

**FINDING
LATITUDE
USING POLARIS
(the North Star)**

Latitude by Polaris

Locate Polaris – Due NORTH & at an Altitude that matches your approx Latitude

Take your Polaris (Star) sight as normally done

Calculate your Ho of Polaris as normally done

Calculate the LHA of Polaris

Go to Special Polaris Table in Nautical Almanac

Calculate your Latitude from your sight

Example

At 18:13:55 on 11 March 2011 You sighted
Polaris at an Hs of $22^{\circ} 48.0'$

Your DR position is $22^{\circ} 06.6' N$ $070^{\circ} 54.7' W$

Your height of eye is 115 ft, the IE is 0

Your Watch Error is 0 sec And ZD is +5

Find the Main Correction for your Ha and apply it to Obtain the Ho

A2 ALTITUDE CORRECTION TABLES 10°-90°—SUN, STARS, PLANETS

OCT.—MAR. SUN			APR.—SEPT.			STARS AND PLANETS				DIP				
App. Alt.	Lower Limb	Upper Limb	App. Alt.	Lower Limb	Upper Limb	App. Alt.	Corr ⁿ	App. Alt.	Additional Corr ⁿ	Ht. of Eye	Corr ⁿ	Ht. of Eye	Ht. of Eye	Corr ⁿ
9 33	+10.8	-21.5	9 39	+10.6	-21.2	9 55	-5.3			m		ft.	m	
9 45	+10.9	-21.4	9 50	+10.7	-21.1	10 07	-5.2			2.4	-2.8	8.0	1.0	-1.8
9 56	+11.0	-21.3	10 02	+10.8	-21.0	10 20	-5.1		VENUS	2.6	-2.9	8.6	1.5	-2.2
10 08	+11.1	-21.2	10 14	+10.9	-20.9	10 32	-5.0		Jan. 1—Feb. 18	2.8	-3.0	9.2	2.0	-2.5
10 20	+11.2	-21.1	10 27	+11.0	-20.8	10 46	-4.9		0	3.0	-3.1	9.8	2.5	-2.8
10 33	+11.3	-21.0	10 40	+11.1	-20.7	10 59	-4.8		0 +0.2	3.2	-3.2	10.5	3.0	-3.0
10 46	+11.4	-20.9	10 53	+11.2	-20.6	11 14	-4.7		41 +0.1	3.4	-3.3	11.2		
11 00	+11.5	-20.8	11 07	+11.3	-20.5	11 29	-4.6		76	3.6	-3.4	11.9		See table
11 15	+11.6	-20.7	11 22	+11.4	-20.4	11 44	-4.5			3.8	-3.4	12.6		←
11 30	+11.7	-20.6	11 37	+11.5	-20.3	12 00	-4.4			4.0	-3.5	13.3		m
11 45	+11.8	-20.5	12 10	+11.6	-20.2	12 17	-4.3			4.3	-3.6	14.1		20 - 7.9
12 01	+11.9	-20.4	12 27	+11.7	-20.1	12 35	-4.2		MARS	4.5	-3.7	14.9		22 - 8.3
12 18	+12.0	-20.3	13 04	+11.9	-19.9	13 12	-4.0		Jan. 1—Dec. 31	4.7	-3.9	15.7		24 - 8.6
12 36	+12.1	-20.2	13 24	+12.1	-19.7	13 32	-3.9		0	5.0	-4.0	16.5		26 - 9.0
12 54	+12.2	-20.1	13 44	+12.2	-19.6	14 16	-3.7		60 +0.1	5.2	-4.0	17.4		28 - 9.3
13 14	+12.3	-20.0	14 06	+12.3	-19.5	14 39	-3.6			5.5	-4.1	18.3		30 - 9.6
13 34	+12.4	-19.9	14 29	+12.4	-19.4	15 03	-3.5			5.8	-4.2	19.1		32 - 10.0
13 55	+12.5	-19.8	15 18	+12.5	-19.3	15 29	-3.4			6.1	-4.3	20.1		34 - 10.3
14 17	+12.6	-19.7	16 13	+12.7	-19.1	16 25	-3.3			6.3	-4.4	21.0		36 - 10.6
14 41	+12.7	-19.6	17 14	+13.0	-18.8	17 27	-3.1			6.6	-4.5	22.0		38 - 10.8
15 05	+12.8	-19.5	18 23	+13.2	-18.6	18 01	-3.0			6.9	-4.6	22.9		
15 31	+12.9	-19.4	19 00	+13.3	-18.5	18 37	-2.9			7.2	-4.7	23.9		40 - 11.1
15 59	+13.0	-19.3	20 02	+13.4	-18.4	19 16	-2.8			7.5	-4.8	24.9		42 - 11.4
16 27	+13.1	-19.2	21 27	+13.7	-18.6	20 24	-2.5			7.9	-4.9	26.0		44 - 11.7
16 58	+13.2	-19.1	22 25	+14.0	-18.3	22 17	-2.4			8.2	-5.0	27.1		46 - 11.9
17 30	+13.3	-19.0	23 20	+14.1	-18.2	23 11	-2.3			8.5	-5.1	28.1		48 - 12.2
18 05	+13.4	-18.9	24 20	+14.2	-18.1	24 09	-2.1			8.8	-5.2	29.2		
18 41	+13.5	-18.8	25 24	+14.3	-18.0	25 12	-2.0			9.2	-5.3	30.4		ft.
19 20	+13.6	-18.7	26 34	+14.4	-17.9	26 20	-2.0			9.5	-5.4	31.5		2 - 1.4
20 02	+13.7	-18.6	27 50	+14.5	-17.8	27 34	-1.8			9.9	-5.5	32.7		4 - 1.9
20 46	+13.8	-18.5	29 13	+14.6	-17.7	28 54	-1.7			10.3	-5.6	33.9		6 - 2.4
21 34	+13.9	-18.4				30 22	-1.6			10.6	-5.7	35.1		8 - 2.7
22 25	+14.0	-18.3				31 58	-1.5			11.0	-5.8	36.3		10 - 3.1
23 20	+14.1	-18.2								11.4	-5.9	37.6		See table
24 20	+14.2	-18.1								11.8	-6.0	38.9		←
25 24	+14.3	-18.0								12.2	-6.1	40.1		ft.
26 34	+14.4	-17.9								12.6	-6.2	41.5		70 - 8.1
27 50	+14.5	-17.8								13.0	-6.3	42.8		75 - 8.4
29 13	+14.6	-17.7								13.4	-6.4	44.2		80 - 8.7
										13.8	-6.5	45.5		85 - 8.9
											-6.6	46.0		

