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	2	3	5	6	8	9	11	13	14	16	18	20	21	23	25	27	29	31	S. 60
55	2	3	5	6	8	9	11	12	14	16	17	19	21	23	25	27	29	31	55
50	1	3	4	6	8	9	11	12	14	15	17	19	21	22	24	26	28	30	50
45	1	3	4	6	7	9	10	12	13	15	17	18	20	22	24	26	28	30	45
40	1	3	4	6	7	9	10	12	13	15	16	18	20	21	23	25	27	29	40
N. 35	1	3	4	5	7	8	10	11	13	14	16	17	19	21	23	24	26	28	S. 35
30	1	3	4	5	7	8	9	11	12	14	15	17	18	20	22	24	26	28	30
25	1	3	4	5	6	8	9	10	12	13	15	16	18	19	21	23	25	27	25
20	1	2	4	5	6	7	9	10	11	13	14	15	17	19	20	22	24	26	20
15	1	2	3	5	6	7	8	9	11	12	13	15	16	18	19	21	23	24	15
N. 10	1	2	3	4	5	7	8	9	10	11	13	14	15	17	18	20	22	23	S. 10
N. 5	1	2	3	4	5	6	7	8	10	11	12	13	15	16	17	19	20	22	S. 5
0	1	2	3	4	5	6	7	8	9	10	11	12	14	15	16	18	19	21	0
S. 5	1	2	3	4	5	5	6	7	8	9	10	12	13	14	15	16	18	19	N. 5
10	1	2	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	10
S. 15	1	2	2	3	4	5	5	6	7	8	9	10	11	11	12	14	15	16	N. 15
20	1	1	2	3	3	4	5	6	6	7	8	9	9	10	11	12	13	14	20
25	1	1	2	2	3	4	4	5	6	6	7	8	8	9	10	10	11	12	25
30	1	1	2	2	3	3	4	4	5	5	6	6	7	7	8	9	9	10	30
35	0	1	1	2	2	3	3	3	4	4	5	5	6	6	6	7	7	8	35
S. 40	0	1	1	1	2	2	2	3	3	3	4	4	4	4	5	5	5	5	N. 40
45	0	0	1	1	1	1	2	2	2	2	2	2	3	3	3	3	3	3	45
50	0	0	0	0	1	1	1	1	1	1	1	1	1	1	1	1	0	0	50
55	0	0	0	0	0	0	0	0	0	0	0	*1	*1	*1	*1	*2	*2	*2	55
S. 60	0	0	0	*1	*1	*1	*1	*1	*1	*2	*2	*2	*3	*3	*3	*4	*5	*5	N. 60

The table gives the angle necessary to convert a Great Circle bearing to a Rhumb Line bearing and the reverse in a *Latitude of Departure* of 32°, but it may be used for any place of departure between latitudes 30° and 34°. 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. 30° and N. 34°, and the one on the right when the place of departure lies between S. 30° and S. 34°.

The direction in which the conversion angle must be applied is determined by the following rules:

Latitude of Departure	Direction of bearing	To convert a Great Circle to a Rhumb Line bearing	To convert a Rhumb Line to a Great Circle bearing
North	Westerly	Subtract	Add
North	Easterly	Add	Subtract
South	Westerly	Add	Subtract
South	Easterly	Subtract	Add

These rules refer to bearings measured from 000° T. in a clockwise direction. Where the figures are given in italics, preceded by an asterisk, the conversion angle must be applied in the reverse sense.

The conversion angle at the place of destination may be taken as equal to that at the place of departure for distances up to 1,000 miles; for much greater distances, the corresponding table in the volume appropriate to the latitude of destination should be used, the places of destination and departure being interchanged.

18	19	20	t Year
0	0	0	1941
1	1	1	1942
1	1	1	1943
1	1	1	1944
2	2	2	1945
2	2	2	1946
2	2	2	1947
2	3	3	1948
3	3	3	1949
3	3	3	1950
3	3	4	1951
4	4	4	1952
4	4	4	1953
4	4	5	1954
4	5	5	1955
5	5	5	1956
5	5	6	1957
5	6	6	1958
6	6	6	1959
6	6	7	1960
6	7	7	1961
7	7	7	1962
7	7	8	1963
7	8	8	1964
7	8	8	1965
7	8	8	9	1966
8	8	9	9	1967
8	8	9	9	1968
8	9	9	10	1969
8	9	10	10	1970
9	9	10	10	1971
9	10	10	11	1972
9	10	10	11	1973
9	10	11	11	1974
9	10	11	12	1975
9	11	11	12	1976
9	11	12	12	1977
11	11	12	13	1978
11	12	12	13	1979
11	12	13	13	1980
12	12	13	14	1981
12	13	13	14	1982
12	13	14	14	1983
12	13	14	15	1984
13	14	14	15	1985
13	14	15	15	1986
13	14	15	16	1987
14	14	15	16	1988
14	15	16	16	1989
14	15	16	17	1990
14	15	16	17	1991
15	16	16	17	1992
15	16	17	18	1993
15	16	17	18	1994
16	16	17	18	1995
16	17	18	19	1996
16	17	18	19	1997
16	17	18	19	1998
17	18	19	20	1999
17	18	19	20	2000

