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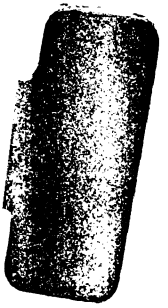

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DIRECTIONAL ASTROLOGY

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DIRECTIONAL ASTROLOGY

TO WHICH IS ADDED A DISCUSSION OF PROBLEMATIC POINTS AND A COMPLETE SET OF TABLES NECESSARY FOR THE CALCULATION OF ARCS OF DIRECTION

BY

SEPHARIAL

AUTHOR OF
"COSMIC SYMBOLISM," "A MANUAL OF ASTROLOGY,"
"A MANUAL OF OCCULTISM," "THE KABALA OF NUMBERS,"
"KABALISTIC ASTROLOGY," ETC.

PHILADELPHIA
DAVID McKAY
604-608 SOUTH WASHINGTON SQUARE
1921

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PRINTED IN GREAT BRITAIN BY
NEILL AND CO., LTD.,
EDINBURGH.

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PREFACE

A WORD by way of introduction to this work may be necessary, inasmuch as it deals with a technical subject, and the scope and purport of it cannot very readily be apprehended by the casual reader. It is essentially a book for the astrological student. To the astronomer it is particularly informing in that it brings out the more scientific part of the subject and shows the mathematical basis underlying the "lucky hits" to which many of our astrological exponents have undisputed claim.

The general scope of this work embraces all that is essential to the art of "directing" as practised by Claudius Ptolemy and Titus de Placidus, and more recently by Sir John Wharton, Mr John Gadbury, Commander Morrison, R.N., and Mr A. J. Pearce, all of whom pursued the same general principles of astronomical directing, and differed considerably in their application of the celestial arcs to the measure of time. These points are reviewed and critically examined in the following pages.

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An attempt having been made to bring the Arabian system of a day for a year into accord with the astronomical system of a degree for a year, some suggestions have here been made as to their rapprochement, the feeling being that, where credit is claimed for one system over another by exponents of either, the probability is that there is truth in both and hence there must be a co-ordinating factor. In the attempt to scientifically extend our horizon to include a prescience of coming events, we have primarily to remember that there are many ways up a mountain, but there is only one top. A study of these various methods may lead to the conclusion that they are all leading in the same direction. It is as if one should say there are three hundred and sixty paces from end to end of the path, and another should say that there are three hundred and sixty-five. Both may be right according to their count and the measure of their tread, but the actual length of the path will remain the same whatever they make of it. This pathway is that which a man has to travel from his cradle to his grave; and there is nothing that concerns a man so vitally as that he should know its trend and gradient, its pitfalls and rocky eminences, in advance of his going, so that experience may be laid by the heels and made to serve instead of to subjugate. And in the direst extreme of human experience we have to remember that "the wise man foreseeth the evil

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and obscureth himself, while the ignorant pass on and are hurt."

I have used a well-known and thoroughly authenticated horoscope for purposes of illustration, and anybody following the rules here given in relation to that horoscope will have no difficulty in following them out in respect to any other horoscope. Particular care has been taken to define the principle underlying each operation, and to give a clean-cut rule of procedure. Unlike most authors, who proceed by befogging the mind of the student with technicalities and afterwards explaining them by means of an appendix, I have devoted the first chapters of my work to technical definitions which are essential to the proper understanding of the subject; and until these are clearly apprehended and understood, the student need go no further.

To save further expense and trouble, my publishers have completed my work by the insertion of a complete set of tables, which include tables of Right Ascension and Declination for every degree of the zodiac, together with the ascensional difference due to the latitudes of London, Birmingham, and Liverpool under the present obliquity of the Ecliptic; also tables of Sines and Tangents, and tables of Proportional Logarithms. These are all that are essential to the present treatise, and in themselves constitute a very valuable addition to the volume. It is, of course, presumed that the

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student of "Directional Astrology" will have mastered the preliminary task of setting a horoscope for any given time and place with adequate precision, and hence that he is familiar with the use of an ephemeris. The present work is intended to replace and supersede *Prognostic Astronomy*, which is now out of print.

Beyond this I have nothing to say, save that I trust to have done my work efficiently and to have left no point on which a reader need question me. In such case the work may be regarded as complete, and so I hope it will be found.

SEPHARIAL.

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Directional Astrology

CHAPTER I

ASTRONOMICAL DEFINITIONS

THE following definitions must be fully understood by the student before the more intricate part of the system of directing is undertaken.

Longitude is of two kinds : longitude in the Orbit, and longitude in the Ecliptic. The latter is the only one recognised and used in this system. It is defined as distance from the vernal equinox, Aries 0, measured on the plane of the Ecliptic or Sun's path.

Latitude.—Celestial latitude is distance north or south of the Ecliptic.

Declination is distance north or south of the Equator. The Ecliptic lies in declination 23° 27′ north and south.

Right Ascension is distance from the vernal equinox measured on the plane of the Equator. Right ascension thus answers to geographical longitude in the same way as declination answers to geographical latitude.

Meridian Distance is the distance of a celestial

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body from the midheaven of a place; that is to say, from its meridian, measured in right ascension.

Semiarc of a planet is half the time it remains above or below the horizon of a place, measured in degrees of right ascension. The diurnal semiarc is half the arc in right ascension of a planet above the horizon, and nocturnal semiarc is half the time it is (measured in right ascension) below the horizon. The diurnal semiarc taken from 180° will give the nocturnal semiarc, and the nocturnal semiarc taken from 180° will give the diurnal semiarc.

Horizontal Arc is the distance in right ascension from a body to the point of its rising or setting. The semiarc less the meridian distance is always the horizontal arc.

Oblique Ascension is the right ascension of a body increased or diminished by its ascensional difference, according as its declination may be south or north. In northern latitudes the right ascension is increased for a body having south declination and decreased for a body having north declination, but the reverse of this is the case in southern latitudes.

Ascensional Difference is the time (measured in right ascension) that a body is above or below the horizon more or less than six hours. If, therefore, its semiarc is more than 90° the excess of 90° is its ascensional difference. All bodies that are not exactly on the equinox (Aries 0 or Libra 0) have ascensional difference. For a planet in south declination the ascensional difference is added to

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its right ascension to get its oblique ascension, and for bodies having north declination the ascensional difference is subtracted. The reverse of this gives the oblique descension. The O.A. plus or minus 180° gives the obl. descension of the opposite point.

Pole of Latitude.—The pole of a place is the same as its latitude. The pole of a planet is measured by a circle of position or small circle parallel to the meridian of a place. The pole of the ascendant is the same as the latitude of the place, and this diminishes as we reach the meridian, where it is 0.

Direction is the process by which we bring the body of a planet to the longitude or body of another in a different part of the heavens either by its rising or setting, and this direction of one body to another, or to the place of another, is measured in right ascension; that is to say, by the number of degrees which pass under the meridian of a place in the interval. All directions are taken in the prime vertical, or circle of observation—that in which a person stands upright facing south. Having the proportional distance of a planet between the meridian and horizon, we may bring another body to the same proportional distance along its own arc until it appears to be in the same relative position as the first body. This supposes that the position and influence of a planet is indelibly located in that part of the heavens in which it was found at the moment of birth. All arcs of direction are measured in right ascension.

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Significators, in this scheme, are the Midheaven, Ascendant, Sun, and Moon. These are the bodies or positions that are directed or moved in the prime vertical in order to form conjunctions, oppositions, and various aspects with other positions and bodies. They are called "significators," from the fact that they are found to signify certain things in the life of an individual; as, the Sun signifies male relationships, the Moon female relationships, the Midheaven honour and position, credit, etc., and the Ascendant the health and general play of events in the individual sphere of life. For further elaboration of this point refer to the *Textbook of Astrology* or *The New Manual of Astrology*.

Promittors.—These are the planets Neptune, Uranus, Saturn, Jupiter, Mars, Venus, and Mercury. The Sun and Moon may also be classed as promittors when the Midheaven or Ascendant is directed to them.

Logarithms, invented by Baron Napier of Merchiston, first-class mathematician and astrologer, were designed for the purpose of simplifying calculations in spherical trigonometry. In this scheme the arc of 90° of a right sphere is made to equal 10·00000, which is called the radix. Then, having the logarithm of any arc, it may be multiplied into any other arc by simple addition of their logarithms; and, similarly, arcs may be divided by one another by subtracting one logarithm from another. Napier thus emphasises the fact that multiplication is

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merely the addition of a number to itself a given number of times, while division is merely subtraction a number of times. Then by means of a proportional circle we can multiply and divide any arc by simple addition and subtraction. The complement of an arc is what it lacks of 90°, and as this is equal to the radix 10, the complement of a logarithm is what it lacks of 10. Thus the logarithm of the sine of 32° is log. sine 9·72421, which is also the log. cosine of 58°, because 58 is the complement of 32, both together making 90. The arithmetical complement of the logarithm is 0·27579, since this, added to the log. sine of 32°, makes 10·00000. Familiarity with the use of logarithms will readily establish their great value in all mathematical calculations connected with the sphere.

I may now ask the reader to take in hand an ephemeris for the current year, 1916, and turn to the 1st January, and the above definitions may then be illustrated.

Let us suppose that a birth took place at noon, Greenwich mean time, on that date in London. The ephemeris being calculated for mean noon at Greenwich, there will be no equation of time necessary. The Sun, Moon, and planets will be in the positions indicated in the ephemeris. The Sun's longitude is seen to be Capricornus 9° 45′ 14″. The Sun never has latitude, inasmuch as it defines the Ecliptic, distance above or below which constitutes celestial latitude. All other bodies have

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latitude except when they are on that point where their orbits cross the Ecliptic, that is, their nodes. The course of the Sun being across the plane of the Equator at an angle of 23° 27′ it will attain that declination at the solstices; that is to say, on the 21st June and the 22nd December. On the 1st January it is found to have declination 23° 6′ south of the Equator, and, therefore, would be immediately overhead at noon at a place which had geographical latitude 23° 6′ south, and the Sun's diurnal course around the Earth would follow this parallel of latitude. The Sun's right ascension (R.A.) can be found in the tables (see Appendix) from its longitude.

Rule 1.—To find the R.A. of any body without latitude.

From the log. cosine of its distance from the nearest equinox subtract the log. cosine of its declination. Remainder is the log. cosine of its R.A. from the same equinox.

Example: The Sun is here 80° 15′ from Aries 0 . . cos. 9·22878
Its declination is 23° 6′ cos. 9·96370

Distance in R.A. from Aries 0 = 79° 23′ . cos. 9·26508

Therefore from 360° take 79° 23′, and the R.A. of the Sun is thus found to be 280° 37′. Note that it is sufficient for our purpose to take the various quantities to the nearest minute of space.

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Now take the Moon's place in the ephemeris, which is seen to be Scorpio 17° 54′. This is 47° 54′ from Libra 0. The declination of the Moon is 22° 7′. Reference to the tables will show that the declination of Scorpio 17° 54′ is 17° 10′ only, and we therefore know that the Moon has latitude and is not on the Ecliptic at this time. The ephemeris shows it to have 5° 9′ of south latitude. In finding its R.A., therefore, we have to take this latitude into account.

Rule 2.—To find the R.A. of a body having latitude.

Add the log. cos. of its distance from the equinox to the log. cos. of its latitude, and from the sum subtract the log. cos. of its declination. The remainder is log. cos. of its R.A. from the same equinox.

Example:	Moon's distance from Libra 0 = 47° 54′ .	cos. 9·82635
	Its latitude is 5° 9′ .	cos. 9·99824
	Sum . .	cos. 9·82459
	Moon's declination, 22° 7′ . . .	cos. 9·96681
Its R.A. from Libra 0 =	43° 53′	cos. 9·85778
R.A. Libra 0 =	180° 0′	
Moon's R.A. =	223° 53′	

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Note.—If we take the arithmetical complement of the log. cos. of the declination and add it to the log. cos. of both the latitude and the longitudinal distance, we shall have the same result.

The R.A. of the other bodies is taken in the same manner, as they all happen to have some measure of latitude. Only when a body is in its node, and therefore coincident with the Ecliptic, does it have no latitude. In such case its R.A. is the same as that of the degree of the Ecliptic it holds.

We have next to find the meridian distances of the several bodies. To do this we have to find the R.A. of the Midheaven and Nadir, and take the nearest distance in R.A. of each body. Thus at noon on the 1st January 1916 the sidereal time is 18h. 39m. 16 secs. Convert this into degrees and minutes of the circle, thus: multiply the hours by 15 and call them degrees; divide the minutes of time by 4 and call them degrees and minutes of space; also divide the seconds of time by 4 and call them minutes and seconds of space.

Thus 18h.	=	270° 0′ 0″
39m.	=	9° 45′ 0″
16s.	=	0° 4′ 0″
R.A. of M.C.	=	279° 49′ 0″
		180° 0′ 0″
R.A. of I.C.	=	99° 49′ 0″

The upper meridian is called the Midheaven

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(*medium cœli*) and the lower meridian is called the Nadir (*imaum cœli*).

Having the R.A. of the M.C. and I.C., we are able to find the quantity of R.A. which separates the various planets from them, and this is the meridian distance of each of such planets.

Thus the Sun's R.A. was found to be 280° 37′, and that of the M.C. (to which it is nearest) is 279° 49′. The difference is 0° 48′, which is therefore the meridian distance of the Sun.

The Moon is found to be in the South-west quarter of the heavens, and therefore nearer to the upper than the lower meridian. Its meridian distance must therefore be taken from this point. Thus :

R.A. of M.C.	=279° 49′
R.A., Moon	=223° 53′
Meridian distance of Moon	= 55° 56′

The other bodies are taken in the same way according to which meridian (upper or lower) they are nearest in R.A.

The semiarcs of the planets and luminaries have next to be found.

Rule 3.—To the log. tangent of the latitude of place for which the figure is set, or the horoscope cast, add the log. tangent of the planet's declination. The sum is the log. sine of the ascensional difference of that planet under the latitude of birth.

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Uniformly, add this ascensional difference to 90° when the planet's R.A. is less than 180°, and subtract it from 90° if the planet's R.A. is more than 180°. The result is the diurnal semiarc of that planet. By subtracting this from 180° you will have the nocturnal semiarc.

Finally, by taking the meridian distance of the planet from its semiarc (diurnal if above the horizon, and nocturnal if below), you will have the horizontal arc, or distance in R.A. from the horizon.

Next find the proportional logarithm of the semiarc of each body, and take its arithmetical complement. Add to this A.C. the proportional logarithm of the planet's meridian distance. This is the constant log. of the planet for purposes of directing.

Enter all these elements into a single table, which is called the Speculum, an example of which will be found in the following pages. The scheme will now be ready for the practice of directing.

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CHAPTER II

EXAMPLE HOROSCOPE

For the purpose of illustrating the method of directing by proportional semiarcs, I have selected the horoscope of John Ruskin, whose *Fors Clavigera, Mornings in Florence,* and other world-renowned works have stamped him indelibly as artist and man of letters as well as an independent thinker of considerable virility.

He was born at 7.30 in the morning of 8th February 1819, in London.

It is an invariable rule in practice to use that semiarc and meridian distance which are related to one another. Thus the Sun in the speculum is just below the east horizon at the moment of birth, as may be seen by comparing its nocturnal semiarc with its distance from the lower meridian, which are 110° 1′ and 108° 44′ respectively. This shows the Sun to be 1° 17′ below the horizon. But as by the diurnal rotation of the earth on its axis from west to east the Sun will be carried above the east horizon upwards towards the Midheaven, during the course of which it will pass the places

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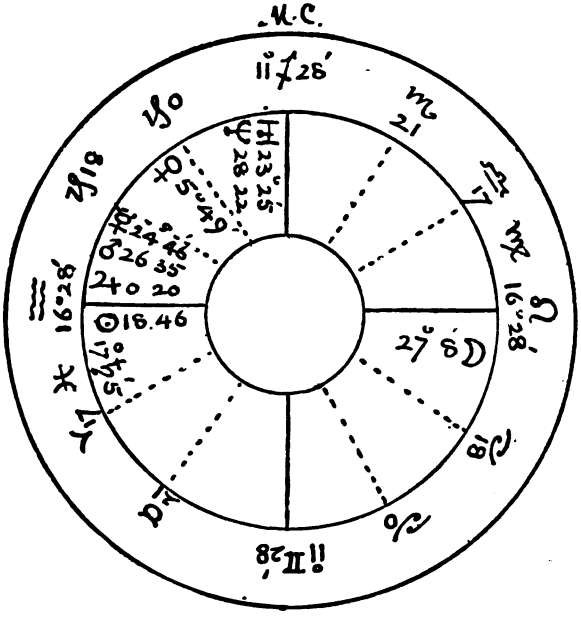

SPECULUM.

Planets.	Lat.	Declin.	R.A.	Merid. Dist.	Semi-arc.	Hor. Arc.
	° ′	° ′	° ′	° ′	° ′	° ′
Sun . .	—	15 13 S.	321 12	108 44	110 1	1 17
Moon . .	5 1 N.	25 39 N.	120 17	50 21	52 51	2 30
Mercury .	0 23 S.	21 34 S.	296 47	46 51	60 11	13 20
Venus . .	5 10 N.	18 10 S.	276 6	26 10	65 37	39 27
Mars . .	0 55 S.	21 45 S.	299 6	49 10	59 53	10 43
Jupiter . .	0 21 S.	20 26 S.	302 37	52 41	62 3	9 22
Saturn . .	1 56 S.	6 54 S.	348 54	81 2	98 45	17 43
Uranus . .	0 6 S.	23 24 S	262 49	12 53	57 1	44 8
Neptune .	1 13 N.	22 14 S.	267 47	17 51	59 5	41 14

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of Mars, Mercury, Venus, Neptune, and Uranus, it will be convenient also to have the semidiurnal arc and the meridian distance from the Midheaven. For whenever we use the nocturnal arc we always use the corresponding meridian distance from the lower meridian, and whenever we use the diurnal arc we also use the corresponding meridian distance from the Midheaven or upper meridian. This point should not be forgotten. It cannot be overlooked if the constant log. of the planet is inserted in the speculum, because this embodies the proportion of the semiarc to the corresponding meridian distance.

Ruskin was agreeably disposed towards the idea of planetary influence in human life, for, although he confessed entire ignorance of the subject himself, he was always willing that others should have the full benefit of his experience and views, and he readily gave his birth data to those who sought it for the purpose of astrological calculations. His assertion that "there is more in it than is generally supposed" was doubtless the opinion he formed of the science from experience; and if it does not carry the weight of scientific criticism, it stamps Ruskin, at all events, as a man of fearless integrity of thought.

In this horoscope we have a remarkable illustration of the principles of astrology. The Sun and Jupiter are rising in the humane sign Aquarius, while most of the planets are rising and above the

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horizon. These are indications of success and distinction in the world. The conjunction of Mars and Mercury in opposition to the Moon indicated that asperity and outspokenness which characterised this man of genius and rendered him fearless in the expression of his views. His eccentricities may well be attributed to the meridian position of Uranus and Neptune, while Venus, in closest aspect to Jupiter, and well elevated, disposed to success in the pursuit of art, of which he became a foremost exponent. But, of course, these positions do not make character. They only afford the opportunity for its full expression. Character and environment together constitute destiny, and it is undoubtedly often the case that one or the other of them is a misfit. It is only when we get a strong innate character with appropriate celestial environment that we look for the expression of genius.

We may now proceed to use this horoscope to illustrate the principles of directing.

Take first the Midheaven. This is directed by right ascension, and the planets coming to the meridian will form arcs of direction to it. The aspects to Midheaven should be noted. Thus the semisquare aspect falls in Capricorn 26° 28′, and the sextile aspect is Aquarius 11° 28′, and planets coming to these points will form aspects in the zodiac to the Midheaven. The square aspect falls in Pisces 11° 28′; and as Saturn is lower in the heavens than that point, it must come up to the

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place of this aspect and form the zodiacal square to the Midheaven. And the times in which these aspects are formed by the several planets will be in the proportion of their semiarcs. These directions are in zodiac.

The other kind of direction is in mundo—that is, in the circle of observation or prime vertical. Thus a body that is on the cusp of the twelfth house is in mundane sextile to the Midheaven or upper meridian, and one that is on the cusp of the eleventh house is in mundane sextile to the horizon or Ascendant. A planet that is in the middle of the eleventh house will be half way between the Midheaven and Ascendant, and, therefore, in semisquare aspect in mundo, because the meridian and horizon are always at right angles to one another. If a planet is not thus situated at the moment of birth it will afterwards attain that position, and the number of equatorial degrees which pass under the meridian from birth to the time when the aspect is formed will be the measure of the arc of direction. The original position of a body, either in the zodiac or in mundo, is always that to which direction is made.

Mundane Directions are those that are made to the apparent place of a celestial body, or to its aspects, in the circle of observation.

Zodiacal Directions are those which are made to the geocentric longitude of a body, or to aspects of that longitude, in the circle of observation or prime vertical.

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All directions are formed by the rotation of the Earth upon its axis from west to east, by which the planets appear to rise, culminate, and set, pursuing a course that is from east to west. The lines or arcs traversed by the planets in this apparent motion are parallels of latitude of the same quantity and denomination as geographical parallels of latitude—that is, lines parallel to the Equator. The planets follow the parallel of declination in which they are found at the time of birth.

It is understood that the radical imprint of a planet is localised in that part of the heavens it occupied at the moment of birth; and although the actual planets do thereafter change their declinations and semiarcs, as well as their meridian distances, the radical imprint of the planet remains ever the same, and is to be regarded as entirely distinct from the planet itself, which, of course, moves along its arc in the heavens.

In the process of directing we are, therefore, only concerned with the radix or root horoscope and the changes which thereafter take place in the heavens, not among the bodies themselves, but in their relations to the radix. All directions of this nature are formed within a few hours of the moment of birth.

Directions (whether in the zodiac or mundo) are of two orders. These are "direct" and "converse."

Direct directions are such as are formed by one

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body being carried by the motion of the Earth towards another body or aspect in the heavens that precedes it. Converse directions, however, are such as are formed in the opposite direction. Thus in the foregoing horoscope of Ruskin, if we bring the Sun to the place of Jupiter, or Mars, or Mercury, or Venus, these would be direct directions, because that is the direct motion of the bodies in the heavens. But if we brought the Sun to the place of Saturn it would appear that we are carrying it backwards to a position that it held previous to the moment of birth. This, however, is not the case. The Sun is joined to the Earth by a direct ray which is called its earth-line, and it is this line which, by the rotation of the Earth on its axis, is carried down (bearing the solar imprint) to the place held by Saturn at the birth. This is a converse direction. But if we bring Saturn up to the place of the Sun it would be a direct direction.

Therefore all directions are formed by the one natural fact of the Earth's rotation on its axis, and aspects that cannot thus be formed are not within the category of primary directions.

We may now pass on to illustrate the method of forming every kind of direction, direct and converse, in zodiac and mundo.

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CHAPTER III

DIRECTIONS IN MUNDO

THE principle involved in this process is that which enters into the construction of the horoscope, wherein we take one-third of the Sun's tropical semiarc as the extent of the house or division of the prime vertical. This principle enters into the construction of the tables of houses for various latitudes, the Sun's extreme declination remaining a constant quantity.

But in every horoscope we have the various planets with different declinations, and therefore with different semiarcs; and consequently we are dealing with arcs which, although parallel to the Equator and to one another, are not parallel to the circle of observation. Hence an equal division of the prime vertical into twelve parts or houses will not effect an equal division of the various planetary semiarcs, which cut the meridian and horizon at varying angles depending on their declinations. Nevertheless, it has been found in practice that one-third of the semiarc, great or small, is equal to a house-space under the pole of that planet.

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Suppose a planet to be exactly rising at the time of birth. Let its semidiurnal arc be 66° 21′. This is an arc of right ascension. Therefore when it has traversed one-third of its arc from the horizon to the meridian, 22° 7′ will have passed under the meridian, and that will be the arc of the planet's direction to the cusp of the twelfth house. Another 22° 7′ will bring it to the cusp of the eleventh house, and yet another arc of the same value will bring it to the meridian. When on the cusp of the twelfth house it will be in sextile aspect to the Midheaven, and when on the cusp of the eleventh it will be in sextile to the Ascendant, both directions being *in mundo*, as distinguished from similar aspects in the zodiac.

If the Sun or Moon happen to be exactly on the cusp of a house, then the planet coming to the cusp by one-third divisions of its semiarc will simultaneously form aspects in mundo to the Sun or Moon. But if they are not so placed, then we have to find their proportional distances from the nearest cusp or limit of a house, and bring the planet to the same proportional distance in order to form the aspect.

Rule.—To find the cuspal distance of a planet. Note the cusp to which it is nearest at the time of birth. The distance of that cusp from the horizon compared with the planet's horizontal arc will give the planet's cuspal distance.

Example.—In the specimen figure the Sun is

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nearest to the cusp of the first house or ascendant, and therefore its horizontal arc, 1° 17′, will be its cuspal distance. The Moon has a semiarc of 52° 51′, and its horizontal arc is 2° 30′, and as this is nearest to the cusp of the seventh house, that will also be its cuspal distance.

Now, as in all directions, the body to which direction is made is considered to remain stationary while the body directed is moved towards it by its natural motion in the heavens, we here direct the Moon to the sesquiquadrate aspect of the Sun, which it attains in the middle of the fifth house, that point being four and a half houses, or 135°, from the ascendant. The Sun, however, is not on the ascendant, and therefore we have to bring the Moon to a proportional distance from the middle of the fifth house. Thus :

As the semiarc of the Sun, 110° 1′, prop. log.	0·21381
arith. comp.	9·78619
Is to its cuspal distance, 1° 17′, .	2·14693
So is the semiarc of Moon, 52° 51′, .	0·53223
To its proportional distance, 0° 37′, prop. log.	2·46535

Now, as one-third of the Moon's semiarc is 17° 37′, that will be its house-space, and one-half will be 8° 48½′, making for one and a half houses 26° 25½′, and from this we subtract the above proportional

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distance, namely 0° 37′, and there remains the arc of direction: Moon, 135°, Sun in mundo, 25° 48½′.

Another example: Bring the Sun in the example horoscope to the mundane conjunction with Jupiter.

In order to effect this the Sun has to cross the horizon, its distance from which has been found to be 1° 17′. Thereafter we employ its diurnal arc and bring it to an equivalent distance from the horizon southwards as Jupiter is in the horoscope, by proportion of their semidiurnal arcs.

Jupiter's semiarc is 62° 3′, and its meridian distance 52° 41′, their difference 9° 22′, which is the horizontal arc of Jupiter and therefore its distance from the cusp of the first house. Then we say:—

As the semiarc Jupiter (arith. comp.) is to its cuspal distance, so is the semiarc of the Sun (diurnal =69° 59′) to its proportional distance from the same cusp southwards. This works out as follows:—

S.A. Jupiter, 62° 3′ . . .		log. 0·46253
Arith. comp.		9·53747
Cusp. distance, 9° 22′ . .		1·28369
S.A. Sun, 69° 59′ . . .		0·41028
Sun's prop. distance	=10° 34′	log. 1·23144
Sun to horizon	= 1° 17′	
Arc of direction	=11° 51′	

Sun conj. Jupiter *m.*

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It should be observed that the arc of direction to the horizon must always be added when the planet or body has to cross the horizon in forming the direction. Here the proportion of the Sun's arc to that of Jupiter gives a cuspal distance of 10° 34′, and to this has to be added the distance of the Sun from below the horizon, making the arc altogether 11° 51′. When crossing the meridian to form a direction, no change of arc is necessary, but the arc to the meridian, which is the meridian distance of the planet, must be added to the arc formed on the other side of it.

It should be observed also that the body to which direction is made, and which is supposed to be stationary, supplies the first and second terms of the proportion, while that body which moves to form the direction supplies the third term and the resulting fourth term. In practice it will be found expedient to arrange all the mundane aspects in the order in which they are formed by each of the planets. The Midheaven and Ascendant remain stationary, and the Sun, Moon, and planets are the promittors that are moved to form directions upon them. Take one of these bodies at a time and make a list of the mundane directions it forms to the Midheaven, Ascendant, Sun, and Moon, calculate them, and arrange them afterwards in the order of their values. Always remember that the diurnal motion of the Earth upon its axis from west to east is the underlying cause of all

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directions, and that the planet to which direction is made, remains still, while the other moves towards it. You cannot then go wrong in your application of the method.

Direction to the conjunction in mundo is effected by bringing the body of a planet to the body of another, and not to its zodiacal longitude merely, as is done in the case of the zodiacal conjunction.

Thus in the case of Uranus to conjunction M.C. in mundo, we take its meridian distance as the arc of direction, whereas in the zodiac we take the meridian distance of its longitude, Sagittarius 23° 25′, and this will be the arc of direction.

In all cases we bring the *body* of the planet directed to the conjunction or aspect of another body in mundo, to form mundane directions, all such directions being formed in the prime vertical, and expressed in terms of right ascension.

It will be found convenient to have the constant log. of the cuspal distance of each planet in the speculum. Subtract the proportional log. of the semiarc from the proportional log. of the cuspal distance. This will give the constant log., to which we have merely to add the proportional log. of the semiarc of any other planet to find the proportional cuspal distance of that planet.

It has been customary to regard the semiarc of a planet as equal to the quadrant, and therefore one-third as equal to a house or 30°. This is true in regard to a prime vertical whose pole is the

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same as the declination of the planet, but it is not true in regard to any other pole or geographical latitude. That is why we take the proportion of the semiarcs in finding the cuspal distances of planets. The test is this: If we take the oblique ascension of a planet, that is, exactly one-third of its semiarc from the horizon, it should have the same oblique ascension as the cusp of the twelfth house, but by adding 60 to the right ascension of the Mid-heaven to get the oblique ascension of that house, we shall find that if the planet has any other declination than 23° 27′ there is a difference between the two results. It cannot, therefore, be truly said that a planet is in mundane sextile aspect to the Mid-heaven when it is one-third of its semiarc above the horizon, inasmuch as its position in the prime vertical does not then coincide with the cusp of the twelfth house; but it may be said to correspond with that cusp on the general proposition that all circles are equal to one another and therefore that all quadrants are equal, and in practice it is found that one-third of a semiarc corresponds with one-third of the prime vertical, and this was allowed by Placidus, who was the first exponent of this system of mundane directions.

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CHAPTER IV

DIRECTIONS IN THE ZODIAC

THESE are calculated on the same principle as mundane directions, that is to say, by proportion of the semiarcs; but instead of taking the actual body of the planet, or its position in the prime vertical, we take the longitude only and direct to that, and also to its aspects in the zodiac.

Thus in the horoscope of Ruskin the planet Neptune holds the longitude Sagittarius 28° 22′, and therefore its zodiacal sextiles will fall in Aquarius 28° 22′ and Libra 28° 22′, its squares in Pisces 28° 22′ and Virgo 28° 22′, and so on.

The longitude of the planet, or its aspect if we are directing to it, remains stationary, and the actual body of the planet or luminary which is directed to it is moved along its own semiarc until it reaches the longitude or aspect to which direction is made.

Therefore we take the meridian distance and semiarc of the ecliptic degree held by a planet and use these as the first and second terms of a proportion, in which the semiarc of the body directed forms the third term.

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Example.—Direct the Sun to a conjunction with Jupiter in the zodiac.

Jupiter's longitude is Aquarius 0° 20′, and from the tables we find this longitude to have R.A. 302° 31′, from which take the R.A. of Midheaven, 249° 56′, and we get its meridian distance, 52° 35′.

The same tables give the ascensional difference under London as 30° 51′, which, taken from 90° as the declination is south, gives the diurnal semi-arc = 59° 9′.

Prop. log. meridian dist.	.	52° 35′ = ·53442
,, semiarc	. .	59° 9′ = ·48332
Constant log. Aquarius	.	0° 20′ = ·05110
Prop. log. Sun's semiarc	.	69° 59′ = ·41028
,, Sun's prop. dist.		62° 13′ = ·46138
Take from Sun's merid. dist.		71° 16′
Arc of direction	. .	9° 3′

The constant logarithm of a longitude, once obtained, should be reserved, as it will serve for all zodiacal directions made to the same point of the ecliptic by simply adding the log. semiarc of the body directed to it. We then have the proportional meridian distance, which, compared with its original distance, gives the arc of direction.

Uniformly, find the R.A. of the longitude to which direction is made; from this derive the meridian distance. Find its declination, and from

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this derive the semiarc. Subtract the proportional logarithm of the semiarc from that of the meridian distance, and derive the constant log. of the given longitude. To this constant log. add the log. semiarc of the body directed to it, and thus obtain the proportional distance of that body from the meridian at the point of direction. The difference between this and its radical meridian distance is the arc of direction.

Examples:—

1. Direct the Sun to aspects of the Midheaven in the zodiac. The aspects to which the Sun applies are the sextile in Aquarius 11° 28′, the semisquare in Capricorn 26° 28′, and the conjunction in Sagittarius 11° 28′.

Aquarius 11° 28′ has R.A. 313° 55′
The Midheaven has R.A. 249° 56′

Merid. dist. of aspect	= 63° 59′	prop. log.	·44921
Asc. diff. 23° 9′			
90° 0′			
Semiarc 66° 51′		prop. log.	·43017
Constant log. of aspect in Aquarius 11° 28′		=	·01904
Add prop. log. Sun's semiarc diurnal			·41028
Sun's prop. dist. from M.C.	66° 59′		·42932
Radical dist. of Sun from M.C.	71° 16′		
Arc of direction, Sun sextile M.C. =	4° 17′		

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2. The next aspect of the Sun to the Midheaven in zodiac falls in Capricorn 26° 28′, which is the semisquare aspect of 45°.

The R.A. of this longitude is 298° 29′, and its meridian distance is therefore 298° 29′ − 249° 56′ = 48° 33′. Its ascensional difference is 28° 40′, which gives its diurnal semiarc = 61° 20′.

Proportional log. 48° 33′ − prop. log. 61° 20′ = constant log. of aspect, ·10150
To this we add the
prop. log. of Sun
as before, namely, ·41028

·51178 = 55° 23′ Sun's propor. meridian distance;
which take from 71° 16′ Sun's radical distance,
remains 15° 53′ the arc of direction Sun semisq. Midheaven.

3. The next aspect of the Sun to Midheaven in zodiac is the conjunction. For this the calculation is simply the difference of their right ascensions.

That of the Sun is 321° 12′
That of the M.C. 249° 56′

Difference 71° 16′ = arc of direction.

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These examples will doubtless serve for all cases that may arise in the course of directing a planet to the longitude and aspects of another in the zodiac.

We may now consider *converse* directions in the zodiac. These are calculated in exactly the same manner as the direct directions; but instead of moving the directed body forward in the heavens, that is, from the Nadir to the Ascendant, from the Ascendant to the Midheaven, from the Midheaven to the Occident, and so on, we move it conversely against the natural diurnal motion of the celestial bodies in the heavens. Thus, in the example horoscope the Moon is in Cancer 27° 8′. Therefore, to bring Saturn to the square aspect of the Moon in the zodiac, we have to bring it to Aries 27° 8′ by converse motion. We therefore find the meridian distance and semiarc of that point in the ecliptic, the meridian distance being taken from the lower meridian, to which it is nearest, and the semiarc being the nocturnal arc. Find the constant log. due to this point of the zodiac, and add to it the log. of the nocturnal semiarc of Saturn. From this we derive the proportional distance of Saturn from the lower meridian, and the difference between this and its radical distance is the arc of direction.

Similarly, we bring the Sun down the eastern heavens to form the converse zodiacal conjunction with Saturn. Here we take the meridian distance of Pisces 17° 5′, and also its semiarc. Find the con-

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stant log. due to these and add to it the log. of the nocturnal semiarc of the Sun. The sum will be the prop. log. of the Sun's meridian distance at the conjunction, and the difference between this and the radical distance of the Sun from the same meridian will be the arc of direction.

The bodies of Jupiter, Mars, Mercury, Venus, Neptune, and Uranus are brought to the zodiacal conjunction with the ascendant conversely by the measure of their horizontal arcs, which are derived by subtracting the meridian distance from the semiarc.

Thus Jupiter comes to the conjunction with the ascendant in zodiac conversely in an arc of 9° 21′, Mars in an arc of 10° 43′, Mercury in an arc of 13° 20′, Venus in an arc of 39° 27′, Neptune in an arc of 41° 14′,[1] and Uranus in an arc of 44° 8′. Similarly, the Moon is brought to an opposition of the ascendant in zodiac by an arc of 2° 30′, which is the difference between its semiarc and meridian distance. This arc is much smaller than appears from its longitudinal position, and is due to the fact that the Moon has 5° of north latitude. A body with much north latitude sets much later and rises much sooner than does the degree of the ecliptic it holds. This is the radical difference between the mundane and zodiacal positions of a celestial body.

[1] An ephemeris of the approximate longitude and latitude of the planet Neptune from 1800 to 1900 A.D. is published by Messrs Foulsham & Co. Price 1s.

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The Midheaven is directed to the conjunction with these planets in the zodiac by an arc equal to the difference of the R.A. of the Midheaven and that of the longitude of the planet.

Thus Venus comes to the Midheaven with the R.A. of Capricorn 5° 49′, which is 276° 25′, and the difference between this and the R.A. of the Midheaven 249° 56′ = 26° 29′ arc of direction of Midheaven conjunction Venus in zodiac.

Uranus comes to the Midheaven in the zodiac by an arc of 12° 53′, Neptune by an arc of 18° 17′, Venus by an arc of 26° 29′ (as above), Mercury by an arc of 46° 44′, Mars by an arc of 48° 41′, Jupiter by an arc of 52° 36′, and the Sun by an arc of 71° 16′. These arcs, it will be observed, differ from the meridian distances of the several bodies as given in the speculum by an increment which is due to the latitudes of the various bodies. The meridian distances in the speculum will be the same as the measure of their directions to conjunction with the Midheaven in mundo.

We may now pass to another series of directions.

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CHAPTER V

ZODIACAL AND MUNDANE PARALLELS

In astrology the parallel of declination is deemed of the same significance and value as the conjunction, but its effects are more lasting, and if formed near the tropics, Cancer 0 or Capricorn 0, they will last for years together and characterise a whole period of the life.

A *zodiacal* parallel is formed by directing a body to the place held by a zodiacal degree which has the same declination as that held by a planet to which direction is made.

Example.—The Sun at birth has 15° 13′ of declination. On the principle that all parallels of declination, being at the same distance from the Equator, act magnetically in unison, any body coming to an ecliptic degree which holds the same declination as the Sun, namely, 15° 13′, whether north or south of the Equator, will act as if in conjunction with the Sun. Reference to the tables will show that there are four points which have this same declination, namely, Aquarius 18° 46′, Taurus 11° 15′, and Scorpio 11° 15′. Therefore, if we

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direct any body to any of these four longitudes in the zodiac by the rules given for directions in the zodiac, we shall bring them to parallels of the Sun in zodiac. The process is exactly the same as if we were directing to an aspect in the zodiac.

A *mundane* parallel is formed by the direction of a body to the same distance on one side of the meridian or horizon as that radically held by another body on the other side of the same meridian or horizon. These can be readily computed by reference to their horizontal arcs.

Example.—Bring Saturn to the mundane parallel of the Sun. The Sun's radical distance from the horizon northwards is determined by the difference of its meridian distance and semiarc, namely, 110° 1′—108° 44′=1° 17′, and we therefore have to bring Saturn to the same distance above the horizon. The semiarc of Saturn is 98° 45′, and its meridian distance 81° 2′; its horizontal arc therefore is 17° 43′. Then say: As the semiarc Sun is to its horizontal distance, so is the semiarc Saturn to its proportional distance, which, being added to the first or radical distance of Saturn from the horizon, will give the arc of direction.

Some writers on this subject have repudiated the parallel in mundo formed upon the horizon, but without adequate reason being adduced in support of their objection. Yet the same writers have not denied the efficacy of parallels formed on the *same* side of the meridian, one south and the other

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north, as in the 4th and 9th houses, or the 11th and 2nd, 10th and 3rd, etc., forgetting that bodies so placed are at equivalent distances from the *horizon*!

The rule for parallels is the same as for aspects. As the semiarc of the stationary body is to its meridian distance, so is the semiarc of the moving body to its proportional distance, which, taken from its primary distance, or added if it passes into another quadrant in forming the aspect, will give the arc of direction.

Thus we may bring Saturn to a parallel with the Moon in mundo. The Moon here is 2° 30′ from the west horizon, and below it. If we bring Saturn along its own arc until it reaches a proportionate distance below the east horizon, we shall have a mundane parallel formed on the same side of the horizon, but on opposite sides of the meridian. We could work this problem by reference to the meridian distances of the two bodies from the Nadir, and the result would be the same.

It should be observed that the Sun and Moon are regarded as significators in the formation of mundane parallels by the other bodies, and the meridian and horizon therefore become sectors, upon which the parallels are formed.

Another form of the parallel in mundo is what is known as the *rapt parallel*. This is formed by the motion of the Earth on its axis, whereby the various bodies are carried from east to west at

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their several relative distances from one another until they come to the same distance on either side of the meridian or horizon. In this case *both* bodies move in the prime vertical at a rate proportionate to their relative semiarcs.

Rule.—As half the sum of their semiarcs is to half the sum of their meridian or horizontal distances, so is the semiarc of the body applying to the angle, to its distance from that angle at the formation of the parallel. This distance taken from its radical distance from the same meridian or horizon will give the arc of direction.

What we are actually doing is to bring the meridian or horizon to the mid-distance between the Sun and a planet, or between the Moon and a planet. And these mid-distances are of the greatest significance, whether in the zodiac or in mundo. Here we are considering them only in mundo.

Example.—Bring the Moon and Saturn to a rapt parallel. This is formed on the lower meridian.

Semiarc, Moon (nocturnal)	52° 51′	
„ Saturn „	98° 45′	
	2)151° 36′	
Half sum of semiarcs .	75° 48′	prop. log. 37560
	Arith. comp.	9·62439

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	Arith. comp.	9·62439
Merid. dist. of Moon .	50° 21′	
„ „ Saturn .	81° 2′	
	2)131° 23′	
	65° 41′ prop. log.	43782
Semiarc, Moon . . .	52° 51′ „	53223
Proportional dist., Moon .	45° 48′ „	·59444
Radical distance .	50° 21′	

Moon rapt. par., Saturn = 4° 33′ arc of direction.

Note.—In all cases where the Midheaven (meridian) and Ascendant (horizon) are employed as sectors, the Sun and Moon are employed as significators. They form aspects by their own apparent motions in the prime vertical, and the planets form aspects to the radical of the Sun and Moon by the same motion. This is the underlying principle of all parallels in mundo, and all rapt parallels. Remember that in mundane directions you are always dealing with the bodies themselves and not their longitudes.

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CHAPTER VI

ORDER OF DIRECTING

THE student will do well to employ some definite method of noting the various directions, and of collating and tabulating his results, otherwise he is sure to overlook some that are important when considered in association with others that attend them, whether they be of the same or a contrary nature. Thus, if in a train or sequence of evil directions there should occur a good aspect of Jupiter to the Sun or Moon, the health and fortunes will be greatly sustained thereby, so that what would otherwise appear a fatal set of arcs, in the presence of this benefic arc of direction would lose that extreme significance, and, although sickness might supervene, the good direction would indicate a favourable crisis.

The following method is therefore suggested as inclusive of all legitimate directions.

1. *Mundane Directions*

(*a*) Direct all the bodies to aspects and conjunctions with the Ascendant from east to west and from west to east.

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(*b*) Direct each of the bodies to all the aspects and the conjunction with the Midheaven, both ways.

(*c*) Direct the Sun to other bodies and their aspects in mundo, both ways.

(*d*) Direct the Moon to other bodies and their aspects in mundo, both ways.

(*e*) Direct each of the planets separately to mundane aspects and conjunctions with the Sun.

(*f*) Do the same in regard to the Moon.

(*g*) Direct the Sun to mundane parallels with the Moon and planets.

(*h*) Direct the Moon to mundane parallels with the Sun and planets.

(*i*) Direct the Sun to rapt parallels with the Moon and planets.

(*j*) Direct the Moon to rapt parallels with the Sun and planets.

2. *Zodiacal Directions*

Follow the same order as for mundane directions, omitting classes (*g*), (*h*), (*i*), and (*j*) (mundane and rapt parallels), which are not formed in the zodiac.

Note that in zodiacal directions a body is always moved to a longitude to form a conjunction or aspect, never the reverse of this. Also that the meridian and horizon are fixed circles which do not move in regard to any particular locality. The Midheaven and Ascendant are those points where

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the ecliptic cuts through the meridian and horizon respectively.

All this long process of directing may appear to be very tedious. It certainly requires patience and method. But once done it lasts for a lifetime, which is a point to be considered. In possession of such a chart one may direct one's course with wisdom and success, avoiding those dangerous shoals, sandbanks, and breakers which occur in the course of every life—or, if it be beyond the power of a man so to do, he can at all events divest evils of much of their power over him by adjusting himself to them, making provision against times of evil fortune and doubling his efforts when times of prosperity are shown. Thus may a man order his going and bring his life to a peaceful end. Sudden death cannot overtake the man who has knowledge of the time of that event years in advance; and the keen edge of many afflictions, to which an all-wise Providence may dispose us for the greater ends of life, are dulled by a philosophic anticipation, so that, cutting less deeply, they leave the vital soul of man unhurt. Therefore, rather than pray that what is foreordained by the laws of life to the inscrutable ends thereof may be averted, let us rather pray with the Psalmist: "Teach me the number of my days, that I may apply my heart to wisdom."

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CHAPTER VII

EFFECTS OF DIRECTIONS

In order to complete this section of the work, which deals with that system of direction by semiarcs currently practised and approved, it will be necessary here to indicate the general effects of directions, so that the nature and import of events may be known as certainly as the time at which they are likely to transpire. I am here speaking of "effects" of directions as if these latter had a direct dynamic result upon the character and actions of an individual. I am disposed to classify astrologers in three main groups—fatalists, casuists, and idealists—according to the various views they take of the nature and purport of astrology. The Fatalists believe, or profess to believe, that there is a planetary configuration and an event which attends it. They admit no possible intervention, amelioration, or extenuation. *Che sarà sarà*, and that is the end of the matter. They argue a certain necessity of connection between character and environment as we find it and planetary positions at the moment of birth. As regards "directions," all of which

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are formed within a few hours of the birth, they speak of them as "seeds sown" in the plastic soil of the human soul which spring up and bear fruit at the appointed time, as measured by the arc of direction. They are born when they are born by necessity of universal law, and they die when they die because fatal arcs of direction are then in force.

They speak of laws of Nature as if they were dynamic forces against which mankind cannot possibly contend. They forget that laws are only mental concepts induced upon our minds by an apprehension of the correlated successiveness of events, and that what we know about natural laws is an infinitesimal part of the possibly knowable. They speak of the bodies of this microscopic solar system of ours as if they were the be-all and end-all of existence. They forget that the continuity of matter is a fact only on the material plane, and that there are forces of an immaterial nature which transcend both matter and what we call the laws of material existence. The moral law is an illustration of this. It is spiritual in its origin and spiritual in its effects. If astrology teaches fatalism, its use is at an end and it becomes a suicidal science, since there is no object in knowing that which must inevitably take place. It would reduce man to an automaton and divest him of all moral responsibility.

The Casuists are those astrologers who accommo-

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date their facts and figures to popular concepts by a discreet use of a *mélange* of spurious philosophy. They forever quote the effete adage: "The wise man rules his stars, the fool obeys them"; and that other which says: "The stars incline but do not compel." They put a premium upon the wisdom of experience and the will-power of a purposeful character, and promptly consign a man to destruction by telling him that his horoscope indicates he has neither one nor the other. They do not suggest to him that astrology, properly conceived and applied, is in itself the very concrete of experience, nor that the will-to-be and the will-to-do are functions of the human soul which rise superior to all circumstance, outlasting life itself.

The Idealists are those among astrologers who regard the intelligible universe as the expression of a Supreme Intelligence, who regard the planetary combinations merely as symbols, knowing that the causes of all effects are within man himself, the cogniser of all experience. They regard the "signs of the times" as the driver of a locomotive regards the signals, not as "causes" of disaster, but as warnings against it, an open book to those who can read the signals, but of no value to those who cannot. They look upon the science of astrology as a wireless operator looks upon his code-book, merely as a means of interpreting the signals—a science evolved by man for the service of man.

My own view of the matter is that there is some-

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thing to say for the materialist side of the question, and a great deal more for the idealistic. There is not the shadow of doubt in my own mind as to the material fact of the interaction of the planetary bodies, nor as to the fact that this interaction is registered by an intervening body of the system only at certain angles. The Platonic dictum that "God geometrises" is nowhere better illustrated than in the law governing the interaction of bodies belonging to the same system. The physical effects of the syzygies, and especially of ecliptic conjunctions of the luminaries, are immediately appreciable. The law of the tides is a concrete example of the fact of interplanetary action. We cannot deny the dynamic effects of planetary action on the material plane, and we have every reason for including in this category the human organism, compounded as it is of cosmic elements and in direct physical relations with a material environment. But that does not warrant us in extending our views to include the action of physical bodies upon the immaterial part of us, the only part of us that is essential and distinctively human. The only thing that can directly affect the soul of man is the soul of another human being. There is continuity of action upon all planes of existence because there is a continuity of matter upon all planes, but we have no grounds for extending the range of action from one plane to another plane, except it be by mediation or agency. Else we

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could say that a good soul must be possessed of a sound body, a beautiful soul of a comely body, and that our moral principles are derived from what we eat and drink—instead of which, what we eat and drink depends on our moral principles. There is sound philosophy in the words of Tennyson when he says that "Soul to soul strikes through a finer element of its own." It is capable of acting mediately through the physical body or immediately through its own essential being. These views will doubtless alter our viewpoint in regard to much that hitherto has been regarded as fundamental to a belief in astrology. The effort to accommodate the facts of astrology to the materialistic science of a generation agone has tended to this issue. Without in any way disposing of astrology as a physical science, it is high time that we learned to interpret the facts of that science in the light of the higher spiritual teaching to which we have access. Otherwise we shall debase the science and enslave our own souls. In such case it were better that our astrology had never been written. As a physical science, astrology has an immense future before it in this utilitarian age upon which we have embarked; but as a fatalistic creed it is not worth an hour's study.

These remarks will enable the reader to understand why, in the following statement of the "Effects of Directions," I have pursued the common practice of attributing certain results or

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sets of conditions as accompanying the formation of "directions" or planetary combinations in the horoscope subsequent to the birth. They should not be regarded as inevitable "effects" of such directions, but rather as things signalled, as if we should hoist the red light to indicate "danger ahead," the green light for "caution," and the white light for "road clear." These signals do not cause disasters, but our ignorance of them, our inability to see them, or our wilful disregard of them may very well result in a catastrophe. Human science has harnessed many of the subtle and intangible forces of Nature and deployed them to the service of man. It may do the same with cosmic forces that are as universal as etheric action.

The Midheaven

This point of the horoscope stands for dignity, influence, authority, and position, the worldly honour and credit of the subject, and for all that is associated with his social and communal status. Good directions, such as the sextile and trine of all planets, and the conjunction and parallel of Jupiter, Venus (and Mercury when well aspected at birth), are indications of an enhanced position, higher honours, social distinctions, increase of prestige, etc.

Evil directions, such as the semisquare, square, and opposition of all planets (including the Sun and Moon in this category), and the conjunctions

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and parallels of Uranus, Neptune, Saturn, and Mars, indicate assaults upon the good name and credit of the subject, hurt to the business affairs, loss of position, rivalries, and unprofitable associations.

The Ascendant

This point of the horoscope indicates things personal to the subject, as health, general welfare, comfort, environment, changes, and the common relationships of life, that which affects him through collective influence, the public state of affairs, etc.

Good aspects (as above enumerated) tend to benefit the subject by a variety of means differing as the nature of the planet which is in aspect by direction.

Evil aspects signal bad health, obstacles, hindrances, incommodities, troubles and annoyances of various kinds, according to the nature and position of the planet directed.

The Sun,

when in a hylegliacal place (as defined by Ptolemy), has significance of the vital constitution and life of the subject. Generally it stands for the father and male representatives of a family, and for the honour, credit, and position of the subject himself. It is thus associated more particularly with the Midheaven.

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The Moon

denotes the health, changes of fortune, the mother and female representatives of the family, the functional powers of the body, and, in its association with the Ascendant, public bodies, the populace, and public concerns generally.

If in a hylegliacal position, it indicates the vital organs and life of the subject.

Note.—Ptolemy defines certain parts of the horoscope as being vested with a vital prerogative, wherein the Sun has precedence by day and the Moon by night. It is a moot point whether other bodies, being in such positions (in the absence of the luminaries), may not be vested with the same prerogative, and again, whether the Sun or Moon, not radically in such a position, may become invested with such significance by coming to a hylegliacal place by direction after birth. Failing either the Sun or Moon, Ptolemy invests the Ascendant with the properties of hyleg or life-giver. But, whatever may be concluded in this debatable matter, it is certain that the Ascendant is most generally affected by evil directions at the time of a physical crisis, the afflicting planet generally indicating the nature of its cause.

The above points in the horoscope, the Mid-heaven, Ascendant, Sun, and Moon, are the significators, because they signify such persons and things in the life of the subject as are capable

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of being affected by the conflict of human circumstance.

All directions are made either (*a*) by the natural motion of the significators to the places and aspects of the planets, or (*b*) by the natural motions of the planets to the places and aspects of the significators.

The triangle (trine) and parts of it are good aspects, and indicate some advantage according to the position and nature of the planet directed. The cross (square) and parts of the square are evil aspects, and indicate similar disadvantages.

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CHAPTER VIII

PLANETARY INDICATORS AND THE MEASURE OF TIME

THE following definitions of planetary indications are necessarily only partial and incomplete, but they will serve doubtless to convey a more or less definite idea of the nature of events which may be expected to attend directions formed by them with the various significators.

It should be observed that the house which a planet directed to holds in the horoscope of birth, or that which a planet which is directed arrives at when the aspect is complete, has chief significance in regard to the department of life in which the events will transpire, the nature of those events depending primarily on (*a*) the nature of the aspect and (*b*) the nature of the planet involved.

In this light, therefore, it may be said that *Neptune* in good aspect indicates events of a beneficial nature connected with the use of the faculties or some special faculty, and frequently in connection with a form of art; benefits from unexpected sources coming mysteriously to the subject; unseen

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and intangible influences at work for the benefit of the subject; brilliant flashes and inspirations of the mind; spiritual aid; intuitive activity.

In evil aspect by direction it denotes chaotic and mysterious events adverse to the interests; scandal, secret enmity; undermining of the credit by misrepresentation and fraud; treachery, ambush; an involved state of affairs; nervous leakage and depletion of energy; wasting of tissue; physical ennui and decline of the vital powers from inscrutable causes; apprehension, fear, and dread of consequence; danger of espionage; loss by fraudulent concerns and false investments; mental unrest and loss of faculty.

Uranus in good aspect denotes civic and governmental honours, preference, advancement; unexpected benefits arising out of public concerns and affairs; ingenuity, inventiveness; originality; success in mechanical and engineering business; strokes of good fortune coming from unexpected sources; new associations and alliances.

