

REFRACTION AT A STANDARD TEMPERATURE OF 10° CELSIUS AND PRESSURE OF 1010 MILLIBARS
Altitude correction Tables revised by Captain Dr. Ivica Tijardović by means of equations from the Nautical Almanac

Main refraction table showing Apparent Altitude (H) = Sextant Altitude ± Index Error - DIP and Refraction (Ro) = 1.002 : tan (H + (7.31 : (H + 4.4)))

DIP OF SEA HORIZON (DIP = 1.758 * √h)

Table for Dip of Sea Horizon with columns for height of eye (h) and corresponding Dip values.

DIP OF SHORE HORIZON (D = 1.855 * (h : d) + 0.42 * d)

EXAMPLE

Textual example showing the calculation of true altitude from sextant altitude, refraction, and dip, including corrections for parallax and moon.

Table for Dip of Shore Horizon with columns for distance (d) in miles and corresponding Dip values.

Table for Sun's Parallax in Altitude (PA) = 0.144 * cos H for various altitudes (0° to 90°).

Table for Sun's Semi-Diameter (SD) by month from Jan. to Dec.

FOR CORRECTING THE SEXTANT ALTITUDE OF THE SUN'S LOWER LIMB

Correction = 16' - 1.758 * √h - (1.002 : tan (H + (7.31 : (H + 4.4)))) + 0.144 * cos H

True Altitude = Sextant Altitude ± Index Error ± Correction ± Month Correction

height of eye in metres

Index Error

On Arc is (-)

Off Arc is (+)

Large table of Index Error corrections for altitudes from 5° to 90° and months from Jan. to Dec.

CORRECTION FOR THE SEXTANT ALTITUDE OF THE MOON'S LOWER LIMB

By ALEX.McLELLAN and S.P.ELLIOT

CORRECTION FOR THE SEXTANT ALTITUDE OF THE MOON'S UPPER LIMB

By ALEX.McLELLAN and S.P.ELLIOT

$$\text{Correction} = \text{HP} \cdot \cos H - (1.002 : \tan (H + (7.31 : (H + 4.4)))) - 0.102 \cdot \cos H \pm 0.2724 \cdot \text{HP}$$

HP – Horizontal Parallax

HP

+ LOWER LIMB
- UPPER LIMB
HP

Altitude	54'	55'	56'	57'	58'	59'	60'	61'
10°	62.4'	63.6'	64.9'	66.2'	67.4'	68.7'	69.9'	71.2'
12°	62.9	64.1	65.4	66.6	67.9	69.1	70.4	71.6
14°	63.1	64.3	65.6	66.8	68.1	69.3	70.6	71.8
16°	63.1	64.3	65.6	66.8	68.0	69.3	70.5	71.7
18°	62.9	64.2	65.4	66.6	67.8	69.1	70.3	71.5
20°	62.6	63.9	65.1	66.3	67.5	68.7	69.9	71.1
22°	62.2	63.4	64.6	65.8	67.0	68.2	69.4	70.6
24°	61.7	62.9	64.1	65.3	66.5	67.7	68.8	70.0
26°	61.1	62.3	63.5	64.6	65.8	67.0	68.1	69.3
28°	60.4	61.6	62.7	63.9	65.1	66.2	67.4	68.5
30°	59.7	60.8	61.9	63.1	64.2	65.4	66.5	67.6
32°	58.8	59.9	61.1	62.2	63.3	64.4	65.5	66.7
34°	57.9	59.0	60.1	61.2	62.3	63.4	64.5	65.6
36°	56.9	58.0	59.1	60.2	61.3	62.4	63.4	64.5
38°	55.9	57.0	58.0	59.1	60.1	61.2	62.3	63.3
40°	54.8	55.8	56.9	57.9	59.0	60.0	61.0	62.1
42°	53.7	54.7	55.7	56.7	57.7	58.7	59.8	60.8
44°	52.4	53.4	54.4	55.4	56.4	57.4	58.4	59.4
46°	51.2	52.2	53.1	54.1	55.1	56.0	57.0	58.0
48°	49.9	50.8	51.8	52.7	53.6	54.6	55.5	56.5
50°	48.5	49.4	50.3	51.3	52.2	53.1	54.0	54.9
52°	47.1	48.0	48.9	49.8	50.7	51.6	52.4	53.3
54°	45.7	46.5	47.4	48.2	49.1	50.0	50.8	51.7
56°	44.2	45.0	45.8	46.7	47.5	48.3	49.2	50.0
58°	42.6	43.5	44.3	45.1	45.9	46.7	47.5	48.3
60°	41.1	41.9	42.6	43.4	44.2	44.9	45.7	46.5
62°	39.5	40.2	41.0	41.7	42.5	43.2	43.9	44.7
64°	37.9	38.6	39.3	40.0	40.7	41.4	42.1	42.8
66°	36.2	36.9	37.5	38.2	38.9	39.6	40.3	40.9
68°	34.5	35.1	35.8	36.4	37.1	37.7	38.4	39.0
70°	32.8	33.4	34.0	34.6	35.2	35.9	36.5	37.1
72°	31.0	31.6	32.2	32.8	33.4	33.9	34.5	35.1
74°	29.3	29.8	30.4	30.9	31.5	32.0	32.6	33.1
76°	27.5	28.0	28.5	29.0	29.6	30.1	30.6	31.1
78°	25.7	26.2	26.7	27.1	27.6	28.1	28.6	29.1
80°	23.9	24.3	24.8	25.2	25.7	26.1	26.6	27.0
82°	22.1	22.5	22.9	23.3	23.7	24.1	24.5	25.0
84°	20.2	20.6	21.0	21.4	21.7	22.1	22.5	22.9
86°	18.4	18.7	19.1	19.4	19.8	20.1	20.5	20.8
88°	16.6	16.9	17.2	17.5	17.8	18.1	18.4	18.7
90°	14.7	15.0	15.3	15.5	15.8	16.1	16.3	16.6

