LAT.	15°		16°		17°		18°		19°		LAT.
H.A.	Alt.	Az.	Alt.	Az.	Alt.	Az.	Alt.	Az.	Alt.	Az.	H.A.
°	° ′ d	°	° ′ d	°	° ′ d	°	° ′ d	°	° ′ d	°	°
0	80 00 −60	0	...		...		...		...		360
1	79 58 60	5	...		...		...		...		359
2	79 50 59	10	...		...		...		...		358
3	79 37 58	15	...		...		...		...		357
4	79 19 56	20	...		...		...		...		356
5	78 57 −54	24	79 52 −54	27	...		...		...		355
6	78 32 53	28	79 24 51	31	...		...		...		354
7	78 02 50	32	78 52 48	35	79 41 −47	38	...		...		353
8	77 30 48	36	78 18 46	38	79 04 44	42	79 47 −41	45	...		352
9	76 55 46	39	77 41 44	42	78 25 42	45	79 06 39	49	79 44 −36	53	351
10	76 18 −44	42	77 01 −41	44	77 43 −39	48	78 22 −36	51	78 58 −33	55	350
11	75 38 41	44	76 20 39	47	77 00 37	50	77 37 34	54	78 11 31	58	349
12	74 57 39	47	75 37 37	49	76 15 34	52	76 50 31	56	77 22 28	60	348
13	74 14 37	49	74 53 35	51	75 29 32	54	76 02 29	58	76 33 26	61	347
14	73 30 35	51	74 07 33	53	74 42 31	56	75 14 28	59	75 43 24	63	346
15	72 45 −34	52	73 20 −31	55	73 54 −29	58	74 24 −25	61	74 52 −22	64	345
16	71 58 31	54	72 33 30	56	73 05 27	59	73 34 24	62	74 01 21	65	344
17	71 11 30	55	71 44 27	58	72 15 25	60	72 44 23	63	73 09 19	66	343
18	70 23 28	57	70 55 26	59	71 25 24	61	71 53 22	64	72 17 18	67	342
19	69 35 27	58	70 06 25	60	70 34 22	62	71 01 20	65	71 25 17	68	341
20	68 45 −25	59	69 15 −23	61	69 43 −21	63	70 09 −18	66	70 32 −15	68	340
21	67 56 25	60	68 25 22	62	68 52 20	64	69 17 18	67	69 39 14	69	339
22	67 05 23	61	67 34 21	63	68 00 19	65	68 24 16	67	68 46 13	70	338
23	66 15 23	61	66 42 20	64	67 08 18	66	67 32 16	68	67 53 13	70	337
24	65 23 20	62	65 50 18	64	66 16 17	66	66 39 15	68	67 00 12	71	336
25	64 32 −20	63	64 58 −17	65	65 23 −16	67	65 46 −14	69	66 06 −11	71	335
26	63 40 19	64	64 06 17	65	64 30 15	67	64 52 12	69	65 13 11	71	334
27	62 48 18	64	63 14 16	66	63 37 14	68	63 59 12	70	64 19 10	72	333
28	61 56 17	65	62 21 15	66	62 44 13	68	63 05 11	70	63 25 9	72	332
29	61 03 16	65	61 28 14	67	61 51 13	69	62 12 11	70	62 31 8	72	331
30	60 11 −15	66	60 35 −14	67	60 57 −11	69	61 18 −10	71	61 37 −7	72	330
31	59 18 14	66	59 42 13	68	60 04 11	69	60 24 9	71	60 43 7	73	329
32	58 25 14	66	58 48 12	68	59 10 10	70	59 30 8	71	59 49 6	73	328
33	57 32 13	67	57 55 11	68	58 16 9	70	58 36 7	71	58 55 6	73	327
34	56 38 12	67	57 01 10	69	57 22 8	70	57 42 7	71	58 00 5	73	326
35	55 45 −11	67	56 07 −9	69	56 28 −8	70	56 48 −6	72	57 06 −4	73	325
36	54 51 10	68	55 13 9	69	55 34 7	70	55 54 6	72	56 12 4	73	324
37	53 58 10	68	54 20 9	69	54 40 6	71	55 00 5	72	55 17 3	73	323
38	53 04 9	68	53 26 8	69	53 46 6	71	54 05 4	72	54 23 3	73	322
39	52 10 9	68	52 32 7	70	52 52 6	71	53 11 4	72	53 29 2	73	321
40	51 16 −8	69	51 38 −7	70	51 58 −5	71	52 17 −4	72	52 34 −1	73	320
41	50 22 7	69	50 43 6	70	51 04 5	71	51 22 2	72	51 40 1	73	319
42	49 28 7	69	49 49 5	70	50 09 4	71	50 28 2	72	50 46 −1	73	318
43	48 34 6	69	48 55 5	70	49 15 3	71	49 34 2	72	49 51 0	73	317
44	47 40 6	69	48 01 4	70	48 21 3	71	48 39 1	72	48 57 0	73	316
45	46 46 −5	69	47 07 −4	70	47 26 −2	71	47 45 −1	72	48 03 0	73	315

In North Latitudes { For argument H.A. on the left, True Azimuth = 360° − Tabulated Azimuth. / For argument H.A. on the right, True Azimuth = Tabulated Azimuth. } See p. 90.

LAT.	15°			16°			17°			18°			19°			LAT.
L.A.	Alt.	d	Az.	Alt.	d	Az.	Alt.	d	Az.	Alt.	d	Az.	Alt.	d	Az.	H.A.
°	° ′		°	° ′		°	° ′		°	° ′		°	° ′		°	°
45	46 46	−5	69	47 07	−4	70	47 26	−2	71	47 45	−1	72	48 03	0	73	315
46	45 52	5	69	46 12	3	70	46 32	2	71	46 51	−1	72	47 08	+1	73	314
47	44 57	4	69	45 18	3	70	45 38	2	71	45 56	0	72	46 14	1	73	313
48	44 03	4	70	44 24	3	70	44 43	1	71	45 02	0	72	45 20	2	73	312
49	43 09	3	70	43 29	1	70	43 49	−1	71	44 08	−1	72	44 25	3	73	311
50	42 15	−3	70	42 35	−1	71	42 55	0	71	43 13	+2	72	43 31	+3	73	310
51	41 20	2	70	41 41	−1	71	42 00	+1	71	42 19	2	72	42 37	3	73	309
52	40 26	2	70	40 46	0	71	41 06	1	71	41 25	2	72	41 43	3	73	308
53	39 32	2	70	39 52	0	71	40 12	1	71	40 30	3	72	40 48	4	73	307
54	38 37	−1	70	38 58	0	71	39 17	2	71	39 36	3	72	39 54	4	73	306
55	37 43	0	70	38 03	+1	70	38 23	+2	71	38 42	+3	72	39 00	+5	73	305
56	36 49	0	70	37 09	1	70	37 29	2	71	37 48	3	72	38 06	5	73	304
57	35 54	+1	70	36 15	1	70	36 34	3	71	36 53	5	72	37 12	5	73	303
58	35 00	1	70	35 20	3	70	35 40	4	71	35 59	5	72	36 18	6	72	302
59	34 06	1	70	34 26	3	70	34 46	4	71	35 05	5	72	35 24	6	72	301
60	33 11	+2	70	33 32	+3	70	33 52	+4	71	34 11	+5	72	34 30	+6	72	300
61	32 17	2	70	32 38	3	70	32 58	4	71	33 17	6	71	33 36	7	72	299
62	31 23	2	70	31 43	4	70	32 03	5	71	32 23	6	71	32 42	7	72	298
63	30 29	3	70	30 49	4	70	31 09	6	71	31 29	7	71	31 48	8	72	297
64	29 34	4	69	29 55	5	70	30 15	6	71	30 35	7	71	30 54	8	72	296
65	28 40	+4	69	29 01	+5	70	29 21	+6	70	29 41	+7	71	30 00	+9	72	295
66	27 46	4	69	28 07	5	70	28 27	7	70	28 47	8	71	29 07	8	71	294
67	26 52	5	69	27 13	6	70	27 33	7	70	27 53	8	71	28 13	9	71	293
68	25 58	5	69	26 19	6	70	26 39	8	70	27 00	8	71	27 19	10	71	292
69	25 04	5	69	25 25	6	69	25 46	7	70	26 06	9	70	26 26	10	71	291
70	24 10	+6	69	24 31	+7	69	24 52	+8	70	25 12	+9	70	25 32	+11	71	290
71	23 16	6	69	23 37	7	69	23 58	9	70	24 19	9	70	24 39	11	70	289
72	22 22	6	69	22 43	8	69	23 04	9	70	23 25	10	70	23 46	11	70	288
73	21 28	7	69	21 49	9	69	22 11	9	69	22 32	10	70	22 52	12	70	287
74	20 34	8	68	20 56	8	69	21 17	10	69	21 38	11	70	21 59	12	70	286
75	19 40	+8	68	20 02	+9	69	20 24	+10	69	20 45	+11	69	21 06	+12	70	285
76	18 46	9	68	19 08	10	69	19 30	11	69	19 52	11	69	20 13	12	70	284
77	17 53	9	68	18 15	10	68	18 37	11	69	18 58	12	69	19 20	13	69	283
78	16 59	9	68	17 21	11	68	17 44	11	69	18 05	13	69	18 27	13	69	282
79	16 06	9	68	16 28	11	68	16 50	12	68	17 12	13	69	17 34	14	69	281
80	15 12	+10	68	15 35	+11	68	15 57	+12	68	16 19	+13	68	16 41	+14	69	280
81	14 19	10	67	14 42	11	68	15 04	13	68	15 27	13	68	15 49	14	68	279
82	13 26	10	67	13 48	12	68	14 11	13	68	14 34	13	68	14 56	15	68	278
83	12 32	12	67	12 55	13	67	13 18	14	68	13 41	14	68	14 04	15	68	277
84	11 39	12	67	12 03	12	67	12 26	13	67	12 49	14	68	13 11	16	68	276
85	10 46	+12	67	11 10	+13	67	11 33	+14	67	11 56	+15	67	12 19	+16	68	275
86		...		10 17	+13	67	10 41	+14	67	11 04	15	67	11 27	16	67	274
87		...			...			...		10 12	+15	67	10 35	+17	67	273
88		...			...			...			...			...		272
89		...			...			...			...			...		271
90		...			...			...			...			...		270

In South Latitudes { For argument H.A. on the left, True Azimuth = 180° + Tabulated Azimuth. / For argument H.A. on the right, True Azimuth = 180° − Tabulated Azimuth. } See p. 91.

LAT.	15°			16°			17°			18°			19°			LAT.
H.A.	Alt.	d	Az.	Alt.	d	Az.	Alt.	d	Az.	Alt.	d	Az.	Alt.	d	Az.	H.A.
°	° ′		°	° ′		°	° ′		°	° ′		°	° ′		°	°
0	50 01	−60	180	49 01	−60	180	48 01	−60	180	47 01	−60	180	46 01	−60	180	360
1	50 00	60	179	49 00	60	179	48 00	60	179	47 00	60	179	46 00	60	179	359
2	49 58	60	177	48 58	60	177	47 58	60	177	46 58	60	177	45 58	60	177	358
3	49 54	60	176	48 54	59	176	47 55	60	176	46 55	60	176	45 55	60	176	357
4	49 49	59	174	48 50	60	174	47 50	60	175	46 50	59	175	45 50	59	175	356
5	49 43	−60	173	48 43	−59	173	47 44	−60	173	46 44	−59	173	45 45	−60	174	355
6	49 35	59	172	48 36	59	172	47 36	59	172	46 37	59	172	45 38	60	172	354
7	49 26	59	170	48 27	59	170	47 28	59	171	46 29	60	171	45 29	59	171	353
8	49 15	58	169	48 17	59	169	47 18	59	169	46 19	59	169	45 20	59	170	352
9	49 04	59	168	48 05	58	168	47 06	58	168	46 08	59	168	45 09	59	168	351
10	48 50	−58	166	47 52	−58	166	46 54	−58	167	45 55	−58	167	44 57	−58	167	350
11	48 36	58	165	47 38	58	165	46 40	58	165	45 42	58	166	44 44	58	166	349
12	48 20	57	164	47 23	58	164	46 25	58	164	45 27	57	164	44 29	57	165	348
13	48 03	57	162	47 06	57	163	46 09	57	163	45 11	57	163	44 14	57	163	347
14	47 45	56	161	46 48	56	161	45 51	56	162	44 54	57	162	43 57	57	162	346
15	47 25	−55	160	46 29	−56	160	45 33	−57	160	44 36	−56	161	43 39	−56	161	345
16	47 05	56	158	46 09	56	159	45 13	56	159	44 17	56	160	43 20	56	160	344
17	46 43	55	157	45 47	55	158	44 52	55	158	43 56	55	158	43 00	55	159	343
18	46 20	54	156	45 25	54	156	44 30	55	157	43 35	55	157	42 39	55	158	342
19	45 56	54	155	45 01	53	155	44 07	54	156	43 12	54	156	42 17	54	156	341
20	45 31	−53	154	44 37	−53	154	43 43	−54	155	42 49	−54	155	41 54	−54	155	340
21	45 05	53	153	44 11	52	153	43 18	53	154	42 24	53	154	41 30	54	154	339
22	44 38	52	152	43 45	52	152	42 52	53	152	41 58	52	153	41 05	53	153	338
23	44 09	51	150	43 17	51	151	42 25	52	151	41 32	52	152	40 39	53	152	337
24	43 40	50	149	42 49	51	150	41 57	52	150	41 04	51	151	40 12	52	151	336
25	43 10	−49	148	42 19	−50	149	41 28	−51	149	40 36	−51	150	39 44	−51	150	335
26	42 40	50	147	41 49	50	148	40 58	50	148	40 07	50	149	39 16	51	149	334
27	42 08	49	146	41 18	49	147	40 27	49	147	39 37	50	148	38 46	50	148	333
28	41 35	48	145	40 46	48	146	39 56	49	146	39 06	49	147	38 16	50	147	332
29	41 02	47	144	40 13	48	145	39 24	48	145	38 34	48	146	37 45	49	146	331
30	40 28	−47	143	39 40	−48	144	38 51	−48	144	38 02	−48	145	37 13	−49	145	330
31	39 53	46	143	39 05	46	143	38 17	47	144	37 29	48	144	36 40	48	144	329
32	39 17	45	142	38 30	45	142	37 43	47	143	36 55	47	143	36 07	47	144	328
33	38 41	44	141	37 54	45	141	37 08	46	142	36 20	46	142	35 33	47	143	327
34	38 04	44	140	37 18	44	140	36 32	45	141	35 45	45	141	34 58	46	142	326
35	37 27	−44	139	36 41	−44	140	35 55	−44	140	35 09	−45	141	34 23	−46	141	325
36	36 48	42	138	36 03	43	139	35 18	44	139	34 33	45	140	33 47	45	140	324
37	36 10	42	138	35 25	42	138	34 40	43	138	33 55	43	139	33 10	44	139	323
38	35 30	41	137	34 46	41	137	34 02	42	138	33 18	43	138	32 33	44	139	322
39	34 50	40	136	34 07	41	136	33 23	42	137	32 39	42	137	31 55	43	138	321
40	34 10	−40	135	33 27	−41	136	32 44	−41	136	32 00	−41	137	31 17	−43	137	320
41	33 29	40	135	32 46	39	135	32 04	41	135	31 21	41	136	30 38	42	136	319
42	32 47	38	134	32 05	39	134	31 23	39	135	30 41	40	135	29 58	41	136	318
43	32 05	38	133	31 24	39	134	30 42	39	134	30 01	40	134	29 18	40	135	317
44	31 23	38	132	30 42	38	133	30 01	39	133	29 20	40	134	28 38	40	134	316
45	30 40	−37	132	30 00	−38	132	29 19	−38	133	28 38	−38	133	27 57	−39	134	315

In North Latitudes { For argument H.A. on the left, True Azimuth = 360° − Tabulated Azimuth. / For argument H.A. on the right, True Azimuth = Tabulated Azimuth. } See p. 90.

LAT.	15°			16°			17°			18°			19°			LAT.
H.A.	Alt.		Az.	Alt.		Az.	Alt.		Az.	Alt.		Az.	Alt.		Az.	H.A.
°	° ′	d	°	° ′	d	°	° ′	d	°	° ′	d	°	° ′	d	°	°
45	30 40	−37	132	30 00	−38	132	29 19	−38	133	28 38	−38	133	27 57	−39	134	315
46	29 56	36	131	29 17	37	132	28 37	38	132	27 56	38	132	27 16	39	133	314
47	29 13	36	131	28 33	36	131	27 54	37	131	27 14	37	132	26 34	38	132	313
48	28 29	35	130	27 50	36	130	27 11	36	131	26 31	36	131	25 52	38	132	312
49	27 44	34	129	27 06	35	130	26 27	35	130	25 48	36	131	25 09	37	131	311
50	26 59	−34	129	26 21	−34	129	25 43	−35	130	25 05	−36	130	24 26	−36	130	310
51	26 14	33	128	25 37	34	129	24 59	35	129	24 21	35	129	23 43	36	130	309
52	25 28	32	128	24 51	33	128	24 14	34	128	23 37	35	129	22 59	35	129	308
53	24 42	32	127	24 06	33	128	23 29	33	128	22 52	34	128	22 15	35	129	307
54	23 56	31	127	23 20	32	127	22 44	33	127	22 07	33	128	21 31	35	128	306
55	23 09	−30	126	22 34	−32	127	21 58	−32	127	21 22	−33	127	20 46	−34	127	305
56	22 23	31	126	21 47	30	126	21 12	32	126	20 37	33	127	20 01	33	127	304
57	21 35	29	125	21 01	31	126	20 26	31	126	19 51	32	126	19 15	32	126	303
58	20 48	29	125	20 14	30	125	19 39	30	125	19 05	32	126	18 30	33	126	302
59	20 00	28	124	19 26	29	125	18 52	30	125	18 18	31	125	17 44	32	125	301
60	19 12	−28	124	18 39	−29	124	18 05	−29	124	17 31	−30	125	16 57	−31	125	300
61	18 24	27	123	17 51	28	124	17 18	29	124	16 44	29	124	16 11	31	124	299
62	17 36	27	123	17 03	28	123	16 30	28	123	15 57	29	124	15 24	30	124	298
63	16 47	26	123	16 15	27	123	15 42	28	123	15 10	29	123	14 37	30	123	297
64	15 58	25	122	15 26	26	122	14 54	27	123	14 22	28	123	13 50	29	123	296
65	15 09	−25	122	14 38	−26	122	14 06	−27	122	13 34	−28	122	13 02	−28	123	295
66	14 20	25	121	13 49	26	122	13 18	27	122	12 46	27	122	12 14	28	122	294
67	13 31	25	121	13 00	25	121	12 29	26	121	11 58	27	122	11 27	28	122	293
68	12 41	24	121	12 11	25	121	11 40	25	121	11 09	26	121	10 38	−27	121	292
69	11 51	23	120	11 21	24	120	10 51	25	121	10 21	−26	121	...			291
70	11 01	−22	120	10 32	−24	120	10 02	−25	120	...			...			290
71	10 11	−22	119	...			...			...			...			289
72	...			...			...			...			...			288
73	...			...			...			...			...			287
74	...			...			...			...			...			286
75	...			...			...			...			...			285

In South Latitudes { For argument H.A. on the left, True Azimuth = 180° + Tabulated Azimuth. / For argument H.A. on the right, True Azimuth = 180° − Tabulated Azimuth. } See p. 91.

