

Pub. No. 249 star sight reduction form

Sight #	1	2			
Star	Alpheratz	Kochab			
DR. Latitude	N 40°	N 40°			
DR. Longitude	W 075°	W 075°			
Date	9/22/2016	9/21/2016			
UT	01:20:15	01:25:37			
Hs	84° 43'	80° 25'			
Index Error	+ 0° 01' (On)	+ 0° 01' (On)			
Hs - Index Error	84° 42'				
Dip	Using AH				
(AH / 2) = Ha	42° 21'				
ACT	-0° 1.1'				
Ho	42° 19.9'				
GHA Υ	16° 19.6'				
GHA Υ increment for minutes & seconds	5° 04.6'				
GHA Υ	21° 24.2'				
AP λ	W 075° 24.2'				
LHA Υ	306°				
Hc	43° 12'				
Zn	085°				
Intercept	0° 52' <i>Away</i>				

Star sight reduction

Ho 249 Vol. 1

Sight, Star, 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
Star	The name of the star you're shooting	USNO Navigational Star Chart Alpheratz is located in the constellation Andromeda	Alpheratz
DR. Latitude	Dead Reckoning Latitude	DR. Latitude means <i>Ded Reckoning Latitude</i> and uses the integral degree of Latitude. It's the Latitude <i>you think you're closest to</i> based on your DR Log. Example- N 40° Note- DR Latitude is also, and often, referred to as Ap Latitude- <i>Assumed position Latitude</i> and is typically derived from your DR Log.	N 40°
DR. Longitude	Dead Reckoning Longitude	DR. Longitude means <i>Ded Reckoning Longitude</i> and is the integral degree of Longitude <i>you think you're closest to</i> based on your DR Log. Example- W 075° Note- DR Longitude is also, and often, referred to as Ap Longitude- <i>Assumed position Longitude</i> and is typically derived from your DR Log.	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 <i>Time</i> below	September 22, 2016
Time	<p>GMT Greenwich Mean Time also known as UT</p> <p>It's based on a 24 hour number.</p>	<p>The time based on Greenwich/Universal Time. Get the time in GMT/UT here- http://time.is/UTC</p> <p>Call NIST- 303-499-7111</p> <p>Shortwave radio- WWV & WWVH 2.5, 5, 10, 15, 20 MHz.</p> <p>To figure GMT add or subtract the time difference between your time zone and Greenwich England.</p> <p>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.</p> <p>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.</p>	01:20:15

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 star 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.	84° 43'
Index Error	The amount of misalignment between the Index mirror and the Horizon mirror.	<p>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.</p> <p>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.</p> <p>If the IE is greater than 0° then the IE is <i>on the arc</i> and must be subtracted from the Hs.</p> <p>If the IE is less than 0° then the IE is <i>off the arc</i> and must be added to the Hs.</p> <p>In our example the IE is <i>on the arc</i> so it must be subtracted from the Hs.</p>	0° 01'
Hs- Index Error	Height of sextant minus the Index Error.	Subtract the Index Error from the Height of sextant.	$\begin{array}{r} \text{(Hs) } 84^{\circ} 43' \\ - 0^{\circ} 01' \\ \hline 84^{\circ} 42' \end{array}$
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.	<p>Dip correction can be found on ALTITUDE CORRECTION TABLES 10° -90° —SUN, STARS, PLANETS on the right hand column of that table.</p> <p>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).</p> <p>ALTITUDE CORRECTION TABLES are attached at the end herein.</p>	When using an AH there is no need to correct for Dip.
(AH / 2)= Ha	Hs <i>minus</i> Index Error divided by 2 = Ha Ha means <i>Height apparent</i> .	Get the final figure from Hs <i>minus</i> Index Error (above) and divide it by 2. The result is the Ha <i>or Height apparent</i> .	$\begin{array}{r} 84^{\circ} 42' \\ \text{divided by 2} \\ \hline \text{Ha} = 42^{\circ} 21' \end{array}$
ACT	Altitude Correction Table	<p>ALTITUDE CORRECTION TABLES are attached at the end herein.</p> <p>Use the ALTITUDE CORRECTION TABLES 10° -90° — SUN,STARS,PLANETS. For brevity these tables are referred to as ACT. Find the <i>Ha</i> correction for the star in the STARS AND PLANETS column. Find where the Ha of 42° 21' would approximately be located- between 40° 08' and 42° 44'.</p> <p>For stars the correction is always subtracted from the Ha figure.</p>	-0° 1.1'
Ho	Height observed	Subtract the star ACT (0° 1.1') from the Ha to arrive at the <i>Ho</i> (Height observed). After all of the above corrections Ho= 42° 19.9' (round it up to 42° 20').	$\begin{array}{r} \text{(Ha) } 42^{\circ} 21' \\ \text{(Act)- } 0^{\circ} 1.1' \\ \hline \text{Ho} = 42^{\circ} 20' \end{array}$

