# The normal gravity formula and the polar flattening according to geodetic reference system 1967

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RIASSUNTO. — Scopo del presente lavoro è di fornire i valori dello schiacciamento $f$ dell'ellissoide di rotazione terrestre e di coefficienti della gravità normale $g$ deducendoli dai valori adottati dall'Assemblea Generale di Geodesia e Geofisica del 1967, tenendo conto della massa dell'atmosfera e facendo uso delle formule chiuse della teoria di Pizzetti-Somigliana che compaiono in: M. Caputo, " The Gravity Field of the Earth from classical and Modern Methods ", Academic Press, 1967.

Si trova

$$f = (298.247047)^{-1}$$

$$g = 978.03101 \; \frac{1 + 0.00193167 \, \sin^2 \varphi}{[1 - 0.00669461 \, \sin^2 \varphi]^{1/2}} \cdot$$

Segue una tavola dei valori del modulo della gravità per la latitudine variabile da 0° a 90° con passo di 1'.

SUMMARY. — We computed the values of flattening $f$ of the equipotential ellipsoid of the Earth's field and of coefficients of the normal gravity, according to the Earth's parameters adopted by the International Union of Geodesy and Geophysics at its General Assembly of 1967 taking into account the mass of atmosphere and using the closed formulae of the Pizzetti-Somigliana theory that appear in: M. Caputo " The Gravity Field of the Earth from classical and modern Methods ", Academic Press, 1967.

We obtained

$$f = (298.247047)^{-1}$$

$$g = 978.03101 \; \frac{1 + 0.00193167 \, \sin^2 \varphi}{[1 - 0.00669461 \, \sin^2 \varphi]^{1/2}} \cdot$$

We added a table of values of modulus of the gravity vector for $\varphi$ varying from 0° to 90° with a pass of 1'.

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The International Astronomical Union in 1964 adopted for the system of astronomical constants the values of the Earth's parameters suggested by the Commission of International Union of Geodesy. The International Union of Geodesy and Geophysics, at its General Assembly of 1967, adopted the same parameters the values of which are:

Equatorial radius $\qquad a_1 = 6.378160 \cdot 10^8$ cm

Coefficient of second order zonal harmonic of the potential $\qquad C_{20} = -1.08270 \cdot 10^{-3}$

Product of mass of Earth and atmosphere times gravitational constant $\qquad (M_a + M)\, G = 3.98603 \cdot 10^{20}\mathrm{cm}^3\mathrm{sec}^{-2}$

Ratio mass of atmosphere to mass of Earth $\qquad \dfrac{M_a}{M} = 0.86 \cdot 10^{-6}$ .

[1]

The purpose of this work is of setting up the polar flattening, $f$, and the coefficients in the formula for the normal gravity field.

We assume that the normal figure of the Earth is an ellipsoid of revolution. In this hypothesis the Pizzetti-Somigliana theory allows us to express the flattening $f$ and the normal gravity ([3]), with closed formulae ([4]).

For the flattening we have ([2]):

$$W = \frac{M\,G}{r}\left\{1 + \sum_{1}^{\infty}\left(\frac{a_1}{r}\right)^{2n} C_{2no}\, P_{2n}(\cos\vartheta)\right\},$$

$$C_{2n} = \frac{(-1)^n}{2\,n+1}\left|1 + \frac{8\,nK_o}{3\,(2\,n+3)\,M}\right| f^n\,(2-f)^n,\qquad [2]$$

and for our needs:

$$C_{20} = +\frac{1}{3}\left|1 - \frac{4\,\varepsilon^3\,a_3^{\varepsilon}\,(1+\varepsilon^2)\,\omega^2}{15\,M\,G\,\{(3+\varepsilon^2)\,\mathrm{arctg}\,\varepsilon - 3\,\varepsilon\}}\right|(f-2)\,f\,,\qquad [2']$$

with:

$$\varepsilon^2 = \frac{a_1^2 - a_3^2}{a_3^2} = \frac{f\,(2-f)}{(1-f)^2} = \sum_{0}^{\infty}(2+n)\,f^{n+1}$$

second eccentricity.

Where $a_3 = a_1 (1 - f)$ is the polar radius of the normal ellipsoid; and we assume the Earth's rotation rate:

$$\omega = 0.72921151 \cdot 10^{-4} \sec^{-1} .$$

The Pizzetti and Clairaut theorems are [1]:

$$g_{a3} = \frac{a_3 \, g_{a1}}{a_1} + \omega^2 \, a_3 \left[ \frac{5}{2} + \frac{3}{2} \, \varepsilon^2 \frac{\sum\limits_0^\infty \frac{(n + 1) \, \varepsilon^{2n} \, (- 1)^n}{(2 \, n + 5) \, (2 \, n + 7)}}{\sum\limits_0^\infty \frac{(n + 1) \, \varepsilon^{2n} \, (- 1)^n}{(2 \, n + 3) \, (2 \, n + 5)}} \right] \qquad [3]$$

$$2 \, \omega^2 \, a_1^2 \, a_3 + 2 \, g_{a1} \, a_1 \, a_3 + g_{a3} \, a_1^2 = 3 \, G \, M , \qquad [4]$$

where:

$g_{a1}$ is the acceleration of gravity at the equator,

$g_{a3}$ is the acceleration of gravity at the Earth's pole.

We can compute $g_{a1}$ and $g_{a3}$ using [3] and [4].
The closed expression of the normal gravity is [1]:

$$g = g_{a1} \frac{1 + (a - f - f \, a) \sin^2 \varphi}{[1 - f \, (2 - f) \sin^2 \varphi]^{1/2}} , \qquad [5]$$

where:

$$a = \frac{g_{a3} - g_{a1}}{g_{a1}} .$$

For the numerical computation of $f$ from [2'] we have:

$$f^3 - f^2 \left[ \frac{15 \, M \, G \sum\limits_n^\infty \frac{(- 1)^n \, \varepsilon^{2n} \, (n + 1)}{(2 \, n + 3) \, (2 \, n + 5)}}{a_1^3 \, \omega^2} + 3 \right] +$$

$$+ f \left[ 3 + \frac{30 \, M \, G}{a_1^3 \, \omega^2} \sum\limits_n^\infty \frac{(- 1)^n \, \varepsilon^{2n} \, (n + 1)}{(2 \, n + 3) \, (2 \, n + 5)} \right] +$$

$$+ \frac{45 \, M \, G \, C_{20}}{a_1^3 \, \omega^2} \sum\limits_0^\infty \frac{(- 1)^n \, \varepsilon^{2n} \, (n + 1)}{(2n + 3) \, (2 \, n + 5)} - 1 = 0 ,$$

which gives with the adopted values [1]:

$$f^{-1} = 298.247047 .$$

For the numerical computation of $g_{a1}$ and $g_{a3}$ we have from [2] and [3]:

$$g_{a1} = \frac{M\,G}{a_1^2\,(1-f)} - \frac{2}{3}\,\omega^2\,a_1 - \frac{\omega^2\,a_1}{3} \left\{ \frac{5}{2} + \frac{2}{3}\,\varepsilon^2\, \frac{\sum\limits_0^\infty \dfrac{(n+1)\,\varepsilon^{2n}\,(-1)^n}{(2\,n+5)\,(2\,n+7)}}{\dfrac{(n+1)\,\varepsilon^{2n}\,(-1)^n}{(2\,n+3)\,(2\,n+5)}} \right\}$$

$$g_{a3} = \frac{M\,G}{a_1^2} - \frac{2}{3}\,\omega^2\,a_1\,(1-f) + \frac{2}{3}\,\omega^2\,a_1\,(1-f)$$

$$\left\{ \frac{5}{2} + \frac{3}{2}\,\varepsilon^2\, \frac{\sum\limits_0^\infty \dfrac{(n+1)\,\varepsilon^{2n}\,(-1)^n}{(2\,n+5)\,(2\,n+7)}}{\sum\limits_0^\infty \dfrac{(n+1)\,\varepsilon^{2n}\,(-1)^n}{(2\,n+3)\,(2\,n+5)}} \right\} .$$

Using the above-mentioned numerical values [1] we obtain:

$$g_{a1} = 978.03101$$

$$g_{a3} = 983.21689$$

$$a = 5.3023715 \cdot 10^{-3} ,$$

from these we can write:

$$g = 978.03101 \frac{1 + .00193167 \sin^2 \varphi}{[1 - .00669461 \sin^2 \varphi]^{1/2}} , \qquad [4']$$

which gives the normal gravity.

According to the closed formulae [2'], [3] and [4], the flattening $f$ and the normal gravity have been calculated with an approximation which is limited only by the approximation with which the parameters are known.

We add in Table I the values of modulus of the gravity vector on the adopted ellipsoid, for $\varphi$ varying from 0º to 90º, with a pass of 1'.

## Table I

| 0° | 0′ 978.03101 | 1° | 0′ | .03258 | 2° | 0′ 978.03730 | 3° | 0′ 978.04515 |
|---|---|---|---|---|---|---|---|---|
| | 1′ .03101 | | 1′ | .03263 | | 1′ .03740 | | 1′ .04531 |
| | 2′ .03101 | | 2′ | .03269 | | 2′ .03751 | | 2′ .04547 |
| | 3′ .03101 | | 3′ | .03274 | | 3′ .03762 | | 3′ .04563 |
| | 4′ .03102 | | 4′ | .03280 | | 4′ .03772 | | 4′ .04579 |
| | 5′ .03102 | | 5′ | .03285 | | 5′ .03783 | | 5′ .04595 |
| | 6′ .03102 | | 6′ | .03191 | | 6′ .03794 | | 6′ .04611 |
| | 7′ .03103 | | 7′ | .03297 | | 7′ .03805 | | 7′ .04627 |
| | 8′ .03104 | | 8′ | .03303 | | 8′ .03816 | | 8′ .04643 |
| | 9′ .03104 | | 9′ | .03309 | | 9′ .03828 | | 9′ .04660 |
| | 10′ .03105 | | 10′ | .03315 | | 10′ .03839 | | 10′ .04676 |
| | 11′ .03106 | | 11′ | .03321 | | 11′ .03850 | | 11′ .04693 |
| | 12′ .03107 | | 12′ | .03327 | | 12′ .03862 | | 12′ .04710 |
| | 13′ .03108 | | 13′ | .03334 | | 13′ .03873 | | 13′ .04726 |
| | 14′ .03109 | | 14′ | .03340 | | 14′ .03885 | | 14′ .04743 |
| | 15′ .03111 | | 15′ | .03347 | | 15′ .03897 | | 15′ .04760 |
| | 16′ .03112 | | 16′ | .03353 | | 16′ .03908 | | 16′ .04777 |
| | 17′ .03113 | | 17′ | .03360 | | 17′ .03920 | | 17′ .04794 |
| | 18′ .03115 | | 18′ | .03367 | | 18′ .03932 | | 18′ .04812 |
| | 19′ .03117 | | 19′ | .03373 | | 19′ .03944 | | 19′ .04829 |
| | 20′ .03118 | | 20′ | .03380 | | 20′ .03957 | | 20′ .04846 |
| | 21′ .03120 | | 21′ | .03387 | | 21′ .03969 | | 21′ .04864 |
| | 22′ .03122 | | 22′ | .03395 | | 22′ .03981 | | 22′ .04881 |
| | 23′ .03124 | | 23′ | .03402 | | 23′ .03994 | | 23′ .04899 |
| | 24′ .03126 | | 24′ | .03409 | | 24′ .04006 | | 24′ .04917 |
| | 25′ .03128 | | 25′ | .03416 | | 25′ .04019 | | 25′ .04935 |
| | 26′ .03130 | | 26′ | .03424 | | 26′ .04032 | | 26′ .04953 |
| | 27′ .03133 | | 27′ | .03431 | | 27′ .04044 | | 27′ .04971 |
| | 28′ .03135 | | 28′ | .03439 | | 28′ .04057 | | 28′ .04989 |
| | 29′ .03138 | | 29′ | .03447 | | 29′ .04070 | | 29′ .05007 |
| | 30′ .03140 | | 30′ | .03455 | | 30′ .04083 | | 30′ .05025 |
| | 31′ .03143 | | 31′ | .03463 | | 31′ .04096 | | 31′ .05043 |
| | 32′ .03146 | | 32′ | .03471 | | 32′ .04110 | | 32′ .05062 |
| | 33′ .03148 | | 33′ | .03479 | | 33′ .04123 | | 33′ .05080 |
| | 34′ .03151 | | 34′ | .03487 | | 34′ .04136 | | 34′ .05099 |
| | 35′ .03154 | | 35′ | .03495 | | 35′ .04150 | | 35′ .05118 |
| | 36′ .03157 | | 36′ | .03503 | | 36′ .04163 | | 36′ .05136 |
| | 37′ .03161 | | 37′ | .03512 | | 37′ .04177 | | 37′ .05155 |
| | 38′ .03164 | | 38′ | .03520 | | 38′ .04191 | | 38′ .05174 |
| | 39′ .03167 | | 39′ | .03529 | | 39′ .04205 | | 39′ .05193 |
| | 40′ .03171 | | 40′ | .03538 | | 40′ .04218 | | 40′ .05212 |
| | 41′ .03174 | | 41′ | .03546 | | 41′ .04232 | | 41′ .05232 |
| | 42′ .03178 | | 42′ | .03555 | | 42′ .04247 | | 42′ .05251 |
| | 43′ .03182 | | 43′ | .03564 | | 43′ .04261 | | 43′ .05270 |
| | 44′ .03185 | | 44′ | .03573 | | 44′ .04275 | | 44′ .05290 |
| | 45′ .03189 | | 45′ | .03582 | | 45′ .04289 | | 45′ .05309 |
| | 46′ .03193 | | 46′ | .03592 | | 46′ .04304 | | 46′ .05329 |
| | 47′ .03197 | | 47′ | .03601 | | 47′ .04318 | | 47′ .05349 |
| | 48′ .03201 | | 48′ | .03610 | | 48′ .04333 | | 48′ .05369 |
| | 49′ .03206 | | 49′ | .03620 | | 49′ .04348 | | 49′ .05388 |
| | 50′ .03210 | | 50′ | .03629 | | 50′ .04362 | | 50′ .05408 |
| | 51′ .03214 | | 51′ | .03639 | | 51′ .04377 | | 51′ .05429 |
| | 52′ .03219 | | 52′ | .03649 | | 52′ .04392 | | 52′ .05449 |
| | 53′ .03224 | | 53′ | .03658 | | 53′ .04407 | | 53′ .05469 |
| | 54′ .03228 | | 54′ | .03668 | | 54′ .04422 | | 54′ .05489 |
| | 55′ .03233 | | 55′ | .03678 | | 55′ .04438 | | 55′ .05510 |
| | 56′ .03238 | | 56′ | .03688 | | 56′ .04453 | | 56′ .05530 |
| | 57′ .03243 | | 57′ | .03699 | | 57′ .04468 | | 57′ .05551 |
| | 58′ .03248 | | 58′ | .03709 | | 58′ .04484 | | 58′ .05572 |
| | 59′ .03253 | | 59′ | .03719 | | 59′ .04499 | | 59′ .05592 |

Table I – (continued)

| 4° | | 5° | | 6° | | 7° | |
|---|---|---|---|---|---|---|---|
| 0′ | 978.05613 | 0′ | 978.07023 | 0′ | 978.08742 | 0′ | 978.10769 |
| 1′ | .05634 | 1′ | .07049 | 1′ | .08774 | 1′ | .10806 |
| 2′ | .05655 | 2′ | .07075 | 2′ | .08805 | 2′ | .10842 |
| 3′ | .05676 | 3′ | .07101 | 3′ | .08836 | 3′ | .10879 |
| 4′ | .05697 | 4′ | .07128 | 4′ | .08868 | 4′ | .10916 |
| 5′ | .05719 | 5′ | .07154 | 5′ | .08900 | 5′ | .10952 |
| 6′ | .05740 | 6′ | .07181 | 6′ | .08931 | 6′ | .10989 |
| 7′ | .05762 | 7′ | .07208 | 7′ | .08963 | 7′ | .11026 |
| 8′ | .05783 | 8′ | .07234 | 8′ | .08995 | 8′ | .11063 |
| 9′ | .05805 | 9′ | .07261 | 9′ | .09027 | 9′ | .11100 |
| 10′ | .05827 | 10′ | .07288 | 10′ | .09059 | 10′ | .11137 |
| 11′ | .05848 | 11′ | .07315 | 11′ | .09091 | 11′ | .11174 |
| 12′ | .05870 | 12′ | .07342 | 12′ | .09123 | 12′ | .11212 |
| 13′ | .05892 | 13′ | .07369 | 13′ | .09155 | 13′ | .11249 |
| 14′ | .05914 | 14′ | .07396 | 14′ | .09188 | 14′ | .11287 |
| 15′ | .05936 | 15′ | .07424 | 15′ | .09220 | 15′ | .11324 |
| 16′ | .05959 | 16′ | .07451 | 16′ | .09253 | 16′ | .11362 |
| 17′ | .05981 | 17′ | .07479 | 17′ | .09286 | 17′ | .11399 |
| 18′ | .06003 | 18′ | .07506 | 18′ | .09318 | 18′ | .11437 |
| 19′ | .06026 | 19′ | .07534 | 19′ | .09351 | 19′ | .11475 |
| 20′ | .06049 | 20′ | .07562 | 20′ | .09384 | 20′ | .11513 |
| 21′ | .06071 | 21′ | .07590 | 21′ | .09417 | 21′ | .11551 |
| 22′ | .06094 | 22′ | .07617 | 22′ | .09450 | 22′ | .11589 |
| 23′ | .06117 | 23′ | .07645 | 23′ | .09483 | 23′ | .11628 |
| 24′ | .06140 | 24′ | .07674 | 24′ | .09516 | 24′ | .11666 |
| 25′ | .06163 | 25′ | .07702 | 25′ | .09550 | 25′ | .11704 |
| 26′ | .06186 | 26′ | .07730 | 26′ | .09583 | 26′ | .11743 |
| 27′ | .06209 | 27′ | .07758 | 27′ | .09617 | 27′ | .11781 |
| 28′ | .06232 | 28′ | .07787 | 28′ | .09650 | 28′ | .11820 |
| 29′ | .06256 | 29′ | .07815 | 29′ | .09684 | 29′ | .11859 |
| 30′ | .06279 | 30′ | .07844 | 30′ | .09718 | 30′ | .11898 |
| 31′ | .06303 | 31′ | .07873 | 31′ | .09751 | 31′ | .11937 |
| 32′ | .06326 | 32′ | .07901 | 32′ | .09785 | 32′ | .11976 |
| 33′ | .06350 | 33′ | .07930 | 33′ | .09819 | 33′ | .12015 |
| 34′ | .06374 | 34′ | .07959 | 34′ | .09853 | 34′ | .12054 |
| 35′ | .06398 | 35′ | .07988 | 35′ | .09888 | 35′ | .12093 |
| 36′ | .06422 | 36′ | .08017 | 36′ | .09922 | 36′ | .12133 |
| 37′ | .06446 | 37′ | .08047 | 37′ | .09956 | 37′ | .12172 |
| 38′ | .06470 | 38′ | .08076 | 38′ | .09991 | 38′ | .12211 |
| 39′ | .06494 | 39′ | .08105 | 39′ | .10025 | 39′ | .12251 |
| 40′ | .06518 | 40′ | .08135 | 40′ | .10060 | 40′ | .12291 |
| 41′ | .06543 | 41′ | .08164 | 41′ | .10094 | 41′ | .12330 |
| 42′ | .06567 | 42′ | .08194 | 42′ | .10129 | 42′ | .12370 |
| 43′ | .06592 | 43′ | .08224 | 43′ | .10164 | 43′ | .12410 |
| 44′ | .06617 | 44′ | .08254 | 44′ | .10199 | 44′ | .12450 |
| 45′ | .06641 | 45′ | .08284 | 45′ | .10234 | 45′ | .12490 |
| 46′ | .06666 | 46′ | .08313 | 46′ | .10269 | 46′ | .12531 |
| 47′ | .06691 | 47′ | .08344 | 47′ | .10304 | 47′ | .12571 |
| 48′ | .06716 | 48′ | .08374 | 48′ | .10340 | 48′ | .12611 |
| 49′ | .06741 | 49′ | .08404 | 49′ | .10375 | 49′ | .12652 |
| 50′ | .06766 | 50′ | .08434 | 50′ | .10410 | 50′ | .12692 |
| 51′ | .06792 | 51′ | .08465 | 51′ | .10446 | 51′ | .12733 |
| 52′ | .06817 | 52′ | .08495 | 52′ | .10482 | 52′ | .12773 |
| 53′ | .06842 | 53′ | .08526 | 53′ | .10517 | 53′ | .12814 |
| 54′ | .06868 | 54′ | .08556 | 54′ | .10553 | 54′ | .12855 |
| 55′ | .06894 | 55′ | .08587 | 55′ | .10589 | 55′ | .12896 |
| 56′ | .06919 | 56′ | .08618 | 56′ | .10625 | 56′ | .12937 |
| 57′ | .06945 | 57′ | .08649 | 57′ | .10661 | 57′ | .12978 |
| 58′ | .06971 | 58′ | .08680 | 58′ | .10697 | 58′ | .13019 |
| 59′ | .06997 | 59′ | .08711 | 59′ | .10733 | 59′ | .13061 |

