Sight #					
DR Latitude	N40°				
DR. Longitude	W075°				
Date	9 / 26 /2016	/ /	/ /	/ /	/ /
UT	13 : 15 :15	: :	: :	: :	: :
Hs	50 ° 07.6 '	° '	° '	° '	° '
Index Error	+ 0° 01'				
Hs – Index Error	50 ° 06.6 '				
Hs – Index Error/2= Ha	25 ° 03.3'	° '	° '	° '	° '
+/-- ACT	+0° 14 '	'	'	'	'
Ho	25 ° 17 '	° '	° '	° '	° '
GHA	17 ° 13.0 '	° '	° '	° '	° '
GHA inc.	3 ° 48.8 '	° '	° '	° '	° '
GHA	21 ° 02 '	° '	° '	° '	° '
LHA	306°	°	°	°	°
Dec	-1 ° 32.1 '	° '	° '	° '	° '
Hc	26 ° 02 '	° '	° '	° '	° '
d/d corr	-43 | -23 '	| '	| '	| '	| '
Z	116°	°	°	°	°
Hc	25° 39'	° '	° '	° '	° '
Ap λ	75 ° 02'	° '	° '	° '	° '
Zn	116 °	°	°	°	°
Intercept	22' *Away*				

Sun sight reduction

using an Artificial Horizon

Sight, DR. Latitude, DR. Longitude

Form label	What is it?	Where to get it?	Figure
Sight #	Sight number	It's the sequential number of the sight you're taking. It's an orderly way of keeping track of the sights you make.	1
DR. Latitude	Dead Reckoning Latitude	DR. Latitude means *Ded Reckoning Latitude* and uses the integral degree of Latitude. It's the Latitude *you think you're closest to* based on your DR Log. **Example- N 40°**	**N 40°**
DR. Longitude	Dead Reckoning Longitude	DR. Longitude means *Ded Reckoning Longitude* and is the integral degree of Longitude *you think you're closest to* based on your DR Log. **Example- W 075°**	**W 075°**

"ded" Reckoning stands for "deduced reckoning" but is usually written *dead reckoning*

Date & Time

Form label	What is it?	Where to get it?	Figure
Date	The Date based on Greenwich Time.	*See Time below*	**September 26, 2016**
Time	GMT Greenwich Mean Time also known as UT It's based on a 24 hour number.	The time based on Greenwich/Universal Time. Get the time in GMT/UT here- http://time.is/UTC Call NIST- 303-499-7111 Shortwave radio- WWV & WWVH 2.5, 5, 10, 15, 20 mHz To figure GMT add or subtract the time difference between your time zone and Greenwich England. For the Eastern US during DST (Daylight Saving Time) add 4 hours to local time. During DST the new day begins at 8 PM local time. For the Eastern US during EST (Eastern Standard Time) add 5 hours to local time. During EST the new day begins at 7 PM local time.	**13:15:15**

Hs, IE, Dip, AH/2, ACT, Ho

Form label	What is it?	Where to get it?	Figure
Hs	**Height of sextant**	Height of sextant- the initial, uncorrected, sextant angle reading of the object you observed. The sextant measurement is from the sea horizon or an Artificial Horizon (AH) to the celestial body (star, Sun, planet, moon) in the sky. The "LL" stands for Lower Limb. See the Artificial Horizon picture with the Sun's Limbs included herein.	**50° 07.6' LL**
Index Error	The amount of misalignment between the Index mirror and the Horizon mirror.	Set the sextant to 0° 00.0° and look at a bright star. If you see only one star, or if they are side by side, there is no Index Error. If you see two of the same star one over top of the other there is Index Error (IE). To find the Index Error in this case turn the micrometer drum until both images of the star appear superimposed or side by side. Read the the amount of IE. If the IE is greater than 0° then the IE is *on the arc* and must be subtracted from the Hs. If the IE is less than 0° then the IE is *off the arc* and must be added to the Hs. In our example the IE is *on the arc* so it must be subtracted from the Hs.	**+ 0° 01'**
Hs- Index Error	Height of sextant minus the Index Error.	Subtract the Index Error from the Height of sextant.	**(Hs) 50° 07.6' - 0° 01' 50° 06.6'**
Dip	Dip is the amount of angle to subtract from the Hs when making an observation using the ocean's horizon. The amount to subtract is determined by the Height of your Eye above the water.	Dip correction can be found on ALTITUDE CORRECTION TABLES 10° -90° —SUN, STARS, PLANETS on the right hand column of that table. In this example we're "on the hard" (on land) and using an Artificial Horizon (AH). There's no Dip correction required when using an Artificial Horizon (AH). ALTITUDE CORRECTION TABLES are attached at the end herein.	**When using an AH there is no need to correct for Dip.**
Hs – Index Error/2= Ha	Hs *minus* Index Error divided by 2 = Ha Ha means *Height apparent.*	Get the final figure from Hs *minus* Index Error (above) and divide it by 2. The result is the Ha *or Height apparent.*	**50° 06.6' divided by 2 Ha= 25° 03.3'**
ACT	Altitude Correction Table	Use the **ALTITUDE CORRECTION TABLES 10° -90° — SUN,STARS,PLANETS**. For brevity these tables are referred to as *ACT.* Find the *Ha* correction for the Sun in the SUN APR.-SEPT. App. Alt. column. Look in the Lower Limb column and find where the Ha of 25° 02.8' would approximately be located- between 24° 53' and 26° 00'. ALTITUDE CORRECTION TABLES are attached at the end herein. For the Sun- Lower Limb observations are always added to the Ha figure.	**0° 14'**
Ho	Height observed	Add the Sun's Lower Limb ACT (0° 14') to the Ha to arrive at the *Ho* (Height observed). After all of the above corrections ***Ho=* 25° 17.3'** (round it down to 25° 17').	**(Ha) 25° 03.3' (Act) + 0° 14' Ho= 25° 17'**

Getting the Sun's GHA and declination

Form label	What is it?	Where to get it?	Figure
GHA	Greenwich Hour Angle based on the integral hour of the sextant observation.	The necessary portion of The Nautical Almanac is provided at the end of this file. Find the Sun's GHA in the Sun's **GHA** column of The Nautical Almanac daily pages for the date and time of the observation. The GHA figure is based only on the integral hour of the observation. Get The Nautical Almanac *daily pages* at TheNauticalAlmanac.com	**17° 13.0'**
Dec	Declination of the Sun. The Sun's position in degrees North or South of the equator	The necessary portion of The Nautical Almanac is provided at the end of this file. Getting the Sun's declination now in this step will save time as you only need to open The Nautical Almanac once to get both GHA and Dec. Declination is recorded in the Sun sight reduction form **Dec** space. Find the Sun's declination in the Sun's **Dec** column of The Nautical Almanac daily pages for the date and time of the observation. The dec figure is based only on the integral hour of the observation. The Sun's declination has a *Name*- it's either *Same Name* or *Contrary Name.* **Northern Hemisphere seasons** In the Northern Hemisphere the Sun's declination is *Same Name* from the beginning of Spring until the end of Summer. The Sun's declination is *Contrary Name* from the beginning of Autumn until the end of Winter. **Southern Hemisphere seasons** In the Southern Hemisphere from the beginning of Spring until the end of Summer the Sun's declination is *Same Name*. The Sun's declination is *Contrary Name* from the beginning of Autumn until the end of Winter. Get The Nautical Almanac *daily pages* at TheNauticalAlmanac.com	**-1° 32.1**
GHA inc.	Greenwich Hour Angle *increment* for the minutes and seconds of time of the sextant observation.	The Nautical Almanac- *Increments & Corrections for Sun, Planets, Aries, Moon (the "yellow pages")* for the minutes and seconds of time of the observation. You can get the Increments & Corrections Table here- https://www.thenauticalalmanac.com/Increments_and_Corrections/Increments_and_Corrections_Table.pdf You can also get the GHA for the Sun on 1 page here: https://www.thenauticalalmanac.com/Increments_and_Corrections/Increments_and_Corrections_Sun_only.pdf The Sun's Increments & Corrections is provided at the end of this file.	**3° 48.8'**
GHA	Greenwich Hour Angle total	Add the Sun's GHA integral hour figure to the Sun's GHA Increment figure. Round the figure up or down.	**17° 13.0'** **+ 3° 48.8'** **21° 02'**

Calculating the Sun's LHA

Form label	What is it?	Where to get it?	Figure
GHA	Greenwich Hour Angle total	This was already done in the previous step but has been included here for clarity Add the Sun's GHA integral hour figure to the Sun's GHA Increment figure. Round the figure up or down.	17° 13.0' + 3° 48.8' 21° 02'
Ap λ	Assumed position Longitude	**In Western longitudes** Combine the DR. Longitude figure with only the minutes (of arc) of the total GHA figure. The Ap λ figure will be used when plotting the LOP on the UPS. **In Eastern longitudes** In Eastern longitudes the Ap λ is determined as follows; DR longitude + (0°60' *minus* GHA minutes of arc) Example- E 075° + (0°60' – 0° 02')= 75° 58' Ap λ	**DR Longitude W 075°** **Ap λ** W075° 02'
LHA	Local Hour Angle total	**In Western longitudes** Subtract Ap λ from the GHA total. Ignore the minutes of GHA. In Western Longitudes if GHA is *less than* the Ap λ first add 360 to the GHA and then subtract the Ap λ from it. **In Eastern longitudes** Round up the GHA to next highest degree and add the DR. longitude to it. If the resulting figure is over 360 then subtract 360 from it.	**GHA** 21° 02' + 360° 381° 02' --- 381° 02' -- **Ap λ** W 075° 02' **LHA = 306°**

Finding the Sun's Hc and Zn

Form label	What is it?	Where to get it?	Figure
Hc	Height computed	The necessary portion of Pub. No. 249 Vol. 2 is provided at the end of this file. You can get the entire Pub. No. 249 Vol. 1, 2, 3 here- https://thenauticalalmanac.com/Pub_No_249_Epoch_2025.html Hc is found in Pub. No. 249 Vol 2. Locate the pages- **LAT 40°** DECLINATION **(0°---14°)** **CONTRARY** NAME TO LATITUDE (It's on page 242) To find Hc you need the DR. Latitude (N 40°) and the LHA (306°) and whole degree of declination. Locate the LHA row of 306° on the sheet and move across until you see where the 1° column (Contrary declination) intersects that row. Find **Hc** in the **Hc** column. In this Sun sight reduction the Sun's declination is *Contrary Name* as the Sun's declination is below the equator, relative to your latitude.	**Hc= 26° 02'**
d	declination correction figure	The necessary portion of Pub. No. 249 Vol. 2 is provided at the end of this file. “d” is found in Pub. No. 249 Vol 2. Locate the pages- **LAT 40°** DECLINATION **(0°---14°)** **CONTRARY** NAME TO LATITUDE (It's on page 242) To find **d** you need the DR. Latitude (N 40°) and the LHA (306°). Locate the LHA row of 306° on the sheet and move across until you see where the 1° column (Contrary declination) intersects that row. Find **d** in the **d** column. Notice there's a *minus* sign beside the **d** figure. That means the correction figure that will be found in the next step must be subtracted from Hc.	**-43**
d corr	declination *correction amount*	The “d corr” figure is the amount that will be added, or subtracted, from Hc and is based on the change of the Sun's declination during the minutes and seconds of time when the observation was made. Use **Table 5- Correction to Tabulated Altitude for Minutes of Declination** to find the correction. First, find where the Sun's minutes of declination appear in the far right or far left column of the table. Locate the **d** figure found in the previous step in the horizontal row at the top of the Table. Where those two figures intersect you'll find the **d corr** figure. **Table 5** is provided at the end of this file. Note- in this Sun sight reduction example the Sun's declination was -1° 32.1' Round that down to -1° 32'. You're using the *32' (thirtytwo minutes of arc)* figure in Table 5 and not 32 minutes of time. In this example “**d**” had a *minus* sign beside it. So, you must put a *minus* sign beside the **d corr** figure.	**-43 / -23**

Finding the Sun's Hc and Zn *continued*

Form label	What is it?	Where to get it?	Figure
Z	Azimuth number or Azimuth angle	The necessary portion of Pub. No. 249 Vol. 2 is provided at the end of this file. You can get the entire Pub. No. 249 Vol. 1, 2, 3 here- https://thenauticalalmanac.com/Pub_No_249_Epoch_2025.html Z is found in Pub. No. 249 Vol 2. Locate the pages- **LAT 40°** DECLINATION **(0°---14°)** **CONTRARY** NAME TO LATITUDE (It's on page 242) To find **Z** you need the DR. Latitude (N 40°) and the LHA (306°). Locate the LHA row of 306° on the page and move across until you see where the 1° column (Contrary declination) intersects that row. Find **Z** in the **Z** column. In a later step Zn is the horizontal angle in degrees that points to the Sun from the Ap. λ. Z is based on True North and not magnetic North.	**Zn= 116°**
Hc	**Height computed** *the final Hc figure*	Using the initial Hc figure found in Pub. No. 249 Vol. 2 add, or subtract, the **d corr** figure.	**Hc= 26° 02'** **d corr = - 0°23'** **Hc= 25° 39'**

Ap λ, Zn and Intercept

Form label	What is it?	Where to get it?	Figure
Ap λ	Assumed position Longitude	**Ap λ** Ap λ stands for Assumed Position Longitude and is a combination of the DR. Longitude integral degree and GHA minutes of arc determined by the following rules; **Ap λ in Western Longitudes** Ap λ stands for Assumed Position Longitude and is a combination of the DR. Longitude integral degree of W 025° and the total GHA minutes figure (57.5'). The GHA for this example was 33° 57.5'. Put Ap λ of W 025° 57.5' in the Ap λ space of the Sun sight reduction form. You will use this figure when plotting the LOP. **In Eastern longitudes** In Eastern longitudes the Ap λ is determined as follows; DR longitude + (0°60' *minus* GHA minutes of arc) Example- E 075° + (0°60' – 0° 02')= 75° 58' Ap λ	**DR Longitude W 075°** **Sun's GHA= 21° 02'** **Ap λ** W075° 02'
Zn	Azimuth number	See explanation above in **Z.** **Zn** is the final azimuth number. Most of the pages of Pub. No. 249 Vol. 2 have the following Zn rules at the top and bottom of each page. **Zn Rules** **To put Z into the right quadrant, apply the following rules-** **For North Latitudes**: LHA greater than 180° then Zn=Z LHA less than 180° then Zn=360° - Z **For South Latitudes**: LHA greater than 180° then Zn=180° - Z LHA less than 180° then Zn=180° + Z Zn is the horizontal angle in degrees that points to the Sun from the Ap. λ. Zn is based on True North and not magnetic North.	**LHA = 306°** **Zn= 116°**

Intercept *continued*

Intercept	Intercept is the distance and direction the LOP (Line Of Position) is drawn from the Ap. λ	The intercept is a mark on the azimuth line on the UPS. The length of the intercept is calculated by comparing Hc to Ho and subtracting the smaller of the two figures from the larger. Once the intercept is calculated and marked on the azimuth line, a 90° line will be drawn through the intercept. This will be the LOP. The direction of the intercept line must be determined and is drawn either *Away* or *Towards* the Sun on the azimuth line from the Ap λ of W 075° 02'. If Hc is greater then the Intercept point is *Away* from the Ap λ. If Ho is greater then the Intercept point is *Towards* the Sun beginning at the Ap λ. In this example Hc is greater so the intercept will be drawn *Away* from Ap λ . The UPS LOP plot is at the end of this file.	**Hc= 25° 39'** **Ho= 25° 17'** **Intercept= 0° 22'**

Fair winds....clear skies & following seas

TheNauticalAlmanac.com

Freely ye have received, freely give.

Altitude Correction Tables for 10° to 90° — Sun, Stars, Planets

SUN
October – March

App. Alt.	Lower Limb	Upper Limb
° ′	′	′
9 33	+10.8	– 21.5
9 45	+10.9	– 21.4
9 56	+11.0	– 21.3
10 08	+11.1	– 21.2
10 20	+11.2	– 21.1
10 33	+11.3	– 21.0
10 46	+11.4	– 20.9
11 00	+11.5	– 20.8
11 15	+11.6	– 20.7
11 30	+11.7	– 20.6
11 45	+11.8	– 20.5
12 01	+11.9	– 20.4
12 18	+12.0	– 20.3
12 36	+12.1	– 20.2
12 54	+12.2	– 20.1
13 14	+12.3	– 20.0
13 34	+12.4	– 19.9
13 55	+12.5	– 19.8
14 17	+12.6	– 19.7
14 41	+12.7	– 19.6
15 05	+12.8	– 19.5
15 31	+12.9	– 19.4
15 59	+13.0	– 19.3
16 27	+13.1	– 19.2
16 58	+13.2	– 19.1
17 30	+13.3	– 19.0
18 05	+13.4	– 18.9
18 41	+13.5	– 18.8
19 20	+13.6	– 18.7
20 02	+13.7	– 18.6
20 46	+13.8	– 18.5
21 34	+13.9	– 18.4
22 25	+14.0	– 18.3
23 20	+14.1	– 18.2
24 20	+14.2	– 18.1
25 24	+14.3	– 18.0
26 34	+14.4	– 17.9
27 50	+14.5	– 17.8
29 13	+14.6	– 17.7
30 44	+14.7	– 17.6
32 24	+14.8	– 17.5
34 15	+14.9	– 17.4
36 17	+15.0	– 17.3
38 34	+15.1	– 17.2
41 06	+15.2	– 17.1
43 56	+15.3	– 17.0
47 07	+15.4	– 16.9
50 43	+15.5	– 16.8
54 46	+15.6	– 16.7
59 21	+15.7	– 16.6
64 28	+15.8	– 16.5
70 10	+15.9	– 16.4
76 24	+16.0	– 16.3
83 05	+16.1	– 16.2
90 00		

SUN
April – September

App. Alt.	Lower Limb	Upper Limb
° ′	′	′
9 39	+10.6	– 21.2
9 50	+10.7	– 21.1
10 02	+10.8	– 21.0
10 14	+10.9	– 20.9
10 27	+11.0	– 20.8
10 40	+11.1	– 20.7
10 53	+11.2	– 20.6
11 07	+11.3	– 20.5
11 22	+11.4	– 20.4
11 37	+11.5	– 20.3
11 53	+11.6	– 20.2
12 10	+11.7	– 20.1
12 27	+11.8	– 20.0
14 45	+11.9	– 19.9
13 04	+12.0	– 19.8
13 24	+12.1	– 19.7
13 44	+12.2	– 19.6
14 06	+12.3	– 19.5
14 29	+12.4	– 19.4
14 53	+12.5	– 19.3
15 18	+12.6	– 19.2
15 45	+12.7	– 19.1
16 13	+12.8	– 19.0
16 43	+12.9	– 18.9
17 14	+13.0	– 18.8
17 47	+13.1	– 18.7
18 23	+13.2	– 18.6
19 00	+13.3	– 18.5
19 41	+13.4	– 18.4
20 24	+13.5	– 18.3
21 10	+13.6	– 18.2
21 59	+13.7	– 18.1
22 52	+13.8	– 18.0
23 49	+13.9	– 17.9
24 51	+14.0	– 17.8
25 58	+14.1	– 17.7
27 11	+14.2	– 17.6
28 31	+14.3	– 17.5
29 58	+14.4	– 17.4
31 33	+14.5	– 17.3
33 18	+14.6	– 17.2
35 15	+14.7	– 17.1
37 24	+14.8	– 17.0
39 48	+14.9	– 16.9
42 28	+15.0	– 16.8
45 29	+15.1	– 16.7
48 52	+15.2	– 16.6
51 41	+15.3	– 16.5
56 59	+15.4	– 16.4
61 50	+15.5	– 16.3
67 15	+15.6	– 16.2
73 14	+15.7	– 16.1
79 42	+15.8	– 16.0
86 21	+15.9	– 15.9
90 00		

Stars & Planets

App. Alt.	Corr
° ′	′
9 55	– 5.3
10 07	– 5.2
10 20	– 5.1
10 32	– 5.0
10 46	– 4.9
10 59	– 4.8
11 14	– 4.7
11 29	– 4.6
11 44	– 4.5
12 00	– 4.4
12 17	– 4.3
12 35	– 4.2
12 53	– 4.1
13 12	– 4.0
13 32	– 3.9
13 53	– 3.8
14 16	– 3.7
14 39	– 3.6
15 03	– 3.5
15 29	– 3.4
15 56	– 3.3
16 25	– 3.2
16 55	– 3.1
17 27	– 3.0
18 01	– 2.9
18 37	– 2.8
19 16	– 2.7
19 56	– 2.6
20 40	– 2.5
21 27	– 2.4
22 17	– 2.3
23 11	– 2.2
24 09	– 2.1
25 12	– 2.0
26 20	– 1.9
27 34	– 1.8
28 54	– 1.7
30 22	– 1.6
31 58	– 1.5
33 43	– 1.4
35 38	– 1.3
37 45	– 1.2
40 06	– 1.1
42 42	– 1.0
45 34	– 0.9
48 45	– 0.8
52 16	– 0.7
56 09	– 0.6
60 26	– 0.5
65 06	– 0.4
70 09	– 0.3
75 32	– 0.2
81 12	– 0.1
87 03	0.0
90 00	

Additional Altitude Correction for Mars & Venus

A small additional altitude correction for Mars & Venus can be obtained in the Daily Pages of The Nautical Almanac for the day of the observation.

