

How to use- TABLE 4. - GHA and Declination of the Sun for the Years 2001 to 2036- Argument "Orbit Time"

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Before beginning

TABLE 4 is attached herein.

TABLE 4 is convenient in size as you don't have to print out a multitude of pages from The Nautical Almanac. It does take a little longer to get GHA & Declination but you may find the savings in space worth the effort.

The GMT hour numbers on the left column of the date & time sheet are very small and hard to see. It was the only way to fit the time in linear form on one page.

Certain words are in bold which should direct you to, or remind you of, specific numbers and places either on TABLE 4 or on the time & date sheet. Dec. is written as such because that's the word you'll be looking for on TABLE 4's first page and not the word *Declination*.

To speed the entire process get the **E** figure, **Dec.** and dec. difference figure in one step since they're located next to each other.

This explanation was written because the "EXPLANATION" on page two of TABLE 4 is too confusing and obscure.

Errors or clarification in procedure

Contact us if you find any errors or need clarification about the following procedure.

How to find Sun's GHA using TABLE 4

TABLE 4. - GHA and Declination of the Sun for the Years 2001 to 2036- Argument "Orbit Time"

In this explanation use the following date and GMT-

January 22, 2017
GMT 17:20:14

1- Write in the date beside the word "Today" on the **date & time sheet**.

2- Make an "X" beside the box of the GMT hour of 17 (whole, integral hour only).

Refer to- **TABLE 4. - GHA and Declination of the Sun for the Years 2001 to 2036- Argument "Orbit Time"**

3- In table **a. Corr. from GMT to OT** find the year 2017 in the **Year** column. To the right of 2017 In the **Corr. h** column find the **h** correction of +14. The **h** stands for *hours*.

4- Go back to the **date & time sheet** and add the table **a. Corr. from GMT to OT h** correction amount of +14 hours to the GMT hour figure that you put an X in. Just count 14 spaces down from the GMT time of 17. This will advance the date to *Tomorrow* at GMT 07:00. Beside the word **Tomorrow** write the date of January 23, 2017. This seems confusing but it's necessary to obtain the correct **E** figure.

Note! In this example you're adding the table **a. Corr. from GMT to OT h** correction of +14 hours to the GMT of 17:20:14. You can obtain the same result by adding the two figures and then subtracting the answer from 24 **ONLY IF** the sum is 24 or greater. See the following example-

$$\begin{array}{r}
 \text{GMT-} \\
 \text{table a. Corr. h} \quad 17:20:14 \\
 \quad \quad \quad +14 \\
 \quad \quad \quad \hline
 \quad \quad \quad 31 \\
 \quad \quad \quad -24 \\
 \quad \quad \quad \hline
 \quad \quad \quad \mathbf{7 \text{ hour}}
 \end{array}$$

Write the **7** below the **hour** box on the time & date sheet **Calculate GHA** area.

5- Now get the **E** figure of ° ' (degrees and minutes). It will be found in **TABLE 4** in the **JAN E** column. Find the **d** column on the left hand side of **TABLE 4**. The **d** stands for *day*. Move down the **d** column to the day number 23. To the right of 23 in the **JAN E** column find **2 06**. The **2 06** stands for **2° 06'**. Write the **E** figure of **2° 06'** below the **E** box on the time & date sheet.

6- Determine the difference between consecutive **E** figures. This is found by comparing the **E** figure you just obtained with the next **E** figure below it. Like this;

$$\begin{array}{r}
 \mathbf{2 \ 06} \\
 - \ \mathbf{2 \ 02} \\
 \hline
 \mathbf{-4 \text{ Diff.}}
 \end{array}$$

Label the answer **Diff.** for *Difference* and write – **4** below the **Diff.** box on the time & date sheet.

Notice the **E** figure is decreasing so the answer must have a – (minus) sign before it. If the **E** figure were increasing you'd still need the difference between the two figures but instead a + (plus) sign would be put before the result.