Getting GHA Aries

Form label	What is it?	Where to get it?	Figure
GHA Υ	Greenwich Hour Angle Aries based on the integral hour and date of the sextant observation.	The necessary portion of The Nautical Almanac is provided at the end of this file. You'll find the GHA Υ in The Nautical Almanac daily pages for the date and time of the observation. The GHA Υ figure is based only on the integral hour of the observation. Get The Nautical Almanac <i>daily pages</i> at TheNauticalAlmanac.com	16° 19.6'
GHA Υ increment for minutes & seconds	Greenwich Hour Angle Aries increment for the minutes and seconds of time of the sextant observation.	The Nautical Almanac- <i>Increments & Corrections for Sun, Planets, Aries, Moon (the "yellow pages")</i> for the minutes and seconds of time of the observation. You can get the Increments & Corrections Table here- https://thenauticalalmanac.com/Increments & Corrections Table.pdf You can also use the GHA Υ Increment from TABLE 4 -- GHA Υ FOR THE YEARS 2011 – 2019 (the second page of TABLE 4) The second page of TABLE 4 is provided at the end of this file.	5° 04.6'
GHA Υ	Greenwich Hour Angle Aries total	Add the GHA Υ integral hour figure to the GHA Υ Increment figure. Round the final figure up or down.	16° 19.6' + 5° 04.6' <hr/> 21° 24.2'

Calculating LHA Aries

Form label	What is it?	Where to get it?	Figure
Ap λ	Assumed position Longitude	Combine the DR. Longitude figure with only the minutes (of arc) of the total GHA Υ figure. The Ap λ figure will be used when plotting the LOP on the UPS.	DR Longitude W 075° Ap λ W075° 24.2'
LHA Υ	Local Hour Angle Aries total	To get the LHA Υ subtract or add the Ap λ from/to the GHA Υ total according to the following rules- In Western longitudes Subtract Ap λ from the GHA total. Ignore the minutes of GHA. In Western Longitudes if GHA is <i>less than</i> the Ap λ first add 360 to the GHA and then subtract the Ap λ from it. In Eastern longitudes Round up the GHA Υ to next highest degree and add the DR. longitude integral degree to it. If the resulting figure is over 360 then subtract 360 from it.	GHA Υ 21° 24.2' + 360° <hr/> 381° 24.2' <hr/> 381° 24.2' - Ap λ W 075° 24.2' <hr/> LHA Υ = 306°

$$\text{LHA } \Upsilon = 306^\circ$$

The LHA figure and DR. Latitude figure are both needed to find Hc and Zn in Pub. No. 249 Vol. 1

Finding Hc and Zn

Form label	What is it?	Where to get it?	Figure
Hc	Height computed	<p>The necessary portion of Pub. No. 249 Vol. 1 is provided at the end of this file.</p> <p>Hc is found in Pub. No. 249 Vol 1.</p> <p>To find Hc you need the DR. Latitude (N 40°) and the LHA Υ (306°).</p> <p>Locate the LHA Υ row of 306° on the sheet and move across until you see where the star, Alpheratz, intersects that row. Find Hc in the Hc column under Alpheratz</p>	Hc= 43° 12'
Zn	Azimuth number or Azimuth angle	<p>The necessary portion of Pub. No. 249 Vol. 1 is provided at the end of this file.</p> <p>Zn is the horizontal angle in degrees that points to the star from the Ap. λ.</p> <p>Approximately, and close enough for us, Zn is the horizontal angle that points to the star from where we took the sextant observation.</p> <p>Zn is based on True North and not magnetic North.</p> <p>Locate the LHA Υ row of 306° on the sheet and move across until you see where the star, Alpheratz, intersects that row. Find Zn in the Zn column under Alpheratz</p>	Zn= 085°
Intercept	Intercept is the distance and direction the LOP (Line Of Position) is drawn from the Ap. λ	<p>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.</p> <p>The direction of the intercept line must be determined and is drawn either <i>Away</i> or <i>Towards</i> the star on the azimuth line from the Ap λ of W 075° 24.2'.</p> <p>If Hc is greater then the Intercept point is <i>Away</i> from the Ap λ. If Ho is greater then the Intercept point is <i>Towards</i> the star beginning at the Ap λ.</p> <p>The UPS LOP plot is at the end of this file.</p>	Hc= 43° 12' Ho= 42° 20' Intercept= 0° 52'

