columns of computed altitude and azimuth or azimuth angle, separate azimuth tables have decreased in popularity.

Azimuth can be determined by computation or by amplitudes (tab. 27, 28), as well as by azimuth table. The method of computation depends somewhat upon the information available. There are three general approaches:

Time azimuth is the name given an azimuth or azimuth angle computed with meridian angle (a function of time), latitude, and polar distance (or declination) as the known quantities.

Altitude azimuth is an azimuth or azimuth angle computed with altitude, latitude, and polar distance as the known quantities.

Time and altitude azimuth is computed with meridian angle, declination, and altitude as the known quantities, the most common formula being

$$\sin Z = \sin t \cos d \sec h.$$

The weakness of this method is that it does not indicate whether the celestial body is north or south of the prime vertical. Usually there is no question on this point, but if Z is near 90°, the quadrant may be in doubt. If this occurs, either the meridian angle or altitude when on the prime vertical can be determined from table 25 or by computation, using the formula

$$\cos t = \tan d \cot L$$

or

$$\sin h = \sin d \csc L.$$

If the altitude is *less*, or the meridian angle is *greater* than the value when the body is on the prime vertical, the azimuth angle should be labeled N or S to agree with the latitude. If h is *greater* or t is *less* than when on the prime vertical, Z should be given the contrary name (N or S) to that of the latitude.

Amplitudes. For checking the compass, a low altitude is desirable because it can be measured easiest and most accurately. If a celestial body is observed when its center is on the *celestial* horizon, the amplitude (art. 2029), which is the arc on the horizon between the prime vertical and the body, can be taken directly from table 27.

2126. Azimuth tables are numerous. Originally, they were designed primarily for use in determining compass error. Since the sun was the celestial body customarily used for this purpose, most of the tables were designed with the sun in mind. Meridian angle is commonly expressed in terms of local apparent time, in intervals varying from about one to 20 minutes. In many of the tables, meridian angle increases *upward* from the bottom of the page.

The following are some of the principal azimuth tables:

Wakeley. The first known azimuth tables for use of the navigator were *The Regiment of the Pole Star* by Andrew Wakeley. These tables were part of the author's *The Mariner's Compass Rectified*, published in London in 1665. These tables show the "true hour of the day" at which the sun is at the various points of the compass.

Lynn Azimuth Tables, by Thomas Lynn (art. 2106), were published in 1829. This 364-page table gives azimuth angle computed by the haversine formula of article 2106.

Towson and Atherton. The *Tables to Facilitate the Practice of Great Circle Sailing*, by the Englishmen John Thomas Towson and J. W. Atherton, were published in

Burdwood. The *Tables of Sun's True Bearing or Azi* John Burdwood, RN, were first published in 1852, with a in 1858, 1862, 1864, and 1866. Captain John E. Davis, RN the British Nautical Almanac Office, later added to the tab for all values of altitude and for declination between 64° were standard in Great Britain for more than a century. T replaced by H.O. 486 (Pub. No. 214) for mariners and A aviators. Burdwood used modifications of the time azimuth fo

Labrosse. Azimuth tables by the Frenchman F. Labross in 1868, and later in Paris. In 275 pages this *Table des Azimu* from 61°N to 61°S, and declinations from 0° to 30°N or S. used:

$$\cot Z = \frac{\tan d \cos L}{\sin t} - \sin L \cot t.$$

Fifteen editions had been published by 1920.

Shortrede. In 1869 Captain Robert Shortrede's *Azim Latitude and Declination* and *Tables for Finding Azimuth* London.

John E. Davis. The first azimuth tables by Captain John in 1875. These were published as an extension of the Burdwood

Perrin. In Paris the *Nouvelles Tables Destinées à Abré* by Ensign de Vaisseau E. Perrin, French Navy, were publi consist of three tables of nine, seven, and six pages, respective determination of azimuth by a short computation. Several editi

Kortazzi, a Russian, produced a volume appropriately *Tables d'Azimuth de Thomson* (art. 2106). These were published

H.O. Pub. No. 66 (Schroeder and Wainwright). *Arcti* tenants Seaton Schroeder and Richard Wainwright, USN, pr use of the USS *Rodgers* in her search for the arctic steamer *Jean* in 1881. Azimuths to the nearest 1′ are given for each 10^m m and 7^h, for latitudes between 70° and 88°, declination 0° to 23°,

Decante. In 1883 Lieutenant de Vaisseau E. Decante, o pared *Table du Cadran Solaire Azimutal*, which was published for latitudes 1° to 66° and declinations 0° to 48°.

Pub. No. 260 (Schroeder and Southerland). The *Azimuths* in 1882 by Lieutenant Seaton Schroeder, USN, and Master USN. These are popularly called "Red Azimuth Tables," bec used for most printings. This designation distinguishes them f Tables" (Pub. No. 261). After 15 editions, these tables are stil are given to the nearest 1′, at 10^m intervals of local apparent "sunset" (middle of the sun on the *celestial* horizon), with the angle of these phenomena given at the bottom of each column. for each 1° of latitude from 0° to 70°. The first part of the book The second part is devoted to tables of latitude and declinat third part gives "contrary name" tables. Declination entries a from 0° to 23°, with the

Table 23. Altitude Correction for Air Temperature.—This table provides a correction to be applied to the altitude of a celestial body when the air temperature varies from the 50° F used for determining mean refraction by means of the *Nautical Almanac*. For maximum accuracy, apply index correction and dip to sextant altitude first, obtaining apparent (rectified) altitude for use in entering this table. Enter the table with altitude and air temperature in degrees Fahrenheit. Apply the correction, in accordance with its tabulated sign, to altitude. Use of the table is explained principally in chapter VIII, and especially in articles 807 and 827.