7- Next use table **b. Interpolation for Hours of OT** to get the amount to correct the **E** figure by. Locate the number **4** in the **Diff.** horizontal row of the table. Find the number **7** in the **h** column on the left side of the table. Where those two numbers (each row and column) intersect find the number **1**. This is 1 minute of arc so write **1'** in the box to the left of table **b. Interpolation for Hours of OT** on the date & time sheet.

8- The **Diff.** figure previously found has a – (minus) sign before it so that means you must subtract the **1** found in table **b. Interpolation for Hours of OT** from the **E** figure. The result is **2° 05'** which is the final corrected **E** figure.

From now on use the original date and GMT

January 22, 2017
GMT 17:20:14

9- Now use the second page of **TABLE 4** and find table **c. Hours and Tens of Minutes of GMT**. The top of the table is incremented from 00m (0 minutes) to 50m (50 minutes) in 10 minute increments. The vertical **h** column is incremented in hours from 00 to 23.

First locate **17** in the **h** column. Next locate **20m** at the top of the table. Where row **17** and column **20m** intersect find **75 00**. This stands for **75° 00'**. Write the figure **75° 00'** in the box to the left of **c. Hours and Tens of Minutes of GMT** on the date & time sheet.

10- On the date & time sheet add the **Final corrected E figure** to the table **c. Hours and Tens of Minutes of GMT** to get **77° 05'**.

11- Now use the second page of **TABLE 4** and find table **d. Minutes and Seconds of GMT (in critical cases ascend)**. The table is incremented from 00 00 (00 minutes 00 seconds) to 10 00 (10 minutes 00 seconds).

Note- there are no remaining minutes to find an increment for so you only need to find the increment for 14 seconds.

14 seconds would fall between 13 and 17 seconds in the far left hand column of table **d**. The increment amount is **0° 04'**.

Write the figure **0° 04'** in the box to the left of table **d. Minutes and Seconds of GMT** on the date & time sheet.

12- On the date & time sheet add the **77° 05'** figure to the table **d. Minutes and Seconds of GMT** figure of **0° 04'** to get the final GHA for number of **77° 09'**. This is the calculated GHA for the Sun on January 22, 2017 at GMT 17:20:14.

Compared with using The Nautical Almanac and *Increments & Corrections for Sun, Planets, Aries, Moon (the "yellow pages")*? The result is **77° 08.3'**. The difference is **0° 00.7'**.

How to find Sun's Declination using TABLE 4

TABLE 4. - GHA and Declination of the Sun for the Years 2001 to 2036- Argument "Orbit Time"

In this explanation use the following date and GMT-

January 22, 2017
GMT 17:20:14

Refer to the **date & time sheet** and find the **Calculate Declination** area.

1- Write in the date beside the word "Today" on the **date & time sheet**.

2- Make an "X" beside the box of the GMT hour of 17 (whole, integral hour only).

Refer to- **TABLE 4. - GHA and Declination of the Sun for the Years 2001 to 2036- Argument "Orbit Time"**

3- In table **a. Corr. from GMT to OT** find the year 2017 in the **Year** column. To the right of 2017 in the **Corr. h** column find the **h** correction of +14. The **h** stands for *hours*.

4- Go back to the **date & time sheet** and add the table **a. Corr. from GMT to OT h** correction amount of +14 hours to the GMT hour figure that you put an X in. Just count 14 spaces down from the GMT time of 17. This will advance the date to *Tomorrow* at GMT 07:00. Beside the word **Tomorrow** write the date of January 23, 2017. This seems confusing but it's necessary to obtain the correct **Dec.** figure.

Note! In this example you're adding the table **a. Corr. from GMT to OT h** correction of +14 hours to the GMT of 17:20:14. You can obtain the same result by adding the two figures and then subtracting the answer from 24 **ONLY IF** the sum is 24 or greater. See the following example-

GMT-	17:20:14
table a. Corr. h	+14

	31
	-24

	7 hour

Write the **7** below the **hour** box on the time & date sheet **Calculate Declination** area.