In evil aspect this planet denotes the breaking down of existing relationships, lesions and fractures, partings and separations, loss of a sudden and unlooked-for nature; hurt by strikes and public demonstrations; nervous lesion, paralysis; breaks and dislocations.

Saturn in good aspect indicates favours from aged persons and benefits from old associations, long investments, time contracts, and a general

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state of stability and steadiness in the fortunes, congenial retirement and sequestration.

In evil aspect Saturn depletes the vital powers, causes physical hurts by falls and contusions, morbid diseases, colds and chills, inhibition of bodily functions; loss of money and property; mental and nervous depression; privations, obstructions, hindrances, and general misfortunes. Saturn is anciently known as the Greater Infortune.

Jupiter in good aspect denotes increase of fortune, opening up of new and lucrative opportunities, expansion of interests, advancement, progress, honours, confidence, good judgment, a general feeling of expansion and well-being, both physical and mental.

In evil aspect Jupiter denotes losses, errors of judgment, vanity or excessive confidence, disfavour of legal men and clericals, physical disabilities arising from congestion and surfeit, excess or over-indulgence, "too much of a good thing," too much *confiance en soi*, and consequent loss of esteem with others. It indicates a period of low finance, due to lavish expenditure, severe losses, or heavy investments. Jupiter is anciently known as the Greater Benefic, but it is certain that its evil aspects denote anything but a beneficial state of affairs.

Mars in good aspect denotes activity, new enterprises, great output of energy with commensurate good results, travelling, the executive powers are stimulated, and much profitable work is done.

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Benefits accrue from military men, business connected with iron, steel, and fire. The muscular system is strengthened and there is a disposition to increased activity. Honours due to deeds of daring and chivalry. Women frequently marry under this aspect.

In evil aspect Mars denotes hurts by burns, scalds, fire, and steel, with loss of blood, abrasions and cuts, and also fevers and inflammatory conditions of the body or that part of it indicated by the position of Mars by direction. Loss by fire or theft, sometimes attended by violence. Sudden alarms and disasters of various sorts. Mars was anciently known as the Lesser Infortune.

The *Sun* in good aspect indicates increase of prestige, honours and emoluments, new friends and associations of a creditable character, general advancement and good fortune.

In evil aspect the Sun denotes losses, disfavour of superiors, troubles through male members of the family, the chief, overseer, or manager of a business; loss by governing bodies; ill-health due to fevers. Reverses of various sorts according to the house in which the direction is completed.

Venus in good aspect signifies social and domestic success, pleasures and enjoyments, gifts and presents, decorations; the young court or marry, and the mature have children born or daughters engaged or given in marriage, and such events happen as cause pleasure and satisfaction. The

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affectional nature is stimulated and the health is good.

In evil aspect Venus denotes sorrows, disappointments, bereavements, grief, and losses, domestic and social troubles, and hurts associated with young women or children. Venus was anciently known as the Lesser Benefic, and the less one has of it when in evil aspect the better for all concerned.

Mercury acts in terms of the planet to which at birth it is in closest aspect; but if not within orbs of an aspect with any planet, then in terms of the ruler of the sign it occupies. In good aspect it usually signifies activity, much occupation of a profitable nature, connected with writings, science, and business of a general nature. Travelling, profitable journeys, good news, gain in connection with the avocation or trade. An active time generally.

In evil aspect Mercury produces annoyances and disturbances, evil news, worry and anxiety, many short journeys to and fro to no purpose or profit, sleeplessness, irregular feeding, unrest.

The *Moon* in good aspect denotes pleasant and profitable changes, a change for the better in the general state of affairs, gain by public associations and concerns, favours from women of mature age, popularity.

In evil aspect it denotes loss by any of the above means, and a state of unrest both physical and mental which leads to neglect of duties and conse-

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quent loss. Hurts from women. Some public affronts may be suffered. Changes are unfortunate, and best avoided.

The Measure of Time

In the foregoing system of primary directions by proportion of the semiarcs, the measure of time is $1° = 1$ year, and every $5' = 1$ month.

Considerable discussion has been devoted to the question of time measurement in directions. Those who advocate the Arabian system of a day for a year have sought to bring primary directions into line with that system by equating arcs of direction made on the foregoing principle of semiarcs, by adding the arc to the Sun's right ascension at birth, and then finding the day after birth at which the Sun attains this new right ascension. The count is made at the rate of one day for a year of life, and two hours for every month.

Others, again, have sought to apply a plus increment at the ratio of 365 to 360, seeing that the Sun moves through 360 degrees in 365 days, which is the same as taking the Sun's mean motion $59' 8''$ as the value for 1 day = 1 year.

But it is obvious that none of these methods has any direct application to the system we are now concerned with, inasmuch as all the directions formed by the diurnal rotation of the Earth on its axis are formed within a few hours of birth so far as they apply to a life of ordinary length, and

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they are measured in degrees of right ascension—that is to say, by the passage of the Equator under the local meridian in the prime vertical,—and therefore degrees of right ascension are the only uniform basis of measurement. It certainly does not seem consistent to measure arcs by one method and equate them in terms of another.

It should be observed, however, that primary directions in right ascension do not always coincide exactly with the events they are held to signify. Sometimes they are too short, and sometimes too long, but never more than a few minutes either way. Commander Morrison, R.N., was of opinion that the event signified was delayed or accelerated by reason of current transits in the horoscope at the time, and he further states that the chief effects may be expected to transpire when the lunar or secondary directions come into accord with them. This gives rather a wide margin of operation to the primary direction, and has led many to the conclusion that the secondary direction is, after all, the important one and deserving of primary consideration. A very little experience will show that it is not so, for, unless there are concurrent primaries in operation, lunar or secondary directions frequently pass with little or no result.

Primary directions and transits appear to answer to all the more important events in life.

At the same time we have to consider the *duration* of effects, and in regard to this it has been observed

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that the process of formation of an arc of direction should be considered. For the longer a direction may be in forming, the longer will those events endure which it signifies. Here we have Fitzroy's old maxim again in evidence: "Long foretold, long last: short notice, soon past."

Thus an aspect to the Ascendant formed during the rising of a sign of short ascension such as Aquarius, Pisces, Aries, Taurus in northern latitudes, and the opposite signs to these in southern latitudes, will be speedily formed and over. On the other hand, a similar direction formed to the Ascendant when in a sign of long ascension will be formed more slowly, and will dissolve more slowly. In such case we might expect the signified event to begin to happen earlier and to end later than in the former case.

One finds in experience, however, that men frequently trace years of toil and suffering to a sudden disaster overtaking them in a moment. In my theory of transits, this could not happen in earlier years, but might easily occur at maturity when the accumulated results of a man's labour were heaped around him. (See Transits.)

The following illustrations will, however, sufficiently prove that there is adequate coincidence between arcs of direction and the events they are held to signify, to warrant the measure of time 1°=1 year as scientifically valid.

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CHAPTER IX

ILLUSTRATION

In the example horoscope given in these pages we have a singularly interesting subject. The chief events of the life are well defined and closely indicated by the attendant arcs of direction. Hundreds of horoscopes, whether pertaining to individuals in high walks of life or of modest position in the world, could be adduced to show that this coincidence of direction and event is not fortuitous, but regular and consistent, and as dependable as any astronomical formulary. The student will find pleasure and instruction in working out the following arcs of direction in the present instance.

John Ruskin leapt into fame and became a "lion" in the world of art in the autumn of 1843 under the direction of

Sun sextile Midheaven mundo 24° 37′

He was married on the 19th April 1848, and, while on his honeymoon, took a chill while sketching in Salisbury Cathedral and was seriously ill. This happened under the adverse directions—

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Moon oppos. Venus mundo conv. 29° 16′
Moon square Venus mundo dir. 29° 16′

The nearness of these adverse arcs to the event of marriage proved unfortunate for such a domestic change. The danger of his choice of a wrong time and a wrong partner for marriage was radically indicated by the Moon's opposition to Mars and Mercury, and nothing but constant bickering could have been expected from such indications.

The first serious break in Ruskin's health was in May 1840, for which we have the direction—

Moon oppos. Saturn zod. 21° 46′

He received honours from the University of Cambridge in May 1867 under the appropriate directions of

Ascendant trine Venus mundo 48° 2′
Ascendant sextile Moon zod. 48° 22′

He was elected Slade Professor of Fine Art on the 10th August 1869, and commenced his course of lectures under the following directions :

Ascendant trine Jupiter zod. 50° 35′
Midheaven par. Jupiter zod. 50° 57′
Ascendant par. Jupiter zod. 51° 14′
Moon rapt par. Jupiter . 51° 22′

In the following year his health gave way, and his mother died in December of that year, 1871. The arc for that year measured from 51° 53′ to 52° 53′, and within these limits we have the significant directions—

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Ascendant square Saturn zod. con.	51° 59′
Moon square Mars mundo . .	52° 0′
Sun par. Uranus zod. con. . .	52° 0′
Ascendant square Jupiter mundo .	52° 41′

followed by Moon par. Mars zod. 53° 3′, close upon the death of his mother.

His health completely broke down again in 1888, under the directions—

Sun opposition Uranus zod. . .	68° 49′
Sun opposition Uranus mundo .	69° 14′
Moon rapt par. Saturn . . .	69° 30′

Here the Sun is hylegliacal, and, being so heavily afflicted from angles of the horoscope, and the Moon also afflicted by Saturn, only disastrous illness and misfortune could have been signified.

Nevertheless, he survived this affliction, and further added to his reputation as a man of letters and exponent of fine art during some ten years, until eventually, with declining vitality laying him open to attack, he was afflicted by influenza and succumbed on 20th January 1900, the arc for that date being 80° 57′. The following significant train of directions was then in force :

Sun par. Uranus zod. . . .	80° 10′
Ascendant square Saturn mundo .	81° 2′
Ascendant sesquiq. Sun zod. .	81° 11′
Ascendant par. Uranus zod. . .	81° 27′
Moon square Mars zod. con. . .	81° 30′

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In view of these directions, it cannot be said that we are not duly signalled by the celestial bodies, not only of the approach of evil times, when more than usual care and attention are due to health and fortunes, but also of those periods of good fortune when the sun smiles upon all our efforts and stimulates us to greater endeavours. The fault is altogether ours if we do not regard these portents. The beneficent Creator, having established these celestial bodies "for signs and for seasons," is ever faithful. He puts up the signals on every occasion. It is for us to apprehend and read them.

In King Edward VII.'s horoscope we have the attachment which led to his marriage indicated by

Venus conjunction Moon mundo . 19° 25′
Moon conjunction Venus con. . 20° 7′

The attempt on his life by the maniac Sipido, when as King he was travelling in Germany, measures to an arc of 58° 25′, and the appropriate direction was—

Sun opposition Neptune zod. 58° 21′

The death of the Empress Frederick (Princess Royal) in August 1901 was indicated by the direction—

Midheaven conjunction Saturn 59° 43′

The death of his royal mother, Queen Victoria,

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requires an arc of 59° 14′, and we find the appropriate directions—

Midheaven square Moon zod.	58° 58′
Ascendant opposition Moon	59° 19′
Saturn semisq. Ascendant	59° 22′
Midheaven conjunction Saturn zod.	59° 42′

These illustrations will doubtless serve for all practical purposes, and they can be worked out at leisure by those who wish to exercise themselves in this art.

Other methods than that here illustrated must claim our attention, inasmuch as they have consistently been advocated by various authors. There are, moreover, several points which may be considered as debateable, and these also have to be considered before our work is rendered complete. We must therefore pass on.

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CHAPTER X

PTOLEMY AND PLACIDUS

It is generally conceded that the system of directing which has so far occupied our attention first originated as a measure of time in the mind of Claudius Ptolemy, the famous geographer, mathematician and astronomer of Alexandria, who flourished in the second century of our era, and wrote a standard work on the subject of astrology called in the Greek *Tetrabiblos*, and in the Latin *Quadripartite*, being four books on the Influence of the Stars. He also wrote the *Syntaxis* and the *Almagest*, which, together with his work on astrology, have been translated into every language in Europe and into many Oriental languages also.

From the writings of Sir Isaac Newton we have evidence that there were many sources of information open to Ptolemy in the pursuit of astrological knowledge, and there is no reason to suppose that he did not avail himself of them fully, for none has ever suggested that astrology as a science was first promulgated by him. But it may certainly be

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affirmed that Ptolemy gave to the Western world the first scientific exposition of the subject. There are two Latin editions of the work and one in Greek. The best translation that we have is the paraphrase of Proclus from the Greek text rendered into English with extensive commentary by J. M. Ashmand, and recently published as a supplement to *Coming Events*. Ashmand has followed the Elzevir text, dated 1635.

The name of Claudius Ptolemy will be revived wherever astronomy and astrology are studied. It is enough for the purpose of this sketch to note that he was born at Pelusium in Egypt, and became a brilliant disciple of the Alexandrian School. It appears that he was born about the year 80 A.D., flourished during the reigns of Adrian and Antoninus Pius, and died in the seventy-eighth year of his age.

Of Placidus de Titus, who first rendered a studied version of Ptolemy's work on astrology, we have very little information. It appears that he was known as Didacus Placidus, and was a native of Bologna, became a monk, and was appointed mathematician to the Archduke Leopold William of Austria. He wrote in the early part of the seventeenth century a work entitled the *Primum Mobile*, in which he gives a thorough digest of the teaching of Ptolemy. The best English translation is by Cooper. Placidus showed that Ptolemy recognised two sets of directions arising out of

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two sets of planetary positions, one in the zodiac and the other in the world, *i.e.* in the prime vertical. To Placidus remains the credit of having elaborated that part of directional astrology which has regard to directions in mundo.

Ptolemy makes it clear in his chapter on the "Number of the Modes of Prorogation" (bk. iii., ch. xiv.) that "when the vital prerogative is vested in the Ascendant, the anareta or killing planet may be brought to it by oblique ascension; and if it be vested in the Midheaven or a body there situate, then direction is to be made by right ascension. If on the occidental horizon, the degrees of oblique descension are to be reckoned. But if not in either of these three places, but in some intermediate station, it should be observed that 'other times' will bring the succeeding place to the preceding one, and not the times of ascension or descension nor of meridian transit as already declared.

"For, if it be desired to calculate agreeably to nature, every process of calculation that can be adopted must be directed to the attainment of one object—that is to say, to ascertain in how many equatorial times the place of the succeeding body or degree will arrive at the position preoccupied at the birth by the preceding body or degree, and, as equatorial times transit equally both the horizon and the meridian, the places in question must be considered in regard to *their proportionate*

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distances from both these, each equatorial degree being taken to signify one year."

Here Ptolemy makes it clear that he directs a body in the heavens to one that precedes it, or a body to a degree that precedes it, which direction is formed by the diurnal rotation of the Earth on its axis from west to east. He also makes it clear that he uses the proportionate distances of bodies from both the horizon and meridian as the basis of the calculation, and the arc of direction is the intervening degrees (equatorial) between them, at the rate of one equatorial degree for a year of life.

It is evident, therefore, that he takes a proportion of the semiarcs, or, as he calls them, " the horary times," of the planets involved. These arcs he describes as parallel to one another and to the Equator, but cutting the circle of the horizon at various degrees of obliquity.

Obviously, therefore, we have to take proportion of their semiarcs and meridian distances, exactly as we have been instructed in the foregoing exposition; and as these semiarcs are regulated by the latitude of the place of birth and the corresponding ascensional differences of the planets, the positions of the bodies will have respect to the prime vertical and will be their apparent places in the plane of that circle. But it is important to note that Ptolemy says nothing concerning converse directions, whether in mundo or in the zodiac.

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That he recognises the mundane position of a body as distinguished from the apparent place of its "degree" of longitude is obvious from his mentioning both in the same sentence; and we distinguish ourselves between the mundane and zodiacal conjunctions only by reference to the body of the planet in the first instance and its longitude in the other case.

To Claudius Ptolemy, therefore, may rightly be accorded the honour of having set astrologers upon the right track with regard to the correct measure of time by reference to the equatorial degrees separating one body from another, or one body from the longitude or aspect of another, as seen from the place of birth.

There is little doubt, from the illustrations of his method that Ptolemy gives, that he uses the "ascensional" times in all cases due to the latitude of the place of birth; and this method serves very well not only for directions to the Ascendant and Descendant, but also for intermediate positions when the planets are in the same or different quarters and on the same side of the meridian, for then their arcs may be measured with great facility and approximate accuracy from the Tables of Houses alone.

Illustration

1. Bring the Sun to the place of Mars in the horoscope of Ruskin.

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	h.	m.
The sidereal time on the Midheaven when Mars' place rises is . .	15	49
That when the Sun rises is . .	16	44
Difference in R.A. on the Midheaven in S.T. . . .	0	55

Divided by 4, this gives 13° 45′ as the arc of direction.

The same arc of direction when exactly calculated by the semiarc method is 13° 49′.

2. Bring the Sun to the conjunction with Venus in zodiac.

	h.	m.
The S.T. at sunrise (as above) is .	16	44
That when Venus' place rises is .	14	35
Difference . .	2	9

This gives an arc of 32° 15′.

3. Bring Saturn to the place of Sun in zodiac.

The declination of Saturn is 6° 54′ S., and this answers to the longitude of Pisces, 12° 37′.

	h.	m.
S.T. on Midheaven when this point rises	17	30
S.T. on Midheaven when Sun rises .	16	44
Difference . .	0	46

This gives an arc of 11° 30′.

4. Bring the Moon to the opposition of Venus in zodiac.

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The declination of the Moon is 25° 39′, which exceeds that of any degree of the zodiac owing to the Moon's extreme latitude north added to the declination of its longitude. But reference to the Tables of Ascensional Difference and Right Ascension will show that its oblique descension answers to the twelfth degree of the sign Leo, which is the same as the oblique ascension of Aquarius 12°. Then the arc between the place and Venus in zodiac and Aquarius 12° will be the arc of direction. Thus:

	h.	m.
S.T. on Midheaven when Venus long. rises	14	35
S.T. on Midheaven when the 12th of Aquarius rises	16	30
Difference . .	1	55

This gives an arc of 28° 45′.

5. Bring the Sun to the opposition of Uranus in zodiac.

Take the opposite degree of the zodiac to that held by Uranus, and bring the Sun to it by oblique arc.

	h.	m.
S.T. when Gemini 23° 25′ rises . .	21	21
S.T. when Sun rises	16	44
Difference . .	4	37

This gives an arc of 69° 15′.

6. Bring Sun to par. Uranus in zodiac direct.

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The declination of Uranus is 23° 24′, which answers to that of Cancer 4°. Find the arc between this and the Sun.

	h.	m.
S.T. on Midheaven when Cancer 4° rises	22	6
S.T. on Midheaven when Sun rises in Aquarius 18° 45′ . . .	16	44
Difference . .	5	22

This gives an arc of 80° 30′.

These examples will serve to show that without recourse to the elaborations of a speculum or the use of proportional logarithms in the computation of proportional arcs, Ptolemy could, by the mere use of a table of ascensions under any latitude, find the time of an indicated event within an arc of 30′ and even less, which, having regard to the approximations which are frequently adduced as "arcs for the event" when both are accurately known, show that they would serve for all practical purposes. I most frequently calculate arcs of direction in this manner, bringing out the results to the nearest quarter of a degree, which measures to three months of time. Ptolemy had constructed such tables, as appears from his *Almagest*, and this is obviously the method he used. In other words, he recognised no other directions than those that could be calculated by the difference of the oblique ascensions of the planets and of their longitudes,

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taking the oblique ascension of their opposite degrees when the arc was formed by descension of a body.

A table of oblique ascensions such as that published by Worsdale enables the calculation to be made with even closer exactness. It has only to be remembered that when we are directing the body of a planet to the body or longitude of another, the longitude corresponding to its declination must be dealt with, and not the longitude of the body itself, as the above examples will sufficiently indicate.

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CHAPTER XI

DIRECTIONS UNDER POLES

THIS method has been much advocated, and especially by Mr R. C. Smith, the first of the almanac writers under the pen-name of "Raphael." It consists in directing a significator under its own pole instead of under the pole of the place for which the horoscope is cast.

To find the Pole of a Planet

Take its R.A., declination, and semiarc.
Then say:

As the semiarc is to 90°,
So is its meridian distance
To the difference of its circle of position and the meridian.

And this difference, compared with its meridian distance, will give its ascensional difference under its own pole.

Then having this and also its declination, from the sine of its ascensional difference under

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its own pole take the tangent of its declination, and the remainder will be the tangent of its pole.

Example.—In the horoscope of Ruskin find the pole of the Sun.

The R.A. of Sun is 321° 12′, the meridian distance (below) 108° 44′, the semiarc 110° 1′, and the declination 15° 13′.

Semiarc 110° 1′ . .	prop. log.		0·21381
	Arith. comp. .		9·78619
Quadrant of 90°			0·30103
Meridian distance .	108° 44′		0·21891
Difference .	88° 57′		0·30613
Asc. diff. under pole	19° 47′	log. sine	9·52951
Sun's declin. . .	15° 13′	log. tang.	9·43458
Pole of Sun . .	=51° 13′	log. tang.	10·09493

It is thus seen that the pole is measured along the tangent by its distance from the meridian or nadir, according as the body may be above or below the Earth at the time. At the meridian the pole would be 0, and at the horizon it would be the same as the latitude. Here "pole" is the same as polar elevation. The difference 88° 57′ indicates the place of the circle of position from the

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plane of the meridian circle. Circles of position are small circles which are parallel to the great circle of the meridian and at right angles to the great circle of the horizon. They are like lateral circles of latitude in relation to which the meridian stands as equator and the Ascendant and Descendant as poles. Hence, if a planet be on the cusp of a house, it will have the same pole as that house.

Having calculated the poles of all the planets, and of the Sun and Moon, direction of one to another of them is thus made.

Rule.—Take the oblique ascension (or descension, as the case may be) of the promittor or body directed to under the pole of significator, and the difference of this from the oblique ascension (or descension) of the significator under the same pole is the arc of direction.

To find the oblique ascension of a body under the pole of another directed to it, to the log. tang. of its declination add the log. tang. of pole of the body directed, and the sum will be the log. sine of its ascensional difference under that pole. From this its oblique ascension can be found by referring it to its R.A. according to the rule (see "Definitions," Chapter I.).

Example.—Direct the Sun in the example horoscope to the place of Venus in the zodiac.

The declination of Capricorn 5° 49′ is 23° 20′. The Sun's pole is 51° 13′. Then—

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Pole of Sun, 51° 13′ .	.	log. tang.	10·09493
Dec. Venus long. .	.	log. tang.	9·63484
Asc. diff. of aspect	32° 28′	log. sine	9·72977
R.A. of aspect .	276° 20′		
O.A. of aspect .	308° 48′	under pole of Sun.	
O.A. of Sun .	. 340° 59′	under its own pole.	
Diff. .	32° 11′	=arc of direction.	

Applying this method to the hint I have already given as to the use of tables of oblique ascension, or tables of houses for various latitudes, we can calculate this arc perfectly well with a table of the houses for latitude 51° 13′, which is the pole of the Sun. And we can calculate all the solar arcs by this means from the same table. Then if we find the pole of the Moon, and refer to the Table of Houses for equivalent latitude, we shall be able to take out all the directions of the Moon under its own pole. The directions of the Ascendant will, of course, be made under the pole of the place of birth, and those of the Midheaven by right ascension only. So that what appears at first a complex and exhaustive piece of work can readily be done by tables of houses, or tables of oblique ascension for various latitudes, in next to no time, as the saying is. And this, I think, may be adjudged the most popular contribution to the theory

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and practice of primary directions that I have been able to make.

Example.—Direct the Sun under its own pole to the opposition of Uranus in the zodiac.

The Sun's pole is 51° 13′. Therefore take in hand the Tables of Houses or the Tables of Oblique Ascension for latitude 51° 13′ N.

The opposition of Uranus falls in Gemini 23° 25′.

	h.	m.
S.T. on Midheaven when Gemini 23° 25′ rises . . .	21	21
S.T. when Sun's place rises .	16	43
	4	38

This converted into arc of R.A. = 69° 30′ = arc of direction.

Example.—Direct the Sun under its own pole to Venus in the zodiac. Pole of Sun = 51° 13′.

	h.	m.
S.T. on Midheaven with Sun rising	16	43
S.T. on Midheaven with Capricorn 5° 49′ rising . . .	14	35
Arc of direction, Sun conj. Venus zodiac = difference . .	2	8

This is equivalent to 32° 0′.

By exact calculation we found it formerly to be 32° 11′. The difference is inconsiderable from the point of view of probable time of the event.

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As to the merits and demerits of these divergent systems of directing, I leave my readers to decide for themselves. *Experientia docet.* I hold no brief for either system, my business being merely to represent and to simplify. This I think I may claim to have done.

The system of directing under the semiarcs in the prime vertical is that which was followed by Ptolemy. The system of directing under the poles of the planets is of considerably more recent origin, and dates to the seventeenth century only. It consists, as will be seen, in directing in the circle of observation due to the pole of the significator or planet directed. The difference is that which one may note as between the tables of houses for one latitude and another. Nothing is simpler or more demonstrable. I leave it at that.

But in general practice it will be found that equally close results may be obtained by simple proportion and the use of the tables. Take the following hint for what it is worth. I am quite satisfied in my own mind that what we call primary directions seldom or never operate exactly to time, and if we correct the observed time of birth by one direction for an event we shall find that subsequent directions are not on schedule time. We have to allow a latitude for the operation of these directions. Such being the case, and, in the experience of the best artists, the import of primary directions being accelerated or retarded by the

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secondary directions and transits, we do not need to observe scruples. Approximations are always valuable.

The following may be regarded as the *via lætitia* in primary directing:—

Rule 1.—As the semiarc of the planet whose pole is required is to 90° of the prime vertical, so is the distance of the body in right ascension from the meridian (upper or lower as the case may be) to its proportional distance in the prime vertical.

Rule 2.—From the sine of their difference subtract the tangent of the planet's declination. The remainder is the tangent of its pole.

Rule 3.—For all directions under the pole of that planet or significator use the Tables of Houses for that latitude which answers to its pole.

Rule 4.—Find the difference between the ascension of the body (by sidereal time or right ascension on the Midheaven) and that of the planet directed to. This will be the arc of direction.

Note.—If the planets involved or the positions involved are between the tenth and fourth westward, take the ascensional degrees of the opposite places.

Rule 5.—Direct the Midheaven by right ascension only, and the Ascendant by oblique ascension under the latitude of birth. Direct the Sun under its own pole and the Moon under its own pole. This completes the entire scheme of primary directing.

Example.—In the horoscope of Ruskin the Sun

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was found to have a pole equal to the latitude of 51° 13′ N. (see p. 72). It must therefore be directed under the Ascendant of 51° 13′. Similarly, the Moon, whose pole is 47° 27′, must be directed under the latitude of that degree. A significator on the Midheaven would thus be directed by right ascension only, as stated by Ptolemy (see p. 64).

For directions of the Sun to other bodies, therefore, we use the Tables of Houses for 51° 13′. Those for Taunton are 51° 1′, which is deemed near enough.

1. Direct the Sun to Jupiter in the horoscope.

	h.	m.
S.T. on Midheaven with Sun rising	16	41
S.T. on Midheaven with Jupiter's long. rising	15	55
Arc of direction = 11° 30′, equivalent to S.T.	0	46

2. Direct the Sun to Mars.

	h.	m.
Sun rising as before, S.T. on Midheaven	16	41
Mars rising, S.T. on Midheaven	15	43
Arc of direction = 14° 30′	0	58

3. Direct the Sun to Mercury in zodiac.

	h.	m.
Sun's rising as before	16	41
Mercury's longitude rising	15	39
Arc of direction = 50° 30′	1	2

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4. Direct the Sun to Venus' longitude.

	h.	m.
Sun's rising as above . . .	16	41
Place of Venus rising . . .	14	30
Arc of direction = 32° 45′ . .	2	11

5. Direct the Sun to Neptune in zodiac.

	h.	m.
Sun's rising as before . . .	16	41
Neptune's long. rising . . .	13	59
Arc of direction = 40° 30′ . .	2	42

6. Direct the Sun to Uranus in zodiac.

	h.	m.
Sun's rising as above	16	41
Uranus' long. rising	13	36
Arc of direction = 46° 15′ . .	3	5

7. Direct the Sun to opposition of Moon in zodiac.

	h.	m.
Sun's rising as before . . .	16	41
Rising of Capricorn 27° 8′, S.T. .	15	47
Arc of direction = 13° 30′ . .	0	54

The various aspects to these promittors can be picked up *en route* as we bring the Sun from the horizon to the Midheaven, which it reaches in an arc of 69° 59′ = 70 years nearly.

We cannot direct Sun to Saturn by the diurnal motion of the Earth, and so we must bring Saturn

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up to the Sun's place. This involves knowing the pole of Saturn.

We may also bring Saturn to the Ascendant under its own pole. But if we were to bring the Sun to Saturn under the Sun's pole, that would be a *prenatal direction*, for the Sun cannot go back from the position it has attained and sink below the eastern horizon. We have therefore no alternative but to regard these directions as invalid, or to admit the thesis already suggested, that in these directions, made contrary to the apparent motion of the bodies in the heavens, we are dealing with the localised impress of the planet at the moment of birth, which impress is carried by the Earth up the western heavens and down the eastern heavens, so that the Sun's localised imprint is here carried down to the place of Saturn. And this is conformable to the theory of directions under the poles of the significators.

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CHAPTER XII

THE PART OF FORTUNE

For a considerable time there was much discussion as to the correct method of finding the place of the Part of Fortune. This, it should be explained, is one of the old Arabic points, which, like the Pomegranate, the Sword, and others, were regulated by the distances of the several bodies from the Sun in the zodiac, the particular point referred to being the same distance in zodiacal degrees from the Ascendant.

It was when astrologers came to apply this theory to the system of primary directions in vogue that the trouble arose as to the correct method of computing this point.

I think that the easiest expression of the case is this :—the Part of Fortune is a mundane point answering to the distance of the Moon from the Sun in the zodiac. Thus in the horoscope of Ruskin the Moon wants 21° 38′ from the opposition of the Sun, and therefore the Part of Fortune will be 21° 38′ below the western horizon in mundo.

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Its mundane position will therefore be 8° 22′ inside the 6th house.

Its meridian distance will be 68° 22′, and its pole 39° 13′. Under this pole we may direct it to aspects in the zodiac, and in mundo. It has been suggested that the Part of Fortune cannot be directed, but can only receive directions from other significators and the planets. This is surely nonsense. Any point in the heavens having been defined and located is carried by the motion of the Earth on its axis from its radical place to others successively in a direction that is contrary to the rotation of the Earth. Hence the Part of Fortune will here be carried down the heavens from the 6th to the 5th and from that to the 4th house successively, forming both mundane and zodiacal aspects under its own pole. The pole of the Part of Fortune and that of Saturn being near to one another, they must be near a mundane parallel, on the same side of the horizon.

There are, however, other suggested methods of taking the place of the Part of Fortune.

Ptolemy says (bk. iii., ch. xii.): "The Part of Fortune is ascertained by computing the number of degrees between the Sun and Moon, and it is placed at an equal number of degrees from the Ascendant in the order of the signs. It is in all cases, both by day and night, to be computed and set down, that the Moon may hold with it the same relation as that which the Sun may hold with

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the Ascendant; and it thus becomes, as it were, a lunar horoscope or Ascendant."

It is therefore clear that Ptolemy intended degrees of oblique ascension or descension, and not merely degrees in the zodiac, the relations of which, in regard to the horizon of any place, are continually changing.

Thus in the horoscope of Ruskin we have—

O.A. of Sun	.	.	341° 13′
O.D. of Moon	157° 26′		
add	180° 0′	337° 26′	
		3° 47′	Moon to oppos. Sun.
O.D. of 7th	.	.	159° 56′
		156° 9′	O.D. of Part of Fortune.

This gives us a position answering to the 10th degree of Leo, and therefore close to the Moon.

Placidus says: "Let the Sun's oblique ascension taken in the Ascendant be subtracted always from the oblique ascension of the Ascendant, as well in the day as in the night, and the remaining difference be added to the Moon's right ascension; the sum will be the right ascension of the Part of Fortune, which will have the Moon's declination."

In the example horoscope the oblique ascension of the Ascendant is 339° 56′, from which take the Sun's oblique ascension 341° 13′ (adding 360 for subtraction), and the remainder is 358° 43′, which

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add to the right ascension of the Moon 120° 17′, and the sum is the right ascension of the Part of Fortune 119° 0′.

The right ascension of the *imum cœli* being 69° 56′, the meridian distance of the Part of Fortune will be 49° 4′, and its semiarc will be that of the Moon, 52° 51′, as it has the same declination as the Moon in all cases. Then semiarc 52° 51′ − 49° 4′ = 3° 47′, which is the same as we derived from the method of Ptolemy. For there we found the oblique descension of the Part of Fortune to be 156° 9′; and the oblique descension of the 7th being 159° 56′, the difference is 3° 47′.

The method of Placidus appears preferable in that we derive at once the right ascension and meridian distance of the Part of Fortune.

The question is, however, whether either is true, and only directions made by the position as thus derived can settle the point in debate.

To enable the student to at once work out the primary arcs, we here append the speculum in the example horoscope:

R.A.	Ner. Dist.	Semiarc.	Horiz. Arc.	Cusp. Dist.
119° 0′	49° 4′	52° 51′	3° 47′	3° 47′

These elements at once suggest that the pole of the Part of Fortune can be found, and direction made by the Part of Fortune in mundo and

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zodiac to the planets, just as if it were a definite body.

The fact that it is merely a symbol, a point in space, does not in the least invalidate its significance in human affairs, as some impulsive students have suggested. For what else are the degrees of the zodiac known as the Midheaven and Ascendant? They are points in space which bear a definite relationship to a particular place at a given time. They do not need to be identified with a star in the heavens in order to obtain a significance in the horoscope. Every tyro in astrology knows as an absolute fact that these points have a very demonstrable significance in a horoscope, and that transits of the major planets over these points, and the passing of these points by planets in direction, are attended by events which leave no shadow of doubt that they are an essential part of the signalling apparatus by which we are forewarned of coming events. And if these, why not the Part of Fortune? Call it a "myth" if you like, but understand that a myth is a "veil" designed to hide a truth which a symbol is said to embody. The symbol handed down to us is identical with that used in China and also in Egypt to indicate "land, territory, a field."

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CHAPTER XIII

LUNAR PARALLAX AND SEMI-DIAMETER

AMONG the problems modernly confronting the student of directional astrology, that of the horizontal parallax of the Moon is perhaps one of the most important and at the same time most perplexing.

The places of the planets as indicated in the horoscope are the geocentric longitudes. They are computed from the standpoint of an observer. But as the place of observation is on the surface of the Earth and not at its centre, the observed position of the Moon will not exactly coincide with its computed geocentric longitude. In the case of the Sun and planets, the distances from the Earth are so great as to render the parallax inconsiderable, that of the Sun being only 9″, and the parallaxes of other bodies beyond it being proportionately less. But in regard to the Moon, its nearness to the Earth renders its parallax of importance if we are to regard the Moon as affecting us by its direct ray. The nearer the Earth it may be, the greater is the angle of parallax. It is

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therefore greatest at the perigee and least at the apogee of the Moon.

As the amount of parallax depends on the Moon's place in its orbit, we make use of the apogee as a point of departure, and the Moon's distance from that point in its orbit where it is furthest from the Earth is called its anomaly.

By comparing the calculated place with the observed place it has been found that the difference of the two at the apogee is 53′ 53″, and at perigee 61′ 23″. It will be sufficient for our purpose if we call these 54′ and 61′ respectively. By the use of the " Ready Reckoner " the amount of the anomaly can always be found for any date or hour, and the corresponding parallax is set against it. The table is here repeated for convenience.

[TABLE

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TABLE OF ANOMALY.

Epoch 1800, Jan. $0^d\ 0^h\ 0^m = 9^s\ 20°\ 20'$.

Years.	Add.	Days.	Add.	Anom.	Hor. Par.
	s ° ′		s ° ′	s °	′
1	2 28 43	1	0 13 4	0 0	54
2	5 27 27	2	0 26 8	6	55
3	8 26 10	3	1 9 12	12	55
4	0 7 57	4	1 22 16	18	55
5	3 6 40	5	2 5 19	24	55
6	6 5 24	6	2 18 23	1 0	55
7	9 4 7	7	3 1 27	6	55
8	0 15 54	8	3 14 31	12	55
9	3 14 38	9	3 27 35	18	55
10	6 13 21	10	4 10 39	24	56
20	1 9 46	11	4 23 43	2 0	56
40	2 19 32	12	5 6 47	6	56
50	9 2 53	13	5 19 51	12	56
60	3 29 18	14	6 2 55	18	57
70	10 12 39	15	6 15 58	24	57
80	5 9 3	16	6 29 2	3 0	57
90	11 22 24	17	7 12 6	6	58
100	6 18 49	18	7 25 10	12	58
Months.	Add.	19	8 8 14	18	59
		20	8 21 18	24	59
January .	0 0 0	21	9 4 22	4 0	59
February .	1 15 1	22	9 17 26	6	59
March . .	1 20 50				
April . .	3 5 51	23	10 0 30	12	60
May . .	4 7 48	24	10 13 34	18	60
June . .	5 22 49	25	10 26 37	24	60
		26	11 9 41	5 0	60
July . .	6 24 46				
August .	8 9 47	27	11 22 45	6	60
September .	9 24 48	28	0 5 49	12	60
October .	10 26 45	29	0 18 53	18	61
November .	0 11 45	30	1 1 57	24	61
December .	1 13 42	31	1 15 1	6 0	61

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Example.—Find the Moon's anomaly for 8th February 1819, and the corresponding horizontal parallax.

	s	°	′
Epoch 1800 . . .	9	20	20
Add 19 . .	9	27	59
February . . .	1	15	1
8 days	3	14	31
Anomaly =	0	17	51

The Moon is therefore within 18° of its apogee or furthest distance from the Earth, and its parallax will therefore be near its minimum. Our table shows that the parallax due to this anomaly is 55′. This would be the difference between the Moon's geocentric longitude and its observed position from the surface of the Earth if it were exactly on the horizon. At the meridian the parallax is 0, and at the horizon it differs, as stated, from 54′ to 61′ according to the distance of the Moon from the Earth, *i.e.* its place in its orbit.

Now, as the horizon is at all points 90° from the zenith or nadir, we can make one of these the apex of a triangle, of which the zenith distance of the Moon at transit is the perpendicular and the base its meridian distance. From these we may find the hypotenuse, which will be the Moon's zenith distance at the time of birth.

Thus, in the example horoscope the latitude of the place is 51° 30′ N., and the Moon has latitude

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5° 1′ N., which therefore must be subtracted, leaving 46° 29′ as the zenith distance of the Moon at transit of the nadir. Its meridian distance is found from the speculum to be 50° 21′. Then

Log. cosine 50° 21′.	. 9·80489
Log. cosine 46° 29′.	. 9·83794
Log. cosine 63° 52′.	. 9·64283

And as 90° is to 55′, so is 63° 52′ to 39′, which is the Moon's parallax, and by which amount she is apparently depressed further below the horizon than she is computed to be. This will affect its meridian distance, etc. The directions of the Moon, if operating dynamically by right lines of energy upon any part of the Earth instead of *via* the centre of the Earth, will hence be affected; and it remains a problem worth some close study and consideration as to what view ought to be taken. It is sufficient here to have indicated the method of calculation. It is one of the factors in the vexed problem of "the uncertain Moon," which has frequently been charged with an inconstancy altogether absent from the directions of the Sun and planets.

The semi-diameters of the Sun and Moon have often been resorted to in order to accommodate a directional arc to the date of an event. Allowing, as is undoubtedly the case, that primary directions have an orb of influence within the limits of which

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it may be said they begin to operate, attain their maximum, and pass off, there yet remains the fact that one would naturally expect the maximum to coincide with the most marked phase of a crisis in the life. This appears to be acknowledged, inasmuch as practitioners in the art of directing make use of arcs of direction, measured from the centres of bodies as determined by their longitudes, in order to correct approximate times of birth. This correction can only be legitimately made on the supposition that arcs of direction are close, if not exact, to the time of the events they are held to signify.

And unless there were this fundamental integrity of the system of direction advocated, unless there was a close agreement throughout a life between the arcs of direction and the events portrayed, there would be no use in making the calculations.

Our longitudes are geocentric and apply to the apparent centre of the bodies. The apparent diameter of the larger planets, on account of their great distance from the Earth, is inconsiderable. But when we come to the Sun and Moon, which are the chief significators, and the bodies that are directed to form the aspects of the promittors, we are concerned with orbs that have a visible diameter. The Sun on account of its immense size, and the Moon on account of its close proximity, appear to have a diameter of about half a degree, or from the centre to the limb about 15′. This becomes an

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important consideration when we are directing either of them to the aspect or conjunction of one of the planets, inasmuch as from first to last contact of the disc of the luminary with the said planet or aspect there will be an included arc of half a degree, and this means six months of time according to the Ptolemaic measure of 1°=1 year. Hence it may well be that a direction is increscent for three months before it attains its actual centrality and maximum strength, and another three months may transpire before the effects wear off. And if to this we add the fact that directions formed at the tropics, *i.e.* near Cancer or Capricorn 0, are very slow in formation (as may be seen from the Tables of Declination), 4° of longitude including only 1′ of declination, it will readily be understood that there is ample room for "latitude" in the timing of events.

It seems desirable, therefore, that a few cases of very well-observed birth-times should be taken, and the arcs of direction computed very closely; and then that these arcs should be compared with the course of events, so that an estimate of the value of the semi-diameters of the Sun and Moon may be made.

The apparent semi-diameter of the Moon is controlled by the same factor as the parallax, namely, its place in the orbit and consequent distance from the Earth. It may be useful to mention that the semi-diameter of the Moon is

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approximately twenty-seven one-hundredths of the parallax. Therefore multiply the parallax by 27 and divide by 100. Thus, when the parallax is 54′, the semi-diameter of the Moon is $54 \times 27 \div 100 = 14\frac{1}{2}'$, and when the parallax is 60, the semi-diameter is $60 \times 27 \div 100 = 16'$.

The Moon directed to the opposition of the Ascendant in the example horoscope works out at 2° 30′; but as the horizontal parallax of the Moon is 55′, its semi-diameter will be nearly 15′, and therefore the direction would read:

Asc. oppos.	Moon	in mundo, first contact	2° 15′
,,	,,	middle	2° 30′
,,	,,	last contact	2° 45′

thus giving a possible range of 30′, or six months for the duration of this indication. This may help to account for the variability that has been noticed in regard to lunar directions, and possibly we may also have to consider taking the parallax into account. The solar directions will be affected by semi-diameter of the Sun, but not appreciably by parallax.

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CHAPTER XIV

LUNAR EQUATIONS

UNDER this head I propose to examine a problem of some interest which appears to have escaped general recognition, but which may very well be considered with the questions of parallax and semi-diameter as having some connection with the noted irregularity of primary lunar directions.

Take an illustration from the horoscope already submitted. We would direct the Moon to conjunction with the nadir, which direction is known as "Midheaven opposition Moon in mundo." It is measured by the arc of the Moon's meridian distance, 50° 21′, and is formed by the rotation of the Earth on its axis, by which the Moon is carried down the western heavens until it makes its meridian transit.

The theory underlying this direction is that there is a permanent significance and value attaching to the radical positions of the Midheaven, Ascendant, and other significators, which is unaffected by the subsequent changes taking place amongst the planets, either on account of their apparent motions

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in the heavens or their real motions in the zodiac. But we have now to consider whether there may not be some value attaching to these subsequent motions of the bodies in the zodiac. These motions, within the narrow limits of time comprised in the formation of directions in a life of ordinary length, would not be appreciable in the case of the planets or the Sun, but in the case of the Moon there would be a quite appreciable increment owing to the velocity of that body in its orbit.

Thus the arc of 50° 21′ cited above would occupy the interval of 3 hours 25 minutes, during which the Moon will have increased its longitude by about 1° 42′, so that it would not actually make the meridian transit for another 7 minutes, although its radical place would then be exactly on the nadir. Its right ascension will be increased by about the same amount, and therefore the actual arc of direction from the time of birth until the bodily transit of the nadir would be about 52° 3′. So far as this case is concerned it is worthy of notice that this arc of the second distance of the Moon to the opposition of the Midheaven, and therefore to the mundane square of the Ascendant, coincided exactly with a period of serious illness and trouble in the life of Ruskin, whereas the arc M.C. opposition Moon in mundo, 50° 21′, exactly coincided with the election of Ruskin to the Slade Professorship of Fine Art, a distinction which brought him into the highest position in his sphere of life.

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Obviously, therefore, the second distance of the Moon is by far the most appropriate.

Let us look at another direction from the same point of view. Direct the Moon under its own pole to the opposition of Saturn.

The Moon's pole is 47° 27′, and its ascensional difference under that pole, derived in the process of finding the pole, is	31° 32′
Its right ascension	120° 17′
Its oblique descension under its pole .	151° 49′
Add	180° 0′
Oblique ascension of opposition Moon	=331° 49′

Then for Saturn's oblique ascension under the same pole—

Pole of Moon tang. . .	10·03712		
Tang. Saturn's decl. . .	9·08283		
Ascl. diff. Saturn sine . .	9·11995 =	7° 31′	
R.A. of Saturn . .		348° 54′	
O.A. of Saturn . .		356° 25′	under Moon's pole.
O.A. of Moon's oppos. .		331° 49′	
Arc. of Moon oppos. Saturn =		24° 36′	

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This corresponds with Ruskin's leap into public estimation and fame, for which we have the arc of direction Sun sextile Midheaven in mundo. Most certainly the Moon to opposition Saturn could not be regarded as in the least degree akin to the nature of events then current in the life of the great artist.

But this arc took 1h. 38m. 24s. to complete, and during that time the Moon had increased its R.A. by some 49′; and as we are bringing Saturn up to the opposition of the Moon under the pole of the Moon, we shall have to curtail the direction by 49′, which results in an arc of 23° 47′. This is nearly a year in advance of Ruskin's great advent, and may very well have coincided with a period of stress and indisposition.

The Moon to the opposition of Venus comes into force at about thirty years of age, or in the thirtieth year of life, when he married; but by adding the increment due to the time of direction to the radical place of the Moon we get an arc which falls out a whole year later, when it is certain Ruskin realised his disappointment.

The directions of the Sun during the course of sixty years would only be affected by an increment of 10′, and they can always be relied upon; but the directions of the Moon are at present very unsatisfactory, and it has been thought that this question of second distances may serve not only to indicate why lunar primary directions are inconstant, but why also they appear to have a more

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durable influence than those of the Sun. The suggestion is that from the time the direction is formed to the radical position of the Moon to the time that it is formed to the actual position of that body in the heavens, may be the extent of its duration; and during this period, which naturally increases in length as the age increases, transits and other secondary indications may come up repeatedly to reinforce the portents of the lunar direction and bring them into play. Certain it is that there are many conditions affecting the directions of the Moon which arise out of its velocity, and to maintain its ancient reputation for inconstancy and fickleness it appears to have jealously guarded its secret even from the lynx eye of the practical astrologer. Whether we have succeeded in compassing the fickle goddess by this exposition remains to be decided by constant experiment conducted by several independent workers. In the cause of a scientific astrology this is worth carrying out, and it is to be hoped that qualified and unprejudiced students will communicate their experience.

It may assist the average student to know that all directions of the Moon to *succeedent* places will fall out sooner, while those to *precedent* places will fall out later, than indicated by the radical or first distance of the Moon, and the arc of direction must therefore be increased or decreased at the rate of 2′ for every degree of the arc of direction. Thus an arc of 39° 15′ requires 1° 18½′.

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CHAPTER XV

CUSPAL DISTANCES

WHEN giving instructions as to the method of directing bodies to aspects of the Ascendant and Midheaven in mundo, it is customary to affirm that one-third of a planet's semiarc is equal to a house-space, so that a planet that is one-third of its semi-arc above the horizon is held to be on the cusp of the 12th house, and when two-thirds of its semiarc above the horizon it is on the cusp of the 11th. But if this were actually the case, we should find that when on the cusp of a house the oblique ascension of an ascending planet is the same as the oblique ascension of the cusp of that house. Such is not the case.

Example.—Direct the Sun in Ruskin's horoscope to the sextile of the Midheaven in mundo. This aspect falls on the cusp of the 12th house.

The semiarc diurnal of the Sun is 69° 59′, and one-third of this is 23° 20′, to which add the Sun's distance under the horizon, 1° 17′, and we get the arc of direction=24° 37′. The Sun is then on the cusp of the 12th house presumably. Let us see.

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The R.A. of the Midheaven is 249° 56′, to which if we add 60 we shall have the oblique ascension of the cusp of the 12th house, 309° 56′. Now, when the R.A. of the Midheaven is increased by an arc of 24° 37′, the oblique ascension of the cusp of the 12th will be increased by the same amount, and will then be 334° 33′, while the oblique ascension of the Sun is 341° 13′. Wherein lies the error ?

It lies in the fact that we are directing the Sun under the pole of the Ascendant, whereas we should direct it under the pole of the 12th house cusp. I here give a table of the polar elevation due to the various houses in several latitudes, from which, by proportion of their parts, we may derive the pole of any house for any minute of the included latitudes.

POLES OF HOUSES.

Lat.	Cusps of 3, 5, 9, 11.	Cusps of 2, 6, 8, 12.
45	18° 57′	34° 11′
46	19 37	35 10
47	20 19	36 10
48	21 2	37 10
49	21 46	38 12
50	22 33	39 15
51	23 21	40 19
52	24 12	41 24
53	25 5	42 31
54	26 1	43 39
55	26 59	44 48

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The pole of the 12th house for the latitude 51° 30′ N. is seen to be 40° 51′, and if we direct the Sun under this pole we shall have the

Ascensional difference of Sun under pole of 12th . .	13° 36′
Right ascension of Sun . .	321° 12′
Oblique ascension of Sun under pole of 12th . . .	334° 48′
Oblique ascension of cusp of the 12th house	309° 56′
Arc of direction . .	24° 52′

This, although not exact, is certainly nearer, and seems to justify the method of directing under the poles of planets.

The fact, however, is that if we take a fixed pole for any house in a given latitude we shall always be in some degree of error, and for the simple reason that the semiarcs of the planets, being parallel to the equator, do not lie in the same plane as the prime vertical, which is the circle we divide into twelve equal parts to form the houses of the heavens. Therefore an equal division of the prime vertical will not result in an equal division of the semiarcs, and either we have to consider the poles of the houses as movable, or, as seems more consistent with the facts, we must regard the house-spaces as unequal. In other words, we shall find that the

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time (measured by degrees of R.A.) that the Sun remains in successive houses is unequal, and the same is to be said of any other body. When, therefore, we take one-third of the semiarc of a planet as equal to one house-space, we are indulging in a free use of the metaphysical concept that "all circles are equal to one another," as defined by the doctrine of Correspondences. Against this I have nothing to say except that it is not mathematics.

Now, just as we take the Sun's oblique ascension under the pole of the Ascendant in order to find its distance from the horizon, so we must take its oblique ascension under the pole of the 12th house in order to find its distance from the cusp of the 12th, and its oblique ascension under the pole of the 11th to find its distance from the cusp of the 11th. Its right distance from the cusp of the 10th will be its arc to that cusp, since the meridian has no polar elevation. Thus:

The pole of the Ascendant is .	51° 30′
The pole of the 12th house . .	40° 51′
The pole of the 11th house . .	23° 46′

The Sun's declination is 15° 13′, log. tang. 9·64380, and if to this we add the tangent of the poles of the houses successively we shall have the sine of the ascensional differences of the Sun under these poles, which, added to its right ascension, will give its oblique ascension under those poles. These are:

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O.A. of Sun under pole of 1st house . 341° 13′
O.A. of Sun under pole of 12th house 334° 48′
O.A. of Sun under pole of 11th house 327° 59′
R.A. of Sun under pole of 10th house 321° 12′

Then, to find the arc of direction between the Sun and any of these cusps, we merely subtract the oblique ascension of the one from the other. The oblique ascensions of the cusps are :

Of the Ascendant . . 339° 56′
Of the 12th . . . 309° 56′
Of the 11th . . . 279° 56′
Of the Midheaven R.A. 249° 56′

Thus we have the following true arcs of direction of the Sun in mundo :

O.A. Sun under pole of Ascendant . 341° 13′
O.A. of the Ascendant . . . 339° 56′

Arc of Sun to conjunction Ascendant 1° 17′

O.A. of Sun under pole of 12th . . 334° 48′
O.A. of 12th house cusp . . . 309° 56′

Arc of Sun to sextile Midheaven mundo 24° 52′

O.A. of Sun under pole of 11th . . 327° 59′
O.A. of cusp of 11th . . . . 279° 56′

Arc of Sun to sextile Ascendant mundo 48° 3′

R.A. of Sun under Meridian . . 321° 12′
R.A. of Midheaven . . . . 249° 56′

71° 16′

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And in all these cases the Sun will have the same oblique ascension as the cusp of the house to which it is directed, at the time of direction being completed. This is what we argue for and obtain.

Also we may find the degrees of R.A. which pass under the meridian while the Sun passes from the cusp of one house to the next, and thus the house-space of the Sun at its present declination.

As the whole diurnal arc of the Sun is less than 90, the house-space will be less than 30°.

Subtract the arc of direction of Sun conjunct Ascendant from the arc of direction Sun conjunct 12th = Sun sextile Midheaven. There remains 23° 35′, the house-space of 12th house.

Subtract the direction of the Sun to the 12th from that to the 11th; there remains 23° 11′, the house-space of the Sun in the 11th. Subtract the arc of direction Sun cusp of the 11th from the Sun conjunct Midheaven; there remains 23° 13′, the house-space of the Sun in the 10th.

And the three house-spaces added together = 69° 59′, which is the diurnal semiarc of the Sun.

Hence it appears that the mundane directions of planets must be taken in terms of the pole of the cusp to which they are directed. The cuspal distances of the planets must also be measured according to the same rule. This will affect all directions calculated by primary arcs on the semi-arc method now commonly in vogue.

But what appears of most vital importance as

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a legitimate conclusion drawn from this critique is that the correct method of directing to any body is by oblique ascension under the pole of that body, which is quite different from taking the direction under the pole of the body directed. At the same time, it appears to dispose of the semiarc method, except as a valuable approximation. For nothing can be more certain than that the cusps of the houses, measured in the prime vertical, are 30° distant from one another by oblique ascension.

These conclusions agree entirely with our mathematics, for we have seen that the house-space of the Sun in the 12th, due to its declination, is 23° 35′; and if to this we add the Sun's direction (from below) to the Ascendant = 1° 17′, we have an arc of direction, Sun to conjunction cusp of 12th = Midheaven sextile Sun in mundo, 24° 52′, which is exactly what we found the direction of the Sun to be by oblique ascension when taken under the pole of the 12th house.

This proves, if anything can, not only that the correct method of directing is under the pole of the planet or position directed to, but also that the house-spaces are variable and depend on the several declinations of the planets, and thus on their oblique ascensions and descensions, taken under the poles of the successive houses.