The table was computed by means of formula:

$$\text{Correction} = R_m\left(1-\frac{510}{460+T}\right).$$

in which R_m is mean refraction and T is temperature in degrees Fahrenheit.

Table 24. Altitude Correction for Atmospheric Pressure.—This table provides a correction to be applied to the altitude of a celestial body when the atmospheric pressure varies from the 29.83 inches (1010 millibars) used for determining mean refraction by means of the *Nautical Almanac*. For most accurate results, apply index correction and dip to sextant altitude first, obtaining apparent (rectified) altitude for use in entering this table. Enter the table with altitude and atmospheric pressure. Apply the correction to altitude, *adding* if the pressure is less than 29.83 inches and *subtracting* if it is more than 29.83 inches. Use of the table is explained principally in chapter VIII, and especially in articles 808 and 827.

The table was computed by means of the formula:

$$\text{Correction} = R_m\left(1-\frac{P}{29.83}\right).$$

in which R_m is mean refraction and P is atmospheric pressure in inches of mercury.

Table 25. Meridian Angle and Altitude of a Body on the Prime Vertical Circle.—A celestial body having a declination of contrary name to the latitude does not cross the prime vertical above the celestial horizon, its nearest approach being at rising or setting.

If the declination and latitude are of the same name, and the declination is numerically greater, the body does not cross the prime vertical, but makes its nearest approach (in azimuth) when its meridian angle, east or west, and altitude are as shown in this table, these values being given in italics above the heavy line. At this time the body is stationary in azimuth.

If the declination and latitude are of the same name and numerically equal, the body passes through the zenith as it crosses both the celestial meridian and the prime vertical, as shown in the table.

If the declination and latitude are of the same name, and the declination is numerically less, the body crosses the prime vertical when its meridian angle, east or west, and altitude are as tabulated in vertical type below the heavy line.

The table is entered with declination of the celestial body and the latitude of the observer. Computed altitudes are given, no allowance having been made for refraction, dip, parallax, etc. The tabulated values apply to any celestial body, but values are not given for declination greater than 23° because the tabulated information is generally desired for the sun only. Use of the information given in this table is discussed in articles 710 and 721.

