9 | 4.7 | 4.5 | 4.3 | 4.1 | 3.9 | 3.8 | 3.6 | 3.5 | 3.4 | 3.2 | 3.1 | 3 |
| 4 | 5.8 | 5.5 | 5.2 | 5.0 | 4.7 | 4.5 | 4.3 | 4.1 | 4.0 | 3.8 | 3.7 | 3.5 | 3.4 | 3.3 | 3.2 | 3.0 | 4 |
| 5 | 5.5 | 5.2 | 5.0 | 4.8 | 4.5 | 4.3 | 4.2 | 4.0 | 3.8 | 3.7 | 3.6 | 3.4 | 3.3 | 3.2 | 3.1 | 3.0 | 5 |
| 6 | 5.3 | 5.0 | 4.8 | 4.6 | 4.4 | 4.2 | 4.0 | 3.9 | 3.7 | 3.6 | 3.4 | 3.3 | 3.2 | 3.1 | 3.0 | 2.9 | 6 |
| 7 | 5.0 | 4.8 | 4.6 | 4.4 | 4.2 | 4.0 | 3.9 | 3.7 | 3.6 | 3.5 | 3.3 | 3.2 | 3.1 | 3.0 | 2.9 | 2.8 | 7 |
| 8 | 4.8 | 4.6 | 4.4 | 4.2 | 4.0 | 3.9 | 3.7 | 3.6 | 3.5 | 3.4 | 3.2 | 3.1 | 3.0 | 2.9 | 2.8 | 2.7 | 8 |
| 9 | 4.6 | 4.4 | 4.2 | 4.1 | 3.9 | 3.8 | 3.6 | 3.5 | 3.4 | 3.3 | 3.1 | 3.0 | 2.9 | 2.9 | 2.8 | 2.7 | 9 |
| 10 | 4.4 | 4.2 | 4.1 | 3.9 | 3.8 | 3.6 | 3.5 | 3.4 | 3.3 | 3.2 | 3.1 | 3.0 | 2.9 | 2.8 | 2.7 | 2.6 | 10 |
| 11 | 4.2 | 4.1 | 3.9 | 3.8 | 3.6 | 3.5 | 3.4 | 3.3 | 3.2 | 3.1 | 3.0 | 2.9 | 2.8 | 2.7 | 2.6 | 2.5 | 11 |
| 12 | 4.1 | 3.9 | 3.8 | 3.7 | 3.5 | 3.4 | 3.3 | 3.2 | 3.1 | 3.0 | 2.9 | 2.8 | 2.7 | 2.6 | 2.6 | 2.5 | 12 |
| 13 | 3.9 | 3.8 | 3.7 | 3.5 | 3.4 | 3.3 | 3.2 | 3.1 | 3.0 | 2.9 | 2.8 | 2.7 | 2.7 | 2.6 | 2.5 | 2.4 | 13 |
| 14 | 3.8 | 3.7 | 3.5 | 3.4 | 3.3 | 3.2 | 3.1 | 3.0 | 2.9 | 2.8 | 2.7 | 2.7 | 2.6 | 2.5 | 2.4 | 2.4 | 14 |
| 15 | 3.7 | 3.5 | 3.4 | 3.3 | 3.2 | 3.1 | 3.0 | 2.9 | 2.8 | 2.8 | 2.7 | 2.6 | 2.5 | 2.5 | 2.4 | 2.3 | 15 |
| 16 | 3.5 | 3.4 | 3.3 | 3.2 | 3.1 | 3.0 | 2.9 | 2.8 | 2.8 | 2.7 | 2.6 | 2.5 | 2.5 | 2.4 | 2.3 | 2.3 | 16 |
| 17 | 3.4 | 3.3 | 3.2 | 3.1 | 3.0 | 2.9 | 2.8 | 2.8 | 2.7 | 2.6 | 2.5 | 2.5 | 2.4 | 2.3 | 2.3 | 2.2 | 17 |
| 18 | 3.3 | 3.2 | 3.1 | 3.0 | 2.9 | 2.9 | 2.8 | 2.7 | 2.6 | 2.5 | 2.5 | 2.4 | 2.4 | 2.3 | 2.2 | 2.2 | 18 |
| 19 | 3.2 | 3.1 | 3.0 | 2.9 | 2.9 | 2.8 | 2.7 | 2.6 | 2.6 | 2.5 | 2.4 | 2.4 | 2.3 | 2.2 | 2.2 | 2.1 | 19 |
| 20 | 3.1 | 3.0 | 2.9 | 2.9 | 2.8 | 2.7 | 2.6 | 2.6 | 2.5 | 2.4 | 2.4 | 2.3 | 2.3 | 2.2 | 2.1 | 2.1 | 20 |
| 21 | 3.0 | 2.9 | 2.8 | 2.8 | 2.7 | 2.6 | 2.6 | 2.5 | 2.4 | 2.4 | 2.3 | 2.3 | 2.2 | 2.1 | 2.1 | 2.0 | 21 |
| 22 | 2.9 | 2.8 | 2.8 | 2.7 | 2.6 | 2.6 | 2.5 | 2.4 | 2.4 | 2.3 | 2.3 | 2.2 | 2.2 | 2.1 | 2.1 | 2.0 | 22 |
| 23 | 2.8 | 2.8 | 2.7 | 2.6 | 2.6 | 2.5 | 2.4 | 2.4 | 2.3 | 2.3 | 2.2 | 2.2 | 2.1 | 2.1 | 2.0 | 2.0 | 23 |
| 24 | 2.8 | 2.7 | 2.6 | 2.5 | 2.5 | 2.4 | 2.4 | 2.3 | 2.3 | 2.2 | 2.2 | 2.1 | 2.1 | 2.0 | 2.0 | 1.9 | 24 |
| 25 | 2.7 | 2.6 | 2.5 | 2.5 | 2.4 | 2.4 | 2.3 | 2.3 | 2.2 | 2.2 | 2.1 | 2.1 | 2.0 | 2.0 | 1.9 | 1.9 | 25 |
| 26 | 2.6 | 2.5 | 2.5 | 2.4 | 2.4 | 2.3 | 2.3 | 2.2 | 2.1 | 2.1 | 2.1 | 2.0 | 2.0 | 1.9 | 1.9 | 1.9 | 26 |
| 27 | 2.5 | 2.5 | 2.4 | 2.4 | 2.3 | 2.2 | 2.2 | 2.1 | 2.1 | 2.1 | 2.0 | 2.0 | 1.9 | 1.9 | 1.9 | 1.8 | 27 |
| 28 | 2.5 | 2.4 | 2.3 | 2.3 | 2.2 | 2.2 | 2.1 | 2.1 | 2.1 | 2.0 | 2.0 | 1.9 | 1.9 | 1.9 | 1.8 | 1.8 | 28 |
| 29 | 2.4 | 2.3 | 2.3 | 2.2 | 2.2 | 2.1 | 2.1 | 2.0 | 2.0 | 2.0 | 1.9 | 1.9 | 1.9 | 1.8 | 1.8 | 1.7 | 29 |
| 30 | 2.3 | 2.3 | 2.2 | 2.2 | 2.1 | 2.1 | 2.0 | 2.0 | 2.0 | 1.9 | 1.9 | 1.8 | 1.8 | 1.8 | 1.7 | 1.7 | 30 |
| 31 | 2.3 | 2.2 | 2.2 | 2.1 | 2.1 | 2.0 | 2.0 | 2.0 | 1.9 | 1.9 | 1.8 | 1.8 | 1.8 | 1.7 | 1.7 | 1.7 | 31 |
| 32 | 2.2 | 2.2 | 2.1 | 2.1 | 2.0 | 2.0 | 1.9 | 1.9 | 1.9 | 1.8 | 1.8 | 1.8 | 1.7 | 1.7 | 1.7 | 1.6 | 32 |
| 33 | 2.1 | 2.1 | 2.1 | 2.0 | 2.0 | 1.9 | 1.9 | 1.9 | 1.8 | 1.8 | 1.8 | 1.7 | 1.7 | 1.7 | 1.6 | 1.6 | 33 |
| 34 | 2.1 | 2.0 | 2.0 | 2.0 | 1.9 | 1.9 | 1.9 | 1.8 | 1.8 | 1.8 | 1.7 | 1.7 | 1.7 | 1.6 | 1.6 | 1.6 | 34 |
| 35 | 2.0 | 2.0 | 2.0 | 1.9 | 1.9 | 1.8 | 1.8 | 1.8 | 1.7 | 1.7 | 1.7 | 1.7 | 1.6 | 1.6 | 1.6 | 1.5 | 35 |
| 36 | 2.0 | 1.9 | 1.9 | 1.9 | 1.8 | 1.8 | 1.8 | 1.7 | 1.7 | 1.7 | 1.6 | 1.6 | 1.6 | 1.6 | 1.5 | 1.5 | 36 |
| 37 | 1.9 | 1.9 | 1.9 | 1.8 | 1.8 | 1.8 | 1.7 | 1.7 | 1.7 | 1.6 | 1.6 | 1.6 | 1.6 | 1.5 | 1.5 | 1.5 | 37 |
| 38 | 1.9 | 1.8 | 1.8 | 1.8 | 1.8 | 1.7 | 1.7 | 1.7 | 1.6 | 1.6 | 1.6 | 1.5 | 1.5 | 1.5 | 1.5 | 1.5 | 38 |
| 39 | 1.8 | 1.8 | 1.8 | 1.7 | 1.7 | 1.7 | 1.6 | 1.6 | 1.6 | 1.6 | 1.5 | 1.5 | 1.5 | 1.5 | 1.4 | 1.4 | 39 |
| 40 | 1.8 | 1.7 | 1.7 | 1.7 | 1.7 | 1.6 | 1.6 | 1.6 | 1.6 | 1.5 | 1.5 | 1.5 | 1.5 | 1.4 | 1.4 | 1.4 | 40 |
| 41 | 1.7 | 1.7 | 1.7 | 1.6 | 1.6 | 1.6 | 1.6 | 1.5 | 1.5 | 1.5 | 1.5 | 1.4 | 1.4 | 1.4 | 1.4 | 1.4 | 41 |
| 42 | 1.7 | 1.7 | 1.6 | 1.6 | 1.6 | 1.6 | 1.5 | 1.5 | 1.5 | 1.5 | 1.4 | 1.4 | 1.4 | 1.4 | 1.4 | 1.3 | 42 |
| 43 | 1.6 | 1.6 | 1.6 | 1.6 | 1.5 | 1.5 | 1.5 | 1.5 | 1.4 | 1.4 | 1.4 | 1.4 | 1.4 | 1.3 | 1.3 | 1.3 | 43 |
| 44 | 1.6 | 1.6 | 1.5 | 1.5 | 1.5 | 1.5 | 1.5 | 1.4 | 1.4 | 1.4 | 1.4 | 1.4 | 1.3 | 1.3 | 1.3 | 1.3 | 44 |
| 45 | 1.5 | 1.5 | 1.5 | 1.5 | 1.5 | 1.4 | 1.4 | 1.4 | 1.4 | 1.4 | 1.3 | 1.3 | 1.3 | 1.3 | 1.3 | 1.2 | 45 |
| 46 | 1.5 | 1.5 | 1.5 | 1.4 | 1.4 | 1.4 | 1.4 | 1.4 | 1.3 | 1.3 | 1.3 | 1.3 | 1.3 | 1.3 | 1.2 | 1.2 | 46 |
| 47 | 1.5 | 1.4 | 1.4 | 1.4 | 1.4 | 1.4 | 1.3 | 1.3 | 1.3 | 1.3 | 1.3 | 1.3 | 1.2 | 1.2 | 1.2 | 1.2 | 47 |
| 48 | 1.4 | 1.4 | 1.4 | 1.4 | 1.4 | 1.3 | 1.3 | 1.3 | 1.3 | 1.3 | 1.2 | 1.2 | 1.2 | 1.2 | 1.2 | 1.2 | 48 |
| 49 | 1.4 | 1.4 | 1.3 | 1.3 | 1.3 | 1.3 | 1.3 | 1.3 | 1.2 | 1.2 | 1.2 | 1.2 | 1.2 | 1.2 | 1.2 | 1.1 | 49 |
| 50 | 1.3 | 1.3 | 1.3 | 1.3 | 1.3 | 1.3 | 1.3 | 1.2 | 1.2 | 1.2 | 1.2 | 1.2 | 1.2 | 1.1 | 1.1 | 1.1 | 50 |
| 51 | 1.3 | 1.3 | 1.3 | 1.3 | 1.2 | 1.2 | 1.2 | 1.2 | 1.2 | 1.2 | 1.2 | 1.1 | 1.1 | 1.1 | 1.1 | 1.1 | 51 |
| 52 | 1.3 | 1.3 | 1.3 | 1.2 | 1.2 | 1.2 | 1.2 | 1.2 | 1.1 | 1.1 | 1.1 | 1.1 | 1.1 | 1.1 | 1.1 | 1.1 | 52 |
| 53 | 1.2 | 1.2 | 1.2 | 1.2 | 1.2 | 1.2 | 1.2 | 1.1 | 1.1 | 1.1 | 1.1 | 1.1 | 1.1 | 1.1 | 1.0 | 1.0 | 53 |
| 54 | 1.2 | 1.2 | 1.2 | 1.2 | 1.1 | 1.1 | 1.1 | 1.1 | 1.1 | 1.1 | 1.1 | 1.0 | 1.0 | 1.0 | 1.0 | 1.0 | 54 |
| 55 | 1.2 | 1.1 | 1.1 | 1.1 | 1.1 | 1.1 | 1.1 | 1.1 | 1.1 | 1.1 | 1.0 | 1.0 | 1.0 | 1.0 | 1.0 | | 55 |
| 56 | 1.1 | 1.1 | 1.1 | 1.1 | 1.1 | 1.1 | 1.1 | 1.0 | 1.0 | 1.0 | 1.0 | 1.0 | 1.0 | 1.0 | | | 56 |
| 57 | 1.1 | 1.1 | 1.1 | 1.1 | 1.0 | 1.0 | 1.0 | 1.0 | 1.0 | 1.0 | 1.0 | 1.0 | 1.0 | | | | 57 |
| 58 | 1.1 | 1.0 | 1.0 | 1.0 | 1.0 | 1.0 | 1.0 | 1.0 | 1.0 | 1.0 | 1.0 | 0.9 | | | | | 58 |
| 59 | 1.0 | 1.0 | 1.0 | 1.0 | 1.0 | 1.0 | 1.0 | 1.0 | 0.9 | 0.9 | 0.9 | | | | | | 59 |
| 60 | 1.0 | 1.0 | 1.0 | 1.0 | 0.9 | 0.9 | 0.9 | 0.9 | 0.9 | 0.9 | | | | | | | 60 |

AÇIKLAMA SAYFASINA DÖNMEK IÇIN TIKLAYINIZ

# EX-MERIDIAN TABLE II

Reduction Plus to True Altitude at Upper Transit

HOUR ANGLE

| A | 0° 5′ | 0° 10′ | 0° 15′ | 0° 20′ | 0° 25′ | 0° 30′ | 0° 35′ | 0° 40′ | 0° 45′ | 0° 50′ | 0° 55′ | 1° 0′ | A |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | 359°55′ | 359°50′ | 359°45′ | 359°40′ | 359°35′ | 359°30′ | 359°25′ | 359°20′ | 359°15′ | 359°10′ | 359° 5′ | 359° 0′ | |
| ″ | ′ | ′ | ′ | ′ | ′ | ′ | ′ | ′ | ′ | ′ | ′ | ′ | ″ |
| 1 | 0·0 | 0·0 | 0·0 | 0·0 | 0·0 | 0·1 | 0·1 | 0·1 | 0·2 | 0·2 | 0·2 | 0·3 | 1 |
| 2 | 0·0 | 0·0 | 0·0 | 0·1 | 0·1 | 0·1 | 0·2 | 0·2 | 0·3 | 0·4 | 0·4 | 0·5 | 2 |
| 3 | 0·0 | 0·0 | 0·1 | 0·1 | 0·1 | 0·2 | 0·3 | 0·4 | 0·5 | 0·6 | 0·7 | 0·8 | 3 |
| 4 | 0·0 | 0·0 | 0·1 | 0·1 | 0·2 | 0·3 | 0·4 | 0·5 | 0·6 | 0·7 | 0·9 | 1·1 | 4 |
| 5 | 0·0 | 0·0 | 0·1 | 0·1 | 0·2 | 0·3 | 0·5 | 0·6 | 0·8 | 0·9 | 1·1 | 1·3 | 5 |
| 6 | 0·0 | 0·0 | 0·1 | 0·2 | 0·3 | 0·4 | 0·5 | 0·7 | 0·9 | 1·1 | 1·3 | 1·6 | 6 |
| 7 | 0·0 | 0·1 | 0·1 | 0·2 | 0·3 | 0·5 | 0·6 | 0·8 | 1·1 | 1·3 | 1·6 | 1·9 | 7 |
| 8 | 0·0 | 0·1 | 0·1 | 0·2 | 0·4 | 0·5 | 0·7 | 0·9 | 1·2 | 1·5 | 1·8 | 2·1 | 8 |
| 9 | 0·0 | 0·1 | 0·2 | 0·3 | 0·4 | 0·6 | 0·8 | 1·1 | 1·4 | 1·7 | 2·0 | 2·4 | 9 |

| A | 1° 5′ | 1° 10′ | 1° 15′ | 1° 20′ | 1° 25′ | 1° 30′ | 1° 35′ | 1° 40′ | 1° 45′ | 1° 50′ | 1° 55′ | 2° 0′ | A |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | 358°55′ | 358°50′ | 358°45′ | 358°40′ | 358°35′ | 358°30′ | 358°25′ | 358°20′ | 358°15′ | 358° 10′ | 358° 5′ | 358° 0′ | |
| ″ | ′ | ′ | ′ | ′ | ′ | ′ | ′ | ′ | ′ | ′ | ′ | ′ | ″ |
| 1 | 0·3 | 0·4 | 0·4 | 0·5 | 0·5 | 0·6 | 0·7 | 0·7 | 0·8 | 0·9 | 1·0 | 1·1 | 1 |
| 2 | 0·6 | 0·7 | 0·8 | 0·9 | 1·0 | 1·2 | 1·3 | 1·5 | 1·6 | 1·8 | 1·9 | 2·1 | 2 |
| 3 | 0·9 | 1·1 | 1·3 | 1·5 | 1·7 | 1·8 | 2·0 | 2·2 | 2·5 | 2·7 | 3·0 | 3·2 | 3 |
| 4 | 1·2 | 1·4 | 1·7 | 1·9 | 2·2 | 2·4 | 2·7 | 3·0 | 3·3 | 3·6 | 3·9 | 4·3 | 4 |
| 5 | 1·6 | 1·8 | 2·1 | 2·4 | 2·7 | 3·0 | 3·4 | 3·7 | 4·1 | 4·5 | 4·9 | 5·3 | 5 |
| 6 | 1·9 | 2·2 | 2·5 | 2·9 | 3·2 | 3·6 | 4·0 | 4·4 | 4·9 | 5·4 | 5·9 | 6·4 | 6 |
| 7 | 2·2 | 2·5 | 2·9 | 3·3 | 3·7 | 4·2 | 4·7 | 5·2 | 5·7 | 6·3 | 6·9 | 7·5 | 7 |
| 8 | 2·5 | 2·9 | 3·3 | 3·8 | 4·3 | 4·8 | 5·4 | 5·9 | 6·5 | 7·1 | 7·8 | 8·5 | 8 |
| 9 | 2·8 | 3·3 | 3·8 | 4·3 | 4·9 | 5·4 | 6·0 | 6·7 | 7·4 | 8·1 | 8·8 | 9·6 | 9 |

| A | 2° 5′ | 2° 10′ | 2° 15′ | 2° 20′ | 2° 25′ | 2° 30′ | 2° 35′ | 2° 40′ | 2° 45′ | 2° 50′ | 2° 55′ | 3° 0′ | A |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | 357°55′ | 357°50′ | 357°45′ | 357°40′ | 357°35′ | 357°30′ | 357°25′ | 357°20′ | 357°15′ | 357°10′ | 357° 5′ | 357° 0′ | |
| ″ | ′ | ′ | ′ | ′ | ′ | ′ | ′ | ′ | ′ | ′ | ′ | ′ | ″ |
| 1 | 1·2 | 1·3 | 1·4 | 1·5 | 1·6 | 1·7 | 1·8 | 1·9 | 2·0 | 2·1 | 2·3 | 2·4 | 1 |
| 2 | 2·3 | 2·5 | 2·7 | 2·9 | 3·1 | 3·3 | 3·5 | 3·8 | 4·0 | 4·2 | 4·5 | 4·8 | 2 |
| 3 | 3·5 | 3·8 | 4·1 | 4·4 | 4·7 | 5·0 | 5·3 | 5·7 | 6·1 | 6·5 | 6·9 | 7·2 | 3 |
| 4 | 4·7 | 5·0 | 5·4 | 5·8 | 6·2 | 6·7 | 7·1 | 7·6 | 8·1 | 8·6 | 9·1 | 9·6 | 4 |
| 5 | 5·8 | 6·3 | 6·8 | 7·3 | 7·8 | 8·3 | 8·9 | 9·5 | 10·1 | 10·7 | 11·4 | 12·0 | 5 |
| 6 | 6·9 | 7·5 | 8·1 | 8·7 | 9·3 | 10·0 | 10·7 | 11·4 | 12·1 | 12·8 | 13·6 | 14·4 | 6 |
| 7 | 8·1 | 8·8 | 9·5 | 10·2 | 10·9 | 11·7 | 12·5 | 13·3 | 14·1 | 14·9 | 15·8 | 16·8 | 7 |
| 8 | 9·2 | 10·0 | 10·8 | 11·6 | 12·5 | 13·3 | 14·2 | 15·1 | 16·1 | 17·1 | 18·1 | 19·2 | 8 |
| 9 | 10·4 | 11·3 | 12·2 | 13·1 | 14·1 | 15·0 | 16·0 | 17·1 | 18·2 | 19·3 | 20·5 | 21·6 | 9 |

| A | 3° 5′ | 3° 10′ | 3° 15′ | 3° 20′ | 3° 25′ | 3° 30′ | 3° 35′ | 3° 40′ | 3° 45′ | 3° 50′ | 3° 55′ | 4° 0′ | A |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | 356°55′ | 356°50′ | 356°45′ | 356°40′ | 356°35′ | 356°30′ | 356°25′ | 356°20′ | 356°15′ | 356°10′ | 356° 5′ | 356° 0′ | |
| ″ | ′ | ′ | ′ | ′ | ′ | ′ | ′ | ′ | ′ | ′ | ′ | ′ | ″ |
| 1 | 2·5 | 2·7 | 2·8 | 2·9 | 3·1 | 3·3 | 3·5 | 3·6 | 3·8 | 4·0 | 4·1 | 4·3 | 1 |
| 2 | 5·1 | 5·3 | 5·6 | 5·9 | 6·2 | 6·5 | 6·8 | 7·1 | 7·5 | 7·8 | 8·2 | 8·5 | 2 |
| 3 | 7·6 | 8·0 | 8·5 | 8·9 | 9·4 | 9·8 | 10·3 | 10·8 | 11·3 | 11·8 | 12·3 | 12·8 | 3 |
| 4 | 10·1 | 10·7 | 11·3 | 11·9 | 12·5 | 13·1 | 13·7 | 14·4 | 15·0 | 15·7 | 16·4 | 17·1 | 4 |
| 5 | 12·7 | 13·4 | 14·1 | 14·8 | 15·6 | 16·3 | 17·1 | 17·9 | 18·8 | 19·6 | 20·5 | 21·3 | 5 |
| 6 | 15·2 | 16·0 | 16·9 | 17·8 | 18·7 | 19·6 | 20·5 | 21·5 | 22·5 | 23·5 | 24·5 | 25·6 | 6 |
| 7 | 17·7 | 18·7 | 19·7 | 20·7 | 21·8 | 22·9 | 24·0 | 25·1 | 26·3 | 27·5 | 28·7 | 29·9 | 7 |
| 8 | 20·3 | 21·4 | 22·5 | 23·7 | 24·9 | 26·1 | 27·4 | 28·7 | 30·0 | 31·3 | 32·7 | 34·1 | 8 |
| 9 | 22·8 | 24·1 | 25·4 | 26·7 | 28·0 | 29·4 | 30·8 | 32·3 | 33·8 | 35·3 | 36·9 | 38·4 | 9 |

Reduction Minus to True Altitude at Lower Transit

AÇIKLAMA SAYFASINA DÖNMEK IÇIN TIKLAYINIZ

# EX-MERIDIAN TABLE III

Second Correction Subtractive from First Correction

| First Corr | Altitude | | | | | | | | | | | | | | | First Corr |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | 15° | 30° | 35° | 40° | 45° | 50° | 53° | 56° | 59° | 62° | 65° | 68° | 71° | 74° | 77° | 80° | |
| ′ | ′ | ′ | ′ | ′ | ′ | ′ | ′ | ′ | ′ | ′ | ′ | ′ | ′ | ′ | ′ | ′ | ′ |
| 15 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.1 | 0.1 | 0.1 | 0.1 | 0.1 | 0.1 | 0.1 | 0.1 | 0.2 | 15 |
| 30 | 0.0 | 0.1 | 0.1 | 0.1 | 0.1 | 0.2 | 0.2 | 0.2 | 0.2 | 0.2 | 0.3 | 0.3 | 0.4 | 0.5 | 0.6 | 0.7 | 30 |
| 35 | 0.1 | 0.1 | 0.1 | 0.2 | 0.2 | 0.2 | 0.2 | 0.3 | 0.3 | 0.3 | 0.4 | 0.4 | 0.5 | 0.6 | 0.8 | 1.0 | 35 |
| 40 | 0.1 | 0.1 | 0.2 | 0.2 | 0.2 | 0.3 | 0.3 | 0.3 | 0.4 | 0.4 | 0.5 | 0.6 | 0.7 | 0.8 | 1.0 | 1.3 | 40 |
| 45 | 0.1 | 0.2 | 0.2 | 0.3 | 0.3 | 0.4 | 0.4 | 0.4 | 0.5 | 0.6 | 0.6 | 0.7 | 0.9 | 1.0 | 1.3 | 1.7 | 45 |
| 50 | 0.1 | 0.2 | 0.3 | 0.3 | 0.4 | 0.4 | 0.5 | 0.5 | 0.6 | 0.7 | 0.8 | 0.9 | 1.1 | 1.3 | 1.6 | 2.1 | 50 |
| 55 | 0.1 | 0.3 | 0.3 | 0.4 | 0.4 | 0.5 | 0.6 | 0.7 | 0.7 | 0.8 | 0.9 | 1.1 | 1.3 | 1.5 | 1.9 | 2.5 | 55 |
| 60 | 0.1 | 0.3 | 0.4 | 0.4 | 0.5 | 0.6 | 0.7 | 0.7 | 0.9 | 1.0 | 1.1 | 1.3 | 1.5 | 1.8 | 2.3 | 3.0 | 60 |
| 65 | 0.2 | 0.4 | 0.4 | 0.5 | 0.6 | 0.7 | 0.8 | 0.9 | 1.0 | 1.2 | 1.3 | 1.5 | 1.8 | 2.1 | 2.7 | 3.5 | 65 |
| 70 | 0.2 | 0.4 | 0.5 | 0.6 | 0.7 | 0.9 | 0.9 | 1.1 | 1.2 | 1.3 | 1.5 | 1.8 | 2.1 | 2.5 | 3.1 | 4.0 | 70 |
| 75 | 0.2 | 0.5 | 0.6 | 0.7 | 0.8 | 1.0 | 1.1 | 1.2 | 1.4 | 1.5 | 1.8 | 2.0 | 2.4 | 2.9 | 3.5 | 4.6 | 75 |
| 80 | 0.3 | 0.5 | 0.7 | 0.8 | 0.9 | 1.1 | 1.2 | 1.4 | 1.6 | 1.8 | 2.0 | 2.3 | 2.7 | 3.3 | 4.0 | 5.3 | 80 |
| 85 | 0.3 | 0.6 | 0.7 | 0.9 | 1.1 | 1.3 | 1.4 | 1.6 | 1.8 | 2.0 | 2.3 | 2.6 | 3.1 | 3.7 | 4.5 | 6.0 | 85 |
| 90 | 0.3 | 0.7 | 0.8 | 1.0 | 1.2 | 1.4 | 1.6 | 1.8 | 2.0 | 2.2 | 2.5 | 2.9 | 3.4 | 4.1 | 5.1 | 6.7 | 90 |
| 93 | 0.3 | 0.7 | 0.9 | 1.1 | 1.3 | 1.5 | 1.7 | 1.9 | 2.1 | 2.4 | 2.7 | 3.1 | 3.7 | 4.4 | 5.5 | 7.1 | 93 |
| 96 | 0.4 | 0.8 | 0.9 | 1.1 | 1.3 | 1.6 | 1.8 | 2.0 | 2.2 | 2.5 | 2.9 | 3.3 | 3.9 | 4.7 | 5.8 | 7.6 | 96 |
| 99 | 0.4 | 0.8 | 1.0 | 1.2 | 1.4 | 1.7 | 1.9 | 2.1 | 2.4 | 2.7 | 3.1 | 3.5 | 4.1 | 5.0 | 6.2 | 8.1 | 99 |
| 102 | 0.4 | 0.9 | 1.1 | 1.3 | 1.5 | 1.8 | 2.0 | 2.2 | 2.5 | 2.9 | 3.2 | 3.7 | 4.4 | 5.3 | 6.6 | 8.6 | 102 |
| 105 | 0.4 | 0.9 | 1.1 | 1.4 | 1.6 | 1.9 | 2.1 | 2.4 | 2.7 | 3.0 | 3.4 | 4.0 | 4.7 | 5.6 | 7.0 | 9.1 | 105 |
| 108 | 0.5 | 1.0 | 1.2 | 1.4 | 1.7 | 2.0 | 2.3 | 2.5 | 2.8 | 3.2 | 3.6 | 4.2 | 4.9 | 5.9 | 7.3 | 9.6 | 108 |
| 111 | 0.5 | 1.0 | 1.3 | 1.5 | 1.8 | 2.1 | 2.4 | 2.7 | 3.0 | 3.4 | 3.8 | 4.4 | 5.2 | 6.3 | 7.8 | 10.2 | 111 |
| 114 | 0.5 | 1.1 | 1.3 | 1.6 | 1.9 | 2.3 | 2.5 | 2.8 | 3.2 | 3.6 | 4.1 | 4.7 | 5.5 | 6.6 | 8.2 | 10.7 | 114 |
| 117 | 0.5 | 1.1 | 1.4 | 1.7 | 2.0 | 2.4 | 2.6 | 3.0 | 3.3 | 3.7 | 4.3 | 4.9 | 5.8 | 6.9 | 8.6 | 11.3 | 117 |
| 120 | 0.6 | 1.2 | 1.5 | 1.8 | 2.1 | 2.5 | 2.8 | 3.1 | 3.5 | 3.9 | 4.5 | 5.2 | 6.1 | 7.3 | 9.1 | 11.9 | 120 |
| 123 | 0.6 | 1.3 | 1.5 | 1.8 | 2.2 | 2.6 | 2.9 | 3.3 | 3.7 | 4.1 | 4.7 | 5.5 | 6.4 | 7.6 | 9.5 | 12.5 | 123 |
| 126 | 0.6 | 1.3 | 1.6 | 1.9 | 2.3 | 2.8 | 3.1 | 3.4 | 3.8 | 4.3 | 5.0 | 5.7 | 6.7 | 8.0 | 10.0 | 13.1 | 126 |
| 129 | 0.7 | 1.4 | 1.7 | 2.0 | 2.4 | 2.9 | 3.2 | 3.6 | 4.0 | 4.6 | 5.2 | 6.0 | 7.0 | 8.4 | 10.5 | 13.7 | 129 |
| 132 | 0.7 | 1.5 | 1.8 | 2.1 | 2.5 | 3.0 | 3.4 | 3.8 | 4.2 | 4.8 | 5.4 | 6.3 | 7.4 | 8.8 | 11.0 | 14.4 | 132 |
| 135 | 0.7 | 1.5 | 1.9 | 2.2 | 2.6 | 3.2 | 3.5 | 3.9 | 4.4 | 5.0 | 5.7 | 6.6 | 7.7 | 9.2 | 11.5 | 15.0 | 135 |
| 138 | 0.7 | 1.6 | 1.9 | 2.3 | 2.8 | 3.3 | 3.7 | 4.1 | 4.6 | 5.2 | 5.9 | 6.9 | 8.0 | 9.7 | 12.0 | 15.7 | 138 |
| 141 | 0.8 | 1.7 | 2.0 | 2.4 | 2.9 | 3.5 | 3.8 | 4.3 | 4.8 | 5.4 | 6.2 | 7.2 | 8.4 | 1.0 | 12.5 | 16.4 | 141 |