LAT.	15°			16°			17°			18°			19°			LAT.
H.A.	Alt.		Az.	Alt.		Az.	Alt.		Az.	Alt.		Az.	Alt.		Az.	H.A.
°	° ′	d	°	° ′	d	°	° ′	d	°	° ′	d	°	° ′	d	°	°
0	79 00	−60	0	80 00	−60	0		...			...			...		360
1	78 58	60	5	79 58	60	5		...			...			...		359
2	78 51	59	9	79 50	59	10		...			...			...		358
3	78 39	58	14	79 37	58	15		...			...			...		357
4	78 23	57	18	79 20	56	20		...			...			...		356
5	78 03	−55	22	78 58	−54	24	79 52	−53	26		...			...		355
6	77 39	53	26	78 33	53	28	79 25	51	31		...			...		354
7	77 12	51	30	78 04	50	32	78 54	49	35	79 42	−46	38		...		353
8	76 42	49	33	77 32	48	35	78 20	46	38	79 06	44	41	79 50	−42	45	352
9	76 09	47	36	76 57	46	39	77 43	44	41	78 27	41	45	79 08	38	48	351
10	75 34	−45	39	76 20	−43	41	77 04	−41	44	77 46	−39	47	78 25	−36	51	350
11	74 57	43	41	75 41	41	44	76 23	39	47	77 03	36	50	77 40	33	53	349
12	74 18	41	44	75 00	39	46	75 41	37	49	76 19	35	52	76 54	31	56	348
13	73 37	39	46	74 18	37	48	74 57	35	51	75 33	32	54	76 07	30	57	347
14	72 55	38	48	73 34	35	50	74 11	33	53	74 46	30	56	75 19	28	59	346
15	72 11	−35	49	72 49	−33	52	73 25	−31	55	73 59	−29	57	74 30	−26	60	345
16	71 27	34	51	72 03	31	54	72 38	29	56	73 10	27	59	73 40	24	62	344
17	70 41	32	53	71 17	31	55	71 50	28	57	72 21	25	60	72 50	23	63	343
18	69 55	31	54	70 29	29	56	71 01	26	59	71 31	23	61	71 59	21	64	342
19	69 08	30	55	69 41	27	57	70 12	25	60	70 41	22	62	71 08	20	65	341
20	68 20	−28	56	68 52	−26	58	69 22	−23	61	69 51	−22	63	70 17	−19	66	340
21	67 31	26	57	68 03	25	59	68 32	22	62	68 59	19	64	69 25	18	66	339
22	66 42	25	58	67 13	24	60	67 41	21	62	68 08	19	65	68 33	17	67	338
23	65 52	24	59	66 22	22	61	66 50	20	63	67 16	17	65	67 40	15	68	337
24	65 03	23	60	65 32	21	62	65 59	19	64	66 24	16	66	66 48	14	68	336
25	64 12	−22	61	64 41	−20	63	65 07	−17	65	65 32	−15	66	65 55	−13	69	335
26	63 21	20	61	63 49	19	63	64 15	16	65	64 40	15	67	65 02	12	69	334
27	62 30	19	62	62 58	18	64	63 23	16	66	63 47	14	67	64 09	11	69	333
28	61 39	19	63	62 06	17	64	62 31	15	66	62 54	12	68	63 16	11	70	332
29	60 47	17	63	61 14	16	65	61 38	14	66	62 01	12	68	62 23	10	70	331
30	59 56	−17	64	60 21	−15	65	60 46	−13	67	61 08	−11	69	61 30	−10	70	330
31	59 04	16	64	59 29	14	66	59 53	13	67	60 15	10	69	60 36	8	71	329
32	58 11	15	65	58 36	13	66	59 00	12	68	59 22	10	69	59 43	8	71	328
33	57 19	14	65	57 44	13	66	58 07	11	68	58 29	9	69	58 49	7	71	327
34	56 26	13	65	56 51	12	67	57 14	11	68	57 35	8	70	57 55	6	71	326
35	55 34	−13	66	55 58	−12	67	56 20	−9	68	56 42	−8	70	57 02	−6	71	325
36	54 41	12	66	55 04	10	67	55 27	9	69	55 48	7	70	56 08	5	71	324
37	53 48	12	66	54 11	10	68	54 34	9	69	54 55	7	70	55 14	5	72	323
38	52 55	11	67	53 18	9	68	53 40	8	69	54 01	6	70	54 20	4	72	322
39	52 01	10	67	52 25	9	68	52 46	7	69	53 07	5	70	53 27	4	72	321
40	51 08	−9	67	51 31	−8	68	51 53	−7	69	52 13	−4	71	52 33	−3	72	320
41	50 15	9	67	50 37	7	68	50 59	6	69	51 20	5	71	51 39	3	72	319
42	49 21	8	67	49 44	7	68	50 05	5	70	50 26	4	71	50 45	2	72	318
43	48 28	8	68	48 50	6	69	49 12	5	70	49 32	3	71	49 51	2	72	317
44	47 34	7	68	47 57	6	69	48 18	4	70	48 38	3	71	48 57	1	72	316
45	46 41	−7	68	47 03	−5	69	47 24	−4	70	47 44	−2	71	48 03	0	72	315

In North Latitudes { For argument H.A. on the left, True Azimuth = 360° − Tabulated Azimuth. / For argument H.A. on the right, True Azimuth = Tabulated Azimuth. } See p. 90.

LAT.	15°			16°			17°			18°			19°			LAT.
H.A.	Alt.	d	Az.	Alt.	d	Az.	Alt.	d	Az.	Alt.	d	Az.	Alt.	d	Az.	H.A.
°	° ′		°	° ′		°	° ′		°	° ′		°	° ′		°	°
45	46 41	−7	68	47 03	−5	69	47 24	−4	70	47 44	−2	71	48 03	0	72	315
46	45 47	6	68	46 09	4	69	46 30	3	70	46 50	1	71	47 09	0	72	314
47	44 53	5	68	45 15	4	69	45 36	2	70	45 56	−1	71	46 15	+1	72	313
48	43 59	4	68	44 21	3	69	44 42	2	70	45 02	0	71	45 22	0	72	312
49	43 06	4	68	43 28	3	69	43 48	1	70	44 09	−1	71	44 28	+1	72	311
50	42 12	−4	68	42 34	−3	69	42 55	−1	70	43 15	0	71	43 34	+1	72	310
51	41 18	3	68	41 40	2	69	42 01	−1	70	42 21	+1	71	42 40	2	72	309
52	40 24	2	68	40 46	1	69	41 07	0	70	41 27	1	71	41 46	3	72	308
53	39 30	2	68	39 52	−1	69	40 13	0	70	40 33	2	71	40 52	3	72	307
54	38 36	1	68	38 58	0	69	39 19	+1	70	39 39	2	71	39 58	4	72	306
55	37 43	−2	68	38 04	0	69	38 25	+1	70	38 45	+3	71	39 05	+4	71	305
56	36 49	−1	69	37 10	+1	69	37 31	2	70	37 51	3	71	38 11	4	71	304
57	35 55	0	69	36 16	1	69	36 37	3	70	36 58	3	71	37 17	5	71	303
58	35 01	0	69	35 23	1	69	35 44	2	70	36 04	4	71	36 24	5	71	302
59	34 07	+1	68	34 29	2	69	34 50	3	70	35 10	4	70	35 30	5	71	301
60	33 13	+1	68	33 35	+2	69	33 56	+3	70	34 16	+5	70	34 36	+6	71	300
61	32 19	2	68	32 41	3	69	33 02	4	70	33 23	5	70	33 43	6	71	299
62	31 25	3	68	31 47	3	69	32 08	5	70	32 29	6	70	32 49	7	71	298
63	30 32	2	68	30 53	4	69	31 15	5	69	31 36	5	70	31 56	7	71	297
64	29 38	3	68	30 00	4	69	30 21	5	69	30 42	6	70	31 02	8	70	296
65	28 44	+3	68	29 06	+4	69	29 27	+6	69	29 48	+7	70	30 09	+8	70	295
66	27 50	4	68	28 12	5	69	28 34	6	69	28 55	7	70	29 15	9	70	294
67	26 57	4	68	27 19	5	69	27 40	7	69	28 01	8	70	28 22	9	70	293
68	26 03	5	68	26 25	6	68	26 47	7	69	27 08	8	69	27 29	9	70	292
69	25 09	5	68	25 31	7	68	25 53	8	69	26 15	8	69	26 36	9	70	291
70	24 16	+5	68	24 38	+7	68	25 00	+8	69	25 21	+9	69	25 43	+9	70	290
71	23 22	6	68	23 44	7	68	24 07	8	69	24 28	9	69	24 50	10	69	289
72	22 28	7	68	22 51	7	68	23 13	9	68	23 35	10	69	23 57	10	69	288
73	21 35	7	68	21 58	8	68	22 20	9	68	22 42	10	69	23 04	11	69	287
74	20 42	7	67	21 04	9	68	21 27	9	68	21 49	10	68	22 11	11	69	286
75	19 48	+8	67	20 11	+9	68	20 34	+9	68	20 56	+11	68	21 18	+12	69	285
76	18 55	8	67	19 18	9	67	19 41	10	68	20 03	11	68	20 25	12	68	284
77	18 02	8	67	18 25	9	67	18 48	10	68	19 10	12	68	19 33	12	68	283
78	17 08	9	67	17 32	10	67	17 55	11	67	18 18	11	68	18 40	13	68	282
79	16 15	10	67	16 39	10	67	17 02	11	67	17 25	12	68	17 48	13	68	281
80	15 22	+10	67	15 46	+11	67	16 09	+12	67	16 32	+13	67	16 55	+14	68	280
81	14 29	10	66	14 53	11	67	15 17	12	67	15 40	13	67	16 03	14	67	279
82	13 36	11	66	14 00	12	66	14 24	12	67	14 47	14	67	15 11	14	67	278
83	12 44	11	66	13 08	12	66	13 32	12	67	13 55	14	67	14 19	14	67	277
84	11 51	11	66	12 15	12	66	12 39	13	66	13 03	14	67	13 27	15	67	276
85	10 58	+12	66	11 23	+12	66	11 47	+14	66	12 11	+15	66	12 35	+15	67	275
86	10 06	+12	66	10 30	+14	66	10 55	14	66	11 19	15	66	11 43	16	66	274
87	...			...			10 03	+14	66	10 27	+16	66	10 52	16	66	273
88	...			...			...			...			10 00	+17	66	272
89	...			...			...			...			...			271
90	...			...			...			...			...			270

In South Latitudes { For argument H.A. on the left, True Azimuth = 180° + Tabulated Azimuth. / For argument H.A. on the right, True Azimuth = 180° − Tabulated Azimuth. } See p. 91

LAT.	15°			16°			17°			18°			19°			LAT.
H.A.	Alt.	d	Az.	Alt.	d	Az.	Alt.	d	Az.	Alt.	d	Az.	Alt.	d	Az.	H.A.
°	° ′		°	° ′		°	° ′		°	° ′		°	° ′		°	°
0	49 01	−60	180	48 01	−60	180	47 01	−60	180	46 01	−60	180	45 01	−60	180	360
1	49 00	60	179	48 00	60	179	47 00	60	179	46 00	60	179	45 00	60	179	359
2	48 58	60	177	47 58	60	177	46 58	60	177	45 58	60	177	44 58	60	177	358
3	48 54	59	176	47 55	60	176	46 55	60	176	45 55	60	176	44 55	60	176	357
4	48 50	60	175	47 50	60	175	46 50	59	175	45 51	60	175	44 51	60	175	356
5	48 43	−59	173	47 44	−60	173	46 44	−59	173	45 45	−60	174	44 45	−59	174	355
6	48 36	59	172	47 37	60	172	46 37	59	172	45 38	60	172	44 38	59	172	354
7	48 27	59	170	47 28	59	171	46 29	59	171	45 29	59	171	44 30	59	171	353
8	48 17	59	169	47 18	59	169	46 19	59	170	45 20	59	170	44 21	59	170	352
9	48 05	58	168	47 07	59	168	46 08	59	168	45 09	59	168	44 10	58	169	351
10	47 52	−58	167	46 54	−58	167	45 56	−59	167	44 57	−58	167	43 59	−59	167	350
11	47 38	57	165	46 40	58	166	45 42	58	166	44 44	58	166	43 46	58	166	349
12	47 23	57	164	46 25	57	164	45 27	57	165	44 30	58	165	43 32	58	165	348
13	47 06	57	163	46 09	57	163	45 12	58	163	44 14	57	164	43 17	58	164	347
14	46 49	57	161	45 52	57	162	44 55	57	162	43 57	56	162	43 00	57	163	346
15	46 30	−56	160	45 33	−56	161	44 36	−56	161	43 40	−57	161	42 43	−57	162	345
16	46 09	55	159	45 13	55	159	44 17	56	160	43 21	56	160	42 24	56	160	344
17	45 48	55	158	44 52	55	158	43 57	56	159	43 01	56	159	42 05	56	159	343
18	45 26	55	157	44 31	55	157	43 35	55	157	42 40	55	158	41 44	55	158	342
19	45 02	54	156	44 08	54	156	43 13	55	156	42 18	55	157	41 23	55	157	341
20	44 38	−53	154	43 44	−54	155	42 49	−54	155	41 55	−54	156	41 00	−54	156	340
21	44 12	52	153	43 19	53	154	42 25	54	154	41 31	54	155	40 36	53	155	339
22	43 46	52	152	42 53	53	153	41 59	52	153	41 06	53	153	40 12	53	154	338
23	43 18	51	151	42 26	52	152	41 33	52	152	40 40	53	152	39 46	52	153	337
24	42 50	51	150	41 58	51	151	41 05	51	151	40 13	52	151	39 20	52	152	336
25	42 21	−51	149	41 29	−51	150	40 37	−51	150	39 45	−51	150	38 53	−52	151	335
26	41 50	49	148	40 59	50	149	40 08	50	149	39 17	51	149	38 25	51	150	334
27	41 19	49	147	40 29	49	148	39 38	50	148	38 47	50	148	37 56	51	149	333
28	40 47	48	146	39 58	49	147	39 07	49	147	38 17	50	148	37 26	50	148	332
29	40 15	48	145	39 25	48	146	38 36	49	146	37 46	49	147	36 56	50	147	331
30	39 41	−47	144	38 52	−47	145	38 03	−47	145	37 14	−48	146	36 24	−48	146	330
31	39 07	46	143	38 19	47	144	37 30	47	144	36 41	47	145	35 52	48	145	329
32	38 32	45	142	37 45	47	143	36 56	46	143	36 08	47	144	35 20	48	144	328
33	37 57	45	142	37 09	45	142	36 22	46	143	35 34	46	143	34 46	47	143	327
34	37 20	44	141	36 34	45	141	35 47	45	142	35 00	46	142	34 12	46	143	326
35	36 43	−43	140	35 57	−44	140	35 11	−45	141	34 24	−45	141	33 37	−45	142	325
36	36 06	43	139	35 20	43	140	34 34	43	140	33 48	44	141	33 02	45	141	324
37	35 28	42	138	34 43	43	139	33 57	43	139	33 12	44	140	32 26	45	140	323
38	34 49	42	138	34 05	43	138	33 20	43	139	32 35	44	139	31 49	44	139	322
39	34 10	41	137	33 26	42	137	32 41	42	138	31 57	43	138	31 12	43	139	321
40	33 30	−40	136	32 46	−40	137	32 03	−42	137	31 19	−42	137	30 34	−42	138	320
41	32 49	39	135	32 07	41	136	31 23	40	136	30 40	42	137	29 56	42	137	319
42	32 09	39	135	31 26	39	135	30 44	41	136	30 01	41	136	29 17	41	136	318
43	31 27	38	134	30 45	39	135	30 03	39	135	29 21	41	135	28 38	41	136	317
44	30 45	37	133	30 04	38	134	29 22	39	134	28 40	39	135	27 58	40	135	316
45	30 03	−37	133	29 22	−37	133	28 41	−38	134	28 00	−39	134	27 18	−40	134	315

In North Latitudes { For argument H.A. on the left, True Azimuth = 360° − Tabulated Azimuth. / For argument H.A. on the right, True Azimuth = Tabulated Azimuth. } See p. 90.

LAT.	15°			16°			17°			18°			19°			LAT.
H.A.	Alt.	d	Az.	Alt.	d	Az.	Alt.	d	Az.	Alt.	d	Az.	Alt.	d	Az.	H.A.
°	° ′		°	° ′		°	° ′		°	° ′		°	° ′		°	°
0	49 01	−60	180	48 01	−60	180	47 01	−60	180	46 01	−60	180	45 01	−60	180	360
1	49 00	60	179	48 00	60	179	47 00	60	179	46 00	60	179	45 00	60	179	359
2	48 58	60	177	47 58	60	177	46 58	60	177	45 58	60	177	44 58	60	177	358
3	48 54	59	176	47 55	60	176	46 55	60	176	45 55	60	176	44 55	60	176	357
4	48 50	60	175	47 50	60	175	46 50	59	175	45 51	60	175	44 51	60	175	356
5	48 43	−59	173	47 44	−60	173	46 44	−59	173	45 45	−60	174	44 45	−59	174	355
6	48 36	59	172	47 37	60	172	46 37	59	172	45 38	60	172	44 38	59	172	354
7	48 27	59	170	47 28	59	171	46 29	59	171	45 29	59	171	44 30	59	171	353
8	48 17	59	169	47 18	59	169	46 19	59	170	45 20	59	170	44 21	59	170	352
9	48 05	58	168	47 07	59	168	46 08	59	168	45 09	59	168	44 10	58	169	351
10	47 52	−58	167	46 54	−58	167	45 56	−59	167	44 57	−58	167	43 59	−59	167	350
11	47 38	57	165	46 40	58	166	45 42	58	166	44 44	58	166	43 46	58	166	349
12	47 23	57	164	46 25	57	164	45 27	57	165	44 30	58	165	43 32	58	165	348
13	47 06	57	163	46 09	57	163	45 12	58	163	44 14	57	164	43 17	58	164	347
14	46 49	57	161	45 52	57	162	44 55	57	162	43 57	56	162	43 00	57	163	346
15	46 30	−56	160	45 33	−56	161	44 36	−56	161	43 40	−57	161	42 43	−57	162	345
16	46 09	55	159	45 13	55	159	44 17	56	160	43 21	56	160	42 24	56	160	344
17	45 48	55	158	44 52	55	158	43 57	56	159	43 01	56	159	42 05	56	159	343
18	45 26	55	157	44 31	55	157	43 35	55	157	42 40	55	158	41 44	55	158	342
19	45 02	54	156	44 08	54	156	43 13	55	156	42 18	55	157	41 23	55	157	341
20	44 38	−53	154	43 44	−54	155	42 49	−54	155	41 55	−54	156	41 00	−54	156	340
21	44 12	52	153	43 19	53	154	42 25	54	154	41 31	54	155	40 36	53	155	339
22	43 46	52	152	42 53	53	153	41 59	52	153	41 06	53	153	40 12	53	154	338
23	43 18	51	151	42 26	52	152	41 33	52	152	40 40	53	152	39 46	52	153	337
24	42 50	51	150	41 58	51	151	41 05	51	151	40 13	52	151	39 20	52	152	336
25	42 21	−51	149	41 29	−51	150	40 37	−51	150	39 45	−51	150	38 53	−52	151	335
26	41 50	49	148	40 59	50	149	40 08	50	149	39 17	51	149	38 25	51	150	334
27	41 19	49	147	40 29	49	148	39 38	50	148	38 47	50	148	37 56	51	149	333
28	40 47	48	146	39 58	49	147	39 07	49	147	38 17	50	148	37 26	50	148	332
29	40 15	48	145	39 25	48	146	38 36	49	146	37 46	49	147	36 56	50	147	331
30	39 41	−47	144	38 52	−47	145	38 03	−47	145	37 14	−48	146	36 24	−48	146	330
31	39 07	46	143	38 19	47	144	37 30	47	144	36 41	47	145	35 52	48	145	329
32	38 32	45	142	37 45	47	143	36 56	46	143	36 08	47	144	35 20	48	144	328
33	37 57	45	142	37 09	45	142	36 22	46	143	35 34	46	143	34 46	47	143	327
34	37 20	44	141	36 34	45	141	35 47	45	142	35 00	46	142	34 12	46	143	326
35	36 43	−43	140	35 57	−44	140	35 11	−45	141	34 24	−45	141	33 37	−45	142	325
36	36 06	43	139	35 20	43	140	34 34	43	140	33 48	44	141	33 02	45	141	324
37	35 28	42	138	34 43	43	139	33 57	43	139	33 12	44	140	32 26	45	140	323
38	34 49	42	138	34 05	43	138	33 20	43	139	32 35	44	139	31 49	44	139	322
39	34 10	41	137	33 26	42	137	32 41	42	138	31 57	43	138	31 12	43	139	321
40	33 30	−40	136	32 46	−40	137	32 03	−42	137	31 19	−42	137	30 34	−42	138	320
41	32 49	39	135	32 07	41	136	31 23	40	136	30 40	42	137	29 56	42	137	319
42	32 09	39	135	31 26	39	135	30 44	41	136	30 01	41	136	29 17	41	136	318
43	31 27	38	134	30 45	39	135	30 03	39	135	29 21	41	135	28 38	41	136	317
44	30 45	37	133	30 04	38	134	29 22	39	134	28 40	39	135	27 58	40	135	316
45	30 03	−37	133	29 22	−37	133	28 41	−38	134	28 00	−39	134	27 18	−40	134	315

In North Latitudes { For argument H.A. on the left, True Azimuth = 360° − Tabulated Azimuth. / For argument H.A. on the right, True Azimuth = Tabulated Azimuth. } See p. 90.

