

# APPENDICES

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# THE WORLD SAILING SHIP ROUTES

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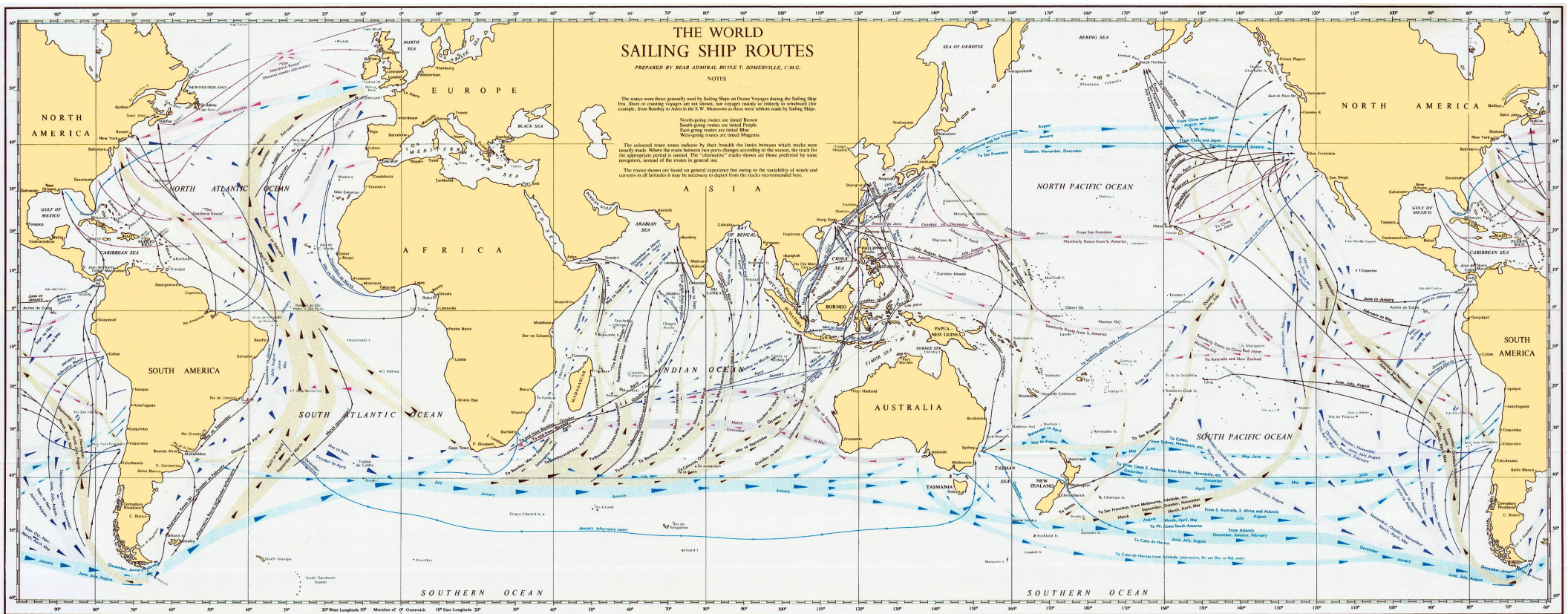
## NOTES

The routes were first generally used by Sailing Ships on Ocean Voyages during the Sailing Ship Era. Since no sailing vessels are now shown, the routes shown are merely to illustrate the example. From Newbury to Aden in S.E. Asia, as shown at those ports, obtain trade by Sailing Ships.

North-going routes are tinted Brown  
South-going routes are tinted Purple  
East-going routes are tinted Blue  
West-going routes are tinted Magenta

The colored route areas indicate by their shades the limits between which winds were usually weak. Where the route between two ports changes according to the season, the track for the appropriate period is named. The "oblique" tracks shown are those performed by some navigators, instead of the routes in general use.

The routes shown are based on general experience but owing to the variability of winds and currents small alterations may be necessary to depart from the tracks recommended here.





# APPENDIX B

## Haversines

Haversines											
i	0°		1°		2°		3°		4°		i
	Log Hav	Nat. Hav	Log Hav	Nat. Hav	Log Hav	Nat. Hav	Log Hav	Nat. Hav	Log Hav	Nat. Hav	
0	Inf. Neg	0.00000	5.88168	0.00008	6.48371	0.00030	6.83584	0.00069	7.08564	0.00122	60
1	2.32539	.00000	.89604	.00008	.49092	.00031	.84065	.00069	.08925	.00123	59
2	2.92745	.00000	.91016	.00008	.49807	.00031	.84543	.00070	.09284	.00124	58
3	3.27963	.00000	.92406	.00008	.50516	.00032	.85019	.00071	.09642	.00125	57
4	.52951	.00000	.93774	.00009	.51219	.00033	.85492	.00072	.09999	.00126	56
5	3.72333	0.00000	5.95121	0.00009	6.51916	0.00033	6.85963	0.00072	7.10354	0.00127	55
6	3.88169	.00000	.96447	.00009	.52608	.00034	.86431	.00073	.10708	.00128	54
7	4.01559	.00000	.97753	.00009	.53295	.00034	.86897	.00074	.11060	.00129	53
8	.13157	.00000	5.99040	.00010	.53976	.00035	.87360	.00075	.11411	.00130	52
9	.23388	.00000	6.00308	.00010	.54652	.00035	.87821	.00076	.11760	.00131	51
10	4.32539	0.00000	6.01557	0.00010	6.55323	0.00036	6.88279	0.00076	7.12108	0.00132	50
11	.40818	.00000	.02789	.00011	.55988	.00036	.88735	.00077	.12455	.00133	49
12	.48375	.00000	.04004	.00011	.56649	.00037	.89188	.00078	.12800	.00134	48
13	.55328	.00000	.05202	.00011	.57304	.00037	.89639	.00079	.13144	.00135	47
14	.61765	.00000	.06384	.00012	.57955	.00038	.90088	.00080	.13486	.00136	46
15	4.67757	0.00000	6.07550	0.00012	6.58600	0.00039	6.90535	0.00080	7.13827	0.00137	45
16	.73363	.00001	.08700	.00012	.59241	.00039	.90979	.00081	.14167	.00139	44
17	.78629	.00001	.09836	.00013	.59878	.00040	.91421	.00082	.14506	.00140	43
18	.83594	.00001	.10956	.00013	.60509	.00040	.91860	.00083	.14843	.00141	42
19	.88290	.00001	.12063	.00013	.61136	.00041	.92298	.00084	.15179	.00142	41
20	4.92745	0.00001	6.13155	0.00014	6.61759	0.00041	6.92733	0.00085	7.15513	0.00143	40
21	4.96983	.00001	.14234	.00014	.62377	.00042	.93166	.00085	.15846	.00144	39
22	5.01024	.00001	.15300	.00014	.62991	.00043	.93597	.00086	.16178	.00145	38
23	.04885	.00001	.16353	.00015	.63600	.00043	.94026	.00087	.16509	.00146	37
24	.08581	.00001	.17393	.00015	.64205	.00044	.94453	.00088	.16839	.00147	36
25	5.12127	0.00001	6.18421	0.00015	6.64806	0.00044	6.94877	0.00089	7.17167	0.00148	35
26	.15534	.00001	.19437	.00016	.65403	.00045	.95300	.00090	.17494	.00150	34
27	.18812	.00002	.20441	.00016	.65996	.00046	.95720	.00091	.17820	.00151	33
28	.21971	.00002	.21433	.00016	.66585	.00046	.96139	.00091	.18144	.00152	32
29	.25019	.00002	.22415	.00017	.67170	.00047	.96555	.00092	.18468	.00153	31
30	5.27963	0.00002	6.23385	0.00017	6.67751	0.00048	6.96970	0.00093	7.18790	0.00154	30
31	.30811	.00002	.24345	.00018	.68328	.00048	.97382	.00094	.19111	.00155	29
32	.33569	.00002	.25294	.00018	.68901	.00049	.97793	.00095	.19430	.00156	28
33	.36242	.00002	.26233	.00018	.69470	.00050	.98201	.00096	.19749	.00158	27
34	.38835	.00002	.27162	.00019	.70036	.00050	.98608	.00097	.20066	.00159	26
35	5.41352	0.00003	6.28081	0.00019	6.70598	0.00051	6.99013	0.00098	7.20383	0.00160	25
36	.43799	.00003	.28991	.00019	.71157	.00051	.99416	.00099	.20698	.00161	24
37	.46179	.00003	.29891	.00020	.71712	.00052	6.99817	.00100	.21012	.00162	23
38	.48496	.00003	.30781	.00020	.72263	.00053	7.00216	.00100	.21325	.00163	22
39	.50752	.00003	.31663	.00021	.72811	.00053	.00613	.00101	.21636	.00165	21
40	5.52951	0.00003	6.32536	0.00021	6.73355	0.00054	7.01009	0.00102	7.21947	0.00166	20
41	.55095	.00004	.33400	.00022	.73896	.00055	.01403	.00103	.22256	.00167	19
42	.57189	.00004	.34256	.00022	.74434	.00056	.01795	.00104	.22565	.00168	18
43	.59232	.00004	.35103	.00022	.74969	.00056	.02185	.00105	.22872	.00169	17
44	.61229	.00004	.35943	.00023	.75500	.00057	.02573	.00106	.23178	.00171	16
45	5.63181	0.00004	6.36774	0.00023	6.76028	0.00058	7.02960	0.00107	7.23483	0.00172	15
46	.65090	.00004	.37597	.00024	.76552	.00058	.03345	.00108	.23787	.00173	14
47	.66958	.00005	.38412	.00024	.77074	.00059	.0372	.00109	.24090	.00174	13
48	.68787	.00005	.39220	.00025	.77592	.00060	.04110	.00110	.24392	.00175	12
49	.70578	.00005	.40021	.00025	.78108	.00060	.04490	.00111	.24693	.00177	11
50	5.72332	0.00005	6.40814	0.00026	6.78620	0.00061	7.04869	0.00112	7.24993	0.00178	10
51	.74052	.00006	.41600	.00026	.79129	.00062	.05245	.00113	.25292	.00179	9
52	.75739	.00006	.42379	.00027	.79636	.00063	.05620	.00114	.25590	.00180	8
53	.77394	.00006	.43151	.00027	.80139	.00063	.05994	.00115	.25886	.00181	7
54	.79017	.00006	.43916	.00027	.80640	.00064	.06366	.00116	.26182	.00183	6
55	5.80611	0.00006	6.44675	0.00028	6.81137	0.00065	7.06736	0.00117	7.26477	0.00184	5
56	.82176	.00007	.45427	.00028	.81632	.00066	.07105	.00118	.26771	.00185	4
57	.83713	.00007	.46172	.00029	.82124	.00066	.07472	.00119	.27064	.00186	3
58	.85224	.00007	.46911	.00029	.82614	.00067	.07837	.00120	.27355	.00188	2
59	.86709	.00007	.47644	.00030	.83100	.00068	.08201	.00121	.27646	.00189	1
60	5.88168	0.00008	6.48371	0.00030	6.83584	0.00069	7.08564	0.00122	7.27936	0.00190	0
	359°		358°		357°		356°		355°		

## Haversines

i	5°		6°		7°		8°		9°		i
	Log Hav	Nat. Hav	Log Hav	Nat. Hav	Log Hav	Nat. Hav	Log Hav	Nat. Hav	Log Hav	Nat. Hav	
0	7. 27936	0. 00190	7. 43760	0. 00274	7. 57135	0. 00373	7. 68717	0. 00487	7. 78929	0. 00616	60
1	. 28225	. 00192	. 44001	. 00275	. 57341	. 00374	. 68897	. 00489	. 79089	. 00618	59
2	. 28513	. 00193	. 44241	. 00277	. 57547	. 00376	. 69077	. 00491	. 79249	. 00620	58
3	. 28800	. 00194	. 44480	. 00278	. 57752	. 00378	. 69257	. 00493	. 79409	. 00622	57
4	. 29086	. 00195	. 44719	. 00280	. 57957	. 00380	. 69437	. 00495	. 79568	. 00625	56
5	7. 29371	0. 00197	7. 44957	0. 00282	7. 58162	0. 00382	7. 69616	0. 00497	7. 79728	0. 00627	55
6	. 29655	. 00198	. 45194	. 00283	. 58366	. 00383	. 69794	. 00499	. 79886	. 00629	54
7	. 29938	. 00199	. 45431	. 00285	. 58569	. 00385	. 69972	. 00501	. 80045	. 00632	53
8	. 30220	. 00201	. 45667	. 00286	. 58772	. 00387	. 70150	. 00503	. 80203	. 00634	52
9	. 30502	. 00202	. 45903	. 00288	. 58974	. 00389	. 70328	. 00505	. 80361	. 00636	51
10	7. 30782	0. 00203	7. 46138	0. 00289	7. 59176	0. 00391	7. 70505	0. 00507	7. 80519	0. 00639	50
11	. 31062	. 00204	. 46372	. 00291	. 59378	. 00392	. 70682	. 00509	. 80677	. 00641	49
12	. 31340	. 00206	. 46605	. 00292	. 59579	. 00394	. 70858	. 00511	. 80834	. 00643	48
13	. 31618	. 00207	. 46838	. 00294	. 59779	. 00396	. 71034	. 00513	. 80991	. 00646	47
14	. 31895	. 00208	. 47071	. 00296	. 59979	. 00398	. 71210	. 00515	. 81147	. 00648	46
15	7. 32171	0. 00210	7. 47302	0. 00297	7. 60179	0. 00400	7. 71385	0. 00517	7. 81303	0. 00650	45
16	. 32446	. 00211	. 47533	. 00299	. 60378	. 00402	. 71560	. 00520	. 81459	. 00653	44
17	. 32720	. 00212	. 47764	. 00300	. 60577	. 00403	. 71735	. 00522	. 81615	. 00655	43
18	. 32994	. 00214	. 47994	. 00302	. 60775	. 00405	. 71909	. 00524	. 81771	. 00657	42
19	. 33266	. 00215	. 48223	. 00304	. 60973	. 00407	. 72083	. 00526	. 81926	. 00660	41
20	7. 33538	0. 00216	7. 48452	0. 00305	7. 61170	0. 00409	7. 72257	0. 00528	7. 82081	0. 00662	40
21	. 33809	. 00218	. 48680	. 00307	. 61367	. 00411	. 72430	. 00530	. 82235	. 00664	39
22	. 34079	. 00219	. 48907	. 00308	. 61564	. 00413	. 72603	. 00532	. 82390	. 00667	38
23	. 34348	. 00221	. 49134	. 00310	. 61760	. 00415	. 72775	. 00534	. 82544	. 00669	37
24	. 34616	. 00222	. 49360	. 00312	. 61955	. 00416	. 72948	. 00536	. 82698	. 00671	36
25	7. 34884	0. 00223	7. 49586	0. 00313	7. 62151	0. 00418	7. 73119	0. 00539	7. 82851	0. 00674	35
26	. 35150	. 00225	. 49811	. 00315	. 62345	. 00420	. 73291	. 00541	. 83004	. 00676	34
27	. 35416	. 00226	. 50036	. 00316	. 62540	. 00422	. 73462	. 00543	. 83157	. 00679	33
28	. 35681	. 00227	. 50259	. 00318	. 62733	. 00424	. 73633	. 00545	. 83310	. 00681	32
29	. 35945	. 00229	. 50483	. 00320	. 62927	. 00426	. 73803	. 00547	. 83463	. 00683	31
30	7. 36209	0. 00230	7. 50706	0. 00321	7. 63120	0. 00428	7. 73974	0. 00549	7. 83615	0. 00686	30
31	. 36471	. 00232	. 50928	. 00323	. 63312	. 00430	. 74143	. 00551	. 83767	. 00688	29
32	. 36733	. 00233	. 51149	. 00325	. 63504	. 00432	. 74313	. 00554	. 83918	. 00691	28
33	. 36994	. 00234	. 51370	. 00326	. 63696	. 00433	. 74482	. 00556	. 84070	. 00693	27
34	. 37254	. 00236	. 51591	. 00328	. 63887	. 00435	. 74651	. 00558	. 84221	. 00695	26
35	7. 37514	0. 00237	7. 51811	0. 00330	7. 64078	0. 00437	7. 74819	0. 00560	7. 84372	0. 00698	25
36	. 37773	. 00239	. 52030	. 00331	. 64269	. 00439	. 74988	. 00562	. 84522	. 00700	24
37	. 38030	. 00240	. 52249	. 00333	. 64458	. 00441	. 75155	. 00564	. 84672	. 00703	23
38	. 38288	. 00241	. 52467	. 00335	. 64648	. 00443	. 75323	. 00567	. 84822	. 00705	22
39	. 38544	. 00243	. 52685	. 00336	. 64837	. 00445	. 75490	. 00569	. 84972	. 00707	21
40	7. 38800	0. 00244	7. 52902	0. 00338	7. 65026	0. 00447	7. 75657	0. 00571	7. 85122	0. 00710	20
41	. 39054	. 00246	. 53119	. 00340	. 65214	. 00449	. 75824	. 00573	. 85271	. 00712	19
42	. 39309	. 00247	. 53335	. 00341	. 65402	. 00451	. 75990	. 00575	. 85420	. 00715	18
43	. 39562	. 00249	. 53550	. 00343	. 65590	. 00453	. 76156	. 00578	. 85569	. 00717	17
44	. 39815	. 00250	. 53766	. 00345	. 65777	. 00455	. 76321	. 00580	. 85717	. 00720	16
45	7. 40067	0. 00252	7. 53980	0. 00347	7. 65964	0. 00457	7. 76487	0. 00582	7. 85866	0. 00722	15
46	. 40318	. 00253	. 54194	. 00348	. 66150	. 00459	. 76652	. 00584	. 86014	. 00725	14
47	. 40568	. 00255	. 54407	. 00350	. 66336	. 00461	. 76816	. 00586	. 86161	. 00727	13
48	. 40818	. 00256	. 54620	. 00352	. 66521	. 00463	. 76981	. 00589	. 86309	. 00730	12
49	. 41067	. 00257	. 54833	. 00353	. 66706	. 00465	. 77145	. 00591	. 86456	. 00732	11
50	7. 41315	0. 00259	7. 55045	0. 00355	7. 66891	0. 00467	7. 77308	0. 00593	7. 86603	0. 00735	10
51	. 41563	. 00260	. 55256	. 00357	. 67075	. 00469	. 77472	. 00595	. 86750	. 00737	9
52	. 41810	. 00262	. 55467	. 00359	. 67259	. 00471	. 77635	. 00598	. 86896	. 00740	8
53	. 42056	. 00263	. 55677	. 00360	. 67443	. 00473	. 77798	. 00600	. 87042	. 00742	7
54	. 42301	. 00265	. 55887	. 00362	. 67626	. 00475	. 77960	. 00602	. 87188	. 00745	6
55	7. 42546	0. 00266	7. 56096	0. 00364	7. 67809	0. 00477	7. 78122	0. 00604	7. 87334	0. 00747	5
56	. 42790	. 00268	. 56305	. 00366	. 67991	. 00479	. 78284	. 00607	. 87480	. 00750	4
57	. 43034	. 00269	. 56513	. 00367	. 68173	. 00481	. 78446	. 00609	. 87625	. 00752	3
58	. 43277	. 00271	. 56721	. 00369	. 68355	. 00483	. 78607	. 00611	. 87770	. 00755	2
59	. 43519	. 00272	. 56928	. 00371	. 68536	. 00485	. 78768	. 00613	. 87915	. 00757	1
60	7. 43760	0. 00274	7. 57135	0. 00373	7. 68717	0. 00487	7. 78929	0. 00616	7. 88059	0. 00760	0
	354°		353°		352°		351°		350°		

## Haversines

i	10°		11°		12°		13°		14°		i
	Log Hav	Nat. Hav	Log Hav	Nat. Hav	Log Hav	Nat. Hav	Log Hav	Nat. Hav	Log Hav	Nat. Hav	
0	7.88059	0.00760	7.96315	0.00919	8.03847	0.01093	8.10772	0.01281	8.17179	0.01485	60
1	.88203	.00762	.96446	.00921	.03967	.01096	.10883	.01285	.17282	.01489	59
2	.88348	.00765	.96577	.00924	.04087	.01099	.10993	.01288	.17384	.01492	58
3	.88491	.00767	.96707	.00927	.04207	.01102	.11104	.01291	.17487	.01496	57
4	.88635	.00770	.96838	.00930	.04326	.01105	.11214	.01295	.17590	.01499	56
5	.88778	0.00772	7.96968	0.00933	8.04446	0.01108	8.11324	0.01298	8.17692	0.01503	55
6	.88921	.00775	.97098	.00935	.04565	.01111	.11435	.01301	.17794	.01506	54
7	.89064	.00777	.97228	.00938	.04684	.01114	.11544	.01305	.17896	.01510	53
8	.89207	.00780	.97358	.00941	.04803	.01117	.11654	.01308	.17998	.01513	52
9	.89349	.00783	.97487	.00944	.04922	.01120	.11764	.01311	.18100	.01517	51
10	7.89491	0.00785	7.97617	0.00947	8.05041	0.01123	8.11873	0.01314	8.18202	0.01521	50
11	.89633	.00788	.97746	.00949	.05159	.01126	.11983	.01318	.18303	.01524	49
12	.89775	.00790	.97875	.00952	.05277	.01129	.12092	.01321	.18405	.01528	48
13	.89916	.00793	.98003	.00955	.05395	.01132	.12201	.01324	.18506	.01531	47
14	.90057	.00795	.98132	.00958	.05513	.01135	.12310	.01328	.18607	.01535	46
15	7.90198	0.00798	7.98260	0.00961	8.05631	0.01138	8.12419	0.01331	8.18709	0.01538	45
16	.90339	.00801	.98389	.00964	.05749	.01142	.12528	.01334	.18810	.01542	44
17	.90480	.00803	.98517	.00966	.05866	.01145	.12636	.01338	.18910	.01546	43
18	.90620	.00806	.98644	.00969	.05984	.01148	.12745	.01341	.19011	.01549	42
19	.90760	.00808	.98772	.00972	.06101	.01151	.12853	.01344	.19112	.01553	41
20	7.90900	0.00811	7.98899	0.00975	8.06218	0.01154	8.12961	0.01348	8.19212	0.01556	40
21	.91039	.00814	.99027	.00978	.06335	.01157	.13069	.01351	.19313	.01560	39
22	.91179	.00816	.99154	.00981	.06451	.01160	.13177	.01354	.19413	.01564	38
23	.91318	.00819	.99281	.00984	.06568	.01163	.13285	.01358	.19513	.01567	37
24	.91457	.00821	.99407	.00986	.06684	.01166	.13392	.01361	.19613	.01571	36
25	7.91596	0.00824	7.99534	0.00989	8.06800	0.01170	8.13500	0.01365	8.19713	0.01574	35
26	.91734	.00827	.99660	.00992	.06917	.01173	.13607	.01368	.19813	.01578	34
27	.91872	.00829	.99786	.00995	.07032	.01176	.13714	.01371	.19913	.01582	33
28	.92010	.00832	7.99912	.00998	.07148	.01179	.13822	.01375	.20012	.01585	32
29	.92148	.00835	8.00038	.01001	.07264	.01182	.13928	.01378	.20112	.01589	31
30	7.92286	0.00837	8.00163	0.01004	8.07379	0.01185	8.14035	0.01382	8.20211	0.01593	30
31	.92423	.00840	.00289	.01007	.07494	.01188	.14142	.01385	.20310	.01596	29
32	.92560	.00843	.00414	.01010	.07610	.01192	.14248	.01388	.20410	.01600	28
33	.92697	.00845	.00539	.01012	.07725	.01195	.14355	.01392	.20509	.01604	27
34	.92834	.00848	.00664	.01015	.07839	.01198	.14461	.01395	.20608	.01607	26
35	7.92970	0.00851	8.00788	0.01018	8.07954	0.01201	8.14567	0.01399	8.20706	0.01611	25
36	.93107	.00853	.00913	.01021	.08069	.01204	.14673	.01402	.20805	.01615	24
37	.93243	.00856	.01037	.01024	.08183	.01207	.14779	.01405	.20904	.01618	23
38	.93379	.00859	.01161	.01027	.08297	.01211	.14885	.01409	.21002	.01622	22
39	.93514	.00861	.01285	.01030	.08411	.01214	.14991	.01412	.21100	.01626	21
40	7.93650	0.00864	8.01409	0.01033	8.08525	0.01217	8.15096	0.01416	8.21199	0.01629	20
41	.93785	.00867	.01532	.01036	.08639	.01220	.15201	.01419	.21297	.01633	19
42	.93920	.00869	.01656	.01039	.08752	.01223	.15307	.01423	.21395	.01637	18
43	.94055	.00872	.01779	.01042	.08866	.01226	.15412	.01426	.21493	.01640	17
44	.94189	.00875	.01902	.01045	.08979	.01230	.15517	.01429	.21590	.01644	16
45	7.94324	0.00877	8.02025	0.01048	8.09092	0.01233	8.15622	0.01433	8.21688	0.01648	15
46	.94458	.00880	.02148	.01051	.09205	.01236	.15726	.01436	.21785	.01651	14
47	.94592	.00883	.02270	.01054	.09318	.01239	.15831	.01440	.21883	.01655	13
48	.94726	.00886	.02392	.01057	.09431	.01243	.15935	.01443	.21980	.01659	12
49	.94859	.00888	.02515	.01060	.09543	.01246	.16040	.01447	.22077	.01663	11
50	7.94992	0.00891	8.02637	0.01063	8.09656	0.01249	8.16144	0.01450	8.22175	0.01666	10
51	.95126	.00894	.02758	.01066	.09768	.01252	.16248	.01454	.22272	.01670	9
52	.95259	.00897	.02880	.01069	.09880	.01255	.16352	.01457	.22368	.01674	8
53	.95391	.00899	.03001	.01072	.09992	.01259	.16456	.01461	.22465	.01677	7
54	.95524	.00902	.03123	.01075	.10104	.01262	.16559	.01464	.22562	.01681	6
55	7.95656	0.00905	8.03244	0.01078	8.10216	0.01265	8.16663	0.01468	8.22658	0.01685	5
56	.95788	.00908	.03365	.01081	.10327	.01268	.16766	.01471	.22755	.01689	4
57	.95920	.00910	.03486	.01084	.10439	.01272	.16870	.01475	.22851	.01692	3
58	.96052	.00913	.03606	.01087	.10550	.01275	.16973	.01478	.22947	.01696	2
59	.96183	.00916	.03727	.01090	.10661	.01278	.17076	.01482	.23044	.01700	1
60	7.96315	0.00919	8.03847	0.01093	8.10772	0.01281	8.17179	0.01485	8.23140	0.01704	0
	349°		348°		347°		346°		345°		