# EX-MERIDIAN TABLE IV

Limits of Hour Angle or Time 'before or after' Meridian Passage

| A | Hour Angle | A | Hour Angle | A | Hour Angle | A | Hour Angle | A | Hour Angle |
|---|---|---|---|---|---|---|---|---|---|
| ″ | m | ″ | m | ″ | m | ″ | m | ″ | m |
| 52·2 | **4** | 7·54 | **17** | 3·37 | **30** | 1·92 | **43** | 1·21 | **56** |
| 40·2 | **5** | 6·94 | **18** | 3·20 | **31** | 1·85 | **44** | 1·17 | **57** |
| 31·4 | **6** | 6·44 | **19** | 3·05 | **32** | 1·78 | **45** | 1·13 | **58** |
| 25·4 | **7** | 6·00 | **20** | 2·92 | **33** | 1·72 | **46** | 1·09 | **59** |
| 21·2 | **8** | 5·64 | **21** | 2·79 | **34** | 1·66 | **47** | 1·06 | **60** |
| 18·0 | **9** | 5·26 | **22** | 2·67 | **35** | 1·60 | **48** | 1·02 | **61** |
| 15·7 | **10** | 4·94 | **23** | 2·55 | **36** | 1·54 | **49** | 0·99 | **62** |
| 13·8 | **11** | 4·60 | **24** | 2·45 | **37** | 1·49 | **50** | 0·96 | **63** |
| 12·2 | **12** | 4·40 | **25** | 2·35 | **38** | 1·43 | **51** | 0·93 | **64** |
| 10·9 | **13** | 4·17 | **26** | 2·25 | **39** | 1·38 | **52** | 0·90 | **65** |
| 9·90 | **14** | 3·94 | **27** | 2·16 | **40** | 1·34 | **53** | 0·87 | **66** |
| 9·02 | **15** | 3·73 | **28** | 2·08 | **41** | 1·29 | **54** | | |
| 8·22 | **16** | 3·54 | **29** | 2·00 | **42** | 1·25 | **55** | | |

# CHANGE of HOUR ANGLE with ALTITUDE

## LATITUDE

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

# CHANGE OF HOUR ANGLE with ALTITUDE

| AZIMUTH | LATITUDE | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | 39° | 42° | 45° | 48° | 51° | 54° | 57° | 60° | 63° | 66° | 69° | 72° |
| ° | ′ | ′ | ′ | ′ | ′ | ′ | ′ | ′ | ′ | ′ | ′ | ′ |
| 1 | 73·73 | 77·10 | 81·03 | 85·63 | 91·05 | 97·48 | 105·20 | 114·60 | 126·21 | 140·88 | 159·89 | 185·43 |
| 2 | 36·87 | 38·56 | 40·52 | 42·82 | 45·53 | 48·75 | 52·61 | 57·31 | 63·11 | 70·45 | 79·96 | 92·73 |
| 3 | 24·59 | 25·71 | 27·02 | 28·56 | 30·36 | 32·51 | 35·08 | 38·21 | 42·09 | 46·98 | 53·32 | 61·83 |
| 4 | 18·45 | 19·29 | 20·27 | 21·42 | 22·78 | 24·39 | 26·32 | 28·67 | 31·58 | 35·25 | 40·00 | 46·39 |
| 5 | 14·76 | 15·44 | 16·23 | 17·15 | 18·23 | 19·52 | 21·07 | 22·95 | 25·27 | 28·21 | 32·02 | 37·13 |
| 6 | 12·31 | 12·87 | 13·53 | 14·30 | 15·20 | 16·28 | 17·57 | 19·13 | 21·04 | 23·48 | 26·65 | 30·91 |
| 7 | 10·56 | 11·04 | 11·60 | 12·26 | 13·04 | 13·96 | 15·07 | 16·41 | 18·07 | 20·17 | 22·90 | 26·55 |
| 8 | 9·25 | 9·67 | 10·16 | 10·74 | 11·42 | 12·22 | 13·19 | 14·37 | 15·83 | 17·67 | 20·05 | 23·25 |
| 9 | 8·23 | 8·60 | 9·04 | 9·55 | 10·16 | 10·88 | 11·74 | 12·78 | 14·08 | 15·72 | 17·84 | 20·69 |
| 10 | 7·41 | 7·75 | 8·14 | 8·61 | 9·15 | 9·80 | 10·57 | 11·52 | 12·68 | 14·16 | 16·07 | 18·64 |
| 11 | 6·74 | 7·05 | 7·41 | 7·83 | 8·33 | 8·92 | 9·62 | 10·48 | 11·54 | 12·89 | 14·63 | 16·96 |
| 12 | 6·19 | 6·47 | 6·80 | 7·19 | 7·64 | 8·18 | 8·83 | 9·62 | 10·59 | 11·83 | 13·42 | 15·56 |
| 13 | 5·72 | 5·98 | 6·29 | 6·64 | 7·06 | 7·56 | 8·16 | 8·89 | 9·79 | 10·93 | 12·40 | 14·39 |
| 14 | 5·32 | 5·56 | 5·85 | 6·18 | 6·57 | 7·03 | 7·59 | 8·27 | 9·11 | 10·16 | 11·53 | 13·38 |
| 15 | 4·97 | 5·20 | 5·46 | 5·77 | 6·14 | 6·57 | 7·09 | 7·73 | 8·51 | 9·50 | 10·78 | 12·50 |
| 16 | 4·67 | 4·88 | 5·13 | 5·42 | 5·77 | 6·17 | 6·66 | 7·26 | 7·99 | 8·92 | 10·12 | 11·74 |
| 17 | 4·40 | 4·60 | 4·84 | 5·11 | 5·44 | 5·82 | 6·28 | 6·84 | 7·53 | 8·41 | 9·54 | 11·07 |
| 18 | 4·16 | 4·36 | 4·58 | 4·84 | 5·14 | 5·51 | 5·94 | 6·47 | 7·13 | 7·96 | 9·03 | 10·47 |
| 19 | 3·95 | 4·13 | 4·34 | 4·59 | 4·88 | 5·23 | 5·64 | 6·14 | 6·77 | 7·55 | 8·57 | 9·94 |
| 20 | 3·76 | 3·93 | 4·14 | 4·37 | 4·65 | 4·97 | 5·37 | 5·85 | 6·44 | 7·19 | 8·16 | 9·46 |
| 21 | 3·59 | 3·76 | 3·95 | 4·17 | 4·43 | 4·75 | 5·12 | 5·58 | 6·15 | 6·86 | 7·79 | 9·03 |
| 22 | 3·44 | 3·59 | 3·78 | 3·99 | 4·24 | 4·54 | 4·90 | 5·34 | 5·88 | 6·56 | 7·45 | 8·64 |
| 24 | 3·16 | 3·31 | 3·48 | 3·67 | 3·91 | 4·18 | 4·51 | 4·92 | 5·42 | 6·04 | 6·86 | 7·96 |
| 26 | 2·94 | 3·07 | 3·23 | 3·41 | 3·63 | 3·88 | 4·19 | 4·56 | 5·02 | 5·61 | 6·37 | 7·38 |
| 28 | 2·74 | 2·87 | 3·01 | 3·18 | 3·39 | 3·62 | 3·91 | 4·26 | 4·69 | 5·24 | 5·94 | 6·89 |
| 30 | 2·57 | 2·69 | 2·83 | 2·99 | 3·18 | 3·40 | 3·67 | 4·00 | 4·41 | 4·92 | 5·58 | 6·47 |
| 32 | 2·43 | 2·54 | 2·67 | 2·82 | 3·00 | 3·21 | 3·47 | 3·77 | 4·16 | 4·64 | 5·27 | 6·11 |
| 34 | 2·30 | 2·41 | 2·53 | 2·67 | 2·84 | 3·04 | 3·28 | 3·58 | 3·94 | 4·40 | 4·99 | 5·79 |
| 36 | 2·19 | 2·29 | 2·41 | 2·54 | 2·70 | 2·89 | 3·12 | 3·40 | 3·75 | 4·18 | 4·75 | 5·51 |
| 38 | 2·09 | 2·19 | 2·30 | 2·43 | 2·58 | 2·76 | 2·98 | 3·25 | 3·58 | 3·99 | 4·53 | 5·26 |
| 40 | 2·00 | 2·09 | 2·20 | 2·33 | 2·47 | 2·65 | 2·86 | 3·11 | 3·43 | 3·82 | 4·34 | 5·03 |
| 42 | 1·92 | 2·01 | 2·11 | 2·23 | 2·38 | 2·54 | 2·74 | 2·99 | 3·29 | 3·67 | 4·17 | 4·84 |
| 44 | 1·85 | 1·94 | 2·04 | 2·15 | 2·29 | 2·45 | 2·64 | 2·88 | 3·17 | 3·54 | 4·02 | 4·66 |
| 46 | 1·79 | 1·87 | 1·97 | 2·08 | 2·21 | 2·37 | 2·55 | 2·78 | 3·06 | 3·42 | 3·88 | 4·50 |
| 48 | 1·73 | 1·81 | 1·90 | 2·01 | 2·14 | 2·29 | 2·47 | 2·69 | 2·96 | 3·31 | 3·75 | 4·35 |
| 50 | 1·68 | 1·76 | 1·85 | 1·95 | 2·07 | 2·22 | 2·40 | 2·61 | 2·88 | 3·21 | 3·64 | 4·22 |
| 52 | 1·63 | 1·71 | 1·80 | 1·90 | 2·02 | 2·16 | 2·33 | 2·54 | 2·80 | 3·12 | 3·54 | 4·11 |
| 55 | 1·57 | 1·64 | 1·73 | 1·82 | 1·94 | 2·08 | 2·24 | 2·44 | 2·69 | 3·00 | 3·41 | 3·95 |
| 60 | 1·49 | 1·55 | 1·63 | 1·73 | 1·84 | 1·96 | 2·12 | 2·31 | 2·54 | 2·84 | 3·22 | 3·74 |
| 65 | 1·42 | 1·49 | 1·56 | 1·65 | 1·75 | 1·88 | 2·03 | 2·21 | 2·43 | 2·71 | 3·08 | 3·57 |
| 70 | 1·37 | 1·43 | 1·51 | 1·59 | 1·69 | 1·81 | 1·95 | 2·13 | 2·34 | 2·62 | 2·97 | 3·44 |
| 75 | 1·33 | 1·39 | 1·46 | 1·55 | 1·65 | 1·76 | 1·90 | 2·07 | 2·28 | 2·55 | 2·89 | 3·35 |
| 80 | 1·31 | 1·37 | 1·44 | 1·52 | 1·61 | 1·73 | 1·86 | 2·03 | 2·24 | 2·50 | 2·83 | 3·29 |
| 85 | 1·29 | 1·35 | 1·42 | 1·50 | 1·60 | 1·71 | 1·84 | 2·01 | 2·21 | 2·47 | 2·80 | 3·25 |
| 90 | 1·29 | 1·35 | 1·41 | 1·49 | 1·59 | 1·70 | 1·84 | 2·00 | 2·20 | 2·46 | 2·79 | 3·24 |

AÇIKLAMA SAYFASINA DÖNMEK IÇIN TIKLAYINIZ

## CHANGE OF ALTITUDE IN ONE MINUTE OF TIME

### AZIMUTH

| Lat. | 40° | 42½° | 45° | 47½° | 50° | 52½° | 55° | 57½° | 60° | 62½° | 65° | 67½° | 70° | 75° | 80° | 90° | Lat. |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 0° | 9.6 | 10.1 | 10.6 | 11.0 | 11.5 | 11.9 | 12.3 | 12.7 | 13.0 | 13.3 | 13.6 | 13.8 | 14.1 | 14.5 | 14.8 | 15.0 | 0° |
| 4° | 9.6 | 10.1 | 10.6 | 11.0 | 11.5 | 11.9 | 12.3 | 12.6 | 13.0 | 13.3 | 13.6 | 13.8 | 14.1 | 14.5 | 14.7 | 15.0 | 4° |
| 8° | 9.5 | 10.0 | 10.5 | 11.0 | 11.4 | 11.8 | 12.2 | 12.5 | 12.9 | 13.2 | 13.5 | 13.7 | 14.0 | 14.4 | 14.6 | 14.9 | 8° |
| 12° | 9.4 | 9.9 | 10.4 | 10.8 | 11.2 | 11.6 | 12.0 | 12.3 | 12.7 | 13.0 | 13.3 | 13.5 | 13.8 | 14.2 | 14.4 | 14.7 | 12° |
| 16° | 9.3 | 9.8 | 10.2 | 10.6 | 11.0 | 11.4 | 11.8 | 12.1 | 12.5 | 12.8 | 13.1 | 13.3 | 13.5 | 13.9 | 14.2 | 14.4 | 16° |
| 20° | 9.1 | 9.5 | 10.0 | 10.4 | 10.8 | 11.1 | 11.5 | 11.8 | 12.2 | 12.5 | 12.8 | 13.0 | 13.2 | 13.6 | 13.9 | 14.1 | 20° |
| 24° | 8.8 | 9.2 | 9.7 | 10.2 | 10.5 | 10.8 | 11.2 | 11.5 | 11.9 | 12.2 | 12.4 | 12.6 | 12.9 | 13.2 | 13.5 | 13.7 | 24° |
| 26° | 8.7 | 9.1 | 9.5 | 9.9 | 10.3 | 10.6 | 11.0 | 11.3 | 11.7 | 12.0 | 12.2 | 12.5 | 12.7 | 13.0 | 13.3 | 13.5 | 26° |
| 28° | 8.5 | 9.0 | 9.4 | 9.7 | 10.1 | 10.4 | 10.8 | 11.1 | 11.5 | 11.7 | 12.0 | 12.2 | 12.4 | 12.8 | 13.1 | 13.2 | 28° |
| 30° | 8.3 | 8.8 | 9.2 | 9.6 | 9.9 | 10.2 | 10.6 | 10.9 | 11.2 | 11.5 | 11.8 | 12.0 | 12.2 | 12.5 | 12.8 | 13.0 | 30° |
| 32° | 8.2 | 8.6 | 9.0 | 9.4 | 9.7 | 10.0 | 10.4 | 10.7 | 11.0 | 11.3 | 11.5 | 11.8 | 12.0 | 12.3 | 12.5 | 12.7 | 32° |
| 34° | 8.0 | 8.4 | 8.8 | 9.2 | 9.5 | 9.8 | 10.2 | 10.5 | 10.8 | 11.0 | 11.3 | 11.5 | 11.7 | 12.0 | 12.3 | 12.4 | 34° |
| 36° | 7.8 | 8.2 | 8.6 | 9.0 | 9.3 | 9.6 | 9.9 | 10.2 | 10.5 | 10.7 | 11.0 | 11.2 | 11.4 | 11.7 | 12.0 | 12.1 | 36° |
| 38° | 7.6 | 8.0 | 8.4 | 8.7 | 9.1 | 9.4 | 9.7 | 10.0 | 10.2 | 10.5 | 10.7 | 10.9 | 11.1 | 11.4 | 11.6 | 11.8 | 38° |
| 40° | 7.4 | 7.7 | 8.1 | 8.5 | 8.8 | 9.1 | 9.4 | 9.7 | 10.0 | 10.2 | 10.4 | 10.6 | 10.8 | 11.1 | 11.3 | 11.5 | 40° |
| 42° | 7.2 | 7.5 | 7.9 | 8.2 | 8.5 | 8.8 | 9.1 | 9.4 | 9.7 | 9.9 | 10.1 | 10.3 | 10.5 | 10.8 | 11.0 | 11.1 | 42° |
| 44° | 6.9 | 7.2 | 7.6 | 8.0 | 8.3 | 8.6 | 8.8 | 9.0 | 9.3 | 9.6 | 9.8 | 10.0 | 10.1 | 10.4 | 10.6 | 10.8 | 44° |
| 46° | 6.7 | 7.0 | 7.4 | 7.7 | 8.0 | 8.3 | 8.5 | 8.7 | 9.0 | 9.2 | 9.4 | 9.6 | 9.8 | 10.1 | 10.3 | 10.4 | 46° |
| 48° | 6.5 | 6.8 | 7.1 | 7.4 | 7.7 | 8.0 | 8.2 | 8.5 | 8.7 | 8.9 | 9.1 | 9.3 | 9.4 | 9.7 | 9.9 | 10.0 | 48° |
| 49° | 6.3 | 6.6 | 6.9 | 7.2 | 7.6 | 7.8 | 8.0 | 8.3 | 8.5 | 8.7 | 8.9 | 9.1 | 9.2 | 9.5 | 9.7 | 9.8 | 49° |
| 50° | 6.2 | 6.5 | 6.8 | 7.1 | 7.4 | 7.6 | 7.9 | 8.1 | 8.3 | 8.5 | 8.7 | 8.9 | 9.1 | 9.3 | 9.5 | 9.6 | 50° |
| 51° | 6.0 | 6.3 | 6.6 | 6.8 | 7.2 | 7.5 | 7.7 | 7.9 | 8.1 | 8.3 | 8.5 | 8.7 | 8.9 | 9.1 | 9.3 | 9.4 | 51° |
| 52° | 5.9 | 6.2 | 6.5 | 6.8 | 7.1 | 7.4 | 7.6 | 7.8 | 8.0 | 8.2 | 8.4 | 8.6 | 8.7 | 8.9 | 9.1 | 9.2 | 52° |
| 53° | 5.8 | 6.1 | 6.4 | 6.7 | 7.0 | 7.3 | 7.5 | 7.7 | 7.9 | 8.1 | 8.3 | 8.4 | 8.5 | 8.7 | 8.9 | 9.0 | 53° |
| 54° | 5.7 | 6.0 | 6.2 | 6.5 | 6.8 | 7.0 | 7.2 | 7.4 | 7.6 | 7.8 | 8.0 | 8.2 | 8.3 | 8.5 | 8.7 | 8.8 | 54° |
| 55° | 5.5 | 5.8 | 6.1 | 6.3 | 6.6 | 6.8 | 7.0 | 7.2 | 7.5 | 7.6 | 7.8 | 8.0 | 8.1 | 8.3 | 8.5 | 8.6 | 55° |
| 56° | 5.4 | 5.7 | 5.9 | 6.2 | 6.4 | 6.7 | 6.9 | 7.1 | 7.3 | 7.4 | 7.6 | 7.8 | 7.9 | 8.1 | 8.3 | 8.4 | 56° |
| 57° | 5.2 | 5.5 | 5.8 | 6.0 | 6.3 | 6.5 | 6.7 | 6.9 | 7.1 | 7.2 | 7.4 | 7.6 | 7.7 | 7.9 | 8.0 | 8.2 | 57° |
| 58° | 5.1 | 5.3 | 5.6 | 5.8 | 6.1 | 6.3 | 6.5 | 6.7 | 6.9 | 7.0 | 7.2 | 7.4 | 7.5 | 7.7 | 7.8 | 8.0 | 58° |
| 59° | 5.0 | 5.2 | 5.5 | 5.7 | 5.9 | 6.1 | 6.3 | 6.5 | 6.7 | 6.9 | 7.0 | 7.2 | 7.3 | 7.5 | 7.6 | 7.7 | 59° |
| 60° | 4.8 | 5.1 | 5.3 | 5.5 | 5.7 | 5.9 | 6.1 | 6.3 | 6.5 | 6.7 | 6.8 | 6.9 | 7.0 | 7.2 | 7.4 | 7.5 | 60° |
| 61° | 4.8 | 5.1 | 5.3 | 5.5 | 5.7 | 5.9 | 6.1 | 6.3 | 6.5 | 6.6 | 6.7 | 6.8 | 6.9 | 7.0 | 7.2 | 7.3 | 61° |
| 62° | 4.5 | 4.7 | 5.0 | 5.2 | 5.4 | 5.6 | 5.8 | 5.9 | 6.1 | 6.2 | 6.4 | 6.5 | 6.6 | 6.7 | 6.9 | 7.0 | 62° |
| 63° | 4.3 | 4.5 | 4.8 | 5.0 | 5.2 | 5.4 | 5.6 | 5.7 | 5.9 | 6.0 | 6.2 | 6.3 | 6.4 | 6.5 | 6.7 | 6.8 | 63° |
| 64° | 4.2 | 4.4 | 4.7 | 4.9 | 5.1 | 5.2 | 5.4 | 5.5 | 5.7 | 5.8 | 6.0 | 6.1 | 6.2 | 6.3 | 6.4 | 6.5 | 64° |
| 65° | 4.1 | 4.3 | 4.5 | 4.7 | 4.9 | 5.0 | 5.2 | 5.3 | 5.5 | 5.6 | 5.8 | 5.9 | 6.0 | 6.1 | 6.2 | 6.3 | 65° |
| 66° | 4.0 | 4.1 | 4.3 | 4.5 | 4.7 | 4.9 | 5.0 | 5.1 | 5.3 | 5.4 | 5.5 | 5.6 | 5.7 | 5.9 | 6.0 | 6.1 | 66° |
| 67° | 3.8 | 4.0 | 4.1 | 4.3 | 4.5 | 4.7 | 4.8 | 5.0 | 5.1 | 5.2 | 5.3 | 5.4 | 5.5 | 5.7 | 5.8 | 5.9 | 67° |
| 68° | 3.6 | 3.8 | 4.0 | 4.1 | 4.3 | 4.5 | 4.6 | 4.8 | 4.9 | 5.0 | 5.1 | 5.1 | 5.2 | 5.4 | 5.5 | 5.6 | 68° |
| 69° | 3.5 | 3.6 | 3.8 | 4.0 | 4.1 | 4.3 | 4.4 | 4.6 | 4.7 | 4.8 | 4.9 | 5.0 | 5.0 | 5.1 | 5.3 | 5.4 | 69° |
| 70° | 3.3 | 3.5 | 3.6 | 3.7 | 3.9 | 4.1 | 4.2 | 4.3 | 4.5 | 4.6 | 4.7 | 4.7 | 4.8 | 4.9 | 5.0 | 5.1 | 70° |
| 71° | 3.1 | 3.3 | 3.5 | 3.6 | 3.7 | 3.9 | 4.0 | 4.1 | 4.2 | 4.3 | 4.4 | 4.5 | 4.6 | 4.7 | 4.8 | 4.9 | 71° |
| 72° | 2.9 | 3.1 | 3.3 | 3.4 | 3.5 | 3.7 | 3.8 | 3.9 | 4.0 | 4.1 | 4.2 | 4.2 | 4.3 | 4.4 | 4.5 | 4.6 | 72° |
| 73° | 2.8 | 3.0 | 3.1 | 3.3 | 3.4 | 3.5 | 3.6 | 3.7 | 3.8 | 3.9 | 4.0 | 4.1 | 4.1 | 4.2 | 4.3 | 4.4 | 73° |
| 74° | 2.6 | 2.8 | 2.9 | 3.1 | 3.2 | 3.3 | 3.4 | 3.5 | 3.6 | 3.7 | 3.8 | 3.9 | 3.9 | 3.9 | 4.0 | 4.1 | 74° |
| 75° | 2.5 | 2.6 | 2.7 | 2.9 | 3.0 | 3.1 | 3.2 | 3.3 | 3.4 | 3.4 | 3.5 | 3.5 | 3.6 | 3.7 | 3.8 | 3.9 | 75° |
| Lat. | 40° | 42½° | 45° | 47½° | 50° | 52½° | 55° | 57½° | 60° | 62½° | 65° | 67½° | 70° | 75° | 80° | 90° | Lat. |

## AUGMENTATION OF THE MOON'S SEMI - DIAMETER

| App. Alt. | Moon's Semi-Diameter | | | | | |
|---|---|---|---|---|---|---|
| | 14.5′ | 15.0′ | 15.5′ | 16.0′ | 16.5′ | 17.0′ |
| ° | ′ | ′ | ′ | ′ | ′ | ′ |
| 10 | 0.0 | 0.0 | 0.1 | 0.1 | 0.1 | 0.1 |
| 20 | 0.1 | 0.1 | 0.1 | 0.1 | 0.1 | 0.1 |
| 30 | 0.1 | 0.1 | 0.1 | 0.1 | 0.2 | 0.2 |
| 40 | 0.1 | 0.2 | 0.2 | 0.2 | 0.2 | 0.2 |
| 50 | 0.2 | 0.2 | 0.2 | 0.2 | 0.2 | 0.2 |
| 60 | 0.2 | 0.2 | 0.2 | 0.2 | 0.3 | 0.3 |
| 70 | 0.2 | 0.2 | 0.3 | 0.3 | 0.3 | 0.3 |
| 80 | 0.2 | 0.2 | 0.3 | 0.3 | 0.3 | 0.3 |
| 90 | 0.2 | 0.2 | 0.3 | 0.3 | 0.3 | 0.3 |

## REDUCTION OF THE MOON'S HORIZONTAL PARALLAX

| Lat. | Horizontal Parallax | | |
|---|---|---|---|
| | 54′ | 58′ | 62′ |
| ° | ′ | ′ | ′ |
| 10 | 0.0 | 0.0 | 0.0 |
| 20 | 0.0 | 0.0 | 0.0 |
| 30 | 0.0 | 0.0 | 0.1 |
| 40 | 0.1 | 0.1 | 0.1 |
| 50 | 0.1 | 0.1 | 0.1 |
| 60 | 0.1 | 0.2 | 0.2 |
| 70 | 0.2 | 0.2 | 0.2 |
| 80 | 0.2 | 0.2 | 0.2 |

## DIP OF THE SEA HORIZON

| m | ft | Dip ′ | m | ft | Dip ′ |
|---|---|---|---|---|---|
| 0.5 | 1.5 | −1.2 | 20.5 | 67 | −8.0 |
| 1.0 | 3 | −1.8 | 21.0 | 69 | −8.1 |
| 1.5 | 5 | −2.2 | 21.5 | 71 | −8.2 |
| 2.0 | 7 | −2.5 | 22.0 | 72 | −8.3 |
| 2.5 | 8 | −2.8 | 22.5 | 74 | −8.3 |
| 3.0 | 10 | −3.0 | 23.0 | 75 | −8.4 |
| 3.5 | 11 | −3.3 | 23.5 | 77 | −8.5 |
| 4.0 | 13 | −3.5 | 24.0 | 79 | −8.6 |
| 4.5 | 15 | −3.7 | 24.5 | 80 | −8.7 |
| 5.0 | 16 | −3.9 | 25.0 | 82 | −8.8 |
| 5.5 | 18 | −4.1 | 25.5 | 84 | −8.9 |
| 6.0 | 20 | −4.3 | 26.0 | 85 | −9.0 |
| 6.5 | 21 | −4.5 | 26.5 | 87 | −9.1 |
| 7.0 | 23 | −4.7 | 27.0 | 89 | −9.1 |
| 7.5 | 25 | −4.8 | 27.5 | 90 | −9.2 |
| 8.0 | 26 | −5.0 | 28.0 | 92 | −9.3 |
| 8.5 | 28 | −5.1 | 28.5 | 94 | −9.4 |
| 9.0 | 30 | −5.3 | 29.0 | 95 | −9.5 |
| 9.5 | 31 | −5.4 | 29.5 | 97 | −9.6 |
| 10.0 | 33 | −5.6 | 30.0 | 98 | −9.6 |
| 10.5 | 34 | −5.7 | 31 | 102 | −9.8 |
| 11.0 | 36 | −5.8 | 32 | 105 | −10.0 |
| 11.5 | 38 | −6.0 | 33 | 108 | −10.1 |
| 12.0 | 39 | −6.1 | 34 | 112 | −10.3 |
| 12.5 | 41 | −6.2 | 35 | 115 | −10.4 |
| 13.0 | 43 | −6.3 | 36 | 118 | −10.6 |
| 13.5 | 44 | −6.5 | 37 | 121 | −10.7 |
| 14.0 | 46 | −6.6 | 38 | 125 | −10.8 |
| 14.5 | 48 | −6.7 | 39 | 128 | -11.0 |
| 15.0 | 49 | −6.8 | 40 | 131 | −11.1 |
| 15.5 | 51 | −6.9 | 41 | 135 | −11.3 |
| 16.0 | 52 | −7.0 | 42 | 138 | −11.4 |
| 16.5 | 54 | −7.1 | 43 | 141 | −11.5 |
| 17.0 | 56 | −7.3 | 44 | 144 | −11.7 |
| 17.5 | 57 | −7.4 | 45 | 148 | −11.8 |
| 18.0 | 59 | −7.5 | 46 | 151 | −11.9 |
| 18.5 | 61 | −7.6 | 47 | 154 | −12.1 |
| 19.0 | 62 | −7.7 | 48 | 157 | −12.2 |
| 19.5 | 64 | −7.8 | 49 | 161 | −12.3 |
| 20.0 | 66 | −7.9 | 50 | 164 | −12.4 |

## SUN

| Parallax in Altitude | | Mean Semi Diameter | |
|---|---|---|---|
| App. Alt. | Parlx. | Month | Mean S.D. |
| ° | ′ | | ′ |
| 0 | + 0.2 | Jan. | 16.3 |
| 10 | + 0.2 | Feb. | 16.2 |
| 20 | + 0.1 | March | 16.1 |
| 30 | + 0.1 | April | 16.0 |
| 40 | + 0.1 | May | 15.8 |
| 50 | + 0.1 | June | 15.8 |
| 60 | + 0.1 | July | 15.8 |
| 70 | + 0.1 | Aug. | 15.8 |
| 80 | + 0.0 | Sept. | 15.9 |
| 90 | + 0.0 | Oct. | 16.1 |
| | | Nov. | 16.2 |
| | | Dec. | 16.3 |

## MEAN REFRACTION

Atmospheric Pressure 1000mbs (29.5ins)
Temperature 10°C (50°F)

| App. Alt. | Refr. | App. Alt. | Refr. | App. Alt. | Refr. |
|---|---|---|---|---|---|
| ° ′ | ′ | ° ′ | ′ | ° ′ | ′ |
| 0 00 | −33.9 | 4 00 | −11.5 | 12 00 | −4.4 |
| 05 | 32.8 | 10 | 11.1 | 20 | 4.3 |
| 10 | 31.8 | 20 | 10.8 | 40 | 4.2 |
| 15 | 30.8 | 30 | 10.5 | 13 00 | 4.0 |
| 20 | 29.9 | 40 | 10.2 | 20 | 3.9 |
| 25 | 29.0 | 50 | 9.9 | 40 | 3.9 |
| 0 30 | −28.2 | 5 00 | −9.7 | 14 00 | −3.8 |
| 35 | 27.4 | 10 | 9.4 | 20 | 3.7 |
| 40 | 26.6 | 20 | 9.2 | 40 | 3.6 |
| 45 | 25.9 | 30 | 8.9 | 15 00 | 3.5 |
| 50 | 25.2 | 40 | 8.7 | 20 | 3.4 |
| 55 | 24.6 | 50 | 8.5 | 40 | 3.4 |
| 1 00 | −23.9 | 6 00 | −8.3 | 16 00 | −3.3 |
| 05 | 23.3 | 10 | 8.1 | 17 00 | 3.1 |
| 10 | 22.7 | 20 | 7.9 | 18 00 | 2.9 |
| 15 | 22.1 | 30 | 7.7 | 19 00 | 2.7 |
| 20 | 21.5 | 40 | 7.5 | 20 00 | 2.6 |
| 25 | 21.0 | 50 | 7.4 | 21 00 | 2.5 |
| 1 30 | −20.5 | 7 00 | −7.2 | 22 00 | −2.3 |
| 35 | 20.1 | 10 | 7.0 | 23 00 | 2.2 |
| 40 | 19.6 | 20 | 6.9 | 24 00 | 2.1 |
| 45 | 19.1 | 30 | 6.8 | 25 00 | 2.0 |
| 50 | 18.7 | 40 | 6.6 | 26 00 | 1.9 |
| 55 | 18.3 | 50 | 6.5 | 27 00 | 1.8 |
| 2 00 | −17.9 | 8 00 | −6.4 | 28 00 | −1.8 |
| 05 | 17.5 | 10 | 6.3 | 29 00 | 1.7 |
| 10 | 17.1 | 20 | 6.2 | 30 00 | 1.7 |
| 15 | 16.8 | 30 | 6.1 | 31 00 | 1.6 |
| 20 | 16.4 | 40 | 6.0 | 32 00 | 1.5 |
| 25 | 16.1 | 50 | 5.9 | 33 00 | 1.5 |
| 2 30 | −15.8 | 9 00 | −5.8 | 34 00 | −1.4 |
| 35 | 15.5 | 10 | 5.7 | 35 00 | 1.4 |
| 40 | 15.2 | 20 | 5.6 | 36 00 | 1.3 |
| 45 | 14.8 | 30 | 5.5 | 37 00 | 1.2 |
| 50 | 14.6 | 40 | 5.4 | 38 00 | 1.2 |
| 55 | 14.4 | 50 | 5.3 | 39 00 | 1.2 |
| 3 00 | −14.1 | 10 00 | −5.2 | 40 00 | −1.1 |
| 05 | 13.8 | 10 | 5.2 | 45 00 | 0.9 |
| 10 | 13.6 | 20 | 5.1 | 50 00 | 0.8 |
| 15 | 13.4 | 30 | 5.0 | 55 00 | 0.7 |
| 20 | 13.1 | 40 | 4.9 | 60 00 | 0.5 |
| 25 | 12.9 | 50 | 4.9 | 65 00 | 0.4 |
| 3 30 | −12.7 | 11 00 | −4.8 | 70 00 | −0.3 |
| 35 | 12.4 | 10 | 4.7 | 75 00 | 0.3 |
| 40 | 12.2 | 20 | 4.7 | 80 00 | 0.2 |
| 45 | 12.1 | 30 | 4.6 | 85 00 | 0.1 |
| 50 | 11.9 | 40 | 4.5 | 90 00 | 0.0 |
| 55 | 11.7 | 50 | 4.5 | | |
| 4 00 | −11.5 | 12 00 | −4.4 | | |