19	16	-
19	56	-2.7
20	40	-2.6
21	27	-2.5
22	17	-2.4
23	11	-2.3
24	09	-2.2
25	12	-2.1
		-2.0

Insert the Main Correction for your Ha on the Form and apply it to Obtain the Ho

1-4 Record Maximum Sextant Height	Ha	22 °	37.6 '
1-5 Look up the altitude correction in the center of Table A2, front of the Almanac (T-8 in notes)	Alt corr.	+ -	2.3 '
1-6 Sum the above two numbers to get Observed Height	Ho	22 °	35.3 '

Insert the Data thus found – GHA γ (H) = $154^{\circ} 15.5'$ and (m/s) = $3^{\circ} 29.3'$ onto the Form 110 and add together to get the GHA γ the result being **$157^{\circ} 44.8'$**

Step 2 Find LHA Aries	GMT date =	11-Mar-11	
2-1 GMT Time in Hours, Minutes and Seconds	GMT time =	23:13:55	
2-2 Find GHA Aries on Left Hand Daily Page of the Nautical Almanac (far left column) for GMT Day and Hour	GHA Aries (Hr) =	154	15.5
2-3 Find GHA Aries minutes correction from Increments and Corrections pages	GHA Aries (Min) =	3	29.3
2-4 GHA Aries - Sum the above two numbers	GHA Aries =	157	44.8