## Haversines

	15°		16°		17°		18°		19°		
	Log Hav	Nat. Hav	Log Hav	Nat. Hav	Log Hav	Nat. Hav	Log Hav	Nat. Hav	Log Hav	Nat. Hav	
0	8. 23140	0. 01704	8. 28711	0. 01937	8. 33940	0. 02185	8. 38867	0. 02447	8. 43522	0. 02724	60
1	. 23235	. 01707	. 28801	. 01941	. 34025	. 02189	. 38946	. 02452	. 43597	. 02729	59
2	. 23331	. 01711	. 28891	. 01945	. 34109	. 02193	. 39026	. 02456	. 43673	. 02734	58
3	. 23427	. 01715	. 28980	. 01949	. 34194	. 02198	. 39105	. 02461	. 43748	. 02738	57
4	. 23523	. 01719	. 29070	. 01953	. 34278	. 02202	. 39185	. 02465	. 43823	. 02743	56
5	8. 23618	0. 01723	8. 29159	0. 01957	8. 34362	0. 02206	8. 39264	0. 02470	8. 43899	0. 02748	55
6	. 23713	. 01726	. 29249	. 01961	. 34446	. 02210	. 39344	. 02474	. 43974	. 02753	54
7	. 23809	. 01730	. 29338	. 01965	. 34530	. 02215	. 39423	. 02479	. 44049	. 02757	53
8	. 23904	. 01734	. 29427	. 01969	. 34614	. 02219	. 39502	. 02483	. 44124	. 02762	52
9	. 23999	. 01738	. 29516	. 01973	. 34698	. 02223	. 39581	. 02488	. 44199	. 02767	51
10	8. 24094	0. 01742	8. 29605	0. 01977	8. 34782	0. 02227	8. 39660	0. 02492	8. 44273	0. 02772	50
11	. 24189	. 01745	. 29694	. 01981	. 34865	. 02232	. 39739	. 02497	. 44348	. 02776	49
12	. 24283	. 01749	. 29783	. 01985	. 34949	. 02236	. 39818	. 02501	. 44423	. 02781	48
13	. 24378	. 01753	. 29872	. 01989	. 35032	. 02240	. 39897	. 02506	. 44498	. 02786	47
14	. 24473	. 01757	. 29960	. 01993	. 35116	. 02245	. 39976	. 02510	. 44572	. 02791	46
15	8. 24567	0. 01761	8. 30049	0. 01998	8. 35199	0. 02249	8. 40055	0. 02515	8. 44647	0. 02796	45
16	. 24661	. 01764	. 30137	. 02002	. 35282	. 02253	. 40133	. 02520	. 44721	. 02800	44
17	. 24755	. 01768	. 30226	. 02006	. 35365	. 02258	. 40212	. 02524	. 44796	. 02805	43
18	. 24850	. 01772	. 30314	. 02010	. 35449	. 02262	. 40290	. 02529	. 44870	. 02810	42
19	. 24944	. 01776	. 30402	. 02014	. 35532	. 02266	. 40369	. 02533	. 44944	. 02815	41
20	8. 25037	0. 01780	8. 30490	0. 02018	8. 35614	0. 02271	8. 40447	0. 02538	8. 45018	0. 02820	40
21	. 25131	. 01784	. 30578	. 02022	. 35697	. 02275	. 40525	. 02542	. 45093	. 02824	39
22	. 25225	. 01788	. 30666	. 02026	. 35780	. 02279	. 40603	. 02547	. 45167	. 02829	38
23	. 25319	. 01791	. 30754	. 02030	. 35863	. 02284	. 40681	. 02552	. 45241	. 02834	37
24	. 25412	. 01795	. 30842	. 02034	. 35945	. 02288	. 40760	. 02556	. 45315	. 02839	36
25	8. 25505	0. 01799	8. 30929	0. 02038	8. 36028	0. 02292	8. 40837	0. 02561	8. 45388	0. 02844	35
26	. 25599	. 01803	. 31017	. 02043	. 36110	. 02297	. 40915	. 02565	. 45462	. 02849	34
27	. 25692	. 01807	. 31104	. 02047	. 36193	. 02301	. 40993	. 02570	. 45536	. 02853	33
28	. 25785	. 01811	. 31192	. 02051	. 36275	. 02305	. 41071	. 02575	. 45610	. 02858	32
29	. 25878	. 01815	. 31279	. 02055	. 36357	. 02310	. 41149	. 02579	. 45683	. 02863	31
30	8. 25971	0. 01818	8. 31366	0. 02059	8. 36439	0. 02314	8. 41226	0. 02584	8. 45757	0. 02868	30
31	. 26064	. 01822	. 31453	. 02063	. 36521	. 02319	. 41304	. 02588	. 45830	. 02873	29
32	. 26156	. 01826	. 31540	. 02067	. 36603	. 02323	. 41381	. 02593	. 45904	. 02878	28
33	. 26249	. 01830	. 31627	. 02071	. 36685	. 02327	. 41459	. 02598	. 45977	. 02883	27
34	. 26341	. 01834	. 31714	. 02076	. 36767	. 02332	. 41536	. 02602	. 46050	. 02887	26
35	8. 26434	0. 01838	8. 31800	0. 02080	8. 36849	0. 02336	8. 41613	0. 02607	8. 46124	0. 02892	25
36	. 26526	. 01842	. 31887	. 02084	. 36930	. 02340	. 41690	. 02612	. 46197	. 02897	24
37	. 26618	. 01846	. 31974	. 02088	. 37012	. 02345	. 41767	. 02616	. 46270	. 02902	23
38	. 26710	. 01850	. 32060	. 02092	. 37093	. 02349	. 41845	. 02621	. 46343	. 02907	22
39	. 26802	. 01854	. 32147	. 02096	. 37175	. 02354	. 41921	. 02626	. 46416	. 02912	21
40	8. 26894	0. 01858	8. 32233	0. 02101	8. 37256	0. 02358	8. 41998	0. 02630	8. 46489	0. 02917	20
41	. 26986	. 01861	. 32319	. 02105	. 37337	. 02363	. 42075	. 02635	. 46562	. 02922	19
42	. 27078	. 01865	. 32405	. 02109	. 37419	. 02367	. 42152	. 02639	. 46634	. 02926	18
43	. 27169	. 01869	. 32491	. 02113	. 37500	. 02371	. 42229	. 02644	. 46707	. 02931	17
44	. 27261	. 01873	. 32577	. 02117	. 37581	. 02376	. 42305	. 02649	. 46780	. 02936	16
45	8. 27352	0. 01877	8. 32663	0. 02121	8. 37662	0. 02380	8. 42382	0. 02653	8. 46852	0. 02941	15
46	. 27443	. 01881	. 32749	. 02126	. 37742	. 02385	. 42458	. 02658	. 46925	. 02946	14
47	. 27534	. 01885	. 32834	. 02130	. 37823	. 02389	. 42535	. 02663	. 46998	. 02951	13
48	. 27626	. 01889	. 32920	. 02134	. 37904	. 02394	. 42611	. 02668	. 47070	. 02956	12
49	. 27717	. 01893	. 33006	. 02138	. 37985	. 02398	. 42687	. 02672	. 47142	. 02961	11
50	8. 27807	0. 01897	8. 33091	0. 02142	8. 38065	0. 02402	8. 42764	0. 02677	8. 47215	0. 02966	10
51	. 27898	. 01901	. 33176	. 02147	. 38146	. 02407	. 42840	. 02682	. 47287	. 02971	9
52	. 27989	. 01905	. 33262	. 02151	. 38226	. 02411	. 42916	. 02686	. 47359	. 02976	8
53	. 28080	. 01909	. 33347	. 02155	. 38306	. 02416	. 42992	. 02691	. 47431	. 02981	7
54	. 28170	. 01913	. 33432	. 02159	. 38387	. 02420	. 43068	. 02696	. 47503	. 02986	6
55	8. 28260	0. 01917	8. 33517	0. 02164	8. 38467	0. 02425	8. 43144	0. 02700	8. 47575	0. 02991	5
56	. 28351	. 01921	. 33602	. 02168	. 38547	. 02429	. 43219	. 02705	. 47647	. 02996	4
57	. 28441	. 01925	. 33686	. 02172	. 38627	. 02434	. 43295	. 02710	. 47719	. 03000	3
58	. 28531	. 01929	. 33771	. 02176	. 38707	. 02438	. 43371	. 02715	. 47791	. 03005	2
59	. 28621	. 01933	. 33856	. 02181	. 38787	. 02443	. 43446	. 02719	. 47862	. 03010	1
60	8. 28711	0. 01937	8. 33940	0. 02185	8. 38867	0. 02447	8. 43522	0. 02724	8. 47934	0. 03015	0
	344°		343°		342°		341°		340°		



## Haversines

i	20°		21°		22°		23°		24°		i
	Log Hav	Nat. Hav	Log Hav	Nat. Hav	Log Hav	Nat. Hav	Log Hav	Nat. Hav	Log Hav	Nat. Hav	
0	8.47934	0.03015	8.52127	0.03321	8.56120	0.03641	8.59931	0.03975	8.63576	0.04323	60
1	.48006	.03020	.52195	.03326	.56185	.03646	.59993	.03980	.63635	.04329	59
2	.48077	.03025	.52263	.03331	.56250	.03652	.60055	.03986	.63695	.04335	58
3	.48149	.03030	.52331	.03337	.56315	.03657	.60117	.03992	.63754	.04340	57
4	.48220	.03035	.52399	.03342	.56379	.03663	.60179	.03998	.63813	.04346	56
5	8.48292	0.03040	8.52467	0.03347	8.56444	0.03668	8.60241	0.04003	8.63872	0.04352	55
6	.48363	.03045	.52535	.03352	.56509	.03674	.60303	.04009	.63932	.04358	54
7	.48434	.03050	.52602	.03358	.56574	.03679	.60365	.04015	.63991	.04364	53
8	.48505	.03055	.52670	.03363	.56638	.03685	.60426	.04020	.64050	.04370	52
9	.48576	.03060	.52738	.03368	.56703	.03690	.60488	.04026	.64109	.04376	51
10	8.48648	0.03065	8.52806	0.03373	8.56767	0.03695	8.60550	0.04032	8.64168	0.04382	50
11	.48719	.03070	.52873	.03379	.56832	.03701	.60611	.04038	.64227	.04388	49
12	.48789	.03075	.52941	.03384	.56896	.03706	.60673	.04043	.64286	.04394	48
13	.48860	.03080	.53008	.03389	.56960	.03712	.60734	.04049	.64345	.04400	47
14	.48931	.03085	.53076	.03394	.57025	.03717	.60796	.04055	.64404	.04406	46
15	8.49002	0.03090	8.53143	0.03400	8.57089	0.03723	8.60857	0.04060	8.64463	0.04412	45
16	.49073	.03095	.53210	.03405	.57153	.03728	.60919	.04066	.64521	.04418	44
17	.49143	.03101	.53277	.03410	.57217	.03734	.60980	.04072	.64580	.04424	43
18	.49214	.03106	.53345	.03415	.57282	.03740	.61041	.04078	.64639	.04430	42
19	.49284	.03111	.53412	.03421	.57346	.03745	.61103	.04083	.64697	.04436	41
20	8.49355	0.03116	8.53479	0.03426	8.57410	0.03751	8.61164	0.04089	8.64756	0.04442	40
21	.49425	.03121	.53546	.03431	.57474	.03756	.61225	.04095	.64815	.04448	39
22	.49496	.03126	.53613	.03437	.57538	.03762	.61286	.04101	.64873	.04454	38
23	.49566	.03131	.53680	.03442	.57601	.03767	.61347	.04106	.64932	.04460	37
24	.49636	.03136	.53747	.03447	.57665	.03773	.61408	.04112	.64990	.04466	36
25	8.49706	0.03141	8.53814	0.03453	8.57729	0.03778	8.61469	0.04118	8.65049	0.04472	35
26	.49777	.03146	.53880	.03458	.57793	.03784	.61530	.04124	.65107	.04478	34
27	.49847	.03151	.53947	.03463	.57856	.03789	.61591	.04130	.65165	.04484	33
28	.49917	.03156	.54014	.03468	.57920	.03795	.61652	.04135	.65224	.04490	32
29	.49987	.03161	.54080	.03474	.57984	.03800	.61713	.04141	.65282	.04496	31
30	8.50056	0.03166	8.54147	0.03479	8.58047	0.03806	8.61773	0.04147	8.65340	0.04502	30
31	.50126	.03171	.54214	.03484	.58111	.03812	.61834	.04153	.65398	.04508	29
32	.50196	.03177	.54280	.03490	.58174	.03817	.61895	.04159	.65456	.04514	28
33	.50266	.03182	.54346	.03495	.58238	.03823	.61955	.04164	.65514	.04520	27
34	.50335	.03187	.54413	.03500	.58301	.03828	.62016	.04170	.65572	.04526	26
35	8.50405	0.03192	8.54479	0.03506	8.58364	0.03834	8.62077	0.04176	8.65630	0.04532	25
36	.50475	.03197	.54545	.03511	.58427	.03839	.62137	.04182	.65688	.04538	24
37	.50544	.03202	.54612	.03517	.58491	.03845	.62197	.04188	.65746	.04544	23
38	.50614	.03207	.54678	.03522	.58554	.03851	.62258	.04194	.65804	.04550	22
39	.50683	.03212	.54744	.03527	.58617	.03856	.62318	.04199	.65862	.04556	21
40	8.50752	0.03218	8.54810	0.03533	8.58680	0.03862	8.62379	0.04205	8.65920	0.04562	20
41	.50821	'03223	.54976	.03538	.58743	.03867	.62439	.04211	.65978	.04569	19
42	.50891	'03228	.54942	.03543	.58806	.03873	.62499	.04217	.66035	.04575	18
43	.50960	.03233	.55008	.03549	.58869	.03879	.62559	.04223	.66093	.04581	17
44	.51029	'03238	'55073	.03554	.58932	.03884	.62619	.04229	.66151	.04587	16
45	8.51098	0.03243	8.55139	0.03560	8.58994	0.03890	8.62680	0.04234	8.66208	0.04593	15
46	.51167	.03248	.55205	.03565	.59057	.03896	.62740	.04240	.66266	.04599	14
47	.51236	.03254	.55271	.03570	.59120	.03901	.62800	.04246	.66323	.04605	13
48	.51305	.03259	.55336	.03576	.59183	.03907	.62860	.04252	.66381	.04611	12
49	.51374	.03264	.55402	.03581	.59245	.03912	.62919	.04258	.66438	.04617	11
50	8.51442	0.03269	8.55467	0.03587	8.59308	0.03918	8.62979	0.04264	8.66496	0.04623	10
51	.51511	.03274	.55533	.03592	.59370	.03924	.63039	.04270	.66553	.04629	9
52	.51580	.03279	.55598	.03597	.59433	.03929	.63099	.04276	.66610	.04636	8
53	.51648	.03285	.55664	.03603	.59495	.03935	.63159	.04281	.66668	.04642	7
54	.51717	.03290	.55729	.03608	.59558	.03941	.63218	.04287	.66725	.04648	6
55	8.51785	0.03295	8.55794	0.03614	8.59620	0.03946	8.63278	0.04293	8.66782	0.04654	5
56	.51854	.03300	.55859	.03619	.59682	.03952	.63338	.04299	.66839	.04660	4
57	.51922	.03305	.55925	.03624	.59745	.03958	.63397	.04305	.66896	.04666	3
58	.51990	.03311	.55990	.03630	.59807	.03963	.63457	.04311	.66953	.04672	2
59	.52058	.03316	.56055	.03635	.59869	.03969	.63516	.04317	.67010	.04678	1
60	8.52127	0.03321	8.56120	0.03641	8.59931	0.03975	8.63576	0.04323	8.67067	0.04685	0
	339°		338°		337°		336°		335°		

## Haversines

i	25°		26°		27°		28°		26°		i
	Log Hav	Nat. Hav	Log Hav	Nat. Hav	Log Hav	Nat. Hav	Log Hav	Nat. Hav	Log Hav	Nat. Hav	
0	8. 67067	0. 04685	8. 70418	0. 05060	8. 73637	0. 05450	8. 76735	0. 05853	8. 79720	0. 06269	60
1	. 67124	. 04691	. 70472	. 05067	. 73690	. 05456	. 76786	. 05859	. 79769	. 06276	59
2	. 67181	. 04697	. 70527	. 05073	. 73742	. 05463	. 76836	. 05866	. 79818	. 06283	58
3	. 67238	. 04703	. 70582	. 05079	. 73795	. 05469	. 76887	. 05873	. 79866	. 06290	57
4	. 67295	. 04709	. 70636	. 05086	. 73847	. 05476	. 76938	. 05880	. 79915	. 06297	56
5	8. 67352	0. 04715	8. 70691	0. 05092	8. 73900	0. 05483	8. 76988	0. 05887	8. 79964	0. 06304	55
6	. 67409	. 04722	. 70745	. 05099	. 73952	. 05489	. 77039	. 05894	. 80013	. 06311	54
7	. 67465	. 04728	. 70800	. 05105	. 74005	. 05496	. 77089	. 05901	. 80061	. 06318	53
8	. 67522	. 04734	. 70854	. 05111	. 74057	. 05503	. 77139	. 05907	. 80110	. 06326	52
9	. 67579	. 04740	. 70909	. 05118	. 74109	. 05509	. 77190	. 05914	. 80158	. 06333	51
10	8. 67635	0. 04746	8. 70963	0. 05124	8. 74162	0. 05516	8. 77240	0. 05921	8. 80207	0. 06340	50
11	. 67692	. 04752	. 71017	. 05131	. 74214	. 05523	. 77291	. 05928	. 80256	. 06347	49
12	. 67748	. 04759	. 71072	. 05137	. 74266	. 05529	. 77341	. 05935	. 80304	. 06354	48
13	. 67805	. 04765	. 71126	. 05144	. 74318	. 05536	. 77391	. 05942	. 80353	. 06361	47
14	. 67861	. 04771	. 71180	. 05150	. 74371	. 05542	. 77441	. 05949	. 80401	. 06368	46
15	8. 67918	0. 04777	8. 71234	0. 05156	8. 74423	0. 05549	8. 77492	0. 05955	8. 80449	0. 06375	45
16	. 67974	. 04783	. 71289	. 05163	. 74475	. 05556	. 77542	. 05962	. 80498	. 06382	44
17	. 68030	. 04790	. 71343	. 05169	. 74527	. 05562	. 77592	. 05969	. 80546	. 06389	43
18	. 68087	. 04796	. 71397	. 05176	. 74579	. 05569	. 77642	. 05976	. 80595	. 06397	42
19	. 68143	. 04802	. 71451	. 05182	. 74631	. 05576	. 77692	. 05983	. 80643	. 06404	41
20	8. 68199	0. 04808	8. 71505	0. 05189	8. 74683	0. 05582	8. 77742	0. 05990	8. 80691	0. 06411	40
21	. 68256	. 04815	. 71559	. 05195	. 74735	. 05589	. 77792	. 05997	. 80739	. 06418	39
22	. 68312	. 04821	. 71613	. 05201	. 74787	. 05596	. 77842	. 06004	. 80788	. 06425	38
23	. 68368	. 04827	. 71667	. 05208	. 74839	. 05603	. 77892	. 06011	. 80836	. 06432	37
24	. 68424	. 04833	. 71721	. 05214	. 74890	. 05609	. 77942	. 06018	. 80884	. 06439	36
25	8. 68480	0. 04839	8. 71774	0. 05221	8. 74942	0. 05616	8. 77992	0. 06024	8. 80932	0. 06446	35
26	. 68536	. 04846	. 71828	. 05227	. 74994	. 05623	. 78042	. 06031	. 80980	. 06454	34
27	. 68592	. 04852	. 71882	. 05234	. 75046	. 05629	. 78092	. 06038	. 81028	. 06461	33
28	. 68648	. 04858	. 71936	. 05240	. 75097	. 05636	. 78142	. 06045	. 81076	. 06468	32
29	. 68704	. 04864	. 71989	. 05247	. 75149	. 05643	. 78191	. 06052	. 81124	. 06475	31
30	8. 68760	0. 04871	8. 72043	0. 05253	8. 75201	0. 05649	8. 78241	0. 06059	8. 81172	0. 06482	30
31	. 68815	. 04877	. 72097	. 05260	. 75252	. 05656	. 78291	. 06066	. 81220	. 06489	29
32	. 68871	. 04883	. 72150	. 05266	. 75304	. 05663	. 78341	. 06073	. 81268	. 06497	28
33	. 68927	. 04890	. 72204	. 05273	. 75355	. 05670	. 78390	. 06080	. 81316	. 06504	27
34	. 68983	. 04896	. 72257	. 05279	. 75407	. 05676	. 78440	. 06087	. 81364	. 06511	26
35	8. 69038	0. 04902	8. 72311	0. 05286	8. 75458	0. 05683	8. 78490	0. 06094	8. 81412	0. 06518	25
36	. 69094	. 04908	. 72364	. 05292	. 75510	. 05690	. 78539	. 06101	. 81460	. 06525	24
37	. 69149	. 04915	. 72418	. 05299	. 75561	. 05697	. 78589	. 06108	. 81508	. 06532	23
38	. 69205	. 04921	. 72471	. 05305	. 75613	. 05703	. 78638	. 06115	. 81555	. 06540	22
39	. 69260	. 04927	. 72525	. 05312	. 75664	. 05710	. 78688	. 06122	. 81603	. 06547	21
40	8. 69316	0. 04934	8. 72578	0. 05318	8. 75715	0. 05717	8. 78737	0. 06129	8. 81651	0. 06554	20
41	. 69371	. 04940	. 72631	. 05325	. 75767	. 05724	. 78787	. 06136	. 81699	. 06561	19
42	. 69427	. 04946	. 72684	. 05331	. 75818	. 05730	. 78836	. 06143	. 81746	. 06568	18
43	. 69482	. 04952	. 72738	. 05338	. 75869	. 05737	. 78885	. 06150	. 81794	. 06576	17
44	. 69537	. 04959	. 72791	. 05345	. 75920	. 05744	. 78935	. 06157	. 81841	. 06583	16
45	8. 69593	0. 04965	8. 72844	0. 05351	8. 75972	0. 05751	8. 78984	0. 06164	8. 81889	0. 06590	15
46	. 69648	. 04971	. 72897	. 05358	. 76023	. 05757	. 79033	. 06171	. 81937	. 06597	14
47	. 69703	. 04978	. 72950	. 05364	. 76074	. 05764	. 79082	. 06178	. 81984	. 06605	13
48	. 69758	. 04984	. 73003	. 05371	. 76125	. 05771	. 79132	. 06185	. 82032	. 06612	12
49	. 69814	. 04990	. 73056	. 05377	. 76176	. 05778	. 79181	. 06192	. 82079	. 06619	11
50	8. 69869	0. 04997	8. 73109	0. 05384	8. 76227	0. 05785	8. 79230	0. 06199	8. 82126	0. 06626	10
51	. 69924	. 05003	. 73162	. 05390	. 76278	. 05791	. 79279	. 06206	. 82174	. 06633	9
52	. 69979	. 05009	. 73215	. 05397	. 76329	. 05798	. 79328	. 06213	. 82221	. 06641	8
53	. 70034	. 05016	. 73268	. 05404	. 76380	. 05805	. 79377	. 06220	. 82269	. 06648	7
54	. 70089	. 05022	. 73321	. 05410	. 76431	. 05812	. 79426	. 06227	. 82316	. 06655	6
55	8. 70144	0. 05028	8. 73374	0. 05417	8. 76481	0. 05819	8. 79475	0. 06234	8. 82363	0. 06662	5
56	. 70198	. 05035	. 73426	. 05423	. 76532	. 05825	. 79524	. 06241	. 82410	. 06670	4
57	. 70253	. 05041	. 73479	. 05430	. 76583	. 05832	. 79573	. 06248	. 82458	. 06677	3
58	. 70308	. 05048	. 73532	. 05436	. 76634	. 05839	. 79622	. 06255	. 82505	. 06684	2
59	. 70363	. 05054	. 73584	. 05443	. 76684	. 05846	. 79671	. 06262	. 82552	. 06691	1
60	8. 70418	0. 05060	8. 73637	0. 05450	8. 76735	0. 05853	8. 79720	0. 06269	8. 82599	0. 06699	0
	339°		338°		337°		336°		335°		

## Haversines

i	30°		31°		32°		33°		34°		i
	Log Hav	Nat. Hav	Log Hav	Nat. Hav	Log Hav	Nat. Hav	Log Hav	Nat. Hav	Log Hav	Nat. Hav	
0	8.82599	0.06699	8.85380	0.07142	8.88068	0.07598	8.90668	0.08066	8.93187	0.08548	60
1	.82646	.06706	.85425	.07149	.88112	.07605	.90711	.08074	.93228	.08556	59
2	.82694	.06713	.85471	.07157	.88156	.07613	.90754	.08082	.93270	.08564	58
3	.82741	.06721	.85516	.07164	.88200	.07621	.90796	.08090	.93311	.08573	57
4	.82788	.06728	.85562	.07172	.88244	.07628	.90839	.08098	.93352	.08581	56
5	8.82835	0.06735	8.85607	0.07179	8.88288	0.07636	8.90881	0.08106	8.93393	0.08589	55
6	.82882	.06742	.85653	.07187	.88332	.07644	.90924	.08114	.93435	.08597	54
7	.82929	.06750	.85698	.07194	.88375	.07652	.90966	.08122	.93476	.08605	53
8	.82976	.06757	.85743	.07202	.88419	.07659	.91009	.08130	.93517	.08613	52
9	.83023	.06764	.85789	.07209	.88463	.07667	.91051	.08138	.93558	.08621	51
10	8.83069	0.06772	8.85834	0.07217	8.88507	0.07675	8.91094	0.08146	8.93599	0.08630	50
11	.83116	.06779	.85879	.07224	.88551	.07683	.91136	.08154	.93640	.08638	49
12	.83163	.06786	.85925	.07232	.88595	.07690	.91179	.08162	.93681	.08646	48
13	.83210	.06794	.85970	.07239	.88638	.07698	.91221	.08170	.93722	.08654	47
14	.83257	.06801	.86015	.07247	.88682	.07706	.91263	.08178	.93764	.08662	46
15	8.83303	0.06808	8.86060	0.07254	8.88726	0.07714	8.91306	0.08186	8.93805	0.08671	45
16	.83350	.06816	.86105	.07262	.88769	.07721	.91348	.08194	.93846	.08679	44
17	.83397	.06823	.86151	.07270	.88813	.07729	.91390	.08202	.93886	.08687	43
18	.83444	.06830	.86196	.07277	.88857	.07737	.91432	.08210	.93927	.08695	42
19	.83490	.06838	.86241	.07285	.88900	.07745	.91475	.08218	.93968	.08703	41
20	8.83537	0.06845	8.86286	0.07292	8.88944	0.07752	8.91517	0.08226	8.94009	0.08711	40
21	.83583	.06852	.86331	.07300	.88988	.07760	.91559	.08234	.94050	.08720	39
22	.83630	.06860	.86376	.07307	.89031	.07768	.91601	.08242	.94091	.08728	38
23	.83676	.06867	.86421	.07315	.89075	.07776	.91643	.08250	.94132	.08736	37
24	.83723	.06874	.86466	.07322	.89118	.07784	.91685	.08258	.94173	.08744	36
25	8.83769	0.06882	8.86511	0.07330	8.89162	0.07791	8.91728	0.08266	8.94213	0.08753	35
26	.83816	.06889	.86556	.07338	.89205	.07799	.91770	.08274	.94254	.08761	34
27	.83862	.06896	.86600	.07345	.89248	.07807	.91812	.08282	.94295	.08769	33
28	.83909	.06904	.86645	.07353	.89292	.07815	.91854	.08290	.94336	.08777	32
29	.83955	.06911	.86690	.07360	.89335	.07823	.91896	.08298	.94376	.08785	31
30	8.84002	0.06919	8.86735	0.07368	8.89379	0.07830	8.91938	0.08306	8.94417	0.08794	30
31	.84048	.06926	.86780	.07376	.89422	.07838	.91980	.08314	.94458	.08802	29
32	.84094	.06933	.86825	.07383	.89465	.07846	.92022	.08322	.94498	.08810	28
33	.84140	.06941	.86869	.07391	.89509	.07854	.92064	.08330	.94539	.08818	27
34	.84187	.06948	.86914	.07398	.89552	.07862	.92105	.08338	.94580	.08827	26
35	8.84233	0.06955	8.86959	0.07406	8.89595	0.07870	8.92147	0.08346	8.94620	0.08835	25
36	.84279	.06963	.87003	.07414	.89638	.07877	.92189	.08354	.94661	.08843	24
37	.84325	.06970	.87048	.07421	.89681	.07885	.92231	.08362	.94701	.08851	23
38	.84371	.06978	.87093	.07429	.89725	.07893	.92273	.08370	.94742	.08860	22
39	.84417	.06985	.87137	.07437	.89768	.07901	.92315	.08378	.94782	.08868	21
40	8.84464	0.06993	8.87182	0.07444	8.89811	0.07909	8.92356	0.08386	8.94823	0.08876	20
41	.84510	.07000	.87226	.07452	.89854	.07917	.92398	.08394	.94863	.08885	19
42	.84556	.07007	.87271	.07459	.89897	.07924	.92440	.08402	.94904	.08893	18
43	.84602	.07015	.87315	.07467	.89940	.07932	.92482	.08410	.94944	.08901	17
44	.84648	.07022	.87360	.07475	.89983	.07940	.92523	.08418	.94985	.08909	16
45	8.84694	0.07030	8.87404	0.07482	8.90026	0.07948	8.92565	0.08427	8.95025	0.08918	15
46	.84740	.07037	.87448	.07490	.90069	.07956	.92607	.08435	.95065	.08926	14
47	.84785	.07045	.87493	.07498	.90112	.07964	.92648	.08443	.95106	.08934	13
48	.84831	.07052	.87537	.07505	.90155	.07972	.92690	.08451	.95146	.08943	12
49	.84877	.07059	.87582	.07513	.90198	.07980	.92731	.08459	.95186	.08951	11
50	8.84923	0.07067	8.87626	0.07521	8.90241	0.07987	8.92773	0.08467	8.95227	0.08959	10
51	.84969	.07074	.87670	.07528	.90284	.07995	.92814	.08475	.95267	.08967	9
52	.85015	.07082	.87714	.07536	.90326	.08003	.92856	.08483	.95307	.08976	8
53	.85060	.07089	.87759	.07544	.90369	.08011	.92897	.08491	.95347	.08984	7
54	.85106	.07097	.87803	.07551	.90412	.08019	.92939	.08499	.95388	.08992	6
55	8.85152	0.07104	8.87847	0.07559	8.90455	0.08027	8.92980	0.08507	8.95428	0.09001	5
56	.85197	.07112	.87891	.07567	.90498	.08035	.93022	.08516	.95468	.09009	4
57	.85243	.07119	.87935	.07574	.90540	.08043	.93063	.08524	.95508	.09017	3
58	.85289	.07127	.87980	.07582	.90583	.08051	.93104	.08532	.95548	.09026	2
59	.85334	.07134	.88024	.07590	.90626	.08059	.93146	.08540	.95588	.09034	1
60	8.85380	0.07142	8.88068	0.07598	8.90668	0.08066	8.93187	0.08548	8.95628	0.09042	0
	329°		328°		327°		326°		325°		