Find the correction in the block labeled **Horizontal parallax**.

The figure will cover the range of 3 days found on that Daily Page.

The correction is to be added to Apparent Altitude.

Refraction

App. Alt.	Corr
°	′
5.5	– 9.1
6.0	– 8.5
6.5	– 7.9
7.0	– 7.5
7.5	– 7.0
8.0	– 6.6
8.5	– 6.3
9.0	– 5.9
9.5	– 5.7
10.0	– 5.4
10.5	– 5.1
11.0	– 4.9
11.5	– 4.7
12.0	– 4.5
12.5	– 4.4
13.0	– 4.2
13.5	– 4.0
14.0	– 3.9
14.5	– 3.8
15.0	– 3.6
15.5	– 3.5
16.0	– 3.4
16.5	– 3.3
17.0	– 3.2
17.5	– 3.1
18.0	– 3.0
18.5	– 2.9
19.0	– 2.9
19.5	– 2.8
20.0	– 2.7
21.0	– 2.6
22.0	– 2.4
23.0	– 2.3
24.0	– 2.2
25.0	– 2.1
26.0	– 2.0
27.0	– 1.9
28.0	– 1.9
29.0	– 1.8
30.0	– 1.7
31.0	– 1.7
32.0	– 1.6
33.0	– 1.5
34.0	– 1.5
35.0	– 1.4
36.0	– 1.4
37.0	– 1.3
38.0	– 1.3
39.0	– 1.2
40.0	– 1.2
45.0	– 1.0
50.0	– 0.8
55.0	– 0.7
60.0	– 0.6
65.0	– 0.5
70.0	– 0.4
75.0	– 0.3
80.0	– 0.2
85.0	– 0.1

DIP
always subtracted from Hs

Ht. of Eye	Corr	Ht. of Eye	Ht. of Eye	Corr
meters	′	**feet**	**meters**	′
2.4	**– 2.8**	8.0	1.0	**– 1.8**
2.6	**– 2.9**	8.6	1.5	**– 2.2**
2.8	**– 3.0**	9.2	2.0	**– 2.5**
3.0	**– 3.1**	9.8	2.5	**– 2.8**
3.2	**– 3.2**	10.5	3.0	**– 3.0**
3.4	**– 3.3**	11.2	See table ←	
3.6	**– 3.4**	11.9		
3.8	**– 3.5**	12.6	**meters**	
4.0	**– 3.6**	13.3	20	**– 7.9**
4.3	**– 3.7**	14.1	22	**– 8.3**
4.5	**– 3.8**	14.9	24	**– 8.6**
4.7	**– 3.9**	15.7	26	**– 9.0**
5.0	**– 4.0**	16.5	28	**– 9.3**
5.2	**– 4.1**	17.4		
5.5	**– 4.2**	18.3	30	**– 9.6**
5.8	**– 4.3**	19.1	32	**– 10.0**
6.1	**– 4.4**	20.1	34	**– 10.3**
6.3	**– 4.5**	21.0	36	**– 10.6**
6.6	**– 4.6**	22.0	38	**– 10.8**
6.9	**– 4.7**	22.9		
7.2	**– 4.8**	23.9	40	**– 11.1**
7.5	**– 4.9**	24.9	42	**– 11.4**
7.9	**– 5.0**	26.0	44	**– 11.7**
8.2	**– 5.1**	27.1	46	**– 11.9**
8.5	**– 5.2**	28.1	48	**– 12.2**
8.8	**– 5.3**	29.2	**feet**	′
9.2	**– 5.4**	30.4	2	**– 1.4**
9.5	**– 5.5**	31.5	4	**– 1.9**
9.9	**– 5.6**	32.7	6	**– 2.4**
10.3	**– 5.7**	33.9	8	**– 2.7**
10.6	**– 5.8**	35.1	10	**– 3.1**
11.0	**– 5.9**	36.3	See table ←	
11.4	**– 6.0**	37.6		
11.8	**– 6.1**	38.9	**feet**	′
12.2	**– 6.2**	40.1	70	**– 8.1**
12.6	**– 6.3**	41.5	75	**– 8.4**
13.0	**– 6.4**	42.8	80	**– 8.7**
13.4	**– 6.5**	44.2	85	**– 8.9**
13.8	**– 6.6**	45.5	90	**– 9.2**
14.2	**– 6.7**	46.9	95	**9.5**
14.7	**– 6.8**	48.4		
15.1	**– 6.9**	49.8	100	**– 9.7**
15.5	**– 7.0**	51.3	105	**– 9.9**
16.0	**– 7.1**	52.8	110	**– 10.2**
16.5	**– 7.2**	54.3	115	**– 10.4**
16.9	**– 7.3**	55.8	120	**– 10.6**
17.4	**– 7.4**	57.4	125	**– 10.8**
17.9	**– 7.5**	58.9	130	**– 11.1**
18.4	**– 7.6**	60.5	135	**– 11.3**
18.8	**– 7.7**	62.1	140	**– 11.5**
19.3	**– 7.8**	63.8	145	**– 11.7**
19.8	**– 7.9**	65.4	150	**– 11.9**
20.4	**– 8.0**	67.1	155	**– 12.1**
20.9	**– 8.1**	68.8		
21.4		70.5		

App. Alt. = Apparent altitude = Sextant altitude corrected for index error and dip.

DUT1 = UT1-UTC = -0.2714 sec ΔT = TT-UT1 = +68.4554 sec

2016 September 24 to Sep. 26 UT

h

Sat	Sun GHA	Sun Dec	Moon GHA	ν	Moon Dec	d	HP
0	181°59.9	S00°32.8	263°56.5	7.6'	N18°25.5	-0.8'	58.2'
1	197°00.1	33.7	278°23.1	7.6'	18°24.6	-0.9'	58.1'
2	212°00.3	34.7	292°49.7	7.6'	18°23.6	-1.0'	58.1'
3	227°00.5	·· 35.7	307°16.4	7.7'	18°22.5	-1.2'	58.1'
4	242°00.8	36.6	321°43.1	7.7'	18°21.3	-1.3'	58.1'
5	257°01.0	37.6	336°09.8	7.8'	18°20.0	-1.4'	58.0'
6	272°01.2	S00°38.6	350°36.6	7.8'	N18°18.5	-1.5'	58.0'
7	287°01.4	39.6	5°03.4	7.8'	18°17.0	-1.6'	58.0'
8	302°01.6	40.5	19°30.3	7.9'	18°15.4	-1.7'	57.9'
9	317°01.8	·· 41.5	33°57.2	7.9'	18°13.6	-1.8'	57.9'
10	332°02.1	42.5	48°24.2	8.0'	18°11.7	-1.9'	57.9'
11	347°02.3	43.5	62°51.2	8.0'	18°09.8	-2.0'	57.9'
12	2°02.5	S00°44.4	77°18.2	8.1'	N18°07.7	-2.1'	57.8'
13	17°02.7	45.4	91°45.3	8.1'	18°05.5	-2.2'	57.8'
14	32°02.9	46.4	106°12.4	8.2'	18°03.2	-2.3'	57.8'
15	47°03.1	·· 47.4	120°39.6	8.2'	18°00.8	-2.4'	57.8'
16	62°03.4	48.3	135°06.8	8.3'	17°58.4	-2.5'	57.7'
17	77°03.6	49.3	149°34.1	8.3'	17°55.8	-2.6'	57.7'
18	92°03.8	S00°50.3	164°01.4	8.4'	N17°53.1	-2.8'	57.7'
19	107°04.0	51.3	178°28.8	8.4'	17°50.3	-2.9'	57.7'
20	122°04.2	52.2	192°56.3	8.5'	17°47.3	-3.0'	57.6'
21	137°04.4	·· 53.2	207°23.7	8.5'	17°44.3	-3.1'	57.6'
22	152°04.6	54.2	221°51.3	8.6'	17°41.2	-3.2'	57.6'
23	167°04.9	55.1	236°18.8	8.6'	17°38.0	-3.3'	57.5'
	SD.=15.9	d=-1.0		S.D.=15.8			

Sun	GHA	Dec	GHA	ν	Dec	d	HP
0	182°05.1	S00°56.1	250°46.5	8.7'	N17°34.7	-3.4'	57.5'
1	197°05.3	57.1	265°14.1	8.7'	17°31.3	-3.5'	57.5'
2	212°05.5	58.1	279°41.9	8.8'	17°27.8	-3.6'	57.5'
3	227°05.7	00°59.0	294°09.7	8.8'	17°24.2	-3.6'	57.4'
4	242°05.9	01°00.0	308°37.5	8.9'	17°20.5	-3.7'	57.4'
5	257°06.2	01.0	323°05.4	8.9'	17°16.7	-3.8'	57.4'
6	272°06.4	S01°02.0	337°33.3	9.0'	N17°12.8	-3.9'	57.4'
7	287°06.6	02.9	352°01.3	9.0'	17°08.9	-4.0'	57.3'
8	302°06.8	03.9	6°29.4	9.1'	17°04.8	-4.1'	57.3'
9	317°07.0	·· 04.9	20°57.5	9.1'	17°00.6	-4.2'	57.3'
10	332°07.2	05.9	35°25.7	9.2'	16°56.3	-4.3'	57.3'
11	347°07.4	06.8	49°53.9	9.2'	16°52.0	-4.4'	57.2'
12	2°07.7	S01°07.8	64°22.1	9.3'	N16°47.6	-4.5'	57.2'
13	17°07.9	08.8	78°50.5	9.4'	16°43.0	-4.6'	57.2'
14	32°08.1	09.7	93°18.9	9.4'	16°38.4	-4.7'	57.2'
15	47°08.3	·· 10.7	107°47.3	9.5'	16°33.7	-4.8'	57.1'
16	62°08.5	11.7	122°15.8	9.5'	16°28.9	-4.8'	57.1'
17	77°08.7	12.7	136°44.3	9.6'	16°24.0	-4.9'	57.1'
18	92°08.9	S01°13.6	151°12.9	9.6'	N16°19.0	-5.0'	57.1'
19	107°09.2	14.6	165°41.6	9.7'	16°14.0	-5.1'	57.0'
20	122°09.4	15.6	180°10.3	9.7'	16°08.8	-5.2'	57.0'
21	137°09.6	·· 16.6	194°39.1	9.8'	16°03.6	-5.3'	57.0'
22	152°09.8	17.5	209°07.9	9.9'	15°58.3	-5.4'	57.0'
23	167°10.0	18.5	223°36.8	9.9'	15°52.9	-5.4'	56.9'
	SD.=15.9	d=-1.0		S.D.=15.6			

Mon	GHA	Dec	GHA	ν	Dec	d	HP
0	182°10.2	S01°19.5	238°05.8	10.0'	N15°47.4	-5.5'	56.9'
1	197°10.4	20.5	252°34.8	10.0'	15°41.8	-5.6'	56.9'
2	212°10.7	21.4	267°03.8	10.1'	15°36.2	-5.7'	56.9'
3	227°10.9	·· 22.4	281°33.0	10.1'	15°30.5	-5.8'	56.8'
4	242°11.1	23.4	296°02.1	10.2'	15°24.7	-5.8'	56.8'
5	257°11.3	24.4	310°31.4	10.3'	15°18.8	-5.9'	56.8'
6	272°11.5	S01°25.3	325°00.7	10.3'	N15°12.9	-6.0'	56.8'
7	287°11.7	26.3	339°30.0	10.4'	15°06.8	-6.1'	56.7'
8	302°11.9	27.3	353°59.4	10.4'	15°00.7	-6.1'	56.7'
9	317°12.1	·· 28.2	8°28.9	10.5'	14°54.5	-6.2'	56.7'
10	332°12.4	29.2	22°58.4	10.5'	14°48.3	-6.3'	56.7'
11	347°12.6	30.2	37°28.0	10.6'	14°42.0	-6.4'	56.6'
12	2°12.8	S01°31.2	51°57.6	10.7'	N14°35.6	-6.4'	56.6'
13	17°13.0	32.1	66°27.3	10.7'	14°29.1	-6.5'	56.6'
14	32°13.2	33.1	80°57.0	10.8'	14°22.5	-6.6'	56.6'
15	47°13.4	·· 34.1	95°26.8	10.8'	14°15.9	-6.6'	56.5'
16	62°13.6	35.1	109°56.7	10.9'	14°09.3	-6.7'	56.5'
17	77°13.8	36.0	124°26.6	10.9'	14°02.5	-6.8'	56.5'
18	92°14.1	S01°37.0	138°56.6	11.0'	N13°55.7	-6.8'	56.5'
19	107°14.3	38.0	153°26.6	11.1'	13°48.8	-6.9'	56.5'
20	122°14.5	39.0	167°56.7	11.1'	13°41.9	-7.0'	56.4'
21	137°14.7	·· 39.9	182°26.8	11.2'	13°34.8	-7.0'	56.4'
22	152°14.9	40.9	196°57.0	11.2'	13°27.8	-7.1'	56.4'
23	167°15.1	41.9	211°27.3	11.3'	13°20.6	-7.2'	56.4'
	SD.=15.9	d=-1.0		S.D.=15.4			

Lat.	Twilight Naut.	Twilight Civil	Sunrise	Sunset	Twilight Civil	Twilight Naut.
N 72°	03:18	04:46	05:54	17:47	18:54	20:20
N 70°	03:35	04:52	05:53	17:48	18:48	20:04
68°	03:48	04:57	05:53	17:48	18:44	19:52
66°	03:59	05:01	05:53	17:49	18:40	19:41
64°	04:08	05:05	05:52	17:49	18:36	19:33
62°	04:15	05:08	05:52	17:49	18:33	19:26
60°	04:21	05:11	05:52	17:50	18:31	19:20
N 58°	04:26	05:13	05:52	17:50	18:29	19:15
56°	04:31	05:15	05:52	17:50	18:27	19:11
54°	04:35	05:16	05:52	17:50	18:25	19:07
52°	04:38	05:18	05:51	17:51	18:24	19:04
50°	04:41	05:19	05:51	17:51	18:23	19:01
45°	04:47	05:22	05:51	17:51	18:20	18:55
N 40°	04:52	05:24	05:51	17:52	18:19	18:50
35°	04:56	05:25	05:50	17:52	18:17	18:47
30°	04:58	05:26	05:50	17:52	18:16	18:44
20°	05:02	05:28	05:50	17:53	18:15	18:41
N 10°	05:04	05:28	05:49	17:54	18:15	18:39
0°	05:04	05:28	05:48	17:55	18:15	18:39
S 10°	05:02	05:26	05:47	17:56	18:17	18:41
20°	04:59	05:25	05:47	17:57	18:19	18:44
30°	04:54	05:21	05:45	17:58	18:22	18:50
35°	04:50	05:19	05:45	17:59	18:24	18:54
40°	04:45	05:17	05:44	18:00	18:27	18:59
45°	04:39	05:13	05:43	18:01	18:30	19:05
S 50°	04:31	05:09	05:42	18:02	18:35	19:13
52°	04:27	05:07	05:41	18:03	18:37	19:17
54°	04:23	05:05	05:40	18:04	18:39	19:22
56°	04:18	05:02	05:40	18:05	18:42	19:27
58°	04:12	04:59	05:39	18:06	18:45	19:33
S 60°	04:06	04:56	05:38	18:07	18:48	19:39

Lat.	Moonrise Sat	Moonrise Sun	Moonrise Mon	Moonset Sat	Moonset Sun	Moonset Mon
N 72°	19:54	22:00	23:53	18:24	18:08	18:01
N 70°	21:08	22:41	–:–	17:09	17:27	17:34
68°	21:46	23:09	–:–	16:31	16:58	17:14
66°	22:12	23:30	–:–	16:05	16:36	16:57
64°	22:32	23:47	–:–	15:44	16:19	16:44
62°	22:49	–:–	00:00	15:28	16:05	16:33
60°	23:03	–:–	00:12	15:14	15:53	16:23
N 58°	23:14	–:–	00:22	15:02	15:42	16:15
56°	23:24	–:–	00:31	14:51	15:33	16:07
54°	23:33	–:–	00:39	14:42	15:25	16:01
52°	23:41	–:–	00:46	14:34	15:18	15:55
50°	23:49	–:–	00:52	14:27	15:11	15:49
45°	–:–	00:04	01:05	14:11	14:57	15:37
N 40°	–:–	00:17	01:16	13:58	14:46	15:28
35°	–:–	00:27	01:26	13:47	14:36	15:19
30°	–:–	00:37	01:34	13:37	14:27	15:12
20°	–:–	00:53	01:49	13:20	14:12	14:59
N 10°	00:12	01:07	02:01	13:06	13:58	14:48
0°	00:26	01:20	02:13	12:52	13:46	14:37
S 10°	00:40	01:34	02:24	12:38	13:33	14:26
20°	00:55	01:48	02:37	12:24	13:20	14:15
30°	01:12	02:04	02:51	12:07	13:04	14:02
35°	01:22	02:13	02:59	11:57	12:55	13:54
40°	01:33	02:24	03:09	11:46	12:45	13:45
45°	01:47	02:36	03:20	11:32	12:33	13:35
S 50°	02:03	02:52	03:33	11:16	12:18	13:23
52°	02:11	02:59	03:39	11:09	12:11	13:17
54°	02:19	03:07	03:46	11:00	12:04	13:10
56°	02:29	03:16	03:53	10:51	11:55	13:03
58°	02:40	03:26	04:02	10:40	11:45	12:55
S 60°	02:53	03:37	04:11	10:27	11:34	12:46

Day	Sun Eqn.of Time 00h mm:ss	Sun Eqn.of Time 12h mm:ss	Sun Mer. Pass hh:mm	Moon Mer.Pass. Upper hh:mm	Moon Mer.Pass. Lower hh:mm	Moon Age 23-25 38-19%
24	08:00	08:10	11:52	06:39	19:06	
25	08:20	08:31	11:51	07:33	19:59	
26	08:41	08:51	11:51	08:25	20:50	