Apply Assumed Longitude to obtain your
LHA γ by subtracting your DR
Longitude Resulting in
LHA $\gamma = 86^{\circ} 50.1'$

2-4	GHA Aries - Sum the above two numbers	GHA Aries =	157	44.8
2-5	DR Longitude (-W, +E)	DR Long =	70	54.7
2-6	LHA Aries (Combine previous numbers)	LHA Aries =	86	50.1

Worksheet at this point

Step 1 Correct Hs to get Ho			
1-1	Record Maximum Sextant Height	Hs	22 ° 48
1-2	Record Index Correction (mark sign + if off, - if on)	IC	Off + 0 On -
1-3	Record eye height (HE) and look up Dip Correction on the right-hand side of Table A2, front of Almanac (T-8 in notes)	Dip	- 10.4
	HE (ft) 115		
1-4	Record Maximum Sextant Height	Ha	22 ° 37.6
1-5	Look up the altitude correction in the center of Table A2, front of the Almanac (T-8 in notes)	Alt corr.	+ 2.3 -
1-6	Sum the above two numbers to get Observed Height	Ho	22 ° 35.3
Step 2 Find LHA Aries		GMT date =	11-Mar-11
2-1	GMT Time in Hours, Minutes and Seconds	GMT time =	23:13:55
2-2	Find GHA Aries on Left Hand Daily Page of the Nautical Almanac (far left column) for GMT Day and Hour	GHA Aries (Hr) =	154 15.5
2-3	Find GHA Aries minutes correction from Increments and Corrections pages	GHA Aries (Min) =	3 29.3
2-4	GHA Aries - Sum the above two numbers	GHA Aries =	157 44.8
2-5	DR Longitude (-W, +E)	DR Long =	70 54.7
2-6	LHA Aries (Combine previous numbers)	LHA Aries =	86 50.1

Starpath Form 110
for
Polaris Sights

Special Polaris Table in Nautical Almanac 1 of 3 pages

(located in your
handouts)