Altitude	54'	55'	56'	57'	58'	59'	60'	61'
10°	33.0'	33.7'	34.4'	35.1'	35.8'	36.5'	37.2'	38.0'
12°	33.5	34.2	34.9	35.6	36.3	37.0	37.7	38.4
14°	33.7	34.4	35.1	35.8	36.4	37.1	37.8	38.5
16°	33.7	34.4	35.1	35.8	36.4	37.1	37.8	38.5
18°	33.5	34.2	34.9	35.6	36.2	36.9	37.6	38.3
20°	33.2	33.9	34.6	35.2	35.9	36.6	37.2	37.9
22°	32.8	33.5	34.1	34.8	35.4	36.1	36.7	37.4
24°	32.3	32.9	33.6	34.2	34.9	35.5	36.2	36.8
26°	31.7	32.3	33.0	33.6	34.2	34.8	35.5	36.1
28°	31.0	31.6	32.2	32.8	33.5	34.1	34.7	35.3
30°	30.2	30.8	31.4	32.0	32.6	33.2	33.8	34.4
32°	29.4	30.0	30.6	31.1	31.7	32.3	32.9	33.4
34°	28.5	29.1	29.6	30.2	30.7	31.3	31.8	32.4
36°	27.5	28.1	28.6	29.1	29.7	30.2	30.7	31.3
38°	26.5	27.0	27.5	28.0	28.6	29.1	29.6	30.1
40°	25.4	25.9	26.4	26.9	27.4	27.9	28.4	28.8
42°	24.2	24.7	25.2	25.6	26.1	26.6	27.1	27.5
44°	23.0	23.5	23.9	24.4	24.8	25.3	25.7	26.2
46°	21.8	22.2	22.6	23.0	23.5	23.9	24.3	24.7
48°	20.5	20.9	21.3	21.6	22.0	22.4	22.8	23.2
50°	19.1	19.5	19.8	20.2	20.6	21.0	21.3	21.7
52°	17.7	18.0	18.4	18.7	19.1	19.4	19.8	20.1
54°	16.2	16.6	16.9	17.2	17.5	17.8	18.1	18.5
56°	14.8	15.0	15.3	15.6	15.9	16.2	16.5	16.8
58°	13.2	13.5	13.7	14.0	14.3	14.5	14.8	15.0
60°	11.7	11.9	12.1	12.3	12.6	12.8	13.0	13.3
62°	10.1	10.3	10.5	10.7	10.9	11.0	11.2	11.4
64°	8.4	8.6	8.8	8.9	9.1	9.3	9.4	9.6
66°	6.8	6.9	7.0	7.2	7.3	7.4	7.6	7.7
68°	5.1	5.2	5.3	5.4	5.5	5.6	5.7	5.8
70°	3.4	3.4	3.5	3.6	3.6	3.7	3.8	3.9
72°	1.6	1.7	1.7	1.7	1.8	1.8	1.8	1.8
74°	-0.1	-0.1	-0.1	-0.1	-0.1	-0.1	-0.1	-0.1
76°	-1.9	-1.9	-2.0	-2.0	-2.0	-2.1	-2.1	-2.1
78°	-3.7	-3.8	-3.8	-3.9	-4.0	-4.0	-4.1	-4.2
80°	-5.5	-5.6	-5.7	-5.8	-5.9	-6.0	-6.1	-6.2
82°	-7.3	-7.5	-7.6	-7.7	-7.9	-8.0	-8.1	-8.3
84°	-9.2	-9.3	-9.5	-9.7	-9.9	-10.0	-10.2	-10.4
86°	-11.0	-11.2	-11.4	-11.6	-11.8	-12.0	-12.2	-12.4
88°	-12.9	-13.1	-13.3	-13.6	-13.8	-14.0	-14.3	-14.5
90°	-14.7	-15.0	-15.3	-15.5	-15.8	-16.1	-16.3	-16.6