	Minutes										Minutes										Minutes										
Seconds	0	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	Seconds
0	0° 00.0'	0° 15.0'	0° 30.0'	0° 45.0'	1° 00.0'	1° 15.0'	1° 30.0'	1° 45.0'	2° 00.0'	2° 15.0'	2° 30.0'	2° 45.0'	3° 00.0'	3° 15.0'	3° 30.0'	3° 45.0'	4° 00.0'	4° 15.0'	4° 30.0'	4° 45.0'	5° 00.0'	5° 15.0'	5° 30.0'	5° 45.0'	6° 00.0'	6° 15.0'	6° 30.0'	6° 45.0'	7° 00.0'	7° 15.0'	0
1	0° 00.3'	0° 15.3'	0° 30.3'	0° 45.3'	1° 00.3'	1° 15.3'	1° 30.3'	1° 45.3'	2° 00.3'	2° 15.3'	2° 30.3'	2° 45.3'	3° 00.3'	3° 15.3'	3° 30.3'	3° 45.3'	4° 00.3'	4° 15.3'	4° 30.3'	4° 45.3'	5° 00.3'	5° 15.3'	5° 30.3'	5° 45.3'	6° 00.3'	6° 15.3'	6° 30.3'	6° 45.3'	7° 00.3'	7° 15.3'	1
2	0° 00.5'	0° 15.5'	0° 30.5'	0° 45.5'	1° 00.5'	1° 15.5'	1° 30.5'	1° 45.5'	2° 00.5'	2° 15.5'	2° 30.5'	2° 45.5'	3° 00.5'	3° 15.5'	3° 30.5'	3° 45.5'	4° 00.5'	4° 15.5'	4° 30.5'	4° 45.5'	5° 00.5'	5° 15.5'	5° 30.5'	5° 45.5'	6° 00.5'	6° 15.5'	6° 30.5'	6° 45.5'	7° 00.5'	7° 15.5'	2
3	0° 00.8'	0° 15.8'	0° 30.8'	0° 45.8'	1° 00.8'	1° 15.8'	1° 30.8'	1° 45.8'	2° 00.8'	2° 15.8'	2° 30.8'	2° 45.8'	3° 00.8'	3° 15.8'	3° 30.8'	3° 45.8'	4° 00.8'	4° 15.8'	4° 30.8'	4° 45.8'	5° 00.8'	5° 15.8'	5° 30.8'	5° 45.8'	6° 00.8'	6° 15.8'	6° 30.8'	6° 45.8'	7° 00.8'	7° 15.8'	3
4	0° 01.0'	0° 16.0'	0° 31.0'	0° 46.0'	1° 01.0'	1° 16.0'	1° 31.0'	1° 46.0'	2° 01.0'	2° 16.0'	2° 31.0'	2° 46.0'	3° 01.0'	3° 16.0'	3° 31.0'	3° 46.0'	4° 01.0'	4° 16.0'	4° 31.0'	4° 46.0'	5° 01.0'	5° 16.0'	5° 31.0'	5° 46.0'	6° 01.0'	6° 16.0'	6° 31.0'	6° 46.0'	7° 01.0'	7° 16.0'	4
5	0° 01.3'	0° 16.3'	0° 31.3'	0° 46.3'	1° 01.2'	1° 16.3'	1° 31.3'	1° 46.3'	2° 01.3'	2° 16.3'	2° 31.3'	2° 46.3'	3° 01.3'	3° 16.3'	3° 31.3'	3° 46.3'	4° 01.2'	4° 16.3'	4° 31.3'	4° 46.3'	5° 01.3'	5° 16.3'	5° 31.3'	5° 46.3'	6° 01.3'	6° 16.3'	6° 31.3'	6° 46.3'	7° 01.3'	7° 16.3'	5
6	0° 01.5'	0° 16.5'	0° 31.5'	0° 46.5'	1° 01.5'	1° 16.5'	1° 31.5'	1° 46.5'	2° 01.5'	2° 16.5'	2° 31.5'	2° 46.5'	3° 01.5'	3° 16.5'	3° 31.5'	3° 46.5'	4° 01.5'	4° 16.5'	4° 31.5'	4° 46.5'	5° 01.5'	5° 16.5'	5° 31.5'	5° 46.5'	6° 01.5'	6° 16.5'	6° 31.5'	6° 46.5'	7° 01.5'	7° 16.5'	6
7	0° 01.8'	0° 16.8'	0° 31.8'	0° 46.8'	1° 01.7'	1° 16.8'	1° 31.8'	1° 46.8'	2° 01.8'	2° 16.8'	2° 31.8'	2° 46.8'	3° 01.8'	3° 16.8'	3° 31.8'	3° 46.8'	4° 01.8'	4° 16.8'	4° 31.8'	4° 46.8'	5° 01.8'	5° 16.8'	5° 31.8'	5° 46.8'	6° 01.8'	6° 16.8'	6° 31.8'	6° 46.8'	7° 01.8'	7° 16.8'	7
8	0° 02.0'	0° 17.0'	0° 32.0'	0° 47.0'	1° 02.0'	1° 17.0'	1° 32.0'	1° 47.0'	2° 02.0'	2° 17.0'	2° 32.0'	2° 47.0'	3° 02.0'	3° 17.0'	3° 32.0'	3° 47.0'	4° 02.0'	4° 17.0'	4° 32.0'	4° 47.0'	5° 02.0'	5° 17.0'	5° 32.0'	5° 47.0'	6° 02.0'	6° 17.0'	6° 32.0'	6° 47.0'	7° 02.0'	7° 17.0'	8
9	0° 02.3'	0° 17.3'	0° 32.3'	0° 47.3'	1° 02.3'	1° 17.3'	1° 32.3'	1° 47.3'	2° 02.3'	2° 17.3'	2° 32.3'	2° 47.3'	3° 02.3'	3° 17.3'	3° 32.3'	3° 47.3'	4° 02.2'	4° 17.3'	4° 32.3'	4° 47.3'	5° 02.3'	5° 17.3'	5° 32.3'	5° 47.3'	6° 02.3'	6° 17.3'	6° 32.3'	6° 47.3'	7° 02.3'	7° 17.3'	9
10	0° 02.5'	0° 17.5'	0° 32.5'	0° 47.5'	1° 02.5'	1° 17.5'	1° 32.5'	1° 47.5'	2° 02.5'	2° 17.5'	2° 32.5'	2° 47.5'	3° 02.5'	3° 17.5'	3° 32.5'	3° 47.5'	4° 02.5'	4° 17.5'	4° 32.5'	4° 47.5'	5° 02.5'	5° 17.5'	5° 32.5'	5° 47.5'	6° 02.5'	6° 17.5'	6° 32.5'	6° 47.5'	7° 02.5'	7° 17.5'	10
11	0° 02.8'	0° 17.8'	0° 32.8'	0° 47.8'	1° 02.8'	1° 17.8'	1° 32.8'	1° 47.8'	2° 02.8'	2° 17.8'	2° 32.8'	2° 47.8'	3° 02.8'	3° 17.8'	3° 32.8'	3° 47.8'	4° 02.8'	4° 17.8'	4° 32.8'	4° 47.8'	5° 02.8'	5° 17.8'	5° 32.8'	5° 47.8'	6° 02.8'	6° 17.8'	6° 32.8'	6° 47.8'	7° 02.8'	7° 17.8'	11
12	0° 03.0'	0° 18.0'	0° 33.0'	0° 48.0'	1° 03.0'	1° 18.0'	1° 33.0'	1° 48.0'	2° 03.0'	2° 18.0'	2° 33.0'	2° 48.0'	3° 03.0'	3° 18.0'	3° 33.0'	3° 48.0'	4° 03.0'	4° 18.0'	4° 33.0'	4° 48.0'	5° 03.0'	5° 18.0'	5° 33.0'	5° 48.0'	6° 03.0'	6° 18.0'	6° 33.0'	6° 48.0'	7° 03.0'	7° 18.0'	12
13	0° 03.3'	0° 18.3'	0° 33.3'	0° 48.3'	1° 03.3'	1° 18.3'	1° 33.3'	1° 48.3'	2° 03.3'	2° 18.3'	2° 33.3'	2° 48.3'	3° 03.3'	3° 18.3'	3° 33.3'	3° 48.3'	4° 03.2'	4° 18.3'	4° 33.3'	4° 48.3'	5° 03.3'	5° 18.3'	5° 33.3'	5° 48.3'	6° 03.3'	6° 18.3'	6° 33.3'	6° 48.3'	7° 03.3'	7° 18.3'	13
14	0° 03.5'	0° 18.5'	0° 33.5'	0° 48.5'	1° 03.5'	1° 18.5'	1° 33.5'	1° 48.5'	2° 03.5'	2° 18.5'	2° 33.5'	2° 48.5'	3° 03.5'	3° 18.5'	3° 33.5'	3° 48.5'	4° 03.5'	4° 18.5'	4° 33.5'	4° 48.5'	5° 03.5'	5° 18.5'	5° 33.5'	5° 48.5'	6° 03.5'	6° 18.5'	6° 33.5'	6° 48.5'	7° 03.5'	7° 18.5'	14
15	0° 03.8'	0° 18.8'	0° 33.8'	0° 48.8'	1° 03.8'	1° 18.8'	1° 33.8'	1° 48.8'	2° 03.8'	2° 18.8'	2° 33.8'	2° 48.8'	3° 03.8'	3° 18.8'	3° 33.8'	3° 48.8'	4° 03.8'	4° 18.8'	4° 33.8'	4° 48.8'	5° 03.8'	5° 18.8'	5° 33.8'	5° 48.8'	6° 03.8'	6° 18.8'	6° 33.8'	6° 48.8'	7° 03.8'	7° 18.8'	15
16	0° 04.0'	0° 19.0'	0° 34.0'	0° 49.0'	1° 04.0'	1° 19.0'	1° 34.0'	1° 49.0'	2° 04.0'	2° 19.0'	2° 34.0'	2° 49.0'	3° 04.0'	3° 19.0'	3° 34.0'	3° 49.0'	4° 04.0'	4° 19.0'	4° 34.0'	4° 49.0'	5° 04.0'	5° 19.0'	5° 34.0'	5° 49.0'	6° 04.0'	6° 19.0'	6° 34.0'	6° 49.0'	7° 04.0'	7° 19.0'	16
17	0° 04.3'	0° 19.3'	0° 34.3'	0° 49.3'	1° 04.3'	1° 19.3'	1° 34.3'	1° 49.3'	2° 04.3'	2° 19.3'	2° 34.3'	2° 49.3'	3° 04.3'	3° 19.3'	3° 34.3'	3° 49.3'	4° 04.3'	4° 19.3'	4° 34.3'	4° 49.3'	5° 04.3'	5° 19.3'	5° 34.3'	5° 49.3'	6° 04.3'	6° 19.3'	6° 34.3'	6° 49.3'	7° 04.3'	7° 19.3'	17
18	0° 04.5'	0° 19.5'	0° 34.5'	0° 49.5'	1° 04.5'	1° 19.5'	1° 34.5'	1° 49.5'	2° 04.5'	2° 19.5'	2° 34.5'	2° 49.5'	3° 04.5'	3° 19.5'	3° 34.5'	3° 49.5'	4° 04.5'	4° 19.5'	4° 34.5'	4° 49.5'	5° 04.5'	5° 19.5'	5° 34.5'	5° 49.5'	6° 04.5'	6° 19.5'	6° 34.5'	6° 49.5'	7° 04.5'	7° 19.5'	18
19	0° 04.8'	0° 19.8'	0° 34.8'	0° 49.8'	1° 04.8'	1° 19.8'	1° 34.8'	1° 49.8'	2° 04.8'	2° 19.8'	2° 34.8'	2° 49.8'	3° 04.8'	3° 19.8'	3° 34.8'	3° 49.8'	4° 04.8'	4° 19.8'	4° 34.8'	4° 49.8'	5° 04.8'	5° 19.8'	5° 34.8'	5° 49.8'	6° 04.8'	6° 19.8'	6° 34.8'	6° 49.8'	7° 04.8'	7° 19.8'	19
20	0° 05.0'	0° 20.0'	0° 35.0'	0° 50.0'	1° 05.0'	1° 20.0'	1° 35.0'	1° 50.0'	2° 05.0'	2° 20.0'	2° 35.0'	2° 50.0'	3° 05.0'	3° 20.0'	3° 35.0'	3° 50.0'	4° 05.0'	4° 20.0'	4° 35.0'	4° 50.0'	5° 05.0'	5° 20.0'	5° 35.0'	5° 50.0'	6° 05.0'	6° 20.0'	6° 35.0'	6° 50.0'	7° 05.0'	7° 20.0'	20
21	0° 05.3'	0° 20.3'	0° 35.3'	0° 50.3'	1° 05.3'	1° 20.3'	1° 35.3'	1° 50.3'	2° 05.3'	2° 20.3'	2° 35.3'	2° 50.3'	3° 05.3'	3° 20.3'	3° 35.3'	3° 50.3'	4° 05.3'	4° 20.3'	4° 35.3'	4° 50.3'	5° 05.3'	5° 20.3'	5° 35.3'	5° 50.3'	6° 05.3'	6° 20.3'	6° 35.3'	6° 50.3'	7° 05.3'	7° 20.3'	21
22	0° 05.5'	0° 20.5'	0° 35.5'	0° 50.5'	1° 05.5'	1° 20.5'	1° 35.5'	1° 50.5'	2° 05.5'	2° 20.5'	2° 35.5'	2° 50.5'	3° 05.5'	3° 20.5'	3° 35.5'	3° 50.5'	4° 05.5'	4° 20.5'	4° 35.5'	4° 50.5'	5° 05.5'	5° 20.5'	5° 35.5'	5° 50.5'	6° 05.5'	6° 20.5'	6° 35.5'	6° 50.5'	7° 05.5'	7° 20.5'	22
23	0° 05.8'	0° 20.8'	0° 35.8'	0° 50.8'	1° 05.8'	1° 20.8'	1° 35.8'	1° 50.8'	2° 05.8'	2° 20.8'	2° 35.8'	2° 50.8'	3° 05.8'	3° 20.8'	3° 35.8'	3° 50.8'	4° 05.8'	4° 20.8'	4° 35.8'	4° 50.8'	5° 05.8'	5° 20.8'	5° 35.8'	5° 50.8'	6° 05.8'	6° 20.8'	6° 35.8'	6° 50.8'	7° 05.8'	7° 20.8'	23
24	0° 06.0'	0° 21.0'	0° 36.0'	0° 51.0'	1° 06.0'	1° 21.0'	1° 36.0'	1° 51.0'	2° 06.0'	2° 21.0'	2° 36.0'	2° 51.0'	3° 06.0'	3° 21.0'	3° 36.0'	3° 51.0'	4° 06.0'	4° 21.0'	4° 36.0'	4° 51.0'	5° 06.0'	5° 21.0'	5° 36.0'	5° 51.0'	6° 06.0'	6° 21.0'	6° 36.0'	6° 51.0'	7° 06.0'	7° 21.0'	24
25	0° 06.3'	0° 21.3'	0° 36.3'	0° 51.3'	1° 06.3'	1° 21.3'	1° 36.3'	1° 51.3'	2° 06.2'	2° 21.3'	2° 36.3'	2° 51.3'	3° 06.3'	3° 21.3'	3° 36.3'	3° 51.3'	4° 06.3'	4° 21.3'	4° 36.3'	4° 51.3'	5° 06.3'	5° 21.3'	5° 36.3'	5° 51.3'	6° 06.3'	6° 21.3'	6° 36.3'	6° 51.3'	7° 06.3'	7° 21.3'	25
26	0° 06.5'	0° 21.5'	0° 36.5'	0° 51.5'	1° 06.5'	1° 21.5'	1° 36.5'	1° 51.5'	2° 06.5'	2° 21.5'	2° 36.5'	2° 51.5'	3° 06.5'	3° 21.5'	3° 36.5'	3° 51.5'	4° 06.5'	4° 21.5'	4° 36.5'	4° 51.5'	5° 06.5'	5° 21.5'	5° 36.5'	5° 51.5'	6° 06.5'	6° 21.5'	6° 36.5'	6° 51.5'	7° 06.5'	7° 21.5'	26
27	0° 06.8'	0° 21.8'	0° 36.8'	0° 51.8'	1° 06.8'	1° 21.8'	1° 36.8'	1° 51.8'	2° 06.7'	2° 21.8'	2° 36.8'	2° 51.8'	3° 06.8'	3° 21.8'	3° 36.8'	3° 51.8'	4° 06.8'	4° 21.8'	4° 36.8'	4° 51.8'	5° 06.8'	5° 21.8'	5° 36.8'	5° 51.8'	6° 06.8'	6° 21.8'	6° 36.8'	6° 51.8'	7° 06.8'	7° 21.8'	27
28	0° 07.0'	0° 22.0'	0° 37.0'	0° 52.0'	1° 07.0'	1° 22.0'	1° 37.0'	1° 52.0'	2° 07.0'	2° 22.0'	2° 37.0'	2° 52.0'	3° 07.0'	3° 22.0'	3° 37.0'	3° 52.0'	4° 07.0'	4° 22.0'	4° 37.0'	4° 52.0'	5° 07.0'	5° 22.0'	5° 37.0'	5° 52.0'	6° 07.0'	6° 22.0'	6° 37.0'	6° 52.0'	7° 07.0'	7° 22.0'	28
29	0° 07.3'	0° 22.3'	0° 37.3'	0° 52.3'	1° 07.3'	1° 22.3'	1° 37.3'	1° 52.3'	2° 07.2'	2° 22.3'	2° 37.3'	2° 52.3'	3° 07.3'	3° 22.3'	3° 37.3'	3° 52.3'	4° 07.3'	4° 22.3'	4° 37.3'	4° 52.3'	5° 07.3'	5° 22.3'	5° 37.3'	5° 52.3'	6° 07.3'	6° 22.3'	6° 37.3'	6° 52.3'	7° 07.3'	7° 22.3'	29
30	0° 07.5'	0° 22.5'	0° 37.5'	0° 52.5'	1° 07.5'	1° 22.5'	1° 37.5'	1° 52.5'	2° 07.5'	2° 22.5'	2° 37.5'	2° 52.5'	3° 07.5'	3° 22.5'	3° 37.5'	3° 52.5'	4° 07.5'	4° 22.5'	4° 37.5'	4° 52.5'	5° 07.5'	5° 22.5'	5° 37.5'	5° 52.5'	6° 07.5'	6° 22.5'	6° 37.5'	6° 52.5'	7° 07.5'	7° 22.5'	30
31	0° 07.8'	0° 22.8'	0° 37.8'	0° 52.8'	1° 07.8'	1° 22.8'	1° 37.8'	1° 52.8'	2° 07.8'	2° 22.8'	2° 37.8'	2° 52.8'	3° 07.8'	3° 22.8'	3° 37.8'	3° 52.8'	4° 07.8'	4° 22.8'	4° 37.8'	4° 52.8'	5° 07.8'	5° 22.8'	5° 37.8'	5° 52.8'	6° 07.8'	6° 22.8'	6° 37.8'	6° 52.8'	7° 07.8'	7° 22.8'	31
32	0° 08.0'	0° 23.0'	0° 38.0'	0° 53.0'	1° 08.0'	1° 23.0'	1° 38.0'	1° 53.0'	2° 08.0'	2° 23.0'	2° 38.0'	2° 53.0'	3° 08.0'	3° 23.0'	3° 38.0'	3° 53.0'	4° 08.0'	4° 23.0'	4° 38.0'	4° 53.0'	5° 08.0'	5° 23.0'	5° 38.0'	5° 53.0'	6° 08.0'	6° 23.0'	6° 38.0'	6° 53.0'	7° 08.0'	7° 23.0'	32
33	0° 08.3'	0° 23.3'	0° 38.3'	0° 53.3'	1° 08.3'	1° 23.3'	1° 38.3'	1° 53.3'	2° 08.3'	2° 23.3'	2° 38.3'	2° 53.3'	3° 08.3'	3° 23.3'	3° 38.3'	3° 53.3'	4° 08.3'	4° 23.3'	4° 38.3'	4° 53.3'	5° 08.3'	5° 23.3'	5° 38.3'	5° 53.3'	6° 08.3'	6° 23.3'	6° 38.3'	6° 53.3'	7° 08.3'	7° 23.3'	33
34	0° 08.5'	0° 23.5'	0° 38.5'	0° 53.5'	1° 08.5'	1° 23.5'	1° 38.5'	1° 53.5'	2° 08.5'	2° 23.5'	2° 38.5'	2° 53.5'	3° 08.5'	3° 23.5'	3° 38.5'	3° 53.5'	4° 08.5'	4° 23.5'	4° 38.5'	4° 53.5'	5° 08.5'	5° 23.5'	5° 38.5'	5° 53.5'	6° 08.5'	6° 23.5'	6° 38.5'	6° 53.5'	7° 08.5'	7° 23.5'	34
35	0° 08.8'	0° 23.8'	0° 38.8'	0° 53.8'	1° 08.8'	1° 23.8'	1° 38.8'	1° 53.8'	2° 08.8'	2° 23.8'	2° 38.8'	2° 53.8'	3° 08.8'	3° 23.8'	3° 38.8'	3° 53.8'	4° 08.7'	4° 23.8'	4° 38.8'	4° 53.8'	5° 08.8'	5° 23.8'	5° 38.8'	5° 53.8'	6° 08.8'	6° 23.8'	6° 38.8'	6° 53.8'	7° 08.8'	7° 23.8'	35
36	0° 09.0'	0° 24.0'	0° 39.0'	0° 54.0'	1° 09.0'	1° 24.0'	1° 39.0'	1° 54.0'	2° 09.0'	2° 24.0'	2° 39.0'	2° 54.0'	3° 09.0'	3° 24.0'	3° 39.0'	3° 54.0'	4° 09.0'	4° 24.0'	4° 39.0'	4° 54.0'	5° 09.0'	5° 24.0'	5° 39.0'	5° 54.0'	6° 09.0'	6° 24.0'	6° 39.0'	6° 54.0'	7° 09.0'	7° 24.0'	36
37	0° 09.3'	0° 24.3'	0° 39.3'	0° 54.3'	1° 09.3'	1° 24.3'	1° 39.3'	1° 54.3'	2° 09.3'	2° 24.3'	2° 39.3'	2° 54.3'	3° 09.3'	3° 24.3'	3° 39.3'	3° 54.3'	4° 09.3'	4° 24.3'	4° 39.3'	4° 54.3'	5° 09.3'	5° 24.3'	5° 39.3'	5° 54.3'	6° 09.3'	6° 24.3'	6° 39.3'	6° 54.3'	7° 09.3'	7° 24.3'	37
38	0° 09.5'	0° 24.5'	0° 39.5'	0° 54.5'	1° 09.5'	1° 24.5'	1° 39.5'	1° 54.5'	2° 09.5'	2° 24.5'	2° 39.5'	2° 54.5'	3° 09.5'	3° 24.5'	3° 39.5'	3° 54.5'	4° 09.5'	4° 24.5'	4° 39.5'	4° 54.5'	5° 09.5'	5° 24.5'	5° 39.5'	5° 54.5'	6° 09.5'	6° 24.5'	6° 39.5'	6° 54.5'	7° 09.5'	7° 24.5'	38
39	0° 09.8'	0° 24.8'	0° 39.8'	0° 54.8'	1° 09.8'	1° 24.8'	1° 39.8'	1° 54.8'	2° 09.8'	2° 24.8'	2° 39.8'	2° 54.8'	3° 09.8'	3° 24.8'	3° 39.8'	3° 54.8'	4° 09.7'	4° 24.8'	4° 39.8'	4° 54.8'	5° 09.8'	5° 24.8'	5° 39.8'	5° 54.8'	6° 09.8'	6° 24.8'	6° 39.8'	6° 54.8'	7° 09.8'	7° 24.8'	39
40	0° 10.0'	0° 25.0'	0° 40.0'	0° 55.0'	1° 10.0'	1° 25.0'	1° 40.0'	1° 55.0'	2° 10.0'	2° 25.0'	2° 40.0'	2° 55.0'	3° 10.0'	3° 25.0'	3° 40.0'	3° 55.0'	4° 10.0'	4° 25.0'	4° 40.0'	4° 55.0'	5° 10.0'	5° 25.0'	5° 40.0'	5° 55.0'	6° 10.0'	6° 25.0'	6° 40.0'	6° 55.0'	7° 10.0'	7° 25.0'	40
41	0° 10.3'	0° 25.3'	0° 40.3'	0° 55.3'	1° 10.3'	1° 25.3'	1° 40.3'	1° 55.3'	2° 10.3'	2° 25.3'	2° 40.3'	2° 55.3'	3° 10.3'	3° 25.3'	3° 40.3'	3° 55.3'	4° 10.3'	4° 25.3'	4° 40.3'	4° 55.3'	5° 10.3'	5° 25.3'	5° 40.3'	5° 55.3'	6° 10.3'	6° 25.3'	6° 40.3'	6° 55.3'	7° 10.3'	7° 25.3'	41
42	0° 10.5'	0° 25.5'	0° 40.5'	0° 55.5'	1° 10.5'	1° 25.5'	1° 40.5'	1° 55.5'	2° 10.5'	2° 25.5'	2° 40.5'	2° 55.5'	3° 10.5'	3° 25.5'	3° 40.5'	3° 55.5'	4° 10.5'	4° 25.5'	4° 40.5'	4° 55.5'	5° 10.5'	5° 25.5'	5° 40.5'	5° 55.5'	6° 10.5'	6° 25.5'	6° 40.5'	6° 55.5'	7° 10.5'	7° 25.5'	42
43	0° 10.8'	0° 25.8'	0° 40.8'	0° 55.8'	1° 10.8'	1° 25.8'	1° 40.8'	1° 55.8'	2° 10.8'	2° 25.8'	2° 40.8'	2° 55.8'	3° 10.8'	3° 25.8'	3° 40.8'	3° 55.8'	4° 10.8'	4° 25.8'	4° 40.8'	4° 55.8'	5° 10.8'	5° 25.8'	5° 40.8'	5° 55.8'	6° 10.8'	6° 25.8'	6° 40.8'	6° 55.8'	7° 10.8'	7° 25.8'	43
44	0° 11.0'	0° 26.0'	0° 41.0'	0° 56.0'	1° 11.0'	1° 26.0'	1° 41.0'	1° 56.0'	2° 11.0'	2° 26.0'	2° 41.0'	2° 56.0'	3° 11.0'	3° 26.0'	3° 41.0'	3° 56.0'	4° 11.0'	4° 26.0'	4° 41.0'	4° 56.0'	5° 11.0'	5° 26.0'	5° 41.0'	5° 56.0'	6° 11.0'	6° 26.0'	6° 41.0'	6° 56.0'	7° 11.0'	7° 26.0'	44
45	0° 11.3'	0° 26.3'	0° 41.3'	0° 56.3'	1° 11.3'	1° 26.3'	1° 41.3'	1° 56.3'	2° 11.3'	2° 26.3'	2° 41.3'	2° 56.3'	3° 11.3'	3° 26.3'	3° 41.3'	3° 56.3'	4° 11.3'	4° 26.3'	4° 41.3'	4° 56.3'	5° 11.3'	5° 26.3'	5° 41.3'	5° 56.3'	6° 11.3'	6° 26.3'	6° 41.3'	6° 56.3'	7° 11.3'	7° 26.3'	45
46	0° 11.5'	0° 26.5'	0° 41.5'	0° 56.5'	1° 11.5'	1° 26.5'	1° 41.5'	1° 56.5'	2° 11.5'	2° 26.5'	2° 41.5'	2° 56.5'	3° 11.5'	3° 26.5'	3° 41.5'	3° 56.5'	4° 11.5'	4° 26.5'	4° 41.5'	4° 56.5'	5° 11.5'	5° 26.5'	5° 41.5'	5° 56.5'	6° 11.5'	6° 26.5'	6° 41.5'	6° 56.5'	7° 11.5'	7° 26.5'	46
47	0° 11.8'	0° 26.8'	0° 41.8'	0° 56.8'	1° 11.8'	1° 26.8'	1° 41.8'	1° 56.8'	2° 11.8'	2° 26.8'	2° 41.8'	2° 56.8'	3° 11.8'	3° 26.8'	3° 41.8'	3° 56.8'	4° 11.8'	4° 26.8'	4° 41.8'	4° 56.8'	5° 11.8'	5° 26.8'	5° 41.8'	5° 56.8'	6° 11.8'	6° 26.8'	6° 41.8'	6° 56.8'	7° 11.8'	7° 26.8'	47
48	0° 12.0'	0° 27.0'	0° 42.0'	0° 57.0'	1° 12.0'	1° 27.0'	1° 42.0'	1° 57.0'	2° 12.0'	2° 27.0'	2° 42.0'	2° 57.0'	3° 12.0'	3° 27.0'	3° 42.0'	3° 57.0'	4° 12.0'	4° 27.0'	4° 42.0'	4° 57.0'	5° 12.0'	5° 27.0'	5° 42.0'	5° 57.0'	6° 12.0'	6° 27.0'	6° 42.0'	6° 57.0'	7° 12.0'	7° 27.0'	48
49	0° 12.3'	0° 27.3'	0° 42.3'	0° 57.3'	1° 12.3'	1° 27.3'	1° 42.3'	1° 57.3'	2° 12.3'	2° 27.3'	2° 42.3'	2° 57.3'	3° 12.3'	3° 27.3'	3° 42.3'	3° 57.3'	4° 12.3'	4° 27.3'	4° 42.3'	4° 57.3'	5° 12.3'	5° 27.3'	5° 42.3'	5° 57.3'	6° 12.3'	6° 27.3'	6° 42.3'	6° 57.3'	7° 12.3'	7° 27.3'	49
50	0° 12.5'	0° 27.5'	0° 42.5'	0° 57.5'	1° 12.5'	1° 27.5'	1° 42.5'	1° 57.5'	2° 12.5'	2° 27.5'	2° 42.5'	2° 57.5'	3° 12.5'	3° 27.5'	3° 42.5'	3° 57.5'	4° 12.5'	4° 27.5'	4° 42.5'	4° 57.5'	5° 12.5'	5° 27.5'	5° 42.5'	5° 57.5'	6° 12.5'	6° 27.5'	6° 42.5'	6° 57.5'	7° 12.5'	7° 27.5'	50
51	0° 12.8'	0° 27.8'	0° 42.8'	0° 57.8'	1° 12.8'	1° 27.8'	1° 42.8'	1° 57.8'	2° 12.8'	2° 27.8'	2° 42.8'	2° 57.8'	3° 12.8'	3° 27.8'	3° 42.8'	3° 57.8'	4° 12.8'	4° 27.8'	4° 42.8'	4° 57.8'	5° 12.8'	5° 27.8'	5° 42.8'	5° 57.8'	6° 12.8'	6° 27.8'	6° 42.8'	6° 57.8'	7° 12.8'	7° 27.8'	51
52	0° 13.0'	0° 28.0'	0° 43.0'	0° 58.0'	1° 13.0'	1° 28.0'	1° 43.0'	1° 58.0'	2° 13.0'	2° 28.0'	2° 43.0'	2° 58.0'	3° 13.0'	3° 28.0'	3° 43.0'	3° 58.0'	4° 13.0'	4° 28.0'	4° 43.0'	4° 58.0'	5° 13.0'	5° 28.0'	5° 43.0'	5° 58.0'	6° 13.0'	6° 28.0'	6° 43.0'	6° 58.0'	7° 13.0'	7° 28.0'	52
53	0° 13.3'	0° 28.3'	0° 43.3'	0° 58.3'	1° 13.3'	1° 28.3'	1° 43.3'	1° 58.3'	2° 13.3'	2° 28.3'	2° 43.3'	2° 58.3'	3° 13.3'	3° 28.3'	3° 43.3'	3° 58.3'	4° 13.3'	4° 28.3'	4° 43.3'	4° 58.3'	5° 13.3'	5° 28.3'	5° 43.3'	5° 58.3'	6° 13.3'	6° 28.3'	6° 43.3'	6° 58.3'	7° 13.3'	7° 28.3'	53
54	0° 13.5'	0° 28.5'	0° 43.5'	0° 58.5'	1° 13.5'	1° 28.5'	1° 43.5'	1° 58.5'	2° 13.5'	2° 28.5'	2° 43.5'	2° 58.5'	3° 13.5'	3° 28.5'	3° 43.5'	3° 58.5'	4° 13.5'	4° 28.5'	4° 43.5'	4° 58.5'	5° 13.5'	5° 28.5'	5° 43.5'	5° 58.5'	6° 13.5'	6° 28.5'	6° 43.5'	6° 58.5'	7° 13.5'	7° 28.5'	54
55	0° 13.8'	0° 28.8'	0° 43.8'	0° 58.8'	1° 13.8'	1° 28.8'	1° 43.8'	1° 58.8'	2° 13.8'	2° 28.8'	2° 43.8'	2° 58.8'	3° 13.8'	3° 28.8'	3° 43.8'	3° 58.8'	4° 13.8'	4° 28.8'	4° 43.8'	4° 58.8'	5° 13.8'	5° 28.8'	5° 43.8'	5° 58.8'	6° 13.8'	6° 28.8'	6° 43.8'	6° 58.8'	7° 13.8'	7° 28.8'	55
56	0° 14.0'	0° 29.0'	0° 44.0'	0° 59.0'	1° 14.0'	1° 29.0'	1° 44.0'	1° 59.0'	2° 14.0'	2° 29.0'	2° 44.0'	2° 59.0'	3° 14.0'	3° 29.0'	3° 44.0'	3° 59.0'	4° 14.0'	4° 29.0'	4° 44.0'	4° 59.0'	5° 14.0'	5° 29.0'	5° 44.0'	5° 59.0'	6° 14.0'	6° 29.0'	6° 44.0'	6° 59.0'	7° 14.0'	7° 29.0'	56
57	0° 14.3'	0° 29.3'	0° 44.3'	0° 59.3'	1° 14.3'	1° 29.3'	1° 44.3'	1° 59.3'	2° 14.3'	2° 29.3'	2° 44.3'	2° 59.3'	3° 14.3'	3° 29.3'	3° 44.3'	3° 59.3'	4° 14.3'	4° 29.3'	4° 44.3'	4° 59.3'	5° 14.3'	5° 29.3'	5° 44.3'	5° 59.3'	6° 14.3'	6° 29.3'	6° 44.3'	6° 59.3'	7° 14.3'	7° 29.3'	57
58	0° 14.5'	0° 29.5'	0° 44.5'	0° 59.5'	1° 14.5'	1° 29.5'	1° 44.5'	1° 59.5'	2° 14.5'	2° 29.5'	2° 44.5'	2° 59.5'	3° 14.5'	3° 29.5'	3° 44.5'	3° 59.5'	4° 14.5'	4° 29.5'	4° 44.5'	4° 59.5'	5° 14.5'	5° 29.5'	5° 44.5'	5° 59.5'	6° 14.5'	6° 29.5'	6° 44.5'	6° 59.5'	7° 14.5'	7° 29.5'	58
59	0° 14.8'	0° 29.8'	0° 44.8'	0° 59.8'	1° 14.8'	1° 29.8'	1° 44.8'	1° 59.8'	2° 14.8'	2° 29.8'	2° 44.8'	2° 59.8'	3° 14.8'	3° 29.8'	3° 44.8'	3° 59.8'	4° 14.8'	4° 29.8'	4° 44.8'	4° 59.8'	5° 14.8'	5° 29.8'	5° 44.8'	5° 59.8'	6° 14.8'	6° 29.8'	6° 44.8'	6° 59.8'	7° 14.8'	7° 29.8'	59
60	0° 15.0'	0° 30.0'	0° 45.0'	1° 00.0'	1° 15.0'	1° 30.0'	1° 45.0'	2° 00.0'	2° 15.0'	2° 30.0'	2° 45.0'	3° 00.0'	3° 15.0'	3° 30.0'	3° 45.0'	4° 00.0'	4° 15.0'	4° 30.0'	4° 45.0'	5° 00.0'	5° 15.0'	5° 30.0'	5° 45.0'	6° 00.0'	6° 15.0'	6° 30.0'	6° 45.0'	7° 00.0'	7° 15.0'	7° 30.0'	60
Seconds	0	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	Seconds
	Minutes										Minutes										Minutes										