TABLE 25

Meridian Angle and Altitude of a Body on the Prime Vertical Circle

Latitude	Declination (same name as latitude) 0° t	0° Alt.	1° t	1° Alt.	2° t	2° Alt.	3° t	3° Alt.	4° t	4° Alt.	5° t	5° Alt.	Latitude
°	h m	°	h m	°	h m	°	h m	°	h m	°	h m	°	°
0	—	—	*90. 0*	*0. 0*	*90. 0*	*0. 0*	*90. 0*	*0. 0*	*90. 0*	*6. 9*	*90. 0*	*0. 0*	0
1	90. 0	0. 0	0. 0	90. 0	*89. 0*	*89. 0*	*70. 5*	*19. 5*	*75. 5*	*14. 5*	*78. 5*	*11. 6*	1
2	90. 0	0. 0	60. 0	30. 0	0. 0	90. 0	*48. 2*	*41. 8*	*60. 0*	*30. 0*	*66. 5*	*23. 6*	2
3	90. 0	0. 0	70. 5	19. 5	48. 2	41. 8	0. 0	90. 0	*41. 5*	*48. 6*	*53. 3*	*36. 9*	3
4	90. 0	0. 0	75. 5	14. 5	60. 0	30. 0	41. 5	48. 6	0. 0	90. 0	*36. 8*	*53. 2*	4
5	90. 0	0. 0	78. 5	11. 6	66. 5	23. 6	53. 2	36. 9	36. 9	53. 2	0. 0	90. 0	5
6	90. 0	0. 0	80. 4	9. 6	70. 6	19. 5	60. 1	30. 0	48. 3	41. 9	33. 7	56. 5	6
7	90. 0	0. 0	81. 8	8. 2	73. 5	16. 6	64. 7	25. 4	55. 3	34. 9	44. 6	45. 7	7
8	90. 0	0. 0	82. 9	7. 2	75. 6	14. 5	68. 1	22. 1	60. 2	30. 1	51. 5	38. 8	8
9	90. 0	0. 0	83. 7	6. 4	77. 3	12. 9	70. 7	19. 5	63. 8	26. 5	56. 5	33. 9	9
10	90. 0	0. 0	84. 3	5. 8	78. 6	11. 6	72. 7	17. 5	66. 6	23. 7	60. 3	30. 1	10
11	90. 0	0. 0	84. 8	5. 2	79. 7	10. 5	74. 4	15. 9	68. 9	21. 4	63. 3	27. 2	11
12	90. 0	0. 0	85. 3	4. 8	80. 5	9. 7	75. 7	14. 8	70. 8	19. 6	65. 7	24. 8	12
13	90. 0	0. 0	85. 7	4. 4	81. 3	8. 9	76. 9	13. 5	72. 4	18. 1	67. 7	22. 8	13
14	90. 0	0. 0	86. 0	4. 1	81. 9	8. 3	77. 9	12. 5	73. 7	16. 8	69. 5	21. 1	14
15	90. 0	0. 0	86. 3	3. 9	82. 5	7. 7	78. 7	11. 7	74. 9	15. 6	70. 9	19. 7	15
16	90. 0	0. 0	86. 5	3. 6	83. 0	7. 3	79. 5	10. 9	75. 9	14. 7	72. 2	18. 4	16
17	90. 0	0. 0	86. 7	3. 4	83. 4	6. 9	80. 1	10. 3	76. 8	13. 8	73. 4	17. 3	17
18	90. 0	0. 0	86. 9	3. 2	83. 8	6. 5	80. 7	9. 8	77. 6	13. 0	74. 4	16. 4	18
19	90. 0	0. 0	87. 1	3. 1	84. 2	6. 2	81. 2	9. 3	78. 3	12. 4	75. 3	15. 5	19
20	90. 0	0. 0	87. 3	2. 9	84. 5	5. 9	81. 7	8. 8	78. 9	11. 8	76. 1	14. 8	20
21	90. 0	0. 0	87. 4	2. 8	84. 8	5. 6	82. 2	8. 4	79. 5	11. 2	76. 8	14. 1	21
22	90. 0	0. 0	87. 5	2. 7	85. 0	5. 3	82. 5	8. 0	80. 0	10. 7	77. 5	13. 5	22
23	90. 0	0. 0	87. 6	2. 6	85. 3	5. 1	82. 9	7. 7	80. 5	10. 3	78. 1	12. 9	23
24	90. 0	0. 0	87. 8	2. 5	85. 5	4. 9	83. 2	7. 4	81. 0	9. 9	78. 7	12. 4	24
25	90. 0	0. 0	87. 9	2. 4	85. 7	4. 7	83. 5	7. 1	81. 4	9. 5	79. 2	11. 9	25
26	90. 0	0. 0	87. 9	2. 3	85. 9	4. 6	83. 8	6. 9	81. 8	9. 2	79. 7	11. 5	26
27	90. 0	0. 0	88. 0	2. 2	86. 1	4. 4	84. 1	6. 6	82. 1	8. 8	80. 1	11. 1	27