## Haversines

i	35°		36°		37°		38°		39°		i
	Log Hav	Nat. Hav	Log Hav	Nat. Hav	Log Hav	Nat. Hav	Log Hav	Nat. Hav	Log Hav	Nat. Hav	
0	8.95628	0.09042	8.97997	0.09549	9.00295	0.10068	9.02528	0.10599	9.04699	0.11143	60
1	.95668	.09051	.98035	.09558	.00333	.10077	.02565	.10608	.04735	.11152	59
2	.95709	.09059	.98074	.09566	.00371	.10086	.02602	.10517	.04770	.11161	58
3	.95749	.09067	.98113	.09575	.00408	.10094	.02638	.10626	.04806	.11170	57
4	.95789	.09076	.98152	.09583	.00446	.10103	.02675	.10635	.04842	.11179	56
5	8.95828	0.09084	8.98191	0.09592	9.00484	0.10112	9.02712	0.10644	9.04877	0.11189	55
6	.95868	.09093	.98229	.09601	.00522	.10121	.02748	.10653	.04913	.11198	54
7	.95908	.09101	.98268	.09609	.00559	.10130	.02785	.10662	.04948	.11207	53
8	.95948	.09109	.98307	.09618	.00597	.10138	.02821	.10671	.04984	.11216	52
9	.95988	.09118	.98346	.09626	.00634	.10147	.02858	.10680	.05019	.11225	51
10	8.96028	0.09126	8.98384	0.09635	9.00672	0.10156	9.02894	0.10689	9.05055	0.11234	50
11	.96068	.09134	.98423	.09643	.00710	.10165	.02931	.10698	.05090	.11244	49
12	.96108	.09143	.98462	.09652	.00747	.10174	.02967	.10707	.05126	.11253	48
13	.96148	.09151	.98500	.09661	.00785	.10182	.03004	.10716	.05161	.11262	47
14	.96187	.09160	.98539	.09669	.00822	.10191	.03040	.10725	.05197	.11271	46
15	8.96227	0.09168	8.98578	0.09678	9.00860	0.10200	9.03077	0.10734	9.05232	0.11280	45
16	.96267	.09176	.98616	.09686	.00897	.10209	.03113	.10743	.05268	.11290	44
17	.96307	.09185	.98655	.09695	.00935	.10218	.03150	.10752	.05303	.11299	43
18	.96346	.09193	.98693	.09704	.00972	.10226	.03186	.10761	.05339	.11308	42
19	.96386	.09202	.98732	.09712	.01009	.10235	.03222	.10770	.05374	.11317	41
20	8.96426	0.09210	8.98770	0.09721	9.01047	0.10244	9.03259	0.10779	9.05409	0.11326	40
21	.96465	.09218	.98809	.09729	.01084	.10253	.03295	.10788	.05445	.11336	39
22	.96505	.09227	.98847	.09738	.01122	.10262	.03331	.10797	.05480	.11345	38
23	.96545	.09235	.98886	.09747	.01159	.10270	.03368	.10806	.05515	.11354	37
24	.96584	.09244	.98924	.09755	.01196	.10279	.03404	.10815	.05551	.11363	36
25	8.96624	0.09252	8.98963	0.09764	9.01234	0.10288	9.03440	0.10824	9.05586	0.11373	35
26	.96663	.09260	.99001	.09773	.01271	.10297	.03476	.10833	.05621	.11382	34
27	.96703	.09269	.99039	.09781	.01308	.10306	.03513	.10842	.05656	.11391	33
28	.96742	.09277	.99078	.09790	.01345	.10315	.03549	.10851	.05692	.11400	32
29	.96782	.09286	.99116	.09799	.01383	.10323	.03585	.10861	.05727	.11410	31
30	8.96821	0.09294	8.99154	0.09807	9.01420	0.10332	9.03621	0.10870	9.05762	0.11419	30
31	.96861	.09303	.99193	.09816	.01457	.10341	.03657	.10879	.05797	.11428	29
32	.96900	.09311	.99231	.09824	.01494	.10350	.03694	.10888	.05832	.11437	28
33	.96940	.09320	.99269	.09833	.01531	.10359	.03730	.10897	.05867	.11447	27
34	.96979	.09328	.99307	.09842	.01569	.10368	.03766	.10906	.05903	.11456	26
35	8.97018	0.09336	8.99346	0.09850	9.01606	0.10377	9.03802	0.10915	9.05938	0.11465	25
36	.97058	.09345	.99384	.09859	.01643	.10386	.03838	.10924	.05973	.11474	24
37	.97097	.09353	.99422	.09868	.01680	.10394	.03874	.10933	.06008	.11484	23
38	.97136	.09362	.99460	.09876	.01717	.10403	.03910	.10942	.06043	.11493	22
39	.97176	.09370	.99498	.09885	.01754	.10412	.03946	.10951	.06078	.11502	21
40	8.97215	0.09379	8.99536	0.09894	9.01791	0.10421	9.03982	0.10960	9.06113	0.11511	20
41	.97254	.09387	.99575	.09903	.01828	.10430	.04018	.10969	.06148	.11521	19
42	.97294	.09396	.99613	.09911	.01865	.10439	.04054	.10978	.06183	.11530	18
43	.97333	.09404	.99651	.09920	.01902	.10448	.04090	.10988	.06218	.11539	17
44	.97372	.09413	.99689	.09929	.01939	.10457	.04126	.10997	.06253	.11549	16
45	8.97411	0.09421	8.99727	0.09937	9.01976	0.10466	9.04162	0.11006	9.06288	0.11558	15
46	.97450	.09430	.99765	.09946	.02013	.10474	.04198	.11015	.06323	.11567	14
47	.97489	.09438	.99803	.09955	.02050	.10483	.04234	.11024	.06358	.11577	13
48	.97529	.09447	.99841	.09963	.02087	.10492	.04270	.11033	.06393	.11586	12
49	.97568	.09455	.99879	.09972	.02124	.10501	.04306	.11042	.06428	.11595	11
50	8.97607	0.09464	8.99917	0.09981	9.02161	0.10510	9.04341	0.11051	9.06462	0.11604	10
51	.97646	.09472	.99955	.09990	.02197	.10519	.04377	.11060	.06497	.11614	9
52	.97685	.09481	.99993	.09998	.02234	.10528	.04413	.11070	.06532	.11623	8
53	.97724	.09489	9.00031	.10007	.02271	.10537	.04449	.11079	.06567	.11632	7
54	.97763	.09498	.00068	.10016	.02308	.10546	.04485	.11088	.06602	.11642	6
55	8.97802	0.09506	9.00106	0.10025	9.02345	0.10555	9.04520	0.11097	9.06637	0.11651	5
56	.97841	.09515	.00144	.10033	.02381	.10564	.04556	.11106	.06671	.11660	4
57	.97880	.09524	.00182	.10042	.02418	.10573	.04592	.11115	.06706	.11670	3
58	.97919	.09532	.00220	.10051	.02455	.10582	.04628	.11124	.06741	.11679	2
59	.97958	.09541	.00258	.10059	.02492	.10591	.04663	.11134	.06776	.11688	1
60	8.97997	0.09549	9.00295	0.10068	9.02528	0.10599	9.04699	0.11143	9.06810	0.11698	0
	324°		323°		322°		321°		320°		

## Haversines

i	40°		41°		42°		43°		44°		i
	Log Hav	Nat. Hav	Log Hav	Nat. Hav	Log Hav	Nat. Hav	Log Hav	Nat. Hav	Log Hav	Nat. Hav	
0	9.06810	0.11698	9.08865	0.12265	9.10866	0.12843	9.12815	0.13432	9.14715	0.14033	60
1	.06845	.11707	.08899	.12274	.10899	.12852	.12847	.13442	.14746	.14043	59
2	.06880	.11716	.08933	.12284	.10932	.12862	.12879	.13452	.14778	.14053	58
3	.06914	.11726	.08966	.12293	.10965	.12872	.12911	.13462	.14809	.14063	57
4	.06949	.11735	.09000	.12303	.10997	.12882	.12943	.13472	.14840	.14073	56
5	9.06984	0.11745	9.09034	0.12312	9.11030	0.12891	9.12975	0.13482	9.14871	0.14084	55
6	.07018	.11754	.09068	.12322	.11063	.12901	.13007	.13492	.14902	.14094	54
7	.07053	.11763	.09101	.12331	.11096	.12911	.13039	.13502	.14934	.14104	53
8	.07088	.11773	.09135	.12341	.11129	.12921	.13071	.13512	.14965	.14114	52
9	.07122	.11782	.09169	.12351	.11161	.12930	.13103	.13522	.14996	.14124	51
10	9.07157	0.11791	9.09202	0.12360	9.11194	0.12940	9.13135	0.13532	9.15027	0.14134	50
11	.07191	.11801	.09236	.12370	.11227	.12950	.13167	.13542	.15058	.14144	49
12	.07226	.11810	.09269	.12379	.11260	.12960	.13199	.13552	.15089	.14154	48
13	.07260	.11820	.09303	.12389	.11292	.12970	.13231	.13562	.15120	.14165	47
14	.07295	.11829	.09337	.12398	.11325	.12979	.13263	.13571	.15152	.14175	46
15	9.07329	0.11838	9.09370	0.12408	9.11358	0.12989	9.13295	0.13581	9.15183	0.14185	45
16	.07364	.11848	.09404	.12418	.11391	.12999	.13326	.13591	.15214	.14195	44
17	.07398	.11857	.09437	.12427	.11423	.13009	.13358	.13601	.15245	.14205	43
18	.07433	.11867	.09471	.12437	.11456	.13018	.13390	.13611	.15276	.14215	42
19	.07467	.11876	.09504	.12443	.11489	.13028	.13422	.13621	.15307	.14226	41
20	9.07501	0.11885	9.09538	0.12456	9.11521	0.13038	9.13454	0.13631	9.15338	0.14236	40
21	.07536	.11895	.09571	.12466	.11554	.13048	.13486	.13641	.15369	.14246	39
22	.07570	.11904	.09605	.12475	.11586	.13058	.13517	.13651	.15400	.14256	38
23	.07605	.11914	.09638	.12485	.11619	.13067	.13549	.13661	.15431	.14266	37
24	.07639	.11923	.09672	.12494	.11652	.13077	.13581	.13671	.15462	.14276	36
25	9.07673	0.11933	9.09705	0.12504	9.11684	0.13087	9.13613	0.13681	9.15493	0.14287	35
26	.07708	.11942	.09739	.12514	.11717	.13097	.13644	.13691	.15524	.14297	34
27	.07742	.11951	.09772	.12523	.11749	.13107	.13676	.13701	.15555	.14307	33
28	.07776	.11961	.09805	.12533	.11782	.13116	.13708	.13711	.15585	.14317	32
29	.07810	.11970	.09839	.12543	.11814	.13126	.13739	.13721	.15616	.14327	31
30	9.07845	0.11980	9.09872	0.12552	9.11847	0.13136	9.13771	0.13731	9.15647	0.14337	30
31	.07879	.11989	.09905	.12562	.11879	.13146	.13803	.13741	.15678	.14348	29
32	.07913	.11999	.09939	.12571	.11912	.13156	.13834	.13751	.15709	.14358	28
33	.07947	.12008	.09972	.12581	.11944	.13166	.13866	.13761	.15740	.14368	27
34	.07981	.12018	.10005	.12591	.11977	.13175	.13898	.13771	.15771	.14378	26
35	9.08016	0.12027	9.10039	0.12600	9.12009	0.13185	9.13929	0.13781	9.15802	0.14388	25
36	.08050	.12036	.10072	.12610	.12041	.13195	.13961	.13791	.15832	.14399	24
37	.08084	.12046	.10105	.12620	.12074	.13205	.13992	.13801	.15863	.14409	23
38	.08118	.12055	.10138	.12629	.12106	.13215	.14024	.13811	.15894	.14419	22
39	.08152	.12065	.10172	.12639	.12139	.13225	.14056	.13822	.15925	.14429	21
40	9.08186	0.12074	9.10205	0.12649	9.12171	0.13235	9.14087	0.13832	9.15955	0.14440	20
41	.08220	.12084	.10238	.12658	.12203	.13244	.14119	.13842	.15986	.14450	19
42	.08254	.12093	.10271	.12668	.12236	.13254	.14150	.13852	.16017	.14460	18
43	.08288	.12103	.10304	.12678	.12268	.13264	.14182	.13862	.16048	.14470	17
44	.08323	.12112	.10337	.12687	.12300	.13274	.14213	.13872	.16078	.14480	16
45	9.08357	0.12122	9.10371	0.12697	9.12332	0.13284	9.14245	0.13882	9.16109	0.14491	15
46	.08391	.12131	.10404	.12707	.12365	.13294	.14276	.13892	.16140	.14501	14
47	.08425	.12141	.10437	.12717	.12397	.13304	.14307	.13902	.16170	.14511	13
48	.08459	.12150	.10470	.12726	.12429	.13314	.14339	.13912	.16201	.14521	12
49	.08492	.12160	.10503	.12736	.12461	.13323	.14370	.13922	.16232	.14532	11
50	9.08526	0.12169	9.10536	0.12746	9.12494	0.13333	9.14402	0.13932	9.16262	0.14542	10
51	.08560	.12179	.10569	.12755	.12526	.13343	.14433	.13942	.16293	.14552	9
52	.08594	.12188	.10302	.12765	.12558	.13353	.14465	.13952	.16324	.14562	8
53	.08628	.12198	.10635	.12775	.12590	.13363	.14496	.13962	.16354	.14573	7
54	.08662	.12207	.10668	.12784	.12622	.13373	.14527	.13972	.16385	.14583	6
55	9.08696	0.12217	9.10701	0.12794	9.12655	0.13383	9.14559	0.13983	9.16415	0.14593	5
56	.08730	.12226	.10734	.12804	.12687	.13393	.14590	.13993	.16446	.14604	4
57	.08764	.12236	.10767	.12814	.12719	.13403	.14621	.14003	.16476	.14614	3
58	.08797	.12245	.10800	.12823	.12751	.13412	.14653	.14013	.16507	.14624	2
59	.08831	.12255	.10833	.12833	.12783	.13422	.14684	.14023	.16537	.14634	1
60	9.08865	0.12265	9.10866	0.12843	9.12815	0.13432	9.14715	0.14033	9.16568	0.14645	0
	319°		318°		317°		316°		315°		

## Haversines

i	45°		46°		47°		48°		49°		i
	Log Hav	Nat. Hav	Log Hav	Nat. Hav	Log Hav	Nat. Hav	Log Hav	Nat. Hav	Log Hav	Nat. Hav	
0	9. 16568	0.14645	9. 18376	0. 15267	9. 20140	0. 15900	9. 21863	0. 16543	9. 23545	0. 17197	60
1	. 16598	. 14655	. 18405	. 15278	. 20169	. 15911	. 21891	. 16554	. 23573	. 17208	59
2	. 16629	. 14665	. 18435	. 15288	. 20198	. 15921	. 21919	. 16565	. 23601	. 17219	58
3	. 16659	. 14676	. 18465	. 15298	. 20227	. 15932	. 21948	. 16576	. 23629	. 17230	57
4	. 16690	. 14686	. 18495	. 15309	. 20256	. 15943	. 21976	. 16587	. 23656	. 17241	56
5	9. 16720	0. 14696	9. 18524	0. 15319	9. 20285	0. 15953	9. 22004	0. 16598	9. 23684	0. 17252	55
6	. 16751	. 14706	. 18554	. 15330	. 20314	. 15964	. 22033	. 16608	. 23712	. 17263	54
7	. 16781	. 14717	. 18584	. 15340	. 20343	. 15975	. 22061	. 16619	. 23739	. 17274	53
8	. 16812	. 14727	. 18613	. 15351	. 20372	. 15985	. 22089	. 16630	. 23767	. 17285	52
9	. 16842	. 14737	. 18643	. 15361	. 20401	. 15996	. 22118	. 16641	. 23794	. 17296	51
10	9. 16872	0. 14748	9. 18673	0. 15372	9. 20430	0. 16007	9. 22146	0. 16652	9. 23822	0. 17307	50
11	. 16903	. 14758	. 18702	. 15382	. 20459	. 16017	. 22174	. 16663	. 23850	. 17318	49
12	. 16933	. 14768	. 18732	. 15393	. 20488	. 16028	. 22202	. 16673	. 23877	. 17329	48
13	. 16963	. 14779	. 18762	. 15403	. 20517	. 16039	. 22231	. 16684	. 23905	. 17340	47
14	. 16994	. 14789	. 18791	. 15414	. 20546	. 16049	. 22259	. 16695	. 23932	. 17351	46
15	9. 17024	0. 14799	9. 18821	0. 15424	9. 20574	0. 16060	9. 22287	0. 16706	9. 23960	0. 17362	45
16	. 17054	. 14810	. 18850	. 15435	. 20603	. 16071	. 22315	. 16717	. 23988	. 17373	44
17	. 17085	. 14820	. 18880	. 15445	. 20632	. 16081	. 22343	. 16728	. 24015	. 17384	43
18	. 17115	. 14830	. 18909	. 15456	. 20661	. 16092	. 22372	. 16738	. 24043	. 17395	42
19	. 17145	. 14841	. 18939	. 15466	. 20690	. 16103	. 22400	. 16749	. 24070	. 17406	41
20	9. 17175	0. 14851	9. 18968	0. 15477	9. 20719	0. 16113	9. 22428	0. 16760	9. 24098	0. 17417	40
21	. 17206	. 14861	. 18998	. 15487	. 20748	. 16124	. 22456	. 16771	. 24125	. 17428	39
22	. 17236	. 14872	. 19027	. 15498	. 20776	. 16135	. 22484	. 16782	. 24153	. 17439	38
23	. 17266	. 14882	. 19057	. 15508	. 20805	. 16145	. 22512	. 16793	. 24180	. 17450	37
24	. 17296	. 14892	. 19086	. 15519	. 20834	. 16156	. 22540	. 16804	. 24208	. 17461	36
25	9. 17327	0. 14903	9. 19116	0. 15530	9. 20863	0. 16167	9. 22569	0. 16815	9. 24235	0. 17472	35
26	. 17357	. 14913	. 19145	. 15540	. 20891	. 16178	. 22597	. 16825	. 24263	. 17483	34
27	. 17387	. 14923	. 19175	. 15551	. 20920	. 16188	. 22625	. 16836	. 24290	. 17494	33
28	. 17417	. 14934	. 19204	. 15561	. 20949	. 16199	. 22653	. 16847	. 24317	. 17505	32
29	. 17447	. 14944	. 19234	. 15572	. 20978	. 16210	. 22681	. 16858	. 24345	. 17517	31
30	9. 17477	0. 14955	9. 19263	0. 15582	9. 21006	0. 16220	9. 22709	0. 16869	9. 24372	0. 17528	30
31	. 17507	. 14965	. 19292	. 15593	. 21035	. 16231	. 22737	. 16880	. 24400	. 17539	29
32	. 17538	. 14975	. 19322	. 15603	. 21064	. 16242	. 22765	. 16891	. 24427	. 17550	28
33	. 17568	. 14986	. 19351	. 15614	. 21092	. 16253	. 22793	. 16902	. 24454	. 17561	27
34	. 17598	. 14996	. 19381	. 15624	. 21121	. 16263	. 22821	. 16913	. 24482	. 17572	26
35	9. 17628	0. 15006	9. 19419	0. 15635	9. 21150	0. 16274	9. 22849	0. 16923	9. 24509	0. 17583	25
36	. 17658	. 15017	. 19439	. 15646	. 21178	. 16285	. 22877	. 16934	. 24536	. 17594	24
37	. 17688	. 15027	. 19469	. 15656	. 21207	. 16296	. 22905	. 16945	. 24564	. 17605	23
38	. 17718	. 15038	. 19498	. 15667	. 21236	. 16306	. 22933	. 16956	. 24591	. 17616	22
39	. 17748	. 15048	. 19527	. 15677	. 21264	. 16317	. 22961	. 16967	. 24618	. 17627	21
40	9. 17778	0. 15058	9. 19557	0. 15688	9. 21293	0. 16328	9. 22989	0. 16978	9. 24646	0. 17638	20
41	. 17808	. 15069	. 19586	. 15698	. 21322	. 16339	. 23017	. 16989	. 24673	. 17649	19
42	. 17838	. 15079	. 19615	. 15709	. 21350	. 16349	. 23045	. 17000	. 24700	. 17661	18
43	. 17868	. 15090	. 19644	. 15720	. 21379	. 16360	. 23073	. 17011	. 24728	. 17672	17
44	. 17898	. 15100	. 19674	. 15730	. 21407	. 16371	. 23100	. 17022	. 24755	. 17683	16
45	9. 17928	0. 15110	9. 19703	0. 15741	9. 21436	0. 16382	9. 23128	0. 17033	9. 24782	0. 17694	15
46	. 17958	. 15121	. 19732	. 15751	. 21464	. 16392	. 23156	. 17044	. 24809	. 17705	14
47	. 17988	. 15131	. 19761	. 15762	. 21493	. 16403	. 23184	. 17055	. 24837	. 17716	13
48	. 18018	. 15142	. 19790	. 15773	. 21521	. 16414	. 23212	. 17066	. 24864	. 17727	12
49	. 18048	. 15152	. 19820	. 15783	. 21550	. 16425	. 23240	. 17076	. 24891	. 17738	11
50	9. 18077	0. 15163	9. 19849	0. 15794	9. 21578	0. 16436	9. 23268	0. 17087	9. 24918	0. 17749	10
51	. 18107	. 15173	. 19878	. 15804	. 21607	. 16446	. 23295	. 17098	. 24945	. 17760	9
52	. 18137	. 15183	. 19907	. 15815	. 21635	. 16457	. 23323	. 17109	. 24973	. 17772	8
53	. 18167	. 15194	. 19936	. 15826	. 21664	. 16468	. 23351	. 17120	. 25000	. 17783	7
54	. 18197	. 15204	. 19965	. 15836	. 21692	. 16479	. 23379	. 17131	. 25027	. 17794	6
55	9. 18227	0. 15215	9. 19995	0. 15847	9. 21721	0. 16489	9. 23407	0. 17142	9. 25054	0. 17805	5
56	. 18256	. 15225	. 20024	. 15858	. 21749	. 16500	. 23434	. 17153	. 25081	. 17816	4
57	. 18286	. 15236	. 20053	. 15868	. 21778	. 16511	. 23462	. 17164	. 25108	. 17827	3
58	. 18316	. 15246	. 20082	. 15879	. 21806	. 16522	. 23490	. 17175	. 25135	. 17838	2
59	. 18346	. 15257	. 20111	. 15889	. 21834	. 16533	. 23518	. 17186	. 25163	. 17849	1
60	9. 18376	0. 15267	9. 20140	0. 15900	9. 21863	0. 16543	9. 23545	0. 17197	9. 25190	0. 17861	0
	314°		313°		312°		311°		310°		

# Haversines

Haversines											
	50°		51°		52°		53°		54°		
	Log Hav	Nat. Hav	Log Hav	Nat. Hav	Log Hav	Nat. Hav	Log Hav	Nat. Hav	Log Hav	Nat. Hav	
0	9. 25190	0. 17861	9. 26797	0. 18534	9. 28368	0. 19217	9. 29906	0. 19909	9. 31409	0. 20611	60
1	. 25217	. 17872	. 26823	. 18545	. 28394	. 19228	. 29931	. 19921	. 31434	. 20623	59
2	. 25244	. 17883	. 26850	. 18557	. 28420	. 19240	. 29956	. 19932	. 31459	. 20634	58
3	. 25271	. 17894	. 26876	. 18568	. 28446	. 19251	. 29981	. 19944	. 31484	. 20646	57
4	. 25298	. 17905	. 26903	. 18579	. 28472	. 19263	. 30007	. 19956	. 31508	. 20658	56
5	9. 25325	0. 17916	9. 26929	0. 18591	9. 28498	0. 19274	9. 30032	0. 19967	9. 31533	0. 20670	55
6	. 25352	. 17928	. 26956	. 18602	. 28524	. 19286	. 30057	. 19979	. 31558	. 20681	54
7	. 25379	. 17939	. 26982	. 18613	. 28549	. 19297	. 30083	. 19991	. 31583	. 20693	53
8	. 25406	. 17950	. 27008	. 18624	. 28575	. 19309	. 30108	. 20002	. 31607	. 20705	52
9	. 25433	. 17961	. 27035	. 18636	. 28601	. 19320	. 30133	. 20014	. 31632	. 20717	51
10	9. 25460	0. 17972	9. 27061	0. 18647	9. 28627	0. 19332	9. 30158	0. 20026	9. 31657	0. 20729	50
11	. 25487	. 17983	. 27088	. 18658	. 28653	. 19343	. 30184	. 20037	. 31682	. 20740	49
12	. 25514	. 17995	. 27114	. 18670	. 28679	. 19355	. 30209	. 20049	. 31706	. 20752	48
13	. 25541	. 18006	. 27140	. 18681	. 28704	. 19366	. 30234	. 20060	. 31731	. 20764	47
14	. 25568	. 18017	. 27167	. 18692	. 28730	. 19378	. 30259	. 20072	. 31756	. 20776	46
15	9. 25595	0. 18028	9. 27193	0. 18704	9. 28756	0. 19389	9. 30285	0. 20084	9. 31780	0. 20788	45
16	. 25622	. 18039	. 27219	. 18715	. 28782	. 19401	. 30310	. 20095	. 31805	. 20799	44
17	. 25649	. 18050	. 27246	. 18727	. 28807	. 19412	. 30335	. 20107	. 31830	. 20811	43
18	. 25676	. 18062	. 27272	. 18738	. 28833	. 19424	. 30360	. 20119	. 31854	. 20823	42
19	. 25703	. 18073	. 27298	. 18749	. 28859	. 19435	. 30385	. 20130	. 31879	. 20835	41
20	9. 25729	0. 18084	9. 27325	0. 18761	9. 28885	0. 19447	9. 30410	0. 20142	9. 31903	0. 20847	40
21	. 25756	. 18095	. 27351	. 18772	. 28910	. 19458	. 30436	. 20154	. 31928	. 20858	39
22	. 25783	. 18106	. 27377	. 18783	. 28936	. 19470	. 30461	. 20165	. 31953	. 20870	38
23	. 25810	. 18118	. 27403	. 18795	. 28962	. 19481	. 30486	. 20177	. 31977	. 20882	37
24	. 25837	. 18129	. 27430	. 18806	. 28987	. 19493	. 30511	. 20189	. 32002	. 20894	36
25	9. 25864	0. 18140	9. 27456	0. 18817	9. 29013	0. 19504	9. 30536	0. 20200	9. 32026	0. 20906	35
26	. 25891	. 18151	. 27482	. 18829	. 29039	. 19516	. 30561	. 20212	. 32051	. 20918	34
27	. 25917	. 18162	. 27508	. 18840	. 29064	. 19527	. 30586	. 20224	. 32076	. 20929	33
28	. 25944	. 18174	. 27535	. 18852	. 29090	. 19539	. 30611	. 20235	. 32100	. 20941	32
29	. 25971	. 18185	. 27561	. 18863	. 29116	. 19550	. 30636	. 20247	. 32125	. 20953	31
30	9. 25998	0. 18196	9. 27587	0. 18874	9. 29141	0. 19562	9. 30662	0. 20259	9. 32149	0. 20965	30
31	. 26025	. 18207	. 27613	. 18886	. 29167	. 19573	. 30687	. 20271	. 32174	. 20977	29
32	. 26051	. 18219	. 27639	. 18897	. 29192	. 19585	. 30712	. 20282	. 32198	. 20989	28
33	. 26078	. 18230	. 27666	. 18908	. 29218	. 19597	. 30737	. 20294	. 32223	. 21000	27
34	. 26105	. 18241	. 27692	. 18920	. 29244	. 19608	. 30762	. 20306	. 32247	. 21012	26
35	9. 26132	0. 18252	9. 27718	0. 18931	9. 29269	0. 19620	9. 30787	0. 20317	9. 32272	0. 21024	25
36	. 26158	. 18263	. 27744	. 18943	. 29295	. 19631	. 30812	. 20329	. 32296	. 21036	24
37	. 26185	. 18275	. 27770	. 18954	. 29320	. 19643	. 30837	. 20341	. 32321	. 21048	23
38	. 26212	. 18286	. 27796	. 18965	. 29346	. 19654	. 30862	. 20352	. 32345	. 21060	22
39	. 26238	. 18297	. 27822	. 18977	. 29371	. 19666	. 30887	. 20364	. 32370	. 21072	21
40	9. 26265	0. 18308	9. 27848	0. 18988	9. 29397	0. 19677	9. 30912	0. 20376	9. 32394	0. 21083	20
41	. 26292	. 18320	. 27875	. 19000	. 29422	. 19689	. 30937	. 20388	. 32418	. 21095	19
42	. 26319	. 18331	. 27901	. 19011	. 29448	. 19701	. 30962	. 20399	. 32443	. 21107	18
43	. 26345	. 18342	. 27927	. 19022	. 29473	. 19712	. 30987	. 20411	. 32467	. 21119	17
44	. 26372	. 18353	. 27953	. 19034	. 29499	. 19724	. 31012	. 20423	. 32492	. 21131	16
45	9. 26398	0. 18365	9. 27979	0. 19045	9. 29524	0. 19735	9. 31036	0. 20435	9. 32516	0. 21143	15
46	. 26425	. 18376	. 28005	. 19057	. 29550	. 19747	. 31061	. 20446	. 32541	. 21155	14
47	. 26452	. 18387	. 28031	. 19068	. 29575	. 19758	. 31086	. 20458	. 32565	. 21167	13
48	. 26478	. 18399	. 28057	. 19080	. 29601	. 19770	. 31111	. 20470	. 32589	. 21178	12
49	. 26505	. 18410	. 28083	. 19091	. 29626	. 19782	. 31136	. 20481	. 32614	. 21190	11
50	9. 26532	0. 18421	9. 28109	0. 19102	9. 29652	0. 19793	9. 31161	0. 20493	9. 32638	0. 21202	10
51	. 26558	. 18432	. 28135	. 19114	. 29677	. 19805	. 31186	. 20505	. 32662	. 21214	9
52	. 26585	. 18444	. 28161	. 19125	. 29703	. 19816	. 31211	. 20517	. 32687	. 21226	8
53	. 26611	. 18455	. 28187	. 19137	. 29728	. 19828	. 31236	. 20528	. 32711	. 21238	7
54	. 26638	. 18466	. 28213	. 19148	. 29753	. 19840	. 31260	. 20540	. 32735	. 21250	6
55	9. 26664	0. 18477	9. 28239	0. 19160	9. 29779	0. 19851	9. 31285	0. 20552	9. 32760	0. 21262	5
56	. 26691	. 18489	. 28265	. 19171	. 29804	. 19863	. 31310	. 20564	. 32784	. 21274	4
57	. 26717	. 18500	. 28291	. 19183	. 29829	. 19874	. 31335	. 20575	. 32808	. 21285	3
58	. 26744	. 18511	. 28317	. 19194	. 29855	. 19886	. 31360	. 20587	. 32833	. 21297	2
59	. 26770	. 18523	. 28342	. 19205	. 29880	. 19898	. 31385	. 20599	. 32857	. 21309	1
60	9. 26797	0. 18534	9. 28368	0. 19217	9. 29906	0. 19909	9. 31409	0. 20611	9. 32881	0. 21321	0
	309°		308°		307°		306°		305°		