Minutes

Seconds	30	31	32	33	34	35	36	37	38	39
0	7° 30.0'	7° 45.0'	8° 00.0'	8° 15.0'	8° 30.0'	8° 45.0'	9° 00.0'	9° 15.0'	9° 30.0'	9° 45.0'
1	7° 30.3'	7° 45.3'	8° 00.3'	8° 15.3'	8° 30.3'	8° 45.3'	9° 00.3'	9° 15.3'	9° 30.3'	9° 45.3'
2	7° 30.5'	7° 45.5'	8° 00.5'	8° 15.5'	8° 30.5'	8° 45.5'	9° 00.5'	9° 15.5'	9° 30.5'	9° 45.5'
3	7° 30.8'	7° 45.8'	8° 00.7'	8° 15.7'	8° 30.7'	8° 45.8'	9° 00.8'	9° 15.8'	9° 30.8'	9° 45.8'
4	7° 31.0'	7° 46.0'	8° 01.0'	8° 16.0'	8° 31.0'	8° 46.0'	9° 01.0'	9° 16.0'	9° 31.0'	9° 46.0'
5	7° 31.3'	7° 46.3'	8° 01.3'	8° 16.3'	8° 31.3'	8° 46.3'	9° 01.3'	9° 16.3'	9° 31.3'	9° 46.3'
6	7° 31.5'	7° 46.5'	8° 01.5'	8° 16.5'	8° 31.5'	8° 46.5'	9° 01.5'	9° 16.5'	9° 31.5'	9° 46.5'
7	7° 31.8'	7° 46.8'	8° 01.8'	8° 16.8'	8° 31.8'	8° 46.8'	9° 01.8'	9° 16.8'	9° 31.8'	9° 46.8'
8	7° 32.0'	7° 47.0'	8° 02.0'	8° 17.0'	8° 32.0'	8° 47.0'	9° 02.0'	9° 17.0'	9° 32.0'	9° 47.0'
9	7° 32.3'	7° 47.3'	8° 02.3'	8° 17.3'	8° 32.3'	8° 47.3'	9° 02.3'	9° 17.3'	9° 32.3'	9° 47.3'
10	7° 32.5'	7° 47.5'	8° 02.5'	8° 17.5'	8° 32.5'	8° 47.5'	9° 02.5'	9° 17.5'	9° 32.5'	9° 47.5'
11	7° 32.8'	7° 47.8'	8° 02.7'	8° 17.7'	8° 32.8'	8° 47.8'	9° 02.8'	9° 17.8'	9° 32.8'	9° 47.8'
12	7° 33.0'	7° 48.0'	8° 03.0'	8° 18.0'	8° 33.0'	8° 48.0'	9° 03.0'	9° 18.0'	9° 33.0'	9° 48.0'
13	7° 33.3'	7° 48.3'	8° 03.3'	8° 18.3'	8° 33.3'	8° 48.3'	9° 03.3'	9° 18.3'	9° 33.3'	9° 48.3'
14	7° 33.5'	7° 48.5'	8° 03.5'	8° 18.5'	8° 33.5'	8° 48.5'	9° 03.5'	9° 18.5'	9° 33.5'	9° 48.5'
15	7° 33.8'	7° 48.8'	8° 03.8'	8° 18.8'	8° 33.8'	8° 48.8'	9° 03.8'	9° 18.8'	9° 33.8'	9° 48.8'
16	7° 34.0'	7° 49.0'	8° 04.0'	8° 19.0'	8° 34.0'	8° 49.0'	9° 04.0'	9° 19.0'	9° 34.0'	9° 49.0'
17	7° 34.3'	7° 49.3'	8° 04.3'	8° 19.3'	8° 34.3'	8° 49.3'	9° 04.3'	9° 19.3'	9° 34.3'	9° 49.3'
18	7° 34.5'	7° 49.5'	8° 04.5'	8° 19.5'	8° 34.5'	8° 49.5'	9° 04.5'	9° 19.5'	9° 34.5'	9° 49.5'
19	7° 34.8'	7° 49.8'	8° 04.8'	8° 19.8'	8° 34.8'	8° 49.8'	9° 04.8'	9° 19.8'	9° 34.8'	9° 49.8'
20	7° 35.0'	7° 50.0'	8° 05.0'	8° 20.0'	8° 35.0'	8° 50.0'	9° 05.0'	9° 20.0'	9° 35.0'	9° 50.0'
21	7° 35.3'	7° 50.3'	8° 05.3'	8° 20.3'	8° 35.3'	8° 50.3'	9° 05.3'	9° 20.3'	9° 35.3'	9° 50.3'
22	7° 35.5'	7° 50.5'	8° 05.5'	8° 20.5'	8° 35.5'	8° 50.5'	9° 05.5'	9° 20.5'	9° 35.5'	9° 50.5'
23	7° 35.8'	7° 50.8'	8° 05.8'	8° 20.8'	8° 35.8'	8° 50.8'	9° 05.8'	9° 20.8'	9° 35.8'	9° 50.8'
24	7° 36.0'	7° 51.0'	8° 06.0'	8° 21.0'	8° 36.0'	8° 51.0'	9° 06.0'	9° 21.0'	9° 36.0'	9° 51.0'
25	7° 36.3'	7° 51.3'	8° 06.2'	8° 21.2'	8° 36.3'	8° 51.3'	9° 06.3'	9° 21.3'	9° 36.3'	9° 51.3'
26	7° 36.5'	7° 51.5'	8° 06.5'	8° 21.5'	8° 36.5'	8° 51.5'	9° 06.5'	9° 21.5'	9° 36.5'	9° 51.5'
27	7° 36.8'	7° 51.8'	8° 06.8'	8° 21.8'	8° 36.8'	8° 51.8'	9° 06.8'	9° 21.8'	9° 36.8'	9° 51.8'
28	7° 37.0'	7° 52.0'	8° 07.0'	8° 22.0'	8° 37.0'	8° 52.0'	9° 07.0'	9° 22.0'	9° 37.0'	9° 52.0'
29	7° 37.3'	7° 52.3'	8° 07.3'	8° 22.3'	8° 37.3'	8° 52.3'	9° 07.3'	9° 22.3'	9° 37.3'	9° 52.3'
30	7° 37.5'	7° 52.5'	8° 07.5'	8° 22.5'	8° 37.5'	8° 52.5'	9° 07.5'	9° 22.5'	9° 37.5'	9° 52.5'
31	7° 37.8'	7° 52.8'	8° 07.8'	8° 22.8'	8° 37.8'	8° 52.8'	9° 07.8'	9° 22.8'	9° 37.8'	9° 52.8'
32	7° 38.0'	7° 53.0'	8° 08.0'	8° 23.0'	8° 38.0'	8° 53.0'	9° 08.0'	9° 23.0'	9° 38.0'	9° 53.0'
33	7° 38.3'	7° 53.3'	8° 08.2'	8° 23.2'	8° 38.3'	8° 53.3'	9° 08.3'	9° 23.3'	9° 38.3'	9° 53.3'
34	7° 38.5'	7° 53.5'	8° 08.5'	8° 23.5'	8° 38.5'	8° 53.5'	9° 08.5'	9° 23.5'	9° 38.5'	9° 53.5'
35	7° 38.8'	7° 53.8'	8° 08.8'	8° 23.8'	8° 38.8'	8° 53.8'	9° 08.8'	9° 23.8'	9° 38.8'	9° 53.8'
36	7° 39.0'	7° 54.0'	8° 09.0'	8° 24.0'	8° 39.0'	8° 54.0'	9° 09.0'	9° 24.0'	9° 39.0'	9° 54.0'
37	7° 39.3'	7° 54.3'	8° 09.3'	8° 24.3'	8° 39.3'	8° 54.3'	9° 09.3'	9° 24.3'	9° 39.3'	9° 54.3'
38	7° 39.5'	7° 54.5'	8° 09.5'	8° 24.5'	8° 39.5'	8° 54.5'	9° 09.5'	9° 24.5'	9° 39.5'	9° 54.5'
39	7° 39.8'	7° 54.8'	8° 09.8'	8° 24.8'	8° 39.8'	8° 54.8'	9° 09.8'	9° 24.8'	9° 39.8'	9° 54.8'
40	7° 40.0'	7° 55.0'	8° 10.0'	8° 25.0'	8° 40.0'	8° 55.0'	9° 10.0'	9° 25.0'	9° 40.0'	9° 55.0'
41	7° 40.3'	7° 55.3'	8° 10.2'	8° 25.2'	8° 40.3'	8° 55.3'	9° 10.3'	9° 25.3'	9° 40.3'	9° 55.3'
42	7° 40.5'	7° 55.5'	8° 10.5'	8° 25.5'	8° 40.5'	8° 55.5'	9° 10.5'	9° 25.5'	9° 40.5'	9° 55.5'
43	7° 40.8'	7° 55.8'	8° 10.8'	8° 25.8'	8° 40.8'	8° 55.8'	9° 10.8'	9° 25.8'	9° 40.8'	9° 55.8'
44	7° 41.0'	7° 56.0'	8° 11.0'	8° 26.0'	8° 41.0'	8° 56.0'	9° 11.0'	9° 26.0'	9° 41.0'	9° 56.0'
45	7° 41.3'	7° 56.3'	8° 11.3'	8° 26.3'	8° 41.3'	8° 56.3'	9° 11.3'	9° 26.3'	9° 41.3'	9° 56.3'
46	7° 41.5'	7° 56.5'	8° 11.5'	8° 26.5'	8° 41.5'	8° 56.5'	9° 11.5'	9° 26.5'	9° 41.5'	9° 56.5'
47	7° 41.8'	7° 56.8'	8° 11.8'	8° 26.8'	8° 41.8'	8° 56.8'	9° 11.8'	9° 26.8'	9° 41.8'	9° 56.8'
48	7° 42.0'	7° 57.0'	8° 12.0'	8° 27.0'	8° 42.0'	8° 57.0'	9° 12.0'	9° 27.0'	9° 42.0'	9° 57.0'
49	7° 42.3'	7° 57.3'	8° 12.3'	8° 27.3'	8° 42.3'	8° 57.3'	9° 12.3'	9° 27.3'	9° 42.3'	9° 57.3'
50	7° 42.5'	7° 57.5'	8° 12.5'	8° 27.5'	8° 42.5'	8° 57.5'	9° 12.5'	9° 27.5'	9° 42.5'	9° 57.5'
51	7° 42.8'	7° 57.8'	8° 12.8'	8° 27.8'	8° 42.8'	8° 57.8'	9° 12.8'	9° 27.8'	9° 42.8'	9° 57.8'
52	7° 43.0'	7° 58.0'	8° 13.0'	8° 28.0'	8° 43.0'	8° 58.0'	9° 13.0'	9° 28.0'	9° 43.0'	9° 58.0'
53	7° 43.3'	7° 58.3'	8° 13.3'	8° 28.3'	8° 43.3'	8° 58.3'	9° 13.3'	9° 28.3'	9° 43.3'	9° 58.3'
54	7° 43.5'	7° 58.5'	8° 13.5'	8° 28.5'	8° 43.5'	8° 58.5'	9° 13.5'	9° 28.5'	9° 43.5'	9° 58.5'
55	7° 43.8'	7° 58.8'	8° 13.7'	8° 28.7'	8° 43.8'	8° 58.8'	9° 13.8'	9° 28.8'	9° 43.8'	9° 58.8'
56	7° 44.0'	7° 59.0'	8° 14.0'	8° 29.0'	8° 44.0'	8° 59.0'	9° 14.0'	9° 29.0'	9° 44.0'	9° 59.0'
57	7° 44.3'	7° 59.3'	8° 14.3'	8° 29.3'	8° 44.3'	8° 59.3'	9° 14.3'	9° 29.3'	9° 44.3'	9° 59.3'
58	7° 44.5'	7° 59.5'	8° 14.5'	8° 29.5'	8° 44.5'	8° 59.5'	9° 14.5'	9° 29.5'	9° 44.5'	9° 59.5'
59	7° 44.8'	7° 59.8'	8° 14.8'	8° 29.8'	8° 44.8'	8° 59.8'	9° 14.8'	9° 29.8'	9° 44.8'	9° 59.8'
60	7° 45.0'	8° 00.0'	8° 15.0'	8° 30.0'	8° 45.0'	9° 00.0'	9° 15.0'	9° 30.0'	9° 45.0'	10° 00.0'
Seconds	30	31	32	33	34	35	36	37	38	39

