Starpath Celestial Navigation Course

Table Selections

Selections from the Nautical Almanac
and from Sight Reduction Tables *needed*
to work practice problems in the course

STARPATH®

12/04/03

CONTENTS

The notation "T-1," "T-2," etc, is for cross reference in the course materials. These are not in general use elsewhere

T - 1

146 **1978 JULY 24, 25, 26 (MON., TUES., WED.)**

G.M.T.	ARIES	VENUS −3.7		MARS +1.7		JUPITER −1.4		SATURN +0.9		STARS		
	G.H.A.	G.H.A.	Dec.	G.H.A.	Dec.	G.H.A.	Dec.	G.H.A.	Dec.	Name	S.H.A.	Dec.
d h	° ′	° ′	° ′	° ′	° ′	° ′	° ′	° ′	° ′		° ′	° ′
24 00	301 21.8	136 16.3	N 7 21.2	127 29.6	N 3 22.1	188 46.6	N21 59.1	149 02.2	N12 55.3	Acamar	315 38.5	S40 23.2
01	316 24.2	151 16.2	20.0	142 30.7	21.4	203 48.5	59.0	164 04.4	55.2	Achernar	335 46.4	S57 20.5
02	331 26.7	166 16.1	18.8	157 31.8	20.8	218 50.3	58.9	179 06.5	55.1	Acrux	173 39.0	S62 59.1
03	346 29.2	181 16.0	·· 17.6	172 32.9	·· 20.2	233 52.2	·· 58.8	194 08.7	·· 55.0	Adhara	255 33.6	S28 56.6
04	1 31.6	196 16.0	16.4	187 34.0	19.5	248 54.1	58.8	209 10.9	54.9	Aldebaran	291 19.9	N16 27.9
05	16 34.1	211 15.9	15.2	202 35.1	18.9	263 55.9	58.7	224 13.1	54.8			
06	31 36.6	226 15.8	N 7 14.0	217 36.1	N 3 18.3	278 57.8	N21 58.6	239 15.3	N12 54.7	Alioth	166 44.1	N56 04.9
07	46 39.0	241 15.8	12.7	232 37.2	17.7	293 59.7	58.5	254 17.5	54.6	Alkaid	153 19.7	N49 25.6
08	61 41.5	256 15.7	11.5	247 38.3	17.0	309 01.5	58.4	269 19.7	54.5	Al Na'ir	28 16.4	S47 03.7
M 09	76 44.0	271 15.6	·· 10.3	262 39.4	·· 16.4	324 03.4	·· 58.3	284 21.8	·· 54.4	Alnilam	276 13.4	S 1 13.0
O 10	91 46.4	286 15.5	09.1	277 40.5	15.8	339 05.3	58.3	299 24.0	54.3	Alphard	218 22.3	S 8 34.0
N 11	106 48.9	301 15.5	07.9	292 41.6	15.1	354 07.1	58.2	314 26.2	54.2			
D 12	121 51.3	316 15.4	N 7 06.7	307 42.7	N 3 14.5	9 09.0	N21 58.1	329 28.4	N12 54.1	Alphecca	126 33.2	N26 47.5
A 13	136 53.8	331 15.3	05.5	322 43.7	13.9	24 10.9	58.0	344 30.6	54.0	Alpheratz	358 10.6	N28 58.3
Y 14	151 56.3	346 15.3	04.3	337 44.8	13.3	39 12.8	57.9	359 32.8	53.9	Altair	62 33.6	N 8 48.9
15	166 58.7	1 15.2	·· 03.1	352 45.9	·· 12.6	54 14.6	·· 57.9	14 34.9	·· 53.8	Ankaa	353 41.5	S42 25.1
16	182 01.2	16 15.1	01.9	7 47.0	12.0	69 16.5	57.8	29 37.1	53.6	Antares	112 58.4	S26 23.0
17	197 03.7	31 15.1	7 00.7	22 48.1	11.4	84 18.4	57.7	44 39.3	53.5			
18	212 06.1	46 15.0	N 6 59.4	37 49.2	N 3 10.7	99 20.2	N21 57.6	59 41.5	N12 53.4	Arcturus	146 19.8	N19 17.9
19	227 08.6	61 15.0	58.2	52 50.3	10.1	114 22.1	57.5	74 43.7	53.3	Atria	108 23.5	S68 59.5
20	242 11.1	76 14.9	57.0	67 51.3	09.5	129 24.0	57.5	89 45.9	53.2	Avior	234 29.4	S59 26.5
21	257 13.5	91 14.8	·· 55.8	82 52.4	·· 08.9	144 25.8	·· 57.4	104 48.0	·· 53.1	Bellatrix	279 00.6	N 6 19.8
22	272 16.0	106 14.8	54.6	97 53.5	08.2	159 27.7	57.3	119 50.2	53.0	Betelgeuse	271 30.1	N 7 24.1
23	287 18.5	121 14.7	53.4	112 54.6	07.6	174 29.6	57.2	134 52.4	52.9			
25 00	302 20.9	136 14.6	N 6 52.2	127 55.7	N 3 07.0	189 31.5	N21 57.1	149 54.6	N12 52.8	Canopus	264 08.3	S52 41.0
01	317 23.4	151 14.6	51.0	142 56.8	06.3	204 33.3	57.0	164 56.8	52.7	Capella	281 13.8	N45 58.4
02	332 25.8	166 14.5	49.7	157 57.8	05.7	219 35.2	57.0	179 59.0	52.6	Deneb	49 48.9	N45 12.3
03	347 28.3	181 14.5	·· 48.5	172 58.9	·· 05.1	234 37.1	·· 56.9	195 01.1	·· 52.5	Denebola	183 00.7	N14 41.6
04	2 30.8	196 14.4	47.3	188 00.0	04.4	249 38.9	56.8	210 03.3	52.4	Diphda	349 22.2	S18 06.1
05	17 33.2	211 14.3	46.1	203 01.1	03.8	264 40.8	56.7	225 05.5	52.3			
06	32 35.7	226 14.3	N 6 44.9	218 02.2	N 3 03.2	279 42.7	N21 56.6	240 07.7	N12 52.2	Dubhe	194 24.5	N61 52.2
07	47 38.2	241 14.2	43.7	233 03.3	02.6	294 44.5	56.6	255 09.9	52.1	Elnath	278 46.2	N28 35.2
08	62 40.6	256 14.2	42.5	248 04.3	01.9	309 46.4	56.5	270 12.1	52.0	Eltanin	90 57.9	N51 29.8
T 09	77 43.1	271 14.1	·· 41.2	263 05.4	·· 01.3	324 48.3	·· 56.4	285 14.2	·· 51.9	Enif	34 12.7	N 9 46.7
U 10	92 45.6	286 14.0	40.0	278 06.5	00.7	339 50.2	56.3	300 16.4	51.8	Fomalhaut	15 52.8	S29 43.9
E 11	107 48.0	301 14.0	38.8	293 07.6	3 00.0	354 52.0	56.2	315 18.6	51.7			
S 12	122 50.5	316 13.9	N 6 37.6	308 08.7	N 2 59.4	9 53.9	N21 56.1	330 20.8	N12 51.6	Gacrux	172 30.5	S56 59.8
D 13	137 52.9	331 13.9	36.4	323 09.8	58.8	24 55.8	56.1	345 23.0	51.5	Gienah	176 19.6	S17 25.4
A 14	152 55.4	346 13.8	35.2	338 10.8	58.1	39 57.6	56.0	0 25.2	51.4	Hadar	149 25.3	S60 16.4
Y 15	167 57.9	1 13.8	·· 34.0	353 11.9	·· 57.5	54 59.5	·· 55.9	15 27.3	·· 51.3	Hamal	328 30.5	N23 21.6
16	183 00.3	16 13.7	32.7	8 13.0	56.9	70 01.4	55.8	30 29.5	51.2	Kaus Aust.	84 18.4	S34 23.6
17	198 02.8	31 13.7	31.5	23 14.1	56.3	85 03.3	55.7	45 31.7	51.1			
18	213 05.3	46 13.6	N 6 30.3	38 15.2	N 2 55.6	100 05.1	N21 55.6	60 33.9	N12 51.0	Kochab	137 18.9	N74 15.0
19	228 07.7	61 13.6	29.1	53 16.3	55.0	115 07.0	55.6	75 36.1	50.9	Markab	14 04.3	N15 05.4
20	243 10.2	76 13.5	27.9	68 17.3	54.4	130 08.9	55.5	90 38.3	50.8	Menkar	314 42.7	N 4 00.3
21	258 12.7	91 13.5	·· 26.7	83 18.4	·· 53.7	145 10.7	·· 55.4	105 40.4	·· 50.7	Menkent	148 38.7	S36 16.0
22	273 15.1	106 13.4	25.4	98 19.5	53.1	160 12.6	55.3	120 42.6	50.6	Miaplacidus	221 46.0	S69 37.9
23	288 17.6	121 13.4	24.2	113 20.6	52.5	175 14.5	55.2	135 44.8	50.4			
26 00	303 20.1	136 13.3	N 6 23.0	128 21.7	N 2 51.8	190 16.4	N21 55.2	150 47.0	N12 50.3	Mirfak	309 18.3	N49 46.9
01	318 22.5	151 13.3	21.8	143 22.7	51.2	205 18.2	55.1	165 49.2	50.2	Nunki	76 30.6	S26 19.3
02	333 25.0	166 13.2	20.6	158 23.8	50.6	220 20.1	55.0	180 51.3	50.1	Peacock	54 00.1	S56 48.1
03	348 27.4	181 13.2	·· 19.3	173 24.9	·· 49.9	235 22.0	·· 54.9	195 53.5	·· 50.0	Pollux	244 00.3	N28 04.7
04	3 29.9	196 13.1	18.1	188 26.0	49.3	250 23.8	54.8	210 55.7	49.9	Procyon	245 27.6	N 5 16.8
05	18 32.4	211 13.1	16.9	203 27.1	48.7	265 25.7	54.7	225 57.9	49.8			
06	33 34.8	226 13.0	N 6 15.7	218 28.2	N 2 48.0	280 27.6	N21 54.7	241 00.1	N12 49.7	Rasalhague	96 30.7	N12 34.8
07	48 37.3	241 13.0	14.5	233 29.2	47.4	295 29.5	54.6	256 02.3	49.6	Regulus	208 11.8	N12 04.4
W 08	63 39.8	256 12.9	13.2	248 30.3	46.8	310 31.3	54.5	271 04.4	49.5	Rigel	281 37.7	S 8 13.6
E 09	78 42.2	271 12.9	·· 12.0	263 31.4	·· 46.2	325 33.2	·· 54.4	286 06.6	·· 49.4	Rigil Kent.	140 27.6	S60 44.9
D 10	93 44.7	286 12.8	10.8	278 32.5	45.5	340 35.1	54.3	301 08.8	49.3	Sabik	102 42.5	S15 41.8
N 11	108 47.2	301 12.8	09.6	293 33.6	44.9	355 36.9	54.2	316 11.0	49.2			
E 12	123 49.6	316 12.7	N 6 08.4	308 34.6	N 2 44.3	10 38.8	N21 54.2	331 13.2	N12 49.1	Schedar	350 10.3	N56 25.0
S 13	138 52.1	331 12.7	07.1	323 35.7	43.6	25 40.7	54.1	346 15.3	49.0	Shaula	96 57.4	S37 05.3
D 14	153 54.6	346 12.7	05.9	338 36.8	43.0	40 42.6	54.0	1 17.5	48.9	Sirius	258 57.3	S16 41.2
A 15	168 57.0	1 12.6	·· 04.7	353 37.9	·· 42.4	55 44.4	·· 53.9	16 19.7	·· 48.8	Spica	158 59.1	S11 02.9
Y 16	183 59.5	16 12.6	03.5	8 39.0	41.7	70 46.3	53.8	31 21.9	48.7	Suhail	223 12.2	S43 20.9
17	199 01.9	31 12.5	02.3	23 40.0	41.1	85 48.2	53.7	46 24.1	48.6			
18	214 04.4	46 12.5	N 6 01.0	38 41.1	N 2 40.5	100 50.0	N21 53.7	61 26.3	N12 48.5	Vega	80 56.4	N38 46.1
19	229 06.9	61 12.5	5 59.8	53 42.2	39.8	115 51.9	53.6	76 28.4	48.4	Zuben'ubi	137 34.5	S15 57.1
20	244 09.3	76 12.4	58.6	68 43.3	39.2	130 53.8	53.5	91 30.6	48.3			
21	259 11.8	91 12.4	·· 57.4	83 44.4	·· 38.6	145 55.7	·· 53.4	106 32.8	·· 48.2		S.H.A.	Mer. Pass.
22	274 14.3	106 12.3	56.1	98 45.4	37.9	160 57.5	53.3	121 35.0	48.1		° ′	h m
23	289 16.7	121 12.3	54.9	113 46.5	37.3	175 59.4	53.2	136 37.2	48.0	Venus	193 53.7	14 55
	h m									Mars	185 34.8	15 27
Mer. Pass.	3 50.0	v −0.1	d 1.2	v 1.1	d 0.6	v 1.9	d 0.1	v 2.2	d 0.1	Jupiter	247 10.5	11 20
										Saturn	207 33.7	13 58

T - 2

1978 JULY 24, 25, 26 (MON., TUES., WED.)

G.M.T.	SUN G.H.A.	SUN Dec.	MOON G.H.A.	MOON v	MOON Dec.	MOON d	MOON H.P.
d h	° ′	° ′	° ′	′	° ′	′	′
24 00	178 23.7	N19 59.3	306 42.0	10.0	S 1 55.1	11.1	59.0
01	193 23.7	58.8	321 11.0	10.2	1 44.0	11.0	59.0
02	208 23.7	58.3	335 40.2	10.2	1 33.0	10.9	59.0
03	223 23.7	·· 57.8	350 09.4	10.2	1 22.1	11.0	58.9
04	238 23.7	57.2	4 38.6	10.3	1 11.1	11.0	58.9
05	253 23.7	56.7	19 07.9	10.3	1 00.1	11.0	58.8
06	268 23.7	N19 56.2	33 37.2	10.4	S 0 49.1	10.9	58.8
07	283 23.6	55.7	48 06.6	10.4	0 38.2	11.0	58.8
08	298 23.6	55.2	62 36.0	10.5	0 27.2	10.9	58.7
M 09	313 23.6	·· 54.6	77 05.5	10.6	0 16.3	10.9	58.7
O 10	328 23.6	54.1	91 35.1	10.5	S 0 05.4	10.9	58.6
N 11	343 23.6	53.6	106 04.6	10.7	N 0 05.5	10.9	58.6
D 12	358 23.6	N19 53.1	120 34.3	10.6	N 0 16.4	10.8	58.6
A 13	13 23.6	52.5	135 03.9	10.8	0 27.2	10.9	58.5
Y 14	28 23.6	52.0	149 33.7	10.7	0 38.1	10.8	58.5
15	43 23.5	·· 51.5	164 03.4	10.8	0 48.9	10.8	58.4
16	58 23.5	51.0	178 33.2	10.9	0 59.7	10.8	58.4
17	73 23.5	50.4	193 03.1	10.9	1 10.5	10.8	58.4
18	88 23.5	N19 49.9	207 33.0	10.9	N 1 21.3	10.7	58.3
19	103 23.5	49.4	222 02.9	11.0	1 32.0	10.7	58.3
20	118 23.5	48.9	236 32.9	11.0	1 42.7	10.7	58.2
21	133 23.5	·· 48.3	251 02.9	11.0	1 53.4	10.7	58.2
22	148 23.5	47.8	265 32.9	11.1	2 04.1	10.6	58.2
23	163 23.5	47.3	280 03.0	11.2	2 14.7	10.6	58.1
25 00	178 23.4	N19 46.7	294 33.2	11.1	N 2 25.3	10.6	58.1
01	193 23.4	46.2	309 03.3	11.3	2 35.9	10.6	58.0
02	208 23.4	45.7	323 33.6	11.2	2 46.5	10.5	58.0
03	223 23.4	·· 45.1	338 03.8	11.3	2 57.0	10.5	58.0
04	238 23.4	44.6	352 34.1	11.3	3 07.5	10.5	57.9
05	253 23.4	44.1	7 04.4	11.3	3 18.0	10.4	57.9
06	268 23.4	N19 43.5	21 34.7	11.4	N 3 28.4	10.4	57.8
07	283 23.4	43.0	36 05.1	11.4	3 38.8	10.3	57.8
08	298 23.4	42.5	50 35.5	11.5	3 49.1	10.4	57.8
T 09	313 23.4	·· 41.9	65 06.0	11.5	3 59.5	10.3	57.7
U 10	328 23.4	41.4	79 36.5	11.5	4 09.8	10.2	57.7
E 11	343 23.4	40.9	94 07.0	11.5	4 20.0	10.3	57.7
S 12	358 23.3	N19 40.3	108 37.5	11.6	N 4 30.3	10.1	57.6
D 13	13 23.3	39.8	123 08.1	11.6	4 40.4	10.2	57.6
A 14	28 23.3	39.3	137 38.7	11.6	4 50.6	10.1	57.5
Y 15	43 23.3	·· 38.7	152 09.3	11.7	5 00.7	10.1	57.5
16	58 23.3	38.2	166 40.0	11.7	5 10.8	10.0	57.5
17	73 23.3	37.6	181 10.7	11.7	5 20.8	10.0	57.4
18	88 23.3	N19 37.1	195 41.4	11.7	N 5 30.8	9.9	57.4
19	103 23.3	36.6	210 12.1	11.8	5 40.7	9.9	57.3
20	118 23.3	36.0	224 42.9	11.8	5 50.6	9.9	57.3
21	133 23.3	·· 35.5	239 13.7	11.8	6 00.5	9.8	57.3
22	148 23.3	34.9	253 44.5	11.8	6 10.3	9.8	57.2
23	163 23.3	34.4	268 15.3	11.9	6 20.1	9.7	57.2
26 00	178 23.3	N19 33.8	282 46.2	11.8	N 6 29.8	9.7	57.2
01	193 23.3	33.3	297 17.0	11.9	6 39.5	9.6	57.1
02	208 23.3	32.7	311 47.9	12.0	6 49.1	9.6	57.1
03	223 23.3	·· 32.2	326 18.9	11.9	6 58.7	9.5	57.0
04	238 23.3	31.7	340 49.8	12.0	7 08.2	9.5	57.0
05	253 23.3	31.1	355 20.8	11.9	7 17.7	9.4	57.0
06	268 23.3	N19 30.6	9 51.7	12.0	N 7 27.1	9.4	56.9
W 07	283 23.3	30.0	24 22.7	12.1	7 36.5	9.4	56.9
E 08	298 23.3	29.5	38 53.8	12.0	7 45.9	9.3	56.9
D 09	313 23.3	·· 28.9	53 24.8	12.0	7 55.2	9.2	56.8
N 10	328 23.3	28.4	67 55.8	12.1	8 04.4	9.2	56.8
E 11	343 23.3	27.8	82 26.9	12.1	8 13.6	9.1	56.7
S 12	358 23.3	N19 27.3	96 58.0	12.1	N 8 22.7	9.1	56.7
D 13	13 23.3	26.7	111 29.1	12.1	8 31.8	9.0	56.7
A 14	28 23.3	26.2	126 00.2	12.1	8 40.8	9.0	56.6
Y 15	43 23.3	·· 25.6	140 31.3	12.2	8 49.8	8.9	56.6
16	58 23.3	25.1	155 02.5	12.1	8 58.7	8.9	56.6
17	73 23.3	24.5	169 33.6	12.2	9 07.6	8.8	56.5
18	88 23.3	N19 23.9	184 04.8	12.2	N 9 16.4	8.8	56.5
19	103 23.3	23.4	198 36.0	12.2	9 25.2	8.7	56.5
20	118 23.3	22.8	213 07.2	12.2	9 33.9	8.6	56.4
21	133 23.3	·· 22.3	227 38.4	12.2	9 42.5	8.6	56.4
22	148 23.3	21.7	242 09.6	12.2	9 51.1	8.5	56.4
23	163 23.3	21.2	256 40.8	12.3	9 59.6	8.5	56.3
	S.D. 15.8	d 0.5	S.D. 16.0		15.7		15.5

Lat.	Twilight Naut.	Twilight Civil	Sunrise	Moonrise 24	Moonrise 25	Moonrise 26	Moonrise 27
°	h m	h m	h m	h m	h m	h m	h m
N 72	□	□	□	21 54	21 49	21 44	21 39
N 70	□	□	□	21 57	21 57	21 59	22 02
68	////	////	01 32	21 59	22 04	22 11	22 20
66	////	////	02 16	22 01	22 10	22 21	22 34
64	////	00 38	02 44	22 02	22 15	22 29	22 46
62	////	01 43	03 06	22 03	22 19	22 37	22 56
60	////	02 16	03 23	22 05	22 23	22 43	23 05
N 58	00 35	02 40	03 38	22 06	22 27	22 49	23 13
56	01 34	02 59	03 50	22 07	22 30	22 53	23 20
54	02 04	03 14	04 01	22 07	22 32	22 58	23 26
52	02 27	03 27	04 11	22 08	22 35	23 02	23 31
50	02 44	03 39	04 19	22 09	22 37	23 06	23 36
45	03 18	04 02	04 37	22 11	22 42	23 14	23 47
N 40	03 42	04 20	04 51	22 12	22 46	23 20	23 56
35	04 01	04 35	05 04	22 13	22 50	23 26	24 04
30	04 16	04 48	05 14	22 14	22 53	23 31	24 11
20	04 41	05 09	05 33	22 16	22 58	23 40	24 23
N 10	05 00	05 26	05 48	22 17	23 03	23 48	24 33
0	05 15	05 41	06 03	22 19	23 08	23 56	24 43
S 10	05 29	05 55	06 17	22 21	23 12	24 03	00 03
20	05 42	06 09	06 33	22 22	23 17	24 11	00 11
30	05 55	06 25	06 50	22 24	23 23	24 20	00 20
35	06 02	06 33	07 00	22 25	23 26	24 26	00 26
40	06 09	06 42	07 12	22 27	23 30	24 32	00 32
45	06 17	06 53	07 25	22 28	23 35	24 39	00 39
S 50	06 26	07 05	07 41	22 30	23 40	24 47	00 47
52	06 29	07 11	07 49	22 31	23 42	24 51	00 51
54	06 33	07 17	07 58	22 32	23 45	24 56	00 56
56	06 38	07 24	08 07	22 33	23 48	25 00	01 00
58	06 43	07 32	08 18	22 34	23 51	25 06	01 06
S 60	06 48	07 40	08 31	22 35	23 55	25 12	01 12

Lat.	Sunset	Twilight Civil	Twilight Naut.	Moonset 24	Moonset 25	Moonset 26	Moonset 27
°	h m	h m	h m	h m	h m	h m	h m
N 72	□	□	□	09 50	11 38	13 24	15 08
N 70	□	□	□	09 50	11 32	13 11	14 46
68	22 35	////	////	09 51	11 27	13 00	14 29
66	21 54	////	////	09 51	11 23	12 51	14 16
64	21 26	23 23	////	09 51	11 19	12 44	14 04
62	21 05	22 26	////	09 51	11 16	12 37	13 55
60	20 48	21 54	////	09 51	11 13	12 32	13 47
N 58	20 34	21 31	23 27	09 52	11 11	12 27	13 40
56	20 21	21 13	22 35	09 52	11 09	12 23	13 33
54	20 11	20 57	22 06	09 52	11 07	12 19	13 28
52	20 01	20 44	21 44	09 52	11 05	12 15	13 23
50	19 53	20 33	21 27	09 52	11 04	12 12	13 18
45	19 35	20 10	20 54	09 52	11 00	12 06	13 08
N 40	19 21	19 52	20 30	09 52	10 57	12 00	13 00
35	19 09	19 37	20 11	09 52	10 55	11 55	12 53
30	18 58	19 24	19 56	09 52	10 53	11 51	12 47
20	18 40	19 04	19 32	09 53	10 49	11 43	12 36
N 10	18 24	18 47	19 13	09 53	10 46	11 37	12 27
0	18 10	18 32	18 57	09 53	10 42	11 31	12 18
S 10	17 56	18 18	18 44	09 53	10 39	11 25	12 10
20	17 40	18 04	18 31	09 53	10 36	11 18	12 00
30	17 23	17 49	18 18	09 53	10 32	11 11	11 50
35	17 13	17 40	18 11	09 53	10 30	11 07	11 44
40	17 02	17 31	18 04	09 53	10 28	11 02	11 37
45	16 48	17 20	17 56	09 53	10 25	10 56	11 29
S 50	16 32	17 08	17 48	09 53	10 21	10 50	11 19
52	16 24	17 02	17 44	09 53	10 20	10 46	11 15
54	16 16	16 56	17 40	09 53	10 18	10 43	11 10
56	16 06	16 49	17 36	09 53	10 16	10 39	11 04
58	15 55	16 42	17 31	09 53	10 14	10 35	10 58
S 60	15 43	16 33	17 26	09 53	10 12	10 31	10 52

Day	SUN Eqn. of Time 00ʰ	SUN Eqn. of Time 12ʰ	SUN Mer. Pass.	MOON Mer. Pass. Upper	MOON Mer. Pass. Lower	MOON Age	MOON Phase
	m s	m s	h m	h m	h m	d	
24	06 25	06 26	12 06	03 41	16 06	19	
25	06 26	06 27	12 06	04 31	16 55	20	◑
26	06 27	06 27	12 06	05 19	17 43	21	