IV.—CONVERSION OF LOCAL MEAN TIME TO GREENWICH MEAN TIME

	Longitude West									
	180°	165°	150°	135°	120°	105°	90°	75°	60°	45°	30°	15°	0°
Zone	+12	+11	+10	+9	+8	+7	+6	+5	+4	+3	+2	+1	0
L.M.T.	G.M.T.	G.M.T.	G.M.T.	G.M.T.	G.M.T.	G.M.T.	G.M.T.	G.M.T.	G.M.T.	G.M.T.	G.M.T.	G.M.T.	G.M.T.
0001	1200	1100	1000	0900	0800	0700	0600	0500	0400	0300	0200	0100	0001
0100	1300	1200	1100	1000	0900	0800	0700	0600	0500	0400	0300	0200	0100
0200	1400	1300	1200	1100	1000	0900	0800	0700	0600	0500	0400	0300	0200
0300	1500	1400	1300	1200	1100	1000	0900	0800	0700	0600	0500	0400	0300
0400	1600	1500	1400	1300	1200	1100	1000	0900	0800	0700	0600	0500	0400
0500	1700	1600	1500	1400	1300	1200	1100	1000	0900	0800	0700	0600	0500
0600	1800	1700	1600	1500	1400	1300	1200	1100	1000	0900	0800	0700	0600
0700	1900	1800	1700	1600	1500	1400	1300	1200	1100	1000	0900	0800	0700
0800	2000	1900	1800	1700	1600	1500	1400	1300	1200	1100	1000	0900	0800
0900	2100	2000	1900	1800	1700	1600	1500	1400	1300	1200	1100	1000	0900
1000	2200	2100	2000	1900	1800	1700	1600	1500	1400	1300	1200	1100	1000
1100	2300	2200	2100	2000	1900	1800	1700	1600	1500	1400	1300	1200	1100
1200	2359	2300	2200	2100	2000	1900	1800	1700	1600	1500	1400	1300	1200
1300	0100	2359	2300	2200	2100	2000	1900	1800	1700	1600	1500	1400	1300
1400	0200	0100	2359	2300	2200	2100	2000	1900	1800	1700	1600	1500	1400
1500	0300	0200	0100	2359	2300	2200	2100	2000	1900	1800	1700	1600	1500
1600	0400	0300	0200	0100	2359	2300	2200	2100	2000	1900	1800	1700	1600
1700	0500	0400	0300	0200	0100	2359	2300	2200	2100	2000	1900	1800	1700
1800	0600	0500	0400	0300	0200	0100	2359	2300	2200	2100	2000	1900	1800
1900	0700	0600	0500	0400	0300	0200	0100	2359	2300	2200	2100	2000	1900
2000	0800	0700	0600	0500	0400	0300	0200	0100	2359	2300	2200	2100	2000
2100	0900	0800	0700	0600	0500	0400	0300	0200	0100	2359	2300	2200	2100
2200	1000	0900	0800	0700	0600	0500	0400	0300	0200	0100	2359	2300	2200
2300	1100	1000	0900	0800	0700	0600	0500	0400	0300	0200	0100	2359	2300
2359	1200	1100	1000	0900	0800	0700	0600	0500	0400	0300	0200	0100	2359

G.M.T. figures in roman type—Greenwich date SAME as local date.
G.M.T. figures in heavy type—Greenwich date ONE DAY AHEAD of local date.

This table gives the Greenwich date and Greenwich mean time (G.M.T.) corresponding to the local date and local mean time (L.M.T.) for any place in longitude *west*. Entering the table with the longitude heading nearest to the dead reckoning longitude, and the L.M.T. to the nearest hour, the *approximate* G.M.T. is taken out directly, the Greenwich date being determined by the rules above.

To avoid confusion, midnight is given as 2359 for the day just ending, and as 0001 for the day just beginning.

Example.—Required the approximate G.M.T. at L.M.T. $23^h\ 37^m$, January 17 in longitude 110° W.

Long. 105° W. (approx.)