Table I – (continued)

| 8° | | 9° | | 10° | | 11° | |
|---|---|---|---|---|---|---|---|
| 0' 978 | .13102 | 0' 978 | .15737 | 0' 978 | .18671 | 0' 978 | .21901 |
| 1' | .13143 | 1' | .15783 | 1' | .18723 | 1' | .21958 |
| 2' | .13185 | 2' | .15830 | 2' | .18774 | 2' | .22014 |
| 3' | .13227 | 3' | .15877 | 3' | .18826 | 3' | .22071 |
| 4' | .13268 | 4' | .15923 | 4' | .18877 | 4' | .22127 |
| 5' | .13310 | 5' | .15970 | 5' | .18929 | 5' | .22184 |
| 6' | .13352 | 6' | .16017 | 6' | .18981 | 6' | .22240 |
| 7' | .13394 | 7' | .16064 | 7' | .19033 | 7' | .22297 |
| 8' | .13436 | 8' | .16111 | 8' | .19085 | 8' | .22354 |
| 9' | .13478 | 9' | .16158 | 9' | .19137 | 9' | .22411 |
| 10' | .13520 | 10' | .16205 | 10' | .19189 | 10' | .22468 |
| 11' | .13563 | 11' | .16253 | 11' | .19241 | 11' | .22525 |
| 12' | .13605 | 12' | .16300 | 12' | .19294 | 12' | .22583 |
| 13' | .13647 | 13' | .16347 | 13' | .19346 | 13' | .22640 |
| 14' | .13690 | 14' | .16395 | 14' | .19399 | 14' | .22697 |
| 15' | .13732 | 15' | .16443 | 15' | .19451 | 15' | .22755 |
| 16' | .13775 | 16' | .16490 | 16' | .19504 | 16' | .22812 |
| 17' | .13818 | 17' | .16538 | 17' | .19557 | 17' | .22870 |
| 18' | .13861 | 18' | .16586 | 18' | .19609 | 18' | .22927 |
| 19' | .13904 | 19' | .16634 | 19' | .19662 | 19' | .22985 |
| 20' | .13947 | 20' | .16682 | 20' | .19715 | 20' | .23043 |
| 21' | .13990 | 21' | .16730 | 21' | .19768 | 21' | .23101 |
| 22' | .14033 | 22' | .16778 | 22' | .19821 | 22' | .23159 |
| 23' | .14076 | 23' | .16827 | 23' | .19875 | 23' | .23217 |
| 24' | .14120 | 24' | .16875 | 24' | .19928 | 24' | .23275 |
| 25' | .14163 | 25' | .16923 | 25' | .19981 | 25' | .23334 |
| 26' | .14207 | 26' | .16972 | 26' | .20035 | 26' | .23392 |
| 27' | .14250 | 27' | .17021 | 27' | .20088 | 27' | .23450 |
| 28' | .14294 | 28' | .17069 | 28' | .20142 | 28' | .23509 |
| 29' | .14338 | 29' | .17118 | 29' | .20196 | 29' | .23567 |
| 30' | .14382 | 30' | .17167 | 30' | .20250 | 30' | .23626 |
| 31' | .14426 | 31' | .17216 | 31' | .20303 | 31' | .23685 |
| 32' | .14470 | 32' | .17265 | 32' | .20357 | 32' | .23744 |
| 33' | .14514 | 33' | .17314 | 33' | .20411 | 33' | .23803 |
| 34' | .14558 | 34' | .17363 | 34' | .20466 | 34' | .23862 |
| 35' | .14602 | 35' | .17412 | 35' | .20520 | 35' | .23921 |
| 36' | .14647 | 36' | .17462 | 36' | .20574 | 36' | .23980 |
| 37' | .14691 | 37' | .17511 | 37' | .20628 | 37' | .24039 |
| 38' | .14736 | 38' | .17561 | 38' | .20683 | 38' | .24098 |
| 39' | .14780 | 39' | .17610 | 39' | .20737 | 39' | .24158 |
| 40' | .14825 | 40' | .17660 | 40' | .20792 | 40' | .24217 |
| 41' | .14870 | 41' | .17710 | 41' | .20847 | 41' | .24277 |
| 42' | .14915 | 42' | .17760 | 42' | .20901 | 42' | .24336 |
| 43' | .14960 | 43' | .17810 | 43' | .20956 | 43' | .24396 |
| 44' | .15005 | 44' | .17860 | 44' | .21011 | 44' | .24456 |
| 45' | .15050 | 45' | .17910 | 45' | .21066 | 45' | .24516 |
| 46' | .15095 | 46' | .17960 | 46' | .21121 | 46' | .24576 |
| 47' | .15141 | 47' | .18010 | 47' | .21177 | 47' | .24636 |
| 48' | .15186 | 48' | .18061 | 48' | .21232 | 48' | .24696 |
| 49' | .15231 | 49' | .18111 | 49' | .21287 | 49' | .24756 |
| 50' | .15277 | 50' | .18162 | 50' | .21343 | 50' | .24816 |
| 51' | .15323 | 51' | .18212 | 51' | .21398 | 51' | .24877 |
| 52' | .15368 | 52' | .18263 | 52' | .21454 | 52' | .24937 |
| 53' | .15414 | 53' | .18314 | 53' | .21509 | 53' | .24998 |
| 54' | .15460 | 54' | .18364 | 54' | .21565 | 54' | .25058 |
| 55' | .15506 | 55' | .18415 | 55' | .21621 | 55' | .25119 |
| 56' | .15552 | 56' | .18466 | 56' | .21677 | 56' | .25180 |
| 57' | .15598 | 57' | .18517 | 57' | .21733 | 57' | .25240 |
| 58' | .15644 | 58' | .18569 | 58' | .21789 | 58' | .25301 |
| 59' | .15691 | 59' | .18620 | 59' | .21845 | 59' | .25362 |

Table I – (continued)

| 12° 0′ 978 | .25423 | 13° 0′ 978 | .29233 | 14° 0′ 978 | .33326 | 15° 0′ 978 | .37697 |
|---|---|---|---|---|---|---|---|
| 1′ | .25484 | 1′ | .29299 | 1′ | .33396 | 1′ | .37772 |
| 2′ | .25546 | 2′ | .29365 | 2′ | .33467 | 2′ | .37847 |
| 3′ | .25607 | 3′ | .29431 | 3′ | .33538 | 3′ | .37922 |
| 4′ | .25668 | 4′ | .29497 | 4′ | .33609 | 4′ | .37998 |
| 5′ | .25730 | 5′ | .29563 | 5′ | .33679 | 5′ | .38073 |
| 6′ | .25791 | 6′ | .29630 | 6′ | .33750 | 6′ | .38149 |
| 7′ | .25853 | 7′ | .29696 | 7′ | .33821 | 7′ | .38224 |
| 8′ | .25915 | 8′ | .29762 | 8′ | .33893 | 8′ | .38300 |
| 9′ | .25977 | 9′ | .29829 | 9′ | .33964 | 9′ | .38376 |
| 10′ | .26038 | 10′ | .29896 | 10′ | .34035 | 10′ | .38452 |
| 11′ | .26100 | 11′ | .29962 | 11′ | .34106 | 11′ | .38528 |
| 12′ | .26162 | 12′ | .30029 | 12′ | .34178 | 12′ | .38604 |
| 13′ | .26224 | 13′ | .30096 | 13′ | .34249 | 13′ | .38680 |
| 14′ | .26287 | 14′ | .30163 | 14′ | .34321 | 14′ | .38756 |
| 15′ | .26349 | 15′ | .30230 | 15′ | .34393 | 15′ | .38832 |
| 16′ | .26411 | 16′ | .30297 | 16′ | .34464 | 16′ | .38908 |
| 17′ | .26474 | 17′ | .30364 | 17′ | .34536 | 17′ | .38985 |
| 18′ | .26536 | 18′ | .30431 | 18′ | .34608 | 18′ | .39061 |
| 19′ | .26599 | 19′ | .30499 | 19′ | .34680 | 19′ | .39138 |
| 20′ | .26661 | 20′ | .30566 | 20′ | .34752 | 20′ | .39214 |
| 21′ | .26724 | 21′ | .30633 | 21′ | .34824 | 21′ | .39291 |
| 22′ | .26787 | 22′ | .30701 | 22′ | .34896 | 22′ | .39368 |
| 23′ | .26850 | 23′ | .30769 | 23′ | .34969 | 23′ | .39445 |
| 24′ | .26913 | 24′ | .30836 | 24′ | .35041 | 24′ | .39522 |
| 25′ | .26976 | 25′ | .30904 | 25′ | .35113 | 25′ | .39599 |
| 26′ | .27039 | 26′ | .30972 | 26′ | .35186 | 26′ | .39676 |
| 27′ | .27102 | 27′ | .31040 | 27′ | .35258 | 27′ | .39753 |
| 28′ | .27166 | 28′ | .31108 | 28′ | .35331 | 28′ | .39830 |
| 29′ | .27229 | 29′ | .31176 | 29′ | .35404 | 29′ | .39907 |
| 30′ | .27292 | 30′ | .31244 | 30′ | .35477 | 30′ | .39985 |
| 31′ | .27356 | 31′ | .31313 | 31′ | .35550 | 31′ | .40062 |
| 32′ | .27420 | 32′ | .31381 | 32′ | .35623 | 32′ | .40140 |
| 33′ | .27483 | 33′ | .31449 | 33′ | .35696 | 33′ | .40217 |
| 34′ | .27547 | 34′ | .31518 | 34′ | .35769 | 34′ | .40295 |
| 35′ | .27611 | 35′ | .31586 | 35′ | .35842 | 35′ | .40373 |
| 36′ | .27675 | 36′ | .31655 | 36′ | .35915 | 36′ | .40450 |
| 37′ | .27739 | 37′ | .31724 | 37′ | .35989 | 37′ | .40528 |
| 38′ | .27803 | 38′ | .31792 | 38′ | .36062 | 38′ | .40606 |
| 39′ | .27867 | 39′ | .31861 | 39′ | .36135 | 39′ | .40684 |
| 40′ | .27931 | 40′ | .31930 | 40′ | .36209 | 40′ | .40762 |
| 41′ | .27996 | 41′ | .31999 | 41′ | .36283 | 41′ | .40841 |
| 42′ | .28060 | 42′ | .32068 | 42′ | .36356 | 42′ | .40919 |
| 43′ | .28125 | 43′ | .32138 | 43′ | .36430 | 43′ | .40997 |
| 44′ | .28189 | 44′ | .32207 | 44′ | .36504 | 44′ | .41076 |
| 45′ | .28254 | 45′ | .32276 | 45′ | .36578 | 45′ | .41154 |
| 46′ | .28319 | 46′ | .32346 | 46′ | .36652 | 46′ | .41233 |
| 47′ | .28383 | 47′ | .32415 | 47′ | .36726 | 47′ | .41311 |
| 48′ | .28448 | 48′ | .32485 | 48′ | .36800 | 48′ | .41390 |
| 49′ | .28513 | 49′ | .32554 | 49′ | .36875 | 49′ | .41469 |
| 50′ | .28578 | 50′ | .32624 | 50′ | .36949 | 50′ | .41548 |
| 51′ | .28643 | 51′ | .32694 | 51′ | .37023 | 51′ | .41627 |
| 52′ | .28709 | 52′ | .32764 | 52′ | .37098 | 52′ | .41706 |
| 53′ | .28774 | 53′ | .32834 | 53′ | .37172 | 52′ | .41785 |
| 54′ | .28839 | 54′ | .32904 | 54′ | .37247 | 54′ | .41864 |
| 55′ | .28905 | 55′ | .32974 | 55′ | .37322 | 55′ | .41943 |
| 56′ | .28970 | 56′ | .33044 | 56′ | .37397 | 56′ | .42022 |
| 57′ | .29036 | 57′ | .33114 | 57′ | .37472 | 57′ | .42102 |
| 58′ | .29101 | 58′ | .33185 | 58′ | .37546 | 58′ | .42181 |
| 59′ | .29167 | 59′ | .33255 | 59′ | .37621 | 59′ | .42261 |

Table I – (continued)

| 16° | | 17° | | 18° | | 19° | |
|---|---|---|---|---|---|---|---|
| 0′ | 978.42340 | 0′ | 978.47251 | 0′ | 978.52424 | 0′ | 978.57851 |
| 1′ | .42420 | 1′ | .47335 | 1′ | .52512 | 1′ | .57944 |
| 2′ | .42500 | 2′ | .47420 | 2′ | .52601 | 2′ | .58037 |
| 3′ | .42580 | 3′ | .47504 | 3′ | .52689 | 3′ | .58129 |
| 4′ | .42660 | 4′ | .47588 | 4′ | .52778 | 4′ | .58222 |
| 5′ | .42739 | 5′ | .47673 | 5′ | .52866 | 5′ | .58315 |
| 6′ | .42820 | 6′ | .47757 | 6′ | .52955 | 6′ | .58408 |
| 7′ | .42900 | 7′ | .47842 | 7′ | .53044 | 7′ | .58501 |
| 8′ | .42980 | 8′ | .47926 | 8′ | .53133 | 8′ | .58594 |
| 9′ | .43060 | 9′ | .48011 | 9′ | .53222 | 9′ | .58687 |
| 10′ | .43140 | 10′ | .48096 | 10′ | .53311 | 10′ | .58780 |
| 11′ | .43221 | 11′ | .48180 | 11′ | .53400 | 11′ | .58874 |
| 12′ | .43301 | 12′ | .48265 | 12′ | .53489 | 12′ | .58967 |
| 13′ | .43382 | 13′ | .48350 | 13′ | .53578 | 13′ | .59060 |
| 14′ | .43463 | 14′ | .48435 | 14′ | .53668 | 14′ | .59154 |
| 15′ | .43543 | 15′ | .48520 | 15′ | .53757 | 15′ | .59247 |
| 16′ | .43624 | 16′ | .48605 | 16′ | .53847 | 16′ | .59341 |
| 17′ | .43705 | 17′ | .48691 | 17′ | .53936 | 17′ | .59435 |
| 18′ | .43786 | 18′ | .48776 | 18′ | .54026 | 18′ | .59528 |
| 19′ | .43867 | 19′ | .48861 | 19′ | .54115 | 19′ | .59622 |
| 20′ | .43948 | 20′ | .48947 | 20′ | .54205 | 20′ | .59716 |
| 21′ | .44029 | 21′ | .49032 | 21′ | .54295 | 21′ | .59810 |
| 22′ | .44110 | 22′ | .49118 | 22′ | .54385 | 22′ | .59904 |
| 23′ | .44192 | 23′ | .49204 | 23′ | .54475 | 23′ | .59998 |
| 24′ | .44273 | 24′ | .49289 | 24′ | .54565 | 24′ | .60092 |
| 25′ | .44354 | 25′ | .49375 | 25′ | .54655 | 25′ | .60187 |
| 26′ | .44436 | 26′ | .49461 | 26′ | .54745 | 26′ | .60281 |
| 27′ | .44518 | 27′ | .49547 | 27′ | .54835 | 27′ | .60375 |
| 28′ | .44599 | 28′ | .49633 | 28′ | .54925 | 28′ | .60470 |
| 29′ | .44681 | 29′ | .49719 | 29′ | .55016 | 29′ | .60564 |
| 30′ | .44763 | 30′ | .49805 | 30′ | .55106 | 30′ | .60659 |
| 31′ | .44845 | 31′ | .49892 | 31′ | .55197 | 31′ | .60754 |
| 32′ | .44927 | 32′ | .49978 | 32′ | .55287 | 32′ | .60848 |
| 33′ | .45009 | 33′ | .50064 | 33′ | .55378 | 33′ | .60943 |
| 34′ | .45091 | 34′ | .50151 | 34′ | .55469 | 34′ | .61038 |
| 34′ | .45173 | 35′ | .50237 | 35′ | .55559 | 35′ | .61133 |
| 35′ | .45255 | 36′ | .50324 | 36′ | .55650 | 36′ | .61228 |
| 37′ | .45338 | 37′ | .50411 | 37′ | .55741 | 37′ | .61323 |
| 38′ | .45420 | 38′ | .50497 | 38′ | .55832 | 38′ | .61418 |
| 39′ | .45503 | 39′ | .50584 | 39′ | .55923 | 39′ | .61513 |
| 40′ | .45585 | 40′ | .50671 | 40′ | .56014 | 40′ | .61608 |
| 41′ | .45668 | 41′ | .50758 | 41′ | .56105 | 41′ | .61704 |
| 42′ | .45750 | 42′ | .50845 | 42′ | .56197 | 42′ | .61799 |
| 43′ | .45833 | 43′ | .50932 | 43′ | .56288 | 43′ | .61895 |
| 44′ | .45916 | 44′ | .51019 | 44′ | .56379 | 44′ | .61990 |
| 45′ | .45999 | 45′ | .51107 | 45′ | .56471 | 45′ | .62086 |
| 46′ | .46082 | 46′ | .51194 | 46′ | .56563 | 46′ | .62181 |
| 47′ | .46165 | 47′ | .51281 | 47′ | .56654 | 47′ | .62277 |
| 48′ | .46249 | 48′ | .51369 | 48′ | .56746 | 48′ | .62373 |
| 49′ | .46331 | 49′ | .51456 | 49′ | .56838 | 49′ | .62469 |
| 50′ | .46415 | 50′ | .51544 | 50′ | .56929 | 50′ | .62564 |
| 51′ | .46498 | 51′ | .51632 | 51′ | .57021 | 51′ | .62661 |
| 52′ | .46581 | 52′ | .51719 | 52′ | .57113 | 52′ | .62757 |
| 53′ | .46665 | 53′ | .51807 | 53′ | .57205 | 53′ | .62853 |
| 54′ | .46748 | 54′ | .51895 | 54′ | .57297 | 54′ | .62949 |
| 55′ | .46832 | 55′ | .51983 | 55′ | .57390 | 55′ | .63045 |
| 56′ | .46916 | 56′ | .52071 | 56′ | .57482 | 56′ | .63142 |
| 57′ | .47000 | 57′ | .52159 | 57′ | .57574 | 57′ | .63238 |
| 58′ | .47083 | 58′ | .52247 | 58′ | .57666 | 58′ | .63334 |
| 59′ | .47167 | 59′ | .52336 | 59′ | .57759 | 59′ | .63431 |