T - 3

208 **1978 OCTOBER 25, 26, 27 (WED., THURS., FRI.)**

G.M.T.	ARIES	VENUS −3.8		MARS +1.7		JUPITER −1.7		SATURN +1.1		STARS			
	G.H.A.	G.H.A.	Dec.	G.H.A.	Dec.	G.H.A.	Dec.	G.H.A.	Dec.	Name	S.H.A.	Dec.	
d h	° ′	° ′	° ′	° ′	° ′	° ′	° ′	° ′	° ′		° ′	° ′	
25 00	33 01.7	165 27.4	S24 38.1	161 15.0	S19 13.3	263 03.8	N18 45.7	230 09.7	N 8 59.2	Acamar	315 37.8	S40 23.3	
01	48 04.1	180 30.6	37.8	176 15.6	13.8	278 06.0	45.6	245 11.9	59.1	Achernar	335 45.7	S57 20.7	
02	63 06.6	195 33.7	37.5	191 16.3	14.2	293 08.2	45.6	260 14.1	59.0	Acrux	173 39.2	S62 58.7	
03	78 09.1	210 36.9 ··	37.1	206 16.9 ··	14.7	308 10.5 ··	45.5	275 16.4 ··	59.0	Adhara	255 33.0	S28 56.4	
04	93 11.5	225 40.0	36.8	221 17.6	15.1	323 12.7	45.5	290 18.6	58.9	Aldebaran	291 19.2	N16 28.0	
05	108 14.0	240 43.2	36.5	236 18.2	15.6	338 14.9	45.4	305 20.9	58.8				
06	123 16.4	255 46.3	S24 36.2	251 18.8	S19 16.1	353 17.1	N18 45.4	320 23.1	N 8 58.7	Alioth	166 44.3	N56 04.5	
07	138 18.9	270 49.5	35.9	266 19.5	16.5	8 19.3	45.3	335 25.3	58.6	Alkaid	153 20.1	N49 25.2	
W 08	153 21.4	285 52.7	35.6	281 20.1	17.0	23 21.5	45.2	350 27.6	58.5	Al Na'ir	28 16.4	S47 03.9	
E 09	168 23.8	300 55.9 ··	35.2	296 20.8 ··	17.4	38 23.8 ··	45.2	5 29.8 ··	58.5	Alnilam	276 12.8	S 1 12.9	
D 10	183 26.3	315 59.0	34.9	311 21.4	17.9	53 26.0	45.1	20 32.0	58.4	Alphard	218 21.9	S 8 33.9	
N 11	198 28.8	331 02.2	34.6	326 22.1	18.4	68 28.2	45.1	35 34.3	58.3				
E 12	213 31.2	346 05.4	S24 34.2	341 22.7	S19 18.8	83 30.4	N18 45.0	50 36.5	N 8 58.2	Alphecca	126 33.6	N26 47.4	
S 13	228 33.7	1 08.6	33.9	356 23.4	19.3	98 32.6	45.0	65 38.8	58.1	Alpheratz	358 10.3	N28 58.6	
D 14	243 36.2	16 11.8	33.6	11 24.0	19.7	113 34.8	44.9	80 41.0	58.0	Altair	62 33.8	N 8 49.0	
A 15	258 38.6	31 15.0 ··	33.2	26 24.7 ··	20.2	128 37.1 ··	44.9	95 43.2 ··	58.0	Ankaa	353 41.2	S42 25.3	
Y 16	273 41.1	46 18.2	32.9	41 25.3	20.6	143 39.3	44.8	110 45.5	57.9	Antares	112 58.8	S26 23.0	
17	288 43.6	61 21.4	32.5	56 26.0	21.1	158 41.5	44.8	125 47.7	57.8				
18	303 46.0	76 24.6	S24 32.2	71 26.6	S19 21.5	173 43.7	N18 44.7	140 50.0	N 8 57.7	Arcturus	146 20.0	N19 17.7	
19	318 48.5	91 27.8	31.8	86 27.3	22.0	188 45.9	44.7	155 52.2	57.6	Atria	108 24.5	S68 59.4	
20	333 50.9	106 31.0	31.5	101 27.9	22.5	203 48.2	44.6	170 54.4	57.5	Avior	234 28.7	S59 26.2	
21	348 53.4	121 34.3 ··	31.1	116 28.5 ··	22.9	218 50.4 ··	44.5	185 56.7 ··	57.5	Bellatrix	278 59.9	N 6 19.8	
22	3 55.9	136 37.5	30.8	131 29.2	23.4	233 52.6	44.5	200 58.9	57.4	Betelgeuse	271 29.5	N 7 24.2	
23	18 58.3	151 40.7	30.4	146 29.8	23.8	248 54.8	44.4	216 01.2	57.3				
26 00	34 00.8	166 43.9	S24 30.1	161 30.5	S19 24.3	263 57.0	N18 44.4	231 03.4	N 8 57.2	Canopus	264 07.5	S52 40.9	
01	49 03.3	181 47.2	29.7	176 31.1	24.7	278 59.3	44.3	246 05.6	57.1	Capella	281 12.9	N45 58.4	
02	64 05.7	196 50.4	29.3	191 31.8	25.2	294 01.5	44.3	261 07.9	57.0	Deneb	49 49.3	N45 12.7	
03	79 08.2	211 53.7 ··	29.0	206 32.4 ··	25.6	309 03.7 ··	44.2	276 10.1 ··	57.0	Denebola	183 00.7	N14 41.5	
04	94 10.7	226 56.9	28.6	221 33.0	26.1	324 05.9	44.2	291 12.4	56.9	Diphda	349 21.9	S18 06.1	
05	109 13.1	242 00.2	28.2	236 33.7	26.5	339 08.2	44.1	306 14.6	56.8				
06	124 15.6	257 03.4	S24 27.9	251 34.3	S19 27.0	354 10.4	N18 44.1	321 16.8	N 8 56.7	Dubhe	194 24.3	N61 51.8	
07	139 18.1	272 06.7	27.5	266 35.0	27.4	9 12.6	44.0	336 19.1	56.6	Elnath	278 45.5	N28 35.3	
T 08	154 20.5	287 09.9	27.1	281 35.6	27.9	24 14.8	44.0	351 21.3	56.5	Eltanin	90 58.6	N51 29.9	
H 09	169 23.0	302 13.2 ··	26.7	296 36.3 ··	28.3	39 17.1 ··	43.9	6 23.6 ··	56.5	Enif	34 12.7	N 9 46.9	
U 10	184 25.4	317 16.5	26.3	311 36.9	28.8	54 19.3	43.9	21 25.8	56.4	Fomalhaut	15 52.7	S29 44.1	
R 11	199 27.9	332 19.7	26.0	326 37.5	29.2	69 21.5	43.8	36 28.0	56.3				
S 12	214 30.4	347 23.0	S24 25.6	341 38.2	S19 29.7	84 23.7	N18 43.8	51 30.3	N 8 56.2	Gacrux	172 30.6	S56 59.5	
D 13	229 32.8	2 26.3	25.2	356 38.8	30.1	99 26.0	43.7	66 32.5	56.1	Gienah	176 19.6	S17 25.3	
A 14	244 35.3	17 29.6	24.8	11 39.5	30.6	114 28.2	43.6	81 34.8	56.1	Hadar	149 25.7	S60 16.1	
Y 15	259 37.8	32 32.9 ··	24.4	26 40.1 ··	31.0	129 30.4 ··	43.6	96 37.0 ··	56.0	Hamal	328 30.0	N23 21.8	
16	274 40.2	47 36.2	24.0	41 40.7	31.5	144 32.6	43.5	111 39.3	55.9	Kaus Aust.	84 18.8	S34 23.7	
17	289 42.7	62 39.5	23.6	56 41.4	31.9	159 34.9	43.5	126 41.5	55.8				
18	304 45.2	77 42.8	S24 23.2	71 42.0	S19 32.4	174 37.1	N18 43.4	141 43.7	N 8 55.7	Kochab	137 20.3	N74 14.7	
19	319 47.6	92 46.1	22.8	86 42.7	32.8	189 39.3	43.4	156 46.0	55.6	Markab	14 04.2	N15 05.7	
20	334 50.1	107 49.4	22.4	101 43.3	33.3	204 41.5	43.3	171 48.2	55.6	Menkar	314 42.2	N 4 00.4	
21	349 52.5	122 52.7 ··	22.0	116 43.9 ··	33.7	219 43.8 ··	43.3	186 50.5 ··	55.5	Menkent	148 38.9	S36 15.8	
22	4 55.0	137 56.0	21.6	131 44.6	34.2	234 46.0	43.2	201 52.7	55.4	Miaplacidus	221 45.3	S69 37.5	
23	19 57.5	152 59.3	21.2	146 45.2	34.6	249 48.2	43.2	216 54.9	55.3				
27 00	34 59.9	168 02.6	S24 20.8	161 45.8	S19 35.1	264 50.5	N18 43.1	231 57.2	N 8 55.2	Mirfak	309 17.4	N49 47.1	
01	50 02.4	183 05.9	20.3	176 46.5	35.5	279 52.7	43.1	246 59.4	55.2	Nunki	76 30.9	S26 19.3	
02	65 04.9	198 09.3	19.9	191 47.1	36.0	294 54.9	43.0	262 01.7	55.1	Peacock	54 00.5	S56 48.4	
03	80 07.3	213 12.6 ··	19.5	206 47.7 ··	36.4	309 57.1 ··	43.0	277 03.9 ··	55.0	Pollux	243 59.7	N28 04.5	
04	95 09.8	228 15.9	19.1	221 48.4	36.9	324 59.4	42.9	292 06.2	54.9	Procyon	245 27.1	N 5 16.8	
05	110 12.3	243 19.3	18.6	236 49.0	37.3	340 01.6	42.9	307 08.4	54.8				
06	125 14.7	258 22.6	S24 18.2	251 49.7	S19 37.8	355 03.8	N18 42.8	322 10.6	N 8 54.8	Rasalhague	96 31.0	N12 34.8	
07	140 17.2	273 26.0	17.8	266 50.3	38.2	10 06.1	42.8	337 12.9	54.7	Regulus	208 11.6	N12 04.3	
08	155 19.7	288 29.3	17.4	281 50.9	38.6	25 08.3	42.7	352 15.1	54.6	Rigel	281 37.0	S 8 13.5	
F 09	170 22.1	303 32.7 ··	16.9	296 51.6 ··	39.1	40 10.5 ··	42.7	7 17.4 ··	54.5	Rigil Kent.	140 28.2	S60 44.7	
R 10	185 24.6	318 36.0	16.5	311 52.2	39.5	55 12.8	42.6	22 19.6	54.4	Sabik	102 42.9	S15 41.8	
I 11	200 27.0	333 39.4	16.0	326 52.8	40.0	70 15.0	42.6	37 21.9	54.3				
D 12	215 29.5	348 42.7	S24 15.6	341 53.5	S19 40.4	85 17.2	N18 42.5	52 24.1	N 8 54.3	Schedar	350 09.9	N56 25.4	
A 13	230 32.0	3 46.1	15.2	356 54.1	40.9	100 19.4	42.5	67 26.4	54.2	Shaula	96 57.8	S37 05.3	
Y 14	245 34.4	18 49.5	14.7	11 54.7	41.3	115 21.7	42.4	82 28.6	54.1	Sirius	258 56.7	S16 41.2	
15	260 36.9	33 52.8 ··	14.3	26 55.4 ··	41.7	130 23.9 ··	42.4	97 30.8 ··	54.0	Spica	158 59.2	S11 02.9	
16	275 39.4	48 56.2	13.8	41 56.0	42.2	145 26.1	42.3	112 33.1	53.9	Suhail	223 11.8	S43 20.6	
17	290 41.8	63 59.6	13.3	56 56.6	42.6	160 28.4	42.3	127 35.3	53.9				
18	305 44.3	79 03.0	S24 12.9	71 57.3	S19 43.1	175 30.6	N18 42.2	142 37.6	N 8 53.8	Vega	80 56.9	N38 46.2	
19	320 46.8	94 06.4	12.4	86 57.9	43.5	190 32.8	42.2	157 39.8	53.7	Zuben'ubi	137 34.8	S15 57.1	
20	335 49.2	109 09.8	12.0	101 58.5	44.0	205 35.1	42.1	172 42.1	53.6				
21	350 51.7	124 13.2 ··	11.5	116 59.1 ··	44.4	220 37.3 ··	42.1	187 44.3 ··	53.5		S.H.A.	Mer. Pass.	
22	5 54.2	139 16.5	11.0	131 59.8	44.8	235 39.5	42.0	202 46.6	53.5		° ′	h m	
23	20 56.6	154 19.9	10.6	147 00.4	45.3	250 41.8	42.0	217 48.8	53.4	Venus	132 43.1	12 50	
	h m									Mars	127 29.7	13 13	
Mer. Pass.	21 40.4	v 3.3	d 0.4	v 0.6	d 0.5	v 2.2	d 0.1	v 2.2	d 0.1	Jupiter	229 56.2	6 23	
										Saturn	197 02.6	8 34	

T - 4

1978 OCTOBER 25, 26, 27 (WED., THURS., FRI.) 209

G.M.T.	SUN G.H.A.	SUN Dec.	MOON G.H.A.	MOON v	MOON Dec.	MOON d	MOON H.P.
d h	° ′	° ′	° ′	′	° ′	′	′
25 00	183 57.1	S11 53.9	259 47.5	13.6	N13 44.1	6.3	54.3
01	198 57.2	54.8	274 20.1	13.6	13 37.8	6.3	54.3
02	213 57.2	55.7	288 52.7	13.6	13 31.5	6.4	54.3
03	228 57.3	·· 56.5	303 25.3	13.7	13 25.1	6.4	54.3
04	243 57.4	57.4	317 58.0	13.7	13 18.7	6.5	54.3
05	258 57.5	58.2	332 30.7	13.7	13 12.2	6.6	54.4
06	273 57.5	S11 59.1	347 03.4	13.7	N13 05.6	6.6	54.4
07	288 57.6	12 00.0	1 36.1	13.7	12 59.0	6.7	54.4
W 08	303 57.7	00.8	16 08.8	13.8	12 52.3	6.8	54.4
E 09	318 57.8	·· 01.7	30 41.6	13.7	12 45.5	6.8	54.4
D 10	333 57.8	02.6	45 14.3	13.8	12 38.7	6.8	54.4
N 11	348 57.9	03.4	59 47.1	13.8	12 31.9	6.9	54.4
E 12	3 58.0	S12 04.3	74 19.9	13.8	N12 25.0	7.0	54.4
S 13	18 58.1	05.2	88 52.7	13.8	12 18.0	7.0	54.4
D 14	33 58.1	06.0	103 25.5	13.8	12 11.0	7.1	54.4
A 15	48 58.2	·· 06.9	117 58.3	13.9	12 03.9	7.2	54.5
Y 16	63 58.3	07.7	132 31.2	13.8	11 56.7	7.2	54.5
17	78 58.3	08.6	147 04.0	13.9	11 49.5	7.2	54.5
18	93 58.4	S12 09.5	161 36.9	13.8	N11 42.3	7.3	54.5
19	108 58.5	10.3	176 09.7	13.9	11 35.0	7.4	54.5
20	123 58.6	11.2	190 42.6	13.9	11 27.6	7.4	54.5
21	138 58.6	·· 12.0	205 15.5	13.9	11 20.2	7.4	54.5
22	153 58.7	12.9	219 48.4	13.9	11 12.8	7.6	54.5
23	168 58.8	13.8	234 21.3	14.0	11 05.2	7.5	54.5
26 00	183 58.8	S12 14.6	248 54.3	13.9	N10 57.7	7.6	54.6
01	198 58.9	15.5	263 27.2	13.9	10 50.1	7.7	54.6
02	213 59.0	16.3	278 00.1	14.0	10 42.4	7.7	54.6
03	228 59.0	·· 17.2	292 33.1	13.9	10 34.7	7.8	54.6
04	243 59.1	18.0	307 06.0	14.0	10 26.9	7.8	54.6
05	258 59.2	18.9	321 39.0	14.0	10 19.1	7.9	54.6
06	273 59.2	S12 19.8	336 12.0	13.9	N10 11.2	7.9	54.7
07	288 59.3	20.6	350 44.9	14.0	10 03.3	8.0	54.7
T 08	303 59.4	21.5	5 17.9	14.0	9 55.3	8.0	54.7
H 09	318 59.4	·· 22.3	19 50.9	14.0	9 47.3	8.1	54.7
U 10	333 59.5	23.2	34 23.9	14.0	9 39.2	8.1	54.7
R 11	348 59.6	24.0	48 56.9	14.0	9 31.1	8.2	54.7
S 12	3 59.6	S12 24.9	63 29.9	14.0	N 9 22.9	8.2	54.7
D 13	18 59.7	25.7	78 02.9	14.0	9 14.7	8.2	54.8
A 14	33 59.8	26.6	92 35.9	14.0	9 06.5	8.3	54.8
Y 15	48 59.8	·· 27.5	107 08.9	14.0	8 58.2	8.4	54.8
16	63 59.9	28.3	121 41.9	14.0	8 49.8	8.4	54.8
17	79 00.0	29.2	136 14.9	14.0	8 41.4	8.4	54.8
18	94 00.0	S12 30.0	150 47.9	14.0	N 8 33.0	8.5	54.9
19	109 00.1	30.9	165 20.9	14.0	8 24.5	8.5	54.9
20	124 00.1	31.7	179 53.9	14.0	8 16.0	8.6	54.9
21	139 00.2	·· 32.6	194 26.9	14.0	8 07.4	8.6	54.9
22	154 00.3	33.4	208 59.9	14.0	7 58.8	8.6	54.9
23	169 00.3	34.3	223 32.9	14.0	7 50.2	8.7	54.9
27 00	184 00.4	S12 35.1	238 05.9	14.0	N 7 41.5	8.7	55.0
01	199 00.4	36.0	252 38.9	14.0	7 32.8	8.8	55.0
02	214 00.5	36.8	267 11.9	14.0	7 24.0	8.8	55.0
03	229 00.6	·· 37.7	281 44.9	14.0	7 15.2	8.8	55.0
04	244 00.6	38.5	296 17.9	13.9	7 06.4	8.9	55.0
05	259 00.7	39.4	310 50.8	14.0	6 57.5	9.0	55.1
06	274 00.7	S12 40.2	325 23.8	14.0	N 6 48.5	8.9	55.1
07	289 00.8	41.1	339 56.8	13.9	6 39.6	9.0	55.1
08	304 00.9	41.9	354 29.7	14.0	6 30.6	9.0	55.1
F 09	319 00.9	·· 42.8	9 02.7	13.9	6 21.6	9.1	55.2
R 10	334 01.0	43.6	23 35.6	13.9	6 12.5	9.1	55.2
I 11	349 01.0	44.5	38 08.5	13.9	6 03.4	9.2	55.2
D 12	4 01.1	S12 45.3	52 41.4	14.0	N 5 54.2	9.1	55.2
A 13	19 01.2	46.2	67 14.4	13.9	5 45.1	9.2	55.2
Y 14	34 01.2	47.0	81 47.3	13.8	5 35.9	9.3	55.3
15	49 01.3	·· 47.8	96 20.1	13.9	5 26.6	9.3	55.3
16	64 01.3	48.7	110 53.0	13.9	5 17.3	9.3	55.3
17	79 01.4	49.5	125 25.9	13.8	5 08.0	9.3	55.3
18	94 01.4	S12 50.4	139 58.7	13.9	N 4 58.7	9.4	55.4
19	109 01.5	51.2	154 31.6	13.8	4 49.3	9.4	55.4
20	124 01.5	52.1	169 04.4	13.8	4 39.9	9.4	55.4
21	139 01.6	·· 52.9	183 37.2	13.8	4 30.5	9.5	55.4
22	154 01.6	53.8	198 10.0	13.8	4 21.0	9.5	55.5
23	169 01.7	54.6	212 42.8	13.7	4 11.5	9.5	55.5
	S.D. 16.1	d 0.9	S.D. 14.8		14.9		15.0

Lat.	Twilight Naut.	Twilight Civil	Sunrise	Moonrise 25	Moonrise 26	Moonrise 27	Moonrise 28
°	h m	h m	h m	h m	h m	h m	h m
N 72	05 40	07 00	08 19	22 55	24 33	00 33	02 11
N 70	05 39	06 51	08 00	23 14	24 44	00 44	02 16
68	05 38	06 43	07 45	23 29	24 54	00 54	02 20
66	05 37	06 37	07 32	23 41	25 01	01 01	02 23
64	05 35	06 31	07 22	23 51	25 08	01 08	02 26
62	05 34	06 26	07 13	24 00	00 00	01 13	02 29
60	05 33	06 22	07 06	24 07	00 07	01 18	02 31
N 58	05 32	06 18	06 59	24 14	00 14	01 22	02 33
56	05 31	06 15	06 53	24 19	00 19	01 26	02 35
54	05 30	06 11	06 48	24 24	00 24	01 29	02 36
52	05 29	06 08	06 43	24 29	00 29	01 32	02 38
50	05 28	06 06	06 39	24 33	00 33	01 35	02 39
45	05 25	05 59	06 30	24 42	00 42	01 41	02 42
N 40	05 22	05 54	06 22	24 49	00 49	01 46	02 44
35	05 20	05 49	06 15	00 02	00 56	01 50	02 46
30	05 17	05 45	06 09	00 09	01 01	01 54	02 48
20	05 10	05 36	05 59	00 22	01 11	02 01	02 51
N 10	05 03	05 28	05 49	00 32	01 19	02 07	02 54
0	04 55	05 19	05 41	00 43	01 27	02 12	02 57
S 10	04 45	05 10	05 32	00 53	01 35	02 17	02 59
20	04 33	04 59	05 22	01 03	01 44	02 23	03 02
30	04 17	04 46	05 11	01 16	01 53	02 30	03 05
35	04 07	04 38	05 05	01 23	01 59	02 33	03 07
40	03 54	04 29	04 57	01 31	02 05	02 38	03 09
45	03 39	04 17	04 49	01 40	02 12	02 42	03 11
S 50	03 19	04 03	04 38	01 52	02 21	02 48	03 14
52	03 10	03 56	04 33	01 57	02 25	02 51	03 16
54	02 58	03 49	04 28	02 03	02 30	02 54	03 17
56	02 45	03 40	04 22	02 09	02 34	02 57	03 19
58	02 30	03 30	04 15	02 16	02 40	03 01	03 20
S 60	02 11	03 19	04 08	02 24	02 46	03 05	03 22

Lat.	Sunset	Twilight Civil	Twilight Naut.	Moonset 25	Moonset 26	Moonset 27	Moonset 28
°	h m	h m	h m	h m	h m	h m	h m
N 72	15 07	16 26	17 46	15 51	15 46	15 41	15 37
N 70	15 27	16 35	17 47	15 31	15 33	15 34	15 35
68	15 42	16 43	17 49	15 15	15 22	15 28	15 33
66	15 54	16 50	17 50	15 02	15 14	15 23	15 32
64	16 05	16 56	17 51	14 51	15 06	15 19	15 31
62	16 14	17 01	17 52	14 42	15 00	15 15	15 30
60	16 21	17 05	17 54	14 34	14 54	15 12	15 29
N 58	16 28	17 09	17 55	14 27	14 49	15 09	15 28
56	16 34	17 13	17 56	14 21	14 45	15 06	15 27
54	16 39	17 16	17 57	14 15	14 41	15 04	15 27
52	16 44	17 19	17 58	14 10	14 37	15 02	15 26
50	16 48	17 22	17 59	14 05	14 34	15 00	15 26
45	16 58	17 28	18 02	13 56	14 26	14 56	15 25
N 40	17 06	17 33	18 05	13 47	14 20	14 52	15 24
35	17 13	17 38	18 08	13 40	14 15	14 49	15 23
30	17 19	17 43	18 11	13 34	14 11	14 46	15 22
20	17 29	17 52	18 18	13 23	14 03	14 42	15 21
N 10	17 39	18 00	18 25	13 13	13 56	14 37	15 20
0	17 47	18 09	18 33	13 04	13 49	14 33	15 18
S 10	17 56	18 18	18 43	12 55	13 42	14 29	15 17
20	18 06	18 29	18 56	12 45	13 35	14 25	15 16
30	18 17	18 42	19 12	12 34	13 27	14 20	15 15
35	18 24	18 50	19 22	12 28	13 22	14 17	15 14
40	18 31	19 00	19 35	12 20	13 17	14 14	15 13
45	18 40	19 12	19 50	12 12	13 10	14 10	15 12
S 50	18 51	19 26	20 10	12 01	13 03	14 06	15 10
52	18 56	19 33	20 20	11 56	12 59	14 03	15 10
54	19 01	19 41	20 32	11 51	12 55	14 01	15 09
56	19 07	19 50	20 45	11 45	12 51	13 59	15 08
58	19 14	20 00	21 01	11 38	12 46	13 56	15 08
S 60	19 22	20 11	21 21	11 31	12 41	13 53	15 07

Day	SUN Eqn. of Time 00ʰ	SUN Eqn. of Time 12ʰ	SUN Mer. Pass.	MOON Mer. Pass. Upper	MOON Mer. Pass. Lower	MOON Age	MOON Phase
	m s	m s	h m	h m	h m	d	
25	15 48	15 52	11 44	06 53	19 16	23	
26	15 55	15 58	11 44	07 38	20 00	24	
27	16 01	16 04	11 44	08 23	20 45	25	