By the semiarc method, taking one-third of a semiarc as equal to a house-space, we are dealing with an approximation which, although useful

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and facile, is not mathematically correct. Rather than that bad habits should become popular, I have undertaken a somewhat lengthy demonstration of this point, which I consider to be now settled beyond further debate.

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CHAPTER XVI

SUGGESTED METHOD OF TRUE DIRECTING

As the result of this examination of the various methods of directing, both by semiarc proportions and by oblique ascensions under the poles, we may come to the conclusion that all the disparities which vitiate the present methods can be disposed of if we proceed along the lines to which our conclusions point. For this purpose we shall require a speculum containing :

1. The right ascension of a planet.
2. Its declination.
3. Its pole.
4. Its ascensional difference under its own pole.

The first of these will, of course, be worked as usual. The declination will be that given in the ephemeris. The pole of the planet will be that derived in the usual way from the ascensional difference of its proportional place in the prime vertical taken under its own declination, as already shown. Its cuspal distance will be the difference between its oblique

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ascension (or descension) taken under the pole of the cusp to which it is nearest and the oblique ascension of the cusp in the prime vertical. These are all the elements required for a complete calculation of all legitimate arcs of direction.

Directions must be made under the pole of the body to which we are directing another. The pole is the same as geographical latitude. It represents the latitude (geographical) or polar elevation (astronomical) at which the cusp of the house cuts into the circle of the prime vertical, or at which a circle of position cuts into it.

Thus in the following diagram let the great circle NZHS, etc., be the sphere of the Earth, of which N is the north pole, S the south pole. Also let ZN be the great circle of the prime vertical at an elevation from the Equator of 51° 30′ N., and H–H the horizon intersecting it at right angles. Then HNZH will be the upper meridian and HSNH will be the lower meridian, the points Z and N marking the zenith and the nadir. The cusps of the 10th, 11th, and 12th houses are shown by the great circles cutting through the prime vertical at different elevations, and these answer exactly to the geographical latitudes (north) of the same values. Thus the pole of the Ascendant is 51° 30′, that of the 12th, 40° 51′, that of the 11th, 23° 46′, and that of the 10th, 0° 0′, as shown in the diagram, the ascensional difference being the arc in R.A. between N–S and H–H.

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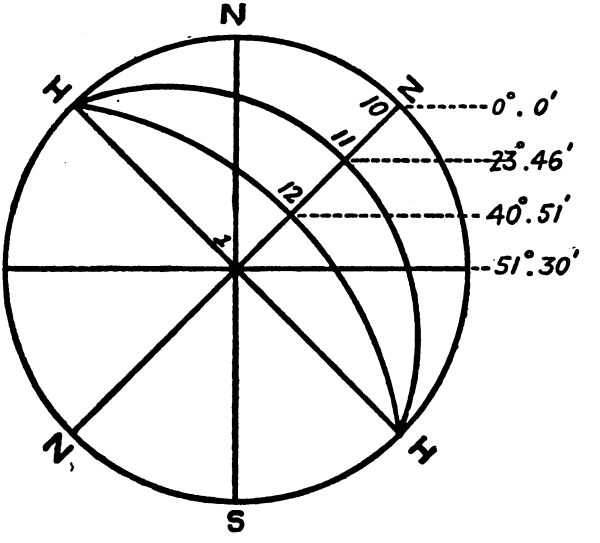
A circle of position is thus seen to be one which passes through a body and converges upon the



horizon north and south exactly like an intermediate cusp of a house.

Rules for Directing

Rule 1.—Find the pole of the body or ecliptic position to which direction is to be made. Find the ascensional difference under this pole of the body to be directed. Apply this ascensional difference to the right ascension of the body to be directed, and obtain its oblique ascension (or descension, as the case may require) under the

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pole of the body to which direction is made. The difference between this and the oblique ascension of the body to which direction is made, taken under its own pole, will be the *arc of direction*.

Rule 2.—In mundane directions take the body of the promittor, *i.e.* body directed to. In zodiacal directions take its longitude.

Rule 3.—In directing to the aspect of a planet in mundo, its cuspal distance taken under its own pole must be directed to under the same pole.

This rule also serves for mundane parallels.

Here is the Speculum required for Ruskin's horoscope.

SPECULUM

Planet.	R.A.	Declin.	Pole.	Ascen. Diff.
Sun . . .	32° 12′	15° 13′ 9·43458	51° 13′ 10·09493	19° 47′
Moon . .	120 17	25 39 9·68142	50 21 10·08147	35 24
Mercury . .	296 47	21 34 9·59688	44 55 9·99885	23 13
Venus . .	276 6	18 10 9·51606	27 13 9·71125	9 43
Mars . . .	299 6	21 45 9·60013	46 22 10·02066	24 44
Jupiter . .	302 37	20 26 9·57119	47 13 10·03355	23 44
Saturn . .	348 54	6 54 9·08283	45 56 10·01423	7 11
Uranus . .	262 49	23 24 9·63623	3 13 8·74904	7 27
Neptune . .	267 47	22 14 9·61148	3 48 8·82147	9 20

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Examples

Direct the Sun in mundo to the conjunction with Venus mundo. The pole of Venus is 27° 13′, its ascensional difference under that pole is 9° 43′, which added to its R.A., 276° 6′ (as Venus' declination is S.), gives its oblique ascension under its own pole = 285° 49′.

The oblique ascension of Sun under the same pole is—

Pole, log. tang. .	27° 13′	9·71125
Decl., log. tang. .	15° 13′	9·43458
Asc. diff. log. sine	8° 2′	9·14583
R.A. of Sun .	321° 12′	
O.A. of Sun .	329° 14′	under Venus' pole.
O.A. Venus .	285° 49′	„ „ „

Arc of direction = 43° 25′ Sun conj. Venus in mun.

Note.—All the tangents being inserted in the speculum under the declinations and poles of the planets, they can be extracted as required.

Direct Uranus to the conjunction with the Moon in mundo.

The pole of the Moon is 50° 21′, its ascensional difference under that pole is 35° 24′, and its oblique descension 155° 41′.

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The declin. of Uranus is	23° 24′	tan. 9·63623
Pole of Moon . .	50° 21′	tan. 0·08147
Asc. diff. under pole .	31° 28′	sine 9·71770
Uranus' R.A.. .	262° 49′	
O.D. Uranus . .	231° 21′	under Moon's pole.
O.D. of Moon. .	155° 41′	,, ,, ,,

Arc of direction = 75° 40′ Uranus conj. Moon in mundo.

These directions take very much less time to calculate than to set out in writing, and with the speculum at hand they are readily figured out in a minute or two.

Direct the Moon to opposition of Venus in mundo.

Oblique descension of the opposition of Venus = 105° 49′.

This is taken under the pole of Venus, from Venus' oblique ascension less 180° = oblique ascension of the opposite point.

Oblique descension of Moon under Venus' pole	134° 37′
Oblique descension of Venus under same pole	105° 49′
Arc of Direction, Moon oppos. Venus mundo	28° 48′

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These examples will doubtless serve for all conjunctions in mundo. For zodiacal directions it will be necessary to find the declination of the degree of the ecliptic held by a planet to which direction is made, or of its aspect, and add the log. tang. of this declination to the log. tang. of its pole. This will give the ascensional difference under that pole. Apply this to the right ascension to get its oblique ascension or oblique descension under that pole. The difference between this and the oblique ascension (or descension) of the planet directed, taken under the same pole, will be the arc of direction.

Planets having the same pole are either in mundane conjunction or in mundane parallel. This gives us the hint as to the calculation of mundane parallels.

Find the oblique ascension or oblique descension of the planet on which the parallel is formed, taken under its own pole. Find the oblique ascension or oblique descension (as the case may require) of the planet forming the parallel, under the same pole. The difference will be the arc of direction.

Example 1. — Bring Saturn in the example horoscope to the mundane parallel of the Moon.

This direction is formed by Saturn coming up to the pole of the Moon on the other side of the meridian.

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Right ascension of the Midheaven .	249° 56′
Oblique descension of Moon under its own pole	155° 45′
Moon's distance from Midheaven, westward	94° 11′
Added to R.A. of M.C. .	249° 56′
Oblique ascension of the parallel, eastward	344° 7′
Oblique ascension of Saturn under Moon's pole	357° 18′
Arc of direction = difference .	13° 11′

This arc of direction, when computed by the semiarc method, is seen to be 8′ short of the actual figures, which throws the time out nearly two months. The arc by that method is 13° 3′ as compared with 13° 11′, the true arc.

Example 2.—Bring Uranus to the mundane parallel of Sun in mundo. Here the planet descends the western horizon until it comes to the same pole westward as the Sun holds eastward.

Oblique ascension of the Sun under its own pole, 51° 13′ . . .	349° 59′
Subtract 180 . . .	180° 0′
Oblique descension of aspect below west horizon	160° 59′
Oblique descension of Uranus under pole of Sun	230° 14′
Arc of direction, Uranus parallel Sun mundo . . .	69° 15′

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This arc of direction by the semiarc method is found to be 70° 57′, which shows an error of 1° 42′, equal to one year and eight months of time.

Time Measure for Arcs

This remark brings me back again to the question of the equation of time, so much in dispute among astrologers. I think there can be little doubt that the true method is "a day for a year," which is certainly the most ancient method, as it is also the most uniform. In twenty-four hours the Earth revolves on its axis and the Sun comes again to the same meridian, having in the interval increased its longitude by more or less than a degree according to its apparent place in its orbit, *i.e.* the season of the year. The mean rate of its motion is 59′ 8″. Then, as all our calculations are made in terms of equatorial degrees, we have to make a proportion 59′ 8″ to 60′, and this gives 24h. 21m. = 1 year 5·334 days = 1 year 5d. 8h. for each 1° in the arc of direction. Thus every 6° in the arc of direction will give an extra month, to be added to the time at the rate of 1° = 1 year, which is the measure of time used in the semiarc method. If we add 5′ for every 6° of arc it will come to the same thing approximately. The measure of a degree of R.A. for a year is due to Placidus. That of the Sun's mean motion, or 1° R.A. = 1 year 5 days, is due to Valentine Naibod. Both are a compromise with facts. The probability is that we ought to

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take the measure according to the season of the year in which the birth takes place, and hence the Sun's actual increase of R.A. on that date, since the Sun is in every natural sense the great chronocrater, or time-maker. Thus, in the case of Ruskin, who was born on the 8th February, the Sun's diurnal increase of R.A. is 3′ 57″=59′ 15″ in arc, but its increase in longitude is 60′ 43″, and this being an excess 1′ 35″ over the mean motion in the zodiac, an arc of direction, at the rate of a day for a year, would measure to so much less, at the rate of about 1½ minutes for every complete degree of the arc. It will thus be seen that the question of the validity of one method over another in primary directions does not rest entirely on the astronomical facts, but also upon the value we attach to the arcs of direction when obtained. As to the astronomy of the case, there is not the slightest doubt in my mind that the method of directing under the pole of the significator is the correct mathematical scheme. But as to the measure of time from arcs thus derived, this is a matter of experiment, and one needs to exhaust all the evidence before coming to a conclusion.

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CHAPTER XVII

CONCLUSION

In the foregoing pages I have endeavoured to set out and critically examine the methods of directing advocated by Ptolemy and Placidus as modernly represented; and I have further sought to establish their validity on general principles. I have not been blind to their imperfections, and have clearly indicated my view of the semiarc method, derived from the principles laid down by these great pioneers of a scientific astrology, when I speak of them as valuable approximations. The discrepancies are those due to incorrect use of words in describing the facts. The term "corresponding to" should be more frequently used in the semiarc method in place of the term "equal to." It is admitted that in both systems—that of proportional semiarcs and that of direction under poles—we are concerned with the apparent places of the planets in the prime vertical, and therefore when we speak of planets as being directed to a conjunction we mean an apparent conjunction as seen from the place of birth, and not either in the zodiac or by

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right ascension, but solely in the prime vertical or circle of observation, which coincides neither with the Equator nor the Ecliptic. Therefore, when we come to the test we find without doubt that the only way of doing this is to bring the directed body along its own arc or parallel of declination to the same pole as the promittor or body directed to. Also, it is apparent that as polar elevation is measured from the zenith in the plane of the prime vertical, planets having the same pole must be in mundane conjunction if on the same side of the meridian, or in mundane parallel if on opposite sides, which fact renders the calculation of mundane parallels a process of such extreme simplicity that I wonder it has never been pointed out before.

To correct the errors arising out of the methods of Ptolemy and Placidus, I have made a complete statement of the true doctrine of polar directions in the plane of the prime vertical, and have supplemented this by a speculum drawn according to the principles laid down, so that by mere inspection of the same, and very little figuring, all directions in mundo can be calculated. For directions in the zodiac it will be necessary to have the pole of the aspect or position in the zodiac, which can be determined by the longitudinal distance from the cusp of the house taken in proportion to the degrees of the ecliptic included in that house from the Table of Poles of the Houses, and from this we get its oblique ascension or oblique de-

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scension under its own pole, and direct to it as in mundane direction.

In effect, it will be found that with a set of tables of oblique ascension, and one of tables of poles, all directions can be correctly calculated in a fraction of the time usually devoted to them, even by the very facile but faulty method of proportion of semiarcs. I have fairly stated both cases, and criticised only where criticism was necessary to correct error. In this I have done no hurt to the cause of scientific astrology, and I conclude this treatise in the earnest belief that I have even done some small service.

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TABLES FOR THE USE OF ASTROLOGICAL STUDENTS

INCLUDING TABLES OF LOGARITHMIC SINES, TANGENTS, ETC., TABLES OF RIGHT ASCENSION, DECLINATION, AND ASCENSIONAL DIFFERENCE, AND TERNARY PROPORTIONAL LOGARITHMS

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TABLES OF LOGARITHMIC SINES, TANGENTS, ETC.

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[0 degrees.]

′	Sine.	Diff.	Tangent.	Diff.	Cotang.	Cosine.	′
0	− ∞	+ ∞	− ∞	∞	+ ∞	0·00000	60
1	6·46373	30103	6·46373	30103	13·53627	0·00000	59
2	6·76476	17609	6·76476	17609	13·23524	0·00000	58
3	6·94085	12494	6·94085	12494	13·05915	0·00000	57
4	7·06579	9691	7·06579	9691	12·93421	0·00000	56
5	7·16270	7918	7·16270	7918	12·83730	0·00000	55
6	7·24188	6694	7·24188	6694	12·75812	0·00000	54
7	7·30882	5800	7·30882	5800	12·69118	0·00000	53
8	7·36682	5115	7·36682	5115	12·63318	0·00000	52
9	7·41797	4576	7·41797	4576	12·58203	0·00000	51
10	7·46373	4139	7·46373	4139	12·53627	0·00000	50
11	7·50512	3779	7·50512	3779	12·49488	0·00000	49
12	7·54291	3476	7·54291	3476	12·45709	0·00000	48
13	7·57767	3218	7·57767	3219	12·42233	0·00000	47
14	7·60985	2997	7·60986	2996	12·39014	0·00000	46
15	7·63982	2802	7·63982	2803	12·36018	0·00000	45
16	7·66784	2633	7·66785	2633	12·33215	0·00000	44
17	7·69417	2483	7·69418	2482	12·30582	9·99999	43
18	7·71900	2348	7·71900	2348	12·28100	9·99999	42
19	7·74248	2227	7·74248	2228	12·25752	9·99999	41
20	7·76475	2119	7·76476	2119	12·23524	9·99999	40
21	7·78594	2021	7·78595	2020	12·21405	9·99999	39
22	7·80615	1930	7·80615	1931	12·19385	9·99999	38
23	7·82545	1848	7·82546	1848	12·17454	9·99999	37
24	7·84393	1773	7·84394	1773	12·15606	9·99999	36
25	7·86166	1704	7·86167	1704	12·13833	9·99999	35
26	7·87870	1639	7·87871	1639	12·12129	9·99999	34
27	7·89509	1579	7·89510	1579	12·10490	9·99999	33
28	7·91088	1524	7·91089	1524	12·08911	9·99999	32
29	7·92612	1472	7·92613	1473	12·07387	9·99998	31
30	7·94084		7·94086		12·05914	9·99998	30
′	Cosine.		Cotang.		Tangent.	Sine.	′

[89 degrees.]

[0 degrees.]

′	Sine.	Diff.	Tangent.	Diff.	Cotang.	Cosine.	′
30	7·94084	1424	7·94086	1424	12·05914	9·99998	30
31	7·95508	1379	7·95510	1379	12·04490	9·99998	29
32	7·96887	1336	7·96889	1336	12·03111	9·99998	28
33	7·98223	1297	7·98225	1297	12·01775	9·99998	27
34	7·99520	1259	7·99522	1259	12·00478	9·99998	26
35	8·00779	1223	8·00781	1223	11·99219	9·99998	25
36	8·02002	1190	8·02004	1190	11·97996	9·99998	24
37	8·03192	1158	8·03194	1159	11·96806	9·99997	23
38	8·04350	1128	8·04353	1128	11·95647	9·99997	22
39	8·05478	1100	8·05481	1100	11·94519	9·99997	21
40	8·06578	1072	8·06581	1072	11·93419	9·99997	20
41	8·07650	1046	8·07653	1047	11·92347	9·99997	19
42	8·08696	1022	8·08700	1022	11·91300	9·99997	18
43	8·09718	999	8·09722	998	11·90278	9·99997	17
44	8·10717	976	8·10720	976	11·89280	9·99996	16
45	8·11693	954	8·11696	955	11·88304	9·99996	15
46	8·12647	934	8·12651	934	11·87349	9·99996	14
47	8·13581	914	8·13585	915	11·86415	9·99996	13
48	8·14495	896	8·14500	895	11·85500	9·99996	12
49	8·15391	877	8·15395	878	11·84605	9·99996	11
50	8·16268	860	8·16273	860	11·83727	9·99995	10
51	8·17128	843	8·17133	843	11·82867	9·99995	9
52	8·17971	827	8·17976	828	11·82024	9·99995	8
53	8·18798	812	8·18804	812	11·81196	9·99995	7
54	8·19610	797	8·19616	797	11·80384	9·99995	6
55	8·20407	782	8·20413	782	11·79587	9·99994	5
56	8·21189	769	8·21195	769	11·78805	9·99994	4
57	8·21958	755	8·21964	756	11·78036	9·99994	3
58	8·22713	743	8·22720	742	11·77280	9·99994	2
59	8·23456	730	8·23462	730	11·76538	9·99994	1
60	8·24186		8·24192		11·75808	9·99993	0
′	Cosine.		Cotang.		Tangent.	Sine.	′

[89 degrees.]

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[1 degree.]

′	Sine.	Diff.	Tangent.	Diff.	Cotang.	Cosine.	′
0	8·24186	717	8·24192	718	11·75808	9·99993	60
1	8·24903	706	8·24910	706	11·75090	9·99993	59
2	8·25609	695	8·25616	696	11·74384	9·99993	58
3	8·26304	684	8·26312	684	11·73688	9·99993	57
4	8·26988	673	8·26996	673	11·73004	9·99992	56
5	8·27661	663	8·27669	663	11·72331	9·99992	55
6	8·28324	653	8·28332	654	11·71668	9·99992	54
7	8·28977	644	8·28986	643	11·71014	9·99992	53
8	8·29621	634	8·29629	634	11·70371	9·99992	52
9	8·30255	624	8·30263	625	11·69737	9·99991	51
10	8·30879	616	8·30888	617	11·69112	9·99991	50
11	8·31495	608	8·31505	607	11·68495	9·99991	49
12	8·32103	599	8·32112	599	11·67888	9·99990	48
13	8·32702	590	8·32711	591	11·67289	9·99990	47
14	8·33292	583	8·33302	584	11·66698	9·99990	46
15	8·33875	575	8·33886	575	11·66114	9·99990	45
16	8·34450	568	8·34461	568	11·65539	9·99989	44
17	8·35018	560	8·35029	561	11·64971	9·99989	43
18	8·35578	553	8·35590	553	11·64410	9·99989	42
19	8·36131	547	8·36143	546	11·63857	9·99989	41
20	8·36678	539	8·36689	540	11·63311	9·99988	40
21	8·37217	533	8·37229	533	11·62771	9·99988	39
22	8·37750	526	8·37762	527	11·62238	9·99988	38
23	8·38276	520	8·38289	520	11·61711	9·99987	37
24	8·38796	514	8·38809	514	11·61191	9·99987	36
25	8·39310	508	8·39323	509	11·60677	9·99987	35
26	8·39818	502	8·39832	502	11·60168	9·99986	34
27	8·40320	496	8·40334	496	11·59666	9·99986	33
28	8·40816	491	8·40830	491	11·59170	9·99986	32
29	8·41307	485	8·41321	486	11·58679	9·99985	31
30	8·41792		8·41807		11·58193	9·99985	30
′	Cosine.		Cotang.		Tangent.	Sine.	′

[88 degrees.]

[1 degree.]

′	Sine.	Diff.	Tangent.	Diff.	Cotang.	Cosine.	′
30	8·41792	480	8·41807	480	11·58193	9·99985	30
31	8·42272	474	8·42287	475	11·57713	9·99985	29
32	8·42746	470	8·42762	470	11·57238	9·99984	28
33	8·43216	464	8·43232	464	11·56768	9·99984	27
34	8·43680	459	8·43696	460	11·56304	9·99984	26
35	8·44139	455	8·44156	455	11·55844	9·99983	25
36	8·44594	450	8·44611	450	11·55389	9·99983	24
37	8·45044	445	8·45061	446	11·54939	9·99983	23
38	8·45489	441	8·45507	441	11·54493	9·99982	22
39	8·45930	436	8·45948	437	11·54052	9·99982	21
40	8·46366	433	8·46385	432	11·53615	9·99982	20
41	8·46799	427	8·46817	428	11·53183	9·99981	19
42	8·47226	424	8·47245	424	11·52755	9·99981	18
43	8·47650	419	8·47669	420	11·52331	9·99981	17
44	8·48069	416	8·48089	416	11·51911	9·99980	16
45	8·48485	411	8·48505	412	11·51495	9·99980	15
46	8·48896	408	8·48917	408	11·51083	9·99979	14
47	8·49304	404	8·49325	404	11·50675	9·99979	13
48	8·49708	400	8·49729	401	11·50271	9·99979	12
49	8·50108	396	8·50130	397	11·49870	9·99978	11
50	8·50504	393	8·50527	393	11·49473	9·99978	10
51	8·50897	390	8·50920	390	11·49080	9·99977	9
52	8·51287	386	8·51310	386	11·48690	9·99977	8
53	8·51673	382	8·51696	383	11·48304	9·99977	7
54	8·52055	379	8·52079	380	11·47921	9·99976	6
55	8·52434	376	8·52459	376	11·47541	9·99976	5
56	8·52810	373	8·52835	373	11·47165	9·99975	4
57	8·53183	369	8·53208	370	11·46792	9·99975	3
58	8·53552	367	8·53578	367	11·46422	9·99974	2
59	8·53919	363	8·53945	363	11·46055	9·99974	1
60	8·54282		8·54308		11·45692	9·99974	0
′	Cosine.		Cotang.		Tangent.	Sine.	′

[88 degrees.]

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[2 degrees.]

′	Sine.	Diff.	Tangent.	Diff.	Cotang.	Cosine.	′
0	8·54282	360	8·54308	361	11·45692	9·99974	60
1	8·54642	357	8·54669	358	11·45331	9·99973	59
2	8·54999	355	8·55027	355	11·44973	9·99973	58
3	8·55354	351	8·55382	352	11·44618	9·99972	57
4	8·55705	349	8·55734	349	11·44266	9·99972	56
5	8·56054	346	8·56083	346	11·43917	9·99971	55
6	8·56400	343	8·56429	344	11·43571	9·99971	54
7	8·56743	341	8·56773	341	11·43227	9·99970	53
8	8·57084	337	8·57114	338	11·42886	9·99970	52
9	8·57421	336	8·57452	336	11·42548	9·99969	51
10	8·57757	332	8·57788	333	11·42212	9·99969	50
11	8·58089	330	8·58121	330	11·41879	9·99968	49
12	8·58419	328	8·58451	328	11·41549	9·99968	48
13	8·58747	325	8·58779	326	11·41221	9·99967	47
14	8·59072	323	8·59105	323	11·40895	9·99967	46
15	8·59395	320	8·59428	321	11·40572	9·99967	45
16	8·59715	318	8·59749	319	11·40251	9·99966	44
17	8·60033	316	8·60068	316	11·39932	9·99966	43
18	8·60349	313	8·60384	314	11·39616	9·99965	42
19	8·60662	311	8·60698	311	11·39302	9·99964	41
20	8·60973	309	8·61009	310	11·38991	9·99964	40
21	8·61282	307	8·61319	307	11·38681	9·99963	39
22	8·61589	305	8·61626	305	11·38374	9·99963	38
23	8·61894	302	8·61931	303	11·38069	9·99962	37
24	8·62196	301	8·62234	301	11·37766	9·99962	36
25	8·62497	298	8·62535	299	11·37465	9·99961	35
26	8·62795	296	8·62834	297	11·37166	9·99961	34
27	8·63091	294	8·63131	295	11·36869	9·99960	33
28	8·63385	293	8·63426	292	11·36574	9·99960	32
29	8·63678	290	8·63718	291	11·36282	9·99959	31
30	8·63968		8·64009		11·35991	9·99959	30
′	Cosine.		Cotang.		Tangent.	Sine.	′

[87 degrees.]

[2 degrees.]

′	Sine.	Diff.	Tangent.	Diff.	Cotang.	Cosine.	′
30	8·63968	288	8·64009	289	11·35991	9·99959	30
31	8·64256	287	8·64298	287	11·35702	9·99958	29
32	8·64543	284	8·64585	285	11·35415	9·99958	28
33	8·64827	283	8·64870	284	11·35130	9·99957	27
34	8·65110	281	8·65154	281	11·34846	9·99956	26
35	8·65391	279	8·65435	280	11·34565	9·99956	25
36	8·65670	277	8·65715	278	11·34285	9·99955	24
37	8·65947	276	8·65993	276	11·34007	9·99955	23
38	8·66223	274	8·66269	274	11·33731	9·99954	22
39	8·66497	272	8·66543	273	11·33457	9·99954	21
40	8·66769	270	8·66816	271	11·33184	9·99953	20
41	8·67039	269	8·67087	269	11·32913	9·99952	19
42	8·67308	267	8·67356	268	11·32644	9·99952	18
43	8·67575	266	8·67624	266	11·32376	9·99951	17
44	8·67841	263	8·67890	264	11·32110	9·99951	16
45	8·68104	263	8·68154	263	11·31846	9·99950	15
46	8·68367	260	8·68417	261	11·31583	9·99949	14
47	8·68627	259	8·68678	260	11·31322	9·99949	13
48	8·68886	258	8·68938	258	11·31062	9·99948	12
49	8·69144	256	8·69196	257	11·30804	9·99948	11
50	8·69400	254	8·69453	255	11·30547	9·99947	10
51	8·69654	253	8·69708	254	11·30292	9·99946	9
52	8·69907	252	8·69962	252	11·30038	9·99946	8
53	8·70159	250	8·70214	251	11·29786	9·99945	7
54	8·70409	249	8·70465	249	11·29535	9·99944	6
55	8·70658	247	8·70714	248	11·29286	9·99944	5
56	8·70905	246	8·70962	246	11·29038	9·99943	4
57	8·71151	244	8·71208	245	11·28792	9·99942	3
58	8·71395	243	8·71453	244	11·28547	9·99942	2
59	8·71638	242	8·71697	243	11·28303	9·99941	1
60	8·71880		8·71940		11·28060	9·99940	0
′	Cosine.		Cotang.		Tangent.	Sine.	′

[87 degrees.]

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[1 degree.]

′	Sine.	Diff.	Tangent.	Diff.	Cotang.	Cosine.	′
0	8·24186	717	8·24192	718	11·75808	9·99993	60
1	8·24903	706	8·24910	706	11·75090	9·99993	59
2	8·25609	695	8·25616	696	11·74384	9·99993	58
3	8·26304	684	8·26312	684	11·73688	9·99993	57
4	8·26988	673	8·26996	673	11·73004	9·99992	56
5	8·27661	663	8·27669	663	11·72331	9·99992	55
6	8·28324	653	8·28332	654	11·71668	9·99992	54
7	8·28977	644	8·28986	643	11·71014	9·99992	53
8	8·29621	634	8·29629	634	11·70371	9·99992	52
9	8·30255	624	8·30263	625	11·69737	9·99991	51
10	8·30879	616	8·30888	617	11·69112	9·99991	50
11	8·31495	608	8·31505	607	11·68495	9·99991	49
12	8·32103	599	8·32112	599	11·67888	9·99990	48
13	8·32702	590	8·32711	591	11·67289	9·99990	47
14	8·33292	583	8·33302	584	11·66698	9·99990	46
15	8·33875	575	8·33886	575	11·66114	9·99990	45
16	8·34450	568	8·34461	568	11·65539	9·99989	44
17	8·35018	560	8·35029	561	11·64971	9·99989	43
18	8·35578	553	8·35590	553	11·64410	9·99989	42
19	8·36131	547	8·36143	546	11·63857	9·99989	41
20	8·36678	539	8·36689	540	11·63311	9·99988	40
21	8·37217	533	8·37229	533	11·62771	9·99988	39
22	8·37750	526	8·37762	527	11·62238	9·99988	38
23	8·38276	520	8·38289	520	11·61711	9·99987	37
24	8·38796	514	8·38809	514	11·61191	9·99987	36
25	8·39310	508	8·39323	509	11·60677	9·99987	35
26	8·39818	502	8·39832	502	11·60168	9·99986	34
27	8·40320	496	8·40334	496	11·59666	9·99986	33
28	8·40816	491	8·40830	491	11·59170	9·99986	32
29	8·41307	485	8·41321	486	11·58679	9·99985	31
30	8·41792		8·41807		11·58193	9·99985	30
′	Cosine.		Cotang.		Tangent.	Sine.	′

[88 degrees.]

[1 degree.]

′	Sine.	Diff.	Tangent.	Diff.	Cotang.	Cosine.	′
30	8·41792	480	8·41807	480	11·58193	9·99985	30
31	8·42272	474	8·42287	475	11·57713	9·99985	29
32	8·42746	470	8·42762	470	11·57238	9·99984	28
33	8·43216	464	8·43232	464	11·56768	9·99984	27
34	8·43680	459	8·43696	460	11·56304	9·99984	26
35	8·44139	455	8·44156	455	11·55844	9·99983	25
36	8·44594	450	8·44611	450	11·55389	9·99983	24
37	8·45044	445	8·45061	446	11·54939	9·99983	23
38	8·45489	441	8·45507	441	11·54493	9·99982	22
39	8·45930	436	8·45948	437	11·54052	9·99982	21
40	8·46366	433	8·46385	432	11·53615	9·99982	20
41	8·46799	427	8·46817	428	11·53183	9·99981	19
42	8·47226	424	8·47245	424	11·52755	9·99981	18
43	8·47650	419	8·47669	420	11·52331	9·99981	17
44	8·48069	416	8·48089	416	11·51911	9·99980	16
45	8·48485	411	8·48505	412	11·51495	9·99980	15
46	8·48896	408	8·48917	408	11·51083	9·99979	14
47	8·49304	404	8·49325	404	11·50675	9·99979	13
48	8·49708	400	8·49729	401	11·50271	9·99979	12
49	8·50108	396	8·50130	397	11·49870	9·99978	11
50	8·50504	393	8·50527	393	11·49473	9·99978	10
51	8·50897	390	8·50920	390	11·49080	9·99977	9
52	8·51287	386	8·51310	386	11·48690	9·99977	8
53	8·51673	382	8·51696	383	11·48304	9·99977	7
54	8·52055	379	8·52079	380	11·47921	9·99976	6
55	8·52434	376	8·52459	376	11·47541	9·99976	5
56	8·52810	373	8·52835	373	11·47165	9·99975	4
57	8·53183	369	8·53208	370	11·46792	9·99975	3
58	8·53552	367	8·53578	367	11·46422	9·99974	2
59	8·53919	363	8·53945	363	11·46055	9·99974	1
60	8·54282		8·54308		11·45692	9·99974	0
′	Cosine.		Cotang.		Tangent.	Sine.	′

[88 degrees.]

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[2 degrees.]

′	Sine.	Diff.	Tangent.	Diff.	Cotang.	Cosine.	′
0	8·54282	360	8·54308	361	11·45692	9·99974	60
1	8·54642	357	8·54669	358	11·45331	9·99973	59
2	8·54999	355	8·55027	355	11·44973	9·99973	58
3	8·55354	351	8·55382	352	11·44618	9·99972	57
4	8·55705	349	8·55734	349	11·44266	9·99972	56
5	8·56054	346	8·56083	346	11·43917	9·99971	55
6	8·56400	343	8·56429	344	11·43571	9·99971	54
7	8·56743	341	8·56773	341	11·43227	9·99970	53
8	8·57084	337	8·57114	338	11·42886	9·99970	52
9	8·57421	336	8·57452	336	11·42548	9·99969	51
10	8·57757	332	8·57788	333	11·42212	9·99969	50
11	8·58089	330	8·58121	330	11·41879	9·99968	49
12	8·58419	328	8·58451	328	11·41549	9·99968	48
13	8·58747	325	8·58779	326	11·41221	9·99967	47
14	8·59072	323	8·59105	323	11·40895	9·99967	46
15	8·59395	320	8·59428	321	11·40572	9·99967	45
16	8·59715	318	8·59749	319	11·40251	9·99966	44
17	8·60033	316	8·60068	316	11·39932	9·99966	43
18	8·60349	313	8·60384	314	11·39616	9·99965	42
19	8·60662	311	8·60698	311	11·39302	9·99964	41
20	8·60973	309	8·61009	310	11·38991	9·99964	40
21	8·61282	307	8·61319	307	11·38681	9·99963	39
22	8·61589	305	8·61626	305	11·38374	9·99963	38
23	8·61894	302	8·61931	303	11·38069	9·99962	37
24	8·62196	301	8·62234	301	11·37766	9·99962	36
25	8·62497	298	8·62535	299	11·37465	9·99961	35
26	8·62795	296	8·62834	297	11·37166	9·99961	34
27	8·63091	294	8·63131	295	11·36869	9·99960	33
28	8·63385	293	8·63426	292	11·36574	9·99960	32
29	8·63678	290	8·63718	291	11·36282	9·99959	31
30	8·63968		8·64009		11·35991	9·99959	30
′	Cosine.		Cotang.		Tangent.	Sine.	′

[87 degrees.]

[2 degrees.]

′	Sine.	Diff.	Tangent.	Diff.	Cotang.	Cosine.	′
30	8·63968	288	8·64009	289	11·35991	9·99959	30
31	8·64256	287	8·64298	287	11·35702	9·99958	29
32	8·64543	284	8·64585	285	11·35415	9·99958	28
33	8·64827	283	8·64870	284	11·35130	9·99957	27
34	8·65110	281	8·65154	281	11·34846	9·99956	26
35	8·65391	279	8·65435	280	11·34565	9·99956	25
36	8·65670	277	8·65715	278	11·34285	9·99955	24
37	8·65947	276	8·65993	276	11·34007	9·99955	23
38	8·66223	274	8·66269	274	11·33731	9·99954	22
39	8·66497	272	8·66543	273	11·33457	9·99954	21
40	8·66769	270	8·66816	271	11·33184	9·99953	20
41	8·67039	269	8·67087	269	11·32913	9·99952	19
42	8·67308	267	8·67356	268	11·32644	9·99952	18
43	8·67575	266	8·67624	266	11·32376	9·99951	17
44	8·67841	263	8·67890	264	11·32110	9·99951	16
45	8·68104	263	8·68154	263	11·31846	9·99950	15
46	8·68367	260	8·68417	261	11·31583	9·99949	14
47	8·68627	259	8·68678	260	11·31322	9·99949	13
48	8·68886	258	8·68938	258	11·31062	9·99948	12
49	8·69144	256	8·69196	257	11·30804	9·99948	11
50	8·69400	254	8·69453	255	11·30547	9·99947	10
51	8·69654	253	8·69708	254	11·30292	9·99946	9
52	8·69907	252	8·69962	252	11·30038	9·99946	8
53	8·70159	250	8·70214	251	11·29786	9·99945	7
54	8·70409	249	8·70465	249	11·29535	9·99944	6
55	8·70658	247	8·70714	248	11·29286	9·99944	5
56	8·70905	246	8·70962	246	11·29038	9·99943	4
57	8·71151	244	8·71208	245	11·28792	9·99942	3
58	8·71395	243	8·71453	244	11·28547	9·99942	2
59	8·71638	242	8·71697	243	11·28303	9·99941	1
60	8·71880		8·71940		11·28060	9·99940	0
′	Cosine.		Cotang.		Tangent.	Sine.	′

[87 degrees.]

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[3 degrees.]

′	Sine.	Diff.	Tangent.	Diff.	Cotang.	Cosine.	′
0	8·71880	240	8·71940	241	11·28060	9·99940	60
1	8·72120	239	8·72181	239	11·27819	9·99940	59
2	8·72359	238	8·72420	239	11·27580	9·99939	58
3	8·72597	237	8·72659	237	11·27341	9·99938	57
4	8·72834	235	8·72896	236	11·27104	9·99938	56
5	8·73069	234	8·73132	234	11·26868	9·99937	55
6	8·73303	232	8·73366	234	11·26634	9·99936	54
7	8·73535	232	8·73600	232	11·26400	9·99936	53
8	8·73767	230	8·73832	231	11·26168	9·99935	52
9	8·73997	229	8·74063	229	11·25937	9·99934	51
10	8·74226	228	8·74292	229	11·25708	9·99934	50
11	8·74454	226	8·74521	227	11·25479	9·99933	49
12	8·74680	226	8·74748	226	11·25252	9·99932	48
13	8·74906	224	8·74974	225	11·25026	9·99932	47
14	8·75130	223	8·75199	224	11·24801	9·99931	46
15	8·75353	222	8·75423	222	11·24577	9·99930	45
16	8·75575	220	8·75645	222	11·24355	9·99929	44
17	8·75795	220	8·75867	220	11·24133	9·99929	43
18	8·76015	219	8·76087	219	11·23913	9·99928	42
19	8·76234	217	8·76306	219	11·23694	9·99927	41
20	8·76451	216	8·76525	217	11·23475	9·99926	40
21	8·76667	216	8·76742	216	11·23258	9·99926	39
22	8·76883	214	8·76958	215	11·23042	9·99925	38
23	8·77097	213	8·77173	214	11·22827	9·99924	37
24	8·77310	212	8·77387	213	11·22613	9·99923	36
25	8·77522	211	8·77600	211	11·22400	9·99923	35
26	8·77733	210	8·77811	211	11·22189	9·99922	34
27	8·77943	209	8·78022	210	11·21978	9·99921	33
28	8·78152	208	8·78232	209	11·21768	9·99920	32
29	8·78360	208	8·78441	208	11·21559	9·99920	31
30	8·78568		8·78649		11·21351	9·99919	30
′	Cosine.		Cotang.		Tangent.	Sine.	′

[86 degrees.]

[3 degrees.]

′	Sine.	Diff.	Tangent.	Diff.	Cotang.	Cosine.	′
30	8·78568	206	8·78649	206	11·21351	9·99919	30
31	8·78774	205	8·78855	206	11·21145	9·99918	29
32	8·78979	204	8·79061	205	11·20939	9·99917	28
33	8·79183	203	8·79266	204	11·20734	9·99917	27
34	8·79386	202	8·79470	203	11·20530	9·99916	26
35	8·79588	201	8·79673	202	11·20327	9·99915	25
36	8·79789	201	8·79875	201	11·20125	9·99914	24
37	8·79990	199	8·80076	201	11·19924	9·99913	23
38	8·80189	199	8·80277	199	11·19723	9·99913	22
39	8·80388	197	8·80476	198	11·19524	9·99912	21
40	8·80585	197	8·80674	198	11·19326	9·99911	20
41	8·80782	196	8·80872	198	11·19128	9·99910	19
42	8·80978	195	8·81068	196	11·18932	9·99909	18
43	8·81173	194	8·81264	196	11·18736	9·99909	17
44	8·81367	193	8·81459	195	11·18541	9·99908	16
45	8·81560	192	8·81653	194	11·18347	9·99907	15
46	8·81752	192	8·81846	193	11·18154	9·99906	14
47	8·81944	190	8·82038	192	11·17962	9·99905	13
48	8·82134	190	8·82230	192	11·17770	9·99904	12
49	8·82324	189	8·82420	190	11·17580	9·99904	11
50	8·82513	188	8·82610	190	11·17390	9·99903	10
51	8·82701	187	8·82799	189	11·17201	9·99902	9
52	8·82888	187	8·82987	188	11·17013	9·99901	8
53	8·83075	186	8·83175	188	11·16825	9·99900	7
54	8·83261	185	8·83361	186	11·16639	9·99899	6
55	8·83446	184	8·83547	186	11·16453	9·99898	5
56	8·83630	183	8·83732	185	11·16268	9·99898	4
57	8·83813	183	8·83916	184	11·16084	9·99897	3
58	8·83996	181	8·84100	184	11·15900	9·99896	2
59	8·84177	181	8·84282	182	11·15718	9·99895	1
60	8·84358		8·84464	182	11·15536	9·99894	0
′	Cosine.		Cotang.		Tangent.	Sine.	′

[86 degrees.]

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[4 degrees.]

′	Sine.	Diff.	Tangent.	Diff.	Cotang.	Cosine.	′
0	8·84358	181	8·84464	182	11·15536	9·99894	60
1	8·84539	179	8·84646	180	11·15354	9·99893	59
2	8·84718	179	8·84826	180	11·15174	9·99892	58
3	8·84897	178	8·85006	179	11·14994	9·99891	57
4	8·85075	177	8·85185	178	11·14815	9·99891	56
5	8·85252	177	8·85363	177	11·14637	9·99890	55
6	8·85429	176	8·85540	177	11·14460	9·99889	54
7	8·85605	175	8·85717	176	11·14283	9·99888	53
8	8·85780	175	8·85893	176	11·14107	9·99887	52
9	8·85955	173	8·86069	174	11·13931	9·99886	51
10	8·86128	173	8·86243	174	11·13757	9·99885	50
11	8·86301	173	8·86417	174	11·13583	9·99884	49
12	8·86474	171	8·86591	172	11·13409	9·99883	48
13	8·86645	171	8·86763	172	11·13237	9·99882	47
14	8·86816	171	8·86935	171	11·13065	9·99881	46
15	8·86987	169	8·87106	171	11·12894	9·99880	45
16	8·87156	169	8·87277	170	11·12723	9·99879	44
17	8·87325	169	8·87447	169	11·12553	9·99879	43
18	8·87494	167	8·87616	169	11·12384	9·99878	42
19	8·87661	168	8·87785	168	11·12215	9·99877	41
20	8·87829	166	8·87953	167	11·12047	9·99876	40
21	8·87995	166	8·88120	167	11·11880	9·99875	39
22	8·88161	165	8·88287	166	11·11713	9·99874	38
23	8·88326	164	8·88453	165	11·11547	9·99873	37
24	8·88490	164	8·88618	165	11·11382	9·99872	36
25	8·88654	163	8·88783	165	11·11217	9·99871	35
26	8·88817	163	8·88948	163	11·11052	9·99870	34
27	8·88980	162	8·89111	163	11·10889	9·99869	33
28	8·89142	162	8·89274	163	11·10726	9·99868	32
29	8·89304	160	8·89437	161	11·10563	9·99867	31
30	8·89464		8·89598		11·10402	9·99866	30
′	Cosine.		Cotang.		Tangent.	Sine.	′

[85 degrees.]

[4 degrees.]

′	Sine.	Diff.	Tangent.	Diff.	Cotang.	Cosine.	′
30	8·89464	161	8·89598	162	11·10402	9·99866	30
31	8·89625	159	8·89760	160	11·10240	9·99865	29
32	8·89784	159	8·89920	160	11·10080	9·99864	28
33	8·89943	159	8·90080	160	11·09920	9·99863	27
34	8·90102	158	8·90240	159	11·09760	9·99862	26
35	8·90260	157	8·90399	158	11·09601	9·99861	25
36	8·90417	157	8·90557	158	11·09443	9·99860	24
37	8·90574	156	8·90715	157	11·09285	9·99859	23
38	8·90730	155	8·90872	157	11·09128	9·99858	22
39	8·90885	155	8·91029	156	11·08971	9·99857	21
40	8·91040	155	8·91185	155	11·08815	9·99856	20
41	8·91195	154	8·91340	155	11·08660	9·99855	19
42	8·91349	153	8·91495	155	11·08505	9·99854	18
43	8·91502	153	8·91650	153	11·08350	9·99853	17
44	8·91655	152	8·91803	154	11·08197	9·99852	16
45	8·91807	152	8·91957	153	11·08043	9·99851	15
46	8·91959	151	8·92110	152	11·07890	9·99850	14
47	8·92110	151	8·92262	152	11·07738	9·99848	13
48	8·92261	150	8·92414	151	11·07586	9·99847	12
49	8·92411	150	8·92565	151	11·07435	9·99846	11
50	8·92561	149	8·92716	150	11·07284	9·99845	10
51	8·92710	149	8·92866	150	11·07134	9·99844	9
52	8·92859	148	8·93016	149	11·06984	9·99843	8
53	8·93007	147	8·93165	148	11·06835	9·99842	7
54	8·93154	147	8·93313	149	11·06687	9·99841	6
55	8·93301	147	8·93462	147	11·06538	9·99840	5
56	8·93448	146	8·93609	147	11·06391	9·99839	4
57	8·93594	146	8·93756	147	11·06244	9·99838	3
58	8·93740	145	8·93903	146	11·06097	9·99837	2
59	8·93885	145	8·94049	146	11·05951	9·99836	1
60	8·94030		8·94195		11·05805	9·99834	0
′	Cosine.		Cotang.		Tangent.	Sine.	′

[85 degrees.]

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[5 degrees.]

′	Sine.	Diff.	Tangent.	Diff.	Cotang.	Cosine.	′
0	8·94030	144	8·94195	145	11·05805	9·99834	60
1	8·94174	143	8·94340	145	11·05660	9·99833	59
2	8·94317	144	8·94485	145	11·05515	9·99832	58
3	8·94461	142	8·94630	143	11·05370	9·99831	57
4	8·94603	143	8·94773	144	11·05227	9·99830	56
5	8·94746	141	8·94917	143	11·05083	9·99829	55
6	8·94887	142	8·95060	142	11·04940	9·99828	54
7	8·95029	141	8·95202	142	11·04798	9·99827	53
8	8·95170	140	8·95344	142	11·04656	9·99825	52
9	8·95310	140	8·95486	141	11·04514	9·99824	51
10	8·95450	139	8·95627	140	11·04373	9·99823	50
11	8·95589	139	8·95767	141	11·04233	9·99822	49
12	8·95728	139	8·95908	139	11·04092	9·99821	48
13	8·95867	138	8·96047	140	11·03953	9·99820	47
14	8·96005	138	8·96187	138	11·03813	9·99819	46
15	8·96143	137	8·96325	139	11·03675	9·99817	45
16	8·96280	137	8·96464	138	11·03536	9·99816	44
17	8·96417	136	8·96602	137	11·03398	9·99815	43
18	8·96553	136	8·96739	138	11·03261	9·99814	42
19	8·96689	136	8·96877	136	11·03123	9·99813	41
20	8·96825	135	8·97013	137	11·02987	9·99812	40
21	8·96960	135	8·97150	135	11·02850	9·99810	39
22	8·97095	134	8·97285	136	11·02715	9·99809	38
23	8·97229	134	8·97421	135	11·02579	9·99808	37
24	8·97363	133	8·97556	135	11·02444	9·99807	36
25	8·97496	133	8·97691	134	11·02309	9·99806	35
26	8·97629	133	8·97825	134	11·02175	9·99804	34
27	8·97762	132	8·97959	133	11·02041	9·99803	33
28	8·97894	132	8·98092	133	11·01908	9·99802	32
29	8·98026	131	8·98225	133	11·01775	9·99801	31
30	8·98157		8·98358		11·01642	9·99800	30
′	Cosine.		Cotang.		Tangent.	Sine.	′

[84 degrees.]

[5 degrees.]

′	Sine.	Diff.	Tangent.	Diff.	Cotang.	Cosine.	′
30	8·98157	131	8·98358	132	11·01642	9·99800	30
31	8·98288	131	8·98490	132	11·01510	9·99798	29
32	8·98419	130	8·98622	131	11·01378	9·99797	28
33	8·98549	130	8·98753	131	11·01247	9·99796	27
34	8·98679	129	8·98884	131	11·01116	9·99795	26
35	8·98808	129	8·99015	130	11·00985	9·99793	25
36	8·98937	129	8·99145	130	11·00855	9·99792	24
37	8·99066	128	8·99275	130	11·00725	9·99791	23
38	8·99194	128	8·99405	129	11·00595	9·99790	22
39	8·99322	128	8·99534	128	11·00466	9·99788	21
40	8·99450	127	8·99662	129	11·00338	9·99787	20
41	8·99577	127	8·99791	128	11·00209	9·99786	19
42	8·99704	126	8·99919	127	11·00081	9·99785	18
43	8·99830	126	9·00046	128	10·99954	9·99783	17
44	8·99956	126	9·00174	127	10·99826	9·99782	16
45	9·00082	125	9·00301	126	10·99699	9·99781	15
46	9·00207	125	9·00427	126	10·99573	9·99780	14
47	9·00332	124	9·00553	126	10·99447	9·99778	13
48	9·00456	125	9·00679	126	10·99321	9·99777	12
49	9·00581	123	9·00805	125	10·99195	9·99776	11
50	9·00704	124	9·00930	125	10·99070	9·99775	10
51	9·00828	123	9·01055	124	10·98945	9·99773	9
52	9·00951	123	9·01179	124	10·98821	9·99772	8
53	9·01074	122	9·01303	124	10·98697	9·99771	7
54	9·01196	122	9·01427	123	10·98573	9·99769	6
55	9·01318	122	9·01550	123	10·98450	9·99768	5
56	9·01440	121	9·01673	123	10·98327	9·99767	4
57	9·01561	121	9·01796	122	10·98204	9·99765	3
58	9·01682	121	9·01918	122	10·98082	9·99764	2
59	9·01803	120	9·02040	122	10·97960	9·99763	1
60	9·01923		9·02162		10·97838	9·99761	0
′	Cosine.		Cotang.		Tangent.	Sine.	′

[84 degrees.]

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[6 degrees.]

′	Sine.	Diff.	Tangent.	Diff.	Cotang.	Cosine.	′
0	9·01923	120	9·02162	121	10·97838	9·99761	60
1	9·02043	120	9·02283	121	10·97717	9·99760	59
2	9·02163	120	9·02404	121	10·97596	9·99759	58
3	9·02283	119	9·02525	120	10·97475	9·99757	57
4	9·02402	118	9·02645	121	10·97355	9·99756	56
5	9·02520	119	9·02766	119	10·97234	9·99755	55
6	9·02639	118	9·02885	120	10·97115	9·99753	54
7	9·02757	117	9·03005	119	10·96995	9·99752	53
8	9·02874	118	9·03124	118	10·96876	9·99751	52
9	9·02992	117	9·03242	119	10·96758	9·99749	51
10	9·03109	117	9·03361	118	10·96639	9·99748	50
11	9·03226	116	9·03479	118	10·96521	9·99747	49
12	9·03342	116	9·03597	117	10·96403	9·99745	48
13	9·03458	116	9·03714	118	10·96286	9·99744	47
14	9·03574	116	9·03832	116	10·96168	9·99742	46
15	9·03690	115	9·03948	117	10·96052	9·99741	45
16	9·03805	115	9·04065	116	10·95935	9·99740	44
17	9·03920	114	9·04181	116	10·95819	9·99738	43
18	9·04034	115	9·04297	116	10·95703	9·99737	42
19	9·04149	113	9·04413	115	10·95587	9·99736	41
20	9·04262	114	9·04528	115	10·95472	9·99734	40
21	9·04376	114	9·04643	115	10·95357	9·99733	39
22	9·04490	113	9·04758	115	10·95242	9·99731	38
23	9·04603	112	9·04873	114	10·95127	9·99730	37
24	9·04715	113	9·04987	114	10·95013	9·99728	36
25	9·04828	112	9·05101	113	10·94899	9·99727	35
26	9·04940	112	9·05214	114	10·94786	9·99726	34
27	9·05052	112	9·05328	113	10·94672	9·99724	33
28	9·05164	111	9·05441	112	10·94559	9·99723	32
29	9·05275	111	9·05553	113	10·94447	9·99721	31
30	9·05386		9·05666		10·94334	9·99720	30
′	Cosine.		Cotang.		Tangent.	Sine.	′

[83 degrees.]

[6 degrees.]

′	Sine.	Diff.	Tangent.	Diff.	Cotang.	Cosine.	′
30	9·05386	111	9·05666	112	10·94334	9·99720	30
31	9·05497	110	9·05778	112	10·94222	9·99718	29
32	9·05607	110	9·05890	112	10·94110	9·99717	28
33	9·05717	110	9·06002	111	10·93998	9·99716	27
34	9·05827	110	9·06113	111	10·93887	9·99714	26
35	9·05937	109	9·06224	111	10·93776	9·99713	25
36	9·06046	109	9·06335	110	10·93665	9·99711	24
37	9·06155	109	9·06445	111	10·93555	9·99710	23
38	9·06264	108	9·06556	110	10·93444	9·99708	22
39	9·06372	109	9·06666	109	10·93334	9·99707	21
40	9·06481	108	9·06775	110	10·93225	9·99705	20
41	9·06589	107	9·06885	109	10·93115	9·99704	19
42	9·06696	108	9·06994	109	10·93006	9·99702	18
43	9·06804	107	9·07103	108	10·92897	9·99701	17
44	9·06911	107	9·07211	109	10·92789	9·99699	16
45	9·07018	106	9·07320	108	10·92680	9·99698	15
46	9·07124	107	9·07428	108	10·92572	9·99696	14
47	9·07231	106	9·07536	107	10·92464	9·99695	13
48	9·07337	105	9·07643	108	10·92357	9·99693	12
49	9·07442	106	9·07751	107	10·92249	9·99692	11
50	9·07548	105	9·07858	106	10·92142	9·99690	10
51	9·07653	105	9·07964	107	10·92036	9·99689	9
52	9·07758	105	9·08071	106	10·91929	9·99687	8
53	9·07863	105	9·08177	106	10·91823	9·99686	7
54	9·07968	104	9·08283	106	10·91717	9·99684	6
55	9·08072	104	9·08389	106	10·91611	9·99683	5
56	9·08176	104	9·08495	105	10·91505	9·99681	4
57	9·08280	103	9·08600	105	10·91400	9·99680	3
58	9·08383	103	9·08705	105	10·91295	9·99678	2
59	9·08486	103	9·08810	104	10·91190	9·99677	1
60	9·08589		9·08914		10·91086	9·99675	0
′	Cosine.		Cotang.		Tangent.	Sine.	′

[83 degrees.]

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[7 degrees.]