Minutes

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Seconds	40	41	42	43	44	45	46	47	48	49
0	10° 00.0'	10° 15.0'	10° 30.0'	10° 45.0'	11° 00.0'	11° 15.0'	11° 30.0'	11° 45.0'	12° 00.0'	12° 15.0'
1	10° 00.3'	10° 15.3'	10° 30.3'	10° 45.3'	11° 00.3'	11° 15.3'	11° 30.3'	11° 45.3'	12° 00.3'	12° 15.3'
2	10° 00.5'	10° 15.5'	10° 30.5'	10° 45.5'	11° 00.5'	11° 15.5'	11° 30.5'	11° 45.5'	12° 00.5'	12° 15.5'
3	10° 00.8'	10° 15.8'	10° 30.8'	10° 45.8'	11° 00.8'	11° 15.8'	11° 30.8'	11° 45.8'	12° 00.8'	12° 15.8'
4	10° 01.0'	10° 16.0'	10° 31.0'	10° 46.0'	11° 01.0'	11° 16.0'	11° 31.0'	11° 46.0'	12° 01.0'	12° 16.0'
5	10° 01.3'	10° 16.3'	10° 31.3'	10° 46.3'	11° 01.3'	11° 16.3'	11° 31.3'	11° 46.3'	12° 01.3'	12° 16.3'
6	10° 01.5'	10° 16.5'	10° 31.5'	10° 46.5'	11° 01.5'	11° 16.5'	11° 31.5'	11° 46.5'	12° 01.5'	12° 16.5'
7	10° 01.8'	10° 16.8'	10° 31.8'	10° 46.8'	11° 01.8'	11° 16.8'	11° 31.8'	11° 46.8'	12° 01.8'	12° 16.8'
8	10° 02.0'	10° 17.0'	10° 32.0'	10° 47.0'	11° 02.0'	11° 17.0'	11° 32.0'	11° 47.0'	12° 02.0'	12° 17.0'
9	10° 02.3'	10° 17.3'	10° 32.3'	10° 47.3'	11° 02.3'	11° 17.3'	11° 32.3'	11° 47.3'	12° 02.3'	12° 17.3'
10	10° 02.5'	10° 17.5'	10° 32.5'	10° 47.5'	11° 02.5'	11° 17.5'	11° 32.5'	11° 47.5'	12° 02.5'	12° 17.5'
11	10° 02.8'	10° 17.8'	10° 32.8'	10° 47.8'	11° 02.8'	11° 17.8'	11° 32.8'	11° 47.8'	12° 02.8'	12° 17.8'
12	10° 03.0'	10° 18.0'	10° 33.0'	10° 48.0'	11° 03.0'	11° 18.0'	11° 33.0'	11° 48.0'	12° 03.0'	12° 18.0'
13	10° 03.3'	10° 18.3'	10° 33.3'	10° 48.3'	11° 03.3'	11° 18.3'	11° 33.3'	11° 48.3'	12° 03.3'	12° 18.3'
14	10° 03.5'	10° 18.5'	10° 33.5'	10° 48.5'	11° 03.5'	11° 18.5'	11° 33.5'	11° 48.5'	12° 03.5'	12° 18.5'
15	10° 03.8'	10° 18.8'	10° 33.8'	10° 48.8'	11° 03.8'	11° 18.8'	11° 33.8'	11° 48.8'	12° 03.8'	12° 18.8'
16	10° 04.0'	10° 19.0'	10° 34.0'	10° 49.0'	11° 04.0'	11° 19.0'	11° 34.0'	11° 49.0'	12° 04.0'	12° 19.0'
17	10° 04.3'	10° 19.3'	10° 34.3'	10° 49.3'	11° 04.3'	11° 19.3'	11° 34.3'	11° 49.3'	12° 04.3'	12° 19.3'
18	10° 04.5'	10° 19.5'	10° 34.5'	10° 49.5'	11° 04.5'	11° 19.5'	11° 34.5'	11° 49.5'	12° 04.5'	12° 19.5'
19	10° 04.8'	10° 19.8'	10° 34.8'	10° 49.8'	11° 04.8'	11° 19.8'	11° 34.8'	11° 49.8'	12° 04.8'	12° 19.8'
20	10° 05.0'	10° 20.0'	10° 35.0'	10° 50.0'	11° 05.0'	11° 20.0'	11° 35.0'	11° 50.0'	12° 05.0'	12° 20.0'
21	10° 05.3'	10° 20.3'	10° 35.3'	10° 50.3'	11° 05.3'	11° 20.3'	11° 35.3'	11° 50.3'	12° 05.3'	12° 20.3'
22	10° 05.5'	10° 20.5'	10° 35.5'	10° 50.5'	11° 05.5'	11° 20.5'	11° 35.5'	11° 50.5'	12° 05.5'	12° 20.5'
23	10° 05.8'	10° 20.8'	10° 35.8'	10° 50.8'	11° 05.8'	11° 20.8'	11° 35.8'	11° 50.8'	12° 05.8'	12° 20.8'
24	10° 06.0'	10° 21.0'	10° 36.0'	10° 51.0'	11° 06.0'	11° 21.0'	11° 36.0'	11° 51.0'	12° 06.0'	12° 21.0'
25	10° 06.3'	10° 21.3'	10° 36.3'	10° 51.3'	11° 06.3'	11° 21.3'	11° 36.3'	11° 51.3'	12° 06.3'	12° 21.3'
26	10° 06.5'	10° 21.5'	10° 36.5'	10° 51.5'	11° 06.5'	11° 21.5'	11° 36.5'	11° 51.5'	12° 06.5'	12° 21.5'
27	10° 06.8'	10° 21.8'	10° 36.8'	10° 51.8'	11° 06.8'	11° 21.8'	11° 36.8'	11° 51.8'	12° 06.8'	12° 21.8'
28	10° 07.0'	10° 22.0'	10° 37.0'	10° 52.0'	11° 07.0'	11° 22.0'	11° 37.0'	11° 52.0'	12° 07.0'	12° 22.0'
29	10° 07.3'	10° 22.3'	10° 37.3'	10° 52.3'	11° 07.3'	11° 22.3'	11° 37.3'	11° 52.3'	12° 07.3'	12° 22.3'
30	10° 07.5'	10° 22.5'	10° 37.5'	10° 52.5'	11° 07.5'	11° 22.5'	11° 37.5'	11° 52.5'	12° 07.5'	12° 22.5'
31	10° 07.8'	10° 22.8'	10° 37.8'	10° 52.8'	11° 07.8'	11° 22.8'	11° 37.8'	11° 52.8'	12° 07.8'	12° 22.8'
32	10° 08.0'	10° 23.0'	10° 38.0'	10° 53.0'	11° 08.0'	11° 23.0'	11° 38.0'	11° 53.0'	12° 08.0'	12° 23.0'
33	10° 08.3'	10° 23.3'	10° 38.3'	10° 53.3'	11° 08.3'	11° 23.3'	11° 38.3'	11° 53.3'	12° 08.3'	12° 23.3'
34	10° 08.5'	10° 23.5'	10° 38.5'	10° 53.5'	11° 08.5'	11° 23.5'	11° 38.5'	11° 53.5'	12° 08.5'	12° 23.5'
35	10° 08.8'	10° 23.8'	10° 38.8'	10° 53.8'	11° 08.8'	11° 23.8'	11° 38.8'	11° 53.8'	12° 08.8'	12° 23.8'
36	10° 09.0'	10° 24.0'	10° 39.0'	10° 54.0'	11° 09.0'	11° 24.0'	11° 39.0'	11° 54.0'	12° 09.0'	12° 24.0'
37	10° 09.3'	10° 24.3'	10° 39.3'	10° 54.3'	11° 09.3'	11° 24.3'	11° 39.3'	11° 54.3'	12° 09.3'	12° 24.3'
38	10° 09.5'	10° 24.5'	10° 39.5'	10° 54.5'	11° 09.5'	11° 24.5'	11° 39.5'	11° 54.5'	12° 09.5'	12° 24.5'
39	10° 09.8'	10° 24.8'	10° 39.8'	10° 54.8'	11° 09.8'	11° 24.8'	11° 39.8'	11° 54.8'	12° 09.8'	12° 24.8'
40	10° 10.0'	10° 25.0'	10° 40.0'	10° 55.0'	11° 10.0'	11° 25.0'	11° 40.0'	11° 55.0'	12° 10.0'	12° 25.0'
41	10° 10.3'	10° 25.3'	10° 40.3'	10° 55.3'	11° 10.3'	11° 25.3'	11° 40.3'	11° 55.3'	12° 10.3'	12° 25.3'
42	10° 10.5'	10° 25.5'	10° 40.5'	10° 55.5'	11° 10.5'	11° 25.5'	11° 40.5'	11° 55.5'	12° 10.5'	12° 25.5'
43	10° 10.8'	10° 25.8'	10° 40.8'	10° 55.8'	11° 10.8'	11° 25.8'	11° 40.8'	11° 55.8'	12° 10.8'	12° 25.8'
44	10° 11.0'	10° 26.0'	10° 41.0'	10° 56.0'	11° 11.0'	11° 26.0'	11° 41.0'	11° 56.0'	12° 11.0'	12° 26.0'
45	10° 11.3'	10° 26.3'	10° 41.3'	10° 56.3'	11° 11.3'	11° 26.3'	11° 41.3'	11° 56.3'	12° 11.3'	12° 26.3'
46	10° 11.5'	10° 26.5'	10° 41.5'	10° 56.5'	11° 11.5'	11° 26.5'	11° 41.5'	11° 56.5'	12° 11.5'	12° 26.5'
47	10° 11.8'	10° 26.8'	10° 41.8'	10° 56.8'	11° 11.8'	11° 26.8'	11° 41.8'	11° 56.8'	12° 11.8'	12° 26.8'
48	10° 12.0'	10° 27.0'	10° 42.0'	10° 57.0'	11° 12.0'	11° 27.0'	11° 42.0'	11° 57.0'	12° 12.0'	12° 27.0'
49	10° 12.3'	10° 27.3'	10° 42.3'	10° 57.3'	11° 12.3'	11° 27.3'	11° 42.3'	11° 57.3'	12° 12.3'	12° 27.3'
50	10° 12.5'	10° 27.5'	10° 42.5'	10° 57.5'	11° 12.5'	11° 27.5'	11° 42.5'	11° 57.5'	12° 12.5'	12° 27.5'
51	10° 12.8'	10° 27.8'	10° 42.8'	10° 57.8'	11° 12.8'	11° 27.8'	11° 42.8'	11° 57.8'	12° 12.8'	12° 27.8'
52	10° 13.0'	10° 28.0'	10° 43.0'	10° 58.0'	11° 13.0'	11° 28.0'	11° 43.0'	11° 58.0'	12° 13.0'	12° 28.0'
53	10° 13.3'	10° 28.3'	10° 43.3'	10° 58.3'	11° 13.3'	11° 28.3'	11° 43.3'	11° 58.3'	12° 13.3'	12° 28.3'
54	10° 13.5'	10° 28.5'	10° 43.5'	10° 58.5'	11° 13.5'	11° 28.5'	11° 43.5'	11° 58.5'	12° 13.5'	12° 28.5'
55	10° 13.8'	10° 28.8'	10° 43.8'	10° 58.8'	11° 13.8'	11° 28.8'	11° 43.8'	11° 58.8'	12° 13.8'	12° 28.8'
56	10° 14.0'	10° 29.0'	10° 44.0'	10° 59.0'	11° 14.0'	11° 29.0'	11° 44.0'	11° 59.0'	12° 14.0'	12° 29.0'
57	10° 14.3'	10° 29.3'	10° 44.3'	10° 59.3'	11° 14.3'	11° 29.3'	11° 44.3'	11° 59.3'	12° 14.3'	12° 29.3'
58	10° 14.5'	10° 29.5'	10° 44.5'	10° 59.5'	11° 14.5'	11° 29.5'	11° 44.5'	11° 59.5'	12° 14.5'	12° 29.5'
59	10° 14.8'	10° 29.8'	10° 44.8'	10° 59.8'	11° 14.8'	11° 29.8'	11° 44.8'	11° 59.8'	12° 14.8'	12° 29.8'
60	10° 15.0'	10° 30.0'	10° 45.0'	11° 00.0'	11° 15.0'	11° 30.0'	11° 45.0'	12° 00.0'	12° 15.0'	12° 30.0'
	40	41	42	43	44	45	46	47	48	49