T - 5

66 **1981 MARCH 26, 27, 28 (THURS., FRI., SAT.)**

G.M.T.	ARIES	VENUS −3.5		MARS +1.3		JUPITER −2.0		SATURN +0.6		STARS		
	G.H.A.	G.H.A.	Dec.	G.H.A.	Dec.	G.H.A.	Dec.	G.H.A.	Dec.	Name	S.H.A.	Dec.
d h	° ′	° ′	° ′	° ′	° ′	° ′	° ′	° ′	° ′		° ′	° ′
26 00	183 21.1	180 52.7	S 0 27.6	176 44.3	N 2 04.9	357 39.3	S 0 43.8	356 18.5	S 0 09.3	Acamar	315 37.3	S40 23.1
01	198 23.6	195 52.3	26.3	191 45.0	05.7	12 42.0	43.7	11 21.1	09.3	Achernar	335 45.6	S57 20.2
02	213 26.0	210 51.9	25.1	206 45.7	06.5	27 44.8	43.5	26 23.8	09.2	Acrux	173 36.1	S62 59.7
03	228 28.5	225 51.5	·· 23.8	221 46.4	·· 07.3	42 47.6	·· 43.4	41 26.4	·· 09.1	Adhara	255 31.8	S28 57.1
04	243 30.9	240 51.1	22.6	236 47.1	08.0	57 50.3	43.3	56 29.1	09.0	Aldebaran	291 17.8	N16 28.2
05	258 33.4	255 50.8	21.3	251 47.8	08.8	72 53.1	43.2	71 31.7	09.0			
06	273 35.9	270 50.4	S 0 20.1	266 48.5	N 2 09.6	87 55.8	S 0 43.0	86 34.3	S 0 08.9	Alioth	166 41.7	N56 03.7
07	288 38.3	285 50.0	18.8	281 49.2	10.4	102 58.6	42.9	101 37.0	08.8	Alkaid	153 17.8	N49 24.4
T 08	303 40.8	300 49.6	17.6	296 49.9	11.2	118 01.4	42.8	116 39.6	08.7	Al Na'ir	28 14.9	S47 03.1
H 09	318 43.3	315 49.3	·· 16.3	311 50.6	·· 12.0	133 04.1	·· 42.6	131 42.3	·· 08.6	Alnilam	276 11.4	S 1 13.0
U 10	333 45.7	330 48.9	15.1	326 51.3	12.7	148 06.9	42.5	146 44.9	08.6	Alphard	218 20.0	S 8 34.8
R 11	348 48.2	345 48.5	13.8	341 52.0	13.5	163 09.6	42.4	161 47.5	08.5			
S 12	3 50.7	0 48.1	S 0 12.5	356 52.7	N 2 14.3	178 12.4	S 0 42.3	176 50.2	S 0 08.4	Alphecca	126 31.6	N26 46.5
D 13	18 53.1	15 47.7	11.3	11 53.4	15.1	193 15.2	42.1	191 52.8	08.3	Alpheratz	358 09.3	N28 59.0
A 14	33 55.6	30 47.4	10.0	26 54.1	15.9	208 17.9	42.0	206 55.5	08.2	Altair	62 32.3	N 8 48.9
Y 15	48 58.0	45 47.0	·· 08.8	41 54.8	·· 16.7	223 20.7	·· 41.9	221 58.1	·· 08.2	Ankaa	353 40.3	S42 24.7
16	64 00.5	60 46.6	07.5	56 55.5	17.4	238 23.4	41.7	237 00.8	08.1	Antares	112 56.3	S26 23.4
17	79 03.0	75 46.2	06.3	71 56.2	18.2	253 26.2	41.6	252 03.4	08.0			
18	94 05.4	90 45.9	S 0 05.0	86 56.8	N 2 19.0	268 29.0	S 0 41.5	267 06.1	S 0 07.9	Arcturus	146 17.9	N19 16.7
19	109 07.9	105 45.5	03.8	101 57.5	19.8	283 31.7	41.4	282 08.7	07.9	Atria	108 20.0	S68 59.4
20	124 10.4	120 45.1	02.5	116 58.2	20.6	298 34.5	41.2	297 11.3	07.8	Avior	234 27.8	S59 27.2
21	139 12.8	135 44.7	S 0 01.2	131 58.9	·· 21.4	313 37.2	·· 41.1	312 14.0	·· 07.7	Bellatrix	278 58.5	N 6 19.8
22	154 15.3	150 44.4	0 00.0	146 59.6	22.1	328 40.0	41.0	327 16.6	07.6	Betelgeuse	271 28.0	N 7 24.1
23	169 17.8	165 44.0	N 0 01.3	162 00.3	22.9	343 42.8	40.8	342 19.3	07.5			
27 00	184 20.2	180 43.6	N 0 02.5	177 01.0	N 2 23.7	358 45.5	S 0 40.7	357 21.9	S 0 07.5	Canopus	264 07.1	S52 41.5
01	199 22.7	195 43.2	03.8	192 01.7	24.5	13 48.3	40.6	12 24.6	07.4	Capella	281 10.9	N45 58.8
02	214 25.2	210 42.8	05.0	207 02.4	25.3	28 51.0	40.5	27 27.2	07.3	Deneb	49 48.5	N45 12.5
03	229 27.6	225 42.5	·· 06.3	222 03.1	·· 26.1	43 53.8	·· 40.3	42 29.8	·· 07.2	Denebola	182 58.4	N14 40.6
04	244 30.1	240 42.1	07.5	237 03.8	26.8	58 56.6	40.2	57 32.5	07.1	Diphda	349 20.9	S18 05.6
05	259 32.5	255 41.7	08.8	252 04.5	27.6	73 59.3	40.1	72 35.1	07.1			
06	274 35.0	270 41.3	N 0 10.1	267 05.2	N 2 28.4	89 02.1	S 0 39.9	87 37.8	S 0 07.0	Dubhe	194 21.1	N61 51.3
07	289 37.5	285 41.0	11.3	282 05.9	29.2	104 04.9	39.8	102 40.4	06.9	Elnath	278 43.8	N28 35.5
08	304 39.9	300 40.6	12.6	297 06.6	30.0	119 07.6	39.7	117 43.1	06.8	Eltanin	90 57.5	N51 29.2
F 09	319 42.4	315 40.2	·· 13.8	312 07.3	·· 30.7	134 10.4	·· 39.6	132 45.7	·· 06.8	Enif	34 11.5	N 9 47.1
R 10	334 44.9	330 39.8	15.1	327 08.0	31.5	149 13.1	39.4	147 48.3	06.7	Fomalhaut	15 51.4	S29 43.4
I 11	349 47.3	345 39.4	16.3	342 08.7	32.3	164 15.9	39.3	162 51.0	06.6			
D 12	4 49.8	0 39.1	N 0 17.6	357 09.4	N 2 33.1	179 18.7	S 0 39.2	177 53.6	S 0 06.5	Gacrux	172 27.8	S57 00.5
A 13	19 52.3	15 38.7	18.9	12 10.1	33.9	194 21.4	39.0	192 56.3	06.4	Gienah	176 17.3	S17 26.3
Y 14	34 54.7	30 38.3	20.1	27 10.8	34.7	209 24.2	38.9	207 58.9	06.4	Hadar	149 22.3	S60 16.8
15	49 57.2	45 37.9	·· 21.4	42 11.5	·· 35.4	224 26.9	·· 38.8	223 01.6	·· 06.3	Hamal	328 28.8	N23 22.3
16	64 59.7	60 37.6	22.6	57 12.2	36.2	239 29.7	38.7	238 04.2	06.2	Kaus Aust.	84 16.4	S34 23.5
17	80 02.1	75 37.2	23.9	72 12.9	37.0	254 32.5	38.5	253 06.8	06.1			
18	95 04.6	90 36.8	N 0 25.1	87 13.6	N 2 37.8	269 35.2	S 0 38.4	268 09.5	S 0 06.0	Kochab	137 18.1	N74 13.8
19	110 07.0	105 36.4	26.4	102 14.3	38.6	284 38.0	38.3	283 12.1	06.0	Markab	14 03.1	N15 06.0
20	125 09.5	120 36.1	27.6	117 15.0	39.3	299 40.7	38.2	298 14.8	05.9	Menkar	314 41.0	N 4 00.8
21	140 12.0	135 35.7	·· 28.9	132 15.7	·· 40.1	314 43.5	·· 38.0	313 17.4	·· 05.8	Menkent	148 36.3	S36 16.6
22	155 14.4	150 35.3	30.2	147 16.4	40.9	329 46.3	37.9	328 20.1	05.7	Miaplacidus	221 44.3	S69 38.6
23	170 16.9	165 34.9	31.4	162 17.1	41.7	344 49.0	37.8	343 22.7	05.7			
28 00	185 19.4	180 34.5	N 0 32.7	177 17.8	N 2 42.5	359 51.8	S 0 37.6	358 25.3	S 0 05.6	Mirfak	309 16.0	N49 47.7
01	200 21.8	195 34.2	33.9	192 18.5	43.2	14 54.5	37.5	13 28.0	05.5	Nunki	76 28.8	S26 19.2
02	215 24.3	210 33.8	35.2	207 19.1	44.0	29 57.3	37.4	28 30.6	05.4	Peacock	53 58.1	S56 47.6
03	230 26.8	225 33.4	·· 36.4	222 19.8	·· 44.8	45 00.1	·· 37.3	43 33.3	·· 05.3	Pollux	243 57.6	N28 04.3
04	245 29.2	240 33.0	37.7	237 20.5	45.6	60 02.8	37.1	58 35.9	05.3	Procyon	245 25.3	N 5 16.3
05	260 31.7	255 32.7	38.9	252 21.2	46.4	75 05.6	37.0	73 38.6	05.2			
06	275 34.2	270 32.3	N 0 40.2	267 21.9	N 2 47.1	90 08.3	S 0 36.9	88 41.2	S 0 05.1	Rasalhague	96 29.2	N12 34.3
07	290 36.6	285 31.9	41.5	282 22.6	47.9	105 11.1	36.7	103 43.8	05.0	Regulus	208 09.4	N12 03.5
S 08	305 39.1	300 31.5	42.7	297 23.3	48.7	120 13.9	36.6	118 46.5	04.9	Rigel	281 35.8	S 8 13.6
A 09	320 41.5	315 31.2	·· 44.0	312 24.0	·· 49.5	135 16.6	·· 36.5	133 49.1	·· 04.9	Rigil Kent.	140 24.8	S60 45.2
T 10	335 44.0	330 30.8	45.2	327 24.7	50.3	150 19.4	36.4	148 51.8	04.8	Sabik	102 40.6	S15 42.1
U 11	350 46.5	345 30.4	46.5	342 25.4	51.0	165 22.1	36.2	163 54.4	04.7			
R 12	5 48.9	0 30.0	N 0 47.7	357 26.1	N 2 51.8	180 24.9	S 0 36.1	178 57.1	S 0 04.6	Schedar	350 09.2	N56 25.9
D 13	20 51.4	15 29.7	49.0	12 26.8	52.6	195 27.7	36.0	193 59.7	04.6	Shaula	96 55.2	S37 05.3
A 14	35 53.9	30 29.3	50.3	27 27.5	53.4	210 30.4	35.8	209 02.3	04.5	Sirius	258 55.4	S16 41.7
Y 15	50 56.3	45 28.9	·· 51.5	42 28.2	·· 54.2	225 33.2	·· 35.7	224 05.0	·· 04.4	Spica	158 56.9	S11 03.8
16	65 58.8	60 28.5	52.8	57 28.9	54.9	240 35.9	35.6	239 07.6	04.3	Suhail	223 10.3	S43 21.6
17	81 01.3	75 28.1	54.0	72 29.6	55.7	255 38.7	35.5	254 10.3	04.2			
18	96 03.7	90 27.8	N 0 55.3	87 30.3	N 2 56.5	270 41.5	S 0 35.3	269 12.9	S 0 04.2	Vega	80 55.6	N38 45.7
19	111 06.2	105 27.4	56.5	102 31.0	57.3	285 44.2	35.2	284 15.6	04.1	Zuben'ubi	137 32.4	S15 57.8
20	126 08.6	120 27.0	57.8	117 31.7	58.1	300 47.0	35.1	299 18.2	04.0			
21	141 11.1	135 26.6	0 59.0	132 32.4	·· 58.8	315 49.7	·· 35.0	314 20.8	·· 03.9		S.H.A.	Mer. Pass.
22	156 13.6	150 26.3	1 00.3	147 33.1	2 59.6	330 52.5	34.8	329 23.5	03.9		° ′	h m
23	171 16.0	165 25.9	01.6	162 33.8	3 00.4	345 55.3	34.7	344 26.1	03.8	Venus	356 23.4	11 57
	h m									Mars	352 40.8	12 11
Mer. Pass.	11 40.7	*v* −0.4	*d* 1.3	*v* 0.7	*d* 0.8	*v* 2.8	*d* 0.1	*v* 2.6	*d* 0.1	Jupiter	174 25.3	0 05
										Saturn	173 01.7	0 11

T - 6

1981 MARCH 26, 27, 28 (THURS., FRI., SAT.)

G.M.T.	SUN G.H.A.	SUN Dec.	MOON G.H.A.	MOON v	MOON Dec.	MOON d	MOON H.P.
d h	° ′	° ′	° ′	′	° ′	′	′
26 00	178 32.4	N 2 05.0	300 24.7	13.2	S16 25.0	6.4	54.2
01	193 32.6	06.0	314 56.9	13.3	16 31.4	6.4	54.2
02	208 32.8	07.0	329 29.2	13.2	16 37.8	6.3	54.2
03	223 33.0	·· 08.0	344 01.4	13.1	16 44.1	6.2	54.3
04	238 33.1	08.9	358 33.5	13.1	16 50.3	6.2	54.3
05	253 33.3	09.9	13 05.6	13.1	16 56.5	6.1	54.3
06	268 33.5	N 2 10.9	27 37.7	13.0	S17 02.6	6.0	54.3
07	283 33.7	11.9	42 09.7	13.0	17 08.6	5.9	54.3
T 08	298 33.9	12.9	56 41.7	13.0	17 14.5	5.9	54.3
H 09	313 34.1	·· 13.8	71 13.7	12.8	17 20.4	5.7	54.3
U 10	328 34.3	14.8	85 45.5	12.9	17 26.1	5.7	54.3
R 11	343 34.5	15.8	100 17.4	12.8	17 31.8	5.7	54.3
S 12	358 34.7	N 2 16.8	114 49.2	12.8	S17 37.5	5.5	54.4
D 13	13 34.9	17.8	129 21.0	12.7	17 43.0	5.5	54.4
A 14	28 35.0	18.7	143 52.7	12.7	17 48.5	5.4	54.4
Y 15	43 35.2	·· 19.7	158 24.4	12.6	17 53.9	5.3	54.4
16	58 35.4	20.7	172 56.0	12.6	17 59.2	5.3	54.4
17	73 35.6	21.7	187 27.6	12.5	18 04.5	5.1	54.4
18	88 35.8	N 2 22.7	201 59.1	12.5	S18 09.6	5.1	54.4
19	103 36.0	23.6	216 30.6	12.5	18 14.7	5.0	54.5
20	118 36.2	24.6	231 02.1	12.4	18 19.7	5.0	54.5
21	133 36.4	·· 25.6	245 33.5	12.3	18 24.7	4.8	54.5
22	148 36.6	26.6	260 04.8	12.4	18 29.5	4.8	54.5
23	163 36.8	27.6	274 36.2	12.2	18 34.3	4.6	54.5
27 00	178 37.0	N 2 28.5	289 07.4	12.3	S18 38.9	4.6	54.5
01	193 37.1	29.5	303 38.7	12.2	18 43.5	4.5	54.5
02	208 37.3	30.5	318 09.9	12.1	18 48.0	4.5	54.6
03	223 37.5	·· 31.5	332 41.0	12.1	18 52.5	4.3	54.6
04	238 37.7	32.5	347 12.1	12.0	18 56.8	4.2	54.6
05	253 37.9	33.4	1 43.1	12.0	19 01.0	4.2	54.6
06	268 38.1	N 2 34.4	16 14.1	12.0	S19 05.2	4.1	54.6
07	283 38.3	35.4	30 45.1	11.9	19 09.3	4.0	54.7
08	298 38.5	36.4	45 16.0	11.9	19 13.3	3.9	54.7
F 09	313 38.7	·· 37.4	59 46.9	11.8	19 17.2	3.8	54.7
R 10	328 38.9	38.3	74 17.7	11.8	19 21.0	3.7	54.7
I 11	343 39.0	39.3	88 48.5	11.7	19 24.7	3.7	54.7
D 12	358 39.2	N 2 40.3	103 19.2	11.7	S19 28.4	3.5	54.7
A 13	13 39.4	41.3	117 49.9	11.6	19 31.9	3.5	54.8
Y 14	28 39.6	42.2	132 20.5	11.6	19 35.4	3.4	54.8
15	43 39.8	·· 43.2	146 51.1	11.6	19 38.8	3.3	54.8
16	58 40.0	44.2	161 21.7	11.5	19 42.1	3.1	54.8
17	73 40.2	45.2	175 52.2	11.5	19 45.2	3.1	54.8
18	88 40.4	N 2 46.2	190 22.7	11.4	S19 48.3	3.0	54.9
19	103 40.6	47.1	204 53.1	11.4	19 51.3	2.9	54.9
20	118 40.8	48.1	219 23.5	11.3	19 54.2	2.9	54.9
21	133 40.9	·· 49.1	233 53.8	11.3	19 57.1	2.7	54.9
22	148 41.1	50.1	248 24.1	11.3	19 59.8	2.6	55.0
23	163 41.3	51.0	262 54.4	11.2	20 02.4	2.5	55.0
28 00	178 41.5	N 2 52.0	277 24.6	11.1	S20 04.9	2.5	55.0
01	193 41.7	53.0	291 54.7	11.2	20 07.4	2.3	55.0
02	208 41.9	54.0	306 24.9	11.0	20 09.7	2.3	55.0
03	223 42.1	·· 55.0	320 54.9	11.1	20 12.0	2.1	55.1
04	238 42.3	55.9	335 25.0	11.0	20 14.1	2.1	55.1
05	253 42.5	56.9	349 55.0	10.9	20 16.2	1.9	55.1
06	268 42.7	N 2 57.9	4 24.9	10.9	S20 18.1	1.9	55.1
07	283 42.8	58.9	18 54.8	10.9	20 20.0	1.7	55.2
S 08	298 43.0	2 59.8	33 24.7	10.8	20 21.7	1.7	55.2
A 09	313 43.2	3 00.8	47 54.5	10.8	20 23.4	1.5	55.2
T 10	328 43.4	01.8	62 24.3	10.8	20 24.9	1.5	55.2
U 11	343 43.6	02.8	76 54.1	10.7	20 26.4	1.3	55.3
R 12	358 43.8	N 3 03.7	91 23.8	10.6	S20 27.7	1.3	55.3
D 13	13 44.0	04.7	105 53.4	10.7	20 29.0	1.1	55.3
A 14	28 44.2	05.7	120 23.1	10.6	20 30.1	1.1	55.3
Y 15	43 44.4	·· 06.7	134 52.7	10.5	20 31.2	0.9	55.4
16	58 44.5	07.6	149 22.2	10.5	20 32.1	0.9	55.4
17	73 44.7	08.6	163 51.7	10.5	20 33.0	0.7	55.4
18	88 44.9	N 3 09.6	178 21.2	10.4	S20 33.7	0.6	55.5
19	103 45.1	10.6	192 50.6	10.4	20 34.3	0.6	55.5
20	118 45.3	11.5	207 20.0	10.4	20 34.9	0.4	55.5
21	133 45.5	·· 12.5	221 49.4	10.3	20 35.3	0.3	55.5
22	148 45.7	13.5	236 18.7	10.3	20 35.6	0.2	55.6
23	163 45.9	14.5	250 48.0	10.2	20 35.8	0.2	55.6
	S.D. 16.1	d 1.0	S.D. 14.8		14.9		15.1

Lat.	Twilight Naut.	Twilight Civil	Sunrise	Moonrise 26	Moonrise 27	Moonrise 28	Moonrise 29
°	h m	h m	h m	h m	h m	h m	h m
N 72	02 30	04 12	05 23	02 36	▬	▬	▬
N 70	02 58	04 24	05 27	01 43	03 35	▬	▬
68	03 19	04 34	05 31	01 11	02 41	04 05	05 06
66	03 35	04 42	05 34	00 48	02 09	03 22	04 20
64	03 48	04 48	05 37	00 30	01 45	02 53	03 50
62	03 58	04 54	05 39	00 15	01 26	02 32	03 27
60	04 07	04 59	05 41	00 02	01 11	02 14	03 09
N 58	04 15	05 03	05 43	24 58	00 58	01 59	02 54
56	04 22	05 07	05 44	24 46	00 46	01 47	02 41
54	04 27	05 10	05 46	24 36	00 36	01 36	02 29
52	04 32	05 13	05 47	24 28	00 28	01 26	02 19
50	04 37	05 16	05 48	24 20	00 20	01 17	02 11
45	04 46	05 21	05 50	24 03	00 03	00 59	01 52
N 40	04 53	05 25	05 52	23 49	24 44	00 44	01 36
35	04 59	05 29	05 54	23 38	24 31	00 31	01 23
30	05 04	05 32	05 56	23 28	24 20	00 20	01 12
20	05 10	05 36	05 58	23 10	24 01	00 01	00 53
N 10	05 15	05 39	06 00	22 55	23 45	24 36	00 36
0	05 17	05 41	06 02	22 41	23 30	24 20	00 20
S 10	05 19	05 43	06 04	22 27	23 15	24 04	00 04
20	05 18	05 44	06 06	22 13	22 58	23 47	24 40
30	05 16	05 44	06 08	21 55	22 40	23 28	24 21
35	05 14	05 43	06 09	21 46	22 29	23 17	24 10
40	05 11	05 43	06 10	21 34	22 16	23 04	23 58
45	05 08	05 42	06 11	21 21	22 02	22 49	23 43
S 50	05 03	05 40	06 13	21 05	21 44	22 30	23 25
52	05 00	05 40	06 13	20 58	21 35	22 21	23 16
54	04 57	05 39	06 14	20 49	21 26	22 11	23 07
56	04 54	05 38	06 15	20 40	21 15	22 00	22 56
58	04 51	05 37	06 16	20 29	21 03	21 48	22 43
S 60	04 46	05 35	06 17	20 17	20 49	21 33	22 29

Lat.	Sunset	Twilight Civil	Twilight Naut.	Moonset 26	Moonset 27	Moonset 28	Moonset 29
°	h m	h m	h m	h m	h m	h m	h m
N 72	18 51	20 02	21 48	05 24	▬	▬	▬
N 70	18 46	19 50	21 18	06 18	06 03	▬	▬
68	18 42	19 40	20 56	06 51	06 58	07 16	07 59
66	18 39	19 31	20 39	07 15	07 31	07 58	08 46
64	18 36	19 24	20 26	07 34	07 55	08 27	09 16
62	18 33	19 19	20 15	07 49	08 14	08 49	09 38
60	18 31	19 14	20 06	08 02	08 30	09 07	09 56
N 58	18 29	19 09	19 58	08 14	08 43	09 22	10 12
56	18 28	19 05	19 51	08 23	08 55	09 35	10 25
54	18 26	19 02	19 45	08 32	09 05	09 46	10 36
52	18 25	18 59	19 40	08 40	09 14	09 56	10 46
50	18 24	18 56	19 35	08 47	09 22	10 04	10 55
45	18 21	18 51	19 26	09 02	09 39	10 23	11 13
N 40	18 19	18 46	19 18	09 14	09 54	10 38	11 29
35	18 17	18 43	19 12	09 25	10 06	10 51	11 42
30	18 16	18 40	19 08	09 34	10 16	11 02	11 53
20	18 13	18 35	19 01	09 50	10 34	11 21	12 12
N 10	18 11	18 32	18 56	10 04	10 50	11 38	12 29
0	18 09	18 29	18 53	10 17	11 05	11 54	12 45
S 10	18 07	18 28	18 52	10 30	11 19	12 09	13 00
20	18 05	18 27	18 52	10 44	11 35	12 26	13 17
30	18 03	18 27	18 54	11 00	11 53	12 45	13 36
35	18 02	18 27	18 56	11 10	12 04	12 56	13 47
40	18 00	18 27	18 59	11 21	12 16	13 09	14 00
45	17 59	18 28	19 02	11 33	12 30	13 24	14 15
S 50	17 57	18 29	19 07	11 49	12 48	13 43	14 33
52	17 57	18 30	19 09	11 56	12 56	13 52	14 42
54	17 56	18 31	19 12	12 04	13 05	14 02	14 52
56	17 55	18 32	19 15	12 13	13 15	14 13	15 03
58	17 54	18 33	19 19	12 23	13 27	14 25	15 15
S 60	17 53	18 34	19 23	12 35	13 41	14 40	15 30

Day	SUN Eqn. of Time 00^h	SUN Eqn. of Time 12^h	SUN Mer. Pass.	MOON Mer. Pass. Upper	MOON Mer. Pass. Lower	MOON Age	MOON Phase
	m s	m s	h m	h m	h m	d	
26	05 51	05 42	12 06	04 06	16 29	20	
27	05 33	05 23	12 05	04 53	17 17	21	◑
28	05 14	05 05	12 05	05 42	18 07	22	

T - 7

CONVERSION OF ARC TO TIME

0°–59°		60°–119°		120°–179°		180°–239°		240°–299°		300°–359°			0′·00	0′·25	0′·50	0′·75
°	h m	°	h m	°	h m	°	h m	°	h m	°	h m	′	m s	m s	m s	m s
0	0 00	60	4 00	120	8 00	180	12 00	240	16 00	300	20 00	0	0 00	0 01	0 02	0 03
1	0 04	61	4 04	121	8 04	181	12 04	241	16 04	301	20 04	1	0 04	0 05	0 06	0 07
2	0 08	62	4 08	122	8 08	182	12 08	242	16 08	302	20 08	2	0 08	0 09	0 10	0 11
3	0 12	63	4 12	123	8 12	183	12 12	243	16 12	303	20 12	3	0 12	0 13	0 14	0 15
4	0 16	64	4 16	124	8 16	184	12 16	244	16 16	304	20 16	4	0 16	0 17	0 18	0 19
5	0 20	65	4 20	125	8 20	185	12 20	245	16 20	305	20 20	5	0 20	0 21	0 22	0 23
6	0 24	66	4 24	126	8 24	186	12 24	246	16 24	306	20 24	6	0 24	0 25	0 26	0 27
7	0 28	67	4 28	127	8 28	187	12 28	247	16 28	307	20 28	7	0 28	0 29	0 30	0 31
8	0 32	68	4 32	128	8 32	188	12 32	248	16 32	308	20 32	8	0 32	0 33	0 34	0 35
9	0 36	69	4 36	129	8 36	189	12 36	249	16 36	309	20 36	9	0 36	0 37	0 38	0 39
10	0 40	70	4 40	130	8 40	190	12 40	250	16 40	310	20 40	10	0 40	0 41	0 42	0 43
11	0 44	71	4 44	131	8 44	191	12 44	251	16 44	311	20 44	11	0 44	0 45	0 46	0 47
12	0 48	72	4 48	132	8 48	192	12 48	252	16 48	312	20 48	12	0 48	0 49	0 50	0 51
13	0 52	73	4 52	133	8 52	193	12 52	253	16 52	313	20 52	13	0 52	0 53	0 54	0 55
14	0 56	74	4 56	134	8 56	194	12 56	254	16 56	314	20 56	14	0 56	0 57	0 58	0 59
15	1 00	75	5 00	135	9 00	195	13 00	255	17 00	315	21 00	15	1 00	1 01	1 02	1 03
16	1 04	76	5 04	136	9 04	196	13 04	256	17 04	316	21 04	16	1 04	1 05	1 06	1 07
17	1 08	77	5 08	137	9 08	197	13 08	257	17 08	317	21 08	17	1 08	1 09	1 10	1 11
18	1 12	78	5 12	138	9 12	198	13 12	258	17 12	318	21 12	18	1 12	1 13	1 14	1 15
19	1 16	79	5 16	139	9 16	199	13 16	259	17 16	319	21 16	19	1 16	1 17	1 18	1 19
20	1 20	80	5 20	140	9 20	200	13 20	260	17 20	320	21 20	20	1 20	1 21	1 22	1 23
21	1 24	81	5 24	141	9 24	201	13 24	261	17 24	321	21 24	21	1 24	1 25	1 26	1 27
22	1 28	82	5 28	142	9 28	202	13 28	262	17 28	322	21 28	22	1 28	1 29	1 30	1 31
23	1 32	83	5 32	143	9 32	203	13 32	263	17 32	323	21 32	23	1 32	1 33	1 34	1 35
24	1 36	84	5 36	144	9 36	204	13 36	264	17 36	324	21 36	24	1 36	1 37	1 38	1 39
25	1 40	85	5 40	145	9 40	205	13 40	265	17 40	325	21 40	25	1 40	1 41	1 42	1 43
26	1 44	86	5 44	146	9 44	206	13 44	266	17 44	326	21 44	26	1 44	1 45	1 46	1 47
27	1 48	87	5 48	147	9 48	207	13 48	267	17 48	327	21 48	27	1 48	1 49	1 50	1 51
28	1 52	88	5 52	148	9 52	208	13 52	268	17 52	328	21 52	28	1 52	1 53	1 54	1 55
29	1 56	89	5 56	149	9 56	209	13 56	269	17 56	329	21 56	29	1 56	1 57	1 58	1 59
30	2 00	90	6 00	150	10 00	210	14 00	270	18 00	330	22 00	30	2 00	2 01	2 02	2 03
31	2 04	91	6 04	151	10 04	211	14 04	271	18 04	331	22 04	31	2 04	2 05	2 06	2 07
32	2 08	92	6 08	152	10 08	212	14 08	272	18 08	332	22 08	32	2 08	2 09	2 10	2 11
33	2 12	93	6 12	153	10 12	213	14 12	273	18 12	333	22 12	33	2 12	2 13	2 14	2 15
34	2 16	94	6 16	154	10 16	214	14 16	274	18 16	334	22 16	34	2 16	2 17	2 18	2 19
35	2 20	95	6 20	155	10 20	215	14 20	275	18 20	335	22 20	35	2 20	2 21	2 22	2 23
36	2 24	96	6 24	156	10 24	216	14 24	276	18 24	336	22 24	36	2 24	2 25	2 26	2 27
37	2 28	97	6 28	157	10 28	217	14 28	277	18 28	337	22 28	37	2 28	2 29	2 30	2 31
38	2 32	98	6 32	158	10 32	218	14 32	278	18 32	338	22 32	38	2 32	2 33	2 34	2 35
39	2 36	99	6 36	159	10 36	219	14 36	279	18 36	339	22 36	39	2 36	2 37	2 38	2 39
40	2 40	100	6 40	160	10 40	220	14 40	280	18 40	340	22 40	40	2 40	2 41	2 42	2 43
41	2 44	101	6 44	161	10 44	221	14 44	281	18 44	341	22 44	41	2 44	2 45	2 46	2 47
42	2 48	102	6 48	162	10 48	222	14 48	282	18 48	342	22 48	42	2 48	2 49	2 50	2 51
43	2 52	103	6 52	163	10 52	223	14 52	283	18 52	343	22 52	43	2 52	2 53	2 54	2 55
44	2 56	104	6 56	164	10 56	224	14 56	284	18 56	344	22 56	44	2 56	2 57	2 58	2 59
45	3 00	105	7 00	165	11 00	225	15 00	285	19 00	345	23 00	45	3 00	3 01	3 02	3 03
46	3 04	106	7 04	166	11 04	226	15 04	286	19 04	346	23 04	46	3 04	3 05	3 06	3 07
47	3 08	107	7 08	167	11 08	227	15 08	287	19 08	347	23 08	47	3 08	3 09	3 10	3 11
48	3 12	108	7 12	168	11 12	228	15 12	288	19 12	348	23 12	48	3 12	3 13	3 14	3 15
49	3 16	109	7 16	169	11 16	229	15 16	289	19 16	349	23 16	49	3 16	3 17	3 18	3 19
50	3 20	110	7 20	170	11 20	230	15 20	290	19 20	350	23 20	50	3 20	3 21	3 22	3 23
51	3 24	111	7 24	171	11 24	231	15 24	291	19 24	351	23 24	51	3 24	3 25	3 26	3 27
52	3 28	112	7 28	172	11 28	232	15 28	292	19 28	352	23 28	52	3 28	3 29	3 30	3 31
53	3 32	113	7 32	173	11 32	233	15 32	293	19 32	353	23 32	53	3 32	3 33	3 34	3 35
54	3 36	114	7 36	174	11 36	234	15 36	294	19 36	354	23 36	54	3 36	3 37	3 38	3 39
55	3 40	115	7 40	175	11 40	235	15 40	295	19 40	355	23 40	55	3 40	3 41	3 42	3 43
56	3 44	116	7 44	176	11 44	236	15 44	296	19 44	356	23 44	56	3 44	3 45	3 46	3 47
57	3 48	117	7 48	177	11 48	237	15 48	297	19 48	357	23 48	57	3 48	3 49	3 50	3 51
58	3 52	118	7 52	178	11 52	238	15 52	298	19 52	358	23 52	58	3 52	3 53	3 54	3 55
59	3 56	119	7 56	179	11 56	239	15 56	299	19 56	359	23 56	59	3 56	3 57	3 58	3 59

The above table is for converting expressions in arc to their equivalent in time ; its main use in this Almanac is for the conversion of longitude for application to L.M.T. (*added* if *west*, *subtracted* if *east*) to give G.M.T. or vice versa, particularly in the case of sunrise, sunset, etc.