5- Now get the declination figure of ° ' (degrees and minutes). It will be found in **TABLE 4** in the **JAN Dec.** column. Find the **d** column on the left hand side of **TABLE 4**. The **d** stands for *day*. Move down the **d** column to the day number 23. To the right of 23 in the **JAN Dec.** column find **19 35**. The **19 35** stands for **19° 35'**. Write the **Dec.** figure of **19° 35'** below the **Dec.** box on the time & date sheet **Calculate Declination** area.

6- Find the difference between consecutive **Dec.** figures. This is already conveniently provided on **Table 4** and found to the right and slightly downward from the **Dec.** figure you just obtained. It's **14** (minutes of arc). Notice the **Dec.** figures are decreasing so the answer must have a - (minus) sign before it. If the **Dec.** figure were increasing you'd put a + (plus) sign before the result.

Write **- 14'** below the **Diff.** box on the time & date sheet **Calculate Declination** area.

7- Next use table **b. Interpolation for Hours of OT** to get the amount to correct the **Dec.** figure by. Locate the number **14** in the **Diff.** horizontal row of the table. Find the number **7** in the **h** column on the left side of the table. Where those two numbers (each row and column) intersect find the number **4**. This is 4 minutes of arc so write **4'** in the box to the left of table **b. Interpolation for Hours of OT** on the date & time sheet **Calculate Declination** area.

8- The **Diff.** figure previously found has a **-** (minus) sign before it so that means you must subtract the **4** found in table **b. Interpolation for Hours of OT** from the **Dec.** figure. The result is **19° 31'**. This is the calculated Declination for the Sun on January 22, 2017 at GMT 17:20:14.

How does the foregoing calculation compare with using The Nautical Almanac ?
The result is **-19° 30.9'**. The difference is **0° 00.1'**



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date & time sheet

0	Yesterday's date-
01	
02	
03	
04	
05	
06	
07	
08	
09	
10	
11	
12	
13	
14	
15	
16	
17	
18	
19	
20	
21	
22	
23	
0	Today's date-
01	
02	
03	
04	
05	
06	
07	
08	
09	
10	
11	
12	
13	
14	
15	
16	
17	
18	
19	
20	
21	
22	
23	
0	Tomorrow's date-
01	
02	
03	
04	
05	
06	
07	
08	
09	
10	
11	
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15	
16	
17	
18	
19	
20	
21	
22	
23	
0	

Calculate GHA

E	Diff.	hour	Line
2° 06'	- 4	7	1
- 1'	table b. Interpolation for Hours of OT		2
2° 05'	Final corrected E figure		3
75° 00'	table c. Hours and Tens of Minutes of GMT		4
77° 05'	Add the two figures above (add lines 3 & 4)		5
0° 04'	table d. Minutes and Seconds of GMT		6
77° 09'	Add the two figures above (add lines 5 & 6)		7
77° 09'	GHA for the Sun for January 22, 2017 GMT 17:20:14		8

GHA work area

E	Diff.	hour	Line
			1
	table b. Interpolation for Hours of OT		2
	Final corrected E figure		3
	table c. Hours and Tens of Minutes of GMT		4
	Add the two figures above (add lines 3 & 4)		5
	table d. Minutes and Seconds of GMT		6
	Add the two figures above (add lines 5 & 6)		7
	GHA for the Sun for		8

Calculate Declination

Dec.	Diff.	hour	Line
19° 35'	- 14	7	1
- 4'	table b. Interpolation for Hours of OT		2
19° 31'	Final corrected Dec. figure		3
19° 31'	Declination for the Sun for January 22, 2017 GMT 17:20:14		4

Declination work area

Dec.	Diff.	hour	Line
			1
	table b. Interpolation for Hours of OT		2
	Final corrected Dec. figure		3
	Declination for the Sun for January 22, 2017 GMT 17:20:14		4`

TABLE 4.—GHA and Declination of the Sun for the Years 2001–2036 — Argument “Orbit Time”