Approx.	Hrs.	Date
L.M.T.	2359	Jan. 17
G.M.T.	0700	**Jan. 18**

IV.—CONVERSION OF LOCAL MEAN TIME TO GREENWICH MEAN TIME

Longitude East												
0°	15°	30°	45°	60°	75°	90°	105°	120°	135°	150°	165°	180°	
0	−1	−2	−3	−4	−5	−6	−7	−8	−9	−10	−11	−12	Zone
L.M.T.	G.M.T.	G.M.T.	G.M.T.	G.M.T.	G.M.T.	G.M.T.	G.M.T.	G.M.T.	G.M.T.	G.M.T.	G.M.T.	G.M.T.	L.M.T.
0001	*2300*	*2200*	*2100*	*2000*	*1900*	*1800*	*1700*	*1600*	*1500*	*1400*	*1300*	*1200*	0001
0100	0001	*2300*	*2200*	*2100*	*2000*	*1900*	*1800*	*1700*	*1600*	*1500*	*1400*	*1300*	0100
0200	0100	0001	*2300*	*2200*	*2100*	*2000*	*1900*	*1800*	*1700*	*1600*	*1500*	*1400*	0200
0300	0200	0100	0001	*2300*	*2200*	*2100*	*2000*	*1900*	*1800*	*1700*	*1600*	*1500*	0300
0400	0300	0200	0100	0001	*2300*	*2200*	*2100*	*2000*	*1900*	*1800*	*1700*	*1600*	0400
0500	0400	0300	0200	0100	0001	*2300*	*2200*	*2100*	*2000*	*1900*	*1800*	*1700*	0500
0600	0500	0400	0300	0200	0100	0001	*2300*	*2200*	*2100*	*2000*	*1900*	*1800*	0600
0700	0600	0500	0400	0300	0200	0100	0001	*2300*	*2200*	*2100*	*2000*	*1900*	0700
0800	0700	0600	0500	0400	0300	0200	0100	0001	*2300*	*2200*	*2100*	*2000*	0800
0900	0800	0700	0600	0500	0400	0300	0200	0100	0001	*2300*	*2200*	*2100*	0900
1000	0900	0800	0700	0600	0500	0400	0300	0200	0100	0001	*2300*	*2200*	1000
1100	1000	0900	0800	0700	0600	0500	0400	0300	0200	0100	0001	*2300*	1100
1200	1100	1000	0900	0800	0700	0600	0500	0400	0300	0200	0100	0001	1200
1300	1200	1100	1000	0900	0800	0700	0600	0500	0400	0300	0200	0100	1300
1400	1300	1200	1100	1000	0900	0800	0700	0600	0500	0400	0300	0200	1400
1500	1400	1300	1200	1100	1000	0900	0800	0700	0600	0500	0400	0300	1500
1600	1500	1400	1300	1200	1100	1000	0900	0800	0700	0600	0500	0400	1600
1700	1600	1500	1400	1300	1200	1100	1000	0900	0800	0700	0600	0500	1700
1800	1700	1600	1500	1400	1300	1200	1100	1000	0900	0800	0700	0600	1800
1900	1800	1700	1600	1500	1400	1300	1200	1100	1000	0900	0800	0700	1900
2000	1900	1800	1700	1600	1500	1400	1300	1200	1100	1000	0900	0800	2000
2100	2000	1900	1800	1700	1600	1500	1400	1300	1200	1100	1000	0900	2100
2200	2100	2000	1900	1800	1700	1600	1500	1400	1300	1200	1100	1000	2200
2300	2200	2100	2000	1900	1800	1700	1600	1500	1400	1300	1200	1100	2300
2359	2300	2200	2100	2000	1900	1800	1700	1600	1500	1400	1300	1200	2359

G.M.T. figures in roman type—Greenwich date SAME as local date.
G.M.T. figures in italic type—Greenwich date ONE DAY BEHIND local date.

This table gives the Greenwich date and Greenwich mean time (G.M.T.) corresponding to the local date and local mean time (L.M.T.) for any place in longitude east. Entering the table with the longitude heading nearest to the dead reckoning longitude, and the L.M.T. to the nearest hour, the *approximate* G.M.T. is taken out directly, the Greenwich date being determined by the rules above.

To avoid confusion, midnight is given as 2359 for the day just ending, and as 0001 for the day just beginning.

Example.—Required the approximate G.M.T. at L.M.T. 02^h 17^m, August 8 in longitude 62° E.

Long. 60° E. (approx.)

Approx.	Hrs.	Date
L.M.T.	0200	Aug. 8
G.M.T.	*2200*	*Aug. 7*

DEC.
0°
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°

V.—DIFFERENCE BETWEEN RHUMB LINE AND GREAT CIRCLE DISTANCES

N. 30°-34° **S. 30°-34°**

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	8	13	18	26	35	46	59	74	93	115	140	169	202	239	S. 60
55	0	1	2	4	7	11	16	22	30	40	53	67	85	106	130	158	190	226	55
50	0	1	2	3	5	9	13	19	26	36	47	61	78	97	120	146	177	212	50
45	0	0	1	2	4	7	11	16	23	32	42	55	71	89	110	135	164	198	45
40	0	0	1	2	4	6	10	14	21	28	38	50	64	81	101	124	151	183	40
N. 35	0	0	1	2	3	5	8	13	18	25	34	45	58	73	92	113	138	167	S. 35
30	0	0	1	1	3	5	8	11	16	23	31	40	52	66	83	102	125	152	30
25	0	0	1	1	3	4	7	10	15	20	28	36	47	59	74	92	112	136	25
20	0	0	1	1	2	4	6	9	13	18	24	32	41	52	65	81	99	120	20
15	0	0	1	1	2	4	6	8	12	16	21	28	36	45	57	70	86	104	15
N. 10	0	0	1	1	2	3	5	7	10	14	18	24	31	39	49	60	73	89	S. 10
N. 5	0	0	1	1	2	3	4	6	9	12	16	20	26	33	41	50	61	74	S. 5
0	0	0	0	1	2	3	4	5	7	10	13	17	21	27	33	41	50	60	0
S. 5	0	0	0	1	1	2	3	4	6	8	10	13	17	21	26	32	39	47	N. 5
10	0	0	0	1	1	2	2	3	5	6	8	10	13	16	20	24	30	36	10
S. 15	0	0	0	1	1	1	2	3	4	5	6	8	10	12	15	18	22	26	N. 15
20	0	0	0	0	1	1	2	2	3	4	5	6	7	9	11	13	16	19	20
25	0	0	0	0	1	1	1	2	2	3	4	5	6	7	9	11	13	15	25
30	0	0	0	0	1	1	1	2	2	3	4	5	6	7	8	10	12	14	30
35	0	0	0	1	1	1	2	2	3	4	5	6	7	9	10	12	15	17	35
S. 40	0	0	0	1	1	2	2	3	4	6	7	9	10	13	15	18	21	25	N. 40
45	0	0	1	1	2	3	4	5	7	8	10	13	16	19	23	27	32	38	45
50	0	0	1	2	3	4	6	8	10	13	16	19	24	29	34	41	48	56	50
55	0	1	1	3	4	6	8	11	14	18	23	28	34	41	49	59	69	81	55
S. 60	0	1	2	4	6	9	12	16	21	26	32	40	48	58	69	82	96	112	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 32°, but may be used for any place of departure between latitudes 30° and 34°. 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. 30° and N. 34°, and the one on the right when the place of departure lies between S. 30° and S. 34°.