## Haversines

i	55°		56°		57°		58°		59°		i
	Log Hav	Nat. Hav	Log Hav	Nat. Hav	Log Hav	Nat. Hav	Log Hav	Nat. Hav	Log Hav	Nat. Hav	
0	9. 32881	0. 21321	9. 34322	0. 22040	9. 35733	0. 22768	9. 37114	0. 23504	9. 38468	0. 24248	60
1	. 32905	. 21333	. 34346	. 22052	. 35756	. 22780	. 37137	. 23516	. 38490	. 24261	59
2	. 32930	. 21345	. 34369	. 22064	. 35779	. 22792	. 37160	. 23529	. 38512	. 24273	58
3	. 32954	. 21357	. 34393	. 22077	. 35802	. 22805	. 37183	. 23541	. 38535	. 24286	57
4	. 32978	. 21369	. 34417	. 22089	. 35826	. 22817	. 37205	. 23553	. 38557	. 24298	56
5	9. 33002	0. 21381	9. 34441	0. 22101	9. 35849	0. 22829	9. 37228	0. 23566	9. 38579	0. 24310	55
6	. 33027	. 21393	. 34464	. 22113	. 35872	. 22841	. 37251	. 23578	. 38602	. 24323	54
7	. 33051	. 21405	. 34488	. 22125	. 35895	. 22853	. 37274	. 23590	. 38624	. 24335	53
8	. 33075	. 21417	. 34512	. 22137	. 35918	. 22866	. 37296	. 23603	. 38646	. 24348	52
9	. 33099	. 21429	. 34535	. 22149	. 35942	. 22878	. 37319	. 23615	. 38668	. 24360	51
10	9. 33123	0. 21440	9. 34559	0. 22161	9. 35965	0. 22890	9. 37342	0. 23627	9. 38691	0. 24373	50
11	. 33148	. 21452	. 34583	. 22173	. 35988	. 22902	. 37364	. 23640	. 38713	. 24385	49
12	. 33172	. 21464	. 34606	. 22185	. 36011	. 22915	. 37387	. 23652	. 38735	. 24398	48
13	. 33196	. 21476	. 34630	. 22197	. 36034	. 22927	. 37410	. 23665	. 38757	. 24410	47
14	. 33220	. 21488	. 34654	. 22209	. 36058	. 22939	. 37433	. 23677	. 38780	. 24423	46
15	9. 33244	0. 21500	9. 34677	0. 22221	9. 36081	0. 22951	9. 37455	0. 23689	9. 38802	0. 24435	45
16	. 33268	. 21512	. 34701	. 22234	. 36104	. 22964	. 37478	. 23702	. 38824	. 24448	44
17	. 33292	. 21524	. 34725	. 22246	. 36127	. 22976	. 37501	. 23714	. 38846	. 24460	43
18	. 33317	. 21536	. 34748	. 22258	. 36150	. 22988	. 37523	. 23726	. 38868	. 24473	42
19	. 33341	. 21548	. 34772	. 22270	. 36173	. 23000	. 37546	. 23739	. 38891	. 24485	41
20	9. 33365	0. 21560	9. 34795	0. 22282	9. 36196	0. 23012	9. 37569	0. 23751	9. 38913	0. 24498	40
21	. 33389	. 21572	. 34819	. 22294	. 36219	. 23025	. 37591	. 23764	. 38935	. 24510	39
22	. 33413	. 21584	. 34843	. 22306	. 36243	. 23037	. 37614	. 23776	. 38957	. 24523	38
23	. 33437	. 21596	. 34866	. 22318	. 36266	. 23049	. 37636	. 23788	. 38979	. 24535	37
24	. 33461	. 21608	. 34890	. 22330	. 36289	. 23061	. 37659	. 23801	. 39002	. 24548	36
25	9. 33485	0. 21620	9. 34913	0. 22343	9. 36312	0. 23074	9. 37682	0. 23813	9. 39024	0. 24560	35
26	. 33509	. 21632	. 34937	. 22355	. 36335	. 23086	. 37704	. 23825	. 39046	. 24573	34
27	. 33533	. 21644	. 34960	. 22367	. 36358	. 23098	. 37727	. 23838	. 39068	. 24585	33
28	. 33557	. 21656	. 34984	. 22379	. 36381	. 23110	. 37749	. 23850	. 39090	. 24598	32
29	. 33581	. 21668	. 35007	. 22391	. 36404	. 23123	. 37772	. 23863	. 39112	. 24611	31
30	9. 33605	0. 21680	9. 35031	0. 22403	9. 36427	0. 23135	9. 37794	0. 23875	9. 39134	0. 24623	30
31	. 33629	. 21692	. 35054	. 22415	. 36450	. 23147	. 37817	. 23887	. 39156	. 24636	29
32	. 33653	. 21704	. 35078	. 22427	. 36473	. 23160	. 37840	. 23900	. 39178	. 24648	28
33	. 33677	. 21716	. 35101	. 22440	. 36496	. 23172	. 37862	. 23912	. 39201	. 24661	27
34	. 33701	. 21728	. 35125	. 22452	. 36519	. 23184	. 37885	. 23925	. 39223	. 24673	26
35	9. 33725	0. 21740	9. 35148	0. 22464	9. 36542	0. 23196	9. 37907	0. 23937	9. 39245	0. 24686	25
36	. 33749	. 21752	. 35172	. 22476	. 36565	. 23209	. 37930	. 23950	. 39267	. 24698	24
37	. 33773	. 21764	. 35195	. 22488	. 36588	. 23221	. 37952	. 23962	. 39289	. 24711	23
38	. 33797	. 21776	. 35219	. 22500	. 36611	. 23233	. 37975	. 23974	. 39311	. 24723	22
39	. 33821	. 21788	. 35242	. 22512	. 36634	. 23246	. 37997	. 23987	. 39333	. 24736	21
40	9. 33845	0. 21800	9. 35266	0. 22525	9. 36657	0. 23253	9. 38020	0. 23999	9. 39355	0. 24749	20
41	. 33869	. 21812	. 35289	. 22537	. 36680	. 23270	. 38042	. 24012	. 39377	. 24761	19
42	. 33893	. 21824	. 35312	. 22549	. 36703	. 23282	. 38065	. 24024	. 39399	. 24774	18
43	. 33917	. 21836	. 35336	. 22561	. 36726	. 23295	. 38087	. 24036	. 39421	. 24786	17
44	. 33941	. 21848	. 35359	. 22571	. 36749	. 23307	. 38110	. 24049	. 39443	. 24799	16
45	9. 33965	0. 21860	9. 35383	0. 22585	9. 36772	0. 23319	9. 38132	0. 24061	9. 39465	0. 24811	15
46	. 33988	. 21872	. 35406	. 22598	. 36794	. 23332	. 38154	. 24074	. 39487	. 24824	14
47	. 34012	. 21884	. 35429	. 22610	. 36817	. 23344	. 38177	. 24086	. 39509	. 24836	13
48	. 34036	. 21896	. 35453	. 22622	. 36840	. 23356	. 38199	. 24099	. 39531	. 24849	12
49	. 34060	. 21908	. 35476	. 22634	. 36863	. 23368	. 38222	. 24111	. 39553	. 24862	11
50	9. 34084	0. 21920	9. 35500	0. 22646	9. 36886	0. 23381	9. 38244	0. 24124	9. 39575	0. 24874	10
51	. 34108	. 21932	. 35523	. 22658	. 36909	. 23393	. 38267	. 24136	. 39597	. 24887	9
52	. 34132	. 21944	. 35546	. 22671	. 36932	. 23405	. 38289	. 24148	. 39619	. 24899	8
53	. 34155	. 21956	. 35570	. 22683	. 36955	. 23418	. 38311	. 24161	. 39641	. 24912	7
54	. 34179	. 21968	. 35593	. 22695	. 36977	. 23430	. 38334	. 24173	. 39663	. 24924	6
55	9. 34203	0. 21980	9. 35610	0. 22707	9. 37000	0. 23442	9. 38356	0. 24186	9. 39685	0. 24937	5
56	. 34227	. 21992	. 35639	. 22719	. 37023	. 23455	. 38378	. 24198	. 39706	. 24950	4
57	. 34251	. 22004	. 35663	. 22731	. 37046	. 23467	. 38401	. 24211	. 39728	. 24962	3
58	. 34274	. 22016	. 35686	. 22744	. 37069	. 23479	. 38423	. 24223	. 39750	. 24975	2
59	. 34298	. 22028	. 35709	. 22756	. 37091	. 23492	. 38445	. 24236	. 39772	. 24987	1
60	9. 34322	0. 22040	9. 35733	0. 22768	9. 37114	0. 23504	9. 38468	0. 24248	9. 39794	0. 25000	0
	304°		303°		302°		301°		300°		



# Haversines

i	60°		61°		62°		63°		64°		i
	Log Hav	Nat. Hav	Log Hav	Nat. Hav	Log Hav	Nat. Hav	Log Hav	Nat. Hav	Log Hav	Nat. Hav	
0	9.39794	0.25000	9.41094	0.25760	9.42368	0.26526	9.43617	0.27300	9.44842	0.28081	60
1	.39816	.25013	.41115	.25772	.42389	.26539	.43638	.27313	.44862	.28095	59
2	.39838	.25025	.41137	.25785	.42410	.26552	.43658	.27326	.44882	.28108	58
3	.39860	.25038	.41158	.25798	.42431	.26565	.43679	.27339	.44903	.28121	57
4	.39881	.25050	.41180	.25810	.42452	.26578	.43699	.27352	.44923	.28134	56
5	9.39903	0.25063	9.41201	0.25823	9.42473	0.26591	9.43720	0.27365	9.44943	0.28147	55
6	.39925	.25076	.41222	.25836	.42494	.26604	.43741	.27378	.44963	.28160	54
7	.39947	.25088	.41244	.25849	.42515	.26616	.43761	.27391	.44983	.28173	53
8	.39969	.25101	.41265	.25861	.42536	.26629	.43782	.27404	.45003	.28186	52
9	.39991	.25113	.41287	.25874	.42557	.26642	.43802	.27417	.45024	.28199	51
10	9.40012	0.25126	9.41308	0.25887	9.42578	0.26655	9.43823	0.27430	9.45044	0.28212	50
11	.40034	.25139	.41329	.25900	.42599	.26668	.43843	.27443	.45064	.28225	49
12	.40056	.25151	.41351	.25912	.42620	.26681	.43864	.27456	.45084	.28238	48
13	.40078	.25164	.41372	.25925	.42641	.26694	.43884	.27469	.45104	.28252	47
14	.40100	.25177	.41393	.25938	.42662	.26706	.43905	.27482	.45124	.28265	46
15	9.40121	0.25189	9.41415	0.25951	9.42682	0.26719	9.43926	0.27495	9.45144	0.28278	45
16	.40143	.25202	.41436	.25963	.42703	.26732	.43946	.27508	.45165	.28291	44
17	.40165	.25214	.41457	.25976	.42724	.26745	.43967	.27521	.45185	.28304	43
18	.40187	.25227	.41479	.25989	.42745	.26758	.43987	.27534	.45205	.28317	42
19	.40208	.25240	.41500	.26002	.42766	.26771	.44008	.27547	.45225	.28330	41
20	9.40230	0.25252	9.41521	0.26014	9.42787	0.26784	9.44028	0.27560	9.45245	0.28343	40
21	.40252	.25265	.41543	.26027	.42808	.26797	.44048	.27573	.45265	.28356	39
22	.40274	.25278	.41564	.26040	.42829	.26809	.44069	.27586	.45285	.28369	38
23	.40295	.25290	.41585	.26053	.42850	.26822	.44089	.27599	.45305	.28383	37
24	.40317	.25303	.41606	.26065	.42870	.26835	.44110	.27612	.45325	.28396	36
25	9.40339	0.25316	9.41628	0.26078	9.42891	0.26848	9.44130	0.27625	9.45345	0.28409	35
26	.40360	.25328	.41649	.26091	.42912	.26861	.44151	.27638	.45365	.28422	34
27	.40382	.25341	.41670	.26104	.42933	.26874	.44171	.27651	.45385	.28435	33
28	.40404	.25354	.41692	.26117	.42954	.26887	.44192	.27664	.45405	.28448	32
29	.40425	.25366	.41713	.26129	.42975	.26900	.44212	.27677	.45426	.28461	31
30	9.40447	0.25379	9.41734	0.26142	9.42996	0.26913	9.44232	0.27690	9.45446	0.28474	30
31	.40469	.25391	.41755	.26155	.43016	.26925	.44253	.27703	.45466	.28488	29
32	.40490	.25404	.41776	.26168	.43037	.26938	.44273	.27716	.45486	.28501	28
33	.40512	.25417	.41798	.26180	.43058	.26951	.44291	.27729	.45506	.28514	27
34	.40534	.25429	.41819	.26193	.43079	.26964	.44314	.27742	.45526	.28527	26
35	9.40555	0.25442	9.41840	0.26206	9.43100	0.26977	9.44334	0.27755	9.45546	0.28540	25
36	.40577	.25455	.41861	.26219	.43120	.26990	.44355	.27768	.45566	.28553	24
37	.40599	.25467	.41882	.26232	.43141	.27003	.44375	.27781	.45586	.28566	23
38	.40620	.25480	.41904	.26244	.43162	.27016	.44396	.27794	.45606	.28580	22
39	.40642	.25493	.41925	.26257	.43183	.27029	.44416	.27807	.45625	.28593	21
40	9.40663	0.25506	9.41946	0.26270	9.43203	0.27042	9.44436	0.27820	9.45645	0.28606	20
41	.40685	.25518	.41967	.26283	.43224	.27055	.44457	.27833	.45665	.28619	19
42	.40707	.25531	.41988	.26296	.43245	.27068	.44477	.27846	.45685	.28632	18
43	.40728	.25544	.42009	.26308	.43266	.27080	.44497	.27859	.45705	.28645	17
44	.40750	.25556	.42031	.26321	.43286	.27093	.44518	.27873	.45725	.28658	16
45	9.40771	0.25569	9.42052	0.26334	9.43307	0.27106	9.44538	0.27886	9.45745	0.28672	15
46	.40793	.25582	.42073	.26347	.43328	.27119	.44558	.27899	.45765	.28685	14
47	.40814	.25594	.42094	.26360	.43348	.27132	.44579	.27912	.45785	.28698	13
48	.40836	.25607	.42115	.26372	.43369	.27145	.44599	.27925	.45805	.28711	12
49	.40858	.25620	.42136	.26385	.43390	.27158	.44619	.27938	.45825	.28724	11
50	9.40879	0.25632	9.42157	0.26398	9.43411	0.27171	9.44639	0.27951	9.45845	0.28737	10
51	.40900	.25645	.42178	.26411	.43431	.27184	.44660	.27964	.45865	.28751	9
52	.40922	.25658	.42199	.26424	.43452	.27197	.44680	.27977	.45884	.28764	8
53	.40943	.25671	.42221	.26437	.43473	.27210	.44700	.27990	.45904	.28777	7
54	.40965	.25683	.42242	.26449	.43493	.27223	.44721	.28003	.45924	.28790	6
55	9.40986	0.25696	9.42263	0.26462	9.43514	0.27236	9.44741	0.28016	9.45944	0.28803	5
56	.41008	.25709	.42284	.26475	.43535	.27249	.44761	.28029	.45964	.28816	4
57	.41029	.25721	.42305	.26488	.43555	.27262	.44781	.28042	.45984	.28830	3
58	.41051	.25734	.42326	.26501	.43576	.27275	.44801	.28055	.46004	.28843	2
59	.41072	.25747	.42347	.26514	.43596	.27288	.44822	.28068	.46023	.28856	1
60	9.41094	0.25760	9.42368	0.26526	9.43617	0.27300	9.44842	0.28081	9.46043	0.28869	0
	299°		298°		297°		296°		295°		

## Haversines

i	65°		66°		67°		68°		69°		i
	Log Hav	Nat. Hav	Log Hav	Nat. Hav	Log Hav	Nat. Hav	Log Hav	Nat. Hav	Log Hav	Nat. Hav	
0	9.46043	0.28869	9.47222	0.29663	9.48378	0.30463	9.49512	0.31270	9.50626	0.32082	60
1	.46063	.28882	.47241	.29676	.48397	.30477	.49531	.31283	.50644	.32095	59
2	.46083	.28895	.47261	.29690	.48416	.30490	.49550	.31297	.50662	.32109	58
3	.46103	.28909	.47280	.29703	.48435	.30504	.49568	.31310	.50681	.32122	57
4	.46123	.28922	.47300	.29716	.48454	.30517	.49587	.31324	.50699	.32136	56
5	9.46142	0.28935	9.47319	0.29730	9.48473	0.30530	9.49606	0.31337	9.50717	0.32150	55
6	.46162	.28948	.47338	.29743	.48492	.30544	.49625	.31351	.50736	.32163	54
7	.46182	.28961	.47358	.29756	.48511	.30557	.49643	.31364	.50754	.32177	53
8	.46202	.28975	.47377	.29770	.48530	.30571	.49662	.31378	.50772	.32190	52
9	.46222	.28988	.47397	.29783	.48549	.30584	.49681	.31391	.50791	.32204	51
10	9.46241	0.29001	9.47416	0.29796	9.48568	0.30597	9.49699	0.31405	9.50809	0.32217	50
11	.46261	.29014	.47435	.29809	.48587	.30611	.49718	.31418	.50827	.32231	49
12	.46281	.29027	.47455	.29823	.48607	.30624	.49737	.31432	.50846	.32245	48
13	.46301	.29041	.47474	.29836	.48626	.30638	.49755	.31445	.50864	.32258	47
14	.46320	.29054	.47493	.29849	.48645	.30651	.49774	.31459	.50882	.32272	46
15	9.46340	0.29067	9.47513	0.29863	9.48664	0.30664	9.49793	0.31472	9.50901	0.32285	45
16	.46360	.29080	.47532	.29876	.48683	.30678	.49811	.31486	.50919	.32299	44
17	.46380	.29093	.47552	.29889	.48702	.30691	.49830	.31499	.50937	.32313	43
18	.46399	.29107	.47571	.29903	.48720	.30705	.49849	.31513	.50956	.32326	42
19	.46419	.29120	.47590	.29916	.48739	.30718	.49867	.31526	.50974	.32340	41
20	9.46439	0.29133	9.47610	0.29929	9.48758	0.30732	9.49886	0.31540	9.50992	0.32353	40
21	.46458	.29146	.47629	.29943	.48777	.30745	.49904	.31553	.51010	.32367	39
22	.46478	.29160	.47648	.29956	.48796	.30758	.49923	.31567	.51029	.32381	38
23	.46498	.29173	.47668	.29969	.48815	.30772	.49942	.31580	.51047	.32394	37
24	.46517	.29186	.47687	.29983	.48834	.30785	.49960	.31594	.51065	.32408	36
25	9.46537	0.29199	9.47706	0.29996	9.48853	0.30799	9.49979	0.31607	9.51083	0.32422	35
26	.46557	.29212	.47725	.30009	.48872	.30812	.49997	.31621	.51102	.32435	34
27	.46576	.29226	.47745	.30023	.48891	.30826	.50016	.31634	.51120	.32449	33
28	.46596	.29239	.47764	.30036	.48910	.30839	.50034	.31648	.51138	.32462	32
29	.46616	.29252	.47783	.30049	.48929	.30852	.50053	.31661	.51156	.32476	31
30	9.46635	0.29265	9.47803	0.30063	9.48948	0.30866	9.50072	0.31675	9.51174	0.32490	30
31	.46655	.29279	.47822	.30076	.48967	.30879	.50090	.31688	.51193	.32503	29
32	.46675	.29292	.47841	.30089	.48986	.30893	.50109	.31702	.51211	.32517	28
33	.46694	.29305	.47860	.30103	.49004	.30906	.50127	.31716	.51229	.32531	27
34	.46714	.29318	.47880	.30116	.49023	.30920	.50146	.31729	.51247	.32544	26
35	9.46733	0.29332	9.47899	0.30129	9.49042	0.30933	9.50164	0.31743	9.51265	0.32558	25
36	.46753	.29345	.47918	.30143	.49061	.30946	.50183	.31756	.51284	.32571	24
37	.46773	.29358	.47937	.30156	.49080	.30960	.50201	.31770	.51302	.32585	23
38	.46792	.29371	.47957	.30169	.49099	.30973	.50220	.31783	.51320	.32599	22
39	.46812	.29385	.47976	.30183	.49118	.30987	.50238	.31797	.51338	.32612	21
40	9.46831	0.29398	9.47995	0.30196	9.49137	0.31000	9.50257	0.31810	9.51356	0.32626	20
41	.46851	.29411	.48014	.30209	.49155	.31014	.50275	.31824	.51374	.32640	19
42	.46871	.29424	.48033	.30223	.49174	.31027	.50294	.31837	.51393	.32653	18
43	.46890	.29438	.48053	.30236	.49193	.31041	.50312	.31851	.51411	.32667	17
44	.46910	.29451	.48072	.30249	.49212	.31054	.50331	.31865	.51429	.32681	16
45	9.46929	0.29464	9.48091	0.30263	9.49231	0.31068	9.50349	0.31878	9.51447	0.32694	15
46	.46949	.29477	.48110	.30276	.49250	.31081	.50368	.31892	.51465	.32708	14
47	.46968	.29491	.48129	.30290	.49268	.31094	.50386	.31905	.51483	.32721	13
48	.46988	.29504	.48148	.30303	.49287	.31108	.50405	.31919	.51501	.32735	12
49	.47007	.29517	.48168	.30316	.49306	.31121	.50423	.31932	.51519	.32749	11
50	9.47027	0.29530	9.48187	0.30330	9.49325	0.31135	9.50442	0.31946	9.51538	0.32762	10
51	.47046	.29544	.48206	.30343	.49344	.31148	.50460	.31959	.51556	.32776	9
52	.47066	.29557	.48225	.30356	.49362	.31162	.50478	.31973	.51574	.32790	8
53	.47085	.29570	.48244	.30370	.49381	.31175	.50497	.31987	.51592	.32803	7
54	.47105	.29583	.48263	.30383	.49400	.31189	.50515	.32000	.51610	.32817	6
55	9.47124	0.29597	9.48282	0.30397	9.49419	0.31202	9.50534	0.32014	9.51628	0.32831	5
56	.47144	.29610	.48302	.30410	.49437	.31216	.50552	.32027	.51646	.32844	4
57	.47163	.29623	.48321	.30423	.49456	.31229	.50570	.32041	.51664	.32858	3
58	.47183	.29637	.48340	.30437	.49475	.31243	.50589	.32054	.51682	.32872	2
59	.47202	.29650	.48359	.30450	.49494	.31256	.50607	.32068	.51700	.32885	1
60	9.47222	0.29663	9.48378	0.30463	9.49512	0.31270	9.50626	0.32082	9.51718	0.32899	0
	294°		293°		292°		291°		290°		

# Haversines

i	70°		71°		72°		73°		74°		i
	Log Hav	Nat. Hav	Log Hav	Nat. Hav	Log Hav	Nat. Hav	Log Hav	Nat. Hav	Log Hav	Nat. Hav	
0	9. 51718	0. 32899	9. 52791	0. 33722	9. 53844	0. 34549	9. 54878	0. 3538i	9. 55893	0. 36218	60
1	. 51736	. 32913	. 52809	. 33735	. 53861	. 34563	. 54895	. 35395	. 55909	. 36232	59
2	. 51754	. 32926	. 52826	. 33749	. 53879	. 34577	. 54912	. 35409	. 55926	. 36246	58
3	. 51772	. 32940	. 52844	. 33763	. 53896	. 34591	. 54929	. 35423	. 55943	. 36260	57
4	. 51790	. 32954	. 52862	. 33777	. 53913	. 34604	. 54946	. 35437	. 55960	. 36274	56
5	9. 51808	0. 32967	9. 52879	0. 33790	9. 53933	0. 34618	9. 54963	0. 35451	9. 55976	0. 36288	55
6	. 51826	. 32981	. 52897	. 33804	. 53948	. 34632	. 54980	. 35465	. 55993	. 36302	54
7	. 51844	. 32995	. 52915	. 33818	. 53966	. 34646	. 54997	. 35479	. 56010	. 36316	53
8	. 51862	. 33008	. 52932	. 33832	. 53983	. 34660	. 55014	. 35493	. 56027	. 36330	52
9	. 51880	. 33022	. 52950	. 33845	. 54000	. 34674	. 55031	. 35507	. 56043	. 36344	51
10	9. 51898	0. 33036	9. 52968	0. 33859	9. 54017	0. 34688	9. 55048	0. 35521	9. 56060	0. 36358	50
11	. 51916	. 33049	. 52985	. 33873	. 54035	. 34701	. 55065	. 35534	. 56077	. 36372	49
12	. 51934	. 33063	. 53003	. 33887	. 54052	. 34715	. 55082	. 35548	. 56093	. 36386	48
13	. 51952	. 33077	. 53021	. 33900	. 54069	. 34729	. 55099	. 35562	. 56110	. 36400	47
14	. 51970	. 33090	. 53038	. 33914	. 54087	. 34743	. 55116	. 35576	. 56127	. 36414	46
15	9. 51988	0. 33104	9. 53056	0. 33928	9. 54104	0. 34757	9. 55133	0. 35590	9. 56144	0. 36428	45
16	. 52006	. 33118	. 53073	. 33942	. 54121	. 34771	. 55150	. 35604	. 56160	. 36442	44
17	. 52024	. 33132	. 53091	. 33956	. 54139	. 34784	. 55167	. 35618	. 56177	. 36456	43
18	. 52042	. 33145	. 53109	. 33969	. 54156	. 34798	. 55184	. 35632	. 56194	. 36470	42
19	. 52060	. 33159	. 53126	. 33983	. 54173	. 34812	. 55201	. 35646	. 56210	. 36484	41
20	9. 52078	0. 33173	9. 53144	0. 33997	9. 54190	0. 34826	9. 55218	0. 35660	9. 56227	0. 36498	40
21	. 52096	. 33186	. 53162	. 34011	. 54208	. 34840	. 55235	. 35674	. 56244	. 36512	39
22	. 52114	. 33200	. 53179	. 34024	. 54225	. 34854	. 55252	. 35688	. 56260	. 36526	38
23	. 52132	. 33214	. 53197	. 34038	. 54242	. 34868	. 55269	. 35702	. 56277	. 36540	37
24	. 52150	. 33227	. 53214	. 34052	. 54260	. 34882	. 55286	. 35716	. 56294	. 36554	36
25	9. 52168	0. 33241	9. 53232	0. 34066	9. 54277	0. 34895	9. 55303	0. 35730	9. 56310	0. 36568	35
26	. 52185	. 33255	. 53249	. 34080	. 54294	. 34909	. 55320	. 35743	. 56327	. 36582	34
27	. 52203	. 33269	. 53267	. 34093	. 54311	. 34923	. 55337	. 35757	. 56343	. 36596	33
28	. 52221	. 33282	. 53285	. 34107	. 54329	. 34937	. 55354	. 35771	. 56360	. 36610	32
29	. 52239	. 33296	. 53302	. 34121	. 54346	. 34951	. 55370	. 35785	. 56377	. 36624	31
30	9. 52257	0. 33310	9. 53320	0. 34135	9. 54363	0. 34965	9. 55387	0. 35799	9. 56393	0. 36638	30
31	. 52275	. 33323	. 53337	. 34149	. 54380	. 34979	. 55404	. 35813	. 56410	. 36652	29
32	. 52293	. 33337	. 53355	. 34162	. 54397	. 34992	. 55421	. 35827	. 56426	. 36666	28
33	. 52311	. 33351	. 53372	. 34176	. 54415	. 35006	. 55438	. 35841	. 56443	. 36680	27
34	. 52328	. 33365	. 53390	. 34190	. 54432	. 35020	. 55455	. 35855	. 56460	. 36694	26
35	9. 52346	0. 33378	9. 53407	0. 34204	9. 54449	0. 35034	9. 55472	0. 35869	9. 56476	0. 36708	25
36	. 52364	. 33392	. 53425	. 34218	. 54466	. 35048	. 55489	. 35883	. 56493	. 36722	24
37	. 52382	. 33406	. 53442	. 34231	. 54483	. 35062	. 55506	. 35897	. 56509	. 36736	23
38	. 52400	. 33419	. 53460	. 34245	. 54501	. 35076	. 55523	. 35911	. 56526	. 36750	22
39	. 52418	. 33433	. 53477	. 34259	. 54518	. 35090	. 55539	. 35925	. 56543	. 36764	21
40	9. 52436	0. 33447	9. 53495	0. 34273	9. 54535	0. 35103	9. 55556	0. 35939	9. 56559	0. 36778	20
41	. 52453	. 33461	. 53512	. 34287	. 54552	. 35117	. 55573	. 35953	. 56576	. 36792	19
42	. 52471	. 33474	. 53530	. 34300	. 54569	. 35131	. 55590	. 35967	. 56592	. 36806	18
43	. 52489	. 33488	. 53547	. 34314	. 54587	. 35145	. 55607	. 35981	. 56609	. 36820	17
44	. 52507	. 33502	. 53565	. 34328	. 54604	. 35159	. 55624	. 35995	. 56625	. 36834	16
45	9. 52525	0. 33515	9. 53582	0. 34342	9. 54621	0. 35173	9. 55641	0. 36009	9. 56642	0. 36848	15
46	. 52542	. 33529	. 53600	. 34356	. 54638	. 35187	. 55657	. 36023	. 56658	. 36862	14
47	. 52560	. 33543	. 53617	. 34369	. 54655	. 35201	. 55674	. 36036	. 56675	. 36877	13
48	. 52578	. 33557	. 53635	. 34383	. 54672	. 35215	. 55691	. 36050	. 56692	. 36891	12
49	. 52596	. 33570	. 53652	. 34397	. 54689	. 35228	. 55708	. 36064	. 56708	. 36905	11
50	9. 52613	0. 33584	9. 53670	0. 34411	9. 54707	0. 35242	9. 55725	0. 36078	9. 56725	0. 36919	10
51	. 52631	. 33598	. 53687	. 34425	. 54724	. 35256	. 55742	. 36092	. 96741	. 36933	9
52	. 52649	. 33612	. 53704	. 34439	. 54741	. 35270	. 55758	. 36106	. 56758	. 36947	8
53	. 52667	. 33625	. 53722	. 34452	. 54758	. 35284	. 55775	. 36120	. 56774	. 36961	7
54	. 52684	. 33639	. 53739	. 34466	. 54775	. 35298	. 55792	. 36184	. 56791	. 36975	6
55	9. 52702	0. 33653	9. 53757	0. 34480	9. 54792	0. 35312	9. 55809	0. 36148	9. 56807	0. 36989	5
56	. 52720	. 33667	. 53774	. 34494	. 54809	. 35326	. 55826	. 36162	. 56824	. 37003	4
57	. 52738	. 33680	. 53792	. 34508	. 54826	. 35340	. 55842	. 36176	. 56840	. 37017	3
58	. 52755	. 33694	. 53809	. 34521	. 54843	. 35354	. 55859	. 36190	. 56856	. 37031	2
59	. 52773	. 33708	. 53826	. 34535	. 54860	. 35368	. 55876	. 36204	. 56873	. 37045	1
60	9. 52791	0. 33722	9. 53844	0. 34549	9. 54878	0. 35381	9. 55893	0. 36218	9. 56889	0. 37059	0
	289°		288°		287°		286°		285°		