Table I — (continued)

| 20° | | 21° | | 22° | | 23° | |
|---|---|---|---|---|---|---|---|
| 0′ | 978.63528 | 0′ | 978.69446 | 0′ | 978.75598 | 0′ | 978.81978 |
| 1′ | .63624 | 1′ | .69546 | 1′ | .75703 | 1′ | .82086 |
| 2′ | .63721 | 2′ | .69647 | 2′ | .75807 | 2′ | .82194 |
| 3′ | .63818 | 3′ | .69748 | 3′ | .75912 | 3′ | .82303 |
| 4′ | .63915 | 4′ | .69848 | 4′ | .76016 | 4′ | .82411 |
| 5′ | .64012 | 5′ | .69949 | 5′ | .76121 | 5′ | .82520 |
| 6′ | .64109 | 6′ | .70050 | 6′ | .76226 | 6′ | .82628 |
| 7′ | .64206 | 7′ | .70151 | 7′ | .76331 | 7′ | .82737 |
| 8′ | .64303 | 8′ | .70252 | 8′ | .76436 | 8′ | .82845 |
| 9′ | .64400 | 9′ | .70354 | 9′ | .76541 | 9′ | .82954 |
| 10′ | .64497 | 10′ | .70455 | 10′ | .76646 | 10′ | .83063 |
| 11′ | .64595 | 11′ | .70556 | 11′ | .76751 | 11′ | .83172 |
| 12′ | .64692 | 12′ | .70658 | 12′ | .76856 | 12′ | .83280 |
| 13′ | .64790 | 13′ | .70759 | 13′ | .76961 | 13′ | .83389 |
| 14′ | .64887 | 14′ | .70860 | 14′ | .77067 | 14′ | .83498 |
| 15′ | .64985 | 15′ | .70962 | 15′ | .77172 | 15′ | .83607 |
| 16′ | .65082 | 16′ | .71064 | 16′ | .77277 | 16′ | .83717 |
| 17′ | .65180 | 17′ | .71165 | 17′ | .77383 | 17′ | .83826 |
| 18′ | .65278 | 18′ | .71267 | 18′ | .77489 | 18′ | .83935 |
| 19′ | .65376 | 19′ | .71369 | 19′ | .77594 | 19′ | .84044 |
| 20′ | .65474 | 20′ | .71471 | 20′ | .77700 | 20′ | .84154 |
| 21′ | .65572 | 21′ | .71573 | 21′ | .77806 | 21′ | .84263 |
| 22′ | .65670 | 22′ | .71675 | 22′ | .77911 | 22′ | .84373 |
| 23′ | .65768 | 23′ | .71777 | 23′ | .78017 | 23′ | .84482 |
| 24′ | .65866 | 24′ | .71879 | 24′ | .78123 | 24′ | .84592 |
| 25′ | .65964 | 25′ | .71981 | 25′ | .78229 | 25′ | .84701 |
| 26′ | .66063 | 26′ | .72083 | 26′ | .78335 | 26′ | .84811 |
| 27′ | .66161 | 27′ | .72186 | 27′ | .78441 | 27′ | .84921 |
| 28′ | .66260 | 28′ | .72288 | 28′ | .78548 | 28′ | .85031 |
| 29′ | .66358 | 29′ | .72390 | 29′ | .78654 | 29′ | .85141 |
| 30′ | .66457 | 30′ | .72493 | 30′ | .78760 | 30′ | .85251 |
| 31′ | .66555 | 31′ | .72596 | 31′ | .78866 | 31′ | .85361 |
| 32′ | .66654 | 32′ | .72698 | 32′ | .78973 | 32′ | .85471 |
| 33′ | .66753 | 33′ | .71801 | 33′ | .79079 | 33′ | .85581 |
| 34′ | .66852 | 34′ | .72904 | 34′ | .79186 | 34′ | .85691 |
| 35′ | .66951 | 35′ | .73006 | 35′ | .79292 | 35′ | .85801 |
| 36′ | .67050 | 36′ | .73109 | 36′ | .79399 | 36′ | .85912 |
| 37′ | .67149 | 37′ | .73212 | 37′ | .79506 | 37′ | .86022 |
| 38′ | .67248 | 38′ | .73315 | 38′ | .79613 | 38′ | .86132 |
| 39′ | .67347 | 39′ | .73418 | 39′ | .79720 | 39′ | .86243 |
| 40′ | .67446 | 40′ | .73522 | 40′ | .79826 | 40′ | .86353 |
| 41′ | .67546 | 41′ | .73625 | 41′ | .79933 | 41′ | .86464 |
| 42′ | .67645 | 42′ | .73728 | 42′ | .80041 | 42′ | .86575 |
| 43′ | .67745 | 43′ | .73831 | 43′ | .80148 | 43′ | .86685 |
| 44′ | .67844 | 44′ | .73935 | 44′ | .80255 | 44′ | .86796 |
| 45′ | .67944 | 45′ | .74038 | 45′ | .80362 | 45′ | .86907 |
| 46′ | .68043 | 46′ | .74142 | 46′ | .80469 | 46′ | .87018 |
| 47′ | .68143 | 47′ | .74246 | 47′ | .80577 | 47′ | .87129 |
| 48′ | .68243 | 48′ | .74349 | 48′ | .80684 | 48′ | .87240 |
| 49′ | .68343 | 49′ | .74453 | 49′ | .80792 | 49′ | .87351 |
| 50′ | .68443 | 50′ | .74557 | 50′ | .80899 | 50′ | .87462 |
| 51′ | .68543 | 51′ | .74661 | 51′ | .81007 | 51′ | .87574 |
| 52′ | .68643 | 52′ | .74764 | 52′ | .81114 | 52′ | .87685 |
| 53′ | .68743 | 53′ | .74868 | 53′ | .81222 | 53′ | .87796 |
| 54′ | .68843 | 54′ | .74972 | 54′ | .81330 | 54′ | .87908 |
| 55′ | .68943 | 55′ | .75077 | 55′ | .81438 | 55′ | .88019 |
| 56′ | .69044 | 56′ | .75181 | 56′ | .81546 | 56′ | .88130 |
| 57′ | .69144 | 57′ | .75285 | 57′ | .81654 | 57′ | .88242 |
| 58′ | .69244 | 58′ | .75389 | 58′ | .81762 | 58′ | .88354 |
| 59′ | .69345 | 59′ | .75494 | 59′ | .81870 | 59′ | .88465 |

Table I – (continued)

| | 24° | | 25° | | 26° | | 27° |
|---|---|---|---|---|---|---|---|
| 0′ | 978.88577 | 0′ | 978.95388 | 0′ | 979.02402 | 0′ | 979.09611 |
| 1′ | .88689 | 1′ | .95503 | 1′ | .02521 | 1′ | .09733 |
| 2′ | .88801 | 2′ | .95618 | 2′ | .02639 | 2′ | .09854 |
| 3′ | .88913 | 3′ | .95734 | 3′ | .02758 | 3′ | .09976 |
| 4′ | .89025 | 4′ | .95849 | 4′ | .02877 | 4′ | .10098 |
| 5′ | .89137 | 5′ | .95965 | 5′ | .02995 | 5′ | .10220 |
| 6′ | .89249 | 6′ | .96080 | 6′ | .03114 | 6′ | .10342 |
| 7′ | .89361 | 7′ | .96196 | 7′ | .03233 | 7′ | .10464 |
| 8′ | .89473 | 8′ | .96312 | 8′ | .03352 | 8′ | .10586 |
| 9′ | .89585 | 9′ | .96427 | 9′ | .03471 | 9′ | .10708 |
| 10′ | .89698 | 10′ | .96543 | 10′ | .03590 | 10′ | .10831 |
| 11′ | .89810 | 11′ | .96659 | 11′ | .03709 | 11′ | .10953 |
| 12′ | .89923 | 12′ | .96775 | 12′ | .03828 | 12′ | .11075 |
| 13′ | .90035 | 13′ | .96891 | 13′ | .03948 | 13′ | .11198 |
| 14′ | .90148 | 14′ | .97007 | 14′ | .04067 | 14′ | .11320 |
| 15′ | .90260 | 15′ | .97123 | 15′ | .04186 | 15′ | .11442 |
| 16′ | .90373 | 16′ | .97239 | 16′ | .04306 | 16′ | .11565 |
| 17′ | .90486 | 17′ | .97355 | 17′ | .04425 | 17′ | .11688 |
| 18′ | .90598 | 18′ | .97471 | 18′ | .04545 | 18′ | .11810 |
| 19′ | .90711 | 19′ | .97587 | 19′ | .04664 | 19′ | .11933 |
| 20′ | .90824 | 20′ | .97704 | 20′ | .04784 | 20′ | .12056 |
| 21′ | .90937 | 21′ | .97820 | 21′ | .04903 | 21′ | .12178 |
| 22′ | .91050 | 22′ | .97937 | 22′ | .05023 | 22′ | .12301 |
| 23′ | .91163 | 23′ | .98053 | 23′ | .05143 | 23′ | .12424 |
| 24′ | .91276 | 24′ | .98170 | 24′ | .05263 | 24′ | .12547 |
| 25′ | .91390 | 25′ | .98286 | 25′ | .05382 | 25′ | .12670 |
| 26′ | .91503 | 26′ | .98403 | 26′ | .05502 | 26′ | .12793 |
| 27′ | .91616 | 27′ | .98520 | 27′ | .05622 | 27′ | .12916 |
| 28′ | .91730 | 28′ | .98636 | 28′ | .05742 | 28′ | .13039 |
| 29′ | .91843 | 29′ | .98753 | 29′ | .05862 | 29′ | .13162 |
| 30′ | .91957 | 30′ | .98870 | 30′ | .05983 | 30′ | .13286 |
| 31′ | .92070 | 31′ | .98987 | 31′ | .06103 | 31′ | .13409 |
| 32′ | .92184 | 32′ | .99104 | 32′ | .06223 | 32′ | .13532 |
| 33′ | .92297 | 33′ | .99221 | 33′ | .06343 | 33′ | .13656 |
| 34′ | .92411 | 34′ | .99338 | 34′ | .06464 | 34′ | .13779 |
| 35′ | .92525 | 35′ | .99455 | 35′ | .06584 | 35′ | .13903 |
| 36′ | .92639 | 36′ | .99572 | 36′ | .06704 | 36′ | .14026 |
| 37′ | .92753 | 37′ | .99690 | 37′ | .06825 | 37′ | .14150 |
| 38′ | .92867 | 38′ | .99807 | 38′ | .06946 | 38′ | .14273 |
| 39′ | .92981 | 39′ | .99924 | 39′ | .07066 | 39′ | .14397 |
| 40′ | .93095 | 40′ | 979.00042 | 40′ | .07187 | 40′ | .14521 |
| 41′ | .93209 | 41′ | .00159 | 41′ | .07307 | 41′ | .14645 |
| 42′ | .93323 | 42′ | .00277 | 42′ | .07418 | 42′ | .14768 |
| 43′ | .93437 | 43′ | .00394 | 43′ | .07549 | 43′ | .14892 |
| 44′ | .93551 | 44′ | .00512 | 44′ | .07670 | 44′ | .15016 |
| 45′ | .93666 | 45′ | .00630 | 45′ | .07791 | 45′ | .15140 |
| 46′ | .93780 | 36′ | .00748 | 46′ | .07912 | 46′ | .15264 |
| 47′ | .93895 | 47′ | .00865 | 47′ | .08033 | 47′ | .15388 |
| 48′ | .94009 | 48′ | .00983 | 48′ | .08154 | 48′ | .15512 |
| 49′ | .94124 | 49′ | .01101 | 49′ | .08275 | 49′ | .15637 |
| 50′ | .94238 | 50′ | .01219 | 50′ | .08396 | 50′ | .15761 |
| 51′ | .94353 | 51′ | .01337 | 51′ | .08517 | 51′ | .15885 |
| 52′ | .94468 | 52′ | .01455 | 52′ | .08639 | 52′ | .16009 |
| 53′ | .94583 | 53′ | .01573 | 53′ | .08760 | 53′ | .16134 |
| 54′ | .94698 | 54′ | .01692 | 54′ | .08881 | 54′ | .16258 |
| 55′ | .94812 | 55′ | .01810 | 55′ | .09003 | 55′ | .16383 |
| 56′ | .94927 | 56′ | .01928 | 56′ | .09124 | 56′ | .16507 |
| 57′ | .95042 | 57′ | .02047 | 57′ | .09246 | 57′ | .16632 |
| 58′ | .95158 | 58′ | .02165 | 58′ | .09367 | 58′ | .16756 |
| 59′ | .95273 | 59′ | .02283 | 59′ | .09489 | 59′ | .16881 |

Table I – (continued)

| 28° | | 29° | | 30° | | 31° | |
|---|---|---|---|---|---|---|---|
| 0' | 979.17006 | 0' | 979.24578 | 0' | 979.32318 | 0' | 979.40217 |
| 1' | .17131 | 1' | .24706 | 1' | .32449 | 1' | .40350 |
| 2' | .17255 | 2' | .24833 | 2' | .32579 | 2' | .40483 |
| 3' | .17380 | 3' | .24961 | 3' | .32710 | 3' | .40616 |
| 4' | .17505 | 4' | .25089 | 4' | .32840 | 4' | .40749 |
| 5' | .17630 | 5' | .25217 | 5' | .32971 | 5' | .40882 |
| 6' | .17755 | 6' | .25345 | 6' | .33101 | 6' | .41015 |
| 7' | .17880 | 7' | .25473 | 7' | .33232 | 7' | .41149 |
| 8' | .18005 | 8' | .25601 | 8' | .33362 | 8' | .41282 |
| 9' | .18131 | 9' | .25729 | 9' | .33493 | 9' | .41415 |
| 10' | .18256 | 10' | .25857 | 10' | .33624 | 10' | .41548 |
| 11' | .18381 | 11' | .25985 | 11' | .33755 | 11' | .41682 |
| 12' | .18506 | 12' | .26113 | 12' | .33886 | 12' | .41815 |
| 13' | .18632 | 13' | .26241 | 13' | .34017 | 13' | .41949 |
| 14' | .18757 | 14' | .26369 | 14' | .34147 | 14' | .42082 |
| 15' | .18883 | 15' | .26498 | 15' | .34278 | 15' | .42215 |
| 16' | .19008 | 16' | .26626 | 16' | .34409 | 16' | .42349 |
| 17' | .19134 | 17' | .26754 | 17' | .34541 | 17' | .42483 |
| 18' | .19259 | 18' | .26883 | 18' | .34662 | 18' | .42616 |
| 19' | .19385 | 19' | .27011 | 19' | .34803 | 19' | .42750 |
| 20' | .19511 | 20' | .27140 | 20' | .34934 | 20' | .42884 |
| 21' | .19636 | 21' | .27268 | 21' | .35065 | 21' | .43017 |
| 22' | .19762 | 22' | .27397 | 22' | .35197 | 22' | .43151 |
| 23' | .19888 | 23' | .27526 | 23' | .35328 | 23' | .43285 |
| 24' | .20014 | 24' | .27654 | 24' | .35459 | 24' | .43419 |
| 25' | .20140 | 25' | .27783 | 25' | .35591 | 25' | .43553 |
| 26' | .20266 | 26' | .27912 | 26' | .35722 | 26' | .43687 |
| 27' | .20392 | 27' | .28041 | 27' | .35854 | 27' | .43821 |
| 28' | .20518 | 28' | .28170 | 28' | .35985 | 28' | .43955 |
| 29' | .20644 | 29' | .28299 | 29' | .36117 | 29' | .44089 |
| 30' | .20770 | 30' | .28428 | 30' | .36248 | 30' | .44223 |
| 31' | .20897 | 31' | .28557 | 31' | .36380 | 31' | .44357 |
| 32' | .21023 | 32' | .28686 | 32' | .36512 | 32' | .44491 |
| 33' | .21149 | 33' | .28815 | 33' | .36644 | 33' | .44626 |
| 34' | .21276 | 34' | .28944 | 34' | .36775 | 34' | .44760 |
| 35' | .21402 | 35' | .29073 | 35' | .36907 | 35' | .44894 |
| 36' | .21528 | 36' | .29203 | 36' | .37039 | 36' | .45029 |
| 37' | .21655 | 37' | .29332 | 37' | .37171 | 37' | .45163 |
| 38' | .21782 | 38' | .29461 | 38' | .37303 | 38' | .45297 |
| 39' | .21908 | 39' | .29591 | 39' | .37435 | 39' | .45432 |
| 40' | .22035 | 40' | .29720 | 40' | .37567 | 40' | .45566 |
| 41' | .22162 | 41' | .29850 | 41' | .37699 | 41' | .45701 |
| 42' | .22288 | 42' | .29979 | 42' | .37831 | 42' | .45836 |
| 43' | .22415 | 43' | .30109 | 43' | .37964 | 43' | .45970 |
| 44' | .22542 | 44' | .30238 | 44' | .38096 | 44' | .46105 |
| 45' | .22669 | 45' | .30368 | 45' | .38228 | 45' | .46240 |
| 46' | .22796 | 46' | .30498 | 46' | .38360 | 46' | .46374 |
| 47' | .22923 | 47' | .30627 | 47' | .38493 | 47' | .46509 |
| 48' | .23050 | 48' | .30757 | 48' | .38625 | 48' | .46644 |
| 49' | .23177 | 49' | .30887 | 49' | .38758 | 49' | .46779 |
| 50' | .23304 | 50' | .31017 | 50' | .38890 | 50' | .46914 |
| 51' | .23431 | 51' | .31147 | 51' | .39023 | 51' | .47049 |
| 52' | .23559 | 52' | .31277 | 52' | .39155 | 52' | .47184 |
| 53' | .23686 | 53' | .31407 | 53' | .39288 | 53' | .47319 |
| 54' | .23813 | 54' | .31537 | 54' | .39420 | 54' | .47454 |
| 55' | .23940 | 55' | .31667 | 55' | .39553 | 55' | .47589 |
| 56' | .24068 | 56' | .31797 | 56' | .39686 | 56' | .47724 |
| 57' | .24195 | 57' | .31927 | 57' | .39819 | 57' | .47859 |
| 58' | .24323 | 58' | .32058 | 58' | .39951 | 58' | .47994 |
| 59' | .24450 | 59' | .32188 | 59' | .40084 | 59' | .48130 |