LHA ARIES	0° - 9°	10° - 19°	20° - 29°	30° - 39°	40° - 49°	50° - 59°	60° - 69°	70° - 79°	80° - 89°	90° - 99°	100° - 109°	110° - 119°
0	28.2	23.9	20.6	18.5	17.7	18.2	19.8	22.7	26.7	31.7	37.5	43.9
1	27.7	23.5	20.4	18.4	17.7	18.3	20.1	23.1	27.2	32.2	38.1	44.6
2	27.2	23.1	20.1	18.3	17.7	18.4	20.3	23.4	27.6	32.8	38.7	45.3
3	26.8	22.8	19.9	18.2	17.7	18.5	20.6	23.8	28.1	33.4	39.4	46.0
4	26.3	22.4	19.6	18.1	17.7	18.7	20.9	24.2	28.6	33.9	40.0	46.7
5	25.9	22.1	19.4	18.0	17.8	18.8	21.1	24.6	29.1	34.5	40.7	47.4
6	25.5	21.8	19.2	17.9	17.8	19.0	21.4	25.0	29.6	35.1	41.3	48.0
7	25.0	21.5	19.0	17.8	17.9	19.2	21.7	25.4	30.1	35.7	42.0	48.7
8	24.6	21.2	18.9	17.8	18.0	19.4	22.1	25.8	30.6	36.3	42.6	49.4
9	24.2	20.9	18.7	17.7	18.1	19.6	22.4	26.3	31.2	36.9	43.3	50.1
10	23.9	20.6	18.5	17.7	18.2	19.8	22.7	26.7	31.7	37.5	43.9	50.8
Lat.	<i>a</i> ₁	<i>a</i> ₁	<i>a</i> ₁	<i>a</i> ₁	<i>a</i> ₁	<i>a</i> ₁	<i>a</i> ₁	<i>a</i> ₁	<i>a</i> ₁	<i>a</i> ₁	<i>a</i> ₁	<i>a</i> ₁
0	0.5	0.5	0.6	0.6	0.6	0.6	0.6	0.5	0.5	0.4	0.4	0.3
10	.5	.6	.6	.6	.6	.6	.6	.5	.5	.4	.4	.4
20	.5	.6	.6	.6	.6	.6	.6	.5	.5	.5	.4	.4
30	.5	.6	.6	.6	.6	.6	.6	.6	.5	.5	.5	.5
40	0.6	0.6	0.6	0.6	0.6	0.6	0.6	0.6	0.6	0.5	0.5	0.5
45	.6	.6	.6	.6	.6	.6	.6	.6	.6	.6	.6	.6
50	.6	.6	.6	.6	.6	.6	.6	.6	.6	.6	.6	.6
55	.6	.6	.6	.6	.6	.6	.6	.6	.6	.6	.6	.7
60	.6	.6	.6	.6	.6	.6	.6	.6	.7	.7	.7	.7
62	0.7	0.6	0.6	0.6	0.6	0.6	0.6	0.7	0.7	0.7	0.7	0.8
64	.7	.6	.6	.6	.6	.6	.6	.7	.7	.7	.8	.8
66	.7	.7	.6	.6	.6	.6	.6	.7	.7	.8	.8	.8
68	0.7	0.7	0.6	0.6	0.6	0.6	0.6	0.7	0.7	0.8	0.9	0.9
Month	<i>a</i> ₂	<i>a</i> ₂	<i>a</i> ₂	<i>a</i> ₂	<i>a</i> ₂	<i>a</i> ₂	<i>a</i> ₂	<i>a</i> ₂	<i>a</i> ₂	<i>a</i> ₂	<i>a</i> ₂	<i>a</i> ₂
Jan.	0.7	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.7	0.7	0.7
Feb.	.7	.7	.8	.8	.8	.8	.9	.9	.9	.9	.9	.8
Mar.	.5	.6	.6	.7	.8	.8	.9	.9	.9	.9	.9	0.9
Apr.	0.4	0.4	0.5	0.6	0.6	0.7	0.8	0.8	0.9	0.9	0.9	1.0
May	.3	.3	.4	.4	.5	.5	.6	.7	.7	.8	.9	0.9
June	.2	.2	.3	.3	.3	.4	.5	.5	.6	.7	.7	.8
July	0.3	0.3	0.3	0.3	0.3	0.3	0.4	0.4	0.4	0.5	0.6	0.6
Aug.	.4	.4	.3	.3	.3	.3	.3	.3	.3	.4	.4	.5
Sept.	.6	.5	.5	.4	.4	.4	.3	.3	.3	.3	.3	.3
Oct.	0.8	0.7	0.6	0.6	0.5	0.5	0.4	0.4	0.3	0.3	0.3	0.3
Nov.	0.9	0.9	0.8	.8	.7	.6	.6	.5	.4	.4	.3	.3
Dec.	1.0	1.0	1.0	0.9	0.9	0.8	0.7	0.7	0.6	0.5	0.4	0.4
Lat.	AZIMUTH											
0	0.4	0.3	0.2	0.1	0.0	359.8	359.7	359.6	359.5	359.4	359.4	359.3
20	0.4	0.3	0.2	0.1	0.0	359.8	359.7	359.6	359.5	359.4	359.3	359.3
40	0.5	0.4	0.3	0.1	359.9	359.8	359.6	359.5	359.4	359.3	359.2	359.1
50	0.6	0.5	0.3	0.1	359.9	359.7	359.6	359.4	359.3	359.1	359.0	359.0
55	0.7	0.5	0.3	0.1	359.9	359.7	359.5	359.3	359.2	359.0	358.9	358.8
60	0.8	0.6	0.4	0.2	359.9	359.7	359.4	359.2	359.0	358.9	358.8	358.7
65	1.0	0.7	0.5	0.2	359.9	359.6	359.3	359.1	358.9	358.7	358.5	358.4

$$\text{Latitude} = \text{Apparent altitude (corrected for refraction)} - 1^\circ + a_0 + a_1 + a_2$$

The table is entered with LHA Aries to determine the column to be used; each column refers to a range of 10°. *a*₀ is taken, with mental interpolation, from the upper table with the units of LHA Aries in degrees as argument; *a*₁, *a*₂ are taken, without interpolation, from the second and third tables with arguments latitude and month respectively. *a*₀, *a*₁, *a*₂, are always positive. The final table gives the azimuth of *Polaris*.