## ADDITIONAL REFRACTION CORRECTIONS FOR AIR TEMPERATURE

*To be applied to the Apparent Altitude*

| App. Alt. | Air Temperature - °C | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| | -5° | 0° | 5° | 10° | 15° | 20° | 25° | 30° | 35° |
| ° ′ | ′ | ′ | ′ | ′ | ′ | ′ | ′ | ′ | ′ |
| 0 00 | −3.4 | −2.0 | −1.0 | 0.0 | +1.0 | +1.9 | +2.8 | +3.7 | +4.7 |
| 20 | 2.7 | 1.8 | 0.9 | 0.0 | 0.9 | 1.5 | 2.2 | 3.1 | 3.7 |
| 40 | 2.4 | 1.6 | 0.8 | 0.0 | 0.8 | 1.3 | 2.0 | 2.7 | 3.3 |
| 1 00 | 2.0 | 1.4 | 0.7 | 0.0 | 0.7 | 1.2 | 1.8 | 2.4 | 2.9 |
| 20 | 1.8 | 1.2 | 0.6 | 0.0 | 0.6 | 1.0 | 1.5 | 2.0 | 2.6 |
| 40 | 1.5 | 1.0 | 0.5 | 0.0 | 0.5 | 0.9 | 1.3 | 1.8 | 2.2 |
| 2 00 | −1.3 | −0.9 | −0.4 | 0.0 | +0.4 | +0.8 | +1.2 | +1.5 | +1.9 |
| 20 | 1.2 | 0.8 | 0.4 | 0.0 | 0.4 | 0.7 | 1.1 | 1.4 | 1.7 |
| 40 | 1.1 | 0.7 | 0.4 | 0.0 | 0.4 | 0.7 | 1.0 | 1.2 | 1.6 |
| 3 00 | 1.0 | 0.7 | 0.3 | 0.0 | 0.3 | 0.6 | 1.0 | 1.2 | 1.5 |
| 20 | 1.0 | 0.6 | 0.3 | 0.0 | 0.3 | 0.6 | 0.9 | 1.1 | 1.4 |
| 40 | 0.9 | 0.6 | 0.3 | 0.0 | 0.3 | 0.6 | 0.8 | 1.0 | 1.3 |
| 4 00 | −0.8 | −0.6 | −0.3 | 0.0 | +0.3 | +0.5 | +0.8 | +1.0 | +1.2 |
| 5 | 0.7 | 0.5 | 0.2 | 0.0 | 0.2 | 0.4 | 0.7 | 0.8 | 1.0 |
| 6 | 0.6 | 0.4 | 0.2 | 0.0 | 0.2 | 0.4 | 0.6 | 0.7 | 0.9 |
| 7 | 0.5 | 0.4 | 0.2 | 0.0 | 0.2 | 0.3 | 0.5 | 0.6 | 0.8 |
| 8 | 0.5 | 0.3 | 0.2 | 0.0 | 0.1 | 0.3 | 0.4 | 0.5 | 0.7 |
| 9 | 0.4 | 0.3 | 0.1 | 0.0 | 0.1 | 0.3 | 0.4 | 0.5 | 0.6 |
| 10 00 | −0.4 | −0.3 | −0.1 | 0.0 | +0.1 | +0.2 | +0.4 | +0.4 | +0.5 |
| 20 | 0.2 | 0.1 | 0.1 | 0.0 | 0.1 | 0.1 | 0.2 | 0.2 | 0.3 |
| 30 | 0.1 | 0.1 | 0.0 | 0.0 | 0.0 | 0.1 | 0.1 | 0.1 | 0.2 |
| 40 | 0.1 | 0.1 | 0.0 | 0.0 | 0.0 | 0.1 | 0.1 | 0.1 | 0.1 |
| 50 | 0.1 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.1 | 0.1 |
| 60 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |

## ADDITIONAL REFRACTION CORRECTIONS FOR ATMOSPHERIC PRESSURE

*To be applied to the Apparent Altitude*

| App. Alt. | Atmospheric Pressure - millibars | | | | |
|---|---|---|---|---|---|
| | 960 | 980 | 1000 | 1020 | 1030 |
| ° ′ | ′ | ′ | ′ | ′ | ′ |
| 0 00 | +1.7 | +0.8 | 0.0 | −0.8 | −1.7 |
| 30 | 1.4 | 0.7 | 0.0 | 0.7 | 1.4 |
| 1 00 | 1.2 | 0.6 | 0.0 | 0.6 | 1.2 |
| 30 | 1.0 | 0.5 | 0.0 | 0.5 | 1.0 |
| 2 00 | +0.9 | +0.4 | 0.0 | −0.4 | −0.9 |
| 4 | 0.6 | 0.3 | 0.0 | 0.3 | 0.6 |
| 6 | 0.4 | 0.2 | 0.0 | 0.2 | 0.4 |
| 8 | 0.3 | 0.2 | 0.0 | 0.2 | 0.3 |
| 10 | 0.3 | 0.1 | 0.0 | 0.1 | 0.3 |
| 15 00 | +0.2 | +0.1 | 0.0 | −0.1 | −0.2 |
| 20 | 0.1 | 0.1 | 0.0 | 0.1 | 0.1 |
| 25 | 0.1 | 0.1 | 0.0 | 0.1 | 0.1 |
| 30 | 0.1 | 0.0 | 0.0 | 0.0 | 0.1 |
| 35 | 0.1 | 0.0 | 0.0 | 0.0 | 0.1 |
| 40 00 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |

# CORRECTION OF MOON'S MER. PASS.

## Corr. Plus to Mer. Pass. in West Long.

| Long. | Difference between times of successive transits. | | | | | | | | | | Long. |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | 39 m. | 42 m. | 45 m. | 48 m. | 51 m. | 54 m. | 57 m. | 60 m. | 63 m. | 66 m. | |
| ° | m. | m. | m. | m. | m. | m. | m. | m. | m. | m. | ° |
| 3 | 0·3 | 0·4 | 0·4 | 0·4 | 0·4 | 0·4 | 0·5 | 0·5 | 0·5 | 0·6 | 3 |
| 6 | 0·6 | 0·7 | 0·8 | 0·8 | 0·8 | 0·9 | 1·0 | 1·0 | 1·0 | 1·1 | 6 |
| 9 | 1·0 | 1·0 | 1·1 | 1·2 | 1·3 | 1·4 | 1·4 | 1·5 | 1·6 | 1·6 | 9 |
| 12 | 1·3 | 1·4 | 1·5 | 1·6 | 1·7 | 1·8 | 1·9 | 2·0 | 2·1 | 2·2 | 12 |
| 15 | 1·6 | 1·8 | 1·9 | 2·0 | 2·1 | 2·2 | 2·4 | 2·5 | 2·6 | 2·8 | 15 |
| 18 | 2·0 | 2·1 | 2·2 | 2·4 | 2·6 | 2·7 | 2·8 | 3·0 | 3·2 | 3·3 | 18 |
| 21 | 2·3 | 2·4 | 2·6 | 2·8 | 3·0 | 3·2 | 3·3 | 3·5 | 3·7 | 3·8 | 21 |
| 24 | 2·6 | 2·8 | 3·0 | 3·2 | 3·4 | 3·6 | 3·8 | 4·0 | 4·2 | 4·4 | 24 |
| 27 | 2·9 | 3·2 | 3·4 | 3·6 | 3·8 | 4·0 | 4·3 | 4·5 | 4·7 | 5·0 | 27 |
| 30 | 3·2 | 3·5 | 3·8 | 4·0 | 4·2 | 4·5 | 4·8 | 5·0 | 5·2 | 5·5 | 30 |
| 33 | 3·6 | 3·8 | 4·1 | 4·4 | 4·7 | 5·0 | 5·2 | 5·5 | 5·8 | 6·0 | 33 |
| 36 | 3·9 | 4·2 | 4·5 | 4·8 | 5·1 | 5·4 | 5·7 | 6·0 | 6·3 | 6·6 | 36 |
| 39 | 4·2 | 4·6 | 4·9 | 5·2 | 5·5 | 5·8 | 6·2 | 6·5 | 6·8 | 7·2 | 39 |
| 42 | 4·6 | 4·9 | 5·2 | 5·6 | 6·0 | 6·3 | 6·6 | 7·0 | 7·4 | 7·7 | 42 |
| 45 | 4·9 | 5·2 | 5·6 | 6·0 | 6·4 | 6·8 | 7·1 | 7·5 | 7·9 | 8·2 | 45 |
| 48 | 5·2 | 5·6 | 6·0 | 6·4 | 6·8 | 7·2 | 7·6 | 8·0 | 8·4 | 8·8 | 48 |
| 51 | 5·5 | 6·0 | 6·4 | 6·8 | 7·2 | 7·6 | 8·1 | 8·5 | 8·9 | 9·4 | 51 |
| 54 | 5·8 | 6·3 | 6·8 | 7·2 | 7·6 | 8·1 | 8·6 | 9·0 | 9·4 | 9·9 | 54 |
| 57 | 6·2 | 6·6 | 7·1 | 7·6 | 8·1 | 8·6 | 9·0 | 9·5 | 10·0 | 10·4 | 57 |
| 60 | 6·5 | 7·0 | 7·5 | 8·0 | 8·5 | 9·0 | 9·5 | 10·0 | 10·5 | 11·0 | 60 |
| 63 | 6·8 | 7·4 | 7·9 | 8·4 | 8·9 | 9·4 | 10·0 | 10·5 | 11·0 | 11·6 | 63 |
| 66 | 7·2 | 7·7 | 8·2 | 8·8 | 9·4 | 9·9 | 10·4 | 11·0 | 11·6 | 12·1 | 66 |
| 69 | 7·5 | 8·0 | 8·6 | 9·2 | 9·8 | 10·4 | 10·9 | 11·5 | 12·1 | 12·6 | 69 |
| 72 | 7·8 | 8·4 | 9·0 | 9·6 | 10·2 | 10·8 | 11·4 | 12·0 | 12·6 | 13·2 | 72 |
| 75 | 8·1 | 8·8 | 9·4 | 10·0 | 10·6 | 11·2 | 11·9 | 12·5 | 13·2 | 13·8 | 75 |
| 78 | 8·4 | 9·1 | 9·8 | 10·4 | 11·0 | 11·7 | 12·4 | 13·0 | 13·6 | 14·3 | 78 |
| 81 | 8·8 | 9·4 | 10·1 | 10·8 | 11·5 | 12·2 | 12·8 | 13·5 | 14·2 | 14·8 | 81 |
| 84 | 9·1 | 9·8 | 10·5 | 11·2 | 11·9 | 12·6 | 13·3 | 14·0 | 14·7 | 15·4 | 84 |
| 87 | 9·4 | 10·2 | 10·9 | 11·6 | 12·3 | 13·0 | 13·8 | 14·5 | 15·2 | 16·0 | 87 |
| 90 | 9·8 | 10·5 | 11·2 | 12·0 | 12·8 | 13·5 | 14·2 | 15·0 | 15·8 | 16·5 | 90 |
| 93 | 10·1 | 10·8 | 11·6 | 12·4 | 13·2 | 14·0 | 14·7 | 15·5 | 16·3 | 17·0 | 93 |
| 96 | 10·4 | 11·2 | 12·0 | 12·8 | 13·6 | 14·4 | 15·2 | 16·0 | 16·8 | 17·6 | 96 |
| 99 | 10·7 | 11·6 | 12·4 | 13·2 | 14·0 | 14·8 | 15·7 | 16·5 | 17·3 | 18·2 | 99 |
| 102 | 11·0 | 11·9 | 12·8 | 13·6 | 14·4 | 15·3 | 16·2 | 17·0 | 17·8 | 18·7 | 102 |
| 105 | 11·4 | 12·2 | 13·1 | 14·0 | 14·9 | 15·8 | 16·6 | 17·5 | 18·4 | 19·2 | 105 |
| 108 | 11·7 | 12·6 | 13·5 | 14·4 | 15·3 | 16·2 | 17·1 | 18·0 | 18·9 | 19·8 | 108 |
| 111 | 12·0 | 13·0 | 13·9 | 14·8 | 15·7 | 16·6 | 17·6 | 18·5 | 19·4 | 20·4 | 111 |
| 114 | 12·4 | 13·3 | 14·2 | 15·2 | 16·2 | 17·1 | 18·0 | 19·0 | 20·0 | 20·9 | 114 |
| 117 | 12·7 | 13·6 | 14·6 | 15·6 | 16·6 | 17·6 | 18·5 | 19·5 | 20·5 | 21·4 | 117 |
| 120 | 13·0 | 14·0 | 15·0 | 16·0 | 17·0 | 18·0 | 19·0 | 20·0 | 21·0 | 22·0 | 120 |
| 123 | 13·3 | 14·4 | 15·4 | 16·4 | 17·4 | 18·4 | 19·5 | 20·5 | 21·5 | 22·6 | 123 |
| 126 | 13·6 | 14·7 | 15·8 | 16·8 | 17·8 | 18·9 | 20·0 | 21·0 | 22·0 | 23·1 | 126 |
| 129 | 14·0 | 15·0 | 16·1 | 17·2 | 18·3 | 19·4 | 20·4 | 21·5 | 22·6 | 23·6 | 129 |
| 132 | 14·3 | 15·4 | 16·5 | 17·6 | 18·7 | 19·8 | 20·9 | 22·0 | 23·1 | 24·2 | 132 |
| 135 | 14·6 | 15·8 | 16·9 | 18·0 | 19·1 | 20·2 | 21·4 | 22·5 | 23·6 | 24·8 | 135 |
| 138 | 15·0 | 16·1 | 17·2 | 18·4 | 19·6 | 20·7 | 21·8 | 23·0 | 24·2 | 25·3 | 138 |
| 141 | 15·3 | 16·4 | 17·6 | 18·8 | 20·0 | 21·2 | 22·3 | 23·5 | 24·7 | 25·8 | 141 |
| 144 | 15·6 | 16·8 | 18·0 | 19·2 | 20·4 | 21·6 | 22·8 | 24·0 | 25·2 | 26·4 | 144 |
| 147 | 15·9 | 17·2 | 18·4 | 19·6 | 20·8 | 22·0 | 23·3 | 24·5 | 25·7 | 27·0 | 147 |
| 150 | 16·2 | 17·5 | 18·8 | 20·0 | 21·2 | 22·5 | 23·8 | 25·0 | 26·2 | 27·5 | 150 |
| 153 | 16·6 | 17·8 | 19·1 | 20·4 | 21·7 | 23·0 | 24·2 | 25·5 | 26·8 | 28·0 | 153 |
| 156 | 16·9 | 18·2 | 19·5 | 20·8 | 22·1 | 23·4 | 24·7 | 26·0 | 27·3 | 28·6 | 156 |
| 159 | 17·2 | 18·6 | 19·9 | 21·2 | 22·5 | 23·8 | 25·2 | 26·5 | 27·8 | 29·2 | 159 |
| 162 | 17·6 | 18·9 | 20·2 | 21·6 | 23·0 | 24·3 | 25·6 | 27·0 | 28·4 | 29·7 | 162 |
| 165 | 17·9 | 19·2 | 20·6 | 22·0 | 23·4 | 24·8 | 26·1 | 27·5 | 28·9 | 30·2 | 165 |
| 168 | 18·2 | 19·6 | 21·0 | 22·4 | 23·8 | 25·2 | 26·6 | 28·0 | 29·4 | 30·8 | 168 |
| 171 | 18·5 | 20·0 | 21·4 | 22·8 | 24·2 | 25·6 | 27·1 | 28·5 | 29·9 | 31·4 | 171 |
| 174 | 18·8 | 20·3 | 21·8 | 23·2 | 24·6 | 26·1 | 27·6 | 29·0 | 30·4 | 31·9 | 174 |
| 177 | 19·2 | 20·6 | 22·1 | 23·6 | 25·1 | 26·6 | 28·0 | 29·5 | 31·0 | 32·4 | 177 |
| 180 | 19·5 | 21·0 | 22·5 | 24·0 | 25·5 | 27·0 | 28·5 | 30·0 | 31·5 | 33·0 | 180 |

Corr. Minus to Mer. Pass. in East Long.

AÇIKLAMA SAYFASINA DÖNMEK IÇIN TIKLAYINIZ

# SUN'S TOTAL CORRECTION

*To be applied to the Observed Altitude of the Sun's Lower (L) or Upper (U) Limb*

| Obs. Alt. | Height of Eye | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | 10.5m (34ft) | | 11.2m (37ft) | | 12.0m (39ft) | | 12.8m 42ft) | | 13.6m (45ft) | | 14.5M (48ft) | | 15.4m (50ft) | | 16.3m (53ft) | |
| | L | U | L | U | L | U | L | U | L | U | L | U | L | U | L | U |
| 06 00 | +1.9 | −30.1 | +1.7 | −30.3 | +1.5 | −30.5 | +1.3 | −30.7 | +1.1 | −30.9 | +0.9 | −31.1 | +0.7 | −31.3 | +0.5 | −31.5 |
| 10 | 2.1 | 29.9 | 1.9 | 30.1 | 1.7 | 30.3 | 1.5 | 30.5 | 1.3 | 30.7 | 1.1 | 30.9 | 0.9 | 31.1 | 0.7 | 31.3 |
| 20 | 2.3 | 29.7 | 2.1 | 29.9 | 1.9 | 30.1 | 1.7 | 30.3 | 1.5 | 30.5 | 1.3 | 30.7 | 1.1 | 30.9 | 0.9 | 31.1 |
| 30 | 2.5 | 29.5 | 2.3 | 29.7 | 2.1 | 29.9 | 1.9 | 30.1 | 1.7 | 30.3 | 1.5 | 30.5 | 1.3 | 30.7 | 1.1 | 30.9 |
| 40 | 2.7 | 29.3 | 2.5 | 29.5 | 2.3 | 29.7 | 2.1 | 29.9 | 1.9 | 30.1 | 1.7 | 30.3 | 1.5 | 30.5 | 1.3 | 30.7 |
| 50 | 2.9 | 29.1 | 2.7 | 29.3 | 2.5 | 29.5 | 2.3 | 29.7 | 2.1 | 29.9 | 1.9 | 30.1 | 1.7 | 30.3 | 1.5 | 30.5 |
| 07 00 | +3.1 | −28.9 | +2.9 | −29.1 | +2.7 | −29.3 | +2.5 | −29.5 | +2.3 | −29.7 | +2.1 | −29.9 | +1.9 | −30.1 | +1.7 | −30.3 |
| 15 | 3.3 | 28.7 | 3.1 | 28.9 | 2.9 | 29.1 | 2.7 | 29.3 | 2.5 | 29.5 | 2.3 | 29.7 | 2.1 | 29.9 | 1.9 | 30.1 |
| 30 | 3.5 | 28.5 | 3.3 | 28.7 | 3.1 | 28.9 | 2.9 | 29.1 | 2.7 | 29.3 | 2.5 | 29.5 | 2.3 | 29.7 | 2.1 | 29.9 |
| 45 | 3.7 | 28.3 | 3.5 | 28.5 | 3.3 | 28.7 | 3.1 | 28.9 | 2.9 | 29.1 | 2.7 | 29.3 | 2.5 | 29.5 | 2.3 | 29.7 |
| 08 00 | 3.9 | 28.1 | 3.7 | 28.3 | 3.5 | 28.5 | 3.3 | 28.7 | 3.1 | 28.9 | 2.9 | 29.1 | 2.7 | 29.3 | 2.5 | 29.5 |
| 15 | 4.1 | 27.9 | 3.9 | 28.1 | 3.7 | 28.3 | 3.5 | 28.5 | 3.3 | 28.7 | 3.1 | 28.9 | 2.9 | 29.1 | 2.7 | 29.3 |
| 30 | 4.3 | 27.7 | 4.1 | 27.9 | 3.9 | 28.1 | 3.7 | 28.3 | 3.5 | 28.5 | 3.3 | 28.7 | 3.1 | 28.9 | 2.9 | 29.1 |
| 45 | 4.5 | 27.5 | 4.3 | 27.7 | 4.1 | 27.9 | 3.9 | 28.1 | 3.7 | 28.3 | 3.5 | 28.5 | 3.3 | 28.7 | 3.1 | 28.9 |
| 09 00 | +4.7 | −27.3 | +4.5 | −27.5 | +4.3 | −27.7 | +4.1 | −27.9 | +3.9 | −28.1 | +3.7 | −28.3 | +3.5 | −28.5 | +3.3 | −28.7 |
| 20 | 4.9 | 27.1 | 4.7 | 27.3 | 4.5 | 27.5 | 4.3 | 27.7 | 4.1 | 27.9 | 3.9 | 28.1 | 3.7 | 28.3 | 3.5 | 28.5 |
| 40 | 5.1 | 26.9 | 4.9 | 27.1 | 4.7 | 27.3 | 4.5 | 27.5 | 4.3 | 27.7 | 4.1 | 27.9 | 3.9 | 28.1 | 3.7 | 28.3 |
| 10 00 | 5.3 | 26.7 | 5.1 | 26.9 | 4.9 | 27.1 | 4.7 | 27.3 | 4.5 | 27.5 | 4.3 | 27.7 | 4.1 | 27.9 | 3.9 | 28.1 |
| 30 | 5.5 | 26.5 | 5.3 | 26.7 | 5.1 | 26.9 | 4.9 | 27.1 | 4.7 | 27.3 | 4.5 | 27.5 | 4.3 | 27.7 | 4.1 | 27.9 |
| 11 00 | 5.7 | 26.3 | 5.5 | 26.5 | 5.3 | 26.7 | 5.1 | 26.9 | 4.9 | 27.1 | 4.7 | 27.3 | 4.5 | 27.5 | 4.3 | 27.7 |
| 30 | 5.9 | 26.1 | 5.7 | 26.3 | 5.5 | 26.5 | 5.3 | 26.7 | 5.1 | 26.9 | 4.9 | 27.1 | 4.7 | 27.3 | 4.5 | 27.5 |
| 12 00 | 6.1 | 25.9 | 5.9 | 26.1 | 5.7 | 26.3 | 5.5 | 26.5 | 5.3 | 26.7 | 5.1 | 26.9 | 4.9 | 27.1 | 4.7 | 27.3 |
| 30 | 6.3 | 25.7 | 6.1 | 25.9 | 5.9 | 26.1 | 5.7 | 26.3 | 5.5 | 26.5 | 5.3 | 26.7 | 5.1 | 26.9 | 4.9 | 27.1 |
| 13 00 | +6.5 | −25.5 | +6.3 | −25.7 | +6.1 | −25.9 | +5.9 | −26.1 | +5.7 | −26.3 | +5.5 | −26.5 | +5.3 | −26.7 | +5.1 | −26.9 |
| 14 00 | 6.7 | 25.3 | 6.5 | 25.5 | 6.3 | 25.7 | 6.1 | 25.9 | 5.9 | 26.1 | 5.7 | 26.3 | 5.5 | 26.5 | 5.3 | 26.7 |
| 15 00 | 6.9 | 25.1 | 6.7 | 25.3 | 6.5 | 25.5 | 6.3 | 25.7 | 6.1 | 25.9 | 5.9 | 26.1 | 5.7 | 26.3 | 5.5 | 26.5 |
| 16 00 | 7.1 | 24.9 | 6.9 | 25.1 | 6.7 | 25.3 | 6.5 | 25.5 | 6.3 | 25.7 | 6.1 | 25.9 | 5.9 | 26.1 | 5.7 | 26.3 |
| 17 00 | 7.3 | 24.7 | 7.1 | 24.9 | 6.9 | 25.1 | 6.7 | 25.3 | 6.5 | 25.5 | 6.3 | 25.7 | 6.1 | 25.9 | 5.9 | 26.1 |
| 18 00 | 7.5 | 24.5 | 7.3 | 24.7 | 7.1 | 24.9 | 6.9 | 25.1 | 6.7 | 25.3 | 6.5 | 25.5 | 6.3 | 25.7 | 6.1 | 25.9 |
| 19 00 | 7.7 | 24.3 | 7.5 | 24.5 | 7.3 | 24.7 | 7.1 | 24.9 | 6.9 | 25.1 | 6.7 | 25.3 | 6.5 | 25.5 | 6.3 | 25.7 |
| 20 00 | +7.9 | −24.1 | +7.7 | −24.3 | +7.5 | −24.5 | +7.3 | −24.7 | +7.1 | −24.9 | +6.9 | −25.1 | +6.7 | −25.3 | +6.5 | −25.5 |
| 22 00 | 8.1 | 23.9 | 7.9 | 24.1 | 7.7 | 24.3 | 7.5 | 24.5 | 7.3 | 24.7 | 7.1 | 24.9 | 6.9 | 25.1 | 6.7 | 25.3 |
| 24 00 | 8.3 | 23.7 | 8.1 | 23.9 | 7.9 | 24.1 | 7.7 | 24.3 | 7.5 | 24.5 | 7.3 | 24.7 | 7.1 | 24.9 | 6.9 | 25.1 |
| 26 00 | 8.5 | 23.5 | 8.3 | 23.7 | 8.1 | 23.9 | 7.9 | 24.1 | 7.7 | 24.3 | 7.5 | 24.5 | 7.3 | 24.7 | 7.1 | 24.9 |
| 29 00 | 8.7 | 23.3 | 8.5 | 23.5 | 8.3 | 23.7 | 8.1 | 23.9 | 7.9 | 24.1 | 7.7 | 24.3 | 7.5 | 24.5 | 7.3 | 24.7 |
| 32 00 | 8.9 | 23.1 | 8.7 | 23.3 | 8.5 | 23.5 | 8.3 | 23.7 | 8.1 | 23.9 | 7.9 | 24.1 | 7.7 | 24.3 | 7.5 | 24.5 |
| 36 00 | 9.1 | 22.9 | 8.9 | 23.1 | 8.7 | 23.3 | 8.5 | 23.5 | 8.3 | 23.7 | 8.1 | 23.9 | 7.9 | 24.1 | 7.7 | 24.3 |
| 40 00 | +9.3 | −22.7 | +9.1 | −22.9 | +8.9 | −23.1 | +8.7 | −23.3 | +8.5 | −23.5 | +8.3 | −23.7 | +8.1 | −23.9 | +7.9 | −24.1 |
| 45 00 | 9.5 | 22.5 | 9.3 | 22.7 | 9.1 | 22.9 | 8.9 | 23.1 | 8.7 | 23.3 | 8.5 | 23.5 | 8.3 | 23.7 | 8.1 | 23.9 |
| 52 00 | 9.7 | 22.3 | 9.5 | 22.5 | 9.3 | 22.7 | 9.1 | 22.9 | 8.9 | 23.1 | 8.7 | 23.3 | 8.5 | 23.5 | 8.3 | 23.7 |
| 60 00 | 9.9 | 22.1 | 9.7 | 22.3 | 9.5 | 22.5 | 9.3 | 22.7 | 9.1 | 22.9 | 8.9 | 23.1 | 8.7 | 23.3 | 8.5 | 23.5 |
| 75 00 | 10.1 | 21.9 | 9.9 | 22.1 | 9.7 | 22.3 | 9.5 | 22.5 | 9.3 | 22.7 | 9.1 | 22.9 | 8.9 | 23.1 | 8.7 | 23.3 |
| 90 00 | 10.3 | 21.7 | 10.1 | 21.9 | 9.9 | 22.1 | 9.7 | 22.3 | 9.5 | 22.5 | 9.3 | 22.7 | 9.1 | 22.9 | 8.9 | 23.1 |

## ADDITIONAL MONTHLY CORRECTION

| | Jan | Feb | Mar | Apr | May | June | July | Aug | Sept | Oct | Nov | Dec |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| LL | +0.2 | +0.2 | +0.1 | 0.0 | −0.1 | −0.2 | −0.2 | −0.2 | −0.1 | 0.0 | +0.2 | +0.2 |
| UL | −0.2 | −0.2 | −0.1 | 0.0 | +0.1 | +0.2 | +0.2 | +0.2 | +0.1 | 0.0 | −0.2 | −0.2 |

# SUN'S TOTAL CORRECTION

*To be applied to the Observed Altitude of the Sun's Lower (L) or Upper (U) Limb*