Table I – (continued)

| 32° | 0′ 979.48265 | 33° | 0′ 979.56452 | 34° | 0′ 979.64769 | 35° | 0′ 979.73205 |
|---|---|---|---|---|---|---|---|
| 1′ | .48400 | 1′ | .56590 | 1′ | .64909 | 1′ | .73347 |
| 2′ | .48536 | 2′ | .56728 | 2′ | .65048 | 2′ | .73488 |
| 3′ | .48671 | 3′ | .56865 | 3′ | .65188 | 3′ | .73630 |
| 4′ | .48807 | 4′ | .57003 | 4′ | .65328 | 4′ | .73771 |
| 5′ | .48942 | 5′ | .57141 | 5′ | .65468 | 5′ | .73913 |
| 6′ | .49078 | 6′ | .57278 | 6′ | .65607 | 6′ | .74055 |
| 7′ | .49213 | 7′ | .57416 | 7′ | .65747 | 7′ | .74197 |
| 8′ | .49349 | 8′ | .57554 | 8′ | .65887 | 8′ | .74338 |
| 9′ | .49484 | 9′ | .57692 | 9′ | .66027 | 9′ | .74480 |
| 10′ | .49620 | 10′ | .57830 | 10′ | .66167 | 10′ | .74622 |
| 11′ | .49756 | 11′ | .57968 | 11′ | .66307 | 11′ | .74764 |
| 12′ | .49892 | 12′ | .58106 | 12′ | .66447 | 12′ | .74906 |
| 13′ | .50027 | 13′ | .58244 | 13′ | .66587 | 13′ | .75048 |
| 14′ | .50163 | 14′ | .58382 | 14′ | .66727 | 14′ | .75190 |
| 15′ | .50299 | 15′ | .58520 | 15′ | .66867 | 15′ | .75332 |
| 16′ | .50435 | 16′ | .58658 | 16′ | .67007 | 16′ | .75474 |
| 17′ | .50571 | 17′ | .58796 | 17′ | .67148 | 17′ | .75616 |
| 18′ | .50707 | 18′ | .58934 | 18′ | .67288 | 18′ | .75758 |
| 19′ | .50843 | 19′ | .59072 | 19′ | .67428 | 19′ | .75900 |
| 20′ | .50979 | 20′ | .59211 | 20′ | .67568 | 20′ | .76042 |
| 21′ | .51115 | 21′ | .59349 | 21′ | .67709 | 21′ | .76184 |
| 22′ | .51251 | 22′ | .59487 | 22′ | .67849 | 22′ | .76326 |
| 23′ | .51388 | 23′ | .59626 | 23′ | .67989 | 23′ | .76468 |
| 24′ | .51524 | 24′ | .59764 | 24′ | .68130 | 24′ | .76611 |
| 25′ | .51660 | 25′ | .59902 | 25′ | .68270 | 25′ | .76753 |
| 26′ | .51796 | 26′ | .60041 | 26′ | .68411 | 26′ | .76895 |
| 27′ | .51933 | 27′ | .60179 | 27′ | .68551 | 27′ | .77038 |
| 28′ | .52069 | 28′ | .60318 | 28′ | .68692 | 28′ | .77180 |
| 29′ | .52205 | 29′ | .60457 | 29′ | .68832 | 29′ | .77322 |
| 30′ | .52342 | 30′ | .60595 | 30′ | .68973 | 30′ | .77465 |
| 31′ | .52478 | 31′ | .60734 | 31′ | .69113 | 31′ | .77607 |
| 32′ | .52615 | 32′ | .60872 | 32′ | .69254 | 32′ | .77750 |
| 33′ | .52751 | 33′ | .61011 | 33′ | .69395 | 33′ | .77892 |
| 34′ | .52888 | 34′ | .61150 | 34′ | .69535 | 34′ | .78035 |
| 35′ | .53025 | 35′ | .61289 | 35′ | .69676 | 35′ | .78177 |
| 36′ | .53161 | 36′ | .61427 | 36′ | .69817 | 36′ | .78320 |
| 37′ | .53298 | 37′ | .61566 | 37′ | .69958 | 37′ | .78462 |
| 38′ | .53435 | 38′ | .61705 | 38′ | .70099 | 38′ | .78605 |
| 39′ | .53572 | 39′ | .61844 | 39′ | .70240 | 39′ | .78748 |
| 40′ | .53708 | 40′ | .61983 | 40′ | .70380 | 40′ | .78890 |
| 41′ | .53845 | 41′ | .62122 | 41′ | .70521 | 41′ | .79033 |
| 42′ | .53982 | 42′ | .62261 | 42′ | .70662 | 42′ | .79176 |
| 43′ | .54119 | 43′ | .62400 | 43′ | .70803 | 43′ | .79319 |
| 44′ | .54256 | 44′ | .62539 | 44′ | .70944 | 44′ | .79461 |
| 45′ | .54393 | 45′ | .62678 | 45′ | .71085 | 45′ | .79604 |
| 46′ | .54530 | 46′ | .62817 | 46′ | .71227 | 46′ | .79747 |
| 47′ | .54667 | 47′ | .62957 | 47′ | .71368 | 47′ | .79890 |
| 48′ | .54804 | 48′ | .63096 | 48′ | .71509 | 48′ | .80033 |
| 49′ | .54941 | 49′ | .63235 | 49′ | .71650 | 49′ | .80176 |
| 50′ | .55078 | 50′ | .63374 | 50′ | .71791 | 50′ | .80319 |
| 51′ | .55216 | 51′ | .63514 | 51′ | .71932 | 51′ | .80462 |
| 52′ | .55353 | 52′ | .63653 | 52′ | .72074 | 52′ | .80605 |
| 53′ | .55490 | 53′ | .63792 | 53′ | .72215 | 53′ | .80748 |
| 54′ | .55628 | 54′ | .63932 | 54′ | .72356 | 54′ | .80891 |
| 55′ | .55765 | 55′ | .64071 | 55′ | .72498 | 55′ | .81034 |
| 56′ | .55902 | 56′ | .64211 | 56′ | .72639 | 56′ | .81177 |
| 57′ | .56040 | 57′ | .64350 | 57′ | .72781 | 57′ | .81321 |
| 58′ | .56177 | 58′ | .64490 | 58′ | .72922 | 58′ | .81464 |
| 59′ | .56315 | 59′ | .64629 | 59′ | .73064 | 59′ | .81607 |

Table I – (continued)

| 36° | | 37° | | 38° | | 39° | |
|---|---|---|---|---|---|---|---|
| 0′ 979 | .81750 | 0′ 979 | .90394 | 0′ 979 | .99126 | 0′ 980 | .07936 |
| 1′ | .81894 | 1′ | .90539 | 1′ | .99273 | 1′ | .08084 |
| 2′ | .82037 | 2′ | .90684 | 2′ | .99419 | 2′ | .08231 |
| 3′ | .82180 | 3′ | .90829 | 3′ | .99565 | 3′ | .08378 |
| 4′ | .82324 | 4′ | .90974 | 4′ | .99711 | 4′ | .08526 |
| 5′ | .82467 | 5′ | .91119 | 5′ | .99858 | 5′ | .08673 |
| 6′ | .82610 | 6′ | .91264 | 6′ 980 | .00004 | 6′ | .08821 |
| 7′ | .82754 | 7′ | .91409 | 7′ | .00150 | 7′ | .08969 |
| 8′ | .82897 | 8′ | .91554 | 8′ | .00297 | 8′ | .09116 |
| 9′ | .83041 | 9′ | .91699 | 9′ | .00443 | 9′ | .09264 |
| 10′ | .83184 | 10′ | .91844 | 10′ | .00590 | 10′ | .09411 |
| 11′ | .83328 | 11′ | .91989 | 11′ | .00736 | 11′ | .09559 |
| 12′ | .83471 | 12′ | .92134 | 12′ | .00882 | 12′ | .09706 |
| 13′ | .83615 | 13′ | .92279 | 13′ | .01029 | 13′ | .09854 |
| 14′ | .83759 | 14′ | .92424 | 14′ | .01175 | 14′ | .10002 |
| 15′ | .83902 | 15′ | .92569 | 15′ | .01322 | 15′ | .10149 |
| 16′ | .84046 | 16′ | .92715 | 16′ | .01468 | 16′ | .10297 |
| 17′ | .84190 | 17′ | .92860 | 17′ | .01615 | 17′ | .10445 |
| 18′ | .84334 | 18′ | .93005 | 18′ | .01762 | 18′ | .10593 |
| 19′ | .84477 | 19′ | .93150 | 19′ | .01908 | 19′ | .10740 |
| 20′ | .84621 | 20′ | .93296 | 20′ | .02055 | 20′ | .10888 |
| 21′ | .84765 | 21′ | .93441 | 21′ | .02201 | 21′ | .11036 |
| 22′ | .84909 | 22′ | .93586 | 22′ | .02348 | 22′ | .11184 |
| 23′ | .85053 | 23′ | .93732 | 23′ | .02495 | 23′ | .11332 |
| 24′ | .85197 | 24′ | .93877 | 24′ | .02642 | 24′ | .11479 |
| 25′ | .85340 | 25′ | .94022 | 25′ | .02788 | 25′ | .11627 |
| 86′ | .85484 | 26′ | .94168 | 26′ | .02935 | 26′ | .11775 |
| 27′ | .85628 | 27′ | .94313 | 27′ | .03082 | 27′ | .11923 |
| 28′ | .85772 | 28′ | .94459 | 28′ | .03229 | 28′ | .12071 |
| 29′ | .85916 | 29′ | .94604 | 29′ | .03375 | 29′ | .12219 |
| 30′ | .86061 | 30′ | .94750 | 30′ | .03522 | 30′ | .12367 |
| 31′ | .86205 | 31′ | .94895 | 31′ | .03669 | 31′ | .12515 |
| 32′ | .86349 | 32′ | .95041 | 32′ | .03816 | 32′ | .12663 |
| 33′ | .86493 | 33′ | .95187 | 33′ | .03963 | 33′ | .12811 |
| 34′ | .86637 | 34′ | .95332 | 34′ | .04110 | 34′ | .12959 |
| 35′ | .86781 | 35′ | .95478 | 35′ | .04257 | 35′ | .13107 |
| 36′ | .86925 | 36′ | .95624 | 36′ | .04404 | 36′ | .13255 |
| 37′ | .87070 | 37′ | .95769 | 37′ | .04551 | 37′ | .13403 |
| 38′ | .87214 | 38′ | .95915 | 38′ | .04698 | 38′ | .13551 |
| 39′ | .87358 | 39′ | .96061 | 39′ | .04845 | 39′ | .13699 |
| 40′ | .87503 | 40′ | .96206 | 40′ | .04992 | 40′ | .13847 |
| 41′ | .87647 | 41′ | .96352 | 41′ | .05139 | 41′ | .13995 |
| 42′ | .87791 | 42′ | .96498 | 42′ | .05286 | 42′ | .14144 |
| 43′ | .87936 | 43′ | .96644 | 43′ | .05433 | 43′ | .14292 |
| 44′ | .88080 | 44′ | .96790 | 44′ | .05580 | 44′ | .14440 |
| 45′ | .88224 | 45′ | .96936 | 45′ | .05727 | 45′ | .14588 |
| 46′ | .88369 | 46′ | .97081 | 46′ | .05874 | 46′ | .14736 |
| 47′ | .88513 | 47′ | .97227 | 47′ | .06021 | 47′ | .14884 |
| 48′ | .88658 | 48′ | .97373 | 48′ | .06168 | 48′ | .15033 |
| 49′ | .88803 | 49′ | .97519 | 49′ | .06316 | 49′ | .15181 |
| 50′ | .88947 | 50′ | .97665 | 50′ | .06463 | 50′ | .15329 |
| 51′ | .89092 | 51′ | .97811 | 51′ | .06610 | 51′ | .15478 |
| 52′ | .89236 | 52′ | .97957 | 52′ | .06757 | 52′ | .15626 |
| 53′ | .89381 | 53′ | .98103 | 52′ | .06905 | 53′ | .15774 |
| 54′ | .89526 | 54′ | .98249 | 54′ | .07052 | 54′ | .15923 |
| 55′ | .89670 | 55′ | .98396 | 55′ | .07199 | 55′ | .16071 |
| 56′ | .89815 | 56′ | .98542 | 56′ | .07347 | 56′ | .16219 |
| 57′ | .89960 | 57′ | .98688 | 57′ | .07494 | 57′ | .16368 |
| 58′ | .90105 | 58′ | .98834 | 58′ | .07641 | 58′ | .16516 |
| 59′ | .90249 | 59′ | .98980 | 59′ | .07789 | 59′ | .16664 |

Table I – (continued)

| 40° | | 41° | | 42° | | 43° | |
|---|---|---|---|---|---|---|---|
| 0′ 980 | .16813 | 0′ 980 | .25746 | 0′ 980 | .34724 | 0′ 980 | .43737 |
| 1′ | .16961 | 1′ | .25895 | 1′ | .34874 | 1′ | .43887 |
| 2′ | .17110 | 2′ | .26044 | 2′ | .35024 | 2′ | .44038 |
| 3′ | .17258 | 3′ | .26194 | 3′ | .35174 | 3′ | .44188 |
| 4′ | .17407 | 4′ | .26343 | 4′ | .35324 | 4′ | .44339 |
| 5′ | .17555 | 5′ | .26492 | 5′ | .35474 | 5′ | .44489 |
| 6′ | .17704 | 6′ | .26642 | 6′ | .35624 | 6′ | .44640 |
| 7′ | .17852 | 7′ | .26791 | 7′ | .35774 | 7′ | .44790 |
| 8′ | .18001 | 8′ | .26941 | 8′ | .35924 | 8′ | .44940 |
| 9′ | .18150 | 9′ | .27090 | 9′ | .36074 | 9′ | .45091 |
| 10′ | .18298 | 10′ | .27239 | 10′ | .36224 | 10′ | .45241 |
| 11′ | .18447 | 11′ | .27389 | 11′ | .36374 | 11′ | .45392 |
| 12′ | .18595 | 12′ | .27538 | 12′ | .36524 | 12′ | .45542 |
| 13′ | .18744 | 13′ | .27688 | 13′ | .36674 | 13′ | .45693 |
| 14′ | .18893 | 14′ | .27837 | 14′ | .36824 | 14′ | .45844 |
| 15′ | .19041 | 15′ | .27987 | 15′ | .36975 | 15′ | .45994 |
| 16′ | .19190 | 16′ | .28136 | 16′ | .37125 | 16′ | .46145 |
| 17′ | .19339 | 17′ | .28286 | 17′ | .37275 | 17′ | .46295 |
| 18′ | .19487 | 18′ | .28435 | 18′ | .37425 | 18′ | .46446 |
| 19′ | .19636 | 19′ | .28585 | 19′ | .37575 | 19′ | .46596 |
| 20′ | .19785 | 20′ | .28734 | 20′ | .37725 | 20′ | .46747 |
| 21′ | .19934 | 21′ | .28884 | 21′ | .37875 | 21′ | .46897 |
| 22′ | .20082 | 22′ | .29033 | 22′ | .38025 | 22′ | .47048 |
| 23′ | .20231 | 23′ | .29183 | 23′ | .38176 | 23′ | .47198 |
| 24′ | .20380 | 24′ | .29332 | 24′ | .38326 | 24′ | .47349 |
| 25′ | .20529 | 25′ | .29482 | 25′ | .38476 | 25′ | .47500 |
| 26′ | .20678 | 26′ | .29632 | 26′ | .38626 | 26′ | .47650 |
| 27′ | .20826 | 27′ | .29781 | 27′ | .38776 | 27′ | .47801 |
| 28′ | .20975 | 28′ | .29931 | 28′ | .38926 | 28′ | .47951 |
| 29′ | .21124 | 29′ | .30080 | 29′ | .39077 | 29′ | .48102 |
| 30′ | .21273 | 30′ | .30230 | 30′ | .39227 | 30′ | .48253 |
| 31′ | .21422 | 31′ | .30380 | 31′ | .39377 | 31′ | .48403 |
| 32′ | .21571 | 32′ | .30529 | 32′ | .39527 | 32′ | .48554 |
| 33′ | .21720 | 33′ | .30679 | 33′ | .39678 | 33′ | .48704 |
| 24′ | .21869 | 34′ | .30829 | 34′ | .39828 | 34′ | .48855 |
| 35′ | .22018 | 35′ | .30978 | 35′ | .39978 | 35′ | .49006 |
| 36′ | .22167 | 36′ | .31128 | 36′ | .40128 | 36′ | .49156 |
| 37′ | .22316 | 37′ | .31278 | 37′ | .40279 | 37′ | .49307 |
| 38′ | .22465 | 38′ | .31428 | 38′ | .40429 | 38′ | .49458 |
| 39′ | .22614 | 39′ | .31577 | 39′ | .40579 | 39′ | .49608 |
| 40′ | .22763 | 40′ | .31727 | 40′ | .40729 | 40′ | .49759 |
| 41′ | .22912 | 41′ | .31877 | 41′ | .40880 | 41′ | .49910 |
| 42′ | .23061 | 42′ | .32027 | 42′ | .41030 | 42′ | .50060 |
| 43′ | .23210 | 43′ | .32176 | 43′ | .41180 | 43′ | .50211 |
| 44′ | .23359 | 44′ | .32326 | 44′ | .41331 | 44′ | .50362 |
| 45′ | .23508 | 45′ | .32476 | 45′ | .41481 | 45′ | .50512 |
| 46′ | .23657 | 46′ | .32626 | 46′ | .41631 | 46′ | .50663 |
| 47′ | .23806 | 47′ | .32776 | 47′ | .41782 | 47′ | .50814 |
| 48′ | .23955 | 48′ | .32925 | 48′ | .41932 | 48′ | .50964 |
| 49′ | .24104 | 49′ | .33075 | 49′ | .42082 | 49′ | .51115 |
| 50′ | .24254 | 50′ | .33225 | 50′ | .42233 | 50′ | .51266 |
| 51′ | .24403 | 51′ | .33375 | 51′ | .42383 | 51′ | .51416 |
| 52′ | .24552 | 52′ | .33525 | 52′ | .42534 | 52′ | .51567 |
| 53′ | .24701 | 53′ | .33675 | 53′ | .42684 | 53′ | .51718 |
| 54′ | .24850 | 54′ | .33825 | 54′ | .42834 | 54′ | .51869 |
| 55′ | .25000 | 55′ | .33974 | 55′ | .42985 | 55′ | .52019 |
| 56′ | .25149 | 56′ | .34124 | 56′ | .43135 | 56′ | .52170 |
| 57′ | .25298 | 57′ | .34274 | 57′ | .43286 | 57′ | .52321 |
| 58′ | .25447 | 58′ | .34424 | 58′ | .43436 | 58′ | .52471 |
| 59′ | .25597 | 59′ | .34574 | 59′ | .43586 | 59′ | .52622 |