28	90. 0	0. 0	88. 1	2. 1	86. 2	4. 3	84. 3	6. 4	82. 4	8. 5	80. 5	10. 7	28
29	90. 0	0. 0	88. 2	2. 1	86. 4	4. 1	84. 6	6. 2	82. 8	8. 3	80. 9	10. 4	29
30	90. 0	0. 0	88. 3	2. 0	86. 5	4. 0	84. 8	6. 0	83. 0	8. 0	81. 3	10. 0	30
31	90. 0	0. 0	88. 3	1. 9	86. 7	3. 9	85. 0	5. 8	83. 3	7. 8	81. 6	9. 7	31
32	90. 0	0. 0	88. 4	1. 9	86. 8	3. 8	85. 2	5. 7	83. 6	7. 6	82. 0	9. 5	32
33	90. 0	0. 0	88. 5	1. 8	86. 9	3. 7	85. 4	5. 5	83. 8	7. 4	82. 3	9. 2	33
34	90. 0	0. 0	88. 5	1. 8	87. 0	3. 6	85. 5	5. 4	84. 0	7. 2	82. 5	9. 0	34
35	90. 0	0. 0	88. 6	1. 7	87. 1	3. 5	85. 7	5. 2	84. 3	7. 0	82. 8	8. 7	35
36	90. 0	0. 0	88. 6	1. 7	87. 2	3. 4	85. 9	5. 1	84. 5	6. 8	83. 1	8. 5	36
37	90. 0	0. 0	88. 7	1. 7	87. 3	3. 3	86. 0	5. 0	84. 7	6. 7	83. 3	8. 3	37
38	90. 0	0. 0	88. 7	1. 6	87. 4	3. 2	86. 2	4. 9	84. 9	6. 5	83. 6	8. 1	38
39	90. 0	0. 0	88. 8	1. 6	87. 5	3. 2	86. 3	4. 8	85. 0	6. 4	83. 8	8. 0	39
40	90. 0	0. 0	88. 8	1. 6	87. 6	3. 1	86. 4	4. 7	85. 2	6. 2	84. 0	7. 8	40
41	90. 0	0. 0	88. 8	1. 5	87. 7	3. 0	86. 5	4. 6	85. 4	6. 1	84. 2	7. 6	41
42	90. 0	0. 0	88. 9	1. 5	87. 8	3. 0	86. 7	4. 5	85. 5	6. 0	84. 4	7. 5	42
43	90. 0	0. 0	88. 9	1. 5	87. 9	2. 9	86. 8	4. 4	85. 7	5. 9	84. 6	7. 3	43
44	90. 0	0. 0	89. 0	1. 4	87. 9	2. 9	86. 9	4. 3	85. 8	5. 8	84. 8	7. 2	44
45	90. 0	0. 0	89. 0	1. 4	88. 0	2. 8	87. 0	4. 2	86. 0	5. 7	85. 0	7. 1	45
46	90. 0	0. 0	89. 0	1. 4	88. 1	2. 8	87. 1	4. 2	86. 1	5. 6	85. 2	7. 0	46
47	90. 0	0. 0	89. 1	1. 4	88. 1	2. 7	87. 2	4. 1	86. 3	5. 5	85. 3	6. 8	47
48	90. 0	0. 0	89. 1	1. 3	88. 2	2. 7	87. 3	4. 0	86. 4	5. 4	85. 5	6. 7	48
49	90. 0	0. 0	89. 1	1. 3	88. 3	2. 7	87. 4	4. 0	86. 5	5. 3	85. 6	6. 6	49
50	90. 0	0. 0	89. 2	1. 3	88. 3	2. 6	87. 5	3. 9	86. 6	5. 2	85. 8	6. 5	50
52	90. 0	0. 0	89. 2	1. 3	88. 4	2. 5	87. 7	3. 8	86. 9	5. 1	86. 1	6. 4	52
54	90. 0	0. 0	89. 3	1. 2	88. 5	2. 5	87. 8	3. 7	87. 1	4. 9	86. 4	6. 2	54
56	90. 0	0. 0	89. 3	1. 2	88. 7	2. 4	88. 0	3. 6	87. 3	4. 8	86. 6	6. 0	56
58	90. 0	0. 0	89. 4	1. 2	88. 7	2. 4	88. 1	3. 5	87. 5	4. 7	86. 9	5. 9	58
60	90. 0	0. 0	89. 4	1. 2	88. 8	2. 3	88. 3	3. 5	87. 7	4. 6	87. 1	5. 8	60
65	90. 0	0. 0	89. 5	1. 1	89. 1	2. 2	88. 6	3. 3	88. 1	4. 4	87. 7	5. 5	65
70	90. 0	0. 0	89. 6	1. 1	89. 3	2. 1	88. 9	3. 2	88. 5	4. 3	88. 2	5. 3	70
75	90. 0	0. 0	89. 7	1. 0	89. 5	2. 1	89. 2	3. 1	88. 9	4. 1	88. 7	5. 2	75
80	90. 0	0. 0	89. 8	1. 0	89. 6	2. 0	89. 5	3. 0	89. 3	4. 1	89. 1	5. 1	80
85	90. 0	0. 0	89. 9	1. 0	89. 8	2. 0	89. 7	3. 0	89. 6	4. 0	89. 6	5. 0	85