Portrait 249- Further explanation.odt

/home/kd/MD/AAAA- CelNav C/Further Explanation/Ho 249/Portrait 249- Further explanation.odt

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			
						2003				m		ft.					
						VENUS				2.4		-2.8		8.0		1.0 - 1.8	
						Jan. 1–Feb. 20				2.6		-2.9		8.6		1.5 - 2.2	
						° /				2.8		-3.0		9.2		2.0 - 2.5	
						0 +0.2				3.0		-3.1		9.8		2.5 - 2.8	
						41 +0.1				3.2		-3.2		10.5		3.0 - 3.0	
						76 +0.1				3.4		-3.3		11.2		←	
						Feb. 21–Dec. 31				3.6		-3.4		11.9		See table	
						° /				3.8		-3.5		12.6		←	
						0 +0.1				4.0		-3.6		13.3		m /	
						60 +0.1				4.3		-3.7		14.1		20 - 7.9	
						MARS				4.5		-3.8		14.9		22 - 8.3	
						Jan. 1–May 2				4.7		-3.9		15.7		24 - 8.6	
						Dec. 17–Dec. 31				5.0		-4.0		16.5		26 - 9.0	
						° /				5.2		-4.1		17.4		28 - 9.3	
						0 +0.1				5.5		-4.2		18.3		30 - 9.6	
						60 +0.1				5.8		-4.3		19.1		32 - 10.0	
						May 3–June 26				6.1		-4.4		20.1		34 - 10.3	
						Oct. 26–Dec. 16				6.3		-4.5		21.0		36 - 10.6	
						° /				6.6		-4.6		22.0		38 - 10.8	
						0 +0.2				6.9		-4.7		22.9		←	
						41 +0.1				7.2		-4.8		23.9		40 - 11.1	
						76 +0.1				7.5		-4.9		24.9		42 - 11.4	
						June 27–Aug. 1				7.9		-5.0		26.0		44 - 11.7	
						Sept. 23–Oct. 25				8.2		-5.1		27.1		46 - 11.9	
						° /				8.5		-5.2		28.1		48 - 12.2	
						0 +0.3				8.8		-5.3		29.2		ft.	
						34 +0.2				9.2		-5.4		30.4		2 - 1.4	
						60 +0.1				9.5		-5.5		31.5		4 - 1.9	
						80 +0.1				9.9		-5.6		32.7		6 - 2.4	
						Aug. 2–Sept. 22				10.3		-5.7		33.9		8 - 2.7	
						° /				10.6		-5.8		35.1		10 - 3.1	
						0 +0.4				11.0		-5.9		36.3		←	
						29 +0.3				11.4		-6.0		37.6		See table	
						51 +0.2				11.8		-6.1		38.9		←	
						68 +0.1				12.2		-6.2		40.1		ft.	
						83				12.6		-6.3		41.5		70 - 8.1	
						25 14 -2.0				13.0		-6.4		42.8		75 - 8.4	
						26 22 -1.9				13.4		-6.5		44.2		80 - 8.7	
						27 36 -1.8				13.8		-6.6		45.5		85 - 8.9	
						28 56 -1.7				14.2		-6.7		46.9		90 - 9.2	
						30 24 -1.6				14.7		-6.8		48.4		95 - 9.5	
						32 00 -1.5				15.1		-6.9		49.8		←	
						33 45 -1.4				15.5		-7.0		51.3		100 - 9.7	
						35 40 -1.3				16.0		-7.1		52.8		105 - 9.9	
						37 48 -1.2				16.5		-7.2		54.3		110 - 10.2	
						40 08 -1.1				16.9		-7.3		55.8		115 - 10.4	
						42 44 -1.0				17.4		-7.4		57.4		120 - 10.6	
						45 36 -0.9				17.9		-7.5		58.9		125 - 10.8	
						48 47 -0.8				18.4		-7.6		60.5		←	
						52 18 -0.7				18.8		-7.7		62.1		130 - 11.1	
						56 11 -0.6				19.3		-7.8		63.8		135 - 11.3	
						60 28 -0.5				19.8		-7.9		65.4		140 - 11.5	
						65 08 -0.4				20.4		-8.0		67.1		145 - 11.7	
						70 11 -0.3				20.9		-8.1		68.8		150 - 11.9	
						75 34 -0.2				21.4		-8.1		70.5		155 - 12.1	
						81 13 -0.1											
						87 03 0.0											
						90 00 0.0											

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

September 21, 22, 23 (Wed., Thu., Fri.)