Table I – (continued)

| 44° | | 45° | | 46° | | 47° | |
|---|---|---|---|---|---|---|---|
| 0′ 980.52773 | | 0′ 980.61821 | | 0′ 980.70871 | | 0′ 980.79911 | |
| 1′ | .52924 | 1′ | .61972 | 1′ | .71022 | 1′ | .80062 |
| 2′ | .53074 | 2′ | .62123 | 2′ | .71173 | 2′ | .80213 |
| 3′ | .53225 | 3′ | .62274 | 3′ | .71324 | 3′ | .80363 |
| 4′ | .53376 | 4′ | .62425 | 4′ | .71474 | 4′ | .80514 |
| 5′ | .53527 | 5′ | .62576 | 5′ | .71625 | 5′ | .80664 |
| 6′ | .53677 | 6′ | .62726 | 6′ | .71776 | 6′ | .80815 |
| 7′ | .53828 | 7′ | .62877 | 7′ | .71927 | 7′ | .80965 |
| 8′ | .53979 | 8′ | .63028 | 8′ | .72077 | 8′ | .81116 |
| 9′ | .54130 | 9′ | .63179 | 9′ | .72228 | 9′ | .81266 |
| 10′ | .54280 | 10′ | .63330 | 10′ | .72379 | 10′ | .81416 |
| 11′ | .54431 | 11′ | .63481 | 11′ | .72530 | 11′ | .81567 |
| 11′ | .54582 | 12′ | .63632 | 12′ | .72680 | 12′ | .81717 |
| 13′ | .54733 | 13′ | .63782 | 13′ | .72831 | 13′ | .81868 |
| 14′ | .54883 | 14′ | .63933 | 14′ | .72982 | 14′ | .82018 |
| 15′ | .55034 | 15′ | .64084 | 15′ | .73133 | 15′ | .82169 |
| 16′ | .55185 | 16′ | .64235 | 16′ | .73283 | 16′ | .82319 |
| 17′ | .55336 | 17′ | .64386 | 17′ | .73434 | 17′ | .82470 |
| 18′ | .55487 | 18′ | .64537 | 18′ | .73589 | 18′ | .82620 |
| 19′ | .55637 | 19′ | .64688 | 19′ | .73736 | 19′ | .82770 |
| 20′ | .55788 | 20′ | .64838 | 20′ | .73886 | 20′ | .82921 |
| 21′ | .55939 | 21′ | .64989 | 21′ | .74037 | 21′ | .83071 |
| 22′ | .56090 | 22′ | .65140 | 22′ | .74188 | 22′ | .83222 |
| 23′ | .56241 | 23′ | .65291 | 23′ | .74338 | 23′ | .83372 |
| 24′ | .56391 | 24′ | .65442 | 24′ | .74489 | 24′ | .83522 |
| 25′ | .56542 | 25′ | .65593 | 25′ | .74640 | 25′ | .83673 |
| 26′ | .56693 | 26′ | .65743 | 26′ | .74790 | 26′ | .83823 |
| 27′ | .56844 | 27′ | .65894 | 27′ | .74941 | 27′ | .83973 |
| 28′ | .56995 | 28′ | .66045 | 28′ | .75092 | 28′ | .84124 |
| 29′ | .57145 | 29′ | .66196 | 29′ | .75243 | 29′ | .84274 |
| 30′ | .57296 | 30′ | .66347 | 30′ | .75393 | 30′ | .84425 |
| 31′ | .57447 | 31′ | .66498 | 31′ | .75544 | 31′ | .84575 |
| 32′ | .57598 | 32′ | .66648 | 32′ | .75695 | 32′ | .84725 |
| 33′ | .57749 | 33′ | .66799 | 33′ | .75845 | 33′ | .84876 |
| 34′ | .57900 | 34′ | .66950 | 34′ | .75996 | 34′ | .85026 |
| 35′ | .58050 | 35′ | .67101 | 35′ | .76147 | 35′ | .85176 |
| 36′ | .58201 | 36′ | .67252 | 36′ | .76297 | 36′ | .85326 |
| 37′ | .58352 | 37′ | .67403 | 37′ | .76448 | 37′ | .85477 |
| 38′ | .58503 | 38′ | .67553 | 38′ | .76599 | 38′ | .85627 |
| 39′ | .58654 | 39′ | .67704 | 39′ | .76749 | 39′ | .85777 |
| 40′ | .58804 | 40′ | .67855 | 40′ | .76900 | 40′ | .85928 |
| 41′ | .58955 | 41′ | .68006 | 41′ | .77050 | 41′ | .86078 |
| 42′ | .59106 | 42′ | .68157 | 42′ | .77201 | 42′ | .86228 |
| 43′ | .59257 | 43′ | .68308 | 43′ | .77352 | 43′ | .86378 |
| 44′ | .59408 | 44′ | .68458 | 44′ | .77502 | 44′ | .86508 |
| 45′ | .59559 | 45′ | .68609 | 45′ | .77653 | 45′ | .86679 |
| 46′ | .59709 | 46′ | .68760 | 46′ | .77804 | 46′ | .86829 |
| 47′ | .59860 | 47′ | .68911 | 47′ | .77954 | 47′ | .86979 |
| 48′ | .60011 | 48′ | .69062 | 48′ | .78105 | 48′ | .87129 |
| 49′ | .60162 | 49′ | .69212 | 49′ | .78255 | 49′ | .87280 |
| 50′ | .60313 | 50′ | .69363 | 50′ | .78406 | 50′ | .87430 |
| 51′ | .60464 | 51′ | .69514 | 51′ | .78556 | 51′ | .87580 |
| 52′ | .60615 | 52′ | .69665 | 52′ | .78707 | 52′ | .87730 |
| 53′ | .60765 | 53′ | .69816 | 53′ | .78858 | 53′ | .87880 |
| 54′ | .60916 | 54′ | .69966 | 54′ | .79008 | 54′ | .88030 |
| 55′ | .61067 | 55′ | .70117 | 55′ | .79159 | 55′ | .88180 |
| 56′ | .61218 | 56′ | .70268 | 56′ | .79309 | 56′ | .88331 |
| 57′ | .61369 | 57′ | .70419 | 57′ | .79460 | 57′ | .88481 |
| 58′ | .61520 | 58′ | .70570 | 58′ | .79610 | 58′ | .88631 |
| 59′ | .61670 | 59′ | .70720 | 59′ | .79761 | 59′ | .88781 |

Table I – (continued)

| 48° | | 49° | | 50° | | 51° | |
|---|---|---|---|---|---|---|---|
| 0′ | 980.88931 | 0′ | 980.97919 | 0′ | 981.06864 | 0′ | 981.15756 |
| 1′ | .89081 | 1′ | .98068 | 1′ | .07013 | 1′ | .15904 |
| 2′ | .89231 | 2′ | .98218 | 2′ | .07162 | 2′ | .16051 |
| 3′ | .89381 | 3′ | .98367 | 3′ | .07310 | 3′ | .16199 |
| 4′ | .89531 | 4′ | .98517 | 4′ | .07459 | 4′ | .16347 |
| 5′ | .89681 | 5′ | .98666 | 5′ | .07608 | 5′ | .16494 |
| 6′ | .89831 | 6′ | .98816 | 6′ | .07756 | 6′ | .16642 |
| 7′ | .89981 | 7′ | .98965 | 7′ | .07905 | 7′ | .16790 |
| 8′ | .90132 | 8′ | .99114 | 8′ | .08053 | 8′ | .16937 |
| 9′ | .90282 | 9′ | .99264 | 9′ | .08202 | 9′ | .17035 |
| 10′ | .90432 | 10′ | .99413 | 10′ | .08350 | 10′ | .17232 |
| 11′ | .90582 | 11′ | .99562 | 11′ | .08499 | 11′ | .17380 |
| 12′ | .90732 | 12′ | .99712 | 12′ | .08647 | 12′ | .17527 |
| 13′ | .90882 | 13′ | .99861 | 13′ | .08796 | 13′ | .17675 |
| 14′ | .91031 | 14′ | 981.00010 | 14′ | .08944 | 14′ | .17822 |
| 15′ | .91181 | 15′ | .00160 | 15′ | .09093 | 15′ | .17969 |
| 16′ | .91331 | 16′ | .00309 | 16′ | .09241 | 16′ | .18117 |
| 17′ | .91481 | 17′ | .00458 | 17′ | .09390 | 17′ | .18264 |
| 18′ | .91631 | 18′ | .00608 | 18′ | .09538 | 18′ | .18412 |
| 19′ | .91781 | 19′ | .00757 | 19′ | .09686 | 19′ | .18559 |
| 20′ | .91931 | 20′ | .00906 | 20′ | .09835 | 20′ | .18706 |
| 21′ | .92081 | 21′ | .01055 | 21′ | .09983 | 21′ | .18854 |
| 22′ | .92231 | 22′ | .01204 | 22′ | .10131 | 22′ | .19001 |
| 23′ | .92381 | 23′ | .01354 | 23′ | .10280 | 23′ | .19148 |
| 24′ | .92531 | 24′ | .01503 | 24′ | .10428 | 24′ | .19295 |
| 25′ | .92681 | 25′ | .01652 | 25′ | .10576 | 25′ | .19443 |
| 26′ | .92830 | 26′ | .01801 | 26′ | .10725 | 26′ | .19590 |
| 27′ | .92980 | 27′ | .01950 | 27′ | .10873 | 27′ | .19737 |
| 28′ | .93130 | 28′ | .02099 | 38′ | .11021 | 28′ | .19884 |
| 29′ | .93280 | 29′ | .02249 | 29′ | .11169 | 29′ | .20031 |
| 30′ | .93430 | 30′ | .02398 | 30′ | .11318 | 30′ | .20179 |
| 31′ | .93579 | 31′ | .02547 | 31′ | .11466 | 31′ | .20326 |
| 32′ | .93729 | 32′ | .02696 | 32′ | .11614 | 32′ | .20473 |
| 33′ | .93879 | 33′ | .02845 | 33′ | .11762 | 33′ | .20620 |
| 34′ | .94029 | 34′ | .02994 | 34′ | .11910 | 34′ | .20767 |
| 35′ | .94179 | 35′ | .03143 | 35′ | .12058 | 35′ | .20914 |
| 36′ | .94328 | 36′ | .03292 | 36′ | .12207 | 36′ | .21061 |
| 37′ | .94478 | 37′ | .03441 | 37′ | .12355 | 37′ | .21208 |
| 38′ | .94628 | 38′ | .03590 | 38′ | .12503 | 38′ | .21355 |
| 39′ | .94778 | 39′ | .03739 | 39′ | .12651 | 39′ | .21502 |
| 40′ | .94927 | 40′ | .03890 | 40′ | .12799 | 40′ | .21649 |
| 41′ | .95077 | 41′ | .04037 | 41′ | .12947 | 41′ | .21796 |
| 42′ | .95227 | 42′ | .04186 | 42′ | .13095 | 42′ | .21943 |
| 43′ | .95376 | 43′ | .04335 | 43′ | .13243 | 43′ | .22090 |
| 44′ | .95526 | 44′ | .04484 | 44′ | .13391 | 44′ | .22236 |
| 45′ | .95676 | 45′ | .04633 | 45′ | .13539 | 45′ | .22383 |
| 46′ | .95825 | 46′ | .04781 | 46′ | .13687 | 46′ | .22530 |
| 47′ | .95975 | 47′ | .04930 | 47′ | .13835 | 47′ | .22677 |
| 48′ | .96124 | 48′ | .05079 | 48′ | .13983 | 48′ | .22824 |
| 49′ | .96274 | 49′ | .05228 | 49′ | .14130 | 49′ | .22970 |
| 50′ | .96424 | 50′ | .05377 | 50′ | .14278 | 50′ | .23117 |
| 51′ | .96573 | 51′ | .05526 | 51′ | .14426 | 51′ | .23264 |
| 52′ | .96723 | 42′ | .05674 | 52′ | .14574 | 52′ | .23411 |
| 53′ | .96872 | 53′ | .05823 | 53′ | .14722 | 53′ | .23557 |
| 54′ | .97022 | 54′ | .05972 | 54′ | .14870 | 54′ | .23704 |
| 55′ | .97171 | 55′ | .06121 | 55′ | .15017 | 55′ | .23851 |
| 56′ | .97321 | 56′ | .06239 | 56′ | .15165 | 56′ | .23997 |
| 57′ | .97471 | 57′ | .06418 | 57′ | .15313 | 57′ | .24144 |
| 58′ | .97620 | 58′ | .06567 | 58′ | .15461 | 58′ | .24290 |
| 59′ | .97770 | 59′ | .06716 | 59′ | .15608 | 59′ | .24437 |

Table I – (continued)

| 52° | 0′ 981.24583 | 53° | 0′ 981.33336 | 54° | 0′ 981.42002 | 55° | 0′ 981.50572 |
|---|---|---|---|---|---|---|---|
| 1′ | .24730 | 1′ | .33481 | 1′ | .42146 | 1′ | .50714 |
| 2′ | .24377 | 2′ | .33626 | 2′ | .42289 | 2′ | .50856 |
| 3′ | .25023 | 3′ | .33771 | 3′ | .42433 | 3′ | .50998 |
| 4′ | .25169 | 4′ | .33916 | 4′ | .42576 | 4′ | .51139 |
| 5′ | .25316 | 5′ | .34061 | 5′ | .42720 | 5′ | .51281 |
| 6′ | .25462 | 6′ | .34206 | 6′ | .42863 | 6′ | .51423 |
| 7′ | .25609 | 7′ | .34351 | 7′ | .43007 | 7′ | .51565 |
| 8′ | .25755 | 8′ | .34496 | 8′ | .43150 | 8′ | .51707 |
| 9′ | .25901 | 9′ | .34641 | 9′ | .43294 | 9′ | .51848 |
| 10′ | .26048 | 10′ | .34786 | 10′ | .43437 | 10′ | .51990 |
| 11′ | .26194 | 11′ | .34931 | 11′ | .43581 | 11′ | .52132 |
| 12′ | .26340 | 12′ | .35076 | 12′ | .43724 | 12′ | .52273 |
| 13′ | .26482 | 13′ | .35221 | 13′ | .43867 | 13′ | .52415 |
| 14′ | .26633 | 14′ | .35366 | 14′ | .44011 | 14′ | .52556 |
| 15′ | .26779 | 15′ | .35511 | 15′ | .44154 | 15′ | .52698 |
| 16′ | .26925 | 16′ | .35656 | 16′ | .44297 | 16′ | .52839 |
| 17′ | .27071 | 17′ | .35800 | 17′ | .44440 | 17′ | .52981 |
| 18′ | .27218 | 18′ | .35945 | 18′ | .44584 | 18′ | .53122 |
| 19′ | .27364 | 19′ | .36090 | 19′ | .44727 | 19′ | .53264 |
| 20′ | .27510 | 20′ | .36235 | 20′ | .44870 | 20′ | .53405 |
| 21′ | .27656 | 21′ | .36379 | 21′ | .45013 | 21′ | .53547 |
| 22′ | .27802 | 22′ | .36524 | 22′ | .45156 | 22′ | .53688 |
| 23′ | .27948 | 23′ | .36668 | 23′ | .45299 | 23′ | .53829 |
| 24′ | .28094 | 24′ | .36813 | 24′ | .45442 | 24′ | .53970 |
| 25′ | .28240 | 25′ | .36958 | 25′ | .45585 | 25′ | .54112 |
| 26′ | .28386 | 26′ | .37102 | 26′ | .45728 | 26′ | .54253 |
| 27′ | .28532 | 27′ | .37247 | 27′ | .45871 | 27′ | .54394 |
| 28′ | .28678 | 28′ | .37391 | 28′ | .46014 | 28′ | .54535 |
| 29′ | .28824 | 29′ | .37536 | 29′ | .46157 | 29′ | .54676 |
| 30′ | .28970 | 30′ | .37680 | 30′ | .46300 | 30′ | .54817 |
| 31′ | .29116 | 31′ | .37825 | 31′ | .46442 | 31′ | .54958 |
| 32′ | .29261 | 32′ | .37969 | 32′ | .46585 | 32′ | .55099 |
| 33′ | .29407 | 33′ | .38113 | 33′ | .46728 | 33′ | .55240 |
| 34′ | .29553 | 34′ | .38258 | 34′ | .46871 | 34′ | .55381 |
| 35′ | .29699 | 35′ | .38402 | 35′ | .47013 | 35′ | .55522 |
| 36′ | .29845 | 36′ | .38546 | 36′ | .47156 | 36′ | .55663 |
| 37′ | .29990 | 37′ | .38691 | 37′ | .47299 | 37′ | .55804 |
| 38′ | .30136 | 38′ | .38835 | 38′ | .47441 | 38′ | .55945 |
| 39′ | .30282 | 39′ | .38979 | 39′ | .47584 | 39′ | .56085 |
| 40′ | .30427 | 40′ | .39123 | 40′ | .47727 | 40′ | .56226 |
| 41′ | .30573 | 41′ | .39268 | 41′ | .47869 | 41′ | .56367 |
| 42′ | .30719 | 42′ | .39412 | 42′ | .48012 | 42′ | .56508 |
| 43′ | .30864 | 43′ | .39556 | 43′ | .48154 | 43′ | .56648 |
| 44′ | .31010 | 44′ | .39700 | 44′ | .48297 | 44′ | .56789 |
| 45′ | .31155 | 45′ | .39844 | 45′ | .48439 | 45′ | .56930 |
| 46′ | .31301 | 46′ | .39988 | 46′ | .48581 | 46′ | .57070 |
| 47′ | .31446 | 47′ | .40132 | 47′ | .48724 | 47′ | .57211 |
| 48′ | .31592 | 48′ | .40276 | 48′ | .48866 | 48′ | .57351 |
| 49′ | .31737 | 49′ | .40420 | 49′ | .49008 | 49′ | .57492 |
| 50′ | .31883 | 50′ | .40564 | 50′ | .49151 | 50′ | .57632 |
| 51′ | .32028 | 51′ | .40708 | 51′ | .49293 | 51′ | .57772 |
| 52′ | .32173 | 52′ | .40852 | 52′ | .49435 | 52′ | .57913 |
| 53′ | .32319 | 53′ | .40996 | 53′ | .49577 | 53′ | .58053 |
| 54′ | .32464 | 54′ | .41140 | 54′ | .49719 | 54′ | .58193 |
| 55′ | .32609 | 55′ | .41283 | 55′ | .49862 | 55′ | .58334 |
| 56′ | .32755 | 56′ | .41427 | 56′ | .50004 | 56′ | .58474 |
| 57′ | .32900 | 57′ | .41571 | 57′ | .50146 | 57′ | .58614 |
| 58′ | .33045 | 58′ | .41715 | 58′ | .50288 | 58′ | .58754 |
| 59′ | .33190 | 59′ | .41858 | 59′ | .50430 | 59′ | .58895 |