We have combined the planet data for two years 1978 and 1981 in this table. Normally this table has data for one year only. It is only the planet data that changes on this table from year to year.

T - 8

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

SUN

App. Alt.	OCT.—MAR. Lower Limb	OCT.—MAR. Upper Limb	App. Alt.	APR.—SEPT. Lower Limb	APR.—SEPT. Upper Limb
° ′	′	′	° ′	′	′
9 34	+10·8	−21·5	9 39	+10·6	−21·2
9 45	+10·9	−21·4	9 51	+10·7	−21·1
9 56	+11·0	−21·3	10 03	+10·8	−21·0
10 08	+11·1	−21·2	10 15	+10·9	−20·9
10 21	+11·2	−21·1	10 27	+11·0	−20·8
10 34	+11·3	−21·0	10 40	+11·1	−20·7
10 47	+11·4	−20·9	10 54	+11·2	−20·6
11 01	+11·5	−20·8	11 08	+11·3	−20·5
11 15	+11·6	−20·7	11 23	+11·4	−20·4
11 30	+11·7	−20·6	11 38	+11·5	−20·3
11 46	+11·8	−20·5	11 54	+11·6	−20·2
12 02	+11·9	−20·4	12 10	+11·7	−20·1
12 19	+12·0	−20·3	12 28	+11·8	−20·0
12 37	+12·1	−20·2	12 46	+11·9	−19·9
12 55	+12·2	−20·1	13 05	+12·0	−19·8
13 14	+12·3	−20·0	13 24	+12·1	−19·7
13 35	+12·4	−19·9	13 45	+12·2	−19·6
13 56	+12·5	−19·8	14 07	+12·3	−19·5
14 18	+12·6	−19·7	14 30	+12·4	−19·4
14 42	+12·7	−19·6	14 54	+12·5	−19·3
15 06	+12·8	−19·5	15 19	+12·6	−19·2
15 32	+12·9	−19·4	15 46	+12·7	−19·1
15 59	+13·0	−19·3	16 14	+12·8	−19·0
16 28	+13·1	−19·2	16 44	+12·9	−18·9
16 59	+13·2	−19·1	17 15	+13·0	−18·8
17 32	+13·3	−19·0	17 48	+13·1	−18·7
18 06	+13·4	−18·9	18 24	+13·2	−18·6
18 42	+13·5	−18·8	19 01	+13·3	−18·5
19 21	+13·6	−18·7	19 42	+13·4	−18·4
20 03	+13·7	−18·6	20 25	+13·5	−18·3
20 48	+13·8	−18·5	21 11	+13·6	−18·2
21 35	+13·9	−18·4	22 00	+13·7	−18·1
22 26	+14·0	−18·3	22 54	+13·8	−18·0
23 22	+14·1	−18·2	23 51	+13·9	−17·9
24 21	+14·2	−18·1	24 53	+14·0	−17·8
25 26	+14·3	−18·0	26 00	+14·1	−17·7
26 36	+14·4	−17·9	27 13	+14·2	−17·6
27 52	+14·5	−17·8	28 33	+14·3	−17·5
29 15	+14·6	−17·7	30 00	+14·4	−17·4
30 46	+14·7	−17·6	31 35	+14·5	−17·3
32 26	+14·8	−17·5	33 20	+14·6	−17·2
34 17	+14·9	−17·4	35 17	+14·7	−17·1
36 20	+15·0	−17·3	37 26	+14·8	−17·0
38 36	+15·1	−17·2	39 50	+14·9	−16·9
41 08	+15·2	−17·1	42 31	+15·0	−16·8
43 59	+15·3	−17·0	45 31	+15·1	−16·7
47 10	+15·4	−16·9	48 55	+15·2	−16·6
50 46	+15·5	−16·8	52 44	+15·3	−16·5
54 49	+15·6	−16·7	57 02	+15·4	−16·4
59 23	+15·7	−16·6	61 51	+15·5	−16·3
64 30	+15·8	−16·5	67 17	+15·6	−16·2
70 12	+15·9	−16·4	73 16	+15·7	−16·1
76 26	+16·0	−16·3	79 43	+15·8	−16·0
83 05	+16·1	−16·2	86 32	+15·9	−15·9
90 00			90 00		

STARS AND PLANETS

App. Alt.	Corrⁿ
° ′	′
9 56	−5·3
10 08	−5·2
10 20	−5·1
10 33	−5·0
10 46	−4·9
11 00	−4·8
11 14	−4·7
11 29	−4·6
11 45	−4·5
12 01	−4·4
12 18	−4·3
12 35	−4·2
12 54	−4·1
13 13	−4·0
13 33	−3·9
13 54	−3·8
14 16	−3·7
14 40	−3·6
15 04	−3·5
15 30	−3·4
15 57	−3·3
16 26	−3·2
16 56	−3·1
17 28	−3·0
18 02	−2·9
18 38	−2·8
19 17	−2·7
19 58	−2·6
20 42	−2·5
21 28	−2·4
22 19	−2·3
23 13	−2·2
24 11	−2·1
25 14	−2·0
26 22	−1·9
27 36	−1·8
28 56	−1·7
30 24	−1·6
32 00	−1·5
33 45	−1·4
35 40	−1·3
37 48	−1·2
40 08	−1·1
42 44	−1·0
45 36	−0·9
48 47	−0·8
52 18	−0·7
56 11	−0·6
60 28	−0·5
65 08	−0·4
70 11	−0·3
75 34	−0·2
81 13	−0·1
87 03	0·0
90 00	

App. Alt.	Additional Corrⁿ
	1981
	VENUS
	Jan. 1-Sept. 27
°	′
0	
42	+ 0·1
	Sept. 28-Nov. 13
°	′
0	
47	+ 0·2
	Nov. 14-Dec. 10
°	′
0	
46	+ 0·3
	Dec. 11-Dec. 26
°	′
0	+ 0·4
11	+ 0·5
41	
	Dec. 27-Dec. 31
°	′
0	
6	+ 0·5
20	+ 0·6
31	+ 0·7
	MARS
	Jan. 1-Dec. 31
°	′
0	
60	+ 0·1
	1978
	VENUS
	July 21-Sept. 2
°	′
0	
47	+ 0·2
	Sept. 3-Sept. 29
°	′
0	
46	+ 0·3
	Sept. 30-Oct. 14
°	′
0	
11	+ 0·4
41	+ 0·5
	Oct. 15-Oct. 22
°	′
0	
6	+ 0·5
20	+ 0·6
31	+ 0·7
	Oct. 23-Nov. 25
°	′
0	
4	+ 0·6
12	+ 0·7
22	+ 0·8

DIP

Ht. of Eye	Corrⁿ	Ht. of Eye	Ht. of Eye	Corrⁿ
m	′	ft.	m	′
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	m	′
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	ft.	′
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	ft.	′
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		
18·4	−7·6	60·5	130	−11·1
18·8	−7·7	62·1	135	−11·3
19·3	−7·8	63·8	140	−11·5
19·8	−7·9	65·4	145	−11·7
20·4	−8·0	67·1	150	−11·9
20·9	−8·1	68·8	155	−12·1
21·4		70·5		

App. Alt. = Apparent altitude = Sextant altitude corrected for index error and dip.
For daylight observations of Venus, see page 260.

App. Alt.	SUN OCT.–MAR. Lower Limb	SUN OCT.–MAR. Upper Limb	SUN APR.–SEPT. Lower Limb	SUN APR.–SEPT. Upper Limb	STARS PLANETS
° ′	′	′	′	′	′
0 00	−18·2	50·5	−18·4	50·2	−34·5
03	17·5	49·8	17·8	49·6	33·8
06	16·9	49·2	17·1	48·9	33·2
09	16·3	48·6	16·5	48·3	32·6
12	15·7	48·0	15·9	47·7	32·0
15	15·1	47·4	15·3	47·1	31·4
0 18	−14·5	46·8	−14·8	46·6	−30·8
21	14·0	46·3	14·2	46·0	30·3
24	13·5	45·8	13·7	45·5	29·8
27	12·9	45·2	13·2	45·0	29·2
30	12·4	44·7	12·7	44·5	28·7
33	11·9	44·2	12·2	44·0	28·2
0 36	−11·5	43·8	−11·7	43·5	−27·8
39	11·0	43·3	11·2	43·0	27·3
42	10·5	42·8	10·8	42·6	26·8
45	10·1	42·4	10·3	42·1	26·4
48	9·6	41·9	9·9	41·7	25·9
51	9·2	41·5	9·5	41·3	25·5
0 54	− 8·8	−41·1	− 9·1	−40·9	−25·1
0 57	8·4	40·7	8·7	40·5	24·7
1 00	8·0	40·3	8·3	40·1	24·3
03	7·7	40·0	7·9	39·7	24·0
06	7·3	39·6	7·5	39·3	23·6
09	6·9	39·2	7·2	39·0	23·2
1 12	− 6·6	−38·9	− 6·8	−38·6	−22·9
15	6·2	38·5	6·5	38·3	22·5
18	5·9	38·2	6·2	38·0	22·2
21	5·6	37·9	5·8	37·6	21·9
24	5·3	37·6	5·5	37·3	21·6
27	4·9	37·2	5·2	37·0	21·2
1 30	− 4·6	−36·9	− 4·9	−36·7	−20·9
35	4·2	36·5	4·4	36·2	20·5
40	3·7	36·0	4·0	35·8	20·0
45	3·2	35·5	3·5	35·3	19·5
50	2·8	35·1	3·1	34·9	19·1
1 55	2·4	34·7	2·6	34·4	18·7
2 00	− 2·0	−34·3	− 2·2	−34·0	−18·3
05	1·6	33·9	1·8	33·6	17·9
10	1·2	33·5	1·5	33·3	17·5
15	0·9	33·2	1·1	32·9	17·2
20	0·5	32·8	0·8	32·6	16·8
25	− 0·2	32·5	0·4	32·2	16·5
2 30	+ 0·2	−32·1	− 0·1	−31·9	−16·1
35	0·5	31·8	+ 0·2	31·6	15·8
40	0·8	31·5	0·5	31·3	15·5
45	1·1	31·2	0·8	31·0	15·2
50	1·4	30·9	1·1	30·7	14·9
2 55	1·6	30·7	1·4	30·4	14·7
3 00	+ 1·9	−30·4	+ 1·7	−30·1	−14·4
05	2·2	30·1	1·9	29·9	14·1
10	2·4	29·9	2·1	29·7	13·9
15	2·6	29·7	2·4	29·4	13·7
20	2·9	29·4	2·6	29·2	13·4
25	3·1	29·2	2·9	28·9	13·2
3 30	+ 3·3	−29·0	+ 3·1	−28·7	−13·0

App. Alt.	SUN OCT.–MAR. Lower Limb	SUN OCT.–MAR. Upper Limb	SUN APR.–SEPT. Lower Limb	SUN APR.–SEPT. Upper Limb	STARS PLANETS
° ′	′	′	′	′	′
3 30	+ 3·3	−29·0	+ 3·1	−28·7	−13·0
35	3·6	28·7	3·3	28·5	12·7
40	3·8	28·5	3·5	28·3	12·5
45	4·0	28·3	3·7	28·1	12·3
50	4·2	28·1	3·9	27·9	12·1
3 55	4·4	27·9	4·1	27·7	11·9
4 00	+ 4·5	−27·8	+ 4·3	−27·5	−11·8
05	4·7	27·6	4·5	27·3	11·6
10	4·9	27·4	4·6	27·2	11·4
15	5·1	27·2	4·8	27·0	11·2
20	5·2	27·1	5·0	26·8	11·1
25	5·4	26·9	5·1	26·7	10·9
4 30	+ 5·6	−26·7	+ 5·3	−26·5	−10·7
35	5·7	26·6	5·5	26·3	10·6
40	5·9	26·4	5·6	26·2	10·4
45	6·0	26·3	5·8	26·0	10·3
50	6·2	26·1	5·9	25·9	10·1
4 55	6·3	26·0	6·0	25·8	10·0
5 00	+ 6·4	−25·9	+ 6·2	−25·6	− 9·9
05	6·6	25·7	6·3	25·5	9·7
10	6·7	25·6	6·4	25·4	9·6
15	6·8	25·5	6·6	25·2	9·5
20	6·9	25·4	6·7	25·1	9·4
25	7·1	25·2	6·8	25·0	9·2
5 30	+ 7·2	−25·1	+ 6·9	−24·9	− 9·1
35	7·3	25·0	7·0	24·8	9·0
40	7·4	24·9	7·2	24·6	8·9
45	7·5	24·8	7·3	24·5	8·8
50	7·6	24·7	7·4	24·4	8·7
5 55	7·7	24·6	7·5	24·3	8·6
6 00	+ 7·8	−24·5	+ 7·6	−24·2	− 8·5
10	8·0	24·3	7·8	24·0	8·3
20	8·2	24·1	8·0	23·8	8·1
30	8·4	23·9	8·1	23·7	7·9
40	8·6	23·7	8·3	23·5	7·7
6 50	8·7	23·6	8·5	23·3	7·6
7 00	+ 8·9	−23·4	+ 8·6	−23·2	− 7·4
10	9·1	23·2	8·8	23·0	7·2
20	9·2	23·1	9·0	22·8	7·1
30	9·3	23·0	9·1	22·7	7·0
40	9·5	22·8	9·2	22·6	6·8
7 50	9·6	22·7	9·4	22·4	6·7
8 00	+ 9·7	−22·6	+ 9·5	−22·3	− 6·6
10	9·9	22·4	9·6	22·2	6·4
20	10·0	22·3	9·7	22·1	6·3
30	10·1	22·2	9·8	22·0	6·2
40	10·2	22·1	10·0	21·8	6·1
8 50	10·3	22·0	10·1	21·7	6·0
9 00	+10·4	−21·9	+10·2	−21·6	− 5·9
10	10·5	21·8	10·3	21·5	5·8
20	10·6	21·7	10·4	21·4	5·7
30	10·7	21·6	10·5	21·3	5·6
40	10·8	21·5	10·6	21·2	5·5
9 50	10·9	21·4	10·6	21·2	5·4
10 00	+11·0	−21·3	+10·7	−21·1	− 5·3

Additional corrections for temperature and pressure are given on the following page.
For bubble sextant observations ignore dip and use the star corrections for Sun, planets, and stars.

T - 9

4m INCREMENTS AND CORRECTIONS 5m

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

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

T - 10

INCREMENTS AND CORRECTIONS

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

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

v

T - 11

48m INCREMENTS AND CORRECTIONS 49m

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

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

T - 12

50m INCREMENTS AND CORRECTIONS 51m

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

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

T - 13

ALTITUDE CORRECTION TABLES 35°–90°—MOON

App. Alt.	35°–39° Corrⁿ	40°–44° Corrⁿ	45°–49° Corrⁿ	50°–54° Corrⁿ	55°–59° Corrⁿ	60°–64° Corrⁿ	65°–69° Corrⁿ	70°–74° Corrⁿ	75°–79° Corrⁿ	80°–84° Corrⁿ	85°–89° Corrⁿ	App. Alt.
′	° ′ ′	° ′ ′	° ′ ′	° ′ ′	° ′ ′	° ′ ′	° ′ ′	° ′ ′	° ′ ′	° ′ ′	° ′ ′	′
00	35 56·5	40 53·7	45 50·5	50 46·9	55 43·1	60 38·9	65 34·6	70 30·1	75 25·3	80 20·5	85 15·6	00
10	56·4	53·6	50·4	46·8	42·9	38·8	34·4	29·9	25·2	20·4	15·5	10
20	56·3	53·5	50·2	46·7	42·8	38·7	34·3	29·7	25·0	20·2	15·3	20
30	56·2	53·4	50·1	46·5	42·7	38·5	34·1	29·6	24·9	20·0	15·1	30
40	56·2	53·3	50·0	46·4	42·5	38·4	34·0	29·4	24·7	19·9	15·0	40
50	56·1	53·2	49·9	46·3	42·4	38·2	33·8	29·3	24·5	19·7	14·8	50
00	36 56·0	41 53·1	46 49·8	51 46·2	56 42·3	61 38·1	66 33·7	71 29·1	76 24·4	81 19·6	86 14·6	00
10	55·9	53·0	49·7	46·0	42·1	37·9	33·5	29·0	24·2	19·4	14·5	10
20	55·8	52·8	49·5	45·9	42·0	37·8	33·4	28·8	24·1	19·2	14·3	20
30	55·7	52·7	49·4	45·8	41·8	37·7	33·2	28·7	23·9	19·1	14·1	30
40	55·6	52·6	49·3	45·7	41·7	37·5	33·1	28·5	23·8	18·9	14·0	40
50	55·5	52·5	49·2	45·5	41·6	37·4	32·9	28·3	23·6	18·7	13·8	50
00	37 55·4	42 52·4	47 49·1	52 45·4	57 41·4	62 37·2	67 32·8	72 28·2	77 23·4	82 18·6	87 13·7	00
10	55·3	52·3	49·0	45·3	41·3	37·1	32·6	28·0	23·3	18·4	13·5	10
20	55·2	52·2	48·8	45·2	41·2	36·9	32·5	27·9	23·1	18·2	13·3	20
30	55·1	52·1	48·7	45·0	41·0	36·8	32·3	27·7	22·9	18·1	13·2	30
40	55·0	52·0	48·6	44·9	40·9	36·6	32·2	27·6	22·8	17·9	13·0	40
50	55·0	51·9	48·5	44·8	40·8	36·5	32·0	27·4	22·6	17·8	12·8	50
00	38 54·9	43 51·8	48 48·4	53 44·6	58 40·6	63 36·4	68 31·9	73 27·2	78 22·5	83 17·6	88 12·7	00
10	54·8	51·7	48·2	44·5	40·5	36·2	31·7	27·1	22·3	17·4	12·5	10
20	54·7	51·6	48·1	44·4	40·3	36·1	31·6	26·9	22·1	17·3	12·3	20
30	54·6	51·5	48·0	44·2	40·2	35·9	31·4	26·8	22·0	17·1	12·2	30
40	54·5	51·4	47·9	44·1	40·1	35·8	31·3	26·6	21·8	16·9	12·0	40
50	54·4	51·2	47·8	44·0	39·9	35·6	31·1	26·5	21·7	16·8	11·8	50
00	39 54·3	44 51·1	49 47·6	54 43·9	59 39·8	64 35·5	69 31·0	74 26·3	79 21·5	84 16·6	89 11·7	00
10	54·2	51·0	47·5	43·7	39·6	35·3	30·8	26·1	21·3	16·5	11·5	10
20	54·1	50·9	47·4	43·6	39·5	35·2	30·7	26·0	21·2	16·3	11·4	20
30	54·0	50·8	47·3	43·5	39·4	35·0	30·5	25·8	21·0	16·1	11·2	30
40	53·9	50·7	47·2	43·3	39·2	34·9	30·4	25·7	20·9	16·0	11·0	40
50	53·8	50·6	47·0	43·2	39·1	34·7	30·2	25·5	20·7	15·8	10·9	50
H.P.	L U	L U	L U	L U	L U	L U	L U	L U	L U	L U	L U	H.P.
′	′ ′	′ ′	′ ′	′ ′	′ ′	′ ′	′ ′	′ ′	′ ′	′ ′	′ ′	′
54·0	1·1 1·7	1·3 1·9	1·5 2·1	1·7 2·4	2·0 2·6	2·3 2·9	2·6 3·2	2·9 3·5	3·2 3·8	3·5 4·1	3·8 4·5	54·0
54·3	1·4 1·8	1·6 2·0	1·8 2·2	2·0 2·5	2·3 2·7	2·5 3·0	2·8 3·2	3·0 3·5	3·3 3·8	3·6 4·1	3·9 4·4	54·3
54·6	1·7 2·0	1·9 2·2	2·1 2·4	2·3 2·6	2·5 2·8	2·7 3·0	3·0 3·3	3·2 3·5	3·5 3·8	3·7 4·1	4·0 4·3	54·6
54·9	2·0 2·2	2·2 2·3	2·3 2·5	2·5 2·7	2·7 2·9	2·9 3·1	3·2 3·3	3·4 3·5	3·6 3·8	3·9 4·0	4·1 4·3	54·9
55·2	2·3 2·3	2·5 2·4	2·6 2·6	2·8 2·8	3·0 2·9	3·2 3·1	3·4 3·3	3·6 3·5	3·8 3·7	4·0 4·0	4·2 4·2	55·2
55·5	2·7 2·5	2·8 2·6	2·9 2·7	3·1 2·9	3·2 3·0	3·4 3·2	3·6 3·4	3·7 3·5	3·9 3·7	4·1 3·9	4·3 4·1	55·5
55·8	3·0 2·6	3·1 2·7	3·2 2·8	3·3 3·0	3·5 3·1	3·6 3·3	3·8 3·4	3·9 3·6	4·1 3·7	4·2 3·9	4·4 4·0	55·8
56·1	3·3 2·8	3·4 2·9	3·5 3·0	3·6 3·1	3·7 3·2	3·8 3·3	4·0 3·4	4·1 3·6	4·2 3·7	4·4 3·8	4·5 4·0	56·1
56·4	3·6 2·9	3·7 3·0	3·8 3·1	3·9 3·2	3·9 3·3	4·0 3·4	4·1 3·5	4·3 3·6	4·4 3·7	4·5 3·8	4·6 3·9	56·4
56·7	3·9 3·1	4·0 3·1	4·1 3·2	4·1 3·3	4·2 3·3	4·3 3·4	4·3 3·5	4·4 3·6	4·5 3·7	4·6 3·8	4·7 3·8	56·7
57·0	4·3 3·2	4·3 3·3	4·3 3·3	4·4 3·4	4·4 3·4	4·5 3·5	4·5 3·5	4·6 3·6	4·7 3·6	4·7 3·7	4·8 3·8	57·0
57·3	4·6 3·4	4·6 3·4	4·6 3·4	4·6 3·5	4·7 3·5	4·7 3·5	4·7 3·6	4·8 3·6	4·8 3·6	4·8 3·7	4·9 3·7	57·3
57·6	4·9 3·6	4·9 3·6	4·9 3·6	4·9 3·6	4·9 3·6	4·9 3·6	4·9 3·6	4·9 3·6	5·0 3·6	5·0 3·6	5·0 3·6	57·6
57·9	5·2 3·7	5·2 3·7	5·2 3·7	5·2 3·7	5·2 3·7	5·1 3·6	5·1 3·6	5·1 3·6	5·1 3·6	5·1 3·6	5·1 3·6	57·9
58·2	5·5 3·9	5·5 3·8	5·5 3·8	5·4 3·8	5·4 3·7	5·4 3·7	5·3 3·7	5·3 3·6	5·2 3·6	5·2 3·5	5·2 3·5	58·2
58·5	5·9 4·0	5·8 4·0	5·8 3·9	5·7 3·9	5·6 3·8	5·6 3·8	5·5 3·7	5·5 3·6	5·4 3·6	5·3 3·5	5·3 3·4	58·5
58·8	6·2 4·2	6·1 4·1	6·0 4·1	6·0 4·0	5·9 3·9	5·8 3·8	5·7 3·7	5·6 3·6	5·5 3·5	5·4 3·5	5·3 3·4	58·8
59·1	6·5 4·3	6·4 4·3	6·3 4·2	6·2 4·1	6·1 4·0	6·0 3·9	5·9 3·8	5·8 3·6	5·7 3·5	5·6 3·4	5·4 3·3	59·1
59·4	6·8 4·5	6·7 4·4	6·6 4·3	6·5 4·2	6·4 4·1	6·2 3·9	6·1 3·8	6·0 3·7	5·8 3·5	5·7 3·4	5·5 3·2	59·4
59·7	7·1 4·6	7·0 4·5	6·9 4·4	6·8 4·3	6·6 4·1	6·5 4·0	6·3 3·8	6·2 3·7	6·0 3·5	5·8 3·3	5·6 3·2	59·7
60·0	7·5 4·8	7·3 4·7	7·2 4·5	7·0 4·4	6·9 4·2	6·7 4·0	6·5 3·9	6·3 3·7	6·1 3·5	5·9 3·3	5·7 3·1	60·0
60·3	7·8 5·0	7·6 4·8	7·5 4·7	7·3 4·5	7·1 4·3	6·9 4·1	6·7 3·9	6·5 3·7	6·3 3·5	6·0 3·2	5·8 3·0	60·3
60·6	8·1 5·1	7·9 5·0	7·7 4·8	7·6 4·6	7·3 4·4	7·1 4·2	6·9 3·9	6·7 3·7	6·4 3·4	6·2 3·2	5·9 2·9	60·6
60·9	8·4 5·3	8·2 5·1	8·0 4·9	7·8 4·7	7·6 4·5	7·3 4·2	7·1 4·0	6·8 3·7	6·6 3·4	6·3 3·2	6·0 2·9	60·9
61·2	8·7 5·4	8·5 5·2	8·3 5·0	8·1 4·8	7·8 4·5	7·6 4·3	7·3 4·0	7·0 3·7	6·7 3·4	6·4 3·1	6·1 2·8	61·2
61·5	9·1 5·6	8·8 5·4	8·6 5·1	8·3 4·9	8·1 4·6	7·8 4·3	7·5 4·0	7·2 3·7	6·9 3·4	6·5 3·1	6·2 2·7	61·5