Height of Eye

| Obs. Alt | 17.2m (56ft) | | 18.2m (60ft) | | 19.2m (63ft) | | 20.2m (66ft) | | 21.2m (70ft) | | 22.2m (73ft) | | 23.3m (77ft) | | 24.4m (80ft) | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | L | U | L | U | L | U | L | U | L | U | L | U | L | U | L | U |
| | ′ | ′ | ′ | ′ | ′ | ′ | ′ | ′ | ′ | ′ | ′ | ′ | ′ | ′ | ′ | ′ |
| 06 00 | +0.3 | −31.7 | +0.1 | −31.9 | −0.1 | −32.1 | −0.3 | −32.3 | −0.5 | −32.5 | −0.7 | −32.7 | −0.9 | −32.9 | −1.1 | −33.1 |
| 10 | 0.5 | 31.5 | 0.3 | 31.7 | +0.1 | 31.9 | 0.1 | 32.1 | 0.3 | 32.3 | 0.5 | 32.5 | 0.7 | 32.7 | 0.9 | 32.9 |
| 20 | 0.7 | 31.3 | 0.5 | 31.5 | 0.3 | 31.7 | +0.1 | 31.9 | 0.1 | 32.1 | 0.3 | 32.3 | 0.5 | 32.5 | 0.7 | 32.7 |
| 30 | 0.9 | 31.1 | 0.7 | 31.3 | 0.5 | 31.5 | 0.3 | 31.7 | +0.1 | 31.9 | 0.1 | 32.1 | 0.3 | 32.3 | 0.5 | 32.5 |
| 40 | 1.1 | 30.9 | 0.9 | 31.1 | 0.7 | 31.3 | 0.5 | 31.5 | 0.3 | 31.7 | +0.1 | 31.9 | 0.1 | 32.1 | 0.3 | 32.3 |
| 50 | 1.3 | 30.7 | 1.1 | 20.9 | 0.9 | 31.1 | 0.7 | 31.3 | 0.5 | 31.5 | 0.3 | 31.7 | +0.1 | 31.9 | 0.1 | 32.1 |
| 07 00 | +1.5 | −30.5 | +1.3 | −30.7 | +1.1 | −30.9 | +0.9 | −31.1 | +0.7 | −31.3 | +0.5 | −31.5 | +0.3 | −31.7 | +0.1 | −31.9 |
| 15 | 1.7 | 30.3 | 1.5 | 30.5 | 1.3 | 30.7 | 1.1 | 30.9 | 0.9 | 31.1 | 0.7 | 31.3 | 0.5 | 31.5 | 0.3 | 31.7 |
| 30 | 1.9 | 30.1 | 1.7 | 30.3 | 1.5 | 30.5 | 1.3 | 30.7 | 1.1 | 30.9 | 0.9 | 31.1 | 0.7 | 31.3 | 0.5 | 31.5 |
| 45 | 2.1 | 29.9 | 1.9 | 30.1 | 1.7 | 30.3 | 1.5 | 30.5 | 1.3 | 30.7 | 1.1 | 30.9 | 0.9 | 31.1 | 0.7 | 31.3 |
| 08 00 | 2.3 | 29.7 | 2.1 | 29.9 | 1.9 | 30.1 | 1.7 | 30.3 | 1.5 | 30.5 | 1.3 | 30.7 | 1.1 | 30.9 | 0.9 | 31.1 |
| 15 | 2.5 | 29.5 | 2.3 | 29.7 | 2.1 | 29.9 | 1.9 | 30.1 | 1.7 | 30.3 | 1.5 | 30.5 | 1.3 | 30.7 | 1.1 | 30.9 |
| 30 | 2.7 | 29.3 | 2.5 | 29.5 | 2.3 | 29.7 | 2.1 | 29.9 | 1.9 | 30.1 | 1.7 | 30.3 | 1.5 | 30.5 | 1.3 | 30.7 |
| 45 | 2.9 | 29.1 | 2.7 | 29.3 | 2.5 | 29.5 | 2.3 | 29.7 | 2.1 | 29.9 | 1.9 | 30.1 | 1.7 | 30.3 | 1.5 | 30.5 |
| 09 00 | +3.1 | −28.9 | +2.9 | −29.1 | +2.7 | −29.3 | +2.5 | 29.5 | +2.3 | 29.7 | +2.1 | −29.9 | +1.9 | −30.1 | +1.7 | −03.3 |
| 20 | 3.3 | 28.7 | 3.1 | 28.9 | 2.9 | 29.1 | 2.7 | 29.3 | 2.5 | 29.5 | 2.3 | 29.7 | 2.1 | 29.9 | 1.9 | 30.1 |
| 40 | 3.5 | 28.5 | 3.3 | 28.7 | 3.1 | 28.9 | 2.9 | 29.1 | 2.7 | 29.3 | 2.5 | 29.5 | 2.3 | 29.7 | 2.1 | 29.9 |
| 10 00 | 3.7 | 28.3 | 3.5 | 28.5 | 3.3 | 28.7 | 3.1 | 28.9 | 2.9 | 29.1 | 2.7 | 29.3 | 2.5 | 29.5 | 2.3 | 29.7 |
| 30 | 3.9 | 28.1 | 3.7 | 28.3 | 3.5 | 28.5 | 3.3 | 28.7 | 3.1 | 28.9 | 2.9 | 29.1 | 2.7 | 29.3 | 2.5 | 29.5 |
| 11 00 | 4.1 | 27.9 | 3.9 | 28.1 | 3.7 | 28.3 | 3.5 | 28.5 | 3.3 | 28.7 | 3.1 | 28.9 | 2.9 | 29.1 | 2.7 | 29.3 |
| 30 | 4.3 | 27.7 | 4.1 | 27.9 | 3.9 | 28.1 | 3.7 | 28.3 | 3.5 | 28.5 | 3.3 | 28.7 | 3.1 | 28.9 | 2.9 | 29.1 |
| 12 00 | 4.5 | 27.5 | 4.3 | 27.7 | 4.1 | 27.9 | 3.9 | 28.1 | 3.7 | 28.3 | 3.5 | 28.5 | 3.3 | 28.7 | 3.1 | 28.9 |
| 30 | 4.7 | 27.3 | 4.5 | 27.5 | 4.3 | 27.7 | 4.1 | 27.9 | 3.9 | 28.1 | 3.7 | 28.3 | 3.5 | 28.5 | 3.3 | 28.7 |
| 13 00 | +4.9 | −27.1 | +4.7 | −27.3 | +4.5 | −37.5 | +4.3 | −27.7 | +4.1 | −27.9 | +3.9 | −28.1 | +3.7 | −28.3 | +3.5 | −28.5 |
| 14 00 | 5.1 | 26.9 | 4.9 | 27.1 | 4.7 | 27.3 | 4.5 | 27.5 | 4.3 | 27.7 | 4.1 | 27.9 | 3.9 | 28.1 | 3.7 | 28.3 |
| 15 00 | 5.3 | 26.7 | 5.1 | 26.9 | 4.9 | 27.1 | 4.7 | 27.3 | 4.5 | 27.5 | 4.3 | 27.7 | 4.1 | 27.9 | 3.9 | 28.1 |
| 16 00 | 5.5 | 26.5 | 5.3 | 26.7 | 5.1 | 26.9 | 4.9 | 27.1 | 4.7 | 27.3 | 4.5 | 27.5 | 4.3 | 27.7 | 4.1 | 27.9 |
| 17 00 | 5.7 | 26.3 | 5.5 | 26.5 | 5.3 | 26.7 | 5.1 | 26.9 | 4.9 | 27.1 | 4.7 | 27.3 | 4.5 | 27.5 | 4.3 | 27.7 |
| 18 00 | 5.9 | 26.1 | 5.7 | 26.3 | 5.5 | 26.5 | 5.3 | 26.7 | 5.1 | 26.9 | 4.9 | 27.1 | 4.7 | 27.3 | 4.5 | 27.5 |
| 19 00 | 6.1 | 25.9 | 5.9 | 26.1 | 5.7 | 26.3 | 5.5 | 26.5 | 5.3 | 26.7 | 5.1 | 26.9 | 4.9 | 27.1 | 4.7 | 27.3 |
| 20 00 | +6.3 | −25.7 | +6.1 | −25.9 | +5.9 | −26.1 | +5.7 | −26.3 | +5.5 | −26.5 | +5.3 | −26.7 | +5.1 | −26.9 | +4.9 | −27.1 |
| 22 00 | 6.5 | 25.5 | 6.3 | 25.7 | 6.1 | 25.9 | 5.9 | 26.1 | 5.7 | 26.3 | 5.5 | 26.5 | 5.3 | 26.7 | 5.1 | 26.9 |
| 24 00 | 6.3 | 25.3 | 6.5 | 25.5 | 6.3 | 25.7 | 6.1 | 25.9 | 5.9 | 26.1 | 5.7 | 26.3 | 5.5 | 26.5 | 5.3 | 26.7 |
| 26 00 | 6.9 | 25.1 | 6.7 | 25.3 | 6.5 | 25.5 | 6.3 | 25.7 | 6.1 | 25.9 | 5.9 | 26.1 | 5.7 | 26.3 | 5.5 | 26.5 |
| 29 00 | 7.1 | 24.9 | 6.9 | 25.1 | 6.7 | 25.3 | 6.5 | 25.5 | 6.3 | 25.7 | 6.1 | 25.9 | 5.9 | 26.1 | 5.7 | 26.3 |
| 32 00 | 7.3 | 24.7 | 7.1 | 24.9 | 6.9 | 25.1 | 6.7 | 25.3 | 6.5 | 25.5 | 6.3 | 25.7 | 6.1 | 25.9 | 5.9 | 26.1 |
| 36 00 | 7.5 | 24.5 | 7.3 | 24.7 | 7.1 | 24.9 | 6.9 | 25.1 | 6.7 | 25.3 | 6.5 | 25.5 | 6.3 | 25.7 | 6.1 | 25.9 |
| 40 00 | +7.7 | −24.3 | +7.5 | −24.7 | +7.3 | 24.7 | +7.1 | −24.9 | +6.9 | −25.1 | +6.7 | −25.3 | 6.5 | −25.5 | 6.3 | −25.7 |
| 45 00 | 7.9 | 24.1 | 7.7 | 24.3 | 7.5 | 24.5 | 7.3 | 24.7 | 7.1 | 24.9 | 6.9 | 25.1 | 6.7 | 25.3 | 6.5 | 25.5 |
| 52 00 | 8.1 | 23.9 | 7.9 | 24.1 | 7.7 | 24.3 | 7.5 | 24.5 | 7.3 | 24.7 | 7.1 | 24.9 | 6.9 | 25.1 | 6.7 | 25.3 |
| 60 00 | 8.3 | 23.7 | 8.1 | 23.9 | 7.9 | 24.1 | 7.7 | 24.3 | 7.5 | 24.5 | 7.3 | 24.7 | 7.1 | 24.9 | 6.9 | 25.1 |
| 75 00 | 8.5 | 23.5 | 8.3 | 23.7 | 8.1 | 23.9 | 7.9 | 24.1 | 7.7 | 24.3 | 7.5 | 24.5 | 7.3 | 24.7 | 7.1 | 24.9 |
| 90 00 | 8.7 | 23.3 | 8.5 | 23.5 | 8.3 | 23.7 | 8.1 | 23.9 | 7.9 | 24.1 | 7.7 | 24.3 | 7.5 | 24.5 | 7.3 | 24.7 |

## ADDITIONAL MONTHLY CORRECTION

| | Jan | Feb | Mar | Apr | May | June | July | Aug | Sept | Oct | Nov | Dec |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| LL | +0.2 | +0.2 | +0.1 | 0.0 | −0.1 | −0.2 | −0.2 | −0.2 | −0.1 | 0.0 | +0.2 | +0.2 |
| UL | −0.2 | −0.2 | −0.1 | 0.0 | +0.1 | +0.2 | +0.2 | +0.2 | +0.1 | 0.0 | −0.2 | −0.2 |

# STAR'S TOTAL CORRECTION

*To be SUBTRACTED from the Observed Altitude of the Star*

Height of Eye

| Metres | 9.1 | 9.8 | 10.5 | 11.2 | 12.0 | 12.8 | 13.6 | 14.5 | 15.4 | 16.3 | 17.2 | 18.2 | 19.2 | 20.2 | 21.2 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Feet | 30 | 32 | 34 | 37 | 39 | 42 | 45 | 48 | 51 | 53 | 56 | 60 | 63 | 66 | 70 |
| Obs. Alt. | ′ | ′ | ′ | ′ | ′ | ′ | ′ | ′ | ′ | ′ | ′ | ′ | ′ | ′ | ′ |
| 6° 00 | 13.6 | 13.8 | 14.0 | 14.2 | 14.4 | 14.6 | 14.8 | 15.0 | 15.2 | 15.4 | 15.6 | 15.8 | 16.0 | 16.2 | 16.4 |
| 12 | 13.4 | 13.6 | 13.8 | 14.0 | 14.2 | 14.4 | 14.6 | 14.8 | 15.0 | 15.2 | 15.4 | 15.6 | 15.8 | 16.0 | 16.2 |
| 24 | 13.2 | 13.4 | 13.6 | 13.8 | 14.0 | 14.2 | 14.4 | 14.6 | 14.8 | 15.0 | 15.2 | 15.4 | 15.6 | 15.8 | 16.0 |
| 36 | 13.0 | 13.2 | 13.4 | 13.6 | 13.8 | 14.0 | 14.2 | 14.4 | 14.6 | 14.8 | 15.0 | 15.2 | 15.4 | 15.6 | 15.8 |
| 48 | 12.8 | 13.0 | 13.2 | 13.4 | 13.6 | 13.8 | 14.0 | 14.2 | 14.4 | 14.6 | 14.8 | 15.0 | 15.2 | 15.4 | 15.6 |
| 7 00 | 12.6 | 12.8 | 13.0 | 13.2 | 13.4 | 13.6 | 13.8 | 14.0 | 14.2 | 14.4 | 14.6 | 14.8 | 15.0 | 15.2 | 15.4 |
| 15 | 12.4 | 12.6 | 12.8 | 13.0 | 13.2 | 13.4 | 13.6 | 13.8 | 14.0 | 14.2 | 14.4 | 14.6 | 14.8 | 15.0 | 15.2 |
| 30 | 12.2 | 12.4 | 12.6 | 12.8 | 13.0 | 13.2 | 13.4 | 13.6 | 13.8 | 14.0 | 14.2 | 14.4 | 14.6 | 14.8 | 15.0 |
| 45 | 12.0 | 12.2 | 12.4 | 12.6 | 12.8 | 13.0 | 13.2 | 13.4 | 13.6 | 13.8 | 14.0 | 14.2 | 14.4 | 14.6 | 14.8 |
| 8 00 | 11.8 | 12.0 | 12.2 | 12.4 | 12.6 | 12.8 | 13.0 | 13.2 | 13.4 | 13.6 | 13.8 | 14.0 | 14.2 | 14.4 | 14.6 |
| 20 | 11.6 | 11.8 | 12.0 | 12.2 | 12.4 | 12.6 | 12.8 | 13.0 | 13.2 | 13.4 | 13.6 | 13.8 | 14.0 | 14.2 | 14.4 |
| 40 | 11.4 | 11.6 | 11.8 | 12.0 | 12.2 | 12.4 | 12.6 | 12.8 | 13.0 | 13.2 | 13.4 | 13.6 | 13.8 | 14.0 | 14.2 |
| 9 00 | 11.2 | 11.4 | 11.6 | 11.8 | 12.0 | 12.2 | 12.4 | 12.6 | 12.8 | 13.0 | 13.2 | 13.4 | 13.6 | 13.8 | 14.0 |
| 20 | 11.0 | 11.2 | 11.4 | 11.6 | 11.8 | 12.0 | 12.2 | 12.4 | 12.6 | 12.8 | 13.0 | 13.2 | 13.4 | 13.6 | 13.8 |
| 40 | 10.8 | 11.0 | 11.2 | 11.4 | 11.6 | 11.8 | 12.0 | 12.2 | 12.4 | 12.6 | 12.8 | 13.0 | 13.2 | 13.4 | 13.6 |
| 10 00 | 10.6 | 10.8 | 11.0 | 11.2 | 11.4 | 11.6 | 11.8 | 12.0 | 12.2 | 12.4 | 12.6 | 12.8 | 13.0 | 13.2 | 13.4 |
| 30 | 10.4 | 10.6 | 10.8 | 11.0 | 11.2 | 11.4 | 11.6 | 11.8 | 12.0 | 12.2 | 12.4 | 12.6 | 12.8 | 13.0 | 13.2 |
| 11 00 | 10.2 | 10.4 | 10.6 | 10.8 | 11.0 | 11.2 | 11.4 | 11.6 | 11.8 | 12.0 | 12.2 | 12.4 | 12.6 | 12.8 | 13.0 |
| 30 | 10.0 | 10.2 | 10.4 | 10.6 | 10.8 | 11.0 | 11.2 | 11.4 | 11.6 | 11.8 | 12.0 | 12.2 | 12.4 | 12.6 | 12.8 |
| 12 00 | 9.8 | 10.0 | 10.2 | 10.4 | 10.6 | 10.8 | 11.0 | 11.2 | 11.4 | 11.6 | 11.8 | 12.0 | 12.2 | 12.4 | 12.6 |
| 30 | 9.6 | 9.8 | 10.0 | 10.2 | 10.4 | 10.6 | 10.8 | 11.0 | 11.2 | 11.4 | 11.6 | 11.8 | 12.0 | 12.2 | 12.4 |
| 13 00 | 9.4 | 9.6 | 9.8 | 10.0 | 10.2 | 10.4 | 10.6 | 10.8 | 11.0 | 11.2 | 11.4 | 11.6 | 11.8 | 12.0 | 12.2 |
| 30 | 9.2 | 9.4 | 9.6 | 9.8 | 10.0 | 10.2 | 10.4 | 10.6 | 10.8 | 11.0 | 11.2 | 11.4 | 11.6 | 11.8 | 12.0 |
| 14 00 | 9.0 | 9.2 | 9.4 | 9.6 | 9.8 | 10.0 | 10.2 | 10.4 | 10.6 | 10.8 | 11.0 | 11.2 | 11.4 | 11.6 | 11.8 |
| 15 00 | 8.8 | 9.0 | 9.2 | 9.4 | 9.6 | 9.8 | 10.0 | 10.2 | 10.4 | 10.6 | 10.8 | 11.0 | 11.2 | 11.4 | 11.6 |
| 16 00 | 8.6 | 8.8 | 9.0 | 9.2 | 9.4 | 9.6 | 9.8 | 10.0 | 10.2 | 10.4 | 10.6 | 10.8 | 11.0 | 11.2 | 11.4 |
| 17 00 | 8.4 | 8.6 | 8.8 | 9.0 | 9.2 | 9.4 | 9.6 | 9.8 | 10.0 | 10.2 | 10.4 | 10.6 | 10.8 | 11.0 | 11.2 |
| 18 00 | 8.2 | 8.4 | 8.6 | 8.8 | 9.0 | 9.2 | 9.4 | 9.6 | 9.8 | 10.0 | 10.2 | 10.4 | 10.6 | 10.8 | 11.0 |
| 19 00 | 8.0 | 8.2 | 8.4 | 8.6 | 8.8 | 9.0 | 9.2 | 9.4 | 9.6 | 9.8 | 10.0 | 10.2 | 10.4 | 10.6 | 10.8 |
| 21 00 | 7.8 | 8.0 | 8.2 | 8.4 | 8.6 | 8.8 | 9.0 | 9.2 | 9.4 | 9.6 | 9.8 | 10.0 | 10.2 | 10.4 | 10.6 |
| 23 00 | 7.6 | 7.8 | 8.0 | 8.2 | 8.4 | 8.6 | 8.8 | 9.0 | 9.2 | 9.4 | 9.6 | 9.8 | 10.0 | 10.2 | 10.4 |
| 25 00 | 7.4 | 7.6 | 7.8 | 8.0 | 8.2 | 8.4 | 8.6 | 8.8 | 9.0 | 9.2 | 9.4 | 9.6 | 9.8 | 10.0 | 10.2 |
| 27 00 | 7.2 | 7.4 | 7.6 | 7.8 | 8.0 | 8.2 | 8.4 | 8.6 | 8.8 | 9.0 | 9.2 | 9.4 | 9.6 | 9.8 | 10.0 |
| 29 00 | 7.0 | 7.2 | 7.4 | 7.6 | 7.8 | 8.0 | 8.2 | 8.4 | 8.6 | 8.8 | 9.0 | 9.2 | 9.4 | 9.6 | 9.8 |
| 33 00 | 6.8 | 7.0 | 7.2 | 7.4 | 7.6 | 7.8 | 8.0 | 8.2 | 8.4 | 8.6 | 8.8 | 9.0 | 9.2 | 9.4 | 9.6 |
| 36 00 | 6.6 | 6.8 | 7.0 | 7.2 | 7.4 | 7.6 | 7.8 | 8.0 | 8.2 | 8.4 | 8.6 | 8.8 | 9.0 | 9.2 | 9.4 |
| 41 00 | 6.4 | 6.6 | 6.8 | 7.0 | 7.2 | 7.4 | 7.6 | 7.8 | 8.0 | 8.2 | 8.4 | 8.6 | 8.8 | 9.0 | 9.2 |
| 48 00 | 6.2 | 6.4 | 6.6 | 6.8 | 7.0 | 7.2 | 7.4 | 7.6 | 7.8 | 8.0 | 8.2 | 8.4 | 8.6 | 8.8 | 9.0 |
| 55 00 | 6.0 | 6.2 | 6.4 | 6.6 | 6.8 | 7.0 | 7.2 | 7.4 | 7.6 | 7.8 | 8.0 | 8.2 | 8.4 | 8.6 | 8.8 |
| 65 00 | 5.8 | 6.0 | 6.2 | 6.4 | 6.6 | 6.8 | 7.0 | 7.2 | 7.4 | 7.6 | 7.8 | 8.0 | 8.2 | 8.4 | 8.6 |
| 75 00 | 5.6 | 5.8 | 6.0 | 6.2 | 6.4 | 6.6 | 6.8 | 7.0 | 7.2 | 7.4 | 7.6 | 7.8 | 8.0 | 8.2 | 8.4 |
| 85 00 | 5.4 | 5.6 | 5.8 | 6.0 | 6.2 | 6.4 | 6.6 | 6.8 | 7.0 | 7.2 | 7.4 | 7.6 | 7.8 | 8.0 | 8.2 |
| 90 00 | 5.3 | 5.5 | 5.7 | 5.9 | 6.1 | 6.3 | 6.5 | 6.7 | 6.9 | 7.1 | 7.3 | 7.5 | 7.7 | 7.9 | 8.1 |

*A shortened table of the Star's Total Correction is given inside the back cover*

# MOON'S TOTAL CORRECTION – LOWER LIMB

*Add to the Observed Altitude of the Moon's Lower limb*

| H.P. | Observed Altitude 38°00′ | 30′ | 39°00′ | 30′ | 40°00′ | 30′ | 41°00′ | 30′ | 42°00′ | 30′ | 43°00′ | 30′ | 44°00′ | 30′ | 45°00′ |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 54.0 | 43.7 | 43.5 | 43.2 | 42.9 | 42.6 | 42.3 | 42.1 | 41.8 | 41.5 | 41.2 | 40.9 | 40.6 | 40.3 | 39.9 | 39.6 |
| 54.2 | 43.9 | 43.7 | 43.4 | 43.1 | 42.8 | 42.6 | 42.3 | 42.0 | 41.7 | 41.4 | 41.1 | 40.8 | 40.5 | 40.1 | 39.8 |
| 54.4 | 44.2 | 43.9 | 43.6 | 43.3 | 43.0 | 42.8 | 42.5 | 42.2 | 41.9 | 41.6 | 41.3 | 41.0 | 40.6 | 40.3 | 40.0 |
| 54.6 | 44.4 | 44.1 | 43.8 | 43.5 | 43.2 | 43.0 | 42.7 | 42.4 | 42.1 | 41.8 | 41.5 | 41.2 | 40.8 | 40.5 | 40.2 |
| 54.8 | 44.6 | 44.3 | 44.0 | 43.7 | 43.5 | 43.2 | 42.9 | 42.6 | 42.3 | 42.0 | 41.7 | 41.4 | 41.0 | 40.7 | 40.4 |
| 55.0 | 44.8 | 44.5 | 44.2 | 43.9 | 43.7 | 43.4 | 43.1 | 42.8 | 42.5 | 42.2 | 41.9 | 41.6 | 41.2 | 40.9 | 40.6 |
| 55.2 | 45.0 | 44.7 | 44.4 | 44.2 | 43.9 | 43.6 | 43.3 | 43.0 | 42.7 | 42.4 | 42.1 | 41.8 | 41.4 | 41.1 | 40.8 |
| 55.4 | 45.2 | 44.9 | 44.6 | 44.4 | 44.1 | 43.8 | 43.5 | 43.2 | 42.9 | 42.6 | 42.3 | 41.9 | 41.6 | 41.3 | 41.0 |
| 55.6 | 45.4 | 45.1 | 44.9 | 44.6 | 44.3 | 44.0 | 43.7 | 43.4 | 43.1 | 42.8 | 42.5 | 42.1 | 41.8 | 41.5 | 41.2 |
| 55.8 | 45.6 | 45.3 | 45.1 | 44.8 | 44.5 | 44.2 | 43.9 | 43.6 | 43.3 | 43.0 | 42.7 | 42.3 | 42.0 | 41.7 | 41.4 |
| 56.0 | 45.8 | 45.6 | 45.3 | 45.0 | 44.7 | 44.4 | 44.1 | 43.8 | 43.5 | 43.2 | 42.9 | 42.5 | 42.2 | 41.9 | 41.6 |
| 56.2 | 46.0 | 45.8 | 45.5 | 45.2 | 44.9 | 44.6 | 44.3 | 44.0 | 43.7 | 43.4 | 43.1 | 42.7 | 42.4 | 42.1 | 41.8 |
| 56.4 | 46.3 | 46.0 | 45.7 | 45.4 | 45.1 | 44.8 | 44.5 | 44.2 | 43.9 | 43.6 | 43.3 | 42.9 | 42.6 | 42.3 | 42.0 |
| 56.6 | 46.5 | 46.2 | 45.9 | 45.6 | 45.3 | 45.0 | 44.7 | 44.4 | 44.1 | 43.8 | 43.5 | 43.1 | 42.8 | 42.5 | 42.2 |
| 56.8 | 46.7 | 46.4 | 46.1 | 45.8 | 45.5 | 45.2 | 44.9 | 44.6 | 44.3 | 44.0 | 43.7 | 43.3 | 43.0 | 42.7 | 42.3 |
| 57.0 | 46.9 | 46.6 | 46.3 | 46.0 | 45.7 | 45.4 | 45.1 | 44.8 | 44.5 | 44.2 | 43.9 | 43.5 | 43.2 | 42.9 | 42.5 |
| 57.2 | 47.1 | 46.8 | 46.5 | 46.2 | 45.9 | 45.6 | 45.3 | 45.0 | 44.7 | 44.4 | 44.1 | 43.7 | 43.4 | 43.1 | 42.7 |
| 57.4 | 47.3 | 47.0 | 46.7 | 46.4 | 46.1 | 45.8 | 45.5 | 45.2 | 44.9 | 44.6 | 44.3 | 43.9 | 43.6 | 43.3 | 42.9 |
| 57.6 | 47.5 | 47.2 | 46.9 | 46.6 | 46.3 | 46.0 | 45.7 | 45.4 | 45.1 | 44.8 | 44.5 | 44.1 | 43.8 | 43.5 | 43.1 |
| 57.8 | 47.7 | 47.4 | 47.1 | 46.8 | 46.5 | 46.2 | 45.9 | 45.6 | 45.3 | 45.0 | 44.6 | 44.3 | 44.0 | 43.7 | 43.3 |
| 58.0 | 47.9 | 47.6 | 47.4 | 47.1 | 46.7 | 46.4 | 46.1 | 45.8 | 45.5 | 45.2 | 44.8 | 44.5 | 44.2 | 43.9 | 43.5 |
| 58.2 | 48.1 | 47.9 | 47.6 | 47.3 | 47.0 | 46.6 | 46.3 | 46.0 | 45.7 | 45.4 | 45.0 | 44.7 | 44.4 | 44.0 | 43.7 |
| 58.4 | 48.4 | 48.1 | 47.8 | 47.5 | 47.2 | 46.8 | 46.5 | 46.2 | 45.9 | 45.6 | 45.2 | 44.9 | 44.6 | 44.2 | 43.9 |
| 58.6 | 48.6 | 48.3 | 48.0 | 47.7 | 47.4 | 47.1 | 46.7 | 46.4 | 46.1 | 45.8 | 45.4 | 45.1 | 44.8 | 44.4 | 44.1 |
| 58.8 | 48.8 | 48.5 | 48.2 | 47.9 | 47.6 | 47.3 | 46.9 | 46.6 | 46.3 | 46.0 | 45.6 | 45.3 | 45.0 | 44.6 | 44.3 |
| 59.0 | 49.0 | 48.7 | 48.4 | 48.1 | 47.8 | 47.5 | 47.1 | 46.8 | 46.5 | 46.2 | 45.8 | 45.5 | 45.2 | 44.8 | 44.5 |
| 59.2 | 49.2 | 48.9 | 48.6 | 48.3 | 48.0 | 47.7 | 47.4 | 47.0 | 46.7 | 46.4 | 46.0 | 45.7 | 45.4 | 45.0 | 44.7 |
| 59.4 | 49.4 | 49.1 | 48.8 | 48.5 | 48.2 | 47.9 | 47.6 | 47.2 | 46.9 | 46.6 | 46.2 | 45.9 | 45.6 | 45.2 | 44.9 |
| 59.6 | 49.6 | 49.3 | 49.0 | 48.7 | 48.4 | 48.1 | 47.8 | 47.4 | 47.1 | 46.8 | 46.4 | 46.1 | 45.8 | 45.4 | 45.1 |
| 59.8 | 49.8 | 49.5 | 49.2 | 48.9 | 48.6 | 48.3 | 48.0 | 47.6 | 47.3 | 47.0 | 46.6 | 46.3 | 46.0 | 45.6 | 45.3 |
| 60.0 | 50.0 | 49.7 | 49.4 | 49.1 | 48.8 | 48.5 | 48.2 | 47.8 | 47.5 | 47.2 | 46.8 | 46.5 | 46.2 | 45.8 | 45.5 |
| 60.2 | 50.3 | 49.9 | 49.6 | 49.3 | 49.0 | 48.7 | 48.4 | 48.0 | 47.7 | 47.4 | 47.0 | 46.7 | 46.3 | 46.0 | 45.6 |
| 60.4 | 50.5 | 50.2 | 49.8 | 49.5 | 49.2 | 48.9 | 48.6 | 48.2 | 47.9 | 47.6 | 47.2 | 46.9 | 46.5 | 46.2 | 45.8 |
| 60.6 | 50.7 | 50.4 | 50.1 | 49.7 | 49.4 | 49.1 | 48.8 | 48.4 | 48.1 | 47.8 | 47.4 | 47.1 | 46.7 | 46.4 | 46.0 |
| 60.8 | 50.9 | 50.6 | 50.3 | 49.9 | 49.6 | 49.3 | 49.0 | 48.6 | 48.3 | 48.0 | 47.6 | 47.3 | 46.9 | 46.6 | 46.2 |
| 61.0 | 51.1 | 50.8 | 50.5 | 50.2 | 49.8 | 49.5 | 49.2 | 48.9 | 48.5 | 48.2 | 47.8 | 47.5 | 47.1 | 46.8 | 46.4 |
| 61.2 | 51.3 | 51.0 | 50.7 | 50.4 | 50.0 | 49.7 | 49.4 | 49.1 | 48.7 | 48.4 | 48.0 | 47.7 | 47.3 | 47.0 | 46.6 |
| 61.4 | 51.5 | 51.2 | 50.9 | 50.6 | 50.2 | 49.9 | 49.6 | 49.3 | 48.9 | 48.6 | 48.2 | 47.9 | 47.5 | 47.2 | 46.8 |
| 61.5 | 51.6 | 51.3 | 51.0 | 50.7 | 50.4 | 50.0 | 49.7 | 49.4 | 49.0 | 48.7 | 48.4 | 48.0 | 47.7 | 47.3 | 46.9 |

## Height of Eye Correction Always ADDED to the Observed Altitude

| | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| Metres | 2 | 2.3 | 2.7 | 3.1 | 3.5 | 3.9 | 4.4 | 4.9 | 5.4 | 5.9 | 6.5 |
| Feet | 7 | 8 | 9 | 10 | 11 | 13 | 14 | 16 | 18 | 19 | 21 |
| Corrn ′ | 9.8 | 9.6 | 9.4 | 9.2 | 9.0 | 8.8 | 8.6 | 8.4 | 8.2 | 8.0 | 7.8 |

# RADAR PLOTTER'S SPEED AND DISTANCE TABLE

| SPEED IN KNOTS | Miles in 1 min. | Miles in 2 min. | Miles in 2½ min. | Miles in 3 min. | Miles in 4 min. | Miles in 5 min. | Miles in 6 min. | SPEED IN KNOTS |
|---|---|---|---|---|---|---|---|---|
| 4·0 | 0·07 | 0·13 | 0·17 | 0·20 | 0·27 | 0·33 | 0·40 | 4·0 |
| 4·5 | 0·08 | 0·15 | 0·19 | 0·23 | 0·30 | 0·38 | 0·45 | 4·5 |
| 5·0 | 0·08 | 0·17 | 0·21 | 0·25 | 0·33 | 0·42 | 0·50 | 5·0 |
| 5·5 | 0·10 | 0·18 | 0·23 | 0·28 | 0·37 | 0·46 | 0·55 | 5·5 |
| 6·0 | 0·10 | 0·20 | 0·25 | 0·30 | 0·40 | 0·50 | 0·60 | 6·0 |
| 6·5 | 0·11 | 0·22 | 0·27 | 0·33 | 0·43 | 0·54 | 0·65 | 6·5 |
| 7·0 | 0·12 | 0·23 | 0·29 | 0·35 | 0·47 | 0·58 | 0·70 | 7·0 |
| 7·5 | 0·13 | 0·25 | 0·31 | 0·38 | 0·50 | 0·63 | 0·75 | 7·5 |
| 8·0 | 0·13 | 0·27 | 0·33 | 0·40 | 0·53 | 0·67 | 0·80 | 8·0 |
| 8·5 | 0·14 | 0·28 | 0·35 | 0·43 | 0·57 | 0·71 | 0·85 | 8·5 |
| 9·0 | 0·15 | 0·30 | 0·38 | 0·45 | 0·60 | 0·75 | 0·90 | 9·0 |
| 9·5 | 0·16 | 0·32 | 0·40 | 0·48 | 0·63 | 0·80 | 0·95 | 9·5 |
| 10·0 | 0·17 | 0·33 | 0·42 | 0·50 | 0·67 | 0·83 | 1·00 | 10·0 |
| 10·5 | 0·18 | 0·35 | 0·44 | 0·53 | 0·70 | 0·88 | 1·05 | 10·5 |
| 11·0 | 0·18 | 0·37 | 0·46 | 0·55 | 0·73 | 0·91 | 1·10 | 11·0 |
| 11·5 | 0·19 | 0·38 | 0·48 | 0·58 | 0·77 | 0·96 | 1·15 | 11·5 |
| 12·0 | 0·20 | 0·40 | 0·50 | 0·60 | 0·80 | 1·00 | 1·20 | 12·0 |
| 12·5 | 0·21 | 0·42 | 0·52 | 0·63 | 0·83 | 1·04 | 1·25 | 12·5 |
| 13·0 | 0·22 | 0·43 | 0·54 | 0·65 | 0·87 | 1·08 | 1·30 | 13·0 |
| 13·5 | 0·23 | 0·45 | 0·56 | 0·68 | 0·90 | 1·13 | 1·35 | 13·5 |
| 14·0 | 0·23 | 0·47 | 0·58 | 0·70 | 0·93 | 1·17 | 1·40 | 14·0 |
| 14·5 | 0·24 | 0·48 | 0·60 | 0·73 | 0·97 | 1·21 | 1·45 | 14·5 |
| 15·0 | 0·25 | 0·50 | 0·63 | 0·75 | 1·00 | 1·25 | 1·50 | 15·0 |
| 15·5 | 0·26 | 0·52 | 0·65 | 0·78 | 1·03 | 1·29 | 1·55 | 15·5 |
| 16·0 | 0·27 | 0·53 | 0·67 | 0·80 | 1·07 | 1·33 | 1·60 | 16·0 |
| 16·5 | 0·28 | 0·55 | 0·69 | 0·83 | 1·10 | 1·38 | 1·65 | 16·5 |
| 17·0 | 0·28 | 0·57 | 0·71 | 0·85 | 1·13 | 1·42 | 1·70 | 17·0 |
| 17·5 | 0·29 | 0·58 | 0·73 | 0·88 | 1·17 | 1·46 | 1·75 | 17·5 |
| 18·0 | 0·30 | 0·60 | 0·75 | 0·90 | 1·20 | 1·50 | 1·80 | 18·0 |
| 18·5 | 0·31 | 0·62 | 0·77 | 0·93 | 1·23 | 1·54 | 1·85 | 18·5 |
| 19·0 | 0·32 | 0·63 | 0·79 | 0·95 | 1·27 | 1·58 | 1·90 | 19·0 |
| 19·5 | 0·33 | 0·65 | 0·81 | 0·98 | 1·30 | 1·63 | 1·95 | 19·5 |
| 20·0 | 0·33 | 0·67 | 0·83 | 1·00 | 1·33 | 1·67 | 2·00 | 20·0 |
| 20·5 | 0·34 | 0·68 | 0·85 | 1·03 | 1·37 | 1·71 | 2·05 | 20·5 |
| 21·0 | 0·35 | 0·70 | 0·88 | 1·05 | 1·40 | 1·75 | 2·10 | 21·0 |
| 21·5 | 0·36 | 0·72 | 0·90 | 1·08 | 1·43 | 1·79 | 2·15 | 21·5 |
| 22·0 | 0·37 | 0·73 | 0·92 | 1·10 | 1·47 | 1·83 | 2·20 | 22·0 |
| 22·5 | 0·38 | 0·75 | 0·94 | 1·13 | 1·50 | 1·88 | 2·25 | 22·5 |
| 23·0 | 0·38 | 0·77 | 0·96 | 1·15 | 1·53 | 1·92 | 2·30 | 23·0 |
| 23·5 | 0·39 | 0·78 | 0·98 | 1·18 | 1·57 | 1·96 | 2·35 | 23·5 |
| 24·0 | 0·40 | 0·80 | 1·00 | 1·20 | 1·60 | 2·00 | 2·40 | 24·0 |
| 24·5 | 0·41 | 0·82 | 1·02 | 1·23 | 1·63 | 2·04 | 2·45 | 24·5 |
| 25·0 | 0·42 | 0·83 | 1·04 | 1·25 | 1·67 | 2·08 | 2·50 | 25·0 |
| 25·5 | 0·43 | 0·85 | 1·06 | 1·28 | 1·70 | 2·13 | 2·55 | 25·5 |
| 26·0 | 0·43 | 0·87 | 1·08 | 1·30 | 1·73 | 2·17 | 2·60 | 26·0 |
| 26·5 | 0·44 | 0·88 | 1·10 | 1·33 | 1·77 | 2·21 | 2·65 | 26·5 |
| 27·0 | 0·45 | 0·90 | 1·13 | 1·35 | 1·80 | 2·25 | 2·70 | 27·0 |
| 27·5 | 0·46 | 0·92 | 1·15 | 1·38 | 1·83 | 2·29 | 2·75 | 27·5 |
| 28·0 | 0·47 | 0·93 | 1·17 | 1·40 | 1·87 | 2·33 | 2·80 | 28·0 |
| 28·5 | 0·48 | 0·95 | 1·19 | 1·43 | 1·90 | 2·38 | 2·85 | 28·5 |
| 29·0 | 0·48 | 0·97 | 1·21 | 1·45 | 1·93 | 2·42 | 2·90 | 29·0 |
| 29·5 | 0·49 | 0·98 | 1·23 | 1·48 | 1·97 | 2·46 | 2·95 | 29·5 |
| 30·0 | 0·50 | 1·00 | 1·25 | 1·50 | 2·00 | 2·50 | 3·00 | 30·0 |
| 30·5 | 0·51 | 1·02 | 1·27 | 1·53 | 2·03 | 2·54 | 3·05 | 30·5 |
| 31·0 | 0·52 | 1·03 | 1·29 | 1·55 | 2·07 | 2·58 | 3·10 | 31·0 |
| 31·5 | 0·53 | 1·05 | 1·31 | 1·58 | 2·10 | 2·63 | 3·15 | 31·5 |
| 32·0 | 0·53 | 1·07 | 1·33 | 1·60 | 2·13 | 2·67 | 3·20 | 32·0 |
| 32·5 | 0·54 | 1·08 | 1·35 | 1·63 | 2·17 | 2·71 | 3·25 | 32·5 |
| 33·0 | 0·55 | 1·10 | 1·38 | 1·65 | 2·20 | 2·75 | 3·30 | 33·0 |
| 33·5 | 0·56 | 1·12 | 1·40 | 1·68 | 2·23 | 2·79 | 3·35 | 33·5 |
| 34·0 | 0·57 | 1·13 | 1·42 | 1·70 | 2·27 | 2·83 | 3·40 | 34·0 |

# RADAR RANGE TABLE

The accompanying table gives the approximate distance of the 'radar horizon' corresponding to different heights of the radar aerial or target from which an echo is returned, and is based on the formula:—

horizon dist. in n.mls = $2.21\sqrt{h}$
where h = height of aerial or target in metres

In similar manner to light waves, radio waves are refracted in passing through the atmosphere. This has the effect of making the distance of the radar horizon for 3cm. waves, under certain standard conditions of the atmosphere, about 15 per cent. greater than the distance of the geometrical horizon. Hence, taking the latter in nautical miles to be $1.92\sqrt{h}$, the distance of the radar horizon becomes $2.21\sqrt{h}$. This will be correct only under the standard conditions, and every departure from such standard will cause the distances to vary somewhat. The standard referred to is as follows:—

Atmospheric *pressure* 1013mb. decreasing with height at the rate of approximately 100mb. per 1000m.