Table I -- (continued)

| 56° | | 57° | | 58° | | 59° | |
|---|---|---|---|---|---|---|---|
| 0' | 981.59035 | 0' | 981.67380 | 0' | 981.75598 | 0' | 981.83678 |
| 1' | .59175 | 1' | .67518 | 1' | .75734 | 1' | .83812 |
| 2' | .59315 | 2' | .67656 | 2' | .75870 | 2' | .83945 |
| 3' | .59455 | 3' | .67794 | 3' | .76005 | 3' | .84079 |
| 4' | .59595 | 4' | .67932 | 4' | .76141 | 4' | .84212 |
| 5' | .59735 | 5' | .68070 | 5' | .76277 | 5' | .84345 |
| 6' | .59875 | 6' | .68208 | 6' | .76413 | 6' | .84479 |
| 7' | .60015 | 7' | .68346 | 7' | .76548 | 7' | .84612 |
| 8' | .60154 | 8' | .68483 | 8' | .76684 | 8' | .84745 |
| 9' | .60294 | 9' | .68621 | 9' | .76819 | 9' | .84878 |
| 10' | .60434 | 10' | .68759 | 10' | .76955 | 10' | .85011 |
| 11' | .60574 | 11' | .68897 | 11' | .77090 | 11' | .85144 |
| 12' | .60713 | 12' | .69034 | 12' | .77226 | 12' | .85277 |
| 13' | .60853 | 13' | .69172 | 13' | .77361 | 13' | .85410 |
| 14' | .60993 | 14' | .69309 | 14' | .77496 | 14' | .85543 |
| 15' | .61132 | 15' | .69447 | 15' | .77631 | 15' | .85676 |
| 16' | .61272 | 16' | .69585 | 16' | .77767 | 16' | .85809 |
| 17' | .61412 | 17' | .69722 | 17' | .77902 | 17' | .85941 |
| 18' | .61551 | 18' | .69859 | 18' | .78037 | 18' | .86074 |
| 19' | .61691 | 19' | .69997 | 19' | .78172 | 19' | .86207 |
| 20' | .61830 | 20' | .70134 | 20' | .78307 | 20' | .86340 |
| 21' | .61969 | 21' | .70271 | 21' | .78442 | 21' | .86472 |
| 22' | .62109 | 22' | .70409 | 22' | .78577 | 22' | 86605 |
| 23' | .62248 | 23' | .70546 | 23' | .78712 | 23' | .86737 |
| 24' | .62388 | 24' | .70683 | 24' | .78847 | 24' | .86870 |
| 25' | .62527 | 25' | .70820 | 25' | .78982 | 25' | .87002 |
| 26' | .62666 | 26' | .70958 | 26' | .79117 | 26' | .87135 |
| 27' | .62805 | 27' | .71095 | 27' | .79252 | 27' | .87267 |
| 28' | .62944 | 28' | .71232 | 28' | .79387 | 28' | .87399 |
| 29' | .63084 | 29' | .71369 | 29' | .79521 | 29' | .87532 |
| 30' | .63223 | 30' | .71506 | 30' | .79656 | 30' | .87664 |
| 31' | .63362 | 31' | .71643 | 31' | .79791 | 31' | .87796 |
| 32' | .63501 | 32' | .71780 | 32' | .79925 | 32' | .87928 |
| 33' | .63640 | 33' | .71916 | 33' | .80060 | 33' | .88060 |
| 34' | .63779 | 34' | .72053 | 34' | .80195 | 34' | .88192 |
| 35' | .63918 | 35' | .72190 | 35' | .80329 | 35' | .88324 |
| 36' | .64057 | 36' | .72327 | 36' | .80463 | 36' | .88456 |
| 37' | .64196 | 37' | .72464 | 37' | .80598 | 37' | .88588 |
| 38' | .64334 | 38' | .72600 | 38' | .80732 | 38' | .88720 |
| 39' | .64473 | 39' | .72737 | 39' | .80867 | 39' | .88852 |
| 40' | .64612 | 40' | .72874 | 40' | .81001 | 40' | .88984 |
| 41' | .64751 | 41' | .73010 | 41' | .81135 | 41' | .89116 |
| 42' | .64889 | 42' | .73147 | 42' | .81269 | 42' | .89247 |
| 43' | .65028 | 43' | .73283 | 43' | .81104 | 43' | .89379 |
| 44' | .65167 | 44' | .73420 | 44' | .81538 | 44' | .89511 |
| 45' | .65305 | 45' | .73556 | 45' | .81672 | 45' | .89642 |
| 46' | .65444 | 46' | .73693 | 46' | .81806 | 46' | .89774 |
| 47' | .65582 | 47' | .73829 | 47' | .81940 | 47' | .89905 |
| 48' | .65721 | 48' | .73965 | 48' | .82074 | 48' | .90037 |
| 49' | .65859 | 49' | .74101 | 49' | .82208 | 49' | .90168 |
| 50' | .65998 | 50' | .74238 | 50' | .82342 | 50' | .90300 |
| 51' | .66136 | 51' | .74374 | 51' | .82476 | 51' | .90431 |
| 52' | .66275 | 52' | .74510 | 52' | .82609 | 52' | .90562 |
| 53' | .66413 | 53' | .74646 | 53' | .82743 | 53' | .90694 |
| 54' | .66551 | 54' | .74782 | 54' | .82877 | 54' | .90825 |
| 55' | .66689 | 55' | .74918 | 55' | .83011 | 55' | .90956 |
| 56' | .66828 | 56' | .75054 | 56' | .83144 | 56' | .91087 |
| 57' | .66966 | 57' | .75190 | 57' | .83278 | 57' | .91218 |
| 58' | .67104 | 58' | .75326 | 58' | .83411 | 58' | .91349 |
| 59' | .67242 | 59' | .75462 | 59' | .83545 | 59' | .91480 |

Table I – (continued)

| | 60° 0′ 981.91611 | | 61° 0′ 981.99387 | | 62° 0′ 982.06996 | | 63° 0′ 982.14428 |
|---|---|---|---|---|---|---|---|
| 1′ | .91742 | 1′ | .99515 | 1′ | .07121 | 1′ | .14551 |
| 2′ | .91873 | 2′ | .99643 | 2′ | .07246 | 2′ | .14673 |
| 3′ | .92004 | 3′ | .99771 | 3′ | .07371 | 3′ | .14795 |
| 4′ | .92135 | 4′ | .99899 | 4′ | .07497 | 4′ | .14917 |
| 5′ | .92265 | 5′ 982.00027 | | 5′ | .07622 | 5′ | .15039 |
| 6′ | .92396 | 6′ | .00155 | 6′ | .07747 | 6′ | .15161 |
| 7′ | .92527 | 7′ | .00283 | 7′ | .07872 | 7′ | .15283 |
| 8′ | .92657 | 8′ | .00411 | 8′ | .07997 | 8′ | .15405 |
| 9′ | .92788 | 9′ | .00539 | 9′ | .08122 | 9′ | .15527 |
| 10′ | .92918 | 10′ | .00667 | 10′ | .08247 | 10′ | .15649 |
| 11′ | .93049 | 11′ | .00795 | 11′ | .08372 | 11′ | .15771 |
| 12′ | .93179 | 12′ | .00922 | 12′ | .08497 | 12′ | .15893 |
| 13′ | .93310 | 13′ | .01050 | 13′ | .08621 | 13′ | .16015 |
| 14′ | .93440 | 14′ | .01177 | 14′ | .08746 | 14′ | .16136 |
| 15′ | .93570 | 15′ | .01305 | 15′ | .08871 | 15′ | .16258 |
| 16′ | .93701 | 16′ | .01433 | 16′ | .08995 | 16′ | .16379 |
| 17′ | .93831 | 17′ | .01560 | 17′ | .09120 | 17′ | .16501 |
| 18′ | .93961 | 18′ | .01687 | 18′ | .09244 | 18′ | .16622 |
| 19′ | .94091 | 19′ | .01815 | 19′ | .09369 | 19′ | .16744 |
| 20′ | .94221 | 20′ | .01942 | 20′ | .09493 | 20′ | .16865 |
| 21′ | .94351 | 21′ | .02069 | 21′ | .09618 | 21′ | .16986 |
| 22′ | .94481 | 22′ | .02197 | 22′ | .09742 | 22′ | .17108 |
| 23′ | .94611 | 23′ | .02324 | 23′ | .09866 | 23′ | .17229 |
| 24′ | .94741 | 24′ | .02451 | 24′ | .09990 | 24′ | .17350 |
| 25′ | .94871 | 25′ | .02578 | 25′ | .10114 | 25′ | .17471 |
| 26′ | .95001 | 26′ | .02705 | 26′ | .10239 | 26′ | .17592 |
| 27′ | .95130 | 27′ | .02832 | 27′ | .10363 | 27′ | .17713 |
| 28′ | .95260 | 28′ | .02959 | 28′ | .10487 | 28′ | .17834 |
| 29′ | .95390 | 29′ | .03086 | 29′ | .10611 | 29′ | .17955 |
| 30′ | .95519 | 30′ | .03213 | 30′ | .10735 | 30′ | .18076 |
| 31′ | .95649 | 31′ | .03339 | 31′ | .10858 | 31′ | .18196 |
| 32′ | .95778 | 32′ | .03466 | 32′ | .10982 | 32′ | .18317 |
| 33′ | .95908 | 33′ | .03593 | 33′ | .11106 | 33′ | .18438 |
| 34′ | .96037 | 34′ | .03720 | 34′ | .11230 | 34′ | .18558 |
| 35′ | .96167 | 35′ | .03846 | 35′ | .11353 | 35′ | .18679 |
| 36′ | .96296 | 36′ | .03973 | 36′ | .11477 | 36′ | .18799 |
| 37′ | .96425 | 37′ | .04099 | 37′ | .11600 | 37′ | .18920 |
| 38′ | .96555 | 38′ | .04226 | 38′ | .11724 | 38′ | .19040 |
| 39′ | .96684 | 39′ | .04352 | 39′ | .11847 | 39′ | .19161 |
| 40′ | .96813 | 40′ | .04478 | 40′ | .11971 | 40′ | .19281 |
| 41′ | .96942 | 41′ | .04604 | 41′ | .12094 | 41′ | .19401 |
| 42′ | .97071 | 42′ | .04731 | 42′ | .12217 | 42′ | .19521 |
| 43′ | .97200 | 43′ | .04857 | 43′ | .12342 | 43′ | .19642 |
| 44′ | .97329 | 44′ | .04983 | 44′ | .12464 | 44′ | .19762 |
| 45′ | .97458 | 45′ | .05110 | 45′ | .12587 | 45′ | .19882 |
| 46′ | .97587 | 46′ | .05235 | 46′ | .12710 | 46′ | .20002 |
| 47′ | .97716 | 47′ | .05362 | 47′ | .12833 | 47′ | .20122 |
| 48′ | .97845 | 48′ | .05488 | 48′ | .12956 | 48′ | .20241 |
| 49′ | .97974 | 49′ | .05614 | 49′ | .13079 | 49′ | .20361 |
| 50′ | .98102 | 50′ | .05739 | 50′ | .13202 | 50′ | .20481 |
| 51′ | .98231 | 51′ | .05865 | 51′ | .13325 | 51′ | .20601 |
| 52′ | .98360 | 52′ | .05991 | 52′ | .13448 | 52′ | .20720 |
| 53′ | .98488 | 53′ | .06117 | 53′ | .13570 | 53′ | .20840 |
| 54′ | .98617 | 54′ | .06242 | 54′ | .13693 | 54′ | .20959 |
| 55′ | .98745 | 55′ | .06368 | 55′ | .13816 | 55′ | .21079 |
| 56′ | .98874 | 56′ | .06494 | 56′ | .13938 | 56′ | .21198 |
| 57′ | .99002 | 57′ | .06619 | 57′ | .14061 | 57′ | .21318 |
| 58′ | .99130 | 58′ | .06745 | 58′ | .14183 | 58′ | .21437 |
| 59′ | .99259 | 59′ | .06870 | 59′ | .14306 | 59′ | .21556 |

Table 1 – (continued)

| 64° | | 65° | | 66° | | 67° | |
|---|---|---|---|---|---|---|---|
| 0′ | 982.21676 | 0′ | 982.28729 | 0′ | 982.35579 | 0′ | 982.42218 |
| 1′ | .21795 | 1′ | .28845 | 1′ | .35692 | 1′ | .42327 |
| 2′ | .21914 | 2′ | .28961 | 2′ | .35804 | 2′ | .42436 |
| 3′ | .22033 | 3′ | .29076 | 3′ | .35916 | 3′ | .42545 |
| 4′ | .22152 | 4′ | .29192 | 4′ | .36029 | 4′ | .42653 |
| 5′ | .22271 | 5′ | .29308 | 5′ | .36141 | 5′ | .42762 |
| 6′ | .22390 | 6′ | .29423 | 6′ | .36253 | 6′ | .42870 |
| 7′ | .22509 | 7′ | .29539 | 7′ | .36365 | 7′ | .42979 |
| 8′ | .22627 | 8′ | .29654 | 8′ | .36477 | 8′ | .43087 |
| 9′ | .22746 | 9′ | .29770 | 9′ | .36589 | 9′ | .43196 |
| 10′ | .22865 | 10′ | .29885 | 10′ | .36701 | 10′ | .43304 |
| 11′ | .22984 | 11′ | .30000 | 11′ | .36813 | 11′ | .43412 |
| 12′ | .23102 | 12′ | .30115 | 12′ | .36924 | 12′ | .43520 |
| 13′ | .23221 | 13′ | .30231 | 13′ | .37036 | 13′ | .43628 |
| 14′ | .23339 | 14′ | .30346 | 14′ | .37148 | 14′ | .43736 |
| 15′ | .23457 | 15′ | .30461 | 15′ | .37259 | 15′ | .43844 |
| 16′ | .23576 | 16′ | .30576 | 16′ | .37371 | 16′ | .43952 |
| 17′ | .23694 | 17′ | .30691 | 17′ | .37482 | 17′ | .44060 |
| 18′ | .23812 | 18′ | .30806 | 18′ | .37594 | 18′ | .44168 |
| 19′ | .23931 | 19′ | .30921 | 19′ | .37705 | 19′ | .44276 |
| 20′ | .24049 | 20′ | .31035 | 20′ | .37816 | 20′ | .44383 |
| 21′ | .24167 | 21′ | .31150 | 21′ | .37927 | 21′ | .44491 |
| 22′ | .24285 | 22′ | .31265 | 22′ | .38039 | 22′ | .44598 |
| 23′ | .24403 | 23′ | .31379 | 23′ | .38150 | 23′ | .44706 |
| 24′ | .24521 | 24′ | .31494 | 24′ | .38261 | 24′ | .44813 |
| 25′ | .24639 | 25′ | .31608 | 25′ | .38372 | 25′ | .44921 |
| 26′ | .24756 | 26′ | .31723 | 26′ | .38483 | 26′ | .45028 |
| 27′ | .24874 | 27′ | .31837 | 27′ | .38594 | 27′ | .45135 |
| 28′ | .24992 | 28′ | .31951 | 28′ | .38704 | 28′ | .45242 |
| 29′ | .25109 | 29′ | .32066 | 29′ | .38815 | 29′ | .45334 |
| 30′ | .25227 | 30′ | .32180 | 30′ | .38926 | 30′ | .45456 |
| 31′ | .25345 | 31′ | .32294 | 31′ | .39036 | 31′ | .45563 |
| 32′ | .25462 | 32′ | .32408 | 32′ | .39147 | 32′ | .45670 |
| 33′ | .25579 | 33′ | .32522 | 33′ | .39258 | 33′ | .45777 |
| 34′ | .25697 | 34′ | .32636 | 34′ | .39368 | 34′ | .45884 |
| 35′ | .25814 | 35′ | .32750 | 35′ | .39478 | 35′ | .45991 |
| 36′ | .25932 | 36′ | .32864 | 36′ | .39589 | 36′ | .46097 |
| 37′ | .26049 | 37′ | .32978 | 37′ | .39699 | 37′ | .46204 |
| 38′ | .26166 | 38′ | .33092 | 38′ | .39809 | 38′ | .46310 |
| 39′ | .26283 | 39′ | .33205 | 39′ | .39919 | 39′ | .46417 |
| 40′ | .26400 | 40′ | .33319 | 40′ | .40029 | 40′ | .46523 |
| 41′ | .26517 | 41′ | .33432 | 41′ | .40139 | 41′ | .46630 |
| 42′ | .26634 | 42′ | .33546 | 42′ | .40249 | 42′ | .46736 |
| 43′ | .26751 | 43′ | .33659 | 43′ | .40359 | 43′ | .46842 |
| 44′ | .26867 | 44′ | .33773 | 44′ | .40469 | 44′ | .46948 |
| 45′ | .26984 | 45′ | .33886 | 45′ | .40579 | 45′ | .47054 |
| 46′ | .27101 | 46′ | .33999 | 46′ | .40689 | 46′ | .47160 |
| 47′ | .27218 | 47′ | .34113 | 47′ | .40798 | 47′ | .47266 |
| 48′ | .27334 | 48′ | .34226 | 48′ | .40908 | 48′ | .47372 |
| 49′ | .27451 | 49′ | .34339 | 49′ | .41017 | 49′ | .47478 |
| 50′ | .27567 | 50′ | .34452 | 50′ | .41127 | 50′ | .47584 |
| 51′ | .27684 | 51′ | .34565 | 51′ | .41236 | 51′ | .47690 |
| 52′ | .27800 | 52′ | .34678 | 52′ | .41346 | 52′ | .47795 |
| 53′ | .27916 | 53′ | .34791 | 53′ | .41455 | 53′ | .47901 |
| 54′ | .28033 | 54′ | .34904 | 54′ | .41564 | 54′ | .48006 |
| 55′ | .28149 | 55′ | .35016 | 55′ | .41673 | 55′ | .48112 |
| 56′ | .28265 | 56′ | .35129 | 56′ | .41783 | 56′ | .48217 |
| 57′ | .28381 | 57′ | .35242 | 57′ | .41892 | 57′ | .48323 |
| 58′ | .28497 | 58′ | .35354 | 58′ | .42001 | 58′ | .48428 |
| 59′ | .28613 | 59′ | .35467 | 59′ | .42110 | 59′ | .48533 |