T - 14

ALTITUDE CORRECTION TABLES 0°–35°—MOON

App. Alt.	0°–4° Corrⁿ	5°–9° Corrⁿ	10°–14° Corrⁿ	15°–19° Corrⁿ	20°–24° Corrⁿ	25°–29° Corrⁿ	30°–34° Corrⁿ	App. Alt.
′	° ′	° ′	° ′	° ′	° ′	° ′	° ′	′
00	0 33·8	5 58·2	10 62·1	15 62·8	20 62·2	25 60·8	30 58·9	00
10	35·9	58·5	62·2	62·8	62·1	60·8	58·8	10
20	37·8	58·7	62·2	62·8	62·1	60·7	58·8	20
30	39·6	58·9	62·3	62·8	62·1	60·7	58·7	30
40	41·2	59·1	62·3	62·8	62·0	60·6	58·6	40
50	42·6	59·3	62·4	62·7	62·0	60·6	58·5	50
00	1 44·0	6 59·5	11 62·4	16 62·7	21 62·0	26 60·5	31 58·5	00
10	45·2	59·7	62·4	62·7	61·9	60·4	58·4	10
20	46·3	59·9	62·5	62·7	61·9	60·4	58·3	20
30	47·3	60·0	62·5	62·7	61·9	60·3	58·2	30
40	48·3	60·2	62·5	62·7	61·8	60·3	58·2	40
50	49·2	60·3	62·6	62·7	61·8	60·2	58·1	50
00	2 50·0	7 60·5	12 62·6	17 62·7	22 61·7	27 60·1	32 58·0	00
10	50·8	60·6	62·6	62·6	61·7	60·1	57·9	10
20	51·4	60·7	62·6	62·6	61·6	60·0	57·8	20
30	52·1	60·9	62·7	62·6	61·6	59·9	57·8	30
40	52·7	61·0	62·7	62·6	61·5	59·9	57·7	40
50	53·3	61·1	62·7	62·6	61·5	59·8	57·6	50
00	3 53·8	8 61·2	13 62·7	18 62·5	23 61·5	28 59·7	33 57·5	00
10	54·3	61·3	62·7	62·5	61·4	59·7	57·4	10
20	54·8	61·4	62·7	62·5	61·4	59·6	57·4	20
30	55·2	61·5	62·8	62·5	61·3	59·6	57·3	30
40	55·6	61·6	62·8	62·4	61·3	59·5	57·2	40
50	56·0	61·6	62·8	62·4	61·2	59·4	57·1	50
00	4 56·4	9 61·7	14 62·8	19 62·4	24 61·2	29 59·3	34 57·0	00
10	56·7	61·8	62·8	62·3	61·1	59·3	56·9	10
20	57·1	61·9	62·8	62·3	61·1	59·2	56·9	20
30	57·4	61·9	62·8	62·3	61·0	59·1	56·8	30
40	57·7	62·0	62·8	62·2	60·9	59·1	56·7	40
50	57·9	62·1	62·8	62·2	60·9	59·0	56·6	50

H.P.	L	U	L	U	L	U	L	U	L	U	L	U	L	U	H.P.
′	′	′	′	′	′	′	′	′	′	′	′	′	′	′	′
54·0	0·3	0·9	0·3	0·9	0·4	1·0	0·5	1·1	0·6	1·2	0·7	1·3	0·9	1·5	54·0
54·3	0·7	1·1	0·7	1·2	0·7	1·2	0·8	1·3	0·9	1·4	1·1	1·5	1·2	1·7	54·3
54·6	1·1	1·4	1·1	1·4	1·1	1·4	1·2	1·5	1·3	1·6	1·4	1·7	1·5	1·8	54·6
54·9	1·4	1·6	1·5	1·6	1·5	1·6	1·6	1·7	1·6	1·8	1·8	1·9	1·9	2·0	54·9
55·2	1·8	1·8	1·8	1·8	1·9	1·9	1·9	1·9	2·0	2·0	2·1	2·1	2·2	2·2	55·2
55·5	2·2	2·0	2·2	2·0	2·3	2·1	2·3	2·1	2·4	2·2	2·4	2·3	2·5	2·4	55·5
55·8	2·6	2·2	2·6	2·2	2·6	2·3	2·7	2·3	2·7	2·4	2·8	2·4	2·9	2·5	55·8
56·1	3·0	2·4	3·0	2·5	3·0	2·5	3·0	2·5	3·1	2·6	3·1	2·6	3·2	2·7	56·1
56·4	3·4	2·7	3·4	2·7	3·4	2·7	3·4	2·7	3·4	2·8	3·5	2·8	3·5	2·9	56·4
56·7	3·7	2·9	3·7	2·9	3·8	2·9	3·8	2·9	3·8	3·0	3·8	3·0	3·9	3·0	56·7
57·0	4·1	3·1	4·1	3·1	4·1	3·1	4·1	3·1	4·2	3·1	4·2	3·2	4·2	3·2	57·0
57·3	4·5	3·3	4·5	3·3	4·5	3·3	4·5	3·3	4·5	3·3	4·5	3·4	4·6	3·4	57·3
57·6	4·9	3·5	4·9	3·5	4·9	3·5	4·9	3·5	4·9	3·5	4·9	3·5	4·9	3·6	57·6
57·9	5·3	3·8	5·3	3·8	5·2	3·8	5·2	3·7	5·2	3·7	5·2	3·7	5·2	3·7	57·9
58·2	5·6	4·0	5·6	4·0	5·6	4·0	5·6	4·0	5·6	3·9	5·6	3·9	5·6	3·9	58·2
58·5	6·0	4·2	6·0	4·2	6·0	4·2	6·0	4·2	6·0	4·1	5·9	4·1	5·9	4·1	58·5
58·8	6·4	4·4	6·4	4·4	6·4	4·4	6·3	4·4	6·3	4·3	6·3	4·3	6·2	4·2	58·8
59·1	6·8	4·6	6·8	4·6	6·7	4·6	6·7	4·6	6·7	4·5	6·6	4·5	6·6	4·4	59·1
59·4	7·2	4·8	7·1	4·8	7·1	4·8	7·1	4·8	7·0	4·7	7·0	4·7	6·9	4·6	59·4
59·7	7·5	5·1	7·5	5·0	7·5	5·0	7·5	5·0	7·4	4·9	7·3	4·8	7·2	4·7	59·7
60·0	7·9	5·3	7·9	5·3	7·9	5·2	7·8	5·2	7·8	5·1	7·7	5·0	7·6	4·9	60·0
60·3	8·3	5·5	8·3	5·5	8·2	5·4	8·2	5·4	8·1	5·3	8·0	5·2	7·9	5·1	60·3
60·6	8·7	5·7	8·7	5·7	8·6	5·7	8·6	5·6	8·5	5·5	8·4	5·4	8·2	5·3	60·6
60·9	9·1	5·9	9·0	5·9	9·0	5·9	8·9	5·8	8·8	5·7	8·7	5·6	8·6	5·4	60·9
61·2	9·5	6·2	9·4	6·1	9·4	6·1	9·3	6·0	9·2	5·9	9·1	5·8	8·9	5·6	61·2
61·5	9·8	6·4	9·8	6·3	9·7	6·3	9·7	6·2	9·5	6·1	9·4	5·9	9·2	5·8	61·5

DIP

Ht. of Eye	Corrⁿ	Ht. of Eye	Ht. of Eye	Corrⁿ	Ht. of Eye
m	′	ft.	m	′	ft.
2·4	−2·8	8·0	9·5	−5·5	31·5
2·6	−2·9	8·6	9·9	−5·6	32·7
2·8	−3·0	9·2	10·3	−5·7	33·9
3·0	−3·1	9·8	10·6	−5·8	35·1
3·2	−3·2	10·5	11·0	−5·9	36·3
3·4	−3·3	11·2	11·4	−6·0	37·6
3·6	−3·4	11·9	11·8	−6·1	38·9
3·8	−3·5	12·6	12·2	−6·2	40·1
4·0	−3·6	13·3	12·6	−6·3	41·5
4·3	−3·7	14·1	13·0	−6·4	42·8
4·5	−3·8	14·9	13·4	−6·5	44·2
4·7	−3·9	15·7	13·8	−6·6	45·5
5·0	−4·0	16·5	14·2	−6·7	46·9
5·2	−4·1	17·4	14·7	−6·8	48·4
5·5	−4·2	18·3	15·1	−6·9	49·8
5·8	−4·3	19·1	15·5	−7·0	51·3
6·1	−4·4	20·1	16·0	−7·1	52·8
6·3	−4·5	21·0	16·5	−7·2	54·3
6·6	−4·6	22·0	16·9	−7·3	55·8
6·9	−4·7	22·9	17·4	−7·4	57·4
7·2	−4·8	23·9	17·9	−7·5	58·9
7·5	−4·9	24·9	18·4	−7·6	60·5
7·9	−5·0	26·0	18·8	−7·7	62·1
8·2	−5·1	27·1	19·3	−7·8	63·8
8·5	−5·2	28·1	19·8	−7·9	65·4
8·8	−5·3	29·2	20·4	−8·0	67·1
9·2	−5·4	30·4	20·9	−8·1	68·8
9·5		31·5	21·4		70·5

MOON CORRECTION TABLE

The correction is in two parts; the first correction is taken from the upper part of the table with argument apparent altitude, and the second from the lower part, with argument H.P., in the same column as that from which the first correction was taken. Separate corrections are given in the lower part for lower (L) and upper (U) limbs. All corrections are to be **added** to apparent altitude, *but 30′ is to be subtracted from the altitude of the upper limb.*

For corrections for pressure and temperature see page A4.

For bubble sextant observations ignore dip, take the mean of upper and lower limb corrections and subtract 15′ from the altitude.

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

T - 15

LAT 45°

DECLINATION (0°-14°) SAME NAME AS LATITUDE

N. Lat. {LHA greater than 180° ..... Zn=Z
{LHA less than 180° ..... Zn=360−Z

S. Lat. {LHA greater than 180° ..... Zn=180−Z
{LHA less than 180° ..... Zn=180+Z

T - 16

T - 17

LAT 45°

DECLINATION (0°-14°) CONTRARY NAME TO LATITUDE

N. Lat. {LHA greater than 180°..... Zn=Z / LHA less than 180°..... Zn=360−Z

S. Lat. {LHA greater than 180°..... Zn=180−Z / LHA less than 180°..... Zn=180+Z

DECLINATION (0°-14°) CONTRARY NAME TO LATITUDE

LAT 45°

T - 18

LAT 45°

DECLINATION (15°-29°) SAME NAME AS LATITUDE

N. Lat. { LHA greater than 180° ..... Zn=Z
LHA less than 180° ..... Zn=360−Z

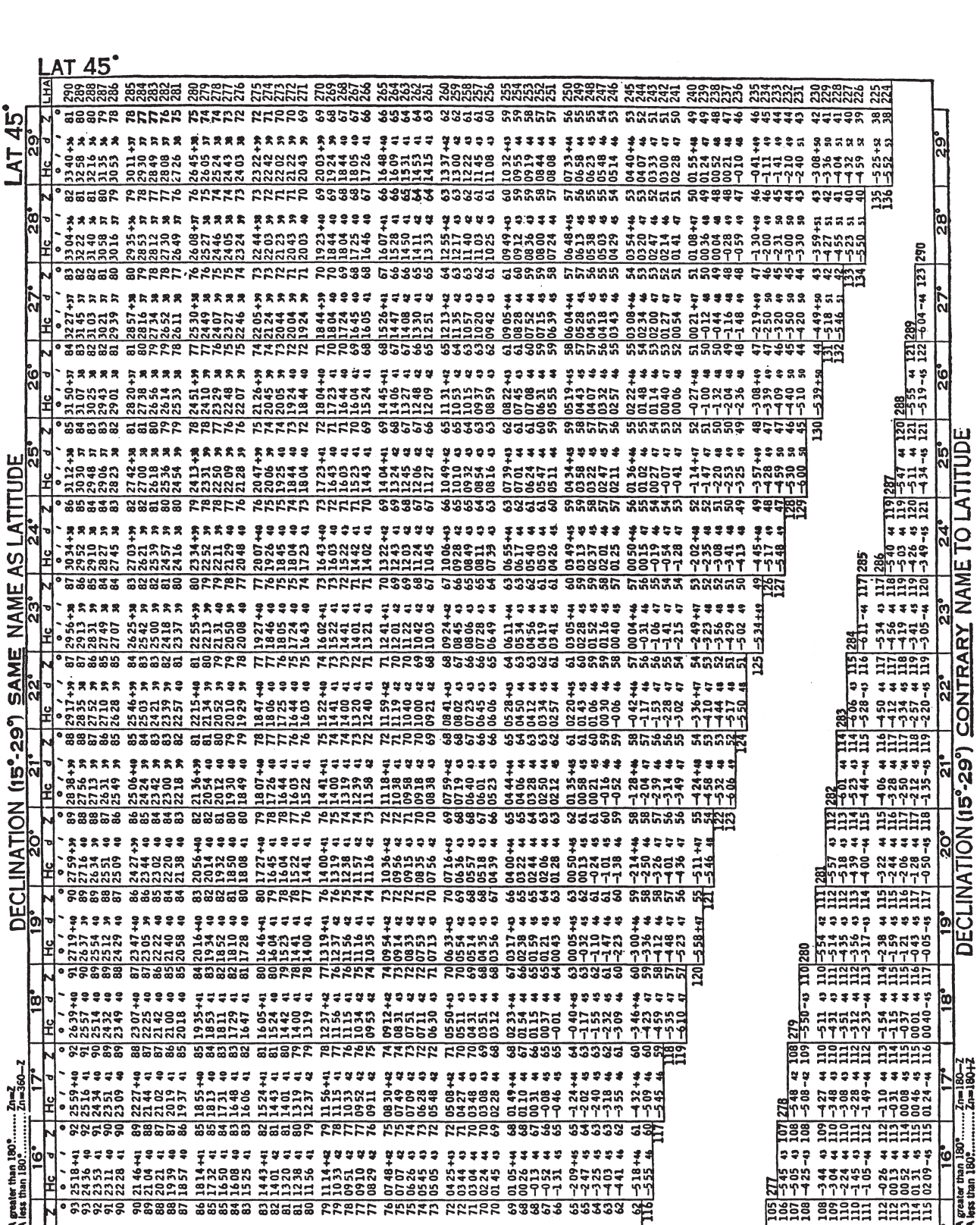
LHA	15° Hc	d	Z	16° Hc	d	Z	17° Hc	d	Z	18° Hc	d	Z	19° Hc	d	Z	20° Hc	d	Z	21° Hc	d	Z	22° Hc	d	Z	23° Hc	d	Z	24° Hc	d	Z	25° Hc	d	Z	26° Hc	d	Z	27° Hc	d	Z	28° Hc	d	Z	29° Hc	d	Z	LHA
0	60 00	+60	180	61 00	+60	180	62 00	+60	180	63 00	+60	180	64 00	+60	180	65 00	+60	180	66 00	+60	180	67 00	+60	180	68 00	+60	180	69 00	+60	180	70 00	+60	180	71 00	+60	180	72 00	+60	180	73 00	+60	180	74 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	64 59	60	178	65 59	60	178	66 59	60	178	67 59	60	178	68 59	60	178	69 59	60	177	70 59	60	177	71 59	60	177	72 59	60	177	73 59	60	177	359
2	59 57	60	176	60 57	60	176	61 57	60	176	62 57	60	176	63 57	60	176	64 57	60	176	65 57	60	175	66 57	60	175	67 56	60	175	68 56	60	175	69 56	60	175	70 56	60	174	71 56	60	174	72 56	59	174	73 55	60	174	358
3	59 54	59	174	60 53	60	174	61 53	60	174	62 53	60	174	63 53	60	174	64 53	59	173	65 52	60	173	66 52	60	173	67 52	60	173	68 52	59	172	69 52	60	172	70 51	59	172	71 50	60	171	72 50	60	171	73 50	59	171	357
4	59 49	59	172	60 48	60	172	61 48	60	172	62 48	59	172	63 47	60	171	64 47	60	171	65 47	59	171	66 46	60	171	67 46	59	170	68 45	59	170	69 44	59	170	70 44	59	169	71 43	59	169	72 42	59	168	73 41	59	168	356
5	59 42	+60	170	60 42	+59	170	61 41	+60	170	62 41	+59	170	63 40	+60	169	64 40	+59	169	65 39	+59	169	66 38	+60	168	67 38	+59	168	68 37	+59	167	69 36	+59	167	70 35	+59	166	71 34	+58	166	72 32	+59	165	73 31	+59	164	355
6	59 34	60	169	60 34	59	168	61 33	59	168	62 33	60	168	63 32	59	167	64 31	59	167	65 30	59	166	66 29	59	166	67 28	59	166	68 27	58	165	69 25	59	165	70 24	58	164	71 22	59	163	72 21	58	162	73 19	58	161	354
7	59 25	59	167	60 24	60	166	61 24	58	166	62 22	59	166	63 21	59	165	64 20	59	165	65 19	59	164	66 18	58	164	67 16	59	163	68 15	58	163	69 13	58	163	70 11	58	161	71 09	58	160	72 07	57	160	73 04	57	159	353
8	59 15	59	165	60 14	58	164	61 12	59	164	62 11	59	164	63 10	58	163	64 08	59	163	65 07	58	162	66 05	58	162	67 03	58	161	68 01	58	160	68 59	57	159	69 56	58	159	70 54	57	158	71 51	57	157	72 48	56	156	352
9	59 03	59	163	60 02	58	163	61 00	58	162	62 57	58	161	63 55	58	160	64 53	58	160	65 51	57	159	66 48	58	159	67 46	57	158	68 43	57	158	69 40	57	156	70 37	56	155	71 33	56	154	72 29	56	153	73 25	55	152	351
10	58 50	+58	161	59 48	+58	161	60 46	+58	160	61 44	+58	160	62 42	+58	159	63 40	+58	158	64 38	+57	158	65 35	+57	157	66 32	+57	156	67 29	+57	156	68 26	+56	155	69 22	+56	154	70 18	+56	153	71 14	+55	152	72 09	+55	150	350
11	58 36	57	159	59 33	58	158	60 31	58	158	61 29	57	158	62 26	58	157	63 24	57	157	64 21	57	156	65 18	56	155	66 14	57	154	67 11	56	153	68 07	56	152	69 03	55	151	69 58	55	150	70 53	54	149	71 47	54	148	349
12	58 20	57	157	59 17	58	157	60 15	57	156	61 12	57	156	62 09	57	155	63 06	57	154	64 03	56	154	64 59	56	153	65 55	56	153	66 51	55	152	67 46	55	151	68 41	55	149	69 36	54	149	70 30	54	148	71 24	53	147	348
13	58 03	57	156	59 00	57	155	59 57	57	155	60 54	57	154	61 51	56	153	62 47	56	153	63 43	56	152	64 39	56	151	65 35	55	151	66 30	55	149	67 25	54	149	68 19	54	147	69 13	53	146	70 06	53	146	70 59	52	145	347
14	57 45	57	154	58 42	56	153	59 38	57	153	60 35	56	152	61 31	56	151	62 27	55	151	63 22	56	150	64 18	55	149	65 13	54	148	66 07	54	147	67 01	54	146	67 55	53	145	68 48	53	143	69 41	52	142	70 33	51	141	346
15	57 26	+56	152	58 22	+56	152	59 18	+56	151	60 14	+56	150	61 10	+55	150	62 05	+55	149	63 00	+55	148	63 55	+54	147	64 49	+54	146	65 43	+54	145	66 37	+53	144	67 30	+52	143	68 22	+52	141	69 14	+51	140	70 05	+50	138	345
16	57 06	56	151	58 02	55	150	58 57	56	149	59 53	55	149	60 48	55	148	61 43	54	147	62 37	54	146	63 31	54	145	64 25	53	144	65 18	53	143	66 11	52	142	67 04	51	141	67 55	51	139	68 46	50	138	69 36	50	136	344
17	56 44	56	149	57 40	55	148	58 35	55	148	59 30	55	147	60 25	54	146	61 19	54	145	62 13	54	144	63 07	53	142	64 00	52	142	64 52	52	141	65 45	52	140	66 37	51	139	67 27	50	138	68 17	49	136	69 06	49	135	343
18	56 22	55	147	57 17	55	146	58 12	54	146	59 06	54	145	60 00	54	144	60 54	53	142	61 48	53	142	62 41	52	141	63 33	52	140	64 25	52	139	65 17	50	138	66 07	51	137	66 58	49	135	67 48	48	134	68 35	48	132	342
19	55 59	54	146	56 53	54	145	57 47	54	144	58 41	54	143	59 35	53	142	60 28	53	142	61 21	53	141	62 14	51	140	63 05	52	139	63 57	51	137	64 48	50	136	65 38	50	135	66 27	49	133	67 16	48	132	68 04	46	130	341
20	55 34	+54	144	56 28	+54	144	57 22	+54	143	58 16	+53	142	59 09	+52	141	60 01	+53	140	60 54	+52	139	61 46	+51	138	62 37	+51	137	63 28	+50	136	64 18	+49	134	65 07	+49	133	65 56	+48	132	66 44	+47	130	67 31	+46	129	340
21	55 09	54	143	56 03	53	141	56 56	53	141	57 49	53	140	58 42	52	139	59 34	51	138	60 25	52	137	61 17	50	136	62 07	51	134	62 58	49	134	63 47	49	132	64 36	48	131	65 24	47	130	66 11	46	128	66 57	45	127	339
22	54 43	53	141	55 36	53	140	56 29	52	138	57 21	52	138	58 13	52	137	59 05	51	136	59 56	51	135	60 47	50	134	61 37	50	133	62 27	48	132	63 15	49	131	64 04	47	130	64 51	46	128	65 37	46	127	66 23	44	125	338
23	54 16	53	140	55 09	52	139	56 01	52	138	56 53	52	137	57 45	51	136	58 36	50	135	59 26	50	134	60 16	50	133	61 06	49	132	61 55	48	131	62 43	48	130	63 31	46	128	64 17	46	127	65 03	45	126	65 48	44	124	337
24	53 48	52	138	54 40	52	138	55 32	52	137	56 24	51	136	57 15	50	135	58 05	50	134	58 55	50	133	59 45	49	132	60 34	48	130	61 22	48	129	62 10	47	128	62 57	46	127	63 43	45	125	64 28	44	124	65 12	43	122	336
25	53 20	+51	137	54 11	+52	136	55 03	+51	135	55 54	+50	134	56 44	+50	133	57 34	+50	132	58 24	+49	131	59 13	+48	130	60 01	+48	129	60 49	+47	128	61 36	+46	126	62 22	+46	125	63 08	+44	124	63 52	+44	122	64 36	+42	121	335
26	52 50	51	136	53 41	51	135	54 32	51	134	55 23	50	133	56 13	50	132	57 03	49	131	57 52	49	130	58 40	48	129	59 28	47	127	60 15	47	126	61 02	45	125	61 47	45	124	62 32	44	122	63 16	43	121	63 59	42	119	334
27	52 20	51	134	53 11	50	133	54 01	50	132	54 51	50	131	55 41	49	130	56 30	49	129	57 19	48	128	58 07	47	127	58 54	47	126	59 41	45	125	60 26	45	124	61 11	44	122	61 56	43	121	62 39	43	119	63 22	41	118	333
28	51 49	51	133	52 40	50	131	53 30	49	130	54 19	49	129	55 08	48	128	55 57	48	127	56 45	47	126	57 32	47	126	58 18	46	125	59 05	45	123	59 51	44	122	60 35	44	121	61 19	43	119	62 02	42	118	62 44	41	116	332
29	51 18	50	132	52 08	49	131	52 57	49	130	53 46	49	129	54 35	48	128	55 23	48	127	56 11	47	126	56 58	46	125	57 44	46	123	58 30	45	122	59 15	44	121	59 59	43	119	60 42	42	118	61 24	42	117	62 06	40	115	331
30	50 46	+49	130	51 35	+49	129	52 24	+49	129	53 13	+48	127	54 01	+48	126	54 49	+47	125	55 36	+46	124	56 22	+46	123	57 08	+45	122	57 53	+45	121	58 38	+44	120	59 22	+42	119	60 04	+42	117	60 46	+41	115	61 27	+40	114	330
31	50 13	49	129	51 02	49	128	51 51	48	127	52 40	48	126	53 28	47	125	54 16	47	124	55 03	46	123	55 50	45	122	56 32	45	121	57 17	44	120	58 01	43	118	58 44	42	117	59 26	42	116	60 08	40	114	60 48	39	113	329
32	49 40	48	128	50 28	48	126	51 17	48	126	52 05	47	125	52 52	47	123	53 39	46	122	54 25	45	122	55 10	45	121	55 55	45	120	56 40	43	118	57 23	43	117	58 06	42	116	58 48	41	114	59 29	40	113	60 09	39	111	328
33	49 06	47	127	49 54	48	126	50 42	48	125	51 30	46	124	52 16	46	123	53 03	46	122	53 49	45	121	54 34	44	119	55 18	44	118	56 02	43	117	56 45	42	116	57 27	42	115	58 09	40	113	58 49	40	112	59 29	39	110	327
34	48 32	48	125	49 20	47	124	50 07	47	124	50 54	46	122	51 40	46	122	52 26	46	121	53 12	45	119	53 57	44	118	54 41	43	117	55 24	43	116	56 07	42	115	56 49	41	113	57 30	+39	111	58 09	+38	110	58 47	+38	109	326
35	47 57	+47	124	48 44	+47	123	49 31	+47	122	50 18	+46	121	51 04	+46	120	51 50	+45	119	52 35	+44	118	53 19	+44	117	54 03	+43	116	54 46	+42	115	55 28	+42	114	56 10	+40	112	56 50	+40	111	57 30	+39	110	58 09	+38	108	325
36	47 21	48	123	48 09	46	122	48 55	47	121	49 42	46	120	50 27	45	119	51 12	45	118	51 57	44	117	52 41	43	116	53 24	43	115	54 07	42	114	54 49	41	113	55 30	40	111	56 10	40	110	56 50	38	108	57 28	38	107	324
37	46 46	46	122	47 32	47	121	48 19	46	120	49 05	45	119	49 50	45	118	50 35	44	117	51 19	44	116	52 03	43	115	52 46	42	114	53 28	42	113	54 10	40	112	54 50	40	110	55 30	40	109	56 10	38	107	56 48	37	106	323
38	46 09	47	121	46 56	46	120	47 42	45	119	48 27	45	118	49 12	45	117	49 57	44	116	50 41	43	115	51 24	43	114	52 07	42	113	52 49	41	112	53 30	40	110	54 10	40	109	54 50	39	108	55 29	38	106	56 07	37	105	322
39	45 33	46	120	46 19	46	119	47 05	45	118	47 50	44	117	48 34	45	116	49 19	43	115	50 02	43	114	50 45	42	113	51 27	42	112	52 09	41	111	52 50	40	109	53 30	40	108	54 10	38	107	54 48	38	105	55 26	37	104	321
40	44 56	+46	119	45 42	+45	118	46 27	+45	117	47 12	+44	116	47 56	+44	115	48 40	+43	114	49 23	+43	113	50 06	+42	112	50 48	+41	111	51 29	+41	109	52 10	+40	108	52 50	+39	107	53 29	+38	106	54 07	+38	105	54 45	+36	103	320
41	44 18	46	118	45 04	45	117	45 49	44	116	46 33	44	115	47 17	44	114	48 01	43	113	48 44	42	112	49 26	42	111	50 08	41	110	50 49	40	108	51 29	40	107	52 09	39	106	52 48	38	105	53 26	37	104	54 03	37	102	319
42	43 41	45	115	44 26	45	115	45 11	44	114	45 55	44	113	46 39	43	113	47 22	42	112	48 04	42	111	48 46	42	110	49 28	41	109	50 09	40	108	50 49	39	106	51 28	39	105	52 07	37	104	52 45	37	103	53 22	36	101	318
43	43 03	44	114	43 49	44	113	44 32	44	113	45 16	43	112	45 59	43	112	46 42	43	111	47 25	41	110	48 06	41	109	48 48	40	108	49 28	40	107	50 08	39	105	50 47	39	104	51 26	37	103	52 03	37	102	52 40	36	100	317
44	42 24	45	113	43 09	44	112	43 53	44	111	44 37	43	110	45 20	42	111	46 02	43	110	46 45	41	109	47 26	41	108	48 07	40	107	48 47	40	106	49 27	39	104	50 06	38	103	50 44	38	102	51 22	36	101	51 58	36	100	316
45	41 45	+45	112	42 30	+44	112	43 14	+43	111	43 57	+43	111	44 40	+42	110	45 22	+42	109	46 04	+42	108	46 46	+40	107	47 26	+40	106	48 06	+40	105	48 46	+39	104	49 25	+38	102	50 03	+37	101	50 40	+36	100	51 16	+36	99	315
46	41 06	45	111	41 51	43	110	42 34	43	110	43 17	43	110	44 00	42	109	44 42	42	108	45 24	41	107	46 05	40	106	46 45	40	105	47 25	40	104	48 05	38	103	48 43	38	102	49 21	37	100	49 58	36	99	50 34	36	98	314
47	40 27	44	110	41 11	43	109	41 54	43	109	42 37	43	109	43 20	42	108	44 02	41	107	44 43	41	106	45 24	40	105	46 04	40	104	46 44	39	103	47 23	38	102	48 01	38	101	48 39	37	100	49 16	36	98	49 52	36	97	313
48	39 48	43	108	40 31	43	108	41 14	43	108	41 57	42	107	42 39	42	107	43 21	41	106	44 02	41	105	44 43	40	104	45 23	40	103	46 03	38	102	46 41	38	101	47 20	37	100	47 57	37	99	48 34	36	97	49 10	35	96	312
49	39 08	43	107	39 51	43	106	40 34	43	106	41 17	42	105	41 59	41	106	42 40	41	104	43 20	40	103	44 02	40	102	44 42	39	102	45 21	39	101	46 00	38	100	46 38	37	98	47 15	37	97	47 52	36	97	48 28	35	95	311
50	38 28	+43	106	39 11	+43	105	39 54	+42	105	40 36	+42	104	41 18	+41	104	41 59	+41	103	42 40	+40	102	43 20	+40	101	44 00	+39	100	44 39	+39	100	45 18	+38	99	45 56	+37	97	46 33	+37	96	47 10	+36	96	47 46	+35	95	310
51	37 48	43	105	38 31	42	104	39 13	42	104	39 55	42	103	40 37	41	103	41 18	41	102	41 59	40	101	42 40	40	100	43 18	40	99	43 58	38	98	44 36	38	98	45 14	37	96	45 51	37	95	46 28	35	94	47 03	35	93	309
52	37 07	43	103	37 50	42	102	38 32	42	102	39 14	42	101	39 56	41	101	40 37	40	100	41 17	40	100	41 57	40	99	42 38	39	98	43 16	38	98	43 54	38	97	44 32	37	95	45 09	36	95	45 45	36	94	46 21	35	93	308
53	36 27	42	102	37 09	42	101	37 51	42	101	38 33	41	100	39 14	41	100	39 56	41	99	40 36	40	98	41 16	39	97	41 55	39	96	42 34	38	96	43 12	38	95	43 50	37	94	44 27	36	94	45 03	35	93	45 39	35	92	307
54	35 46	42	101	36 28	42	100	37 10	41	100	37 52	41	99	38 33	41	98	39 14	40	97	39 54	40	96	40 34	39	95	41 13	39	94	41 52	38	93	42 30	37	93	43 07	37	92	43 44	35	92	44 21	35	91	44 56	35	90	306
55	35 05	+42	100	35 47	+42	99	36 29	+41	99	37 10	+41	98	37 51	+41	97	38 32	+40	96	39 12	+40	96	39 52	+39	95	40 31	+38	94	41 09	+39	93	41 48	+37	92	42 25	+37	91	43 02	+36	91	43 38	+36	90	44 14	+35	89	305
56	34 24	42	98	35 06	41	97	35 48	41	97	36 29	41	96	37 10	41	95	37 50	40	95	38 30	40	94	39 10	39	93	39 49	38	92	40 27	38	92	41 05	38	91	41 43	37	90	42 20	36	90	42 56	35	89	43 31	35	88	304
57	33 43	42	97	34 25	41	96	35 06	41	96	35 47	41	95	36 28	40	94	37 08	40	93	37 48	40	93	38 28	39	92	39 07	38	91	39 45	38	90	40 23	37	89	41 00	37	88	41 37	36	88	42 13	35	87	42 49	35	86	303
58	33 01	42	96	33 43	41	95	34 24	41	94	35 06	40	93	35 46	40	93	36 26	40	92	37 06	40	91	37 45	39	90	38 24	39	90	39 03	38	89	39 41	37	88	40 18	37	87	40 55	36	86	41 31	36	86	42 07	35	85	302
59	32 20	41	94	33 01	41	93	33 42	40	93	34 22	40	92	35 02	40	91	35 42	39	90	36 21	39	90	37 00	38	89	37 38	38	88	38 16	37	87	38 53	37	86	39 30	36	86	40 06	36	85	40 42	35	84	41 17	35	83	301
60	31 38	42	93	32 20	41	92	33 01	41	92	33 42	40	91	34 22	40	90	35 02	40	89	35 42	39	89	36 21	39	88	37 00	38	87	37 38	38	86	38 16	37	85	38 53	37	84	39 30	36	84	40 06	36	83	40 42	35	82	300
61	30 56	42	91	31 38	41	90	32 19	41	90	33 00	40	89	33 40	40	88	34 20	40	88	35 00	39	87	35 39	39	86	36 17	39	85	36 56	37	84	37 34	37	84	38 12	37	83	38 49	36	82	39 24	35	81	39 59	35	80	299
62	30 15	41	89	30 56	41	88	31 37	41	88	32 18	40	87	32 58	40	86	33 38	39	86	34 17	39	85	34 57	39	84	35 35	38	83	36 13	38	82	36 51	37	81	37 28	37	81	38 05	36	80	38 41	36	79	39 17	35	78	298
63	29 33	41	87	30 14	41	86	30 55	40	86	31 35	40	85	32 15	40	84	32 55	40	83	33 35	39	83	34 14	39	82	34 53	38	81	35 31	38	80	36 09	37	79	36 46	37	78	37 23	36	78	37 59	35	77	38 35	35	76	297
64	28 51	41	85	29 32	40	84	30 13	40	84	30 53	40	83	31 33	40	82	32 13	39	81	32 52	40	81	33 32	38	80	34 10	38	79	34 48	38	78	35 26	37	77	36 03	37	76	36 40	37	75	37 17	35	75	37 52	36	74	296
65	28 09	+41	97	28 50	+40	96	29 30	+41	95	30 11	+40	94	30 51	+40	94	31 31	+39	93	32 10	+39	92	32 49	+39	91	33 28	+38	90	34 06	+38	89	34 44	+37	88	35 21	+37	87	35 58	+36	86	36 34	+36	85	37 10	+36	84	295
66	27 26	41	96	28 07	41	95	28 48	41	95	29 29	40	94	30 09	39	93	30 48	40	92	31 28	39	91	32 07	38	90	32 45	39	89	33 24	37	88	34 02	37	87	34 39	37	86	35 16	36	85	35 52	36	84	36 28	36	83	294
67	26 44	41	95	27 25	41	94	28 06	40	93	28 46	40	92	29 26	40	92	30 06	39	91	30 45	39	90	31 24	39	89	32 03	38	88	32 41	38	88	33 19	37	87	33 56	37	86	34 33	37	85	35 10	36	84	35 46	36	83	293
68	26 02	41	93	26 43	40	93	27 23	41	93	28 04	40	92	28 44	39	91	29 23	40	91	30 03	39	90	30 42	38	89	31 20	39	88	31 58	38	87	32 36	37	86	33 14	37	85	33 51	37	84	34 28	36	83	35 04	36	82	292
69	25 20	41	91	26 01	40	90	26 41	40	90	27 21	40	89	28 01	40	89	28 41	39	88	29 20	39	88	29 59	39	87	30 38	38	87	31 16	38	86	31 54	38	85	32 32	37	84	33 09	37	83	33 46	36	82	34 22	36	82	291