Minutes

Minutes

	50	51	52	53	54	55	56	57	58	59	Seconds
	12° 30.0'	12° 45.0'	13° 00.0'	13° 15.0'	13° 30.0'	13° 45.0'	14° 00.0'	14° 15.0'	14° 30.0'	14° 45.0'	0
	12° 30.3'	12° 45.3'	13° 00.3'	13° 15.3'	13° 30.3'	13° 45.3'	14° 00.3'	14° 15.3'	14° 30.3'	14° 45.3'	1
	12° 30.5'	12° 45.5'	13° 00.5'	13° 15.5'	13° 30.5'	13° 45.5'	14° 00.5'	14° 15.5'	14° 30.5'	14° 45.5'	2
	12° 30.8'	12° 45.8'	13° 00.8'	13° 15.8'	13° 30.8'	13° 45.8'	14° 00.8'	14° 15.8'	14° 30.8'	14° 45.8'	3
	12° 31.0'	12° 46.0'	13° 01.0'	13° 16.0'	13° 31.0'	13° 46.0'	14° 01.0'	14° 16.0'	14° 31.0'	14° 46.0'	4
	12° 31.3'	12° 46.3'	13° 01.3'	13° 16.3'	13° 31.3'	13° 46.3'	14° 01.3'	14° 16.3'	14° 31.3'	14° 46.3'	5
	12° 31.5'	12° 46.5'	13° 01.5'	13° 16.5'	13° 31.5'	13° 46.5'	14° 01.5'	14° 16.5'	14° 31.5'	14° 46.5'	6
	12° 31.8'	12° 46.8'	13° 01.8'	13° 16.8'	13° 31.8'	13° 46.8'	14° 01.8'	14° 16.8'	14° 31.8'	14° 46.8'	7
	12° 32.0'	12° 47.0'	13° 02.0'	13° 17.0'	13° 32.0'	13° 47.0'	14° 02.0'	14° 17.0'	14° 32.0'	14° 47.0'	8
	12° 32.3'	12° 47.3'	13° 02.3'	13° 17.3'	13° 32.3'	13° 47.3'	14° 02.3'	14° 17.3'	14° 32.3'	14° 47.3'	9
	12° 32.5'	12° 47.5'	13° 02.5'	13° 17.5'	13° 32.5'	13° 47.5'	14° 02.5'	14° 17.5'	14° 32.5'	14° 47.5'	10
	12° 32.8'	12° 47.8'	13° 02.8'	13° 17.8'	13° 32.8'	13° 47.8'	14° 02.8'	14° 17.8'	14° 32.8'	14° 47.8'	11
	12° 33.0'	12° 48.0'	13° 03.0'	13° 18.0'	13° 33.0'	13° 48.0'	14° 03.0'	14° 18.0'	14° 33.0'	14° 48.0'	12
	12° 33.3'	12° 48.3'	13° 03.3'	13° 18.3'	13° 33.3'	13° 48.3'	14° 03.3'	14° 18.3'	14° 33.3'	14° 48.3'	13
	12° 33.5'	12° 48.5'	13° 03.5'	13° 18.5'	13° 33.5'	13° 48.5'	14° 03.5'	14° 18.5'	14° 33.5'	14° 48.5'	14
	12° 33.8'	12° 48.8'	13° 03.8'	13° 18.8'	13° 33.8'	13° 48.8'	14° 03.8'	14° 18.8'	14° 33.8'	14° 48.8'	15
	12° 34.0'	12° 49.0'	13° 04.0'	13° 19.0'	13° 34.0'	13° 49.0'	14° 04.0'	14° 19.0'	14° 34.0'	14° 49.0'	16
	12° 34.3'	12° 49.3'	13° 04.3'	13° 19.3'	13° 34.3'	13° 49.3'	14° 04.3'	14° 19.3'	14° 34.3'	14° 49.3'	17
	12° 34.5'	12° 49.5'	13° 04.5'	13° 19.5'	13° 34.5'	13° 49.5'	14° 04.5'	14° 19.5'	14° 34.5'	14° 49.5'	18
	12° 34.8'	12° 49.8'	13° 04.8'	13° 19.8'	13° 34.8'	13° 49.8'	14° 04.8'	14° 19.8'	14° 34.8'	14° 49.8'	19
	12° 35.0'	12° 50.0'	13° 05.0'	13° 20.0'	13° 35.0'	13° 50.0'	14° 05.0'	14° 20.0'	14° 35.0'	14° 50.0'	20
	12° 35.3'	12° 50.3'	13° 05.3'	13° 20.3'	13° 35.3'	13° 50.3'	14° 05.3'	14° 20.3'	14° 35.3'	14° 50.3'	21
	12° 35.5'	12° 50.5'	13° 05.5'	13° 20.5'	13° 35.5'	13° 50.5'	14° 05.5'	14° 20.5'	14° 35.5'	14° 50.5'	22
	12° 35.8'	12° 50.8'	13° 05.8'	13° 20.8'	13° 35.8'	13° 50.8'	14° 05.8'	14° 20.8'	14° 35.8'	14° 50.8'	23
	12° 36.0'	12° 51.0'	13° 06.0'	13° 21.0'	13° 36.0'	13° 51.0'	14° 06.0'	14° 21.0'	14° 36.0'	14° 51.0'	24
	12° 36.3'	12° 51.3'	13° 06.3'	13° 21.3'	13° 36.3'	13° 51.3'	14° 06.3'	14° 21.3'	14° 36.3'	14° 51.3'	25
	12° 36.5'	12° 51.5'	13° 06.5'	13° 21.5'	13° 36.5'	13° 51.5'	14° 06.5'	14° 21.5'	14° 36.5'	14° 51.5'	26
	12° 36.8'	12° 51.8'	13° 06.8'	13° 21.8'	13° 36.8'	13° 51.8'	14° 06.8'	14° 21.8'	14° 36.8'	14° 51.8'	27
	12° 37.0'	12° 52.0'	13° 07.0'	13° 22.0'	13° 37.0'	13° 52.0'	14° 07.0'	14° 22.0'	14° 37.0'	14° 52.0'	28
	12° 37.3'	12° 52.3'	13° 07.3'	13° 22.3'	13° 37.3'	13° 52.3'	14° 07.3'	14° 22.3'	14° 37.3'	14° 52.3'	29
	12° 37.5'	12° 52.5'	13° 07.5'	13° 22.5'	13° 37.5'	13° 52.5'	14° 07.5'	14° 22.5'	14° 37.5'	14° 52.5'	30
	12° 37.8'	12° 52.8'	13° 07.8'	13° 22.8'	13° 37.8'	13° 52.8'	14° 07.8'	14° 22.8'	14° 37.8'	14° 52.8'	31
	12° 38.0'	12° 53.0'	13° 08.0'	13° 23.0'	13° 38.0'	13° 53.0'	14° 08.0'	14° 23.0'	14° 38.0'	14° 53.0'	32
	12° 38.3'	12° 53.3'	13° 08.3'	13° 23.3'	13° 38.3'	13° 53.3'	14° 08.3'	14° 23.3'	14° 38.3'	14° 53.3'	33
	12° 38.5'	12° 53.5'	13° 08.5'	13° 23.5'	13° 38.5'	13° 53.5'	14° 08.5'	14° 23.5'	14° 38.5'	14° 53.5'	34
	12° 38.8'	12° 53.8'	13° 08.8'	13° 23.8'	13° 38.8'	13° 53.8'	14° 08.8'	14° 23.8'	14° 38.8'	14° 53.8'	35
	12° 39.0'	12° 54.0'	13° 09.0'	13° 24.0'	13° 39.0'	13° 54.0'	14° 09.0'	14° 24.0'	14° 39.0'	14° 54.0'	36
	12° 39.3'	12° 54.3'	13° 09.3'	13° 24.3'	13° 39.3'	13° 54.3'	14° 09.3'	14° 24.3'	14° 39.3'	14° 54.3'	37
	12° 39.5'	12° 54.5'	13° 09.5'	13° 24.5'	13° 39.5'	13° 54.5'	14° 09.5'	14° 24.5'	14° 39.5'	14° 54.5'	38
	12° 39.8'	12° 54.8'	13° 09.8'	13° 24.8'	13° 39.8'	13° 54.8'	14° 09.8'	14° 24.8'	14° 39.8'	14° 54.8'	39
	12° 40.0'	12° 55.0'	13° 10.0'	13° 25.0'	13° 40.0'	13° 55.0'	14° 10.0'	14° 25.0'	14° 40.0'	14° 55.0'	40
	12° 40.3'	12° 55.3'	13° 10.3'	13° 25.3'	13° 40.3'	13° 55.3'	14° 10.3'	14° 25.3'	14° 40.3'	14° 55.3'	41
	12° 40.5'	12° 55.5'	13° 10.5'	13° 25.5'	13° 40.5'	13° 55.5'	14° 10.5'	14° 25.5'	14° 40.5'	14° 55.5'	42
	12° 40.8'	12° 55.8'	13° 10.8'	13° 25.8'	13° 40.8'	13° 55.8'	14° 10.8'	14° 25.8'	14° 40.8'	14° 55.8'	43
	12° 41.0'	12° 56.0'	13° 11.0'	13° 26.0'	13° 41.0'	13° 56.0'	14° 11.0'	14° 26.0'	14° 41.0'	14° 56.0'	44
	12° 41.3'	12° 56.3'	13° 11.3'	13° 26.3'	13° 41.3'	13° 56.3'	14° 11.3'	14° 26.3'	14° 41.3'	14° 56.3'	45
	12° 41.5'	12° 56.5'	13° 11.5'	13° 26.5'	13° 41.5'	13° 56.5'	14° 11.5'	14° 26.5'	14° 41.5'	14° 56.5'	46
	12° 41.8'	12° 56.8'	13° 11.8'	13° 26.8'	13° 41.8'	13° 56.8'	14° 11.8'	14° 26.8'	14° 41.8'	14° 56.8'	47
	12° 42.0'	12° 57.0'	13° 12.0'	13° 27.0'	13° 42.0'	13° 57.0'	14° 12.0'	14° 27.0'	14° 42.0'	14° 57.0'	48
	12° 42.3'	12° 57.3'	13° 12.3'	13° 27.3'	13° 42.3'	13° 57.3'	14° 12.3'	14° 27.3'	14° 42.3'	14° 57.3'	49
	12° 42.5'	12° 57.5'	13° 12.5'	13° 27.5'	13° 42.5'	13° 57.5'	14° 12.5'	14° 27.5'	14° 42.5'	14° 57.5'	50
	12° 42.8'	12° 57.8'	13° 12.8'	13° 27.8'	13° 42.8'	13° 57.8'	14° 12.8'	14° 27.8'	14° 42.8'	14° 57.8'	51
	12° 43.0'	12° 58.0'	13° 13.0'	13° 28.0'	13° 43.0'	13° 58.0'	14° 13.0'	14° 28.0'	14° 43.0'	14° 58.0'	52
	12° 43.3'	12° 58.3'	13° 13.3'	13° 28.3'	13° 43.3'	13° 58.3'	14° 13.3'	14° 28.3'	14° 43.3'	14° 58.3'	53
	12° 43.5'	12° 58.5'	13° 13.5'	13° 28.5'	13° 43.5'	13° 58.5'	14° 13.5'	14° 28.5'	14° 43.5'	14° 58.5'	54
	12° 43.8'	12° 58.8'	13° 13.8'	13° 28.8'	13° 43.8'	13° 58.8'	14° 13.8'	14° 28.8'	14° 43.8'	14° 58.8'	55
	12° 44.0'	12° 59.0'	13° 14.0'	13° 29.0'	13° 44.0'	13° 59.0'	14° 14.0'	14° 29.0'	14° 44.0'	14° 59.0'	56
	12° 44.3'	12° 59.3'	13° 14.3'	13° 29.3'	13° 44.3'	13° 59.3'	14° 14.3'	14° 29.3'	14° 44.3'	14° 59.3'	57
	12° 44.5'	12° 59.5'	13° 14.5'	13° 29.5'	13° 44.5'	13° 59.5'	14° 14.5'	14° 29.5'	14° 44.5'	14° 59.5'	58
	12° 44.8'	12° 59.8'	13° 14.8'	13° 29.8'	13° 44.8'	13° 59.8'	14° 14.8'	14° 29.8'	14° 44.8'	14° 59.8'	59
	12° 45.0'	13° 00.0'	13° 15.0'	13° 30.0'	13° 45.0'	14° 00.0'	14° 15.0'	14° 30.0'	14° 45.0'	15° 00.0'	60
	50	51	52	53	54	55	56	57	58	59	Seconds

Minutes

TABLE 5. — Correction to Tabulated Altitude for Minutes of Declination

d '	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	32	33	34	35	36	37	38	39	40	41	42	43	44	45	46	47	48	49	50	51	52	53	54	55	56	57	58	59	60	*d* '
0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	**0**
1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	**1**
2	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	**2**
3	0	0	0	0	0	0	0	0	0	0	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	3	3	3	3	3	3	3	3	3	3	**3**
4	0	0	0	0	0	0	0	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	4	4	4	4	4	4	4	4	**4**
5	0	0	0	0	0	0	1	1	1	1	1	1	1	1	1	1	1	2	2	2	2	2	2	2	2	2	2	2	2	2	3	3	3	3	3	3	3	3	3	3	3	4	4	4	4	4	4	4	4	4	4	4	4	4	5	5	5	5	5	5	**5**
6	0	0	0	0	0	1	1	1	1	1	1	1	1	1	2	2	2	2	2	2	2	2	2	2	2	3	3	3	3	3	3	3	3	3	4	4	4	4	4	4	4	4	4	4	4	5	5	5	5	5	5	5	5	5	6	6	6	6	6	6	**6**
7	0	0	0	0	1	1	1	1	1	1	1	1	2	2	2	2	2	2	2	2	2	3	3	3	3	3	3	3	3	4	4	4	4	4	4	4	4	4	5	5	5	5	5	5	5	5	5	6	6	6	6	6	6	6	6	7	7	7	7	7	**7**
8	0	0	0	1	1	1	1	1	1	1	1	2	2	2	2	2	2	2	3	3	3	3	3	3	3	3	4	4	4	4	4	4	4	5	5	5	5	5	5	5	5	6	6	6	6	6	6	6	7	7	7	7	7	7	7	7	8	8	8	8	**8**
9	0	0	0	1	1	1	1	1	1	2	2	2	2	2	2	2	3	3	3	3	3	3	3	4	4	4	4	4	4	4	5	5	5	5	5	5	6	6	6	6	6	6	6	7	7	7	7	7	7	8	8	8	8	8	8	8	9	9	9	9	**9**
10	0	0	0	1	1	1	1	1	2	2	2	2	2	2	2	3	3	3	3	3	4	4	4	4	4	4	4	5	5	5	5	5	6	6	6	6	6	6	6	7	7	7	7	7	8	8	8	8	8	8	8	9	9	9	9	9	10	10	10	10	**10**
11	0	0	1	1	1	1	1	1	2	2	2	2	2	3	3	3	3	3	3	4	4	4	4	4	5	5	5	5	5	6	6	6	6	6	6	7	7	7	7	7	8	8	8	8	8	8	9	9	9	9	9	10	10	10	10	10	10	11	11	11	**11**
12	0	0	1	1	1	1	1	2	2	2	2	2	3	3	3	3	3	4	4	4	4	4	5	5	5	5	5	6	6	6	6	6	7	7	7	7	7	8	8	8	8	8	9	9	9	9	9	10	10	10	10	10	11	11	11	11	11	12	12	12	**12**
13	0	0	1	1	1	1	2	2	2	2	2	3	3	3	3	3	4	4	4	4	5	5	5	5	5	6	6	6	6	6	7	7	7	7	8	8	8	8	8	9	9	9	9	10	10	10	10	10	11	11	11	11	11	12	12	12	12	13	13	13	**13**
14	0	0	1	1	1	1	2	2	2	2	3	3	3	3	4	4	4	4	4	5	5	5	5	6	6	6	6	7	7	7	7	7	8	8	8	8	9	9	9	9	10	10	10	10	10	11	11	11	11	12	12	12	12	13	13	13	13	14	14	14	**14**
15	0	0	1	1	1	2	2	2	2	2	3	3	3	4	4	4	4	4	5	5	5	6	6	6	6	6	7	7	7	8	8	8	8	8	9	9	9	10	10	10	10	10	11	11	11	12	12	12	12	12	13	13	13	14	14	14	14	14	15	15	**15**
16	0	1	1	1	1	2	2	2	2	3	3	3	3	4	4	4	5	5	5	5	6	6	6	6	7	7	7	7	8	8	8	9	9	9	9	10	10	10	10	11	11	11	11	12	12	12	13	13	13	13	14	14	14	14	15	15	15	15	16	16	**16**
17	0	1	1	1	1	2	2	2	3	3	3	3	4	4	4	5	5	5	5	6	6	6	7	7	7	7	8	8	8	8	9	9	9	10	10	10	10	11	11	11	12	12	12	12	13	13	13	14	14	14	14	15	15	15	16	16	16	16	17	17	**17**
18	0	1	1	1	2	2	2	2	3	3	3	4	4	4	4	5	5	5	6	6	6	7	7	7	8	8	8	8	9	9	9	10	10	10	10	11	11	11	12	12	12	13	13	13	14	14	14	14	15	15	15	16	16	16	16	17	17	17	18	18	**18**
19	0	1	1	1	2	2	2	3	3	3	3	4	4	4	5	5	5	6	6	6	7	7	7	8	8	8	9	9	9	10	10	10	10	11	11	11	12	12	12	13	13	13	14	14	14	15	15	15	16	16	16	16	17	17	17	18	18	18	19	19	**19**
20	0	1	1	1	2	2	2	3	3	3	4	4	4	5	5	5	6	6	6	7	7	7	8	8	8	9	9	9	10	10	10	11	11	11	12	12	12	13	13	13	14	14	14	15	15	15	16	16	16	17	17	17	18	18	18	19	19	19	20	20	**20**
21	0	1	1	1	2	2	2	3	3	4	4	4	5	5	5	6	6	6	7	7	7	8	8	8	9	9	9	10	10	10	11	11	12	12	12	13	13	13	14	14	14	15	15	15	16	16	16	17	17	18	18	18	19	19	19	20	20	20	21	21	**21**
22	0	1	1	1	2	2	3	3	3	4	4	4	5	5	6	6	6	7	7	7	8	8	8	9	9	10	10	10	11	11	11	12	12	12	13	13	14	14	14	15	15	15	16	16	16	17	17	18	18	18	19	19	19	20	20	21	21	21	22	22	**22**
23	0	1	1	2	2	2	3	3	3	4	4	5	5	5	6	6	7	7	7	8	8	8	9	9	10	10	10	11	11	12	12	12	13	13	13	14	14	15	15	15	16	16	16	17	17	18	18	18	19	19	20	20	20	21	21	21	22	22	23	23	**23**
24	0	1	1	2	2	2	3	3	4	4	4	5	5	6	6	6	7	7	8	8	8	9	9	10	10	10	11	11	12	12	12	13	13	14	14	14	15	15	16	16	16	17	17	18	18	18	19	19	20	20	20	21	21	22	22	22	23	23	24	24	**24**
25	0	1	1	2	2	2	3	3	4	4	5	5	5	6	6	7	7	8	8	8	9	9	10	10	10	11	11	12	12	12	13	13	14	14	15	15	15	16	16	17	17	18	18	18	19	19	20	20	20	21	21	22	22	22	23	23	24	24	25	25	**25**
26	0	1	1	2	2	3	3	3	4	4	5	5	6	6	6	7	7	8	8	9	9	10	10	10	11	11	12	12	13	13	13	14	14	15	15	16	16	16	17	17	18	18	19	19	20	20	20	21	21	22	22	23	23	23	24	24	25	25	26	26	**26**
27	0	1	1	2	2	3	3	4	4	4	5	5	6	6	7	7	8	8	9	9	9	10	10	11	11	12	12	13	13	14	14	14	15	15	16	16	17	17	18	18	18	19	19	20	20	21	21	22	22	22	23	23	24	24	25	25	26	26	27	27	**27**
28	0	1	1	2	2	3	3	4	4	5	5	6	6	7	7	7	8	8	9	9	10	10	11	11	12	12	13	13	14	14	14	15	15	16	16	17	17	18	18	19	19	20	20	21	21	21	22	22	23	23	24	24	25	25	26	26	27	27	28	28	**28**
29	0	1	1	2	2	3	3	4	4	5	5	6	6	7	7	8	8	9	9	10	10	11	11	12	12	13	13	14	14	14	15	15	16	16	17	17	18	18	19	19	20	20	21	21	22	22	23	23	24	24	25	25	26	26	27	27	28	28	28	29	**29**
30	0	1	1	2	2	3	4	4	4	5	6	6	6	7	8	8	8	9	10	10	10	11	11	12	12	13	14	14	14	15	16	16	16	17	17	18	18	19	20	20	20	21	22	22	22	23	24	24	24	25	26	26	26	27	27	28	28	29	30	30	**30**
31	1	1	2	2	3	3	4	4	5	5	6	6	7	7	8	8	9	9	10	10	11	11	12	12	13	13	14	14	15	16	16	17	17	18	18	19	19	20	20	21	21	22	22	23	23	24	24	25	25	26	26	27	27	28	28	29	29	30	30	31	**31**
32	1	1	2	2	3	3	4	4	5	5	6	6	7	7	8	9	9	10	10	11	11	12	12	13	13	14	14	15	15	16	17	17	18	18	19	19	20	20	21	21	22	22	23	23	24	25	25	26	26	27	27	28	28	29	29	30	30	31	31	32	**32**
33	1	1	2	2	3	3	4	4	5	6	6	7	7	8	8	9	9	10	10	11	12	12	13	13	14	14	15	15	16	16	17	18	18	19	19	20	20	21	21	22	23	23	24	24	25	25	26	26	27	28	28	29	29	30	30	31	31	32	32	33	**33**
34	1	1	2	2	3	3	4	5	5	6	6	7	7	8	8	9	10	10	11	11	12	12	13	14	14	15	15	16	16	17	18	18	19	19	20	20	21	21	22	23	23	24	24	25	26	26	27	27	28	28	29	29	30	31	31	32	32	33	33	34	**34**
35	1	1	2	2	3	4	4	5	5	6	6	7	8	8	9	9	10	10	11	12	12	13	13	14	15	15	16	16	17	18	18	19	19	20	20	21	22	22	23	23	24	24	25	26	26	27	27	28	29	29	30	30	31	32	32	33	33	34	34	35	**35**
36	1	1	2	2	3	4	4	5	5	6	7	7	8	8	9	10	10	11	11	12	13	13	14	14	15	16	16	17	17	18	19	19	20	20	21	22	22	23	23	24	25	25	26	26	27	28	28	29	29	30	31	31	32	32	33	34	34	35	35	36	**36**
37	1	1	2	2	3	4	4	5	6	6	7	7	8	9	9	10	10	11	12	12	13	14	14	15	15	16	17	17	18	18	19	20	20	21	22	22	23	23	24	25	25	26	27	27	28	28	29	30	30	31	31	32	33	33	34	35	35	36	36	37	**37**
38	1	1	2	3	3	4	4	5	6	6	7	8	8	9	10	10	11	11	12	13	13	14	15	15	16	16	17	18	18	19	20	20	21	22	22	23	23	24	25	25	26	27	27	28	28	29	30	30	31	32	32	33	34	34	35	35	36	37	37	38	**38**
39	1	1	2	3	3	4	5	5	6	6	7	8	8	9	10	10	11	12	12	13	14	14	15	16	16	17	18	18	19	20	20	21	21	22	23	23	24	25	25	26	27	27	28	29	29	30	31	31	32	32	33	34	34	35	36	36	37	38	38	39	**39**
40	1	1	2	3	3	4	5	5	6	7	7	8	9	9	10	11	11	12	13	13	14	15	15	16	17	17	18	19	19	20	21	21	22	23	23	24	25	25	26	27	27	28	29	29	30	31	31	32	33	33	34	35	35	36	37	37	38	39	39	40	**40**
41	1	1	2	3	3	4	5	5	6	7	8	8	9	10	10	11	12	12	13	14	14	15	16	16	17	18	18	19	20	20	21	22	23	23	24	25	25	26	27	27	28	29	29	30	31	31	32	33	33	34	35	36	36	37	38	38	39	40	40	41	**41**
42	1	1	2	3	4	4	5	6	6	7	8	8	9	10	10	11	12	13	13	14	15	15	16	17	18	18	19	20	20	21	22	22	23	24	24	25	26	27	27	28	29	29	30	31	32	32	33	34	34	35	36	36	37	38	38	39	40	41	41	42	**42**
43	1	1	2	3	4	4	5	6	6	7	8	9	9	10	11	11	12	13	14	14	15	16	16	17	18	19	19	20	21	22	22	23	24	24	25	26	26	27	28	29	29	30	31	32	32	33	34	34	35	36	37	37	38	39	39	40	41	42	42	43	**43**
44	1	1	2	3	4	4	5	6	7	7	8	9	10	10	11	12	12	13	14	15	15	16	17	18	18	19	20	20	21	22	23	23	24	25	26	26	27	28	29	29	30	31	32	32	33	34	34	35	36	37	37	38	39	40	40	41	42	43	43	44	**44**
45	1	1	2	3	4	4	5	6	7	8	8	9	10	10	11	12	13	14	14	15	16	16	17	18	19	19	20	21	22	22	23	24	25	26	26	27	28	28	29	30	31	32	32	33	34	34	35	36	37	38	38	39	40	40	41	42	43	44	44	45	**45**
46	1	2	2	3	4	5	5	6	7	8	8	9	10	11	12	12	13	14	15	15	16	17	18	18	19	20	21	21	22	23	24	25	25	26	27	28	28	29	30	31	31	32	33	34	34	35	36	37	38	38	39	40	41	41	42	43	44	44	45	46	**46**
47	1	2	2	3	4	5	5	6	7	8	9	9	10	11	12	13	13	14	15	16	16	17	18	19	20	20	21	22	23	24	24	25	26	27	27	28	29	30	31	31	32	33	34	34	35	36	37	38	38	39	40	41	42	42	43	44	45	45	46	47	**47**
48	1	2	2	3	4	5	6	6	7	8	9	10	10	11	12	13	14	14	15	16	17	18	18	19	20	21	22	22	23	24	25	26	26	27	28	29	30	30	31	32	33	34	34	35	36	37	38	38	39	40	41	42	42	43	44	45	46	46	47	48	**48**
49	1	2	2	3	4	5	6	7	7	8	9	10	11	11	12	13	14	15	16	16	17	18	19	20	20	21	22	23	24	24	25	26	27	28	29	29	30	31	32	33	33	34	35	36	37	38	38	39	40	41	42	42	43	44	45	46	46	47	48	49	**49**
50	1	2	2	3	4	5	6	7	7	8	9	10	11	12	12	13	14	15	16	17	18	18	19	20	21	22	22	23	24	25	26	27	28	28	29	30	31	32	32	33	34	35	36	37	38	38	39	40	41	42	42	43	44	45	46	47	48	48	49	50	**50**
51	1	2	3	3	4	5	6	7	8	8	9	10	11	12	13	14	14	15	16	17	18	19	20	20	21	22	23	24	25	26	26	27	28	29	30	31	31	32	33	34	35	36	37	37	38	39	40	41	42	42	43	44	45	46	47	48	48	49	50	51	**51**
52	1	2	3	3	4	5	6	7	8	9	10	10	11	12	13	14	15	16	16	17	18	19	20	21	22	23	23	24	25	26	27	28	29	29	30	31	32	33	34	35	36	36	37	38	39	40	41	42	42	43	44	45	46	47	48	49	49	50	51	52	**52**
53	1	2	3	4	4	5	6	7	8	9	10	11	11	12	13	14	15	16	17	18	19	19	20	21	22	23	24	25	26	26	27	28	29	30	31	32	33	34	34	35	36	37	38	39	40	41	42	42	43	44	45	46	47	48	49	49	50	51	52	53	**53**
54	1	2	3	4	4	5	6	7	8	9	10	11	12	13	14	14	15	16	17	18	19	20	21	22	22	23	24	25	26	27	28	29	30	31	32	32	33	34	35	36	37	38	39	40	40	41	42	43	44	45	46	47	48	49	50	50	51	52	53	54	**54**
55	1	2	3	4	5	6	6	7	8	9	10	11	12	13	14	15	16	16	17	18	19	20	21	22	23	24	25	26	27	28	28	29	30	31	32	33	34	35	36	37	38	38	39	40	41	42	43	44	45	46	47	48	49	50	50	51	52	53	54	55	**55**
56	1	2	3	4	5	6	7	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	21	22	23	24	25	26	27	28	29	30	31	32	33	34	35	35	36	37	38	39	40	41	42	43	44	45	46	47	48	49	49	50	51	52	53	54	55	56	**56**
57	1	2	3	4	5	6	7	8	9	10	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	28	29	30	31	32	33	34	35	36	37	38	39	40	41	42	43	44	45	46	47	48	48	49	50	51	52	53	54	55	56	57	**57**
58	1	2	3	4	5	6	7	8	9	10	11	12	13	14	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	32	33	34	35	36	37	38	39	40	41	42	43	44	44	45	46	47	48	49	50	51	52	53	54	55	56	57	58	**58**
59	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	30	31	32	33	34	35	36	37	38	39	40	41	42	43	44	45	46	47	48	49	50	51	52	53	54	55	56	57	58	59	**59**