Table 1 – (continued)

| 68° | 0′ 982.48638 | 69° | 0′ 982.54831 | 70° | 0′ 982.60788 | 71° | 0′ 982.66504 |
|---|---|---|---|---|---|---|---|
| 1′ | .48743 | 1′ | .54932 | 1′ | .60886 | 1′ | .66597 |
| 2′ | .48848 | 2′ | .55033 | 2′ | .60983 | 2′ | .66690 |
| 3′ | .48953 | 3′ | .55134 | 3′ | .61080 | 3′ | .66783 |
| 4′ | .49058 | 4′ | .55235 | 4′ | .61177 | 4′ | .66876 |
| 5′ | .49163 | 5′ | .55336 | 5′ | .61274 | 5′ | .66969 |
| 6′ | .49268 | 6′ | .55437 | 6′ | .61371 | 6′ | .67062 |
| 7′ | .49373 | 7′ | .55538 | 7′ | .61468 | 7′ | .67154 |
| 8′ | .49477 | 8′ | .55639 | 8′ | .61565 | 8′ | .67247 |
| 9′ | .49582 | 9′ | .55740 | 9′ | .61661 | 9′ | .67340 |
| 10′ | .49686 | 10′ | .55840 | 10′ | .61758 | 10′ | .67432 |
| 11′ | .49791 | 11′ | .55941 | 11′ | .61855 | 11′ | .67525 |
| 12′ | .49895 | 12′ | .56041 | 12′ | .61951 | 12′ | .67617 |
| 13′ | .50000 | 13′ | .56142 | 13′ | .62047 | 13′ | .67709 |
| 14′ | .50104 | 14′ | .56242 | 14′ | .62144 | 14′ | .67802 |
| 15′ | .50208 | 15′ | .56342 | 15′ | .62240 | 15′ | .67894 |
| 16′ | .50312 | 16′ | .56443 | 16′ | .62336 | 16′ | .67986 |
| 17′ | .50416 | 17′ | .56543 | 17′ | .62433 | 17′ | .68078 |
| 18′ | .50520 | 18′ | .56643 | 18′ | .62529 | 18′ | .68170 |
| 19′ | .50624 | 19′ | .56743 | 19′ | .62625 | 19′ | .68262 |
| 20′ | .50728 | 20′ | .56843 | 20′ | .62721 | 20′ | .68354 |
| 21′ | .50832 | 21′ | .56943 | 21′ | .62817 | 21′ | .68446 |
| 22′ | .50936 | 22′ | .57043 | 22′ | .62912 | 22′ | .68537 |
| 23′ | .51039 | 23′ | .57143 | 23′ | .63008 | 23′ | .68629 |
| 24′ | .51143 | 24′ | .57242 | 24′ | .63104 | 24′ | .68720 |
| 25′ | .51247 | 25′ | .57342 | 25′ | .63200 | 25′ | .68812 |
| 26′ | .51350 | 26′ | .57442 | 26′ | .63295 | 26′ | .68903 |
| 27′ | .51453 | 27′ | .57541 | 27′ | .63391 | 27′ | .68995 |
| 28′ | .51557 | 28′ | .57641 | 28′ | .63486 | 28′ | .69086 |
| 29′ | .51660 | 29′ | .57740 | 29′ | .63581 | 29′ | .69177 |
| 30′ | .51763 | 30′ | .57839 | 30′ | .63677 | 30′ | .69268 |
| 31′ | .51867 | 31′ | .57939 | 31′ | .63772 | 31′ | .69359 |
| 32′ | .51970 | 32′ | .58038 | 32′ | .63867 | 32′ | .69450 |
| 33′ | .52023 | 33′ | .58137 | 33′ | .63962 | 33′ | .69541 |
| 34′ | .52176 | 34′ | .58236 | 34′ | .64057 | 34′ | .69632 |
| 35′ | .52279 | 35′ | .58335 | 35′ | .64152 | 35′ | .69723 |
| 36′ | .52382 | 36′ | .58434 | 36′ | .64247 | 36′ | .69814 |
| 37′ | .52484 | 37′ | .58533 | 37′ | .64342 | 37′ | .69904 |
| 38′ | .52587 | 38′ | .58632 | 38′ | .64437 | 38′ | .69995 |
| 39′ | .52690 | 39′ | .58730 | 39′ | .64531 | 39′ | .70085 |
| 40′ | .52792 | 40′ | .58829 | 40′ | .64626 | 40′ | .70176 |
| 41′ | .52895 | 41′ | .58928 | 41′ | .64720 | 41′ | .70266 |
| 42′ | .52997 | 42′ | .59026 | 42′ | .64815 | 42′ | .70357 |
| 43′ | .53100 | 43′ | .59125 | 43′ | .64909 | 43′ | .70447 |
| 44′ | .53202 | 44′ | .59223 | 44′ | .65004 | 44′ | .70537 |
| 45′ | .53304 | 45′ | .59321 | 45′ | .65098 | 45′ | .70627 |
| 46′ | .53407 | 46′ | .59420 | 46′ | .65192 | 46′ | .70717 |
| 47′ | .53509 | 47′ | .59518 | 47′ | .65286 | 47′ | .70807 |
| 48′ | .53611 | 48′ | .59616 | 48′ | .65380 | 48′ | .70897 |
| 49′ | .53713 | 49′ | .59714 | 49′ | .65474 | 49′ | .70987 |
| 50′ | .53815 | 50′ | .59812 | 50′ | .65568 | 50′ | .71076 |
| 51′ | .53917 | 51′ | .59910 | 51′ | .65662 | 51′ | .71166 |
| 52′ | .54019 | 52′ | .60008 | 52′ | .65756 | 52′ | .71256 |
| 53′ | .54120 | 53′ | .60106 | 53′ | .65850 | 53′ | .71345 |
| 54′ | .54222 | 54′ | .60203 | 54′ | .65943 | 54′ | .71435 |
| 55′ | .54324 | 55′ | .60301 | 55′ | .66037 | 55′ | .71524 |
| 56′ | .54425 | 56′ | .60399 | 56′ | .66130 | 56′ | .71613 |
| 57′ | .54527 | 57′ | .60496 | 57′ | .66224 | 57′ | .71703 |
| 58′ | .54628 | 58′ | .60594 | 58′ | .66317 | 58′ | .71792 |
| 59′ | .54729 | 09′ | .60691 | 59′ | .66410 | 59′ | .71881 |

Table I — (continued)

| 72° | 0′ 982.71970 | 73° | 0′ 982.77180 | 74° | 0′ 982.82127 | 75° | 0′ 982.86807 |
|---|---|---|---|---|---|---|---|
| 1′ | .72059 | 1′ | .77264 | 1′ | .82208 | 1′ | .86882 |
| 2′ | .72148 | 2′ | .77349 | 2′ | .82288 | 2′ | .86958 |
| 3′ | .72236 | 3′ | .77434 | 3′ | .82368 | 3′ | .87033 |
| 4′ | .72325 | 4′ | .77518 | 4′ | .82448 | 4′ | .87109 |
| 5′ | .72414 | 5′ | .77602 | 5′ | .82528 | 5′ | .87184 |
| 6′ | .72502 | 6′ | .77687 | 6′ | .82608 | 6′ | .87260 |
| 7′ | .72591 | 7′ | .77771 | 7′ | .82687 | 7′ | .87335 |
| 8′ | .72679 | 8′ | .77855 | 8′ | .82768 | 8′ | .87410 |
| 9′ | .72768 | 9′ | .77939 | 9′ | .82847 | 9′ | .87485 |
| 10′ | .72856 | 10′ | .78023 | 10′ | .82926 | 10′ | .87560 |
| 11′ | .72944 | 11′ | .78107 | 11′ | .83006 | 11′ | .87635 |
| 12′ | .73032 | 12′ | .78191 | 12′ | .83085 | 12′ | .87710 |
| 13′ | .73121 | 13′ | .78274 | 13′ | .83164 | 13′ | .87784 |
| 14′ | .73209 | 14′ | .78358 | 14′ | .83244 | 14′ | .87859 |
| 15′ | .73297 | 15′ | .78442 | 15′ | .83323 | 15′ | .87934 |
| 16′ | .73384 | 16′ | .78525 | 16′ | .83402 | 16′ | .88008 |
| 17′ | .73472 | 17′ | .78609 | 17′ | .83481 | 17′ | .88083 |
| 18′ | .73560 | 18′ | .78692 | 18′ | .83560 | 18′ | .88157 |
| 19′ | .73648 | 19′ | .78775 | 19′ | .83639 | 19′ | .88231 |
| 20′ | .73735 | 20′ | .78859 | 20′ | .83717 | 20′ | .88306 |
| 21′ | .73823 | 21′ | .78942 | 21′ | .83796 | 21′ | .88380 |
| 22′ | .73910 | 22′ | .79025 | 22′ | .83875 | 22′ | .88454 |
| 23′ | .73998 | 23′ | .79108 | 23′ | .83953 | 23′ | .88528 |
| 24′ | .74085 | 24′ | .79191 | 24′ | .84032 | 24′ | .88602 |
| 25′ | .74172 | 25′ | .79274 | 25′ | .84110 | 25′ | .88676 |
| 26′ | .74259 | 26′ | .79356 | 26′ | .84188 | 26′ | .88749 |
| 27′ | .74346 | 27′ | .79439 | 27′ | .84267 | 27′ | .88823 |
| 28′ | .74433 | 28′ | .79522 | 28′ | .84345 | 28′ | .88897 |
| 29′ | .74520 | 29′ | .79604 | 29′ | .84423 | 29′ | .88970 |
| 30′ | .74607 | 30′ | .79687 | 30′ | .84501 | 30′ | .89044 |
| 31′ | .74694 | 31′ | .79769 | 31′ | .84579 | 31′ | .89117 |
| 32′ | .74781 | 32′ | .79852 | 32′ | .84657 | 32′ | .89190 |
| 33′ | .74867 | 33′ | .79934 | 33′ | .84735 | 33′ | .89264 |
| 34′ | .74954 | 34′ | .80016 | 34′ | .84812 | 34′ | .89337 |
| 35′ | .75041 | 35′ | .80098 | 35′ | .84890 | 35′ | .89410 |
| 36′ | .75127 | 36′ | .80180 | 36′ | .84968 | 36′ | .89483 |
| 37′ | .75213 | 37′ | .80262 | 37′ | .85045 | 37′ | .89556 |
| 38′ | .75300 | 38′ | .80344 | 38′ | .85122 | 38′ | .89629 |
| 39′ | .75386 | 39′ | .80426 | 39′ | .85200 | 39′ | .89701 |
| 40′ | .75472 | 40′ | .80508 | 40′ | .85277 | 40′ | .89774 |
| 41′ | .75558 | 41′ | .80590 | 41′ | .85354 | 41′ | .89847 |
| 42′ | .75644 | 42′ | .80671 | 42′ | .85431 | 42′ | .89919 |
| 43′ | .75730 | 43′ | .80753 | 43′ | .85508 | 43′ | .89992 |
| 44′ | .75816 | 44′ | .80834 | 44′ | .85585 | 44′ | .90064 |
| 45′ | .75902 | 45′ | .80916 | 45′ | .85662 | 45′ | .90136 |
| 46′ | .75987 | 46′ | .80997 | 46′ | .85739 | 46′ | .90208 |
| 47′ | .76073 | 47′ | .81078 | 47′ | .85816 | 47′ | .90281 |
| 48′ | .76159 | 48′ | .81159 | 48′ | .85893 | 48′ | .90353 |
| 49′ | .76244 | 49′ | .81240 | 49′ | .85969 | 49′ | .90425 |
| 50′ | .76330 | 50′ | .81321 | 50′ | .86046 | 50′ | .90497 |
| 51′ | .76415 | 51′ | .81402 | 51′ | .86122 | 51′ | .90568 |
| 52′ | .76500 | 52′ | .81483 | 52′ | .86198 | 52′ | .90640 |
| 53′ | .76585 | 53′ | .81564 | 53′ | .86275 | 53′ | .90712 |
| 54′ | .76671 | 54′ | .81645 | 54′ | .86351 | 54′ | .90783 |
| 55′ | .76756 | 55′ | .81725 | 55′ | .86427 | 55′ | .90855 |
| 56′ | .76841 | 56′ | .81806 | 56′ | .86503 | 56′ | .90926 |
| 57′ | .76926 | 57′ | .81886 | 57′ | .86579 | 57′ | .90998 |
| 58′ | .77010 | 58′ | .81967 | 58′ | .86655 | 58′ | .91069 |
| 59′ | .77095 | 59′ | .82047 | 59′ | .86731 | 59′ | .91140 |

Table I — (continued)

| 76° | 0′ 982.91211 | 77° | 0′ 982.95337 | 78° | 0′ 982.99177 | 79° | 0′ 983.02728 |
|---|---|---|---|---|---|---|---|
| 1′ | .91283 | 1′ | .95403 | 1′ | .99238 | 1′ | .02784 |
| 2′ | .91353 | 2′ | .95469 | 2′ | .99300 | 2′ | .02841 |
| 3′ | .91424 | 3′ | .95535 | 3′ | .99361 | 3′ | .02898 |
| 4′ | .91495 | 4′ | .95602 | 4′ | .99423 | 4′ | .02954 |
| 5′ | .91566 | 5′ | .95668 | 5′ | .99484 | 5′ | .03010 |
| 6′ | .91637 | 6′ | .95734 | 6′ | .99545 | 6′ | .03067 |
| 7′ | .91707 | 7′ | .95799 | 7′ | .99606 | 7′ | .03123 |
| 8′ | .91778 | 8′ | .95865 | 8′ | .99667 | 8′ | .03179 |
| 9′ | .91848 | 9′ | .95931 | 9′ | .99728 | 9′ | .03235 |
| 10′ | .91919 | 10′ | .95997 | 10′ | .99789 | 10′ | .03291 |
| 11′ | .91989 | 11′ | .96062 | 11′ | .99850 | 11′ | .03347 |
| 12′ | .92059 | 12′ | .96128 | 12′ | .99910 | 12′ | .03403 |
| 13′ | .92129 | 13′ | .96193 | 13′ | .99971 | 13′ | .03458 |
| 14′ | .92199 | 14′ | .96258 | 14′ 983.00031 | | 14′ | .03514 |
| 15′ | .92269 | 15′ | .96324 | 15′ | .00092 | 15′ | .03570 |
| 16′ | .92339 | 16′ | .96389 | 16′ | .00152 | 16′ | .03625 |
| 17′ | .92409 | 17′ | .96454 | 17′ | .00213 | 17′ | .03681 |
| 18′ | .92479 | 18′ | .96519 | 18′ | .00273 | 18′ | .03736 |
| 19′ | .92548 | 19′ | .96584 | 19′ | .00333 | 19′ | .03791 |
| 20′ | .92618 | 20′ | .96649 | 20′ | .00393 | 20′ | .03846 |
| 21′ | .92687 | 21′ | .96713 | 21′ | .00453 | 21′ | .03901 |
| 22′ | .92757 | 22′ | .96778 | 22′ | .00513 | 22′ | .03956 |
| 23′ | .92826 | 23′ | .96843 | 23′ | .00573 | 23′ | .04011 |
| 24′ | .92895 | 24′ | .96907 | 24′ | .00632 | 24′ | .04066 |
| 25′ | .92965 | 25′ | .96972 | 25′ | .00692 | 25′ | .04121 |
| 26′ | .93034 | 26′ | .97036 | 26′ | .00751 | 26′ | .04175 |
| 27′ | .93103 | 27′ | .97100 | 27′ | .00811 | 27′ | .04230 |
| 28′ | .93172 | 28′ | .97164 | 28′ | .00870 | 28′ | .04284 |
| 29′ | .93241 | 29′ | .97229 | 29′ | .00930 | 29′ | .04339 |
| 30′ | .93309 | 30′ | .97293 | 30′ | .00989 | 30′ | .04393 |
| 31′ | .93378 | 31′ | .97357 | 31′ | .01048 | 31′ | .04447 |
| 32′ | .93447 | 32′ | .97421 | 32′ | .01107 | 32′ | .04502 |
| 33′ | .93515 | 33′ | .97484 | 33′ | .01166 | 33′ | .04556 |
| 34′ | .93584 | 34′ | .97548 | 34′ | .01225 | 34′ | .04610 |
| 35′ | .93652 | 35′ | .97612 | 35′ | .01284 | 35′ | .04664 |
| 36′ | .93720 | 36′ | .97675 | 36′ | .01342 | 36′ | .04717 |
| 37′ | .93789 | 37′ | .97739 | 37′ | .01401 | 37′ | .04771 |
| 38′ | .93857 | 38′ | .97802 | 38′ | .01460 | 38′ | .04825 |
| 39′ | .93925 | 39′ | .97865 | 39′ | .01518 | 39′ | .04878 |
| 40′ | .93993 | 40′ | .97929 | 40′ | .01577 | 40′ | .04932 |
| 41′ | .94061 | 41′ | .97992 | 41′ | .01635 | 41′ | .04985 |
| 42′ | .94129 | 42′ | .98055 | 42′ | .01693 | 42′ | .05039 |
| 43′ | .94196 | 43′ | .98118 | 43′ | .01751 | 43′ | .05092 |
| 44′ | .94264 | 44′ | .98181 | 44′ | .01809 | 44′ | .05145 |
| 45′ | .94332 | 45′ | .98244 | 45′ | .01867 | 45′ | .05198 |
| 46′ | .94399 | 46′ | .98307 | 46′ | .01925 | 46′ | .05251 |
| 47′ | .94467 | 47′ | .98369 | 47′ | .01983 | 47′ | .05304 |
| 48′ | .94534 | 48′ | .98432 | 48′ | .02041 | 48′ | .05357 |
| 49′ | .94601 | 49′ | .98494 | 49′ | .02099 | 49′ | .05410 |
| 50′ | .94669 | 50′ | .98557 | 50′ | .02156 | 50′ | .05462 |
| 51′ | .94736 | 51′ | .98619 | 51′ | .02214 | 51′ | .05515 |
| 52′ | .94803 | 52′ | .98681 | 52′ | .02271 | 52′ | .05567 |
| 53′ | .94870 | 53′ | .98744 | 53′ | .02329 | 53′ | .05620 |
| 54′ | .94937 | 54′ | .98806 | 54′ | .02386 | 54′ | .05672 |
| 55′ | .95004 | 55′ | .98868 | 55′ | .02443 | 55′ | .05724 |
| 56′ | .95070 | 56′ | .98930 | 56′ | .02500 | 56′ | .05777 |
| 57′ | .95137 | 57′ | .98992 | 57′ | .02557 | 57′ | .05829 |
| 58′ | .95204 | 58′ | .99054 | 58′ | .02614 | 58′ | .05881 |
| 59′ | .95270 | 59′ | .99115 | 59′ | .02671 | 59′ | .05933 |