S. Lat. { LHA greater than 180° ..... Zn=180−Z
LHA less than 180° ..... Zn=180+Z

DECLINATION (15°-29°) SAME NAME AS LATITUDE

LAT 45°

T - 19



T - 20

LAT 45°

N. Lat. {LHA greater than 180°....... Zn=Z; LHA less than 180°........... Zn=360−Z}

DECLINATION (15°-29°) CONTRARY NAME TO LATITUDE

LHA	15° Hc	d	Z	16° Hc	d	Z	17° Hc	d	Z	18° Hc	d	Z	19° Hc	d	Z	20° Hc	d	Z	21° Hc	d	Z
	° ′	′	°	° ′	′	°	° ′	′	°	° ′	′	°	° ′	′	°	° ′	′	°	° ′	′	°
69	03 32	45	115	02 47	45	116	02 02	45	117	01 17	45	117	00 32	45	118	−0 13	45	119	−0 58	45	119
68	04 11	46	116	03 25	45	117	02 40	45	117	01 55	45	118	01 10	46	119	00 24	45	119	−0 21	45	120
67	04 49	46	117	04 03	45	117	03 18	46	118	02 32	45	119	01 47	46	119	01 01	45	120	00 16	46	121
66	05 26	45	118	04 41	46	118	03 55	46	119	03 09	46	120	02 23	45	120	01 38	46	121	00 52	46	121
65	06 04	−46	118	05 18	−46	119	04 32	−46	120	03 46	−46	120	03 00	−46	121	02 14	−46	122	01 28	−46	122
64	06 41	46	119	05 55	46	120	05 09	46	120	04 23	47	121	03 36	46	122	02 50	46	122	02 04	47	123
63	07 18	46	120	06 32	47	120	05 45	46	121	04 59	47	122	04 12	46	122	03 26	47	123	02 39	46	124
62	07 55	47	121	07 08	47	121	06 21	46	122	05 35	47	123	04 48	47	123	04 01	47	124	03 14	46	124
61	08 31	47	121	07 44	47	122	06 57	47	123	06 10	47	123	05 23	47	124	04 36	47	124	03 49	47	125
60	09 07	−47	122	08 20	−47	123	07 33	−47	123	06 46	−48	124	05 58	−47	125	05 11	−47	125	04 24	−48	126
59	09 43	47	123	08 56	48	124	08 08	47	124	07 21	48	125	06 33	47	125	05 46	48	126	04 58	48	127
58	10 18	47	124	09 31	48	124	08 43	48	125	07 55	47	126	07 08	48	126	06 20	48	127	05 32	48	127
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49	15 22	50	131	14 32	50	132	13 42	50	132	12 52	50	133	12 02	50	133	11 12	51	134	10 21	50	134
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46	16 57	51	133	16 06	51	134	15 15	51	135	14 24	51	135	13 33	51	136	12 42	52	136	11 50	51	137
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41	19 25	52	138	18 33	52	138	17 41	53	139	16 48	52	139	15 56	53	140	15 03	53	140	14 10	52	141
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39	20 21	53	140	19 28	53	140	18 35	53	141	17 42	53	141	16 49	53	142	15 56	53	142	15 03	53	143
38	20 48	53	141	19 55	53	141	19 02	53	142	18 09	54	142	17 15	53	142	16 22	54	143	15 28	53	143
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36	21 41	53	142	20 48	54	143	19 54	54	143	19 00	54	144	18 06	54	144	17 12	54	145	16 18	54	145
35	22 07	−54	143	21 13	−54	144	20 19	−54	144	19 25	−54	145	18 31	−55	145	17 36	−54	146	16 42	−54	146
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33	22 57	55	145	22 02	55	146	21 07	54	146	20 13	55	147	19 18	55	147	18 23	55	147	17 28	55	148
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16	28 16	59	162	27 17	58	163	26 19	59	163	25 20	58	163	24 22	59	163	23 23	59	164	22 24	58	164
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1	30 00	60	179	29 00	60	179	28 00	60	179	27 00	60	179	26 00	60	179	25 00	60	179	24 00	60	179
0	30 00	−60	180	29 00	−60	180	28 00	−60	180	27 00	−60	180	26 00	−60	180	25 00	−60	180	24 00	−60	180

LHA	22° Hc	d	Z	23° Hc	d	Z	24° Hc	d	Z	25° Hc	d	Z	26° Hc	d	Z	27° Hc	d	Z	28° Hc	d	Z	29° Hc	d	Z	LHA
	° ′	′	°	° ′	′	°	° ′	′	°	° ′	′	°	° ′	′	°	° ′	′	°	° ′	′	°	° ′	′	°	
69	−1 43	45	120	−2 26	45	121	−3 13	45	121	−3 58	45	122	−4 43	45	123	−5 28	45	123	291						
68	−1 06	46	121	−1 52	45	121	−2 37	45	122	−3 22	45	123	−4 07	46	123	−4 53	45	124	−5 38	45	125	292			
67	−0 30	46	121	−1 16	45	122	−2 01	46	123	−2 47	45	123	−3 32	46	124	−4 18	45	125	−5 03	45	125	−5 48	46	126	293
66	00 06	46	122	−0 40	45	123	−1 25	46	123	−2 11	46	124	−2 57	46	125	−3 43	46	125	−4 29	45	126	−5 14	46	127	294
65	00 42	−46	123	−0 04	−46	123	−0 50	−46	124	−1 36	−46	125	−2 22	−46	125	−3 08	−46	126	−3 54	−46	127	−4 40	−46	127	295
64	01 17	46	124	00 31	46	124	−0 15	47	125	−1 02	46	125	−1 48	46	126	−2 34	46	127	−3 20	47	127	−4 07	46	128	296
63	01 53	47	124	01 06	47	125	00 19	46	126	−0 27	47	126	−1 14	46	127	−2 00	47	127	−2 47	46	128	−3 33	47	129	297
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61	03 02	47	126	02 15	47	126	01 28	47	127	00 41	47	128	−0 06	48	128	−0 54	47	129	−1 41	47	129	−2 28	47	130	299
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22	20 04	58	158	19 06	58	159	18 08	57	159	17 11	58	159	16 13	58	160	15 15	57	160	14 18	58	160	13 20	58	160	338
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20	20 34	−58	160	19 36	−58	161	18 38	−58	161	17 40	−58	161	16 42	−58	161	15 44	−59	162	14 45	−58	162	13 47	−58	162	340
19	20 48	58	161	19 50	59	161	18 51	58	162	17 53	58	162	16 55	58	162	15 57	59	162	14 58	58	163	14 00	58	163	341
18	21 01	58	162	20 03	59	162	19 04	58	163	18 06	58	163	17 08	59	163	16 09	58	163	15 11	59	164	14 12	58	164	342
17	21 14	59	163	20 15	58	163	19 17	59	164	18 18	58	164	17 20	59	164	16 21	59	164	15 22	58	165	14 24	59	165	343
16	21 26	59	164	20 27	59	164	19 28	58	165	18 30	59	165	17 31	59	165	16 32	59	165	15 33	58	165	14 35	59	166	344
15	21 37	−59	165	20 38	−59	165	19 39	−59	166	18 40	−58	166	17 42	−59	166	16 43	−59	166	15 44	−59	166	14 45	−59	167	345
14	21 48	59	166	20 49	59	166	19 50	59	166	18 51	59	167	17 52	59	167	16 53	59	167	15 54	59	167	14 55	60	167	346
13	21 58	60	167	20 58	59	167	19 59	59	167	19 00	59	168	18 01	59	168	17 02	59	168	16 03	60	168	15 03	59	168	347
12	22 07	60	168	21 07	59	168	20 08	59	168	19 09	59	169	18 10	60	169	17 10	59	169	16 11	59	169	15 12	59	169	348
11	22 15	59	169	21 16	60	169	20 16	59	169	19 17	59	169	18 18	60	170	17 18	59	170	16 19	60	170	15 19	59	170	349
10	22 23	−60	170	21 23	−59	170	20 24	−60	170	19 24	−59	170	18 25	−59	171	17 26	−60	171	16 26	−60	171	15 26	−59	171	350
9	22 30	60	171	21 30	59	171	20 31	60	171	19 31	59	171	18 32	60	172	17 32	60	172	16 32	59	172	15 33	60	172	351
8	22 36	59	172	21 37	60	172	20 37	60	172	19 37	59	172	18 38	60	172	17 38	60	173	16 38	59	173	15 39	60	173	352
7	22 42	60	173	21 42	60	173	20 42	59	173	19 43	60	173	18 43	60	173	17 43	60	174	16 43	59	174	15 44	60	174	353
6	22 47	60	174	21 47	60	174	20 47	60	174	19 47	60	174	18 47	59	174	17 48	60	174	16 48	60	175	15 48	60	175	354
5	22 51	−60	175	21 51	−60	175	20 51	−60	175	19 51	−60	175	18 51	−60	175	17 51	−59	175	16 52	−60	175	15 52	−60	176	355
4	22 54	60	176	21 54	60	176	20 54	60	176	19 54	60	176	18 54	59	176	17 55	60	176	16 55	60	176	15 55	60	176	356
3	22 57	60	177	21 57	60	177	20 57	60	177	19 57	60	177	18 57	60	177	17 57	60	177	16 57	60	177	15 57	60	177	357
2	22 59	60	178	21 59	60	178	20 59	60	178	19 59	60	178	18 59	60	178	17 59	60	178	16 59	60	178	15 59	60	178	358
1	23 00	60	179	22 00	60	179	21 00	60	179	20 00	60	179	19 00	60	179	18 00	60	179	17 00	60	179	16 00	60	179	359
0	23 00	−60	180	22 00	−60	180	21 00	−60	180	20 00	−60	180	19 00	−60	180	18 00	−60	180	17 00	−60	180	16 00	−60	180	360

S. Lat. {LHA greater than 180°....... Zn=180−Z; LHA less than 180°........... Zn=180+Z}

DECLINATION (15°-29°) CONTRARY NAME TO LATITUDE

LAT 45°

T - 21

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

T - 22

276 **POLARIS (POLE STAR) TABLES, 1978**
FOR DETERMINING LATITUDE FROM SEXTANT ALTITUDE AND FOR AZIMUTH

L.H.A. ARIES	240°– 249°	250°– 259°	260°– 269°	270°– 279°	280°– 289°	290°– 299°	300°– 309°	310°– 319°	320°– 329°	330°– 339°	340°– 349°	350°– 359°
	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	1 43·3	1 38·8	1 33·0	1 26·2	1 18·5	1 10·3	1 01·6	0 52·9	0 44·4	0 36·3	0 28·8	0 22·3
1	42·9	38·2	32·3	25·4	17·7	09·4	1 00·8	52·1	43·5	35·5	28·1	21·7
2	42·5	37·7	31·7	24·7	16·9	08·6	0 59.9	51·2	42·7	34·7	27·4	21·1
3	42·1	37·2	31·0	24·0	16·1	07·7	59·0	50·3	41·9	33·9	26·8	20·5
4	41·7	36·6	30·4	23·2	15·3	06·8	58·2	49·5	41·1	33·2	26·1	20·0
5	1 41·2	1 36·0	1 29·7	1 22·4	1 14·5	1 06·0	0 57·3	0 48·6	0 40·3	0 32·4	0 25·4	0 19·4
6	40·8	35·4	29·0	21·7	13·6	05·1	56·4	47·8	39·4	31·7	24·8	18·9
7	40·3	34·8	28·3	20·9	12·8	04·3	55·5	46·9	38·6	31·0	24·1	18·4
8	39·8	34·2	27·6	20·1	11·9	03·4	54·7	46·1	37·8	30·2	23·5	17·9
9	39·3	33·6	26·9	19·3	11·1	02·5	53·8	45·2	37·0	29·5	22·9	17·4
10	1 38·8	1 33·0	1 26·2	1 18·5	1 10·3	1 01·6	0 52·9	0 44·4	0 36·3	0 28·8	0 22·3	0 16·9
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	0·4	0·3	0·3	0·2	0·2	0·2	0·2	0·2	0·3	0·4	0·4
10	·5	·4	·4	·3	·3	·2	·2	·2	·3	·3	·4	·5
20	·5	·5	·4	·4	·3	·3	·3	·3	·3	·4	·4	·5
30	·5	·5	·5	·4	·4	·4	·4	·4	·4	·4	·5	·5
40	0·6	0·5	0·5	0·5	0·5	0·5	0·5	0·5	0·5	0·5	0·5	0·6
45	·6	·6	·6	·5	·5	·5	·5	·5	·5	·6	·6	·6
50	·6	·6	·6	·6	·6	·6	·6	·6	·6	·6	·6	·6
55	·6	·6	·7	·7	·7	·7	·7	·7	·7	·7	·6	·6
60	·7	·7	·7	·8	·8	·8	·8	·8	·8	·7	·7	·7
62	0·7	0·7	0·8	0·8	0·8	0·8	0·9	0·8	0·8	0·8	0·7	0·7
64	·7	·7	·8	·8	·9	0·9	0·9	0·9	·9	·8	·8	·7
66	·7	·8	·8	0·9	0·9	1·0	1·0	1·0	0·9	·9	·8	·7
68	0·7	0·8	0·9	1·0	1·0	1·1	1·1	1·0	1·0	0·9	0·9	0·8
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.	0·5	0·5	0·5	0·5	0·5	0·6	0·6	0·6	0·6	0·6	0·7	0·7
Feb.	·4	·4	·4	·4	·4	·4	·4	·5	·5	·5	·5	·6
Mar.	·4	·4	·4	·3	·3	·3	·3	·3	·3	·4	·4	·4
Apr.	0·5	0·5	0·4	0·3	0·3	0·3	0·2	0·2	0·2	0·2	0·3	0·3
May	·7	·6	·5	·4	·4	·3	·3	·2	·2	·2	·2	·2
June	·8	·7	·7	·6	·5	·4	·4	·3	·3	·2	·2	·2
July	0·9	0·9	0·8	0·7	0·7	0·6	0·5	0·5	0·4	0·3	0·3	0·3
Aug.	1·0	·9	·9	·9	·8	·8	·7	·6	·6	·5	·4	·4
Sept.	0·9	·9	·9	·9	·9	·9	·8	·8	·7	·7	·6	·6
Oct.	0·8	0·9	0·9	0·9	0·9	0·9	0·9	0·9	0·9	0·9	0·8	0·8
Nov.	·7	·8	·8	·9	·9	·9	1·0	1·0	1·0	1·0	0·9	0·9
Dec.	0·5	0·6	0·7	0·7	0·8	0·8	0·9	0·9	1·0	1·0	1·0	1·0
Lat.	AZIMUTH											
°	°	°	°	°	°	°	°	°	°	°	°	°
0	0·4	0·6	0·7	0·7	0·8	0·8	0·8	0·8	0·8	0·7	0·6	0·5
20	0·5	0·6	0·7	0·8	0·8	0·9	0·9	0·9	0·8	0·8	0·7	0·5
40	0·6	0·7	0·9	1·0	1·0	1·1	1·1	1·1	1·0	0·9	0·8	0·7
50	0·7	0·9	1·0	1·1	1·2	1·3	1·3	1·3	1·2	1·1	1·0	0·8
55	0·8	1·0	1·1	1·3	1·4	1·4	1·5	1·4	1·4	1·2	1·1	0·9
60	0·9	1·1	1·3	1·5	1·6	1·6	1·7	1·6	1·6	1·4	1·3	1·0
65	1·0	1·3	1·5	1·7	1·9	1·9	2·0	1·9	1·8	1·7	1·5	1·2

Latitude = Apparent altitude (corrected for refraction) $-1° + a_0 + a_1 + a_2$

The table is entered with L.H.A. 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 L.H.A. 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*.