Air *temperature* at sea level 30° C. decreasing with height at the rate of 6.5° C per 1000m.

60 per cent. *relative humidity* remaining constant with height.

Apart from variations from the above standard, the range at which target echoes can be seen on the P.P.I. screen will depend to a considerable extent on the characteristics of the particular radar installation and on the echoing qualities of the target.

Used with discretion, however, the information given in the table can be of much value to the radar observer.

Note: — The sum of the radar horizon distances of aerial and target respectively gives the maximum distance from which that target can return an echo.

*Examples:—*

1. A target of height 120m (390ft) should begin to appear on the P.P.I. of an installation with an aerial mounted 10m (33ft) above sea level at a range of approximately 24 + 7 = 31 miles

2. If an echo first appears on the P.P.I. (aerial 10m (33ft) above sea level) at a range of 26 miles, the probable height of the target is of the order of about 70m (230ft). This may assist in identifying it.

*CAUTION: — TO BE USED WITH 3cm. WAVE RADAR ONLY.*

| m | ft. | Range Mls | m. | ft. | Range Mls |
|---|---|---|---|---|---|
| 2 | 7 | 3.1 | 110 | 360 | 23 |
| 4 | 13 | 4.4 | 120 | 390 | 24 |
| 6 | 20 | 5.4 | 130 | 430 | 25 |
| 8 | 26 | 6.3 | 140 | 460 | 26 |
| 10 | 33 | 7.0 | 150 | 490 | 27 |
| 15 | 49 | 8.6 | 160 | 530 | 28 |
| 20 | 66 | 9.9 | 170 | 560 | 29 |
| 25 | 82 | 11.1 | 180 | 590 | 30 |
| 30 | 98 | 12.1 | 190 | 620 | 31 |
| 35 | 115 | 13.1 | 200 | 660 | 31 |
| 40 | 131 | 14.0 | 220 | 720 | 33 |
| 45 | 148 | 14.8 | 240 | 790 | 34 |
| 50 | 164 | 15.6 | 260 | 850 | 36 |
| 55 | 180 | 16.0 | 280 | 920 | 37 |
| 60 | 197 | 17.1 | 300 | 980 | 38 |
| 70 | 230 | 18.5 | 320 | 1050 | 40 |
| 80 | 262 | 19.8 | 340 | 1120 | 41 |
| 90 | 295 | 21.0 | 360 | 1180 | 42 |
| 100 | 328 | 22.1 | 380 | 1250 | 43 |
| 110 | 360 | 23.0 | 400 | 1310 | 44 |

# DISTANCE BY VERTICAL ANGLE

Height of Object

| Distance mls | m 46 | 47.5 | 49 | 50.5 | 52 | 53.5 | 55 | 56.5 | 58 | 59.5 | 61 | 62.5 | 64 | 65.5 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | ft 151 | 156 | 161 | 166 | 171 | 176 | 180 | 185 | 190 | 195 | 200 | 205 | 210 | 215 |
| | ° ′ | ° ′ | ° ′ | ° ′ | ° ′ | ° ′ | ° ′ | ° ′ | ° ′ | ° ′ | ° ′ | ° ′ | ° ′ | ° ′ |
| 0.1 | 13 57 | 14 23 | 14 49 | 15 15 | 15 41 | 16 07 | 16 32 | 16 58 | 17 23 | 17 49 | 18 14 | 18 39 | 19 04 | 19 29 |
| .2 | 7 05 | 7 18 | 7 32 | 7 45 | 7 59 | 8 13 | 8 27 | 8 40 | 8 54 | 9 08 | 9 21 | 9 35 | 9 48 | 10 02 |
| .3 | 4 44 | 4 53 | 5 02 | 5 12 | 5 21 | 5 30 | 5 39 | 5 48 | 5 58 | 6 07 | 6 16 | 6 25 | 6 34 | 6 43 |
| .4 | 3 33 | 3 40 | 3 47 | 3 54 | 4 01 | 4 08 | 4 15 | 4 22 | 4 29 | 4 36 | 4 42 | 4 49 | 5 49 | 5 03 |
| 0.5 | 2 51 | 2 56 | 3 02 | 3 07 | 3 13 | 3 18 | 3 24 | 3 29 | 3 35 | 3 41 | 3 46 | 3 52 | 3 57 | 4 03 |
| .6 | 2 22 | 2 27 | 2 31 | 2 36 | 2 41 | 2 45 | 2 50 | 2 55 | 2 59 | 3 04 | 3 09 | 3 13 | 3 18 | 3 22 |
| .7 | 2 02 | 2 06 | 2 10 | 2 14 | 2 18 | 2 22 | 2 26 | 2 30 | 2 34 | 2 38 | 2 42 | 2 46 | 2 50 | 2 54 |
| .8 | 1 47 | 1 51 | 1 54 | 1 57 | 2 01 | 2 04 | 2 08 | 2 11 | 2 15 | 2 18 | 2 21 | 2 25 | 2 28 | 2 32 |
| .9 | 1 35 | 1 38 | 1 41 | 1 44 | 1 47 | 1 50 | 1 53 | 1 56 | 2 00 | 2 03 | 2 06 | 2 09 | 2 12 | 2 15 |
| 1.0 | 1 25 | 1 28 | 1 31 | 1 34 | 1 36 | 1 39 | 1 42 | 1 45 | 1 48 | 1 50 | 1 53 | 1 56 | 1 59 | 2 02 |
| .1 | 1 18 | 1 20 | 1 23 | 1 25 | 1 28 | 1 30 | 1 33 | 1 35 | 1 38 | 1 40 | 1 43 | 1 45 | 1 48 | 1 50 |
| .2 | 1 11 | 1 13 | 1 16 | 1 18 | 1 20 | 1 23 | 1 25 | 1 27 | 1 30 | 1 32 | 1 34 | 1 37 | 1 39 | 1 41 |
| .3 | 1 06 | 1 08 | 1 10 | 1 12 | 1 14 | 1 16 | 1 18 | 1 21 | 1 23 | 1 24 | 1 27 | 1 29 | 1 31 | 1 34 |
| .4 | 1 01 | 1 03 | 1 05 | 1 07 | 1 09 | 1 11 | 1 13 | 1 15 | 1 17 | 1 19 | 1 21 | 1 23 | 1 25 | 1 27 |
| 1.5 | 0 57 | 0 59 | 1 01 | 1 02 | 1 04 | 1 06 | 1 08 | 1 10 | 1 12 | 1 14 | 1 15 | 1 17 | 1 19 | 1 21 |
| .6 | 0 53 | 0 55 | 0 57 | 0 59 | 1 00 | 1 02 | 1 04 | 1 06 | 1 08 | 1 09 | 1 11 | 1 12 | 1 14 | 1 16 |
| .7 | 0 50 | 0 52 | 0 53 | 0 55 | 0 57 | 0 58 | 1 00 | 1 02 | 1 03 | 1 05 | 1 07 | 1 08 | 1 10 | 1 12 |
| .8 | 0 47 | 0 49 | 0 50 | 0 52 | 0 54 | 0 55 | 0 56 | 0 58 | 1 00 | 1 01 | 1 03 | 1 04 | 1 06 | 1 08 |
| .9 | 0 45 | 0 46 | 0 48 | 0 49 | 0 51 | 0 52 | 0 54 | 0 55 | 0 57 | 0 58 | 1 00 | 1 01 | 1 03 | 1 04 |
| 2.0 | 0 43 | 0 44 | 0 45 | 0 47 | 0 48 | 0 50 | 0 51 | 0 52 | 0 54 | 0 55 | 0 57 | 0 58 | 0 59 | 1 01 |
| .1 | 0 41 | 0 42 | 0 43 | 0 45 | 0 46 | 0 47 | 0 49 | 0 50 | 0 51 | 0 53 | 0 54 | 0 55 | 0 57 | 0 58 |
| .2 | 0 39 | 0 40 | 0 41 | 0 43 | 0 44 | 0 45 | 0 46 | 0 48 | 0 49 | 0 50 | 0 51 | 0 53 | 0 54 | 0 55 |
| .3 | 0 37 | 0 38 | 0 39 | 0 41 | 0 42 | 0 43 | 0 44 | 0 46 | 0 47 | 0 48 | 0 49 | 0 50 | 0 52 | 0 53 |
| .4 | 0 36 | 0 37 | 0 38 | 0 39 | 0 40 | 0 41 | 0 43 | 0 44 | 0 45 | 0 46 | 0 47 | 0 48 | 0 49 | 0 51 |
| 2.5 | 0 34 | 0 35 | 0 36 | 0 37 | 0 39 | 0 40 | 0 41 | 0 42 | 0 43 | 0 44 | 0 45 | 0 46 | 0 48 | 0 49 |
| .6 | 0 33 | 0 34 | 0 35 | 0 36 | 0 37 | 0 38 | 0 39 | 0 40 | 0 41 | 0 42 | 0 44 | 0 45 | 0 46 | 0 47 |
| .7 | 0 32 | 0 33 | 0 34 | 0 35 | 0 36 | 0 37 | 0 38 | 0 39 | 0 40 | 0 41 | 0 42 | 0 43 | 0 44 | 0 45 |
| .8 | 0 30 | 0 31 | 0 32 | 0 33 | 0 34 | 0 35 | 0 36 | 0 37 | 0 38 | 0 39 | 0 40 | 0 41 | 0 42 | 0 43 |
| .9 | 0 29 | 0 30 | 0 31 | 0 32 | 0 33 | 0 34 | 0 35 | 0 36 | 0 37 | 0 38 | 0 39 | 0 40 | 0 41 | 0 42 |
| 3.0 | 0 28 | 0 29 | 0 30 | 0 31 | 0 32 | 0 33 | 0 34 | 0 35 | 0 36 | 0 37 | 0 38 | 0 39 | 0 40 | 0 41 |
| .2 | 0 27 | 0 28 | 0 29 | 0 29 | 0 30 | 0 31 | 0 32 | 0 33 | 0 34 | 0 35 | 0 35 | 0 36 | 0 37 | 0 38 |
| .4 | 0 25 | 0 26 | 0 27 | 0 28 | 0 28 | 0 29 | 0 30 | 0 31 | 0 32 | 0 32 | 0 33 | 0 34 | 0 35 | 0 36 |
| .6 | 0 24 | 0 24 | 0 25 | 0 26 | 0 27 | 0 28 | 0 28 | 0 29 | 0 30 | 0 31 | 0 31 | 0 32 | 0 33 | 0 34 |
| .8 | 0 22 | 0 23 | 0 24 | 0 25 | 0 25 | 0 26 | 0 27 | 0 28 | 0 28 | 0 29 | 0 30 | 0 31 | 0 31 | 0 32 |
| 4.0 | 0 21 | 0 22 | 0 23 | 0 23 | 0 24 | 0 25 | 0 26 | 0 26 | 0 27 | 0 28 | 0 28 | 0 29 | 0 30 | 0 30 |
| .2 | 0 20 | 0 21 | 0 22 | 0 22 | 0 23 | 0 24 | 0 24 | 0 25 | 0 26 | 0 26 | 0 27 | 0 28 | 0 28 | 0 29 |
| .4 | 0 19 | 0 20 | 0 21 | 0 21 | 0 22 | 0 23 | 0 23 | 0 24 | 0 24 | 0 25 | 0 26 | 0 26 | 0 27 | 0 28 |
| .6 | 0 19 | 0 19 | 0 20 | 0 20 | 0 21 | 0 22 | 0 22 | 0 23 | 0 23 | 0 24 | 0 25 | 0 25 | 0 26 | 0 26 |
| .8 | 0 18 | 0 18 | 0 19 | 0 20 | 0 20 | 0 21 | 0 21 | 0 22 | 0 22 | 0 23 | 0 24 | 0 24 | 0 25 | 0 25 |
| 5.0 | 0 17 | 0 18 | 0 18 | 0 19 | 0 19 | 0 20 | 0 20 | 0 21 | 0 22 | 0 22 | 0 23 | 0 23 | 0 24 | 0 24 |
| .2 | 0 16 | 0 17 | 0 17 | 0 18 | 0 19 | 0 19 | 0 20 | 0 20 | 0 21 | 0 21 | 0 22 | 0 22 | 0 23 | 0 23 |
| .4 | 0 16 | 0 16 | 0 17 | 0 17 | 0 18 | 0 18 | 0 19 | 0 19 | 0 20 | 0 20 | 0 21 | 0 21 | 0 22 | 0 23 |
| .6 | 0 15 | 0 16 | 0 16 | 0 17 | 0 17 | 0 18 | 0 18 | 0 19 | 0 19 | 0 20 | 0 20 | 0 21 | 0 21 | 0 22 |
| .8 | 0 15 | 0 15 | 0 16 | 0 16 | 0 17 | 0 17 | 0 18 | 0 18 | 0 19 | 0 19 | 0 20 | 0 20 | 0 20 | 0 21 |
| 6.0 | 0 14 | 0 15 | 0 15 | 0 16 | 0 16 | 0 17 | 0 17 | 0 17 | 0 18 | 0 18 | 0 19 | 0 19 | 0 20 | 0 20 |

Tan. $\theta = \frac{h}{d}$. Where $\theta$ = vertical angle, h = height of object, and d = distance.

# EXTREME RANGE TABLE

| Elevation | | Height of Eye | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | m | 1.5 | 3 | 4.5 | 6 | 8 | 10 | 12 | 14 | 16 | 18 | 20 | 22 |
| m | ft | 5 | 10 | 15 | 20 | 26 | 33 | 39 | 46 | 52 | 59 | 66 | 72 |
| 0 | 0 | 2.6 | 3.6 | 4.4 | 5.1 | 5.9 | 6.6 | 7.3 | 7.8 | 8.4 | 8.9 | 9.4 | 9.8 |
| 2 | 7 | 5.5 | 6.6 | 7.4 | 8.1 | 8.9 | 9.6 | 10.2 | 10.8 | 11.3 | 11.9 | 12.3 | 12.8 |
| 4 | 13 | 6.8 | 7.8 | 8.6 | 9.3 | 10.1 | 10.8 | 11.4 | 12.0 | 12.6 | 13.1 | 13.6 | 14.0 |
| 6 | 20 | 7.7 | 8.8 | 9.6 | 10.3 | 11.1 | 11.8 | 12.4 | 13.0 | 13.5 | 14.0 | 14.5 | 15.0 |
| 8 | 26 | 8.5 | 9.6 | 10.4 | 11.1 | 11.9 | 12.6 | 13.2 | 13.8 | 14.3 | 14.8 | 15.3 | 15.8 |
| 10 | 33 | 9.2 | 10.3 | 11.1 | 11.8 | 12.6 | 13.3 | 13.9 | 14.5 | 15.0 | 15.5 | 16.0 | 16.5 |
| 12 | 39 | 9.8 | 10.9 | 11.7 | 12.4 | 13.2 | 13.9 | 14.5 | 15.1 | 15.6 | 16.1 | 16.6 | 17.1 |
| 14 | 46 | 10.4 | 11.5 | 12.3 | 13.0 | 13.8 | 14.5 | 15.1 | 15.7 | 16.2 | 16.7 | 17.2 | 17.7 |
| 16 | 52 | 10.9 | 12.0 | 12.8 | 13.5 | 14.3 | 15.0 | 15.6 | 16.2 | 16.8 | 17.3 | 17.7 | 18.2 |
| 18 | 59 | 11.4 | 12.5 | 13.3 | 14.0 | 14.8 | 15.5 | 16.1 | 16.7 | 17.3 | 17.8 | 18.3 | 18.7 |
| 20 | 66 | 11.9 | 13.0 | 13.8 | 14.5 | 15.3 | 16.0 | 16.6 | 17.2 | 17.7 | 18.3 | 18.7 | 19.2 |
| 22 | 72 | 12.4 | 13.5 | 14.3 | 15.0 | 15.8 | 16.5 | 17.1 | 17.7 | 18.2 | 18.7 | 19.2 | 19.7 |
| 24 | 79 | 12.8 | 13.9 | 14.7 | 15.4 | 16.2 | 16.9 | 17.5 | 18.1 | 18.6 | 19.2 | 19.6 | 20.1 |
| 26 | 85 | 13.2 | 14.3 | 15.1 | 15.8 | 16.6 | 17.3 | 17.9 | 18.5 | 19.1 | 19.6 | 20.1 | 20.5 |
| 28 | 92 | 13.7 | 14.7 | 15.5 | 16.2 | 17.0 | 17.7 | 18.3 | 18.9 | 19.5 | 20.0 | 20.5 | 20.9 |
| 30 | 98 | 14.0 | 15.1 | 15.9 | 16.6 | 17.4 | 18.1 | 18.7 | 19.3 | 19.9 | 20.4 | 20.8 | 21.3 |
| 35 | 115 | 15.0 | 16.0 | 16.8 | 17.5 | 18.3 | 19.0 | 19.7 | 20.2 | 20.8 | 21.3 | 21.8 | 22.2 |
| 40 | 131 | 15.8 | 16.9 | 17.7 | 18.4 | 19.2 | 19.9 | 20.5 | 21.1 | 21.6 | 22.1 | 22.6 | 23.1 |
| 45 | 148 | 16.6 | 17.7 | 18.5 | 19.2 | 20.0 | 20.7 | 21.3 | 21.9 | 22.4 | 22.9 | 23.4 | 23.9 |
| 50 | 164 | 17.4 | 18.4 | 19.2 | 19.9 | 20.7 | 21.4 | 22.1 | 22.7 | 23.2 | 23.7 | 24.2 | 24.6 |
| 55 | 180 | 18.1 | 19.2 | 20.0 | 20.7 | 21.5 | 22.2 | 22.8 | 23.4 | 23.9 | 24.4 | 24.9 | 25.4 |
| 60 | 197 | 18.8 | 19.9 | 20.7 | 21.4 | 22.2 | 22.9 | 23.5 | 24.1 | 24.6 | 25.1 | 25.6 | 26.1 |
| 65 | 213 | 19.5 | 20.5 | 21.3 | 22.0 | 22.8 | 23.5 | 24.1 | 24.7 | 25.3 | 25.8 | 26.3 | 26.7 |
| 70 | 230 | 20.1 | 21.1 | 21.9 | 22.7 | 23.5 | 24.2 | 24.8 | 25.4 | 25.9 | 26.4 | 26.9 | 27.4 |
| 75 | 246 | 20.7 | 21.7 | 22.5 | 23.3 | 24.1 | 24.8 | 25.4 | 26.0 | 26.5 | 27.0 | 27.5 | 28.0 |
| 80 | 262 | 21.3 | 22.4 | 23.2 | 23.9 | 24.7 | 25.4 | 26.0 | 26.6 | 27.1 | 27.6 | 28.1 | 28.6 |
| 85 | 279 | 21.9 | 22.9 | 23.7 | 24.4 | 25.2 | 25.9 | 26.6 | 27.2 | 27.7 | 28.2 | 28.7 | 29.1 |
| 90 | 295 | 22.4 | 23.5 | 24.3 | 25.0 | 25.8 | 26.5 | 27.1 | 27.7 | 28.3 | 28.8 | 29.2 | 29.7 |
| 95 | 312 | 23.0 | 24.0 | 24.8 | 25.6 | 26.3 | 27.0 | 27.7 | 28.3 | 28.8 | 29.3 | 29.8 | 30.2 |
| 100 | 328 | 23.5 | 24.6 | 25.4 | 26.1 | 26.9 | 27.6 | 28.2 | 28.8 | 29.3 | 29.8 | 30.3 | 30.8 |
| 110 | 361 | 24.5 | 25.6 | 26.4 | 27.1 | 27.9 | 28.6 | 29.2 | 29.8 | 30.4 | 30.9 | 31.3 | 31.8 |
| 120 | 394 | 25.5 | 26.6 | 27.4 | 28.1 | 28.9 | 29.6 | 30.2 | 30.8 | 31.3 | 31.8 | 32.3 | 32.8 |
| 130 | 427 | 26.5 | 27.5 | 28.3 | 29.0 | 29.8 | 30.5 | 31.1 | 31.7 | 32.3 | 32.8 | 33.3 | 33.7 |
| 140 | 459 | 27.4 | 28.4 | 29.2 | 29.9 | 30.7 | 31.4 | 32.0 | 32.6 | 33.2 | 33.7 | 34.2 | 34.6 |
| 150 | 492 | 28.2 | 29.3 | 30.1 | 30.8 | 31.6 | 32.3 | 32.9 | 33.5 | 34.0 | 34.5 | 35.0 | 35.5 |
| 160 | 525 | 29.1 | 30.1 | 30.9 | 31.6 | 32.4 | 33.1 | 33.8 | 34.3 | 34.9 | 35.4 | 35.9 | 36.3 |
| 170 | 558 | 29.9 | 30.9 | 31.7 | 32.4 | 33.2 | 33.9 | 34.6 | 35.2 | 35.7 | 36.2 | 36.7 | 37.1 |
| 180 | 591 | 30.7 | 31.7 | 32.5 | 33.2 | 34.0 | 34.7 | 35.4 | 35.9 | 36.5 | 37.0 | 37.5 | 37.9 |
| 190 | 623 | 31.4 | 32.5 | 33.3 | 34.0 | 34.8 | 35.5 | 36.1 | 36.7 | 37.3 | 37.8 | 38.2 | 38.7 |
| 200 | 656 | 32.2 | 33.3 | 34.1 | 34.8 | 35.6 | 36.3 | 36.9 | 37.5 | 38.0 | 38.5 | 39.0 | 39.5 |
| 210 | 689 | 32.9 | 34.0 | 34.8 | 35.5 | 36.3 | 37.0 | 37.6 | 38.2 | 38.7 | 39.2 | 39.7 | 40.2 |
| 220 | 722 | 33.6 | 34.7 | 35.5 | 36.2 | 37.0 | 37.7 | 38.3 | 38.9 | 39.5 | 40.0 | 40.4 | 40.9 |
| 230 | 755 | 34.3 | 35.4 | 36.2 | 36.9 | 37.7 | 38.4 | 39.0 | 39.6 | 40.1 | 40.7 | 41.1 | 41.6 |
| 240 | 787 | 35.0 | 36.1 | 36.9 | 37.6 | 38.4 | 39.1 | 39.7 | 40.3 | 40.8 | 41.3 | 41.8 | 42.3 |
| 250 | 820 | 35.7 | 36.8 | 37.6 | 38.3 | 39.1 | 39.8 | 40.4 | 41.0 | 41.5 | 42.0 | 42.5 | 43.0 |
| 260 | 853 | 36.3 | 37.4 | 38.2 | 38.9 | 39.7 | 40.4 | 41.0 | 41.6 | 42.2 | 42.7 | 43.2 | 43.6 |
| 270 | 886 | 37.0 | 38.1 | 38.9 | 39.6 | 40.4 | 41.0 | 41.7 | 42.3 | 42.8 | 43.3 | 43.8 | 44.3 |
| 280 | 919 | 37.6 | 38.7 | 39.5 | 40.2 | 41.0 | 41.7 | 42.3 | 42.9 | 43.4 | 43.9 | 44.4 | 44.9 |
| 290 | 951 | 38.2 | 39.3 | 40.1 | 40.8 | 41.6 | 42.3 | 42.9 | 43.5 | 44.1 | 44.6 | 45.0 | 45.5 |
| 300 | 984 | 38.9 | 39.9 | 40.7 | 41.4 | 42.2 | 42.9 | 43.5 | 44.1 | 44.7 | 45.2 | 45.7 | 46.1 |

# DIP OF THE SHORE HORIZON or Dip at Different Ranges

| Miles | Height of Eye: m / ft | 1.5 / 5 | 3 / 10 | 4.5 / 15 | 6 / 20 | 7.5 / 25 | 9 / 30 | 10.5 / 36 | 12 / 39 | 13.5 / 44 | 15 / 49 | 17.5 / 57 | 20 / 66 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 0.1 | | −27.9 | −55.7 | −1 23.5 | −1 51.3 | −2 19.1 | −2 46.9 | −3 14.7 | −3 42.5 | −4 10.3 | −4 38.1 | −5 24.5 | −6 10.8 |
| .2 | | 14.0 | 27.9 | 41.8 | 55.7 | 1 09.6 | 1 23.5 | 1 37.4 | 1 51.3 | 2 05.2 | 2 19.1 | 2 42.3 | 3 05.5 |
| .3 | | 9.4 | 18.7 | 27.9 | 37.2 | 46.5 | 55.8 | 1 05.0 | 1 14.3 | 1 23.6 | 1 32.8 | 1 48.3 | 2 03.7 |
| .4 | | 7.1 | 14.1 | 21.0 | 28.0 | 34.9 | 41.9 | 48.8 | 55.8 | 1 02.7 | 1 09.7 | 1 21.3 | 1 32.9 |
| .5 | | 5.8 | 11.3 | 16.9 | 22.4 | 28.0 | 33.6 | 39.1 | 44.7 | 50.3 | 55.8 | 1 05.1 | 1 14.4 |
| 0.6 | | −4.9 | −9.5 | −14.2 | −18.8 | −23.4 | −28.1 | −32.7 | −37.3 | −42.0 | −46.6 | −54.3 | −1 02.1 |
| .7 | | 4.3 | 8.2 | 12.2 | 16.2 | 20.2 | 24.1 | 28.1 | 32.1 | 36.1 | 40.0 | 46.7 | 53.3 |
| .8 | | 3.8 | 7.3 | 10.8 | 14.2 | 17.7 | 21.2 | 24.7 | 28.2 | 31.6 | 35.1 | 40.9 | 46.7 |
| .9 | | 3.5 | 6.6 | 9.7 | 12.7 | 15.8 | 18.9 | 22.0 | 25.1 | 28.2 | 31.3 | 36.4 | 41.6 |
| 1.0 | | 3.2 | 6.0 | 8.8 | 11.5 | 14.3 | 17.1 | 19.9 | 22.7 | 25.4 | 28.2 | 32.9 | 37.5 |
| 1.2 | | −2.8 | −5.1 | −7.5 | −9.8 | −12.1 | −14.4 | −16.7 | −19.0 | −21.4 | −23.7 | −27.6 | −31.4 |
| .4 | | 2.6 | 4.6 | 6.5 | 8.5 | 10.5 | 12.5 | 14.5 | 16.5 | 18.5 | 20.5 | 23.8 | 27.1 |
| .6 | | 2.4 | 4.1 | 5.9 | 7.6 | 9.4 | 11.1 | 12.9 | 14.7 | 16.3 | 18.1 | 21.0 | 23.9 |
| .8 | | 2.3 | 3.9 | 5.4 | 6.9 | 8.5 | 10.0 | 11.6 | 13.1 | 14.7 | 16.2 | 18.8 | 21.4 |
| 2.0 | | 2.2 | 3.6 | 5.0 | 6.4 | 7.8 | 9.2 | 10.6 | 12.0 | 13.4 | 14.8 | 17.1 | 19.4 |
| 2.5 | | | −3.3 | −4.4 | −5.5 | −6.6 | −7.7 | −8.8 | −10.0 | −11.1 | −12.2 | −14.0 | −15.9 |
| 3.0 | | | 3.1 | 4.1 | 5.0 | 5.9 | 6.8 | 7.8 | 8.7 | 9.6 | 10.5 | 12.1 | 13.6 |
| .5 | | | | 3.9 | 4.7 | 5.5 | 6.2 | 7.0 | 7.8 | 8.6 | 9.4 | 10.8 | 12.1 |
| 4.0 | | | | 3.8 | 4.5 | 5.2 | 5.9 | 6.6 | 7.3 | 7.9 | 8.6 | 9.8 | 11.0 |
| .5 | | | | | 4.4 | 5.0 | 5.6 | 6.2 | 6.8 | 7.5 | 8.1 | 9.1 | 10.1 |
| 5.0 | | | | | | 4.9 | 5.5 | 6.1 | 6.6 | 7.2 | 7.7 | 8.6 | 9.6 |
| 6.0 | | | | | | | 5.3 | 5.8 | 6.2 | 6.7 | 7.2 | 7.9 | 8.7 |
| 7.0 | | | | | | | | | 6.1 | 6.5 | 6.9 | 7.6 | 8.3 |
| 8.0 | | | | | | | | | | | | 7.4 | 8.0 |
| 9.0 | | | | | | | | | | | | | 7.9 |

| Miles | Height of Eye: m / ft | 20 / 66 | 22.5 / 74 | 25 / 82 | 27.5 / 90 | 30 / 98 | 32.5 / 107 | 35 / 115 | 37.5 / 123 | 40 / 131 | 42.5 / 139 | 45 / 148 | 47.5 / 156 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 0.1 | | −6 10.8 | −6 57.2 | −7 43.5 | −8 29.9 | −9 16.2 | −10 02.6 | −10 48.9 | −11 35.3 | −12 21.6 | −13 08.0 | −13 54.3 | −14 40.7 |
| .2 | | 3 05.5 | 3 28.6 | 3 51.8 | 4 15.0 | 4 38.2 | 5 01.4 | 5 24.5 | 5 47.7 | 6 10.9 | 6 34.0 | 6 57.2 | 7 20.4 |
| .3 | | 2 03.7 | 2 19.2 | 2 34.6 | 2 50.1 | 3 05.5 | 3 21.0 | 3 36.3 | 3 51.9 | 4 07.3 | 4 22.8 | 4 38.2 | 4 53.7 |
| .4 | | 1 32.9 | 1 44.5 | 1 56.0 | 2 07.6 | 2 19.2 | 2 30.8 | 2 42.4 | 2 54.0 | 3 05.6 | 3 17.2 | 3 28.7 | 3 40.3 |
| .5 | | 1 14.4 | 1 23.6 | 1 32.9 | 1 42.2 | 1 51.4 | 2 00.7 | 2 10.0 | 2 19.3 | 2 28.5 | 2 37.8 | 2 47.1 | 2 56.3 |
| 0.6 | | −1 02.1 | −1 09.8 | −1 17.5 | −1 25.2 | −1 33.0 | −1 40.7 | −1 48.4 | −1 56.1 | −2 03.9 | −2 11.6 | −2 19.3 | −2 27.0 |
| .7 | | 53.3 | 59.9 | 1 06.5 | 1 13.1 | 1 19.8 | 1 26.4 | 1 33.0 | 1 39.6 | 1 46.2 | 1 52.8 | 1 59.4 | 2 06.1 |
| .8 | | 46.7 | 52.5 | 58.3 | 1 04.1 | 1 09.9 | 1 15.7 | 1 21.5 | 1 27.2 | 1 33.0 | 1 38.8 | 1 44.6 | 1 50.4 |
| .9 | | 41.6 | 46.7 | 51.9 | 57.0 | 1 02.2 | 1 07.3 | 1 12.5 | 1 17.6 | 1 22.8 | 1 27.9 | 1 33.1 | 1 38.2 |
| 1.0 | | 37.5 | 42.1 | 46.8 | 51.4 | 56.0 | 1 00.7 | 1 05.3 | 1 09.9 | 1 14.6 | 1 19.2 | 1 23.9 | 1 28.5 |
| 1.2 | | −31.4 | −35.3 | −39.1 | −43.0 | −46.9 | −50.7 | −54.6 | −58.4 | −1 02.3 | −1 06.2 | −1 10.0 | −1 13.9 |
| .4 | | 27.1 | 30.4 | 33.7 | 37.0 | 40.3 | 43.6 | 46.9 | 50.3 | 53.9 | 56.9 | 1 00.2 | 1 03.5 |
| .6 | | 23.9 | 26.8 | 29.7 | 32.6 | 35.4 | 38.3 | 41.2 | 44.1 | 47.0 | 49.9 | 52.8 | 55.7 |
| .8 | | 21.4 | 23.9 | 26.5 | 29.1 | 31.7 | 34.2 | 36.8 | 39.4 | 42.0 | 44.5 | 47.1 | 49.7 |
| 2.0 | | 19.4 | 21.7 | 24.0 | 26.3 | 28.7 | 31.0 | 33.3 | 35.6 | 37.9 | 40.2 | 42.6 | 44.9 |
| 2.5 | | −15.9 | −17.8 | −19.6 | −21.5 | −23.3 | −25.2 | −27.0 | −28.9 | −30.7 | −32.6 | −34.4 | −36.3 |
| 3.0 | | 13.6 | 15.2 | 16.7 | 18.3 | 19.8 | 21.4 | 22.9 | 24.4 | 26.0 | 27.5 | 29.1 | 30.6 |
| 3.5 | | 12.1 | 13.4 | 14.7 | 16.0 | 17.4 | 18.7 | 20.0 | 21.3 | 22.7 | 24.0 | 25.3 | 26.6 |
| 4.0 | | 11.0 | 12.1 | 13.3 | 14.4 | 15.6 | 16.8 | 17.9 | 19.1 | 20.2 | 21.4 | 22.5 | 23.7 |
| 4.5 | | 10.1 | 11.2 | 12.2 | 13.2 | 14.3 | 15.3 | 16.3 | 17.4 | 18.4 | 19.5 | 20.4 | 21.5 |
| 5.0 | | −9.6 | −10.5 | −11.4 | −12.4 | −13.3 | −14.2 | −15.1 | −16.1 | −17.0 | −17.9 | −18.8 | −19.8 |
| 6.0 | | 8.7 | 9.5 | 10.3 | 11.0 | 11.8 | 12.6 | 13.4 | 14.1 | 14.9 | 15.7 | 16.4 | 17.2 |
| 7.0 | | 8.3 | 8.9 | 9.6 | 10.2 | 10.9 | 11.6 | 12.2 | 12.9 | 13.6 | 14.2 | 14.9 | 15.5 |
| 8.0 | | 8.0 | 8.6 | 9.2 | 9.8 | 10.3 | 10.9 | 11.5 | 12.1 | 12.6 | 13.2 | 13.8 | 14.4 |
| 9.0 | | 7.9 | 8.4 | 9.0 | 9.5 | 10.0 | 10.5 | 11.0 | 11.5 | 12.1 | 12.6 | 13.1 | 13.6 |
| 10.0 | | | | −8.9 | −9.3 | −9.8 | −10.3 | −10.7 | −11.2 | −11.6 | −12.1 | −12.6 | −13.0 |
| 11.0 | | | | | | 9.7 | 10.1 | 10.5 | 11.0 | 11.4 | 11.8 | 12.2 | 12.7 |
| 12.0 | | | | | | | | | 10.9 | 11.3 | 11.6 | 12.0 | 12.4 |
| 13.0 | | | | | | | | | | 11.2 | 11.6 | 11.9 | 12.3 |
| 14.0 | | | | | | | | | | | | | 12.2 |