Aries		Venus		Mars		Jupiter		Saturn		Stars		
Wed	GHA	GHA	Dec	GHA	Dec	GHA	Dec	GHA	Dec	SHA	Dec	
0	0°18.0	155°19.9	-10°05.0	94°50.0	-25°54.0	177°35.7	0°01.1	110°41.9	-20°37.5	Alpheratz	357°40.8	29°11.1
1	15°20.5	170°19.5	-10°06.2	109°50.7	-25°54.0	192°37.7	0°00.9	125°44.2	-20°37.6	Ankaa	353°13.2	-42°12.8
2	30°23.0	185°19.1	-10°07.4	124°51.4	-25°54.0	207°39.7	0°00.6	140°46.5	-20°37.6	Schedar	349°37.3	56°37.7
3	45°25.4	200°18.7	-10°08.6	139°52.1	-25°54.0	222°41.6	0°00.4	155°48.8	-20°37.6	Diphda	348°53.3	-17°53.6
4	60°27.9	215°18.4	-10°09.8	154°52.8	-25°54.1	237°43.6	0°00.2	170°51.1	-20°37.6	Achernar	335°24.7	-57°09.0
5	75°30.3	230°18.0	-10°11.0	169°53.5	-25°54.1	252°45.6	-0°00.0	185°53.4	-20°37.7	Hamal	327°58.0	23°32.4
6	90°32.8	245°17.6	-10°12.2	184°54.2	-25°54.1	267°47.6	-0°00.2	200°55.7	-20°37.7	Polaris	316°26.0	89°19.8
7	105°35.3	260°17.2	-10°13.4	199°54.9	-25°54.1	282°49.5	-0°00.4	215°58.0	-20°37.7	Akamar	315°16.4	-40°14.2
8	120°37.7	275°16.8	-10°14.6	214°55.6	-25°54.1	297°51.5	-0°00.6	231°00.3	-20°37.8	Menkar	314°12.5	4°09.3
9	135°40.2	290°16.4	-10°15.8	229°56.3	-25°54.2	312°53.5	-0°00.9	246°02.6	-20°37.8	Mirfak	308°36.8	49°54.9
10	150°42.7	305°16.0	-10°17.0	244°57.0	-25°54.2	327°55.4	-0°01.1	261°04.9	-20°37.8	Aldebaran	290°46.7	16°32.4
11	165°45.1	320°15.6	-10°18.2	259°57.7	-25°54.2	342°57.4	-0°01.3	276°07.3	-20°37.8	Rigel	281°09.9	-8°11.0
12	180°47.6	335°15.3	-10°19.4	274°58.4	-25°54.2	357°59.4	-0°01.5	291°09.6	-20°37.9	Capella	280°31.1	46°00.6
13	195°50.1	350°14.9	-10°20.6	289°59.1	-25°54.2	13°01.3	-0°01.7	306°11.9	-20°37.9	Bellatrix	278°29.6	6°21.8
14	210°52.5	5°14.5	-10°21.8	304°59.8	-25°54.2	28°03.3	-0°01.9	321°14.2	-20°37.9	Elnath	278°09.8	28°37.1
15	225°55.0	20°14.1	-10°23.1	320°00.5	-25°54.3	43°05.3	-0°02.1	336°16.5	-20°38.0	Alnilam	275°44.1	-1°11.5
16	240°57.5	35°13.7	-10°24.3	335°01.2	-25°54.3	58°07.2	-0°02.4	351°18.8	-20°38.0	Betelgeuse	270°58.9	7°24.5
17	255°59.9	50°13.3	-10°25.5	350°01.9	-25°54.3	73°09.2	-0°02.6	6°21.1	-20°38.0	Canopus	263°55.2	-52°42.1
18	271°02.4	65°12.9	-10°26.7	5°02.6	-25°54.3	88°11.2	-0°02.8	21°23.4	-20°38.0	Sirius	258°31.7	-16°44.1
19	286°04.8	80°12.5	-10°27.9	20°03.3	-25°54.3	103°13.1	-0°03.0	36°25.7	-20°38.1	Adara	255°10.9	-28°59.6
20	301°07.3	95°12.1	-10°29.1	35°04.0	-25°54.3	118°15.1	-0°03.2	51°28.0	-20°38.1	Procyon	244°57.5	5°11.0