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 $2\frac{1}{2}$° 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 5 miles for a change of 70°, and 10 miles for a change of 90°.

Example.—Required the difference in distance between the Rhumb Line track and the Great Circle track from Perth, W. Australia (Lat. 31° 52′ S., Long. 116° 03′ E.) to Durban (Lat. 29° 53′ S., Long. 30° 53′ E.).

Entering the argument column on the right with the *Latitude of Destination* of 29° 53′ S., and interpolating by inspection for the *Change of Longitude* of 85° 10′, it will be seen that the difference in distance is about 126 nautical miles.

VI.—ADJUSTMENT TO REFRACTION IN SPECIAL CONDITIONS

Height in feet	Observed Altitude 10°	15°	20°	30°	45°	60°	Height in metres
	′	′	′	′	′	′	
0	−1	0	0	0	0	0	0
5000	0	0	0	0	0	0	1500
10000	+1	0	0	0	0	0	3000
15000	1	+1	+1	0	0	0	4600
20000	2	1	1	+1	0	0	6100
25000	2	1	1	1	0	0	7600
30000	3	2	1	1	0	0	9100
35000	3	2	1	1	+1	0	10700
40000	+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 when special accuracy is required.

VII.—TRUE AZIMUTH OF THE POLE STAR

1940-1960 L.H.A. ♈	True Azimuth	1960-1980 L.H.A. ♈	True Azimuth	1980-2000 L.H.A. ♈	True Azimuth
°	°	°	°	°	°
0	001	0	001	0	001
1	000	1	000	2	000
53	359	59	359	68	359
181	000	181	000	182	000
233	001	239	001	248	001
360		360		360	

These tables give the True Azimuth of the Pole Star, over various periods of time, for an observer between latitudes N. 30° and N. 34°. The argument L.H.A.♈ is obtained from G.H.A.♈ by *subtracting west* longitude or *adding east* longitude.

VIII.—DIP OF THE SEA HORIZON

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

Height in feet	Dist.	Height in metres	Height in feet
0		0	287
1	1		317
4	2	1	349
9	3	2	382
15	4	4	417
22	5	6	453
31	6	9	491
42	7	12	531
54	8	16	571
68	9	20	614
83	10	25	658
100	11	30	703
118	12	36	750
137	13	42	798
158	14	48	848
181	15	55	900
205	16	62	953
231	17	70	1000
258	18	78	1060
287	19	87	1120

IX.—D

Height in feet	Dist.	Height in metres	Height in feet
0		0	28
1	1		31
3	2	1	34
6	3	2	37
11	4	3	40
17	5	5	43
24	6	7	46
32	7	9	49
41	8	12	53
51	9	15	56
62	10	19	60
75	11	22	63
89	12	27	67
103	13	31	71
119	14	36	75
137	15	41	80
155	16	47	84
174	17	53	88
195	18	59	93
216	19	66	98
239	20	73	103
263	21	80	107
288	22	87	112

These tables
miles, with argun

At the mom
over the sea hori
its height to the

E AZIMUTH OF
OLE STAR

60-1980		1980-2000	
A.	True Azi-muth	L.H.A. ♈	True Azi-muth
°	°	°	°
0	001	0	001
1	000	2	000
59	359	68	359
81	000	182	000
39	001	248	001
60		360	

give the True Azimuth over various periods of erver between latitudes 34°. The argument ined from G.H.A.♈ by ongitude or *adding east*

Height in metres	Height in feet	Dip	Height in metres
1160	6740	81′	2050
1200	6910	82	2100
1230	7080	83	2160
1270	7250	84	2210
1320	7430	85	2260
1360	7610	86	2320
1400	7790	87	2370
1440	7970	88	2420
1480	8150	89	2480
1530	8340	90	2540
1570	8520	91	2590
1620	8710	92	2650
1660	8900	93	2710
1710	9100	94	2770
1760	9290	95	2830
1800	9490	96	2890
1850	9690	97	2950
1900	9890	98	3010
1950	10100	99	3070
2000	10300	100	3140
2050	10500		3200

arc, with argument height ired when the altitude is rom the observed altitude.