N. Lat. { L.H.A. greater than 180° .....Zn=Z; L.H.A. less than 180°............Zn=360°–Z }

DECLINATION (0° – 14°) **CONTRARY** NAME TO LATITUDE

LAT 40°

LHA	0° Hc	0° d	0° Z	1° Hc	1° d	1° Z	2° Hc	2° d	2° Z	3° Hc	3° d	3° Z	4° Hc	4° d	4° Z
	° ′	′	°	° ′	′	°	° ′	′	°	° ′	′	°	° ′	′	°
69	15 56	−40	104	15 16	−41	105	14 35	−40	105	13 55	−41	106	13 14	−40	107
68	16 41	−41	105	16 00	−40	105	15 20	−41	106	14 39	−41	107	13 58	−41	108
67	17 25	−41	105	16 44	−40	106	16 04	−41	107	15 23	−41	108	14 42	−41	108
66	18 09	−40	106	17 29	−41	107	16 48	−41	108	16 07	−41	108	15 26	−42	109
65	18 53	−40	107	18 13	−42	107	17 31	−41	108	16 50	−41	109	16 09	−42	110
64	19 37	−41	107	18 56	−41	108	18 15	−41	109	17 34	−42	110	16 52	−42	110
63	20 21	−41	108	19 40	−42	109	18 58	−41	110	18 17	−42	110	17 35	−42	111
62	21 05	−42	109	20 23	−41	110	19 42	−42	110	19 00	−42	111	18 18	−42	112
61	21 48	−42	110	21 06	−41	110	20 25	−42	111	19 43	−43	112	19 00	−42	113
60	22 31	−42	110	21 49	−42	111	21 07	−42	112	20 25	−42	113	19 43	−43	113
59	23 14	−42	111	22 32	−42	112	21 50	−43	113	21 07	−42	113	20 25	−43	114
58	23 57	−42	112	23 15	−43	113	22 32	−43	113	21 49	−43	114	21 06	−43	115
57	24 40	−43	113	23 57	−43	113	23 14	−43	114	22 31	−43	115	21 48	−43	116
56	25 22	−43	113	24 39	−43	114	23 56	−43	115	23 13	−44	116	22 29	−43	116
55	26 04	−43	114	25 21	−43	115	24 38	−44	116	23 54	−44	117	23 10	−44	117
54	26 46	−44	115	26 02	−43	116	25 19	−44	117	24 35	−44	117	23 51	−44	118
53	27 27	−43	116	26 44	−44	117	26 00	−44	117	25 16	−45	118	24 31	−44	119
52	28 08	−43	117	27 25	−45	117	26 40	−44	118	25 56	−45	119	25 11	−44	120
51	28 49	−44	117	28 05	−44	118	27 21	−45	119	26 36	−45	120	25 51	−45	121
50	29 30	−45	118	28 45	−44	119	28 01	−45	120	27 16	−45	121	26 31	−46	121
49	30 10	−45	119	29 25	−45	120	28 40	−45	121	27 55	−45	121	27 10	−46	122
48	30 50	−45	120	30 05	−45	121	29 20	−46	122	28 34	−46	122	27 48	−46	123
47	31 30	−46	121	30 44	−45	122	29 59	−46	122	29 13	−46	123	28 27	−47	124
46	32 09	−46	122	31 23	−46	123	30 37	−46	123	29 51	−46	124	29 05	−47	125
45	32 48	−46	123	32 02	−46	123	31 16	−47	124	30 29	−47	125	29 42	−47	126
44	33 26	−46	124	32 40	−47	124	31 53	−47	125	31 06	−47	126	30 19	−47	127
43	34 04	−46	125	33 18	−47	125	32 31	−48	126	31 43	−47	127	30 56	−48	128
42	34 42	−47	126	33 55	−47	126	33 08	−48	127	32 20	−48	128	31 32	−48	128
41	35 19	−47	126	34 32	−48	127	33 44	−48	128	32 56	−48	129	32 08	−48	129
40	35 56	−48	127	35 08	−48	128	34 20	−48	129	33 32	−49	130	32 43	−48	130
39	36 32	−48	128	35 44	−48	129	34 56	−49	130	34 07	−49	131	33 18	−49	131
38	37 08	−49	129	36 19	−48	130	35 31	−49	131	34 42	−50	132	33 52	−49	132
37	37 43	−49	130	36 54	−49	131	36 05	−49	132	35 16	−50	133	34 26	−50	133
36	38 18	−49	131	37 29	−50	132	36 39	−50	133	35 49	−50	134	34 59	−50	134
35	38 52	−50	133	38 02	−50	133	37 12	−50	134	36 22	−50	135	35 32	−51	135
34	39 26	−51	134	38 35	−50	134	37 45	−50	135	36 55	−51	136	36 04	−51	136
33	39 59	−51	135	39 08	−51	135	38 17	−51	136	37 26	−51	137	36 35	−51	137
32	40 31	−51	136	39 40	−51	137	38 49	−51	137	37 58	−52	138	37 06	−52	138
31	41 03	−52	137	40 11	−51	138	39 20	−52	138	38 28	−52	139	37 36	−52	140
30	41 34	−52	138	40 42	−52	139	39 50	−52	139	38 58	−52	140	38 06	−53	141
29	42 04	−52	139	41 12	−52	140	40 20	−53	141	39 27	−53	141	38 34	−52	142
28	42 34	−53	140	41 41	−52	141	40 49	−53	142	39 56	−53	142	39 03	−54	143
27	43 03	−53	142	42 10	−53	142	41 17	−54	143	40 23	−53	143	39 30	−54	144
26	43 31	−54	143	42 37	−53	143	41 44	−54	144	40 50	−54	145	39 56	−54	145
25	43 58	−54	144	43 04	−53	145	42 11	−54	145	41 17	−55	146	40 22	−54	146
24	44 25	−54	145	43 31	−55	146	42 36	−54	146	41 42	−55	147	40 47	−54	148
23	44 50	−54	147	43 56	−55	147	43 01	−54	148	42 07	−55	148	41 12	−56	149
22	45 15	−54	148	44 21	−56	148	43 25	−55	149	42 30	−55	150	41 35	−56	150
21	45 39	−55	149	44 44	−55	150	43 49	−56	150	42 53	−56	151	41 57	−55	151
20	46 03	−56	150	45 07	−56	151	44 11	−56	152	43 15	−56	152	42 19	−56	153
19	46 25	−56	152	45 29	−56	152	44 33	−57	153	43 36	−56	153	42 40	−57	154
18	46 46	−56	153	45 50	−57	154	44 53	−57	154	43 56	−56	155	43 00	−57	155
17	47 06	−57	155	46 09	−56	155	45 13	−57	155	44 16	−57	156	43 19	−58	156
16	47 25	−57	156	46 28	−57	156	45 31	−57	157	44 34	−57	157	43 37	−58	158
15	47 44	−58	157	46 46	−57	158	45 49	−58	158	44 51	−57	159	43 54	−58	159
14	48 01	−58	159	47 03	−58	159	46 05	−58	160	45 07	−58	160	44 09	−58	160
13	48 17	−58	160	47 19	−58	161	46 21	−58	161	45 23	−59	161	44 24	−58	162
12	48 32	−58	162	47 34	−59	162	46 35	−58	162	45 37	−59	163	44 38	−58	163
11	48 46	−59	163	47 47	−58	164	46 49	−59	164	45 50	−59	164	44 51	−59	164
10	48 58	−58	165	48 00	−59	165	47 01	−59	165	46 02	−59	166	45 03	−59	166
9	49 10	−59	166	48 11	−59	166	47 12	−59	167	46 13	−59	167	45 14	−59	167
8	49 20	−59	168	48 21	−59	168	47 22	−59	168	46 23	−60	168	45 23	−59	169
7	49 30	−60	169	48 30	−59	169	47 31	−60	170	46 31	−59	170	45 32	−60	170
6	49 38	−60	171	48 38	−59	171	47 39	−60	171	46 39	−60	171	45 39	−59	171
5	49 44	−59	172	48 45	−60	172	47 45	−60	173	46 45	−59	173	45 46	−60	173
4	49 50	−60	174	48 50	−60	174	47 50	−59	174	46 51	−60	174	45 51	−60	174
3	49 54	−59	175	48 55	−60	175	47 55	−60	176	46 55	−60	176	45 55	−60	176
2	49 58	−60	177	48 58	−60	177	47 58	−60	177	46 58	−60	177	45 58	−60	177
1	49 59	−60	178	48 59	−60	178	47 59	−60	179	46 59	−60	179	45 59	−60	179
0	50 00	−60	180	49 00	−60	180	48 00	−60	180	47 00	−60	180	46 00	−60	180

LHA	5° Hc	5° d	5° Z	6° Hc	6° d	6° Z	7° Hc	7° d	7° Z	8° Hc	8° d	8° Z	9° Hc	9° d	9° Z
	° ′	′	°	° ′	′	°	° ′	′	°	° ′	′	°	° ′	′	°
69	12 34	−41	108	11 53	−41	108	11 12	−41	109	10 31	−42	110	09 49	−41	111
68	13 17	−41	108	12 36	−41	109	11 55	−41	110	11 14	−42	111	10 32	−41	111
67	14 01	−41	109	13 20	−42	110	12 38	−41	111	11 57	−42	111	11 15	−42	112
66	14 44	−41	110	14 03	−42	111	13 21	−42	111	12 39	−42	112	11 57	−42	113
65	15 27	−41	110	14 46	−42	111	14 04	−42	112	13 22	−42	113	12 40	−42	113
64	16 10	−42	111	15 28	−42	112	14 46	−42	113	14 04	−42	113	13 22	−43	114
63	16 53	−42	112	16 11	−42	113	15 29	−43	113	14 46	−42	114	14 04	−43	115
62	17 36	−43	113	16 53	−42	113	16 11	−43	114	15 28	−43	115	14 45	−43	116
61	18 18	−43	113	17 35	−43	114	16 52	−42	115	16 10	−43	116	15 27	−44	116
60	19 00	−43	114	18 17	−43	115	17 34	−43	116	16 51	−43	116	16 08	−44	117
59	19 42	−43	115	18 59	−44	116	18 15	−43	116	17 32	−44	117	16 48	−43	118
58	20 23	−43	116	19 40	−44	116	18 56	−43	117	18 13	−44	118	17 29	−44	119
57	21 05	−44	116	20 21	−44	117	19 37	−44	118	18 53	−44	119	18 09	−44	119
56	21 46	−44	117	21 02	−44	118	20 18	−45	119	19 33	−44	119	18 49	−45	120
55	22 26	−44	118	21 42	−44	119	20 58	−45	119	20 13	−44	120	19 29	−45	121
54	23 07	−45	119	22 22	−44	120	21 38	−45	120	20 53	−45	121	20 08	−45	122
53	23 47	−45	120	23 02	−45	120	22 17	−45	121	21 32	−45	122	20 47	−46	122
52	24 27	−45	120	23 42	−46	121	22 56	−45	122	22 11	−46	123	21 25	−45	123
51	25 06	−45	121	24 21	−46	122	23 35	−45	123	22 50	−46	123	22 04	−46	124
50	25 45	−45	122	25 00	−46	123	24 14	−46	124	23 28	−46	124	22 42	−47	125
49	26 24	−46	123	25 38	−46	124	24 52	−46	124	24 06	−47	125	23 19	−47	126
48	27 02	−46	124	26 16	−46	124	25 30	−47	125	24 43	−47	126	23 56	−47	127
47	27 40	−46	125	26 54	−47	125	26 07	−47	126	25 20	−47	127	24 33	−47	127
46	28 18	−47	126	27 31	−47	126	26 44	−47	127	25 57	−48	128	25 09	−48	128
45	28 55	−47	126	28 08	−47	127	27 21	−48	128	26 33	−48	128	25 45	−48	129
44	29 32	−48	127	28 44	−47	128	27 57	−48	129	27 09	−49	129	26 20	−48	130
43	30 08	−48	128	29 20	−48	129	28 32	−48	130	27 44	−49	130	26 55	−48	131
42	30 44	−48	129	29 56	−49	130	29 07	−48	131	28 19	−49	131	27 30	−49	132
41	31 20	−49	130	30 31	−49	131	29 42	−49	131	28 53	−49	132	28 04	−50	133
40	31 55	−49	131	31 06	−50	132	30 16	−49	132	29 27	−50	133	28 37	−49	134
39	32 29	−49	132	31 40	−50	133	30 50	−50	133	30 00	−50	134	29 10	−50	135
38	33 03	−50	133	32 13	−50	134	31 23	−50	134	30 33	−50	135	29 43	−51	136
37	33 36	−50	134	32 46	−50	135	31 56	−51	135	31 05	−50	136	30 15	−51	137
36	34 09	−50	135	33 19	−51	136	32 28	−51	136	31 37	−51	137	30 46	−51	137
35	34 41	−51	136	33 50	−51	137	32 59	−51	137	32 08	−51	138	31 17	−52	138
34	35 13	−51	137	34 22	−52	138	33 30	−51	138	32 39	−52	139	31 47	−52	139
33	35 44	−52	138	34 52	−51	139	34 01	−52	139	33 09	−52	140	32 17	−53	140
32	36 14	−52	139	35 22	−52	140	34 30	−52	140	33 38	−53	141	32 45	−52	142
31	36 44	−52	140	35 52	−53	141	34 59	−52	141	34 07	−53	142	33 14	−53	143
30	37 13	−53	141	36 20	−52	142	35 28	−53	142	34 35	−54	143	33 41	−53	144
29	37 42	−54	142	36 48	−53	143	35 55	−53	144	35 02	−54	144	34 08	−53	145
28	38 09	−53	144	37 16	−54	144	36 22	−54	145	35 28	−53	145	34 35	−54	146
27	38 36	−54	145	37 42	−54	145	36 48	−54	146	35 54	−54	146	35 00	−54	147
26	39 02	−54	146	38 08	−54	146	37 14	−55	147	36 19	−54	147	35 25	−55	148
25	39 28	−55	147	38 33	−54	147	37 39	−55	148	36 44	−55	149	35 49	−55	149
24	39 53	−55	148	38 58	−55	149	38 03	−56	149	37 07	−55	150	36 12	−55	150
23	40 16	−55	149	39 21	−55	150	38 26	−56	150	37 30	−55	151	36 35	−56	151
22	40 39	−55	151	39 44	−56	151	38 48	−56	152	37 52	−56	152	36 56	−56	152
21	41 02	−56	152	40 06	−56	152	39 10	−57	153	38 13	−56	153	37 17	−56	154
20	41 23	−56	153	40 27	−57	153	39 30	−56	154	38 34	−57	154	37 37	−56	155
19	41 43	−56	154	40 47	−57	155	39 50	−57	155	38 53	−57	156	37 56	−57	156
18	42 03	−57	156	41 06	−57	156	40 09	−57	156	39 12	−57	157	38 15	−58	157
17	42 21	−57	157	41 24	−57	157	40 27	−57	158	39 30	−58	158	38 32	−57	158
16	42 39	−57	158	41 42	−58	158	40 44	−58	159	39 46	−57	159	38 49	−58	160
15	42 56	−58	159	41 58	−58	160	41 00	−58	160	40 02	−58	160	39 04	−58	161
14	43 11	−58	161	42 13	−58	161	41 15	−58	161	40 17	−58	162	39 19	−58	162
13	43 26	−58	162	42 28	−59	162	41 29	−58	163	40 31	−58	163	39 33	−59	163
12	43 40	−59	163	42 41	−58	164	41 43	−59	164	40 44	−59	164	39 45	−58	165
11	43 52	−58	165	42 54	−59	165	41 55	−59	165	40 56	−59	166	39 57	−59	166
10	44 04	−59	166	43 05	−59	166	42 06	−59	167	41 07	−59	167	40 08	−59	167
9	44 15	−60	167	43 15	−59	168	42 16	−59	168	41 17	−59	168	40 18	−59	168
8	44 24	−59	169	43 25	−60	169	42 25	−59	169	41 26	−59	169	40 27	−60	170
7	44 32	−59	170	43 33	−60	170	42 33	−59	171	41 34	−60	171	40 34	−59	171
6	44 40	−60	172	43 40	−60	172	42 40	−59	172	41 41	−60	172	40 41	−60	172
5	44 46	−60	173	43 46	−60	173	42 46	−59	173	41 47	−60	173	40 47	−60	173
4	44 51	−60	174	43 51	−60	174	42 51	−60	175	41 51	−59	175	40 52	−60	175
3	44 55	−60	176	43 55	−60	176	42 55	−60	176	41 55	−60	176	40 55	−60	176
2	44 58	−60	177	43 58	−60	177	42 58	−60	177	41 58	−60	177	40 58	−60	177
1	44 59	−60	179	43 59	−60	179	42 59	−60	179	41 59	−60	179	40 59	−60	179
0	45 00	−60	180	44 00	−60	180	43 00	−60	180	42 00	−60	180	41 00	−60	180