Numbers in italics indicate nearest approach to prime vertical

TABLE 25

Meridian Angle and Altitude of a Body on the Prime Vertical Circle

Latitude	Declination (same name as latitude) 6° t	6° Alt.	7° t	7° Alt.	8° t	8° Alt.	9° t	9° Alt.	10° t	10° Alt.	11° t	11° Alt.	Latitude
°	°	°	°	°	°	°	°	°	°	°	°	°	°
0	90.0	0.0	90.0	0.0	90.0	0.0	90.0	0.0	90.0	0.0	90.0	0.0	0
1	89.4	9.6	81.8	8.2	82.9	7.2	83.7	6.4	84.3	5.8	84.8	5.2	1
2	79.9	19.5	73.5	18.6	75.6	14.5	77.3	12.9	78.6	11.6	79.7	10.5	2
3	69.1	30.0	64.7	25.4	68.1	22.1	70.7	19.5	72.7	17.5	74.4	15.9	3
4	58.3	41.9	55.3	34.9	60.3	30.1	63.8	26.5	66.8	23.7	68.9	21.4	4
5	38.7	56.5	44.6	45.7	51.5	38.8	56.5	33.9	60.8	30.1	63.8	27.2	5
6	0.0	90.0	31.1	59.1	41.6	48.7	48.4	41.8	53.4	37.0	57.3	33.8	6
7	31.1	69.1	0.0	90.0	29.1	61.1	39.2	51.2	45.9	44.0	50.8	39.7	7
8	41.6	48.7	29.1	61.1	0.0	90.0	27.5	62.8	37.3	53.3	43.7	46.8	8
9	48.4	41.9	39.2	51.2	27.5	62.8	0.0	90.0	26.1	64.3	35.4	55.1	9
10	53.4	37.0	45.9	44.6	37.2	53.3	26.1	64.3	0.0	90.0	24.9	65.5	10
11	57.3	33.2	50.8	39.7	43.7	46.8	35.4	55.1	24.9	66.5	0.0	90.0	11
12	60.4	30.2	54.7	35.9	48.6	42.0	41.8	48.8	33.9	56.6	23.9	66.6	12
13	62.9	27.7	57.9	32.8	52.5	38.2	46.7	44.1	40.2	50.5	32.7	58.0	13
14	65.1	25.6	60.5	30.2	55.7	35.1	50.6	40.3	45.0	46.9	38.8	52.1	14
15	66.9	23.8	62.7	28.1	58.4	32.5	53.8	37.2	48.8	42.1	43.5	47.5	15
16	68.5	22.3	64.6	26.2	60.7	30.3	56.5	34.6	52.1	39.0	47.3	43.8	16
17	69.9	20.9	66.3	24.6	62.6	28.4	58.8	32.3	54.8	36.4	50.5	40.7	17
18	71.1	19.8	67.8	23.2	64.4	26.8	60.8	30.4	57.1	34.2	53.3	38.1	18
19	72.2	18.7	69.1	22.0	65.9	25.3	62.6	28.7	59.2	32.2	55.6	35.9	19
20	73.2	17.8	70.3	20.9	67.3	24.0	64.2	27.2	61.0	30.5	57.7	33.9	20
21	74.1	17.0	71.3	19.9	68.5	22.9	65.6	25.9	62.7	29.0	59.6	32.2	21
22	74.9	16.2	72.3	19.0	69.6	21.8	66.9	24.7	64.1	27.6	61.2	30.6	22
23	75.7	15.5	73.2	18.2	70.7	20.9	68.1	23.6	65.5	26.4	62.7	29.2	23
24	76.3	14.9	74.0	17.4	71.6	20.0	69.2	22.6	66.7	25.3	64.1	28.0	24
25	77.0	14.3	74.7	16.8	72.5	19.2	70.1	21.7	67.8	24.3	65.4	26.8	25
26	77.6	13.8	75.4	16.1	73.3	18.5	71.1	20.9	68.8	23.3	66.5	25.8	26
27	78.1	13.3	76.1	15.6	74.0	17.9	71.9	20.2	69.8	22.5	67.6	24.9	27
28	78.6	12.9	76.6	15.0	74.7	17.2	72.7	19.5	70.6	21.7	68.6	24.0	28
29	79.1	12.5	77.2	14.6	75.3	16.7	73.4	18.8	71.5	21.0	69.6	23.2	29
30	79.5	12.1	77.7	14.1	75.9	16.2	74.1	18.2	72.2	20.3	70.3	22.4	30
31	79.9	11.7	78.2	13.7	76.5	15.7	74.7	17.7	72.9	19.7	71.1	21.7	31
32	80.3	11.4	78.7	13.3	77.0	15.2	75.3	17.2	73.6	19.1	71.9	21.1	32
33	80.7	11.1	79.1	12.9	77.5	14.8	75.9	16.7	74.2	18.6	72.6	20.5	33
34	81.0	10.8	79.5	12.6	78.0	14.4	76.4	16.2	74.8	18.1	73.3	20.0	34
35	81.4	10.5	79.9	12.3	78.4	14.0	76.9	15.8	75.4	17.6	73.9	19.4	35
36	81.7	10.2	80.3	12.0	78.8	13.7	77.4	15.4	76.0	17.2	74.5	18.9	36
37	82.0	10.0	80.6	11.7	79.3	13.4	77.9	15.1	76.5	16.8	75.1	18.5	37
38	82.3	9.8	81.0	11.4	79.6	13.1	78.3	14.7	77.0	16.4	75.6	18.1	38
39	82.5	9.6	81.3	11.2	80.0	12.8	78.7	14.4	77.4	16.0	76.1	17.6	39
40	82.8	9.4	81.6	10.9	80.4	12.5	79.1	14.1	77.9	15.7	76.6	17.3	40
41	83.1	9.2	81.9	10.7	80.7	12.2	79.5	13.8	78.3	15.3	77.1	16.9	41
42	83.3	9.0	82.2	10.5	81.0	12.0	79.9	13.6	78.7	15.0	77.5	16.6	42
43	83.5	8.8	82.4	10.3	81.3	11.8	80.2	13.3	79.1	14.8	78.0	16.2	43
44	83.8	8.7	82.7	10.1	81.6	11.6	80.6	13.0	79.5	14.5	78.4	16.9	44
45	84.0	8.5	82.9	9.9	81.9	11.4	80.9	12.8	79.8	14.2	78.8	15.7	45
46	84.2	8.4	83.2	9.8	82.2	11.2	81.2	12.6	80.2	14.0	79.2	15.4	46
47	84.4	8.2	83.4	9.6	82.5	11.0	81.5	12.4	80.5	13.7	79.6	15.1	47
48	84.6	8.1	83.7	9.4	82.7	10.8	81.8	12.2	80.9	13.5	79.9	14.9	48
49	84.8	8.0	83.9	9.3	83.0	10.6	82.1	12.0	81.2	13.3	80.3	14.6	49
50	84.9	7.8	84.1	9.2	83.2	10.5	82.4	11.8	81.5	13.1	80.6	14.4	50
52	85.3	7.6	84.5	8.9	83.7	10.2	82.9	11.5	82.1	12.7	81.3	14.0	52
54	85.6	7.4	84.9	8.7	84.1	9.9	83.4	11.1	82.6	12.4	81.9	13.6	54
56	85.9	7.2	85.2	8.6	84.6	9.7	83.9	10.9	83.2	12.1	82.5	13.3	56
58	86.2	7.1	85.6	8.3	85.0	9.4	84.3	10.6	83.7	11.8	83.0	13.0	58
60	86.5	6.9	85.9	8.1	85.3	9.2	84.8	10.4	84.2	11.6	83.6	12.7	60
65	87.2	6.6	86.7	7.7	86.2	8.8	85.8	9.9	85.3	11.0	84.8	12.2	65
70	87.8	6.4	87.4	7.5	87.1	8.5	86.7	9.6	86.3	10.6	85.9	11.7	70
75	88.4	6.2	88.1	7.2	87.8	8.3	87.6	9.3	87.3	10.4	87.0	11.4	75
80	88.9	6.1	88.8	7.1	88.6	8.1	88.4	9.1	88.2	10.2	88.0	11.2	80
85	89.5	6.0	89.4	7.0	89.3	8.0	89.2	9.0	89.1	10.0	89.0	11.0	85