DECLINATION (15°-29°) CONTRARY NAME TO LATITUDE — LAT 20°

N. Lat. {LHA greater than 180°..... Zn=Z; LHA less than 180°..... Zn=360−Z

LHA	15° Hc	d	Z	16° Hc	d	Z	17° Hc	d	Z	18° Hc	d	Z	19° Hc	d	Z	20° Hc	d	Z	21° Hc	d	Z	22° Hc	d	Z	23° Hc	d	Z	24° Hc	d	Z	25° Hc	d	Z	26° Hc	d	Z	27° Hc	d	Z	28° Hc	d	Z	29° Hc	d	Z	LHA
	° ′	′	°	° ′	′	°	° ′	′	°	° ′	′	°	° ′	′	°	° ′	′	°	° ′	′	°	° ′	′	°	° ′	′	°	° ′	′	°	° ′	′	°	° ′	′	°	° ′	′	°	° ′	′	°	° ′	′	°	
29	44 52	47	139	44 05	46	140	43 19	47	140	42 32	48	141	41 44	47	142	40 57	48	143	40 09	49	144	39 20	48	145	38 32	49	145	37 43	49	146	36 54	50	147	36 04	49	147	35 15	50	148	34 25	51	149	33 34	50	149	331
28	45 28	46	140	44 42	48	141	43 54	47	142	43 07	48	142	42 19	49	143	41 30	48	144	40 42	49	145	39 53	49	145	39 04	50	146	38 14	50	147	37 24	50	148	36 34	50	148	35 44	51	149	34 53	50	150	34 03	51	150	332
27	46 04	47	141	45 17	48	142	44 29	48	143	43 41	49	143	42 52	49	144	42 03	49	145	41 14	50	146	40 24	50	146	39 34	50	147	38 44	50	148	37 54	51	149	37 03	50	149	36 13	51	150	35 22	52	151	34 30	51	151	333
26	46 40	49	142	45 51	48	143	45 03	49	144	44 14	49	144	43 25	50	145	42 35	50	146	41 45	50	147	40 55	50	148	40 05	51	148	39 14	51	149	38 23	51	150	37 32	52	150	36 40	51	151	35 49	52	152	34 57	52	152	334
25	47 14	−49	143	46 25	−49	144	45 36	−50	145	44 46	−50	146	43 56	−50	146	43 06	−50	147	42 16	−51	148	41 25	−51	149	40 34	−51	149	39 43	−52	150	38 51	−52	151	37 59	−51	151	37 08	−53	152	36 15	−52	152	35 23	−52	153	335

DECLINATION (15°-29°) CONTRARY NAME TO LATITUDE — LAT 21°

N. Lat. {LHA greater than 180°..... Zn=Z; LHA less than 180°..... Zn=360−Z

LHA	15° Hc	d	Z	16° Hc	d	Z	17° Hc	d	Z	18° Hc	d	Z	19° Hc	d	Z	20° Hc	d	Z	21° Hc	d	Z	22° Hc	d	Z	23° Hc	d	Z	24° Hc	d	Z	25° Hc	d	Z	26° Hc	d	Z	27° Hc	d	Z	28° Hc	d	Z	29° Hc	d	Z	LHA
	° ′	′	°	° ′	′	°	° ′	′	°	° ′	′	°	° ′	′	°	° ′	′	°	° ′	′	°	° ′	′	°	° ′	′	°	° ′	′	°	° ′	′	°	° ′	′	°	° ′	′	°	° ′	′	°	° ′	′	°	
29	44 06	47	139	43 19	47	140	42 32	47	141	41 45	48	142	40 57	48	143	40 09	49	143	39 20	49	144	38 31	49	145	37 42	49	146	36 53	50	146	36 03	49	147	35 14	50	148	34 24	51	148	33 33	50	149	32 43	51	150	331
28	44 42	47	140	43 55	48	141	43 07	48	142	42 19	48	143	41 31	49	144	40 42	49	144	39 53	50	145	39 03	49	146	38 14	50	147	37 24	51	147	36 33	50	148	35 43	51	149	34 52	50	149	34 02	51	150	33 11	52	151	332
27	45 18	48	141	44 30	49	142	43 41	49	143	42 52	49	144	42 03	49	145	41 14	50	145	40 24	50	146	39 34	50	147	38 44	51	148	37 53	50	148	37 03	51	149	36 12	51	150	35 21	52	150	34 29	51	151	33 38	52	152	333
26	45 52	49	143	45 03	49	143	44 14	49	144	43 25	50	145	42 35	50	146	41 45	50	147	40 55	51	147	40 04	50	148	39 14	52	149	38 22	51	149	37 31	51	150	36 40	52	151	35 48	52	151	34 56	52	152	34 04	52	152	334
25	46 26	−50	144	45 36	−49	145	44 47	−50	145	43 57	−51	146	43 06	−50	147	42 16	−51	148	41 25	−51	148	40 34	−52	149	39 42	−51	150	38 51	−52	150	37 59	−52	151	37 07	−52	152	36 15	−53	152	35 22	−52	153	34 30	−53	153	335
14	51 28	56	158	50 32	56	159	49 36	57	159	48 39	56	160	47 43	57	160	46 46	56	161	45 50	57	161	44 53	57	162	43 56	57	162	42 59	57	162	42 02	57	163	41 05	58	163	40 07	57	164	39 10	57	164	38 13	58	164	346
13	51 48	56	159	50 52	57	160	49 55	57	161	48 58	57	161	48 01	57	162	47 04	57	162	46 07	57	162	45 10	57	163	44 13	58	163	43 15	57	164	42 18	58	164	41 20	57	164	40 23	58	165	39 25	58	165	38 27	58	165	347
12	52 07	57	161	51 10	57	161	50 13	57	162	49 16	57	162	48 19	58	163	47 21	57	163	46 24	58	164	45 26	58	164	44 28	57	164	43 31	58	165	42 33	58	165	41 35	58	166	40 37	58	166	39 39	58	166	38 41	58	167	348
11	52 25	57	162	51 28	58	163	50 30	58	163	49 32	57	164	48 35	58	164	47 37	58	165	46 39	58	165	45 41	58	165	44 43	58	166	43 45	58	166	42 47	59	166	41 48	58	167	40 50	58	167	39 52	59	167	38 53	58	168	349
10	52 41	−58	164	51 43	−58	164	50 45	−58	165	49 47	−58	165	48 49	−58	166	47 51	−58	166	46 53	−59	166	45 54	−58	167	44 56	−58	167	43 58	−59	167	42 59	−58	168	42 01	−59	168	41 02	−59	168	40 03	−58	168	39 05	−59	169	350

DECLINATION (0°-14°) SAME NAME AS LATITUDE — LAT 21°

N. Lat. {LHA greater than 180°..... Zn=Z; LHA less than 180°..... Zn=360−Z

LHA	0° Hc	d	Z	1° Hc	d	Z	2° Hc	d	Z	3° Hc	d	Z	4° Hc	d	Z	5° Hc	d	Z	6° Hc	d	Z	7° Hc	d	Z	8° Hc	d	Z	9° Hc	d	Z	10° Hc	d	Z	11° Hc	d	Z	12° Hc	d	Z	13° Hc	d	Z	14° Hc	d	Z	LHA
	° ′	′	°	° ′	′	°	° ′	′	°	° ′	′	°	° ′	′	°	° ′	′	°	° ′	′	°	° ′	′	°	° ′	′	°	° ′	′	°	° ′	′	°	° ′	′	°	° ′	′	°	° ′	′	°	° ′	′	°	
30	53 57	+36	122	54 33	+35	121	55 08	+34	119	55 42	+33	118	56 15	+32	116	56 47	+31	115	57 18	+30	113	57 48	+28	111	58 16	+27	110	58 43	+26	108	59 09	+24	106	59 33	+22	105	59 55	+21	103	60 16	+20	101	60 36	+18	99	330
31	53 09	36	121	53 45	34	120	54 19	34	118	54 53	32	117	55 25	31	115	55 56	30	114	56 26	29	112	56 55	28	111	57 23	27	109	57 50	25	107	58 15	23	106	58 38	23	104	59 01	20	102	59 21	19	100	59 40	18	98	329
32	52 21	35	120	52 56	33	119	53 29	33	117	54 02	32	116	54 34	31	114	55 05	29	113	55 34	29	111	56 03	27	110	56 30	26	108	56 56	25	106	57 21	23	105	57 44	22	103	58 06	20	101	58 26	19	100	58 45	17	98	328
33	51 32	34	119	52 06	33	118	52 39	33	116	53 12	31	115	53 43	30	113	54 13	29	112	54 42	28	110	55 10	27	109	55 37	25	107	56 02	24	106	56 26	23	104	56 49	22	102	57 11	20	101	57 31	18	99	57 49	17	97	327
34	50 43	33	118	51 16	33	117	51 49	32	115	52 21	30	114	52 51	30	113	53 21	28	111	53 49	28	110	54 17	26	108	54 43	25	107	55 08	24	105	55 32	22	103	55 54	22	102	56 16	19	100	56 35	19	98	56 54	17	97	326

DECLINATION (0°-14°) SAME NAME AS LATITUDE — LAT 22°

N. Lat. {LHA greater than 180°..... Zn=Z; LHA less than 180°..... Zn=360−Z

LHA	0° Hc	d	Z	1° Hc	d	Z	2° Hc	d	Z	3° Hc	d	Z	4° Hc	d	Z	5° Hc	d	Z	6° Hc	d	Z	7° Hc	d	Z	8° Hc	d	Z	9° Hc	d	Z	10° Hc	d	Z	11° Hc	d	Z	12° Hc	d	Z	13° Hc	d	Z	14° Hc	d	Z	LHA
	° ′	′	°	° ′	′	°	° ′	′	°	° ′	′	°	° ′	′	°	° ′	′	°	° ′	′	°	° ′	′	°	° ′	′	°	° ′	′	°	° ′	′	°	° ′	′	°	° ′	′	°	° ′	′	°	° ′	′	°	
5	67 28	+59	167	68 27	+58	166	69 25	+58	166	70 23	+59	165	71 22	+58	164	72 20	+57	163	73 17	+58	163	74 15	+57	161	75 12	+56	160	76 08	+57	159	77 05	+55	157	78 00	+55	156	78 55	+54	154	79 49	+53	151	80 42	+51	148	355
6	67 14	58	164	68 12	58	164	69 10	58	163	70 08	57	162	71 05	57	161	72 02	57	160	72 59	56	159	73 55	56	158	74 51	56	157	75 47	55	155	76 42	54	153	77 36	53	152	78 29	51	149	79 20	51	147	80 11	48	144	354
7	66 58	57	162	67 55	57	161	68 52	57	160	69 49	57	159	70 46	56	158	71 42	56	157	72 38	55	156	73 33	55	155	74 28	54	153	75 22	53	152	76 15	52	150	77 07	51	148	77 58	50	145	78 48	48	142	79 36	45	139	353
8	66 40	56	159	67 36	56	159	68 32	56	158	69 28	56	157	70 24	55	156	71 19	55	154	72 14	54	153	73 08	53	152	74 01	53	150	74 54	51	148	75 45	51	146	76 36	49	144	77 25	48	141	78 13	45	138	78 58	43	135	352
9	66 19	56	157	67 15	55	156	68 10	55	155	69 05	55	154	70 00	54	153	70 54	53	152	71 47	53	150	72 40	52	149	73 32	51	147	74 23	50	145	75 13	49	143	76 02	47	141	76 49	45	138	77 34	44	135	78 18	40	132	351
30	53 25	+37	123	54 02	+37	122	54 39	+35	120	55 14	+34	119	55 48	+34	117	56 22	+32	116	56 54	+31	114	57 25	+30	113	57 55	+29	111	58 24	+27	110	58 51	+26	108	59 17	+24	106	59 41	+23	104	60 04	+22	102	60 26	+19	101	330
31	52 38	37	122	53 15	35	121	53 50	35	119	54 25	34	118	54 59	33	117	55 32	31	115	56 03	31	114	56 34	29	112	57 03	28	110	57 31	27	109	57 58	25	107	58 23	24	105	58 47	23	104	59 10	21	102	59 31	19	100	329
32	51 50	36	121	52 26	36	120	53 02	34	118	53 36	33	117	54 09	32	116	54 41	31	114	55 12	30	113	55 42	29	111	56 11	27	110	56 38	27	108	57 05	25	106	57 30	23	105	57 53	22	103	58 15	21	101	58 36	19	99	328
33	51 03	35	120	51 38	34	119	52 12	34	117	52 46	32	116	53 18	32	115	53 50	30	113	54 20	30	112	54 50	28	110	55 18	27	109	55 45	26	107	56 11	25	106	56 36	25	104	56 59	22	102	57 21	20	100	57 41	19	99	327
34	50 14	35	119	50 49	34	118	51 23	33	116	51 56	32	115	52 28	31	114	52 59	30	112	53 29	29	111	53 58	27	109	54 25	27	108	54 52	25	106	55 17	25	105	55 42	22	103	56 04	22	102	56 26	20	100	56 46	19	98	326

N. Lat. {LH.A. greater than 180°.....Zn=Z; LH.A. less than 180°.....Zn=360°−Z

S. Lat. {LH.A. greater than 180°.....Zn=180°−Z; LH.A. less than 180°.....Zn=180°+Z

Selected parts of Pub. 249 Sight Reduction Tables for use with special running fix problems

* * * use Table 5, page 116 for the d-corr to Hc * * *

T - 24

DECLINATION (15°-29°) SAME NAME AS LATITUDE — LAT 26°

N. Lat. {LHA greater than 180°: Zn=Z; LHA less than 180°: Zn=360−Z}

LHA	15° Hc	d	Z	16° Hc	d	Z	17° Hc	d	Z	18° Hc	d	Z	19° Hc	d	Z	20° Hc	d	Z	21° Hc	d	Z	22° Hc	d	Z	23° Hc	d	Z	24° Hc	d	Z	25° Hc	d	Z	26° Hc	d	Z	27° Hc	d	Z	28° Hc	d	Z	29° Hc	d	Z	LHA
10	75 34	+46	138	76 20	+44	135	77 04	+42	132	77 46	+39	129	78 25	+36	125	79 01	+33	121	79 34	+28	117	80 02	+23	112	80 25	+18	106	80 43	+12	100	80 55	+ 6	94	81 01	− 1	88	81 00	− 8	81	80 52	−14	75	80 38	−19	69	350
11	74 57	44	135	75 41	42	132	76 23	40	129	77 03	37	126	77 40	34	122	78 14	31	118	78 45	26	114	79 11	22	108	79 31	17	103	78 57	12	98	79 08	5	93	79 13	0	87	79 13	− 7	82	79 08	−11	76	79 48	−14	72	349
12	74 18	42	132	75 00	41	129	75 41	38	127	76 19	35	123	76 54	32	120	77 26	29	116	77 55	25	112	78 20	21	108	78 41	16	102	78 57	11	97	78 14	5	92	78 19	+ 1	87	78 20	− 5	82	78 15	− 9	77	78 06	−15	73	347
13	73 37	41	130	74 18	39	127	74 57	36	124	75 33	34	121	76 07	31	118	76 38	27	114	77 05	24	110	77 29	19	106	77 48	15	102	78 03	11	96	77 10	10	92	78 14	5	87	78 20	− 5	82	78 15	− 9	78	78 06	−15	73	346
14	72 55	39	127	73 34	37	125	74 11	35	122	74 46	33	119	75 19	29	116	75 48	26	112	76 14	23	108	76 37	18	104	76 55	15	100	77 10	10	96	77 20	5	92	77 25	− 1	87	77 26	− 4	82	77 22	− 8	78	77 14	−13	73	346
40	51 08	+22	98	51 30	+22	97	51 52	+21	95	52 13	+19	94	52 32	+18	92	52 50	+17	91	53 07	+15	89	53 23	+14	88	53 37	+13	86	53 50	+12	84	54 02	+10	83	54 12	+ 8	81	54 20	+ 8	79	54 28	+ 6	78	54 34	+ 4	76	320
41	50 14	25	98	50 37	21	96	50 58	21	95	51 19	19	93	51 38	18	92	51 56	17	90	52 13	16	89	52 29	14	87	52 43	13	85	52 56	12	84	53 08	10	82	53 18	9	80	53 27	8	79	53 35	6	77	53 41	5	76	319
42	49 21	22	97	49 43	22	96	50 05	20	94	50 25	19	93	50 44	18	91	51 02	17	90	51 19	16	88	51 35	15	87	51 50	13	85	52 03	12	84	52 15	10	82	52 25	9	80	52 35	8	79	52 43	6	77	52 49	5	76	318
43	48 27	23	97	48 50	21	95	49 11	20	94	49 31	19	92	49 50	19	92	50 09	16	91	50 25	16	88	50 41	15	86	50 56	13	85	51 09	12	83	51 21	11	82	51 32	10	80	51 42	8	78	51 50	7	77	51 57	6	75	317
44	47 34	22	96	47 56	21	95	48 17	20	93	48 37	20	92	48 57	18	91	49 15	17	89	49 32	15	88	49 47	15	86	50 02	14	85	50 16	12	83	50 28	11	82	50 39	10	80	50 49	8	78	50 57	8	77	51 05	6	75	316

DECLINATION (0°-14°) CONTRARY NAME TO LATITUDE — LAT 27°

N. Lat. {LHA greater than 180°: Zn=Z; LHA less than 180°: Zn=360−Z}

LHA	0° Hc	d	Z	1° Hc	d	Z	2° Hc	d	Z	3° Hc	d	Z	4° Hc	d	Z	5° Hc	d	Z	6° Hc	d	Z	7° Hc	d	Z	8° Hc	d	Z	9° Hc	d	Z	10° Hc	d	Z	11° Hc	d	Z	12° Hc	d	Z	13° Hc	d	Z	14° Hc	d	Z	LHA
69	18 37	29	100	18 08	29	101	17 39	29	102	17 10	30	103	16 40	30	104	16 10	30	105	15 40	30	105	15 10	31	106	14 39	30	107	14 09	31	108	13 38	31	109	13 07	32	110	12 35	31	111	12 04	32	112	11 32	32	112	291
68	19 30	29	100	19 01	29	101	18 32	30	102	18 02	30	103	17 32	30	104	17 02	30	105	16 32	31	106	16 01	31	107	15 30	31	108	14 59	31	109	14 28	31	109	13 57	32	110	13 25	31	111	12 54	32	112	12 22	33	113	292
67	20 22	29	101	19 53	29	102	19 24	30	103	18 54	30	104	18 24	30	105	17 54	31	106	17 23	31	106	16 52	31	107	16 21	31	108	15 50	31	109	15 19	32	110	14 47	32	111	14 15	32	112	13 43	32	113	13 11	33	114	293
66	21 15	29	101	20 46	30	102	20 16	30	104	19 46	30	104	19 16	31	105	18 45	31	106	18 14	31	107	17 43	31	108	17 12	32	109	16 40	31	110	16 09	32	111	15 37	32	111	15 05	33	112	14 32	32	113	14 00	33	114	294
65	22 07	−29	102	21 38	−30	103	21 08	−30	104	20 38	−31	105	20 07	−31	106	19 36	−31	107	19 05	−31	108	18 34	−31	108	18 03	−32	109	17 31	−32	110	16 59	−33	111	16 26	−32	112	15 54	−33	113	15 21	−33	114	14 48	−33	115	295

DECLINATION (0°-14°) CONTRARY NAME TO LATITUDE — LAT 28°

N. Lat. {LHA greater than 180°: Zn=Z; LHA less than 180°: Zn=360−Z}

LHA	0° Hc	d	Z	1° Hc	d	Z	2° Hc	d	Z	3° Hc	d	Z	4° Hc	d	Z	5° Hc	d	Z	6° Hc	d	Z	7° Hc	d	Z	8° Hc	d	Z	9° Hc	d	Z	10° Hc	d	Z	11° Hc	d	Z	12° Hc	d	Z	13° Hc	d	Z	14° Hc	d	Z	LHA
26	52 31	46	134	51 45	47	135	50 58	48	136	50 10	48	137	49 22	48	138	48 34	49	139	47 45	49	140	46 56	50	140	46 06	50	141	45 16	50	142	44 26	51	143	43 35	51	144	42 44	51	144	41 53	51	145	41 02	52	146	334
25	53 09	−47	135	52 22	−48	136	51 34	−48	137	50 46	−49	138	49 57	−49	139	49 08	−49	140	48 19	−50	141	47 29	−50	142	46 39	−51	143	45 48	−51	143	44 57	−51	144	44 06	−51	145	43 15	−52	145	42 23	−52	146	41 31	−52	147	335
24	53 46	48	137	52 58	48	138	52 10	49	139	51 21	49	139	50 32	50	140	49 42	50	141	48 52	51	142	48 01	50	143	47 11	52	144	46 19	51	144	45 28	52	145	44 36	52	146	43 44	52	147	42 52	52	147	42 00	53	148	336
23	54 22	49	138	53 33	49	139	52 44	49	140	51 55	50	141	51 05	50	141	50 15	51	142	49 24	51	143	48 33	52	144	47 41	51	145	46 50	52	146	45 58	52	146	45 06	53	147	44 13	53	148	43 20	53	148	42 27	53	149	337
22	54 57	49	139	54 08	50	140	53 18	50	141	52 28	51	142	51 37	51	143	50 46	51	144	49 55	52	145	49 03	52	145	48 11	52	146	47 19	52	147	46 27	53	148	45 34	53	148	44 41	53	149	43 48	54	150	42 54	53	150	338
21	55 31	50	141	54 41	50	142	53 51	51	143	53 00	51	144	52 09	52	144	51 17	52	145	50 25	52	146	49 33	53	147	48 40	52	148	47 48	53	148	46 55	54	149	46 01	53	149	45 08	54	150	44 14	54	151	43 20	54	151	339
20	56 04	−51	142	55 13	−51	143	54 22	−51	144	53 31	−52	145	52 39	−53	146	51 47	−53	147	50 54	−53	147	50 01	−53	148	49 08	−53	149	48 15	−54	150	47 21	−55	150	46 28	−54	151	45 34	−55	152	44 39	−54	152	43 45	−55	153	340
9	60 42	58	161	59 44	57	162	58 47	58	162	57 49	58	163	56 51	58	163	55 53	58	164	54 55	59	164	53 56	58	165	52 58	59	165	51 59	58	166	51 01	59	166	50 02	58	166	49 04	59	167	48 05	59	167	47 06	58	167	351
8	60 58	58	163	60 00	58	164	59 02	58	164	58 04	59	165	57 05	58	165	56 07	59	166	55 08	59	166	54 09	59	166	53 11	59	167	52 12	59	167	51 13	59	167	50 14	59	168	49 15	59	168	48 16	59	168	47 18	60	169	352
7	61 12	58	165	60 14	59	166	59 15	58	166	58 17	59	167	57 18	59	167	56 19	59	167	55 20	59	168	54 21	59	168	53 22	59	168	52 23	59	169	52 24	59	169	50 25	59	169	49 26	59	169	48 27	60	170	47 27	59	170	353
6	61 25	59	167	60 26	59	168	59 27	59	168	58 28	59	169	57 29	59	169	56 30	59	169	55 31	60	169	54 31	59	170	53 32	59	170	52 33	59	170	51 34	60	171	50 34	59	171	49 35	60	171	48 35	59	171	47 36	59	171	354
5	61 36	−60	169	60 36	−59	170	59 37	−59	170	58 38	−60	170	57 38	−59	171	56 39	−59	171	55 40	−60	171	54 40	−59	171	53 41	−60	172	52 41	−59	172	51 42	−60	172	50 42	−59	172	49 43	−60	172	48 43	−60	173	47 43	−59	173	355

DECLINATION (15°-29°) SAME NAME AS LATITUDE — LAT 28°

N. Lat. {LHA greater than 180°: Zn=Z; LHA less than 180°: Zn=360−Z}

LHA	15° Hc	d	Z	16° Hc	d	Z	17° Hc	d	Z	18° Hc	d	Z	19° Hc	d	Z	20° Hc	d	Z	21° Hc	d	Z	22° Hc	d	Z	23° Hc	d	Z	24° Hc	d	Z	25° Hc	d	Z	26° Hc	d	Z	27° Hc	d	Z	28° Hc	d	Z	29° Hc	d	Z	LHA
25	63 26	+31	114	63 59	+31	112	64 30	+29	110	64 59	+27	108	65 26	+26	106	65 52	+23	104	66 15	+22	102	66 37	+19	99	66 56	+17	97	67 13	+15	94	67 28	+12	92	67 40	+10	89	67 50	+ 8	87	67 58	+ 5	84	68 03	+ 2	81	335
26	62 38	31	113	63 09	31	111	63 40	28	109	64 08	27	107	64 35	25	105	65 00	23	103	65 23	21	101	65 44	19	99	66 03	17	96	66 20	15	94	66 35	13	91	66 48	10	89	66 58	7	86	67 05	5	84	67 11	2	81	334
27	61 49	31	112	62 20	29	110	62 49	28	108	63 17	27	106	63 44	24	104	64 08	23	102	64 31	21	100	64 52	19	98	65 11	16	96	65 27	15	93	65 42	13	91	65 55	10	88	66 05	8	86	66 13	5	84	66 18	3	81	333
28	60 59	31	111	61 30	29	109	61 59	27	107	62 26	26	105	62 52	24	103	63 16	23	101	63 39	20	99	63 59	19	97	64 18	17	95	64 35	14	93	64 49	13	90	65 02	10	88	65 12	8	86	65 20	5	83	65 26	3	81	332
29	60 10	30	110	60 40	28	108	61 08	27	106	61 35	26	104	62 01	23	102	62 24	22	100	62 46	21	98	63 07	18	96	63 25	17	94	63 42	14	92	63 56	13	90	64 09	10	88	64 19	8	85	64 27	7	83	64 34	4	81	331

DECLINATION (15°-29°) SAME NAME AS LATITUDE — LAT 27°

N. Lat. {LHA greater than 180°: Zn=Z; LHA less than 180°: Zn=360−Z}

LHA	15° Hc	d	Z	16° Hc	d	Z	17° Hc	d	Z	18° Hc	d	Z	19° Hc	d	Z	20° Hc	d	Z	21° Hc	d	Z	22° Hc	d	Z	23° Hc	d	Z	24° Hc	d	Z	25° Hc	d	Z	26° Hc	d	Z	27° Hc	d	Z	28° Hc	d	Z	29° Hc	d	Z	LHA
5	77 08	+56	158	78 04	+55	156	78 59	+54	154	79 53	+53	152	80 46	+52	149	81 38	+50	146	82 28	+47	142	83 15	+42	137	83 57	+38	130	84 35	+30	123	85 05	+20	113	85 25	+ 8	102	85 33	− 6	89	85 27	−18	76	85 09	−28	65	355
6	76 46	54	154	77 40	54	152	78 34	52	150	79 26	51	147	80 17	49	144	81 06	47	141	81 53	43	136	82 36	39	131	83 15	34	125	83 49	28	118	84 15	19	106	84 34	9	99	84 43	5	89	84 35	15	79	84 20	20	68	354
7	76 21	51	151	77 14	51	148	78 05	50	146	78 55	49	143	79 44	46	140	80 30	44	136	81 14	40	132	81 54	36	127	82 30	31	121	83 01	25	114	83 24	15	106	83 39	7	98	83 46	3	88	83 43	13	79	83 30	20	70	353
8	75 53	51	147	76 44	50	144	77 34	48	142	78 22	46	139	79 08	44	136	79 52	41	132	80 33	37	128	81 10	33	124	81 43	28	118	82 11	23	111	82 34	11	102	82 46	6	95	82 52	2	88	82 50	10	80	82 40	18	72	352
9	75 22	49	143	76 11	48	141	76 59	46	138	77 45	45	135	78 30	41	132	79 11	39	128	79 50	35	124	80 25	30	120	80 55	26	114	81 21	19	108	81 40	9	102	81 53	6	95	81 59	2	88	81 57	8	81	81 49	16	74	351
10	74 49	+47	140	75 36	+47	138	76 23	+44	135	77 07	+42	132	77 49	+39	129	78 28	+37	125	79 05	+32	121	79 37	+29	117	80 06	+24	112	80 30	+18	106	80 48	+12	100	81 00	+ 6	94	81 06	− 1	88	81 05	− 8	81	80 57	−16	75	350
11	74 14	48	137	75 00	48	135	75 44	42	132	76 26	40	129	77 06	38	126	77 44	34	123	78 18	31	119	78 49	27	114	79 16	22	110	79 38	17	104	79 55	12	99	80 07	5	93	80 12	0	88	80 12	7	82	80 05	12	76	349
12	73 36	45	135	74 21	43	132	75 04	40	130	75 44	38	127	76 23	35	123	76 58	33	120	77 31	29	116	78 00	25	112	78 25	21	108	78 46	16	103	79 02	11	98	79 13	6	93	79 19	0	87	79 19	6	82	79 13	10	77	348
13	72 58	42	132	73 40	42	130	74 22	39	127	75 01	38	124	75 37	34	121	76 11	31	118	76 42	28	114	77 10	24	110	77 34	20	106	77 54	15	102	78 09	11	97	78 20	5	92	78 25	+ 1	87	78 26	5	82	78 21	9	77	347
14	72 17	42	130	72 59	39	127	73 38	38	125	74 16	35	122	74 51	33	119	75 24	29	116	75 53	27	112	76 20	22	108	76 42	19	104	77 01	15	100	77 16	10	96	77 26	4	91	77 32	1	87	77 33	4	82	77 29	8	78	346
40	50 58	+25	100	51 23	+25	98	51 46	+22	97	52 08	+21	95	52 29	+20	94	52 49	+18	92	53 07	+18	91	53 25	+16	89	53 41	+14	87	53 55	+14	86	54 09	+11	84	54 20	+11	82	54 31	+ 9	81	54 40	+ 8	79	54 48	+ 6	77	320
41	50 05	25	99	50 30	23	98	50 53	22	96	51 15	21	95	51 36	19	93	51 55	19	92	52 14	17	90	52 31	16	89	52 47	15	87	53 02	13	85	53 15	12	84	53 27	11	82	53 38	10	80	53 48	9	79	53 55	7	77	319
42	49 13	24	98	49 37	23	97	50 00	23	96	50 21	21	94	50 42	20	93	51 02	18	91	51 20	18	90	51 38	16	88	51 54	15	87	52 09	13	85	52 22	13	83	52 35	11	82	52 46	9	80	52 55	8	79	53 03	7	77	318
43	48 20	23	98	48 43	23	96	49 06	22	96	49 28	21	94	49 49	19	92	50 08	19	92	50 27	17	89	50 44	17	89	51 00	15	86	51 15	14	85	51 29	13	83	51 42	11	81	51 53	10	80	52 03	8	78	52 11	8	77	317
44	47 27	23	97	47 50	23	96	48 13	22	95	48 35	20	93	48 55	20	92	49 15	19	90	49 34	17	89	49 51	16	87	50 07	15	86	50 22	14	84	50 36	13	83	50 49	11	81	51 00	10	80	51 10	9	78	51 19	8	77	316