IX.—DISTANCE TO THE SEA HORIZON IN NAUTICAL MILES

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

IX.—DISTANCE TO THE SEA HORIZON IN STATUTE MILES

Height in feet	Dist.	Height in metres
0		0
1	1	
3	2	1
6	3	2
11	4	3
17	5	5
24	6	7
32	7	9
41	8	12
51	9	15
62	10	19
75	11	22
89	12	27
103	13	31
119	14	36
137	15	41
155	16	47
174	17	53
195	18	59
216	19	66
239	20	73
263	21	80
288	22	87
314	23	95
342	24	104
370	25	113
400	26	122
431	27	131
463	28	141
496	29	151
530	30	161
565	31	172
602	32	183
639	33	195
678	34	206
718	35	219
759	36	231
801	37	244
845	38	257
889	39	271
935	40	285
982	41	299
1030	42	313
1070	43	328
1120	44	344
1180	45	359
1230	46	375
1280	47	392
1340	48	408
1390	49	425
1450	50	443
1510	51	460
1570	52	479
1630	53	497
1690	54	516
1750	55	535
1820	56	554
1880	57	574
1950	58	594
2010	59	615
2080	60	636
2150	61	657
2220	62	678
2290	63	700
2370	64	723
2440	65	745
2520	66	768
2590	67	791
2670	68	815
2750	69	839
2830	70	863
2910	71	888
2990	72	913
3080	73	938
3160	74	964
3250	75	990
3330	76	1010
3420	77	1040
3510	78	1070
3600	79	1090
3690	80	1120
3780	81	1150
3880	82	1180
3970	83	1210
4070	84	1240
4160	85	1270
4260	86	1300
4360	87	1330
4460	88	1360
4560	89	1390
4670	90	1420
4770	91	1450
4870	92	1480
4980	93	1510
5090	94	1550
5200	95	1580
5310	96	1610
5420	97	1650
5530	98	1680
5640	99	1720
5750	100	1750
5870	101	1790
5990	102	1820
6100	103	1860
6220	104	1890
6340	105	1930
6460	106	1970
6580	107	2000
6710	108	2040
6830	109	2080
6960	110	2120
6960	111	2120
7080	112	2160
7210	113	2190
7340	114	2230
7470	115	2270
7600	116	2310
7730	117	2350
7870	118	2390
8000	119	2440
8140	120	2480
8280	121	2520
8410	122	2560
8550	123	2600
8690	124	2650
8830	125	2690
8980	126	2730
9120	127	2780
9270	128	2820
9410	129	2870
9560	130	2910
9710	131	2960
9860	132	3000
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′			
Height in feet	Range	Height in metres	Height in feet	Range	Height in metres	Height in feet	Range	Height in metres	Height in feet	Range	Height in metres	
0		0	0		0	0		0	0		0	
1060	0	325	978	0	298	890	0	271	801	0	244	
3230	5	985	2960	5	904	2690	5	822	2430	5	741	
5430	10	1650	4990	10	1520	4540	10	1380	4100	10	1250	
7670	15	2330	7050	15	2140	6430	15	1960	5810	15	1770	
9950	20	3030	9150	20	2790	8350	20	2540	7550	20	2300	
12200	25	3740	11200	25	3440	10300	25	3140	9340	25	2840	
14600	30	4450	13400	30	4100	12300	30	3750	11100	30	3400	
17000	35	5180	15600	35	4780	14300	35	4370	13000	35	3960	
19400	40	5920	17900	40	5460	16400	40	5000	14900	40	4540	
21900	45	6680	20200	45	6160	18500	45	5650	16800	45	5130	
24400	50	7440	22500	50	6870	20600	50	6300	18800	50	5730	
26900	55	8210	24900	55	7590	22800	55	6970	20800	55	6350	
29500	60	9000	27300	60	8320	25100	60	7650	22800	60	6970	

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

2° 00′			1° 50′		
Height in feet	Range	Height in metres	Height in feet	Range	Height in metres
0		0	0		0
535	0	163	491	0	149
1630	5	498	1500	5	458
2770	10	845	2550	10	777
3940	15	1200	3630	15	1100
5160	20	1570	4760	20	1450
6410	25	1950	5920	25	1800
7700	30	2340	7130	30	2170
9030	35	2750	8360	35	2550
10400	40	3160	9640	40	2940
11800	45	3590	10900	45	3340
13200	50	4030	12300	50	3750
14700	55	4480	13700	55	4170
16200	60	4950	15100	60	4610

1° 00′			0° 55′		
Height in feet	Range	Height in metres	Height in feet	Range	Height in metres
0		0	0		0
270	0	82	247	0	75
839	5	255	772	5	235
1440	10	440	1330	10	406
2090	15	637	1930	15	590
2770	20	845	2570	20	784
3490	25	1060	3250	25	991
4250	30	1290	3960	30	1200
5050	35	1530	4710	35	1430
5880	40	1790	5500	40	1670
6750	45	2060	6330	45	1930
7670	50	2330	7200	50	2190
8610	55	2620	8100	55	2470
9600	60	2920	9050	60	2750

0° 30′			0° 25′		
Height in feet	Range	Height in metres	Height in feet	Range	Height in metres
0		0	0		0
137	0	41	115	0	35
440	5	134	374	5	114
782	10	238	671	10	204
1160	15	354	1000	15	306
1570	20	481	1380	20	420
2030	25	620	1790	25	546
2520	30	770	2240	30	683
3060	35	932	2720	35	831
3620	40	1100	3250	40	991
4230	45	1290	3810	45	1160
4880	50	1480	4410	50	1340
5560	55	1690	5050	55	1540
6280	60	1910	5730	60	1740

L MILES

ice, to the nearest 5 nautical
the height of the observer.
ation to the object, and the
ressed in feet or in metres.
that the angle of elevation
oo feet, is 0° 48′. Required

bserver is 7,000 − 1,500 =
0° 50′ (the nearest tabulated
gument columns since the
nterval between 5,130 and
miles, is 45 nautical miles.

an object, whose height is
uments of the table are the
nce in height between the
he distance is given to the
rom 10 to 60 nautical miles.
, finds that the angle of
of the ship.

osing the right-hand of the
oulated value, so that the

in height, ***when the object***
the object is beyond the
ent results, there should be
error will not be serious.
nge. They should prove
sion than for small ones.