OT 00 ^h	JAN		FEB		MAR		APR		MAY		JUN		JUL		AUG		SEP		OCT		NOV		DEC		OT 00 ^h
	E	Dec.	E	Dec.	E	Dec.	E	Dec.	E	Dec.	E	Dec.	E	Dec.	E	Dec.	E	Dec.	E	Dec.	E	Dec.	E	Dec.	
1	3 38	S17 16 17	1 53	S 7 49 23	3 58	N 4 19 23	5 42	N14 54 18	5 35	N21 58	4 05	N23 08	3 24	N18 10 16	4 56	N 8 29 21	7 31	S 2 57 24	9 06	S14 14 19	7 50	S21 42	1	d	
2	4 05	22 58 6	1 36	16 59 18	1 56	7 26 23	4 03	4 42 23	5 44	15 12 18	5 32	22 06 8	4 02	23 04	4 3 25	17 54 15	5 01	8 08 22	7 36	3 21 23	9 07	14 33 19	7 44	21 51 9	
3	3 58	22 52 6	1 35	16 41 17	1 59	7 03 23	4 07	5 05 23	5 46	15 30 17	5 30	22 00 8	3 59	23 00	4 3 26	17 39 16	5 06	7 46 22	7 41	3 44 23	9 07	14 52 19	7 38	22 00 9	
4	3 52	22 47 7	1 35	16 24 18	2 02	6 40 23	4 12	5 28 23	5 47	15 47 18	5 28	22 14 8	3 56	23 05	3 28	17 23 15	5 11	7 24 22	7 46	4 07 23	9 07	15 11 18	7 33	22 09 8	
5	3 45	22 40 6	1 32	16 06 18	2 05	6 17 23	4 16	5 51 23	5 49	16 05 17	5 25	22 29 6	3 53	22 50	3 29	17 08 17	5 16	7 02 22	7 50	4 30 23	9 07	15 29 19	7 27	22 17 8	
6	3 38	S22 34 8	1 30	S15 48 19	2 09	S 5 54 23	4 20	N 6 14 22	5 50	N16 22 17	5 22	N22 35	3 51	N22 44	3 30	N16 51 16	5 21	N 6 40 23	7 55	S 4 53 23	9 06	S15 48 18	7 20	S22 25 7	
7	3 31	22 26 7	1 29	15 29 18	2 12	5 31 23	4 25	6 36 23	5 51	16 39 16	5 20	22 41 6	3 48	22 38	3 32	16 35 17	5 26	6 17 23	7 59	5 16 23	9 05	16 06 17	7 14	22 32 7	
8	3 25	22 19 8	1 28	15 11 19	2 16	5 07 24	4 29	6 59 22	5 52	16 55 17	5 17	22 47 6	3 46	22 32	3 34	16 18 17	5 31	5 55 23	8 03	5 39 23	9 05	16 23 18	7 08	22 39 6	
9	3 19	22 11 9	1 28	14 52 20	2 19	4 44 24	4 33	7 21 23	5 53	17 12 16	5 14	22 53 5	3 44	22 25 7	3 36	16 01 17	5 36	5 32 23	8 08	6 02 23	9 04	16 41 17	6 54	22 45 6	
10	3 12	22 02 9	1 27	14 32 20	2 23	4 20 23	4 37	7 44 22	5 54	17 28 15	5 11	22 58 4	3 41	22 18 7	3 38	15 44 18	5 41	5 10 23	8 12	6 25 23	9 03	16 58 17	6 54	22 51 6	
11	3 06	S21 53 9	1 27	S14 13 20	2 27	S 3 57 24	4 41	N 8 06 22	5 54	N17 43 16	5 08	N23 02 4	3 39	N22 11 8	3 40	N15 26 17	5 46	N 4 47 23	8 16	S 6 48 22	9 01	S17 15 17	6 47	S22 57 5	
12	3 00	21 44 10	1 27	13 53 20	2 31	3 33 23	4 45	8 28 22	5 55	17 59 15	5 05	23 06 4	3 37	22 03 9	3 42	15 09 19	5 52	4 24 23	8 20	7 10 23	9 00	17 32 16	6 41	23 02 4	
13	2 55	21 34 10	1 27	13 33 20	2 35	3 10 23	4 49	8 50 21	5 55	18 14 15	5 02	23 10 4	3 35	21 54 8	3 45	14 50 19	5 57	4 01 23	8 23	7 33 23	8 58	17 48 16	6 34	23 06 4	
14	2 49	21 24 10	1 28	13 13 20	2 39	2 46 24	4 53	9 11 22	5 55	18 29 14	4 59	23 14 3	3 33	21 46 9	3 48	14 32 18	6 02	3 36 23	8 27	7 55 23	8 56	18 04 16	6 27	23 10 4	
15	2 43	21 14 11	1 28	12 53 21	2 43	2 22 23	4 57	9 33 22	5 55	18 43 15	4 56	23 17 2	3 32	21 37 10	3 50	14 14 19	6 07	3 15 23	8 31	8 18 22	8 53	18 20 15	6 19	23 14 3	