′	Sine.	Diff.	Tangent.	Diff.	Cotang.	Cosine.	′
0	9·08589	103	9·08914	105	10·91086	9·99675	60
1	9·08692	103	9·09019	104	10·90981	9·99674	59
2	9·08795	102	9·09123	104	10·90877	9·99672	58
3	9·08897	102	9·09227	103	10·90773	9·99670	57
4	9·08999	102	9·09330	104	10·90670	9·99669	56
5	9·09101	101	9·09434	103	10·90566	9·99667	55
6	9·09202	102	9·09537	103	10·90463	9·99666	54
7	9·09304	101	9·09640	102	10·90360	9·99664	53
8	9·09405	101	9·09742	103	10·90258	9·99663	52
9	9·09506	100	9·09845	102	10·90155	9·99661	51
10	9·09606	101	9·09947	102	10·90053	9·99659	50
11	9·09707	100	9·10049	101	10·89951	9·99658	49
12	9·09807	100	9·10150	102	10·89850	9·99656	48
13	9·09907	99	9·10252	101	10·89748	9·99655	47
14	9·10006	100	9·10353	101	10·89647	9·99653	46
15	9·10106	99	9·10454	101	10·89546	9·99651	45
16	9·10205	99	9·10555	101	10·89445	9·99650	44
17	9·10304	98	9·10656	100	10·89344	9·99648	43
18	9·10402	99	9·10756	100	10·89244	9·99647	42
19	9·10501	98	9·10856	100	10·89144	9·99645	41
20	9·10599	98	9·10956	100	10·89044	9·99643	40
21	9·10697	98	9·11056	99	10·88944	9·99642	39
22	9·10795	98	9·11155	99	10·88845	9·99640	38
23	9·10893	97	9·11254	99	10·88746	9·99638	37
24	9·10990	97	9·11353	99	10·88647	9·99637	36
25	9·11087	97	9·11452	99	10·88548	9·99635	35
26	9·11184	97	9·11551	98	10·88449	9·99633	34
27	9·11281	96	9·11649	98	10·88351	9·99632	33
28	9·11377	97	9·11747	98	10·88253	9·99630	32
29	9·11474	96	9·11845	98	10·88155	9·99629	31
30	9·11570		9·11943		10·88057	9·99627	30
′	Cosine.		Cotang.		Tangent.	Sine.	′

[82 degrees.]

[7 degrees.]

′	Sine.	Diff.	Tangent.	Diff.	Cotang.	Cosine.	D.	′
30	9·11570	96	9·11943	97	10·88057	9·99627	2	30
31	9·11666	95	9·12040	98	10·87960	9·99625	1	29
32	9·11761	96	9·12138	97	10·87862	9·99624	2	28
33	9·11857	95	9·12235	97	10·87765	9·99622	2	27
34	9·11952	95	9·12332	96	10·87668	9·99620	2	26
35	9·12047	95	9·12428	97	10·87572	9·99618	1	25
36	9·12142	94	9·12525	96	10·87475	9·99617	2	24
37	9·12236	95	9·12621	96	10·87379	9·99615	2	23
38	9·12331	94	9·12717	96	10·87283	9·99613	2	22
39	9·12425	94	9·12813	96	10·87187	9·99612	1	21
40	9·12519	93	9·12909	95	10·87091	9·99610	2	20
41	9·12612	94	9·13004	95	10·86996	9·99608	2	19
42	9·12706	93	9·13099	95	10·86901	9·99607	1	18
43	9·12799	93	9·13194	95	10·86806	9·99605	2	17
44	9·12892	93	9·13289	95	10·86711	9·99603	2	16
45	9·12985	93	9·13384	94	10·86616	9·99601	2	15
46	9·13078	93	9·13478	95	10·86522	9·99600	1	14
47	9·13171	92	9·13573	94	10·86427	9·99598	2	13
48	9·13263	92	9·13667	94	10·86333	9·99596	2	12
49	9·13355	92	9·13761	93	10·86239	9·99595	1	11
50	9·13447	92	9·13854	94	10·86146	9·99593	2	10
51	9·13539	91	9·13948	93	10·86052	9·99591	2	9
52	9·13630	92	9·14041	93	10·85959	9·99589	2	8
53	9·13722	91	9·14134	93	10·85866	9·99588	1	7
54	9·13813	91	9·14227	93	10·85773	9·99586	2	6
55	9·13904	90	9·14320	92	10·85680	9·99584	2	5
56	9·13994	91	9·14412	92	10·85588	9·99582	2	4
57	9·14085	90	9·14504	93	10·85496	9·99581	1	3
58	9·14175	91	9·14597	91	10·85403	9·99579	2	2
59	9·14266	90	9·14688	92	10·85312	9·99577	2	1
60	9·14356		9·14780		10·85220	9·99575	2	0
′	Cosine.		Cotang.		Tangent.	Sine.		′

[82 degrees.]

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′	Sine.	Diff.	Tangent.	Diff.	Cotang.	Cosine.	D.	′
0	9·14356	89	9·14780	92	10·85220	9·99575	1	60
1	9·14445	90	9·14872	91	10·85128	9·99574	2	59
2	9·14535	89	9·14963	91	10·85037	9·99572	2	58
3	9·14624	90	9·15054	91	10·84946	9·99570	2	57
4	9·14714	89	9·15145	91	10·84855	9·99568	2	56
5	9·14803	88	9·15236	91	10·84764	9·99566	1	55
6	9·14891	89	9·15327	90	10·84673	9·99565	2	54
7	9·14980	89	9·15417	91	10·84583	9·99563	2	53
8	9·15069	88	9·15508	90	10·84492	9·99561	2	52
9	9·15157	88	9·15598	90	10·84402	9·99559	2	51
10	9·15245	88	9·15688	89	10·84312	9·99557	1	50
11	9·15333	88	9·15777	90	10·84223	9·99556	2	49
12	9·15421	87	9·15867	89	10·84133	9·99554	2	48
13	9·15508	88	9·15956	90	10·84044	9·99552	2	47
14	9·15596	87	9·16046	89	10·83954	9·99550	2	46
15	9·15683	87	9·16135	89	10·83865	9·99548	2	45
16	9·15770	87	9·16224	88	10·83776	9·99546	1	44
17	9·15857	87	9·16312	89	10·83688	9·99545	2	43
18	9·15944	86	9·16401	88	10·83599	9·99543	2	42
19	9·16030	86	9·16489	88	10·83511	9·99541	2	41
20	9·16116	87	9·16577	88	10·83423	9·99539	2	40
21	9·16203	86	9·16665	88	10·83335	9·99537	2	39
22	9·16289	85	9·16753	88	10·83247	9·99535	2	38
23	9·16374	86	9·16841	87	10·83159	9·99533	1	37
24	9·16460	85	9·16928	88	10·83072	9·99532	2	36
25	9·16545	86	9·17016	87	10·82984	9·99530	2	35
26	9·16631	85	9·17103	87	10·82897	9·99528	2	34
27	9·16716	85	9·17190	87	10·82810	9·99526	2	33
28	9·16801	85	9·17277	86	10·82723	9·99524	2	32
29	9·16886	84	9·17363	87	10·82637	9·99522	2	31
30	9·16970		9·17450		10·82550	9·99520		30
′	Cosine.		Cotang.		Tangent.	Sine.		′

′	Sine.	Diff.	Tangent.	Diff.	Cotang.	Cosine.	D.	′
30	9·16970	85	9·17450	86	10·82550	9·99520	2	30
31	9·17055	84	9·17536	86	10·82464	9·99518	1	29
32	9·17139	84	9·17622	86	10·82378	9·99517	2	28
33	9·17223	84	9·17708	86	10·82292	9·99515	2	27
34	9·17307	84	9·17794	86	10·82206	9·99513	2	26
35	9·17391	83	9·17880	85	10·82120	9·99511	2	25
36	9·17474	84	9·17965	86	10·82035	9·99509	2	24
37	9·17558	83	9·18051	85	10·81949	9·99507	2	23
38	9·17641	83	9·18136	85	10·81864	9·99505	2	22
39	9·17724	83	9·18221	85	10·81779	9·99503	2	21
40	9·17807	83	9·18306	85	10·81694	9·99501	2	20
41	9·17890	82	9·18391	85	10·81609	9·99499	2	19
42	9·17973	83	9·18475	84	10·81525	9·99497	2	18
43	9·18055	82	9·18560	85	10·81440	9·99495	1	17
44	9·18137	82	9·18644	84	10·81356	9·99494	2	16
45	9·18220	82	9·18728	84	10·81272	9·99492	2	15
46	9·18302	81	9·18812	84	10·81188	9·99490	2	14
47	9·18383	82	9·18896	84	10·81104	9·99488	2	13
48	9·18465	82	9·18979	83	10·81021	9·99486	2	12
49	9·18547	81	9·19063	84	10·80937	9·99484	2	11
50	9·18628	81	9·19146	83	10·80854	9·99482	2	10
51	9·18709	81	9·19229	83	10·80771	9·99480	2	9
52	9·18790	81	9·19312	83	10·80688	9·99478	2	8
53	9·18871	81	9·19395	83	10·80605	9·99476	2	7
54	9·18952	81	9·19478	83	10·80522	9·99474	2	6
55	9·19033	80	9·19561	82	10·80439	9·99472	2	5
56	9·19113	80	9·19643	82	10·80357	9·99470	2	4
57	9·19193	80	9·19725	82	10·80275	9·99468	2	3
58	9·19273	80	9·19807	82	10·80193	9·99466	2	2
59	9·19353	80	9·19889	82	10·80111	9·99464	2	1
60	9·19433		9·19971		10·80029	9·99462		0
′	Covine.		Cotang.		Tangent.	Sine.		′

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′	Sine.	Diff.	Tangent.	Diff.	Cotang.	Cosine.	D.	′
0	9·19433	80	9·19971	82	10·80029	9·99462	2	60
1	9·19513	79	9·20053	81	10·79947	9·99460	2	59
2	9·19592	80	9·20134	82	10·79866	9·99458	2	58
3	9·19672	79	9·20216	81	10·79784	9·99456	2	57
4	9·19751	79	9·20297	81	10·79703	9·99454	2	56
5	9·19830	79	9·20378	81	10·79622	9·99452	2	55
6	9·19909	79	9·20459	81	10·79541	9·99450	2	54
7	9·19988	79	9·20540	81	10·79460	9·99448	2	53
8	9·20067	78	9·20621	80	10·79379	9·99446	2	52
9	9·20145	78	9·20701	81	10·79299	9·99444	2	51
10	9·20223	79	9·20782	80	10·79218	9·99442	2	50
11	9·20302	78	9·20862	80	10·79138	9·99440	2	49
12	9·20380	78	9·20942	80	10·79058	9·99438	2	48
13	9·20458	77	9·21022	80	10·78978	9·99436	2	47
14	9·20535	78	9·21102	80	10·78898	9·99434	2	46
15	9·20613	78	9·21182	79	10·78818	9·99432	3	45
16	9·20691	77	9·21261	80	10·78739	9·99429	2	44
17	9·20768	77	9·21341	79	10·78659	9·99427	2	43
18	9·20845	77	9·21420	79	10·78580	9·99425	2	42
19	9·20922	77	9·21499	79	10·78501	9·99423	2	41
20	9·20999	77	9·21578	79	10·78422	9·99421	2	40
21	9·21076	77	9·21657	79	10·78343	9·99419	2	39
22	9·21153	76	9·21736	78	10·78264	9·99417	2	38
23	9·21229	77	9·21814	79	10·78186	9·99415	2	37
24	9·21306	76	9·21893	78	10·78107	9·99413	2	36
25	9·21382	76	9·21971	78	10·78029	9·99411	2	35
26	9·21458	76	9·22049	78	10·77951	9·99409	2	34
27	9·21534	76	9·22127	78	10·77873	9·99407	3	33
28	9·21610	75	9·22205	78	10·77795	9·99404	2	32
29	9·21685	76	9·22283	78	10·77717	9·99402	2	31
30	9·21761		9·22361		10·77639	9·99400		30
′	Cosine.		Cotang.		Tangent.	Sine.		′

′	Sine.	Diff.	Tangent.	Diff.	Cotang.	Cosine.	D.	′
30	9·21761	75	9·22361	77	10·77639	9·99400	2	30
31	9·21836	76	9·22438	78	10·77562	9·99398	2	29
32	9·21912	76	9·22516	77	10·77484	9·99396	2	28
33	9·21987	75	9·22593	77	10·77407	9·99394	2	27
34	9·22062	75	9·22670	77	10·77330	9·99392	2	26
35	9·22137	75	9·22747	77	10·77253	9·99390	2	25
36	9·22211	74	9·22824	77	10·77176	9·99388	2	24
37	9·22286	75	9·22901	76	10·77099	9·99385	3	23
38	9·22361	75	9·22977	77	10·77023	9·99383	2	22
39	9·22435	74	9·23054	76	10·76946	9·99381	2	21
40	9·22509	74	9·23130	76	10·76870	9·99379	2	20
41	9·22583	74	9·23206	77	10·76794	9·99377	2	19
42	9·22657	74	9·23283	76	10·76717	9·99375	3	18
43	9·22731	74	9·23359	76	10·76641	9·99372	2	17
44	9·22805	73	9·23435	75	10·76565	9·99370	2	16
45	9·22878	74	9·23510	76	10·76490	9·99368	2	15
46	9·22952	73	9·23586	75	10·76414	9·99366	2	14
47	9·23025	73	9·23661	76	10·76339	9·99364	2	13
48	9·23098	73	9·23737	75	10·76263	9·99362	3	12
49	9·23171	73	9·23812	75	10·76188	9·99359	2	11
50	9·23244	73	9·23887	75	10·76113	9·99357	2	10
51	9·23317	73	9·23962	75	10·76038	9·99355	2	9
52	9·23390	72	9·24037	75	10·75963	9·99353	2	8
53	9·23462	73	9·24112	74	10·75888	9·99351	3	7
54	9·23535	72	9·24186	75	10·75814	9·99348	2	6
55	9·23607	72	9·24261	74	10·75739	9·99346	2	5
56	9·23679	73	9·24335	75	10·75665	9·99344	2	4
57	9·23752	71	9·24410	74	10·75590	9·99342	2	3
58	9·23823	72	9·24484	74	10·75516	9·99340	3	2
59	9·23895	72	9·24558	74	10·75442	9·99337	2	1
60	9·23967		9·24632		10·75368	9·99335		0
′	Cosine.		Cotang.		Tangent.	Sine.		′

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′	Sine.	Diff.	Tangent.	Diff.	Cotang.	Cosine.	D.	′
0	9·23967	72	9·24632	74	10·75368	9·99335	2	60
1	9·24039	71	9·24706	73	10·75294	9·99333	2	59
2	9·24110	71	9·24779	74	10·75221	9·99331	3	58
3	9·24181	72	9·24853	73	10·75147	9·99328	2	57
4	9·24253	71	9·24926	74	10·75074	9·99326	2	56
5	9·24324	71	9·25000	73	10·75000	9·99324	2	55
6	9·24395	71	9·25073	73	10·74927	9·99322	3	54
7	9·24466	70	9·25146	73	10·74854	9·99319	2	53
8	9·24536	71	9·25219	73	10·74781	9·99317	2	52
9	9·24607	70	9·25292	73	10·74708	9·99315	2	51
10	9·24677	71	9·25365	72	10·74635	9·99313	3	50
11	9·24748	70	9·25437	73	10·74563	9·99310	2	49
12	9·24818	70	9·25510	72	10·74490	9·99308	2	48
13	9·24888	70	9·25582	73	10·74418	9·99306	2	47
14	9·24958	70	9·25655	72	10·74345	9·99304	3	46
15	9·25028	70	9·25727	72	10·74273	9·99301	2	45
16	9·25098	70	9·25799	72	10·74201	9·99299	2	44
17	9·25168	69	9·25871	72	10·74129	9·99297	3	43
18	9·25237	70	9·25943	72	10·74057	9·99294	2	42
19	9·25307	69	9·26015	71	10·73985	9·99292	2	41
20	9·25376	69	9·26086	72	10·73914	9·99290	2	40
21	9·25445	69	9·26158	72	10·73842	9·99288	3	39
22	9·25514	69	9·26229	72	10·73771	9·99285	2	38
23	9·25583	69	9·26301	71	10·73699	9·99283	2	37
24	9·25652	69	9·26372	71	10·73628	9·99281	3	36
25	9·25721	69	9·26443	71	10·73557	9·99278	2	35
26	9·25790	68	9·26514	71	10·73486	9·99276	2	34
27	9·25858	69	9·26585	70	10·73415	9·99274	3	33
28	9·25927	68	9·26655	71	10·73345	9·99271	2	32
29	9·25995	68	9·26726	71	10·73274	9·99269	2	31
30	9·26063		9·26797		10·73203	9·99267		30
′	Cosine.		Cotang.		Tangent.	Sine.		′

′	Sine.	Diff.	Tangent.	Diff.	Cotang.	Cosine.	D.	′
30	9·26063	68	9·26797	70	10·73203	9·99267	3	30
31	9·26131	68	9·26867	70	10·73133	9·99264	2	29
32	9·26199	68	9·26937	71	10·73063	9·99262	2	28
33	9·26267	68	9·27008	70	10·72992	9·99260	3	27
34	9·26335	68	9·27078	70	10·72922	9·99257	2	26
35	9·26403	67	9·27148	70	10·72852	9·99255	3	25
36	9·26470	68	9·27218	70	10·72782	9·99252	2	24
37	9·26538	67	9·27288	69	10·72712	9·99250	2	23
38	9·26605	67	9·27357	70	10·72643	9·99248	3	22
39	9·26672	67	9·27427	69	10·72573	9·99245	2	21
40	9·26739	67	9·27496	70	10·72504	9·99243	2	20
41	9·26806	67	9·27566	69	10·72434	9·99241	3	19
42	9·26873	67	9·27635	69	10·72365	9·99238	2	18
43	9·26940	67	9·27704	69	10·72296	9·99236	3	17
44	9·27007	66	9·27773	69	10·72227	9·99233	2	16
45	9·27073	67	9·27842	69	10·72158	9·99231	2	15
46	9·27140	66	9·27911	69	10·72089	9·99229	3	14
47	9·27206	67	9·27980	69	10·72020	9·99226	2	13
48	9·27273	66	9·28049	68	10·71951	9·99224	3	12
49	9·27339	66	9·28117	69	10·71883	9·99221	2	11
50	9·27405	66	9·28186	68	10·71814	9·99219	2	10
51	9·27471	66	9·28254	69	10·71746	9·99217	3	9
52	9·27537	65	9·28323	68	10·71677	9·99214	2	8
53	9·27602	66	9·28391	68	10·71609	9·99212	3	7
54	9·27668	66	9·28459	68	10·71541	9·99209	2	6
55	9·27734	65	9·28527	68	10·71473	9·99207	3	5
56	9·27799	65	9·28595	67	10·71405	9·99204	2	4
57	9·27864	66	9·28662	68	10·71338	9·99202	2	3
58	9·27930	65	9·28730	68	10·71270	9·99200	3	2
59	9·27995	65	9·28798	67	10·71202	9·99197	2	1
60	9·28060		9·28865		10·71135	9·99195		0
′	Cosine.		Cotang.		Tangent.	Sine.		′

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′	Sine.	Diff.	Tangent.	Diff.	Cotang.	Cosine.	D.	′
0	9·28060	65	9·28865	68	10·71135	9·99195	3	60
1	9·28125	65	9·28933	67	10·71067	9·99192	2	59
2	9·28190	64	9·29000	67	10·71000	9·99190	3	58
3	9·28254	65	9·29067	67	10·70933	9·99187	2	57
4	9·28319	65	9·29134	67	10·70866	9·99185	3	56
5	9·28384	64	9·29201	67	10·70799	9·99182	2	55
6	9·28448	64	9·29268	67	10·70732	9·99180	3	54
7	9·28512	65	9·29335	67	10·70665	9·99177	2	53
8	9·28577	64	9·29402	66	10·70598	9·99175	3	52
9	9·28641	64	9·29468	67	10·70532	9·99172	2	51
10	9·28705	64	9·29535	66	10·70465	9·99170	3	50
11	9·28769	64	9·29601	67	10·70399	9·99167	2	49
12	9·28833	63	9·29668	66	10·70332	9·99165	3	48
13	9·28896	64	9·29734	66	10·70266	9·99162	2	47
14	9·28960	64	9·29800	66	10·70200	9·99160	3	46
15	9·29024	63	9·29866	66	10·70134	9·99157	2	45
16	9·29087	63	9·29932	66	10·70068	9·99155	3	44
17	9·29150	64	9·29998	66	10·70002	9·99152	2	43
18	9·29214	63	9·30064	66	10·69936	9·99150	3	42
19	9·29277	63	9·30130	65	10·69870	9·99147	2	41
20	9·29340	63	9·30195	66	10·69805	9·99145	3	40
21	9·29403	63	9·30261	65	10·69739	9·99142	2	39
22	9·29466	63	9·30326	65	10·69674	9·99140	3	38
23	9·29529	62	9·30391	66	10·69609	9·99137	2	37
24	9·29591	63	9·30457	65	10·69543	9·99135	3	36
25	9·29654	62	9·30522	65	10·69478	9·99132	2	35
26	9·29716	63	9·30587	65	10·69413	9·99130	3	34
27	9·29779	62	9·30652	65	10·69348	9·99127	3	33
28	9·29841	62	9·30717	65	10·69283	9·99124	2	32
29	9·29903	63	9·30782	64	10·69218	9·99122	3	31
30	9·29966		9·30846		10·69154	9·99119		30
′	Cosine.		Cotang.		Tangent.	Sine.		′

[11 degrees.]

′	Sine.	Diff.	Tangent.	Diff.	Cotang.	Cosine.	D.	′
30	9·29966	62	9·30846	65	10·69154	9·99119	2	30
31	9·30028	62	9·30911	64	10·69089	9·99117	3	29
32	9·30090	61	9·30975	65	10·69025	9·99114	2	28
33	9·30151	62	9·31040	64	10·68960	9·99112	3	27
34	9·30213	62	9·31104	64	10·68896	9·99109	3	26
35	9·30275	61	9·31168	65	10·68832	9·99106	2	25
36	9·30336	62	9·31233	64	10·68767	9·99104	3	24
37	9·30398	61	9·31297	64	10·68703	9·99101	2	23
38	9·30459	62	9·31361	64	10·68639	9·99099	3	22
39	9·30521	61	9·31425	64	10·68575	9·99096	3	21
40	9·30582	61	9·31489	63	10·68511	9·99093	2	20
41	9·30643	61	9·31552	64	10·68448	9·99091	3	19
42	9·30704	61	9·31616	63	10·68384	9·99088	2	18
43	9·30765	61	9·31679	64	10·68321	9·99086	3	17
44	9·30826	61	9·31743	63	10·68257	9·99083	3	16
45	9·30887	60	9·31806	64	10·68194	9·99080	2	15
46	9·30947	61	9·31870	63	10·68130	9·99078	3	14
47	9·31008	60	9·31933	63	10·68067	9·99075	3	13
48	9·31068	61	9·31996	63	10·68004	9·99072	3	12
49	9·31129	60	9·32059	63	10·67941	9·99070	2	11
50	9·31189	61	9·32122	63	10·67878	9·99067	3	10
51	9·31250	60	9·32185	63	10·67815	9·99064	3	9
52	9·31310	60	9·32248	63	10·67752	9·99062	3	8
53	9·31370	60	9·32311	62	10·67689	9·99059	3	7
54	9·31430	60	9·32373	63	10·67627	9·99056	3	6
55	9·31490	59	9·32436	62	10·67564	9·99054	2	5
56	9·31549	60	9·32498	63	10·67502	9·99051	3	4
57	9·31609	60	9·32561	62	10·67439	9·99048	3	3
58	9·31669	59	9·32623	62	10·67377	9·99046	2	2
59	9·31728	60	9·32685	62	10·67315	9·99043	3	1
60	9·31788		9·32747		10·67253	9·99040	3	0
′	Cosine.		Cotang.		Tangent.	Sine.		′

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[12 degrees.]

′	Sine.	Diff.	Tangent.	Diff.	Cotang.	Cosine.	D.	′
0	9·31788	59	9·32747	63	10·67253	9·99040	2	60
1	9·31847	60	9·32810	62	10·67190	9·99038	3	59
2	9·31907		9·32872		10·67128	9·99035		58
3	9·31966	59	9·32933	61	10·67067	9·99032	3	57
4	9·32025	59	9·32995	62	10·67005	9·99030	2	56
5	9·32084	59	9·33057	62	10·66943	9·99027	3	55
6	9·32143	59	9·33119	61	10·66881	9·99024	3	54
7	9·32202	59	9·33180	62	10·66820	9·99022	2	53
8	9·32261	59	9·33242	61	10·66758	9·99019	3	52
9	9·32319	58	9·33303	62	10·66697	9·99016	3	51
10	9·32378	59	9·33365	61	10·66635	9·99013	3	50
11	9·32437	59	9·33426	61	10·66574	9·99011	2	49
12	9·32495	58	9·33487	61	10·66513	9·99008	3	48
13	9·32553	58	9·33548	61	10·66452	9·99005	3	47
14	9·32612	59	9·33609	61	10·66391	9·99002	3	46
15	9·32670	58	9·33670	61	10·66330	9·99000	2	45
16	9·32728	58	9·33731	61	10·66269	9·98997	3	44
17	9·32786	58	9·33792	61	10·66208	9·98994	3	43
18	9·32844	58	9·33853	60	10·66147	9·98991	3	42
19	9·32902	58	9·33913	61	10·66087	9·98989	2	41
20	9·32960	58	9·33974	60	10·66026	9·98986	3	40
21	9·33018	57	9·34034	61	10·65966	9·98983	3	39
22	9·33075	58	9·34095	60	10·65905	9·98980	3	38
23	9·33133	57	9·34155	60	10·65845	9·98978	2	37
24	9·33190	58	9·34215	61	10·65785	9·98975	3	36
25	9·33248	57	9·34276	60	10·65724	9·98972	3	35
26	9·33305	57	9·34336	60	10·65664	9·98969	3	34
27	9·33362	58	9·34396	60	10·65604	9·98967	2	33
28	9·33420	57	9·34456	60	10·65544	9·98964	3	32
29	9·33477	57	9·34516	60	10·65484	9·98961	3	31
30	9·33534		9·34576		10·65424	9·98958	3	30
′	Cosine.		Cotang.		Tangent.	Sine.		′

[77 degrees.]

[12 degrees.]

′	Sine.	Diff.	Tangent.	Diff.	Cotang.	Cosine.	D.	′
30	9·33534	57	9·34576	59	10·65424	9·98958	3	30
31	9·33591	56	9·34635	60	10·65365	9·98955	2	29
32	9·33647	57	9·34695	60	10·65305	9·98953	3	28
33	9·33704	57	9·34755	59	10·65245	9·98950	3	27
34	9·33761	57	9·34814	60	10·65186	9·98947	3	26
35	9·33818	56	9·34874	59	10·65126	9·98944	3	25
36	9·33874	57	9·34933	59	10·65067	9·98941	3	24
37	9·33931	56	9·34992	59	10·65008	9·98938	2	23
38	9·33987	56	9·35051	60	10·64949	9·98936	3	22
39	9·34043	57	9·35111	59	10·64889	9·98933	3	21
40	9·34100	56	9·35170	59	10·64830	9·98930	3	20
41	9·34156	56	9·35229	59	10·64771	9·98927	3	19
42	9·34212	56	9·35288	59	10·64712	9·98924	3	18
43	9·34268	56	9·35347	58	10·64653	9·98921	2	17
44	9·34324	56	9·35405	59	10·64595	9·98919	3	16
45	9·34380	56	9·35464	59	10·64536	9·98916	3	15
46	9·34436	55	9·35523	58	10·64477	9·98913	3	14
47	9·34491	56	9·35581	59	10·64419	9·98910	3	13
48	9·34547	55	9·35640	58	10·64360	9·98907	3	12
49	9·34602	56	9·35698	59	10·64302	9·98904	3	11
50	9·34658	55	9·35757	58	10·64243	9·98901	3	10
51	9·34713	56	9·35815	58	10·64185	9·98898	2	9
52	9·34769	55	9·35873	58	10·64127	9·98896	3	8
53	9·34824	55	9·35931	58	10·64069	9·98893	3	7
54	9·34879	55	9·35989	58	10·64011	9·98890	3	6
55	9·34934	55	9·36047	58	10·63953	9·98887	3	5
56	9·34989	55	9·36105	58	10·63895	9·98884	3	4
57	9·35044	55	9·36163	58	10·63837	9·98881	3	3
58	9·35099	55	9·36221	58	10·63779	9·98878	3	2
59	9·35154	55	9·36279	57	10·63721	9·98875	3	1
60	9·35209		9·36336		10·63664	9·98872	3	0
′	Cosine.		Cotang.		Tangent.	Sine.		′

[77 degrees.]

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[13 degrees.]

′	Sine.	Diff.	Tangent.	Diff.	Cotang.	Cosine.	D.	′
0	9·35209	54	9·36336	58	10·63664	9·98872	3	60
1	9·35263	55	9·36394	58	10·63606	9·98869	2	59
2	9·35318	55	9·36452	57	10·63548	9·98867	3	58
3	9·35373	54	9·36509	57	10·63491	9·98864	3	57
4	9·35427	54	9·36566	58	10·63434	9·98861	3	56
5	9·35481	55	9·36624	57	10·63376	9·98858	3	55
6	9·35536	54	9·36681	57	10·63319	9·98855	3	54
7	9·35590	54	9·36738	57	10·63262	9·98852	3	53
8	9·35644	54	9·36795	57	10·63205	9·98849	3	52
9	9·35698	54	9·36852	57	10·63148	9·98846	3	51
10	9·35752	54	9·36909	57	10·63091	9·98843	3	50
11	9·35806	54	9·36966	57	10·63034	9·98840	3	49
12	9·35860	54	9·37023	57	10·62977	9·98837	3	48
13	9·35914	54	9·37080	57	10·62920	9·98834	3	47
14	9·35968	54	9·37137	56	10·62863	9·98831	3	46
15	9·36022	53	9·37193	57	10·62807	9·98828	3	45
16	9·36075	54	9·37250	56	10·62750	9·98825	3	44
17	9·36129	53	9·37306	57	10·62694	9·98822	3	43
18	9·36182	54	9·37363	56	10·62637	9·98819	3	42
19	9·36236	53	9·37419	57	10·62581	9·98816	3	41
20	9·36289	53	9·37476	56	10·62524	9·98813	3	40
21	9·36342	53	9·37532	56	10·62468	9·98810	3	39
22	9·36395	54	9·37588	56	10·62412	9·98807	3	38
23	9·36449	53	9·37644	56	10·62356	9·98804	3	37
24	9·36502	53	9·37700	56	10·62300	9·98801	3	36
25	9·36555	53	9·37756	56	10·62244	9·98798	3	35
26	9·36608	52	9·37812	56	10·62188	9·98795	3	34
27	9·36660	53	9·37868	56	10·62132	9·98792	3	33
28	9·36713	53	9·37924	56	10·62076	9·98789	3	32
29	9·36766	53	9·37980	55	10·62020	9·98786	3	31
30	9·36819		9·38035		10·61965	9·98783	3	30
′	Cosine.		Cotang.		Tangent.	Sine.		′

[76 degrees.]

[13 degrees.]

′	Sine.	Diff.	Tangent.	Diff.	Cotang.	Cosine.	D.	′
30	9·36819	52	9·38035	56	10·61965	9·98783	3	30
31	9·36871	53	9·38091	56	10·61909	9·98780	3	29
32	9·36924	52	9·38147	55	10·61853	9·98777	3	28
33	9·36976	52	9·38202	55	10·61798	9·98774	3	27
34	9·37028	53	9·38257	56	10·61743	9·98771	3	26
35	9·37081	52	9·38313	55	10·61687	9·98768	3	25
36	9·37133	52	9·38368	55	10·61632	9·98765	3	24
37	9·37185	52	9·38423	56	10·61577	9·98762	3	23
38	9·37237	52	9·38479	55	10·61521	9·98759	3	22
39	9·37289	52	9·38534	55	10·61466	9·98756	3	21
40	9·37341	52	9·38589	55	10·61411	9·98753	3	20
41	9·37393	52	9·38644	55	10·61356	9·98750	4	19
42	9·37445	52	9·38699	55	10·61301	9·98746	3	18
43	9·37497	52	9·38754	55	10·61246	9·98743	3	17
44	9·37549	51	9·38808	54	10·61192	9·98740	3	16
45	9·37600	52	9·38863	55	10·61137	9·98737	3	15
46	9·37652	51	9·38918	55	10·61082	9·98734	3	14
47	9·37703	52	9·38972	54	10·61028	9·98731	3	13
48	9·37755	51	9·39027	55	10·60973	9·98728	3	12
49	9·37806	52	9·39082	55	10·60918	9·98725	3	11
50	9·37858	51	9·39136	54	10·60864	9·98722	3	10
51	9·37909	51	9·39190	54	10·60810	9·98719	4	9
52	9·37960	51	9·39245	55	10·60755	9·98715	3	8
53	9·38011	51	9·39299	54	10·60701	9·98712	3	7
54	9·38062	51	9·39353	54	10·60647	9·98709	3	6
55	9·38113	51	9·39407	54	10·60593	9·98706	3	5
56	9·38164	51	9·39461	54	10·60539	9·98703	3	4
57	9·38215	51	9·39515	54	10·60485	9·98700	3	3
58	9·38266	51	9·39569	54	10·60431	9·98697	3	2
59	9·38317	51	9·39623	54	10·60377	9·98694	3	1
60	9·38368		9·39677		10·60323	9·98690	4	0
′	Cosine.		Cotang.		Tangent.	Sine.		′

[76 degrees.]

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[14 degrees.]

′	Sine.	Diff.	Tangent.	Diff.	Cotang.	Cosine.	D.	′
0	9·38368	50	9·39677	54	10·60323	9·98690	3	60
1	9·38418	51	9·39731	54	10·60269	9·98687	3	59
2	9·38469	50	9·39785	53	10·60215	9·98684	3	58
3	9·38519	51	9·39838	54	10·60162	9·98681	3	57
4	9·38570	50	9·39892	53	10·60108	9·98678	3	56
5	9·38620	50	9·39945	54	10·60055	9·98675	4	55
6	9·38670	51	9·39999	53	10·60001	9·98671	3	54
7	9·38721	50	9·40052	54	10·59948	9·98668	3	53
8	9·38771	50	9·40106	53	10·59894	9·98665	3	52
9	9·38821	50	9·40159	53	10·59841	9·98662	3	51
10	9·38871	50	9·40212	54	10·59788	9·98659	3	50
11	9·38921	50	9·40266	53	10·59734	9·98656	4	49
12	9·38971	50	9·40319	53	10·59681	9·98652	3	48
13	9·39021	50	9·40372	53	10·59628	9·98649	3	47
14	9·39071	50	9·40425	53	10·59575	9·98646	3	46
15	9·39121	49	9·40478	53	10·59522	9·98643	3	45
16	9·39170	50	9·40531	53	10·59469	9·98640	4	44
17	9·39220	50	9·40584	52	10·59416	9·98636	3	43
18	9·39270	49	9·40636	53	10·59364	9·98633	3	42
19	9·39319	50	9·40689	53	10·59311	9·98630	3	41
20	9·39369	49	9·40742	53	10·59258	9·98627	4	40
21	9·39418	49	9·40795	52	10·59205	9·98623	3	39
22	9·39467	50	9·40847	53	10·59153	9·98620	3	38
23	9·39517	49	9·40900	52	10·59100	9·98617	3	37
24	9·39566	49	9·40952	53	10·59048	9·98614	4	36
25	9·39615	49	9·41005	52	10·58995	9·98610	3	35
26	9·39664	49	9·41057	52	10·58943	9·98607	3	34
27	9·39713	49	9·41109	52	10·58891	9·98604	3	33
28	9·39762	49	9·41161	53	10·58839	9·98601	4	32
29	9·39811	49	9·41214	52	10·58786	9·98597	3	31
30	9·39860		9·41266		10·58734	9·98594		30
′	Cosine.		Cotang.		Tangent.	Sine.		′

[75 degrees.]

[14 degrees.]

′	Sine.	Diff.	Tangent.	Diff.	Cotang.	Cosine.	D.	′
30	9·39860	49	9·41266	52	10·58734	9·98594	3	30
31	9·39909	49	9·41318	52	10·58682	9·98591	3	29
32	9·39958	48	9·41370	52	10·58630	9·98588	4	28
33	9·40006	49	9·41422	52	10·58578	9·98584	3	27
34	9·40055	48	9·41474	52	10·58526	9·98581	3	26
35	9·40103	49	9·41526	52	10·58474	9·98578	4	25
36	9·40152	48	9·41578	51	10·58422	9·98574	3	24
37	9·40200	49	9·41629	52	10·58371	9·98571	3	23
38	9·40249	48	9·41681	52	10·58319	9·98568	3	22
39	9·40297	49	9·41733	51	10·58267	9·98565	4	21
40	9·40346	48	9·41784	52	10·58216	9·98561	3	20
41	9·40394	48	9·41836	51	10·58164	9·98558	3	19
42	9·40442	48	9·41887	52	10·58113	9·98555	4	18
43	9·40490	48	9·41939	51	10·58061	9·98551	3	17
44	9·40538	48	9·41990	51	10·58010	9·98548	3	16
45	9·40586	48	9·42041	52	10·57959	9·98545	4	15
46	9·40634	48	9·42093	51	10·57907	9·98541	3	14
47	9·40682	48	9·42144	51	10·57856	9·98538	3	13
48	9·40730	48	9·42195	51	10·57805	9·98535	4	12
49	9·40778	47	9·42246	51	10·57754	9·98531	3	11
50	9·40825	48	9·42297	51	10·57703	9·98528	3	10
51	9·40873	48	9·42348	51	10·57652	9·98525	4	9
52	9·40921	47	9·42399	51	10·57601	9·98521	3	8
53	9·40968	48	9·42450	51	10·57550	9·98518	3	7
54	9·41016	47	9·42501	51	10·57499	9·98515	4	6
55	9·41063	48	9·42552	51	10·57448	9·98511	3	5
56	9·41111	47	9·42603	50	10·57397	9·98508	3	4
57	9·41158	47	9·42653	51	10·57347	9·98505	4	3
58	9·41205	47	9·42704	51	10·57296	9·98501	3	2
59	9·41252	48	9·42755	50	10·57245	9·98498	4	1
60	9·41300		9·42805		10·57195	9·98494		0
′	Cosine.		Cotang.		Tangent.	Sine.		′

[75 degrees.]

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′	Sine.	Diff.	Tangent.	Diff.	Cotang.	Cosine.	D.	′
0	9·41300	47	9·42805	51	10·57195	9·98494	3	60
1	9·41347	47	9·42856	50	10·57144	9·98491	3	59
2	9·41394	47	9·42906	51	10·57094	9·98488	4	58
3	9·41441	47	9·42957	50	10·57043	9·98484	3	57
4	9·41488	47	9·43007	50	10·56993	9·98481	4	56
5	9·41535	47	9·43057	51	10·56943	9·98477	3	55
6	9·41582	46	9·43108	50	10·56892	9·98474	3	54
7	9·41628	47	9·43158	50	10·56842	9·98471	4	53
8	9·41675	47	9·43208	50	10·56792	9·98467	3	52
9	9·41722	46	9·43258	50	10·56742	9·98464	4	51
10	9·41768	47	9·43308	50	10·56692	9·98460	3	50
11	9·41815	46	9·43358	50	10·56642	9·98457	4	49
12	9·41861	47	9·43408	50	10·56592	9·98453	3	48
13	9·41908	46	9·43458	50	10·56542	9·98450	3	47
14	9·41954	47	9·43508	50	10·56492	9·98447	4	46
15	9·42001	46	9·43558	49	10·56442	9·98443	3	45
16	9·42047	46	9·43607	50	10·56393	9·98440	4	44
17	9·42093	47	9·43657	50	10·56343	9·98436	3	43
18	9·42140	46	9·43707	49	10·56293	9·98433	4	42
19	9·42186	46	9·43756	50	10·56244	9·98429	3	41
20	9·42232	46	9·43806	49	10·56194	9·98426	4	40
21	9·42278	46	9·43855	50	10·56145	9·98422	3	39
22	9·42324	46	9·43905	49	10·56095	9·98419	4	38
23	9·42370	46	9·43954	50	10·56046	9·98415	3	37
24	9·42416	45	9·44004	49	10·55996	9·98412	3	36
25	9·42461	46	9·44053	49	10·55947	9·98409	4	35
26	9·42507	46	9·44102	49	10·55898	9·98405	3	34
27	9·42553	46	9·44151	50	10·55849	9·98402	4	33
28	9·42599	45	9·44201	49	10·55799	9·98398	3	32
29	9·42644	46	9·44250	49	10·55750	9·98395	4	31
30	9·42690		9·44299		10·55701	9·98391		30
′	Cosine.		Cotang.		Tangent.	Sine.		′

′	Sine.	Diff.	Tangent.	Diff.	Cotang.	Cosine.	D.	′
30	9·42690	45	9·44299	49	10·55701	9·98391	3	30
31	9·42735	46	9·44348	49	10·55652	9·98388	4	29
32	9·42781	45	9·44397	49	10·55603	9·98384	3	28
33	9·42826	46	9·44446	49	10·55554	9·98381	4	27
34	9·42872	45	9·44495	49	10·55505	9·98377	4	26
35	9·42917	45	9·44544	48	10·55456	9·98373	3	25
36	9·42962	46	9·44592	49	10·55408	9·98370	4	24
37	9·43008	45	9·44641	49	10·55359	9·98366	3	23
38	9·43053	45	9·44690	48	10·55310	9·98363	4	22
39	9·43098	45	9·44738	49	10·55262	9·98359	3	21
40	9·43143	45	9·44787	49	10·55213	9·98356	4	20
41	9·43188	45	9·44836	48	10·55164	9·98352	3	19
42	9·43233	45	9·44884	49	10·55116	9·98349	4	18
43	9·43278	45	9·44933	48	10·55067	9·98345	3	17
44	9·43323	44	9·44981	48	10·55019	9·98342	4	16
45	9·43367	45	9·45029	49	10·54971	9·98338	4	15
46	9·43412	45	9·45078	48	10·54922	9·98334	3	14
47	9·43457	45	9·45126	48	10·54874	9·98331	4	13
48	9·43502	44	9·45174	48	10·54826	9·98327	3	12
49	9·43546	45	9·45222	49	10·54778	9·98324	4	11
50	9·43591	44	9·45271	48	10·54729	9·98320	3	10
51	9·43635	45	9·45319	48	10·54681	9·98317	4	9
52	9·43680	44	9·45367	48	10·54633	9·98313	4	8
53	9·43724	45	9·45415	48	10·54585	9·98309	3	7
54	9·43769	44	9·45463	48	10·54537	9·98306	4	6
55	9·43813	44	9·45511	48	10·54489	9·98302	3	5
56	9·43857	44	9·45559	47	10·54441	9·98299	4	4
57	9·43901	45	9·45606	48	10·54394	9·98295	4	3
58	9·43946	44	9·45654	48	10·54346	9·98291	3	2
59	9·43990	44	9·45702	48	10·54298	9·98288	4	1
60	9·44034		9·45750		10·54250	9·98284		0
′	Cosine.		Cotang.		Tangent.	Sine.		′

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′	Sine.	Diff.	Tangent.	Diff.	Cotang.	Cosine.	D.	′
0	9·44034	44	9·45750	47	10·54250	9·98284	3	60
1	9·44078	44	9·45797	48	10·54203	9·98281	4	59
2	9·44122	44	9·45845	47	10·54155	9·98277	4	58
3	9 44166	44	9·45892	48	10·54108	9·98273	3	57
4	9·44210	43	9·45940	47	10·54060	9·98270	4	56
5	9·44253	44	9·45987	48	10·54013	9·98266	4	55
6	9·44297	44	9·46035	47	10·53965	9·98262	3	54
7	9·44341	44	9·46082	48	10·53918	9·98259	4	53
8	9·44385	43	9·46130	47	10·53870	9·98255	4	52
9	9·44428	44	9·46177	47	10·53823	9·98251	3	51
10	9·44472	44	9·46224	47	10·53776	9·98248	4	50
11	9·44516	43	9·46271	48	10 53729	9·98244	4	49
12	9·44559	43	9·46319	47	10·53681	9·98240	3	48
13	9·44602	44	9 46366	47	10·53634	9·98237	4	47
14	9·44646	43	9·46413	47	10·53587	9·98233	4	46
15	9·44689	44	9·46460	47	10·53540	9·98229	3	45
16	9·44733	43	9·46507	47	10·53493	9 98226	4	44
17	9·44776	43	9 46554	47	10·53446	9·98222	4	43
18	9·44819	43	9·46601	47	10·53399	9·98218	3	42
19	9·44862	43	9·46648	46	10·53352	9·98215	4	41
20	9·44905	43	9 46694	47	10·53306	9·98211	4	40
21	9 44948	44	9·46741	47	10·53259	9·98207	3	39
22	9 44992	43	9·46788	47	10·53212	9·98204	4	38
23	9·45035	42	9 46835	46	10·53165	9·98200	4	37
24	9·45077	43	9·46881	47	10·53119	9·98196	4	36
25	9·45120	43	9·46928	47	10·53072	9·98192	3	35
26	9·45163	43	9·46975	46	10·53025	9·98189	4	34
27	9·45206	43	9·47021	47	10·52979	9·98185	4	33
28	9·45249	43	9·47068	46	10·52932	9·98181	4	32
29	9·45292	42	9·47114	46	10·52886	9·98177	3	31
30	9·45334		9·47160		10·52840	9·98174		30
′	Cosine.		Cotang.		Tangent.	Sine.		′

′	Sine.	Diff.	Tangent.	Diff.	Cotang.	Cosine.	D.	′
30	9·45334	43	9·47160	47	10·52840	9·98174	4	30
31	9·45377	42	9·47207	46	10·52793	9·98170	4	29
32	9·45419	43	9·47253	46	10·52747	9·98166	4	28
33	9·45462	42	9·47299	47	10·52701	9·98162	4	27
34	9·45504	43	9·47346	46	10·52654	9·98159	3	26
35	9·45547	42	9·47392	46	10·52608	9·98155	4	25
36	9·45589	43	9·47438	46	10·52562	9·98151	4	24
37	9·45632	42	9·47484	46	10·52516	9·98147	4	23
38	9·45674	42	9·47530	46	10·52470	9·98144	3	22
39	9·45716	42	9·47576	46	10·52424	9·98140	4	21
40	9·45758	43	9·47622	46	10·52378	9·98136	4	20
41	9·45801	42	9·47668	46	10·52332	9·98132	4	19
42	9·45843	42	9·47714	46	10·52286	9·98129	3	18
43	9·45885	42	9·47760	46	10·52240	9·98125	4	17
44	9·45927	42	9·47806	46	10·52194	9·98121	4	16
45	9·45969	42	9·47852	45	10·52148	9·98117	4	15
46	9·46011	42	9·47897	46	10·52103	9·98113	3	14
47	9·46053	42	9·47943	46	10·52057	9·98110	4	13
48	9·46095	41	9·47989	46	10·52011	9·98106	4	12
49	9·46136	42	9·48035	45	10·51965	9·98102	4	11
50	9·46178	42	9·48080	46	10·51920	9·98098	4	10
51	9·46220	42	9·48126	45	10·51874	9·98094	4	9
52	9·46262	41	9·48171	46	10·51829	9·98090	3	8
53	9·46303	42	9·48217	45	10·51783	9·98087	4	7
54	9·46345	41	9·48262	45	10·51738	9·98083	4	6
55	9·46386	42	9·48307	46	10·51693	9·98079	4	5
56	9·46428	41	9·48353	45	10·51647	9·98075	4	4
57	9·46469	42	9·48398	45	10·51602	9·98071	4	3
58	9·46511	41	9·48443	46	10·51557	9·98067	4	2
59	9·46552	42	9·48489	45	10·51511	9·98063	3	1
60	9·46594		9·48534		10·51466	9·98060		0
′	Cosine.		Cotang.		Tangent.	Sine.		′

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[17 degrees.]

′	Sine.	Diff.	Tangent.	Diff.	Cotang.	Cosine.	D.	′
0	9·46594	41	9·48534	45	10·51466	9·98060	4	60
1	9·46635	41	9·48579	45	10·51421	9·98056	4	59
2	9·46676	41	9·48624	45	10·51376	9·98052	4	58
3	9·46717	41	9·48669	45	10·51331	9·98048	4	57
4	9·46758	42	9·48714	45	10·51286	9·98044	4	56
5	9·46800	41	9·48759	45	10·51241	9·98040	4	55
6	9·46841	41	9·48804	45	10·51196	9·98036	4	54
7	9·46882	41	9·48849	45	10·51151	9·98032	3	53
8	9·46923	41	9·48894	45	10·51106	9·98029	4	52
9	9·46964	41	9·48939	45	10·51061	9·98025	4	51
10	9·47005	40	9·48984	45	10·51016	9·98021	4	50
11	9·47045	41	9·49029	45	10·50971	9·98017	4	49
12	9·47086	41	9·49073	44	10·50927	9·98013	4	48
13	9·47127	41	9·49118	45	10·50882	9·98009	4	47
14	9·47168	41	9·49163	45	10·50837	9·98005	4	46
15	9·47209	40	9·49207	44	10·50793	9·98001	4	45
16	9·47249	41	9·49252	45	10·50748	9·97997	4	44
17	9·47290	40	9·49296	44	10·50704	9·97993	4	43
18	9·47330	41	9·49341	45	10·50659	9·97989	3	42
19	9·47371	40	9·49385	44	10·50615	9·97986	4	41
20	9·47411	41	9·49430	45	10·50570	9·97982	4	40
21	9·47452	40	9·49474	44	10·50526	9·97978	4	39
22	9·47492	41	9·49519	45	10·50481	9·97974	4	38
23	9·47533	40	9·49563	44	10·50437	9·97970	4	37
24	9·47573	40	9·49607	44	10·50393	9·97966	4	36
25	9·47613	41	9·49652	44	10·50348	9·97962	4	35
26	9·47654	40	9·49696	44	10·50304	9·97958	4	34
27	9·47694	40	9·49740	44	10·50260	9·97954	4	33
28	9·47734	40	9·49784	44	10·50216	9·97950	4	32
29	9·47774	40	9·49828	44	10·50172	9·97946	4	31
30	9·47814		9·49872		10·50128	9·97942		30
′	Cosine.		Cotang.		Tangent.	Sine.		′

[72 degrees.]

[17 degrees.]

′	Sine.	Diff.	Tangent.	Diff.	Cotang.	Cosine.	D.	′
30	9·47814	40	9·49872	44	10·50128	9·97942	4	30
31	9·47854	40	9·49916	44	10·50084	9·97938	4	29
32	9·47894	40	9·49960	44	10·50040	9·97934	4	28
33	9·47934	40	9·50004	44	10·49996	9·97930	4	27
34	9·47974	40	9·50048	44	10·49952	9·97926	4	26
35	9·48014	40	9·50092	44	10·49908	9·97922	4	25
36	9·48054	40	9·50136	44	10·49864	9·97918	4	24
37	9·48094	39	9·50180	43	10·49820	9·97914	4	23
38	9·48133	40	9·50223	44	10·49777	9·97910	4	22
39	9·48173	40	9·50267	44	10·49733	9·97906	4	21
40	9·48213	39	9·50311	44	10·49689	9·97902	4	20
41	9·48252	40	9·50355	43	10·49645	9·97898	4	19
42	9·48292	40	9·50398	44	10·49602	9·97894	4	18
43	9·48332	39	9·50442	43	10·49558	9·97890	4	17
44	9·48371	40	9·50485	44	10·49515	9·97886	4	16
45	9·48411	39	9·50529	43	10·49471	9·97882	4	15
46	9·48450	40	9·50572	44	10·49428	9·97878	4	14
47	9·48490	39	9·50616	43	10·49384	9·97874	4	13
48	9·48529	39	9·50659	44	10·49341	9·97870	4	12
49	9·48568	39	9·50703	43	10·49297	9·97866	5	11
50	9·48607	40	9·50746	43	10·49254	9·97861	4	10
51	9·48647	39	9·50789	44	10·49211	9·97857	4	9
52	9·48686	39	9·50833	43	10·49167	9·97853	4	8
53	9·48725	39	9·50876	43	10·49124	9·97849	4	7
54	9·48764	39	9·50919	43	10·49081	9·97845	4	6
55	9·48803	39	9·50962	43	10·49038	9·97841	4	5
56	9·48842	39	9·51005	43	10·48995	9·97837	4	4
57	9·48881	39	9·51048	44	10·48952	9·97833	4	3
58	9·48920	39	9·51092	43	10·48908	9·97829	4	2
59	9·48959	39	9·51135	43	10·48865	9·97825	4	1
60	9·48998		9·51178		10·48822	9·97821		0
′	Cosine.		Cotang.		Tangent.	Sine.		′

[72 degrees.]

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[18 degrees.]

′	Sine.	Diff.	Tangent.	Diff.	Cotang.	Cosine.	D.	′
0	9·48998	39	9·51178	43	10·48822	9·97821	4	60
1	9·49037	39	9·51221	43	10·48779	9·97817	5	59
2	9·49076	39	9·51264	42	10·48736	9·97812	4	58
3	9·49115	38	9·51306	43	10·48694	9·97808	4	57
4	9·49153	39	9·51349	43	10·48651	9·97804	4	56
5	9·49192	39	9·51392	43	10·48608	9·97800	4	55
6	9·49231	38	9·51435	43	10·48565	9·97796	4	54
7	9·49269	39	9·51478	42	10·48522	9·97792	4	53
8	9·49308	39	9·51520	43	10·48480	9·97788	4	52
9	9·49347	38	9·51563	43	10·48437	9·97784	5	51
10	9·49385	39	9·51606	42	10·48394	9·97779	4	50
11	9·49424	38	9·51648	43	10·48352	9·97775	4	49
12	9·49462	38	9·51691	43	10·48309	9·97771	4	48
13	9·49500	39	9·51734	42	10·48266	9·97767	4	47
14	9·49539	38	9·51776	43	10·48224	9·97763	4	46
15	9·49577	38	9·51819	42	10·48181	9·97759	5	45
16	9·49615	39	9·51861	42	10·48139	9·97754	4	44
17	9·49654	38	9·51903	43	10·48097	9·97750	4	43
18	9·49692	38	9·51946	42	10·48054	9·97746	4	42
19	9·49730	38	9·51988	43	10·48012	9·97742	4	41
20	9·49768	38	9·52031	42	10·47969	9·97738	4	40
21	9·49806	38	9·52073	42	10·47927	9·97734	5	39
22	9·49844	38	9·52115	42	10·47885	9·97729	4	38
23	9·49882	38	9·52157	43	10·47843	9·97725	4	37
24	9·49920	38	9·52200	42	10·47800	9·97721	4	36
25	9·49958	38	9·52242	42	10·47758	9·97717	4	35
26	9·49996	38	9·52284	42	10·47716	9·97713	5	34
27	9·50034	38	9·52326	42	10·47674	9·97708	4	33
28	9·50072	38	9·52368	42	10·47632	9·97704	4	32
29	9·50110	38	9·52410	42	10·47590	9·97700	4	31
30	9·50148		9·52452		10·47548	9·97696		30
′	Cosine.		Cotang.		Tangent.	Sine.		′

[71 degrees.]