server

2° 40′			2° 20′		
eight in eet	Range	Height in metres	Height in feet	Range	Height in metres
0		0	0		0
712	0	217	624	0	190
160	5	660	1900	5	579
650	10	1110	3210	10	980
190	15	1580	4570	15	1390
750	20	2050	5960	20	1810
360	25	2540	7390	25	2250
000	30	3050	8850	30	2690
600	35	3560	10300	35	3150
400	40	4080	11900	40	3620
100	45	4620	13400	45	4110
900	50	5170	15100	50	4600
800	55	5730	16700	55	5100
600	60	6300	18400	60	5620

X.—TABLE OF RANGES IN NAUTICAL MILES

Height of object *greater* than height of observer

Angle of elevation

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

Angle of elevation

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

Angle of elevation

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

X.—TABLE OF RANGES IN NAUTICAL MILES

Height of object *less* than height of observer

Angle of depression												
0° 05′			0° 10′			0° 15′			0° 20′			
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	
4	0	1	9	0	2	13	0	4	17	0	5	
11	1	3	24	1	7	38	1	11	51	1	15	
17	2	5	39	2	12	61	2	18	83	2	25	
21	3	6	52	3	15	83	3	25	114	3	34	
24	4	7	64	4	19	103	4	31	143	4	43	
25	5		74	5	22	122	5	37	171	5	52	
26	6	*8*	82	6	25	140	6	42	197	6	60	
24	7		89	7	27	156	7	47	222	7	67	
21	8	*7*	95	8	29	170	8	52	245	8	74	
16	9	*5*	99	9	30	183	9	55	267	9	81	
0	10	*0*	*103*	10	*32*	212	10	64	323	10	98	
			77	15	*24*	231	15	70	386	15	117	
			13	20	*4*	*213*	20	*65*	411	20	125	
			0	25	*0*	*155*	25	*48*	*398*	25	*122*	
						59	30	*18*	*346*	30	*106*	
						0	35	*0*	*258*	35	*79*	
									130	40	*40*	
									0	45	*0*	

Angle of depression												
0° 25′			0° 30′			1° 10′						
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				
21	0	6	26	0	8	61	0	18				
64	1	19	77	1	23	183	1	56				
106	2	32	127	2	39	305	2	92				
145	3	44	176	3	53	424	3	129				
183	4	55	223	4	68	541	4	165				
220	5	67	268	5	81	658	5	200				
255	6	77	312	6	95	772	6	235				
288	7	88	355	7	108	886	7	270				
320	8	97	396	8	120	997	8	304				
351	9	107	435	9	132	1100	9	337				
434	10	132	544	10	166	1430	10	435				
541	15	164	695	15	212	1930	15	589				
609	20	185	808	20	246	2400	20	732				
640	25	195	884	25	269	2830	25	862				
634	30	*194*	921	30	280	3220	30	982				
590	35	*180*	*921*	35	*281*	3570	35	1080				
506	40	*155*	*882*	40	*269*	3880	40	1180				
385	45	*118*	*805*	45	*246*	4160	45	1270				
226	50	*69*	*690*	50	*211*	4400	50	1340				
28	55	*9*	*537*	55	*164*	4600	55	1400				
0	60	*0*	*346*	60	*106*	4760	60	1450				

Angle of depression												
0° 35′			0° 40′			0° 45′			0° 50′			
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	
30	0	9	35	0	10	39	0	12	44	0	13	
91	1	27	104	1	31	117	1	35	130	1	39	
150	2	45	172	2	52	194	2	59	216	2	65	
207	3	63	238	3	72	269	3	82	300	3	91	
263	4	80	302	4	92	342	4	104	382	4	116	
317	5	96	366	5	111	414	5	126	463	5	141	
370	6	112	427	6	130	485	6	147	542	6	165	
421	7	128	488	7	148	554	7	168	620	7	189	
471	8	143	546	8	166	621	8	189	696	8	212	
519	9	158	603	9	183	687	9	209	771	9	235	
655	10	199	765	10	233	876	10	267	986	10	300	
850	15	259	1000	15	306	1160	15	353	1310	15	400	
1000	20	307	1200	20	367	1400	20	428	1600	20	489	
1120	25	343	1370	25	417	1610	25	491	1850	25	566	
1200	30	368	1490	30	456	1780	30	543	2070	30	631	
1250	35	381	1580	35	482	1910	35	583	2240	35	685	
1260	40	*384*	1630	40	497	2000	40	612	2380	40	727	
1230	45	*374*	*1650*	45	*502*	2060	45	629	2480	45	757	
1160	50	*352*	*1620*	50	*494*	2080	50	634	2540	50	776	
1050	55	*319*	*1560*	55	*474*	*2070*	55	*629*	2570	55	783	
899	60	*274*	*1460*	60	*443*	*2010*	60	*611*	*2560*	60	*780*	