16	2 38	S21 03 12	1 29	S12 32 21	2 47	S 1 59 24	5 00	N 9 55 21	5 55	N18 58 13	4 52	N23 19 2	3 30	N21 27 10	3 53	N13 55 19	6 13	N 2 52 23	8 34	S 8 40 22	8 51	S18 35 15	6 12	S23 17 3	
17	2 32	20 51 12	1 30	12 11 21	2 51	1 35 24	5 04	10 16 21	5 54	19 11 14	4 49	23 21 2	3 29	21 17 10	3 56	13 36 19	6 18	2 29 23	8 37	9 02 22	8 48	18 50 15	6 05	23 20 2	
18	2 28	20 39 12	1 31	11 50 21	2 56	1 11 24 5	5 07	10 37 21	5 54	19 25 13	4 46	23 23 2	3 27	21 07 10	3 59	13 17 19	6 23	2 06 23	8 40	9 24 22	8 45	19 05 15	5 58	23 22 2	
19	2 23	20 27 12	1 32	11 29 21	3 00	0 47 23	5 11	10 58 21	5 54	19 38 13	4 43	23 25 0	3 26	20 57 11	4 03	12 58 20	6 29	1 43 24	8 43	9 46 22	8 42	19 19 14	5 50	23 24 2	
20	2 19	20 15 13	1 33	11 08 22	3 04	0 24 24	5 14	11 19 20	5 53	19 51 13	4 39	23 25 1	3 25	20 46 11	4 06	12 38 20	6 34	1 19 23	8 46	10 07 22	8 39	19 33 13	5 43	23 25 1	
21	2 14	S20 02 14	1 35	S10 46 21	3 09	0 00 24	5 17	N11 39 21	5 52	N20 04 12	4 36	N23 26 0	3 24	N20 35 12	4 10	N12 18 20	6 40	N 0 56 23	8 49	S10 29 21	8 35	S19 46 14	5 35	S23 26 0	
22	2 10	19 48 13	1 36	10 25 22	3 13	N 0 24 23	5 20	12 00 20	5 51	20 16 12	4 33	23 26 0	3 24	20 23 12	4 13	11 58 20	6 45	0 30 24	8 51	10 50 21	8 32	20 00 13	5 28	23 26 0	
23	2 06	19 35 13	1 38	10 03 23	3 18	0 47 24	5 23	12 20 20	5 50	20 28 12	4 29	23 26 1	3 23	20 11 12	4 17	11 38 20	6 50	N 0 09 23	8 53	11 11 11	8 28	20 13 11	5 21	23 26 0	
24	2 02	19 21 15	1 40	9 41 22	3 22	1 11 24 5	5 26	12 40 20	5 49	20 39 11	4 26	23 25 1	3 23	19 59 13	4 21	11 18 21	6 55	S 0 14 23	8 56	11 32 21	8 24	20 25 12	5 13	23 25 1	
25	1 58	19 06 15	1 43	9 19 23	3 27	1 35 23	5 28	13 00 19	5 47	20 50 11	4 23	23 24 2	3 22	19 46 12	4 25	10 57 20	7 01	0 37 24	8 58	11 53 21	8 19	20 37 12	5 06	23 24 1	
26	1 55	S18 51 15	1 45	S 8 56 22	3 31	N 1 58 24	5 31	N13 19 20	5 46	N21 01 11	4 20	N23 22 2	3 22	N19 34 14	4 29	N10 37 21	7 06	S 1 01 23	8 59	S12 14 21	8 15	S20 49 12	4 58	S23 23 2	
27	1 52	18 36 15	1 47	8 34 23	3 36	2 22 23	5 34	13 39 19	5 44	21 12 10	4 17	23 20 3	3 22	19 20 13	4 34	10 16 21	7 11	1 24 23	9 01	12 35 20	8 10	21 01 11	4 44	23 21 3	
28	1 48	18 21 16	1 50	8 11 22	3 40	2 45 23	5 36	13 58 19	5 43	21 22 9	4 14	23 18 3	3 22	19 07 14	4 38	9 55 21	7 16	1 47 23	9 02	12 55 20	8 05	21 12 11	4 44	23 18 3	
29	1 46	18 05 16	1 53	7 49 23	3 45	3 09 23	5 38	14 17 18	5 41	21 31 10	4 11	23 15 3	3 23	18 53 14	4 42	9 34 21	7 21	2 11 23	9 04	13 15 20	8 00	21 22 10	4 36	23 15 3	
30	1 43	17 49 16	1 53	7 29 23	3 49	3 32 23	5 40	14 35 19	5 39	21 41 9	4 08	23 12 4	3 23	18 39 15	4 47	9 13 22	7 26	2 34 23	9 05	13 35 19	7 55	21 32 10	4 29	23 12 4	
31	1 41	S17 33 17	1 51	S17 33 17	3 54	N 3 55 24	5 37	N21 50 8	5 37	N21 50 8	3 24	N18 24 14	3 24	N18 24 14	4 52	N 8 51 22	9 05	S13 54 20	9 05	S13 54 20	4 22	S23 08 4	4 22	S23 08 4	