21	316°09.8	110°11.8	-10°30.3	50°04.7	-25°54.3	133°17.1	-0°03.4	66°30.3	-20°38.1	Pollux	243°25.1	27°59.0
22	331°12.2	125°11.4	-10°31.5	65°05.4	-25°54.4	148°19.1	-0°03.6	81°32.6	-20°38.2	Avior	234°17.4	-59°33.6
23	346°14.7	140°11.0	-10°32.7	80°06.1	-25°54.4	163°21.0	-0°03.9	96°34.9	-20°38.2	Suhail	222°51.1	-43°29.9
Mer.pass.:23:54		v-0.4 d-1.2 m-3.8		v0.7 d-0.0 m-0.1		v2.0 d-0.2 m-1.5		v2.3 d-0.0 m0.5		Miaplacidus	221°39.8	-69°47.0
										Alphard	217°54.2	-8°43.8
										Regulus	207°41.4	11°53.2
										Dubhe	193°49.8	61°39.6
										Denebola	182°31.7	14°28.9
										Genah	175°50.3	-17°37.9
										Acruz	173°07.4	-63°11.4
										Gacrux	171°58.9	-57°12.3
										Alioth	166°19.4	55°52.4
										Spica	158°29.2	-11°14.7
										Alcaid	152°57.7	49°14.1
										Hadar	148°45.2	-60°27.1
										Menkent	148°05.3	-36°27.0
										Arcturus	145°53.9	19°06.3
										Rigel Kent.	139°49.1	-60°54.2
										Zubenelg.	137°03.2	-16°06.4
										Kochab	137°21.1	74°05.6
										Alphecca	126°09.4	26°39.9
										Antares	112°23.7	-26°27.9
										Atria	107°23.6	-69°03.4
										Sabik	102°10.1	-15°44.5
										Shaula	96°19.0	-37°06.8
										Rasalhague	96°04.5	12°33.3
										Etamin	90°45.1	51°29.7
										Kaus Aust.	83°40.8	-34°22.4
										Vega	80°37.4	38°48.4
										Nunki	75°55.5	-26°16.4
										Altair	62°06.0	8°55.0
										Peacock	53°15.5	-56°40.8
										Deneb	49°29.7	45°20.8
										Enif	33°44.7	9°57.3
										Alnair	27°40.7	-46°52.7
										Fomalhaut	15°21.3	-29°31.9
										Scheat	13°50.9	28°10.6
										Markab	13°35.8	15°17.9
										2016/9/2	SHA	Mer.pass
										Venus	155°01.9	13:39
										Mars	94°32.0	17:40
										Jupiter	177°17.7	12:08
										Saturn	110°23.8	16:35
										2016/9/2	SHA	Mer.pass
										Venus	153°53.4	13:40
										Mars	93°49.6	17:39
										Jupiter	177°05.8	12:05
										Saturn	110°20.1	16:31
										2016/9/2	SHA	Mer.pass
										Venus	152°44.8	13:40
										Mars	93°07.0	17:38
										Jupiter	176°53.9	12:02
										Saturn	110°16.2	16:27
										Horizontal parallax		
										Venus:	0.1	
										Mars:	0.1	
Mer.pass.:23:47		v-0.4 d-1.2 m-3.8		v0.7 d-0.0 m-0.0		v2.0 d-0.2 m-1.5		v2.3 d-0.0 m0.5				