Angle of depression												
0° 55′			1° 00′			2° 20′						
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				
48	0	14	52	0	16	123	0	37				
144	1	43	157	1	47	369	1	112				
238	2	72	260	2	79	614	2	187				
331	3	100	362	3	110	858	3	261				
422	4	128	462	4	140	1090	4	335				
512	5	156	560	5	170	1340	5	408				
600	6	182	657	6	200	1570	6	481				
687	7	209	753	7	229	1810	7	553				
772	8	235	847	8	258	2050	8	625				
855	9	260	939	9	286	2280	9	696				
1090	10	334	1200	10	368	2970	10	908				
1470	15	448	1620	15	495	4100	15	1250				
1800	20	549	2000	20	610	5190	20	1580				
2100	25	640	2340	25	714	6230	25	1900				
2350	30	719	2640	30	806	7250	30	2210				
2570	35	786	2910	35	887	8220	35	2500				
2760	40	841	3130	40	956	9150	40	2790				
2900	45	885	3320	45	1010	10000	45	3060				
3010	50	918	3470	50	1050	10900	50	3320				
3080	55	938	3580	55	1090	11700	55	3570				
3110	60	947	3660	60	1110	12500	60	3810				

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′			
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	88	0	26	
61	1	18	70	1	21	79	1	24	263	1	80	
183	2	56	210	2	64	237	2	72	437	2	133	
305	3	92	349	3	106	393	3	119	610	3	185	
424	4	129	486	4	148	548	4	167	780	4	238	
541	5	165	621	5	189	701	5	213	950	5	289	
658	6	200	755	6	230	852	6	259	1110	6	340	
772	7	235	887	7	270	1000	7	305	1280	7	391	
886	8	270	1010	8	310	1150	8	351	1440	8	441	
997	9	304	1140	9	350	1290	9	395	1610	9	491	
1100	10	337	1270	10	388	1440	10	440	2090	10	638	
1430	15	435	1650	15	503	1870	15	570	2860	15	872	
1930	20	589	2240	20	684	2550	20	778	3590	20	1090	
2400	25	732	2790	25	853	3190	25	974	4290	25	1300	
2830	30	862	3310	30	1010	3800	30	1150	4940	30	1500	
3220	35	982	3790	35	1150	4370	35	1330	5560	35	1690	
3570	40	1080	4230	40	1290	4900	40	1490	6140	40	1870	
3880	45	1180	4640	45	1410	5390	45	1640	6680	45	2030	
4160	50	1270	5000	50	1520	5840	50	1780	7190	50	2190	
4400	55	1340	5330	55	1620	6260	55	1900	7660	55	2330	
4600	60	1400	5620	60	1710	6640	60	2020	8080	60	2460	
4760		1450	5870		1790	6980		2120				

Angle of depression												
1° 50′			2° 00′			2° 20′			2° 40′			
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	
97	1	29	106	1	32	123	1	37	141	1	43	
290	2	88	316	2	96	369	2	112	422	2	128	
481	3	146	526	3	160	614	3	187	703	3	214	
672	4	204	734	4	223	858	4	261	982	4	299	
860	5	262	940	5	286	1090	5	335	1250	5	383	
1040	6	319	1140	6	349	1340	6	408	1530	6	467	
1230	7	375	1340	7	410	1570	7	481	1800	7	551	
1410	8	432	1550	8	472	1810	8	553	2080	8	634	
1590	9	487	1750	9	533	2050	9	625	2350	9	717	
1780	10	542	1940	10	594	2280	10	696	2620	10	799	
2310	15	705	2530	15	772	2970	15	908	3420	15	1040	
3170	20	967	3480	20	1060	4100	20	1250	4720	20	1430	
3990	25	1210	4390	25	1330	5190	25	1580	5980	25	1820	
4770	30	1450	5260	30	1600	6230	30	1900	7210	30	2190	
5520	35	1680	6090	35	1850	7250	35	2210	8400	35	2560	
6230	40	1890	6890	40	2100	8220	40	2500	9550	40	2910	
6890	45	2100	7650	45	2330	9150	45	2790	10600	45	3250	
7530	50	2290	8370	50	2550	10000	50	3060	11700	50	3570	
8120	55	2470	9050	55	2750	10900	55	3320	12700	55	3890	
8670	60	2640	9690	60	2950	11700	60	3570	13700	60	4190	
9190		2800	10300		3140	12500		3810	14700		4490	

Angle of depression												
2° 40′			3° 00′			3° 20′			3° 40′			
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	
141	1	43	159	1	48	176	1	53	194	1	59	
422	2	128	476	2	145	529	2	161	582	2	177	
703	3	214	792	3	241	880	3	268	969	3	295	
982	4	299	1100	4	337	1230	4	375	1350	4	412	
1250	5	383	1410	5	432	1570	5	481	1730	5	529	
1530	6	467	1730	6	527	1920	6	586	2120	6	646	
1800	7	551	2040	7	621	2270	7	692	2500	7	762	
2080	8	634	2340	8	715	2610	8	796	2880	8	877	
2350	9	717	2650	9	809	2950	9	901	3250	9	993	
2620	10	799	2950	10	902	3290	10	1000	3630	10	1100	
3420	15	1040	3860	15	1170	4300	15	1310	4750	15	1440	
4720	20	1430	5340	20	1620	5960	20	1810	6580	20	2000	
5980	25	1820	6780	25	2060	7580	25	2310	8380	25	2550	
7210	30	2190	8180	30	2490	9160	30	2790	10100	30	3090	
8400	35	2560	9550	35	2910	10700	35	3260	11800	35	3610	
9550	40	2910	10800	40	3310	12200	40	3720	13500	40	4120	
10600	45	3250	12100	45	3710	13600	45	4170	15100	45	4620	
11700	50	3570	13400	50	4090	15100	50	4600	16700	50	5120	
12700	55	3890	14600	55	4460	16400	55	5020	18300	55	5590	
13700	60	4190	15800	60	4810	17800	60	5440	19900	60	6060	
14700		4490	16900		5160	19100		5840	21300		6510	