LAT.	15°			16°			17°			18°			19°			LAT.
H.A.	Alt.	d	Az.	Alt.	d	Az.	Alt.	d	Az.	Alt.	d	Az.	Alt.	d	Az.	H.A.
°	° ′		°	° ′		°	° ′		°	° ′		°	° ′		°	°
45	30 03	−37	133	29 22	−37	133	28 41	−38	134	28 00	−39	134	27 18	−40	134	315
46	29 20	36	132	28 40	37	133	27 59	37	133	27 18	38	133	26 37	39	134	314
47	28 37	36	132	27 57	36	132	27 17	37	132	26 37	38	133	25 56	39	133	313
48	27 54	35	131	27 14	36	131	26 35	37	132	25 55	38	132	25 14	38	132	312
49	27 10	35	130	26 31	35	131	25 52	36	131	25 12	37	131	24 32	37	132	311
50	26 25	−33	130	25 47	−35	130	25 08	−35	130	24 29	−36	131	23 50	−37	131	310
51	25 41	34	129	25 03	34	130	24 24	34	130	23 46	36	130	23 07	36	131	309
52	24 56	33	129	24 18	33	129	23 40	34	129	23 02	35	130	22 24	36	130	308
53	24 10	32	128	23 33	33	128	22 56	34	129	22 18	34	129	21 40	35	129	307
54	23 25	32	128	22 48	32	128	22 11	33	128	21 34	34	129	20 56	34	129	306
55	22 39	−31	127	22 02	−31	127	21 26	−33	128	20 49	−33	128	20 12	−34	128	305
56	21 52	30	127	21 17	32	127	20 40	31	127	20 04	33	128	19 28	34	128	304
57	21 06	30	126	20 30	30	126	19 55	32	127	19 19	32	127	18 43	33	127	303
58	20 19	29	126	19 44	30	126	19 09	31	126	18 33	31	127	17 57	32	127	302
59	19 32	29	125	18 57	29	125	18 22	30	126	17 47	31	126	17 12	32	126	301
60	18 44	−28	125	18 10	−29	125	17 36	−30	125	17 01	−30	126	16 26	−31	126	300
61	17 57	28	124	17 23	28	125	16 49	29	125	16 15	30	125	15 40	31	125	299
62	17 09	27	124	16 35	27	124	16 02	29	124	15 28	30	125	14 54	30	125	298
63	16 21	27	123	15 48	28	124	15 14	28	124	14 41	29	124	14 07	29	124	297
64	15 33	27	123	15 00	27	123	14 27	28	123	13 54	29	124	13 21	30	124	296
65	14 44	−26	123	14 12	−27	123	13 39	−27	123	13 06	−27	123	12 34	−29	123	295
66	13 55	25	122	13 23	26	122	12 51	26	123	12 19	28	123	11 46	28	123	294
67	13 06	24	122	12 35	26	122	12 03	26	122	11 31	27	122	10 59	28	123	293
68	12 17	24	122	11 46	25	122	11 15	26	122	10 43	−26	122	10 11	−27	122	292
69	11 28	23	121	10 57	24	121	10 26	−25	121	...			...			291
70	10 39	−23	121	10 08	−24	121	...			...			...			290

In South Latitudes { For argument H.A. on the left, True Azimuth = 180° + Tabulated Azimuth. / For argument H.A. on the right, True Azimuth = 180° − Tabulated Azimuth. } See p. 91.

LAT.	15°			16°			17°			18°			19°			LAT.
H.A.	Alt.	d	Az.	Alt.	d	Az.	Alt.	d	Az.	Alt.	d	Az.	Alt.	d	Az.	H.A.
°	° ′		°	° ′		°	° ′		°	° ′		°	° ′		°	°
0	78 00	−60	0	79 00	−60	0	80 00	−60	0		...			...		360
1	77 58	60	4	78 58	60	5	79 58	60	5		...			...		359
2	77 52	60	8	78 51	59	9	79 50	59	10		...			...		358
3	77 41	58	13	78 39	58	14	79 37	57	15		...			...		357
4	77 26	57	17	78 24	57	18	79 20	56	20		...			...		356
5	77 08	−56	20	78 04	−55	22	78 59	−54	24	79 53	−53	26		...		355
6	76 46	54	24	77 40	53	26	78 34	53	28	79 26	51	31		...		354
7	76 21	53	27	77 14	52	29	78 05	50	32	78 56	49	34	79 44	−47	38	353
8	75 53	51	31	76 44	50	33	77 34	48	35	78 22	46	38	79 08	44	41	352
9	75 22	49	33	76 11	47	36	76 59	45	38	77 46	44	41	78 30	42	44	351
10	74 49	−47	36	75 37	−46	38	76 23	−44	41	77 07	−41	44	77 49	−39	47	350
11	74 14	45	39	75 00	44	41	75 44	41	44	76 27	40	46	77 07	37	50	349
12	73 37	43	41	74 21	41	43	75 04	40	46	75 44	37	49	76 23	35	52	348
13	72 58	41	43	73 41	40	45	74 22	38	48	75 01	35	51	75 37	32	54	347
14	72 17	39	45	72 59	38	47	73 38	35	50	74 16	33	53	74 51	30	56	346
15	71 36	−38	47	72 16	−36	49	72 54	−34	52	73 30	−31	54	74 04	−29	57	345
16	70 53	36	49	71 32	34	51	72 09	32	53	72 43	29	56	73 16	27	59	344
17	70 09	34	50	70 46	32	52	71 22	30	55	71 56	28	57	72 27	25	60	343
18	69 24	33	51	70 00	30	54	70 35	29	56	71 08	27	58	71 38	24	61	342
19	68 38	31	53	69 14	30	55	69 47	27	57	70 19	25	59	70 48	22	62	341
20	67 52	−30	54	68 26	−28	56	68 59	−26	58	69 29	−23	60	69 58	−21	63	340
21	67 05	29	55	67 38	26	57	68 10	25	59	68 40	23	61	69 07	19	64	339
22	66 17	27	56	66 49	25	58	67 20	23	60	67 49	21	62	68 16	18	64	338
23	65 28	25	57	66 00	24	59	66 30	22	61	66 59	20	63	67 25	17	65	337
24	64 40	25	58	65 11	23	60	65 40	21	62	66 08	19	64	66 34	17	66	336
25	63 50	−23	59	64 21	−22	60	64 50	−20	62	65 17	−18	64	65 42	−16	66	335
26	63 01	23	59	63 30	20	61	63 59	19	63	64 25	17	65	64 50	15	67	334
27	62 11	22	60	62 40	20	62	63 07	17	63	63 33	15	65	63 58	14	67	333
28	61 20	20	61	61 49	19	62	62 16	17	64	62 42	15	66	63 05	12	68	332
29	60 30	20	61	60 58	18	63	61 24	15	64	61 49	13	66	62 13	12	68	331
30	59 39	−19	62	60 06	−16	63	60 33	−15	65	60 57	−13	67	61 20	−11	68	330
31	58 48	18	62	59 15	16	64	59 40	14	65	60 05	12	67	60 28	11	69	329
32	57 56	17	63	58 23	15	64	58 48	13	66	59 12	11	67	59 35	10	69	328
33	57 05	16	63	57 31	14	65	57 56	13	66	58 20	11	68	58 42	9	69	327
34	56 13	15	64	56 39	14	65	57 03	11	66	57 27	10	68	57 49	8	69	326
35	55 21	−15	64	55 46	−12	65	56 11	−11	67	56 34	−9	68	56 56	−8	69	325
36	54 29	14	64	54 54	12	66	55 18	10	67	55 41	9	68	56 03	7	70	324
37	53 36	12	65	54 01	11	66	54 25	9	67	54 48	8	68	55 09	6	70	323
38	52 44	12	65	53 09	11	66	53 32	8	67	53 55	7	69	54 16	5	70	322
39	51 51	11	65	52 16	10	66	52 39	8	68	53 02	7	69	53 23	5	70	321
40	50 59	−11	65	51 23	−9	67	51 46	−7	68	52 09	−6	69	52 30	−5	70	320
41	50 06	10	66	50 30	8	67	50 53	7	68	51 15	5	69	51 36	4	70	319
42	49 13	9	66	49 37	8	67	50 00	6	68	50 22	5	69	50 43	4	70	318
43	48 20	8	66	48 44	7	67	49 07	6	68	49 29	5	69	49 49	2	70	317
44	47 27	8	66	47 51	7	67	48 14	6	68	48 35	3	69	48 56	2	70	316
45	46 34	−7	66	46 58	−6	67	47 20	−4	68	47 42	−3	69	48 03	−2	70	315

In North Latitudes { For argument H.A. on the left, True Azimuth = 360° − Tabulated Azimuth. / For argument H.A. on the right, True Azimuth = Tabulated Azimuth. } See p. 90.

LAT.	15°			16°			17°			18°			19°			LAT.
H.A.	Alt.	d	Az.	Alt.	d	Az.	Alt.	d	Az.	Alt.	d	Az.	Alt.	d	Az.	H.A.
°	° ′		°	° ′		°	° ′		°	° ′		°	° ′		°	°
45	46 34	−7	66	46 58	−6	67	47 20	−4	68	47 42	−3	69	48 03	−2	70	315
46	45 41	7	67	46 05	6	67	46 27	4	68	46 49	3	69	47 09	1	70	314
47	44 48	6	67	45 11	5	68	45 34	4	69	45 55	2	69	46 16	−1	70	313
48	43 55	6	67	44 18	4	68	44 40	3	69	45 02	2	70	45 22	0	70	312
49	43 02	6	67	43 25	4	68	43 47	3	69	44 08	1	70	44 29	0	70	311
50	42 08	−4	67	42 31	−3	68	42 54	−2	69	43 15	−1	70	43 35	+1	70	310
51	41 15	4	67	41 38	3	68	42 00	1	69	42 22	−1	70	42 42	1	70	309
52	40 22	4	67	40 45	3	68	41 07	−1	69	41 28	0	70	41 49	1	70	308
53	39 28	3	67	39 51	2	68	40 13	0	69	40 35	0	70	40 55	2	70	307
54	38 35	3	67	38 58	2	68	39 20	0	69	39 41	+1	69	40 02	2	70	306
55	37 41	−2	67	38 04	−1	68	38 26	+1	69	38 48	+2	69	39 09	+3	70	305
56	36 48	1	67	37 11	0	68	37 33	1	69	37 54	3	69	38 15	4	70	304
57	35 55	−1	67	36 17	+1	68	36 40	1	69	37 01	3	69	37 22	4	70	303
58	35 01	0	67	35 24	1	68	35 46	2	69	36 08	3	69	36 29	4	70	302
59	34 08	0	67	34 31	1	68	34 53	2	69	35 14	4	69	35 35	5	70	301
60	33 14	+1	67	33 37	+2	68	33 59	+3	68	34 21	+4	69	34 42	+5	70	300
61	32 21	1	67	32 44	2	68	33 06	3	68	33 28	4	69	33 49	6	70	299
62	31 28	1	67	31 50	3	68	32 13	3	68	32 35	4	69	32 56	6	70	298
63	30 34	2	67	30 57	3	68	31 20	4	68	31 41	6	69	32 03	6	69	297
64	29 41	2	67	30 04	3	68	30 26	5	68	30 48	6	69	31 10	7	69	296
65	28 47	+3	67	29 10	+4	68	29 33	+5	68	29 55	+6	69	30 17	+7	69	295
66	27 54	3	67	28 17	5	68	28 40	5	68	29 02	7	69	29 24	7	69	294
67	27 01	4	67	27 24	5	67	27 47	6	68	28 09	7	68	28 31	8	69	293
68	26 08	4	67	26 31	5	67	26 54	6	68	27 16	7	68	27 38	8	69	292
69	25 14	5	67	25 38	5	67	26 01	6	68	26 23	8	68	26 45	9	69	291
70	24 21	+5	67	24 45	+6	67	25 08	+7	68	25 30	+8	68	25 52	+10	68	290
71	23 28	5	67	23 51	7	67	24 15	7	67	24 37	9	68	25 00	9	68	289
72	22 35	6	67	22 58	7	67	23 22	8	67	23 45	9	68	24 07	10	68	288
73	21 42	6	66	22 06	7	67	22 29	8	67	22 52	9	68	23 15	10	68	287
74	20 49	7	66	21 13	7	67	21 36	9	67	21 59	10	67	22 22	11	68	286
75	19 56	+7	66	20 20	+8	67	20 43	+10	67	21 07	+10	67	21 30	+11	68	285
76	19 03	8	66	19 27	9	66	19 51	9	67	20 14	11	67	20 37	12	67	284
77	18 10	8	66	18 34	9	66	18 58	10	67	19 22	11	67	19 45	12	67	283
78	17 17	9	66	17 42	9	66	18 06	10	66	18 29	12	67	18 53	12	67	282
79	16 25	9	66	16 49	10	66	17 13	11	66	17 37	12	67	18 01	13	67	281
80	15 32	+9	66	15 57	+10	66	16 21	+11	66	16 45	+12	66	17 09	+13	67	280
81	14 39	10	65	15 04	11	66	15 29	11	66	15 53	13	66	16 17	14	66	279
82	13 47	10	65	14 12	11	65	14 36	13	66	15 01	13	66	15 25	14	66	278
83	12 55	10	65	13 20	11	65	13 44	13	66	14 09	14	66	14 33	15	66	277
84	12 02	11	65	12 27	13	65	12 52	14	65	13 17	14	66	13 42	15	66	276
85	11 10	+12	65	11 35	+13	65	12 01	+13	65	12 26	+14	65	12 50	+16	66	275
86	10 18	+12	65	10 44	+13	65	11 09	14	65	11 34	15	65	11 59	16	65	274
87	...			...			10 17	+15	65	10 43	+15	65	11 08	16	65	273
88	...			...			...			...			10 17	+16	65	272
89	...			...			...			...			...			271
90	...			...			...			...			...			270

In South Latitudes { For argument H.A. on the left, True Azimuth = 180° + Tabulated Azimuth. / For argument H.A. on the right, True Azimuth = 180° − Tabulated Azimuth. } See p. 91.