[18 degrees.]

′	Sine.	Diff.	Tangent.	Diff.	Cotang.	Cosine.	D.	′
30	9·50148	37	9·52452	42	10·47548	9·97696	5	30
31	9·50185	38	9·52494	42	10·47506	9·97691	4	29
32	9·50223	38	9·52536	42	10·47464	9·97687	4	28
33	9·50261	37	9·52578	42	10·47422	9·97683	4	27
34	9·50298	38	9·52620	41	10·47380	9·97679	5	26
35	9·50336	38	9·52661	42	10·47339	9·97674	4	25
36	9·50374	37	9·52703	42	10·47297	9·97670	4	24
37	9·50411	38	9·52745	42	10·47255	9·97666	4	23
38	9·50449	37	9·52787	42	10·47213	9·97662	5	22
39	9·50486	37	9·52829	41	10·47171	9·97657	4	21
40	9·50523	38	9·52870	42	10·47130	9·97653	4	20
41	9·50561	37	9·52912	41	10·47088	9·97649	4	19
42	9·50598	37	9·52953	42	10·47047	9·97645	5	18
43	9·50635	38	9·52995	42	10·47005	9·97640	4	17
44	9·50673	37	9·53037	41	10·46963	9·97636	4	16
45	9·50710	37	9·53078	42	10·46922	9·97632	4	15
46	9·50747	37	9·53120	41	10·46880	9·97628	5	14
47	9·50784	37	9·53161	41	10·46839	9·97623	4	13
48	9·50821	37	9·53202	42	10·46798	9·97619	4	12
49	9·50858	38	9·53244	41	10·46756	9·97615	5	11
50	9·50896	37	9·53285	42	10·46715	9·97610	4	10
51	9·50933	37	9·53327	41	10·46673	9·97606	4	9
52	9·50970	37	9·53368	41	10·46632	9·97602	5	8
53	9·51007	36	9·53409	41	10·46591	9·97597	4	7
54	9·51043	37	9·53450	42	10·46550	9·97593	4	6
55	9·51080	37	9·53492	41	10·46508	9·97589	5	5
56	9·51117	37	9·53533	41	10·46467	9·97584	4	4
57	9·51154	37	9·53574	41	10·46426	9·97580	4	3
58	9·51191	36	9·53615	41	10·46385	9·97576	5	2
59	9·51227	37	9·53656	41	10·46344	9·97571	4	1
60	9·51264		9·53697		10·46303	9·97567		0
′	Cosine.		Cotang.		Tangent.	Sine.		′

[71 degrees.]

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[19 degrees.]

′	Sine.	Diff.	Tangent.	Diff.	Cotang.	Cosine.	D.	′
0	9·51264	37	9·53697	41	10·46303	9·97567	4	60
1	9·51301	37	9·53738	41	10·46262	9·97563	5	59
2	9·51338	36	9·53779	41	10·46221	9·97558	4	58
3	9·51374	37	9·53820	41	10·46180	9·97554	4	57
4	9·51411	36	9·53861	41	10·46139	9·97550	5	56
5	9·51447	37	9·53902	41	10·46098	9·97545	4	55
6	9·51484	36	9·53943	41	10·46057	9·97541	5	54
7	9·51520	37	9·53984	41	10·46016	9·97536	4	53
8	9·51557	36	9·54025	40	10·45975	9·97532	4	52
9	9·51593	36	9·54065	41	10·45935	9·97528	5	51
10	9·51629	37	9·54106	41	10·45894	9·97523	4	50
11	9·51666	36	9·54147	40	10·45853	9·97519	4	49
12	9·51702	36	9·54187	41	10·45813	9·97515	5	48
13	9·51738	36	9·54228	41	10·45772	9·97510	4	47
14	9·51774	37	9·54269	40	10·45731	9·97506	5	46
15	9·51811	36	9·54309	41	10·45691	9·97501	4	45
16	9·51847	36	9·54350	40	10·45650	9·97497	5	44
17	9·51883	36	9·54390	41	10·45610	9·97492	4	43
18	9·51919	36	9·54431	40	10·45569	9·97488	4	42
19	9·51955	36	9·54471	41	10·45529	9·97484	5	41
20	9·51991	36	9·54512	40	10·45488	9·97479	4	40
21	9·52027	36	9·54552	41	10·45448	9·97475	5	39
22	9·52063	36	9·54593	40	10·45407	9·97470	4	38
23	9·52099	36	9·54633	40	10·45367	9·97466	5	37
24	9·52135	36	9·54673	41	10·45327	9·97461	4	36
25	9·52171	36	9·54714	40	10·45286	9·97457	4	35
26	9·52207	35	9·54754	40	10·45246	9·97453	5	34
27	9·52242	36	9·54794	41	10·45206	9·97448	4	33
28	9·52278	36	9·54835	40	10·45165	9·97444	5	32
29	9·52314	36	9·54875	40	10·45125	9·97439	4	31
30	9·52350		9·54915		10·45085	9·97435		30
′	Cosine.		Cotang.		Tangent.	Sine.		′

[70 degrees.]

[19 degrees.]

′	Sine.	Diff.	Tangent.	Diff.	Cotang.	Cosine.	D.	′
30	9·52350	35	9·54915	40	10·45085	9·97435	5	30
31	9·52385	36	9·54955	40	10·45045	9·97430	4	29
32	9·52421	35	9·54995	40	10·45005	9·97426	5	28
33	9·52456	36	9·55035	40	10·44965	9·97421	4	27
34	9·52492	35	9·55075	40	10·44925	9·97417	5	26
35	9·52527	36	9·55115	40	10·44885	9·97412	4	25
36	9·52563	35	9·55155	40	10·44845	9·97408	5	24
37	9·52598	36	9·55195	40	10·44805	9·97403	4	23
38	9·52634	35	9·55235	40	10·44765	9·97399	5	22
39	9·52669	36	9·55275	40	10·44725	9·97394	4	21
40	9·52705	35	9·55315	40	10·44685	9·97390	5	20
41	9·52740	35	9·55355	40	10·44645	9·97385	4	19
42	9·52775	36	9·55395	39	10·44605	9·97381	5	18
43	9·52811	35	9·55434	40	10·44566	9·97376	4	17
44	9·52846	35	9·55474	40	10·44526	9·97372	5	16
45	9·52881	35	9·55514	40	10·44486	9·97367	4	15
46	9·52916	35	9·55554	39	10·44446	9·97363	5	14
47	9·52951	35	9·55593	40	10·44407	9·97358	5	13
48	9·52986	35	9·55633	40	10·44367	9·97353	4	12
49	9·53021	35	9·55673	39	10·44327	9·97349	5	11
50	9·53056	36	9·55712	40	10·44288	9·97344	4	10
51	9·53092	34	9·55752	39	10·44248	9·97340	5	9
52	9·53126	35	9·55791	40	10·44209	9·97335	4	8
53	9·53161	35	9·55831	39	10·44169	9·97331	5	7
54	9·53196	35	9·55870	40	10·44130	9·97326	4	6
55	9·53231	35	9·55910	39	10·44090	9·97322	5	5
56	9·53266	35	9·55949	40	10·44051	9·97317	5	4
57	9·53301	35	9·55989	39	10·44011	9·97312	4	3
58	9·53336	34	9·56028	39	10·43972	9·97308	5	2
59	9·53370	35	9·56067	40	10·43933	9·97303	4	1
60	9·53405		9·56107		10·43893	9·97299		0
′	Cosine.		Cotang.		Tangent.	Sine.		′

[70 degrees.]

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[20 degrees.]

′	Sine.	Diff.	Tangent.	Diff.	Cotang.	Cosine.	D.	′
0	9·53405	35	9·56107	39	10·43893	9·97299	5	60
1	9·53440	35	9·56146	39	10·43854	9·97294	5	59
2	9·53475	34	9·56185	39	10·43815	9·97289	4	58
3	9·53509	35	9·56224	40	10·43776	9·97285	5	57
4	9·53544	34	9·56264	39	10·43736	9·97280	4	56
5	9·53578	35	9·56303	39	10·43697	9·97276	5	55
6	9·53613	34	9·56342	39	10·43658	9·97271	5	54
7	9·53647	35	9·56381	39	10·43619	9·97266	4	53
8	9·53682	34	9·56420	39	10·43580	9·97262	5	52
9	9·53716	35	9·56459	39	10·43541	9·97257	5	51
10	9·53751	34	9·56498	39	10·43502	9·97252	4	50
11	9·53785	34	9·56537	39	10·43463	9·97248	5	49
12	9·53819	35	9·56576	39	10·43424	9·97243	5	48
13	9·53854	34	9·56615	39	10·43385	9·97238	4	47
14	9·53888	34	9·56654	39	10·43346	9·97234	5	46
15	9·53922	35	9·56693	39	10·43307	9·97229	5	45
16	9·53957	34	9·56732	39	10·43268	9·97224	4	44
17	9·53991	34	9·56771	39	10·43229	9·97220	5	43
18	9·54025	34	9·56810	39	10·43190	9·97215	5	42
19	9·54059	34	9·56849	38	10·43151	9·97210	4	41
20	9·54093	34	9·56887	39	10·43113	9·97206	5	40
21	9·54127	34	9·56926	39	10·43074	9·97201	5	39
22	9·54161	34	9·56965	39	10·43035	9·97196	4	38
23	9·54195	34	9·57004	38	10·42996	9·97192	5	37
24	9·54229	34	9·57042	39	10·42958	9·97187	5	36
25	9·54263	34	9·57081	39	10·42919	9·97182	4	35
26	9·54297	34	9·57120	38	10·42880	9·97178	5	34
27	9·54331	34	9·57158	39	10·42842	9·97173	5	33
28	9·54365	34	9·57197	38	10·42803	9·97168	5	32
29	9·54399	34	9·57235	39	10·42765	9·97163	4	31
30	9·54433	34	9·57274	39	10·42726	9·97159	5	30
′	Cosine.		Cotang.		Tangent.	Sine.		′

[69 degrees.]

[20 degrees.]

′	Sine.	Diff.	Tangent.	Diff.	Cotang.	Cosine.	D.	′
30	9·54433	33	9·57274	38	10·42726	9·97159	5	30
31	9·54466	34	9·57312	39	10·42688	9·97154	5	29
32	9·54500	34	9·57351	38	10·42649	9·97149	5	28
33	9·54534	33	9·57389	39	10·42611	9·97145	4	27
34	9·54567	34	9·57428	38	10·42572	9·97140	5	26
35	9·54601	34	9·57466	38	10·42534	9·97135	5	25
36	9·54635	33	9·57504	39	10·42496	9·97130	5	24
37	9·54668	34	9·57543	38	10·42457	9·97126	4	23
38	9·54702	33	9·57581	38	10·42419	9·97121	5	22
39	9·54735	34	9·57619	39	10·42381	9·97116	5	21
40	9·54769	33	9·57658	38	10·42342	9·97111	4	20
41	9·54802	34	9·57696	38	10·42304	9·97107	5	19
42	9·54836	33	9·57734	38	10·42266	9·97102	5	18
43	9·54869	34	9·57772	38	10·42228	9·97097	5	17
44	9·54903	33	9·57810	39	10·42190	9·97092	5	16
45	9·54936	33	9·57849	38	10·42151	9·97087	4	15
46	9·54969	34	9·57887	38	10·42113	9·97083	5	14
47	9·55003	33	9·57925	38	10·42075	9·97078	5	13
48	9·55036	33	9·57963	38	10·42037	9·97073	5	12
49	9·55069	33	9·58001	38	10·41999	9·97068	5	11
50	9·55102	34	9·58039	38	10·41961	9·97063	4	10
51	9·55136	33	9·58077	38	10·41923	9·97059	5	9
52	9·55169	33	9·58115	38	10·41885	9·97054	5	8
53	9·55202	33	9·58153	38	10·41847	9·97049	5	7
54	9·55235	33	9·58191	38	10·41809	9·97044	5	6
55	9·55268	33	9·58229	38	10·41771	9·97039	4	5
56	9·55301	33	9·58267	37	10·41733	9·97035	5	4
57	9·55334	33	9·58304	38	10·41696	9·97030	5	3
58	9·55367	33	9·58342	38	10·41658	9·97025	5	2
59	9·55400	33	9·58380	38	10·41620	9·97020	5	1
60	9·55433	33	9·58418	38	10·41582	9·97015	5	0
′	Cosine.		Cotang.		Tangent.	Sine.		′

[69 degrees.]

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[19 degrees.]

′	Sine.	Diff.	Tangent.	Diff.	Cotang.	Cosine.	D.	′
0	9·51264	37	9·53697	41	10·46303	9·97567	4	60
1	9·51301	37	9·53738	41	10·46262	9·97563	5	59
2	9·51338	36	9·53779	41	10·46221	9·97558	4	58
3	9·51374	37	9·53820	41	10·46180	9·97554	4	57
4	9·51411	36	9·53861	41	10·46139	9·97550	5	56
5	9·51447	37	9·53902	41	10·46098	9·97545	4	55
6	9·51484	36	9·53943	41	10·46057	9·97541	5	54
7	9·51520	37	9·53984	41	10·46016	9·97536	4	53
8	9·51557	36	9·54025	40	10·45975	9·97532	4	52
9	9·51593	36	9·54065	41	10·45935	9·97528	5	51
10	9·51629	37	9·54106	41	10·45894	9·97523	4	50
11	9·51666	36	9·54147	40	10·45853	9·97519	4	49
12	9·51702	36	9·54187	41	10·45813	9·97515	5	48
13	9·51738	36	9·54228	41	10·45772	9·97510	4	47
14	9·51774	37	9·54269	40	10·45731	9·97506	5	46
15	9·51811	36	9·54309	41	10·45691	9·97501	4	45
16	9·51847	36	9·54350	40	10·45650	9·97497	5	44
17	9·51883	36	9·54390	41	10·45610	9·97492	4	43
18	9·51919	36	9·54431	40	10·45569	9·97488	4	42
19	9·51955	36	9·54471	41	10·45529	9·97484	5	41
20	9·51991	36	9·54512	40	10·45488	9·97479	4	40
21	9·52027	36	9·54552	41	10·45448	9·97475	5	39
22	9·52063	36	9·54593	40	10·45407	9·97470	4	38
23	9·52099	36	9·54633	40	10·45367	9·97466	5	37
24	9·52135	36	9·54673	41	10·45327	9·97461	4	36
25	9·52171	36	9·54714	40	10·45286	9·97457	4	35
26	9·52207	35	9·54754	40	10·45246	9·97453	5	34
27	9·52242	36	9·54794	41	10·45206	9·97448	4	33
28	9·52278	36	9·54835	40	10·45165	9·97444	5	32
29	9·52314	36	9·54875	40	10·45125	9·97439	4	31
30	9·52350		9·54915		10·45085	9·97435		30
′	Cosine.		Cotang.		Tangent.	Sine.		′

[70 degrees.]

[19 degrees.]

′	Sine.	Diff.	Tangent.	Diff.	Cotang.	Cosine.	D.	′
30	9·52350	35	9·54915	40	10·45085	9·97435	5	30
31	9·52385	36	9·54955	40	10·45045	9·97430	4	29
32	9·52421	35	9·54995	40	10·45005	9·97426	4	28
33	9·52456	36	9·55035	40	10·44965	9·97421	5	27
34	9·52492	35	9·55075	40	10·44925	9·97417	4	26
35	9·52527	36	9·55115	40	10·44885	9·97412	5	25
36	9·52563	35	9·55155	40	10·44845	9·97408	4	24
37	9·52598	36	9·55195	40	10·44805	9·97403	5	23
38	9·52634	35	9·55235	40	10·44765	9·97399	4	22
39	9·52669	36	9·55275	40	10·44725	9·97394	5	21
40	9·52705	35	9·55315	40	10·44685	9·97390	4	20
41	9·52740	35	9·55355	40	10·44645	9·97385	5	19
42	9·52775	36	9·55395	39	10·44605	9·97381	4	18
43	9·52811	35	9·55434	40	10·44566	9·97376	5	17
44	9·52846	35	9·55474	40	10·44526	9·97372	4	16
45	9·52881	35	9·55514	40	10·44486	9·97367	5	15
46	9·52916	35	9·55554	39	10·44446	9·97363	4	14
47	9·52951	35	9·55593	40	10·44407	9·97358	5	13
48	9·52986	35	9·55633	40	10·44367	9·97353	4	12
49	9·53021	35	9·55673	39	10·44327	9·97349	5	11
50	9·53056	35	9·55712	40	10·44288	9·97344	4	10
51	9·53092	34	9·55752	39	10·44248	9·97340	5	9
52	9·53126	35	9·55791	40	10·44209	9·97335	4	8
53	9·53161	35	9·55831	39	10·44169	9·97331	5	7
54	9·53196	35	9·55870	40	10·44130	9·97326	4	6
55	9·53231	35	9·55910	39	10·44090	9·97322	5	5
56	9·53266	35	9·55949	40	10·44051	9·97317	5	4
57	9·53301	35	9·55989	39	10·44011	9·97312	4	3
58	9·53336	34	9·56028	39	10·43972	9·97308	5	2
59	9·53370	35	9·56067	39	10·43933	9·97303	4	1
60	9·53405		9·56107		10·43893	9·97299		0
′	Cosine.		Cotang.		Tangent.	Sine.		′

[70 degrees.]

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[20 degrees.]

′	Sine.	Diff.	Tangent.	Diff.	Cotang.	Cosine.	D.	′
0	9·53405	35	9·56107	39	10·43893	9·97299	5	60
1	9·53440	35	9·56146	39	10·43854	9·97294	5	59
2	9·53475	34	9·56185	39	10·43815	9·97289	5	58
3	9·53509	35	9·56224	40	10·43776	9·97285	4	57
4	9·53544	34	9·56264	39	10·43736	9·97280	5	56
5	9·53578	35	9·56303	39	10·43697	9·97276	4	55
6	9·53613	34	9·56342	39	10·43658	9·97271	5	54
7	9·53647	35	9·56381	39	10·43619	9·97266	5	53
8	9·53682	34	9·56420	39	10·43580	9·97262	4	52
9	9·53716	35	9·56459	39	10·43541	9·97257	5	51
10	9·53751	34	9·56498	39	10·43502	9·97252	5	50
11	9·53785	34	9·56537	39	10·43463	9·97248	4	49
12	9·53819	35	9·56576	39	10·43424	9·97243	5	48
13	9·53854	34	9·56615	39	10·43385	9·97238	5	47
14	9·53888	34	9·56654	39	10·43346	9·97234	4	46
15	9·53922	35	9·56693	39	10·43307	9·97229	5	45
16	9·53957	34	9·56732	39	10·43268	9·97224	5	44
17	9·53991	34	9·56771	39	10·43229	9·97220	4	43
18	9·54025	34	9·56810	39	10·43190	9·97215	5	42
19	9·54059	34	9·56849	38	10·43151	9·97210	5	41
20	9·54093	34	9·56887	39	10·43113	9·97206	4	40
21	9·54127	34	9·56926	39	10·43074	9·97201	5	39
22	9·54161	34	9·56965	39	10·43035	9·97196	5	38
23	9·54195	34	9·57004	38	10·42996	9·97192	4	37
24	9·54229	34	9·57042	39	10·42958	9·97187	5	36
25	9·54263	34	9·57081	39	10·42919	9·97182	5	35
26	9·54297	34	9·57120	38	10·42880	9·97178	4	34
27	9·54331	34	9·57158	39	10·42842	9·97173	5	33
28	9·54365	34	9·57197	38	10·42803	9·97168	5	32
29	9·54399	34	9·57235	39	10·42765	9·97163	5	31
30	9·54433	34	9·57274	39	10·42726	9·97159	4	30
′	Cosine.		Cotang.		Tangent.	Sine.		′

[69 degrees.]

[20 degrees.]

′	Sine.	Diff.	Tangent.	Diff.	Cotang.	Cosine.	D.	′
30	9·54433	33	9·57274	38	10·42726	9·97159	5	30
31	9·54466	34	9·57312	39	10·42688	9·97154	5	29
32	9·54500	34	9·57351	38	10·42649	9·97149	5	28
33	9·54534	33	9·57389	39	10·42611	9·97145	4	27
34	9·54567	34	9·57428	38	10·42572	9·97140	5	26
35	9·54601	34	9·57466	38	10·42534	9·97135	5	25
36	9·54635	33	9·57504	39	10·42496	9·97130	5	24
37	9·54668	34	9·57543	38	10·42457	9·97126	4	23
38	9·54702	33	9·57581	38	10·42419	9·97121	5	22
39	9·54735	34	9·57619	39	10·42381	9·97116	5	21
40	9·54769	33	9·57658	38	10·42342	9·97111	4	20
41	9·54802	34	9·57696	38	10·42304	9·97107	5	19
42	9·54836	33	9·57734	38	10·42266	9·97102	5	18
43	9·54869	34	9·57772	38	10·42228	9·97097	5	17
44	9·54903	33	9·57810	39	10·42190	9·97092	5	16
45	9·54936	33	9·57849	38	10·42151	9·97087	4	15
46	9·54969	34	9·57887	38	10·42113	9·97083	5	14
47	9·55003	33	9·57925	38	10·42075	9·97078	5	13
48	9·55036	33	9·57963	38	10·42037	9·97073	5	12
49	9·55069	33	9·58001	38	10·41999	9·97068	5	11
50	9·55102	34	9·58039	38	10·41961	9·97063	4	10
51	9·55136	33	9·58077	38	10·41923	9·97059	5	9
52	9·55169	33	9·58115	38	10·41885	9·97054	5	8
53	9·55202	33	9·58153	38	10·41847	9·97049	5	7
54	9·55235	33	9·58191	38	10·41809	9·97044	5	6
55	9·55268	33	9·58229	38	10·41771	9·97039	4	5
56	9·55301	33	9·58267	37	10·41733	9·97035	5	4
57	9·55334	33	9·58304	38	10·41696	9·97030	5	3
58	9·55367	33	9·58342	38	10·41658	9·97025	5	2
59	9·55400	33	9·58380	38	10·41620	9·97020	5	1
60	9·55433		9·58418		10·41582	9·97015		0
′	Cosine.		Cotang.		Tangent.	Sine.		′

[69 degrees.]

Digitized by Google

′	Sine.	Diff.	Tangent.	Diff.	Cotang.	Cosine.	D.	′
0	9·55433		9·58418		10·41582	9·97015		60
1	9·55466	33	9·58455	37	10·41545	9·97010	5	59
2	9·55499	33	9·58493	38	10·41507	9·97005	5	58
3	9·55532	33	9·58531	38	10·41469	9·97001	4	57
4	9·55564	32	9·58569	38	10·41431	9·96996	5	56
5	9·55597	33	9·58606	37	10·41394	9·96991	5	55
6	9·55630	33	9·58644	38	10·41356	9·96986	5	54
7	9·55663	33	9·58681	37	10·41319	9·96981	5	53
8	9·55695	32	9·58719	38	10·41281	9·96976	5	52
9	9·55728	33	9·58757	38	10·41243	9·96971	5	51
10	9·55761	33	9·58794	37	10·41206	9·96966	4	50
11	9·55793	32	9·58832	38	10·41168	9·96962	5	49
12	9·55826	33	9·58869	37	10·41131	9·96957	5	48
13	9·55858	32	9·58907	38	10·41093	9·96952	5	47
14	9·55891	33	9·58944	37	10·41056	9·96947	5	46
15	9·55923	32	9·58981	37	10·41019	9·96942	5	45
16	9·55956	33	9·59019	38	10·40981	9·96937	5	44
17	9·55988	32	9·59056	37	10·40944	9·96932	5	43
18	9·56021	33	9·59094	38	10·40906	9·96927	5	42
19	9·56053	32	9·59131	37	10·40869	9·96922	5	41
20	9·56085	32	9·59168	37	10·40832	9·96917	5	40
21	9·56118	33	9·59205	37	10·40795	9·96912	5	39
22	9·56150	32	9·59243	38	10·40757	9·96907	4	38
23	9·56182	32	9·59280	37	10·40720	9·96903	5	37
24	9·56215	33	9·59317	37	10·40683	9·96898	5	36
25	9·56247	32	9·59354	37	10·40646	9·96893	5	35
26	9·56279	32	9·59391	38	10·40609	9·96888	5	34
27	9·56311	32	9·59429	37	10·40571	9·96883	5	33
28	9·56343	32	9·59466	37	10·40534	9·96878	5	32
29	9·56375	32	9·59503	37	10·40497	9·96873	5	31
30	9·56408	33	9·59540	37	10·40460	9·96868	5	30
′	Cosine.		Cotang.		Tangent.	Sine.		′

	Sine.	Diff.	Tangent.	Diff.	Cotang.	Cosine.	D.	′
30	9·56408	32	9·59540	37	10·40460	9·96868	5	30
31	9·56440	32	9·59577	37	10·40423	9·96863	5	29
32	9·56472	32	9·59614	37	10·40386	9·96858	5	28
33	9·56504	32	9·59651	37	10·40349	9·96853	5	27
34	9·56536	32	9·59688	37	10·40312	9·96848	5	26
35	9·56568	31	9·59725	37	10·40275	9·96843	5	25
36	9·56599	32	9·59762	37	10·40238	9·96838	5	24
37	9·56631	32	9·59799	36	10·40201	9·96833	5	23
38	9·56663	32	9·59835	37	10·40165	9·96828	5	22
39	9·56695	32	9·59872	37	10·40128	9·96823	5	21
40	9·56727	32	9·59909	37	10·40091	9·96818	5	20
41	9·56759	31	9·59946	37	10·40054	9·96813	5	19
42	9·56790	32	9·59983	36	10·40017	9·96808	5	18
43	9·56822	32	9·60019	37	10·39981	9·96803	5	17
44	9·56854	32	9·60056	37	10·39944	9·96798	5	16
45	9·56886	31	9·60093	37	10·39907	9·96793	5	15
46	9·56917	32	9·60130	36	10·39870	9·96788	5	14
47	9·56949	31	9·60166	37	10·39834	9·96783	5	13
48	9·56980	32	9·60203	37	10·39797	9·96778	6	12
49	9·57012	32	9·60240	36	10·39760	9·96772	5	11
50	9·57044	31	9·60276	37	10·39724	9·96767	5	10
51	9·57075	32	9·60313	36	10·39687	9·96762	5	9
52	9·57107	31	9·60349	37	10·39651	9·96757	5	8
53	9·57138	31	9·60386	36	10·39614	9·96752	5	7
54	9·57169	32	9·60422	37	10·39578	9·96747	5	6
55	9·57201	31	9·60459	36	10·39541	9·96742	5	5
56	9·57232	32	9·60495	37	10·39505	9·96737	5	4
57	9·57264	31	9·60532	36	10·39468	9·96732	5	3
58	9·57295	31	9·60568	37	10·39432	9·96727	5	2
59	9·57326	32	9·60605	36	10·39395	9·96722	5	1
60	9·57358	32	9·60641	36	10·39359	9·96717	5	0
′	Cosine.		Cotang.		Tangent.	Sine.		′

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′	Sine.	Diff.	Tangent.	Diff.	Cotang.	Cosine.	D.	′
0	9·57358	31	9·60641	36	10·39359	9·96717	6	60
1	9·57389	31	9·60677	37	10·39323	9·96711	5	59
2	9·57420	31	9·60714	36	10·39286	9·96706	5	58
3	9·57451	31	9·60750	36	10·39250	9·96701	5	57
4	9·57482	32	9·60786	37	10·39214	9·96696	5	56
5	9·57514	31	9·60823	36	10·39177	9·96691	5	55
6	9·57545	31	9·60859	36	10·39141	9·96686	5	54
7	9·57576	31	9·60895	36	10·39105	9·96681	5	53
8	9·57607	31	9·60931	36	10·39069	9·96676	6	52
9	9·57638	31	9·60967	37	10·39033	9·96670	5	51
10	9·57669	31	9·61004	36	10·38996	9·96665	5	50
11	9·57700	31	9·61040	36	10·38960	9·96660	5	49
12	9·57731	31	9·61076	36	10·38924	9·96655	5	48
13	9·57762	31	9·61112	36	10·38888	9·96650	5	47
14	9·57793	31	9·61148	36	10·38852	9·96645	5	46
15	9·57824	31	9·61184	36	10·38816	9·96640	6	45
16	9·57855	30	9·61220	36	10·38780	9·96634	5	44
17	9·57885	31	9·61256	36	10·38744	9·96629	5	43
18	9·57916	31	9·61292	36	10·38708	9·96624	5	42
19	9·57947	31	9·61328	36	10·38672	9·96619	5	41
20	9·57978	30	9·61364	36	10·38636	9·96614	6	40
21	9·58008	31	9·61400	36	10·38600	9·96608	5	39
22	9·58039	31	9·61436	36	10·38564	9·96603	5	38
23	9·58070	31	9·61472	36	10·38528	9·96598	5	37
24	9·58101	30	9·61508	36	10·38492	9·96593	5	36
25	9·58131	31	9·61544	35	10·38456	9·96588	6	35
26	9·58162	30	9·61579	36	10·38421	9·96582	5	34
27	9·58192	31	9·61615	36	10·38385	9·96577	5	33
28	9·58223	30	9·61651	36	10·38349	9·96572	5	32
29	9·58253	30	9·61687	35	10·38313	9·96567	5	31
30	9·58284	31	9·61722		10·38278	9·96562		30
′	Cosine.		Cotang.		Tangent.	Sine.		′

′	Sine.	Diff.	Tangent.	Diff.	Cotang.	Cosine.	D.	′
30	9·58284	30	9·61722	36	10·38278	9·96562	6	30
31	9·58314	31	9·61758	36	10·38242	9·96556	5	29
32	9·58345	30	9·61794	36	10·38206	9·96551	5	28
33	9·58375	31	9·61830	35	10·38170	9·96546	5	27
34	9·58406	30	9·61865	36	10·38135	9·96541	6	26
35	9·58436	31	9·61901	35	10·38099	9·96535	5	25
36	9·58467	30	9·61936	36	10·38064	9·96530	5	24
37	9·58497	30	9·61972	36	10·38028	9·96525	5	23
38	9·58527	30	9·62008	35	10·37992	9·96520	6	22
39	9·58557	31	9·62043	36	10·37957	9·96514	5	21
40	9·58588	30	9·62079	35	10·37921	9·96509	5	20
41	9·58618	30	9·62114	36	10·37886	9·96504	6	19
42	9·58648	30	9·62150	35	10·37850	9·96498	5	18
43	9·58678	31	9·62185	36	10·37815	9·96493	5	17
44	9·58709	30	9·62221	35	10·37779	9·96488	5	16
45	9·58739	30	9·62256	36	10·37744	9·96483	6	15
46	9·58769	30	9·62292	35	10·37708	9·96477	5	14
47	9·58799	30	9·62327	35	10·37673	9·96472	5	13
48	9·58829	30	9·62362	36	10·37638	9·96467	6	12
49	9·58859	30	9·62398	35	10·37602	9·96461	5	11
50	9·58889	30	9·62433	35	10·37567	9·96456	5	10
51	9·58919	30	9·62468	36	10·37532	9·96451	6	9
52	9·58949	30	9·62504	35	10·37496	9·96445	5	8
53	9·58979	30	9·62539	35	10·37461	9·96440	5	7
54	9·59009	30	9·62574	35	10·37426	9·96435	6	6
55	9·59039	30	9·62609	36	10·37391	9·96429	5	5
56	9·59069	29	9·62645	35	10·37355	9·96424	5	4
57	9·59098	30	9·62680	35	10·37320	9·96419	6	3
58	9·59128	30	9·62715	35	10·37285	9·96413	5	2
59	9·59158	30	9·62750	35	10·37250	9·96408	5	1
60	9·59188		9·62785		10·37215	9·96403		0
′	Cosine.		Cotang.		Tangent.	Sine.		′

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[23 degrees.]

′	Sine.	Diff.	Tangent.	Diff.	Cotang.	Cosine.	D.	′
0	9·59188		9·62785		10·37215	9·96403		60
1	9·59218	30	9·62820	35	10·37180	9·96397	6	59
2	9·59247	29	9·62855	35	10·37145	9·96392	5	58
3	9·59277	30	9·62890	35	10·37110	9·96387	5	57
4	9·59307	30	9·62926	36	10·37074	9·96381	6	56
5	9·59336	29	9·62961	35	10·37039	9·96376	5	55
6	9·59366	30	9·62996	35	10·37004	9·96370	6	54
7	9·59396	30	9·63031	35	10·36969	9·96365	5	53
8	9·59425	29	9·63066	35	10·36934	9·96360	5	52
9	9·59455	30	9·63101	35	10·36899	9·96354	6	51
10	9·59484	29	9·63135	34	10·36865	9·96349	5	50
11	9·59514	30	9·63170	35	10·36830	9·96343	6	49
12	9·59543	29	9·63205	35	10·36795	9·96338	5	48
13	9·59573	30	9·63240	35	10·36760	9·96333	5	47
14	9·59602	29	9·63275	35	10·36725	9·96327	6	46
15	9·59632	30	9·63310	35	10·36690	9·96322	5	45
16	9·59661	29	9·63345	34	10·36655	9·96316	6	44
17	9·59690	29	9·63379	35	10·36621	9·96311	5	43
18	9·59720	30	9·63414	35	10·36586	9·96305	6	42
19	9·59749	29	9·63449	35	10·36551	9·96300	5	41
20	9·59778	29	9·63484	35	10·36516	9·96294	6	40
21	9·59808	30	9·63519	34	10·36481	9·96289	5	39
22	9·59837	29	9·63553	35	10·36447	9·96284	5	38
23	9·59866	29	9·63588	35	10·36412	9·96278	6	37
24	9·59895	29	9·63623	34	10·36377	9·96273	5	36
25	9·59924	30	9·63657	35	10·36343	9·96267	6	35
26	9·59954	29	9·63692	34	10·36308	9·96262	5	34
27	9·59983	29	9·63726	35	10·36274	9·96256	6	33
28	9·60012	29	9·63761	35	10·36239	9·96251	5	32
29	9·60041	29	9·63796	34	10·36204	9·96245	6	31
30	9·60070	29	9·63830	34	10·36170	9·96240	5	30
′	Cosine.		Cotang.		Tangent.	Sine.		′

[66 degrees.]

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[23 degrees.]

′	Sine.	Diff.	Tangent.	Diff.	Cotang.	Cosine.	D.	′
30	9·60070		9·63830		10·36170	9·96240		30
31	9·60099	29	9·63865	35	10·36135	9·96234	6	29
32	9·60128	29	9·63899	34	10·36101	9·96229	5	28
33	9·60157	29	9·63934	35	10·36066	9·96223	6	27
34	9·60186	29	9·63968	34	10·36032	9·96218	5	26
35	9·60215	29	9·64003	35	10·35997	9·96212	6	25
36	9·60244	29	9·64037	34	10·35963	9·96207	5	24
37	9·60273	29	9·64072	35	10·35928	9·96201	6	23
38	9·60302	29	9·64106	34	10·35894	9·96196	5	22
39	9·60331	28	9·64140	34	10·35860	9·96190	6	21
40	9·60359	29	9·64175	35	10·35825	9·96185	5	20
41	9·60388	29	9·64209	34	10·35791	9·96179	6	19
42	9·60417	29	9·64243	34	10·35757	9·96174	5	18
43	9·60446	28	9·64278	35	10·35722	9·96168	6	17
44	9·60474	29	9·64312	34	10·35688	9·96162	6	16
45	9·60503	29	9·64346	34	10·35654	9·96157	5	15
46	9·60532	29	9·64381	35	10·35619	9·96151	6	14
47	9·60561	28	9·64415	34	10·35585	9·96146	5	13
48	9·60589	29	9·64449	34	10·35551	9·96140	6	12
49	9·60618	28	9·64483	34	10·35517	9·96135	6	11
50	9·60646	29	9·64517	34	10·35483	9·96129	6	10
51	9·60675	29	9·64552	35	10·35448	9·96123	6	9
52	9·60704	28	9·64586	34	10·35414	9·96118	6	8
53	9·60732	29	9·64620	34	10·35380	9·96112	6	7
54	9·60761	28	9·64654	34	10·35346	9·96107	6	6
55	9·60789	29	9·64688	34	10·35312	9·96101	6	5
56	9·60818	28	9·64722	34	10·35278	9·96095	6	4
57	9·60846	29	9·64756	34	10·35244	9·96090	6	3
58	9·60875	28	9·64790	34	10·35210	9·96084	6	2
59	9·60903	28	9·64824	34	10·35176	9·96079	6	1
60	9·60931		9·64858		10·35142	9·96073		0
′	Cosine.		Cotang.		Tangent.	Sine.		′

[66 degrees.]

[24 degrees.]

′	Sine.	Diff.	Tangent.	Diff.	Cotang.	Cosine.	D.	′
0	9·60931	29	9·64858	34	10·35142	9·96073	6	60
1	9·60960	28	9·64892	34	10·35108	9·96067	5	59
2	9·60988	28	9·64926	34	10·35074	9·96062	6	58
3	9·61016	29	9·64960	34	10·35040	9·96056	6	57
4	9·61045	28	9·64994	34	10·35006	9·96050	5	56
5	9·61073	28	9·65028	34	10·34972	9·96045	6	55
6	9·61101	28	9·65062	34	10·34938	9·96039	5	54
7	9·61129	29	9·65096	34	10·34904	9·96034	6	53
8	9·61158	28	9·65130	34	10·34870	9·96028	6	52
9	9·61186	28	9·65164	33	10·34836	9·96022	5	51
10	9·61214	28	9·65197	34	10·34803	9·96017	6	50
11	9·61242	28	9·65231	34	10·34769	9·96011	6	49
12	9·61270	28	9·65265	34	10·34735	9·96005	5	48
13	9·61298	28	9·65299	34	10·34701	9·96000	6	47
14	9·61326	28	9·65333	33	10·34667	9·95994	6	46
15	9·61354	28	9·65366	34	10·34634	9·95988	6	45
16	9·61382	29	9·65400	34	10·34600	9·95982	5	44
17	9·61411	27	9·65434	33	10·34566	9·95977	6	43
18	9·61438	28	9·65467	34	10·34533	9·95971	6	42
19	9·61466	28	9·65501	34	10·34499	9·95965	5	41
20	9·61494	28	9·65535	33	10·34465	9·95960	6	40
21	9·61522	28	9·65568	34	10·34432	9·95954	6	39
22	9·61550	28	9·65602	34	10·34398	9·95948	6	38
23	9·61578	28	9·65636	33	10·34364	9·95942	5	37
24	9·61606	28	9·65669	34	10·34331	9·95937	6	36
25	9·61634	28	9·65703	33	10·34297	9·95931	6	35
26	9·61662	27	9·65736	34	10·34264	9·95925	5	34
27	9·61689	28	9·65770	33	10·34230	9·95920	6	33
28	9·61717	28	9·65803	34	10·34197	9·95914	6	32
29	9·61745	28	9·65837	33	10·34163	9·95908	6	31
30	9·61773		9·65870		10·34130	9·95902		30
′	Cosine.		Cotang.		Tangent.	Sine.		′

[65 degrees.]

[24 degrees.]

′	Sine.	Diff.	Tangent.	Diff.	Cotang.	Cosine.	D.	′
30	9·61773	27	9·65870	34	10·34130	9·95902	5	30
31	9·61800	28	9·65904	33	10·34096	9·95897	6	29
32	9·61828	28	9·65937	34	10·34063	9·95891	6	28
33	9·61856	27	9·65971	33	10·34029	9·95885	6	27
34	9·61883	28	9·66004	34	10·33996	9·95879	6	26
35	9·61911	28	9·66038	33	10·33962	9·95873	5	25
36	9·61939	27	9·66071	33	10·33929	9·95868	6	24
37	9·61966	28	9·66104	34	10·33896	9·95862	6	23
38	9·61994	27	9·66138	33	10·33862	9·95856	6	22
39	9·62021	28	9·66171	33	10·33829	9·95850	6	21
40	9·62049	27	9·66204	34	10·33796	9·95844	5	20
41	9·62076	28	9·66238	33	10·33762	9·95839	6	19
42	9·62104	27	9·66271	33	10·33729	9·95833	6	18
43	9·62131	28	9·66304	33	10·33696	9·95827	6	17
44	9·62159	27	9·66337	34	10·33663	9·95821	6	16
45	9·62186	28	9·66371	33	10·33629	9·95815	5	15
46	9·62214	27	9·66404	33	10·33596	9·95810	6	14
47	9·62241	27	9·66437	33	10·33563	9·95804	6	13
48	9·62268	28	9·66470	33	10·33530	9·95798	6	12
49	9·62296	27	9·66503	34	10·33497	9·95792	6	11
50	9·62323	27	9·66537	33	10·33463	9·95786	6	10
51	9·62350	27	9·66570	33	10·33430	9·95780	5	9
52	9·62377	28	9·66603	33	10·33397	9·95775	6	8
53	9·62405	27	9·66636	33	10·33364	9·95769	6	7
54	9·62432	27	9·66669	33	10·33331	9·95763	6	6
55	9·62459	27	9·66702	33	10·33298	9·95757	6	5
56	9·62486	27	9·66735	33	10·33265	9·95751	6	4
57	9·62513	28	9·66768	33	10·33232	9·95745	6	3
58	9·62541	27	9·66801	33	10·33199	9·95739	6	2
59	9·62568	27	9·66834	33	10·33166	9·95733	5	1
60	9·62595	27	9·66867	33	10·33133	9·95728	5	0
′	Cosine.		Cotang.		Tangent.	Sine.		′

[65 degrees.]

Digitized by Google

[25 degrees.]

′	Sine.	Diff.	Tangent.	Diff.	Cotang.	Cosine.	D.	′
0	9·62595	27	9·66867	33	10·33133	9·95728	6	60
1	9·62622	27	9·66900	33	10·33100	9·95722	6	59
2	9·62649	27	9·66933	33	10·33067	9·95716	6	58
3	9·62676	27	9·66966	33	10·33034	9·95710	6	57
4	9·62703	27	9·66999	33	10·33001	9·95704	6	56
5	9·62730	27	9·67032	33	10·32968	9·95698	6	55
6	9·62757	27	9·67065	33	10·32935	9·95692	6	54
7	9·62784	27	9·67098	33	10·32902	9·95686	6	53
8	9·62811	27	9·67131	32	10·32869	9·95680	6	52
9	9·62838	27	9·67163	33	10·32837	9·95674	6	51
10	9·62865	27	9·67196	33	10·32804	9·95668	5	50
11	9·62892	26	9·67229	33	10·32771	9·95663	6	49
12	9·62918	27	9·67262	33	10·32738	9·95657	6	48
13	9·62945	27	9·67295	32	10·32705	9·95651	6	47
14	9·62972	27	9·67327	33	10·32673	9·95645	6	46
15	9·62999	27	9·67360	33	10·32640	9·95639	6	45
16	9·63026	26	9·67393	33	10·32607	9·95633	6	44
17	9·63052	27	9·67426	32	10·32574	9·95627	6	43
18	9·63079	27	9·67458	33	10·32542	9·95621	6	42
19	9·63106	27	9·67491	33	10·32509	9·95615	6	41
20	9·63133	26	9·67524	32	10·32476	9·95609	6	40
21	9·63159	27	9·67556	33	10·32444	9·95603	6	39
22	9·63186	27	9·67589	33	10·32411	9·95597	6	38
23	9·63213	26	9·67622	32	10·32378	9·95591	6	37
24	9·63239	27	9·67654	33	10·32346	9·95585	6	36
25	9·63266	26	9·67687	32	10·32313	9·95579	6	35
26	9·63292	27	9·67719	33	10·32281	9·95573	6	34
27	9·63319	26	9·67752	33	10·32248	9·95567	6	33
28	9·63345	27	9·67785	32	10·32215	9·95561	6	32
29	9·63372	26	9·67817	33	10·32183	9·95555	6	31
30	9·63398		9·67850		10·32150	9·95549		30
′	Cosine.		Cotang.		Tangent.	Sine.		′

[64 degrees.]

[25 degrees.]

′	Sine.	Diff.	Tangent.	Diff.	Cotang.	Cosine.	D.	′
30	9·63398	27	9·67850	32	10·32150	9·95549	6	30
31	9·63425	26	9·67882	33	10·32118	9·95543	6	29
32	9·63451	27	9·67915	32	10·32085	9·95537	6	28
33	9·63478	26	9·67947	33	10·32053	9·95531	6	27
34	9·63504	27	9·67980	32	10·32020	9·95525	6	26
35	9·63531	26	9·68012	32	10·31988	9·95519	6	25
36	9·63557	26	9·68044	33	10·31956	9·95513	6	24
37	9·63583	27	9·68077	32	10·31923	9·95507	7	23
38	9·63610	26	9·68109	33	10·31891	9·95500	6	22
39	9·63636	26	9·68142	32	10·31858	9·95494	6	21
40	9·63662	27	9·68174	32	10·31826	9·95488	6	20
41	9·63689	26	9·68206	33	10·31794	9·95482	6	19
42	9·63715	26	9·68239	32	10·31761	9·95476	6	18
43	9·63741	26	9·68271	32	10·31729	9·95470	6	17
44	9·63767	27	9·68303	33	10·31697	9·95464	6	16
45	9·63794	26	9·68336	32	10·31664	9·95458	6	15
46	9·63820	26	9·68368	32	10·31632	9·95452	6	14
47	9·63846	26	9·68400	32	10·31600	9·95446	6	13
48	9·63872	26	9·68432	33	10·31568	9·95440	6	12
49	9·63898	26	9·68465	32	10·31535	9·95434	7	11
50	9·63924	26	9·68497	32	10·31503	9·95427	6	10
51	9·63950	26	9·68529	32	10·31471	9·95421	6	9
52	9·63976	26	9·68561	32	10·31439	9·95415	6	8
53	9·64002	26	9·68593	33	10·31407	9·95409	6	7
54	9·64028	26	9·68626	32	10·31374	9·95403	6	6
55	9·64054	26	9·68658	32	10·31342	9·95397	6	5
56	9·64080	26	9·68690	32	10·31310	9·95391	7	4
57	9·64106	26	9·68722	32	10·31278	9·95384	6	3
58	9·64132	26	9·68754	32	10·31246	9·95378	6	2
59	9·64158	26	9·68786	32	10·31214	9·95372	6	1
60	9·64184		9·68818		10·31182	9·95366		0
′	Cosine.		Cotang.		Tangent.	Sine.		′

[64 degrees.]

Digitized by Google

[26 degrees.]

′	Sine.	Diff.	Tangent.	Diff.	Cotang.	Cosine.	D.	′
0	9·64184	26	9·68818	32	10·31182	9·95366	6	60
1	9·64210	26	9·68850	32	10·31150	9·95360	6	59
2	9·64236	26	9·68882	32	10·31118	9·95354	6	58
3	9·64262	26	9·68914	32	10·31086	9·95348	7	57
4	9·64288	25	9·68946	32	10·31054	9·95341	6	56
5	9·64313	26	9·68978	32	10·31022	9·95335	6	55
6	9·64339	26	9·69010	32	10·30990	9·95329	6	54
7	9·64365	26	9·69042	32	10·30958	9·95323	6	53
8	9·64391	26	9·69074	32	10·30926	9·95317	7	52
9	9·64417	25	9·69106	32	10·30894	9·95310	6	51
10	9·64442	26	9·69138	32	10·30862	9·95304	6	50
11	9·64468	26	9·69170	32	10·30830	9·95298	6	49
12	9·64494	25	9·69202	32	10·30798	9·95292	6	48
13	9·64519	26	9·69234	32	10·30766	9·95286	7	47
14	9·64545	26	9·69266	32	10·30734	9·95279	6	46
15	9·64571	25	9·69298	31	10·30702	9·95273	6	45
16	9·64596	26	9·69329	32	10·30671	9·95267	6	44
17	9·64622	25	9·69361	32	10·30639	9·95261	7	43
18	9·64647	26	9·69393	32	10·30607	9·95254	6	42
19	9·64673	25	9·69425	32	10·30575	9·95248	6	41
20	9·64698	26	9·69457	31	10·30543	9·95242	6	40
21	9·64724	25	9·69488	32	10·30512	9·95236	7	39
22	9·64749	26	9·69520	32	10·30480	9·95229	6	38
23	9·64775	25	9·69552	32	10·30448	9·95223	6	37
24	9·64800	26	9·69584	31	10·30416	9·95217	6	36
25	9·64826	25	9·69615	32	10·30385	9·95211	7	35
26	9·64851	26	9·69647	32	10·30353	9·95204	6	34
27	9·64877	25	9·69679	31	10·30321	9·95198	6	33
28	9·64902	25	9·69710	32	10·30290	9·95192	7	32
29	9·64927	26	9·69742	32	10·30258	9·95185	6	31
30	9·64953		9·69774		10·30226	9·95179		30
′	Cosine.		Cotang.		Tangent.	Sine.		′

[63 degrees.]

[26 degrees.]

′	Sine.	Diff.	Tangent.	Diff.	Cotang.	Cosine.	D.	′
30	9·64953	25	9·69774	31	10·30226	9·95179	6	30
31	9·64978	25	9·69805	32	10·30195	9·95173	6	29
32	9·65003	26	9·69837	31	10·30163	9·95167	7	28
33	9·65029	25	9·69868	32	10·30132	9·95160	6	27
34	9·65054	25	9·69900	32	10·30100	9·95154	6	26
35	9·65079	25	9·69932	31	10·30068	9·95148	7	25
36	9·65104	26	9·69963	32	10·30037	9·95141	6	24
37	9·65130	25	9·69995	31	10·30005	9·95135	6	23
38	9·65155	25	9·70026	32	10·29974	9·95129	6	22
39	9·65180	25	9·70058	31	10·29942	9·95122	6	21
40	9·65205	25	9·70089	32	10·29911	9·95116	6	20
41	9·65230	25	9·70121	31	10·29879	9·95110	7	19
42	9·65255	26	9·70152	32	10·29848	9·95103	6	18
43	9·65281	25	9·70184	31	10·29816	9·95097	7	17
44	9·65306	25	9·70215	32	10·29785	9·95090	6	16
45	9·65331	25	9·70247	31	10·29753	9·95084	6	15
46	9·65356	25	9·70278	31	10·29722	9·95078	7	14
47	9·65381	25	9·70309	32	10·29691	9·95071	6	13
48	9·65406	25	9·70341	31	10·29659	9·95065	6	12
49	9·65431	25	9·70372	32	10·29628	9·95059	7	11
50	9·65456	25	9·70404	31	10·29596	9·95052	6	10
51	9·65481	25	9·70435	31	10·29565	9·95046	7	9
52	9·65506	25	9·70466	32	10·29534	9·95039	6	8
53	9·65531	25	9·70498	31	10·29502	9·95033	6	7
54	9·65556	24	9·70529	31	10·29471	9·95027	7	6
55	9·65580	25	9·70560	32	10·29440	9·95020	6	5
56	9·65605	25	9·70592	31	10·29408	9·95014	7	4
57	9·65630	25	9·70623	31	10·29377	9·95007	6	3
58	9·65655	25	9·70654	31	10·29346	9·95001	6	2
59	9·65680	25	9·70685	32	10·29315	9·94995	7	1
60	9·65705		9·70717		10·29283	9·94988		0
′	Cosine.		Cotang.		Tangent.	Sine.		′

[63 degrees.]

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[27 degrees.]

′	Sine.	Diff.	Tangent.	Diff.	Cotang.	Cosine.	D.	′
0	9·65705	24	9·70717	31	10·29283	9·94988	6	60
1	9·65729	25	9·70748	31	10·29252	9·94982	7	59
2	9·65754	25	9·70779	31	10·29221	9·94975	6	58
3	9·65779	25	9·70810	31	10·29190	9·94969	7	57
4	9·65804	24	9·70841	32	10·29159	9·94962	6	56
5	9·65828	25	9·70873	31	10·29127	9·94956	7	55
6	9·65853	25	9·70904	31	10·29096	9·94949	6	54
7	9·65878	24	9·70935	31	10·29065	9·94943	7	53
8	9·65902	25	9·70966	31	10·29034	9·94936	6	52
9	9·65927	25	9·70997	31	10·29003	9·94930	7	51
10	9·65952	24	9·71028	31	10·28972	9·94923	6	50
11	9·65976	25	9·71059	31	10·28941	9·94917	6	49
12	9·66001	24	9·71090	31	10·28910	9·94911	7	48
13	9·66025	25	9·71121	32	10·28879	9·94904	6	47
14	9·66050	25	9·71153	31	10·28847	9·94898	7	46
15	9·66075	24	9·71184	31	10·28816	9·94891	6	45
16	9·66099	25	9·71215	31	10·28785	9·94885	7	44
17	9·66124	24	9·71246	31	10·28754	9·94878	7	43
18	9·66148	25	9·71277	31	10·28723	9·94871	6	42
19	9·66173	24	9·71308	31	10·28692	9·94865	7	41
20	9·66197	24	9·71339	31	10·28661	9·94858	6	40
21	9·66221	25	9·71370	31	10·28630	9·94852	7	39
22	9·66246	24	9·71401	30	10·28599	9·94845	6	38
23	9·66270	25	9·71431	31	10·28569	9·94839	7	37
24	9·66295	24	9·71462	31	10·28538	9·94832	6	36
25	9·66319	24	9·71493	31	10·28507	9·94826	7	35
26	9·66343	25	9·71524	31	10·28476	9·94819	6	34
27	9·66368	24	9·71555	31	10·28445	9·94813	7	33
28	9·66392	24	9·71586	31	10·28414	9·94806	7	32
29	9·66416	25	9·71617	31	10·28383	9·94799	6	31
30	9·66441		9·71648		10·28352	9·94793		30
′	Cosine.		Cotang.		Tangent.	Sine.		′

[62 degrees.]

[27 degrees.]

′	Sine.	Diff.	Tangent.	Diff.	Cotang.	Cosine.	D.	′
30	9·66441	24	9·71648	31	10·28352	9·94793	7	30
31	9·66465	24	9·71679	30	10·28321	9·94786	6	29
32	9·66489	24	9·71709	31	10·28291	9·94780	7	28
33	9·66513	24	9·71740	31	10·28260	9·94773	6	27
34	9·66537	25	9·71771	31	10·28229	9·94767	7	26
35	9·66562	24	9·71802	31	10·28198	9·94760	7	25
36	9·66586	24	9·71833	30	10·28167	9·94753	6	24
37	9·66610	24	9·71863	31	10·28137	9·94747	7	23
38	9·66634	24	9·71894	31	10·28106	9·94740	6	22
39	9·66658	24	9·71925	30	10·28075	9·94734	7	21
40	9·66682	24	9·71955	31	10·28045	9·94727	7	20
41	9·66706	25	9·71986	31	10·28014	9·94720	6	19
42	9·66731	24	9·72017	31	10·27983	9·94714	7	18
43	9·66755	24	9·72048	30	10·27952	9·94707	7	17
44	9·66779	24	9·72078	31	10·27922	9·94700	6	16
45	9·66803	24	9·72109	31	10·27891	9·94694	7	15
46	9·66827	24	9·72140	30	10·27860	9·94687	7	14
47	9·66851	24	9·72170	31	10·27830	9·94680	6	13
48	9·66875	24	9·72201	30	10·27799	9·94674	7	12
49	9·66899	23	9·72231	31	10·27769	9·94667	7	11
50	9·66922	24	9·72262	31	10·27738	9·94660	6	10
51	9·66946	24	9·72293	30	10·27707	9·94654	7	9
52	9·66970	24	9·72323	31	10·27677	9·94647	7	8
53	9·66994	24	9·72354	30	10·27646	9·94640	6	7
54	9·67018	24	9·72384	31	10·27616	9·94634	7	6
55	9·67042	24	9·72415	30	10·27585	9·94627	7	5
56	9·67066	24	9·72445	31	10·27555	9·94620	6	4
57	9·67090	23	9·72476	30	10·27524	9·94614	7	3
58	9·67113	24	9·72506	31	10·27494	9·94607	7	2
59	9·67137	24	9·72537	30	10·27463	9·94600	7	1
60	9·67161		9·72567		10·27433	9·94593		0
′	Cosine.		Cotang.		Tangent.	Sine.		′

[62 degrees.]