EXAMPLE

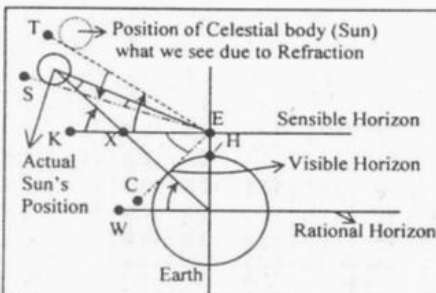
Find the True Altitude of the Moon if the Sextant Altitude of the Lower Limb is 33° 29', Sextant Index Error is 2' off the arc (+).

Height of Eye (h) above the horizon is 20 m, Horizontal Parallax (HP) for the time of observation is 59.1'.

If there is observed Upper Limb then use upper right Table.

From the upper left Table, with Altitude (33° 29') and HP (59.1'), find out the Correction → 63.8' = 1° 03.8'

True Altitude = Sextant Altitude ± Index Error - Dip of Sea Horizon ± Correction = 33°29' + 0°02' - 0°07.9' + 1°03.8' = 34° 26.9'



In the figure it is observed Sun's Lower Limb. Distance HE is Height of Eye. Angle between S, E, T is Refraction. Angle between K, E, C is Dip of Sea Horizon. Angle between E, Centre of Actual Sun's Position and Centre of Earth is Sun's Parallax in Altitude. Angle between K, E, T is Sun's Semi-Diameter. Angle between W, Centre of Earth and Centre of Actual Sun's Position is Sun's Apparent Altitude. Angle between W, Centre of Earth and Centre of Actual Sun's Position or angle between K, X and Centre of Actual Sun's Position is True Altitude. Sun's (Moon's) True Altitude for Lower Limb = Sextant Altitude ± Index Error - Refraction - Dip of Sea Horizon + Sun's (Moon's) Parallax in Altitude + Sun's (Moon's) Semi-Diameter. Moon may have very small correction for Augmentation too. Star's (Planet's) True Altitude = Sextant Alt. ± Index Error - Refraction - Dip of Sea Horizon. Venus and Mars may have very small correction for parallax too.

TABLE FOR CONVERTING TIME INTO ARC AND THE REVERSE

The table for converting Time into Arc and the reverse is of the greatest use as the conversion can be done both with rapidity and practical accuracy.

Examination of the table will show that the hours and minutes are given corresponding to each degree of arc; the first column in addition, also represents the minutes and seconds of time for minutes of arc.

The table will be found exceedingly simple to use, and is best illustrated by examples. It will be seen that accuracy is gained by interpolation.

EXAMPLE—

Arc into Time
 Convert 91° 52' 20" into Time
 91° = 6h 4m
 52' = 3m 28s
 20" = 1.3s
6h 7m 29.3s

Time into Arc
 Convert 11h 42m 39s into Arc
 11h 40m = 175° 00'
 2m 39s = 39¼
175° 39¼