# DISTANCE OF THE SEA HORIZON

| Height | | Dist. | Height | | Dist. | Height | | Dist |
|---|---|---|---|---|---|---|---|---|
| m | ft | mls | m | ft | Miles | m | ft | Miles |
| | | | 40 | 131 | 13.3 | 200 | 656 | 29.6 |
| 0.5 | 1.6 | 1.5 | 42 | 138 | 13.6 | 205 | 673 | 30.0 |
| 1.0 | 3 | 2.1 | 44 | 144 | 13.9 | 210 | 689 | 30.4 |
| 1.5 | 5 | 2.6 | 46 | 151 | 14.2 | 215 | 705 | 30.7 |
| 2.0 | 7 | 3.0 | 48 | 157 | 14.5 | 220 | 722 | 31.1 |
| 2.5 | 8 | 3.3 | 50 | 164 | 14.8 | 225 | 738 | 31.4 |
| 3.0 | 10 | 3.6 | 52 | 171 | 15.1 | 230 | 755 | 31.8 |
| 3.5 | 11 | 3.9 | 54 | 177 | 15.4 | 235 | 771 | 32.1 |
| 4.0 | 13 | 4.2 | 56 | 184 | 15.7 | 240 | 787 | 32.5 |
| 4.5 | 15 | 4.4 | 58 | 190 | 16.0 | 245 | 804 | 32.8 |
| 5.0 | 16 | 4.7 | 60 | 197 | 16.2 | 250 | 820 | 33.1 |
| 5.5 | 18 | 4.9 | 62 | 203 | 16.5 | 260 | 853 | 33.8 |
| 6.0 | 20 | 5.1 | 64 | 210 | 16.8 | 270 | 886 | 34.4 |
| 6.5 | 21 | 5.3 | 66 | 217 | 17.0 | 280 | 919 | 35.1 |
| 7.0 | 23 | 5.5 | 68 | 223 | 17.3 | 290 | 951 | 35.7 |
| 7.5 | 25 | 5.7 | 70 | 230 | 17.5 | 300 | 984 | 36.3 |
| 8.0 | 26 | 5.9 | 72 | 236 | 17.8 | 310 | 1017 | 36.9 |
| 8.5 | 28 | 6.1 | 74 | 243 | 18.0 | 320 | 1050 | 37.5 |
| 9.0 | 30 | 6.3 | 76 | 249 | 18.3 | 330 | 1083 | 38.1 |
| 9.5 | 31 | 6.5 | 78 | 256 | 18.5 | 340 | 1115 | 38.6 |
| 10.0 | 33 | 6.6 | 80 | 262 | 18.7 | 350 | 1148 | 39.2 |
| 11 | 36 | 6.9 | 82 | 269 | 19.0 | 360 | 1181 | 39.8 |
| 12 | 39 | 7.3 | 84 | 276 | 19.2 | 370 | 1214 | 40.3 |
| 13 | 43 | 7.6 | 86 | 282 | 19.4 | 380 | 1247 | 40.8 |
| 14 | 46 | 7.8 | 88 | 289 | 19.7 | 390 | 1280 | 41.4 |
| 15 | 49 | 8.1 | 90 | 295 | 19.9 | 400 | 1312 | 41.9 |
| 16 | 52 | 8.4 | 92 | 302 | 20.1 | 410 | 1345 | 42.4 |
| 17 | 56 | 8.6 | 94 | 308 | 20.3 | 420 | 1378 | 42.9 |
| 18 | 59 | 8.9 | 96 | 315 | 20.5 | 430 | 1411 | 43.4 |
| 19 | 62 | 9.1 | 98 | 322 | 20.7 | 440 | 1444 | 43.9 |
| 20 | 66 | 9.4 | 100 | 328 | 21.0 | 450 | 1476 | 44.4 |
| 21 | 69 | 9.6 | 105 | 344 | 21.5 | 460 | 1509 | 44.9 |
| 22 | 72 | 9.8 | 110 | 361 | 22.0 | 470 | 1542 | 45.4 |
| 23 | 75 | 10.0 | 115 | 377 | 22.5 | 480 | 1575 | 45.9 |
| 24 | 79 | 10.3 | 120 | 394 | 23.0 | 490 | 1608 | 46.4 |
| 25 | 82 | 10.5 | 125 | 410 | 23.4 | 500 | 1640 | 46.8 |
| 26 | 85 | 10.7 | 130 | 427 | 23.9 | 510 | 1673 | 47.3 |
| 27 | 89 | 10.9 | 135 | 443 | 24.3 | 520 | 1706 | 47.8 |
| 28 | 92 | 11.1 | 140 | 459 | 24.8 | 530 | 1739 | 48.2 |
| 29 | 95 | 11.3 | 145 | 476 | 25.2 | 540 | 1772 | 48.7 |
| 30 | 98 | 11.5 | 150 | 492 | 25.7 | 550 | 1804 | 49.1 |
| 31 | 102 | 11.7 | 155 | 509 | 26.1 | 560 | 1837 | 49.6 |
| 32 | 105 | 11.9 | 160 | 525 | 26.5 | 570 | 1870 | 50.0 |
| 33 | 108 | 12.0 | 165 | 541 | 26.9 | 580 | 1903 | 50.5 |
| 34 | 112 | 12.2 | 170 | 558 | 27.3 | 590 | 1936 | 50.9 |
| 35 | 115 | 12.4 | 175 | 574 | 27.7 | 600 | 1969 | 51.3 |
| 36 | 118 | 12.6 | 180 | 591 | 28.1 | 610 | 2001 | 51.7 |
| 37 | 121 | 12.7 | 185 | 607 | 28.5 | 620 | 2034 | 52.2 |
| 38 | 125 | 12.9 | 190 | 623 | 28.9 | 630 | 2067 | 52.6 |
| 39 | 128 | 13.1 | 195 | 640 | 29.3 | 640 | 2100 | 53.0 |
| 40 | 131 | 13.3 | 200 | 656 | 29.6 | 650 | 2133 | 53.4 |

# CORRECTION REQUIRED to CONVERT a RADIO GREAT CIRCLE BEARING to MERCATORIAL BEARING

| Mean Lat. | DIFFERENCE OF LONGITUDE OF SHIP AND RADIO STATION | | | | | | | | | | | | | | Mean Lat. |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | 2° | 4° | 6° | 8° | 10° | 12° | 14° | 16° | 18° | 20° | 22° | 24° | 26° | 28° | 30° | |
| ° | ° | ° | ° | ° | ° | ° | ° | ° | ° | ° | ° | ° | ° | ° | ° | ° |
| 84 | 1·0 | 2·0 | 3·0 | 4·0 | 5·0 | 6·0 | 7·0 | 8·0 | 9·0 | 9·9 | 10·9 | 11·9 | 12·9 | 13·9 | 14·9 | 84 |
| 81 | 1·0 | 2·0 | 2·9 | 4·0 | 4·9 | 5·9 | 6·9 | 7·9 | 8·9 | 9·9 | 10·9 | 11·9 | 12·8 | 13·8 | 14·8 | 81 |
| 78 | 1·0 | 2·0 | 2·9 | 3·9 | 4·9 | 5·9 | 6·8 | 7·8 | 8·8 | 9·8 | 10·8 | 11·7 | 12·7 | 13·7 | 14·7 | 78 |
| 75 | 1·0 | 1·9 | 2·9 | 3·9 | 4·8 | 5·8 | 6·8 | 7·7 | 8·7 | 9·7 | 10·7 | 11·6 | 12·6 | 13·5 | 14·4 | 75 |
| 72 | 1·0 | 1·9 | 2·9 | 3·8 | 4·8 | 5·7 | 6·7 | 7·6 | 8·6 | 9·5 | 10·5 | 11·4 | 12·4 | 13·3 | 14·3 | 72 |
| 69 | 0·9 | 1·9 | 2·8 | 3·7 | 4·7 | 5·6 | 6·5 | 7·5 | 8·4 | 9·3 | 10·3 | 11·2 | 12·1 | 13·1 | 14·0 | 69 |
| 66 | 0·9 | 1·8 | 2·8 | 3·7 | 4·6 | 5·5 | 6·4 | 7·3 | 8·2 | 9·1 | 10·0 | 11·0 | 11·9 | 12·8 | 13·7 | 66 |
| 63 | 0·9 | 1·8 | 2·7 | 3·6 | 4·5 | 5·4 | 6·3 | 7·1 | 8·0 | 8·9 | 9·8 | 10·7 | 11·6 | 12·5 | 13·3 | 63 |
| 60 | 0·9 | 1·7 | 2·6 | 3·5 | 4·3 | 5·2 | 6·1 | 6·9 | 7·8 | 8·6 | 9·5 | 10·4 | 11·2 | 12·1 | 12·9 | 60 |
| 57 | 0·8 | 1·7 | 2·5 | 3·4 | 4·2 | 5·0 | 5·9 | 6·7 | 7·5 | 8·4 | 9·2 | 10·0 | 10·9 | 11·7 | 12·5 | 57 |
| 54 | 0·8 | 1·6 | 2·4 | 3·3 | 4·1 | 4·9 | 5·7 | 6·5 | 7·3 | 8·1 | 8·9 | 9·7 | 10·5 | 11·3 | 12·1 | 54 |
| 51 | 0·8 | 1·6 | 2·3 | 3·1 | 3·9 | 4·7 | 5·5 | 6·2 | 7·0 | 7·8 | 8·5 | 9·3 | 10·1 | 10·8 | 11·6 | 51 |
| 48 | 0·8 | 1·5 | 2·2 | 3·0 | 3·7 | 4·5 | 5·2 | 5·9 | 6·7 | 7·4 | 8·2 | 8·9 | 9·6 | 10·4 | 11·1 | 48 |
| 45 | 0·7 | 1·4 | 2·1 | 2·8 | 3·5 | 4·2 | 4·9 | 5·6 | 6·3 | 7·1 | 7·8 | 8·5 | 9·2 | 9·9 | 10·6 | 45 |
| 42 | 0·7 | 1·4 | 2·0 | 2·7 | 3·4 | 4·0 | 4·7 | 5·4 | 6·0 | 6·7 | 7·4 | 8·0 | 8·7 | 9·4 | 10·0 | 42 |
| 39 | 0·6 | 1·3 | 1·9 | 2·5 | 3·2 | 3·8 | 4·4 | 5·0 | 5·7 | 6·3 | 6·9 | 7·5 | 8·1 | 8·8 | 9·4 | 39 |
| 36 | 0·6 | 1·2 | 1·8 | 2·4 | 3·0 | 3·5 | 4·1 | 4·7 | 5·3 | 5·9 | 6·4 | 7·0 | 7·6 | 8·2 | 8·7 | 36 |
| 33 | 0·5 | 1·1 | 1·6 | 2·2 | 2·7 | 3·3 | 3·8 | 4·4 | 4·9 | 5·4 | 6·0 | 6·5 | 7·1 | 7·6 | 8·1 | 33 |
| 30 | 0·5 | 1·0 | 1·5 | 2·0 | 2·5 | 3·0 | 3·5 | 4·0 | 4·5 | 5·0 | 5·5 | 6·0 | 6·5 | 7·0 | 7·4 | 30 |
| 27 | 0·5 | 0·9 | 1·4 | 1·8 | 2·3 | 2·7 | 3·2 | 3·6 | 4·1 | 4·5 | 5·0 | 5·4 | 5·9 | 6·3 | 6·8 | 27 |
| 24 | 0·4 | 0·8 | 1·2 | 1·6 | 2·1 | 2·4 | 2·9 | 3·3 | 3·6 | 4·0 | 4·4 | 4·8 | 5·2 | 5·6 | 6·0 | 24 |
| 21 | 0·3 | 0·7 | 1·1 | 1·4 | 1·8 | 2·2 | 2·5 | 2·9 | 3·2 | 3·6 | 3·9 | 4·3 | 4·6 | 5·0 | 5·3 | 21 |
| 18 | 0·3 | 0·6 | 0·9 | 1·2 | 1·6 | 1·9 | 2·2 | 2·5 | 2·8 | 3·1 | 3·4 | 3·7 | 4·0 | 4·3 | 4·6 | 18 |
| 15 | 0·3 | 0·5 | 0·8 | 1·0 | 1·3 | 1·6 | 1·8 | 2·1 | 2·3 | 2·6 | 2·8 | 3·1 | 3·3 | 3·6 | 3·8 | 15 |
| 12 | 0·2 | 0·4 | 0·6 | 0·8 | 1·0 | 1·3 | 1·5 | 1·7 | 1·9 | 2·1 | 2·3 | 2·5 | 2·7 | 2·9 | 3·1 | 12 |
| 9 | 0·2 | 0·3 | 0·5 | 0·6 | 0·8 | 1·0 | 1·1 | 1·2 | 1·4 | 1·6 | 1·7 | 1·9 | 2·0 | 2·2 | 2·3 | 9 |
| 6 | 0·1 | 0·2 | 0·3 | 0·4 | 0·5 | 0·6 | 0·7 | 0·8 | 0·9 | 1·0 | 1·1 | 1·2 | 1·3 | 1·5 | 1·6 | 6 |
| 3 | 0·1 | 0·1 | 0·2 | 0·2 | 0·3 | 0·3 | 0·4 | 0·4 | 0·5 | 0·5 | 0·6 | 0·6 | 0·7 | 0·7 | 0·8 | 3 |
| | 2° | 4° | 6° | 8° | 10° | 12° | 14° | 16° | 18° | 20° | 22° | 24° | 26° | 28° | 30° | |

In both North and South latitudes always allow the above corrections towards the Equator from the Radio Great Circle bearing to obtain the corresponding Mercatorial line of bearing.

**N.B.**—The Bearings must always be laid off, on the chart, from the Radio Station.

EXAMPLE 1. A ship in D.R. position Lat. 39° 37′ N., Long. 56° 25′ W., receives from a Radio Station in Lat. 35° 14′ N., Long. 75° 32′ W., the Radio bearing 074°. Find the correction and the corresponding Mercatorial bearing.

Mean Lat. is ½ (39° 37′ + 35° 14′) or ½ (74° 51′) = 37°·4.

D. Long. is 75° 32′ − 56° 25′ = 19°·1.

For Mean Lat. 37°·4 and D. Long. 19°·1 the Table gives a correction of 6° (approx.).

Allowing this correction towards the Equator the corresponding Mercatorial bearing is found to be 074° + 6° = 080°.

EXAMPLE 2. A ship in D.R. position Lat. 37° 26′ S., Long. 84° 35′ W., finds, with her own apparatus, the Radio bearing of a station in Lat. 36° 37′ S., Long. 73° 03′ W., to be 089°. Find the correction and the corresponding Mercatorial bearing.

For Mean Lat. 37° and D. Long. 11°·5 the Table gives a correction of 3°·5 (approx.).

Allowing this correction towards the Equator the corresponding Mercatorial bearing is found to be 089° − 3°·5 = 085°·5.

# CONVERSION OF ARC TO TIME

| Arc | Time | Arc | Time | Arc | Time | Arc | Time | Arc | Time | Arc | Time | Arc | Time | Arc | Time. |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| ° | h. m. | ° | h. m. | ° | h. m. | ° | h. m. | ° | h. m. | ° | h. m. | Parts of 1′ | s. | ″ | s. |
| ′ | m. s. | | | | | | | | | | | | | | |
| 0 | 0 00 | 60 | 4 00 | 120 | 8 00 | 180 | 12 00 | 240 | 16 00 | 300 | 20 00 | 0·1 | 0·4 | 0 | 0·00 |
| 1 | 0 04 | 61 | 4 04 | 121 | 8 04 | 181 | 12 04 | 241 | 16 04 | 301 | 20 04 | | | 1 | 0·07 |
| 2 | 0 08 | 62 | 4 08 | 122 | 8 08 | 182 | 12 08 | 242 | 16 08 | 302 | 20 08 | 0·2 | 0·8 | 2 | 0·13 |
| 3 | 0 12 | 63 | 4 12 | 123 | 8 12 | 183 | 12 12 | 243 | 16 12 | 303 | 20 12 | | | 3 | 0·20 |
| 4 | 0 16 | 64 | 4 16 | 124 | 8 16 | 184 | 12 16 | 244 | 16 16 | 304 | 20 16 | 0·3 | 1·2 | 4 | 0·27 |
| 5 | 0 20 | 65 | 4 20 | 125 | 8 20 | 185 | 12 20 | 245 | 16 20 | 305 | 20 20 | 0·4 | 1·6 | 5 | 0·33 |
| 6 | 0 24 | 66 | 4 24 | 126 | 8 24 | 186 | 12 24 | 246 | 16 24 | 306 | 20 24 | | | 6 | 0·40 |
| 7 | 0 28 | 67 | 4 28 | 127 | 8 28 | 187 | 12 28 | 247 | 16 28 | 307 | 20 28 | 0·5 | 2·0 | 7 | 0·47 |
| 8 | 0 32 | 68 | 4 32 | 128 | 8 32 | 188 | 12 32 | 248 | 16 32 | 308 | 20 32 | | | 8 | 0·53 |
| 9 | 0 36 | 69 | 4 36 | 129 | 8 36 | 189 | 12 36 | 249 | 16 36 | 309 | 20 36 | 0·6 | 2·4 | 9 | 0·60 |
| 10 | 0 40 | 70 | 4 40 | 130 | 8 40 | 190 | 12 40 | 250 | 16 40 | 310 | 20 40 | | | 10 | 0·67 |
| 11 | 0 44 | 71 | 4 44 | 131 | 8 44 | 191 | 12 44 | 251 | 16 44 | 311 | 20 44 | 0·7 | 2·8 | 11 | 0·73 |
| 12 | 0 48 | 72 | 4 48 | 132 | 8 48 | 192 | 12 48 | 252 | 16 48 | 312 | 20 48 | | | 12 | 0·80 |
| 13 | 0 52 | 73 | 4 52 | 133 | 8 52 | 193 | 12 52 | 253 | 16 52 | 313 | 20 52 | 0·8 | 3·2 | 13 | 0·87 |
| 14 | 0 56 | 74 | 4 56 | 134 | 8 56 | 194 | 12 56 | 254 | 16 56 | 314 | 20 56 | | | 14 | 0·93 |
| 15 | 1 00 | 75 | 5 00 | 135 | 9 00 | 195 | 13 00 | 255 | 17 00 | 315 | 21 00 | 0·9 | 3·6 | 15 | 1·00 |
| 16 | 1 04 | 76 | 5 04 | 136 | 9 04 | 196 | 13 04 | 256 | 17 04 | 316 | 21 04 | | | 16 | 1·07 |
| 17 | 1 08 | 77 | 5 08 | 137 | 9 08 | 197 | 13 08 | 257 | 17 08 | 317 | 21 08 | | | 17 | 1·13 |
| 18 | 1 12 | 78 | 5 12 | 138 | 9 12 | 198 | 13 12 | 258 | 17 12 | 318 | 21 12 | | | 18 | 1·20 |
| 19 | 1 16 | 79 | 5 16 | 139 | 9 16 | 199 | 13 16 | 259 | 17 16 | 319 | 21 16 | | | 19 | 1·27 |
| 20 | 1 20 | 80 | 5 20 | 140 | 9 20 | 200 | 13 20 | 260 | 17 20 | 320 | 21 20 | | | 20 | 1·33 |
| 21 | 1 24 | 81 | 5 24 | 141 | 9 24 | 201 | 13 24 | 261 | 17 24 | 321 | 21 24 | | | 21 | 1·40 |
| 22 | 1 28 | 82 | 5 28 | 142 | 9 28 | 202 | 13 28 | 262 | 17 28 | 322 | 21 28 | | | 22 | 1·47 |
| 23 | 1 32 | 83 | 5 32 | 143 | 9 32 | 203 | 13 32 | 263 | 17 32 | 323 | 21 32 | | | 23 | 1·53 |
| 24 | 1 36 | 84 | 5 36 | 144 | 9 36 | 204 | 13 36 | 264 | 17 36 | 324 | 21 36 | | | 24 | 1·60 |
| 25 | 1 40 | 85 | 5 40 | 145 | 9 40 | 205 | 13 40 | 265 | 17 40 | 325 | 21 40 | | | 25 | 1·67 |
| 26 | 1 44 | 86 | 5 44 | 146 | 9 44 | 206 | 13 44 | 266 | 17 44 | 326 | 21 44 | | | 26 | 1·73 |
| 27 | 1 48 | 87 | 5 48 | 147 | 9 48 | 207 | 13 48 | 267 | 17 48 | 327 | 21 48 | | | 27 | 1·80 |
| 28 | 1 52 | 88 | 5 52 | 148 | 9 52 | 208 | 13 52 | 268 | 17 52 | 328 | 21 52 | | | 28 | 1·87 |
| 29 | 1 56 | 89 | 5 56 | 149 | 9 56 | 209 | 13 56 | 269 | 17 56 | 329 | 21 56 | | | 29 | 1·93 |
| 30 | 2 00 | 90 | 6 00 | 150 | 10 00 | 210 | 14 00 | 270 | 18 00 | 330 | 22 00 | | | 30 | 2·00 |
| 31 | 2 04 | 91 | 6 04 | 151 | 10 04 | 211 | 14 04 | 271 | 18 04 | 331 | 22 04 | | | 31 | 2·07 |
| 32 | 2 08 | 92 | 6 08 | 152 | 10 08 | 212 | 14 08 | 272 | 18 08 | 332 | 22 08 | | | 32 | 2·13 |
| 33 | 2 12 | 93 | 6 12 | 153 | 10 12 | 213 | 14 12 | 273 | 18 12 | 333 | 22 12 | | | 33 | 2·20 |
| 34 | 2 16 | 94 | 6 16 | 154 | 10 16 | 214 | 14 16 | 274 | 18 16 | 334 | 22 16 | | | 34 | 2·27 |
| 35 | 2 20 | 95 | 6 20 | 155 | 10 20 | 215 | 14 20 | 275 | 18 20 | 335 | 22 20 | | | 35 | 2·33 |
| 36 | 2 24 | 96 | 6 24 | 156 | 10 24 | 216 | 14 24 | 276 | 18 24 | 336 | 22 24 | | | 36 | 2·40 |
| 37 | 2 28 | 97 | 6 28 | 157 | 10 28 | 217 | 14 28 | 277 | 18 28 | 337 | 22 28 | | | 37 | 2·47 |
| 38 | 2 32 | 98 | 6 32 | 158 | 10 32 | 218 | 14 32 | 278 | 18 32 | 338 | 22 32 | | | 38 | 2·53 |
| 39 | 2 36 | 99 | 6 36 | 159 | 10 36 | 219 | 14 36 | 279 | 18 36 | 339 | 22 36 | | | 39 | 2·60 |
| 40 | 2 40 | 100 | 6 40 | 160 | 10 40 | 220 | 14 40 | 280 | 18 40 | 340 | 22 40 | | | 40 | 2·67 |
| 41 | 2 44 | 101 | 6 44 | 161 | 10 44 | 221 | 14 44 | 281 | 18 44 | 341 | 22 44 | | | 41 | 2·73 |
| 42 | 2 48 | 102 | 6 48 | 162 | 10 48 | 222 | 14 48 | 282 | 18 48 | 342 | 22 48 | | | 42 | 2·80 |
| 43 | 2 52 | 103 | 6 52 | 163 | 10 52 | 223 | 14 52 | 283 | 18 52 | 343 | 22 52 | | | 43 | 2·87 |
| 44 | 2 56 | 104 | 6 56 | 164 | 10 56 | 224 | 14 56 | 284 | 18 56 | 344 | 22 56 | | | 44 | 2·93 |
| 45 | 3 00 | 105 | 7 00 | 165 | 11 00 | 225 | 15 00 | 285 | 19 00 | 345 | 23 00 | | | 45 | 3·00 |
| 46 | 3 04 | 106 | 7 04 | 166 | 11 04 | 226 | 15 04 | 286 | 19 04 | 346 | 23 04 | | | 46 | 3·07 |
| 47 | 3 08 | 107 | 7 08 | 167 | 11 08 | 227 | 15 08 | 287 | 19 08 | 347 | 23 08 | | | 47 | 3·13 |
| 48 | 3 12 | 108 | 7 12 | 168 | 11 12 | 228 | 15 12 | 288 | 19 12 | 348 | 23 12 | | | 48 | 3·20 |
| 49 | 3 16 | 109 | 7 16 | 169 | 11 16 | 229 | 15 16 | 289 | 19 16 | 349 | 23 16 | | | 49 | 3·27 |
| 50 | 3 20 | 110 | 7 20 | 170 | 11 20 | 230 | 15 20 | 290 | 19 20 | 350 | 23 20 | | | 50 | 3·33 |
| 51 | 3 24 | 111 | 7 24 | 171 | 11 24 | 231 | 15 24 | 291 | 19 24 | 351 | 23 24 | | | 51 | 3·40 |
| 52 | 3 28 | 112 | 7 28 | 172 | 11 28 | 232 | 15 28 | 292 | 19 28 | 352 | 23 28 | | | 52 | 3·47 |
| 53 | 3 32 | 113 | 7 32 | 173 | 11 32 | 233 | 15 32 | 293 | 19 32 | 353 | 23 32 | | | 53 | 3·53 |
| 54 | 3 36 | 114 | 7 36 | 174 | 11 36 | 234 | 15 36 | 294 | 19 36 | 354 | 23 36 | | | 54 | 3·60 |
| 55 | 3 40 | 115 | 7 40 | 175 | 11 40 | 235 | 15 40 | 295 | 19 40 | 355 | 23 40 | | | 55 | 3·67 |
| 56 | 3 44 | 116 | 7 44 | 176 | 11 44 | 236 | 15 44 | 296 | 19 44 | 356 | 23 44 | | | 56 | 3·73 |
| 57 | 3 48 | 117 | 7 48 | 177 | 11 48 | 237 | 15 48 | 297 | 19 48 | 357 | 23 48 | | | 57 | 3·80 |
| 58 | 3 52 | 118 | 7 52 | 178 | 11 52 | 238 | 15 52 | 298 | 19 52 | 358 | 23 52 | | | 58 | 3·87 |
| 59 | 3 56 | 119 | 7 56 | 179 | 11 56 | 239 | 15 56 | 299 | 19 56 | 359 | 23 56 | | | 59 | 3·93 |
| 60 | 4 00 | 120 | 8 00 | 180 | 12 00 | 240 | 16 00 | 300 | 20 00 | 360 | 24 00 | | | 60 | 4·00 |

# SUN'S TOTAL CORRECTION

*To be applied to the Observed Altitude of the Sun's Lower (L) or Upper (U) Limb*