LAT.	15°			16°			17°			18°			19°			LAT.
H.A.	Alt.	d	Az.	Alt.	d	Az.	Alt.	d	Az.	Alt.	d	Az.	Alt.	d	Az.	H.A.
°	° ′		°	° ′		°	° ′		°	° ′		°	° ′		°	°
0	48 01	−60	180	47 01	−60	180	46 01	−60	180	45 01	−60	180	44 01	−60	180	360
1	48 00	60	179	47 00	60	179	46 00	60	179	45 00	60	179	44 00	60	179	359
2	47 58	60	177	46 58	60	177	45 58	60	177	44 58	60	177	43 58	60	178	358
3	47 55	60	176	46 55	60	176	45 55	60	176	44 55	60	176	43 55	59	176	357
4	47 50	60	175	46 50	59	175	45 51	60	175	44 51	60	175	43 51	60	175	356
5	47 44	−60	173	46 44	−59	174	45 45	−60	174	44 45	−59	174	43 46	−60	174	355
6	47 37	60	172	46 37	59	172	45 38	60	172	44 38	59	172	43 39	60	173	354
7	47 28	59	171	46 29	59	171	45 30	60	171	44 30	59	171	43 31	59	171	353
8	47 18	59	169	46 19	59	170	45 20	59	170	44 21	59	170	43 22	59	170	352
9	47 07	59	168	46 08	59	168	45 09	58	169	44 10	58	169	43 12	59	169	351
10	46 54	−58	167	45 56	−58	167	44 57	−58	167	43 59	−59	168	43 00	−58	168	350
11	46 41	58	166	45 42	57	166	44 44	58	166	43 46	58	166	42 48	59	167	349
12	46 26	58	164	45 28	58	165	44 30	58	165	43 32	58	165	42 34	58	165	348
13	46 09	57	163	45 12	57	163	44 14	57	164	43 17	58	164	42 19	57	164	347
14	45 52	56	162	44 55	57	162	43 58	57	163	43 01	57	163	42 03	57	163	346
15	45 34	−56	161	44 37	−56	161	43 40	−56	161	42 43	−56	162	41 46	−56	162	345
16	45 14	56	160	44 18	56	160	43 21	56	160	42 25	56	161	41 28	56	161	344
17	44 53	55	158	43 57	55	159	43 01	55	159	42 05	55	159	41 09	56	160	343
18	44 31	54	157	43 36	55	158	42 40	55	158	41 45	55	158	40 49	55	159	342
19	44 08	54	156	43 14	55	157	42 18	54	157	41 23	54	157	40 28	55	158	341
20	43 45	−54	155	42 50	−54	155	41 55	−53	156	41 01	−55	156	40 06	−55	157	340
21	43 20	53	154	42 26	53	154	41 31	53	155	40 37	54	155	39 43	54	155	339
22	42 54	53	153	42 00	52	153	41 07	53	154	40 13	53	154	39 19	54	154	338
23	42 27	52	152	41 34	52	152	40 41	53	153	39 47	52	153	38 54	53	153	337
24	41 59	51	151	41 07	52	151	40 14	52	152	39 21	52	152	38 28	52	152	336
25	41 30	−50	150	40 38	−50	150	39 46	−51	151	38 54	−52	151	38 01	−51	151	335
26	41 01	50	149	40 09	50	149	39 18	51	150	38 26	51	150	37 34	51	150	334
27	40 30	49	148	39 40	50	148	38 48	50	149	37 57	50	149	37 05	50	150	333
28	39 59	48	147	39 09	49	147	38 18	49	148	37 27	49	148	36 36	50	149	332
29	39 27	48	146	38 37	48	146	37 47	48	147	36 57	49	147	36 06	49	148	331
30	38 54	−47	145	38 05	−47	146	37 16	−48	146	36 26	−49	146	35 36	−49	147	330
31	38 21	47	144	37 32	47	145	36 43	47	145	35 54	48	146	35 04	48	146	329
32	37 47	46	143	36 58	46	144	36 10	47	144	35 21	47	145	34 32	48	145	328
33	37 12	45	142	36 24	46	143	35 36	46	143	34 48	47	144	33 59	47	144	327
34	36 36	44	142	35 49	45	142	35 02	46	143	34 14	46	143	33 26	47	143	326
35	36 00	−44	141	35 13	−44	141	34 26	−45	142	33 39	−45	142	32 52	−46	143	325
36	35 23	43	140	34 37	44	140	33 51	45	141	33 04	45	141	32 17	45	142	324
37	34 46	43	139	34 00	43	140	33 14	44	140	32 28	44	141	31 41	44	141	323
38	34 07	41	139	33 22	42	139	32 37	43	139	31 51	43	140	31 05	44	140	322
39	33 29	41	138	32 44	42	138	31 59	42	139	31 14	43	139	30 29	44	139	321
40	32 50	−41	137	32 06	−42	137	31 21	−42	138	30 37	−43	138	29 52	−43	139	320
41	32 10	40	136	31 26	40	137	30 43	42	137	29 58	41	138	29 14	42	138	319
42	31 30	40	136	30 47	40	136	30 03	40	136	29 20	41	137	28 36	42	137	318
43	30 49	39	135	30 06	39	135	29 24	40	136	28 40	40	136	27 57	41	137	317
44	30 08	38	134	29 26	39	135	28 43	39	135	28 01	40	136	27 18	41	136	316
45	29 26	−37	134	28 45	−39	134	28 03	−39	134	27 21	−40	135	26 38	−40	135	315

In North Latitudes { For argument H.A. on the left, True Azimuth = 360° − Tabulated Azimuth. / For argument H.A. on the right, True Azimuth = Tabulated Azimuth. } See p. 90.

LAT.	15°			16°			17°			18°			19°			LAT.
L.A.	Alt.		Az.	Alt.		Az.	Alt.		Az.	Alt.		Az.	Alt.		Az.	H.A.
°	° ′	d	°	° ′	d	°	° ′	d	°	° ′	d	°	° ′	d	°	°
45	29 26	−37	134	28 45	−39	134	28 03	−39	134	27 21	−40	135	26 38	−40	135	315
46	28 44	37	133	28 03	37	133	27 22	39	134	26 40	39	134	25 58	39	135	314
47	28 01	36	132	27 21	37	133	26 40	37	133	25 59	38	134	25 17	38	134	313
48	27 19	36	132	26 38	36	132	25 58	37	133	25 17	37	133	24 36	38	133	312
49	26 35	35	131	25 56	36	132	25 16	37	132	24 35	37	132	23 55	38	133	311
50	25 52	−35	131	25 12	−35	131	24 33	−36	131	23 53	−36	132	23 13	−37	132	310
51	25 07	33	130	24 29	35	130	23 50	35	131	23 10	35	131	22 31	37	131	309
52	24 23	33	130	23 45	34	130	23 06	34	130	22 27	35	131	21 48	36	131	308
53	23 38	32	129	23 00	33	129	22 22	34	130	21 44	35	130	21 05	35	130	307
54	22 53	32	129	22 16	33	129	21 38	33	129	21 00	34	129	20 22	35	130	306
55	22 08	−32	128	21 31	−32	128	20 53	−32	129	20 16	−34	129	19 38	−34	129	305
56	21 22	31	128	20 45	31	128	20 09	33	128	19 31	33	128	18 54	34	129	304
57	20 36	30	127	20 00	31	127	19 23	31	128	18 47	33	128	18 10	33	128	303
58	19 50	30	127	19 14	31	127	18 38	31	127	18 02	32	127	17 25	32	128	302
59	19 03	29	126	18 28	30	126	17 52	31	127	17 16	31	127	16 40	32	127	301
60	18 16	−28	126	17 41	−29	126	17 06	−30	126	16 31	−31	126	15 55	−32	127	300
61	17 29	28	125	16 55	29	125	16 20	30	126	15 45	31	126	15 09	31	126	299
62	16 42	28	125	16 08	29	125	15 33	29	125	14 58	29	126	14 24	31	126	298
63	15 54	27	124	15 20	27	125	14 46	28	125	14 12	29	125	13 38	30	125	297
64	15 06	26	124	14 33	27	124	13 59	28	124	13 25	28	125	12 51	29	125	296
65	14 18	−25	124	13 45	−26	124	13 12	−27	124	12 39	−29	124	12 05	−29	124	295
66	13 30	25	123	12 57	26	123	12 25	27	124	11 51	27	124	11 18	28	124	294
67	12 42	25	123	12 09	25	123	11 37	26	123	11 04	27	123	10 31	−27	123	293
68	11 53	24	122	11 21	25	123	10 49	26	123	10 17	−27	123	...			292
69	11 05	24	122	10 33	−25	122	10 01	−25	122	...			...			291
70	10 16	−23	122	...			...			...			...			290

In South Latitudes { For argument H.A. on the left, True Azimuth = 180° + Tabulated Azimuth. / For argument H.A. on the right, True Azimuth = 180° − Tabulated Azimuth. } See p. 91.

LAT.	15°			16°			17°			18°			19°			LAT.
H.A	Alt.		Az.	Alt.		Az.	Alt.		Az.	Alt.		Az.	Alt.		Az.	H.A.
°	° ′	d	°	° ′	d	°	° ′	d	°	° ′	d	°	° ′	d	°	°
0	77 00	−60	0	78 00	−60	0	79 00	−60	0	80 00	−60	0		...		360
1	76 58	60	4	77 58	60	4	78 58	60	5	79 58	60	5		...		359
2	76 52	59	8	77 52	60	8	78 51	59	9	79 50	59	10		...		358
3	76 43	59	12	77 41	58	13	78 40	59	14	79 38	58	15		...		357
4	76 29	58	15	77 27	58	16	78 24	57	18	79 21	56	19		...		356
5	76 12	−56	19	77 09	−56	20	78 05	−56	22	79 00	−55	24	79 54	−53	26	355
6	75 52	55	22	76 47	54	24	77 41	53	26	78 35	52	28	79 28	52	30	354
7	75 28	53	25	76 22	52	27	77 15	52	29	78 07	50	31	78 57	49	34	353
8	75 02	52	28	75 54	50	30	76 46	50	32	77 36	49	35	78 24	46	38	352
9	74 33	50	31	75 24	49	33	76 14	48	35	77 02	46	38	77 48	44	41	351
10	74 02	−48	34	74 51	−47	36	75 39	−45	38	76 26	−44	41	77 10	−42	44	350
11	73 29	47	36	74 16	45	38	75 03	44	41	75 47	41	43	76 30	39	46	349
12	72 54	45	39	73 40	43	41	74 24	41	43	75 07	39	46	75 48	37	48	348
13	72 17	43	41	73 01	41	43	73 44	39	45	74 26	38	48	75 05	35	50	347
14	71 38	41	43	72 21	39	45	73 03	37	47	73 43	36	50	74 21	33	52	346
15	70 58	−39	44	71 40	−38	47	72 20	−35	49	72 59	−34	51	73 35	−31	54	345
16	70 17	38	46	70 58	36	48	71 37	34	50	72 14	32	53	72 49	29	55	344
17	69 35	37	48	70 14	34	50	70 52	32	52	71 28	30	54	72 02	28	57	343
18	68 51	34	49	69 30	33	51	70 06	30	53	70 41	28	56	71 14	26	58	342
19	68 07	33	50	68 44	31	52	69 20	29	55	69 54	27	57	70 26	25	59	341
20	67 22	−32	52	67 58	−30	54	68 33	−28	56	69 06	−26	58	69 37	−24	60	340
21	66 36	30	53	67 12	29	55	67 45	26	57	68 17	24	59	68 48	23	61	339
22	65 50	29	54	66 24	27	56	66 57	25	58	67 28	23	60	67 58	21	62	338
23	65 03	28	55	65 36	26	57	66 08	24	59	66 39	22	60	67 08	20	63	337
24	64 15	27	56	64 48	25	57	65 19	22	59	65 49	21	61	66 17	19	63	336
25	63 27	−26	57	63 59	−23	58	64 30	−22	60	64 59	−20	62	65 26	−17	64	335
26	62 38	24	57	63 10	23	59	63 40	21	61	64 08	18	63	64 35	16	64	334
27	61 49	23	58	62 20	21	60	62 50	20	61	63 18	18	63	63 44	16	65	333
28	61 00	22	59	61 30	20	60	61 59	18	62	62 27	17	64	62 53	15	65	332
29	60 10	21	59	60 40	19	61	61 09	18	62	61 36	16	64	62 01	14	66	331
30	59 20	−20	60	59 50	−19	61	60 18	−17	63	60 44	−15	65	61 09	−13	66	330
31	58 30	19	60	58 59	18	62	59 26	15	63	59 53	14	65	60 17	12	67	329
32	57 39	18	61	58 08	17	62	58 35	15	64	59 01	13	65	59 25	11	67	328
33	56 49	18	61	57 17	16	63	57 43	14	64	58 09	12	66	58 33	11	67	327
34	55 58	17	62	56 25	15	63	56 52	14	65	57 17	12	66	57 41	10	67	326
35	55 06	−15	62	55 34	−14	64	56 00	−13	65	56 25	−11	66	56 48	−9	68	325
36	54 15	15	63	54 42	13	64	55 08	12	65	55 32	10	66	55 56	9	68	324
37	53 24	15	63	53 50	12	64	54 16	11	65	54 40	9	67	55 03	8	68	323
38	52 32	13	63	52 58	12	64	53 24	11	66	53 48	9	67	54 11	8	68	322
39	51 40	13	64	52 06	11	65	52 31	9	66	52 55	8	67	53 18	7	68	321
40	50 48	−12	64	51 14	−10	65	51 39	−9	66	52 03	−8	67	52 25	−6	68	320
41	49 56	11	64	50 22	10	65	50 46	8	66	51 10	7	67	51 32	5	69	319
42	49 04	11	64	49 29	9	65	49 54	8	66	50 17	6	68	50 39	4	69	318
43	48 12	10	65	48 37	9	66	49 01	7	67	49 24	5	68	49 47	4	69	317
44	47 19	9	65	47 44	7	66	48 08	6	67	48 32	5	68	48 54	4	69	316
45	46 27	−9	65	46 52	−7	66	47 16	−6	67	47 39	−5	68	48 01	−3	69	315

In North Latitudes { For argument H.A. on the left, True Azimuth = 360° − Tabulated Azimuth. / For argument H.A. on the right, True Azimuth = Tabulated Azimuth. } See p. 90.

LAT.	15°			16°			17°			18°			19°			LAT.
H.A.	Alt.	d	Az.	Alt.	d	Az.	Alt.	d	Az.	Alt.	d	Az.	Alt.	d	Az.	H.A.
°	° ′		°	° ′		°	° ′		°	° ′		°	° ′		°	°
45	46 27	−9	65	46 52	−7	66	47 16	−6	67	47 39	−5	68	48 01	−3	69	315
46	45 34	8	65	45 59	7	66	46 23	5	67	46 46	4	68	47 08	2	69	314
47	44 42	8	65	45 06	6	66	45 30	4	67	45 53	3	68	46 15	2	69	313
48	43 49	7	65	44 14	6	66	44 37	4	67	45 00	3	68	45 22	1	69	312
49	42 56	6	66	43 21	5	66	43 44	3	67	44 07	2	68	44 29	−1	69	311
50	42 04	−6	66	42 28	−4	66	42 52	−3	67	43 14	−1	68	43 36	0	69	310
51	41 11	5	66	41 35	4	67	41 59	3	67	42 21	−1	68	42 43	0	69	309
52	40 18	4	66	40 42	3	67	41 06	2	67	41 28	0	68	41 50	+1	69	308
53	39 25	4	66	39 49	2	67	40 13	2	67	40 35	0	68	40 57	1	69	307
54	38 32	3	66	38 56	2	67	39 20	−1	67	39 42	+1	68	40 04	2	69	306
55	37 39	−2	66	38 03	−1	67	38 27	0	67	38 50	0	68	39 12	+2	69	305
56	36 47	3	66	37 11	2	67	37 34	0	67	37 57	+1	68	38 19	2	69	304
57	35 54	2	66	36 18	−1	67	36 41	+1	67	37 04	2	68	37 26	3	69	303
58	35 01	2	66	35 25	0	67	35 48	1	67	36 11	2	68	36 33	3	69	302
59	34 08	−1	66	34 32	0	67	34 55	2	67	35 18	3	68	35 40	4	69	301
60	33 15	0	66	33 39	+1	67	34 02	+2	67	34 25	+3	68	34 47	+5	69	300
61	32 22	0	66	32 46	1	67	33 09	3	67	33 32	4	68	33 55	4	68	299
62	31 29	+1	66	31 53	2	67	32 16	4	67	32 39	5	68	33 02	5	68	298
63	30 36	1	66	31 00	2	67	31 24	3	67	31 47	4	68	32 09	6	68	297
64	29 43	2	66	30 07	3	67	30 31	4	67	30 54	5	68	31 17	6	68	296
65	28 50	+2	66	29 14	+4	66	29 38	+4	67	30 01	+6	68	30 24	+7	68	295
66	27 57	3	66	28 22	3	66	28 45	5	67	29 09	6	67	29 31	7	68	294
67	27 05	3	66	27 29	4	66	27 53	5	67	28 16	6	67	28 39	7	68	293
68	26 12	3	66	26 36	5	66	27 00	6	67	27 23	7	67	27 46	8	68	292
69	25 19	4	66	25 43	6	66	26 07	7	67	26 31	7	67	26 54	8	68	291
70	24 26	+5	66	24 51	+5	66	25 15	+6	67	25 38	+8	67	26 02	+8	67	290
71	23 33	6	66	23 58	6	66	24 22	7	66	24 46	8	67	25 09	10	67	289
72	22 41	5	65	23 05	7	66	23 30	7	66	23 54	8	67	24 17	10	67	288
73	21 48	6	65	22 13	7	66	22 37	8	66	23 01	9	67	23 25	10	67	287
74	20 56	6	65	21 20	8	66	21 45	8	66	22 09	10	66	22 33	10	67	286
75	20 03	+7	65	20 28	+8	66	20 53	+9	66	21 17	+10	66	21 41	+11	67	285
76	19 11	7	65	19 36	8	65	20 00	10	66	20 25	10	66	20 49	11	66	284
77	18 18	8	65	18 43	9	65	19 08	10	66	19 33	11	66	19 57	12	66	283
78	17 26	8	65	17 51	9	65	18 16	10	65	18 41	11	66	19 05	13	66	282
79	16 34	8	65	16 59	10	65	17 24	11	65	17 49	12	66	18 14	12	66	281
80	15 41	+10	65	16 07	+10	65	16 32	+11	65	16 57	+12	65	17 22	+13	66	280
81	14 49	10	64	15 15	11	65	15 40	12	65	16 06	12	65	16 31	13	65	279
82	13 57	10	64	14 23	11	64	14 49	12	65	15 14	13	65	15 39	14	65	278
83	13 05	11	64	13 31	12	64	13 57	12	65	14 23	13	65	14 48	14	65	277
84	12 13	11	64	12 40	11	64	13 06	12	64	13 31	14	65	13 57	15	65	276
85	11 22	+11	64	11 48	+12	64	12 14	+13	64	12 40	+14	64	13 06	+15	65	275
86	10 30	+12	64	10 57	12	64	11 23	13	64	11 49	15	64	12 15	15	64	274
87	...			10 05	+13	64	10 32	+14	64	10 58	15	64	11 24	16	64	273
88	...			...			...			10 07	+16	64	10 33	+17	64	272
89	...			...			...			...			...			271
90	...			...			...			...			...			270

In South Latitudes { For argument H.A. on the left, True Azimuth = 180° + Tabulated Azimuth. / For argument H.A. on the right, True Azimuth = 180° − Tabulated Azimuth. } See p. 91.

LAT.	15°			16°			17°			18°			19°			LAT.
H.A.	Alt.		Az.	Alt.		Az.	Alt.		Az.	Alt.		Az.	Alt.		Az.	H.A.
°	° ′	d	°	° ′	d	°	° ′	d	°	° ′	d	°	° ′	d	°	°
0	47 01	−60	180	46 01	−60	180	45 01	−60	180	44 01	−60	180	43 01	−60	180	360
1	47 00	60	179	46 00	60	179	45 00	60	179	44 00	60	179	43 00	60	179	359
2	46 58	60	177	45 58	60	177	44 58	60	178	43 58	60	178	42 58	59	178	358
3	46 55	60	176	45 55	60	176	44 55	60	176	43 55	59	176	42 56	60	176	357
4	46 50	59	175	45 51	60	175	44 51	60	175	43 51	60	175	42 51	59	175	356
5	46 44	−59	174	45 45	−60	174	44 45	−59	174	43 46	−60	174	42 46	−60	174	355
6	46 37	59	172	45 38	59	172	44 38	59	173	43 39	59	173	42 39	59	173	354
7	46 29	59	171	45 30	60	171	44 30	59	171	43 31	59	171	42 32	59	172	353
8	46 19	59	170	45 20	59	170	44 21	59	170	43 22	59	170	42 23	59	170	352
9	46 08	58	169	45 09	58	169	44 11	59	169	43 12	59	169	42 13	59	169	351
10	45 56	−58	167	44 58	−59	167	43 59	−58	168	43 00	−58	168	42 02	−59	168	350
11	45 43	58	166	44 45	58	166	43 46	58	167	42 48	58	167	41 49	58	167	349
12	45 28	57	165	44 30	57	165	43 32	57	165	42 34	58	166	41 36	58	166	348
13	45 12	57	164	44 15	57	164	43 17	57	164	42 19	57	164	41 22	58	165	347
14	44 56	57	162	43 58	56	163	43 01	57	163	42 04	57	163	41 06	57	164	346
15	44 38	−57	161	43 41	−57	162	42 44	−57	162	41 47	−57	162	40 50	−57	162	345
16	44 18	55	160	43 22	56	160	42 25	56	161	41 29	57	161	40 32	56	161	344
17	43 58	55	159	43 02	55	159	42 06	56	160	41 10	56	160	40 13	56	160	343
18	43 37	55	158	42 41	55	158	41 45	55	159	40 50	56	159	39 54	56	159	342
19	43 14	54	157	42 19	54	157	41 24	55	157	40 29	55	158	39 33	55	158	341
20	42 51	−54	156	41 56	−53	156	41 02	−55	156	40 06	−54	157	39 11	−54	157	340
21	42 27	53	155	41 33	54	155	40 38	54	155	39 43	53	156	38 49	54	156	339
22	42 01	52	154	41 08	53	154	40 14	53	154	39 20	54	155	38 25	53	155	338
23	41 35	52	153	40 42	52	153	39 48	52	153	38 55	53	154	38 01	53	154	337
24	41 08	51	152	40 15	51	152	39 22	52	152	38 29	52	153	37 36	53	153	336
25	40 40	−51	151	39 48	−51	151	38 55	−51	151	38 02	−51	152	37 10	−52	152	335
26	40 11	50	150	39 19	50	150	38 27	51	150	37 35	51	151	36 43	52	151	334
27	39 41	49	149	38 50	50	149	37 58	50	149	37 07	51	150	36 15	51	150	333
28	39 11	49	148	38 20	49	148	37 29	50	149	36 38	50	149	35 46	50	149	332
29	38 39	48	147	37 49	48	147	36 59	49	148	36 08	49	148	35 17	50	148	331
30	38 07	−47	146	37 18	−48	146	36 28	−49	147	35 37	−48	147	34 47	−49	147	330
31	37 34	46	145	36 45	47	145	35 56	48	146	35 06	48	146	34 16	49	147	329
32	37 01	46	144	36 12	47	145	35 23	47	145	34 34	48	145	33 44	48	146	328
33	36 27	46	143	35 38	46	144	34 50	47	144	34 01	47	145	33 12	47	145	327
34	35 52	45	142	35 04	45	143	34 16	46	143	33 28	47	144	32 39	46	144	326
35	35 16	−44	142	34 29	−45	142	33 41	−45	143	32 54	−46	143	32 06	−46	143	325
36	34 40	44	141	33 53	44	141	33 06	44	142	32 19	45	142	31 32	46	142	324
37	34 03	43	140	33 17	44	141	32 30	44	141	31 44	45	141	30 57	45	142	323
38	33 26	43	139	32 40	43	140	31 54	43	140	31 08	44	141	30 21	44	141	322
39	32 48	42	139	32 02	42	139	31 17	43	139	30 31	43	140	29 45	43	140	321
40	32 09	−41	138	31 24	−41	138	30 39	−42	139	29 54	−42	139	29 09	−43	139	320
41	31 30	40	137	30 46	41	138	30 01	41	138	29 17	42	138	28 32	43	139	319
42	30 50	39	137	30 07	41	137	29 23	41	137	28 39	42	138	27 54	42	138	318
43	30 10	39	136	29 27	40	136	28 44	41	137	28 00	41	137	27 16	41	137	317
44	29 30	39	135	28 47	39	136	28 04	40	136	27 21	40	136	26 37	40	137	316
45	28 49	−38	135	28 06	−38	135	27 24	−39	135	26 41	−39	136	25 58	−40	136	315

In North Latitudes { For argument H.A. on the left, True Azimuth = 360° − Tabulated Azimuth. / For argument H.A. on the right, True Azimuth = Tabulated Azimuth. } See p. 90.

LAT.	15°			16°			17°			18°			19°			LAT.
H.A.	Alt.	d	Az.	Alt.	d	Az.	Alt.	d	Az.	Alt.	d	Az.	Alt.	d	Az.	H.A.
°	° ′		°	° ′		°	° ′		°	° ′		°	° ′		°	°
45	28 49	−38	135	28 06	−38	135	27 24	−39	135	26 41	−39	136	25 58	−40	136	315
46	28 07	37	134	27 26	38	134	26 43	38	135	26 01	39	135	25 19	40	135	314
47	27 25	36	133	26 44	37	134	26 03	38	134	25 21	39	134	24 39	39	135	313
48	26 43	36	133	26 02	36	133	25 21	37	133	24 40	38	134	23 58	38	134	312
49	26 00	35	132	25 20	36	133	24 39	36	133	23 58	37	133	23 17	38	134	311
50	25 17	−34	132	24 37	−35	132	23 57	−36	132	23 17	−37	133	22 36	−37	133	310
51	24 34	34	131	23 54	34	131	23 15	36	132	22 35	36	132	21 54	36	132	309
52	23 50	33	130	23 11	34	131	22 32	35	131	21 52	35	131	21 12	36	132	308
53	23 06	33	130	22 27	33	130	21 48	34	131	21 09	35	131	20 30	36	131	307
54	22 21	32	129	21 43	33	130	21 05	34	130	20 26	34	130	19 47	35	131	306
55	21 36	−31	129	20 59	−33	129	20 21	−33	130	19 42	−33	130	19 04	−35	130	305
56	20 51	31	128	20 14	32	129	19 36	32	129	18 58	33	129	18 20	33	130	304
57	20 06	31	128	19 29	31	128	18 52	32	129	18 14	32	129	17 37	34	129	303
58	19 20	30	128	18 43	30	128	18 07	32	128	17 30	32	128	16 53	33	129	302
59	18 34	29	127	17 58	30	127	17 21	30	128	16 45	32	128	16 08	32	128	301
60	17 48	−29	127	17 12	−30	127	16 36	−30	127	16 00	−31	127	15 23	−31	128	300
61	17 01	28	126	16 26	29	126	15 50	29	127	15 14	30	127	14 38	31	127	299
62	16 14	27	126	15 39	28	126	15 04	29	126	14 29	30	126	13 53	30	127	298
63	15 27	27	125	14 53	28	126	14 18	29	126	13 43	29	126	13 08	30	126	297
64	14 40	26	125	14 06	27	125	13 31	28	125	12 57	29	126	12 22	29	126	296
65	13 53	−26	124	13 19	−27	125	12 45	−28	125	12 10	−28	125	11 36	−29	125	295
66	13 05	25	124	12 31	26	124	11 58	27	124	11 24	28	125	10 50	29	125	294
67	12 17	25	124	11 44	26	124	11 11	27	124	10 37	−27	124	10 04	−28	124	293
68	11 29	24	123	10 56	25	124	10 23	−26	124	...			...			292
69	10 41	−24	123	10 08	−24	123	...			...			...			291
70	...			...			...			...			...			290

In South Latitudes { For argument H.A. on the left, True Azimuth = 180° + Tabulated Azimuth. / For argument H.A. on the right, True Azimuth = 180° − Tabulated Azimuth. } See p. 91.

EXPLANATION

By agreement with the Admiralty, the *Astronomical Navigation Tables* are produced by H.M. Nautical Almanac Office to the general requirements of the Air Ministry.

These tables are designed to give, in a simple and direct manner, the solution of the astronomical spherical triangle that occurs in navigational practice. They have been planned for use with the *Air Almanac* (Air Publication 1602) and are consequently designed primarily to meet the requirements of modern air navigation: their use can however be extended to surface navigation, as in the case of the *Air Almanac*, within the limitations of the precision of the tabulated altitude and azimuth.

The general object of the *Astronomical Navigation Tables* is to facilitate the calculation of the Altitude and Azimuth of an observed heavenly body, as seen from some position close to that of the observer. This information, together with the observed altitude, allows to be plotted on the chart a position line upon which the observer must lie; two such position lines serve in general to determine the position of the observer. The tables have been arranged with special relation to the determination of the altitude and azimuth when an assumed position is adopted such that the latitude and hour angle are both integral degrees; interpolation in this case is consequently restricted to interpolation to the declination of the body observed, and provision has been made for this to be done in a simple manner. The precision of the tabulated data is consistent with that adopted for the *Air Almanac*, namely that the altitudes are given to the nearest minute of arc, and so are correct to within $0'{\cdot}5$; this standard of precision is sufficient for all purposes of air navigation and, in fact, is at present (1938) considerably greater than the precision obtainable in an altitude observed with a bubble sextant. Although these tables have been prepared in conjunction with the *Air Almanac*, they are equally applicable for use with any otber almanac from which the Greenwich Hour Angle and Declination of the body observed can be found for the time of observation; it is intended, however, that the two publications should provide, in the most convenient form, all the material for a rapid solution of the navigator's problem, for all practical observations.

The *Astronomical Navigation Tables* consist of main tables and auxiliary tables. The main tables give the Tabulated Altitude, to the nearest minute of arc, and the Tabulated Azimuth, to the nearest degree, with the three arguments:—

Latitude —each integral degree from S.69° to N.69°.

Declination—for 22 selected stars for the epoch 1940 and each integral degree from S.28° to N.28°.

Hour Angle—each integral degree for which the altitude is greater than 10°* and less than 80°.

Thus for every combination of an integral degree of latitude, declination and hour angle in the above ranges, the tables give immediately the quantities required.

* The limit is decreased for declinations appropriate to the Sun (0°–23°) in latitudes above 55°, where the Sun may be at low altitudes for long periods of each day, and in latitudes below 30°, where the Sun rises rapidly, and the azimuth at low altitudes is required for checking compasses.

EXPLANATION

In the case of the separate tabulations for the 22 stars, the values of the declinations used in the tables are those of the stars themselves at the middle of 1940; the declinations of the stars change slowly owing to precession and to other causes, but the effect of these changes can be allowed for by means of a simple correcting term, which although smaller, is catered for in a similar way to the interpolation for the declination of other bodies. The stars have been selected for their brightness and their distribution in the sky, and are the same in both name and number as stars Nos. 1-22 in the *Air Almanac*. The tables for integral degrees of declination are applicable to observations of the Sun, Moon and planets, as well as for all stars with declinations between S.29° and N.29°; a list of 13 such stars is given in the *Air Almanac* (Nos. 23-35). It is only for stars outside these limits of declination, in particular stars Nos. 36-50 in the *Air Almanac*, that these tables are not applicable; some other method of obtaining the altitude and azimuth must then be employed. The 22 stars catered for separately may however be regarded as generally sufficient for all practical purposes of air navigation; with the 13 additional stars to be used in exceptional circumstances, reference to other methods should be unnecessary.

The interpolation of tables with three arguments is both laborious and difficult, and should be avoided wherever possible; no provision has therefore been made for interpolation other than for declination, and the navigator should not interpolate for latitude and hour angle, but should use an assumed position so that this may be avoided. The arrangement of the tables, however, allows for interpolation for latitude and hour angle without, in general, the necessity for the comparison of figures on different pages, and the tables may therefore be interpolated for these arguments for the solution of special problems.

The tabulated altitude includes the effect of atmospheric refraction, and is thus directly comparable with the corrected sextant reading; it is in fact the altitude of the body as would be measured by an observer. The refraction included is based on the mean value of the refraction at a height of 5,000 feet in normal conditions, and it is unlikely that at heights in that neighbourhood the refraction will differ by more than 0'·5 from that used. Table VI on page 222 gives the adjustment necessary at heights that differ materially from the basic height adopted; the values in this table should only be applied in extreme cases, and where great accuracy is necessary.

The tabulated azimuth is measured from the elevated pole either to the east or to the west. This can be converted to true azimuth, measured always from the north through east, either by the rules given at the foot of each page, or by the use of Table III on pages 90 and 91.

For the greater convenience of the user, the tables are issued in fourteen volumes, each of which caters for a belt of latitude, 5° in width, in both the northern and southern hemispheres. In each volume tabulations are given for five integral degrees of latitude; working from an assumed position, whose latitude is taken to be the nearest integral degree to that of the D.R. (or estimated) position of the observer, each tabular latitude suffices to cover observations from positions within 0° 30' of the integral degree used. The Explanation and auxiliary tables are reprinted in each volume.

Each volume consists of two main parts, pages 2–89 giving the tabulations for the selected 22 stars and pages 94–209 those for declinations 0°–28°. Each part is

divided into sections of four pages, covering one star or one whole degree of declination; separate indexes on the margin enable immediate reference to be made to the first opening of each section. Throughout, the arrangement of the tabulations in each section is generally the same; the five values of latitude (LAT.) are given across the page and the values of the hour angle (H.A.) down the page. For the stars, the tabulations for NORTH latitudes precede those for SOUTH latitudes, and for the integral degrees of declination, those for the SAME name as the latitude precede those for CONTRARY name. The amount of tabulation varies in each case with different stars and declinations, and in some cases there are no tabulations either in north or in south latitudes, as the star or a body of the given declination does not reach an altitude which makes it suitable for observation in those latitudes; occasionally it has been necessary to continue the tabulation from one page on to the previous page, and for one or two stars, in south latitudes, on to two pages before.

For the stars, each column refers to a given latitude, and contains for all applicable values of the hour angle, the altitude (Alt.), its variation with time (t) and the azimuth (Az.). For the degrees of declination, the variation t is replaced by the difference (d) between the altitude given and that for the following degree. The procedure of entering and interpolating the tables is not appreciably different in the two cases.

An assumed position is taken close to the D.R. position so that the latitude is an integral degree, while the longitude is chosen so that the hour angle, formed by the combination of longitude (*added* if *east*, *subtracted* if *west*) with the G.H.A., taken from the *Air Almanac*, is also an integral degree. The appropriate part (star or degree of declination) is chosen, and the correct section obtained by the marginal index, using the star number, or the integral degree numerically *less* than the declination of the observed body as found from the *Air Almanac*. In this section, the column is chosen corresponding to the assumed latitude, care being taken to select the correct hemisphere. In this column, the values of Alt., t, and Az. can be read off for the stars, corresponding to the particular integral hour angle; for a degree of declination, the values of Alt., d and Az. are similarly found.

The tabulated altitude must now be corrected, in the case of the 22 stars, for the effect of precession, and for other bodies, interpolated to the true declination. Table I on the inside front cover gives the correction to be applied to the altitude of the stars for all years to 2000 for values of t; this correction must be added or subtracted according to the sign prefixed to t. For each star a limiting year is given before which this correction cannot exceed 1′, and there is therefore no need to apply it until after that date. Similarly, the inside back cover and its facing page contain Table XV, with arguments d and the minutes of the declination of the body, giving the correction to be applied to the tabulated altitude taken out for an integral degree; this correction is to be applied to the tabulated altitude with the same sign as that of d.

It is unnecessary to correct the tabulated azimuth in any way, but it must of course be converted to true azimuth before being used to plot a position line.

Having thus obtained the corrected tabulated altitude and the true azimuth, the position line is drawn in the usual manner. The intercept is obtained from the difference between the corrected sextant reading and the corrected tabulated altitude, and is set off from the assumed position either *towards* the direction given

by the true azimuth or in the opposite direction (*away* from), according to the following rules:

Corr. Tab. Alt. *less* than Corr. Sext. Rdg., intercept *towards*;
Corr. Tab. Alt. *greater* than Corr. Sext. Rdg., intercept *away*.

The position line is then drawn at right angles to the intercept through the point so obtained. The expression corrected sextant reading is used conveniently for the observed altitude to emphasize that this quantity is the altitude as measured by the sextant, corrected only for sextant errors and for dome refraction if applicable. As the atmospheric refraction is catered for in the tabulated altitude, no correction for this should be applied to the sextant reading.

If the assumed position is close to the true position, a slight inaccuracy in plotting the tabulated azimuth is unimportant; when the tabulated azimuth is near 0° or 180° advantage may be taken of this to draw the position line simply as part of a parallel of latitude. A double border rule, given when the azimuth is within a few degrees of the meridian, indicates the portions of the tables where this can be done without great error; the limit of azimuth has been varied slightly in different volumes, according to the latitude, so as to reduce the error due to this simplified procedure. The accuracy of this method depends upon the error in the assumed longitude; for an error of 20 miles in the D.R. longitude, the maximum error introduced into the deduced latitude is about 2 miles, while the remaining error (due to the use of an assumed position) may reach a maximum of 2 miles in the worst case. This method should therefore only be adopted either when errors up to about 4 miles can be tolerated, or when the D.R. longitude is known to be fairly accurate, if the D.R. position is liable to much greater error than 20 miles, this method should not be used. An assumed position is taken and the tables entered in exactly the same way (whether for stars or other bodies) as for an ordinary observation, but there is now no necessity to take out the azimuth or to convert to true azimuth. The tabulated altitude is corrected by Table I or Table XV as necessary, and the intercept formed by the usual rules. The intercept is then set off from the assumed position *towards* or *away* from the direction of the object observed, this direction being taken as true north or true south; the position line is thus drawn in as a parallel of latitude. Although the procedure of entering the tables is exactly the same, this method saves a considerable amount of work in the plotting of the position line.

A list of the auxiliary tables is given in the list of contents; in general the titles of these tables are self-explanatory and their use either self-evident or explained on the page concerned.

Tables VII, VIII, IX, X, XI and XIII are arranged as critical tables, so that the result is obtained immediately without interpolation. The argument is divided into intervals, successive intervals corresponding to successive values of the result; for any values of the argument, inside one of these intervals, the corresponding result is the quantity opposite that interval and has in general a maximum error of less than half a unit in the last figure given; when successive values of the result are not consecutive integers, this error can rise to half the difference between successive values. The tabulated values of the argument correspond to half-way values of the result, and these are always chosen so that when the argument is exactly equal to one of the tabulated values, the nearest value of the result is the one corresponding to the previous interval. Thus the rule to be followed is:

When the argument is an exact tabulated value, the *upper* of the two possible values of the result should be taken.

ILLUSTRATIONS

Example 1.—On 1940 December 31, local date, about one hour after sunset, in dead reckoning position latitude 18° 17′ N., longitude 125° 50′ W., star number 11 (Deneb) was observed to obtain a position line. Corrected sextant reading 26° 57′; G.M.T. of observation $02^h\ 58^m\ 14^s$.

From Table IV, page 92 :

Long. 120° W. (approx.)		
Approx.	Hrs.	Date
L.M.T.	1900	1940 Dec. 31
G.M.T.	0300	1941 Jan. 1

From *Air Almanac*, 1941 Jan. 1 :

		°	′
G.H.A. ♈	($02^h\ 50^m$) .	142	52
Increment	($8^m\ 14^s$) .	2	04
S.H.A.	(No. 11) .	50	09
G.H.A. of star . .		195	05
Long. of ass. position .		−126	05

From page 43 :
Lat. of ass. position 18° NORTH

Star No. 11 — H.A. 69°

	°	′
Tab. Alt. . . .	27	23
Correction . . .		—
Corr. Tab. Alt. . .	27	23
Corr. Sext. Rdg. . .	26	57
Intercept . . .	26′ *away*	

No correction for date is necessary in 1941.

Tab. Az. 48°

Assumed position :
Lat. 18° N.
Long. 126° 05′ W.

From Table III, page 90 :
True Az. 312° T.

Example 2.—On 1950 August 17, Greenwich date, in dead reckoning position latitude 15° 52′ S., longitude 26° 29′ E., star number 4 (Alpheratz) was observed to obtain a position line. From the *Almanac* of that date it was found that the G.H.A. of the star corresponding to the G.M.T. of observation was 355° 14′. Corrected sextant reading 40° 35′.

	°	′
G.H.A. of star . .	355	14
Long. of ass. position .	+26	46
	382	00
	−360	

From page 16 :
Lat. of ass. position 16° SOUTH

Star No. 4 — H.A. 22°

	°	′
Tab. Alt. . . .	40	27
Correction (Table I) .	−	3
Corr. Tab. Alt. . .	40	24
Corr. Sext. Rdg. . .	40	35
Intercept . . .	11′ *towards*	

t . . −18
Year . . 1950

Tab. Az. 154°

Assumed position :
Lat. 16° S.
Long. 26° 46′ E.

From Table III, page 91 :
True Az. 334° T.

Example 3.—On 1941 January 1, local date, at approximate local noon, in dead reckoning position latitude 18° 40′ N., longitude 47° 47′ W., the Sun was observed to obtain a position line. Corrected sextant reading 48° 18′; G.M.T. of observation $15^h\ 11^m\ 27^s$.

From Table IV, page 92:

Long. 45° W. (approx.)		
Approx.	Hrs.	Date
L.M.T.	1200	Jan. 1
G.M.T.	1500	Jan. 1

From *Air Almanac*, 1941 Jan. 1:

			°	′
G.H.A.	($15^h\ 10^m$)	.	46	35
Increment	($1^m\ 27^s$)	.	0	22
G.H.A. of Sun		.	46	57
Long. of ass. position		.	− 47	57
			− 1	00
			+360	

From page 189:

Lat. of ass. position 19° N. Dec. 23° 00′ S. CONTRARY name H.A. 359°

Tab. Alt. . . .	48°	00	*d* . .	−60
Correction (Table XV).		0	Minutes of dec.	00
Corr. Tab. Alt. . .	48	00		
Corr. Sext. Rdg.. .	48	18		
Intercept . . .		18′ *towards*		

Tab. Az. 179°

Assumed position: Lat. 19° N. Long. 47° 57′ W.

From Table III, page 90: True Az. 179° T.

Since there is a double border rule opposite the entry on page 189, this observation may be reduced by the method described on page 213. In this case the intercept is set off from the assumed position *towards* the Sun (i.e. southwards), and the position line drawn as a parallel of latitude. There is then no necessity to take ont the tabulated azimuth.

Example 4.—On 1941 January 2, local date, about one hour before sunrise, in dead reckoning position latitude 14° 38′ S., longitude 147° 58′ E., Mars was observed to obtain a position line. Corrected sextant reading 25° 59′; G.M.T. of observation $18^h\ 38^m\ 17^s$.

From Table IV, page 93:

Long. 150° E. (approx.)		
Approx.	Hrs.	Date
L.M.T.	0500	Jan. 2
G.M.T.	*1900*	*Jan. 1*

From *Air Almanac*, 1941 Jan. 1:

			°	′
G.H.A.	(18^h)	. .	135	14
Increment	($38^m\ 17^s$)	.	9	36
G.H.A. of Mars		. .	144	50
Long. of ass. position		.	+148	10

From page 171:

Lat. of ass. position 15° S. Dec. 19° 20′ S. SAME name H.A. 293°

Tab. Alt. . . .	26°	12′	*d* . .	+8
Correction (Table XV)	+	3	Minutes of dec.	20
Corr. Tab. Alt. . .	26	15		
Corr. Sext. Rdg.. .	25	59		
Intercept . . .		16′ *away*		

Tab. Az. 76°

Assumed position: Lat. 15° S. Long. 148° 10′ E.

From Table III, page 91: True Az. 104° T.

IVa.—CHANGE OF SEXTANT READING WITH TIME

Due to motion of body observed

True Azimuth of body	Latitude 15°	Latitude 17°	Latitude 19°	True Azimuth of body
°	′	′	′	°
090	+43	+43	+43	090
095	43	43	42	085
100	43	42	42	080
105	42	42	41	075
110	41	40	40	070
115	39	39	39	065
120	+38	+37	+37	060
125	36	35	35	055
130	33	33	33	050
135	31	30	30	045
140	28	28	27	040
145	25	25	24	035
150	+22	+22	+21	030
155	18	18	18	025
160	15	15	15	020
165	11	11	11	015
170	8	7	7	010
175	+4	+4	+4	005
180	0	0	0	000
185	−4	−4	−4	355
190	8	7	7	350
195	11	11	11	345
200	15	15	15	340
205	18	18	18	335
210	−22	−22	−21	330
215	25	25	24	325
220	28	28	27	320
225	31	30	30	315
230	33	33	33	310
235	36	35	35	305
240	−38	−37	−37	300
245	39	39	39	295
250	41	40	40	290
255	42	42	41	285
260	43	42	42	280
265	43	43	42	275
270	−43	−43	−43	270

Due to motion of observer

Difference between True Az. of body and Track	Ground speed in m.p.h. 100	130	160	190	220	250	280	310	340	Difference between True Az. of body and Track
°	′	′	′	′	′	′	′	′	′	°
000	+4	+6	+7	+8	+10	+11	+12	+13	+15	360
005	4	6	7	8	10	11	12	13	15	355
010	4	6	7	8	9	11	12	13	15	350
015	4	5	7	8	9	10	12	13	14	345
020	4	5	7	8	9	10	11	13	14	340
025	4	5	6	7	9	10	11	12	13	335
030	+4	+5	+6	+7	+8	+9	+11	+12	+13	330
035	4	5	6	7	8	9	10	11	12	325
040	3	4	5	6	7	8	9	10	11	320
045	3	4	5	6	7	8	9	10	10	315
050	3	4	4	5	6	7	8	9	9	310
055	2	3	4	5	5	6	7	8	8	305
060	+2	+3	+3	+4	+5	+5	+6	+7	+7	300
065	2	2	3	3	4	5	5	6	6	295
070	1	2	2	3	3	4	4	5	5	290
075	1	1	2	2	2	3	3	3	4	285
080	+1	+1	1	1	2	2	2	2	3	280
085	0	0	+1	+1	+1	+1	+1	+1	+1	275
090	0	0	0	0	0	0	0	0	0	270
095	0	0	−1	−1	−1	−1	−1	−1	−1	265
100	−1	−1	1	1	2	2	2	2	3	260
105	1	1	2	2	2	3	3	3	4	255
110	1	2	2	3	3	4	4	5	5	250
115	2	2	3	3	4	5	5	6	6	245
120	−2	−3	−3	−4	−5	−5	−6	−7	−7	240
125	2	3	4	5	5	6	7	8	8	235
130	3	4	4	5	6	7	8	9	9	230
135	3	4	5	6	7	8	9	10	10	225
140	3	4	5	6	7	8	9	10	11	220
145	4	5	6	7	8	9	10	11	12	215
150	−4	−5	−6	−7	−8	−9	−11	−12	−13	210
155	4	5	6	7	9	10	11	12	13	205
160	4	5	7	8	9	10	11	13	14	200
165	4	5	7	8	9	10	12	13	14	195
170	4	6	7	8	9	11	12	13	15	190
175	4	6	7	8	10	11	12	13	15	185
180	−4	−6	−7	−8	−10	−11	−12	−13	−15	180

The theoretical change of sextant reading in any interval of time depends partly on the motion of the body observed across the sky and partly on the motion of the observer over the Earth's surface.

The two tables above give this change, in an interval of three minutes of time, due to each of these causes; a + sign denotes that the sextant reading is increasing, and a − sign that it is decreasing. The theoretical change of sextant reading in three minutes of time is obtained by combining the appropriate entries from each table.

IVb.—CHANGE OF SEXTANT READING WITH TIME

Interval of time	Change in 3m (from Table IVa)																								Interval of time
	0′	3′	6′	9′	12′	15′	18′	21′	24′	27′	30′	33′	36′	39′	42′	45′	48′	51′	54′	57′	60′				
m s	′	′	′	′	′	′	′	′	′	′	′	′	′	′	′	′	′	′	′	′	′				m s
0 00	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0				0 00
05	0	0	0	0	0	0	0	1	1	1	1	1	1	1	1	1	1	1	2	2	2				05
10	0	0	0	0	1	1	1	1	1	2	2	2	2	2	2	2	3	3	3	3	3				10
15	0	0	0	1	1	1	2	2	2	2	2	3	3	3	4	4	4	4	4	5	5				15
20	0	0	1	1	1	2	2	2	3	3	3	4	4	4	5	5	5	6	6	6	7				20
25	0	0	1	1	2	2	2	3	3	4	4	5	5	5	6	6	7	7	8	8	8				25
0 30	0	0	1	2	2	2	3	4	4	4	5	6	6	6	7	8	8	8	9	10	10				0 30
35	0	1	1	2	2	3	4	4	5	5	6	6	7	8	8	9	9	10	10	11	12				35
40	0	1	1	2	3	3	4	5	5	6	7	7	8	9	9	10	11	11	12	13	13				40
45	0	1	2	2	3	4	4	5	6	7	8	8	9	10	10	11	12	13	14	14	15				45
50	0	1	2	2	3	4	5	6	7	8	8	9	10	11	12	12	13	14	15	16	17				50
0 55	0	1	2	3	4	5	6	6	7	8	9	10	11	12	13	14	15	16	16	17	18				0 55
1 00	0	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20				1 00
05	0	1	2	3	4	5	6	8	9	10	11	12	13	14	15	16	17	18	20	21	22				05
10	0	1	2	4	5	6	7	8	9	10	12	13	14	15	16	18	19	20	21	22	23				10
15	0	1	2	4	5	6	8	9	10	11	12	14	15	16	18	19	20	21	22	24	25				15
20	0	1	3	4	5	7	8	9	11	12	13	15	16	17	19	20	21	23	24	25	27				20
25	0	1	3	4	6	7	8	10	11	13	14	16	17	18	20	21	23	24	26	27	28				25
1 30	0	2	3	4	6	8	9	10	12	14	15	16	18	20	21	22	24	26	27	28	30				1 30
35	0	2	3	5	6	8	10	11	13	14	16	17	19	21	22	24	25	27	28	30	32				35
40	0	2	3	5	7	8	10	12	13	15	17	18	20	22	23	25	27	28	30	32	33				40
45	0	2	4	5	7	9	10	12	14	16	18	19	21	23	24	26	28	30	32	33	35				45
50	0	2	4	6	7	9	11	13	15	16	18	20	22	24	26	28	29	31	33	35	37				50
1 55	0	2	4	6	8	10	12	13	15	17	19	21	23	25	27	29	31	33	34	36	38				1 55
2 00	0	2	4	6	8	10	12	14	16	18	20	22	24	26	28	30	32	34	36	38	40				2 00
05	0	2	4	6	8	10	12	15	17	19	21	23	25	27	29	31	33	35	38	40	42				05
10	0	2	4	6	9	11	13	15	17	20	22	24	26	28	30	32	35	37	39	41	43				10
15	0	2	4	7	9	11	14	16	18	20	22	25	27	29	32	34	36	38	40	43	45				15
20	0	2	5	7	9	12	14	16	19	21	23	26	28	30	33	35	37	40	42	44	47				20
25	0	2	5	7	10	12	14	17	19	22	24	27	29	31	34	36	39	41	44	46	48				25
2 30	0	2	5	8	10	12	15	18	20	22	25	28	30	32	35	38	40	42	45	48	50				2 30
35	0	3	5	8	10	13	16	18	21	23	26	28	31	34	36	39	41	44	46	49	52				35
40	0	3	5	8	11	13	16	19	21	24	27	29	32	35	37	40	43	45	48	51	53				40
45	0	3	6	8	11	14	16	19	22	25	28	30	33	36	38	41	44	47	50	52	55				45
50	0	3	6	8	11	14	17	20	23	26	28	31	34	37	40	42	45	48	51	54	57				50
2 55	0	3	6	9	12	15	18	20	23	26	29	32	35	38	41	44	47	50	52	55	58				2 55
3 00	0	3	6	9	12	15	18	21	24	27	30	33	36	39	42	45	48	51	54	57	60				3 00

This table gives the theoretical change of sextant reading in any interval of time up to 3m, in terms of the change in 3m obtained from the tables on the opposite page. If the interval is greater than 3m, it may be split into multiples of 3m and a residue, and the corresponding entries from the table added together.

A knowledge of this change enables sights on different objects taken at slightly different times to be adjusted to a specified exact time, which may be either the exact time of one of them or a moment when a fix is required for a particular reason.

NOTES

NOTES

NOTES

V.—DIFFERENCE BETWEEN RHUMB LINE AND GREAT CIRCLE DISTANCES

N. 15°-19° **S. 15°-19°**

Latitude of Destination	Change of Longitude																		Latitude of Destination
	5°	10°	15°	20°	25°	30°	35°	40°	45°	50°	55°	60°	65°	70°	75°	80°	85°	90°	
°																			°
N. 60	0	1	3	6	9	14	20	27	36	47	60	75	93	113	137	164	196	231	S. 60
55	0	1	3	5	8	11	16	23	30	40	51	65	81	100	121	147	176	209	55
50	0	1	2	4	6	9	13	19	25	34	44	56	70	87	106	129	156	186	50
45	0	1	1	3	5	7	11	15	21	28	37	47	60	75	92	113	137	164	45
40	0	0	1	2	4	6	9	12	17	23	31	40	51	64	79	97	118	143	40
N. 35	0	0	1	2	3	4	7	10	14	19	25	33	43	54	67	83	101	123	S. 35
30	0	0	1	1	2	3	5	8	11	15	21	27	35	45	56	69	85	103	30
25	0	0	0	1	2	3	4	6	9	12	17	22	29	36	46	57	69	85	25
20	0	0	0	1	1	2	3	5	7	10	13	17	22	29	36	45	55	68	20
15	0	0	0	0	1	2	3	4	5	8	10	13	17	22	28	35	43	52	15
N. 10	0	0	0	0	1	1	2	3	4	6	7	10	13	16	21	26	32	39	S. 10
N. 5	0	0	0	0	0	1	1	2	3	4	5	7	9	11	14	18	22	27	S. 5
0	0	0	0	0	0	1	1	1	2	3	3	4	6	7	9	11	14	17	0
S. 5	0	0	0	0	0	0	1	1	1	2	2	3	3	4	5	7	8	10	N. 5
10	0	0	0	0	0	0	0	0	1	1	1	1	2	2	3	4	4	5	10
S. 15	0	0	0	0	0	0	0	0	0	1	1	1	1	2	2	2	3	3	N. 15
20	0	0	0	0	0	0	0	0	1	1	1	2	2	2	3	4	4	5	20
25	0	0	0	0	0	1	1	1	1	2	2	3	4	5	6	7	8	10	25
30	0	0	0	0	1	1	1	2	3	3	4	6	7	9	11	13	15	19	30
35	0	0	0	1	1	2	2	3	4	6	8	9	12	15	18	22	26	31	35
S. 40	0	0	1	1	2	3	4	5	7	9	12	15	18	23	28	33	40	48	N. 40
45	0	0	1	2	3	4	6	8	11	14	17	22	27	33	40	49	58	69	45
50	0	1	1	3	4	6	9	12	15	20	25	31	38	46	56	67	80	95	50
55	0	1	2	4	6	8	12	16	21	27	34	42	51	62	74	89	106	125	55
S. 60	0	1	3	5	8	11	16	21	28	35	44	55	67	80	96	114	135	159	N. 60

This table gives the difference, in nautical miles, between the distance from one place to another by the Rhumb Line track and the distance by the Great Circle track. It is based on a *Latitude of Departure* of 17°, but may be used for any place of departure between latitudes 15° and 19°. Of the two argument columns headed *Latitude of Destination*, the one on the left is to be used when the place of departure lies between N. 15° and N. 19°, and the one on the right when the place of departure lies between S. 15° and S. 19°.

The table is intended to give only the approximate difference of distance between the two tracks. For intermediate values of the arguments *Latitude of Destination* and *Change of Longitude*, the figures in the table should be interpolated by inspection. If the *Latitude of Departure* differs by the maximum of 2½° from that on which the table is based, the error in the result will not exceed 2 miles up to a *Change of Longitude* of 50°, but may reach 4 miles for a change of 70°, and 8 miles for a change of 90°.

Example.—Required the difference in distance between the Rhumb Line track and the Great Circle track from Rangoon (Lat. 16° 50′ N., Long. 96° 00′ E.) to Cairo (Lat. 30° 00′ N., Long. 31° 20′ E.):

Entering the argument column on the left with the *Latitude of Destination* of 30° 00′ N., and interpolating by inspection for the *Change of Longitude* of 64° 40′, it will be seen that the difference in distance is about 34 nautical miles.

VI.—ADJUSTMENT TO REFRACTION IN SPECIAL CONDITIONS

Height in feet	Observed Altitude									Height in metres
	4°	6°	8°	10°	15°	20°	30°	45°	60°	
	′	′	′	′	′	′	′	′	′	
0	−2	−1	−1	−1	0	0	0	0	0	0
5000	0	0	0	0	0	0	0	0	0	1500
10000	+1	+1	+1	+1	0	0	0	0	0	3000
15000	2	2	2	1	+1	+1	0	0	0	4600
20000	3	2	2	2	1	1	+1	0	0	6100
25000	4	3	2	2	1	1	1	0	0	7600
30000	4	3	3	3	2	1	1	0	0	9100
35000	5	4	3	3	2	1	1	+1	0	10700
40000	+5	+4	+3	+3	+2	+2	+1	+1	0	12200

This table gives the additional correction for refraction to be applied to the *observed* altitude beyond that already included in the altitude tabulated in the main tables. It is only intended for use by an observer at great heights, and when special accuracy is required.

VII.—TRUE AZIMUTH OF THE POLE STAR

1940–1960		1960–1980		1980–2000	
L.H.A. ♈	True Azimuth	L.H.A. ♈	True Azimuth	L.H.A. ♈	True Azimuth
°	°	°	°	°	°
0	000	0	000	0	000
56	359	64	359	73	359
177	000	177	000	177	000
236	001	244	001	253	001
357	000	357	000	357	000
360		360		360	

These tables give the True Azimuth of the Pole Star, over various periods of time, for an observer between latitudes N. 15° and N. 19°. The argument L.H.A. ♈ is obtained from G.H.A. ♈ by *subtracting west* longitude or *adding east* longitude.

VIII.—DIP OF THE SEA HORIZON

Height in feet	Dip	Height in metres	Height in feet	Dip	Height in metres	Height in feet	Dip	Height in metres	Height in feet	Dip	Height in metres	Height in feet	Dip	Height in metres
	′			′			′			′			′	
0		0	437	21	133	1700	41	520	3810	61	1160	6740	81	2050
2	1		481	22	146	1790	42	546	3930	62	1200	6910	82	2100
6	2	1	527	23	160	1880	43	573	4060	63	1230	7080	83	2160
12	3	3	575	24	175	1970	44	600	4190	64	1270	7250	84	2210
21	4	6	625	25	190	2060	45	628	4330	65	1320	7430	85	2260
31	5	9	677	26	206	2150	46	657	4460	66	1360	7610	86	2320
43	6	13	731	27	222	2250	47	686	4600	67	1400	7790	87	2370
58	7	17	787	28	240	2340	48	716	4740	68	1440	7970	88	2420
75	8	22	845	29	257	2440	49	746	4880	69	1480	8150	89	2480
93	9	28	906	30	276	2550	50	777	5020	70	1530	8340	90	2540
114	10	34	968	31	295	2650	51	809	5170	71	1570	8520	91	2590
137	11	41	1030	32	314	2760	52	841	5320	72	1620	8710	92	2650
162	12	49	1090	33	335	2860	53	874	5470	73	1660	8900	93	2710
189	13	57	1160	34	356	2980	54	908	5620	74	1710	9100	94	2770
218	14	66	1230	35	377	3090	55	942	5770	75	1760	9290	95	2830
250	15	76	1310	36	399	3200	56	977	5930	76	1800	9490	96	2890
283	16	86	1380	37	422	3320	57	1010	6090	77	1850	9690	97	2950
318	17	97	1460	38	446	3440	58	1040	6250	78	1900	9890	98	3010
356	18	108	1540	39	470	3560	59	1080	6410	79	1950	10100	99	3070
395	19	120	1620	40	495	3680	60	1120	6580	80	2000	10300	100	3140
437	20	133	1700		520	3810		1160	6740		2050	10500		3200

This table gives the dip of the sea horizon, in minutes of arc, with argument height of eye of the observer in feet or in metres. It is only required when the altitude is measured from the sea horizon. The dip is to be *subtracted* from the observed altitude.

IX.—DISTANCE TO THE SEA HORIZON IN NAUTICAL MILES

Height in feet	Dist.	Height in metres	Height in feet	Dist.	Height in metres	Height in feet	Dist.	Height in metres	Height in feet	Dist.	Height in metres	Height in feet	Dist.	Height in metres	Height in feet	Dist.	Height in metres
0		0	287		87	1120		341	2500		762	4420		1340	6890		2100
	1		317	20	96	1170	39	359	2580	58	788	4540	77	1380	7040	96	2140
1		1	349	21	106	1240	40	378	2670	59	815	4650	78	1420	7180	97	2190
4	2		382	22	116	1300	41	396	2760	60	843	4770	79	1450	7330	98	2230
9	3	2	417	23	127	1360	42	416	2850	61	871	4900	80	1490	7480	99	2280
15	4	4	453	24	138	1430	43	436	2950	62	900	5020	81	1530	7630	100	2320
22	5	6	491	25	149	1490	44	456	3040	63	929	5140	82	1560	7780	101	2370
31	6	9	531	26	161	1560	45	477	3140	64	958	5270	83	1600	7940	102	2420
42	7	12	571	27	174	1630	46	498	3240	65	988	5390	84	1640	8100	103	2460
54	8	16	614	28	187	1700	47	520	3340	66	1010	5520	85	1680	8250	104	2510
68	9	20	658	29	200	1770	48	542	3440	67	1050	5650	86	1720	8410	105	2560
83	10	25	703	30	214	1850	49	564	3540	68	1080	5780	87	1760	8570	106	2610
100	11	30	750	31	228	1920	50	587	3650	69	1110	5920	88	1800	8730	107	2660
118	12	36	798	32	243	2000	51	611	3750	70	1140	6050	89	1840	8900	108	2710
137	13	42	848	33	258	2080	52	635	3860	71	1170	6190	90	1880	9060	109	2760
158	14	48	900	34	274	2160	53	659	3970	72	1210	6330	91	1920	9230	110	2810
181	15	55	953	35	290	2240	54	684	4080	73	1240	6460	92	1970	9400	111	2860
205	16	62	1000	36	307	2320	55	709	4190	74	1270	6610	93	2010	9560	112	2910
231	17	70	1060	37	324	2410	56	735	4310	75	1310	6750	94	2050	9740	113	2960
258	18	78	1120	38	341	2500	57	762	4420	76	1340	6890	95	2100	9910	114	3020
287	19	87															

IX.—DISTANCE TO THE SEA HORIZON IN STATUTE MILES

Height in feet	Dist.	Height in metres	Height in feet	Dist.	Height in metres	Height in feet	Dist.	Height in metres	Height in feet	Dist.	Height in metres	Height in feet	Dist.	Height in metres	Height in feet	Dist.	Height in metres
0		0	288		87	1120		344	2520		768	4460		1360	6960		2120
	1		314	23	95	1180	45	359	2590	67	791	4560	89	1390	7080	111	2160
1		1	342	24	104	1230	46	375	2670	68	815	4670	90	1420	7210	112	2190
3	2		370	25	113	1280	47	392	2750	69	839	4770	91	1450	7340	113	2230
6	3	2	400	26	122	1340	48	408	2830	70	863	4870	92	1480	7470	114	2270
11	4	3	431	27	131	1390	49	425	2910	71	888	4980	93	1510	7600	115	2310
17	5	5	463	28	141	1450	50	443	2990	72	913	5090	94	1550	7730	116	2350
24	6	7	496	29	151	1510	51	460	3080	73	938	5200	95	1580	7870	117	2390
32	7	9	530	30	161	1570	52	479	3160	74	964	5310	96	1610	8000	118	2440
41	8	12	565	31	172	1630	53	497	3250	75	990	5420	97	1650	8140	119	2480
51	9	15	602	32	183	1690	54	516	3330	76	1010	5530	98	1680	8280	120	2520
62	10	19	639	33	195	1750	55	535	3420	77	1040	5640	99	1720	8410	121	2560
75	11	22	678	34	206	1820	56	554	3510	78	1070	5750	100	1750	8550	122	2600
89	12	27	718	35	219	1880	57	574	3600	79	1090	5870	101	1790	8690	123	2650
103	13	31	759	36	231	1950	58	594	3690	80	1120	5990	102	1820	8830	124	2690
119	14	36	801	37	244	2010	59	615	3780	81	1150	6100	103	1860	8980	125	2730
137	15	41	845	38	257	2080	60	636	3880	82	1180	6220	104	1890	9120	126	2780
155	16	47	889	39	271	2150	61	657	3970	83	1210	6340	105	1930	9270	127	2820
174	17	53	935	40	285	2220	62	678	4070	84	1240	6460	106	1970	9410	128	2870
195	18	59	982	41	299	2290	63	700	4160	85	1270	6580	107	2000	9560	129	2910
216	19	66	1030	42	313	2370	64	723	4260	86	1300	6710	108	2040	9710	130	2960
239	20	73	1070	43	328	2440	65	745	4360	87	1330	6830	109	2080	9860	131	3000
263	21	80	1120	44	344	2520	66	768	4460	88	1360	6960	110	2120	10000	132	3050
288	22	87															

These tables give the distance to the sea horizon, in nautical miles and in statute miles, with argument height of eye of the observer in feet or in metres.

At the moment when an object of known height is just appearing or disappearing over the sea horizon, its distance may be found by adding the distance corresponding to its height to the distance corresponding to the height of eye of the observer.

X.—TABLE OF RANGES IN NAUTICAL MILES

The tables below and on the opposite page give the distance, to the nearest 5 nautical miles, of an object, whose height is known and is *greater* than the height of the observer. The arguments of the table are the observed *angle of elevation* to the object, and the *difference in height* between the object and the observer, expressed in feet or in metres.

Example.—An observer, whose height is 1,500 feet, finds that the angle of elevation to the summit of a mountain, whose height is known to be 7,000 feet, is 0° 48′. Required the distance away of the mountain.

The difference in height between the mountain and the observer is 7,000 − 1,500 = 5,500 feet. Entering on the opposite page the column headed 0° 50′ (the nearest tabulated value to 0° 48′), and choosing the left-hand of the two argument columns since the height is measured in feet, it is seen that 5,500 lies in the interval between 5,130 and 5,910, so that the distance of the mountain, to the nearest 5 miles, is 45 nautical miles.

The tables on pages 226 to 228 give the distance of an object, whose height is known, and is *less* than the height of the observer. The arguments of the table are the observed *angle of depression* to the object, and the *difference in height* between the observer and the object, expressed in feet or in metres. The distance is given to the nearest mile up to 10 nautical miles, and to the nearest 5 miles from 10 to 60 nautical miles.

Example.—An observer, whose height is 1,500 metres, finds that the angle of depression to a ship is 5° 37′. Required the distance away of the ship.

Entering on page 228 the column headed 5° 30′, and choosing the right-hand of the two argument columns, it is seen that 1,500 is an exact tabulated value, so that the distance away of the ship is 8 nautical miles.

On page 226, figures in *italics* represent the difference in height, *when the object observed is beyond the sea horizon.* If it is uncertain whether the object is beyond the horizon or not, and the two parts of the table give widely different results, there should be no doubt which is the correct one, while in doubtful cases the error will not be serious.

These tables are intended to give only the approximate range. They should prove a more reliable guide for large angles of elevation and depression than for small ones.

Height of object *greater* than height of observer

Angle of elevation												
4° 00′			3° 40′			3° 20′			3° 00′			
Height in feet	Range	Height in metres	Height in feet	Range	Height in metres	Height in feet	Range	Height in metres	Height in feet	Range	Height in metres	
0		0	0		0	0		0	0		0	
1060	0	325	978	0	298	890	0	271	801	0	244	
3230	5	985	2960	5	904	2690	5	822	2430	5	741	
5430	10	1650	4990	10	1520	4540	10	1380	4100	10	1250	
7670	15	2330	7050	15	2140	6430	15	1960	5810	15	1770	
9950	20	3030	9150	20	2790	8350	20	2540	7550	20	2300	
12200	25	3740	11200	25	3440	10300	25	3140	9340	25	2840	
14600	30	4450	13400	30	4100	12300	30	3750	11100	30	3400	
17000	35	5180	15600	35	4780	14300	35	4370	13000	35	3960	
19400	40	5920	17900	40	5460	16400	40	5000	14900	40	4540	
21900	45	6680	20200	45	6160	18500	45	5650	16800	45	5130	
24400	50	7440	22500	50	6870	20600	50	6300	18800	50	5730	
26900	55	8210	24900	55	7590	22800	55	6970	20800	55	6350	
29500	60	9000	27300	60	8320	25100	60	7650	22800	60	6970	

Angle of elevation						
2° 40′			2° 20′			
Height in feet	Range	Height in metres	Height in feet	Range	Height in metres	
0		0	0		0	
712	0	217	624	0	190	
2160	5	660	1900	5	579	
3650	10	1110	3210	10	980	
5190	15	1580	4570	15	1390	
6750	20	2050	5960	20	1810	
8360	25	2540	7390	25	2250	
10000	30	3050	8850	30	2690	
11600	35	3560	10300	35	3150	
13400	40	4080	11900	40	3620	
15100	45	4620	13400	45	4110	
16900	50	5170	15100	50	4600	
18800	55	5730	16700	55	5100	
20600	60	6300	18400	60	5620	

X.—TABLE OF RANGES IN NAUTICAL MILES

Height of object *greater* than height of observer

Angle of elevation

2° 00′			1° 50′			1° 40′			1° 30′			1° 20′			1° 10′		
Height in feet	Range	Height in metres	Height in feet	Range	Height in metres	Height in feet	Range	Height in metres	Height in feet	Range	Height in metres	Height in feet	Range	Height in metres	Height in feet	Range	Height in metres
0		0	0		0	0		0	0		0	0		0	0		0
535	0	163	491	0	149	447	0	136	402	0	122	358	0	109	314	0	95
1630	5	498	1500	5	458	1370	5	417	1230	5	377	1100	5	336	971	5	296
2770	10	845	2550	10	777	2330	10	710	2100	10	643	1880	10	575	1660	10	508
3940	15	1200	3630	15	1100	3320	15	1010	3020	15	920	2710	15	826	2400	15	731
5160	20	1570	4760	20	1450	4360	20	1330	3960	20	1200	3570	20	1080	3170	20	966
6410	25	1950	5920	25	1800	5440	25	1650	4950	25	1510	4460	25	1360	3980	25	1210
7700	30	2340	7130	30	2170	6550	30	1990	5970	30	1820	5400	30	1640	4820	30	1470
9030	35	2750	8360	35	2550	7700	35	2340	7040	35	2140	6370	35	1940	5710	35	1740
10400	40	3160	9640	40	2940	8890	40	2710	8140	40	2480	7390	40	2250	6630	40	2020
11800	45	3590	10900	45	3340	10100	45	3080	9280	45	2820	8440	45	2570	7590	45	2310
13200	50	4030	12300	50	3750	11300	50	3470	10400	50	3180	9520	50	2900	8590	50	2620
14700	55	4480	13700	55	4170	12600	55	3860	11600	55	3550	10600	55	3240	9630	55	2930
16200	60	4950	15100	60	4610	14000	60	4270	12900	60	3930	11800	60	3600	10700	60	3260

Angle of elevation

1° 00′			0° 55′			0° 50′			0° 45′			0° 40′			0° 35′		
Height in feet	Range	Height in metres	Height in feet	Range	Height in metres	Height in feet	Range	Height in metres	Height in feet	Range	Height in metres	Height in feet	Range	Height in metres	Height in feet	Range	Height in metres
0		0	0		0	0		0	0		0	0		0	0		0
270	0	82	247	0	75	225	0	68	203	0	62	181	0	55	159	0	48
839	5	255	772	5	235	706	5	215	640	5	195	573	5	174	507	5	154
1440	10	440	1330	10	406	1220	10	373	1110	10	339	1000	10	305	893	10	272
2090	15	637	1930	15	590	1780	15	542	1620	15	495	1470	15	448	1310	15	401
2770	20	845	2570	20	784	2370	20	724	2170	20	663	1970	20	602	1770	20	542
3490	25	1060	3250	25	991	3000	25	916	2760	25	842	2520	25	768	2270	25	694
4250	30	1290	3960	30	1200	3670	30	1120	3390	30	1030	3100	30	945	2810	30	858
5050	35	1530	4710	35	1430	4380	35	1330	4050	35	1230	3720	35	1130	3390	35	1030
5880	40	1790	5500	40	1670	5130	40	1560	4750	40	1450	4380	40	1330	4000	40	1220
6750	45	2060	6330	45	1930	5910	45	1800	5490	45	1670	5070	45	1540	4650	45	1410
7670	50	2330	7200	50	2190	6740	50	2050	6270	50	1910	5810	50	1770	5340	50	1620
8610	55	2620	8100	55	2470	7600	55	2310	7090	55	2160	6580	55	2000	6070	55	1850
9600	60	2920	9050	60	2750	8500	60	2590	7940	60	2420	7390	60	2250	6840	60	2080

Angle of elevation

0° 30′			0° 25′			0° 20′			0° 15′			0° 10′			0° 05′		
Height in feet	Range	Height in metres	Height in feet	Range	Height in metres	Height in feet	Range	Height in metres	Height in feet	Range	Height in metres	Height in feet	Range	Height in metres	Height in feet	Range	Height in metres
0		0	0		0	0		0	0		0	0		0	0		0
137	0	41	115	0	35	93	0	28	71	0	21	48	0	14	26	0	8
440	5	134	374	5	114	308	5	93	241	5	73	175	5	53	109	5	33
782	10	238	671	10	204	561	10	171	450	10	137	339	10	103	229	10	69
1160	15	354	1000	15	306	852	15	259	697	15	212	542	15	165	387	15	118
1570	20	481	1380	20	420	1180	20	360	982	20	299	783	20	238	584	20	178
2030	25	620	1790	25	546	1540	25	471	1300	25	397	1060	25	323	818	25	249
2520	30	770	2240	30	683	1950	30	595	1660	30	507	1370	30	420	1090	30	332
3060	35	932	2720	35	831	2390	35	730	2060	35	629	1730	35	528	1400	35	427
3620	40	1100	3250	40	991	2870	40	877	2500	40	762	2120	40	648	1750	40	533
4230	45	1290	3810	45	1160	3390	45	1030	2970	45	907	2550	45	779	2130	45	651
4880	50	1480	4410	50	1340	3950	50	1200	3480	50	1060	3020	50	922	2560	50	780
5560	55	1690	5050	55	1540	4540	55	1380	4040	55	1230	3530	55	1070	3020	55	921
6280	60	1910	5730	60	1740	5180	60	1570	4620	60	1410	4070	60	1240	3520	60	1070

X.—TABLE OF RANGES IN NAUTICAL MILES

Height of object *less* than height of observer

Angle of depression

0° 05′			0° 10′			0° 15′			0° 20′			0° 25′			0° 30′		
Height in feet	Range	Height in metres	Height in feet	Range	Height in metres	Height in feet	Range	Height in metres	Height in feet	Range	Height in metres	Height in feet	Range	Height in metres	Height in feet	Range	Height in metres
0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
4	1	1	9	1	2	13	1	4	17	1	5	21	1	6	26	1	8
11	2	3	24	2	7	38	2	11	51	2	15	64	2	19	77	2	23
17	3	5	39	3	12	61	3	18	83	3	25	106	3	32	127	3	39
21	4	6	52	4	15	83	4	25	114	4	34	145	4	44	176	4	53
24	5	7	64	5	19	103	5	31	143	5	43	183	5	55	223	5	68
25	6	8	74	6	22	122	6	37	171	6	52	220	6	67	268	6	81
26	7	8	82	7	25	140	7	42	197	7	60	255	7	77	312	7	95
24	8	7	89	8	27	156	8	47	222	8	67	288	8	88	355	8	108
21	9	5	95	9	29	170	9	52	245	9	74	320	9	97	396	9	120
16	10	5	99	10	30	183	10	55	267	10	81	351	10	107	435	10	132
0		0	103	15	32	212	15	64	323	15	98	434	15	132	544	15	166
			77	20	24	231	20	70	386	20	117	541	20	164	695	20	212
			13	25	4	213	25	65	411	25	125	609	25	185	808	25	246
			0		0	155	30	48	398	30	122	640	30	195	884	30	269
						59	35	18	346	35	106	634	35	194	921	35	280
						0		0	258	40	79	590	40	180	921	40	281
									130	45	40	506	45	155	882	45	269
									0		0	385	50	118	805	50	246
												226	55	69	690	55	211
												28	60	9	537	60	164
												0		0	346		106

Angle of depression

0° 35′			0° 40′			0° 45′			0° 50′			0° 55′			1° 00′		
Height in feet	Range	Height in metres	Height in feet	Range	Height in metres	Height in feet	Range	Height in metres	Height in feet	Range	Height in metres	Height in feet	Range	Height in metres	Height in feet	Range	Height in metres
0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
30	1	9	35	1	10	39	1	12	44	1	13	48	1	14	52	1	16
91	2	27	104	2	31	117	2	35	130	2	39	144	2	43	157	2	47
150	3	45	172	3	52	194	3	59	216	3	65	238	3	72	260	3	79
207	4	63	238	4	72	269	4	82	300	4	91	331	4	100	362	4	110
263	5	80	302	5	92	342	5	104	382	5	116	422	5	128	462	5	140
317	6	96	366	6	111	414	6	126	463	6	141	512	6	156	560	6	170
370	7	112	427	7	130	485	7	147	542	7	165	600	7	182	657	7	200
421	8	128	488	8	148	554	8	168	620	8	189	687	8	209	753	8	229
471	9	143	546	9	166	621	9	189	696	9	212	772	9	235	847	9	258
519	10	158	603	10	183	687	10	209	771	10	235	855	10	260	939	10	286
655	15	199	765	15	233	876	15	267	986	15	300	1090	15	334	1200	15	368
850	20	259	1000	20	306	1160	20	353	1310	20	400	1470	20	448	1620	20	495
1000	25	307	1200	25	367	1400	25	428	1600	25	489	1800	25	549	2000	25	610
1120	30	343	1370	30	417	1610	30	491	1850	30	566	2100	30	640	2340	30	714
1200	35	368	1490	35	456	1780	35	543	2070	35	631	2350	35	719	2640	35	806
1250	40	381	1580	40	482	1910	40	583	2240	40	685	2570	40	786	2910	35	887
1260	45	384	1630	45	497	2000	45	612	2380	45	727	2760	45	841	3130	40	956
1230	50	374	1650	50	502	2060	50	629	2480	50	757	2990	50	885	3320	45	1010
1160	55	352	1620	55	494	2080	55	634	2540	55	776	3010	55	918	3470	50	1050
1050	60	319	1560	60	474	2070	60	629	2570	60	783	3080	60	938	3580	55	1090
899		274	1460		443	2010		611	2560		780	3110		947	3660	60	1110

For explanation, see page 224.