## Haversines

i	75°		76°		77°		78°		79°		i
	Log Hav	Nat. Hav	Log Hav	Nat. Hav	Log Hav	Nat. Hav	Log Hav	Nat. Hav	Log Hav	Nat. Hav	
0	9.56889	0.37059	9.57868	0.37904	9.58830	0.38752	9.59774	0.39604	9.60702	0.40460	60
1	.56906	.37073	.57885	.37918	.58846	.38767	.59790	.39619	.60717	.40474	59
2	.56922	.37087	.57901	.37932	.58862	.38781	.59806	.39633	.60733	.40488	58
3	.56939	.37101	.57917	.37946	.58878	.38795	.59821	.39647	.60748	.40502	57
4	.56955	.37115	.57933	.37960	.58893	.38809	.59837	.39661	.60763	.40517	56
5	9.56972	0.37129	9.57949	0.37974	9.58909	0.38823	9.59852	0.39676	9.60779	0.40531	55
6	.56988	.37143	.57965	.37989	.58925	.38837	.59868	.39690	.60794	.40545	54
7	.57005	.37157	.57981	.38003	.58941	.38852	.59883	.39704	.60809	.40560	53
8	.57021	.37171	.57998	.38017	.58957	.38866	.59899	.39718	.60825	.40574	52
9	.57037	.37186	.58014	.38031	.58973	.38880	.59915	.39732	.60840	.40588	51
10	9.57054	0.37200	9.58030	0.38045	9.58989	0.38894	9.59930	0.39747	9.60855	0.40602	50
11	.57070	.37214	.58046	.38059	.59004	.38908	.59946	.39761	.60870	.40617	49
12	.57087	.37228	.58062	.38073	.59020	.38923	.59961	.39775	.60886	.40631	48
13	.57103	.37242	.58078	.38087	.59036	.38937	.59977	.39789	.60901	.40645	47
14	.57119	.37256	.58094	.38102	.59052	.38951	.59992	.39804	.60916	.40660	46
15	9.57136	0.37270	9.58110	0.38116	9.59068	0.38965	9.60008	0.39818	9.60931	0.40674	45
16	.57152	.37284	.58126	.38130	.59083	.38979	.60023	.39832	.60947	.40688	44
17	.57169	.37298	.58143	.38144	.59099	.38994	.60039	.39846	.60962	.40702	43
18	.57185	.37312	.58159	.38158	.59115	.39008	.60054	.39861	.60977	.40717	42
19	.57201	.37326	.58175	.38172	.59131	.39022	.60070	.39875	.60992	.40731	41
20	9.57218	0.37340	9.58191	0.38186	9.59147	0.39036	9.60085	0.39889	9.61008	0.40745	40
21	.57234	.37354	.58207	.38200	.59162	.39050	.60101	.39903	.61023	.40760	39
22	.57250	.37368	.58223	.38215	.59178	.39064	.60116	.39918	.61038	.40774	38
23	.57267	.37382	.58239	.38229	.59194	.39079	.60132	.39932	.61053	.40788	37
24	.57283	.37397	.58255	.38243	.59210	.39093	.60147	.39946	.61069	.40802	36
25	9.57299	0.37411	9.58271	0.38257	9.59225	0.39107	9.60163	0.39960	9.61084	0.40817	35
26	.57316	.37425	.58287	.38271	.59241	.39121	.60178	.39975	.61099	.40831	34
27	.57332	.37439	.58303	.38285	.59257	.39135	.60194	.39989	.61114	.40845	33
28	.57348	.37453	.58319	.38299	.59273	.39150	.60209	.40003	.61129	.40860	32
29	.57365	.37467	.58335	.38314	.59289	.39164	.60225	.40017	.61145	.40874	31
30	9.57381	0.37481	9.58351	0.38328	9.59304	0.39178	9.60240	0.40032	9.61160	0.40888	30
31	.57397	.37495	.58367	.38342	.59320	.39192	.60256	.40046	.61175	.40903	29
32	.57414	.37509	.58383	.38356	.59336	.39206	.60271	.40060	.61190	.40917	28
33	.57430	.37523	.58399	.38370	.59351	.39221	.60287	.40074	.61205	.40931	27
34	.57446	.37537	.58415	.38384	.59367	.39235	.60302	.40089	.61221	.40945	26
35	9.57463	0.37551	9.58431	0.38398	9.59383	0.39249	9.60318	0.40103	9.61236	0.40960	25
36	.57479	.37566	.58447	.38413	.59399	.39263	.60333	.40117	.61251	.40974	24
37	.57495	.37580	.58463	.38427	.59414	.39277	.60348	.40131	.61266	.40988	23
38	.57511	.37594	.58479	.38441	.59430	.39292	.60364	.40146	.61281	.41003	22
39	.57528	.37608	.58495	.38455	.59446	.39306	.60379	.40160	.61296	.41017	21
40	9.57544	0.37622	9.58511	0.38469	9.59461	0.39320	9.60395	0.40174	9.61312	0.41031	20
41	.57560	.37636	.58527	.38483	.59477	.39334	.60410	.40188	.61327	.41046	19
42	.57577	.37650	.58543	.38498	.59493	.39348	.60426	.40203	.61342	.41060	18
43	.57593	.37664	.58559	.38512	.59508	.39363	.60441	.40217	.61357	.41074	17
44	.57609	.37678	.58575	.38526	.59524	.39377	.60456	.40231	.61372	.41089	16
45	9.57625	0.37692	9.58591	0.38540	9.59540	0.39391	9.60472	0.40245	9.61387	0.41103	15
46	.57642	.37706	.58607	.38554	.59556	.39405	.60487	.40260	.61402	.41117	14
47	.57658	.37721	.58623	.38568	.59571	.39420	.60502	.40274	.61417	.41131	13
48	.57674	.37735	.58639	.38582	.59587	.39434	.60518	.40288	.61433	.41146	12
49	.57690	.37749	.58655	.38597	.59602	.39448	.60533	.40303	.61448	.41160	11
50	9.57706	0.37763	9.58671	0.38611	9.59618	0.39462	9.60549	0.40317	9.61463	0.41174	10
51	.57723	.37777	.58687	.38625	.59634	.39476	.60564	.40331	.61478	.41189	9
52	.57739	.37791	.58703	.38639	.59649	.39491	.60579	.40345	.61493	.41203	8
53	.57755	.37805	.58719	.38653	.59665	.39505	.60595	.40360	.61508	.41217	7
54	.57771	.37819	.58735	.38667	.59681	.39519	.60610	.40374	.61523	.41232	6
55	9.57787	0.37833	9.58750	0.38682	9.59696	0.39533	9.60625	0.40388	9.61538	0.41246	5
56	.57804	.37847	.58766	.38696	.59712	.39548	.60641	.40402	.61553	.41260	4
57	.57820	.37862	.58782	.38710	.59728	.39562	.60656	.40417	.61568	.41275	3
58	.57836	.37876	.58798	.38724	.59743	.39576	.60671	.40431	.61583	.41289	2
59	.57852	.37890	.58814	.38738	.59759	.39590	.60687	.40445	.61598	.41303	1
60	9.57868	0.37904	9.58830	0.38752	9.59774	0.39604	9.60702	0.40460	9.61614	0.41318	0
	284°		283°		282°		281°		280°		

# Haversines

i	80°		81°		82°		83°		84°		i
	Log Hav	Nat. Hav	Log Hav	Nat. Hav	Log Hav	Nat. Hav	Log Hav	Nat. Hav	Log Hav	Nat. Hav	
0	9. 61614	0. 41318	9. 62509	0. 42178	9. 63389	0. 43041	9. 64253	0. 43907	9. 65102	0. 44774	60
1	. 61629	. 41332	. 62524	. 42193	. 63403	. 43056	. 64267	. 43921	. 65116	. 44788	59
2	. 61644	. 41346	. 62538	. 42207	. 63418	. 43070	. 64281	. 43935	. 65130	. 44803	58
3	. 61659	. 41361	. 62553	. 42221	. 63432	. 43085	. 64296	. 43950	. 65144	. 44817	57
4	. 61674	. 41375	. 62568	. 42236	. 63447	. 43099	. 64310	. 43964	. 65158	. 44831	56
5	9. 61689	0. 41389	9. 62583	0. 42250	9. 63461	0. 43113	9. 64324	0. 43979	9. 65172	0. 44846	55
6	. 61704	. 41404	. 62598	. 42264	. 63476	. 43128	. 64339	. 43993	. 65186	. 44860	54
7	. 61719	. 41418	. 62612	. 42279	. 63490	. 43142	. 64353	. 44008	. 65200	. 44875	53
8	. 61734	. 41432	. 62627	. 42293	. 63505	. 43157	. 64367	. 44022	. 65214	. 44889	52
9	. 61749.	. 41447	. 62642	. 42308	. 63519	. 43171	. 64381	. 44036	. 65228	. 44904	51
10	9. 61764	0. 41461	9. 62657	0. 42322	9. 63534	0. 43185	9. 64396	0. 44051	9. 65242	0. 44918	50
11	. 61779	. 41475	. 62671	. 42336	. 63548	. 43200	. 64410	. 44065	. 65256	. 44933	49
12	. 61794	. 41490	. 62686	. 42351	. 63563	. 43214	. 64424	. 44080	. 65270	. 44947	48
13	. 61809	. 41504	. 62701	. 42365	. 63577	. 43229	. 64438	. 44094	. 65284	. 44962	47
14	. 61824	. 41518	. 62716	. 42379	. 63592	. 43243	. 64452	. 44109	. 65298	. 44976	46
15	9. 61839	0. 41533	9. 62730	0. 42394	9. 63606	0. 43257	9. 64467	0. 44123	9. 65312	0. 44991	45
16	. 61854	. 41547	. 62745	. 42408	. 63621	. 43272	. 64481	. 44138	. 65326	. 45005	44
17	. 61869	. 41561	. 62760	. 42423	. 63635	. 43286	. 64495	. 44152	. 65340	. 45020	43
18	. 61884	. 41576	. 62774	. 42437	. 63649	. 43301	. 64509	. 44166	. 65354	. 45034	42
19	. 61899	. 41590	. 62789	. 42451	. 63664	. 43315	. 64523	. 44181	. 65368	. 45048	41
20	9. 61914	0. 41604	9. 62804	0. 42466	9. 63678	0. 43330	9. 64538	0. 44195	9. 65382	0. 45063	40
21	. 61929	. 41619	. 62819	. 42480	. 63693	. 43344	. 64552	. 44210	. 65396	. 45077	39
22	. 61944	. 41633	. 62833	. 42494	. 63707	. 43358	. 64566	. 44224	. 65410	. 45092	38
23	. 61959	. 41647	. 62848	. 42509	. 63722	. 43373	. 64580	. 44239	. 65424	. 45106	37
24	. 61974	. 41662	. 62863	. 42523	. 63736	. 43387	. 64594	. 44253	. 65438	. 45121	36
25	9. 61989	0. 41676	9. 62877	0. 42538	9. 63751	0. 43402	9. 64609	0. 44268	9. 65452	0. 45135	35
26	. 62003	. 41690	. 62892	. 42552	. 63765	. 43416	. 64623	. 44282	. 65466	. 45150	34
27	. 62018	. 41705	. 62907	. 42566	. 63779	. 43430	. 64637	. 44296	. 65480	. 45164	33
28	. 62033	. 41719	. 62921	. 42581	. 63794	. 43445	. 64651	. 44311	. 65493	. 45179	32
29	. 62048	. 41733	. 62936	. 42595	. 63808	. 43459	. 64665	. 44325	. 65507	. 45193	31
30	9. 62063	0. 41748	9. 62951	0. 42610	9. 63823	0. 43474	9. 64679	0. 44340	9. 65521	0. 45208	30
31	. 62078	. 41762	. 62965	. 42624	. 63837	. 43488	. 64694	. 44354	. 65535	. 45222	29
32	. 62093	. 41776	. 62980	. 42638	. 63851	. 43503	. 64708	. 44369	. 65549	. 45237	28
33	. 62108	. 41791	. 62995	. 42653	. 63866	. 43517	. 64722	. 44383	. 65563	. 45251	27
34	. 62.123	. 41805	. 63009	. 42667	. 63880	. 43531	. 64736	. 44398	. 65577	. 45266	26
35	9. 62138	0. 41819	9. 63024	0. 42681	9. 63895	0. 43546	9. 64750	0. 44412	9. 65591	0. 45280	25
36	. 62153	. 41834	. 63039	. 42696	. 63909	. 43560	. 64764	. 44427	. 65605	. 45295	24
37	. 62168	. 41848	. 63053	. 42710	. 63923	. 43575	. 64778	. 44441	. 65619	. 45309	23
38	. 62182	. 41862	. 63068	. 42725	. 63938	. 43589	. 64793	. 44455	. 65632	. 45324	22
39	. 62197	. 41877	. 63082	. 42739	. 63952	. 43603	. 64807	. 44470	. 65646	. 45338	21
40	9. 62212	0. 41891	9. 63097	0. 42753	9. 63966	0. 43618	9. 64821	0. 44484	9. 65660	0. 45353	20
41	. 62227	. 41905	. 63112	. 42768	. 63981	. 43632	. 64835	. 44499	. 65674	. 45367	19
42	. 62242	. 41920	. 63126	. 42782	. 63995	. 43647	. 64849	. 44513	. 65688	. 45381	18
43	. 62257	. 41934	. 63141	. 42797	. 64010	. 43661	. 64863	. 44528	. 65702	. 45396	17
44	. 62272	. 41949	. 63156	. 42811	. 64024	. 43676	. 64877	. 44542	. 65716	. 45410	16
45	9. 62287	0. 41963	9. 63170	0. 42825	9. 64038	0. 43690	9. 64891	0. 44557	9. 65729	0. 45425	15
46	. 62301	. 41977	. 63185	. 42840	. 64053	. 43704	. 64905	. 44571	. 65743	. 45439	14
47	. 62316	. 41992	. 63199	. 42854	. 64067	. 43719	. 64919	. 44586	. 65757	. 45454	13
48	. 62331	. 42006	. 63214	. 42869	. 64081	. 43733	. 64934	. 44600	. 65771	. 45468	12
49	. 62346	. 42020	. 63228	. 42883	. 64096	. 43748	. 64948	. 44614	. 65785	. 45483	11
50	9. 62361	0. 42035	9. 63243	0. 42897	9. 64110	0. 43762	9. 64962	0. 44629	9. 65799	0. 45497	10
51	. 62376	. 42049	. 63258	. 42912	. 64124	. 43777	. 64976	. 44643	. 65812	. 45512	9
52	. 62390	. 42063	. 63272	. 42926	. 64139	. 43791	. 64990	. 44658	. 65826	. 45526	8
53	. 62405	. 42078	. 63287	. 42941	. 64153	. 43805	. 65004	. 44672	. 65840	. 45541	7
54	. 62420	. 42092	. 63301	. 42955	. 64167	. 43820	. 65018	. 44687	. 65854	. 45555	6
55	9. 62435	0. 42106	9. 63316	0. 42969	9. 64181	0. 43834	9. 65032	0. 44701	9. 65868	0. 45570	5
56	. 62450	. 42121	. 63330	. 42984	. 64196	. 43849	. 65046	. 44716	. 65881	. 45584	4
57	. 62464	. 42135	. 63345	. 42998	. 64210	. 43863	. 65060	. 44730	. 65895	. 45599	3
58	. 62479	. 42150	. 63360	. 43013	. 64224	. 43878	. 65074	. 44745	. 65909	. 45613	2
59	. 62494	. 42164	. 63374	. 43027	. 64239	. 43892	. 65088	. 44759	. 65923	. 45628	1
60	9. 62509	0. 42178	9. 63389	0. 43041	9. 64253	0. 43907	9. 65102	0. 44774	9. 65937	0. 45642	0
	279°		278°		277°		276°		275°		

## Haversines

i	85°		86°		87°		88°		89°		i
	Log Hav	Nat. Hav	Log Hav	Nat. Hav	Log Hav	Nat. Hav	Log Hav	Nat. Hav	Log Hav	Nat. Hav	
0	9. 65937	0. 45642	9. 66757	0. 46512	9. 67562	0. 47383	9. 68354	0. 48255	9. 69132	0. 49127	60
1	. 65950	. 45657	. 66770	. 46527	. 67576	. 47398	. 68367	. 48270	. 69145	. 49142	59
2	. 65964	. 45671	. 66784	. 46541	. 67589	. 47412	. 68380	. 48284	. 69158	. 49156	58
3	. 65978	. 45686	. 66797	. 46556	. 67602	. 47427	. 68393	. 48299	. 69171	. 49171	57
4	. 65992	. 45700	. 66811	. 46570	. 67616	. 47441	. 68407	. 48313	. 69184	. 49186	56
5	9. 66006	0. 45715	9. 66824	0. 46585	9. 67629	0. 47456	9. 68420	0. 48328	9. 69197	0. 49200	55
6	. 66019	. 45729	. 66838	. 46599	. 67642	. 47470	. 68433	. 48342	. 69209	. 49215	54
7	. 66033	. 45744	. 66851	. 46614	. 67656	. 47485	. 68446	. 48357	. 69222	. 49229	53
8	. 66047	. 45758	. 66865	. 46628	. 67669	. 47499	. 68459	. 48371	. 69235	. 49244	52
9	. 66061	. 45773	. 66878	. 46643	. 67682	. 47514	. 68472	. 48386	. 69248	. 49258	51
10	9. 66074	0. 45787	9. 66892	0. 46657	9. 67695	0. 47528	9. 68485	0. 48400	9. 69261	0. 49273	50
11	. 66088	. 45802	. 66905	. 46672	. 67709	. 47543	. 68498	. 48415	. 69274	. 49287	49
12	. 66102	. 45816	. 66919	. 46686	. 67722	. 47558	. 68511	. 48429	. 69286	. 49302	48
13	. 66116	. 45831	. 66932	. 46701	. 67735	. 47572	. 68524	. 48444	. 69299	. 49316	47
14	. 66129	. 45845	. 66946	. 46715	. 67748	. 47587	. 68537	. 48459	. 69312	. 49331	46
15	9. 66143	0. 45860	9. 66959	0. 46730	9. 67762	0. 47601	9. 68550	0. 48473	9. 69325	0. 49346	45
16	. 66157	. 45874	. 66973	. 46744	. 67775	. 47616	. 68563	. 48488	. 69338	. 49360	44
17	. 66170	. 45889	. 66986	. 46759	. 67788	. 47630	. 68576	. 48502	. 69350	. 49375	43
18	. 66184	. 45903	. 67000	. 46773	. 67801	. 47645	. 68589	. 48517	. 69363	. 49389	42
19	. 66198	. 45918	. 67013	. 46788	. 67815	. 47659	. 68602	. 48531	. 69376	. 49404	41
20	9. 66212	0. 45932	9. 67027	0. 46802	9. 67828	0. 47674	9. 68615	0. 48546	9. 69389	0. 49418	40
21	. 66225	. 45947	. 67040	. 46817	. 67841	. 47688	. 68628	. 48560	. 69402	. 49433	39
22	. 66239	. 45961	. 67054	. 46831	. 67854	. 47703	. 68641	. 48575	. 69414	. 49447	38
23	. 66253	. 45976	. 67067	. 46846	. 67868	. 47717	. 68654	. 48589	. 69427	. 49462	37
24	. 66266	. 45990	. 67081	. 46860	. 67881	. 47732	. 68667	. 48604	. 69440	. 49476	36
25	9. 66280	0. 46005	9. 67094	0. 46875	9. 67894	0. 47746	9. 68680	0. 48618	9. 69453	0. 49491	35
26	. 66294	. 46019	. 67108	. 46890	. 67907	. 47761	. 68693	. 48633	. 69465	. 49505	34
27	. 66307	. 46034	. 67121	. 46904	. 67920	. 47775	. 68706	. 48648	. 69478	. 49520	33
28	. 66321	. 46048	. 67134	. 46919	. 67934	. 47790	. 68719	. 48662	. 69491	. 49535	32
29	. 66335	. 46063	. 67148	. 46933	. 67947	. 47804	. 68732	. 48677	. 69504	. 49549	31
30	9. 66348	0. 46077	9. 67161	0. 46948	9. 67960	0. 47819	9. 68745	0. 48691	9. 69516	0. 49564	30
31	. 66362	. 46092	. 67175	. 46962	. 67973	. 47834	. 68758	. 48706	. 69529	. 49578	29
32	. 66376	. 46106	. 67188	. 46977	. 67986	. 47848	. 68771	. 48720	. 69542	. 49593	28
33	. 66389	. 46121	. 67202	. 46991	. 68000	. 47863	. 68784	. 48735	. 69555	. 49607	27
34	. 66403	. 46135	. 67215	. 47006	. 68013	. 47877	. 68797	. 48749	. 69567	. 49622	26
35	9. 66417	0. 46150	9. 67228	0. 47020	9. 68026	0. 47892	9. 68810	0. 48764	9. 69580	0. 49636	25
36	. 66430	. 46164	. 67242	. 47035	. 68039	. 47906	. 68823	. 48778	. 69593	. 49651	24
37	. 66444	. 46179	. 67255	. 47049	. 68052	. 47921	. 68836	. 48793	. 69605	. 49665	23
38	. 66458	. 46193	. 67269	. 47064	. 68066	. 47935	. 68849	. 48807	. 69618	. 49680	22
39	. 66471	. 46208	. 67282	. 47078	. 68079	. 47950	. 68862	. 48822	. 69631	. 49695	21
40	9. 66485	0. 46222	9. 67295	0. 47093	9. 68092	0. 47964	9. 68875	0. 48837	9. 69644	0. 49709	20
41	. 66499	. 46237	. 67309	. 47107	. 68105	. 47979	. 68887	. 48851	. 69656	. 49724	19
42	. 66512	. 46251	. 67322	. 47122	. 68118	. 47993	. 68900	. 48866	. 69669	. 49738	18
43	. 66526	. 46266	. 67336	. 47136	. 68131	. 48008	. 68913	. 48880	. 69682	. 49753	17
44	. 66539	. 46280	. 67349	. 47151	. 68144	. 48022	. 68926	. 48895	. 69694	. 49767	16
45	9. 66553	0. 46295	9. 67362	0. 47165	9. 68158	0. 48037	9. 68939	0. 48909	9. 69707	0. 49782	15
46	. 66567	. 46309	. 67376	. 47180	. 68171	. 48052	. 68952	. 48924	. 69720	. 49796	14
47	. 66580	. 46324	. 67389	. 47194	. 68184	. 48066	. 68965	. 48938	. 69732	. 49811	13
48	. 66594	. 46338	. 67402	. 47209	. 68197	. 48081	. 68978	. 48953	. 69745	. 49825	12
49	. 66607	. 46353	. 67416	. 47223	. 68210	. 48095	. 68991	. 48967	. 69758	. 49840	11
50	9. 66621	0. 46367	9. 67429	0. 47238	9. 68223	0. 48110	9. 69004	0. 48982	9. 69770	0. 49855	10
51	. 66635	. 46382	. 67443	. 47252	. 68236	. 48124	. 69017	. 48997	. 69783	. 49869	9
52	. 66648	. 46396	. 67456	. 47267	. 68249	. 48139	. 69029	. 49011	. 69796	. 49884	8
53	. 66662	. 46411	. 67469	. 47282	. 68263	. 48153	. 69042	. 49026	. 69808	. 49898	7
54	. 66675	. 46425	. 67483	. 47296	. 68276	. 48168	. 69055	. 49040	. 69821	. 49913	6
55	9. 66689	0. 46440	9. 67496	0. 47311	9. 68289	0. 48182	9. 69068	0. 49055	9. 69834	0. 49927	5
56	. 66702	. 46454	. 67509	. 47325	. 68302	. 48197	. 69081	. 49069	. 69846	. 49942	4
57	. 66716	. 46469	. 67522	. 47340	. 68315	. 48211	. 69094	. 49084	. 69859	. 49956	3
58	. 66730	. 46483	. 67536	. 47354	. 68328	. 48226	. 69107	. 49098	. 69872	. 49971	2
59	. 66743	. 46498	. 67549	. 47369	. 68341	. 48240	. 69120	. 49113	. 69884	. 49985	1
60	9. 66757	0. 46512	9. 67562	0. 47383	9. 68354	0. 48255	9. 69132	0. 49127	9. 69897	0. 50000	0
	274°		273°		272°		271°		270°		

# Haversines

i	90°		91°		92°		93°		94°		i
	Log Hav	Nat. Hav	Log Hav	Nat. Hav	Log Hav	Nat. Hav	Log Hav	Nat. Hav	Log Hav	Nat. Hav	
0	9. 69897	0. 50000	9. 70648	0. 50873	9. 71387	0. 51745	9. 72112	0. 52617	9. 72825	0. 53488	60
1	. 69910	. 50015	. 70661	. 50887	. 71399	. 51760	. 72124	. 52631	. 72837	. 53502	59
2	. 69922	. 50029	. 70673	. 50902	. 71411	. 51774	. 72136	. 52646	. 72849	. 53517	58
3	. 69935	. 50044	. 70686	. 50916	. 71123	. 51789	. 72148	. 52660	. 72861	. 53531	57
4	. 69948	. 50058	. 70698	. 50931	. 71436	. 51803	. 72160	. 52675	. 72873	. 53546	56
5	9. 69960	0. 50073	9. 70710	0. 50945	9. 71448	0. 51818	9. 72172	0. 52689	9. 72884	0. 53560	55
6	. 69973	. 50087	. 70723	. 50960	. 71460	. 51832	. 72184	. 52704	. 72896	. 53575	54
7	. 69985	. 50102	. 70735	. 50974	. 71472	. 51847	. 72196	. 52718	. 72908	. 53539	53
8	. 69998	. 50116	. 70748	. 50989	. 71484	. 51861	. 72208	. 52733	. 72920	. 53604	52
9	. 70011	. 50131	. 70760	. 51003	. 71496	. 51876	. 72220	. 52748	. 72931	. 53618	51
10	9. 70023	0. 50145	9. 70772	0. 51018	9. 71509	0. 51890	9. 72232	0. 52762	9. 72943	0. 53633	50
11	. 70036	. 50160	. 70785	. 51033	. 71521	. 51905	. 72244	. 52777	. 72955	. 53647	49
12	. 70048	. 50175	. 70797	. 51047	. 71533	. 51919	. 72256	. 52791	. 72967	. 53662	48
13	. 70061	. 50189	. 70809	. 51062	. 71545	. 51934	. 72268	. 52806	. 72978	. 53676	47
14	. 70074	. 50204	. 70822	. 51076	. 71557	. 51948	. 72280	. 52820	. 72990	. 53691	46
15	9. 70086	0. 50218	9. 70834	0. 51091	9. 71569	0. 51963	9. 72292	0. 52835	9. 73002	0. 53705	45
16	. 70099	. 50233	. 70847	. 51105	. 71582	. 51978	. 72304	. 52849	. 73014	. 53720	44
17	. 70111	. 50247	. 70859	. 51120	. 71594	. 51992	. 72316	. 52864	. 73025	. 53734	43
18	. 70124	. 50262	. 70871	. 51134	. 71606	. 52007	. 72328	. 52878	. 73037	. 53749	42
19	. 70136	. 50276	. 70884	. 51149	. 71618	. 52021	. 72340	. 52893	. 73049	. 53763	41
20	9. 70149	0. 50291	9. 70896	0. 51163	9. 71630	0. 52036	9. 72352	0. 52907	9. 73060	0. 53778	40
21	. 70161	. 50305	. 70908	. 51178	. 71642	. 52050	. 72363	. 52922	. 73072	. 53792	39
22	. 70174	. 50320	. 70921	. 51193	. 71654	. 52065	. 72375	. 52936	. 73084	. 53807	38
23	. 70187	. 50335	. 70933	. 51207	. 71666	. 52079	. 72387	. 52951	. 73096	. 53821	37
24	. 70199	. 50349	. 70945	. 51222	. 71679	. 52094	. 72399	. 52965	. 73107	. 53836	36
25	9. 70212	0. 50364	9. 70958	0. 51236	9. 71691	0. 52108	9. 72411	0. 52980	9. 73119	0. 53850	35
26	. 70224	. 50378	. 70970	. 51251	. 71703	. 52123	. 72423	. 52994	. 73131	. 53865	34
27	. 70237	. 50393	. 70982	. 51265	. 71715	. 52137	. 72435	. 53009	. 73142	. 53879	33
28	. 70249	. 50407	. 70995	. 51280	. 71727	. 52152	. 72447	. 53023	. 73154	. 53894	32
29	. 70262	. 50422	. 71007	. 51294	. 71739	. 52166	. 72459	. 53038	. 73166	. 53908	31
30	9. 70274	0. 50436	9. 71019	0. 51309	9. 71751	0. 52181	9. 72471	0. 53052	9. 73177	0. 53923	30
31	. 70287	. 50451	. 71032	. 51323	. 71763	. 52195	. 72482	. 53067	. 73189	. 53937	29
32	. 70299	. 50465	. 71044	. 51338	. 71775	. 52210	. 72494	. 53081	. 73201	. 53952	28
33	. 70312	. 50480	. 71056	. 51352	. 71787	. 52225	. 72506	. 53096	. 73212	. 53966	27
34	. 70324	. 50495	. 71068	. 51367	. 71800	. 52239	. 72518	. 53110	. 73224	. 53981	26
35	9. 70337	0. 50509	9. 71081	0. 51382	9. 71812	0. 52254	9. 72530	0. 53125	9. 73236	0. 53995	25
36	. 70349	. 50524	. 71093	. 51396	. 71824	. 52268	. 72542	. 53140	. 73247	. 54010	24
37	. 70362	. 50538	. 71105	. 51411	. 71836	. 52283	. 72554	. 53154	. 73259	. 54024	23
38	. 70374	. 50553	. 71118	. 51425	. 71848	. 52297	. 72565	. 53169	. 73271	. 54039	22
39	. 70387	. 50567	. 71130	. 51440	. 71860	. 52312	. 72577	. 53183	. 73282	. 54053	21
40	9. 70399	0. 50582	9. 71142	0. 51454	9. 71872	0. 52326	9. 72589	0. 53198	9. 73294	0. 54068	20
41	. 70412	. 50596	. 71154	. 51469	. 71884	. 52341	. 72601	. 53212	. 73306	. 54082	19
42	. 70424	. 50611	. 71167	. 51483	. 71896	. 52355	. 72613	. 53227	. 73317	. 54097	18
43	. 70437	. 50625	. 71179	. 51498	. 71908	. 52370	. 72625	. 53241	. 73329	. 54111	17
44	. 70449	. 50640	. 71191	. 51512	. 71920	. 52384	. 72637	. 53256	. 73341	. 54126	16
45	9. 70462	0. 50654	9. 71203	0. 51527	9. 71932	0. 52399	9. 72648	0. 53270	9. 73352	0. 54140	15
46	. 70474	. 50669	. 71216	. 51541	. 71944	. 52413	. 72660	. 53285	. 73364	. 54155	14
47	. 70487	. 50684	. 71228	. 51556	. 71956	. 52428	. 72672	. 53299	. 73375	. 54169	13
48	. 70499	. 50698	. 71240	. 51571	. 71968	. 52442	. 72684	. 53314	. 73387	. 54184	12
49	. 70512	. 50713	. 71252	. 51585	. 71980	. 52457	. 72696	. 53328	. 73399	. 54198	11
50	9. 70524	0. 50727	9. 71265	0. 51600	9. 71992	0. 52472	9. 72708	0. 53343	9. 73410	0. 54213	10
51	. 70537	. 50742	. 71277	. 51614	. 72004	. 52486	. 72719	. 53357	. 73422	. 54227	9
52	. 70549	. 50756	. 71289	. 51629	. 72016	. 52501	. 72731	. 53372	. 73433	. 54242	8
53	. 70561	. 50771	. 71301	. 51643	. 72028	. 52515	. 72743	. 53386	. 73445	. 54256	7
54	. 70574	. 50785	. 71314	. 51658	. 72040	. 52530	. 72755	. 53401	. 73457	. 54271	6
55	9. 70586	0. 50800	9. 71326	0. 51672	9. 72052	0. 52544	9. 72767	0. 53415	9. 73468	0. 54285	5
56	. 70599	. 50814	. 71338	. 51687	. 72064	. 52559	. 72778	. 53430	. 73480	. 54300	4
57	. 70611	. 50829	. 71350	. 51701	. 72076	. 52573	. 72790	. 53444	. 73491	. 54314	3
58	. 70624	. 50844	. 71362	. 51716	. 72088	. 52588	. 72802	. 53459	. 73503	. 54329	2
59	. 70636	. 50858	. 71375	. 51730	. 72100	. 52602	. 72814	. 53473	. 73515	. 54343	1
60	9. 70648	0. 50873	9. 71387	0. 51745	9. 72112	0. 52617	9. 72825	0. 53488	9. 73526	0. 54358	0
	269°		268°		267°		266°		265°		

## Haversines

i	95°		96°		97°		98°		99°		i
	Log Hav	Nat. Hav	Log Hav	Nat. Hav	Log Hav	Nat. Hav	Log Hav	Nat. Hav	Log Hav	Nat. Hav	
0	9. 73526	0. 54358	9. 74215	0. 55226	9. 74891	0. 56093	9. 75556	0. 56959	9. 76209	0. 57822	60
1	. 73538	. 54372	. 74226	. 55241	. 74902	. 56108	. 75567	. 56973	. 76220	. 57836	59
2	. 73549	. 54387	. 74237	. 55255	. 74914	. 56122	. 75578	. 56987	. 76231	. 57850	58
3	. 73561	. 54401	. 74249	. 55270	. 74925	. 56137	. 75589	. 57002	. 76241	. 57865	57
4	. 73572	. 54416	. 74260	. 55284	. 74936	. 56151	. 75600	. 57016	. 76252	. 57879	56
5	9. 73584	0. 54430	9. 71272	0. 55299	9. 74947	0. 56166	9. 75611	0. 57031	9. 76263	0. 57894	55
6	. 73596	. 54445	. 74283	. 55313	. 74958	. 56180	. 75622	. 57045	. 76274	. 57908	54
7	. 73607	. 54459	. 74294	. 55328	. 74969	. 56195	. 75633	. 57059	. 76285	. 57922	53
8	. 73619	. 54474	. 74306	. 55342	. 74981	. 56209	. 75644	. 57074	. 76296	. 57937	52
9	. 73630	. 54488	. 74317	. 55357	. 74992	. 56223	. 75655	. 57088	. 76306	. 57951	51
10	9. 73642	0. 54503	0. 74323	0. 55371	9. 75003	0. 56238	9. 75666	0. 57103	9. 76317	0. 57965	50
11	. 73653	. 54517	. 74340	. 55386	. 75014	. 56252	. 75677	. 57117	. 76328	. 57980	49
12	. 73665	. 54532	. 74351	. 55400	. 75025	. 56267	. 75688	. 57131	. 76338	. 57994	48
13	. 73676	. 54546	. 74362	. 55414	. 75036	. 56281	. 75698	. 57146	. 76349	. 58008	47
14	. 73688	. 54561	. 74374	. 55429	. 75047	. 56296	. 75709	. 57160	. 76360	. 58023	46
15	9. 73699	0. 54575	9. 74385	0. 55443	9. 75059	0. 56310	9. 75720	0. 57175	9. 76371	0. 58037	45
16	. 73711	. 54590	. 74396	. 55458	. 75070	. 56324	. 75731	. 57189	. 76381	. 58051	44
17	. 73722	. 54604	. 74408	. 55472	. 75081	. 56339	. 75742	. 57203	. 76392	. 58066	43
18	. 73734	. 54619	. 74419	. 55487	. 75092	. 56353	. 75753	. 57218	. 76403	. 58080	42
19	. 73746	. 54633	. 74430	. 55501	. 75103	. 56368	. 75764	. 57232	. 76414	. 58095	41
20	9. 73757	0. 54647	9. 74442	0. 55516	9. 75114	0. 56382	9. 75775	0. 57247	9. 76424	0. 58109	40
21	. 73769	. 54662	. 74453	. 55530	. 75125	. 56397	. 75786	. 57261	. 76435	. 58123	39
22	. 73780	. 54676	. 74464	. 55545	. 75136	. 56411	. 75797	. 57275	. 76446	. 58138	38
23	. 73792	. 54691	. 74475	. 55559	. 75147	. 56425	. 75808	. 57290	. 76456	. 58152	37
24	. 73803	. 54705	. 74487	. 55573	. 75159	. 56440	. 75819	. 57304	. 76467	. 58166	36
25	9. 73815	0. 54720	9. 74498	0. 55588	9. 75170	0. 56454	9. 75830	0. 57319	9. 76478	0. 58181	35
26	. 73826	. 54734	. 74509	. 55602	. 75181	. 56469	. 75840	. 57333	. 76489	. 58195	34
27	. 73838	. 54749	. 74521	. 55617	. 75192	. 56483	. 75851	. 57347	. 76499	. 58209	33
28	. 73849	. 54763	. 74532	. 55631	. 75203	. 56497	. 75862	. 57362	. 76510	. 58224	32
29	. 73860	. 54778	. 74543	. 55646	. 75214	. 56512	. 75873	. 57376	. 76521	. 58238	31
30	9. 73872	0. 54792	9. 74554	0. 55660	9. 75225	0. 56526	9. 75884	0. 57390	9. 76531	0. 58252	30
31	. 73883	. 54807	. 74566	. 55675	. 75236	. 56541	. 75895	. 57405	. 76542	. 58267	29
32	. 73895	. 54821	. 74577	. 55689	. 75247	. 56555	. 75906	. 57419	. 76553	. 58281	28
33	. 73906	. 54836	. 74588	. 55704	. 75258	. 56570	. 75917	. 57434	. 76563	. 58295	27
34	. 73918	. 54850	. 74600	. 55718	. 75269	. 56584	. 75927	. 57448	. 76574	. 58310	26
35	9. 73929	0. 54865	9. 74611	0. 55732	9. 75280	0. 56598	9. 75938	0. 57462	9. 76585	0. 58324	25
36	. 73941	. 54879	. 74622	. 55747	. 75291	. 56613	. 75949	. 57477	. 76595	. 58338	24
37	. 73952	. 54894	. 74633	. 55761	. 75303	. 56627	. 75960	. 57491	. 76606	. 58353	23
38	. 73964	. 54908	. 74645	. 55776	. 75314	. 56642	. 75971	. 57506	. 76617	. 58367	22
39	. 73975	. 54923	. 74656	. 55790	. 75325	. 56656	. 75982	. 57520	. 76627	. 58381	21
40	9. 73987	0. 54937	9. 74667	0. 55805	9. 75336	0. 56670	9. 75993	0. 57534	9. 76638	0. 58396	20
41	. 73998	. 54952	. 74678	. 55819	. 75347	. 56685	. 76004	. 57549	. 76649	. 58410	19
42	. 74009	. 54966	. 74690	. 55834	. 75358	. 56699	. 76014	. 57563	. 76659	. 58424	18
43	. 74021	. 54980	. 74701	. 55848	. 75369	. 56714	. 76025	. 57577	. 76670	. 58439	17
44	. 74032	. 54995	. 74712	. 55862	. 75380	. 56728	. 76036	. 57592	. 76681	. 58453	16
45	9. 74044	0. 55009	9. 74723	0. 55877	9. 75391	0. 56743	9. 76047	0. 57606	9. 76691	0. 58467	15
46	. 74055	. 55024	. 74734	. 55891	. 75402	. 56757	. 76058	. 57621	. 76702	. 58482	14
47	. 74067	. 55038	. 74746	. 55906	. 75413	. 56771	. 76069	. 57635	. 76713	. 58496	13
48	. 74078	. 55053	. 74757	. 55920	. 75424	. 56786	. 76079	. 57649	. 76723	. 58510	12
49	. 74089	. 55067	. 74768	. 55935	. 75435	. 56800	. 76090	. 57664	. 76734	. 58525	11
50	9. 74101	0. 55082	9. 74779	0. 55949	9. 75446	0. 56815	9. 76101	0. 57678	9. 76745	0. 58539	10
51	. 74112	. 55096	. 74791	. 55964	. 75457	. 56829	. 76112	. 57692	. 76755	. 58553	9
52	. 74124	. 55111	. 74802	. 55978	. 75468	. 56843	. 76123	. 57707	. 76766	. 58568	8
53	. 74135	. 55125	. 74813	. 55992	. 75479	. 56858	. 76134	. 57721	. 76777	. 58582	7
54	. 74146	. 55140	. 74824	. 56007	. 75490	. 56872	. 76144	. 57736	. 76787	. 58596	6
55	9. 74158	0. 55154	9. 7483.5	0. 56021	9. 75501	0. 56887	9. 76155	0. 57750	9. 76798	0. 58611	5
56	. 74169	. 55169	. 74846	. 56036	. 75512	. 56901	. 76166	. 57764	. 76808	. 58625	4
57	. 74181	. 55183	. 74858	. 56050	. 75523	. 56915	. 76177	. 57779	. 76819	. 58639	3
58	. 74192	. 55197	. 74869	. 56065	. 75534	. 56930	. 76188	. 57793	. 76830	. 58654	2
59	. 74203	. 55212	. 74880	. 56079	. 75545	. 56944	. 76198	. 57807	. 76840	. 58668	1
60	9. 74215	0. 55226	9. 74891	0. 56093	9. 75556	0. 56959	9. 76209	0. 57822	9. 76851	0. 58682	0
	264°		263°		262°		261°		260°		



## Haversines

i	100°		101°		102°		103°		104°		i
	Log Hav	Nat. Hav	Log Hav	Nat. Hav	Log Hav	Nat. Hav	Log Hav	Nat. Hav	Log Hav	Nat. Hav	
0	9.76851	0.58682	9.77481	0.59540	9.78101	0.60396	9.78709	0.61248	9.79306	0.62096	60
1	.76861	.58697	.77492	.59555	.78111	.60410	.78719	.61262	.79316	.62110	59
2	.76872	.58711	.77502	.59569	.78121	.60424	.78729	.61276	.79326	.62124	58
3	.76883	.58725	.77512	.59583	.78131	.60438	.78739	.61290	.79336	.62138	57
4	.76893	.58740	.77523	.59598	.78141	.60452	.78749	.61304	.79346	.62153	56
5	9.76904	0.58754	9.77533	0.59612	9.78152	0.60467	9.78759	0.61318	9.79356	0.62167	55
6	.76914	.58768	.77544	.59626	.78162	.60481	.78769	.61333	.79366	.62181	54
7	.76925	.58783	.77554	.59640	.78172	.60495	.78779	.61347	.79376	.62195	53
8	.76936	.58797	.77564	.59655	.78182	.60509	.78789	.61361	.79385	.62209	52
9	.76946	.58811	.77575	.59669	.78192	.60524	.78799	.61375	.79395	.62223	51
10	9.76957	0.58826	9.77585	0.59683	9.78203	0.60538	9.78809	0.61389	9.79405	0.62237	50
11	.76967	.58840	.77596	.59697	.78213	.60552	.78819	.61403	.79415	.62251	49
12	.76978	.58854	.77606	.59712	.78223	.60566	.78829	.61418	.79425	.62265	48
13	.76988	.58869	.77616	.59726	.78233	.60580	.78839	.61432	.79434	.62279	47
14	.76999	.58883	.77627	.59740	.78243	.60595	.78849	.61446	.79444	.62294	46
15	9.77009	0.58897	9.77637	0.59755	9.78254	0.60609	9.78859	0.61460	9.79454	0.62308	45
16	.77020	.58911	.77647	.59769	.78264	.60623	.78869	.61474	.79464	.62322	44
17	.77031	.58926	.77658	.59783	.78274	.60637	.78879	.61488	.79474	.62336	43
18	.77041	.58940	.77668	.59797	.78284	.60652	.78889	.61502	.79484	.62350	42
19	.77052	.58954	.77679	.59812	.78294	.60666	.78899	.61517	.79493	.62364	41
20	9.77062	0.58969	9.77689	0.59826	9.78305	0.60680	9.78909	0.61531	9.79503	0.62378	40
21	.77073	.58983	.77699	.59840	.78315	.60694	.78919	.61545	.79513	.62392	39
22	.77083	.58997	.77710	.59854	.78325	.60708	.78929	.61559	.79523	.62406	38
23	.771094	.59012	.77720	.59869	.78335	.60723	.78939	.61573	.79533	.62420	37
24	.77104	.59026	.77730	.59883	.78345	.60737	.78949	.61587	.79542	.62434	36
25	9.77115	0.59040	9.77741	0.59897	9.78355	0.60751	9.78959	0.61602	9.79552	0.62449	35
26	.77125	.59055	.7775.1	.59911	.78365	.60765	.78969	.61616	.79562	.62463	34
27	.77136	.59069	.77761	.59926	.78376	.60779	.78979	.61630	.79572	.62477	33
28	.77146	.59083	.77772	.59940	.78386	.60794	.78989	.61644	.79582	.62491	32
29	.77157	.59097	.77782	.59954	.78396	.60808	.78999	.61658	.79591	.62505	31
30	9.77167	0.59112	9.77792	0.59968	9.78406	0.60822	9.79009	0.61672	9.79601	0.62519	30
31	.77178	.59126	.77803	.59983	.78416	.60836	.79019	.61686	.79611	.62533	29
32	.77188	.59140	.77813	.59997	.78426	.60850	.79029	.61701	.79621	.62547	28
33	.77199	.59155	.77823	.60011	.78436	.60865	.79039	.61715	.79631	.62561	27
34	.77209	.59169	.77834	.60025	.78447	.60879	.79049	.61729	.79640	.62575	26
35	9.77220	0.59183	9.77844	0.60040	9.78457	0.60893	9.79059	0.61743	9.79650	0.62589	25
36	.77230	.59198	.77854	.60054	.78467	.60907	.79069	.61757	.79660	.62603	24
37	.77241	.59212	.77864	.60068	.78477	.60921	.79079	.61771	.79670	.62618	23
38	.77251	.59226	.77875	.60082	.78487	.60936	.79089	.61785	.79679	.62632	22
39	.77262	.59240	.77885	.60097	.78497	.60950	.79099	.61800	.79689	.62646	21
40	9.77272	0.59255	9.77895	0.60111	9.78507	0.60964	9.79108	0.61814	9.79699	0.62660	20
41	.77283	.59269	.77906	.60125	.78517	.60978	.79118	.61828	.79709	.62674	19
42	.77293	.59283	.77916	.60139	.78528	.60992	.79128	.61842	.79718	.62688	18
43	.77304	.59298	.77926	.60154	.78538	.61006	.79138	.61856	.79728	.62702	17
44	.77314	.59312	.77936	.60168	.78548	.61021	.79148	.61870	.79738	.62716	16
45	9.77325	0.59326	9.77947	0.60182	9.78558	0.61035	9.79158	0.61884	9.79748	0.62730	15
46	.77335	.59340	.77957	.60196	.78568	.61049	.79168	.61898	.79757	.62744	14
47	.77346	.59355	.77967	.60211	.78578	.61063	.79178	.61913	.79767	.62758	13
48	.77356	.59369	.77978	.60225	.78588	.61077	.79188	.61927	.79777	.62772	12
49	.77366	.59383	.77988	.60239	.78598	.61092	.79198	.61941	.79787	.62786	11
50	9.77377	0.59398	9.77998	0.60253	9.78608	0.61106	9.79208	0.61955	9.79796	0.62800	10
51	.77387	.59412	.78008	.60268	.78618	.61120	.79217	.61969	.79806	.62814	9
52	.77398	.59426	.78019	.60282	.78628	.61134	.79227	.61983	.79816	.62829	8
53	.77408	.59440	.78029	.60296	.78638	.61148	.79237	.61997	.79825	.62843	7
54	.77419	.59455	.78039	.60310	.78649	.61163	.79247	.62011	.79835	.62857	6
55	9.77429	0.59469	9.78049	0.60324	9.78659	0.61177	9.79257	0.62026	9.79845	0.62871	5
56	.77440	.59483	.78060	.60339	.78669	.61191	.79267	.62040	.79855	.62885	4
57	.77450	.59498	.78070	.60353	.78679	.61205	.79277	.62054	.79864	.62899	3
58	.77460	.59512	.78080	.60367	.78689	.61219	.79287	.62068	.79874	.62913	2
59	.77471	.59526	.78090	.60381	.78699	.61233	.79297	.62082	.79884	.62927	1
60	9.77481	0.59540	9.78101	0.60396	9.78709	0.61248	9.79306	0.62096	9.79893	0.62941	0
	259°		258°		257°		256°		255°		

## Haversines

i	105°		106°		107°		108°		109°		i
	Log Hav	Nat. Hav	Log Hav	Nat. Hav	Log Hav	Nat. Hav	Log Hav	Nat. Hav	Log Hav	Nat. Hav	
0	9. 79893	0. 62941	9. 80470	0. 63782	9. 81036	0. 64619	9. 81592	0. 65451	9. 82137	0. 66278	60
1	. 79903	. 62955	. 80479	. 63796	. 81045	. 64632	. 81601	. 65465	. 82146	. 66292	59
2	. 79913	. 62969	. 80489	. 63810	. 81054	. 64646	. 81610	. 65479	. 82155	. 66306	58
3	. 79922	. 62983	. 80498	. 63824	. 81064	. 64660	. 81619	. 65492	. 82164	. 66320	57
4	. 79932	. 62997	. 80508	. 63838	. 81073	. 64674	. 81628	. 65506	. 82173	. 66333	56
5	9. 79942	0. 63011	9. 80517	0. 63852	9. 81082	0. 64688	9. 81637	0. 65520	9. 82182	0. 66347	55
6	. 79951	. 63025	. 80527	. 63866	. 81092	. 64702	. 81647	. 65534	. 82191	. 66361	54
7	. 79961	. 63039	. 80536	. 63880	. 81101	. 64716	. 81656	. 65548	. 82200	. 66375	53
8	. 79971	. 63053	. 80546	. 63894	. 81110	. 64730	. 81665	. 65561	. 82209	. 66388	52
9	. 79980	. 63067	. 80555	. 63908	. 81120	. 64744	. 81674	. 65575	. 82218	. 66402	51
10	9. 79990	0. 63081	9. 80565	0. 63922	9. 81129	0. 64758	9. 81683	0. 65589	9. 82227	0. 66416	50
11	. 80000	. 63095	. 80574	. 63936	. 81138	. 64772	. 81692	. 65603	. 82236	. 66430	49
12	. 80009	. 63109	. 80584	. 63950	. 81148	. 64785	. 81701	. 65617	. 82245	. 66443	48
13	. 80019	. 63123	. 80593	. 63964	. 81157	. 64799	. 81711	. 65631	. 82254	. 66457	47
14	. 80029	. 63138	. 80603	. 63977	. 81166	. 64818	. 81720	. 65644	. 82263	. 66471	46
15	9. 80038	0. 63152	9. 80612	0. 63991	9. 81176	0. 64827	9. 81729	0. 65658	9. 82272	0. 66485	45
16	. 80048	. 63166	. 80622	. 64005	. 81185	. 64841	. 81738	. 65672	. 82281	. 66498	44
17	. 80058	. 63180	. 80631	. 64019	. 81194	. 64855	. 81747	. 65686	. 82290	. 66512	43
18	. 80067	. 63194	. 80641	. 64033	. 81204	. 64869	. 81756	. 65700	. 82299	. 66526	42
19	. 80077	. 63208	. 80650	. 64047	. 81213	. 64883	. 81765	. 65713	. 82308	. 66539	41
20	9. 80087	0. 63222	9. 80660	0. 64061	9. 81222	0. 64897	9. 81775	0. 65727	9. 82317	0. 66553	40
21	. 80096	. 63236	. 80669	. 64075	. 81231	. 64910	. 81784	. 65741	. 82326	. 66567	39
22	. 80106	. 63250	. 80678	. 64089	. 81241	. 64924	. 81793	. 65755	. 82335	. 66581	38
23	. 80116	. 63264	. 80688	. 64103	. 81250	. 64938	. 81802	. 65769	. 82344	. 66594	37
24	. 80125	. 63278	. 80697	. 64117	. 81259	. 64952	. 81811	. 65782	. 82353	. 66608	36
25	9. 80135	0. 63292	9. 80707	0. 64131	9. 81269	0. 64966	9. 81820	0. 65796	9. 82362	0. 66622	35
26	. 80144	. 63306	. 80716	. 64145	. 81278	. 64980	. 81829	. 65810	. 82371	. 66635	34
27	. 80154	. 63320	. 80726	. 64159	. 81287	. 64994	. 81838	. 65824	. 82380	. 66649	33
28	. 80164	. 63334	. 80735	. 64173	. 81296	. 65008	. 81847	. 65838	. 82388	. 66663	32
29	. 80173	. 63348	. 80745	. 64187	. 81306	. 65021	. 81857	. 65851	. 82397	. 66677	31
30	9. 80183	0. 63362	9. 80754	0. 64201	9. 81315	0. 65035	9. 81866	0. 65865	9. 82406	0. 66690	30
31	. 80192	. 63376	. 80763	. 64215	. 81324	. 65049	. 81875	. 65879	. 82415	. 66704	29
32	. 80202	. 63390	. 80773	. 64229	. 81333	. 65063	. 81884	. 65893	. 82424	. 66718	28
33	. 80212	. 63404	. 80782	. 64243	. 81343	. 65077	. 81893	. 65907	. 82433	. 66731	27
34	. 80221	. 63418	. 80792	. 64257	. 81352	. 65091	. 81902	. 65920	. 82442	. 66745	26
35	9. 80231	0. 63432	9. 80801	0. 64270	9. 81361	0. 65105	9. 81911	0. 65934	9. 82451	0. 66759	25
36	. 80240	. 63446	. 80811	. 64284	. 81370	. 65118	. 81920	. 65948	. 82460	. 66773	24
37	. 80250	. 63460	. 80820	. 64298	. 81380	. 65132	. 81929	. 65962	. 82469	. 66786	23
38	. 80260	. 63474	. 80829	. 64312	. 81389	. 65146	. 81938	. 65976	. 82478	. 66800	22
39	. 80269	. 63488	. 80839	. 64326	. 81398	. 65160	. 81947	. 65989	. 82487	. 66814	21
40	9. 80279	0. 63502	9. 80848	0. 64340	9. 81407	0. 65174	9. 81956	0. 66003	9. 82495	0. 66827	20
41	. 80288	. 63516	. 80858	. 64354	. 81417	. 65188	. 81965	. 66017	. 82504	. 66841	19
42	. 80298	. 63530	. 80867	. 64368	. 81426	. 65202	. 81975	. 66031	. 82513	. 66855	18
43	. 80307	. 63544	. 80876	. 64382	. 81435	. 65216	. 81984	. 66044	. 82522	. 66868	17
44	. 80317	. 63558	. 80886	. 64396	. 81444	. 65229	. 81993	. 66058	. 82531	. 66882	16
45	9. 80327	0. 63572	9. 80895	0. 64410	9. 81454	0. 65243	9. 82002	0. 66072	9. 82540	0. 66896	15
46	. 80336	. 63586	. 80905	. 64424	. 81463	. 65257	. 82011	. 66086	. 82549	. 66910	14
47	. 80346	. 63600	. 80914	. 64438	. 81472	. 65271	. 82020	. 66100	. 82558	. 66923	13
48	. 80355	. 63614	. 80923	. 64452	. 81481	. 65285	. 82029	. 66113	. 82567	. 66937	12
49	. 80365	. 63628	. 80933	. 64466	. 81490	. 65299	. 82038	. 66127	. 82575	. 66951	11
50	9. 80374	0. 63642	9. 80942	0. 64479	9. 81500	0. 65312	9. 82047	0. 66141	9. 82584	0. 66964	10
51	. 80384	. 63656	. 80952	. 64493	. 81509	. 65326	. 82056	. 66155	. 82593	. 66978	9
52	. 80393	. 63670	. 80961	. 64507	. 81518	. 65340	. 82065	. 66168	. 82602	. 66992	8
53	. 80403	. 63684	. 80970	. 64521	. 81527	. 65354	. 82074	. 66182	. 82611	. 67005	7
54	. 80413	. 63698	. 80980	. 64535	. 81536	. 65368	. 82083	. 66196	. 82620	. 67019	6
55	9. 80422	0. 63712	9. 80989	0. 64549	9. 81546	0. 65382	9. 82092	0. 66210	9. 82629	0. 67033	5
56	. 80432	. 63726	. 80998	. 64563	. 81555	. 65396	. 82101	. 66223	. 82638	. 67046	4
57	. 80441	. 63740	. 81008	. 64577	. 81564	. 65409	. 82110	. 66237	. 82646	. 67060	3
58	. 80451	. 63754	. 81017	. 64591	. 81573	. 65423	. 82119	. 66251	. 82655	. 67074	2
59	. 80460	. 63768	. 81026	. 64605	. 81582	. 65437	. 82128	. 66265	. 82664	. 67087	1
60	9. 80470	0. 63782	9. 81036	0. 64619	9. 81592	0. 65451	9. 82137	0. 66278	9. 82673	0. 67101	0
	254°		253°		252°		251°		250°		

## Haversines

i	110°		111°		112°		113°		114°		i
	Log Hav	Nat. Hav	Log Hav	Nat. Hav	Log Hav	Nat. Hav	Log Hav	Nat. Hav	Log Hav	Nat. Hav	
0	9. 82673	0. 67101	9. 83199	0. 67918	9. 83715	0. 68730	9. 84221	0. 69537	9. 84718	0. 70337	60
1	. 82682	. 67115	. 83207	. 67932	. 83723	. 68744	. 84230	. 69550	. 84726	. 70350	59
2	. 82691	. 67128	. 83216	. 67946	. 83732	. 68757	. 84238	. 69563	. 84735	. 70363	58
3	. 82699	. 67142	. 83225	. 67959	. 83740	. 68771	. 84246	. 69577	. 84743	. 70377	57
4	. 82708	. 67156	. 83233	. 67973	. 83749	. 68784	. 84255	. 69590	. 84751	. 70390	56
5	9. 82717	0. 67169	9. 83242	0. 67986	9. 83757	0. 68798	9. 84263	0. 69603	9. 84759	0. 70403	55
6	. 82726	. 67183	. 83251	. 68000	. 83766	. 68811	. 84271	. 69617	. 84767	. 70417	54
7	. 82735	. 67197	. 83259	. 68013	. 83774	. 68825	. 84280	. 69630	. 84776	. 70430	53
8	. 82744	. 67210	. 83268	. 68027	. 83783	. 68838	. 84288	. 69644	. 84784	. 70443	52
9	. 82752	. 67224	. 83277	. 68041	. 83791	. 68852	. 84296	. 69657	. 84792	. 70456	51
10	9. 82761	0. 67238	9. 83285	0. 68054	9. 83800	0. 68865	9. 84305	0. 69670	9. 84800	0. 70470	50
11	. 82770	. 67251	. 83294	. 68068	. 83808	. 68879	. 84313	. 69684	. 84808	. 70483	49
12	. 82779	. 67265	. 83303	. 68081	. 83817	. 68892	. 84321	. 69697	. 84817	. 70496	48
13	. 82788	. 67279	. 83311	. 68095	. 83825	. 68906	. 84330	. 69710	. 84825	. 70509	47
14	. 82796	. 67292	. 83320	. 68108	. 83834	. 68919	. 84338	. 69724	. 84833	. 70523	46
15	9. 82805	0. 67306	9. 83329	0. 68122	9. 83842	0. 68932	9. 84346	0. 69737	9. 84841	0. 70536	45
16	. 82814	. 67319	. 83337	. 68135	. 83851	. 68946	. 84355	. 69751	. 84849	. 70549	44
17	. 82823	. 67333	. 83346	. 68149	. 83859	. 68959	. 84363	. 69764	. 84857	. 70562	43
18	. 82832	. 67347	. 83355	. 68163	. 83868	. 68973	. 84371	. 69777	. 84866	. 70576	42
19	. 82840	. 67360	. 83363	. 68176	. 83876	. 68986	. 84380	. 69791	. 84874	. 70589	41
20	9. 82849	0. 67374	9. 83372	0. 68190	9. 83885	0. 69000	9. 84388	0. 69804	9. 84882	0. 70602	40
21	. 82858	. 67388	. 83380	. 68203	. 83893	. 69013	. 84396	. 69817	. 84890	. 70615	39
22	. 82867	. 67401	. 83389	. 68217	. 83902	. 69027	. 84405	. 69831	. 84898	. 70629	38
23	. 82876	. 67415	. 83398	. 68230	. 83910	. 69040	. 84413	. 69844	. 84906	. 70642	37
24	i 82884	. 67429	. 83406	. 68244	. 83919	. 69054	. 84421	. 69857	. 84914	. 70655	36
25	9. 82893	0. 67442	9. 83415	0. 68257	9. 83927	0. 69067	9. 84430	0. 69871	9. 84923	0. 70668	35
26	. 82902	. 67456	. 83424	. 68271	. 83935	. 69080	. 84438	. 69884	. 84931	. 70682	34
27	. 82911	. 67469	. 83432	. 68284	. 83944	. 69094	. 84446	. 69897	. 84939	. 70695	33
28	. 82920	. 67483	. 83441	. 68298	. 83952	. 69107	. 84454	. 69911	. 84947	. 70708	32
29	. 82928	. 67497	. 83449	. 68312	. 83961	. 69121	. 84463	. 69924	. 84955	. 70721	31
30	9. 82937	0. 67510	9. 83458	0. 68325	9. 83969	0. 69134	9. 84471	0. 69937	9. 84963	0. 70735	30
31	. 82946	. 67524	. 83467	. 68339	. 83978	. 69148	. 84479	. 69951	. 84971	. 70748	29
32	. 82955	. 67538	. 83475	. 68352	. 83986	. 69161	. 84488	. 69964	. 84979	. 70761	28
33	. 82963	. 67551	. 83484	. 68366	. 83995	. 69174	. 84496	. 69977	. 84988	. 70774	27
34	. 82972	. 67565	. 83492	. 68379	. 84003	. 69188	. 84504	. 69991	. 84996	. 70788	26
35	9. 82981	0. 67578	9. 83501	0. 68393	9. 84011	0. 69201	9. 84512	0. 70004	9. 85004	0. 70801	25
36	. 82990	. 67592	. 83510	. 68406	. 84020	. 69215	. 84521	. 70017	. 85012	. 70814	24
37	. 82998	. 67606	. 83518	. 68420	. 84028	. 69228	. 84529	. 70031	. 85020	. 70827	23
38	. 83007	. 67619	. 83527	. 68433	. 84037	. 69242	. 84537	. 70044	. 85028	. 70840	22
39	. 83016	. 67633	. 83535	. 68447	. 84045	. 69255	. 84545	. 70057	. 85036	. 70854	21
40	9. 83025	0. 67647	9. 83544	0. 68460	9. 84054	0. 69268	9. 84554	0. 70071	9. 85044	0. 70867	20
41	. 83033	. 67660	. 83552	. 68474	. 84062	. 69282	. 84562	. 70084	. 85052	. 70880	19
42	. 83042	. 67674	. 83561	. 68487	. 84070	. 69295	. 84570	. 70097	. 85061	. 70893	18
43	. 83051	. 67687	. 83570	. 68501	. 84079	. 69309	. 84578	. 70111	. 85069	. 70907	17
44	. 83059	. 67701	. 83578	. 68514	. 84087	. 69322	. 84587	. 70124	. 85077	. 70920	16
45	9. 83068	0. 67715	9. 83587	0. 68528	9. 84096	0. 69336	9. 84595	0. 70137	9. 85085	0. 70933	15
46	. 83077	. 67728	. 83595	. 68541	. 84104	. 69349	. 84603	. 70151	. 85093	. 70946	14
47	. 83086	. 67742	. 83604	. 68555	. 84112	. 69362	. 84611	. 70164	. 85101	. 70959	13
48	. 83094	. 67755	. 83612	. 68568	. 84121	. 69376	. 84620	. 70177	. 85109	. 70973	12
49	. 83103	. 67769	. 83621	. 68582	. 84129	. 69389	. 84628	. 70191	. 85117	. 70986	11
50	9. 83112	0. 67783	9. 83630	0. 68595	9. 84138	0. 69403	9. 84636	0. 70204	9. 85125	0. 70999	10
51	. 83120	. 67796	. 83638	. 68609	. 84146	. 69416	. 84644	. 70217	. 85133	. 71012	9
52	. 83129	. 67810	. 83647	. 68622	. 84154	. 69429	. 84653	. 70230	. 85141	. 71025	8
53	. 83138	. 67823	. 83655	. 68636	. 84163	. 69443	. 84661	. 70244	. 85149	. 71039	7
54	. 83147	. 67837	. 83664	. 68649	. 84171	. 69456	. 84669	. 70257	. 85158	. 71052	6
55	9. 83155	0. 67850	9. 83672	0. 68663	9. 84179	0. 69470	9. 84677	0. 70270	9. 85166	0. 71065	5
56	. 83164	. 67864	. 83681	. 68676	. 84188	. 69483	. 84685	. 70284	. 85174	. 71078	4
57	. 83173	. 67878	. 83689	. 68690	. 84196	. 69496	. 84694	. 70297	. 85182	. 71091	3
58	. 83181	. 67891	. 83698	. 68703	. 84205	. 69510	. 84702	. 70310	. 85190	. 71105	2
59	. 83190	. 67905	. 83706	. 68717	. 84213	. 69523	. 84710	. 70324	. 85198	. 71118	1
60	9. 83199	0. 67918	9. 83715	0. 68730	9. 84221	0. 69537	9. 84718	0. 70337	9. 85206	0. 71131	0
	249°		248°		247°		246°		245°		

## Haversines

i	115°		116°		117°		118°		119°		i
	Log Hav	Nat. Hav	Log Hav	Nat. Hav	Log Hav	Nat. Hav	Log Hav	Nat. Hav	Log Hav	Nat. Hav	
0	9. 85206	0. 71131	9. 85684	0. 71919	9. 86153	0. 72700	9. 86613	0. 73474	9. 87064	0. 74240	60
1	. 85214	. 71144	. 85692	. 71932	. 86161	. 72712	. 86621	. 73486	. 87072	. 74253	59
2	. 85222	. 71157	. 85700	. 71945	. 86169	. 72725	. 86628	. 73499	. 87079	. 74266	58
3	. 85230	. 71170	. 85708	. 71958	. 86176	. 72738	. 86636	. 73512	. 87086	. 74279	57
4	. 85238	. 71184	. 85716	. 71971	. 86184	. 72751	. 86643	. 73525	. 87094	. 74291	56
5	9. 85246	0. 71197	9. 85724	0. 71984	9. 86192	0. 72764	9. 86651	0. 73538	9. 87101	0. 74304	55
6	. 85254	. 71210	. 85731	. 71997	. 86200	. 72777	. 86659	. 73551	. 87109	. 74317	54
7	. 85262	. 71223	. 85739	. 72010	. 86207	. 72790	. 86666	. 73563	. 87116	. 74329	53
8	. 85270	. 71236	. 85747	. 72023	. 86215	. 72803	. 86674	. 73576	. 87124	. 74342	52
9	. 85278	. 71249	. 85755	. 72036	. 86223	. 72816	. 86681	. 73589	. 87131	. 74355	51
10	9. 85286	0. 71263	9. 85763	0. 72049	9. 86230	0. 72829	9. 86689	0. 73602	9. 87138	0. 74368	50
11	. 85294	. 71276	. 85771	. 72062	. 86238	. 72842	. 86696	. 73615	. 87146	. 74380	49
12	. 85302	. 71289	. 85779	. 72075	. 86246	. 72855	. 86704	. 73628	. 87153	. 74393	48
13	. 85310	. 71302	. 85787	. 72088	. 86254	. 72868	. 86712	. 73640	. 87161	. 74406	47
14	. 85318	. 71315	. 85794	. 72101	. 86261	. 72881	. 86719	. 73653	. 87168	. 74418	46
15	9. 85326	0. 71328	9. 85802	0. 72114	9. 86269	0. 72894	9. 86727	0. 73666	9. 87175	0. 74431	45
16	. 85334	. 71342	. 85810	. 72127	. 86277	. 72907	. 86734	. 73679	. 87183	. 74444	44
17	. 85342	. 71355	. 85818	. 72141	. 86284	. 72920	. 86742	. 73692	. 87190	. 74456	43
18	. 85350	. 71368	. 85826	. 72154	. 86292	. 72932	. 86749	. 73704	. 87198	. 74469	42
19	. 85358	. 71381	. 85834	. 72167	. 86300	. 72945	. 86757	. 73717	. 87205	. 74482	41
20	9. 85366	0. 71394	9. 85841	0. 72180	9. 86307	0. 72958	9. 86764	0. 73730	9. 87212	0. 74494	40
21	. 85374	. 71407	. 85849	. 72193	. 86315	. 72971	. 86772	. 73743	. 87220	. 74507	39
22	. 85382	. 71420	. 85857	. 72206	. 86323	. 72984	. 86780	. 73756	. 87227	. 74520	38
23	. 85390	. 71434	. 85865	. 72219	. 86331	. 72997	. 86787	. 73768	. 87235	. 74533	37
24	. 85398	. 71447	. 85873	. 72232	. 86338	. 73010	. 86795	. 73781	. 87242	. 74545	36
25	9. 85406	0. 71460	9. 85881	0. 72245	9. 86346	0. 73023	9. 86802	0. 73794	9. 87249	0. 74558	35
26	. 85414	. 71473	. 85888	. 72258	. 86354	. 73036	. 86810	. 73807	. 87257	. 74571	34
27	. 85422	. 71486	. 85896	. 72271	. 86361	. 73049	. 86817	. 73820	. 87264	. 74583	33
28	. 85430	. 71499	. 85904	. 72284	. 86369	. 73062	. 86825	. 73832	. 87271	. 74596	32
29	. 85438	. 71512	. 85912	. 72297	. 86377	. 73075	. 86832	. 73845	. 87279	. 74609	31
30	9. 85446	0. 71526	9. 85920	0. 72310	9. 86384	0. 73087	9. 86840	0. 73858	9. 87286	0. 74621	30
31	. 85454	. 71539	. 85928	. 72323	. 86392	. 73100	. 86847	. 73871	. 87294	. 74634	29
32	. 85462	. 71552	. 85935	. 72336	. 86400	. 73113	. 86855	. 73883	. 87301	. 74646	28
33	. 85470	. 71565	. 85943	. 72349	. 86407	. 73126	. 86862	. 73896	. 87308	. 74659	27
34	. 85478	. 71578	. 85951	. 72362	. 86415	. 73139	. 86870	. 73909	. 87316	. 74672	26
35	9. 85486	0. 71591	9. 85959	0. 72375	9. 86423	0. 73152	9. 86877	0. 73922	9. 87323	0. 74684	25
36	. 85494	. 71604	. 85967	. 72388	. 86430	. 73165	. 86885	. 73935	. 87330	. 74697	24
37	. 85502	. 71617	. 85974	. 72401	. 86438	. 73178	. 86892	. 73947	. 87338	. 74710	23
38	. 85510	. 71631	. 85982	. 72414	. 86446	. 73191	. 86900	. 73960	. 87345	. 74722	22
39	. 85518	. 71644	. 85990	. 72427	. 86453	. 73203	. 86907	. 73973	. 87352	. 74735	21
40	9. 85526	0. 71657	9. 85998	0. 72440	9. 86461	0. 73216	9. 86915	0. 73986	9. 87360	0. 74748	20
41	. 85534	. 71670	. 86006	. 72453	. 86468	. 73229	. 86922	. 73998	. 87367	. 74760	19
42	. 85542	. 71683	. 86013	. 72466	. 86476	. 73242	. 86930	. 74011	. 87374	. 74773	18
43	. 85550	. 71696	. 86021	. 72479	. 86484	. 73255	. 86937	. 74024	. 87382	. 74786	17
44	. 85557	. 71709	. 86029	. 72492	. 86491	. 73268	. 86945	. 74037	. 87389	. 74798	16
45	9. 85565	0. 71722	9. 86037	0. 72505	9. 86499	0. 73281	9. 86952	0. 74049	9. 87396	0. 74811	15
46	. 85573	. 71735	. 86045	. 72518	. 86507	. 73294	. 86960	. 74062	. 87404	. 74823	14
47	. 85581	. 71748	. 86052	. 72531	. 86514	. 73306	. 86967	. 74075	. 87411	. 74836	13
48	. 85589	. 71762	. 86060	. 72544	. 86522	. 73319	. 86975	. 74088	. 87418	. 74849	12
49	. 85597	. 71775	. 86068	. 72557	. 86529	. 73332	. 86982	. 74100	. 87426	. 74861	11
50	9. 85605	0. 71788	9. 86076	0. 72570	9. 86537	0. 73345	9. 86990	0. 74113	9. 87433	0. 74874	10
51	. 85613	. 71801	. 86083	. 72583	. 86545	. 73358	. 86997	. 74126	. 87440	. 74887	9
52	. 85621	. 71814	. 86091	. 72596	. 86552	. 73371	. 87004	. 74139	. 87448	. 74899	8
53	. 85629	. 71827	. 86099	. 72609	. 86560	. 73384	. 87012	. 74151	. 87455	. 74912	7
54	. 85637	. 71840	. 86107	. 72622	. 86568	. 73396	. 87019	. 74164	. 87462	. 74924	6
55	9. 85645	0. 71853	9. 86114	0. 72635	9. 86575	0. 73409	9. 87027	0. 74177	9. 87470	0. 74937	5
56	. 85653	. 71866	. 86122	. 72648	. 86583	. 73422	. 87034	. 74190	. 87477	. 74950	4
57	. 85660	. 71879	. 86130	. 72661	. 86590	. 73435	. 87042	. 74202	. 87484	. 74962	3
58	. 85668	. 71892	. 86138	. 72674	. 86598	. 73448	. 87049	. 74215	. 87492	. 74975	2
59	. 85676	. 71905	. 86145	. 72687	. 86606	. 73461	. 87057	. 74228	. 87499	. 74987	1
60	9. 85684	0. 71919	9. 86153	0. 72700	9. 86613	0. 73474	9. 87064	0. 74240	9. 87506	0. 75000	0
	244°		243°		242°		241°		240°		

## Haversines

i	120°		121°		122°		123°		124°		i
	Log Hav	Nat. Hav	Log Hav	Nat. Hav	Log Hav	Nat. Hav	Log Hav	Nat. Hav	Log Hav	Nat. Hav	
0	9. 87506	0. 75000	9. 87939	0. 75752	9. 88364	0. 76496	9. 88780	0. 77232	9. 89187	0. 77960	60
1	. 87513	. 75013	. 87947	. 75764	. 88371	. 76508	. 88787	. 77244	. 89194	. 77972	59
2	. 87521	. 75025	. 87954	. 75777	. 88378	. 76521	. 88793	. 77256	. 89200	. 77984	58
3	. 87528	. 75038	. 87961	. 75789	. 88385	. 76533	. 88800	. 77269	. 89207	. 77996	57
4	. 87535	. 75050	. 87968	. 75802	. 88392	. 76545	. 88807	. 77281	. 89214	. 78008	56
5	9. 87543	0. 75063	9. 87975	0. 75814	9. 88399	0. 76558	9. 88814	0. 77293	9. 89221	0. 78020	55
6	. 87550	. 75076	. 87982	. 75827	. 88406	. 76570	. 88821	. 77305	. 89227	. 78032	54
7	. 87557	. 75088	. 87989	. 75839	. 88413	. 76582	. 88828	. 77317	. 89234	. 78044	53
8	. 87564	. 75101	. 87996	. 75852	. 88420	. 76595	. 88835	. 77329	. 89241	. 78056	52
9	. 87572	. 75113	. 88004	. 75864	. 88427	. 76607	. 88841	. 77342	. 89247	. 78068	51
10	9. 87579	0. 75126	9. 88011	0. 75876	9. 88434	0. 76619	9. 88848	0. 77354	9. 89254	0. 78080	50
11	. 87586	. 75138	. 88018	. 75889	. 88441	. 76632	. 88855	. 77366	. 89261	. 78092	49
12	. 87593	. 75151	. 88025	. 75901	. 88448	. 76644	. 88862	. 77378	. 89267	. 78104	48
13	. 87601	. 75164	. 88032	. 75914	. 88455	. 76656	. 88869	. 77390	. 89274	. 78116	47
14	. 87608	. 75176	. 88039	. 75926	. 88462	. 76668	. 88876	. 77402	. 89281	. 78128	46
15	9. 87615	0. 75189	9. 88046	0. 75939	9. 88469	0. 76681	9. 88882	0. 77415	9. 89287	0. 78140	45
16	. 87623	. 75201	. 88053	. 75951	. 88476	. 76693	. 88889	. 77427	. 89294	. 78152	44
17	. 87630	. 75214	. 88061	. 75964	. 88483	. 76705	. 88896	. 77439	. 89301	. 78164	43
18	. 87637	. 75226	. 88068	. 75976	. 88490	. 76718	. 88903	. 77451	. 89308	. 78176	42
19	. 87644	. 75239	. 88075	. 75988	. 88496	. 76730	. 88910	. 77463	. 89314	. 78188	41
20	9. 87652	0. 75251	9. 88082	0. 76001	9. 88503	0. 76742	9. 88916	0. 77475	9. 89321	0. 78200	40
21	. 87659	. 75264	. 88089	. 76013	. 88510	. 76754	. 88923	. 77488	. 89328	. 78212	39
22	. 87666	. 75277	. 88096	. 76026	. 88517	. 76767	. 88930	. 77500	. 89334	. 78224	38
23	. 87673	. 75289	. 88103	. 76038	. 88524	. 76779	. 88937	. 77512	. 89341	. 78236	37
24	. 87680	. 75302	. 88110	. 76050	. 88531	. 76791	. 88944	. 77524	. 89348	. 78248	36
25	9. 87688	0. 75314	9. 88117	0. 76063	9. 88538	0. 76804	9. 88950	0. 77536	9. 89354	0. 78260	35
26	. 87695	. 75327	. 88124	. 76075	. 88545	. 76816	. 88957	. 77548	. 89361	. 78272	34
27	. 87702	. 75339	. 88131	. 76088	. 88552	. 76828	. 88964	. 77560	. 89368	. 78284	33
28	. 87709	. 75352	. 88139	. 76100	. 88559	. 76840	. 88971	. 77573	. 89374	. 78296	32
29	. 87717	. 75364	. 88146	. 76113	. 88566	. 76853	. 88978	. 77585	. 89381	. 78308	31
30	9. 87724	0. 75377	9. 88153	0. 76125	9. 88573	0. 76865	9. 88984	0. 77597	9. 89387	0. 78320	30
31	. 87731	. 75389	. 88160	. 76137	. 88580	. 76877	. 88991	. 77609	. 89394	. 78332	29
32	. 87738	. 75402	. 88167	. 76150	. 88587	. 76890	. 88998	. 77621	. 89400	. 78344	28
33	. 87745	. 75415	. 88174	. 76162	. 88594	. 76902	. 89005	. 77633	. 89407	. 78356	27
34	. 87753	. 75427	. 88181	. 76175	. 88600	. 76914	. 89012	. 77645	. 89414	. 78368	26
35	9. 87760	0. 75440	9. 88188	0. 76187	9. 88607	0. 76926	9. 89018	0. 77657	9. 89421	0. 78380	25
36	. 87767	. 75452	. 88195	. 76199	. 88614	. 76939	. 89025	. 77670	. 89427	. 78392	24
37	. 87774	. 75465	. 88202	. 76212	. 88621	. 76951	. 89032	. 77682	. 89434	. 78404	23
38	. 87782	. 75477	. 88209	. 76224	. 88628	. 76963	. 89039	. 77694	. 89441	. 78416	22
39	. 87789	. 75490	. 88216	. 76236	. 88635	. 76975	. 89045	. 77706	. 89447	. 78428	21
40	9. 87796	0. 75502	9. 88223	0. 76249	9. 88642	0. 76988	9. 89052	0. 77718	9. 89454	0. 78440	20
41	. 87803	. 75515	. 88230	. 76261	. 88649	. 77000	. 89059	. 77730	. 89460	. 78452	19
42	. 87810	. 75527	. 88237	. 76274	. 88656	. 77012	. 89066	. 77742	. 89467	. 78464	18
43	. 87818	. 75540	. 88244	. 76286	. 88663	. 77024	. 89072	. 77754	. 89474	. 78476	17
44	. 87825	. 75552	. 88252	. 76298	. 88670	. 77036	. 89079	. 77766	. 89480	. 78488	16
45	9. 87832	0. 75565	9. 88259	0. 76311	9. 88677	0. 77049	9. 89086	0. 77779	9. 89487	0. 78500	15
46	. 87839	. 75577	. 88266	. 76323	. 88683	. 77061	. 89093	. 77791	. 89493	. 78512	14
47	. 87846	. 75590	. 88273	. 76335	. 88690	. 77073	. 89099	. 77803	. 89500	. 78524	13
48	. 87853	. 75602	. 88280	. 76348	. 88697	. 77085	. 89106	. 77815	. 89507	. 78536	12
49	. 87861	. 75615	. 88287	. 76360	. 88704	. 77098	. 89113	. 77827	. 89513	. 78548	11
50	9. 87868	0. 75627	9. 88294	0. 76373	9. 88711	0. 77110	9. 89120	0. 77839	9. 89520	0. 78560	10
51	. 87875	. 75640	. 88301	. 76385	. 88718	. 77122	. 89126	. 77851	. 89527	. 78571	9
52	. 87882	. 75652	. 88308	. 76397	. 88725	. 77134	. 89133	. 77863	. 89533	. 78583	8
53	. 87889	. 75665	. 88315	. 76410	. 88732	. 77147	. 89140	. 77875	. 89540	. 78595	7
54	. 87896	. 75677	. 88322	. 76422	. 88739	. 77159	. 89147	. 77887	. 89546	. 78607	6
55	9. 87904	0. 75690	9. 88329	0. 76434	9. 88745	0. 77171	9. 89153	0. 77899	9. 89553	0. 78619	5
56	. 87911	. 75702	. 88336	. 76447	. 88752	. 77183	. 89160	. 77911	. 89559	. 78631	4
57	. 87918	. 75714	. 88343	. 76459	. 88759	. 77195	. 89167	. 77923	. 89566	. 78643	3
58	. 87925	. 75727	. 88350	. 76471	. 88766	. 77208	. 89174	. 77936	. 89573	. 78655	2
59	. 87932	. 75739	. 88357	. 76484	. 88773	. 77220	. 89180	. 77948	. 89579	. 78667	1
60	9. 87939	0. 75752	9. 88364	0. 76496	9. 88780	0. 77232	9. 89187	0. 77960	9. 89586	0. 78679	0
	239°		238°		237°		236°		235°		

## Haversines

i	125°		126°		127°		128°		129°		i
	Log Hav	Nat. Hav	Log Hav	Nat. Hav	Log Hav	Nat. Hav	Log Hav	Nat. Hav	Log Hav	Nat. Hav	
0	9.89586	0.78679	9.89976	0.79389	9.90358	0.80091	9.90732	0.80783	9.91098	0.81466	60
1	.89592	.78691	.89983	.79401	.90365	.80102	.90738	.80795	.91104	.81477	59
2	.89599	.78703	.89989	.79413	.90371	.80114	.90744	.80806	.91110	.81489	58
3	.89606	.78715	.89995	.79425	.90377	.80126	.90751	.80817	.91116	.81500	57
4	.89612	.78726	.90002	.79436	.90383	.80137	.90757	.80829	.91122	.81511	56
5	9.89619	0.78738	9.90008	0.79448	9.90390	0.80149	9.90763	0.80840	9.91128	0.81523	55
6	.89625	.78750	.90015	.79460	.90396	.80160	.90769	.80852	.91134	.81534	54
7	.89632	.78762	.90021	.79472	.90402	.80172	.90775	.80863	.91140	.81545	53
8	.89638	.78774	.90028	.79483	.90409	.80184	.90781	.80875	.91146	.81556	52
9	.89645	.78786	.90034	.79495	.90415	.80195	.90787	.80886	.91152	.81568	51
10	9.89651	0.78798	9.90040	0.79507	9.90421	0.80207	9.90794	0.80898	9.91158	0.81579	50
11	.89658	.78810	.90047	.79519	.90428	.80218	.90800	.80909	.91164	.81590	49
12	.89665	.78822	.90053	.79530	.90434	.80230	.90806	.80920	.91170	.81601	48
13	.89671	.78833	.90060	.79542	.90440	.80242	.90812	.80932	.91176	.81613	47
14	.89678	.78845	.90066	.79554	.90446	.80253	.90818	.80943	.91182	.81624	46
15	9.89684	0.78857	9.90072	0.79565	9.90452	0.80265	9.90824	0.80955	9.91188	0.81635	45
16	.89691	.78869	.90079	.79577	.90459	.80276	.90830	.80966	.91194	.81647	44
17	.89697	.78881	.90085	.79589	.90465	.80288	.90836	.80978	.91200	.81658	43
18	.89704	.78893	.90092	.79601	.90471	.80299	.90843	.80989	.91206	.81669	42
19	.89710	.78905	.90098	.79612	.90478	.80311	.90849	.81000	.91212	.81680	41
20	9.89717	0.78917	9.90104	0.79624	9.90484	0.80323	9.90855	0.81012	9.91218	0.81692	40
21	.89723	.78928	.90111	.79636	.90490	.80334	.90861	.81023	.91224	.81703	39
22	.89730	.78940	.90117	.79648	.90496	.80346	.90867	.81035	.91230	.81714	38
23	.89736	.78952	.90124	.79659	.90503	.80357	.90873	.81046	.91236	.81725	37
24	.89743	.78964	.90130	.79671	.90509	.80369	.90879	.81057	.91242	.81737	36
25	9.89749	0.78976	9.90136	0.79683	9.90515	0.80380	9.90885	0.81069	9.91248	0.81748	35
26	.89756	.78988	.90143	.79694	.90521	.80392	.90892	.81080	.91254	.81759	34
27	.89763	.79000	.90149	.79706	.90527	.80403	.90898	.81092	.91260	.81770	33
28	.89769	.79011	.90156	.79718	.90534	.80415	.90904	.81103	.91265	.81781	32
29	.89776	.79023	.90162	.79729	.90540	.80427	.90910	.81114	.91271	.81793	31
30	9.89782	0.79035	9.90168	0.79741	9.90546	0.80438	9.90916	0.81126	9.91277	0.81804	30
31	.89789	.79047	.90175	.79753	.90552	.80450	.90922	.81137	.91283	.81815	29
32	.89795	.79059	.90181	.79765	.90559	.80461	.90928	.81148	.91289	.81826	28
33	.89802	.79071	.90187	.79776	.90565	.80473	.90934	.81160	.91295	.81838	27
34	.89808	.79082	.90194	.79788	.90571	.80484	.90940	.81171	.91301	.81849	26
35	9.89815	0.79094	9.90200	0.79800	9.90577	0.80496	9.90946	0.81183	9.91307	0.81860	25
36	.89821	.79106	.90206	.79811	.90584	.80507	.90952	.81194	.91313	.81871	24
37	.89828	.79118	.90213	.79823	.90590	.80519	.90958	.81205	.91319	.81882	23
38	.89834	.79130	.90219	.79835	.90596	.80530	.90965	.81217	.91325	.81894	22
39	.89840	.79142	.90225	.79846	.90602	.80542	.90971	.81228	.91331	.81905	21
40	9.89847	0.79153	9.90232	0.79858	9.90608	0.80553	9.90977	0.81239	9.91337	0.81916	20
41	.89853	.79165	.90238	.79870	.90615	.80565	.90983	.81251	.91343	.81927	19
42	.89860	.79177	.90244	.79881	.90621	.80576	.90989	.81262	.91349	.81938	18
43	.89866	.79189	.90251	.79893	.90627	.80588	.90995	.81273	.91355	.81950	17
44	.89873	.79201	.90257	.79905	.90633	.80599	.91001	.81285	.91361	.81961	16
45	9.89879	0.79212	9.90264	0.79916	9.90639	0.80611	9.91007	0.81296	9.91367	0.81972	15
46	.89886	.79224	.90270	.79928	.90646	.80622	.91013	.81308	.91372	.81983	14
47	.89892	.79236	.90276	.79940	.90652	.80634	.91019	.81319	.91378	.81994	13
48	.89899	.79248	.90282	.79951	.90658	.80645	.91025	.81330	.91384	.82005	12
49	.89905	.79260	.90289	.79963	.90664	.80657	.91031	.81342	.91390	.82017	11
50	9.89912	0.79271	9.90295	0.79974	9.90670	0.80668	9.91037	0.81353	9.91396	0.82028	10
51	.89918	.79283	.90301	.79986	.90676	.80680	.91043	.81364	.91402	.82039	9
52	.89925	.79295	.90308	.79998	.90683	.80691	.91049	.81376	.91408	.82050	8
53	.89931	.79307	.90314	.80009	.90689	.80703	.91055	.81387	.91414	.82061	7
54	.89938	.79319	.90320	.80021	.90695	.80714	.91061	.81398	.91420	.82072	6
55	9.89944	0.79330	9.90327	0.80033	9.90701	0.80726	9.91067	0.81409	9.91426	0.82084	5
56	.89950	.79342	.90333	.80044	.90707	.80737	.91074	.81421	.91432	.82095	4
57	.89957	.79354	.90339	.80056	.90714	.80749	.91080	.81432	.91437	.82106	3
58	.89963	.79366	.90346	.80068	.90720	.80760	.91086	.81443	.91443	.82117	2
59	.89970	.79377	.90352	.80079	.90726	.80772	.91092	.81455	.91449	.82128	1
60	9.89976	0.79389	9.90358	0.80091	9.90732	0.80783	9.91098	0.81466	9.91455	0.82139	0
	234°		233°		232°		231°		230°		