Numbers in double indicate nearest approach to prime vertical

TABLE 25

Meridian Angle and Altitude of a Body on the Prime Vertical Circle

Latitude	Declination (same name as latitude)												Latitude
	12°		13°		14°		15°		16°		17°		
	t	Alt.	t	Alt.	t	Alt.	t	Alt.	t	Alt.	t	Alt.	
°	°	°	°	°	°	°	°	°	°	°	°	°	°
0	*90.0*	*0.0*	*90.0*	*0.0*	*90.0*	*0.0*	*90.0*	*0.0*	*90.0*	*0.0*	*90.0*	*0.0*	0
1	*85.8*	*4.8*	*85.7*	*4.4*	*86.0*	*4.1*	*86.3*	*3.9*	*86.5*	*3.6*	*86.7*	*3.4*	1
2	*80.5*	*9.7*	*81.3*	*8.9*	*81.9*	*8.3*	*82.5*	*7.7*	*83.0*	*7.3*	*83.4*	*6.9*	2
3	*75.7*	*14.6*	*76.9*	*13.5*	*77.9*	*12.5*	*78.7*	*11.7*	*79.5*	*10.9*	*80.1*	*10.3*	3
4	*70.8*	*19.6*	*72.4*	*18.1*	*73.7*	*16.8*	*74.9*	*15.6*	*75.9*	*14.7*	*76.8*	*13.8*	4
5	*65.7*	*24.8*	*67.7*	*23.8*	*69.5*	*21.1*	*70.9*	*19.7*	*72.2*	*18.4*	*73.4*	*17.3*	5
6	*60.4*	*30.2*	*62.9*	*27.7*	*65.1*	*25.8*	*66.9*	*23.8*	*68.5*	*22.3*	*69.9*	*20.9*	6
7	*54.7*	*35.9*	*57.9*	*32.8*	*60.5*	*30.2*	*62.7*	*28.1*	*64.6*	*26.2*	*66.3*	*24.6*	7
8	*48.6*	*42.0*	*52.5*	*38.2*	*55.7*	*35.1*	*58.4*	*32.5*	*60.7*	*30.3*	*62.6*	*28.4*	8
9	*41.8*	*48.8*	*46.7*	*44.1*	*50.6*	*40.8*	*53.8*	*37.3*	*56.5*	*34.6*	*58.8*	*32.8*	9
10	*33.9*	*56.6*	*40.2*	*50.5*	*45.0*	*45.9*	*48.8*	*42.1*	*52.1*	*39.0*	*54.3*	*36.4*	10
11	*23.9*	*66.6*	*32.7*	*58.0*	*38.8*	*52.1*	*43.5*	*47.5*	*47.3*	*45.8*	*50.5*	*40.7*	11
12	0.0	90.0	*23.0*	*67.6*	*31.5*	*59.3*	*37.5*	*53.4*	*42.2*	*49.0*	*46.0*	*45.5*	12
13	23.0	67.6	0.0	90.0	*22.2*	*68.4*	*30.5*	*60.4*	*36.4*	*54.7*	*41.0*	*50.8*	13
14	31.5	59.3	22.2	68.4	0.0	90.0	*21.5*	*69.2*	*29.6*	*61.4*	*35.4*	*55.8*	14
15	37.5	53.4	30.5	60.4	21.5	69.2	0.0	90.0	*20.9*	*69.9*	*28.8*	*62.8*	15
16	42.2	49.0	36.4	54.7	29.6	61.4	20.9	69.9	0.0	90.0	*20.8*	*70.5*	16
17	46.0	45.3	41.0	50.3	35.4	55.8	28.8	62.8	20.3	70.5	0.0	90.0	17
18	49.1	42.3	44.7	46.7	39.9	51.5	34.4	56.9	28.1	63.1	19.8	71.1	18
19	51.9	39.7	47.9	43.7	43.6	48.0	38.9	52.7	33.6	57.8	27.4	63.9	19
20	54.3	37.4	50.6	41.1	46.8	45.0	42.6	49.2	38.0	53.7	32.9	58.7	20
21	56.4	35.5	53.0	38.9	49.5	42.4	45.7	46.2	41.7	50.3	37.2	54.7	21
22	58.3	33.7	55.2	36.9	51.9	40.2	48.5	43.7	44.8	47.4	40.8	51.3	22
23	60.0	32.1	57.1	35.1	54.0	38.3	50.9	41.5	47.5	44.9	43.9	48.4	23
24	61.5	30.7	58.8	33.6	55.9	36.5	53.0	39.5	49.9	42.7	46.6	46.0	24
25	62.9	29.5	60.3	32.2	57.7	34.9	54.9	37.8	52.1	40.7	49.0	43.8	25