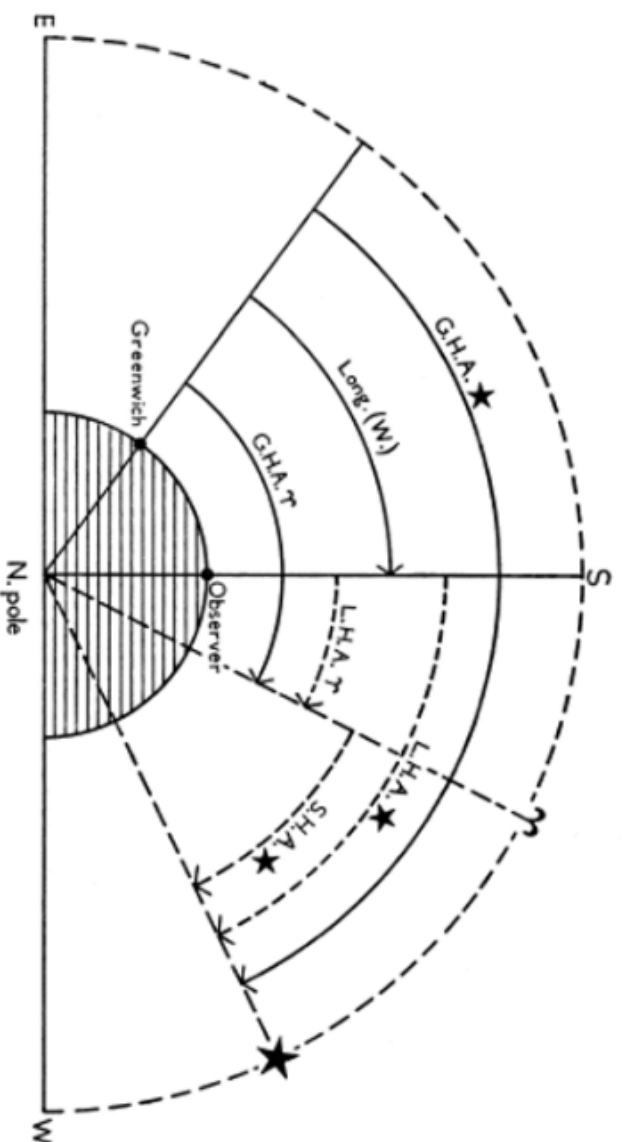
TABLE 4 — GHA Y FOR THE YEARS 2011-2019

c. INCREMENT OF GHA Y FOR MINUTES AND SECONDS

	00 ^s	04 ^s	08 ^s	12 ^s	16 ^s	20 ^s	24 ^s	28 ^s		32 ^s	36 ^s	40 ^s	44 ^s	48 ^s	52 ^s	56 ^s	60 ^s	
m	o	r	o	r	o	r	o	r	m	o	r	o	r	o	r	o	r	m
00	0	00	0	01	0	02	0	03	00	0	08	0	09	0	10	0	11	00
01	0	15	0	16	0	17	0	18	01	0	23	0	24	0	25	0	26	01
02	0	30	0	31	0	32	0	33	02	0	38	0	39	0	40	0	41	02
03	0	45	0	46	0	47	0	48	03	0	53	0	54	0	55	0	56	03
04	1	00	1	01	1	02	1	03	04	1	08	1	09	1	10	1	11	04
05	1	15	1	16	1	17	1	18	05	1	23	1	24	1	25	1	26	05
06	1	30	1	31	1	32	1	33	06	1	38	1	39	1	40	1	41	06
07	1	45	1	46	1	47	1	48	07	1	53	1	54	1	55	1	56	07
08	2	00	2	01	2	02	2	03	08	2	08	2	09	2	10	2	11	08
09	2	15	2	16	2	17	2	18	09	2	23	2	24	2	25	2	26	09
10	2	30	2	31	2	32	2	33	10	2	38	2	39	2	40	2	41	10
11	2	45	2	46	2	47	2	48	11	2	53	2	54	2	55	2	56	11
12	3	00	3	01	3	02	3	03	12	3	09	3	10	3	11	3	12	12
13	3	16	3	17	3	18	3	19	13	3	24	3	25	3	26	3	27	13
14	3	31	3	32	3	33	3	34	14	3	39	3	40	3	41	3	42	14
15	3	46	3	47	3	48	3	49	15	3	54	3	55	3	56	3	57	15
16	4	01	4	02	4	03	4	04	16	4	09	4	10	4	11	4	12	16
17	4	16	4	17	4	18	4	19	17	4	24	4	25	4	26	4	27	17
18	4	31	4	32	4	33	4	34	18	4	39	4	40	4	41	4	42	18
19	4	46	4	47	4	48	4	49	19	4	54	4	55	4	56	4	57	19
20	5	01	5	02	5	03	5	04	20	5	09	5	10	5	11	5	12	20
21	5	16	5	17	5	18	5	19	21	5	24	5	25	5	26	5	27	21
22	5	31	5	32	5	33	5	34	22	5	39	5	40	5	41	5	42	22
23	5	46	5	47	5	48	5	49	23	5	54	5	55	5	56	5	57	23
24	6	01	6	02	6	03	6	04	24	6	09	6	10	6	11	6	12	24
25	6	16	6	17	6	18	6	19	25	6	24	6	25	6	26	6	27	25
26	6	31	6	32	6	33	6	34	26	6	39	6	40	6	41	6	42	26
27	6	46	6	47	6	48	6	49	27	6	54	6	55	6	56	6	57	27
28	7	01	7	02	7	03	7	04	28	7	09	7	10	7	11	7	12	28
29	7	16	7	17	7	18	7	19	29	7	24	7	25	7	26	7	27	29
30	7	31	7	32	7	33	7	34	30	7	39	7	40	7	41	7	42	30
31	7	46	7	47	7	48	7	49	31	7	54	7	55	7	56	7	57	31
32	8	01	8	02	8	03	8	04	32	8	09	8	10	8	11	8	12	32
33	8	16	8	17	8	18	8	19	33	8	24	8	25	8	26	8	27	33
34	8	31	8	32	8	33	8	34	34	8	39	8	40	8	41	8	42	34
35	8	46	8	47	8	48	8	49	35	8	54	8	55	8	56	8	57	35