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[28 degrees.]

′	Sine.	Diff.	Tangent.	Diff.	Cotang.	Cosine.	D.	′
0	9·67161	24	9·72567	31	10·27433	9·94593	6	60
1	9·67185	23	9·72598	30	10·27402	9·94587	7	59
2	9·67208	24	9·72628	31	10·27372	9·94580	7	58
3	9·67232	24	9·72659	30	10·27341	9·94573	6	57
4	9·67256	24	9·72689	31	10·27311	9·94567	7	56
5	9·67280	23	9·72720	30	10·27280	9·94560	7	55
6	9·67303	24	9·72750	30	10·27250	9·94553	7	54
7	9·67327	23	9·72780	31	10·27220	9·94546	6	53
8	9·67350	24	9·72811	30	10·27189	9·94540	7	52
9	9·67374	24	9·72841	31	10·27159	9·94533	7	51
10	9·67398	23	9·72872	30	10·27128	9·94526	7	50
11	9·67421	24	9·72902	30	10·27098	9·94519	6	49
12	9·67445	23	9·72932	31	10·27068	9·94513	7	48
13	9·67468	24	9·72963	30	10·27037	9·94506	7	47
14	9·67492	23	9·72993	30	10·27007	9·94499	7	46
15	9·67515	24	9·73023	31	10·26977	9·94492	7	45
16	9·67539	23	9·73054	30	10·26946	9·94485	6	44
17	9·67562	24	9·73084	30	10·26916	9·94479	7	43
18	9·67586	23	9·73114	30	10·26886	9·94472	7	42
19	9·67609	24	9·73144	31	10·26856	9·94465	7	41
20	9·67633	23	9·73175	30	10·26825	9·94458	7	40
21	9·67656	24	9·73205	30	10·26795	9·94451	6	39
22	9·67680	23	9·73235	30	10·26765	9·94445	7	38
23	9·67703	23	9·73265	30	10·26735	9·94438	7	37
24	9·67726	24	9·73295	31	10·26705	9·94431	7	36
25	9·67750	23	9·73326	30	10·26674	9·94424	7	35
26	9·67773	23	9·73356	30	10·26644	9·94417	7	34
27	9·67796	24	9·73386	30	10·26614	9·94410	6	33
28	9·67820	23	9·73416	30	10·26584	9·94404	7	32
29	9·67843	23	9·73446	30	10·26554	9·94397	7	31
30	9·67866		9·73476		10·26524	9·94390		30
′	Cosine.		Cotang.		Tangent.	Sine.		′

[61 degrees.]

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[28 degrees.]

′	Sine.	Diff.	Tangent.	Diff.	Cotang.	Cosine.	D.	′
30	9·67866	24	9·73476	31	10·26524	9·94390	7	30
31	9·67890	23	9·73507	30	10·26493	9·94383	7	29
32	9·67913	23	9·73537	30	10·26463	9·94376	7	28
33	9·67936	23	9·73567	30	10·26433	9·94369	7	27
34	9·67959	23	9·73597	30	10·26403	9·94362	7	26
35	9·67982	24	9·73627	30	10·26373	9·94355	6	25
36	9·68006	23	9·73657	30	10·26343	9·94349	7	24
37	9·68029	23	9·73687	30	10·26313	9·94342	7	23
38	9·68052	23	9·73717	30	10·26283	9·94335	7	22
39	9·68075	23	9·73747	30	10·26253	9·94328	7	21
40	9·68098	23	9·73777	30	10·26223	9·94321	7	20
41	9·68121	23	9·73807	30	10·26193	9·94314	7	19
42	9·68144	23	9·73837	30	10·26163	9·94307	7	18
43	9·68167	23	9·73867	30	10·26133	9·94300	7	17
44	9·68190	23	9·73897	30	10·26103	9·94293	7	16
45	9·68213	24	9·73927	30	10·26073	9·94286	7	15
46	9·68237	23	9·73957	30	10·26043	9·94279	6	14
47	9·68260	23	9·73987	30	10·26013	9·94273	7	13
48	9·68283	22	9·74017	30	10·25983	9·94266	7	12
49	9·68305	23	9·74047	30	10·25953	9·94259	7	11
50	9·68328	23	9·74077	30	10·25923	9·94252	7	10
51	9·68351	23	9·74107	30	10·25893	9·94245	7	9
52	9·68374	23	9·74137	29	10·25863	9·94238	7	8
53	9·68397	23	9·74166	30	10·25834	9·94231	7	7
54	9·68420	23	9·74196	30	10·25804	9·94224	7	6
55	9·68443	23	9·74226	30	10·25774	9·94217	7	5
56	9·68466	23	9·74256	30	10·25744	9·94210	7	4
57	9·68489	23	9·74286	30	10·25714	9·94203	7	3
58	9·68512	22	9·74316	29	10·25684	9·94196	7	2
59	9·68534	23	9·74345	30	10·25655	9·94189	7	1
60	9·68557		9·74375		10·25625	9·94182		0
′	Cosine.		Cotang.		Tangent.	Sine.		′

[61 degrees.]

′	Sine.	Diff.	Tangent.	Diff.	Cotang.	Cosine.	D.	′
0	9·68557	23	9·74375	30	10·25625	9·94182	7	60
1	9·68580	23	9·74405	30	10·25595	9·94175	7	59
2	9·68603	22	9·74435	30	10·25565	9·94168	7	58
3	9·68625	23	9·74465	29	10·25535	9·94161	7	57
4	9·68648	23	9·74494	30	10·25506	9·94154	7	56
5	9·68671	23	9·74524	30	10·25476	9·94147	7	55
6	9·68694	22	9·74554	29	10·25446	9·94140	7	54
7	9·68716	23	9·74583	30	10·25417	9·94133	7	53
8	9·68739	23	9·74613	30	10·25387	9·94126	7	52
9	9·68762	22	9·74643	30	10·25357	9·94119	7	51
10	9·68784	23	9·74673	29	10·25327	9·94112	7	50
11	9·68807	22	9·74702	30	10·25298	9·94105	7	49
12	9·68829	23	9·74732	30	10·25268	9·94098	8	48
13	9·68852	23	9·74762	29	10·25238	9·94090	7	47
14	9·68875	22	9·74791	30	10·25209	9·94083	7	46
15	9·68897	23	9·74821	30	10·25179	9·94076	7	45
16	9·68920	22	9·74851	29	10·25149	9·94069	7	44
17	9·68942	23	9·74880	30	10·25120	9·94062	7	43
18	9·68965	22	9·74910	29	10·25090	9·94055	7	42
19	9·68987	23	9·74939	30	10·25061	9·94048	7	41
20	9·69010	22	9·74969	29	10·25031	9·94041	7	40
21	9·69032	23	9·74998	30	10·25002	9·94034	7	39
22	9·69055	22	9·75028	30	10·24972	9·94027	7	38
23	9·69077	23	9·75058	29	10·24942	9·94020	8	37
24	9·69100	22	9·75087	30	10·24913	9·94012	7	36
25	9·69122	22	9·75117	29	10·24883	9·94005	7	35
26	9·69144	23	9·75146	30	10·24854	9·93998	7	34
27	9·69167	22	9·75176	29	10·24824	9·93991	7	33
28	9·69189	23	9·75205	30	10·24795	9·93984	7	32
29	9·69212	23	9·75235	29	10·24765	9·93977	7	31
30	9·69234	22	9·75264		10·24736	9·93970		30
′	Cosine.		Cotang.		Tangent.	Sine.		′

′	Sine.	Diff.	Tangent.	Diff.	Cotang.	Cosine.	D.	′
30	9·69234	22	9·75264	30	10·24736	9·93970	7	30
31	9·69256	23	9·75294	29	10·24706	9·93963	8	29
32	9·69279	22	9·75323	30	10·24677	9·93955	7	28
33	9·69301	22	9·75353	29	10·24647	9·93948	7	27
34	9·69323	22	9·75382	29	10·24618	9·93941	7	26
35	9·69345	23	9·75411	30	10·24589	9·93934	7	25
36	9·69368	22	9·75441	29	10·24559	9·93927	7	24
37	9·69390	22	9·75470	30	10·24530	9·93920	8	23
38	9·69412	22	9·75500	29	10·24500	9·93912	7	22
39	9·69434	22	9·75529	29	10·24471	9·93905	7	21
40	9·69456	23	9·75558	30	10·24442	9·93898	7	20
41	9·69479	22	9·75588	29	10·24412	9·93891	7	19
42	9·69501	22	9·75617	30	10·24383	9·93884	8	18
43	9·69523	22	9·75647	29	10·24353	9·93876	7	17
44	9·69545	22	9·75676	29	10·24324	9·93869	7	16
45	9·69567	22	9·75705	30	10·24295	9·93862	7	15
46	9·69589	22	9·75735	29	10·24265	9·93855	8	14
47	9·69611	22	9·75764	29	10·24236	9·93847	7	13
48	9·69633	22	9·75793	29	10·24207	9·93840	7	12
49	9·69655	22	9·75822	30	10·24178	9·93833	7	11
50	9·69677	22	9·75852	29	10·24148	9·93826	7	10
51	9·69699	22	9·75881	29	10·24119	9·93819	8	9
52	9·69721	22	9·75910	29	10·24090	9·93811	7	8
53	9·69743	22	9·75939	30	10·24061	9·93804	7	7
54	9·69765	22	9·75969	29	10·24031	9·93797	8	6
55	9·69787	22	9·75998	29	10·24002	9·93789	7	5
56	9·69809	22	9·76027	29	10·23973	9·93782	7	4
57	9·69831	22	9·76056	30	10·23944	9·93775	7	3
58	9·69853	22	9·76086	29	10·23914	9·93768	8	2
59	9·69875	22	9·76115	29	10·23885	9·93760	7	1
60	9·69897		9·76144		10·23856	9·93753		0
′	Cosine.		Cotang.		Tangent.	Sine.		′

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′	Sine.	Diff.	Tangent.	Diff.	Cotang.	Cosine.	D.	′
0	9·69897	22	9·76144	29	10·23856	9·93753	7	60
1	9·69919	22	9·76173	29	10·23827	9·93746	8	59
2	9·69941	22	9·76202	29	10·23798	9·93738	7	58
3	9·69963	21	9·76231	30	10·23769	9·93731	7	57
4	9·69984	22	9·76261	29	10·23739	9·93724	7	56
5	9·70006	22	9·76290	29	10·23710	9·93717	8	55
6	9·70028	22	9·76319	29	10·23681	9·93709	7	54
7	9·70050	22	9·76348	29	10·23652	9·93702	7	53
8	9·70072	21	9·76377	29	10·23623	9·93695	8	52
9	9·70093	22	9·76406	29	10·23594	9·93687	7	51
10	9·70115	22	9·76435	29	10·23565	9·93680	7	50
11	9·70137	22	9·76464	29	10·23536	9·93673	8	49
12	9·70159	21	9·76493	29	10·23507	9·93665	7	48
13	9·70180	22	9·76522	29	10·23478	9·93658	8	47
14	9·70202	22	9·76551	29	10·23449	9·93650	7	46
15	9·70224	21	9·76580	29	10·23420	9·93643	7	45
16	9·70245	22	9·76609	30	10·23391	9·93636	8	44
17	9·70267	21	9·76639	29	10·23361	9·93628	7	43
18	9·70288	22	9·76668	29	10·23332	9·93621	7	42
19	9·70310	22	9·76697	28	10·23303	9·93614	8	41
20	9·70332	21	9·76725	29	10·23275	9·93606	7	40
21	9·70353	22	9·76754	29	10·23246	9·93599	8	39
22	9·70375	21	9·76783	29	10·23217	9·93591	7	38
23	9·70396	22	9·76812	29	10·23188	9·93584	7	37
24	9·70418	21	9·76841	29	10·23159	9·93577	8	36
25	9·70439	22	9·76870	29	10·23130	9·93569	7	35
26	9·70461	21	9·76899	29	10·23101	9·93562	8	34
27	9·70482	22	9·76928	29	10·23072	9·93554	7	33
28	9·70504	21	9·76957	29	10·23043	9·93547	8	32
29	9·70525	22	9·76986	29	10·23014	9·93539	7	31
30	9·70547		9·77015		10·22985	9·93532		30
′	Cosine.		Cotang.		Tangent.	Sine.		′

′	Sine.	Diff.	Tangent.	Diff.	Cotang.	Cosine.	D.	′
30	9·70547	21	9·77015	29	10·22985	9·93532	7	30
31	9·70568	22	9·77044	29	10·22956	9·93525	8	29
32	9·70590	21	9·77073	28	10·22927	9·93517	7	28
33	9·70611	22	9·77101	29	10·22899	9·93510	8	27
34	9·70633	21	9·77130	29	10·22870	9·93502	7	26
35	9·70654	21	9·77159	29	10·22841	9·93495	8	25
36	9·70675	22	9·77188	29	10·22812	9·93487	7	24
37	9·70697	21	9·77217	29	10·22783	9·93480	8	23
38	9·70718	21	9·77246	28	10·22754	9·93472	7	22
39	9·70739	22	9·77274	29	10·22726	9·93465	8	21
40	9·70761	21	9·77303	29	10·22697	9·93457	7	20
41	9·70782	21	9·77332	29	10·22668	9·93450	8	19
42	9·70803	21	9·77361	29	10·22639	9·93442	7	18
43	9·70824	22	9·77390	28	10·22610	9·93435	8	17
44	9·70846	21	9·77418	29	10·22582	9·93427	7	16
45	9·70867	21	9·77447	29	10·22553	9·93420	8	15
46	9·70888	21	9·77476	29	10·22524	9·93412	7	14
47	9·70909	22	9·77505	28	10·22495	9·93405	8	13
48	9·70931	21	9·77533	29	10·22467	9·93397	7	12
49	9·70952	21	9·77562	29	10·22438	9·93390	8	11
50	9·70973	21	9·77591	28	10·22409	9·93382	7	10
51	9·70994	21	9·77619	29	10·22381	9·93375	8	9
52	9·71015	21	9·77648	29	10·22352	9·93367	7	8
53	9·71036	22	9·77677	29	10·22323	9·93360	8	7
54	9·71058	21	9·77706	28	10·22294	9·93352	8	6
55	9·71079	21	9·77734	29	10·22266	9·93344	7	5
56	9·71100	21	9·77763	28	10·22237	9·93337	8	4
57	9·71121	21	9·77791	29	10·22209	9·93329	7	3
58	9·71142	21	9·77820	29	10·22180	9·93322	8	2
59	9·71163	21	9·77849	28	10·22151	9·93314	7	1
60	9·71184		9·77877		10·22123	9·93307		0
′	Cosine.		Cotang.		Tangent.	Sine.		′

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[31 degrees.]

′	Sine.	Diff.	Tangent.	Diff.	Cotang.	Cosine.	D.	′
0	9·71184	21	9·77877	29	10·22123	9·93307	8	60
1	9·71205	21	9·77906	29	10·22094	9·93299	8	59
2	9·71226	21	9·77935	28	10·22065	9·93291	7	58
3	9·71247	21	9·77963	29	10·22037	9·93284	8	57
4	9·71268	21	9·77992	28	10·22008	9·93276	7	56
5	9·71289	21	9·78020	29	10·21980	9·93269	8	55
6	9·71310	21	9·78049	28	10·21951	9·93261	8	54
7	9·71331	21	9·78077	29	10·21923	9·93253	7	53
8	9·71352	21	9·78106	29	10·21894	9·93246	8	52
9	9·71373	20	9·78135	28	10·21865	9·93238	8	51
10	9·71393	21	9·78163	29	10·21837	9·93230	7	50
11	9·71414	21	9·78192	28	10·21808	9·93223	8	49
12	9·71435	21	9·78220	29	10·21780	9·93215	8	48
13	9·71456	21	9·78249	28	10·21751	9·93207	7	47
14	9·71477	21	9·78277	29	10·21723	9·93200	8	46
15	9·71498	21	9·78306	28	10·21694	9·93192	8	45
16	9·71519	20	9·78334	29	10·21666	9·93184	7	44
17	9·71539	21	9·78363	28	10·21637	9·93177	8	43
18	9·71560	21	9·78391	28	10·21609	9·93169	8	42
19	9·71581	21	9·78419	29	10·21581	9·93161	7	41
20	9·71602	20	9·78448	28	10·21552	9·93154	8	40
21	9·71622	21	9·78476	29	10·21524	9·93146	8	39
22	9·71643	21	9·78505	28	10·21495	9·93138	7	38
23	9·71664	21	9·78533	29	10 21467	9·93131	8	37
24	9·71685	20	9·78562	28	10·21438	9·93123	8	36
25	9·71705	21	9·78590	28	10·21410	9·93115	7	35
26	9·71726	21	9·78618	29	10·21382	9·93108	8	34
27	9·71747	20	9·78647	28	10·21353	9·93100	8	33
28	9·71767	21	9·78675	29	10·21325	9·93092	8	32
29	9·71788	21	9·78704	28	10·21296	9·93084	7	31
30	9·71809		9·78732		10·21268	9·93077		30
′	Cosine.		Cotang.		Tangent.	Sine.		′

[58 degrees.]

[31 degrees.]

′	Sine.	Diff.	Tangent.	Diff.	Cotang.	Cosine.	D.	′
30	9·71809	20	9·78732	28	10·21268	9·93077	8	30
31	9·71829	21	9·78760	29	10·21240	9·93069	8	29
32	9·71850	20	9·78789	28	10·21211	9·93061	8	28
33	9·71870	21	9·78817	28	10·21183	9·93053	7	27
34	9·71891	20	9·78845	29	10·21155	9·93046	8	26
35	9·71911	21	9·78874	28	10·21126	9·93038	8	25
36	9·71932	20	9·78902	28	10·21098	9·93030	8	24
37	9·71952	21	9·78930	29	10·21070	9·93022	8	23
38	9·71973	21	9·78959	28	10·21041	9·93014	7	22
39	9·71994	20	9·78987	28	10·21013	9·95007	8	21
40	9·72014	20	9·79015	28	10·20985	9·92999	8	20
41	9·72034	21	9·79043	29	10·20957	9·92991	8	19
42	9·72055	20	9·79072	28	10·20928	9·92983	7	18
43	9·72075	21	9·79100	28	10·20900	9·92976	8	17
44	9·72096	20	9·79128	28	10·20872	9·92968	8	16
45	9·72116	21	9·79156	29	10·20844	9·92960	8	15
46	9·72137	20	9·79185	28	10·20815	9·92952	8	14
47	9·72157	20	9·79213	28	10·20787	9·92944	8	13
48	9·72177	21	9·79241	28	10·20759	9·92936	7	12
49	9·72198	20	9·79269	28	10·20731	9·92929	8	11
50	9·72218	20	9·79297	29	10·20703	9·92921	8	10
51	9·72238	21	9·79326	28	10·20674	9·92913	8	9
52	9·72259	20	9·79354	28	10·20646	9·92905	8	8
53	9·72279	20	9·79382	28	10·20618	9·92897	8	7
54	9·72299	21	9·79410	28	10·20590	9·92889	8	6
55	9·72320	20	9·79438	28	10·20562	9·92881	7	5
56	9·72340	20	9·79466	29	10·20534	9·92874	8	4
57	9·72360	21	9·79495	28	10·20505	9·92866	8	3
58	9·72381	20	9·79523	28	10·20477	9·92858	8	2
59	9·72401	20	9·79551	28	10·20449	9·92850	8	1
60	9·72421		9·79579		10·20421	9·92842	8	0
′	Cosine.		Cotang.		Tangent.	Sine.		′

[58 degrees.]

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[32 degrees.]

′	Sine.	Diff.	Tangent.	Diff	Cotang.	Cosine.	D.	′
0	9·72421	20	9·79579	28	10·20421	9·92842	8	60
1	9·72441	20	9·79607	28	10·20393	9·92834	8	59
2	9·72461	21	9·79635	28	10·20365	9·92826	8	58
3	9·72482	20	9·79663	28	10·20337	9·92818	8	57
4	9·72502	20	9·79691	28	10·20309	9·92810	7	56
5	9·72522	20	9·79719	28	10·20281	9·92803	8	55
6	9·72542	20	9·79747	29	10·20253	9·92795	8	54
7	9·72562	20	9·79776	28	10·20224	9·92787	8	53
8	9·72582	20	9·79804	28	10·20196	9·92779	8	52
9	9·72602	20	9·79832	28	10·20168	9·92771	8	51
10	9·72622	21	9·79860	28	10·20140	9·92763	8	50
11	9·72643	20	9·79888	28	10·20112	9·92755	8	49
12	9·72663	20	9·79916	28	10·20084	9·92747	8	48
13	9·72683	20	9·79944	28	10·20056	9·92739	8	47
14	9·72703	20	9·79972	28	10·20028	9·92731	8	46
15	9·72723	20	9·80000	28	10·20000	9·92723	8	45
16	9·72743	20	9·80028	28	10·19972	9·92715	8	44
17	9·72763	20	9·80056	28	10·19944	9·92707	8	43
18	9·72783	20	9·80084	28	10·19916	9·92699	8	42
19	9·72803	20	9·80112	28	10·19888	9·92691	8	41
20	9·72823	20	9·80140	28	10·19860	9·92683	8	40
21	9·72843	20	9·80168	27	10·19832	9·92675	8	39
22	9·72863	20	9·80195	28	10·19805	9·92667	8	38
23	9·72883	19	9·80223	28	10·19777	9·92659	8	37
24	9·72902	20	9·80251	28	10·19749	9·92651	8	36
25	9·72922	20	9·80279	28	10·19721	9·92643	8	35
26	9·72942	20	9·80307	28	10·19693	9·92635	8	34
27	9·72962	20	9·80335	28	10·19665	9·92627	8	33
28	9·72982	20	9·80363	28	10·19637	9·92619	8	32
29	9·73002	20	9·80391	28	10·19609	9·92611	8	31
30	9·73022	20	9·80419	28	10·19581	9·92603	8	30
′	Cosine.	Diff.	Cotang.	Diff	Tangent.	Sine.	D.	′

[57 degrees.]

[32 degrees.]

′	Sine.	Diff.	Tangent.	Diff.	Cotang.	Cosine.	D.	′
30	9·73022	19	9·80419	28	10·19581	9·92603	8	30
31	9·73041	20	9·80447	27	10·19553	9·92595	8	29
32	9·73061	20	9·80474	28	10·19526	9·92587	8	28
33	9·73081	20	9·80502	28	10·19498	9·92579	8	27
34	9·73101	20	9·80530	28	10·19470	9·92571	8	26
35	9·73121	19	9·80558	28	10·19442	9·92563	8	25
36	9·73140	20	9·80586	28	10·19414	9·92555	9	24
37	9·73160	20	9·80614	28	10·19386	9·92546	8	23
38	9·73180	20	9·80642	27	10·19358	9·92538	8	22
39	9·73200	19	9·80669	28	10·19331	9·92530	8	21
40	9·73219	20	9·80697	28	10·19303	9·92522	8	20
41	9·73239	20	9·80725	28	10·19275	9·92514	8	19
42	9·73259	19	9·80753	28	10·19247	9·92506	8	18
43	9·73278	20	9·80781	27	10·19219	9·92498	8	17
44	9·73298	20	9·80808	28	10·19192	9·92490	8	16
45	9·73318	19	9·80836	28	10·19164	9·92482	9	15
46	9·73337	20	9·80864	28	10·19136	9·92473	8	14
47	9·73357	20	9·80892	27	10·19108	9·92465	8	13
48	9·73377	19	9·80919	28	10·19081	9·92457	8	12
49	9·73396	20	9·80947	28	10·19053	9·92449	8	11
50	9·73416	19	9·80975	28	10·19025	9·92441	8	10
51	9·73435	20	9·81003	27	10·18997	9·92433	8	9
52	9·73455	19	9·81030	28	10·18970	9·92425	9	8
53	9·73474	20	9·81058	28	10·18942	9·92416	8	7
54	9·73494	19	9·81086	27	10·18914	9·92408	8	6
55	9·73513	20	9·81113	28	10·18887	9·92400	8	5
56	9·73533	19	9·81141	28	10·18859	9·92392	8	4
57	9·73552	20	9·81169	27	10·18831	9·92384	8	3
58	9·73572	19	9·81196	28	10·18804	9·92376	9	2
59	9·73591	20	9·81224	28	10·18776	9·92367	8	1
60	9·73611	20	9·81252	28	10·18748	9·92359	8	0
′	Cosine.	Diff.	Cotang.	Diff.	Tangent.	Sine.	D.	′

[57 degreçs.]

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′	Sine.	Diff.	Tangent.	Diff.	Cotang.	Cosine.	D.	′
0	9·73611	19	9·81252	27	10·18748	9·92359	8	60
1	9·73630	20	9·81279	28	10·18721	9·92351	8	59
2	9·73650	19	9·81307	28	10·18693	9·92343	8	58
3	9·73669	20	9·81335	27	10·18665	9·92335	9	57
4	9·73689	19	9·81362	28	10·18638	9·92326	8	56
5	9·73708	19	9·81390	28	10·18610	9·92318	8	55
6	9·73727	20	9·81418	27	10·18582	9·92310	8	54
7	9·73747	19	9·81445	28	10·18555	9·92302	9	53
8	9·73766	19	9·81473	27	10·18527	9·92293	8	52
9	9·73785	20	9·81500	28	10·18500	9·92285	8	51
10	9·73805	19	9·81528	28	10·18472	9·92277	8	50
11	9·73824	19	9·81556	27	10·18444	9·92269	9	49
12	9·73843	20	9·81583	28	10·18417	9·92260	8	48
13	9·73863	19	9·81611	27	10·18389	9·92252	8	47
14	9·73882	19	9·81638	28	10·18362	9·92244	9	46
15	9·73901	20	9·81666	27	10·18334	9·92235	8	45
16	9·73921	19	9·81693	28	10·18307	9·92227	8	44
17	9·73940	19	9·81721	27	10·18279	9·92219	8	43
18	9·73959	19	9·81748	28	10·18252	9·92211	9	42
19	9·73978	19	9·81776	27	10·18224	9·92202	8	41
20	9·73997	19	9·81803	28	10·18197	9·92194	8	40
21	9·74017	20	9·81831	27	10·18169	9·92186	9	39
22	9·74036	19	9·81858	28	10·18142	9·92177	8	38
23	9·74055	19	9·81886	27	10·18114	9·92169	8	37
24	9·74074	19	9·81913	28	10·18087	9·92161	9	36
25	9·74093	20	9·81941	27	10·18059	9·92152	8	35
26	9·74113	19	9·81968	28	10·18032	9·92144	8	34
27	9·74132	19	9·81996	27	10·18004	9.92136	9	33
28	9·74151	19	9·82023	28	10·17977	9·92127	8	32
29	9·74170	19	9·82051	27	10·17949	9·92119	8	31
30	9·74189	19	9·82078	27	10·17922	9·92111	8	30
′	Cosine.		Cotang.		Tangent.	Sine.		′

′	Sine.	Diff.	Tangent.	Diff.	Cotang.	Cosine.	D.	′
30	9·74189	19	9·82078	28	10·17922	9·92111	8	30
31	9·74208	19	9·82106	27	10·17894	9·92102	9	29
32	9·74227	19	9·82133	28	10·17867	9·92094	8	28
33	9·74246	19	9·82161	27	10·17839	9·92086	8	27
34	9·74265	19	9·82188	27	10·17812	9·92077	9	26
35	9·74284	19	9·82215	28	10·17785	9·92069	8	25
36	9·74303	19	9·82243	27	10·17757	9·92060	8	24
37	9·74322	19	9·82270	28	10·17730	9·92052	8	23
38	9·74341	19	9·82298	27	10·17702	9·92044	9	22
39	9·74360	19	9·82325	27	10·17675	9·92035	8	21
40	9·74379	19	9·82352	28	10·17648	9·92027	9	20
41	9·74398	19	9·82380	27	10·17620	9·92018	8	19
42	9·74417	19	9·82407	28	10·17593	9·92010	8	18
43	9·74436	19	9·82435	27	10·17565	9·92002	9	17
44	9·74455	19	9·82462	27	10·17538	9·91993	8	16
45	9·74474	19	9·82489	28	10·17511	9·91985	9	15
46	9·74493	19	9·82517	27	10·17483	9·91976	8	14
47	9·74512	19	9·82544	27	10·17456	9·91968	9	13
48	9·74531	18	9·82571	28	10·17429	9·91959	8	12
49	9·74549	19	9·82599	27	10·17401	9·91951	9	11
50	9·74568	19	9·82626	27	10·17374	9·91942	8	10
51	9·74587	19	9·82653	28	10·17347	9·91934	9	9
52	9·74606	19	9·82681	27	10·17319	9·91925	8	8
53	9·74625	19	9·82708	27	10·17292	9·91917	9	7
54	9·74644	18	9·82735	27	10·17265	9·91908	8	6
55	9·74662	19	9·82762	28	10·17238	9·91900	9	5
56	9·74681	19	9·82790	27	10·17210	9·91891	8	4
57	9·74700	19	9·82817	27	10·17183	9·91883	9	3
58	9·74719	18	9·82844	27	10·17156	9·91874	8	2
59	9·74737	19	9·82871	28	10·17129	9·91866	9	1
60	9·74756	19	9·82899	28	10·17101	9·91857	9	0
′	Cosine.		Cotang.		Tangent.	Sine.		′

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[34 degrees.]

′	Sine.	Diff.	Tangent.	Diff.	Cotang.	Cosine.	D.	′
0	9·74756	19	9·82899	27	10·17101	9·91857	8	60
1	9·74775	19	9·82926	27	10·17074	9·91849	9	59
2	9·74794	18	9·82953	27	10·17047	9·91840	8	58
3	9·74812	19	9·82980	28	10·17020	9·91832	9	57
4	9·74831	19	9·83008	27	10·16992	9·91823	8	56
5	9·74850	18	9·83035	27	10·16965	9·91815	9	55
6	9·74868	19	9·83062	27	10·16938	9·91806	8	54
7	9·74887	19	9·83089	28	10·16911	9·91798	9	53
8	9·74906	18	9·83117	27	10·16883	9·91789	8	52
9	9·74924	19	9·83144	27	10·16856	9·91781	9	51
10	9·74943	18	9·83171	27	10·16829	9·91772	9	50
11	9·74961	19	9·83198	27	10·16802	9·91763	8	49
12	9·74980	19	9·83225	27	10·16775	9·91755	9	48
13	9·74999	18	9·83252	28	10·16748	9·91746	8	47
14	9·75017	19	9·83280	27	10·16720	9·91738	9	46
15	9·75036	18	9·83307	27	10·16693	9·91729	9	45
16	9·75054	19	9·83334	27	10·16666	9·91720	8	44
17	9·75073	18	9·83361	27	10·16639	9·91712	9	43
18	9·75091	19	9·83388	27	10·16612	9·91703	8	42
19	9·75110	18	9·83415	27	10·16585	9·91695	9	41
20	9·75128	19	9·83442	28	10·16558	9·91686	9	40
21	9·75147	18	9·83470	27	10·16530	9·91677	8	39
22	9·75165	19	9·83497	27	10·16503	9·91669	9	38
23	9·75184	18	9·83524	27	10·16476	9·91660	9	37
24	9·75202	19	9·83551	27	10·16449	9·91651	8	36
25	9·75221	18	9·83578	27	10·16422	9·91643	9	35
26	9·75239	19	9·83605	27	10·16395	9·91634	9	34
27	9·75258	18	9·83632	27	10·16368	9·91625	8	33
28	9·75276	18	9·83659	27	10·16341	9·91617	9	32
29	9·75294	19	9·83686	27	10·16314	9·91608	9	31
30	9·75313		9·83713		10·16287	9·91599		30
′	Cosine.		Cotang.		Tangent.	Sine.		′

[55 degrees.]

[34 degrees.]

′	Sine.	Diff.	Tangent.	Diff.	Cotang.	Cosine.	D.	′
30	9·75313	18	9·83723	27	10·16287	9·91599	8	30
31	9·75331	19	9·83740	28	10·16260	9·91591	9	29
32	9·75350	18	9·83768	27	10·16232	9·91582	9	28
33	9·75368	18	9·83795	27	10·16205	9·91573	8	27
34	9·75386	19	9·83822	27	10·16178	9·91565	9	26
35	9·75405	18	9·83849	27	10·16151	9·91556	9	25
36	9·75423	18	9·83876	27	10·16124	9·91547	9	24
37	9·75441	18	9·83903	27	10·16097	9·91538	8	23
38	9·75459	19	9·83930	27	10·16070	9·91530	9	22
39	9·75478	18	9·83957	27	10·16043	9·91521	9	21
40	9·75496	18	9·83984	27	10·16016	9·91512	8	20
41	9·75514	19	9·84011	27	10·15989	9·91504	9	19
42	9·75533	18	9·84038	27	10·15962	9·91495	9	18
43	9·75551	18	9·84065	27	10·15935	9·91486	9	17
44	9·75569	18	9·84092	27	10·15908	9·91477	8	16
45	9·75587	18	9·84119	27	10·15881	9·91469	9	15
46	9·75605	19	9·84146	27	10·15854	9·91460	9	14
47	9·75624	18	9·84173	27	10·15827	9·91451	9	13
48	9·75642	18	9·84200	27	10·15800	9·91442	9	12
49	9·75660	18	9·84227	27	10·15773	9·91433	8	11
50	9·75678	18	9·84254	26	10·15746	9·91425	9	10
51	9·75696	18	9·84280	27	10·15720	9·91416	9	9
52	9·75714	19	9·84307	27	10·15693	9·91407	9	8
53	9·75733	18	9·84334	27	10·15666	9·91398	9	7
54	9·75751	18	9·84361	27	10·15639	9·91389	8	6
55	9·75769	18	9·84388	27	10·15612	9·91381	9	5
56	9·75787	18	9·84415	27	10·15585	9·91372	9	4
57	9·75805	18	9·84442	27	10·15558	9·91363	9	3
58	9·75823	18	9·84469	27	10·15531	9·91354	9	2
59	9·75841	18	9·84496	27	10·15504	9·91345	9	1
60	9·75859		9·84523		10·15477	9·91336		0
′	Cosine.		Cotang.		Tangent.	Sine.		′

[55 degrees.]

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[35 degrees.]

′	Sine.	Diff.	Tangent.	Diff.	Cotang.	Cosine.	D.	′
0	9·75859	18	9·84523	27	10·15477	9·91336	8	60
1	9·75877	18	9·84550	26	10·15450	9·91328	9	59
2	9·75895	18	9·84576	27	10·15424	9·91319	9	58
3	9·75913	18	9·84603	27	10·15397	9·91310	9	57
4	9·75931	18	9·84630	27	10·15370	9·91301	9	56
5	9·75949	18	9·84657	27	10·15343	9·91292	9	55
6	9·75967	18	9·84684	27	10·15316	9·91283	9	54
7	9·75985	18	9·84711	27	10·15289	9·91274	9	53
8	9·76003	18	9·84738	26	10·15262	9·91266	8	52
9	9·76021	18	9·84764	27	10·15236	9·91257	9	51
10	9·76039	18	9·84791	27	10·15209	9·91248	9	50
11	9·76057	18	9·84818	27	10·15182	9·91239	9	49
12	9·76075	18	9·84845	27	10·15155	9·91230	9	48
13	9·76093	18	9·84872	27	10·15128	9·91221	9	47
14	9·76111	18	9·84899	26	10·15101	9·91212	9	46
15	9·76129	17	9·84925	27	10·15075	9·91203	9	45
16	9·76146	18	9·84952	27	10·15048	9·91194	9	44
17	9·76164	18	9·84979	27	10·15021	9·91185	9	43
18	9·76182	18	9·85006	27	10·14994	9·91176	9	42
19	9·76200	18	9·85033	26	10·14967	9·91167	9	41
20	9·76218	18	9·85059	27	10·14941	9·91158	9	40
21	9·76236	17	9·85086	27	10·14914	9·91149	8	39
22	9·76253	18	9·85113	27	10·14887	9·91141	9	38
23	9·76271	18	9·85140	26	10·14860	9·91132	9	37
24	9·76289	18	9·85166	27	10·14834	9·91123	9	36
25	9·76307	17	9·85193	27	10·14807	9·91114	9	35
26	9·76324	18	9·85220	27	10·14780	9·91105	9	34
27	9·76342	18	9·85247	26	10·14753	9·91096	9	33
28	9·76360	18	9·85273	27	10·14727	9·91087	9	32
29	9·76378	17	9·85300	27	10·14700	9·91078	9	31
30	9·76395		9·85327		10·14673	9·91069	9	30
′	Cosine.		Cotang.		Tangent.	Sine.		′

[54 degrees.]

[35 degrees.]

′	Sine.	Diff.	Tangent.	Diff.	Cotang.	Cosine.	Diff.	′
30	9·76395	18	9·85327	27	10·14673	9·91069	9	30
31	9·76413	18	9·85354	26	10·14646	9·91060	9	29
32	9·76431	17	9·85380	27	10·14620	9·91051	9	28
33	9·76448	18	9·85407	27	10·14593	9·91042	9	27
34	9·76466	18	9·85434	26	10·14566	9·91033	10	26
35	9·76484	17	9·85460	27	10·14540	9·91023	9	25
36	9·76501	18	9·85487	27	10·14513	9·91014	9	24
37	9·76519	18	9·85514	26	10·14486	9·91005	9	23
38	9·76537	17	9·85540	27	10·14460	9·90996	9	22
39	9·76554	18	9·85567	27	10·14433	9·90987	9	21
40	9·76572	18	9·85594	26	10·14406	9·90978	9	20
41	9·76590	17	9·85620	27	10·14380	9·90969	9	19
42	9·76607	18	9·85647	27	10·14353	9·90960	9	18
43	9·76625	17	9·85674	26	10·14326	9·90951	9	17
44	9·76642	18	9·85700	27	10·14300	9·90942	9	16
45	9·76660	17	9·85727	27	10·14273	9·90933	9	15
46	9·76677	18	9·85754	26	10·14246	9·90924	9	14
47	9·76695	17	9·85780	27	10·14220	9·90915	9	13
48	9·76712	18	9·85807	27	10·14193	9·90906	10	12
49	9·76730	17	9·85834	26	10·14166	9·90896	9	11
50	9·76747	18	9·85860	27	10·14140	9·90887	9	10
51	9·76765	17	9·85887	26	10·14113	9·90878	9	9
52	9·76782	18	9·85913	27	10·14087	9·90869	9	8
53	9·76800	17	9·85940	27	10·14060	9·90860	9	7
54	9·76817	18	9·85967	26	10·14033	9·90851	9	6
55	9·76835	17	9·85993	27	10·14007	9·90842	10	5
56	9·76852	18	9·86020	26	10·13980	9·90832	9	4
57	9·76870	17	9·86046	27	10·13954	9·90823	9	3
58	9·76887	17	9·86073	27	10·13927	9·90814	9	2
59	9·76904	18	9·86100	26	10·13900	9·90805	9	1
60	9·76922		9·86126		10·13874	9·90796		0
′	Cosine.		Cotang.		Tangent.	Sine.	′	′

[54 degrees.]

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[36 degrees.]

′	Sine.	Diff.	Tangent.	Diff.	Cotang.	Cosine.	Diff.	′
0	9·76922	17	9·86126	27	10·13874	9·90796	9	60
1	9·76939	18	9·86153	26	10·13847	9·90787	10	59
2	9·76957	17	9·86179	27	10·13821	9·90777	9	58
3	9·76974	17	9·86206	26	10·13794	9·90768	9	57
4	9·76991	18	9·86232	27	10·13768	9·90759	9	56
5	9·77009	17	9·86259	26	10·13741	9·90750	9	55
6	9·77026	17	9·86285	27	10·13715	9·90741	10	54
7	9·77043	18	9·86312	26	10·13688	9·90731	9	53
8	9·77061	17	9·86338	27	10·13662	9·90722	9	52
9	9·77078	17	9·86365	27	10·13635	9·90713	9	51
10	9·77095	17	9·86392	26	10·13608	9·90704	10	50
11	9·77112	18	9·86418	27	10·13582	9·90694	9	49
12	9·77130	17	9·86445	26	10·13555	9·90685	9	48
13	9·77147	17	9·86471	27	10·13529	9·90676	9	47
14	9·77164	17	9·86498	26	10·13502	9·90667	10	46
15	9·77181	18	9·86524	27	10·13476	9·90657	9	45
16	9·77199	17	9·86551	26	10·13449	9·90648	9	44
17	9·77216	17	9·86577	26	10·13423	9·90639	9	43
18	9·77233	17	9·86603	27	10·13397	9·90630	10	42
19	9·77250	18	9·86630	26	10·13370	9·90620	9	41
20	9·77268	17	9·86656	27	10·13344	9·90611	9	40
21	9·77285	17	9·86683	26	10·13317	9·90602	10	39
22	9·77302	17	9·86709	27	10·13291	9·90592	9	38
23	9·77319	17	9·86736	26	10·13264	9·90583	9	37
24	9·77336	17	9·86762	27	10·13238	9·90574	9	36
25	9·77353	17	9·86789	26	10·13211	9·90565	10	35
26	9·77370	17	9·86815	27	10·13185	9·90555	9	34
27	9·77387	18	9·86842	26	10·13158	9·90546	9	33
28	9·77405	17	9·86868	26	10·13132	9·90537	10	32
29	9·77422	17	9·86894	27	10·13106	9·90527	9	31
30	9·77439		9·86921		10·13079	9·90518		30
′	Cosine.		Cotang.		Tangent.	Sine.		′

[53 degrees.]

[36 degrees.]

′	Sine.	Diff.	Tangent.	Diff.	Cotang.	Cosine.	Diff.	′
30	9·77439	17	9·86921	26	10·13079	9·90518	9	30
31	9·77456	17	9·86947	27	10·13053	9·90509	10	29
32	9·77473	17	9·86974	26	10·13026	9·90499	9	28
33	9·77490	17	9·87000	27	10·13000	9·90490	10	27
34	9·77507	17	9·87027	26	10·12973	9·90480	9	26
35	9·77524	17	9·87053	26	10·12947	9·90471	9	25
36	9·77541	17	9·87079	27	10·12921	9·90462	10	24
37	9·77558	17	9·87106	26	10·12894	9·90452	9	23
38	9·77575	17	9·87132	26	10·12868	9·90443	9	22
39	9·77592	17	9·87158	27	10·12842	9·90434	10	21
40	9·77609	17	9·87185	26	10·12815	9·90424	9	20
41	9·77626	17	9·87211	27	10·12789	9·90415	10	19
42	9·77643	17	9·87238	26	10·12762	9·90405	9	18
43	9·77660	17	9·87264	26	10·12736	9·90396	10	17
44	9·77677	17	9·87290	27	10·12710	9·90386	9	16
45	9·77694	17	9·87317	26	10·12683	9·90377	9	15
46	9·77711	17	9·87343	26	10·12657	9·90368	10	14
47	9·77728	16	9·87369	27	10·12631	9·90358	9	13
48	9·77744	17	9·87396	26	10·12604	9·90349	10	12
49	9·77761	17	9·87422	26	10·12578	9·90339	9	11
50	9·77778	17	9·87448	27	10·12552	9·90330	10	10
51	9·77795	17	9·87475	26	10·12525	9·90320	9	9
52	9·77812	17	9·87501	26	10·12499	9·90311	10	8
53	9·77829	17	9·87527	27	10·12473	9·90301	9	7
54	9·77846	16	9·87554	26	10·12446	9·90292	10	6
55	9·77862	17	9·87580	26	10·12420	9·90282	9	5
56	9·77879	17	9·87606	27	10·12394	9·90273	10	4
57	9·77896	17	9·87633	26	10·12367	9·90263	9	3
58	9·77913	17	9·87659	26	10·12341	9·90254	10	2
59	9·77930	16	9·87685	26	10·12315	9·90244	9	1
60	9·77946		9·87711		10·12289	9·90235		0
′	Cosine.		Cotang.		Tangent.	Sine.		′

[53 degrees.]

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[37 degrees.]

′	Sine.	Diff.	Tangent.	Diff.	Cotang.	Cosine.	Diff.	′
0	9·77946	17	9·87711	27	10·12289	9·90235	10	60
1	9·77963	17	9·87738	26	10·12262	9·90225	9	59
2	9·77980	17	9·87764	26	10·12236	9·90216	10	58
3	9·77997	16	9·87790	27	10·12210	9·90206	9	57
4	9·78013	17	9·87817	26	10·12183	9·90197	10	56
5	9·78030	17	9·87843	26	10·12157	9·90187	9	55
6	9·78047	16	9·87869	26	10·12131	9·90178	10	54
7	9·78063	17	9·87895	27	10·12105	9·90168	9	53
8	9·78080	17	9·87922	26	10·12078	9·90159	10	52
9	9·78097	16	9·87948	26	10·12052	9·90149	10	51
10	9·78113	17	9·87974	26	10·12026	9·90139	9	50
11	9·78130	17	9·88000	27	10·12000	9·90130	10	49
12	9·78147	16	9·88027	26	10·11973	9·90120	9	48
13	9·78163	17	9·88053	26	10·11947	9·90111	10	47
14	9·78180	17	9·88079	26	10·11921	9·90101	10	46
15	9·78197	16	9·88105	26	10·11895	9·90091	9	45
16	9·78213	17	9·88131	27	10·11869	9·90082	10	44
17	9·78230	16	9·88158	26	10·11842	9·90072	9	43
18	9·78246	17	9·88184	26	10·11816	9·90063	10	42
19	9·78263	17	9·88210	26	10·11790	9·90053	10	41
20	9·78280	16	9·88236	26	10·11764	9·90043	9	40
21	9·78296	17	9·88262	27	10·11738	9·90034	10	39
22	9·78313	16	9·88289	26	10·11711	9·90024	10	38
23	9·78329	17	9·88315	26	10·11685	9·90014	9	37
24	9·78346	16	9·88341	26	10·11659	9·90005	10	36
25	9·78362	17	9·88367	26	10·11633	9·89995	10	35
26	9·78379	16	9·88393	27	10·11607	9·89985	9	34
27	9·78395	17	9·88420	26	10·11580	9·89976	10	33
28	9·78412	16	9·88446	26	10·11554	9·89966	10	32
29	9·78428	17	9·88472	26	10·11528	9·89956	9	31
30	9·78445		9·88498		10·11502	9·89947		30
′	Cosine.		Cotang.		Tangent.	Sine.		′

[52 degrees.]

[37 degrees.]

′	Sine.	Diff.	Tangent.	Diff.	Cotang.	Cosine.	Diff.	′
30	9·78445	16	9·88498	26	10·11502	9·89947	10	30
31	9·78461	17	9·88524	26	10·11476	9·89937	10	29
32	9·78478	16	9·88550	27	10·11450	9·89927	9	28
33	9·78494	16	9·88577	26	10·11423	9·89918	10	27
34	9·78510	17	9·88603	26	10·11397	9·89908	10	26
35	9·78527	16	9·88629	26	10·11371	9·89898	10	25
36	9·78543	17	9·88655	26	10·11345	9·89888	9	24
37	9·78560	16	9·88681	26	10·11319	9·89879	10	23
38	9·78576	16	9·88707	26	10·11293	9·89869	10	22
39	9·78592	17	9·88733	26	10·11267	9·89859	10	21
40	9·78609	16	9·88759	27	10·11241	9·89849	9	20
41	9·78625	17	9·88786	26	10·11214	9·89840	10	19
42	9·78642	16	9·88812	26	10·11188	9·89830	10	18
43	9·78658	16	9·88838	26	10·11162	9·89820	10	17
44	9·78674	17	9·88864	26	10·11136	9·89810	9	16
45	9·78691	16	9·88890	26	10·11110	9·89801	10	15
46	9·78707	16	9·88916	26	10·11084	9·89791	10	14
47	9·78723	16	9·88942	26	10·11058	9·89781	10	13
48	9·78739	17	9·88968	26	10·11032	9·89771	10	12
49	9·78756	16	9·88994	26	10·11006	9·89761	9	11
50	9·78772	16	9·89020	26	10·10980	9·89752	10	10
51	9·78788	17	9·89046	27	10·10954	9·89742	10	9
52	9·78805	16	9·89073	26	10·10927	9·89732	10	8
53	9·78821	16	9·89099	26	10·10901	9·89722	10	7
54	9·78837	16	9·89125	26	10·10875	9·89712	10	6
55	9·78853	16	9·89151	26	10·10849	9·89702	9	5
56	9·78869	17	9·89177	26	10·10823	9·89693	10	4
57	9·78886	16	9·89203	26	10·10797	9·89683	10	3
58	9·78902	16	9·89229	26	10·10771	9·89673	10	2
59	9·78918	16	9·89255	26	10·10745	9·89663	10	1
60	9·78934		9·89281		10·10719	9·89653		0
′	Cosine.		Cotang.		Tangent.	Sine.		′

[52 degrees.]

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[38 degrees.]

′	Sine.	Diff.	Tangent.	Diff.	Cotang.	Cosine.	Diff.	′
0	9·78934	16	9·89281	26	10·10719	9·89653	10	60
1	9·78950	17	9·89307	26	10·10693	9·89643	10	59
2	9·78967	16	9·89333	26	10·10667	9·89633	9	58
3	9·78983	16	9·89359	26	10·10641	9·89624	10	57
4	9·78999	16	9·89385	26	10·10615	9·89614	10	56
5	9·79015	16	9·89411	26	10·10589	9·89604	10	55
6	9·79031	16	9·89437	26	10·10563	9·89594	10	54
7	9·79047	16	9·89463	26	10·10537	9·89584	10	53
8	9·79063	16	9·89489	26	10·10511	9·89574	10	52
9	9·79079	16	9·89515	26	10·10485	9·89564	10	51
10	9·79095	16	9·89541	26	10·10459	9·89554	10	50
11	9·79111	17	9·89567	26	10·10433	9·89544	10	49
12	9·79128	16	9·89593	26	10·10407	9·89534	10	48
13	9·79144	16	9·89619	26	10·10381	9·89524	10	47
14	9·79160	16	9·89645	26	10·10355	9·89514	10	46
15	9·79176	16	9·89671	26	10·10329	9·89504	9	45
16	9·79192	16	9·89697	26	10·10303	9·89495	10	44
17	9·79208	16	9·89723	26	10·10277	9·89485	10	43
18	9·79224	16	9·89749	26	10·10251	9·89475	10	42
19	9·79240	16	9·89775	26	10·10225	9·89465	10	41
20	9·79256	16	9·89801	26	10·10199	9·89455	10	40
21	9·79272	16	9·89827	26	10·10173	9·89445	10	39
22	9·79288	16	9·89853	26	10·10147	9·89435	10	38
23	9·79304	15	9·89879	26	10·10121	9·89425	10	37
24	9·79319	16	9·89905	26	10·10095	9·89415	10	36
25	9·79335	16	9·89931	26	10·10069	9·89405	10	35
26	9·79351	16	9·89957	26	10·10043	9·89395	10	34
27	9·79367	16	9·89983	26	10·10017	9·89385	10	33
28	9·79383	16	9·90009	26	10·09991	9·89375	11	32
29	9·79399	16	9·90035	26	10·09965	9·89364	10	31
30	9·79415		9·90061		10·09939	9·89354		30
′	Cosine.		Cotang.		Tangent.	Sine.		′

[51 degrees.]

[38 degrees.]

′	Sine.	Diff.	Tangent.	Diff.	Cotang.	Cosine.	Diff.	′
30	9·79415	16	9·90061	25	10·09939	9·89354	10	30
31	9·79431	16	9·90086	26	10·09914	9·89344	10	29
32	9·79447	16	9·90112	26	10·09888	9·89334	10	28
33	9·79463	15	9·90138	26	10·09862	9·89324	10	27
34	9·79478	16	9·90164	26	10·09836	9·89314	10	26
35	9·79494	16	9·90190	26	10·09810	9·89304	10	25
36	9·79510	16	9·90216	26	10·09784	9·89294	10	24
37	9·79526	16	9·90242	26	10·09758	9·89284	10	23
38	9·79542	16	9·90268	26	10·09732	9·89274	10	22
39	9·79558	15	9·90294	26	10·09706	9·89264	10	21
40	9·79573	16	9·90320	26	10·09680	9·89254	10	20
41	9·79589	16	9·90346	25	10·09654	9·89244	11	19
42	9·79605	16	9·90371	26	10·09629	9·89233	10	18
43	9·79621	15	9·90397	26	10·09603	9·89223	10	17
44	9·79636	16	9·90423	26	10·09577	9·89213	10	16
45	9·79652	16	9·90449	26	10·09551	9·89203	10	15
46	9·79668	16	9·90475	26	10·09525	9·89193	10	14
47	9·79684	15	9·90501	26	10·09499	9·89183	10	13
48	9·79699	16	9·90527	26	10·09473	9·89173	11	12
49	9·79715	16	9·90553	25	10·09447	9·89162	10	11
50	9·79731	15	9·90578	26	10·09422	9·89152	10	10
51	9·79746	16	9·90604	26	10·09396	9·89142	10	9
52	9·79762	16	9·90630	26	10·09370	9·89132	10	8
53	9·79778	15	9·90656	26	10·09344	9·89122	10	7
54	9·79793	16	9·90682	26	10·09318	9·89112	11	6
55	9·79809	16	9·90708	26	10·09292	9·89101	10	5
56	9·79825	15	9·90734	25	10·09266	9·89091	10	4
57	9·79840	16	9·90759	26	10·09241	9·89081	10	3
58	9·79856	16	9·90785	26	10·09215	9·89071	11	2
59	9·79872	15	9·90811	26	10·09189	9·89060	10	1
60	9·79887		9·90837		10·09163	9·89050		0
′	Cosine.		Cotang.		Tangent.	Sine.		′

[51 degrees.]

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[39 degrees.]