Table I – (continued)

| 80° | 0′ 983.05985 | 81° | 0′ 983.08944 | 82° | 0′ 983.11601 | 83° | 0′ 983.13953 |
|---|---|---|---|---|---|---|---|
| 1′ | .06036 | 1′ | .08990 | 1′ | .11643 | 1′ | .13990 |
| 2′ | .06088 | 2′ | .09037 | 2′ | .11684 | 2′ | .14027 |
| 3′ | .06140 | 3′ | .09084 | 3′ | .11726 | 3′ | .14063 |
| 4′ | .06191 | 4′ | .09130 | 4′ | .11767 | 4′ | .14099 |
| 5′ | .06243 | 5′ | .09177 | 5′ | .11809 | 5′ | .14136 |
| 6′ | .06294 | 6′ | .09223 | 6′ | .11850 | 6′ | .14172 |
| 7′ | .06345 | 7′ | .09269 | 7′ | .11891 | 7′ | .14208 |
| 8′ | .06396 | 8′ | .09315 | 8′ | .11932 | 8′ | .14244 |
| 9′ | .06448 | 9′ | .09361 | 9′ | .11973 | 9′ | .14280 |
| 10′ | .06499 | 10′ | .09407 | 10′ | .12014 | 10′ | .14316 |
| 11′ | .06549 | 11′ | .09453 | 11′ | .12055 | 11′ | .14351 |
| 12′ | .06600 | 12′ | .09499 | 12′ | .12096 | 12′ | .14387 |
| 13′ | .06651 | 13′ | .09545 | 13′ | .12137 | 13′ | .14423 |
| 14′ | .06702 | 14′ | .09591 | 14′ | .12177 | 14′ | .14458 |
| 15′ | .06752 | 15′ | .09636 | 15′ | .12218 | 15′ | .14494 |
| 16′ | .06803 | 16′ | .09682 | 16′ | .12258 | 16′ | .14529 |
| 17′ | .06853 | 17′ | .09727 | 17′ | .12299 | 17′ | .14564 |
| 18′ | .06904 | 18′ | .09773 | 18′ | .12339 | 18′ | .14599 |
| 19′ | .06954 | 19′ | .09818 | 19′ | .12379 | 19′ | .14634 |
| 20′ | .07004 | 20′ | .09863 | 20′ | .12419 | 20′ | .14669 |
| 21′ | .07054 | 21′ | .09908 | 21′ | .12459 | 21′ | .14704 |
| 22′ | .07104 | 22′ | .09953 | 22′ | .12499 | 22′ | .14739 |
| 23′ | .07154 | 23′ | .09998 | 23′ | .12539 | 23′ | .14774 |
| 24′ | .07204 | 24′ | .10043 | 24′ | .12579 | 24′ | .14808 |
| 25′ | .07254 | 25′ | .10088 | 25′ | .12618 | 25′ | .14843 |
| 26′ | .07304 | 26′ | .10132 | 26′ | .12658 | 26′ | .14877 |
| 27′ | .07353 | 27′ | .10177 | 27′ | .12697 | 27′ | .14912 |
| 28′ | .07403 | 28′ | .10221 | 28′ | .12737 | 28′ | .14946 |
| 29′ | .07452 | 29′ | .10266 | 29′ | .12776 | 29′ | .14980 |
| 30′ | .07502 | 30′ | .10310 | 30′ | .12815 | 30′ | .15014 |
| 31′ | .07551 | 31′ | .10354 | 31′ | .12855 | 31′ | .15048 |
| 32′ | .07600 | 32′ | .10399 | 32′ | .12894 | 32′ | .15082 |
| 33′ | .07649 | 33′ | .10443 | 33′ | .12933 | 33′ | .15116 |
| 34′ | .07698 | 34′ | .10487 | 34′ | .12972 | 34′ | .15150 |
| 35′ | .07747 | 35′ | .10531 | 35′ | .13010 | 35′ | .15184 |
| 36′ | .07796 | 36′ | .10574 | 36′ | .13049 | 36′ | .15217 |
| 37′ | .07845 | 37′ | .10618 | 37′ | .13088 | 37′ | .15251 |
| 38′ | .07893 | 38′ | .10662 | 38′ | .13126 | 38′ | .15284 |
| 39′ | .07942 | 39′ | .10705 | 39′ | .13165 | 39′ | .15318 |
| 40′ | .07991 | 40′ | .10749 | 40′ | .13203 | 40′ | .15351 |
| 41′ | .08039 | 41′ | .10792 | 41′ | .13242 | 41′ | .15384 |
| 42′ | .08087 | 42′ | .10836 | 42′ | .13280 | 42′ | .15417 |
| 43′ | .08136 | 43′ | .10879 | 43′ | .13318 | 43′ | .15450 |
| 44′ | .08184 | 44′ | .10922 | 44′ | .13356 | 44′ | .15483 |
| 45′ | .08232 | 45′ | .10965 | 45′ | .13394 | 45′ | .15516 |
| 46′ | .08280 | 46′ | .11008 | 46′ | .13432 | 46′ | .15549 |
| 47′ | .08328 | 47′ | .11051 | 47′ | .13470 | 47′ | .15581 |
| 48′ | .08376 | 48′ | .11094 | 48′ | .13507 | 48′ | .15614 |
| 49′ | .08424 | 49′ | .11136 | 49′ | .13545 | 49′ | .15646 |
| 50′ | .08471 | 50′ | .11179 | 50′ | .13583 | 50′ | .15679 |
| 51′ | .08519 | 51′ | .11222 | 51′ | .13620 | 51′ | .15711 |
| 52′ | .08566 | 52′ | .11264 | 52′ | .13657 | 52′ | .15743 |
| 53′ | .08614 | 53′ | .11307 | 53′ | .13695 | 53′ | .15776 |
| 54′ | .08661 | 54′ | .11349 | 54′ | .13732 | 54′ | .15808 |
| 55′ | .08708 | 55′ | .11391 | 55′ | .13769 | 55′ | .15840 |
| 56′ | .08756 | 56′ | .11433 | 56′ | .13806 | 56′ | .15871 |
| 57′ | .08803 | 57′ | .11475 | 57′ | .13843 | 57′ | .15903 |
| 58′ | .08850 | 58′ | .11517 | 58′ | .13880 | 58′ | .15935 |
| 59′ | .08897 | 59′ | .11559 | 59′ | .13917 | 59′ | .15967 |

Table I — (continued)

| 84° | 0′ 983.15998 | 85° | 0′ 983.17733 | 86° | 0′ 983.19155 | 87° | 0′ 983.20262 |
|---|---|---|---|---|---|---|---|
| 1′ | .16030 | 1′ | .17759 | 1′ | .19176 | 1′ | .20278 |
| 2′ | .16061 | 2′ | .17785 | 2′ | .19197 | 2′ | .20294 |
| 3′ | .16092 | 3′ | .17811 | 3′ | .19218 | 3′ | .20310 |
| 4′ | .16123 | 4′ | .17837 | 4′ | .19238 | 4′ | .20325 |
| 5′ | .16155 | 5′ | .17863 | 5′ | .19259 | 5′ | .20341 |
| 6′ | .16186 | 6′ | .17889 | 6′ | .19280 | 6′ | .20356 |
| 7′ | .16217 | 7′ | .17915 | 7′ | .19300 | 7′ | .20371 |
| 8′ | .16247 | 8′ | .17940 | 8′ | .19321 | 8′ | .20386 |
| 9′ | .16278 | 9′ | .17966 | 9′ | .19341 | 9′ | .20401 |
| 10′ | .16309 | 10′ | .17991 | 10′ | .19361 | 10′ | .20416 |
| 11′ | .16339 | 11′ | .18017 | 11′ | .19381 | 11′ | .20431 |
| 12′ | .16370 | 12′ | .18042 | 12′ | .19401 | 12′ | .20446 |
| 13′ | .16400 | 13′ | .18067 | 13′ | .19421 | 13′ | .20461 |
| 14′ | .16431 | 14′ | .18092 | 14′ | .19441 | 14′ | .20476 |
| 15′ | .16461 | 15′ | .18117 | 15′ | .19461 | 15′ | .20490 |
| 16′ | .16491 | 16′ | .18142 | 16′ | .19481 | 16′ | .20505 |
| 17′ | .16521 | 17′ | .18167 | 17′ | .19500 | 17′ | .20519 |
| 18′ | .16551 | 18′ | .18192 | 18′ | .19520 | 18′ | .20533 |
| 19′ | .16581 | 19′ | .18217 | 19′ | .19540 | 19′ | .20548 |
| 20′ | .16611 | 20′ | .18241 | 20′ | .19559 | 20′ | .20562 |
| 21 | .16641 | 21′ | .18266 | 21′ | .19578 | 21′ | .20576 |
| 22′ | .16670 | 22′ | .18290 | 22′ | .19597 | 22′ | .20590 |
| 23′ | .16700 | 23′ | .18315 | 23′ | .19617 | 23′ | .20604 |
| 24′ | .16729 | 24′ | .18339 | 24′ | .19636 | 24′ | .20617 |
| 25′ | .16759 | 25′ | .18363 | 25′ | .19655 | 25′ | .20631 |
| 26′ | .16788 | 26′ | .18387 | 26′ | .19673 | 26′ | .20645 |
| 27′ | .16817 | 27′ | .18411 | 27′ | .19692 | 27′ | .20658 |
| 28′ | .16846 | 28′ | .18435 | 28′ | .19711 | 28′ | .20672 |
| 29′ | .16875 | 29′ | .18459 | 29′ | .19729 | 29′ | .20685 |
| 30′ | .16904 | 30′ | .18483 | 30′ | .19748 | 30′ | .20698 |
| 31′ | .16933 | 31′ | .18506 | 31′ | .19766 | 31′ | .20711 |
| 32′ | .16962 | 32′ | .18530 | 32′ | .19785 | 32′ | .20724 |
| 33′ | .16991 | 33′ | .18554 | 33′ | .19803 | 33′ | .20737 |
| 34′ | .17019 | 34′ | .18577 | 34′ | .19821 | 34′ | .20750 |
| 35′ | .17048 | 35′ | .18600 | 35′ | .19839 | 35′ | .20763 |
| 36′ | .17076 | 36′ | .18623 | 36′ | .19857 | 36′ | .20776 |
| 37′ | .17105 | 37′ | .18647 | 37′ | .19875 | 37′ | .20788 |
| 38′ | .17133 | 38′ | .18670 | 38′ | .19893 | 38′ | .20801 |
| 39′ | .17161 | 39′ | .18693 | 39′ | .19911 | 39′ | .20813 |
| 40′ | .17189 | 40′ | .18715 | 40′ | .19928 | 40′ | .20826 |
| 41′ | .17217 | 41′ | .18738 | 41′ | .19946 | 41′ | .20838 |
| 42′ | .17245 | 42′ | .18761 | 42′ | .19963 | 42′ | .20850 |
| 43′ | .17273 | 43′ | .18784 | 43′ | .19981 | 43′ | .20862 |
| 44′ | .17301 | 44′ | .18806 | 44′ | .19998 | 44′ | .20874 |
| 45′ | .17328 | 45′ | .18829 | 45′ | .20015 | 45′ | .20886 |
| 46′ | .17356 | 46′ | .18851 | 46′ | .20032 | 46′ | .20898 |
| 47′ | .17383 | 47′ | .18873 | 47′ | .20049 | 47′ | .20910 |
| 48′ | .17411 | 48′ | .18895 | 48′ | .20066 | 48′ | .20922 |
| 49′ | .17438 | 49′ | .18917 | 49′ | .20083 | 49′ | .20933 |
| 50′ | .17465 | 50′ | .18939 | 50′ | .20100 | 50′ | .20945 |
| 51′ | .17492 | 51′ | .18961 | 51′ | .20116 | 51′ | .20956 |
| 52′ | .17519 | 52′ | .18983 | 52′ | .20133 | 52′ | .20967 |
| 53′ | .17546 | 53′ | .19005 | 53′ | .20149 | 53′ | .20979 |
| 54′ | .17573 | 54′ | .19027 | 54′ | .20166 | 54′ | .20990 |
| 55′ | .17600 | 55′ | .19048 | 55′ | .20182 | 55′ | .21001 |
| 56′ | .17627 | 56′ | .19070 | 56′ | .20198 | 56′ | .21012 |
| 57′ | .17653 | 57′ | .19091 | 57′ | .20215 | 57′ | .21023 |
| 58′ | .17680 | 58′ | .19112 | 58′ | .20231 | 58′ | .21033 |
| 59′ | .17706 | 59′ | .19134 | 59′ | .20247 | 59′ | .21044 |

| 88° | | 88° | | 89° | | 89° | |
|---|---|---|---|---|---|---|---|
| 0′ 983 | .21055 | 30 ′983 | .21332 | 0′983 | .21531 | 31′ 983 | .21652 |
| 1′ | .21065 | 31′ | .21340 | 1′ | .21536 | 32′ | .21655 |
| 2′ | .21076 | 32′ | .21348 | 2′ | .21541 | 33′ | .21657 |
| 3′ | .21086 | 33′ | .21356 | 3′ | .21546 | 34′ | .21659 |
| 4′ | .21096 | 34′ | .21363 | 4′ | .21551 | 35′ | .21662 |
| 5′ | .21107 | 35′ | .21371 | 5′ | .21556 | 36′ | .21664 |
| 6′ | .21117 | 36′ | .21378 | 6′ | .21561 | 37′ | .21666 |
| 7′ | .21127 | 37′ | .21386 | 7′ | .21565 | 38′ | .21668 |
| 8′ | .21137 | 38′ | .21393 | 8′ | .21570 | 39′ | .21670 |
| 9′ | .21146 | 39′ | .21400 | 9′ | .21575 | 40′ | .21672 |
| 10′ | .21156 | 40′ | .21407 | 10′ | .21579 | 41′ | .21673 |
| 11′ | .21166 | 41′ | .21414 | 11′ | .21583 | 42′ | .21675 |
| 12′ | .21175 | 42′ | .21421 | 12′ | .21588 | 43′ | .21676 |
| 13′ | .21185 | 43′ | .21428 | 13′ | .21592 | 44′ | .21678 |
| 14′ | .21194 | 44′ | .21435 | 14′ | .21596 | 45′ | .21679 |
| 15′ | .21203 | 45′ | .21441 | 15′ | .21600 | 46′ | .21681 |
| 16′ | .21213 | 46′ | .21448 | 16′ | .21604 | 47′ | .21682 |
| 17′ | .21222 | 47′ | .21454 | 17′ | .21608 | 48′ | .21683 |
| 18′ | .21231 | 48′ | .21461 | 18′ | .21611 | 49′ | .21684 |
| 19′ | .21240 | 49′ | .21467 | 19′ | .21615 | 50′ | .21685 |
| 20′ | .21249 | 50′ | .21473 | 20′ | .21619 | 51′ | .21686 |
| 21′ | .21257 | 51′ | .21479 | 21′ | .21622 | 52′ | .21686 |
| 22′ | .21266 | 52′ | .21485 | 22′ | .21626 | 53′ | .21687 |
| 23′ | .21275 | 53′ | .21491 | 23′ | .21629 | 54′ | .21688 |
| 24′ | .21283 | 54′ | .21497 | 24′ | .21632 | 55′ | .21688 |
| 25′ | .21292 | 55′ | .21503 | 25′ | .21635 | 56′ | .21689 |
| 26′ | .21300 | 56′ | .21509 | 26′ | .21638 | 57′ | .21689 |
| 27′ | .21308 | 57′ | .21514 | 27′ | .21641 | 58′ | .21689 |
| 28′ | .21316 | 58′ | .21520 | 28′ | .21644 | 59′ | .21689 |
| 29′ | .21324 | 59′ | .21525 | 29′ | .21647 | | |
| | | | | 30′ | .21650 | 90° 0′ 983 | .21689 |

# REFERENCES

[1] CAPUTO M., *The gravity field of the Earth*. Academic Press, New York-London, p. 33 (1967).

[2] CAPUTO M., *The gravity field of the Earth*. Accademic Press, New York-London, p. 32 (1967).

[3] SOMIGLIANA C., *Teoria generale del campo gravitaz'onale dell'ellissoide di rotazione*. «Mem. Soc. Astr. It.», 4, (1927).

[1] VERNIANI F., *The total mass of the Earth's Atmosphere* «Journ. of Geophysical Research», 71, 385 (1966).