36	9	01	9	02	9	03	9	04	36	9	10	9	11	9	12	9	13	36
37	9	17	9	18	9	19	9	20	37	9	25	9	26	9	27	9	28	37
38	9	32	9	33	9	34	9	35	38	9	40	9	41	9	42	9	43	38
39	9	47	9	48	9	49	9	50	39	9	55	9	56	9	57	9	58	39
40	10	02	10	03	10	04	10	05	40	10	10	10	11	10	12	10	13	40
41	10	17	10	18	10	19	10	20	41	10	25	10	26	10	27	10	28	41
42	10	32	10	33	10	34	10	35	42	10	40	10	41	10	42	10	43	42
43	10	47	10	48	10	49	10	50	43	10	55	10	56	10	57	10	58	43
44	11	02	11	03	11	04	11	05	44	11	10	11	11	11	12	11	13	44
45	11	17	11	18	11	19	11	20	45	11	25	11	26	11	27	11	28	45
46	11	32	11	33	11	34	11	35	46	11	40	11	41	11	42	11	43	46
47	11	47	11	48	11	49	11	50	47	11	55	11	56	11	57	11	58	47
48	12	02	12	03	12	04	12	05	48	12	10	12	11	12	12	12	13	48
49	12	17	12	18	12	19	12	20	49	12	25	12	26	12	27	12	28	49
50	12	32	12	33	12	34	12	35	50	12	40	12	41	12	42	12	43	50
51	12	47	12	48	12	49	12	50	51	12	55	12	56	12	57	12	58	51
52	13	02	13	03	13	04	13	05	52	13	10	13	11	13	12	13	13	52
53	13	17	13	18	13	19	13	20	53	13	25	13	26	13	27	13	28	53
54	13	32	13	33	13	34	13	35	54	13	40	13	41	13	42	13	43	54
55	13	47	13	48	13	49	13	50	55	13	55	13	56	13	57	13	58	55
56	14	02	14	03	14	04	14	05	56	14	10	14	11	14	12	14	13	56
57	14	17	14	18	14	19	14	20	57	14	25	14	26	14	27	14	28	57
58	14	32	14	33	14	34	14	35	58	14	40	14	41	14	42	14	43	58
59	14	47	14	48	14	49	14	50	59	14	55	14	56	14	57	14	58	59

Example. The value of GHAY for 2012 August 17 at 05^h 11^m 41^s UT is (a) 310° 00' + (b) 090° 59' + (c) 002° 55' = 043° 54'.

GHA LHA SHA diagram



The above diagram, showing the plane of the equator as seen from the north pole, illustrates the relationship between the Greenwich and local hour angles, and longitude and sidereal hour angle.

G.H.A. of Aries (γ), Sun, Moon and planets are tabulated directly ; for these :

$$L.H.A. = G.H.A. - W. longitude (+ E. longitude)$$

For the stars :

$$G.H.A. * = G.H.A. \gamma + S.H.A. *$$

$$L.H.A. * = G.H.A. \gamma + S.H.A. * - W. longitude (+ E. longitude)$$

$$L.H.A. * = L.H.A. \gamma + S.H.A. *$$