10° Hc	10° d	10° Z	11° Hc	11° d	11° Z	12° Hc	12° d	12° Z	13° Hc	13° d	13° Z	14° Hc	14° d	14° Z	LHA
° ′	′	°	° ′	′	°	° ′	′	°	° ′	′	°	° ′	′	°	
09 08	−41	111	08 27	−42	112	07 45	−41	113	07 04	−42	114	06 22	−42	114	291
09 51	−42	112	09 09	−42	113	08 27	−41	114	07 46	−42	114	07 04	−42	115	292
10 33	−42	113	09 51	−42	113	09 09	−42	114	08 27	−42	115	07 45	−42	116	293
11 15	−42	113	10 33	−42	114	09 51	−42	115	09 09	−42	116	08 27	−43	116	294
11 58	−43	114	11 15	−42	115	10 33	−43	116	09 50	−42	116	09 08	−43	117	295
12 39	−42	115	11 57	−43	116	11 14	−43	116	10 31	−43	117	09 48	−43	118	296
13 21	−43	116	12 38	−43	116	11 55	−43	117	11 12	−43	118	10 29	−43	118	297
14 02	−43	116	13 19	−43	117	12 36	−43	118	11 53	−44	118	11 09	−43	119	298
14 43	−43	117	14 00	−43	118	13 17	−44	118	12 33	−44	119	11 49	−44	120	299
15 24	−44	118	14 40	−43	119	13 57	−44	119	13 13	−44	120	12 29	−44	121	300
16 05	−44	119	15 21	−44	119	14 37	−44	120	13 53	−45	121	13 08	−44	121	301
16 45	−44	119	16 01	−45	120	15 16	−44	121	14 32	−45	121	13 47	−44	122	302
17 25	−45	120	16 40	−44	121	15 56	−45	121	15 11	−45	122	14 26	−45	123	303
18 04	−44	121	17 20	−45	122	16 35	−45	122	15 50	−45	123	15 05	−46	124	304
18 44	−45	122	17 59	−45	122	17 14	−46	123	16 28	−45	124	15 43	−46	124	305
19 23	−46	122	18 37	−45	123	17 52	−46	124	17 06	−45	124	16 21	−46	125	306
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20 40	−46	124	19 54	−46	125	19 08	−47	125	18 21	−46	126	17 35	−46	127	308
21 18	−47	125	20 31	−46	125	19 45	−47	126	18 58	−46	127	18 12	−47	127	309
21 55	−46	126	21 09	−47	126	20 22	−47	127	19 35	−47	128	18 48	−47	128	310
22 32	−47	126	21 45	−47	127	20 58	−47	128	20 11	−47	128	19 24	−48	129	311
23 09	−47	127	22 22	−47	128	21 35	−48	129	20 47	−48	129	19 59	−47	130	312
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25 32	−48	131	24 44	−49	131	23 55	−49	132	23 06	−49	133	22 17	−49	133	316
26 07	−49	132	25 18	−49	132	24 29	−49	133	23 40	−50	133	22 50	−49	134	317
26 41	−49	132	25 52	−50	133	25 02	−49	134	24 13	−50	134	23 23	−50	135	318
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27 48	−50	134	26 58	−50	135	26 08	−51	136	25 17	−50	136	24 27	−51	137	320
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28 52	−50	136	28 02	−51	137	27 11	−51	137	26 20	−51	138	25 29	−51	139	322
29 24	−51	137	28 33	−51	138	27 42	−52	138	26 50	−51	139	25 59	−52	139	323
29 55	−51	138	29 04	−52	139	28 12	−52	139	27 20	−51	140	26 29	−52	140	324
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32 21	−53	143	31 28	−54	144	30 34	−53	144	29 41	−54	145	28 47	−53	145	329
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33 15	−54	145	32 21	−54	146	31 27	−54	146	30 33	−54	147	29 39	−55	147	331
33 41	−55	146	32 46	−54	147	31 52	−54	147	30 58	−55	148	30 03	−55	148	332
34 06	−55	147	33 11	−54	148	32 17	−55	148	31 22	−55	149	30 27	−55	149	333
34 30	−55	148	33 35	−55	149	32 40	−55	149	31 45	−55	150	30 50	−55	150	334
34 54	−55	150	33 59	−56	150	33 03	−55	150	32 08	−56	151	31 12	−55	151	335
35 17	−56	151	34 21	−55	151	33 26	−56	152	32 30	−56	152	31 34	−56	152	336
35 39	−56	152	34 43	−56	152	33 47	−56	153	32 51	−56	153	31 55	−56	153	337
36 00	−56	153	35 04	−56	153	34 08	−56	154	33 12	−57	154	32 15	−56	155	338
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36 59	−57	156	36 02	−57	157	35 05	−57	157	34 08	−57	157	33 11	−57	158	341
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37 35	−58	159	36 37	−58	159	35 39	−57	159	34 42	−58	160	33 44	−58	160	343
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39 59	−60	179	38 59	−59	179	38 00	−60	179	37 00	−60	179	36 00	−60	179	359
40 00	−60	180	39 00	−60	180	38 00	−60	180	37 00	−60	180	36 00	−60	180	360

S. Lat. { L.H.A. greater than 180° ....Zn=180°–Z; L.H.A. less than 180°............Zn=180°+Z }

N. Lat. { L.H.A. greater than 180° .....Zn=Z
L.H.A. less than 180°.............Zn=360°–Z

DECLINATION (0° – 14°) **SAME** NAME AS LATITUDE

LAT 40°

	0°			1°			2°			3°			4°		
LHA	Hc	d	Z	Hc	d	Z	Hc	d	Z	Hc	d	Z	Hc	d	Z
	° ′	′	°	° ′	′	°	° ′	′	°	° ′	′	°	° ′	′	°
0	50 00	60	180	51 00	60	180	52 00	60	180	53 00	60	180	54 00	60	180
1	49 59	60	178	50 59	60	178	51 59	60	178	52 59	60	178	53 59	60	178
2	49 58	59	177	50 57	60	177	51 57	60	177	52 57	60	177	53 57	60	177
3	49 54	60	175	50 54	60	175	51 54	60	175	52 54	60	175	53 54	60	175
4	49 50	60	174	50 50	60	174	51 50	59	174	52 49	60	173	53 49	60	173
5	49 44	60	172	50 44	60	172	51 44	59	172	52 43	60	172	53 43	60	172
6	49 38	59	171	50 37	60	171	51 37	59	170	52 36	60	170	53 36	59	170
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15	47 44	57	157	48 41	57	157	49 38	57	156	50 35	57	156	51 32	57	155
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46	32 09	45	122	32 54	46	121	33 40	44	120	34 24	45	119	35 09	44	119
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	5°			6°			7°			8°			9°		
LHA	Hc	d	Z	Hc	d	Z	Hc	d	Z	Hc	d	Z	Hc	d	Z
	° ′	′	°	° ′	′	°	° ′	′	°	° ′	′	°	° ′	′	°
0	55 00	60	180	56 00	60	180	57 00	60	180	58 00	60	180	59 00	60	180
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68	20 00	39	101	20 39	39	100	21 18	38	99	21 56	39	98	22 35	38	97
69	19 14	39	100	19 53	39	99	20 32	39	98	21 11	38	97	21 49	38	97

	10°			11°			12°			13°			14°			
LHA	Hc	d	Z	Hc	d	Z	Hc	d	Z	Hc	d	Z	Hc	d	Z	LHA
	° ′	′	°	° ′	′	°	° ′	′	°	° ′	′	°	° ′	′	°	
0	60 00	60	180	61 00	60	180	62 00	60	180	63 00	60	180	64 00	60	180	360
1	59 59	60	178	60 59	60	178	61 59	60	178	62 59	60	178	63 59	60	178	359
2	59 57	60	176	60 57	60	176	61 57	60	176	62 57	59	176	63 56	60	176	358
3	59 53	60	174	60 53	59	174	61 52	60	174	62 52	60	174	63 52	60	173	357
4	59 47	60	172	60 47	60	172	61 47	59	172	62 46	60	171	63 46	59	171	356
5	59 40	60	170	60 40	59	170	61 39	60	170	62 39	59	169	63 38	59	169	355
6	59 32	59	168	60 31	59	168	61 30	59	168	62 29	59	167	63 28	59	167	354
7	59 22	59	166	60 21	59	166	61 20	58	166	62 18	59	165	63 17	59	165	353
8	59 10	59	164	60 09	58	164	61 07	59	164	62 06	58	163	63 04	58	163	352
9	58 57	58	163	59 55	59	162	60 54	58	162	61 52	58	161	62 50	58	161	351
10	58 43	58	161	59 41	57	160	60 38	58	160	61 36	58	159	62 34	57	159	350
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18	56 00	55	147	56 55	54	146	57 49	53	145	58 42	53	145	59 35	53	144	342
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36	46 13	45	123	46 58	45	122	47 43	44	121	48 27	44	120	49 11	43	119	324
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38	44 55	45	121	45 40	44	120	46 24	43	119	47 07	43	118	47 50	43	117	322
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63	27 00	39	100	27 39	38	99	28 17	38	98	28 55	37	97	29 32	37	96	297
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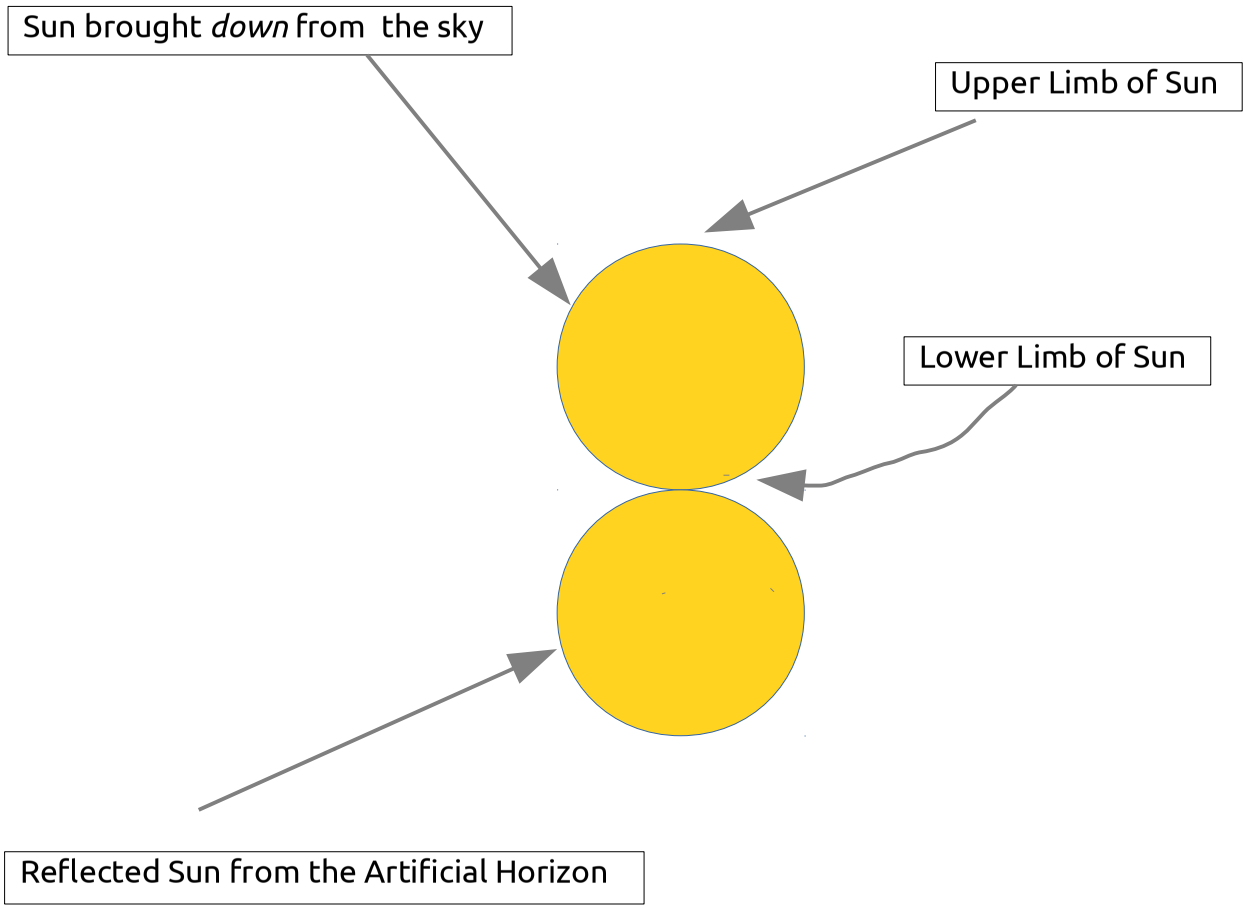
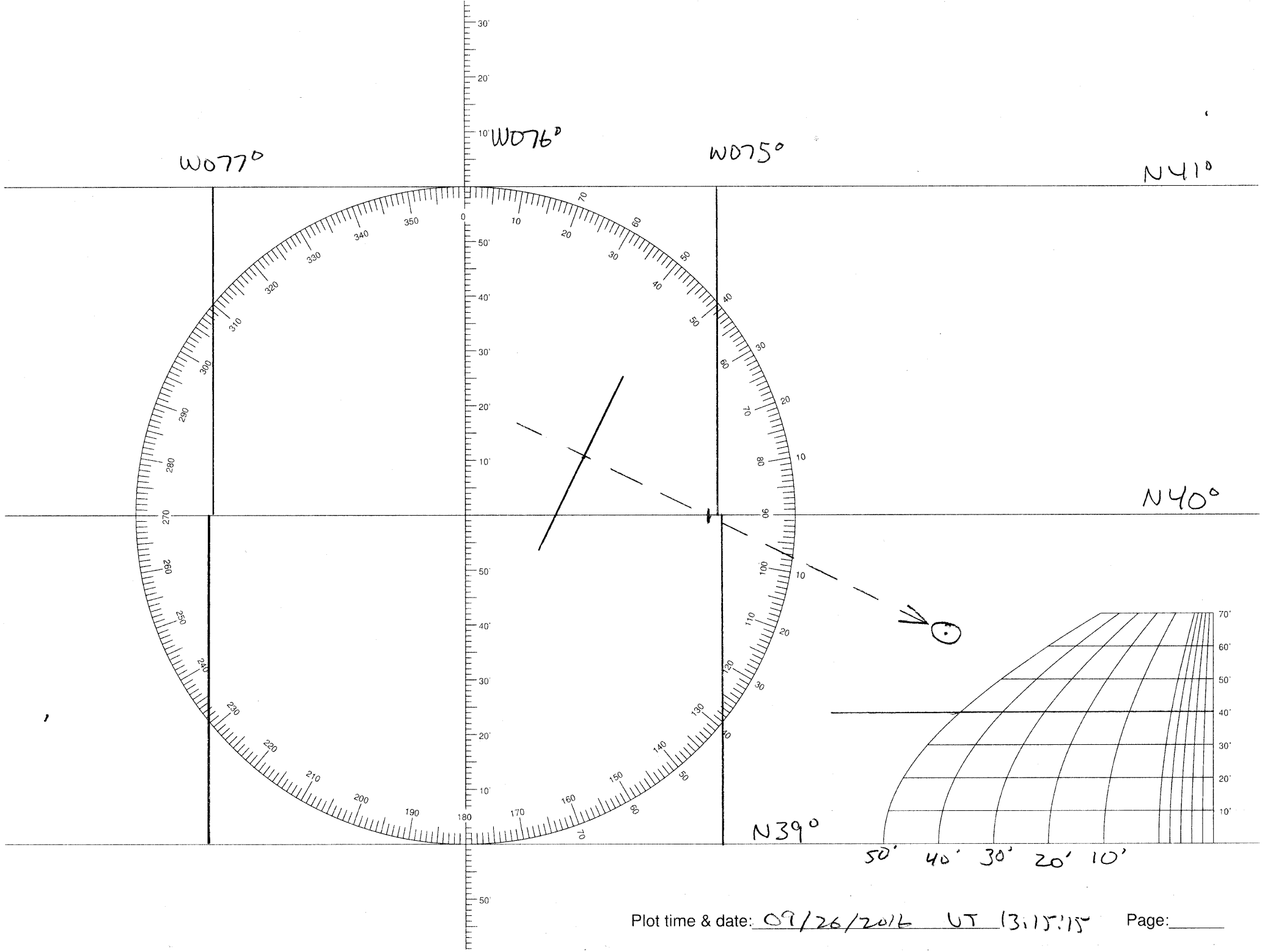
65	25 30	38	99	26 08	38	98	26 46	37	97	27 23	38	96	28 01	37	95	295
66	24 44	38	98	25 22	38	97	26 00	38	96	26 38	37	95	27 15	37	94	294
67	23 59	38	97	24 37	38	96	25 14	38	95	25 52	37	95	26 29	37	94	293
68	23 13	38	97	23 51	38	96	24 29	37	95	25 06	37	94	25 43	37	93	292
69	22 27	38	96	23 05	38	95	23 43	37	94	24 20	37	93	24 57	37	92	291

S. Lat. { L.H.A. greater than 180° ....Zn=180°–Z
L.H.A. less than 180°............Zn=180°+Z

DECLINATION (0° – 14°) **SAME** NAME AS LATITUDE

Make the Sun look like this when using an Artificial Horizon





Plot time & date: 09/26/2016 UT 13:15:15 Page: