LAT.	25°			26°			27°			28°			29°			LAT.
H.A.	Alt.	d	Az.	Alt.	d	Az.	Alt.	d	Az.	Alt.	d	Az.	Alt.	d	Az.	H.A.
°	° ′		°	° ′		°	° ′		°	° ′		°	° ′		°	°
0	...			...			...			...			...			360
1	...			...			...			...			...			359
2	...			...			...			...			...			358
3	...			...			...			...			...			357
4	...			...			...			...			...			356
5	...			...			...			...			...			355
6	...			...			...			...			...			354
7	...			...			...			...			...			353
8	...			...			...			...			...			352
9	...			...			...			...			...			351
10	...			...			...			...			...			350
11	...			...			...			80 00	+12	99	79 48	+17	104	349
12	79 08	−6	82	79 13	0	87	79 13	+6	93	79 08	11	98	78 57	17	103	348
13	78 14	5	82	78 19	+1	87	78 20	5	92	78 15	11	97	78 06	15	102	347
14	77 20	4	82	77 26	0	87	77 26	6	91	77 23	10	96	77 14	15	100	346
15	76 26	−3	83	76 32	+1	87	76 33	+6	91	76 30	+10	95	76 22	+15	99	345
16	75 32	2	83	75 38	2	86	75 40	5	90	75 37	10	94	75 31	14	98	344
17	74 38	2	83	74 44	2	86	74 46	6	90	74 44	10	94	74 39	13	97	343
18	73 44	−1	83	73 50	3	86	73 53	6	89	73 51	10	93	73 47	13	96	342
19	72 50	0	83	72 57	2	86	72 59	6	89	72 58	10	92	72 54	14	96	341
20	71 57	−1	83	72 03	+3	86	72 06	+6	89	72 06	+9	92	72 02	+13	95	340
21	71 03	0	82	71 09	3	85	71 12	7	88	71 13	9	91	71 10	13	94	339
22	70 09	0	82	70 15	4	85	70 19	7	88	70 20	9	91	70 17	13	94	338
23	69 15	+1	82	69 22	4	85	69 26	6	88	69 27	10	90	69 25	13	93	337
24	68 21	1	82	68 28	4	85	68 32	7	87	68 34	10	90	68 33	12	92	336
25	67 27	+2	82	67 34	+5	84	67 39	+7	87	67 41	+10	89	67 40	+13	92	335
26	66 33	3	82	66 41	4	84	66 45	8	87	66 48	10	89	66 48	12	91	334
27	65 40	2	82	65 47	5	84	65 52	8	86	65 55	10	88	65 55	13	91	333
28	64 46	3	82	64 53	6	84	64 59	8	86	65 02	10	88	65 03	13	90	332
29	63 52	3	82	64 00	5	84	64 05	9	86	64 09	10	88	64 10	13	90	331
30	62 58	+4	81	63 06	+6	83	63 12	+8	85	63 16	+11	87	63 18	+13	89	330
31	62 04	5	81	62 13	6	83	62 19	8	85	62 23	11	87	62 26	12	89	329
32	61 11	4	81	61 19	7	83	61 26	8	85	61 30	11	86	61 33	13	88	328
33	60 17	5	81	60 26	7	83	60 33	8	84	60 37	11	86	60 41	13	88	327
34	59 23	5	81	59 32	7	82	59 39	9	84	59 45	11	86	59 48	13	87	326
35	58 30	+5	81	58 39	+7	82	58 46	+10	84	58 52	+11	85	58 56	+13	87	325
36	57 36	6	80	57 45	8	82	57 53	10	83	57 59	12	85	58 03	14	87	324
37	56 43	6	80	56 52	8	82	57 00	10	83	57 06	12	85	57 11	14	86	323
38	55 49	6	80	55 59	8	81	56 07	10	83	56 14	11	84	56 19	13	86	322
39	54 56	6	80	55 05	9	81	55 14	10	83	55 21	12	84	55 26	14	85	321
40	54 02	+7	80	54 12	+9	81	54 21	+10	82	54 28	+13	84	54 34	+14	85	320
41	53 09	7	79	53 19	9	81	53 28	11	82	53 36	12	83	53 42	14	85	319
42	52 15	8	79	52 26	9	80	52 35	11	82	52 43	13	83	52 50	14	84	318
43	51 22	8	79	51 33	9	80	51 42	11	81	51 51	12	83	51 57	15	84	317
44	50 29	8	79	50 40	9	80	50 49	12	81	50 58	13	82	51 05	15	84	316
45	49 35	+9	79	49 47	+10	80	49 57	+11	81	50 06	+13	82	50 13	+15	83	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. 9

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

For 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.

26° DECLINATION **SAME** NAME AS LATITUDE 26°

LAT.	25°		26°		27°		28°		29°		LAT.
H.A.	Alt.	Az.	Alt.	Az.	Alt.	Az.	Alt.	Az.	Alt.	Az.	H.A.
°	° ′ d	°	° ′ d	°	° ′ d	°	° ′ d	°	° ′ d	°	°
90	10 45+23	66	11 09+24	66	11 33+25	67	11 56+26	67	12 20+26	67	270
91	...		10 20+24	66	10 44+25	66	11 08 26	66	11 32 27	66	269
92	...		...		...		10 20+26	66	10 44+27	66	268
93	...		...		...		...		...		267
94	...		...		...		...		...		266
95	...		...		...		...		...		265

26° DECLINATION **CONTRARY** NAME TO LATITUDE 26°

LAT.	25°		26°		27°		28°		29°		LAT.
H.A.	Alt.	Az.	Alt.	Az.	Alt.	Az.	Alt.	Az.	Alt.	Az.	H.A.
°	° ′ d	°	° ′ d	°	° ′ d	°	° ′ d	°	° ′ d	°	°
45	23 02−43	136	22 18−43	137	21 35−44	137	20 51−45	137	20 07−45	137	315
46	22 24 42	136	21 41 43	136	20 58 44	136	20 15 44	136	19 31 44	137	314
47	21 46 42	135	21 04 43	135	20 21 43	136	19 38 44	136	18 55 44	136	313
48	21 07 41	134	20 25 42	135	19 43 42	135	19 01 43	135	18 19 44	135	312
49	20 28 41	134	19 47 42	134	19 05 42	134	18 24 43	134	17 42 44	135	311
50	19 49−41	133	19 08−41	133	18 27−42	133	17 46−43	134	17 04−43	134	310
51	19 09 40	132	18 28 40	133	17 48 41	133	17 07 42	133	16 26 42	133	309
52	18 29 40	132	17 49 40	132	17 09 41	132	16 28 41	132	15 48 42	133	308
53	17 48 39	131	17 08 39	131	16 29 40	132	15 49 41	132	15 09 41	132	307
54	17 07 39	130	16 28 39	131	15 49 40	131	15 10 41	131	14 30 41	131	306
55	16 25−38	130	15 47−39	130	15 08−39	130	14 30−40	131	13 51−41	131	305
56	15 44 38	129	15 06 38	130	14 28 39	130	13 49 39	130	13 11 40	130	304
57	15 02 37	129	14 24 38	129	13 46 38	129	13 09 39	129	12 31 40	129	303
58	14 19 36	128	13 42 37	128	13 05 38	129	12 28 39	129	11 50 39	129	302
59	13 36 36	128	13 00 37	128	12 23 37	128	11 46 38	128	11 10 39	128	301
60	12 53−35	127	12 17−36	127	11 41−37	127	11 05−38	128	10 28−38	128	300
61	12 10 35	126	11 34 35	127	10 59 37	127	10 23−37	127	...		299
62	11 26 34	126	10 51 35	126	10 16−36	126	...		...		298
63	10 42−34	125	10 08−35	126	...		...		...		297
64	...		...		...		...		...		296
65	...		...		...		...		...		295

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

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.	25°			26°			27°			28°			29°			LAT.
H.A.	Alt.	d	Az.	Alt.	d	Az.	Alt.	d	Az.	Alt.	d	Az.	Alt.	d	Az.	H.A.
°	° ′	d	°	° ′	d	°	° ′	d	°	° ′	d	°	° ′	d		°
0	...			...			...			...			...			360
1	...			...			...			...			...			359
2	...			...			...			...			...			358
3	...			...			...			...			...			357
4	...			...			...			...			...			356
5	...			...			...			...			...			355
6	...			...			...			...			...			354
7	...			...			...			...			...			353
8	...			...			...			...			...			352
9	...			...			...			...			...			351
10	...			...			...			...			...			350
11	79 55	−12	76	...			...			...			...			349
12	79 02	11	77	79 13	−5	82	79 19	0	87	79 19	+6	93	79 14	+11	98	348
13	78 09	9	77	78 20	5	82	78 25	+1	87	78 26	6	92	78 21	11	97	347
14	77 16	8	78	77 26	3	82	77 32	1	87	77 33	6	91	77 29	11	96	346
15	76 23	−8	78	76 33	−3	82	76 39	+1	87	76 40	+6	91	76 37	+11	95	345
16	75 30	7	79	75 40	3	82	75 45	2	86	75 47	6	90	75 45	10	94	344
17	74 36	5	79	74 46	2	82	74 52	2	86	74 54	6	90	74 52	11	94	343
18	73 43	5	79	73 53	2	82	73 59	2	86	74 01	7	89	74 00	10	93	342
19	72 50	5	79	72 59	−1	82	73 05	3	86	73 08	7	89	73 08	10	92	341
20	71 56	−3	79	72 06	0	82	72 12	+3	85	72 15	+7	89	72 15	+10	92	340
21	71 03	3	79	71 12	+1	82	71 19	3	85	71 22	7	88	71 23	10	91	339
22	70 09	2	79	70 19	1	82	70 26	3	85	70 29	7	88	70 30	10	91	338
23	69 16	2	79	69 26	1	82	69 32	5	85	69 37	7	87	69 38	10	90	337
24	68 22	1	79	68 32	2	82	68 39	5	84	68 44	7	87	68 45	11	90	336
25	67 29	−1	79	67 39	+2	82	67 46	+5	84	67 51	+7	87	67 53	+10	89	335
26	66 36	−1	79	66 45	3	82	66 53	5	84	66 58	8	86	67 00	11	89	334
27	65 42	0	79	65 52	3	82	66 00	5	84	66 05	8	86	66 08	10	88	333
28	64 49	0	79	64 59	3	81	65 07	5	84	65 12	8	86	65 16	10	88	332
29	63 55	+2	79	64 05	4	81	64 14	5	83	64 19	9	85	64 23	11	87	331
30	63 02	+2	79	63 12	+4	81	63 20	+7	83	63 27	+8	85	63 31	+11	87	330
31	62 09	2	79	62 19	4	81	62 27	7	83	62 34	9	85	62 38	11	87	329
32	61 15	3	79	61 26	4	81	61 34	7	83	61 41	9	84	61 46	11	86	328
33	60 22	3	79	60 33	4	81	60 41	7	82	60 48	10	84	60 54	11	86	327
34	59 28	4	79	59 39	6	80	59 48	8	82	59 56	9	84	60 01	12	86	326
35	58 35	+4	79	58 46	+6	80	58 56	+7	82	59 03	+10	84	59 09	+12	85	325
36	57 42	4	78	57 53	6	80	58 03	8	82	58 11	9	83	58 17	12	85	324
37	56 49	4	78	57 00	6	80	57 10	8	81	57 18	10	83	57 25	12	84	323
38	55 55	5	78	56 07	7	80	56 17	8	81	56 25	11	83	56 32	13	84	322
39	55 02	5	78	55 14	7	79	55 24	9	81	55 33	11	82	55 40	13	84	321
40	54 09	+6	78	54 21	+7	79	54 31	+10	81	54 41	+10	82	54 48	+13	83	320
41	53 16	6	78	53 28	8	79	53 39	9	80	53 48	11	82	53 56	13	83	319
42	52 23	6	78	52 35	8	79	52 46	10	80	52 56	11	81	53 04	13	83	318
43	51 30	6	77	51 42	9	79	51 53	10	80	52 03	12	81	52 12	13	82	317
44	50 37	7	77	50 49	9	78	51 01	10	80	51 11	12	81	51 20	13	82	316
45	49 44	+7	77	49 57	+9	78	50 08	+11	79	50 19	+12	81	50 28	+14	82	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.	25°			26°			27°			28°			29°			LAT.
L.A.	Alt.		Az.	Alt.		Az.	Alt.		Az.	Alt.		Az.	Alt.		Az.	H.A.
°	° ′	d	°	° ′	d	°	° ′	d	°	° ′	d	°	° ′	d	°	°
45	49 44	+7	77	49 57	+9	78	50 08	+11	79	50 19	+12	81	50 28	+14	82	315
46	48 51	8	77	49 04	9	78	49 16	11	79	49 27	12	80	49 36	14	81	314
47	47 58	8	77	48 11	10	78	48 23	11	79	48 34	13	80	48 44	14	81	313
48	47 05	8	76	47 19	9	78	47 31	11	79	47 42	13	80	47 53	14	81	312
49	46 12	9	76	46 26	10	77	46 39	11	78	46 50	13	79	47 01	14	80	311
50	45 19	+9	76	45 33	+11	77	45 46	+12	78	45 58	+14	79	46 09	+15	80	310
51	44 27	9	76	44 41	11	77	44 54	12	78	45 06	14	79	45 17	15	80	309
52	43 34	10	76	43 48	12	77	44 02	12	78	44 14	14	78	44 26	15	79	308
53	42 41	10	75	42 56	11	76	43 10	13	77	43 23	14	78	43 34	16	79	307
54	41 49	10	75	42 04	11	76	42 18	13	77	42 31	14	78	42 43	16	79	306
55	40 56	+11	75	41 11	+12	76	41 26	+13	77	41 39	+15	78	41 51	+16	78	305
56	40 04	11	75	40 19	13	76	40 34	13	76	40 47	15	77	41 00	16	78	304
57	39 11	12	75	39 27	13	75	39 42	14	76	39 56	15	77	40 09	16	78	303
58	38 19	12	74	38 35	13	75	38 50	14	76	39 04	16	77	39 18	16	77	302
59	37 27	12	74	37 43	13	75	37 58	15	76	38 13	15	76	38 26	17	77	301
60	36 35	+12	74	36 51	+13	75	37 06	+15	75	37 21	+16	76	37 35	+18	77	300
61	35 42	13	74	35 59	14	74	36 15	15	75	36 30	16	76	36 44	18	76	299
62	34 50	13	73	35 07	14	74	35 23	16	75	35 39	16	75	35 53	18	76	298
63	33 58	14	73	34 15	15	74	34 32	15	74	34 47	17	75	35 02	19	76	297
64	33 06	14	73	33 24	14	74	33 40	16	74	33 56	17	75	34 12	18	75	296
65	32 14	+14	73	32 32	+15	73	32 49	+16	74	33 05	+18	74	33 21	+19	75	295
66	31 23	14	72	31 40	16	73	31 58	16	74	32 14	18	74	32 30	19	75	294
67	30 31	15	72	30 49	16	73	31 06	17	73	31 23	18	74	31 40	19	74	293
68	29 39	15	72	29 57	17	72	30 15	18	73	30 33	18	74	30 49	20	74	292
69	28 48	15	72	29 06	17	72	29 24	18	73	29 42	19	73	29 59	20	74	291
70	27 56	+16	71	28 15	+17	72	28 33	+18	72	28 51	+19	73	29 09	+20	73	290
71	27 05	16	71	27 24	17	72	27 43	18	72	28 01	19	73	28 18	21	73	289
72	26 13	17	71	26 33	17	71	26 52	18	72	27 10	20	72	27 28	21	73	288
73	25 22	17	71	25 42	18	71	26 01	19	71	26 20	20	72	26 38	21	72	287
74	24 31	17	70	24 51	18	71	25 11	19	71	25 30	20	72	25 48	22	72	286
75	23 40	+17	70	24 00	+19	70	24 20	+20	71	24 40	+20	71	24 59	+21	72	285
76	22 49	18	70	23 09	19	70	23 30	20	70	23 50	20	71	24 09	22	71	284
77	21 58	18	69	22 19	19	70	22 39	21	70	23 00	21	71	23 19	23	71	283
78	21 07	19	69	21 28	20	69	21 49	21	70	22 10	21	70	22 30	22	71	282
79	20 17	18	69	20 38	20	69	20 59	21	69	21 20	22	70	21 41	22	70	281
80	19 26	+19	68	19 48	+20	69	20 09	+21	69	20 30	+23	69	20 51	+23	70	280
81	18 36	19	68	18 58	20	68	19 20	21	69	19 41	22	69	20 02	24	69	279
82	17 45	20	68	18 08	21	68	18 30	22	68	18 52	22	69	19 13	24	69	278
83	16 55	20	68	17 18	21	68	17 40	22	68	18 02	24	68	18 24	24	69	277
84	16 05	21	67	16 28	22	67	16 51	22	68	17 13	24	68	17 36	24	68	276
85	15 15	+21	67	15 39	+21	67	16 02	+22	67	16 24	+24	68	16 47	+25	68	275
86	14 25	22	67	14 49	22	67	15 12	24	67	15 36	24	67	15 59	25	68	274
87	13 36	21	66	14 00	22	66	14 24	23	67	14 47	24	67	15 10	26	67	273
88	12 46	22	66	13 11	23	66	13 35	24	66	13 59	24	67	14 22	26	67	272
89	11 57	22	66	12 22	23	66	12 46	24	66	13 10	25	66	13 34	26	66	271
90	11 08	+23	65	11 33	+23	65	11 58	+24	66	12 22	+26	66	12 46	+27	66	270

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.	25°		26°		27°		28°		29°		LAT.
H.A.	Alt.	Az.	Alt.	Az.	Alt.	Az.	Alt.	Az.	Alt.	Az.	H.A.
°	° ′ d	°	° ′ d	°	° ′ d	°	° ′ d	°	° ′ d	°	°
90	11 08+23	65	11 33+23	65	11 58+24	66	12 22+26	66	12 46+27	66	270
91	10 19+23	65	10 44+24	65	11 09 25	65	11 34 26	65	11 59 27	66	269
92	...		...		10 21+25	65	10 46+26	65	11 11 27	65	268
93	...		...		...		...		10 24+28	65	267
94	...		...		...		...		...		266
95	...		...		...		...		...		265

LAT.	25°		26°		27°		28°		29°		LAT.
H.A.	Alt.	Az.	Alt.	Az.	Alt.	Az.	Alt.	Az.	Alt.	Az.	H.A.
°	° ′ d	°	° ′ d	°	° ′ d	°	° ′ d	°	° ′ d	°	°
45	22 19−43	137	21 35−44	137	20 51−45	138	20 06−44	138	19 22−45	138	315
46	21 42 43	136	20 58 43	137	20 14 43	137	19 31 45	137	18 47 45	137	314
47	21 04 42	136	20 21 43	136	19 38 44	136	18 54 43	136	18 11 44	137	313
48	20 26 42	135	19 43 42	135	19 01 43	136	18 18 43	136	17 35 44	136	312
49	19 47 41	134	19 05 41	135	18 23 42	135	17 41 43	135	16 58 43	135	311
50	19 08−40	134	18 27−41	134	17 45−42	134	17 03−42	134	16 21−43	135	310
51	18 29 40	133	17 48 41	133	17 07 42	134	16 25 41	134	15 44 43	134	309
52	17 49 40	132	17 09 41	133	16 28 41	133	15 47 41	133	15 06 42	133	308
53	17 09 39	132	16 29 40	132	15 49 41	132	15 08 41	133	14 28 42	133	307
54	16 28 38	131	15 49 39	131	15 09 40	132	14 29 40	132	13 49 41	132	306
55	15 47−38	131	15 08−38	131	14 29−39	131	13 50−40	131	13 10−40	131	305
56	15 06 37	130	14 28 39	130	13 49 39	130	13 10 39	131	12 31 40	131	304
57	14 25 38	130	13 46 37	130	13 08 38	130	12 30 39	130	11 51 39	130	303
58	13 43 37	129	13 05 37	129	12 27 38	129	11 49 38	129	11 11 39	130	302
59	13 00 36	128	12 23 37	129	11 46 38	129	11 08 38	129	10 31−39	129	301
60	12 18−36	128	11 41−36	128	11 04−37	128	10 27−37	128	...		300
61	11 35 35	127	10 59 36	127	10 22−36	128	...		...		299
62	10 52 35	127	10 16−35	127	...		...		...		298
63	10 08−34	126	...		...		...		...		297
64	...		...		...		...		...		296
65	...		...		...		...		...		295

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. 9

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

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.	25°			26°			27°			28°			29°			LAT.
H.A.	Alt.	d	Az.	Alt.	d	Az.	Alt.	d	Az.	Alt.	d	Az.	Alt.	d	Az.	H.A.
°	° ′		°	° ′		°	° ′		°	° ′		°	° ′		°	°
0	...			...			...			...			...			360
1	...			...			...			...			...			359
2	...			...			...			...			...			358
3	...			...			...			...			...			357
4	...			...			...			...			...			356
5	...			...			...			...			...			355
6	...			...			...			...			...			354
7	...			...			...			...			...			353
8	...			...			...			...			...			352
9	...			...			...			...			...			351
10	...			...			...			...			...			350
11	79 43	−18	71	80 00	−12	76	...			...			...			349
12	78 51	15	72	79 08	11	77	79 19	−5	82	79 25	0	87	79 25	+6	93	348
13	78 00	15	73	78 15	9	77	78 26	5	82	78 32	0	87	78 32	6	92	347
14	77 08	13	73	77 23	9	78	77 33	4	82	77 39	+1	87	77 40	6	91	346
15	76 15	−11	74	76 30	−8	78	76 40	−3	82	76 46	+2	86	76 48	+6	91	345
16	75 23	10	75	75 37	6	78	75 47	2	82	75 53	2	86	75 55	6	90	344
17	74 31	10	75	74 44	5	79	74 54	2	82	75 00	3	86	75 03	6	90	343
18	73 38	8	75	73 51	4	79	74 01	−1	82	74 08	2	86	74 10	7	89	342
19	72 45	7	76	72 58	4	79	73 08	0	82	73 15	3	86	73 18	6	89	341
20	71 53	−7	76	72 06	−4	79	72 15	0	82	72 22	+3	85	72 25	+7	88	340
21	71 00	6	76	71 13	3	79	71 22	+1	82	71 29	4	85	71 33	7	88	339
22	70 07	5	76	70 20	3	79	70 29	1	82	70 36	4	85	70 40	7	88	338
23	69 14	4	77	69 27	2	79	69 37	1	82	69 44	4	85	69 48	7	87	337
24	68 21	4	77	68 34	1	79	68 44	1	82	68 51	5	84	68 56	7	87	336
25	67 28	−3	77	67 41	−1	79	67 51	+2	82	67 58	+5	84	68 03	+8	87	335
26	66 35	2	77	66 48	0	79	66 58	2	81	67 06	5	84	67 11	8	86	334
27	65 42	2	77	65 55	0	79	66 05	3	81	66 13	5	84	66 18	9	86	333
28	64 49	1	77	65 02	+1	79	65 12	4	81	65 20	6	83	65 26	9	86	332
29	63 57	1	77	64 09	1	79	64 19	4	81	64 28	6	83	64 34	8	85	331
30	63 04	−1	77	63 16	+2	79	63 27	+4	81	63 35	+7	83	63 42	+8	85	330
31	62 11	0	77	62 23	3	79	62 34	4	81	62 43	6	83	62 49	9	85	329
32	61 18	0	77	61 30	3	79	61 41	5	80	61 50	7	82	61 57	9	84	328
33	60 25	+1	77	60 37	4	79	60 48	6	80	60 58	7	82	61 05	9	84	327
34	59 32	1	77	59 45	3	78	59 56	5	80	60 05	8	82	60 13	10	84	326
35	58 39	+2	77	58 52	+4	78	59 03	+6	80	59 13	+8	82	59 21	+10	83	325
36	57 46	2	77	57 59	4	78	58 11	6	80	58 20	9	81	58 29	10	83	324
37	56 53	3	77	57 06	5	78	57 18	7	80	57 28	9	81	57 37	10	83	323
38	56 00	4	76	56 14	5	78	56 25	7	79	56 36	9	81	56 45	10	82	322
39	55 07	4	76	55 21	5	78	55 33	7	79	55 44	9	81	55 53	11	82	321
40	54 15	+4	76	54 28	+6	78	54 41	+7	79	54 51	+10	80	55 01	+11	82	320
41	53 22	4	76	53 36	6	77	53 48	8	79	53 59	10	80	54 09	11	81	319
42	52 29	5	76	52 43	7	77	52 56	8	78	53 07	10	80	53 17	12	81	318
43	51 36	6	76	51 51	6	77	52 03	9	78	52 15	10	80	52 25	12	81	317
44	50 44	5	76	50 58	7	77	51 11	9	78	51 23	10	79	51 33	13	80	316
45	49 51	+6	75	50 06	+7	77	50 19	+9	78	50 31	+11	79	50 42	+12	80	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.	25°			26°			27°			28°			29°			LAT.
H.A.	Alt.	d	Az.	Alt.	d	Az.	Alt.	d	Az.	Alt.	d	Az.	Alt.	d	Az.	H.A.
°	° ′		°	° ′		°	° ′		°	° ′		°	° ′		°	°
45	49 51	+6	75	50 06	+7	77	50 19	+9	78	50 31	+11	79	50 42	+12	80	315
46	48 59	6	75	49 13	8	76	49 27	9	78	49 39	11	79	49 50	13	80	314
47	48 06	7	75	48 21	8	76	48 34	10	77	48 47	11	78	48 58	13	80	313
48	47 13	8	75	47 28	9	76	47 42	11	77	47 55	12	78	48 07	13	79	312
49	46 21	8	75	46 36	9	76	46 50	11	77	47 03	12	78	47 15	14	79	311
50	45 28	+8	75	45 44	+9	76	45 58	+11	77	46 12	+12	78	46 24	+14	79	310
51	44 36	8	74	44 52	9	75	45 06	11	76	45 20	12	77	45 32	14	78	309
52	43 44	8	74	44 00	10	75	44 14	12	76	44 28	13	77	44 41	14	78	308
53	42 51	10	74	43 07	11	75	43 23	11	76	43 37	13	77	43 50	14	78	307
54	41 59	10	74	42 15	11	75	42 31	12	76	42 45	14	77	42 59	14	77	306
55	41 07	+10	74	41 23	+12	75	41 39	+12	75	41 54	+13	76	42 07	+16	77	305
56	40 15	10	74	40 32	11	74	40 47	13	75	41 02	14	76	41 16	16	77	304
57	39 23	10	73	39 40	11	74	39 56	13	75	40 11	14	76	40 25	16	77	303
58	38 31	11	73	38 48	12	74	39 04	14	75	39 20	14	75	39 34	16	76	302
59	37 39	11	73	37 56	13	74	38 13	13	74	38 28	15	75	38 43	17	76	301
60	36 47	+12	73	37 04	+13	73	37 21	+14	74	37 37	+16	75	37 53	+16	76	300
61	35 55	12	72	36 13	13	73	36 30	14	74	36 46	16	75	37 02	17	75	299
62	35 03	13	72	35 21	14	73	35 39	14	74	35 55	16	74	36 11	17	75	298
63	34 12	12	72	34 30	14	73	34 47	15	73	35 04	17	74	35 21	17	75	297
64	33 20	13	72	33 38	15	72	33 56	16	73	34 13	17	74	34 30	18	74	296
65	32 28	+14	72	32 47	+15	72	33 05	+16	73	33 23	+17	73	33 40	+18	74	295
66	31 37	14	71	31 56	15	72	32 14	16	72	32 32	17	73	32 49	19	74	294
67	30 46	14	71	31 05	15	72	31 23	17	72	31 41	18	73	31 59	19	73	293
68	29 54	15	71	30 14	15	71	30 33	16	72	30 51	18	72	31 09	19	73	292
69	29 03	15	71	29 23	16	71	29 42	17	72	30 01	18	72	30 19	19	73	291
70	28 12	+15	70	28 32	+16	71	28 51	+18	71	29 10	+19	72	29 29	+19	72	290
71	27 21	15	70	27 41	17	70	28 01	17	71	28 20	19	71	28 39	20	72	289
72	26 30	16	70	26 50	17	70	27 10	18	71	27 30	19	71	27 49	20	72	288
73	25 39	16	69	26 00	17	70	26 20	18	70	26 40	19	71	26 59	21	71	287
74	24 48	17	69	25 09	18	70	25 30	18	70	25 50	20	71	26 10	20	71	286
75	23 57	+17	69	24 19	+18	69	24 40	+19	70	25 00	+20	70	25 20	+21	71	285
76	23 07	17	69	23 28	19	69	23 50	19	69	24 10	21	70	24 31	21	70	284
77	22 16	18	68	22 38	19	69	23 00	19	69	23 21	21	70	23 42	21	70	283
78	21 26	18	68	21 48	19	68	22 10	20	69	22 31	21	69	22 52	22	70	282
79	20 35	19	68	20 58	19	68	21 20	21	68	21 42	21	69	22 03	23	69	281
80	19 45	+19	67	20 08	+20	68	20 30	+21	68	20 53	+21	68	21 14	+23	69	280
81	18 55	19	67	19 18	20	67	19 41	21	68	20 03	23	68	20 26	23	68	279
82	18 05	20	67	18 29	20	67	18 52	21	67	19 14	23	68	19 37	23	68	278
83	17 15	20	67	17 39	21	67	18 02	22	67	18 26	22	67	18 48	24	68	277
84	16 26	20	66	16 50	21	67	17 13	23	67	17 37	23	67	18 00	24	67	276
85	15 36	+21	66	16 00	+22	66	16 24	+23	66	16 48	+24	67	17 12	+24	67	275
86	14 47	21	66	15 11	22	66	15 36	23	66	16 00	24	66	16 24	24	67	274
87	13 57	22	65	14 22	23	66	14 47	23	66	15 11	25	66	15 36	25	66	273
88	13 08	22	65	13 34	22	65	13 59	23	65	14 23	25	66	14 48	25	66	272
89	12 19	23	65	12 45	23	65	13 10	24	65	13 35	25	65	14 00	26	65	271
90	11 31	+22	64	11 56	+24	64	12 22	+24	65	12 48	+25	65	13 13	+26	65	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.	25°		26°		27°		28°		29°		LAT.
H.A.	Alt.	Az.	Alt.	Az.	Alt.	Az.	Alt.	Az.	Alt.	Az.	H.A.
°	° ′ d	°	° ′ d	°	° ′ d	°	° ′ d	°	° ′ d	°	°
90	11 31+22	64	11 56+24	64	12 22+24	65	12 48+25	65	13 13+26	65	270
91	10 42+23	64	11 08 24	64	11 34 25	64	12 00 26	64	12 26 26	65	269
92	...		10 20+24	64	10 46+25	64	11 12 26	64	11 38 27	64	268
93	...		...		...		10 25+27	64	10 52 27	64	267
94	...		...		...		...		10 05+27	63	266
95	...		...		...		...		...		265

LAT.	25°		26°		27°		28°		29°		LAT.
H.A.	Alt.	Az.	Alt.	Az.	Alt.	Az.	Alt.	Az.	Alt.	Az.	H.A.
°	° ′ d	°	° ′ d	°	° ′ d	°	° ′ d	°	° ′ d	°	°
45	21 36−44	138	20 51−44	138	20 06−44	138	19 22−45	139	18 37−46	139	315
46	20 59 43	137	20 15 44	137	19 31 44	138	18 46 44	138	18 02 45	138	314
47	20 22 43	136	19 38 43	137	18 54 43	137	18 11 44	137	17 27 45	137	313
48	19 44 42	136	19 01 42	136	18 18 43	136	17 35 44	137	16 51 44	137	312
49	19 06 41	135	18 24 42	135	17 41 43	136	16 58 43	136	16 15 44	136	311
50	18 28−41	135	17 46−42	135	17 03−42	135	16 21−43	135	15 38−43	135	310
51	17 49 41	134	17 07 41	134	16 25 41	134	15 44 43	135	15 01 42	135	309
52	17 09 39	133	16 28 40	134	15 47 41	134	15 06 42	134	14 24 42	134	308
53	16 30 40	133	15 49 40	133	15 08 40	133	14 27 41	133	13 46 41	133	307
54	15 50 39	132	15 10 40	132	14 29 40	132	13 49 41	133	13 08 41	133	306
55	15 09−38	131	14 30−39	132	13 50−40	132	13 10−40	132	12 30−41	132	305
56	14 29 38	131	13 49 38	131	13 10 39	131	12 31 40	131	11 51 40	132	304
57	13 47 37	130	13 09 38	131	12 30 39	131	11 51 39	131	11 12 40	131	303
58	13 06 37	130	12 28 38	130	11 49 38	130	11 11 39	130	10 32−39	130	302
59	12 24 36	129	11 46 36	129	11 08 37	130	10 30−38	130	...		301
60	11 42−36	129	11 05−37	129	10 27−37	129	...		...		300
61	11 00 35	128	10 23−36	128	...		...		...		299
62	10 17−35	128	...		...		...		...		298
63	...		...		...		...		...		297
64	...		...		...		...		...		296
65	...		...		...		...		...		295

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

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'·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 other 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.64° to N.64°.

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 thirteen 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 azimnth 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 June 30, local date, about two hours after sunset, in dead reckoning position latitude 28° 17′ N., longitude 125° 20′ W., star number 21 (Spica) was observed to obtain a position line. Corrected sextant reading 39° 17′: G.M.T. of observation $05^h\ 18^m\ 14^s$.

From Table IV, page 92:

Long. 120° W. (approx.)

Approx.	Hrs.	Date
L.M.T.	2100	June 30
G.M.T.	0500	July 1

From *Air Almanac*, 1940 July 1:

		°	′
G.H.A. ♈	($05^h\ 10^m$) .	356	36
Increment	($8^m\ 14^s$) .	2	04
S.H.A.	(No. 21) .	159	29
G.H.A. of star	. .	518	09
Long. of ass. position	.	−125	09
		393	00
		−360	

From page 82:

Lat. of ass. position 28° NORTH

Star No. 21 — H.A. 33°

	°	′
Tab. Alt. . . .	39	43
Correction . . .		—
Corr. Tab. Alt. . .	39	43
Corr. Sext. Rdg. . .	39	17
Intercept . . .	26′ *away*	

No correction for date is necessary in 1940.

Tab. Az. 136°

Assumed position: Lat. 28° N., Long. 125° 09′ W.

From Table III, page 90: True Az. 224° T.

Example 2.—On 1950 August 17, Greenwich date, in dead reckoning position latitude 25° 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 31° 28′.

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

From page 17:

Lat. of ass. position 26° SOUTH

Star No. 4 — H.A. 22°

	°	′
Tab. Alt. . . .	31	20
Correction (Table I) .	−	3
Corr. Tab. Alt. . .	31	17
Corr. Sext. Rdg. . .	31	28
Intercept . . .	11′ *towards*	

t . . −18

Year . 1950

Tab. Az. 157°

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

From Table III, page 91: True Az. 337° T.

Example 3.—On 1940 July 1, local date, at approximate local noon, in dead reckoning position latitude 28° 40′ S., longitude 49° 47′ W., the Sun was observed to obtain a position line. Corrected sextant reading 38° 08′; G.M.T. of observation $15^h\ 11^m\ 27^s$.

From Table IV, page 92:

Long. 45° W. (approx.)

	Hrs.	Date
Approx. L.M.T.	1200	July 1
G.M.T.	1500	July 1

From *Air Almanac*, 1940 July 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		− 49	57
		− 3	00
		+360	

From page 189:

Lat. of ass. position 29° S. Dec. 23° 06′ N. CONTRARY name H.A. 357°

Tab. Alt.	37°	56′	*d* −60	Tab. Az. 176°
Correction (Table XV)	−	6	Minutes of dec. 06	
Corr. Tab. Alt.	37	50		
Corr. Sext. Rdg.	38	08		
Intercept	18′ *towards*			

Assumed position: Lat. 29° S. Long. 49° 57′ W.

From Table III, page 91: True Az. 004° 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. northwards), and the position line drawn as a parallel of latitude. There is then no necessity to take out the tabulated azimuth.

Example 4.—On 1940 July 2, local date, shortly before sunrise, in dead reckoning position latitude 24° 38′ N., longitude 147° 58′ E., Jupiter was observed to obtain a position line. Corrected sextant reading 47° 46′; G.M.T. of observation $19^h\ 08^m\ 17^s$.

From Table IV, page 93:

Long. 150° E. (approx.)

	Hrs.	Date
Approx. L.M.T.	0500	July 2
G.M.T.	*1900*	*July 1*

From *Air Almanac*, 1940 July 1:

		°	′
G.H.A.	(19^h)	167	12
Increment	($08^m\ 17^s$)	2	05
G.H.A. of Jupiter		169	17
Long. of ass. position		+147	43

From page 146:

Lat. of ass. position 25° N. Dec. 13° 35′ N. SAME name H.A. 317°

Tab. Alt.	47°	49′	*d* +23	Tab. Az. 98°
Correction (Table XV)	+	13	Minutes of dec. 35	
Corr. Tab. Alt.	48	02		
Corr. Sext. Rdg.	47	46		
Intercept	16′ *away*			

Assumed position: Lat. 25° N. Long. 147° 43′ E.

From Table III, page 90: True Az. 098° T.

IVa.—CHANGE OF SEXTANT READING WITH TIME

Due to motion of body observed

True Azimuth of body	Latitude 25°	27°	29°	True Azimuth of body
°	′	′	′	°
090	+41	+40	+39	090
095	41	40	39	085
100	40	39	39	080
105	39	39	38	075
110	38	38	37	070
115	37	36	36	065
120	+35	+35	+34	060
125	33	33	32	055
130	31	31	30	050
135	29	28	28	045
140	26	26	25	040
145	23	23	23	035
150	+20	+20	+20	030
155	17	17	17	025
160	14	14	13	020
165	11	10	10	015
170	7	7	7	010
175	+4	+3	+3	005
180	0	0	0	000
185	−4	−3	−3	355
190	7	7	7	350
195	11	10	10	345
200	14	14	13	340
205	17	17	17	335
210	−20	−20	−20	330
215	23	23	23	325
220	26	26	25	320
225	29	28	28	315
230	31	31	30	310
235	33	33	32	305
240	−35	−35	−34	300
245	37	36	36	295
250	38	38	37	290
255	39	39	38	285
260	40	39	39	280
265	41	40	39	275
270	−41	−40	−39	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.

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V.—DIFFERENCE BETWEEN RHUMB LINE AND GREAT CIRCLE DISTANCES

N. 25°-29° **S. 25°-29°**

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	5	9	13	19	26	35	46	60	75	94	115	140	169	201	238	S. 60
55	0	1	2	4	7	11	16	23	31	41	53	67	84	104	128	155	186	222	55
50	0	1	2	3	6	9	13	19	26	35	46	60	75	94	116	142	171	205	50
45	0	1	1	3	5	7	11	16	23	31	41	53	67	85	105	128	156	188	45
40	0	0	1	2	4	6	9	14	20	27	36	47	60	75	94	116	141	170	40
N. 35	0	0	1	2	3	5	8	12	17	23	31	41	53	67	84	103	126	153	S. 35
30	0	0	1	1	2	4	7	10	15	20	27	36	46	59	74	91	111	135	30
25	0	0	0	1	2	4	6	9	12	17	23	31	40	51	64	79	97	118	25
20	0	0	0	1	2	3	5	8	11	15	20	27	34	44	55	68	83	102	20
15	0	0	0	1	2	3	4	6	9	13	17	22	29	37	46	57	70	86	15
N. 10	0	0	0	1	1	2	4	5	8	11	14	19	24	30	38	47	58	70	S. 10
N. 5	0	0	0	1	1	2	3	4	6	9	11	15	19	24	30	37	46	56	S. 5
0	0	0	0	1	1	2	2	4	5	7	9	12	15	19	23	29	35	43	0
S. 5	0	0	0	0	1	1	2	3	4	5	7	9	11	14	17	21	26	32	N. 5
10	0	0	0	0	1	1	1	2	3	4	5	6	8	10	12	15	18	22	10
S. 15	0	0	0	0	0	1	1	1	2	3	3	4	6	7	8	10	12	15	N. 15
20	0	0	0	0	0	1	1	1	2	2	3	3	4	5	6	7	9	11	20
25	0	0	0	0	0	1	1	1	2	2	2	3	4	5	6	7	8	9	25
30	0	0	0	0	1	1	1	1	2	3	3	4	5	6	7	9	10	12	30
35	0	0	0	1	1	1	2	2	3	4	5	6	8	9	11	13	16	18	35
S. 40	0	0	0	1	1	2	3	4	5	6	8	10	12	15	18	21	25	30	N. 40
45	0	0	1	1	2	3	4	6	8	10	12	15	19	23	27	33	39	46	45
50	0	0	1	2	3	5	7	9	11	15	18	23	28	34	40	48	57	68	50
55	0	1	2	3	5	7	9	13	17	21	26	32	40	48	57	68	81	95	55
S. 60	0	1	2	4	7	10	13	18	23	29	36	45	54	65	78	93	109	128	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 27°, but may be used for any place of departure between latitudes 25° and 29°. 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. 25° and N. 29°, and the one on the right when the place of departure lies between S. 25° and S. 29°.

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 9 miles for a change of 90°.

Example.—Required the difference in distance between the Rhumb Line track and the Great Circle track from Brisbane (Lat. 27° 30′ S., Long. 153° 00′ E.) to Pitcairn I. (Lat. 25° 00′ S., Long. 130° 00′ W.).

Entering the argument column on the right with the *Latitude of Destination* of 25° 00′ S., and interpolating by inspection for the *Change of Longitude* of 77° 00′, it will be seen that the difference in distance is about 70 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
54	359	61	359	70	359
179	000	180	000	180	000
234	001	241	001	250	001
359	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. 25° and N. 29°. 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	1	0	437	21	133	1700	41	520	3810	61	1160	6740	81	2050
2			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	1	0	287	20	87	1120	39	341	2500	58	762	4420	77	1340	6890	96	2100
1	2		317	21	96	1170	40	359	2580	59	788	4540	78	1380	7040	97	2140
4	3	1	349	22	106	1240	41	378	2670	60	815	4650	79	1420	7180	98	2190
9	4	2	382	23	116	1300	42	396	2760	61	843	4770	80	1450	7330	99	2230
15	5	4	417	24	127	1360	43	416	2850	62	871	4900	81	1490	7480	100	2280
22	6	6	453	25	138	1430	44	436	2950	63	900	5020	82	1530	7630	101	2320
31	7	9	491	26	149	1490	45	456	3040	64	929	5140	83	1560	7780	102	2370
42	8	12	531	27	161	1560	46	477	3140	65	958	5270	84	1600	7940	103	2420
54	9	16	571	28	174	1630	47	498	3240	66	988	5390	85	1640	8100	104	2460
68	10	20	614	29	187	1700	48	520	3340	67	1010	5520	86	1680	8250	105	2510
83	11	25	658	30	200	1770	49	542	3440	68	1050	5650	87	1720	8410	106	2560
100	12	30	703	31	214	1850	50	564	3540	69	1080	5780	88	1760	8570	107	2610
118	13	36	750	32	228	1920	51	587	3650	70	1110	5920	89	1800	8730	108	2660
137	14	42	798	33	243	2000	52	611	3750	71	1140	6050	90	1840	8900	109	2710
158	15	48	848	34	258	2080	53	635	3860	72	1170	6190	91	1880	9060	110	2760
181	16	55	900	35	274	2160	54	659	3970	73	1210	6330	92	1920	9230	111	2810
205	17	62	953	36	290	2240	55	684	4080	74	1240	6460	93	1970	9400	112	2860
231	18	70	1000	37	307	2320	56	709	4190	75	1270	6610	94	2010	9560	113	2910
258	19	78	1060	38	324	2410	57	735	4310	76	1310	6750	95	2050	9740	114	2960
287		87	1120		341	2500		762	4420		1340	6890		2100	9910		3020

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

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′			2° 40′			2° 20′		
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
1060	0	325	978	0	298	890	0	271	801	0	244	712	0	217	624	0	190
3230	5	985	2960	5	904	2690	5	822	2430	5	741	2160	5	660	1900	5	579
5430	10	1650	4990	10	1520	4540	10	1380	4100	10	1250	3650	10	1110	3210	10	980
7670	15	2330	7050	15	2140	6430	15	1960	5810	15	1770	5190	15	1580	4570	15	1390
9950	20	3030	9150	20	2790	8350	20	2540	7550	20	2300	6750	20	2050	5960	20	1810
12200	25	3740	11200	25	3440	10300	25	3140	9340	25	2840	8360	25	2540	7390	25	2250
14600	30	4450	13400	30	4100	12300	30	3750	11100	30	3400	10000	30	3050	8850	30	2690
17000	35	5180	15600	35	4780	14300	35	4370	13000	35	3960	11600	35	3560	10300	35	3150
19400	40	5920	17900	40	5460	16400	40	5000	14900	40	4540	13400	40	4080	11900	40	3620
21900	45	6680	20200	45	6160	18500	45	5650	16800	45	5130	15100	45	4620	13400	45	4110
24400	50	7440	22500	50	6870	20600	50	6300	18800	50	5730	16900	50	5170	15100	50	4600
26900	55	8210	24900	55	7590	22800	55	6970	20800	55	6350	18800	55	5730	16700	55	5100
29500	60	9000	27300	60	8320	25100	60	7650	22800	60	6970	20600	60	6309	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	0	99	10	30	183	10	55	267	10	81	351	10	107	435	10	132
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	40	887
1260	45	384	1630	45	497	2000	45	612	2380	45	727	2760	45	841	3130	45	956
1230	50	374	1650	50	502	2060	50	629	2480	50	757	2900	50	885	3320	50	1010
1160	55	352	1620	55	494	2080	55	634	2540	55	776	3010	55	918	3470	55	1050
1050	60	319	1560	60	474	2070	60	629	2570	60	783	3080	60	938	3580	60	1090
899		274	1460		443	2010		611	2560		780	3110		947	3660		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	20	2790
6230	30	1900	7210	30	2190	8180	30	2490	9160	30	2790	10100	30	3090	11100	25	3380
7250	35	2210	8400	35	2560	9550	35	2910	10700	35	3260	11800	30	3610	13000	30	3960
8220	40	2500	9550	40	2910	10800	40	3340	12200	40	3720	13500	35	4120	14800	35	4530
9150	45	2790	10600	45	3250	12100	45	3710	13600	45	4170	15100	40	4620	16700	40	5090
10000	50	3060	11700	50	3570	13400	50	4090	15100	50	4600	16700	45	5120	18400	45	5630
10900	55	3320	12700	55	3890	14600	55	4460	16400	55	5020	18300	50	5590	20200	50	6160
11700	60	3570	13700	60	4190	15800	60	4810	17800	60	5440	19900	55	6060	21900	55	6680
12500		3810	14700		4490	16900		5160	19100		5840	21300	60	6510	23600	60	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′			6° 30′			7° 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
238	1	72	265	1	81	292	1	89	319	1	97	346	1	105	373	1	113
716	2	218	796	2	242	876	2	267	956	2	291	1030	2	316	1110	2	340
1190	3	363	1320	3	404	1450	3	444	1590	3	485	1720	3	526	1860	3	567
1660	4	507	1850	4	564	2040	4	621	2220	4	679	2410	4	736	2600	4	793
2130	5	651	2370	5	725	2610	5	798	2860	5	872	3100	5	945	3340	5	1010
2600	6	795	2900	6	885	3190	6	974	3490	6	1060	3780	6	1150	4080	6	1240
3070	7	938	3420	7	1040	3770	7	1150	4120	7	1250	4470	7	1360	4820	7	1460
3540	8	1080	3940	8	1200	4340	8	1320	4750	8	1440	5150	8	1570	5550	8	1690
4010	9	1220	4460	9	1360	4920	9	1500	5370	9	1630	5830	9	1770	6290	9	1910
4470	10	1360	4980	10	1510	5490	10	1670	6000	10	1830	6510	10	1980	7020	10	2140
5860	15	1780	6530	15	1990	7200	15	2190	7870	15	2390	8540	15	2600	9210	15	2800
8140	20	2480	9070	20	2760	10000	20	3050	10900	20	3330	11800	20	3620	12800	20	3910
10300	25	3160	11500	25	3530	12700	25	3890	14000	25	4260	15200	25	4630	16400	25	5000
12500	30	3830	14000	30	4280	15500	30	4730	16900	30	5180	18400	30	5630	19900	30	6080
14700	35	4490	16400	35	5020	18200	35	5550	19900	35	6080	21700	35	6620	23400	35	7150
16800	40	5140	18800	40	5750	20800	40	6360	22800	40	6980	24900	40	7590	26900	40	8210
18900	45	5780	21200	45	6470	23500	45	7160	25800	45	7860	28000	45	8550	30300	45	9250
21000	50	6400	23500	50	7180	26000	50	7950	28600	50	8730	31100	50	9510	33700	50	10200
23000	55	7020	25800	55	7870	28600	55	8730	31400	55	9590	34200	55	10400	37100	55	11300
25000	60	7620	28000	60	8550	31100	60	9490	34200	60	10400	37300	60	11300	40400	60	12300
26900		8210	30200		9230	33600		10200	36900		11200	40300		12200	43600		13300

Angle of depression

7° 30′			8° 00′			8° 30′			9° 00′			9° 30′			10° 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
399	1	121	427	1	130	454	1	138	481	1	146	508	1	154	535	1	163
1190	2	365	1270	2	390	1360	2	415	1440	2	439	1520	2	464	1600	2	489
1990	3	608	2130	3	649	2260	3	691	2400	3	732	2540	3	774	2670	3	815
2790	4	851	2980	4	909	3170	4	966	3360	4	1020	3550	4	1080	3740	4	1140
3580	5	1090	3830	5	1160	4070	5	1240	4310	5	1310	4560	5	1390	4810	5	1460
4380	6	1330	4670	6	1420	4970	6	1510	5270	6	1600	5570	6	1690	5870	6	1790
5170	7	1570	5520	7	1680	5870	7	1790	6220	7	1890	6580	7	2000	6930	7	2110
5960	8	1810	6360	8	1940	6770	8	2060	7180	8	2180	7580	8	2310	8000	8	2430
6750	9	2050	7210	9	2190	7670	9	2330	8130	9	2470	8590	9	2610	9060	9	2760
7530	10	2290	8050	10	2450	8560	10	2610	9080	10	2760	9600	10	2920	10100	10	3080
9880	15	3010	10500	15	3220	11200	15	3420	11900	15	3630	12600	15	3840	13200	15	4050
13700	20	4200	14700	20	4480	15600	20	4770	16600	20	5060	17500	20	5350	18500	20	5640
17600	25	5370	18800	25	5740	20000	25	6110	21200	25	6480	22500	25	6860	23700	25	7230
21400	30	6530	22900	30	6980	24400	30	7440	25900	30	7890	27400	30	8350	28900	30	8810
25200	35	7680	26900	35	8220	28700	35	8760	30500	35	9290	32200	35	9830	34000	35	10300
28900	40	8820	30900	40	9440	33000	40	10000	35000	40	10600	37000	40	11300	39100	40	11900
32600	45	9950	34900	45	10600	37200	45	11300	39500	45	12000	41800	45	12700	44200	45	13400
36300	50	11000	38800	50	11800	41400	50	12600	44000	50	13400	46600	50	14200	49200	50	15000
39900	55	12100	42700	55	13000	45600	55	13900	48400	55	14700	51300	55	15600	54200	55	16500
43500	60	13200	46600	60	14200	49700	60	15100	52800	60	16100	56000	60	17000	59100	60	18000
47000		14300	50400		15300	53800		16400	57200		17400	60600		18400	64000		19500

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′			6° 30′			7° 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
238	0	72	265	0	81	292	0	89	319	0	97	346	0	105	373	0	
716	1	218	796	1	242	876	1	267	956	1	291	1030	1	316	1110	1	
1190	2	363	1320	2	404	1450	2	444	1590	2	485	1720	2	526	1860	2	
1660	3	507	1850	3	564	2040	3	621	2220	3	679	2410	3	736	2600	3	
2130	4	651	2370	4	725	2610	4	798	2860	4	872	3100	4	945	3340	4	
2600	5	795	2900	5	885	3190	5	974	3490	5	1060	3780	5	1150	4080	5	
3070	6	938	3420	6	1040	3770	6	1150	4120	6	1250	4470	6	1360	4820	6	
3540	7	1080	3940	7	1200	4340	7	1320	4750	7	1440	5150	7	1570	5550	7	
4010	8	1220	4460	8	1360	4920	8	1500	5370	8	1630	5830	8	1770	6290	8	
4470	9	1360	4980	9	1510	5490	9	1670	6000	9	1830	6510	9	1980	7020	9	
5860	10	1780	6530	10	1990	7200	10	2190	7870	10	2390	8540	10	2600	9210	10	
8140	15	2480	9070	15	2760	10000	15	3050	10900	15	3330	11800	15	3620	12800	15	
10300	20	3160	11500	20	3530	12700	20	3890	14000	20	4260	15200	20	4630	16400	20	
12500	25	3830	14000	25	4280	15500	25	4730	16900	25	5180	18400	25	5630	19900	25	
14700	30	4490	16400	30	5020	18200	30	5550	19900	30	6080	21700	30	6620	23400	30	
16800	35	5140	18800	35	5750	20800	35	6360	22800	35	6980	24900	35	7590	26900	35	
18900	40	5780	21200	40	6470	23500	40	7160	25800	40	7860	28000	40	8550	30300	40	
21000	45	6400	23500	45	7180	26000	45	7950	28600	45	8730	31100	45	9510	33700	45	
23000	50	7020	25800	50	7870	28600	50	8730	31400	50	9590	34200	50	10400	37100	50	
25000	55	7620	28000	55	8550	31100	55	9490	34200	55	10400	37300	55	11300	40400	55	
26900	60	8210	30200	60	9230	33600	60	10200	36900	60	11200	40300	60	12200	43600	60	

Angle of depression

7° 30′			8° 00′			8° 30′			9° 00′			9° 30′			10° 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
399	0	121	427	0	130	454	0	138	481	0	146	508	0	154	535	0	
1190	1	365	1270	1	390	1360	1	415	1440	1	439	1520	1	464	1600	1	
1990	2	608	2130	2	649	2260	2	691	2400	2	732	2540	2	774	2670	2	
2790	3	851	2980	3	909	3170	3	966	3360	3	1020	3550	3	1080	3740	3	
3580	4	1090	3830	4	1160	4070	4	1240	4310	4	1310	4560	4	1390	4810	4	
4380	5	1330	4670	5	1420	4970	5	1510	5270	5	1600	5570	5	1690	5870	5	
5170	6	1570	5520	6	1680	5870	6	1790	6220	6	1890	6580	6	2000	6930	6	
5960	7	1810	6360	7	1940	6770	7	2060	7180	7	2180	7580	7	2310	8000	7	
6750	8	2050	7210	8	2190	7670	8	2330	8130	8	2470	8590	8	2610	9060	8	
7530	9	2290	8050	9	2450	8560	9	2610	9080	9	2760	9600	9	2920	10100	9	
9880	10	3010	10500	10	3220	11200	10	3420	11900	10	3630	12600	10	3840	13200	10	
13700	15	4200	14700	15	4480	15600	15	4770	16600	15	5060	17500	15	5350	18500	15	
17600	20	5370	18800	20	5740	20000	20	6110	21200	20	6480	22500	20	6860	23700	20	
21400	25	6530	22900	25	6980	24400	25	7440	25900	25	7890	27400	25	8350	28900	25	
25200	30	7680	26900	30	8220	28700	30	8760	30500	30	9290	32200	30	9830	34000	30	
28900	35	8820	30900	35	9440	33000	35	10000	35000	35	10600	37000	35	11300	39100	35	
32600	40	9950	34900	40	10600	37200	40	11300	39500	40	12000	41800	40	12700	44200	40	
36300	45	11000	38800	45	11800	41400	45	12600	44000	45	13400	46600	45	14200	49200	45	
39900	50	12100	42700	50	13000	45600	50	13900	48400	50	14700	51300	50	15600	54200	50	
43500	55	13200	46600	55	14200	49700	55	15100	52800	55	16100	56000	55	17000	59100	55	
47000	60	14300	50400	60	15300	53800	60	16400	57200	60	17400	60600	60	18400	64000	60	

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

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

m s	° ′
06 37	1 40
42	1 41
45	1 42
50	1 43
53	1 44
06 58	1 45
07 01	1 46
06	1 47
09	1 48
14	1 49
17	1 50
22	1 51
25	1 52
30	1 53
33	1 54
38	1 55
41	1 56
46	1 57
49	1 58
54	1 59
07 57	2 00
08 02	2 01
05	2 02
10	2 03
13	2 04
18	2 05
21	2 06
26	2 07
29	2 08
34	2 09
37	2 10
42	2 11
45	2 12
50	2 13
53	2 14
08 58	2 15
09 01	2 16
06	2 17
09	2 18
14	2 19
17	2 20
22	2 21
25	2 22
30	2 23
33	2 24
38	2 25
41	2 26
46	2 27
49	2 28
54	2 29
09 57	2 30
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	′	m s
0	0 00	60	4 00	120	8 00	180	12 00	240	16 00	300	20 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
2	0 08	62	4 08	122	8 08	182	12 08	242	16 08	302	20 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
4	0 16	64	4 16	124	8 16	184	12 16	244	16 16	304	20 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
6	0 24	66	4 24	126	8 24	186	12 24	246	16 24	306	20 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
8	0 32	68	4 32	128	8 32	188	12 32	248	16 32	308	20 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
10	0 40	70	4 40	130	8 40	190	12 40	250	16 40	310	20 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
12	0 48	72	4 48	132	8 48	192	12 48	252	16 48	312	20 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
14	0 56	74	4 56	134	8 56	194	12 56	254	16 56	314	20 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
16	1 04	76	5 04	136	9 04	196	13 04	256	17 04	316	21 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
18	1 12	78	5 12	138	9 12	198	13 12	258	17 12	318	21 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
20	1 20	80	5 20	140	9 20	200	13 20	260	17 20	320	21 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
22	1 28	82	5 28	142	9 28	202	13 28	262	17 28	322	21 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
24	1 36	84	5 36	144	9 36	204	13 36	264	17 36	324	21 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
26	1 44	86	5 44	146	9 44	206	13 44	266	17 44	326	21 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
28	1 52	88	5 52	148	9 52	208	13 52	268	17 52	328	21 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
30	2 00	90	6 00	150	10 00	210	14 00	270	18 00	330	22 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
32	2 08	92	6 08	152	10 08	212	14 08	272	18 08	332	22 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
34	2 16	94	6 16	154	10 16	214	14 16	274	18 16	334	22 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
36	2 24	96	6 24	156	10 24	216	14 24	276	18 24	336	22 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
38	2 32	98	6 32	158	10 32	218	14 32	278	18 32	338	22 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
40	2 40	100	6 40	160	10 40	220	14 40	280	18 40	340	22 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
42	2 48	102	6 48	162	10 48	222	14 48	282	18 48	342	22 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
44	2 56	104	6 56	164	10 56	224	14 56	284	18 56	344	22 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
46	3 04	106	7 04	166	11 04	226	15 04	286	19 04	346	23 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
48	3 12	108	7 12	168	11 12	228	15 12	288	19 12	348	23 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
50	3 20	110	7 20	170	11 20	230	15 20	290	19 20	350	23 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
52	3 28	112	7 28	172	11 28	232	15 28	292	19 28	352	23 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
54	3 36	114	7 36	174	11 36	234	15 36	294	19 36	354	23 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
56	3 44	116	7 44	176	11 44	236	15 44	296	19 44	356	23 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
58	3 52	118	7 52	178	11 52	238	15 52	298	19 52	358	23 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

XV.—CORRECTION TO TABULATED ALTITUDE FOR MINUTES OF DECLINATION

′	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 ′
0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	00
1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	01
2	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
3	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
4	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
5	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
6	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
7	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
8	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
9	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	5	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	6	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	5	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	7	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	8	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	4	4	4	5	5	5	6	6	6	7	7	7	8	8	8	9	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	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	29
30	1	1	2	2	3	3	4	4	5	6	6	7	7	7	8	8	9	9	10	10	11	11	12	13	13	14	14	14	15	16	30
31	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	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	14	15	16	16	17	18	18	19	20	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

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
20	10 11 11	11 12 12	12 13 13	13 14 14	14 15 15	15 16 16	16 17 17	17 18 18	18 19 19	19 20 20	20
21	11 11 12	12 12 13	13 13 14	14 14 15	15 15 16	16 16 17	17 18 18	18 19 19	19 20 20	20 21 21	21
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