Step 1 LHA $\gamma = 87^\circ$ find a_0

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POLARIS (POLE STAR) TABLES, 2011

FOR DETERMINING LATITUDE FROM SEXTANT ALTITUDE AND FOR AZIMUTH

LHA ARIES	0° - 9°	10° - 19°	20° - 29°	30° - 39°	40° - 49°	50° - 59°	60° - 69°	70° - 79°	80° - 89°	90° - 99°	100° - 109°	110° - 119°
	a_0	a_0	a_0	a_0	a_0	a_0	a_0	a_0	a_0	a_0	a_0	a_0
0	0 28.2	0 23.9	0 20.6	0 18.5	0 17.7	0 18.2	0 19.8	0 22.7	0 26.7	0 31.7	0 37.5	0 43.9
1	27.7	23.5	20.4	18.4	17.7	18.3	20.1	23.1	27.2	32.2	38.1	44.6
2	27.2	23.1	20.1	18.3	17.7	18.4	20.3	23.4	27.6	32.8	38.7	45.3
3	26.8	22.8	19.9	18.2	17.7	18.5	20.6	23.8	28.1	33.4	39.4	46.0
4	26.3	22.4	19.6	18.1	17.7	18.7	20.9	24.2	28.6	33.9	40.0	46.7
5	0 25.9	0 22.1	0 19.4	0 18.0	0 17.8	0 18.8	0 21.1	0 24.6	0 29.1	0 34.5	0 40.7	0 47.4
6	25.5	21.8	19.2	17.9	17.8	19.0	21.4	25.0	29.6	35.1	41.3	48.0
7	25.0	21.5	19.0	17.8	17.9	19.2	21.7	25.4	30.1	35.7	42.0	48.7
8	24.6	21.2	18.9	17.8	18.0	19.4	22.1	25.8	30.6	36.3	42.6	49.4
9	24.2	20.9	18.7	17.7	18.1	19.6	22.4	26.3	31.2	36.9	43.3	50.1
10	0 23.9	0 20.6	0 18.5	0 17.7	0 18.2	0 19.8	0 22.7	0 26.7	0 31.7	0 37.5	0 43.9	0 50.8

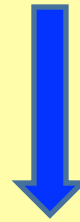


Step 2 Latitude = 22°

Find a_1



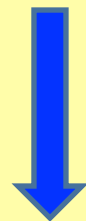
Lat.	a_1	a_1	a_1	a_1	a_1	a_1	a_1	a_1	a_1	a_1	a_1	a_1
0	0.5	0.5	0.6	0.6	0.6	0.6	0.6	0.5	0.5	0.4	0.4	0.3
10	.5	.6	.6	.6	.6	.6	.6	.5	.5	.4	.4	.4
20	.5	.6	.6	.6	.6	.6	.6	.5	.5	.5	.4	.4
30	.5	.6	.6	.6	.6	.6	.6	.6	.5	.5	.5	.5
40	0.6	0.6	0.6	0.6	0.6	0.6	0.6	0.6	0.6	0.5	0.5	0.5
45	.6	.6	.6	.6	.6	.6	.6	.6	.6	.6	.6	.6
50	.6	.6	.6	.6	.6	.6	.6	.6	.6	.6	.6	.6
55	.6	.6	.6	.6	.6	.6	.6	.6	.6	.6	.6	.7
60	.6	.6	.6	.6	.6	.6	.6	.6	.7	.7	.7	.7
62	0.7	0.6	0.6	0.6	0.6	0.6	0.6	0.7	0.7	0.7	0.7	0.8
64	.7	.6	.6	.6	.6	.6	.6	.7	.7	.7	.8	.8
66	.7	.7	.6	.6	.6	.6	.6	.7	.7	.8	.8	.8
68	0.7	0.7	0.6	0.6	0.6	0.6	0.6	0.7	0.7	0.8	0.9	0.9