′	Sine.	Diff.	Tangent.	Diff.	Cotang.	Cosine.	Diff.	′
0	9·79887	16	9·90837	26	10·09163	9·89050	10	60
1	9·79903	15	9·90863	26	10·09137	9·89040	10	59
2	9·79918	16	9·90889	25	10·09111	9·89030	10	58
3	9·79934	16	9·90914	26	10·09086	9·89020	11	57
4	9·79950	15	9·90940	26	10·09060	9·89009	10	56
5	9·79965	16	9·90966	26	10·09034	9·88999	10	55
6	9·79981	15	9·90992	26	10·09008	9·88989	11	54
7	9·79996	16	9·91018	25	10·08982	9·88978	10	53
8	9·80012	15	9·91043	26	10·08957	9·88968	10	52
9	9·80027	16	9·91069	26	10·08931	9·88958	10	51
10	9·80043	15	9·91095	26	10·08905	9·88948	11	50
11	9·80058	16	9·91121	26	10·08879	9·88937	10	49
12	9·80074	15	9·91147	25	10·08853	9·88927	10	48
13	9·80089	16	9·91172	26	10·08828	9·88917	11	47
14	9·80105	15	9·91198	26	10·08802	9·88906	10	46
15	9·80120	16	9·91224	26	10·08776	9·88896	10	45
16	9·80136	15	9·91250	26	10·08750	9·88886	11	44
17	9·80151	15	9·91276	25	10·08724	9·88875	10	43
18	9·80166	16	9·91301	26	10·08699	9·88865	10	42
19	9·80182	15	9·91327	26	10·08673	9·88855	11	41
20	9·80197	16	9·91353	26	10·08647	9·88844	10	40
21	9·80213	15	9·91379	25	10·08621	9·88834	10	39
22	9·80228	16	9·91404	26	10·08596	9·88824	11	38
23	9·80244	15	9·91430	26	10·08570	9·88813	10	37
24	9·80259	15	9·91456	26	10·08544	9·88803	10	36
25	9·80274	16	9·91482	25	10·08518	9·88793	11	35
26	9·80290	15	9·91507	26	10·08493	9·88782	10	34
27	9·80305	15	9·91533	26	10·08467	9·88772	11	33
28	9·80320	16	9·91559	26	10·08441	9·88761	10	32
29	9·80336	15	9·91585	25	10·08415	9·88751	10	31
30	9·80351	15	9·91610	26	10·08390	9·88741	10	30
′	Cosine.		Cotang.		Tangent.	Sine.		′

[50 degrees.]

[39 degrees.]

′	Sine.	Diff.	Tangent.	Diff.	Cotang.	Cosine.	Diff.	′
30	9·80351	15	9·91610	26	10·08390	9·88741	11	30
31	9·80366	16	9·91636	26	10·08364	9·88730	10	29
32	9·80382	15	9·91662	26	10·08338	9·88720	11	28
33	9·80397	15	9·91688	25	10·08312	9·88709	10	27
34	9·80412	16	9·91713	26	10·08287	9·88699	11	26
35	9·80428	15	9·91739	26	10·08261	9·88688	10	25
36	9·80443	15	9·91765	26	10·08235	9·88678	10	24
37	9·80458	15	9·91791	25	10·08209	9·88668	11	23
38	9·80473	16	9·91816	26	10·08184	9·88657	10	22
39	9·80489	15	9·91842	26	10·08158	9·88647	11	21
40	9·80504	15	9·91868	25	10·08132	9·88636	10	20
41	9·80519	15	9·91893	26	10·08107	9·88626	11	19
42	9·80534	16	9·91919	26	10·08081	9·88615	10	18
43	9·80550	15	9·91945	26	10·08055	9·88605	11	17
44	9·80565	15	9·91971	25	10·08029	9·88594	10	16
45	9·80580	15	9·91996	26	10·08004	9·88584	11	15
46	9·80595	15	9·92022	26	10·07978	9·88573	10	14
47	9·80610	15	9·92048	25	10·07952	9·88563	11	13
48	9·80625	16	9·92073	26	10·07927	9·88552	10	12
49	9·80641	15	9·92099	26	10·07901	9·88542	11	11
50	9·80656	15	9·92125	25	10·07875	9·88531	10	10
51	9·80671	15	9·92150	26	10·07850	9·88521	11	9
52	9·80686	15	9·92176	26	10·07824	9·88510	11	8
53	9·80701	15	9·92202	25	10·07798	9·88499	10	7
54	9·80716	15	9·92227	26	10·07773	9·88489	11	6
55	9·80731	15	9·92253	26	10·07747	9·88478	10	5
56	9·80746	16	9·92279	25	10·07721	9·88468	11	4
57	9·80762	15	9·92304	26	10·07696	9·88457	10	3
58	9·80777	15	9·92330	26	10·07670	9·88447	11	2
59	9·80792	15	9·92356	25	10·07644	9·88436	11	1
60	9·80807		9·92381		10·07619	9·88425		0
′	Cosine.		Cotang.		Tangent.	Sine.		′

[50 degrees.]

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[40 degrees.]

′	Sine.	Diff.	Tangent.	Diff.	Cotang.	Cosine.	Diff.	′
0	9·80807	15	9·92381	26	10·07619	9·88425	10	60
1	9·80822	15	9·92407	26	10·07593	9·88415	11	59
2	9·80837	15	9·92433	25	10·07567	9·88404	10	58
3	9·80852	15	9·92458	26	10·07542	9·88394	11	57
4	9·80867	15	9·92484	26	10·07516	9·88383	11	56
5	9·80882	15	9·92510	25	10·07490	9·88372	10	55
6	9·80897	15	9·92535	26	10·07465	9·88362	11	54
7	9·80912	15	9·92561	26	10·07439	9·88351	11	53
8	9·80927	15	9·92587	25	10·07413	9·88340	10	52
9	9·80942	15	9·92612	26	10·07388	9·88330	11	51
10	9·80957	15	9·92638	25	10·07362	9·88319	11	50
11	9·80972	15	9·92663	26	10·07337	9·88308	10	49
12	9·80987	15	9·92689	26	10·07311	9·88298	11	48
13	9·81002	15	9·92715	25	10·07285	9·88287	11	47
14	9·81017	15	9·92740	26	10·07260	9·88276	10	46
15	9·81032	15	9·92766	26	10·07234	9·88266	11	45
16	9·81047	14	9·92792	25	10·07208	9·88255	11	44
17	9·81061	15	9·92817	26	10·07183	9·88244	10	43
18	9·81076	15	9·92843	25	10·07157	9·88234	11	42
19	9·81091	15	9·92868	26	10·07132	9·88223	11	41
20	9·81106	15	9·92894	26	10·07106	9·88212	11	40
21	9·81121	15	9·92920	25	10·07080	9·88201	10	39
22	9·81136	15	9·92945	26	10·07055	9·88191	11	38
23	9·81151	15	9·92971	25	10·07029	9·88180	11	37
24	9·81166	14	9·92996	26	10·07004	9·88169	11	36
25	9·81180	15	9·93022	26	10·06978	9·88158	10	35
26	9·81195	15	9·93048	25	10·06952	9·88148	11	34
27	9·81210	15	9·93073	26	10·06927	9·88137	11	33
28	9·81225	15	9·93099	25	10·06901	9·88126	11	32
29	9·81240	14	9·93124	26	10·06876	9·88115	10	31
30	9·81254		9·93150		10·06850	9·88105		30
′	Cosine.		Cotang.		Tangent.	Sine.		′

[49 degrees.]

[40 degrees.]

′	Sine.	Diff.	Tangent.	Diff.	Cotang.	Cosine.	Diff.	′
30	9·81254	15	9·93150	25	10·06850	9·88105	11	30
31	9·81269	15	9·93175	26	10·06825	9·88094	11	29
32	9·81284	15	9·93201	26	10·06799	9·88083	11	28
33	9·81299	15	9·93227	25	10·06773	9·88072	11	27
34	9·81314	14	9·93252	26	10·06748	9·88061	10	26
35	9·81328	15	9·93278	25	10·06722	9·88051	11	25
36	9·81343	15	9·93303	26	10·06697	9·88040	11	24
37	9·81358	14	9·93329	25	10·06671	9·88029	11	23
38	9·81372	15	9·93354	26	10·06646	9·88018	11	22
39	9·81387	15	9·93380	26	10·06620	9·88007	11	21
40	9·81402	15	9·93406	25	10·06594	9·87996	11	20
41	9·81417	14	9·93431	26	10·06569	9·87985	10	19
42	9·81431	15	9·93457	25	10·06543	9·87975	11	18
43	9·81446	15	9·93482	26	10·06518	9·87964	11	17
44	9·81461	14	9·93508	25	10·06492	9·87953	11	16
45	9·81475	15	9·93533	26	10·06467	9·87942	11	15
46	9·81490	15	9·93559	25	10·06441	9·87931	11	14
47	9·81505	14	9·93584	26	10·06416	9·87920	11	13
48	9·81519	15	9·93610	26	10·06390	9·87909	11	12
49	9·81534	15	9·93636	25	10·06364	9·87898	11	11
50	9·81549	14	9·93661	26	10·06339	9·87887	10	10
51	9·81563	15	9·93687	25	10·06313	9·87877	11	9
52	9·81578	14	9·93712	26	10·06288	9·87866	11	8
53	9·81592	15	9·93738	25	10·06262	9·87855	11	7
54	9·81607	15	9·93763	26	10·06237	9·87844	11	6
55	9·81622	14	9·93789	25	10·06211	9·87833	11	5
56	9·81636	15	9·93814	26	10·06186	9·87822	11	4
57	9·81651	14	9·93840	25	10·06160	9·87811	11	3
58	9·81665	15	9·93865	26	10·06135	9·87800	11	2
59	9·81680	14	9·93891	25	10·06109	9·87789	11	1
60	9·81694		9·93916		10·06084	9·87778		0
′	Cosine.		Cotang.		Tangent.	Sine.		′

[49 degrees.]

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[41 degrees.]

′	Sine.	Diff.	Tangent.	Diff.	Cotang.	Cosine.	Diff.	′
0	9·81694	15	9·93916	26	10·06084	9·87778	11	60
1	9·81709	14	9·93942	25	10·06058	9·87767	11	59
2	9·81723	15	9·93967	26	10·06033	9·87756	11	58
3	9·81738	14	9·93993	25	10·06007	9·87745	11	57
4	9·81752	15	9·94018	26	10·05982	9·87734	11	56
5	9·81767	14	9·94044	25	10·05956	9·87723	11	55
6	9·81781	15	9·94069	26	10·05931	9·87712	11	54
7	9·81796	14	9·94095	25	10·05905	9·87701	11	53
8	9·81810	15	9·94120	26	10·05880	9·87690	11	52
9	9·81825	14	9·94146	25	10·05854	9·87679	11	51
10	9·81839	15	9·94171	26	10·05829	9·87668	11	50
11	9·81854	14	9·94197	25	10·05803	9·87657	11	49
12	9·81868	14	9·94222	26	10·05778	9·87646	11	48
13	9·81882	15	9·94248	25	10·05752	9·87635	11	47
14	9·81897	14	9·94273	26	10·05727	9·87624	11	46
15	9·81911	15	9·94299	25	10·05701	9·87613	12	45
16	9·81926	14	9·94324	26	10·05676	9·87601	11	44
17	9·81940	15	9·94350	25	10·05650	9·87590	11	43
18	9·81955	14	9·94375	26	10·05625	9·87579	11	42
19	9·81969	14	9·94401	25	10·05599	9·87568	11	41
20	9·81983	15	9·94426	26	10·05574	9·87557	11	40
21	9·81998	14	9·94452	25	10·05548	9·87546	11	39
22	9·82012	14	9·94477	26	10·05523	9·87535	11	38
23	9·82026	15	9·94503	25	10·05497	9·87524	11	37
24	9·82041	14	9·94528	26	10·05472	9·87513	12	36
25	9·82055	14	9·94554	25	10·05446	9·87501	11	35
26	9·82069	15	9·94579	25	10·05421	9·87490	11	34
27	9·82084	14	9·94604	26	10·05396	9·87479	11	33
28	9·82098	14	9·94630	25	10·05370	9·87468	11	32
29	9·82112	14	9·94655	26	10·05345	9·87457	11	31
30	9·82126	14	9·94681	25	10·05319	9·87446	11	30
′	Cosine.		Cotang.		Tangent.	Sine.		′

[48 degrees.]

[41 degrees.]

′	Sine.	Diff.	Tangent.	Diff.	Cotang.	Cosine.	Diff.	′
30	9·82126	15	9·94681	25	10·05319	9·87446	12	30
31	9·82141	14	9·94706	26	10·05294	9·87434	11	29
32	9·82155	14	9·94732	26	10·05268	9·87423	11	28
33	9·82169	15	9·94757	25	10·05243	9·87412	11	27
34	9·82184	14	9·94783	26	10·05217	9·87401	11	26
35	9·82198	14	9·94808	25	10·05192	9·87390	12	25
36	9·82212	14	9·94834	26	10·05166	9·87378	11	24
37	9·82226	14	9·94859	25	10·05141	9·87367	11	23
38	9·82240	15	9·94884	25	10·05116	9·87356	11	22
39	9·82255	14	9·94910	26	10·05090	9·87345	11	21
40	9·82269	14	9·94935	25	10·05065	9·87334	12	20
41	9·82283	14	9·94961	26	10·05039	9·87322	11	19
42	9·82297	14	9·94986	25	10·05014	9·87311	11	18
43	9·82311	15	9·95012	26	10·04988	9·87300	12	17
44	9·82326	14	9·95037	25	10·04963	9·87288	11	16
45	9·82340	14	9·95062	26	10·04938	9·87277	11	15
46	9·82354	14	9·95088	25	10·04912	9·87266	11	14
47	9·82368	14	9·95113	26	10·04887	9·87255	12	13
48	9·82382	14	9·95139	25	10·04861	9·87243	11	12
49	9·82396	14	9·95164	26	10·04836	9·87232	11	11
50	9·82410	14	9·95190	25	10·04810	9·87221	12	10
51	9·82424	15	9·95215	25	10·04785	9·87209	11	9
52	9·82439	14	9·95240	26	10·04760	9·87198	11	8
53	9·82453	14	9·95266	25	10·04734	9·87187	12	7
54	9·82467	14	9·95291	26	10·04709	9·87175	11	6
55	9·82481	14	9·95317	25	10·04683	9·87164	11	5
56	9·82495	14	9·95342	26	10·04658	9·87153	12	4
57	9·82509	14	9·95368	25	10·04632	9·87141	11	3
58	9·82523	14	9·95393	25	10·04607	9·87130	11	2
59	9·82537	14	9·95418	26	10·04582	9·87119	11	1
60	9·82551	14	9·95444	26	10·04556	9·87107	12	0
′	Cosine.		Cotang.		Tangent.	Sine.		′

[48 degrees.]

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′	Sine.	Diff.	Tangent.	Diff.	Cotang.	Cosine.	Diff.	′
0	9·82551	14	9·95444	25	10·04556	9·87107	11	60
1	9·82565	14	9·95469	26	10·04531	9·87096	11	59
2	9·82579	14	9·95495	25	10·04505	9·87085	12	58
3	9·82593	14	9·95520	25	10·04480	9·87073	11	57
4	9·82607	14	9·95545	26	10·04455	9·87062	12	56
5	9·82621	14	9·95571	25	10·04429	9·87050	11	55
6	9·82635	14	9·95596	26	10·04404	9·87039	11	54
7	9·82649	14	9·95622	25	10·04378	9·87028	12	53
8	9·82663	14	9·95647	25	10·04353	9·87016	11	52
9	9·82677	14	9·95672	26	10·04328	9·87005	12	51
10	9·82691	14	9·95698	25	10·04302	9·86993	11	50
11	9·82705	14	9·95723	25	10·04277	9·86982	12	49
12	9·82719	14	9·95748	26	10·04252	9·86970	11	48
13	9·82733	14	9·95774	25	10·04226	9·86959	12	47
14	9·82747	14	9·95799	26	10·04201	9·86947	11	46
15	9·82761	14	9·95825	25	10·04175	9·86936	12	45
16	9·82775	13	9·95850	25	10·04150	9·86924	11	44
17	9·82788	14	9·95875	26	10·04125	9·86913	11	43
18	9·82802	14	9·95901	25	10·04099	9·86902	12	42
19	9·82816	14	9·95926	26	10·04074	9·86890	11	41
20	9·82830	14	9·95952	25	10·04048	9·86879	12	40
21	9·82844	14	9·95977	25	10·04023	9·86867	12	39
22	9·82858	14	9·96002	26	10·03998	9·86855	11	38
23	9·82872	13	9·96028	25	10·03972	9·86844	12	37
24	9·82885	14	9·96053	25	10·03947	9·86832	11	36
25	9·82899	14	9·96078	26	10·03922	9·86821	12	35
26	9·82913	14	9·96104	25	10·03896	9·86809	11	34
27	9·82927	14	9·96129	26	10·03871	9·86798	12	33
28	9·82941	14	9·96155	25	10·03845	9·86786	11	32
29	9·82955	13	9·96180	25	10·03820	9·86775	12	31
30	9·82968		9·96205		10·03795	9·86763		30
′	Cosine.		Cotang.		Tangent.	Sine.		′

′	Sine.	Diff.	Tangent.	Diff.	Cotang.	Cosine.	Diff.	′
30	9·82968	14	9·96205	26	10·03795	9·86763	11	30
31	9·82982	14	9·96231	25	10·03769	9·86752	12	29
32	9·82996	14	9·96256	25	10·03744	9·86740	12	28
33	9·83010	13	9·96281	26	10·03719	9·86728	11	27
34	9·83023	14	9·96307	25	10·03693	9·86717	12	26
35	9·83037	14	9·96332	25	10·03668	9·86705	11	25
36	9·83051	14	9·96357	26	10·03643	9·86694	12	24
37	9·83065	13	9·96383	25	10·03617	9·86682	12	23
38	9·83078	14	9·96408	25	10·03592	9·86670	11	22
39	9·83092	14	9·96433	26	10·03567	9·86659	12	21
40	9·83106	14	9·96459	25	10·03541	9·86647	12	20
41	9·83120	13	9·96484	26	10·03516	9·86635	11	19
42	9·83133	14	9·96510	25	10·03490	9·86624	12	18
43	9·83147	14	9·96535	25	10·03465	9·86612	12	17
44	9·83161	13	9·96560	26	10·03440	9·86600	11	16
45	9·83174	14	9·96586	25	10·03414	9·86589	12	15
46	9·83188	14	9·96611	25	10·03389	9·86577	12	14
47	9·83202	13	9·96636	26	10·03364	9·86565	11	13
48	9·83215	14	9·96662	25	10·03338	9·86554	12	12
49	9·83229	13	9·96687	25	10·03313	9·86542	12	11
50	9·83242	14	9·96712	26	10·03288	9·86530	12	10
51	9·83256	14	9·96738	25	10·03262	9·86518	11	9
52	9·83270	13	9·96763	25	10·03237	9·86507	12	8
53	9·83283	14	9·96788	26	10·03212	9·86495	12	7
54	9·83297	13	9·96814	25	10·03186	9·86483	11	6
55	9·83310	14	9·96839	25	10·03161	9·86472	12	5
56	9·83324	14	9·96864	26	10·03136	9·86460	12	4
57	9·83338	13	9·96890	25	10·03110	9·86448	12	3
58	9·83351	14	9·96915	25	10·03085	9·86436	12	2
59	9·83365	13	9·96940	26	10·03060	9·86425	11	1
60	9·83378		9·96966		10·03034	9·86413	12	0
′	Cosine.		Cotang.		Tangent.	Sine.		′

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[43 degrees.]

′	Sine.	Diff.	Tangent.	Diff.	Cotang.	Cosine.	Diff.	′
0	9·83378	14	9·96966	25	10·03034	9·86413	12	60
1	9·83392	13	9·96991	25	10·03009	9·86401	12	59
2	9·83405	14	9·97016	26	10·02984	9·86389	12	58
3	9·83419	13	9·97042	25	10·02958	9·86377	11	57
4	9·83432	14	9·97067	25	10·02933	9·86366	12	56
5	9·83446	13	9·97092	26	10·02908	9·86354	12	55
6	9·83459	14	9·97118	25	10·02882	9·86342	12	54
7	9·83473	13	9·97143	25	10·02857	9·86330	12	53
8	9·83486	14	9·97168	25	10·02832	9·86318	12	52
9	9·83500	13	9·97193	26	10·02807	9·86306	11	51
10	9·83513	14	9·97219	25	10·02781	9·86295	12	50
11	9·83527	13	9·97244	25	10·02756	9·86283	12	49
12	9·83540	14	9·97269	26	10·02731	9·86271	12	48
13	9·83554	13	9·97295	25	10·02705	9·86259	12	47
14	9·83567	14	9·97320	25	10·02680	9·86247	12	46
15	9·83581	13	9·97345	26	10·02655	9·86235	12	45
16	9·83594	14	9·97371	25	10·02629	9·86223	12	44
17	9·83608	13	9·97396	25	10·02604	9·86211	11	43
18	9·83621	13	9·97421	26	10·02579	9·86200	12	42
19	9·83634	14	9·97447	25	10·02553	9·86188	12	41
20	9·83648	13	9·97472	25	10·02528	9·86176	12	40
21	9·83661	13	9·97497	26	10·02503	9·86164	12	39
22	9·83674	14	9·97523	25	10·02477	9·86152	12	38
23	9·83688	13	9·97548	25	10·02452	9·86140	12	37
24	9·83701	14	9·97573	25	10·02427	9·86128	12	36
25	9·83715	13	9·97598	26	10·02402	9·86116	12	35
26	9·83728	13	9·97624	25	10·02376	9·86104	12	34
27	9·83741	14	9·97649	25	10·02351	9·86092	12	33
28	9·83755	13	9·97674	26	10·02326	9·86080	12	32
29	9·83768	13	9·97709	25	10·02300	9·86068	12	31
30	9·83781		9·97725		10·02275	9·86056		30
′	Cosine.		Cotang.		Tangent.	Sine.		′

[46 degrees.]

[43 degrees.]

′	Sine.	Diff.	Tangent.	Diff.	Cotang.	Cosine.	Diff.	′
30	9·83781	14	9·97725	25	10·02275	9·86056	12	30
31	9·83795	13	9·97750	26	10·02250	9·86044	12	29
32	9·83808	13	9·97776	25	10·02224	9·86032	12	28
33	9·83821	13	9·97801	25	10·02199	9·86020	12	27
34	9·83834	14	9·97826	25	10·02174	9·86008	12	26
35	9·83848	13	9·97851	26	10·02149	9·85996	12	25
36	9·83861	13	9·97877	25	10·02123	9·85984	12	24
37	9·83874	13	9·97902	25	10·02098	9·85972	12	23
38	9·83887	14	9·97927	26	10·02073	9·85960	12	22
39	9·83901	13	9·97953	25	10·02047	9·85948	12	21
40	9·83914	13	9·97978	25	10·02022	9·85936	12	20
41	9·83927	13	9·98003	26	10·01997	9·85924	12	19
42	9·83940	14	9·98029	25	10·01971	9·85912	12	18
43	9·83954	13	9·98054	25	10·01946	9·85900	12	17
44	9·83967	13	9·98079	25	10·01921	9·85888	12	16
45	9·83980	13	9·98104	26	10·01896	9·85876	12	15
46	9·83993	13	9·98130	25	10·01870	9·85864	13	14
47	9·84006	14	9·98155	25	10·01845	9·85851	12	13
48	9·84020	13	9·98180	26	10·01820	9·85839	12	12
49	9·84033	13	9·98206	25	10·01794	9·85827	12	11
50	9·84046	13	9·98231	25	10·01769	9·85815	12	10
51	9·84059	13	9·98256	25	10·01744	9·85803	12	9
52	9·84072	13	9·98281	26	10·01719	9·85791	12	8
53	9·84085	13	9·98307	25	10·01693	9·85779	13	7
54	9·84098	14	9·98332	25	10·01668	9·85766	12	6
55	9·84112	13	9·98357	26	10·01643	9·85754	12	5
56	9·84125	13	9·98383	25	10·01617	9·85742	12	4
57	9·84138	13	9·98408	25	10·01592	9·85730	12	3
58	9·84151	13	9·98433	25	10·01567	9·85718	12	2
59	9·84164	13	9·98458	26	10·01542	9·85706	13	1
60	9·84177		9·98484		10·01516	9·85693		0
′	Cosine.		Cotang.		Tangent.	Sine.		

[46 degrees.]

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[44 degrees.]

′	Sine.	Diff.	Tangent.	Diff.	Cotang.	Cosine.	Diff.	′
0	9·84177	13	9·98484	25	10·01516	9·85693	12	60
1	9·84190	13	9·98509	25	10·01491	9·85681	12	59
2	9·84203	13	9·98534	26	10·01466	9·85669	12	58
3	9·84216	13	9·98560	25	10·01440	9·85657	12	57
4	9·84229	13	9·98585	25	10·01415	9·85645	13	56
5	9·84242	13	9·98610	25	10·01390	9·85632	12	55
6	9·84255	14	9·98635	26	10·01365	9·85620	12	54
7	9·84269	13	9·98661	25	10·01339	9·85608	12	53
8	9·84282	13	9·98686	25	10·01314	9·85596	13	52
9	9·84295	13	9·98711	26	10·01289	9·85583	12	51
10	9·84308	13	9·98737	25	10·01263	9·85571	12	50
11	9·84321	13	9·98762	25	10·01238	9·85559	12	49
12	9·84334	13	9·98787	25	10·01213	9·85547	13	48
13	9·84347	13	9·98812	26	10·01188	9·85534	12	47
14	9·84360	13	9·98838	25	10·01162	9·85522	12	46
15	9·84373	12	9·98863	25	10·01137	9·85510	13	45
16	9·84385	13	9·98888	25	10·01112	9·85497	12	44
17	9·84398	13	9·98913	26	10·01087	9·85485	12	43
18	9·84411	13	9·98939	25	10·01061	9·85473	13	42
19	9·84424	13	9·98964	25	10·01036	9·85460	12	41
20	9·84437	13	9·98989	26	10·01011	9·85448	12	40
21	9·84450	13	9·99015	25	10·00985	9·85436	13	39
22	9·84463	13	9·99040	25	10·00960	9·85423	12	38
23	9·84476	13	9·99065	25	10·00935	9·85411	12	37
24	9·84489	13	9·99090	26	10·00910	9·85399	13	36
25	9·84502	13	9·99116	25	10·00884	9·85386	12	35
26	9·84515	13	9·99141	25	10·00859	9·85374	13	34
27	9·84528	12	9·99166	25	10·00834	9·85361	12	33
28	9·84540	13	9·99191	26	10·00809	9·85349	12	32
29	9·84553	13	9·99217	25	10·00783	9·85337	13	31
30	9·84566		9·99242		10·00758	9·85324		30
′	Cosine		Cotang.		Tangent.	Sine.		′

[45 degrees.]

[44 degrees.]

′	Sine.	Diff.	Tangent.	Diff.	Cotang.	Cosine.	Diff.	′
30	9·84566	13	9·99242	25	10·00758	9·85324	12	30
31	9·84579	13	9·99267	26	10·00733	9·85312	13	29
32	9·84592	13	9·99293	25	10·00707	9·85299	12	28
33	9·84605	13	9·99318	25	10·00682	9·85287	13	27
34	9·84618	12	9·99343	25	10·00657	9·85274	12	26
35	9·84630	13	9·99368	26	10·00632	9·85262	12	25
36	9·84643	13	9·99394	25	10·00606	9·85250	13	24
37	9·84656	13	9·99419	25	10·00581	9·85237	12	23
38	9·84669	13	9·99444	25	10·00556	9·85225	13	22
39	9·84682	12	9·99469	26	10·00531	9·85212	12	21
40	9·84694	13	9·99495	25	10·00505	9·85200	13	20
41	9·84707	13	9·99520	25	10·00480	9·85187	12	19
42	9·84720	13	9·99545	25	10·00455	9·85175	13	18
43	9·84733	12	9·99570	26	10·00430	9·85162	12	17
44	9·84745	13	9·99596	25	10·00404	9·85150	13	16
45	9·84758	13	9·99621	25	10·00379	9·85137	12	15
46	9·84771	13	9·99646	26	10·00354	9·85125	13	14
47	9·84784	12	9·99672	25	10·00328	9·85112	12	13
48	9·84796	13	9·99697	25	10·00303	9·85100	13	12
49	9·84809	13	9·99722	25	10·00278	9·85087	13	11
50	9·84822	13	9·99747	26	10·00253	9·85074	12	10
51	9·84835	12	9·99773	25	10·00227	9·85062	13	9
52	9·84847	13	9·99798	25	10·00202	9·85049	12	8
53	9·84860	13	9·99823	25	10·00177	9·85037	13	7
54	9·84873	12	9·99848	26	10·00152	9·85024	12	6
55	9·84885	13	9·99874	25	10·00126	9·85012	13	5
56	9·84898	13	9·99899	25	10·00101	9·84999	13	4
57	9·84911	12	9·99924	25	10·00076	9·84986	12	3
58	9·84923	13	9·99949	26	10·00051	9·84974	13	2
59	9·84936	13	9·99975	25	10·00025	9·84961	12	1
60	9·84949		10·00000		10·00000	9·84949		0
′	Cosine.		Cotang.		Tangent.	Sine.		′

[45 degrees.]

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TABLES OF RIGHT ASCENSION, DECLINATION, AND ASCENSIONAL DIFFERENCE

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Aries and Libra					Ascensional Difference					
Deg.	Declin.		Rt. Ascen.		London		Birming'm		Liverpool	
°	°	′	°	′	°	′	°	′	°	′
0	0	0	0	0	0	0	0	0	0	0
1	0	24	0	55	0	30	0	31	0	32
2	0	48	1	50	1	0	1	2	1	4
3	1	12	2	45	1	30	1	33	1	37
4	1	36	3	40	2	0	2	4	2	9
5	1	59	4	35	2	30	2	35	2	41
6	2	23	5	30	3	0	3	6	3	13
7	2	47	6	26	3	30	3	37	3	45
8	3	10	7	21	4	0	4	8	4	17
9	3	34	8	16	4	30	4	39	4	49
10	3	58	9	11	5	0	5	10	5	21
11	4	21	10	7	5	30	5	41	5	53
12	4	45	11	2	6	0	6	12	6	25
13	5	8	11	58	6	30	6	43	6	57
14	5	31	12	53	7	0	7	14	7	29
15	5	55	13	49	7	29	7	45	8	1
16	6	18	14	44	7	59	8	16	8	33
17	6	41	15	40	8	29	8	46	9	5
18	7	4	16	36	8	58	9	17	9	37
19	7	27	17	32	9	28	9	48	10	8
20	7	49	18	28	9	57	10	18	10	40
21	8	12	19	24	10	27	10	49	11	12
22	8	34	20	20	10	56	11	19	11	48
23	8	57	21	17	11	26	11	49	12	15
24	9	19	22	13	11	55	12	20	12	46
25	9	41	23	10	12	24	12	50	13	17
26	10	3	24	6	12	53	13	20	13	49
27	10	24	25	3	13	22	13	50	14	20
28	10	46	26	0	13	51	14	20	14	51
29	11	7	26	57	14	20	14	50	15	22
30	11	29	27	55	14	48	15	19	15	53

☞ For the R.A. of Libra add 180° to the same degree of Aries. The Declin. and Asc. Diff. are the same for both.

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Taurus and Scorpio					Ascensional Difference					
Deg.	Declin.		Rt. Ascen.		London		Birming'm		Liverpool	
°	°	′	°	′	°	′	°	′	°	′
0	11	29	27	55	14	48	15	19	15	53
1	11	50	28	52	15	17	15	49	16	23
2	12	10	29	49	15	45	16	19	16	54
3	12	31	30	47	16	14	16	48	17	24
4	12	51	31	45	16	42	17	17	17	55
5	13	12	32	43	17	10	17	46	18	25
6	13	32	33	41	17	38	18	15	18	55
7	13	51	34	39	18	5	18	44	19	25
8	14	11	35	38	18	33	19	12	19	54
9	14	30	36	37	19	0	19	41	20	24
10	14	49	37	35	19	27	20	9	20	53
11	15	8	38	34	19	54	20	37	21	22
12	15	27	39	33	20	21	21	5	21	51
13	15	45	40	33	20	47	21	32	22	20
14	16	3	41	32	21	14	21	59	22	48
15	16	21	42	32	21	40	22	26	23	16
16	16	38	43	32	22	5	22	53	23	44
17	16	55	44	32	22	31	23	20	24	12
18	17	12	45	32	22	56	23	46	24	39
19	17	29	46	33	23	21	24	12	25	6
20	17	45	47	33	23	46	24	37	25	33
21	18	1	48	34	24	10	25	8	25	59
22	18	17	49	35	24	34	25	28	26	25
23	18	32	50	36	24	57	25	52	26	51
24	18	47	51	37	25	21	26	16	27	16
25	19	1	52	39	25	43	26	40	27	41
26	19	16	53	40	26	6	27	4	28	5
27	19	30	54	42	26	28	27	27	28	29
28	19	43	55	44	26	49	27	49	28	53
29	19	57	56	47	27	11	28	11	29	16
30	20	10	57	49	27	31	28	33	29	39

☞ For R.A. of Scorpio add 180° to the same degree of Taurus. The Declin. and Asc. Diff. are the same for both.

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GEMINI & SAGITTARIUS					ASCENSIONAL DIFFERENCE					
Deg.	Declin.		Rt. Ascen.		London		Birming'm		Liverpool	
°	°	′	°	′	°	′	°	′	°	′
0	20	10	57	49	27	31	28	33	29	39
1	20	22	58	52	27	52	28	54	30	1
2	20	35	59	54	28	12	29	15	30	23
3	20	46	60	57	28	31	29	35	30	44
4	20	57	62	0	28	49	29	54	31	4
5	21	8	63	3	29	8	30	13	31	24
6	21	19	64	7	29	25	30	32	31	43
7	21	29	65	10	29	42	30	50	32	2
8	21	39	66	14	29	59	31	7	32	20
9	21	49	67	18	30	15	31	23	32	37
10	21	58	68	22	30	30	31	40	32	54
11	22	6	69	26	30	45	31	55	33	10
12	22	14	70	30	30	58	32	9	33	26
13	22	22	71	34	31	11	32	23	33	40
14	22	29	72	39	31	24	32	37	33	54
15	22	36	73	43	31	36	32	49	34	7
16	22	43	74	48	31	48	33	1	34	20
17	22	49	75	52	31	58	33	12	34	31
18	22	55	76	57	32	8	33	22	34	42
19	23	0	78	2	32	17	33	32	34	52
20	23	4	79	7	32	25	33	41	35	1
21	23	9	80	12	32	33	33	49	35	10
22	23	13	81	17	32	40	33	56	35	17
23	23	16	82	22	32	46	34	2	35	24
24	23	19	83	28	32	51	34	7	35	30
25	23	21	84	33	32	55	34	12	35	35
26	23	23	85	38	32	59	34	16	35	39
27	23	25	86	44	33	2	34	19	35	42
28	23	26	87	49	33	4	34	21	35	44
29	23	27	88	55	33	5	34	22	35	45
30	23	27	90	0	33	6	34	23	35	46

☞ For the R.A. of Sagittarius add 180° to the same degree of Gemini. The Declin. and Asc. Diff. are the same for both.

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Cancer and Capricornus					Ascensional Difference					
Deg.	Declin.		Rt. Ascen.		London		Birming'm		Liverpool	
°	°	′	°	′	°	′	°	′	°	′
0	23	27	90	0	33	6	34	23	35	46
1	23	27	91	5	33	5	34	22	35	45
2	23	26	92	11	33	4	34	21	35	44
3	23	25	93	16	33	2	34	19	35	42
4	23	23	94	22	32	59	34	16	35	39
5	23	21	95	27	32	55	34	12	35	35
6	23	19	96	32	32	51	34	7	35	30
7	23	16	97	38	32	46	34	2	35	24
8	23	13	98	43	32	40	33	56	35	17
9	23	9	99	48	32	33	33	49	35	10
10	23	4	100	53	32	25	33	41	35	1
11	23	0	101	58	32	17	33	32	34	52
12	22	55	103	3	32	8	33	22	34	42
13	22	49	104	8	31	58	33	12	34	31
14	22	43	105	12	31	48	33	1	34	20
15	22	36	106	17	31	36	32	49	34	7
16	22	29	107	21	31	24	32	37	33	54
17	22	22	108	26	31	11	32	23	33	40
18	22	14	109	30	30	58	32	9	33	26
19	22	6	110	34	30	45	31	55	33	10
20	21	58	111	38	30	30	31	40	32	54
21	21	49	112	42	30	15	31	23	32	37
22	21	39	113	46	29	59	31	7	32	20
23	21	29	114	50	29	42	30	50	32	2
24	21	19	115	53	29	25	30	32	31	43
25	21	8	116	57	29	8	30	13	31	24
26	20	57	118	0	28	49	29	54	31	4
27	20	46	119	3	28	31	29	35	30	44
28	20	35	120	6	28	12	29	15	30	23
29	20	22	121	8	27	52	28	54	30	1
30	20	10	122	11	27	31	28	33	29	39

☞ For the R.A. of Capricornus add 180° to the same degree of Cancer. The Declin. and Asc. Diff. are the same for both.

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Leo and Aquarius					Ascensional Difference					
Deg.	Declin.		Rt. Ascen.		London		Birming'm		Liverpool	
°	°	′	°	′	°	′	°	′	°	′
0	20	10	122	11	27	31	28	33	29	39
1	19	57	123	13	27	11	28	11	29	16
2	19	43	124	16	26	49	27	49	28	53
3	19	30	125	18	26	28	27	27	28	29
4	19	16	126	20	26	6	27	4	28	5
5	19	1	127	21	25	43	26	40	27	41
6	18	47	128	23	25	21	26	16	27	16
7	18	32	129	24	24	57	25	52	26	51
8	18	17	130	25	24	34	25	28	26	25
9	18	1	131	26	24	10	25	3	25	59
10	17	45	132	27	23	46	24	37	25	33
11	17	29	133	27	23	21	24	12	25	6
12	17	12	134	28	22	56	23	46	24	39
13	16	55	135	28	22	31	23	20	24	12
14	16	38	136	28	22	5	22	53	23	44
15	16	21	137	28	21	40	22	26	23	16
16	16	3	138	28	21	14	21	59	22	48
17	15	45	139	27	20	47	21	32	22	20
18	15	27	140	27	20	21	21	5	21	51
19	15	8	141	26	19	54	20	37	21	22
20	14	49	142	25	19	27	20	9	20	53
21	14	30	143	23	19	0	19	41	20	24
22	14	11	144	22	18	33	19	12	19	54
23	13	51	145	21	18	5	18	44	19	25
24	13	32	146	19	17	38	18	15	18	55
25	13	12	147	17	17	10	17	46	18	25
26	12	51	148	15	16	42	17	17	17	55
27	12	31	149	13	16	14	16	48	17	24
28	12	10	150	11	15	45	16	19	16	54
29	11	50	151	8	15	17	15	49	16	23
30	11	29	152	5	14	48	15	19	15	53

☞ For the R.A. of Aquarius add 180° to the same degree of Leo. The Declin. and Asc. Diff. are the same for both.

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Virgo and Pisces					Ascensional Difference					
Deg.	Declin.		Rt. Ascen.		London		Birming'm		Liverpool	
°	°	′	°	′	°	′	°	′	°	′
0	11	29	152	5	14	48	15	19	15	53
1	11	7	153	3	14	20	14	50	15	22
2	10	46	154	0	13	51	14	20	14	51
3	10	24	154	57	13	22	13	50	14	20
4	10	3	155	54	12	53	13	20	13	49
5	9	41	156	50	12	24	12	50	13	17
6	9	19	157	47	11	55	12	20	12	46
7	8	57	158	43	11	26	11	49	12	15
8	8	34	159	40	10	56	11	19	11	43
9	8	12	160	36	10	27	10	49	11	12
10	7	49	161	32	9	57	10	18	10	40
11	7	27	162	28	9	28	9	48	10	8
12	7	4	163	24	8	58	9	17	9	37
13	6	41	164	20	8	29	8	46	9	5
14	6	18	165	16	7	59	8	16	8	33
15	5	55	166	11	7	29	7	45	8	1
16	5	31	167	7	7	0	7	14	7	29
17	5	8	168	2	6	30	6	43	6	57
18	4	45	168	58	6	0	6	12	6	25
19	4	21	169	53	5	30	5	41	5	53
20	3	58	170	49	5	0	5	10	5	21
21	3	34	171	44	4	30	4	39	4	49
22	3	10	172	39	4	0	4	8	4	17
23	2	47	173	34	3	30	3	37	3	45
24	2	23	174	30	3	0	3	6	3	13
25	1	59	175	25	2	30	2	35	2	41
26	1	36	176	20	2	0	2	4	2	9
27	1	12	177	15	1	30	1	33	1	37
28	0	48	178	10	1	0	1	2	1	4
29	0	24	179	5	0	30	0	31	0	32
30	0	0	180	0	0	0	0	0	0	0

☞ For the R.A. of Pisces add 180° to the same degree of Virgo. The Declin. and Asc. Diff. are the same for both.

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TERNARY PROPORTIONAL LOGARITHMS

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Ternary Proportional Logarithms

′	0°	1°	2°	3°	4°	5°	6°	7°	8°	9°
0	Infinite	2'25527	1 95424	1 77815	1'65321	1 55630	1'47712	1 41017	1'35218	1'30103
1	4'03342	2'24809	1'95064	1 77575	1'65141	1 55486	1 47592	1'40914	1'35128	1'30023
2	3'73239	2 24103	1'94706	1 77335	1'64961	1'55342	1'47472	1 40811	1'35038	1'29942
3	3'55630	2'23408	1'94352	1 77097	1 64782	1 55198	1 47352	1'40708	1'34948	1'29862
4	3'43136	2'22724	1'94000	1 76861	1'64603	1'55055	1 47232	1 40606	1'34858	1'29782
5	3'33445	2'22051	1 93651	1 76625	1 64426	1'54912	1 47113	1 40503	1'34768	1'29703
6	3'25527	2'21388	1'93305	1 76391	1'64249	1'54770	1'46994	1 404014	1'34679	1'29623
7	3'18833	2'20735	1'92962	1'76158	1'64073	1'54629	1'46876	1'40300	1'34589	1'29544
8	3'13033	2'20091	1'92621	1'75927	1'63897	1'54487	1'46758	1 40198	1'34500	1'29464
9	3'07918	2'19457	1'92283	1'75696	1'63722	1'54347	1'46640	1'40097	1'34411	1'29385
10	3'03342	2'18833	1'91948	1'75467	1'63548	1'54206	1 46522	1 39996	1'34323	1'29306
11	2'99203	2'18217	1'91615	1'75239	1'63375	1'54066	1'46404	1'39895	1'34234	1'29227
12	2'95424	2'17609	1'91285	1'75012	1'63202	1'53927	1 46288	1'39794	1'34146	1'29148
13	2'91948	2'17010	1'90957	1'74787	1'63030	1'53788	1 46171	1'39694	1 34058	1'29070
14	2'88730	2'16419	1'90632	1'74562	1 62859	1 53649	1'46055	1 39593	1'33970	1'28991
15	2'85733	2'15836	1'90309	1'74339	1'62688	1'53511	1 45938	1 39493	1'33882	1'28913
16	2'82930	2'15261	1'89988	1'74117	1'62518	1'53374	1 45824	1'39394	1'33794	1'28835
17	2'80297	2'14693	1'89670	1'73896	1'62349	1'53236	1 45708	1'39294	1'33707	1'28757
18	2'77815	2'14133	1'89354	1'73676	1'62180	1'53100	1'45593	1'39195	1'33619	1'28679
19	2 75467	2'13580	1'89041	1'73457	1'62012	1'52963	1'45478	1 39096	1'33532	1'28601
20	2'73239	2 13033	1'88730	1'73239	1'61845	1 52827	1'45364	1 38997	1'33445	1'28524
21	2'71120	2'12494	1'88420	1'73023	1'61678	1'52692	1'45250	1'38899	1'33359	1'28446
22	2'69100	2'11961	1'88114	1'72807	1'61512	1'52557	1'45136	1'38800	1'33272	1'28369
23	2'67170	2'11435	1'87809	1'72593	1'61347	1'52422	1'45022	1'38702	1'33186	1'28292
24	2'65321	2'10914	1'87506	1'72379	1'61182	1'52288	1'44909	1'38604	1'33099	1'28215
25	2'63548	2'10400	1'87206	1 72167	1'61018	1'52154	1'44796	1'38506	1'33013	1 28138
26	2'61845	2'09893	1'86907	1'71956	1'60854	1'52021	1'44684	1'38409	1'32927	1'28061
27	2'60206	2'09390	1'86611	1 71745	1'60691	1'51888	1'44571	1'38312	1'32842	1'27984
28	2'58627	2'08894	1'86316	1'71536	1'60529	1'51755	1'44459	1'38215	1'32756	1'27908
29	2'57103	2'08403	1'86024	1'71328	1'60367	1'51623	1'44347	1'38118	1'32671	1'27831
30	2'55630	2'07918	1'85733	1'71120	1'60206	1'51491	1'44236	1'38021	1'32585	1'27755
31	2'54206	2'07438	1'85445	1'70914	1'60045	1'51360	1'44125	1'37925	1'32500	1'27679
32	2 52827	2'06964	1'85158	1'70709	1'59885	1'51229	1'44014	1 37829	1'32415	1'27603
33	2'51491	2'06494	1'84873	1'70504	1'59726	1'51098	1'43903	1'37733	1'32331	1 27527
34	2'50194	2 06030	1'84590	1'70301	1'59567	1'50968	1'43793	1'37637	1'32246	1 27451
35	2'48936	2'05570	1'84309	1'70099	1 59409	1'50838	1'43683	1'37541	1'32162	1'27376
36	2'47712	2'05115	1'84030	1'69897	1'59251	1'50708	1'43573	1'37446	1'32077	1'27300
37	2'46522	2'04665	1'83752	1'69696	1'59094	1'50579	1'43463	1'37351	1'31993	1'27225
38	2'45364	2'04220	1'83477	1'69497	1'58938	1'50451	1'43354	1'37256	1'31909	1'27150
39	2'44236	2'03779	1'83203	1'69298	1'58782	1'50322	1'43245	1'37161	1'31826	1'27075
40	2'43136	2'03342	1'82930	1'69100	1'58627	1'50194	1'43136	1'37067	1'31742	1'27000
41	2'42064	2'02910	1'82660	1'68903	1'58472	1'50067	1'43028	1'36972	1'31659	1'26925
42	2'41017	2'02482	1'82391	1 68707	1'58317	1'49940	1'42920	1'36878	1'31575	1'26850
43	2 39996	2'02060	1'82124	1'68512	1'58164	1'49813	1'42812	1'36784	1'31492	1'26776
44	2'38997	2'01639	1'81858	1'68318	1'58011	1'49687	1'42704	1'36691	1'31409	1'26701
45	2'38021	2'01223	1'81594	1'68124	1'57858	1'49560	1'42597	1'36597	1'31326	1'26627
46	2'37067	2'00812	1'81332	1'67932	1'57706	1'49435	1'42490	1'36504	1'31244	1'26553
47	2'36133	2'00404	1'81071	1'67740	1'57554	1'49309	1'42383	1'36411	1'31161	1'26479
48	2'35218	2'00000	1'80811	1'67549	1'57403	1'49184	1'42276	1'36318	1'31079	1'26405
49	2'34323	1'99600	1 80554	1'67359	1'57253	1'49060	1'42170	1'36225	1'30997	1'26331
50	2'33445	1'99203	1 80297	1'67170	1'57103	1'48936	1'42064	1'36133	1'30915	1'26257
51	2'32585	1'98810	1'80043	1'66981	1'56953	1'48812	1'41958	1'36040	1 30833	1'26184
52	2'31742	1'98421	1'79790	1 66794	1'56804	1'48688	1'41853	1'35948	1'30751	1'26110
53	2'30915	1'98035	1'79538	1'66607	1'56656	1'48565	1'41747	1'35856	1'30670	1'26037
54	2'30103	1'97652	1'79287	1'66421	1'56508	1'48442	1'41642	1'35765	1'30588	1'25964
55	2'29306	1'97273	1'79039	1 66236	1'56360	1'48320	1'41538	1'35673	1'30507	1'25891
56	2'28524	1'96897	1'78791	1'66051	1'56213	1'48197	1'41433	1'35582	1'30426	1'25818
57	2'27755	1 96524	1'78545	1'65868	1'56067	1 48076	1'41329	1'35491	1'30345	1'25745
58	2'27000	1'96154	1'78300	1'63635	1'55921	1'47954	1'41225	1'35400	1'30264	1'25672
59	2'26257	1'95788	1'78057	1 65503	1 55775	1'47813	1'41121	1 35309	1'30183	1'25600
60	2'25527	1'95424	1'77815	1 65321	1'55630	1 47712	1'41017	1'35218	1'30103	1'25527

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Ternary Proportional Logarithms

′	10°	11°	12°	13°	14°	15°	16°	17°	18°	19°
0	1·25527	1·21388	1·17609	1·14133	1·10914	1·07918	1·05115	1·02482	1·00000	0·97652
1	1·25458	1·21322	1·17549	1·14077	1·10863	1·07870	1·05070	1·02440	0·99960	0·97614
2	1·25383	1·21257	1·17489	1·14022	1·10811	1·07822	1·05025	1·02397	0·99920	0·97576
3	1·25311	1·21191	1·17429	1·13966	1·10760	1·07774	1·04980	1·02355	0·99880	0·97538
4	1·25239	1·21126	1·17369	1·13911	1·10708	1·07726	1·04935	1·02312	0·99839	0·97500
5	1·25167	1·21060	1·17309	1·13855	1·10657	1·07678	1·04890	1·02270	0·99799	0·97462
6	1·25095	1·20995	1·17249	1·13800	1·10605	1·07630	1·04845	1·02228	0·99759	0·97424
7	1·25024	1·20930	1·17189	1·13745	1·10554	1·07582	1·04800	1·02185	0·99719	0·97386
8	1·24952	1·20865	1·17129	1·13690	1·10503	1·07534	1·04755	1·02143	0·99679	0·97348
9	1·24881	1·20800	1·17070	1·13635	1·10452	1·07486	1·04710	1·02101	0·99640	0·97310
10	1·24809	1·20735	1·17010	1·13580	1·10400	1·07438	1·04665	1·02059	0·99600	0·97273
11	1·24738	1·20670	1·16951	1·13525	1·10349	1·07391	1·04620	1·02017	0·99560	0·97235
12	1·24667	1·20605	1·16891	1·13470	1·10298	1·07343	1·04576	1·01974	0·99520	0·97197
13	1·24596	1·20541	1·16832	1·13415	1·10247	1·07295	1·04531	1·01932	0·99480	0·97159
14	1·24526	1·20476	1·16773	1·13360	1·10197	1·07248	1·04486	1·01890	0·99441	0·97122
15	1·24455	1·20412	1·16714	1·13306	1·10146	1·07200	1·04442	1·01848	0·99401	0·97084
16	1·24384	1·20348	1·16655	1·13251	1·10095	1·07153	1·04397	1·01806	0·99361	0·97047
17	1·24314	1·20284	1·16596	1·13197	1·10044	1·07105	1·04353	1·01764	0·99322	0·97009
18	1·24244	1·20219	1·16537	1·13142	1·09994	1·07058	1·04308	1·01723	0·99282	0·96972
19	1·24173	1·20155	1·16478	1·13088	1·09943	1·07011	1·04264	1·01681	0·99243	0·96934
20	1·24103	1·20091	1·16419	1·13033	1·09893	1·06964	1·04220	1·01639	0·99203	0·96897
21	1·24033	1·20028	1·16361	1·12979	1·09842	1·06916	1·04175	1·01597	0·99164	0·96859
22	1·23963	1·19964	1·16302	1·12925	1·09792	1·06869	1·04131	1·01556	0·99124	0·96822
23	1·23894	1·19900	1·16243	1·12871	1·09741	1·06822	1·04087	1·01514	0·99085	0·96784
24	1·23824	1·19837	1·16185	1·12817	1·09691	1·06775	1·04043	1·01472	0·99045	0·96747
25	1·23754	1·19773	1·16127	1·12763	1·09641	1·06728	1·03999	1·01431	0·99006	0·96710
26	1·23685	1·19710	1·16068	1·12709	1·09591	1·06681	1·03955	1·01389	0·98967	0·96673
27	1·23616	1·19647	1·16010	1·12655	1·09540	1·06634	1·03911	1·01348	0·98928	0·96635
28	1·23546	1·19584	1·15952	1·12601	1·09490	1·06588	1·03867	1·01306	0·98888	0·96598
29	1·23477	1·19520	1·15894	1·12548	1·09440	1·06541	1·03823	1·01265	0·98849	0·96561
30	1·23408	1·19457	1·15836	1·12494	1·09390	1·06494	1·03779	1·01223	0·98810	0·96524
31	1·23339	1·19395	1·15778	1·12440	1·09341	1·06447	1·03735	1·01182	0·98771	0·96487
32	1·23271	1·19332	1·15721	1·12387	1·09291	1·06401	1·03691	1·01141	0·98732	0·96450
33	1·23202	1·19269	1·15663	1·12333	1·09241	1·06354	1·03647	1·01100	0·98693	0·96413
34	1·23133	1·19206	1·15605	1·12280	1·09191	1·06308	1·03604	1·01058	0·98654	0·96376
35	1·23065	1·19144	1·15548	1·12227	1·09142	1·06261	1·03560	1·01017	0·98615	0·96339
36	1·22997	1·19081	1·15490	1·12173	1·09092	1·06215	1·03516	1·00976	0·98576	0·96302
37	1·22928	1·19019	1·15433	1·12120	1·09042	1·06168	1·03473	1·00935	0·98537	0·96265
38	1·22860	1·18957	1·15375	1·12067	1·08993	1·06122	1·03429	1·00894	0·98498	0·96228
39	1·22792	1·18895	1·15318	1·12014	1·08943	1·06076	1·03386	1·00853	0·98459	0·96191
40	1·22724	1·18833	1·15261	1·11961	1·08894	1·06030	1·03342	1·00812	0·98421	0·96154
41	1·22657	1·18771	1·15204	1·11908	1·08845	1·05983	1·03299	1·00771	0·98382	0·96117
42	1·22589	1·18709	1·15147	1·11855	1·08796	1·05937	1·03256	1·00730	0·98343	0·96081
43	1·22521	1·18647	1·15090	1·11802	1·08746	1·05891	1·03212	1·00689	0·98304	0·96044
44	1·22454	1·18585	1·15033	1·11750	1·08697	1·05845	1·03169	1·00648	0·98266	0·96007
45	1·22386	1·18523	1·14976	1·11697	1·08648	1·05799	1·03126	1·00607	0·98227	0·95971
46	1·22319	1·18462	1·14919	1·11644	1·08599	1·05753	1·03083	1·00567	0·98189	0·95934
47	1·22252	1·18400	1·14863	1·11592	1·08550	1·05707	1·03039	1·00526	0·98150	0·95897
48	1·22185	1·18339	1·14806	1·11539	1·08501	1·05662	1·02996	1·00485	0·98111	0·95861
49	1·22118	1·18278	1·14750	1·11487	1·08452	1·05616	1·02953	1·00445	0·98073	0·95824
50	1·22051	1·18217	1·14693	1·11435	1·08403	1·05570	1·02910	1·00404	0·98035	0·95788
51	1·21984	1·18155	1·14637	1·11382	1·08355	1·05524	1·02867	1·00363	0·97996	0·95751
52	1·21918	1·18094	1·14581	1·11330	1·08306	1·05479	1·02824	1·00323	0·97958	0·95715
53	1·21851	1·18033	1·14524	1·11278	1·08257	1·05443	1·02781	1·00282	0·97919	0·95678
54	1·21785	1·17973	1·14468	1·11226	1·08209	1·05388	1·02739	1·00242	0·97881	0·95642
55	1·21718	1·17912	1·14412	1·11174	1·08160	1·05342	1·02696	1·00202	0·97843	0·95606
56	1·21652	1·17851	1·14356	1·11122	1·08112	1·05297	1·02653	1·00161	0·97805	0·95569
57	1·21586	1·17790	1·14300	1·11070	1·08063	1·05251	1·02610	1·00121	0·97766	0·95533
58	1·21520	1·17730	1·14244	1·11018	1·08015	1·05206	1·02568	1·00080	0·97728	0·95497
59	1·21454	1·17669	1·14189	1·10966	1·07966	1·05161	1·02525	1·00040	0·97690	0·95460
60	1·21388	1·17609	1·14133	1·10914	1·07918	1·05115	1·02482	1·00000	0·97652	0·95424