26	64.2	28.3	61.7	30.9	59.3	33.5	56.7	36.2	54.0	39.0	51.2	41.8	26
27	65.3	27.3	63.1	29.7	60.7	32.2	58.3	34.8	55.8	37.4	53.1	40.1	27
28	66.4	26.3	64.3	28.6	62.0	31.0	59.7	33.5	57.4	36.0	54.9	38.5	28
29	67.5	25.4	65.4	27.6	63.3	29.9	61.1	32.3	58.8	34.6	56.5	37.1	29
30	68.4	24.6	66.4	26.7	64.4	28.9	62.3	31.2	60.2	33.5	58.0	35.8	30
31	69.3	23.8	67.4	25.9	65.5	28.0	63.5	30.2	61.5	32.4	59.4	34.6	31
32	70.1	23.1	68.3	25.1	66.5	27.2	64.6	29.2	62.7	31.3	60.7	33.5	32
33	70.9	22.4	69.2	24.4	67.4	26.4	65.6	28.4	63.8	30.4	61.9	32.5	33
34	71.6	21.8	70.0	23.7	68.3	25.6	66.6	27.6	64.8	29.5	63.0	31.5	34
35	72.3	21.3	70.7	23.1	69.1	24.9	67.5	26.8	65.8	28.7	64.1	30.6	35
36	73.0	20.7	71.5	22.5	69.9	24.3	68.4	26.1	66.8	28.0	65.1	29.8	36
37	73.6	20.2	72.2	21.9	70.7	23.7	69.2	25.5	67.6	27.3	66.1	29.1	37
38	74.2	19.7	72.8	21.4	71.4	23.1	69.9	24.9	68.5	26.6	67.0	28.4	38
39	74.8	19.3	73.4	20.9	72.1	22.6	70.7	24.3	69.3	26.0	67.8	27.7	39
40	75.3	18.9	74.0	20.5	72.7	22.1	71.4	23.7	70.0	25.4	68.6	27.1	40
41	75.8	18.5	74.6	20.1	73.3	21.6	72.0	23.2	70.7	24.8	69.4	26.5	41
42	76.3	18.1	75.1	19.6	73.9	21.2	72.7	22.8	71.4	24.3	70.2	25.9	42
43	76.8	17.7	75.7	19.3	74.5	20.8	73.3	22.3	72.1	23.8	70.9	25.4	43
44	77.3	17.4	76.2	18.9	75.0	20.4	73.9	21.9	72.7	23.4	71.5	24.9	44
45	77.7	17.1	76.7	18.5	75.6	20.0	74.5	21.5	73.3	22.9	72.2	24.4	45
46	78.2	16.8	77.1	18.2	76.1	19.7	75.0	21.1	73.9	22.5	72.8	24.0	46
47	78.6	16.5	77.6	17.9	76.6	19.3	75.5	20.7	74.5	22.1	73.4	23.6	47
48	79.0	16.2	78.0	17.6	77.0	19.0	76.0	20.4	75.0	21.8	74.0	23.2	48
49	79.4	16.0	78.4	17.3	77.5	18.7	76.5	20.1	75.6	21.4	74.6	22.8	49
50	79.7	15.7	78.8	17.1	77.9	18.4	77.0	19.7	76.1	21.1	75.1	22.4	50
52	80.4	15.3	79.6	16.6	78.8	17.9	77.9	19.2	77.1	20.5	76.2	21.8	52
54	81.1	14.9	80.3	16.1	79.6	17.4	78.8	18.7	78.0	19.9	77.2	21.2	54
56	81.7	14.5	81.0	15.7	80.3	17.0	79.6	18.2	78.8	19.4	78.1	20.7	56
58	82.4	14.2	81.7	15.4	81.0	16.6	80.4	17.8	79.7	19.0	79.0	20.2	58
60	83.0	13.9	82.3	15.1	81.7	16.2	81.1	17.4	80.5	18.6	79.8	19.7	60
65	84.3	13.3	83.8	14.4	83.3	15.5	82.8	16.6	82.3	17.7	81.8	18.8	65
70	85.6	12.8	85.2	13.8	84.8	14.9	84.4	16.0	84.0	17.1	83.6	18.1	70
75	86.7	12.4	86.5	13.5	86.2	14.5	85.9	15.5	85.6	16.6	85.3	17.6	75
80	87.9	12.2	87.7	13.2	87.5	14.2	87.3	15.2	87.1	16.3	86.9	17.3	80
85	88.9	12.0	88.8	13.1	88.8	14.1	88.7	15.1	88.6	16.1	88.5	17.1	85