Height of Eye

| Obs. Alt. | 2.0m (7ft) | | 2.3m (8ft) | | 2.7m (9ft) | | 3.1m (10ft) | | 3.5m (11ft) | | 3.9m (13ft) | | 4.4m (15ft) | | 4.9m (16ft) | | 5.4m (18ft) | | 5.9m (20ft) | | 6.5m (21ft) | | 7.1m (23ft) | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | L | U | L | U | L | U | L | U | L | U | L | U | L | U | L | U | L | U | L | U | L | U | L | U |
| 10 00 | +8.5 | -23.5 | +8.3 | -23.7 | +8.1 | -23.9 | +7.9 | -24.1 | +7.7 | -24.3 | +7.5 | -24.5 | +7.3 | -24.7 | +7.1 | -24.9 | +6.9 | -25.1 | +6.7 | -25.3 | +6.5 | -25.5 | +6.1 | -25.7 |
| 30 | 8.7 | 23.3 | 8.5 | 23.5 | 8.3 | 23.7 | 8.1 | 23.9 | 7.9 | 24.1 | 7.7 | 24.3 | 7.5 | 24.5 | 7.3 | 24.7 | 7.1 | 24.9 | 6.9 | 25.1 | 6.7 | 25.3 | 6.5 | 25.5 |
| 11 00 | 8.9 | 23.1 | 8.7 | 23.3 | 8.5 | 23.5 | 8.3 | 23.7 | 8.1 | 23.9 | 7.9 | 24.1 | 7.7 | 24.3 | 7.5 | 24.5 | 7.3 | 24.7 | 7.1 | 24.9 | 6.9 | 25.1 | 6.7 | 25.3 |
| 30 | 9.1 | 22.9 | 8.9 | 23.1 | 8.7 | 23.3 | 8.5 | 23.5 | 8.3 | 23.7 | 8.1 | 23.9 | 7.9 | 24.1 | 7.7 | 24.3 | 7.5 | 24.5 | 7.3 | 24.7 | 7.1 | 24.9 | 6.9 | 25.1 |
| 12 00 | 9.3 | 22.7 | 9.1 | 22.9 | 8.9 | 23.1 | 8.7 | 23.3 | 8.5 | 23.5 | 8.3 | 23.7 | 8.1 | 23.9 | 7.9 | 24.1 | 7.7 | 24.3 | 7.5 | 24.5 | 7.3 | 24.7 | 7.1 | 24.9 |
| 30 | 9.5 | 22.5 | 9.3 | 22.7 | 9.1 | 22.9 | 8.9 | 23.1 | 8.7 | 23.3 | 8.5 | 23.5 | 8.3 | 23.7 | 8.1 | 23.9 | 7.9 | 24.1 | 7.7 | 24.3 | 7.5 | 24.5 | 7.3 | 24.7 |
| 13 00 | +9.7 | -22.3 | +9.5 | -22.5 | +9.3 | -22.7 | +9.1 | -22.9 | +8.9 | -23.1 | +8.7 | -23.3 | +8.5 | -23.5 | +8.3 | -23.7 | +8.1 | -23.9 | +7.9 | -24.1 | +7.7 | -24.3 | +7.5 | -24.5 |
| 14 00 | 9.9 | 22.1 | 9.7 | 22.3 | 9.5 | 22.5 | 9.3 | 22.7 | 9.1 | 22.9 | 8.9 | 23.1 | 8.7 | 23.3 | 8.5 | 23.5 | 8.3 | 23.7 | 8.1 | 23.9 | 7.9 | 24.1 | 7.7 | 24.3 |
| 15 00 | 10.1 | 21.9 | 9.9 | 22.1 | 9.7 | 22.3 | 9.5 | 22.5 | 9.3 | 22.7 | 9.1 | 22.9 | 8.9 | 23.1 | 8.7 | 23.3 | 8.5 | 23.5 | 8.3 | 23.7 | 8.1 | 23.9 | 7.9 | 24.1 |
| 16 00 | 10.3 | 21.7 | 10.1 | 21.9 | 9.9 | 22.1 | 9.7 | 22.3 | 9.5 | 22.5 | 9.3 | 22.7 | 9.1 | 22.9 | 8.9 | 23.1 | 8.7 | 23.3 | 8.5 | 23.5 | 8.3 | 23.7 | 8.1 | 23.9 |
| 17 00 | 10.5 | 21.5 | 10.3 | 21.7 | 10.1 | 21.9 | 9.9 | 22.1 | 9.7 | 22.3 | 9.5 | 22.5 | 9.3 | 22.7 | 9.1 | 22.9 | 8.9 | 23.1 | 8.7 | 23.3 | 8.5 | 23.5 | 8.3 | 23.7 |
| 18 00 | 10.7 | 21.3 | 10.5 | 21.5 | 10.3 | 21.7 | 10.1 | 21.9 | 9.9 | 22.1 | 9.7 | 22.3 | 9.5 | 22.5 | 9.3 | 22.7 | 9.1 | 22.9 | 8.9 | 23.1 | 8.7 | 23.3 | 8.5 | 23.5 |
| 19 00 | 10.9 | 21.1 | 10.7 | 21.3 | 10.5 | 21.5 | 10.3 | 21.7 | 10.1 | 21.9 | 9.9 | 22.1 | 9.7 | 22.3 | 9.5 | 22.5 | 9.3 | 22.7 | 9.1 | 22.9 | 8.9 | 23.1 | 8.7 | 23.3 |
| 20 00 | +11.1 | -20.9 | +10.9 | -21.1 | +10.7 | -21.3 | +10.5 | -21.5 | +10.3 | -21.7 | +10.1 | -21.9 | +9.9 | -22.1 | +9.7 | -22.3 | +9.5 | -22.5 | +9.3 | -22.7 | +9.1 | -22.9 | +8.9 | -23.1 |
| 22 00 | 11.3 | 20.7 | 11.1 | 20.9 | 10.9 | 21.1 | 10.7 | 21.3 | 10.5 | 21.5 | 10.3 | 21.7 | 10.1 | 21.9 | 9.9 | 22.1 | 9.7 | 22.3 | 9.5 | 22.5 | 9.3 | 22.7 | 9.1 | 22.9 |
| 24 00 | 11.5 | 20.5 | 11.3 | 20.7 | 11.1 | 20.9 | 10.9 | 21.1 | 10.7 | 21.3 | 10.5 | 21.5 | 10.3 | 21.7 | 10.1 | 21.9 | 9.9 | 22.1 | 9.7 | 22.3 | 9.5 | 22.5 | 9.3 | 22.7 |
| 26 00 | 11.7 | 20.3 | 11.5 | 20.5 | 11.3 | 20.7 | 11.1 | 20.9 | 10.9 | 21.1 | 10.7 | 21.3 | 10.5 | 21.5 | 10.3 | 21.7 | 10.1 | 21.9 | 9.9 | 22.1 | 9.7 | 22.3 | 9.5 | 22.5 |
| 29 00 | 11.9 | 20.1 | 11.7 | 20.3 | 11.5 | 20.5 | 11.3 | 20.7 | 11.1 | 20.9 | 10.9 | 21.1 | 10.7 | 21.3 | 10.5 | 21.5 | 10.3 | 21.7 | 10.1 | 21.9 | 9.9 | 22.1 | 9.7 | 22.3 |
| 32 00 | 12.1 | 19.9 | 11.9 | 20.1 | 11.7 | 20.3 | 11.5 | 20.5 | 11.3 | 20.7 | 11.1 | 20.9 | 10.9 | 21.1 | 10.7 | 21.3 | 10.5 | 21.5 | 10.3 | 21.7 | 10.1 | 21.9 | 9.9 | 22.1 |
| 36 00 | 12.3 | 19.7 | 12.1 | 19.9 | 11.9 | 20.1 | 11.7 | 20.3 | 11.5 | 20.5 | 11.3 | 20.7 | 11.1 | 20.9 | 10.9 | 21.1 | 10.7 | 21.3 | 10.5 | 21.5 | 10.3 | 21.7 | 10.1 | 21.9 |
| 40 00 | +12.5 | -19.5 | +12.3 | -19.7 | +12.1 | -19.9 | +11.9 | -20.1 | +11.7 | -20.3 | +11.5 | -20.7 | +11.3 | -20.7 | +11.1 | -20.9 | +10.9 | -21.1 | +10.7 | -21.3 | +10.5 | -21.5 | +10.3 | -21.7 |
| 45 00 | 12.7 | 19.3 | 12.5 | 19.5 | 12.3 | 19.7 | 12.1 | 19.9 | 11.9 | 20.1 | 11.7 | 20.3 | 11.5 | 20.5 | 11.3 | 20.7 | 11.1 | 20.9 | 10.9 | 21.1 | 10.7 | 21.3 | 10.5 | 21.5 |
| 52 00 | 12.9 | 19.1 | 12.7 | 19.3 | 12.5 | 19.5 | 12.3 | 19.7 | 12.1 | 19.9 | 11.9 | 20.1 | 11.7 | 20.3 | 11.5 | 20.5 | 11.3 | 20.7 | 11.1 | 20.9 | 10.9 | 21.1 | 10.7 | 21.3 |
| 60 00 | 13.1 | 18.9 | 12.9 | 19.1 | 12.7 | 19.3 | 12.5 | 19.5 | 12.3 | 19.7 | 12.1 | 19.9 | 11.9 | 20.1 | 11.7 | 20.3 | 11.5 | 20.5 | 11.3 | 20.7 | 11.1 | 20.9 | 10.9 | 21.1 |
| 75 00 | 13.3 | 18.7 | 13.1 | 18.9 | 12.9 | 19.1 | 12.7 | 19.3 | 12.5 | 19.5 | 12.3 | 19.7 | 12.1 | 19.9 | 11.9 | 20.1 | 11.7 | 20.3 | 11.5 | 20.5 | 11.3 | 20.7 | 11.1 | 20.9 |
| 90 00 | 13.5 | 18.5 | 13.3 | 18.7 | 13.1 | 18.9 | 12.9 | 19.1 | 12.7 | 19.3 | 12.5 | 19.5 | 12.3 | 19.7 | 12.1 | 19.9 | 11.9 | 20.1 | 11.7 | 20.3 | 11.5 | 20.5 | 11.3 | 20.7 |

| Obs. Alt. | 17.2m (56ft) | | 18.2m (60ft) | | 19.2m (63ft) | | 20.2m (66ft) | | 21.2m (70ft) | | 22.2m (73ft) | | 23.3m (77ft) | | 24.4m (80ft) | | 25.5m (84ft) | | 26.3m (88ft) | | 27.9m (92ft) | | 29.1m (96ft) | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | L | U | L | U | L | U | L | U | L | U | L | U | L | U | L | U | L | U | L | U | L | U | L | U |
| 10 00 | +3.7 | -28.3 | +3.5 | -28.5 | +3.3 | -28.7 | +3.1 | -28.9 | +2.9 | -29.1 | +2.7 | -29.3 | +2.5 | -29.5 | +2.3 | -29.7 | +2.1 | -29.9 | +1.9 | -30.1 | +1.7 | -30.3 | +1.5 | -30.5 |
| 30 | 3.9 | 28.1 | 3.7 | 28.3 | 3.5 | 28.5 | 3.3 | 28.7 | 3.1 | 28.9 | 2.9 | 29.1 | 2.7 | 29.3 | 2.5 | 29.5 | 2.3 | 29.7 | 2.1 | 29.9 | 1.9 | 30.1 | 1.7 | 30.3 |
| 11 00 | 4.1 | 27.9 | 3.9 | 28.1 | 3.7 | 28.3 | 3.5 | 28.5 | 3.3 | 28.7 | 3.1 | 28.9 | 2.9 | 29.1 | 2.7 | 29.3 | 2.5 | 29.5 | 2.3 | 29.7 | 2.1 | 29.9 | 1.9 | 30.1 |
| 30 | 4.3 | 27.7 | 4.1 | 27.9 | 3.9 | 28.1 | 3.7 | 28.3 | 3.5 | 28.5 | 3.3 | 28.7 | 3.1 | 28.9 | 2.9 | 29.1 | 2.7 | 29.3 | 2.5 | 29.5 | 2.3 | 29.7 | 2.1 | 29.9 |
| 12 00 | 4.5 | 27.5 | 4.3 | 27.7 | 4.1 | 27.9 | 3.9 | 28.1 | 3.7 | 28.3 | 3.5 | 28.5 | 3.3 | 28.7 | 3.1 | 28.9 | 2.9 | 29.1 | 2.7 | 29.3 | 2.5 | 29.5 | 2.3 | 29.7 |
| 30 | 4.7 | 27.3 | 4.5 | 27.5 | 4.3 | 27.7 | 4.1 | 27.9 | 3.9 | 28.1 | 3.7 | 28.3 | 3.5 | 28.5 | 3.3 | 28.7 | 3.1 | 28.9 | 2.9 | 29.1 | 2.7 | 29.3 | 2.5 | 29.5 |
| 13 00 | +4.9 | -27.1 | +4.7 | -27.3 | +4.5 | -27.5 | +4.3 | -27.7 | +4.1 | -27.9 | +3.9 | -28.1 | +3.7 | -28.3 | +3.5 | -28.5 | +3.3 | -28.7 | +3.1 | -28.9 | +2.9 | -29.1 | +2.7 | -29.3 |
| 14 00 | 5.1 | 26.9 | 4.9 | 27.1 | 4.7 | 27.3 | 4.5 | 27.5 | 4.3 | 27.7 | 4.1 | 27.9 | 3.9 | 28.1 | 3.7 | 28.3 | 3.5 | 28.5 | 3.3 | 28.7 | 3.1 | 28.9 | 2.9 | 29.1 |
| 15 00 | 5.3 | 26.7 | 5.1 | 26.9 | 4.9 | 27.1 | 4.7 | 27.3 | 4.5 | 27.5 | 4.3 | 27.7 | 4.1 | 27.9 | 3.9 | 28.1 | 3.7 | 28.3 | 3.5 | 28.5 | 3.3 | 28.7 | 3.1 | 28.9 |
| 16 00 | 5.5 | 26.5 | 5.3 | 26.7 | 5.1 | 26.9 | 4.9 | 27.1 | 4.7 | 27.3 | 4.5 | 27.5 | 4.3 | 27.7 | 4.1 | 27.9 | 3.9 | 28.1 | 3.7 | 28.3 | 3.5 | 28.5 | 3.3 | 28.7 |
| 17 00 | 5.7 | 26.3 | 5.5 | 26.5 | 5.3 | 26.7 | 5.1 | 26.9 | 4.9 | 27.1 | 4.7 | 27.3 | 4.5 | 27.5 | 4.3 | 27.7 | 4.1 | 27.9 | 3.9 | 28.1 | 3.7 | 28.3 | 3.5 | 28.5 |
| 18 00 | 5.9 | 26.1 | 5.7 | 26.3 | 5.5 | 26.5 | 5.3 | 26.7 | 5.1 | 26.9 | 4.9 | 27.1 | 4.7 | 27.3 | 4.5 | 27.5 | 4.3 | 27.7 | 4.1 | 27.9 | 3.9 | 28.1 | 3.7 | 28.3 |
| 19 00 | 6.1 | 25.9 | 5.9 | 26.1 | 5.7 | 26.3 | 5.5 | 26.5 | 5.3 | 26.7 | 5.1 | 26.9 | 4.9 | 27.1 | 4.7 | 27.3 | 4.5 | 27.5 | 4.3 | 27.7 | 4.1 | 27.9 | 3.9 | 28.1 |
| 20 00 | +6.3 | -25.7 | +6.1 | -25.9 | +5.9 | -26.1 | +5.7 | -26.3 | +5.5 | -26.5 | +5.3 | -26.7 | +5.1 | -26.9 | +4.9 | -27.1 | +4.7 | -27.3 | +4.5 | -27.5 | +4.3 | -27.7 | +4.1 | -27.9 |
| 22 00 | 6.5 | 25.5 | 6.3 | 25.7 | 6.1 | 25.9 | 5.9 | 26.1 | 5.7 | 26.3 | 5.5 | 26.5 | 5.3 | 26.7 | 5.1 | 26.9 | 4.9 | 27.1 | 4.7 | 27.3 | 4.5 | 27.5 | 4.3 | 27.7 |
| 24 00 | 6.3 | 25.3 | 6.5 | 25.5 | 6.3 | 25.7 | 6.1 | 25.9 | 5.9 | 26.1 | 5.7 | 26.3 | 5.5 | 26.5 | 5.3 | 26.7 | 5.1 | 26.9 | 4.9 | 27.1 | 4.7 | 27.3 | 4.5 | 27.5 |
| 26 00 | 6.9 | 25.1 | 6.7 | 25.3 | 6.5 | 25.5 | 6.3 | 25.7 | 6.1 | 25.9 | 5.9 | 26.1 | 5.7 | 26.3 | 5.5 | 26.5 | 5.3 | 26.7 | 5.1 | 26.9 | 4.9 | 27.1 | 4.7 | 27.3 |
| 29 00 | 7.1 | 24.9 | 6.9 | 25.1 | 6.7 | 25.3 | 6.5 | 25.5 | 6.3 | 25.7 | 6.1 | 25.9 | 5.9 | 26.1 | 5.7 | 26.3 | 5.5 | 26.5 | 5.3 | 26.7 | 5.1 | 26.9 | 4.9 | 27.1 |
| 32 00 | 7.3 | 24.7 | 7.1 | 24.9 | 6.9 | 25.1 | 6.7 | 25.3 | 6.5 | 25.5 | 6.3 | 25.7 | 6.1 | 25.9 | 5.9 | 26.1 | 5.7 | 26.3 | 5.5 | 26.5 | 5.3 | 26.7 | 5.1 | 26.9 |
| 36 00 | 7.5 | 24.5 | 7.3 | 24.7 | 7.1 | 24.9 | 6.9 | 25.1 | 6.7 | 25.3 | 6.5 | 25.5 | 6.3 | 25.7 | 6.1 | 25.9 | 5.9 | 26.1 | 5.7 | 26.3 | 5.5 | 26.5 | 5.3 | 26.7 |
| 40 00 | +7.7 | -24.3 | +7.5 | -24.7 | +7.3 | 24.7 | +7.1 | -24.9 | +6.9 | -25.1 | +6.7 | -25.3 | 6.5 | -25.5 | 6.3 | -25.7 | 6.1 | -25.9 | 5.9 | -26.1 | +5.7 | -26.3 | +5.5 | -26.5 |
| 45 00 | 7.9 | 24.1 | 7.7 | 24.3 | 7.5 | 24.5 | 7.3 | 24.7 | 7.1 | 24.9 | 6.9 | 25.1 | 6.7 | 25.3 | 6.5 | 25.5 | 6.3 | 25.7 | 6.1 | 25.9 | 5.9 | 26.1 | 5.7 | 26.3 |
| 52 00 | 8.1 | 23.9 | 7.9 | 24.1 | 7.7 | 24.3 | 7.5 | 24.5 | 7.3 | 24.7 | 7.1 | 24.9 | 6.9 | 25.1 | 6.7 | 25.3 | 6.5 | 25.5 | 6.3 | 25.7 | 6.1 | 25.9 | 5.9 | 26.1 |
| 60 00 | 8.3 | 23.7 | 8.1 | 23.9 | 7.9 | 24.1 | 7.7 | 24.3 | 7.5 | 24.5 | 7.3 | 24.7 | 7.1 | 24.9 | 6.9 | 25.1 | 6.7 | 25.3 | 6.5 | 25.5 | 6.3 | 25.7 | 6.1 | 25.9 |
| 75 00 | 8.5 | 23.5 | 8.3 | 23.7 | 8.1 | 23.9 | 7.9 | 24.1 | 7.7 | 24.3 | 7.5 | 24.5 | 7.3 | 24.7 | 7.1 | 24.9 | 6.9 | 25.1 | 6.7 | 25.3 | 6.5 | 25.5 | 6.3 | 25.7 |
| 90 00 | 8.7 | 23.3 | 8.5 | 23.5 | 8.3 | 23.7 | 8.1 | 23.9 | 7.9 | 24.1 | 7.7 | 24.3 | 7.5 | 24.5 | 7.3 | 24.7 | 7.1 | 24.9 | 6.9 | 25.1 | 6.7 | 25.3 | 6.5 | 25.5 |

## ADDITIONAL MONTHLY CORRECTION

| | Jan | Feb | Mar | Apr | May | June | July | Aug | Sept | Oct | Nov | Dec |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| LL | +0.2 | +0.2 | +0.1 | 0.0 | -0.1 | -0.2 | -0.2 | -0.2 | -0.1 | 0.0 | +0.2 | +0.2 |
| UL | -0.2 | -0.2 | -0.1 | 0.0 | +0.1 | +0.2 | +0.2 | +0.2 | +0.1 | 0.0 | -0.2 | -0.2 |

| 7.7m (25ft) | | 8.4m (28ft) | | 9.1m (30ft) | | 9.8m (32ft) | | 10.5m (34ft) | | 11.2m (37ft) | | 12.0m (39ft) | | 12.8m 42ft) | | 13.6m (45ft) | | 14.5M (48ft) | | 15.4m (50ft) | | 16.3m (53ft) | | 17.2m (56ft) | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| L | U | L | U | L | U | L | U | L | U | L | U | L | U | L | U | L | U | L | U | L | U | L | U | L | U |
| +6.1 | -25.9 | +5.9 | -26.1 | +5.7 | -26.3 | +5.5 | -26.5 | +5.3 | -26.7 | +5.1 | -26.9 | +4.9 | -27.1 | +4.7 | -27.3 | +4.5 | -27.5 | +4.3 | -27.7 | +4.1 | -27.9 | +3.9 | -28.1 | +3.7 | -28.3 |
| 6.3 | 25.7 | 6.1 | 25.9 | 5.9 | 26.1 | 5.7 | 26.3 | 5.5 | 26.5 | 5.3 | 26.7 | 5.1 | 26.9 | 4.9 | 27.1 | 4.7 | 27.3 | 4.5 | 27.5 | 4.3 | 27.7 | 4.1 | 27.9 | 3.9 | 28.1 |
| 6.5 | 25.5 | 6.3 | 25.7 | 6.1 | 25.9 | 5.9 | 26.1 | 5.7 | 26.3 | 5.5 | 26.5 | 5.3 | 26.7 | 5.1 | 26.9 | 4.9 | 27.1 | 4.7 | 27.3 | 4.5 | 27.5 | 4.3 | 27.7 | 4.1 | 27.9 |
| 6.7 | 25.3 | 6.5 | 25.5 | 6.3 | 25.7 | 6.1 | 25.9 | 5.9 | 26.1 | 5.7 | 26.3 | 5.5 | 26.5 | 5.3 | 26.7 | 5.1 | 26.9 | 4.9 | 27.1 | 4.7 | 27.3 | 4.5 | 27.5 | 4.3 | 27.7 |
| 6.9 | 25.1 | 6.7 | 25.3 | 6.5 | 25.5 | 6.3 | 25.7 | 6.1 | 25.9 | 5.9 | 26.1 | 5.7 | 26.3 | 5.5 | 26.5 | 5.3 | 26.7 | 5.1 | 26.9 | 4.9 | 27.1 | 4.7 | 27.3 | 4.5 | 27.5 |
| 7.1 | 24.9 | 6.9 | 25.1 | 6.7 | 25.3 | 6.5 | 25.5 | 6.3 | 25.7 | 6.1 | 25.9 | 5.9 | 26.1 | 5.7 | 26.3 | 5.5 | 26.5 | 5.3 | 26.7 | 5.1 | 26.9 | 4.9 | 27.1 | 4.7 | 27.3 |
| +7.3 | -24.7 | +7.1 | -24.9 | +6.9 | -25.1 | +6.7 | -25.3 | +6.5 | -25.5 | +6.3 | -25.7 | +6.1 | -25.9 | +5.9 | -26.1 | +5.7 | -26.3 | +5.5 | -26.5 | +5.3 | -26.7 | +5.1 | -26.9 | +4.9 | -27.1 |
| 7.5 | 24.5 | 7.3 | 24.7 | 7.1 | 24.9 | 6.9 | 25.1 | 6.7 | 25.3 | 6.5 | 25.5 | 6.3 | 25.7 | 6.1 | 25.9 | 5.9 | 26.1 | 5.7 | 26.3 | 5.5 | 26.5 | 5.3 | 26.7 | 5.1 | 26.9 |
| 7.7 | 24.3 | 7.5 | 24.5 | 7.3 | 24.7 | 7.1 | 24.9 | 6.9 | 25.1 | 6.7 | 25.3 | 6.5 | 25.5 | 6.3 | 25.7 | 6.1 | 25.9 | 5.9 | 26.1 | 5.7 | 26.3 | 5.5 | 26.5 | 5.3 | 26.7 |
| 7.9 | 24.1 | 7.7 | 24.3 | 7.5 | 24.5 | 7.3 | 24.7 | 7.1 | 24.9 | 6.9 | 25.1 | 6.7 | 25.3 | 6.5 | 25.5 | 6.3 | 25.7 | 6.1 | 25.9 | 5.9 | 26.1 | 5.7 | 26.3 | 5.5 | 26.5 |
| 8.1 | 23.9 | 7.9 | 24.1 | 7.7 | 24.3 | 7.5 | 24.5 | 7.3 | 24.7 | 7.1 | 24.9 | 6.9 | 25.1 | 6.7 | 25.3 | 6.5 | 25.5 | 6.3 | 25.7 | 6.1 | 25.9 | 5.9 | 26.1 | 5.7 | 26.3 |
| 8.3 | 23.7 | 8.1 | 23.9 | 7.9 | 24.1 | 7.7 | 24.3 | 7.5 | 24.5 | 7.3 | 24.7 | 7.1 | 24.9 | 6.9 | 25.1 | 6.7 | 25.3 | 6.5 | 25.5 | 6.3 | 25.7 | 6.1 | 25.9 | 5.9 | 26.1 |
| 8.5 | 23.5 | 8.3 | 23.7 | 8.1 | 23.9 | 7.9 | 24.1 | 7.7 | 24.3 | 7.5 | 24.5 | 7.3 | 24.7 | 7.1 | 24.9 | 6.9 | 25.1 | 6.7 | 25.3 | 6.5 | 25.5 | 6.3 | 25.7 | 6.1 | 25.9 |
| +8.7 | -23.3 | +8.5 | -23.5 | +8.3 | -23.7 | +8.1 | -23.9 | +7.9 | -24.1 | +7.7 | -24.3 | +7.5 | -24.5 | +7.3 | -24.7 | +7.1 | -24.9 | +6.9 | -25.1 | +6.7 | -25.3 | +6.5 | -25.5 | +6.3 | -25.7 |
| 8.9 | 23.1 | 8.7 | 23.3 | 8.5 | 23.5 | 8.3 | 23.7 | 8.1 | 23.9 | 7.9 | 24.1 | 7.7 | 24.3 | 7.5 | 24.5 | 7.3 | 24.7 | 7.1 | 24.9 | 6.9 | 25.1 | 6.7 | 25.3 | 6.5 | 25.5 |
| 9.1 | 22.9 | 8.9 | 23.1 | 8.7 | 23.3 | 8.5 | 23.5 | 8.3 | 23.7 | 8.1 | 23.9 | 7.9 | 24.1 | 7.7 | 24.3 | 7.5 | 24.5 | 7.3 | 24.7 | 7.1 | 24.9 | 6.9 | 25.1 | 6.3 | 25.3 |
| 9.3 | 22.7 | 9.1 | 22.9 | 8.9 | 23.1 | 8.7 | 23.3 | 8.5 | 23.5 | 8.3 | 23.7 | 8.1 | 23.9 | 7.9 | 24.1 | 7.7 | 24.3 | 7.5 | 24.5 | 7.3 | 24.7 | 7.1 | 24.9 | 6.9 | 25.1 |
| 9.5 | 22.5 | 9.3 | 22.7 | 9.1 | 22.9 | 8.9 | 23.1 | 8.7 | 23.3 | 8.5 | 23.5 | 8.3 | 23.7 | 8.1 | 23.9 | 7.9 | 24.1 | 7.7 | 24.3 | 7.5 | 24.5 | 7.3 | 24.7 | 7.1 | 24.9 |
| 9.7 | 22.3 | 9.5 | 22.5 | 9.3 | 22.7 | 9.1 | 22.9 | 8.9 | 23.1 | 8.7 | 23.3 | 8.5 | 23.5 | 8.3 | 23.7 | 8.1 | 23.9 | 7.9 | 24.1 | 7.7 | 24.3 | 7.5 | 24.5 | 7.3 | 24.7 |
| 9.9 | 22.1 | 9.7 | 22.3 | 9.5 | 22.5 | 9.3 | 22.7 | 9.1 | 22.9 | 8.9 | 23.1 | 8.7 | 23.3 | 8.5 | 23.5 | 8.3 | 23.7 | 8.1 | 23.9 | 7.9 | 24.1 | 7.7 | 24.3 | 7.5 | 24.5 |
| +10.1 | -21.9 | +9.9 | -22.1 | +9.7 | -22.3 | +9.5 | -22.5 | +9.3 | -22.7 | +9.1 | -22.9 | +8.9 | -23.1 | +8.7 | -23.3 | +8.5 | -23.5 | +8.3 | -23.7 | +8.1 | -23.9 | +7.9 | -24.1 | +7.7 | -24.3 |
| 10.3 | 21.7 | 10.1 | 21.9 | 9.9 | 22.1 | 9.7 | 22.3 | 9.5 | 22.5 | 9.3 | 22.7 | 9.1 | 22.9 | 8.9 | 23.1 | 8.7 | 23.3 | 8.5 | 23.5 | 8.3 | 23.7 | 8.1 | 23.9 | 7.9 | 24.1 |
| 10.5 | 21.5 | 10.3 | 21.7 | 10.1 | 21.9 | 9.9 | 22.1 | 9.7 | 22.3 | 9.5 | 22.5 | 9.3 | 22.7 | 9.1 | 22.9 | 8.9 | 23.1 | 8.7 | 23.3 | 8.5 | 23.5 | 8.3 | 23.7 | 8.1 | 23.9 |
| 10.7 | 21.3 | 10.5 | 21.5 | 10.3 | 21.7 | 10.1 | 21.9 | 9.9 | 22.1 | 9.7 | 22.3 | 9.5 | 22.5 | 9.3 | 22.7 | 9.1 | 22.9 | 8.9 | 23.1 | 8.7 | 23.3 | 8.5 | 23.5 | 8.3 | 23.7 |
| 10.9 | 21.1 | 10.7 | 21.3 | 10.5 | 21.5 | 10.3 | 21.7 | 10.1 | 21.9 | 9.9 | 22.1 | 9.7 | 22.3 | 9.5 | 22.5 | 9.3 | 22.7 | 9.1 | 22.9 | 8.9 | 23.1 | 8.7 | 23.3 | 8.5 | 23.5 |
| 11.1 | 20.9 | 10.9 | 21.1 | 10.7 | 21.3 | 10.5 | 21.5 | 10.3 | 21.7 | 10.1 | 21.9 | 9.9 | 22.1 | 9.7 | 22.3 | 9.5 | 22.5 | 9.3 | 22.7 | 9.1 | 22.9 | 8.9 | 23.1 | 8.7 | 23.3 |