TABLE FOR CONVERTING TIME INTO ARC AND THE REVERSE

HM	°	HM	°	HM	°	HM	°	HM	°	HM	°
MS	'	MS	'	MS	'	MS	'	MS	'	MS	'
4	1	4 4	61	8 4	121	12 4	181	16 4	241	20 4	301
8	2	4 8	62	8 8	122	12 8	182	16 8	242	20 8	302
12	3	4 12	63	8 12	123	12 12	183	16 12	243	20 12	303
16	4	4 16	64	8 16	124	12 16	184	16 16	244	20 16	304
0 20	5	4 20	65	8 20	125	12 20	185	16 20	245	20 20	305
24	6	4 24	66	8 24	126	12 24	186	16 24	246	20 24	306
28	7	4 28	67	8 28	127	12 28	187	16 28	247	20 28	307
32	8	4 32	68	8 32	128	12 32	188	16 32	248	20 32	308
36	9	4 36	69	8 36	129	12 36	189	16 36	249	20 36	309
0 40	10	4 40	70	8 40	130	12 40	190	16 40	250	20 40	310
44	11	4 44	71	8 44	131	12 44	191	16 44	251	20 44	311
48	12	4 48	72	8 48	132	12 48	192	16 48	252	20 48	312
52	13	4 52	73	8 52	133	12 52	193	16 52	253	20 52	313
56	14	4 56	74	8 56	134	12 56	194	16 56	254	20 56	314
1 0	15	5 0	75	9 0	135	13 0	195	17 0	255	21 0	315
1 4	16	5 4	76	9 4	136	13 4	196	17 4	256	21 4	316
1 8	17	5 8	77	9 8	137	13 8	197	17 8	257	21 8	317
1 12	18	5 12	78	9 12	138	13 12	198	17 12	258	21 12	318
1 16	19	5 16	79	9 16	139	13 16	199	17 16	259	21 16	319
1 20	20	5 20	80	9 20	140	13 20	200	17 20	260	21 20	320
1 24	21	5 24	81	9 24	141	13 24	201	17 24	261	21 24	321
1 28	22	5 28	82	9 28	142	13 28	202	17 28	262	21 28	322
1 32	23	5 32	83	9 32	143	13 32	203	17 32	263	21 32	323
1 36	24	5 36	84	9 36	144	13 36	204	17 36	264	21 36	324
1 40	25	5 40	85	9 40	145	13 40	205	17 40	265	21 40	325
1 44	26	5 44	86	9 44	146	13 44	206	17 44	266	21 44	326
1 48	27	5 48	87	9 48	147	13 48	207	17 48	267	21 48	327
1 52	28	5 52	88	9 52	148	13 52	208	17 52	268	21 52	328
1 56	29	5 56	89	9 56	149	13 56	209	17 56	269	21 56	329
2 0	30	6 0	90	10 0	150	14 0	210	18 0	270	22 0	330
2 4	31	6 4	91	10 4	151	14 4	211	18 4	271	22 4	331
2 8	32	6 8	92	10 8	152	14 8	212	18 8	272	22 8	332
2 12	33	6 12	93	10 12	153	14 12	213	18 12	273	22 12	333
2 16	34	6 16	94	10 16	154	14 16	214	18 16	274	22 16	334
2 20	35	6 20	95	10 20	155	14 20	215	18 20	275	22 20	335
2 24	36	6 24	96	10 24	156	14 24	216	18 24	276	22 24	336
2 28	37	6 28	97	10 28	157	14 28	217	18 28	277	22 28	337
2 32	38	6 32	98	10 32	158	14 32	218	18 32	278	22 32	338
2 36	39	6 36	99	10 36	159	14 36	219	18 36	279	22 36	339
2 40	40	6 40	100	10 40	160	14 40	220	18 40	280	22 40	340
2 44	41	6 44	101	10 44	161	14 44	221	18 44	281	22 44	341
2 48	42	6 48	102	10 48	162	14 48	222	18 48	282	22 48	342
2 52	43	6 52	103	10 52	163	14 52	223	18 52	283	22 52	343
2 56	44	6 56	104	10 56	164	14 56	224	18 56	284	22 56	344
3 0	45	7 0	105	11 0	165	15 0	225	19 0	285	23 0	345
3 4	46	7 4	106	11 4	166	15 4	226	19 4	286	23 4	346
3 8	47	7 8	107	11 8	167	15 8	227	19 8	287	23 8	347
3 12	48	7 12	108	11 12	168	15 12	228	19 12	288	23 12	348
3 16	49	7 16	109	11 16	169	15 16	229	19 16	289	23 16	349
3 20	50	7 20	110	11 20	170	15 20	230	19 20	290	23 20	350
3 24	51	7 24	111	11 24	171	15 24	231	19 24	291	23 24	351
3 28	52	7 28	112	11 28	172	15 28	232	19 28	292	23 28	352
3 32	53	7 32	113	11 32	173	15 32	233	19 32	293	23 32	353
3 36	54	7 36	144	11 36	174	15 36	234	19 36	294	23 36	354
3 40	55	7 40	115	11 40	175	15 40	235	19 40	295	23 40	355
3 44	56	7 44	116	11 44	176	15 44	236	19 44	296	23 44	356
3 48	57	7 48	117	11 48	177	15 48	237	19 48	297	23 48	357
3 52	58	7 52	118	11 52	178	15 52	238	19 52	298	23 52	358
3 56	59	7 56	119	11 56	179	15 56	239	19 56	299	23 56	359
4 0	60	8 0	120	12 0	180	16 0	240	20 0	300	24 0	360