Angle of depression						
3° 40′			4° 00′			
Height in feet	Range	Height in metres	Height in feet	Range	Height in metres	
0	0	0	0	0	0	
194	1	59	212	1	64	
582	2	177	636	2	193	
969	3	295	1050	3	322	
1350	4	412	1470	4	450	
1730	5	529	1890	5	578	
2120	6	646	2310	6	706	
2500	7	762	2730	7	832	
2880	8	877	3140	8	959	
3250	9	993	3560	9	1080	
3630	10	1100	3970	10	1210	
4750	15	1440	5190	15	1580	
6580	20	2000	7200	20	2190	
8380	25	2550	9180	25	2790	
10100	30	3090	11100	30	3380	
11800	35	3610	13000	35	3960	
13500	40	4120	14800	40	4530	
15100	45	4620	16700	45	5090	
16700	50	5120	18400	50	5630	
18300	55	5590	20200	55	6160	
19900	60	6060	21900	60	6680	
21300		6510	23600		7190	

For explanation, see page 224.

X.—TABLE OF RANGES IN NAUTICAL MILES

Height of object *less* than height of observer

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

Angle of depression												
6° 30′			7° 00′			7° 30′			8° 00′			
Height in feet	Range	Height in metres	Height in feet	Range	Height in metres	Height in feet	Range	Height in metres	Height in feet	Range	Height in metres	
0		0	0		0	0		0	0		0	
346	0	105	373	0	113	399	0	121	427	0	130	
1030	1	316	1110	1	340	1190	1	365	1270	1	390	
1720	2	526	1860	2	567	1990	2	608	2130	2	649	
2410	3	736	2600	3	793	2790	3	851	2980	3	909	
3100	4	945	3340	4	1010	3580	4	1090	3830	4	1160	
3780	5	1150	4080	5	1240	4380	5	1330	4670	5	1420	
4470	6	1360	4820	6	1460	5170	6	1570	5520	6	1680	
5150	7	1570	5550	7	1690	5960	7	1810	6360	7	1940	
5830	8	1770	6290	8	1910	6750	8	2050	7210	8	2190	
6510	9	1980	7020	9	2140	7530	9	2290	8050	9	2450	
8540	10	2600	9210	10	2800	9880	10	3010	10500	10	3220	
11800	15	3620	12800	15	3910	13700	15	4200	14700	15	4480	
15200	20	4630	16400	20	5000	17600	20	5370	18800	20	5740	
18400	25	5630	19900	25	6080	21400	25	6530	22900	25	6980	
21700	30	6620	23400	30	7150	25200	30	7680	26900	30	8220	
24900	35	7590	26900	35	8210	28900	35	8820	30900	35	9440	
28000	40	8550	30300	40	9250	32600	40	9950	34900	40	10600	
31100	45	9510	33700	45	10200	36300	45	11000	38800	45	11800	
34200	50	10400	37100	50	11300	39900	50	12100	42700	50	13000	
37300	55	11300	40400	55	12300	43500	55	13200	46600	55	14200	
40300	60	12200	43600	60	13300	47000	60	14300	50400	60	15300	

Angle of depression												
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	
0		0	0		0	0		0	0		0	
454	0	138	481	0	146	508	0	154	535	0	163	
1360	1	415	1440	1	439	1520	1	464	1600	1	489	
2260	2	691	2400	2	732	2540	2	774	2670	2	815	
3170	3	966	3360	3	1020	3550	3	1080	3740	3	1140	
4070	4	1240	4310	4	1310	4560	4	1390	4810	4	1460	
4970	5	1510	5270	5	1600	5570	5	1690	5870	5	1790	
5870	6	1790	6220	6	1890	6580	6	2000	6930	6	2110	
6770	7	2060	7180	7	2180	7580	7	2310	8000	7	2430	
7670	8	2330	8130	8	2470	8590	8	2610	9060	8	2760	
8560	9	2610	9080	9	2760	9600	9	2920	10100	9	3080	
11200	10	3420	11900	10	3630	12600	10	3840	13200	10	4050	
15600	15	4770	16600	15	5060	17500	15	5350	18500	15	5640	
20000	20	6110	21200	20	6480	22500	20	6860	23700	20	7230	
24400	25	7440	25900	25	7890	27400	25	8350	28900	25	8810	
28700	30	8760	30500	30	9290	32200	30	9830	34000	30	10300	
33000	35	10000	35000	35	10600	37000	35	11300	39100	35	11900	
37200	40	11300	39500	40	12000	41800	40	12700	44200	40	13400	
41400	45	12600	44000	45	13400	46600	45	14200	49200	45	15000	
45600	50	13900	48400	50	14700	51300	50	15600	54200	50	16500	
49700	55	15100	52800	55	16100	56000	55	17000	59100	55	18000	
53800	60	16400	57200	60	17400	60600	60	18400	64000	60	19500	

For explanation, see page 224.

°F	°C
−52	−46
50	45
49	44
47	43
45	42
43	41
41	40
40	39
38	38
36	37
34	36
32	35
31	34
29	33
27	32
25	31
23	30
22	29
20	28
18	27
16	−26
−14	

Statute Miles
Statute Miles
Nautical Mile
Feet
Yards
Fathoms

Miles per hou
Miles per hou
Knots
Miles per hou

LIQ
Gallons to Li

Pounds to Ki

Inches of Me