a. Corr. from GMT to OT

Year	Corr.	Year	Corr.	Year	Corr.
2001	+10	2013	+13	2025	+15
2002	+5	2014	+7	2026	+9
2003	-1	2015	+1	2027	+4
2004	-7	2016	-5	2028	-2
2004	+17*	2016	+19*	2028	+22*
2005	+11	2017	+14	2029	+16
2006	+6	2018	+8	2030	+10
2007	0	2019	+2	2031	+4
2008	-6	2020	-4	2032	-1
2008	+18*	2020	+20*	2032	+23*
2009	+12	2021	+14	2033	+17
2010	+6	2022	+8	2034	+11
2011	+1	2023	+3	2035	+5
2012	-5	2024	-3	2036	-1
2012	+19*	2024	+21*	2036	+23*

b. Interpolation for Hours of OT

Year	Diff.																								
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	
2001	h	'	'	'	'	'	'	'	'	'	'	'	'	'	'	'	'	'	'	'	'	'	'	'	'
2002	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
2003	1	0	0	0	0	0	0	0	0	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
2004	2	0	0	0	0	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
2005	3	0	0	1	1	1	1	1	1	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2
2006	4	0	0	1	1	1	1	1	1	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2
2007	5	0	0	1	1	1	1	1	1	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2
2008	6	0	1	1	1	1	1	1	1	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2
2009	7	0	1	1	1	1	1	1	1	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2
2010	8	0	1	1	1	1	1	1	1	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2
2011	9	0	1	1	1	1	1	1	1	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2
2012	10	0	1	1	1	1	1	1	1	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2
2012	11	0	1	1	1	1	1	1	1	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2

* After Feb. 29