DECLINATION (15°-29°) CONTRARY NAME TO LATITUDE — LAT 28°

N. Lat. {LHA greater than 180°..... Zn=Z; LHA less than 180°..... Zn=360−Z

LHA	15° Hc	d	Z	16° Hc	d	Z	17° Hc	d	Z	18° Hc	d	Z	19° Hc	d	Z	20° Hc	d	Z	21° Hc	d	Z	22° Hc	d	Z	23° Hc	d	Z	24° Hc	d	Z	25° Hc	d	Z	26° Hc	d	Z	27° Hc	d	Z	28° Hc	d	Z	29° Hc	d	Z	LHA
34	35 51	48	138	35 03	48	139	34 15	48	140	33 27	49	140	32 38	49	141	31 49	49	142	31 00	49	143	30 11	49	143	29 22	50	144	28 32	49	144	27 43	50	145	26 53	50	146	26 03	50	146	25 13	51	147	24 22	50	148	326
33	36 26	49	139	35 37	48	140	34 49	49	141	34 00	49	141	33 11	49	142	32 22	50	143	31 32	49	143	30 43	50	144	29 53	50	145	29 03	50	145	28 13	51	146	27 22	50	147	26 32	51	147	25 41	51	148	24 50	51	148	327
32	37 00	49	140	36 11	49	141	35 22	49	142	34 33	50	142	33 43	49	143	32 54	50	144	32 04	50	144	31 14	51	145	30 23	50	146	29 33	51	146	28 42	51	147	27 51	51	147	27 00	51	148	26 09	51	149	25 18	52	149	328
31	37 33	49	141	36 44	49	142	35 55	50	143	35 05	50	143	34 15	50	144	33 25	51	145	32 34	50	145	31 44	51	146	30 53	51	147	30 02	51	147	29 11	52	148	28 19	51	148	27 28	52	149	26 36	51	149	25 45	52	150	329
30	38 06	-49	142	37 17	-51	143	36 26	-50	144	35 36	-50	144	34 46	-51	145	33 55	-51	146	33 04	-51	146	32 13	-51	147	31 22	-52	147	30 30	-51	148	29 39	-52	149	28 47	-52	149	27 55	-52	150	27 03	-52	150	26 11	-53	151	330
9	46 08	59	167	45 09	59	168	44 10	59	168	43 11	59	168	42 12	59	169	41 13	59	169	40 14	59	169	39 15	59	169	38 16	59	169	37 17	59	170	36 18	59	170	35 19	59	170	34 20	60	170	33 20	59	171	32 21	59	171	351
8	46 18	59	169	45 19	59	169	44 20	59	169	43 21	59	170	42 22	59	170	41 23	59	170	40 24	60	170	39 24	59	170	38 25	59	171	37 26	59	171	36 27	60	171	35 27	59	171	34 28	59	171	33 29	60	172	32 29	59	172	352
7	46 28	59	170	45 29	59	170	44 30	60	171	43 30	59	171	42 31	59	171	41 32	60	171	40 32	59	171	39 33	60	172	38 33	59	172	37 34	60	172	36 34	59	172	35 35	59	172	34 36	60	172	33 36	59	173	32 37	60	173	353
6	46 37	60	172	45 37	59	172	44 38	60	172	43 38	59	172	42 39	60	172	41 39	59	172	40 40	60	173	39 40	60	173	38 40	59	173	37 41	60	173	36 41	59	173	35 42	60	173	34 42	60	174	33 42	59	174	32 43	60	174	354
5	46 44	-60	173	45 44	-60	173	44 44	-59	173	43 45	-60	173	42 45	-60	174	41 45	-59	174	40 46	-60	174	39 46	-60	174	38 46	-59	174	37 47	-60	174	36 47	-60	174	35 47	-59	175	34 48	-60	175	33 48	-60	175	32 48	-60	175	355

DECLINATION (0°-14°) CONTRARY NAME TO LATITUDE — LAT 29°

N. Lat. {LHA greater than 180°..... Zn=Z; LHA less than 180°..... Zn=360−Z

LHA	0° Hc	d	Z	1° Hc	d	Z	2° Hc	d	Z	3° Hc	d	Z	4° Hc	d	Z	5° Hc	d	Z	6° Hc	d	Z	7° Hc	d	Z	8° Hc	d	Z	9° Hc	d	Z	10° Hc	d	Z	11° Hc	d	Z	12° Hc	d	Z	13° Hc	d	Z	14° Hc	d	Z	LHA
49	35 01	36	113	34 25	36	114	33 49	37	115	33 12	37	116	32 35	37	117	31 58	38	118	31 20	38	119	30 42	39	119	30 03	39	120	29 24	39	121	28 45	40	122	28 05	40	123	27 25	40	124	26 45	41	125	26 04	41	125	311
48	35 49	36	114	35 13	36	115	34 37	38	116	33 59	37	117	33 22	38	117	32 44	38	118	32 06	39	119	31 27	39	120	30 48	39	121	30 09	40	122	29 29	40	123	28 49	40	124	28 09	41	125	27 28	41	125	26 47	41	126	312
47	36 37	36	114	36 01	37	115	35 24	38	116	34 46	38	117	34 08	38	118	33 30	39	119	32 51	39	120	32 12	39	121	31 33	40	122	30 53	40	123	30 13	41	124	29 32	40	124	28 52	42	125	28 10	41	126	27 29	42	127	313
46	37 25	37	115	36 48	37	116	36 11	38	117	35 33	38	118	34 55	39	119	34 16	39	120	33 37	40	121	32 57	40	122	32 17	40	123	31 37	41	124	30 56	40	124	30 16	42	125	29 34	41	126	28 53	42	127	28 11	42	128	314
45	38 12	-37	116	37 35	-38	117	36 57	-38	118	36 19	-39	119	35 40	-39	120	35 01	-39	121	34 22	-40	122	33 42	-41	123	33 01	-40	123	32 21	-41	124	31 40	-42	125	30 58	-42	126	30 16	-42	127	29 34	-42	128	28 52	-42	128	315
14	58 04	55	153	57 09	56	154	56 13	55	154	55 18	56	155	54 22	56	156	53 26	56	156	52 30	57	157	51 33	56	157	50 37	57	158	49 40	56	158	48 44	57	159	47 47	57	159	46 50	57	160	45 53	58	160	44 55	57	161	346
13	58 27	56	155	57 31	55	155	56 36	57	156	55 39	56	157	54 43	56	157	53 47	57	158	52 50	57	158	51 53	57	159	50 56	57	159	49 59	57	160	49 02	57	160	48 05	58	161	47 07	57	161	46 10	58	162	45 12	57	162	347
12	58 49	56	156	57 53	57	157	56 56	56	158	56 00	57	158	55 03	57	159	54 06	57	159	53 09	58	160	52 11	57	160	51 14	57	161	50 17	58	161	49 19	58	162	48 21	57	162	47 24	58	163	46 26	58	163	45 28	58	163	348
11	59 09	57	158	58 12	57	159	57 15	57	159	56 18	57	160	55 21	57	160	54 24	58	161	53 26	58	161	52 28	57	162	51 31	58	162	50 33	58	163	49 35	58	163	48 37	58	164	47 39	58	164	46 41	59	164	45 42	58	165	349
10	59 28	-57	160	58 31	-58	161	57 33	-57	161	56 36	-58	162	55 38	-58	162	54 40	-58	163	53 42	-58	163	52 44	-58	164	51 46	-58	164	50 48	-59	164	49 49	-58	165	48 51	-58	165	47 53	-59	165	46 54	-58	166	45 56	-59	166	350

DECLINATION (0°-14°) CONTRARY NAME TO LATITUDE — LAT 30°

N. Lat. {LHA greater than 180°..... Zn=Z; LHA less than 180°..... Zn=360−Z

LHA	0° Hc	d	Z	1° Hc	d	Z	2° Hc	d	Z	3° Hc	d	Z	4° Hc	d	Z	5° Hc	d	Z	6° Hc	d	Z	7° Hc	d	Z	8° Hc	d	Z	9° Hc	d	Z	10° Hc	d	Z	11° Hc	d	Z	12° Hc	d	Z	13° Hc	d	Z	14° Hc	d	Z	LHA
29	49 14	46	132	48 28	46	133	47 42	48	134	46 54	47	135	46 07	48	136	45 19	48	137	44 31	49	138	43 42	49	138	42 53	49	139	42 04	50	140	41 14	50	141	40 24	50	141	39 34	51	142	38 43	50	143	37 53	51	143	331
28	49 53	47	133	49 06	47	134	48 19	48	135	47 31	48	136	46 43	49	137	45 54	49	138	45 05	49	139	44 16	49	139	43 27	50	140	42 37	50	141	41 47	51	142	40 56	51	142	40 05	50	143	39 15	52	144	38 23	51	145	332
27	50 30	47	135	49 43	48	135	48 55	48	136	48 07	49	137	47 18	49	138	46 29	50	139	45 39	49	140	44 50	51	141	43 59	50	141	43 09	51	142	42 18	51	143	41 27	51	144	40 36	51	144	39 45	52	145	38 53	52	146	333
26	51 07	48	136	50 19	49	137	49 30	49	138	48 41	49	139	47 52	50	139	47 02	50	140	46 12	50	141	45 22	50	142	44 32	51	143	43 41	52	143	42 49	51	144	41 58	52	145	41 06	52	145	40 14	52	146	39 22	52	147	334
25	51 43	-49	137	50 54	-49	138	50 05	-50	139	49 15	-49	140	48 26	-51	141	47 35	-50	141	46 45	-51	142	45 54	-51	143	45 03	-52	144	44 11	-51	144	43 20	-52	145	42 28	-53	146	41 35	-52	146	40 43	-53	147	39 50	-53	148	335

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

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

Selected parts of Pub. 249 Sight Reduction Tables
for use with special running fix problems

* * * use Table 5, page 116 for the d-corr to Hc * * *

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

LHA	8° Hc	d	Z	9° Hc	d	Z	10° Hc	d	Z	11° Hc	d	Z	12° Hc	d	Z	LHA
	° ′	′	°	° ′	′	°	° ′	′	°	° ′	′	°	° ′	′	°	
0	88 00	60	180	89 00	60	180	90 00	−60	90	89 00	−60	0	88 00	−60	0	360
1	87 46	50	154	88 36	25	135	89 01	−25	90	88 36	−50	44	87 46	−55	26	359
2	87 11	36	135	87 47	15	117	88 02	−14	90	87 48	−36	63	87 12	−47	44	358
3	86 26	27	124	86 53	10	108	87 03	−10	90	86 53	−27	71	86 26	−38	56	357
4	85 34	22	117	85 56	08	104	86 04	−07	90	85 57	−21	75	85 36	−32	63	356

LAT 10°

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

LHA	1° Hc	d	Z	2° Hc	d	Z	3° Hc	d	Z	4° Hc	d	Z	5° Hc	d	Z	LHA
	° ′	′	°	° ′	′	°	° ′	′	°	° ′	′	°	° ′	′	°	
4	71 34	−58	167	70 36	−59	168	69 37	−59	168	68 38	−59	169	67 39	−59	169	356
3	71 46	−60	170	70 46	−59	171	69 47	−59	171	68 48	−60	172	67 48	−59	172	357
2	71 54	−60	174	70 54	−60	174	69 54	−60	174	68 54	−59	174	67 55	−60	175	358
1	71 58	−60	177	70 58	−59	177	69 59	−60	177	68 59	−60	177	67 59	−60	177	359
0	72 00	−60	180	71 00	−60	180	70 00	−60	180	69 00	−60	180	68 00	−60	180	360

LAT 17°

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

LHA	0° Hc	d	Z	1° Hc	d	Z	2° Hc	d	Z	3° Hc	d	Z	4° Hc	d	Z	LHA
	° ′	′	°	° ′	′	°	° ′	′	°	° ′	′	°	° ′	′	°	
0	67 00	60	180	68 00	60	180	69 00	60	180	70 00	60	180	71 00	60	180	360
1	66 59	60	177	67 59	60	177	68 59	60	177	69 59	60	177	70 59	59	177	359
2	66 55	60	175	67 55	60	175	68 55	59	174	69 54	60	174	70 54	60	174	358
3	66 49	59	172	67 48	60	172	68 48	59	172	69 47	60	171	70 47	59	171	357
4	66 40	60	170	67 40	59	169	68 39	59	169	69 38	59	168	70 37	58	168	356

LAT 23°

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

LHA	10° Hc	d	Z	11° Hc	d	Z	12° Hc	d	Z	13° Hc	d	Z	14° Hc	d	Z	LHA
	° ′	′	°	° ′	′	°	° ′	′	°	° ′	′	°	° ′	′	°	
0	73 00	60	180	74 00	60	180	75 00	60	180	76 00	60	180	77 00	60	180	360
1	72 58	60	177	73 58	60	176	74 58	60	176	75 58	60	176	76 58	60	176	359
2	72 54	59	173	73 53	60	173	74 53	60	172	75 53	59	172	76 52	59	171	358
3	72 46	59	170	73 45	59	169	74 44	59	169	75 43	59	168	76 42	59	167	357
4	72 35	59	167	73 34	58	166	74 32	58	165	75 30	58	164	76 28	58	163	356

LAT 27°

DECLINATION (15° – 29°) **CONTRARY** NAME TO LATITUDE

LHA	17° Hc	d	Z	18° Hc	d	Z	19° Hc	d	Z	20° Hc	d	Z	21° Hc	d	Z	LHA
	° ′	′	°	° ′	′	°	° ′	′	°	° ′	′	°	° ′	′	°	
4	43 50	−60	175	42 50	−59	175	41 51	−60	175	40 51	−60	175	39 51	−60	175	356
3	43 55	−60	176	42 55	−60	176	41 55	−60	176	40 55	−60	176	39 55	−60	176	357
2	43 58	−60	177	42 58	−60	177	41 58	−60	177	40 58	−60	178	39 58	−60	178	358
1	43 59	−60	179	42 59	−60	179	41 59	−60	179	40 59	−60	179	39 59	−60	179	359
0	44 00	−60	180	43 00	−60	180	42 00	−60	180	41 00	−60	180	40 00	−60	180	360

LAT 29°

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

LHA	10° Hc	d	Z	11° Hc	d	Z	12° Hc	d	Z	13° Hc	d	Z	14° Hc	d	Z	LHA
	° ′	′	°	° ′	′	°	° ′	′	°	° ′	′	°	° ′	′	°	
4	45 50	−60	174	44 50	−59	174	43 51	−60	175	42 51	−60	175	41 51	−60	175	356
3	45 54	−59	176	44 55	−60	176	43 55	−60	176	42 55	−60	176	41 55	−60	176	357
2	45 58	−60	177	44 58	−60	177	43 58	−60	177	42 58	−60	177	41 58	−60	177	358
1	45 59	−60	179	44 59	−60	179	43 59	−60	179	42 59	−60	179	41 59	−60	179	359
0	46 00	−60	180	45 00	−60	180	44 00	−60	180	43 00	−60	180	42 00	−60	180	360

LAT 34°

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

LHA	9° Hc	d	Z	10° Hc	d	Z	11° Hc	d	Z	12° Hc	d	Z	13° Hc	d	Z	LHA
	° ′	′	°	° ′	′	°	° ′	′	°	° ′	′	°	° ′	′	°	
4	44 51	−60	174	43 51	−60	175	42 51	−60	175	41 51	−60	175	40 51	−60	175	356
3	44 55	−60	176	43 55	−60	176	42 55	−60	176	41 55	−60	176	40 55	−60	176	357
2	44 58	−60	177	43 58	−60	177	42 58	−60	177	41 58	−60	177	40 58	−60	177	358
1	44 59	−60	179	43 59	−60	179	42 59	−60	179	41 59	−60	179	40 59	−60	179	359
0	45 00	−60	180	44 00	−60	180	43 00	−60	180	42 00	−60	180	41 00	−60	180	360

LAT 36°

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

LHA	0° Hc	d	Z	1° Hc	d	Z	2° Hc	d	Z	3° Hc	d	Z	4° Hc	d	Z	LHA
	° ′	′	°	° ′	′	°	° ′	′	°	° ′	′	°	° ′	′	°	
0	52 00	60	180	53 00	60	180	54 00	60	180	55 00	60	180	56 00	60	180	360
1	51 59	60	178	52 59	60	178	53 59	60	178	54 59	60	178	55 59	60	178	359
2	51 57	60	177	52 57	60	177	53 57	60	177	54 57	60	177	55 57	60	176	358
3	51 54	60	175	52 54	60	175	53 54	60	175	54 54	59	175	55 53	60	175	357
4	51 49	60	174	52 49	60	173	53 49	60	173	54 49	59	173	55 48	60	173	356

LAT 38°

DECLINATION (15° – 29°) **SAME** NAME AS LATITUDE

LHA	17° Hc	d	Z	18° Hc	d	Z	19° Hc	d	Z	20° Hc	d	Z	21° Hc	d	Z	LHA
	° ′	′	°	° ′	′	°	° ′	′	°	° ′	′	°	° ′	′	°	
0	63 00	60	180	64 00	60	180	65 00	60	180	66 00	60	180	67 00	60	180	360
1	62 59	60	178	63 59	60	178	64 59	60	178	65 59	60	178	66 59	60	178	359
2	62 57	60	176	63 57	60	176	64 57	60	176	65 57	59	175	66 56	60	175	358
3	62 53	60	174	63 53	59	174	64 52	60	173	65 52	60	173	66 52	60	173	357
4	62 47	60	172	63 47	60	171	64 47	59	171	65 46	60	171	66 46	59	170	356

LAT 44°

DECLINATION (15° – 29°) **SAME** NAME AS LATITUDE

LHA	17° Hc	d	Z	18° Hc	d	Z	19° Hc	d	Z	20° Hc	d	Z	21° Hc	d	Z	LHA
	° ′	′	°	° ′	′	°	° ′	′	°	° ′	′	°	° ′	′	°	
0	51 00	60	180	52 00	60	180	53 00	60	180	54 00	60	180	55 00	60	180	360
1	51 00	60	178	52 00	60	178	53 00	60	178	54 00	60	178	55 00	60	178	359
2	50 58	60	177	51 58	60	177	52 58	60	177	53 58	60	177	54 58	60	177	358
3	50 56	60	175	51 56	60	175	52 56	60	175	53 56	60	175	54 56	60	175	357
4	50 53	60	174	51 53	60	174	52 53	60	174	53 53	59	174	54 52	60	174	356

LAT 56°

T - 27

N(x) Table

This table can be used for several calculations in celestial navigation. Examples are given in Section 11.5 and in the Answers section.

The phrase "C = N(20)" means that C equals the N value that is listed beside x = 20, or C = 1073. The phrase "N(B) =56" means that B equals the x value that is listed beside N = 56, or B = 71 Some applications require interpolation of the table.

This table uses Meridian Angle instead of Local Hour Angle. Meridian angle (t) is defined as: t west = LHA for LHA < 180 and t east = 360 - LHA for LHA > 180.

x	N(x)	x	N(x)	x	N(x)
1	4048	31	664	61	134
2	3355	32	635	62	124
3	2950	33	608	63	115
4	2663	34	581	64	107
5	2440	35	556	65	98
6	2258	36	531	66	90
7	2105	37	508	67	83
8	1972	38	485	68	76
9	1855	39	463	69	69
10	1751	40	442	70	62
11	1656	41	422	71	56
12	1571	42	402	72	50
13	1492	43	383	73	45
14	1419	44	364	74	40
15	1352	45	347	75	35
16	1289	46	329	76	30
17	1230	47	313	77	26
18	1174	48	297	78	22
19	1122	49	281	79	19
20	1073	50	267	80	15
21	1026	51	252	81	12
22	982	52	238	82	10
23	940	53	225	83	7
24	900	54	212	84	5
25	861	55	199	85	4
26	825	56	187	86	2
27	790	57	176	87	1
28	756	58	165	88	1
29	724	59	154	89	0
30	693	60	144		

SIGHT REDUCTION PROCEDURE

Find v from:
N(v) = N(90 - dec) + N(t); if t > 90, use t = 180 - t.

Find w from:
N(w) = N(dec) - N(90 - v);

Find u from:
u = 90 - w + Lat, for same name.
u = 90 - w - Lat, for contrary name.
If u > 90 (either name), use u = 180 - u.

Find Hc from:
N(Hc) = N(90 - v) + N(u).

Find Z from:
N(Z) = N(v) - N(90 - Hc);
for all contrary names or for same names with original u > 90, use Z = 180 - Z.

This method of sight reduction lies somewhere between a tool for emergency use and a novelty. We developed it for use with an equally short perpetual almanac of the sun. The idea was to have all that is needed for emergency navigation on one small card. We first published this in 1987 and since then (now 2003) we have had exactly zero feedback on its use. That is, we have no idea if anyone has ever used it for anything! It remains, however, the world's shortest sight reduction tables that will indeed give accurate results for any sight—which, together with a dollar, will get you a cup of coffee... except maybe in Seattle.

Solar Index Corrections

Form for doing Index Correction with the sun as described in Sec. 11.6. May be duplicated for use with the course or actual sights.

Toward or Away		Date	
On	Off	Diff	Check SD
sight #	-	-	+
	=	= ÷2	= ÷4
SD=		=	=

Toward or Away		Date	
On	Off	Diff	Check SD
sight #	-	-	+
	=	= ÷2	= ÷4
SD=		=	=

Toward or Away		Date	
On	Off	Diff	Check SD
sight #	-	-	+
	=	= ÷2	= ÷4
SD=		=	=

Toward or Away		Date	
On	Off	Diff	Check SD
sight #	-	-	+
	=	= ÷2	= ÷4
SD=		=	=

Toward or Away		Date	
On	Off	Diff	Check SD
sight #	-	-	+
	=	= ÷2	= ÷4
SD=		=	=

Toward or Away		Date	
On	Off	Diff	Check SD
sight #	-	-	+
	=	= ÷2	= ÷4
SD=		=	=

Toward or Away		Date	
On	Off	Diff	Check SD
sight #	-	-	+
	=	= ÷2	= ÷4
SD=		=	=

Toward or Away		Date	
On	Off	Diff	Check SD
sight #	-	-	+
	=	= ÷2	= ÷4
SD=		=	=

Toward or Away		Date	
On	Off	Diff	Check SD
sight #	-	-	+
	=	= ÷2	= ÷4
SD=		=	=

Toward or Away		Date	
On	Off	Diff	Check SD
sight #	-	-	+
	=	= ÷2	= ÷4
SD=		=	=

Toward or Away		Date	
On	Off	Diff	Check SD
sight #	-	-	+
	=	= ÷2	= ÷4
SD=		=	=

Toward or Away		Date	
On	Off	Diff	Check SD
sight #	-	-	+
	=	= ÷2	= ÷4
SD=		=	=

Emergency Almanac for the Sun

Declination and (GHA - 175°) given as degrees–minutes for 00h GMT

day	January		February		March		day	April		May		June		day	July		August		September		day	October		November		December	
1	S 23–04	4–12	S 17–18	1–37	S 7–46	1–52	1	N 4–21	3–59	N 14–56	5–43	N 21–59	5–35	1	N 23–09	4–05	N 18–09	3–25	N 8–28	4–57	1	S 3–00	7–32	S 14–17	9–05	S 21–44	7–48
4	S 22–48	3–51	S 16–26	1–32	S 6–37	2–01	4	N 5–31	4–12	N 15–50	5–48	N 22–23	5–28	4	N 22–55	3–57	N 17–22	3–29	N 7–22	5–12	4	S 4–10	7–46	S 15–13	9–06	S 22–10	7–30
7	S 22–28	3–31	S 15–32	1–28	S 5–28	2–11	7	N 6–39	4–25	N 16–41	5–52	N 22–42	5–20	7	N 22–38	3–49	N 16–34	3–33	N 6–15	5–27	7	S 5–19	8–00	S 16–08	9–05	S 22–33	7–12
10	S 22–04	3–11	S 14–35	1–26	S 4–17	2–22	10	N 7–46	4–37	N 17–30	5–54	N 22–59	5–12	10	N 22–18	3–42	N 15–43	3–39	N 5–07	5–42	10	S 6–28	8–12	S 17–00	9–02	S 22–52	6–52
13	S 21–36	2–54	S 13–36	1–26	S 3–07	2–34	13	N 8–52	4–49	N 18–16	5–55	N 23–11	5–03	13	N 21–54	3–36	N 14–49	3–46	N 3–59	5–58	13	S 7–35	8–24	S 17–50	8–57	S 23–07	6–31
16	S 21–04	2–37	S 12–35	1–27	S 1–56	2–47	16	N 9–57	5–01	N 18–59	5–55	N 23–20	4–53	16	N 21–27	3–31	N 13–54	3–54	N 2–50	6–14	16	S 8–42	8–34	S 18–37	8–50	S 23–18	6–10
19	S 20–29	2–22	S 11–32	1–30	S 0–45	3–00	19	N 11–00	5–11	N 19–40	5–54	N 23–25	4–43	19	N 20–56	3–27	N 12–56	4–04	N 1–40	6–30	19	S 9–48	8–43	S 19–21	8–41	S 23–24	5–48
22	S 19–50	2–09	S 10–27	1–35	N 0–27	3–13	22	N 12–02	5–20	N 20–17	5–52	N 23–27	4–34	22	N 20–22	3–25	N 11–57	4–15	N 0–30	6–46	22	S 10–53	8–51	S 20–02	8–30	S 23–27	5–26
25	S 19–08	1–57	S 9–21	1–41	N 1–37	3–27	25	N 13–02	5–29	N 20–52	5–48	N 23–24	4–24	25	N 19–46	3–23	N 10–56	4–26	S 0–40	7–02	25	S 11–56	8–57	S 20–39	8–18	S 23–25	5–03
28	S 18–23	1–47	S 8–14	1–49	N 2–48	3–40	28	N 14–00	5–36	N 21–23	5–43	N 23–18	4–14	28	N 19–06	3–23	N 9–53	4–39	S 1–50	7–17	28	S 12–57	9–02	S 21–13	8–03	S 23–18	4–41

Procedure. For declination, interpolate for hour and day as follows: Find dec at 1400 (14h 00m) on Nov 6. At 00h on Nov 4 the value is S 15° 13′ and on Nov 7 it is S 16° 08′, so for 72h the increase was 55′. The time wanted is 62h past 00h on Nov 4, so the correction is (62/72) × 55′ = 47′ and the dec = S 15° 13′ + 47′ = S 16° 00′ at 1400 on Nov 6.

For GHA, interpolate the table for the 00h value on the proper date, add 175°, and then add the GMT converted to angle using the **Arc to Time Table.** If needed, subtract 360°. EXAMPLE: Find GHA at 14h 22m 13s on Nov 27. From Nov 25 to 28, the 00h value decreases from 8° 18′ to 8° 03′, or 5′ per day, so the 00h value on Nov 27 is 8° 08′. To convert GMT to angle, use: 14h = 14h × (15°/1h) = 210°; 22m = 22m × (15′/1m) = 330′ = 5° 30′; and 13s = 13s × (1′/4s) = 3′. So GHA = 8° 08′ + 175° + 210° + 5° 30′ + 3′ = 398° 41′ = 38° 41′ as the GHA at 14h 22m 13s on Nov 27.

The accuracy of the interpolated values for any year should be within 10′ in most cases. The error is primarily due to an average over the leap year cycle.

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