| 30.3m (100ft) | | 31.6m (104ft) | | 32.9m (108ft) | | 34.0m (112ft) | | 35.5m (117ft) | | 37.0m (121ft) | | 38.5m (126ft) | | 40.0m (131ft) | | 41.5m (135ft) | | 43.0m (140ft) | | 44.5m (145ft) | | 46.0m (150ft) | | 47.5m (155ft) | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| L | U | L | U | L | U | L | U | L | U | L | U | L | U | L | U | L | U | L | U | L | U | L | U | L | U |
| +1.3 | -30.7 | +1.1 | -30.9 | +0.9 | -31.1 | +0.7 | -31.3 | +0.5 | -31.5 | +0.3 | -31.7 | +0.1 | -31.9 | -0.1 | -32.1 | -0.3 | -32.3 | -0.5 | -32.5 | -0.7 | -32.7 | -0.9 | -32.9 | -1.1 | -33.1 |
| 1.5 | 30.5 | 1.3 | 30.7 | 1.1 | 30.9 | 0.9 | 31.1 | 0.7 | 31.3 | 0.5 | 31.5 | 0.3 | 31.7 | +0.1 | 31.9 | 0.1 | 32.1 | 0.3 | 32.3 | 0.5 | 32.5 | 0.7 | 32.7 | 0.9 | 32.9 |
| 1.7 | 30.3 | 1.5 | 30.5 | 1.3 | 30.7 | 1.1 | 30.9 | 0.9 | 31.1 | 0.7 | 31.3 | 0.5 | 31.5 | 0.3 | 31.7 | +0.1 | 31.9 | 0.1 | 32.1 | 0.3 | 32.3 | 0.5 | 32.5 | 0.7 | 32.7 |
| 1.9 | 30.1 | 1.7 | 30.3 | 1.5 | 30.5 | 1.3 | 30.7 | 1.1 | 30.9 | 0.9 | 31.1 | 0.7 | 31.3 | 0.5 | 31.5 | 0.3 | 31.7 | +0.1 | 31.9 | 0.1 | 32.1 | 0.3 | 32.3 | 0.5 | 32.5 |
| 2.1 | 29.9 | 1.9 | 30.1 | 1.7 | 30.3 | 1.5 | 30.5 | 1.3 | 30.7 | 1.1 | 30.9 | 0.9 | 31.1 | 0.7 | 31.3 | 0.5 | 31.5 | 0.3 | 31.7 | +0.1 | 31.9 | 0.1 | 32.1 | 0.3 | 32.3 |
| 2.3 | 29.7 | 2.1 | 29.9 | 1.9 | 30.1 | 1.7 | 30.3 | 1.5 | 30.5 | 1.3 | 30.7 | 1.1 | 30.9 | 0.9 | 31.1 | 0.7 | 31.3 | 0.5 | 31.5 | 0.3 | 31.7 | +0.1 | 31.9 | 0.1 | 32.1 |
| +2.5 | -29.5 | +2.3 | -29.7 | +2.1 | -29.9 | +1.9 | -30.1 | +1.7 | -30.3 | +1.5 | -30.5 | +1.3 | -30.7 | +1.1 | -30.9 | +0.9 | -31.1 | +0.7 | -31.3 | +0.5 | -31.5 | +0.3 | -31.7 | +0.1 | -31.9 |
| 2.7 | 29.3 | 2.5 | 29.5 | 2.3 | 29.7 | 2.1 | 29.9 | 1.9 | 30.1 | 1.7 | 30.3 | 1.5 | 30.5 | 1.3 | 30.7 | 1.1 | 30.9 | 0.9 | 31.1 | 0.7 | 31.3 | 0.5 | 31.5 | 0.3 | 31.7 |
| 2.9 | 29.1 | 2.7 | 29.3 | 2.5 | 29.5 | 2.3 | 29.7 | 2.1 | 29.9 | 1.9 | 30.1 | 1.7 | 30.3 | 1.5 | 30.5 | 1.3 | 30.7 | 1.1 | 30.9 | 0.9 | 31.1 | 0.7 | 31.3 | 0.5 | 31.5 |
| 3.1 | 28.9 | 2.9 | 29.1 | 2.7 | 29.3 | 2.5 | 29.5 | 2.3 | 29.7 | 2.1 | 29.9 | 1.9 | 30.1 | 1.7 | 30.3 | 1.5 | 30.5 | 1.3 | 30.7 | 1.1 | 30.9 | 0.9 | 31.1 | 0.7 | 31.3 |
| 3.3 | 28.7 | 3.1 | 28.9 | 2.9 | 29.1 | 2.7 | 29.3 | 2.5 | 29.5 | 2.3 | 29.7 | 2.1 | 29.9 | 1.9 | 30.1 | 1.7 | 30.3 | 1.5 | 30.5 | 1.3 | 30.7 | 1.1 | 30.9 | 0.9 | 31.1 |
| 3.5 | 28.5 | 3.3 | 28.7 | 3.1 | 28.9 | 2.9 | 29.1 | 2.7 | 29.3 | 2.5 | 29.5 | 2.3 | 29.7 | 2.1 | 29.9 | 1.9 | 30.1 | 1.7 | 30.3 | 1.5 | 30.5 | 1.3 | 30.7 | 1.1 | 30.9 |
| 3.7 | 28.3 | 3.5 | 28.5 | 3.3 | 28.7 | 3.1 | 28.9 | 2.9 | 29.1 | 2.7 | 29.3 | 2.5 | 29.5 | 2.3 | 29.7 | 2.1 | 29.9 | 1.9 | 30.1 | 1.7 | 30.3 | 1.5 | 30.5 | 1.3 | 30.7 |
| +3.9 | -28.1 | +3.7 | -28.3 | +3.5 | -28.5 | +3.3 | -28.7 | +3.1 | -28.9 | +2.9 | -29.1 | +2.7 | -29.3 | +2.5 | -29.5 | +2.3 | -29.7 | +2.1 | -29.9 | +1.9 | -30.1 | +1.7 | -30.3 | +1.5 | -30.5 |
| 4.1 | 27.9 | 3.9 | 28.1 | 3.7 | 28.3 | 3.5 | 28.5 | 3.3 | 28.7 | 3.1 | 28.9 | 2.9 | 29.1 | 2.7 | 29.3 | 2.5 | 29.5 | 2.3 | 29.7 | 2.1 | 29.9 | 1.9 | 30.1 | 1.7 | 30.3 |
| 4.3 | 27.7 | 4.1 | 27.9 | 3.9 | 28.1 | 3.7 | 28.3 | 3.5 | 28.5 | 3.3 | 28.7 | 3.1 | 28.9 | 2.9 | 29.1 | 2.7 | 29.3 | 2.5 | 29.5 | 2.3 | 29.7 | 2.1 | 29.9 | 1.9 | 30.1 |
| 4.5 | 27.5 | 4.3 | 27.7 | 4.1 | 27.9 | 3.9 | 28.1 | 3.7 | 28.3 | 3.5 | 28.5 | 3.3 | 28.7 | 3.1 | 28.9 | 2.9 | 29.1 | 2.7 | 29.3 | 2.5 | 29.5 | 2.3 | 29.7 | 2.1 | 29.9 |
| 4.7 | 27.3 | 4.5 | 27.5 | 4.3 | 27.7 | 4.1 | 27.9 | 3.9 | 28.1 | 3.7 | 28.3 | 3.5 | 28.5 | 3.3 | 28.7 | 3.1 | 28.9 | 2.9 | 29.1 | 2.7 | 29.3 | 2.5 | 29.5 | 2.3 | 29.7 |
| 4.9 | 27.1 | 4.7 | 27.3 | 4.5 | 27.5 | 4.3 | 27.7 | 4.1 | 27.9 | 3.9 | 28.1 | 3.7 | 28.3 | 3.5 | 28.5 | 3.3 | 28.7 | 3.1 | 28.9 | 2.9 | 29.1 | 2.7 | 29.3 | 2.5 | 29.5 |
| 5.1 | 26.9 | 4.9 | 27.1 | 4.7 | 27.3 | 4.5 | 27.5 | 4.3 | 27.7 | 4.1 | 27.9 | 3.9 | 28.1 | 3.7 | 28.3 | 3.5 | 28.5 | 3.3 | 28.7 | 3.1 | 28.9 | 2.9 | 29.1 | 2.7 | 29.3 |
| +5.3 | -26.7 | +5.1 | -26.9 | +4.9 | -27.1 | +4.7 | 27.3 | +4.5 | -27.5 | +4.3 | -27.7 | +4.1 | -27.9 | +3.9 | -28.1 | +3.7 | -28.3 | +3.5 | -28.5 | +3.3 | -28.7 | +3.1 | -28.9 | +2.9 | -29.1 |
| 5.5 | 26.5 | 5.3 | 26.7 | 5.1 | 26.9 | 4.9 | 27.1 | 4.7 | 27.3 | 4.5 | 27.5 | 4.3 | 27.7 | 4.1 | 27.9 | 3.9 | 28.1 | 3.7 | 28.3 | 3.5 | 28.5 | 3.3 | 28.7 | 3.1 | 28.9 |
| 5.7 | 26.3 | 5.5 | 26.5 | 5.3 | 26.7 | 5.1 | 26.9 | 4.9 | 27.1 | 4.7 | 27.3 | 4.5 | 27.5 | 4.3 | 27.7 | 4.1 | 27.9 | 3.9 | 28.1 | 3.7 | 28.3 | 3.5 | 28.5 | 3.3 | 28.7 |
| 5.9 | 26.1 | 5.7 | 26.3 | 5.5 | 26.5 | 5.3 | 26.7 | 5.1 | 26.9 | 4.9 | 27.1 | 4.7 | 27.3 | 4.5 | 27.5 | 4.3 | 27.7 | 4.1 | 27.9 | 3.9 | 28.1 | 3.7 | 28.3 | 3.5 | 28.5 |
| 6.1 | 25.9 | 5.9 | 26.1 | 5.7 | 26.3 | 5.5 | 26.5 | 5.3 | 26.7 | 5.1 | 26.9 | 4.9 | 27.1 | 4.7 | 27.3 | 4.5 | 27.5 | 4.3 | 27.7 | 4.1 | 27.9 | 3.9 | 28.1 | 3.7 | 28.3 |
| 6.3 | 25.7 | 6.1 | 25.9 | 5.9 | 26.1 | 5.7 | 26.3 | 5.5 | 26.5 | 5.3 | 26.7 | 5.1 | 26.9 | 4.9 | 27.1 | 4.7 | 27.3 | 4.5 | 27.5 | 4.3 | 27.7 | 4.1 | 27.9 | 3.9 | 28.1 |

## DECIMALS OF THE DEGREE

| ′ | .0 | .2 | .4 | .6 | .8 |
|---|---|---|---|---|---|
| 0 | 0.000 | 0.003 | 0.007 | 0.010 | 0.013 |
| 1 | .017 | .020 | .023 | .027 | .030 |
| 2 | .033 | .037 | .040 | .043 | .047 |
| 3 | .050 | .053 | .057 | .060 | .063 |
| 4 | .067 | .070 | .073 | .077 | .080 |
| 5 | 0.083 | 0.087 | 0.090 | 0.093 | 0.097 |
| 6 | .100 | .103 | .107 | .110 | .113 |
| 7 | .117 | .120 | .123 | .127 | .130 |
| 8 | .133 | .137 | .140 | .143 | .147 |
| 9 | .150 | .153 | .157 | .160 | .163 |
| 10 | 0.167 | 0.170 | 0.173 | 0.177 | 0.180 |
| 11 | .183 | .187 | .190 | .193 | .197 |
| 12 | .200 | .203 | .207 | .210 | .213 |
| 13 | .217 | .220 | .223 | .227 | .230 |
| 14 | .233 | .237 | .240 | .243 | .247 |
| 15 | 0.250 | 0.253 | 0.257 | 0.260 | 0.263 |
| 16 | .267 | .270 | .273 | .277 | .280 |
| 17 | .283 | .287 | .290 | .293 | .297 |
| 18 | .300 | .303 | .307 | .310 | .313 |
| 19 | .317 | .320 | .323 | .327 | .330 |
| 20 | 0.333 | 0.337 | 0.340 | 0.343 | 0.347 |
| 21 | .350 | .353 | .357 | .360 | .363 |
| 22 | .367 | .370 | .373 | .377 | .380 |
| 23 | .383 | .387 | .390 | .393 | .397 |
| 24 | .400 | .403 | .407 | .410 | .413 |
| 25 | 0.417 | 0.420 | 0.423 | 0.427 | 0.430 |
| 26 | .433 | .437 | .440 | .443 | .447 |
| 27 | .450 | .453 | .457 | .460 | .463 |
| 28 | .467 | .470 | .473 | .477 | .480 |
| 29 | .483 | .487 | .490 | .493 | .497 |
| 30 | 0.500 | 0.503 | 0.507 | 0.510 | 0.513 |
| 31 | .517 | .520 | .523 | .527 | .530 |
| 32 | .533 | .537 | .540 | .543 | .547 |
| 33 | .550 | .553 | .557 | .560 | .563 |
| 34 | .567 | .570 | .573 | .577 | .580 |
| 35 | 0.583 | 0.587 | 0.590 | 0.593 | 0.597 |
| 36 | .600 | .603 | .607 | .610 | .613 |
| 37 | .617 | .620 | .623 | .627 | .630 |
| 38 | .633 | .637 | .640 | .643 | .647 |
| 39 | .650 | .653 | .657 | .660 | .663 |
| 40 | 0.667 | 0.670 | 0.673 | 0.677 | 0.680 |
| 41 | .683 | .687 | .690 | .693 | .697 |
| 42 | .700 | .703 | .707 | .710 | .713 |
| 43 | .717 | .720 | .723 | .727 | .730 |
| 44 | .733 | .737 | .740 | .743 | .747 |
| 45 | 0.750 | 0.753 | 0.757 | 0.760 | 0.763 |
| 46 | .767 | .770 | .773 | .777 | .780 |
| 47 | .783 | .787 | .790 | .793 | .797 |
| 48 | .800 | .803 | .807 | .810 | .813 |
| 49 | .817 | .820 | .823 | .827 | .830 |
| 50 | 0.833 | 0.837 | 0.840 | 0.843 | 0.847 |
| 51 | .850 | .853 | .857 | .860 | .863 |
| 52 | .867 | .870 | .873 | .877 | .880 |
| 53 | .883 | .887 | .890 | .893 | .897 |
| 54 | .900 | .903 | .907 | .910 | .913 |
| 55 | 0.917 | 0.920 | 0.923 | 0.927 | 0.930 |
| 56 | .933 | .937 | .940 | .943 | .947 |
| 57 | .950 | .953 | .957 | .960 | .963 |
| 58 | .967 | .970 | .973 | .977 | .980 |
| 59 | .983 | .987 | .990 | .993 | .997 |

## STAR'S TOTAL CORRECTION

| Metres | 2.0 | 2.3 | 2.7 | 3.1 | 3.5 | 3.9 | 4.4 | 4.9 | 5.4 | 5.9 | 6.5 | 7.1 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Feet | 7 | 8 | 9 | 10 | 11 | 13 | 14 | 16 | 18 | 19 | 21 | 23 |
| Obs. Alt. | ′ | ′ | ′ | ′ | ′ | ′ | ′ | ′ | ′ | ′ | ′ | ′ |
| 10 00 | 7.8 | 8.0 | 8.2 | 8.4 | 8.6 | 8.8 | 9.0 | 9.2 | 9.4 | 9.6 | 9.8 | 10.0 |
| 30 | 7.6 | 7.8 | 8.0 | 8.2 | 8.4 | 8.6 | 8.8 | 9.0 | 9.2 | 9.4 | 9.6 | 9.8 |
| 11 00 | 7.4 | 7.6 | 7.8 | 8.0 | 8.2 | 8.4 | 8.6 | 8.8 | 9.0 | 9.2 | 9.4 | 9.6 |
| 30 | 7.2 | 7.4 | 7.6 | 7.8 | 8.0 | 8.2 | 8.4 | 8.6 | 8.8 | 9.0 | 9.2 | 9.4 |
| 12 00 | 7.0 | 7.2 | 7.4 | 7.6 | 7.8 | 8.0 | 8.2 | 8.4 | 8.6 | 8.8 | 9.0 | 9.2 |
| 30 | 6.8 | 7.0 | 7.2 | 7.4 | 7.6 | 7.8 | 8.0 | 8.2 | 8.4 | 8.6 | 8.8 | 9.0 |
| 13 00 | 6.6 | 6.8 | 7.0 | 7.2 | 7.4 | 7.6 | 7.8 | 8.0 | 8.2 | 8.4 | 8.6 | 8.8 |
| 30 | 6.4 | 6.6 | 6.8 | 7.0 | 7.2 | 7.4 | 7.6 | 7.8 | 8.0 | 8.2 | 8.4 | 8.6 |
| 14 00 | 6.2 | 6.4 | 6.6 | 6.8 | 7.0 | 7.2 | 7.4 | 7.6 | 7.8 | 8.0 | 8.2 | 8.4 |
| 15 00 | 6.0 | 6.2 | 6.4 | 6.6 | 6.8 | 7.0 | 7.2 | 7.4 | 7.6 | 7.8 | 8.0 | 8.2 |
| 16 00 | 5.8 | 6.0 | 6.2 | 6.4 | 6.6 | 6.8 | 7.0 | 7.2 | 7.4 | 7.6 | 7.8 | 8.0 |
| 17 00 | 5.6 | 5.8 | 6.0 | 6.2 | 6.4 | 6.6 | 6.8 | 7.0 | 7.2 | 7.4 | 7.6 | 7.8 |
| 18 00 | 5.4 | 5.6 | 5.8 | 6.0 | 6.2 | 6.4 | 6.6 | 6.8 | 7.0 | 7.2 | 7.4 | 7.6 |
| 19 00 | 5.2 | 5.4 | 5.6 | 5.8 | 6.0 | 6.2 | 6.4 | 6.6 | 6.8 | 7.0 | 7.2 | 7.4 |
| 21 00 | 5.0 | 5.2 | 5.4 | 5.6 | 5.8 | 6.0 | 6.2 | 6.4 | 6.6 | 6.8 | 7.0 | 7.2 |
| 23 00 | 4.8 | 5.0 | 5.2 | 5.4 | 5.6 | 5.8 | 6.0 | 6.2 | 6.4 | 6.6 | 6.8 | 7.0 |
| 25 00 | 4.6 | 4.8 | 5.0 | 5.2 | 5.4 | 5.6 | 5.8 | 6.0 | 6.2 | 6.4 | 6.6 | 6.8 |
| 27 00 | 4.4 | 4.6 | 4.8 | 5.0 | 5.2 | 5.4 | 5.6 | 5.8 | 6.0 | 6.2 | 6.4 | 6.6 |
| 29 00 | 4.2 | 4.4 | 4.6 | 4.8 | 5.0 | 5.2 | 5.4 | 5.6 | 5.8 | 6.0 | 6.2 | 6.4 |
| 33 00 | 4.0 | 4.2 | 4.4 | 4.6 | 4.8 | 5.0 | 5.2 | 5.4 | 5.6 | 5.8 | 6.0 | 6.2 |
| 36 00 | 3.8 | 4.0 | 4.2 | 4.4 | 4.6 | 4.8 | 5.0 | 5.2 | 5.4 | 5.6 | 5.8 | 6.0 |
| 41 00 | 3.6 | 3.8 | 4.0 | 4.2 | 4.4 | 4.6 | 4.8 | 5.0 | 5.2 | 5.4 | 5.6 | 5.8 |
| 48 00 | 3.4 | 3.6 | 3.8 | 4.0 | 4.2 | 4.4 | 4.6 | 4.8 | 5.0 | 5.2 | 5.4 | 5.6 |
| 55 00 | 3.2 | 3.4 | 3.6 | 3.8 | 4.0 | 4.2 | 4.4 | 4.6 | 4.8 | 5.0 | 5.2 | 5.4 |
| 65 00 | 3.0 | 3.2 | 3.4 | 3.6 | 3.8 | 4.0 | 4.2 | 4.4 | 4.6 | 4.8 | 5.0 | 5.2 |
| 75 00 | 2.8 | 3.0 | 3.2 | 3.4 | 3.6 | 3.8 | 4.0 | 4.2 | 4.4 | 4.6 | 4.8 | 5.0 |
| 85 00 | 2.6 | 2.8 | 3.0 | 3.2 | 3.4 | 3.6 | 3.8 | 4.0 | 4.2 | 4.4 | 4.6 | 4.8 |
| 90 00 | 2.5 | 2.7 | 2.9 | 3.1 | 3.3 | 3.5 | 3.7 | 3.9 | 4.1 | 4.3 | 4.5 | 4.7 |

| Metres | 22.2 | 23.3 | 24.4 | 25.5 | 26.7 | 27.9 | 29.1 | 30.3 | 31.6 | 32.9 | 34.0 | 35.5 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Feet | 73 | 76 | 80 | 84 | 88 | 92 | 95 | 99 | 104 | 108 | 112 | 116 |
| Obs. Alt. | ′ | ′ | ′ | ′ | ′ | ′ | ′ | ′ | ′ | ′ | ′ | ′ |
| 10 00 | 13.6 | 13.8 | 14.0 | 14.2 | 14.4 | 14.6 | 14.8 | 15.0 | 15.2 | 15.4 | 15.6 | 15.8 |
| 30 | 13.4 | 13.6 | 13.8 | 14.0 | 14.2 | 14.4 | 14.6 | 14.8 | 15.0 | 15.2 | 15.4 | 15.6 |
| 11 00 | 13.2 | 13.4 | 13.6 | 13.8 | 14.0 | 14.2 | 14.4 | 14.6 | 14.8 | 15.0 | 15.2 | 15.4 |
| 30 | 13.0 | 13.2 | 13.4 | 13.6 | 13.8 | 14.0 | 14.2 | 14.4 | 14.6 | 14.8 | 15.0 | 15.2 |
| 12 00 | 12.8 | 13.0 | 13.2 | 13.4 | 13.6 | 13.8 | 14.0 | 14.2 | 14.4 | 14.6 | 14.8 | 15.0 |
| 30 | 12.6 | 12.8 | 13.0 | 13.2 | 13.4 | 13.6 | 13.8 | 14.0 | 14.2 | 14.4 | 14.6 | 14.8 |
| 13 00 | 12.4 | 12.6 | 12.8 | 13.0 | 13.2 | 13.4 | 13.6 | 13.8 | 14.0 | 14.2 | 14.4 | 14.6 |
| 30 | 12.2 | 12.4 | 12.6 | 12.8 | 13.0 | 13.2 | 13.4 | 13.6 | 13.8 | 14.0 | 14.2 | 14.4 |
| 14 00 | 12.0 | 12.2 | 12.4 | 12.6 | 12.8 | 13.0 | 13.2 | 13.4 | 13.6 | 13.8 | 14.0 | 14.2 |
| 15 00 | 11.8 | 12.0 | 12.2 | 12.4 | 12.6 | 12.8 | 13.0 | 13.2 | 13.4 | 13.6 | 13.8 | 14.0 |
| 16 00 | 11.6 | 11.8 | 12.0 | 12.2 | 12.4 | 12.6 | 12.8 | 13.0 | 13.2 | 13.4 | 13.6 | 13.8 |
| 17 00 | 11.4 | 11.6 | 11.8 | 12.0 | 12.2 | 12.4 | 12.6 | 12.8 | 13.0 | 13.2 | 13.4 | 13.6 |
| 18 00 | 11.2 | 11.4 | 11.6 | 11.8 | 12.0 | 12.2 | 12.4 | 12.6 | 12.8 | 13.0 | 13.2 | 13.4 |
| 19 00 | 11.0 | 11.2 | 11.4 | 11.6 | 11.8 | 12.0 | 12.2 | 12.4 | 12.6 | 12.8 | 13.0 | 13.2 |
| 21 00 | 10.8 | 11.0 | 11.2 | 11.4 | 11.6 | 11.8 | 12.0 | 12.2 | 12.4 | 12.6 | 12.8 | 13.0 |
| 23 00 | 10.6 | 10.8 | 11.0 | 11.2 | 11.4 | 11.6 | 11.8 | 12.0 | 12.2 | 12.4 | 12.6 | 12.8 |
| 25 00 | 10.4 | 10.6 | 10.8 | 11.0 | 11.2 | 11.4 | 11.6 | 11.8 | 12.0 | 12.2 | 12.4 | 12.6 |
| 27 00 | 10.2 | 10.4 | 10.6 | 10.8 | 11.0 | 11.2 | 11.4 | 11.6 | 11.8 | 12.0 | 12.2 | 12.4 |
| 29 00 | 10.0 | 10.2 | 10.4 | 10.6 | 10.8 | 11.0 | 11.2 | 11.4 | 11.6 | 11.8 | 12.0 | 12.2 |
| 33 00 | 9.8 | 10.0 | 10.2 | 10.4 | 10.6 | 10.8 | 11.0 | 11.2 | 11.4 | 11.6 | 11.8 | 12.0 |
| 36 00 | 9.6 | 9.8 | 10.0 | 10.2 | 10.4 | 10.6 | 10.8 | 11.0 | 11.2 | 11.4 | 11.6 | 11.8 |
| 41 00 | 9.4 | 9.6 | 9.8 | 10.0 | 10.2 | 10.4 | 10.6 | 10.8 | 11.0 | 11.2 | 11.4 | 11.6 |
| 48 00 | 9.2 | 9.4 | 9.6 | 9.8 | 10.0 | 10.2 | 10.4 | 10.6 | 10.8 | 11.0 | 11.2 | 11.4 |
| 55 00 | 9.0 | 9.2 | 9.4 | 9.6 | 9.8 | 10.0 | 10.2 | 10.4 | 10.6 | 10.8 | 11.0 | 11.2 |
| 65 00 | 8.8 | 9.0 | 9.2 | 9.4 | 9.6 | 9.8 | 10.0 | 10.2 | 10.4 | 10.6 | 10.8 | 11.0 |
| 75 00 | 8.6 | 8.8 | 9.0 | 9.2 | 9.4 | 9.6 | 9.8 | 10.0 | 10.2 | 10.4 | 10.6 | 10.8 |
| 85 00 | 8.4 | 8.6 | 8.8 | 9.0 | 9.2 | 9.4 | 9.6 | 9.8 | 10.0 | 10.2 | 10.4 | 10.6 |
| 90 00 | 8.3 | 8.5 | 8.7 | 8.9 | 9.1 | 9.3 | 9.5 | 9.7 | 9.9 | 10.1 | 10.3 | 10.5 |

*To be SUBTRACTED from the Observed Altitude of the Star*

Height of Eye

| 7.7 | 8.4 | 9.1 | 9.8 | 10.5 | 11.2 | 12.0 | 12.8 | 13.6 | 14.5 | 15.4 | 16.3 | 17.2 | 18.2 | 19.2 | 20.2 | 21.2 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 25 | 28 | 30 | 32 | 34 | 37 | 38 | 42 | 45 | 48 | 51 | 53 | 56 | 60 | 63 | 66 | 70 |
| ′ | ′ | ′ | ′ | ′ | ′ | ′ | ′ | ′ | ′ | ′ | ′ | ′ | ′ | ′ | ′ | ′ |
| 10.2 | 10.4 | 10.6 | 10.8 | 11.0 | 11.2 | 11.4 | 11.6 | 11.8 | 12.0 | 12.2 | 12.4 | 12.6 | 12.8 | 13.0 | 13.2 | 13.4 |
| 10.0 | 10.2 | 10.4 | 10.6 | 10.8 | 11.0 | 11.2 | 11.4 | 11.6 | 11.8 | 12.0 | 12.2 | 12.4 | 12.6 | 12.8 | 13.0 | 13.2 |
| 9.8 | 10.0 | 10.2 | 10.4 | 10.6 | 10.8 | 11.0 | 11.2 | 11.4 | 11.6 | 11.8 | 12.0 | 12.2 | 12.4 | 12.6 | 12.8 | 13.0 |
| 9.6 | 9.8 | 10.0 | 10.2 | 10.4 | 10.6 | 10.8 | 11.0 | 11.2 | 11.4 | 11.6 | 11.8 | 12.0 | 12.2 | 12.4 | 12.6 | 12.8 |
| 9.4 | 9.6 | 9.8 | 10.0 | 10.2 | 10.4 | 10.6 | 10.8 | 11.0 | 11.2 | 11.4 | 11.6 | 11.8 | 12.0 | 12.2 | 12.4 | 12.6 |
| 9.2 | 9.4 | 9.6 | 9.8 | 10.0 | 10.2 | 10.4 | 10.6 | 10.8 | 11.0 | 11.2 | 11.4 | 11.6 | 11.8 | 12.0 | 12.2 | 12.4 |
| 9.0 | 9.2 | 9.4 | 9.6 | 9.8 | 10.0 | 10.2 | 10.4 | 10.6 | 10.8 | 11.0 | 11.2 | 11.4 | 11.6 | 11.8 | 12.0 | 12.2 |
| 8.8 | 9.0 | 9.2 | 9.4 | 9.6 | 9.8 | 10.0 | 10.2 | 10.4 | 10.6 | 10.8 | 11.0 | 11.2 | 11.4 | 11.6 | 11.8 | 12.0 |
| 8.6 | 8.8 | 9.0 | 9.2 | 9.4 | 9.6 | 9.8 | 10.0 | 10.2 | 10.4 | 10.6 | 10.8 | 11.0 | 11.2 | 11.4 | 11.6 | 11.8 |
| 8.4 | 8.6 | 8.8 | 9.0 | 9.2 | 9.4 | 9.6 | 9.8 | 10.0 | 10.2 | 10.4 | 10.6 | 10.8 | 11.0 | 11.2 | 11.4 | 11.6 |
| 8.2 | 8.4 | 8.6 | 8.8 | 9.0 | 9.2 | 9.4 | 9.6 | 9.8 | 10.0 | 10.2 | 10.4 | 10.6 | 10.8 | 11.0 | 11.2 | 11.4 |
| 8.0 | 8.2 | 8.4 | 8.6 | 8.8 | 9.0 | 9.2 | 9.4 | 9.6 | 9.8 | 10.0 | 10.2 | 10.4 | 10.6 | 10.8 | 11.0 | 11.2 |
| 7.8 | 8.0 | 8.2 | 8.4 | 8.6 | 8.8 | 9.0 | 9.2 | 9.4 | 9.6 | 9.8 | 10.0 | 10.2 | 10.4 | 10.6 | 10.8 | 11.0 |
| 7.6 | 7.8 | 8.0 | 8.2 | 8.4 | 8.6 | 8.8 | 9.0 | 9.2 | 9.4 | 9.6 | 9.8 | 10.0 | 10.2 | 10.4 | 10.6 | 10.8 |
| 7.4 | 7.6 | 7.8 | 8.0 | 8.2 | 8.4 | 8.6 | 8.8 | 9.0 | 9.2 | 9.4 | 9.6 | 9.8 | 10.0 | 10.2 | 10.4 | 10.6 |
| 7.2 | 7.4 | 7.6 | 7.8 | 8.0 | 8.2 | 8.4 | 8.6 | 8.8 | 9.0 | 9.2 | 9.4 | 9.6 | 9.8 | 10.0 | 10.2 | 10.4 |
| 7.0 | 7.2 | 7.4 | 7.6 | 7.8 | 8.0 | 8.2 | 8.4 | 8.6 | 8.8 | 9.0 | 9.2 | 9.4 | 9.6 | 9.8 | 10.0 | 10.2 |
| 6.8 | 7.0 | 7.2 | 7.4 | 7.6 | 7.8 | 8.0 | 8.2 | 8.4 | 8.6 | 8.8 | 9.0 | 9.2 | 9.4 | 9.6 | 9.8 | 10.0 |
| 6.6 | 6.8 | 7.0 | 7.2 | 7.4 | 7.6 | 7.8 | 8.0 | 8.2 | 8.4 | 8.6 | 8.8 | 9.0 | 9.2 | 9.4 | 9.6 | 9.8 |
| 6.4 | 6.6 | 6.8 | 7.0 | 7.2 | 7.4 | 7.6 | 7.8 | 8.0 | 8.2 | 8.4 | 8.6 | 8.8 | 9.0 | 9.2 | 9.4 | 9.6 |
| 6.2 | 6.4 | 6.6 | 6.8 | 7.0 | 7.2 | 7.4 | 7.6 | 7.8 | 8.0 | 8.2 | 8.4 | 8.6 | 8.8 | 9.0 | 9.2 | 9.4 |
| 6.0 | 6.2 | 6.4 | 6.6 | 6.8 | 7.0 | 7.2 | 7.4 | 7.6 | 7.8 | 8.0 | 8.2 | 8.4 | 8.6 | 8.8 | 9.0 | 9.2 |
| 5.8 | 6.0 | 6.2 | 6.4 | 6.6 | 6.8 | 7.0 | 7.2 | 7.4 | 7.6 | 7.8 | 8.0 | 8.2 | 8.4 | 8.6 | 8.8 | 9.0 |
| 5.6 | 5.8 | 6.0 | 6.2 | 6.4 | 6.6 | 6.8 | 7.0 | 7.2 | 7.4 | 7.6 | 7.8 | 8.0 | 8.2 | 8.4 | 8.6 | 8.8 |
| 5.4 | 5.6 | 5.8 | 6.0 | 6.2 | 6.4 | 6.6 | 6.8 | 7.0 | 7.2 | 7.4 | 7.6 | 7.8 | 8.0 | 8.2 | 8.4 | 8.6 |
| 5.2 | 5.4 | 5.6 | 5.8 | 6.0 | 6.2 | 6.4 | 6.6 | 6.8 | 7.0 | 7.2 | 7.4 | 7.6 | 7.8 | 8.0 | 8.2 | 8.4 |
| 5.0 | 5.2 | 5.4 | 5.6 | 5.8 | 6.0 | 6.2 | 6.4 | 6.6 | 6.8 | 7.0 | 7.2 | 7.4 | 7.6 | 7.8 | 8.0 | 8.2 |
| 4.9 | 5.1 | 5.3 | 5.5 | 5.7 | 5.9 | 6.1 | 6.3 | 6.5 | 6.7 | 6.9 | 7.1 | 7.3 | 7.5 | 7.7 | 7.9 | 8.1 |

| 37.0 | 38.5 | 40.0 | 41.5 | 43.0 | 44.5 | 46.0 | 47.5 | 49.0 |
|---|---|---|---|---|---|---|---|---|
| 121 | 126 | 131 | 136 | 141 | 146 | 151 | 156 | 161 |
| ′ | ′ | ′ | ′ | ′ | ′ | ′ | ′ | ′ |
| 16.0 | 16.2 | 16.4 | 16.6 | 16.8 | 17.0 | 17.2 | 17.4 | 17.6 |
| 15.8 | 16.0 | 16.2 | 16.4 | 16.6 | 16.8 | 17.0 | 17.2 | 17.4 |
| 15.6 | 15.8 | 16.0 | 16.2 | 16.4 | 16.6 | 16.8 | 17.0 | 17.2 |
| 15.4 | 15.6 | 15.8 | 16.0 | 16.2 | 16.4 | 16.6 | 16.8 | 17.0 |
| 15.2 | 15.4 | 15.6 | 15.8 | 16.0 | 16.2 | 16.4 | 16.6 | 16.8 |
| 15.0 | 15.2 | 15.4 | 15.6 | 15.8 | 16.0 | 16.2 | 16.4 | 16.6 |
| 14.8 | 15.0 | 15.2 | 15.4 | 15.6 | 15.8 | 16.0 | 16.2 | 16.4 |
| 14.6 | 14.8 | 15.0 | 15.2 | 15.4 | 15.6 | 15.8 | 16.0 | 16.2 |
| 14.4 | 14.6 | 14.8 | 15.0 | 15.2 | 15.4 | 15.6 | 15.8 | 16.0 |
| 14.2 | 14.4 | 14.6 | 14.8 | 15.0 | 15.2 | 15.4 | 15.6 | 15.8 |
| 14.0 | 14.2 | 14.4 | 14.6 | 14.8 | 15.0 | 15.2 | 15.4 | 15.6 |
| 13.8 | 14.0 | 14.2 | 14.4 | 14.6 | 14.8 | 15.0 | 15.2 | 15.4 |
| 13.6 | 13.8 | 14.0 | 14.2 | 14.4 | 14.6 | 14.8 | 15.0 | 15.2 |
| 13.4 | 13.6 | 13.8 | 14.0 | 14.2 | 14.4 | 14.6 | 14.8 | 15.0 |
| 13.2 | 13.4 | 13.6 | 13.8 | 14.0 | 14.2 | 14.4 | 14.6 | 14.8 |
| 13.0 | 13.2 | 13.4 | 13.6 | 13.8 | 14.0 | 14.2 | 14.4 | 14.6 |
| 12.8 | 13.0 | 13.2 | 13.4 | 13.6 | 13.8 | 14.0 | 14.2 | 14.4 |
| 12.6 | 12.8 | 13.0 | 13.2 | 13.4 | 13.6 | 13.8 | 14.0 | 14.2 |
| 12.4 | 12.6 | 12.8 | 13.0 | 13.2 | 13.4 | 13.6 | 13.8 | 14.0 |
| 12.2 | 12.4 | 12.6 | 12.8 | 13.0 | 13.2 | 13.4 | 13.6 | 13.8 |
| 12.0 | 12.2 | 12.4 | 12.6 | 12.8 | 13.0 | 13.2 | 13.4 | 13.6 |
| 11.8 | 12.0 | 12.2 | 12.4 | 12.6 | 12.8 | 13.0 | 13.2 | 13.4 |
| 11.6 | 11.8 | 12.0 | 12.2 | 12.4 | 12.6 | 12.8 | 13.0 | 13.2 |
| 11.4 | 11.6 | 11.8 | 12.0 | 12.2 | 12.4 | 12.6 | 12.8 | 13.0 |
| 11.2 | 11.4 | 11.6 | 11.8 | 12.0 | 12.2 | 12.4 | 12.6 | 12.8 |
| 11.0 | 11.2 | 11.4 | 11.6 | 11.8 | 12.0 | 12.2 | 12.4 | 12.6 |
| 10.8 | 11.0 | 11.2 | 11.4 | 11.6 | 11.8 | 12.0 | 12.2 | 12.4 |
| 10.7 | 10.9 | 11.1 | 11.3 | 11.5 | 11.7 | 11.9 | 12.1 | 12.3 |