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Ternary Proportional Logarithms

′	20°	21°	22°	23°	24°	25°	26°	27°	28°	29°
0	95424	93305	91285	89354	87506	85733	84030	82391	80811	79287
1	95388	93271	91252	89323	87476	85704	84002	82364	80786	79262
2	95352	93236	91219	89292	87446	85675	83974	82337	80760	79238
3	95316	93202	91186	89260	87416	85646	83946	82311	80734	79213
4	95280	93168	91154	89229	87386	85618	83919	82284	80708	79188
5	95244	93133	91121	89197	87356	85589	83891	82257	80682	79163
6	95208	93099	91088	89166	87326	85560	83863	82230	80657	79138
7	95172	93065	91055	89135	87296	85531	83835	82204	80631	79113
8	95136	93030	91023	89103	87266	85502	83808	82177	80605	79088
9	95100	92996	90990	89072	87236	85473	83780	82150	80579	79063
10	95064	92962	90957	89041	87206	85445	83752	82124	80554	79039
11	95028	92928	90925	89010	87176	85416	83725	82097	80528	79014
12	94992	92894	90892	88978	87146	85387	83697	82070	80502	78989
13	94956	92860	90859	88947	87116	85358	83670	82044	80477	78964
14	94921	92825	90827	88916	87086	85330	83642	82017	80451	78939
15	94885	92791	90794	88885	87056	85301	83614	81991	80425	78915
16	94849	92757	90762	88854	87026	85272	83587	81964	80400	78890
17	94813	92723	90729	88823	86996	85244	83559	81938	80374	78865
18	94778	92689	90697	88792	86967	85215	83532	81911	80349	78840
19	94742	92655	90664	88761	86937	85187	83504	81884	80323	78816
20	94706	92621	90632	88730	86907	85158	83477	81858	80297	78791
21	94671	92587	90599	88699	86877	85129	83449	81832	80272	78766
22	94635	92554	90567	88668	86848	85101	83422	81805	80246	78742
23	94600	92520	90535	88637	86818	85072	83394	81779	80221	78717
24	94564	92486	90502	88606	86788	85044	83367	81752	80195	78693
25	94529	92452	90470	88575	86759	85015	83339	81726	80170	78668
26	94493	92418	90438	88544	86729	84987	83312	81699	80144	78643
27	94458	92385	90406	88513	86699	84958	83285	81673	80119	78619
28	94423	92351	90373	88482	86670	84930	83257	81647	80094	78594
29	94387	92317	90341	88451	86640	84902	83230	81620	80068	78570
30	94352	92283	90309	88420	86611	84873	83203	81594	80043	78545
31	94317	92250	90277	88390	86581	84845	83175	81568	80017	78521
32	94281	92216	90245	88359	86552	84816	83148	81541	79992	78496
33	94246	92183	90213	88328	86522	84788	83121	81515	79967	78472
34	94211	92149	90181	88297	86493	84760	83094	81489	79941	78447
35	94176	92115	90148	88267	86463	84732	83066	81463	79916	78423
36	94141	92082	90116	88236	86434	84703	83039	81436	79891	78398
37	94105	92048	90084	88205	86404	84675	83012	81410	79865	78374
38	94070	92015	90052	88175	86375	84647	82985	81384	79840	78349
39	94035	91981	90020	88144	86346	84619	82958	81358	79815	78325
40	94000	91948	89988	88114	86316	84590	82930	81332	79790	78300
41	93965	91915	89957	88083	86287	84562	82903	81305	79764	78276
42	93930	91881	89925	88052	86258	84534	82876	81279	79739	78252
43	93895	91848	89893	88022	86228	84506	82849	81253	79714	78227
44	93860	91815	89861	87991	86199	84478	82822	81227	79689	78203
45	93825	91781	89829	87961	86170	84450	82795	81201	79663	78179
46	93791	91748	89797	87930	86140	84421	82768	81175	79638	78154
47	93756	91715	89766	87900	86111	84393	82741	81149	79613	78130
48	93721	91682	89734	87870	86082	84365	82714	81123	79588	78106
49	93686	91648	89702	87839	86053	84337	82687	81097	79563	78081
50	93651	91615	89670	87809	86024	84309	82660	81071	79538	78057
51	93617	91582	89639	87778	85995	84281	82633	81045	79513	78033
52	93582	91549	89607	87748	85965	84253	82606	81019	79488	78009
53	93547	91516	89575	87718	85936	84225	82579	80993	79463	77984
54	93513	91483	89544	87687	85907	84197	82552	80967	79437	77960
55	93478	91450	89512	87657	85878	84169	82525	80941	79412	77936
56	93443	91417	89481	87627	85849	84141	82498	80915	79387	77912
57	93409	91384	89449	87597	85820	84114	82471	80889	79362	77888
58	93374	91351	89417	87566	85791	84086	82445	80863	79337	77863
59	93340	91318	89386	87536	85762	84058	82418	80837	79312	77839
60	93305	91285	89354	87506	85733	84030	82391	80811	79287	77815

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Ternary Proportional Logarithms

′	30°	31°	32°	33°	34°	35°	36°	37°	38°	39°
0	77815	76391	75012	73676	72379	71120	69897	68707	67549	66421
1	77791	76368	74990	73654	72358	71100	69877	68688	67530	66402
2	77767	76344	74967	73632	72337	71079	69857	68668	67511	66384
3	77743	76321	74944	73610	72316	71058	69837	68648	67492	66365
4	77719	76298	74922	73588	72294	71038	69817	68629	67473	66347
5	77695	76274	74899	73566	72273	71017	69797	68609	67454	66328
6	77671	76251	74877	73544	72252	70997	69777	68590	67435	66310
7	77647	76228	74854	73523	72231	70976	69756	68570	67416	66291
8	77623	76205	74832	73501	72209	70955	69736	68551	67397	66273
9	77599	76181	74809	73479	72188	70935	69716	68531	67378	66254
10	77575	76158	74787	73457	72167	70914	69696	68512	67359	66236
11	77551	76135	74764	73435	72146	70894	69676	68492	67340	66217
12	77527	76112	74742	73413	72125	70873	69656	68473	67321	66199
13	77503	76089	74719	73392	72103	70852	69636	68454	67302	66180
14	77479	76065	74697	73370	72082	70832	69616	68434	67283	66162
15	77455	76042	74674	73348	72061	70811	69596	68415	67264	66143
16	77431	76019	74652	73326	72040	70791	69576	68395	67245	66125
17	77407	75996	74629	73305	72019	70770	69557	68376	67226	66106
18	77383	75973	74607	73283	71998	70750	69537	68356	67207	66088
19	77359	75950	74585	73261	71977	70729	69517	68337	67188	66070
20	77335	75927	74562	73239	71956	70709	69497	68318	67170	66051
21	77311	75903	74540	73218	71935	70688	69477	68298	67151	66033
22	77288	75880	74517	73196	71914	70668	69457	68279	67132	66014
23	77264	75857	74495	73174	71892	70647	69437	68259	67113	65996
24	77240	75834	74473	73153	71871	70627	69417	68240	67094	65978
25	77216	75811	74450	73131	71850	70606	69397	68221	67075	65959
26	77192	75788	74428	73109	71829	70586	69377	68201	67056	65941
27	77169	75765	74406	73088	71808	70566	69358	68182	67038	65923
28	77145	75742	74383	73066	71787	70545	69338	68163	67019	65904
29	77121	75719	74361	73044	71766	70525	69318	68143	67000	65886
30	77097	75696	74339	73023	71745	70504	69298	68124	66981	65868
31	77074	75673	74317	73001	71724	70484	69278	68105	66962	65849
32	77050	75650	74294	72980	71703	70464	69258	68086	66944	65831
33	77026	75627	74272	72958	71682	70443	69239	68066	66925	65813
34	77002	75604	74250	72936	71662	70423	69219	68047	66906	65794
35	76979	75581	74228	72915	71641	70403	69199	68028	66887	65776
36	76955	75559	74205	72893	71620	70382	69179	68008	66869	65758
37	76931	75536	74183	72872	71599	70362	69159	67989	66850	65739
38	76908	75513	74161	72850	71578	70342	69140	67970	66831	65721
39	76884	75490	74139	72829	71557	70321	69120	67951	66812	65703
40	76861	75467	74117	72807	71536	70301	69100	67932	66794	65685
41	76837	75444	74095	72786	71515	70281	69080	67912	66775	65666
42	76813	75421	74072	72764	71494	70260	69061	67893	66756	65648
43	76790	75398	74050	72743	71473	70240	69041	67874	66737	65630
44	76766	75376	74028	72721	71453	70220	69021	67855	66719	65612
45	76743	75353	74006	72700	71432	70200	69002	67836	66700	65594
46	76719	75330	73984	72678	71411	70179	68982	67816	66681	65575
47	76696	75307	73962	72657	71390	70159	68962	67797	66663	65557
48	76672	75285	73940	72636	71369	70139	68942	67778	66644	65539
49	76649	75262	73918	72614	71349	70119	68923	67759	66625	65521
50	76625	75239	73896	72593	71328	70099	68903	67740	66607	65503
51	76602	75216	73874	72571	71307	70078	68884	67721	66588	65484
52	76578	75194	73852	72550	71286	70058	68864	67702	66570	65466
53	76555	75171	73830	72529	71265	70038	68844	67682	66551	65448
54	76531	75148	73808	72507	71245	70018	68825	67663	66532	65430
55	76508	75126	73786	72486	71224	69998	68805	67644	66514	65412
56	76485	75103	73764	72465	71203	69977	68785	67625	66495	65394
57	76461	75080	73742	72443	71183	69957	68766	67606	66477	65376
58	76438	75058	73720	72422	71162	69937	68746	67587	66458	65357
59	76414	75035	73698	72401	71141	69917	68727	67568	66439	65339
60	76391	75012	73676	72379	71120	69897	68707	67549	66421	65321

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Ternary Proportional Logarithms

′	40°	41°	42°	43°	44°	45°	46°	47°	48°	49°
0	65321	64249	63202	62180	61182	60206	59251	58317	57403	56508
1	65303	64231	63185	62164	61166	60190	59236	58302	57388	56493
2	65285	64214	63168	62147	61149	60174	59220	58287	57373	56478
3	65267	64196	63151	62130	61133	60158	59204	58271	57358	56463
4	65249	64178	63133	62113	61116	60142	59189	58256	57343	56449
5	65231	64161	63116	62096	61100	60126	59173	58241	57328	56434
6	65213	64143	63099	62080	61083	60110	59157	58225	57313	56419
7	65195	64125	63082	62063	61067	60094	59141	58210	57298	56404
8	65177	64108	63065	62046	61051	60078	59126	58194	57283	56390
9	65159	64090	63047	62029	61034	60061	59110	58179	57268	56375
10	65141	64073	63030	62012	61018	60045	59094	58164	57253	56360
11	65123	64055	63013	61996	61001	60029	59079	58148	57238	56345
12	65105	64038	62996	61979	60985	60013	59063	58133	57223	56331
13	65087	64020	62979	61962	60969	59997	59047	58118	57208	56316
14	65069	64002	62962	61945	60952	59981	59032	58102	57193	56301
15	65051	63985	62945	61929	60936	59965	59016	58087	57178	56287
16	65033	63967	62927	61912	60920	59949	59000	58072	57163	56272
17	65015	63950	62910	61895	60903	59933	58985	58056	57148	56257
18	64997	63932	62893	61878	60887	59917	58969	58041	57133	56243
19	64979	63915	62876	61862	60871	59901	58954	58026	57118	56228
20	64961	63897	62859	61845	60854	59885	58938	58011	57103	56213
21	64943	63880	62842	61828	60838	59870	58922	57995	57088	56199
22	64925	63862	62825	61812	60822	59854	58907	57980	57073	56184
23	64907	63845	62808	61795	60805	59838	58891	57965	57058	56169
24	64889	63827	62791	61778	60789	59822	58875	57949	57043	56155
25	64871	63810	62774	61762	60773	59806	58860	57934	57028	56140
26	64853	63792	62757	61745	60756	59790	58844	57919	57013	56125
27	64835	63775	62739	61728	60740	59774	58829	57904	56998	56111
28	64818	63757	62722	61712	60724	59758	58813	57888	56983	56096
29	64800	63740	62705	61695	60708	59742	58798	57873	56968	56081
30	64782	63722	62688	61678	60691	59726	58782	57858	56953	56067
31	64764	63705	62671	61662	60675	59710	58766	57843	56938	56052
32	64746	63688	62654	61645	60659	59694	58751	57827	56923	56037
33	64728	63670	62637	61628	60642	59678	58735	57812	56908	56023
34	64710	63653	62620	61612	60626	59663	58720	57797	56893	56008
35	64692	63635	62603	61595	60610	59647	58704	57782	56879	55994
36	64675	63618	62586	61579	60594	59631	58689	57767	56864	55979
37	64657	63601	62569	61562	60578	59615	58673	57751	56849	55964
38	64639	63583	62552	61545	60561	59599	58658	57736	56834	55950
39	64621	63566	62535	61529	60545	59583	58642	57721	56819	55935
40	64603	63548	62518	61512	60529	59567	58627	57706	56804	55921
41	64586	63531	62501	61496	60513	59551	58611	57691	56789	55906
42	64568	63514	62484	61479	60496	59536	58596	57675	56774	55892
43	64550	63496	62468	61463	60480	59520	58580	57660	56759	55877
44	64532	63479	62451	61446	60464	59504	58565	57645	56745	55862
45	64514	63462	62434	61429	60448	59488	58549	57630	56730	55848
46	64497	63444	62417	61413	60432	59472	58534	57615	56715	55833
47	64479	63427	62400	61396	60416	59457	58518	57600	56700	55819
48	64461	63410	62383	61380	60399	59441	58503	57584	56685	55804
49	64443	63392	62366	61363	60383	59425	58487	57569	56670	55790
50	64426	63375	62349	61347	60367	59409	58472	57554	56656	55775
51	64408	63358	62332	61330	60351	59393	58456	57539	56641	55761
52	64390	63340	62315	61314	60335	59378	58441	57524	56626	55746
53	64373	63323	62298	61297	60319	59362	58425	57509	56611	55732
54	64355	63306	62282	61281	60303	59346	58410	57494	56596	55717
55	64337	63289	62265	61264	60286	59330	58395	57479	56582	55703
56	64320	63271	62248	61248	60270	59314	58379	57463	56567	55688
57	64302	63254	62231	61231	60254	59299	58364	57448	56552	55674
58	64284	63237	62214	61215	60238	59283	58348	57433	56537	55659
59	64267	63220	62197	61198	60222	59267	58333	57418	56522	55645
60	64249	63202	62180	61182	60206	59251	58317	57403	56508	55630

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Ternary Proportional Logarithms

l	50°	51°	52°	53°	54°	55°	56°	57°	58°	59°
0	55630	54770	53927	53100	52288	51491	50708	49940	49184	48442
1	55616	54756	53913	53086	52274	51478	50696	49927	49172	48430
2	55601	54742	53899	53072	52261	51465	50683	49914	49159	48418
3	55587	54728	53885	53059	52248	51452	50670	49902	49147	48405
4	55572	54714	53871	53045	52234	51438	50657	49889	49135	48393
5	55558	54699	53857	53031	52221	51425	50644	49876	49122	48381
6	55543	54685	53843	53018	52208	51412	50631	49864	49110	48369
7	55529	54671	53830	53004	52194	51399	50618	49851	49097	48356
8	55515	54657	53816	52991	52181	51386	50605	49838	49085	48344
9	55500	54643	53802	52977	52167	51373	50592	49826	49072	48332
10	55486	54629	53788	52963	52154	51360	50579	49813	49060	48320
11	55471	54614	53774	52950	52141	51346	50566	49800	49047	48307
12	55457	54600	53760	52936	52127	51333	50554	49788	49035	48295
13	55442	54586	53746	52922	52114	51320	50541	49775	49023	48283
14	55428	54572	53732	52909	52101	51307	50528	49762	49010	48271
15	55414	54558	53719	52895	52087	51294	50515	49750	48998	48258
16	55399	54544	53705	52882	52074	51281	50502	49737	48985	48246
17	55385	54530	53691	52868	52061	51268	50489	49724	48973	48234
18	55370	54516	53677	52855	52047	51255	50476	49712	48960	48222
19	55356	54501	53663	52841	52034	51242	50464	49699	48948	48210
20	55342	54487	53649	52827	52021	51229	50451	49687	48936	48197
21	55327	54473	53636	52814	52007	51215	50438	49674	48923	48185
22	55313	54459	53622	52800	51994	51202	50425	49661	48911	48173
23	55299	54445	53608	52787	51981	51189	50412	49649	48898	48161
24	55284	54431	53594	52773	51967	51176	50399	49636	48886	48149
25	55270	54417	53580	52760	51954	51163	50387	49623	48874	48136
26	55255	54403	53567	52746	51941	51150	50374	49611	48861	48124
27	55241	54389	53553	52732	51927	51137	50361	49598	48849	48112
28	55227	54375	53539	52719	51914	51124	50348	49586	48836	48100
29	55212	54361	53525	52705	51901	51111	50335	49573	48824	48088
30	55198	54347	53511	52692	51888	51098	50322	49560	48812	48076
31	55184	54332	53498	52678	51874	51085	50310	49548	48799	48063
32	55169	54318	53484	52665	51861	51072	50297	49535	48787	48051
33	55155	54304	53470	52651	51848	51059	50284	49523	48775	48039
34	55141	54290	53456	52638	51835	51046	50271	49510	48762	48027
35	55127	54276	53442	52624	51821	51033	50258	49498	48750	48015
36	55112	54262	53429	52611	51808	51020	50246	49485	48737	48003
37	55098	54248	53415	52597	51795	51007	50233	49472	48725	47990
38	55084	54234	53401	52584	51781	50994	50220	49460	48713	47978
39	55069	54220	53387	52570	51768	50981	50207	49447	48700	47966
40	55055	54206	53374	52557	51755	50968	50194	49435	48688	47954
41	55041	54192	53360	52543	51742	50955	50182	49422	48676	47942
42	55026	54178	53346	52530	51729	50942	50169	49410	48663	47930
43	55012	54164	53332	52516	51715	50929	50156	49397	48651	47918
44	54998	54150	53319	52503	51702	50916	50143	49385	48639	47906
45	54984	54136	53305	52489	51689	50903	50131	49372	48626	47893
46	54969	54122	53291	52476	51676	50890	50118	49360	48614	47881
47	54955	54108	53278	52462	51662	50877	50105	49347	48602	47869
48	54941	54094	53264	52449	51649	50864	50092	49334	48590	47857
49	54927	54080	53250	52436	51636	50851	50080	49322	48577	47845
50	54912	54066	53236	52422	51623	50838	50067	49309	48565	47833
51	54898	54052	53223	52409	51610	50825	50054	49297	48553	47821
52	54884	54038	53209	52395	51596	50812	50041	49284	48540	47809
53	54870	54024	53195	52382	51583	50799	50029	49272	48528	47797
54	54855	54011	53182	52368	51570	50786	50016	49259	48516	47785
55	54841	53997	53168	52355	51557	50773	50003	49247	48503	47772
56	54827	53983	53154	52342	51544	50760	49991	49234	48491	47760
57	54813	53969	53141	52328	51530	50747	49978	49222	48479	47748
58	54799	53955	53127	52315	51517	50734	49965	49209	48467	47736
59	54784	53941	53113	52301	51504	50721	49952	49197	48454	47724
60	54770	53927	53100	52288	51491	50708	49940	49184	48442	47712

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Ternary Proportional Logarithms

′	60°	61°	62°	63°	64°	65°	66°	67°	68°	69°	70°	71°
0	47712	46994	46288	45593	44909	44236	43573	42920	42276	41642	41017	40401
1	47700	46982	46276	45582	44898	44225	43562	42909	42266	41632	41007	40391
2	47688	46971	46265	45570	44887	44214	43551	42898	42255	41621	40997	40381
3	47676	46959	46253	45559	44875	44203	43540	42887	42244	41611	40986	40371
4	47664	46947	46241	45547	44864	44191	43529	42877	42234	41600	40976	40361
5	47652	46935	46230	45536	44853	44180	43518	42866	42223	41590	40966	40350
6	47640	46923	46218	45524	44841	44169	43507	42855	42213	41579	40955	40340
7	47628	46911	46206	45513	44830	44158	43496	42844	42202	41569	40945	40330
8	47616	46899	46195	45501	44819	44147	43485	42833	42191	41559	40935	40320
9	47604	46888	46183	45490	44808	44136	43474	42823	42181	41548	40924	40310
10	47592	46876	46171	45478	44796	44125	43463	42812	42170	41538	40914	40300
11	47580	46864	46160	45467	44785	44114	43452	42801	42159	41527	40904	40289
12	47568	46852	46148	45456	44774	44102	43441	42790	42149	41517	40894	40279
13	47556	46840	46137	45444	44762	44091	43431	42780	42138	41506	40883	40269
14	47544	46828	46125	45433	44751	44080	43420	42769	42128	41496	40873	40259
15	47532	46817	46113	45421	44740	44069	43409	42758	42117	41485	40863	40249
16	47520	46805	46102	45410	44729	44058	43398	42747	42106	41475	40852	40239
17	47508	46793	46090	45398	44717	44047	43387	42737	42096	41464	40842	40228
18	47496	46781	46078	45387	44706	44036	43376	42726	42085	41454	40832	40218
19	47484	46769	46067	45375	44695	44025	43365	42715	42075	41443	40821	40208
20	47472	46758	46055	45364	44684	44014	43354	42704	42064	41433	40811	40198
21	47460	46746	46044	45353	44672	44003	43343	42693	42053	41423	40801	40188
22	47448	46734	46032	45341	44661	43992	43332	42683	42043	41412	40791	40178
23	47436	46722	46020	45330	44650	43981	43321	42672	42032	41402	40780	40168
24	47424	46710	46009	45318	44639	43969	43310	42661	42022	41391	40770	40157
25	47412	46699	45997	45307	44627	43958	43300	42651	42011	41381	40760	40147
26	47400	46687	45986	45295	44616	43947	43289	42640	42000	41370	40749	40137
27	47388	46675	45974	45284	44605	43936	43278	42629	41990	41360	40739	40127
28	47376	46663	45962	45273	44594	43925	43267	42618	41979	41350	40729	40117
29	47364	46652	45951	45261	44583	43914	43256	42608	41969	41339	40719	40107
30	47352	46640	45939	45250	44571	43903	43245	42597	41958	41329	40708	40097
31	47340	46628	45928	45238	44560	43892	43234	42586	41948	41318	40698	40087
32	47328	46616	45916	45227	44549	43881	43223	42575	41937	41308	40688	40076
33	47316	46604	45905	45216	44538	43870	43212	42565	41927	41298	40678	40066
34	47304	46593	45893	45204	44526	43859	43202	42554	41916	41287	40667	40056
35	47292	46581	45881	45193	44515	43848	43191	42543	41905	41277	40657	40046
36	47280	46569	45870	45182	44504	43837	43180	42533	41895	41266	40647	40036
37	47268	46557	45858	45170	44493	43826	43169	42522	41884	41256	40637	40026
38	47256	46546	45847	45159	44482	43815	43158	42511	41874	41246	40626	40016
39	47244	46534	45835	45147	44470	43804	43147	42500	41863	41235	40616	40006
40	47232	46522	45824	45136	44459	43793	43136	42490	41853	41225	40606	39996
41	47220	46510	45812	45125	44448	43782	43126	42479	41842	41214	40596	39985
42	47208	46499	45800	45113	44437	43771	43115	42468	41832	41204	40585	39975
43	47196	46487	45789	45102	44426	43760	43104	42458	41821	41194	40575	39965
44	47185	46475	45777	45091	44414	43749	43093	42447	41811	41183	40565	39955
45	47173	46464	45766	45079	44403	43738	43082	42436	41800	41173	40555	39945
46	47161	46452	45754	45068	44392	43727	43071	42426	41789	41162	40544	39935
47	47149	46440	45743	45057	44381	43716	43060	42415	41779	41152	40534	39925
48	47137	46428	45731	45045	44370	43705	43050	42404	41768	41142	40524	39915
49	47125	46417	45720	45034	44359	43694	43039	42394	41758	41131	40514	39905
50	47113	46405	45708	45022	44347	43683	43028	42383	41747	41121	40503	39895
51	47101	46393	45697	45011	44336	43672	43017	42372	41737	41111	40493	39885
52	47089	46382	45685	45000	44325	43661	43006	42362	41726	41100	40483	39874
53	47077	46370	45674	44988	44314	43650	42995	42351	41716	41090	40473	39864
54	47066	46358	45662	44977	44303	43639	42985	42340	41705	41080	40463	39854
55	47054	46346	45651	44966	44292	43628	42974	42330	41695	41069	40452	39844
56	47042	46335	45639	44955	44280	43617	42963	42319	41684	41059	40442	39834
57	47030	46323	45628	44943	44269	43606	42952	42308	41674	41048	40432	39824
58	47018	46311	45616	44932	44258	43595	42941	42298	41663	41038	40422	39814
59	47006	46300	45605	44921	44247	43584	42931	42287	41653	41028	40412	39804
60	46994	46288	45593	44909	44236	43573	42920	42276	41642	41017	40401	39794

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Ternary Proportional Logarithms

′	72°	73°	74°	75°	76°	77°	78°	79°	80°	81°	82°	83°
0	39794	39195	38604	38021	37446	36878	36318	35765	35218	34679	34146	33619
1	39784	39185	38594	38011	37436	36869	36309	35755	35209	34670	34137	33611
2	39774	39173	38585	38002	37427	36859	36299	35746	35200	34661	34128	33602
3	39764	39165	38575	37992	37417	36850	36290	35737	35191	34652	34119	33593
4	39754	39155	38565	37983	37408	36841	36281	35728	35182	34643	34111	33585
5	39744	39145	38555	37973	37398	36831	36271	35719	35173	34634	34102	33576
6	39734	39136	38545	37963	37389	36822	36262	35710	35164	34625	34093	33567
7	39724	39126	38536	37954	37379	36812	36253	35700	35155	34616	34084	33558
8	39714	39116	38526	37944	37370	36803	36244	35691	35146	34607	34075	33550
9	39704	39106	38516	37934	37360	36794	36234	35682	35137	34598	34066	33541
10	39694	39096	38506	37925	37351	36784	36225	35673	35128	34589	34058	33532
11	39684	39086	38497	37915	37341	36775	36216	35664	35119	34581	34049	33524
12	39674	39076	38487	37905	37332	36766	36207	35655	35110	34572	34040	33515
13	39664	39066	38477	37896	37322	36756	36197	35646	35101	34563	34031	33506
14	39653	39056	38467	37886	37313	36747	36188	35636	35092	34554	34022	33498
15	39643	39046	38458	37877	37303	36737	36179	35627	35083	34545	34014	33489
16	39633	39037	38448	37867	37294	36728	36170	35618	35074	34536	34005	33480
17	39623	39027	38438	37857	37284	36719	36160	35609	35065	34527	33996	33471
18	39613	39017	38428	37848	37275	36709	36151	35600	35056	34518	33987	33463
19	39603	39007	38419	37838	37265	36700	36142	35591	35047	34509	33978	33454
20	39593	38997	38409	37829	37256	36691	36133	35582	35038	34500	33970	33445
21	39583	38987	38399	37819	37246	36681	36123	35573	35029	34491	33961	33437
22	39573	38977	38389	37809	37237	36672	36114	35563	35020	34483	33952	33428
23	39563	38968	38380	37800	37227	36663	36105	35554	35011	34474	33943	33419
24	39553	38958	38370	37790	37218	36653	36096	35545	35002	34465	33935	33411
25	39543	38948	38360	37781	37208	36644	36086	35536	34993	34456	33926	33402
26	39533	38938	38351	37771	37199	36634	36077	35527	34984	34447	33917	33393
27	39523	38928	38341	37761	37189	36625	36068	35518	34975	34438	33908	33385
28	39513	38918	38331	37752	37180	36616	36059	35509	34966	34429	33899	33376
29	39503	38908	38321	37742	37171	36606	36050	35500	34957	34420	33891	33367
30	39493	38899	38312	37733	37161	36597	36040	35491	34948	34411	33882	33359
31	39483	38889	38302	37723	37152	36588	36031	35481	34939	34403	33873	33350
32	39473	38879	38292	37713	37142	36578	36022	35472	34930	34394	33864	33341
33	39464	38869	38282	37704	37133	36569	36013	35463	34921	34385	33856	33333
34	39454	38859	38273	37694	37123	36560	36003	35454	34912	34376	33847	33324
35	39444	38849	38263	37685	37114	36550	35994	35445	34903	34367	33838	33315
36	39434	38839	38253	37675	37104	36541	35985	35436	34894	34358	33829	33307
37	39424	38830	38244	37665	37095	36532	35976	35427	34885	34349	33820	33298
38	39414	38820	38234	37656	37085	36522	35967	35418	34876	34340	33812	33289
39	39404	38810	38224	37646	37076	36513	35957	35409	34867	34332	33803	33281
40	39394	38800	38215	37637	37067	36504	35948	35400	34858	34323	33794	33272
41	39384	38790	38205	37627	37057	36494	35939	35391	34849	34314	33785	33263
42	39374	38781	38195	37618	37048	36485	35930	35381	34840	34305	33777	33255
43	39364	38771	38186	37608	37038	36476	35921	35372	34831	34296	33768	33246
44	39354	38761	38176	37599	37029	36467	35911	35363	34822	34287	33759	33237
45	39344	38751	38166	37589	37019	36457	35902	35354	34813	34278	33750	33229
46	39334	38741	38156	37579	37010	36448	35893	35345	34804	34270	33742	33220
47	39324	38731	38147	37570	37001	36439	35884	35336	34795	34261	33733	33211
48	39314	38722	38137	37560	36991	36429	35875	35327	34786	34252	33724	33203
49	39304	38712	38127	37551	36982	36420	35865	35318	34777	34243	33715	33194
50	39294	38702	38118	37541	36972	36411	35856	35309	34768	34234	33707	33186
51	39284	38692	38108	37532	36963	36401	35847	35300	34759	34225	33698	33177
52	39274	38682	38098	37522	36953	36392	35838	35291	34750	34217	33689	33168
53	39264	38673	38089	37513	36944	36383	35829	35282	34741	34208	33681	33160
54	39254	38663	38079	37503	36935	36374	35820	35273	34732	34199	33672	33151
55	39245	38653	38069	37494	36925	36364	35810	35264	34723	34190	33663	33142
56	39235	38643	38060	37484	36916	36355	35801	35254	34715	34181	33654	33134
57	39225	38633	38050	37474	36906	36346	35792	35245	34706	34172	33646	33125
58	39215	38624	38040	37465	36897	36336	35783	35236	34697	34164	33637	33117
59	39205	38614	38031	37455	36888	36327	35774	35227	34688	34155	33628	33108
60	39195	38604	38021	37446	36878	36318	35765	35218	34679	34146	33619	33099

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Ternary Proportional Logarithms

′	84°	85°	86°	87°	88°	89°	90°	91°	92°	93°	94°	95°
0	33099	32585	32077	31575	31079	30588	30103	29623	29148	28679	28214	27755
1	33091	32577	32069	31567	31071	30580	30095	29615	29141	28671	28207	27747
2	33082	32568	32061	31559	31063	30572	30087	29607	29133	28663	28199	27740
3	33073	32560	32052	31550	31054	30564	30079	29599	29125	28656	28191	27732
4	33065	32551	32044	31542	31046	30556	30071	29591	29117	28648	28184	27724
5	33056	32543	32035	31534	31038	30548	30063	29583	29109	28640	28176	27717
6	33048	32534	32027	31525	31030	30539	30055	29575	29101	28632	28168	27709
7	33039	32526	32019	31517	31021	30531	30047	29567	29093	28625	28161	27702
8	33030	32517	32010	31509	31013	30523	30039	29560	29086	28617	28153	27694
9	33022	32509	32002	31501	31005	30515	30031	29552	29078	28609	28145	27686
10	33013	32500	31993	31492	30997	30507	30023	29544	29070	28601	28138	27679
11	33005	32492	31985	31484	30989	30499	30015	29536	29062	28593	28130	27671
12	32996	32483	31977	31476	30980	30491	30007	29528	29054	28586	28122	27664
13	32987	32475	31968	31467	30972	30483	29999	29520	29046	28578	28114	27656
14	32979	32466	31960	31459	30964	30475	29991	29512	29038	28570	28107	27648
15	32970	32458	31951	31451	30956	30466	29983	29504	29031	28562	28099	27641
16	32962	32449	31943	31442	30948	30458	29975	29496	29023	28555	28091	27633
17	32953	32441	31935	31434	30939	30450	29967	29488	29015	28547	28084	27626
18	32944	32432	31926	31426	30931	30442	29958	29480	29007	28539	28076	27618
19	32936	32424	31918	31418	30923	30434	29950	29472	28999	28531	28068	27610
20	32927	32415	31909	31409	30915	30426	29942	29464	28991	28524	28061	27603
21	32919	32407	31901	31401	30907	30418	29934	29456	28984	28516	28053	27595
22	32910	32398	31893	31393	30898	30410	29926	29448	28976	28508	28045	27588
23	32902	32390	31884	31384	30890	30302	29918	29441	28968	28500	28038	27580
24	32893	32381	31876	31376	30882	30393	29910	29433	28960	28493	28030	27572
25	32884	32373	31867	31368	30874	30385	29902	29425	28952	28485	28022	27565
26	32876	32365	31859	31360	30866	30377	29894	29417	28944	28477	28015	27557
27	32867	32356	31851	31351	30857	30369	29886	29409	28937	28469	28007	27550
28	32859	32348	31842	31343	30849	30361	29878	29401	28929	28462	27999	27542
29	32850	32339	31834	31335	30841	30353	29870	29393	28921	28454	27992	27534
30	32842	32331	31826	31326	30833	30345	29862	29385	28913	28446	27984	27527
31	32833	32322	31817	31318	30825	30337	29854	29377	28905	28438	27976	27519
32	32824	32314	31809	31310	30817	30329	29846	29369	28897	28431	27969	27512
33	32816	32305	31801	31302	30808	30321	29838	29361	28890	28423	27961	27504
34	32807	32297	31792	31293	30800	30313	29830	29354	28882	28415	27953	27497
35	32799	32288	31784	31285	30792	30305	29822	29346	28874	28407	27946	27489
36	32790	32280	31775	31277	30784	30296	29814	29338	28866	28400	27938	27481
37	32782	32271	31767	31269	30776	30288	29806	29330	28858	28392	27930	27474
38	32773	32263	31759	31260	30768	30280	29798	29322	28851	28384	27923	27466
39	32765	32255	31750	31252	30759	30272	29790	29314	28843	28376	27915	27459
40	32756	32246	31742	31244	30751	30264	29782	29306	28835	28369	27908	27451
41	32747	32238	31734	31236	30743	30256	29775	29298	28827	28361	27900	27444
42	32739	32229	31725	31227	30735	30248	29767	29290	28819	28353	27892	27436
43	32730	32221	31717	31219	30727	30240	29759	29282	28811	28346	27885	27429
44	32722	32212	31709	31211	30719	30232	29751	29275	28804	28338	27877	27421
45	32713	32204	31700	31203	30710	30224	29743	29267	28796	28330	27869	27413
46	32705	32195	31692	31194	30702	30216	29735	29259	28788	28322	27862	27406
47	32696	32187	31684	31186	30694	30208	29727	29251	28780	28315	27854	27398
48	32688	32179	31675	31178	30686	30200	29719	29243	28772	28307	27846	27391
49	32679	32170	31667	31170	30678	30192	29711	29235	28765	28299	27839	27383
50	32671	32162	31659	31161	30670	30183	29703	29227	28757	28292	27831	27376
51	32662	32153	31650	31153	30662	30175	29695	29219	28749	28284	27824	27368
52	32654	32145	31642	31145	30653	30167	29687	29211	28741	28276	27816	27360
53	32645	32136	31634	31137	30645	30159	29679	29204	28733	28268	27808	27353
54	32636	32128	31625	31128	30637	30151	29671	29196	28726	28261	27801	27345
55	32628	32120	31617	31120	30629	30143	29663	29188	28718	28253	27793	27338
56	32619	32111	31609	31112	30621	30135	29655	29180	28710	28245	27785	27330
57	32611	32103	31600	31104	30613	30127	29647	29172	28702	28238	27778	27323
58	32602	32094	31592	31095	30605	30119	29639	29164	28695	28230	27770	27315
59	32594	32086	31584	31087	30596	30111	29631	29156	28687	28222	27763	27308
60	32585	32077	31575	31079	30588	30103	29623	29148	28679	28214	27755	27300

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Ternary Proportional Logarithms

′	96°	97°	98°	99°	100°	101°	102°	103°	104°	105°	106°	107°
0	27300	26850	26405	25964	25527	25095	24667	24244	23824	23408	22997	22589
1	27293	26843	26397	25956	25520	25088	24660	24237	23817	23401	22990	22582
2	27285	26835	26390	25949	25513	25081	24653	24229	23810	23395	22983	22575
3	27278	26828	26382	25942	25506	25074	24646	24222	23803	23388	22976	22569
4	27270	26820	26375	25934	25498	25066	24639	24215	23796	23381	22969	22562
5	27262	26813	26368	25927	25491	25059	24632	24208	23789	23374	22963	22555
6	27255	26805	26360	25920	25484	25052	24625	24201	23782	23367	22956	22548
7	27247	26798	26353	25913	25477	25045	24618	24194	23775	23360	22949	22542
8	27240	26790	26346	25905	25469	25038	24610	24187	23768	23353	22942	22535
9	27232	26783	26338	25898	25462	25031	24603	24180	23761	23346	22935	22528
10	27225	26776	26331	25891	25455	25024	24596	24173	23754	23339	22928	22521
11	27217	26768	26323	25883	25448	25016	24589	24166	23747	23333	22922	22515
12	27210	26761	26316	25876	25440	25009	24582	24159	23740	23326	22915	22508
13	27202	26753	26309	25869	25433	25002	24575	24152	23734	23319	22908	22501
14	27195	26746	26301	25861	25426	24995	24568	24145	23727	23312	22901	22494
15	27187	26738	26294	25854	25419	24988	24561	24138	23720	23305	22894	22488
16	27180	26731	26287	25847	25412	24981	24554	24131	23713	23298	22888	22481
17	27172	26723	26279	25840	25404	24973	24547	24124	23706	23291	22881	22474
18	27165	26716	26272	25832	25397	24966	24540	24117	23699	23284	22874	22467
19	27157	26709	26265	25825	25390	24959	24533	24110	23692	23278	22867	22461
20	27150	26701	26257	25818	25383	24952	24526	24103	23685	23271	22860	22454
21	27142	26694	26250	25810	25376	24945	24518	24096	23678	23264	22854	22447
22	27135	26686	26242	25803	25368	24938	24511	24089	23671	23257	22847	22440
23	27127	26679	26235	25796	25361	24931	24504	24082	23664	23250	22840	22434
24	27120	26671	26228	25789	25354	24923	24497	24075	23657	23243	22833	22427
25	27112	26664	26220	25781	25347	24916	24490	24068	23650	23236	22826	22420
26	27105	26656	26213	25774	25339	24909	24483	24061	23643	23229	22819	22413
27	27097	26649	26206	25767	25332	24902	24476	24054	23636	23223	22813	22407
28	27090	26642	26198	25759	25325	24895	24469	24047	23629	23216	22806	22400
29	27082	26634	26191	25752	25318	24888	24462	24040	23623	23209	22799	22393
30	27075	26627	26184	25745	25311	24881	24455	24033	23616	23202	22792	22386
31	27067	26619	26176	25738	25303	24874	24448	24026	23609	23195	22785	22380
32	27060	26612	26169	25730	25296	24866	24441	24019	23602	23188	22779	22373
33	27052	26605	26162	25723	25289	24859	24434	24012	23595	23181	22772	22366
34	27045	26597	26154	25716	25282	24852	24427	24005	23588	23175	22765	22359
35	27037	26590	26147	25709	25275	24845	24420	23998	23581	23168	22758	22353
36	27030	26582	26140	25701	25267	24838	24413	23991	23574	23161	22752	22346
37	27022	26575	26132	25694	25260	24831	24405	23984	23567	23154	22745	22339
38	27015	26567	26125	25687	25253	24824	24398	23977	23560	23147	22738	22333
39	27007	26560	26118	25680	25246	24817	24391	23970	23553	23140	22731	22326
40	27000	26553	26110	25672	25239	24809	24384	23963	23546	23133	22724	22319
41	26992	26545	26103	25665	25231	24802	24377	23956	23539	23127	22718	22312
42	26985	26538	26096	25658	25224	24795	24370	23949	23533	23120	22711	22306
43	26977	26530	26088	25650	25217	24788	24363	23942	23526	23113	22704	22299
44	26970	26523	26081	25643	25210	24781	24356	23935	23519	23106	22697	22292
45	26962	26516	26074	25636	25203	24774	24349	23928	23512	23099	22690	22286
46	26955	26508	26066	25629	25196	24767	24342	23921	23505	23092	22684	22279
47	26947	26501	26059	25621	25188	24760	24335	23914	23498	23086	22677	22272
48	26940	26493	26052	25614	25181	24752	24328	23908	23491	23079	22670	22265
49	26932	26486	26044	25607	25174	24745	24321	23901	23484	23072	22663	22259
50	26925	26479	26037	25600	25167	24738	24314	23894	23477	23065	22657	22252
51	26917	26471	26030	25592	25160	24731	24307	23887	23470	23058	22650	22245
52	26910	26464	26022	25585	25152	24724	24300	23880	23464	23051	22643	22239
53	26902	26456	26015	25578	25145	24717	24293	23873	23457	23044	22636	22232
54	26895	26449	26008	25571	25138	24710	24286	23866	23450	23038	22629	22225
55	26887	26442	26000	25563	25131	24703	24279	23859	23443	23031	22623	22218
56	26880	26434	25993	25556	25124	24696	24272	23852	23436	23024	22616	22212
57	26872	26427	25986	25549	25117	24689	24265	23845	23429	23017	22609	22205
58	26865	26419	25978	25542	25109	24681	24258	23838	23422	23010	22602	22198
59	26858	26412	25971	25534	25102	24674	24251	23831	23415	23004	22596	22192
60	26850	26405	25964	25527	25095	24667	24244	23824	23408	22997	22589	22185

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Ternary Proportional Logarithms

′	108°	109°	110°	111°	112°	113°	114°	115°	116°	117°	118°	119°
0	22185	21785	21388	20995	20605	20219	19837	19457	19081	18709	18339	17973
1	22178	21778	21381	20988	20599	20213	19830	19451	19075	18702	18333	17966
2	22171	21771	21375	20982	20593	20207	19824	19445	19069	18696	18327	17960
3	22165	21765	21368	20975	20586	20200	19818	19439	19063	18690	18321	17954
4	22158	21758	21362	20969	20580	20194	19811	19432	19056	18684	18315	17948
5	22151	21751	21355	20962	20573	20187	19805	19426	19050	18678	18308	17942
6	22145	21745	21349	20956	20567	20181	19799	19420	19044	18672	18302	17936
7	22138	21738	21342	20949	20560	20175	19792	19413	19038	18665	18296	17930
8	22131	21732	21335	20943	20554	20168	19786	19407	19032	18659	18290	17924
9	22125	21725	21329	20936	20547	20162	19780	19401	19025	18653	18284	17918
10	22118	21718	21322	20930	20541	20155	19773	19395	19019	18647	18278	17912
11	22111	21712	21316	20923	20534	20149	19767	19388	19013	18641	18272	17906
12	22105	21705	21309	20917	20528	20143	19761	19382	19007	18634	18266	17900
13	22098	21698	21303	20910	20522	20136	19754	19376	19000	18628	18259	17894
14	22091	21692	21296	20904	20515	20130	19748	19369	18994	18622	18253	17887
15	22084	21685	21289	20897	20509	20123	19742	19363	18988	18616	18247	17881
16	22078	21678	21283	20891	20502	20117	19735	19357	18982	18610	18241	17875
17	22071	21672	21276	20884	20496	20111	19729	19351	18976	18604	18235	17869
18	22064	21665	21270	20878	20489	20104	19723	19344	18969	18597	18229	17863
19	22058	21659	21263	20871	20483	20098	19716	19338	18963	18591	18223	17857
20	22051	21652	21257	20865	20476	20091	19710	19332	18957	18585	18217	17851
21	22044	21645	21250	20858	20470	20085	19704	19325	18951	18579	18210	17845
22	22038	21639	21243	20852	20464	20079	19697	19319	18944	18573	18204	17839
23	22031	21632	21237	20845	20457	20072	19691	19313	18938	18567	18198	17833
24	22024	21626	21230	20839	20451	20066	19685	19307	18932	18560	18192	17827
25	22018	21619	21224	20832	20444	20060	19678	19300	18926	18554	18186	17821
26	22011	21612	21217	20826	20438	20053	19672	19294	18920	18548	18180	17815
27	22004	21606	21211	20819	20431	20047	19666	19288	18913	18542	18174	17809
28	21998	21599	21204	20813	20425	20040	19659	19282	18907	18536	18168	17803
29	21991	21592	21198	20806	20418	20034	19653	19275	18901	18530	18162	17797
30	21984	21586	21191	20800	20412	20028	19647	19269	18895	18523	18155	17790
31	21978	21579	21184	20793	20406	20021	19640	19263	18888	18517	18149	17784
32	21971	21573	21178	20787	20399	20015	19634	19257	18882	18511	18143	17778
33	21964	21566	21171	20780	20393	20009	19628	19250	18876	18505	18137	17772
34	21958	21559	21165	20774	20386	20002	19621	19244	18870	18499	18131	17766
35	21951	21553	21158	20767	20380	19996	19615	19238	18864	18493	18125	17760
36	21944	21546	21152	20761	20373	19989	19609	19231	18857	18487	18119	17754
37	21938	21540	21145	20754	20367	19983	19602	19225	18851	18480	18113	17748
38	21931	21533	21139	20748	20361	19977	19596	19219	18845	18474	18107	17742
39	21924	21526	21132	20741	20354	19970	19590	19213	18839	18468	18100	17736
40	21918	21520	21126	20735	20348	19964	19584	19206	18833	18462	18094	17730
41	21911	21513	21119	20728	20341	19958	19577	19200	18826	18456	18088	17724
42	21904	21507	21112	20722	20335	19951	19571	19194	18820	18450	18082	17718
43	21898	21500	21106	20715	20328	19945	19565	19188	18814	18443	18076	17712
44	21891	21493	21099	20709	20322	19938	19558	19181	18808	18437	18070	17706
45	21884	21487	21093	20702	20316	19932	19552	19175	18802	18431	18064	17700
46	21878	21480	21086	20696	20309	19926	19546	19169	18795	18425	18058	17694
47	21871	21474	21080	20690	20303	19919	19539	19163	18789	18419	18052	17688
48	21864	21467	21073	20683	20296	19913	19533	19156	18783	18413	18046	17682
49	21858	21460	21067	20676	20290	19907	19527	19150	18777	18407	18040	17676
50	21851	21454	21060	20670	20284	19900	19520	19144	18771	18400	18033	17669
51	21844	21447	21054	20664	20277	19894	19514	19138	18764	18394	18027	17663
52	21838	21441	21047	20657	20271	19888	19508	19131	18758	18388	18021	17657
53	21831	21434	21041	20651	20264	19881	19502	19125	18752	18382	18015	17651
54	21824	21427	21034	20644	20258	19875	19495	19119	18746	18376	18009	17645
55	21818	21421	21028	20638	20251	19869	19489	19113	18740	18370	18003	17639
56	21811	21414	21021	20631	20245	19862	19483	19106	18733	18364	17997	17633
57	21805	21408	21015	20625	20239	19856	19476	19100	18727	18357	17991	17627
58	21798	21401	21008	20618	20232	19849	19470	19094	18721	18351	17985	17621
59	21791	21395	21001	20612	20226	19843	19464	19088	18715	18345	17979	17615
60	21785	21388	20995	20605	20219	19837	19457	19081	18709	18339	17973	17609

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Ternary Proportional Logarithms

′	120°	121°	122°	123°	124°	125°	126°	127°	128°	129°	130°	131°
0	17609	17249	16891	16537	16185	15836	15490	15147	14806	14468	14133	13800
1	17603	17243	16885	16531	16179	15830	15484	15141	14801	14463	14127	13795
2	17597	17237	16879	16525	16173	15825	15479	15135	14795	14457	14122	13789
3	17591	17231	16873	16519	16168	15819	15473	15130	14789	14451	14116	13784
4	17585	17225	16868	16513	16162	15813	15467	15124	14784	14446	14111	13778
5	17579	17219	16862	16507	16156	15807	15461	15118	14778	14440	14105	13773
6	17573	17213	16856	16501	16150	15802	15456	15113	14772	14435	14100	13767
7	17567	17207	16850	16496	16144	15796	15450	15107	14767	14429	14094	13761
8	17561	17201	16844	16490	16138	15790	15444	15101	14761	14423	14088	13756
9	17555	17195	16838	16484	16133	15784	15439	15096	14755	14418	14083	13750
10	17549	17189	16832	16478	16127	15778	15433	15090	14750	14412	14077	13745
11	17543	17183	16826	16472	16121	15773	15427	15084	14744	14407	14072	13739
12	17537	17177	16820	16466	16115	15767	15421	15079	14738	14401	14066	13734
13	17531	17171	16814	16460	16109	15761	15416	15073	14733	14395	14061	13728
14	17525	17165	16808	16454	16103	15755	15410	15067	14727	14390	14055	13723
15	17519	17159	16802	16449	16098	15749	15404	15061	14722	14384	14049	13717
16	17513	17153	16796	16443	16092	15744	15398	15056	14716	14379	14044	13712
17	17507	17147	16791	16437	16086	15738	15393	15050	14710	14373	14038	13706
18	17501	17141	16785	16431	16080	15732	15387	15044	14705	14367	14033	13701
19	17495	17135	16779	16425	16074	15726	15381	15039	14699	14362	14027	13695
20	17489	17129	16773	16419	16068	15721	15375	15033	14693	14356	14022	13690
21	17483	17123	16767	16413	16063	15715	15370	15027	14688	14351	14016	13684
22	17477	17117	16761	16407	16057	15709	15364	15022	14682	14345	14011	13679
23	17471	17111	16755	16402	16051	15703	15358	15016	14676	14339	14005	13673
24	17465	17105	16749	16396	16045	15697	15353	15010	14671	14334	14000	13668
25	17459	17099	16743	16390	16039	15692	15347	15005	14665	14328	13994	13662
26	17453	17093	16737	16384	16034	15686	15341	14999	14659	14323	13988	13657
27	17447	17087	16731	16378	16028	15680	15335	14993	14654	14317	13983	13651
28	17441	17082	16725	16372	16022	15674	15330	14988	14648	14311	13977	13646
29	17435	17076	16720	16366	16016	15669	15324	14982	14643	14306	13972	13640
30	17429	17070	16714	16361	16010	15663	15318	14976	14637	14300	13966	13635
31	17423	17064	16708	16355	16005	15657	15312	14971	14631	14295	13961	13629
32	17417	17058	16702	16349	15999	15651	15307	14965	14626	14289	13955	13624
33	17411	17052	16696	16343	15993	15646	15301	14959	14620	14284	13950	13618
34	17405	17046	16690	16337	15987	15640	15295	14954	14614	14278	13944	13613
35	17399	17040	16684	16331	15981	15634	15290	14948	14609	14272	13938	13607
36	17393	17034	16678	16325	15975	15628	15284	14942	14603	14267	13933	13602
37	17387	17028	16672	16320	15970	15623	15278	14937	14598	14261	13927	13596
38	17381	17022	16666	16314	15964	15617	15272	14931	14592	14256	13922	13591
39	17375	17016	16660	16308	15958	15611	15267	14925	14586	14250	13916	13585
40	17369	17010	16655	16302	15952	15605	15261	14919	14581	14244	13911	13580
41	17363	17004	16649	16296	15946	15599	15255	14914	14575	14239	13905	13574
42	17357	16998	16643	16290	15941	15594	15250	14908	14569	14233	13900	13569
43	17351	16992	16637	16284	15935	15588	15244	14902	14564	14228	13894	13563
44	17345	16986	16631	16279	15929	15582	15238	14897	14558	14222	13889	13558
45	17339	16980	16625	16273	15923	15576	15232	14891	14553	14217	13883	13552
46	17333	16974	16619	16267	15917	15571	15227	14886	14547	14211	13878	13547
47	17327	16968	16613	16261	15912	15565	15221	14880	14541	14205	13872	13541
48	17321	16963	16607	16255	15906	15559	15215	14874	14536	14200	13866	13536
49	17315	16957	16602	16249	15900	15553	15210	14869	14530	14194	13861	13530
50	17309	16951	16596	16243	15894	15548	15204	14863	14524	14189	13855	13525
51	17303	16945	16590	16238	15888	15542	15198	14857	14519	14183	13850	13519
52	17297	16939	16584	16232	15883	15536	15192	14852	14513	14177	13844	13514
53	17291	16933	16578	16226	15877	15530	15187	14846	14508	14172	13839	13508
54	17285	16927	16572	16220	15871	15525	15181	14840	14502	14166	13833	13503
55	17279	16921	16566	16214	15865	15519	15175	14835	14496	14161	13828	13497
56	17273	16915	16560	16208	15859	15513	15170	14829	14491	14155	13822	13492
57	17267	16909	16554	16203	15854	15507	15164	14823	14485	14150	13817	13486
58	17261	16903	16549	16197	15848	15502	15158	14818	14480	14144	13811	13481
59	17255	16897	16543	16191	15842	15496	15153	14812	14474	14138	13806	13475
60	17249	16891	16537	16185	15836	15490	15147	14806	14468	14133	13800	13470

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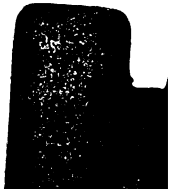

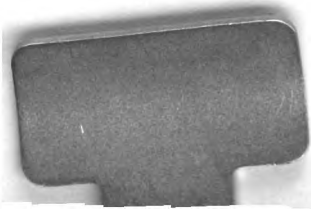

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