Numbers in italics indicate nearest approach to prime vertical

TABLE 25

Meridian Angle and Altitude of a Body on the Prime Vertical Circle

Latitude	Declination (same name as latitude)														Latitude
	18°		19°		20°		21°		22°		23°				
	t	Alt.	t	Alt.	t	Alt.	t	Alt.	t	Alt.	t	Alt.			
°	°	°	°	°	°	°	°	°	°	°	°	°	°	°	°
0	90.0	0.0	90.0	6.0	90.0	6.0	90.0	0.6	90.0	6.9	90.0	9.6	—	0	0
1	89.9	8.2	87.1	5.1	87.3	2.9	87.4	2.8	87.5	3.7	87.6	2.6		1	1
2	83.8	6.5	84.3	6.2	84.5	5.9	84.8	5.6	85.0	5.8	85.3	5.1		2	2
3	80.7	9.3	81.2	9.3	81.7	8.8	82.2	8.4	82.5	8.0	82.9	7.7		3	3
4	77.6	15.0	78.3	12.4	78.9	11.8	79.5	11.2	80.0	10.7	80.5	10.3		4	4
5	74.4	16.4	75.3	15.5	76.1	14.8	76.8	14.1	77.5	13.5	78.1	12.9		5	5
6	71.1	19.8	73.2	18.7	73.2	17.8	74.1	17.0	74.8	16.3	75.7	15.5		6	6
7	67.8	23.3	69.1	22.0	70.3	20.9	71.3	19.9	72.3	19.0	73.2	18.2		7	7
8	64.4	26.8	65.9	25.3	67.3	24.0	68.5	22.9	69.6	21.8	70.7	20.8		8	8
9	60.8	30.4	62.6	28.7	64.2	27.2	65.6	25.8	66.9	24.7	68.1	23.6		9	9
10	57.1	34.2	59.3	32.2	61.0	30.5	62.7	29.0	64.1	27.8	65.5	26.4		10	10
11	53.3	38.1	55.6	35.9	57.7	33.9	59.6	32.3	61.2	30.6	62.7	29.3		11	11
12	49.1	42.3	51.9	39.7	54.3	37.4	56.4	36.5	58.3	33.7	60.6	32.1		12	12
13	44.7	46.7	47.9	43.7	50.6	41.1	53.0	38.9	55.3	36.6	57.6	35.2		13	13
14	39.6	51.5	43.6	48.0	46.8	45.0	49.5	42.3	51.9	40.2	54.0	38.8		14	14
15	33.4	56.9	38.9	52.7	42.6	49.2	45.7	46.2	48.5	43.7	50.9	42.5		15	15
16	28.1	62.1	33.6	57.8	38.0	53.7	41.7	50.3	44.8	47.4	47.5	44.9		16	16
17	19.8	71.1	27.4	63.9	33.9	58.1	37.9	54.7	40.8	51.3	43.9	48.4		17	17
18	0.0	90.0	19.5	71.7	30.8	64.6	33.2	59.0	36.5	55.6	40.1	52.5		18	18
19	19.3	71.7	0.0	90.0	18.8	72.2	28.2	65.3	31.5	60.4	36.8	56.4		19	19
20	26.8	64.6	18.9	72.2	0.0	90.0	18.5	72.6	25.7	66.4	32.8	61.2		20	20
21	32.2	59.6	26.2	65.3	18.5	72.6	0.0	90.0	18.2	73.1	29.1	67.0		21	21
22	36.5	55.6	31.5	60.4	25.7	65.9	18.2	73.1	0.0	90.0	25.4	72.5		22	22
23	40.1	52.3	35.8	56.4	31.0	61.1	25.3	66.5	17.9	73.5	0.0	90.0		23	23
24	43.1	49.4	39.3	53.2	35.2	57.2	30.4	61.8	24.8	67.1	17.6	73.9		24	24
25	45.8	47.0	42.4	50.4	38.7	54.0	34.6	58.0	30.0	62.4	24.5	67.6		25	25
26	48.2	44.8	45.1	48.0	41.7	51.3	38.1	54.8	34.1	58.7	29.5	63.0		26	26
27	50.4	42.9	47.5	45.8	44.4	48.9	41.1	52.1	37.5	55.6	33.6	59.4		27	27
28	52.3	41.2	49.6	43.9	46.8	46.8	43.8	49.8	40.5	52.9	37.0	56.3		28	28
29	54.1	39.6	51.6	42.2	49.0	44.9	46.2	47.7	43.2	50.6	40.0	53.7		29	29
30	55.8	38.2	53.4	40.6	50.9	43.2	48.3	45.8	45.6	48.5	42.7	51.4		30	30
31	57.3	36.9	55.0	39.2	52.7	41.6	50.3	44.1	47.7	46.7	45.1	49.3		31	31
32	58.7	35.7	56.6	37.9	54.4	40.2	52.1	42.6	49.7	45.0	47.2	47.5		32	32
33	60.0	34.6	58.0	36.7	55.9	38.9	53.8	41.1	51.5	43.5	49.2	45.8		33	33
34	61.2	33.5	59.3	35.6	57.3	37.7	55.3	39.9	53.2	42.1	51.0	44.3		34	34
35	62.4	32.6	60.5	34.6	58.7	36.6	56.8	38.7	54.8	40.8	52.7	42.9		35	35
36	63.4	31.7	61.7	33.6	59.9	35.6	58.1	37.6	56.2	39.6	54.3	41.7		36	36
37	64.5	30.9	62.8	32.8	61.1	34.6	59.4	36.5	57.6	38.5	55.7	40.5		37	37
38	65.4	30.1	63.9	31.9	62.2	33.7	60.6	35.6	58.9	37.5	57.1	39.4		38	38
39	66.3	29.4	64.8	31.2	63.3	32.9	61.7	34.7	60.1	36.6	58.4	38.4		39	39
40	67.2	28.7	65.8	30.4	64.3	32.1	62.8	33.9	61.2	35.6	59.6	37.4		40	40
41	68.1	28.1	66.7	29.8	65.2	31.4	63.8	33.1	62.3	34.8	60.8	36.6		41	41
42	68.8	27.5	67.5	29.1	66.2	30.7	64.8	32.4	63.3	34.0	61.9	35.7		42	42
43	69.6	26.9	68.3	28.5	67.0	30.1	65.7	31.7	64.3	33.3	62.9	35.0		43	43
44	70.3	26.4	69.1	27.9	67.9	29.5	66.6	31.1	65.3	32.6	63.9	34.2		44	44
45	71.0	25.9	69.9	27.4	68.7	28.9	67.4	30.5	66.2	32.0	64.9	33.5		45	45
46	71.7	25.4	70.6	26.9	69.4	28.4	68.2	29.9	67.0	31.4	65.8	32.9		46	46
47	72.4	25.0	71.3	26.4	70.2	27.9	69.0	29.3	67.9	30.8	66.7	32.3		47	47
48	73.0	24.6	71.9	26.0	70.9	27.4	69.8	28.8	68.7	30.3	67.5	31.7		48	48
49	73.6	24.2	72.6	25.6	71.6	26.9	70.5	28.3	69.4	29.8	68.3	31.2		49	49
50	74.2	23.8	73.2	25.2	72.2	26.5	71.2	27.9	70.2	29.3	69.1	30.7		50	50
52	75.3	23.1	74.4	24.4	73.5	25.7	72.5	27.1	71.6	28.4	70.6	29.7		52	52
54	76.3	22.5	75.5	23.7	74.7	25.0	73.8	26.3	72.9	27.6	72.0	28.9		54	54
56	77.3	21.9	76.6	23.1	75.8	24.4	75.0	25.6	74.2	26.9	73.4	28.1		56	56
58	78.3	21.4	77.6	22.6	76.9	23.8	76.1	25.0	75.4	26.2	74.6	27.4		58	58
60	79.2	20.9	78.5	22.1	77.9	23.3	77.2	24.4	76.5	25.6	75.8	26.8		60	60
65	81.3	19.9	80.8	21.1	80.2	22.2	79.7	23.3	79.1	24.4	78.6	25.5		65	65
70	83.2	19.2	82.8	20.3	82.4	21.3	82.0	22.4	81.5	23.5	81.1	24.6		70	70
75	85.0	18.7	84.7	19.7	84.4	20.7	84.1	21.8	83.8	22.8	83.5	23.9		75	75
80	86.7	18.3	86.5	19.3	86.3	20.3	86.1	21.3	85.9	22.4	85.7	23.4		80	80
85	88.4	18.1	88.3	19.1	88.2	20.1	88.1	21.1	88.0	22.1	87.9	23.1		85	85

Numbers in italics indicate nearest approach to prime vertical