X.—TABLE OF RANGES IN NAUTICAL MILES

Height of object *less* than height of observer

Angle of depression

1° 10′			1° 20′			1° 30′			1° 40′			1° 50′			2° 00′		
Height in feet	Range	Height in metres	Height in feet	Range	Height in metres	Height in feet	Range	Height in metres	Height in feet	Range	Height in metres	Height in feet	Range	Height in metres	Height in feet	Range	Height in metres
0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
61	1	18	70	1	21	79	1	24	88	1	26	97	1	29	106	1	32
183	2	56	210	2	64	237	2	72	263	2	80	290	2	88	316	2	96
305	3	92	349	3	106	393	3	119	437	3	133	481	3	146	526	3	160
424	4	129	486	4	148	548	4	167	610	4	185	672	4	204	734	4	223
541	5	165	621	5	189	701	5	213	780	5	238	860	5	262	940	5	286
658	6	200	755	6	230	852	6	259	950	6	289	1040	6	319	1140	6	349
772	7	235	887	7	270	1000	7	305	1110	7	340	1230	7	375	1340	7	410
886	8	270	1010	8	310	1150	8	351	1280	8	391	1410	8	432	1550	8	472
997	9	304	1140	9	350	1290	9	395	1440	9	441	1590	9	487	1750	9	533
1100	10	337	1270	10	388	1440	10	440	1610	10	491	1780	10	542	1940	10	594
1430	15	435	1650	15	503	1870	15	570	2090	15	638	2310	15	705	2530	15	772
1930	20	589	2240	20	684	2550	20	778	2860	20	872	3170	20	967	3480	20	1060
2400	25	732	2790	25	853	3190	25	974	3590	25	1090	3990	25	1210	4390	25	1330
2830	30	862	3310	30	1010	3800	30	1150	4290	30	1300	4770	30	1450	5260	30	1600
3220	35	982	3790	35	1150	4370	35	1330	4940	35	1500	5520	35	1680	6090	35	1850
3570	40	1080	4230	40	1290	4900	40	1490	5560	40	1690	6230	40	1890	6890	40	2100
3880	45	1180	4640	45	1410	5390	45	1640	6140	45	1870	6890	45	2100	7650	45	2330
4160	50	1270	5000	50	1520	5840	50	1780	6680	50	2030	7530	50	2290	8370	50	2550
4400	55	1340	5330	55	1620	6260	55	1900	7190	55	2190	8120	55	2470	9050	55	2750
4600	60	1400	5620	60	1710	6640	60	2020	7660	60	2330	8670	60	2640	9690	60	2950
4760		1450	5870		1790	6980		2120	8080		2460	9190		2800	10300		3140

Angle of depression

2° 20′			2° 40′			3° 00′			3° 20′			3° 40′			4° 00′		
Height in feet	Range	Height in metres	Height in feet	Range	Height in metres	Height in feet	Range	Height in metres	Height in feet	Range	Height in metres	Height in feet	Range	Height in metres	Height in feet	Range	Height in metres
0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
123	1	37	141	1	43	159	1	48	176	1	53	194	1	59	212	1	64
369	2	112	422	2	128	476	2	145	529	2	161	582	2	177	636	2	193
614	3	187	703	3	214	792	3	241	880	3	268	969	3	295	1050	3	322
858	4	261	982	4	299	1100	4	337	1230	4	375	1350	4	412	1470	4	450
1090	5	335	1250	5	383	1410	5	432	1570	5	481	1730	5	529	1890	5	578
1340	6	408	1530	6	467	1730	6	527	1920	6	586	2120	6	646	2310	6	706
1570	7	481	1800	7	551	2040	7	621	2270	7	692	2500	7	762	2730	7	832
1810	8	553	2080	8	634	2340	8	715	2610	8	796	2880	8	877	3140	8	959
2050	9	625	2350	9	717	2650	9	809	2950	9	901	3250	9	993	3560	9	1080
2280	10	696	2620	10	799	2950	10	902	3290	10	1000	3630	10	1100	3970	10	1210
2970	15	908	3420	15	1040	3860	15	1170	4300	15	1310	4750	15	1440	5190	15	1580
4100	20	1250	4720	20	1430	5340	20	1620	5960	20	1810	6580	20	2000	7200	20	2190
5190	25	1580	5980	25	1820	6780	25	2060	7580	25	2310	8380	25	2550	9180	25	2790
6230	30	1900	7210	30	2190	8180	30	2490	9160	30	2790	10100	30	3090	11100	30	3380
7250	35	2210	8400	35	2560	9550	35	2910	10700	35	3260	11800	35	3610	13000	35	3960
8220	40	2500	9550	40	2910	10800	40	3310	12200	40	3720	13500	40	4120	14800	40	4530
9150	45	2790	10600	45	3250	12100	45	3710	13600	45	4170	15100	45	4620	16700	45	5090
10000	50	3060	11700	50	3570	13400	50	4090	15100	50	4600	16700	50	5120	18400	50	5630
10900	55	3320	12700	55	3890	14600	55	4460	16400	55	5020	18300	55	5590	20200	55	6160
11700	60	3570	13700	60	4190	15800	60	4810	17800	60	5440	19900	60	6060	21900	60	6680
12500		3810	14700		4490	16900		5160	19100		5840	21300		6510	23600		7190

For explanation, see page 224.

X.—TABLE OF RANGES IN NAUTICAL MILES

Height of object *less* than height of observer

Angle of depression												
4° 30′			5° 00′			5° 30′			6° 00′			
Height in feet	Range	Height in metres	Height in feet	Range	Height in metres	Height in feet	Range	Height in metres	Height in feet	Range	Height in metres	
0		0	0		0	0		0	0		0	
238	0	72	265	0	81	292	0	89	319	0	97	
716	1	218	796	1	242	876	1	267	956	1	291	
1190	2	363	1320	2	404	1450	2	444	1590	2	485	
1660	3	507	1850	3	564	2040	3	621	2220	3	679	
2130	4	651	2370	4	725	2610	4	798	2860	4	872	
2600	5	795	2900	5	885	3190	5	974	3490	5	1060	
3070	6	938	3420	6	1040	3770	6	1150	4120	6	1250	
3540	7	1080	3940	7	1200	4340	7	1320	4750	7	1440	
4010	8	1220	4460	8	1360	4920	8	1500	5370	8	1630	
4470	9	1360	4980	9	1510	5490	9	1670	6000	9	1830	
5860	10	1780	6530	10	1990	7200	10	2190	7870	10	2390	
8140	15	2480	9070	15	2760	10000	15	3050	10900	15	3330	
10300	20	3160	11500	20	3530	12700	20	3890	14000	20	4260	
12500	25	3830	14000	25	4280	15500	25	4730	16900	25	5180	
14700	30	4490	16400	30	5020	18200	30	5550	19900	30	6080	
16800	35	5140	18800	35	5750	20800	35	6360	22800	35	6980	
18900	40	5780	21200	40	6470	23500	40	7160	25800	40	7860	
21000	45	6400	23500	45	7180	26000	45	7950	28600	45	8730	
23000	50	7020	25800	50	7870	28600	50	8730	31400	50	9590	
25000	55	7620	28000	55	8550	31100	55	9490	34200	55	10400	
26900	60	8210	30200	60	9230	33600	60	10200	36900	60	11200	

Angle of depression												
7° 30′			8° 00′			8° 30′			9° 00′			
Height in feet	Range	Height in metres	Height in feet	Range	Height in metres	Height in feet	Range	Height in metres	Height in feet	Range	Height in metres	
0		0	0		0	0		0	0		0	
399	0	121	427	0	130	454	0	138	481	0	146	
1190	1	365	1270	1	390	1360	1	415	1440	1	439	
1990	2	608	2130	2	649	2260	2	691	2400	2	732	
2790	3	851	2980	3	909	3170	3	966	3360	3	1020	
3580	4	1090	3830	4	1160	4070	4	1240	4310	4	1310	
4380	5	1330	4670	5	1420	4970	5	1510	5270	5	1600	
5170	6	1570	5520	6	1680	5870	6	1790	6220	6	1890	
5960	7	1810	6360	7	1940	6770	7	2060	7180	7	2180	
6750	8	2050	7210	8	2190	7670	8	2330	8130	8	2470	
7530	9	2290	8050	9	2450	8560	9	2610	9080	9	2760	
9880	10	3010	10500	10	3220	11200	10	3420	11900	10	3630	
13700	15	4200	14700	15	4480	15600	15	4770	16600	15	5060	
17600	20	5370	18800	20	5740	20000	20	6110	21200	20	6480	
21400	25	6530	22900	25	6980	24400	25	7440	25900	25	7890	
25200	30	7680	26900	30	8220	28700	30	8760	30500	30	9290	
28900	35	8820	30900	35	9440	33000	35	10000	35000	35	10600	
32600	40	9950	34900	40	10600	37200	40	11300	39500	40	12000	
36300	45	11000	38800	45	11800	41400	45	12600	44000	45	13400	
39900	50	12100	42700	50	13000	45600	50	13900	48400	50	14700	
43500	55	13200	46600	55	14200	49700	55	15100	52800	55	16100	
47000	60	14300	50400	60	15300	53800	60	16400	57200	60	17400	

Angle of depression												
9° 30′			10° 00′									
Height in feet	Range	Height in metres	Height in feet	Range	Height in metres							
0		0	0		0							
508	0	154	535	0	163							
1520	1	464	1600	1	489							
2540	2	774	2670	2	815							
3550	3	1080	3740	3	1140							
4560	4	1390	4810	4	1460							
5570	5	1690	5870	5	1790							
6580	6	2000	6930	6	2110							
7580	7	2310	8000	7	2430							
8590	8	2610	9060	8	2760							
9600	9	2920	10100	9	3080							
12600	10	3840	13200	10	4050							
17500	15	5350	18500	15	5640							
22500	20	6860	23700	20	7230							
27400	25	8350	28900	25	8810							
32200	30	9830	34000	30	10300							
37000	35	11300	39100	35	11900							
41800	40	12700	44200	40	13400							
46600	45	14200	49200	45	15000							
51300	50	15600	54200	50	16500							
56000	55	17000	59100	55	18000							
60600	60	18400	64000	60	19500							

For explanation, see page 224.

XI.—TEMPERATURE CONVERSION

FAHRENHEIT AND CENTIGRADE

°F	°C	°F	°C	°F	°C	°F	°C	°F	°C	°F	°C	°F	°C
−52	−46	−14	−25	+23	−4	+61	+17	+99	+38	+137	+59	+175	+80
50	45	13	24	25	3	63	18	101	39	139	60	176	81
49	44	11	23	27	2	65	19	103	40	140	61	178	82
47	43	9	22	29	−1	67	20	104	41	142	62	180	83
45	42	7	21	31	0	68	21	106	42	144	63	182	84
43	41	5	20	32	+1	70	22	108	43	146	64	184	85
41	40	4	19	34	2	72	23	110	44	148	65	185	86
40	39	−2	18	36	3	74	24	112	45	149	66	187	87
38	38	0	17	38	4	76	25	113	46	151	67	189	88
36	37	+2	16	40	5	77	26	115	47	153	68	191	89
34	36	4	15	41	6	79	27	117	48	155	69	193	90
32	35	5	14	43	7	81	28	119	49	157	70	194	91
31	34	7	13	45	8	83	29	121	50	158	71	196	92
29	33	9	12	47	9	85	30	122	51	160	72	198	93
27	32	11	11	49	10	86	31	124	52	162	73	200	94
25	31	13	10	50	11	88	32	126	53	164	74	202	95
23	30	14	9	52	12	90	33	128	54	166	75	203	96
22	29	16	8	54	13	92	34	130	55	167	76	205	97
20	28	18	7	56	14	94	35	131	56	169	77	207	98
18	27	20	6	58	15	95	36	133	57	171	78	209	99
16	−26	22	−5	59	+16	97	+37	135	+58	173	+79	211	+100
−14		+23		+61		+99		+137		+175		+212	

XII.—CONVERSION FACTORS

Conversion	Ratio	Factor	Reciprocal
DISTANCE			
Statute Miles to Nautical Miles ...	66 to 76	0·8684	1·1515
Statute Miles „ Kilometres	66 „ 41	1·6093	0·6214
Nautical Miles „ Kilometres	76 „ 41	1·8531	0·5396
Feet „ Metres	25 „ 82	0·3048	3·2808
Yards „ Metres	32 „ 35	0·9144	1·0936
Fathoms „ Feet	6 „ 1	6·0	0·1667
SPEED			
Miles per hour to Knots	66 to 76	0·8684	1·1515
Miles per hour „ Metres per second ...	38 „ 85	0·4470	2·2369
Knots „ Metres per second ...	35 „ 68	0·5148	1·9426
Miles per hour „ Feet per second ...	22 „ 15	1·4667	0·6818
LIQUID MEASURE			
Gallons to Litres	50 to 11	4·5460	0·2200
WEIGHT			
Pounds to Kilograms	44 to 97	0·4536	2·2046
PRESSURE			
Inches of Mercury to Millibars ...	2100 to 62	33·87	0·02953

XIII.—CONVERSION OF TIME TO ARC

For Intervals of 10m

h m	° ′	h m	° ′	h m	° ′
00 00	0 00	08 00	120 00	16 00	240 00
10	2 30	10	122 30	10	242 30
20	5 00	20	125 00	20	245 00
30	7 30	30	127 30	30	247 30
40	10 00	40	130 00	40	250 00
50	12 30	50	132 30	50	252 30
01 00	15 00	09 00	135 00	17 00	255 00
10	17 30	10	137 30	10	257 30
20	20 00	20	140 00	20	260 00
30	22 30	30	142 30	30	262 30
40	25 00	40	145 00	40	265 00
50	27 30	50	147 30	50	267 30
02 00	30 00	10 00	150 00	18 00	270 00
10	32 30	10	152 30	10	272 30
20	35 00	20	155 00	20	275 00
30	37 30	30	157 30	30	277 30
40	40 00	40	160 00	40	280 00
50	42 30	50	162 30	50	282 30
03 00	45 00	11 00	165 00	19 00	285 00
10	47 30	10	167 30	10	287 30
20	50 00	20	170 00	20	290 00
30	52 30	30	172 30	30	292 30
40	55 00	40	175 00	40	295 00
50	57 30	50	177 30	50	297 30
04 00	60 00	12 00	180 00	20 00	300 00
10	62 30	10	182 30	10	302 30
20	65 00	20	185 00	20	305 00
30	67 30	30	187 30	30	307 30
40	70 00	40	190 00	40	310 00
50	72 30	50	192 30	50	312 30
05 00	75 00	13 00	195 00	21 00	315 00
10	77 30	10	197 30	10	317 30
20	80 00	20	200 00	20	320 00
30	82 30	30	202 30	30	322 30
40	85 00	40	205 00	40	325 00
50	87 30	50	207 30	50	327 30
06 00	90 00	14 00	210 00	22 00	330 00
10	92 30	10	212 30	10	332 30
20	95 00	20	215 00	20	335 00
30	97 30	30	217 30	30	337 30
40	100 00	40	220 00	40	340 00
50	102 30	50	222 30	50	342 30
07 00	105 00	15 00	225 00	23 00	345 00
10	107 30	10	227 30	10	347 30
20	110 00	20	230 00	20	350 00
30	112 30	30	232 30	30	352 30
40	115 00	40	235 00	40	355 00
50	117 30	50	237 30	50	357 30

Interpolation Table

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

When the argument is an exact tabulated value, the *upper* of the two possible values of the result should be taken.

XIV.—CONVERSION OF ARC TO TIME

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

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

XV.—CORRECTION TO TABULATED ALTITUDE FOR MINUTES OF DECLINATION

d	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
′											′
00	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	00
01	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	01
02	1 1 1	1 1 1	1 1 1	1 1 1	1 1 2	2 2 2	2 2 2	2 2 2	2 2 2	2 2 2	02
03	2 2 2	2 2 2	2 2 2	2 2 2	2 2 2	2 2 2	2 2 3	3 3 3	3 3 3	3 3 3	03
04	2 2 2	2 2 2	2 3 3	3 3 3	3 3 3	3 3 3	3 3 3	3 4 4	4 4 4	4 4 4	04
05	3 3 3	3 3 3	3 3 3	3 3 4	4 4 4	4 4 4	4 4 4	4 4 4	5 5 5	5 5 5	05
06	3 3 3	3 4 4	4 4 4	4 4 4	4 4 4	5 5 5	5 5 5	5 5 5	6 6 6	6 6 6	06
07	4 4 4	4 4 4	4 4 5	5 5 5	5 5 5	5 5 6	6 6 6	6 6 6	6 7 7	7 7 7	07
08	4 4 4	5 5 5	5 5 5	5 5 6	6 6 6	6 6 6	7 7 7	7 7 7	7 7 8	8 8 8	08
09	5 5 5	5 5 5	6 6 6	6 6 6	6 7 7	7 7 7	7 8 8	8 8 8	8 8 9	9 9 9	09
10	5 5 6	6 6 6	6 6 6	7 7 7	7 7 8	8 8 8	8 8 8	9 9 9	9 9 10	10 10 10	10
11	6 6 6	6 6 7	7 7 7	7 8 8	8 8 8	8 9 9	9 9 9	10 10 10	10 10 10	11 11 11	11
12	6 6 7	7 7 7	7 8 8	8 8 8	9 9 9	9 9 10	10 10 10	10 11 11	11 11 11	12 12 12	12
13	7 7 7	7 8 8	8 8 8	9 9 9	9 10 10	10 10 10	11 11 11	11 11 12	12 12 12	13 13 13	13
14	7 7 8	8 8 8	9 9 9	9 10 10	10 10 10	11 11 11	11 12 12	12 12 13	13 13 13	14 14 14	14
15	8 8 8	8 9 9	9 10 10	10 10 10	11 11 11	12 12 12	12 12 13	13 13 14	14 14 14	14 15 15	15
16	8 9 9	9 9 10	10 10 10	11 11 11	11 12 12	12 13 13	13 13 14	14 14 14	15 15 15	15 16 16	16
17	9 9 9	10 10 10	10 11 11	11 12 12	12 12 13	13 13 14	14 14 14	15 15 15	16 16 16	16 17 17	17
18	9 10 10	10 10 11	11 11 12	12 12 13	13 13 14	14 14 14	15 15 15	16 16 16	16 17 17	17 18 18	18
19	10 10 10	11 11 11	12 12 12	13 13 13	14 14 14	15 15 15	16 16 16	16 17 17	17 18 18	18 19 19	19
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