Step 3 Month = March find a_2



Month	a_2	a_2	a_2	a_2	a_2	a_2	a_2	a_2	a_2	a_2	a_2	a_2
Jan.	0.7	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.7	0.7	0.7
Feb.	0.7	0.7	0.8	0.8	0.8	0.8	0.9	0.9	0.9	0.9	0.9	0.8
Mar.	0.5	0.6	0.6	0.7	0.8	0.8	0.9	0.9	0.9	0.9	0.9	0.9
Apr.	0.4	0.4	0.5	0.6	0.6	0.7	0.8	0.8	0.9	0.9	0.9	1.0
May	0.3	0.3	0.4	0.4	0.5	0.5	0.6	0.7	0.7	0.8	0.9	0.9
June	0.2	0.2	0.3	0.3	0.3	0.4	0.5	0.5	0.6	0.7	0.7	0.8
July	0.3	0.3	0.3	0.3	0.3	0.3	0.4	0.4	0.4	0.5	0.6	0.6
Aug.	0.4	0.4	0.3	0.3	0.3	0.3	0.3	0.3	0.3	0.4	0.4	0.5
Sept.	0.6	0.5	0.5	0.4	0.4	0.4	0.3	0.3	0.3	0.3	0.3	0.3
Oct.	0.8	0.7	0.6	0.6	0.5	0.5	0.4	0.4	0.3	0.3	0.3	0.3
Nov.	0.9	0.9	0.8	0.8	0.7	0.6	0.6	0.5	0.4	0.4	0.3	0.3
Dec.	1.0	1.0	1.0	0.9	0.9	0.8	0.7	0.7	0.6	0.5	0.4	0.4



Calculate Latitude

$$\text{Latitude} = \text{Ho} - 1^\circ + a_0 + a_1 + a_2$$

$$\text{Latitude} = 22^\circ 35.3' - 1^\circ + 30.1' + 0.5' + 0.9'$$

$$\text{Latitude} = 22^\circ 06.8' \text{ N}$$

This resulting Latitude is 0.2 mi North of our DR
Latitude of 22° 06.6' N

Final Worksheet

Step 1 Correct Hs to get Ho				
1-1	Record Maximum Sextant Height	Hs	22 °	48
1-2	Record Index Correction (mark sign + if off, - if on)	IC	Off + On -	0
1-3	Record eye height (HE) and look up Dip Correction on the right-hand side of Table A2, front of Almanac (T-8 in notes)	Dip		10.4
	HE (ft)	115		
1-4	Record Maximum Sextant Height	Ha	22 °	37.6
1-5	Look up the altitude correction in the center of Table A2, front of the Almanac (T-8 in notes)	Alt corr.	+ -	2.3
1-6	Sum the above two numbers to get Observed Height	Ho	22 °	35.3

Starpath Form 110
for
Polaris Sights

Step 2 Find LHA Aries		GMT date = 11-Mar-11	
2-1	GMT Time in Hours, Minutes and Seconds	GMT time = 23:13:55	
2-2	Find GHA Aries on Left Hand Daily Page of the Nautical Almanac (far left column) for GMT Day and Hour	GHA Aries (Hr) =	154 15.5
2-3	Find GHA Aries minutes correction from Increments and Corrections pages	GHA Aries (Min) =	3 29.3
2-4	GHA Aries - Sum the above two numbers	GHA Aries =	157 44.8
2-5	DR Longitude (-W, +E)	DR Long =	70 54.7
2-6	LHA Aries (Combine previous numbers)	LHA Aries =	86 50.1
Step 3 Latitude Determination			
3-1	HO	HO =	22 35.3
3-2	a0 from Polaris Table (using LHA Aries)	a0 =	30.1
3-3	a1 from Polaris Table (using DR Latitude)	a1 =	0.5
3-4	a2 from Polaris Table (using Month)	a2 =	0.9
3-5	Subtract 1 Degree	- 1 =	21
3-6	Sum the above five numbers to get LATITUDE	LATITUDE = N	22 6.8