# Haversines

i	130°		131°		132°		133°		134°		i
	Log Hav	Nat. Hav	Log Hav	Nat. Hav	Log Hav	Nat. Hav	Log Hav	Nat. Hav	Log Hav	Nat. Hav	
0	9.91455	0.82139	9.91805	0.82803	9.92146	0.83457	9.92480	0.84100	9.92805	0.84733	60
1	.91461	.82151	.91810	.82814	.92152	.83467	.92485	.84111	.92811	.84743	59
2	.91467	.82162	.91816	.82825	.92157	.83478	.92491	.84121	.92816	.84754	58
3	.91473	.82173	.91822	.82836	.92163	.83489	.92496	.84132	.92821	.84764	57
4	.91479	.82184	.91828	.82847	.92169	.83500	.92502	.84142	.92827	.84775	56
5	9.91485	0.82195	9.91833	0.82858	9.92174	0.83511	9.92507	0.84153	9.92832	0.84785	55
6	.91490	.82206	.91839	.82869	.92180	.83521	.92512	.84164	.92837	.84796	54
7	.91496	.82217	.91845	.82880	.92185	.83532	.92518	.84174	.92843	.84806	53
8	.91502	.82228	.91851	.82891	.92191	.83543	.92523	.84185	.92848	.84817	52
9	.91508	.82240	.91856	.82902	.92197	.83554	.92529	.84196	.92853	.84827	51
10	9.91514	0.82251	9.91862	0.82913	9.92202	0.83564	9.92534	0.84206	9.92859	0.84837	50
11	.91520	.82262	.91868	.82924	.92208	.83575	.92540	.84217	.92864	.84848	49
12	.91526	.82273	.91874	.82934	.92213	.83586	.92545	.84227	.92869	.84858	48
13	.91532	.82284	.91879	.82945	.92219	.83597	.92551	.84238	.92875	.84869	47
14	.91537	.82295	.91885	.82956	.92225	.83608	.92556	.84249	.92880	.84879	46
15	9.91543	0.82306	9.91891	0.82967	9.92230	0.83618	9.92562	0.84259	9.92885	0.84890	45
16	.91549	.82317	.91896	.82978	.92236	.83629	.92567	.84270	.92891	.84900	44
17	.91555	.82328	.91902	.82989	.92241	.83640	.92573	.84280	.92896	.84910	43
18	.91561	.82339	.91908	.83000	.92247	.83651	.92578	.84291	.92901	.84921	42
19	.91567	.82351	.91914	.83011	.92253	.83661	.92584	.84302	.92907	.84931	41
20	9.91573	0.82362	9.91919	0.83022	9.92258	0.83672	9.92589	0.84312	9.92912	0.84942	40
21	.91578	.82373	.91925	.83033	.92264	.83683	.92594	.84323	.92917	.84952	39
22	.91584	.82384	.91931	.83044	.92269	.83694	.92600	.84333	.92923	.84962	38
23	.91590	.82395	.91936	.83055	.92275	.83704	.92605	.84344	.92928	.84973	37
24	.91596	.82406	.91942	.83066	.92280	.83715	.92611	.84354	.92933	.84983	36
25	9.91602	0.82417	9.91948	0.83077	9.92286	0.83726	9.92616	0.84365	9.92939	0.84994	35
26	.91608	.82428	.91954	.83087	.92292	.83737	.92622	.84376	.92944	.85004	34
27	.91613	.82439	.91959	.83098	.92297	.83747	.92627	.84386	.92949	.85014	33
28	.91619	.82450	.91965	.83109	.92303	.83758	.92633	.84397	.92955	.85025	32
29	.91625	.82461	.91971	.83120	.92308	.83769	.92638	.84407	.92960	.85035	31
30	9.91631	0.82472	9.91976	0.83131	9.92314	0.83780	9.92643	0.84418	9.92965	0.85045	30
31	.91637	.82483	.91982	.83142	.92319	.83790	.92649	.84428	.92970	.85056	29
32	.91643	.82495	.91988	.83153	.92325	.83801	.92654	.84439	.92975	.85066	28
33	.91648	.82506	.91993	.83164	.92330	.83812	.92660	.84449	.92981	.85077	27
34	.91654	.82517	.91999	.83175	.92336	.83822	.92665	.84460	.92986	.85087	26
35	9.91660	0.82528	9.92005	0.83185	9.92342	0.83833	9.92670	0.84470	9.92992	0.85097	25
36	.91666	.82539	.92010	.83196	.92347	.83844	.92676	.84481	.92997	.85108	24
37	.91672	.82550	.92016	.83207	.92353	.83855	.92681	.84492	.93002	.85118	23
38	.91677	.82561	.92022	.83218	.92358	.83865	.92687	.84502	.93007	.85128	22
39	.91683	.82572	.92027	.83229	.92364	.83876	.92692	.84513	.93013	.85139	21
40	9.91689	0.82583	9.92033	0.83240	9.92369	0.83887	9.92698	0.84523	9.93018	0.85149	20
41	.91695	.82594	.92039	.83251	.92375	.83897	.92703	.84534	.93023	.85159	19
42	.91701	.82605	.92044	.83262	.92380	.83908	.92708	.84544	.93029	.85170	18
43	.91706	.82616	.92050	.83272	.92386	.83919	.92714	.84555	.93034	.85180	17
44	.91712	.82627	.92056	.83283	.92391	.83929	.92719	.84565	.93039	.85190	16
45	9.91718	0.82638	9.92061	0.83294	9.92397	0.83940	9.92725	0.84576	9.93044	0.85201	15
46	.91724	.82649	.92067	.83305	.92402	.83951	.92730	.84586	.93050	.85211	14
47	.91730	.82660	.92073	.83316	.92408	.83961	.92735	.84597	.93055	.85221	13
48	.91735	.82671	.92078	.83327	.92413	.83972	.92741	.84607	.93060	.85232	12
49	.91741	.82682	.92084	.83337	.92419	.83983	.92746	.84618	.93065	.85242	11
50	9.91747	0.82693	9.92090	0.83348	9.92425	0.83993	9.92751	0.84628	9.93071	0.85252	10
51	.91753	.82704	.92095	.83359	.92430	.84004	.92757	.84639	.93076	.85263	9
52	.91758	.82715	.92101	.83370	.92436	.84015	.92762	.84649	.93081	.85273	8
53	.91764	.82726	.92107	.83381	.92441	.84025	.92768	.84660	.93086	.85283	7
54	.91770	.82737	.92112	.83392	.92447	.84036	.92773	.84670	.93092	.85294	6
55	9.91776	0.82748	9.92118	0.83402	9.92452	0.84047	9.92778	0.84681	9.93097	0.85304	5
56	.91782	.82759	.92124	.83413	.92458	.84057	.92784	.84691	.93102	.85314	4
57	.91787	.82770	.92129	.83424	.92463	.84068	.92789	.84702	.93107	.85324	3
58	.91793	.82781	.92135	.83435	.92469	.84079	.92794	.84712	.93113	.85335	2
59	.91799	.82792	.92140	.83446	.92474	.84089	.92800	.84722	.93118	.85345	1
60	9.91805	0.82803	9.92146	0.83457	9.92480	0.84100	9.92805	0.84733	9.93123	0.85355	0
	229°		228°		227°		226°		225°		

## Haversines

i	135°		136°		137°		138°		139°		i
	Log Hav	Nat. Hav	Log Hav	Nat. Hav	Log Hav	Nat. Hav	Log Hav	Nat. Hav	Log Hav	Nat. Hav	
0	9.93123	0.85355	9.93433	0.85967	9.93736	0.86568	9.94030	0.87157	9.94318	0.87735	60
1	.93128	.85366	.93438	.85977	.93741	.86578	.94035	.87167	.94322	.87745	59
2	.93134	.85376	.93443	.85987	.93746	.86588	.94040	.87177	.94327	.87755	58
3	.93139	.85386	.93448	.85997	.93751	.86597	.94045	.87186	0.94332	.87764	57
4	.93144	.85396	.93454	.86007	.93755	.86607	.94050	.87196	.94336	.87774	56
5	9.93149	0.85407	9.93459	0.86017	9.93760	0.86617	9.94055	0.87206	9.94341	0.87783	55
6	.93154	.85417	.93464	.86028	.93765	.86627	.94059	.87216	.94346	.87793	54
7	.93160	.85427	.93469	.86038	.93770	.86637	.94064	.87225	.94351	.87802	53
8	.93165	.85438	.93474	.86048	.93775	.86647	.94069	.87235	.94355	.87812	52
9	.93170	.85448	.93479	.86058	.93780	.86657	.94074	.87245	.94360	.87821	51
10	9.93175	0.85458	9.93484	0.86068	9.93785	0.86667	9.94079	0.87254	9.94365	0.87831	50
11	.93181	.85468	.93489	.86078	.93790	.86677	.94084	.87264	.94369	.87840	49
12	.93186	.85479	.93494	.86088	.93795	.86686	.94088	.87274	.94374	.87850	48
13	.93191	.85489	.93499	.86098	.93800	.86696	.94093	.87283	.94379	.87859	47
14	.93196	.85499	.93504	.86108	.93805	.86706	.94098	.87293	.94383	.87869	46
15	9.93201	0.85509	9.93509	0.86118	9.93810	0.86716	9.94103	0.87303	9.94388	0.87878	45
16	.93207	.85520	.93515	.86128	.93815	.86726	.94108	.87313	.94393	.87888	44
17	.93212	.85530	.93520	.86138	.93820	.86736	.94112	.87322	.94398	.87897	43
18	.93217	.85540	.93525	.86148	.93825	.86746	.94117	.87332	.94402	.87907	42
19	.93222	.85550	.93530	.86158	.93830	.86756	.94122	.87342	.94407	.87916	41
20	9.93227	0.85560	9.93535	0.86168	9.93835	0.86765	9.94127	0.87351	9.94412	0.87926	40
21	.93232	.85571	.93540	.86178	.93840	.86775	.94132	.87361	.94416	.87935	39
22	.93238	.85581	.93545	.86189	.93845	.86785	.94137	.87371	.94421	.87945	38
23	.93243	.85591	.93550	.86199	.93849	.86795	.94141	.87380	.94426	.87954	37
24	.93248	.85601	.93555	.86209	.93854	.86805	.94146	.87390	.94430	.87964	36
25	9.93253	0.85612	9.93560	0.86219	9.93859	0.86815	9.94151	0.87400	9.94435	0.87973	35
26	.93258	.85622	.93565	.86229	.93864	.86825	.94156	.87409	.94440	.87982	34
27	.93264	.85632	.93570	.86239	.93869	.86834	.94161	.87419	.94444	.87992	33
28	.93269	.85642	.93575	.86249	.93874	.86844	.94165	.87429	.94449	.88001	32
29	.93274	.85652	.93580	.86259	.93879	.86854	.94170	.87438	.94454	.88011	31
30	9.93279	0.85663	9.93585	0.86269	9.93884	0.86864	9.94175	0.87448	9.94458	0.88020	30
31	.93284	.85673	.93590	.86279	.93889	.86874	.94180	.87457	.94463	.88030	29
32	.93289	.85683	.93595	.86289	.93894	.86884	.94184	.87467	.94468	.88039	28
33	.93295	.85693	.93600	.86299	.93899	.86893	.94189	.87477	.94472	.88049	27
34	.93300	.85703	.93605	.86309	.93904	.86903	.94194	.87486	.94477	.88058	26
35	9.93305	0.85713	9.93611	0.86319	9.93908	0.86913	9.94199	0.87496	9.94482	0.88067	25
36	.93310	.85724	.93616	.86329	.93913	.86923	.94204	.87506	.94486	.88077	24
37	.93315	.85734	.93621	.86339	.93918	.86933	.94208	.87515	.94491	.88086	23
38	.93320	.85744	.93626	.86349	.93923	.86942	.94213	.87525	.94496	.88096	22
39	.93326	.85754	.93631	.86359	.93928	.86952	.94218	.87534	.94500	.88105	21
40	9.93331	0.85764	9.93636	0.86369	9.93933	0.86962	9.94223	0.87544	9.94505	0.88115	20
41	.93336	.85774	.93641	.86379	.93938	.86972	.94227	.87554	.94509	.88124	19
42	.93341	.85785	.93646	.86389	.93943	.86982	.94232	.87563	.94514	.88133	18
43	.93346	.85795	.93651	.86399	.93948	.86991	.94237	.87573	.94519	.88143	17
44	.93351	.85805	.93656	.86409	.93952	.87001	.94242	.87582	.94523	.88152	16
45	9.93356	0.85815	9.93661	0.86419	9.93957	0.87011	9.94246	0.87592	9.94528	0.88162	15
46	.93362	.85825	.93666	.86429	.93962	.87021	.94251	.87602	.94533	.88171	14
47	.93367	.85835	.93671	.86438	.93967	.87030	.94256	.87611	.94537	.88180	13
48	.93372	.85846	.93676	.86448	.93972	.87040	.94261	.87621	.94542	.88190	12
49	.93377	.85856	.93681	.86458	.93977	.87050	.94265	.87630	.94546	.88199	11
50	9.93382	0.85866	9.93686	0.86468	9.93982	0.87060	9.94270	0.87640	9.94551	0.88209	10
51	.93387	.85876	.93691	.86478	.93987	.87070	.94275	.87649	.94556	.88218	9
52	.93392	.85886	.93696	.86488	.93991	.87079	.94280	.87659	.94560	.88227	8
53	.93397	.85896	.93701	.86498	.93996	.87089	.94284	.87669	.94565	.88237	7
54	.93403	.85906	.93706	.86508	.94001	.87099	.94289	.87678	.94570	.88246	6
55	9.93408	0.85916	9.93711	0.86518	9.94006	0.87109	9.94294	0.87688	9.94574	0.88255	5
56	.93413	.85927	.93716	.86528	.94011	.87118	.94299	.87697	.94579	.88265	4
57	.93418	.85937	.93721	.86538	.94016	.87128	.94303	.87707	.94583	.88274	3
58	.93423	.85947	.93726	.86548	.94021	.87138	.94308	.87716	.94588	.88284	2
59	.93428	.85957	.93731	.86558	.94026	.87148	.94313	.87726	.94593	.88293	1
60	9.93433	0.85967	9.93736	0.86568	9.94030	0.87157	9.94318	0.87735	9.94597	0.88302	0
	224°		223°		222°		221°		220°		



# Haversines

	140°		141°		142°		143°		144°		
	Log Hav	Nat. Hav	Log Hav	Nat. Hav	Log Hav	Nat. Hav	Log Hav	Nat. Hav	Log Hav	Nat. Hav	
0	9.94597	0.88302	9.94869	0.88857	9.95134	0.89401	9.95391	0.89932	9.95641	0.90451	60
1	.94602	.88312	.94874	.88866	.95138	.89409	.95396	.89941	.95645	.90459	59
2	.94606	.88321	.94878	.88876	.95143	.89418	.95400	.89949	.95649	.90468	58
3	.94611	.88330	.94883	.88885	.95147	.89427	.95404	.89958	.95654	.90476	57
4	.94616	.88340	.94887	.88894	.95151	.89436	.95408	.89967	.95658	.90485	56
5	9.94620	0.88349	9.94892	0.88903	9.95156	0.89445	9.95412	0.89975	9.95662	0.90494	55
6	.94625	.88358	.94896	.88912	.95160	.89454	.95417	.89984	.95666	.90502	54
7	.94629	.88368	.94901	.88921	.95164	.89463	.95421	.89993	.95670	.90511	53
8	.94634	.88377	.94905	.88930	.95169	.89472	.95425	.90002	.95674	.90519	52
9	.94638	.88386	.94909	.88940	.95173	.89481	.95429	.90010	.95678	.90528	51
10	9.94643	0.88396	9.94914	0.88949	9.95177	0.89490	9.95433	0.90019	9.95682	0.90536	50
11	.94648	.88405	.94918	.88958	.95182	.89499	.95438	.90028	.95686	.90545	49
12	.94652	.88414	.94923	.88967	.95186	.89508	.95442	.90037	.95690	.90553	48
13	.94557	.88423	.94927	.88976	.95190	.89517	.95446	.90045	.95694	.90562	47
14	.94661	.88433	.94932	.88985	.95195	.89526	.95450	.90054	.95699	.90570	46
15	9.94666	0.88442	9.94936	0.88994	9.95199	0.89534	9.95454	0.90063	9.95703	0.90579	45
16	.94670	.88451	.94941	.89003	.95203	.89543	.95459	.90071	.95707	.90587	44
17	.94675	.88461	.94945	.89012	.95208	.89552	.95463	.90080	.95711	.90596	43
18	.94680	.88470	.94950	.89022	.95212	.89561	.95467	.90089	.95715	.90604	42
19	.94684	.88479	.94954	.89031	.95216	.89570	.95471	.90097	.95719	.90613	41
20	9.94689	0.88489	9.94958	0.89040	9.95221	0.89579	9.95475	0.90106	9.95723	0.90621	40
21	.94693	.88498	.94963	.89049	.95225	.89588	.95480	.90115	.95727	.90630	39
22	.94698	.88507	.94967	.89058	.95229	.89597	.95484	.90124	.95731	.90638	38
23	.94702	.88516	.94972	.89067	.95234	.89606	.95488	.90132	.95735	.90647	37
24	.94707	.88526	.94976	.89076	.95238	.89614	.95492	.90141	.95739	.90655	36
25	9.94711	0.88535	9.94981	0.89085	9.95242	0.89623	9.95496	0.90150	9.95743	0.90664	35
26	.94716	.88544	.94985	.89094	.95246	.89632	.95501	.90158	.95747	.90672	34
27	.94721	.88553	.94989	.89103	.95251	.89641	.95505	.90167	.95751	.90680	33
28	.94725	.88563	.94994	.89112	.95255	.89650	.95509	.90176	.95755	.90689	32
29	.94730	.88572	.94998	.89121	.95259	.89659	.95513	.90184	.95759	.90697	31
30	9.94734	0.88581	9.95003	0.89130	9.95264	0.89668	9.95517	0.90193	9.95763	0.90706	30
31	.94739	.88590	.95007	.89139	.95268	.89677	.95521	.90201	.95768	.90714	29
32	.94743	.88600	.95011	.89149	.95272	.89685	.95526	.90210	.95772	.90723	28
33	.94748	.88609	.95016	.89158	.95276	.89694	.95530	.90219	.95776	.90731	27
34	.94752	.88618	.95020	.89167	.95281	.89703	.95534	.90227	.95780	.90740	26
35	9.94757	0.88627	9.95025	0.89176	9.95285	0.89712	9.95538	0.90236	9.95784	0.90748	25
36	.94761	.88637	.95029	.89185	.95289	.89721	.95542	.90245	.95788	.90756	24
37	.94766	.88646	.95033	.89194	.95294	.89730	.95546	.90253	.95792	.90765	23
38	.94770	.88655	.95038	.89203	.95298	.89738	.95550	.90262	.95796	.90773	22
39	.94774	.88664	.95042	.89212	.95302	.89747	.95555	.90271	.95800	.90782	21
40	9.94779	0.88674	9.95047	0.89221	9.95306	0.89756	9.95559	0.90279	9.95804	0.90790	20
41	.94784	.88683	.95051	.89230	.95311	.89765	.95563	.90288	.95808	.90798	19
42	.94788	.88692	.95055	.89239	.95315	.89774	.95567	.90296	.95812	.90807	18
43	.94793	.88701	.95060	.89248	.95319	.89782	.95571	.90305	.95816	.90815	17
44	.94797	.88710	.95064	.89257	.95323	.89791	.95575	.90314	.95820	.90824	16
45	9.94802	0.88720	9.95069	0.89266	9.95328	0.89800	9.95579	0.90322	9.95824	0.90832	15
46	.94806	.88729	.95073	.89275	.95332	.89809	.95584	.90331	.95828	.90840	14
47	.94811	.88738	.95077	.89284	.95336	.89818	.95588	.90339	.95832	.90849	13
48	.94815	.88747	.95082	.89293	.95340	.89826	.95592	.90348	.95836	.90857	12
49	.94820	.88756	.95086	.89302	.95345	.89835	.95596	.90357	.95840	.90866	11
50	9.94824	0.88766	9.95090	0.89311	9.95349	0.89844	9.95600	0.90365	9.95844	0.90874	10
51	.94829	.88775	.95095	.89320	.95353	.89853	.95604	.90374	.95848	.90882	9
52	.94833	.88784	.95099	.89329	.95357	.89862	.95608	.90382	.95852	.90891	8
53	.94838	.88793	.95104	.89338	.95362	.89870	.95613	.90391	.95856	.90899	7
54	.94842	.88802	.95108	.89347	.95366	.89879	.95617	.90399	.95860	.90907	6
55	9.94847	0.88811	9.95112	0.89356	9.95370	0.89888	9.95621	0.90408	9.95864	0.90916	5
56	.94851	.88821	.95117	.89365	.95374	.89897	.95625	.90417	.95868	.90924	4
57	.94856	.88830	.95121	.89374	.95379	.89906	.95629	.90425	.95872	.90933	3
58	.94860	.88839	.95125	.89383	.95383	.89914	.95633	.90434	.95876	.90941	2
59	.94865	.88848	.95130	.89392	.95387	.89923	.95637	.90442	.95880	.90949	1
60	9.94869	0.88857	9.95134	0.89401	9.95391	0.89932	9.95641	0.90451	9.95884	0.90958	0
	219°		218°		217°		216°		215°		

## Haversines

i	145°		146°		147°		148°		149°		i
	Log Hav	Nat. Hav	Log Hav	Nat. Hav	Log Hav	Nat. Hav	Log Hav	Nat. Hav	Log Hav	Nat. Hav	
0	9.95884	0.90958	9.96119	0.91452	9.96347	0.91934	9.96568	0.92402	9.96782	0.92858	60
1	.95888	.90966	.96123	.91460	.96351	.91941	.96572	.92410	.96786	.92866	59
2	.95892	.90974	.96127	.91468	.96355	.91949	.96576	.92418	.96189	.92873	58
3	.95896	.90983	.96131	.91476	.96359	.91957	.96579	.92426	.96793	.92881	57
4	.95900	.90991	.96135	.91484	.96362	.91965	.96583	.92433	.96796	.92888	56
5	9.95904	0.90999	9.96139	0.91493	9.96366	0.91973	9.96586	0.92441	9.96800	0.92896	55
6	.95908	.91008	.96142	.91501	.96370	.91981	.96590	.92449	.96803	.92903	54
7	.95912	.91016	.96146	.91509	.96374	.91989	.96594	.92456	.96807	.92911	53
8	.95916	.91024	.96150	.91517	.96377	.91997	.96597	.92464	.96810	.92918	52
9	.95920	.91033	.96154	.91525	.96381	.92005	.96601	.92472	.96814	.92926	51
10	9.95924	0.91041	9.96158	0.91533	9.96385	0.92013	9.96604	0.92479	9.96817	0.92933	50
11	.95928	.91049	.96162	.91541	.96388	.92020	.96608	.92487	.96821	.92941	49
12	.95932	.91057	.96165	.91549	.96392	.92028	.96612	.92495	.96824	.92948	48
13	.95936	.91066	.96169	.91557	.96396	.92036	.96615	.92502	.96827	.92955	47
14	.95939	.91074	.96173	.91565	.96400	.92044	.96619	.92510	.96831	.92963	46
15	9.95943	0.91082	9.96177	0.91573	9.96403	0.92052	9.96622	0.92518	9.96834	0.92970	45
16	.95947	.91091	.96181	.91582	.96407	.92060	.96626	.92525	.96837	.92978	44
17	.95951	.91099	.96185	.91590	.96411	.92068	.96630	.92533	.96841	.92985	43
18	.95955	.91107	.96188	.91598	.96414	.92076	.96633	.92541	.96845	.92993	42
19	.95959	.91115	.96192	.91606	.96418	.92083	.96637	.92548	.96848	.93000	41
20	9.95963	0.91124	9.96196	0.91614	9.96422	0.92091	9.96640	0.92556	9.96852	0.93007	40
21	.95967	.91132	.96200	.91622	.96426	.92099	.96644	.92563	.96855	.93015	39
22	.95971	.91140	.96204	.91630	.96429	.92107	.96648	.92571	.96859	.93022	38
23	.95975	.91149	.96208	.91638	.96433	.92115	.96651	.92579	.96862	.93030	37
24	.95979	.91157	.96211	.91646	.96437	.92123	.96655	.92586	.96866	.93037	36
25	9.95983	0.91165	9.96215	0.91654	9.96440	0.92130	9.96658	0.92594	9.96869	0.93045	35
26	.95987	.91173	.96219	.91662	.96444	.92138	.96662	.92602	.96873	.93052	34
27	.95991	.91182	.96223	.91670	.96448	.92146	.96665	.92609	.96876	.93059	33
28	.95995	.91190	.96227	.91678	.96451	.92154	.96669	.92617	.96879	.93067	32
29	.95999	.91198	.96230	.91686	.96455	.92162	.96673	.92624	.96883	.93074	31
30	9.96002	0.91206	9.96234	0.91694	9.96459	0.92170	9.96676	0.92632	9.96886	0.93081	30
31	.96006	.91215	.96238	.91702	.96462	.92177	.96680	.92640	.96890	.93089	29
32	.96010	.91223	.96242	.91710	.96466	.92185	.96683	.92647	.96894	.93096	28
33	.96014	.91231	.96246	.91718	.96470	.92193	.96687	.92655	.96897	.93104	27
34	.96018	.91239	.96249	.91726	.96473	.92201	.96690	.92662	.96900	.93111	26
35	9.96022	0.91247	9.96253	0.91734	9.96477	0.92209	9.96694	0.92670	9.96904	0.93118	25
36	.96026	.91256	.96257	.91742	.96481	.92216	.96697	.92678	.96907	.93126	24
37	.96030	.91264	.96261	.91750	.96484	.92224	.96701	.92685	.96910	.93133	23
38	.96034	.91272	.96265	.91758	.96488	.92232	.96705	.92693	.96914	.93140	22
39	.96038	.91280	.96268	.91766	.96492	.92240	.96708	.92700	.96917	.93148	21
40	9.96042	0.91289	9.96272	0.91774	9.96495	0.92248	9.96712	0.92708	9.96921	0.93155	20
41	.96046	.91297	.96276	.91782	.96499	.92255	.96715	.92715	.96924	.93162	19
42	.96049	.91305	.96280	.91790	.96503	.92263	.96719	.92723	.96928	.93170	18
43	.96053	.91313	.96283	.91798	.96506	.92271	.96722	.92730	.96931	.93177	17
44	.96057	.91321	.96287	.91806	.96510	.92279	.96726	.92738	.96934	.93184	16
45	9.96061	0.91329	9.96291	0.91814	9.96514	0.92286	9.96729	0.92746	9.96938	0.93192	15
46	.96065	.91338	.96295	.91822	.96517	.92294	.96733	.92753	.96941	.93199	14
47	.96069	.91346	.96299	.91830	.96521	.92302	.96736	.92761	.96945	.93206	13
48	.96073	.91354	.96302	.91838	.96525	.92310	.96740	.92768	.96948	.93214	12
49	.96077	.91362	.96306	.91846	.96528	.92317	.96743	.92776	.96951	.93221	11
50	9.96081	0.91370	9.96310	0.91854	9.96532	0.92325	9.96747	0.92783	9.96955	0.93228	10
51	.96084	.91379	.96314	.91862	.96536	.92333	.96750	.92791	.96958	.93236	9
52	.96088	.91387	.96317	.91870	.96539	.92341	.96754	.92798	.96962	.93243	8
53	.96092	.91395	.96321	.91878	.96543	.92348	.96758	.92806	.96965	.93250	7
54	.96096	.91403	.96325	.91886	.96547	.92356	.96761	.92813	.96968	.93258	6
55	9.96100	0.91411	9.96329	0.91894	9.96550	0.92364	9.96765	0.92821	9.96972	0.93265	5
56	.96104	.91419	.96332	.91902	.96554	.92372	.96768	.92828	.96975	.93272	4
57	.96108	.91427	.96336	.91910	.96557	.92379	.96772	.92836	.96979	.93279	3
58	.96112	.91436	.96340	.91918	.96561	.92387	.96775	.92843	.96982	.93287	2
59	.96115	.91444	.96344	.91926	.96565	.92395	.96779	.92851	.96985	.93294	1
60	9.96119	0.91452	9.96347	0.91934	9.96568	0.92402	9.96782	0.92858	9.96989	0.93301	0
	214°		213°		212°		211°		210°		

## Haversines

	150°		151°		152°		153°		154°		
	Log Hav	Nat. Hav	Log Hav	Nat. Hav	Log Hav	Nat. Hav	Log Hav	Nat. Hav	Log Hav	Nat. Hav	
0	9.96989	0.93301	9.97188	0.93731	9.97381	0.94147	9.97566	0.94550	9.97745	0.94940	60
1	.96992	.93309	.97192	.93738	.97384	.94154	.97569	.94557	.97748	.94946	59
2	.96996	.93316	.97195	.93745	.97387	.94161	.97572	.94564	.97751	.94952	58
3	.96999	.93323	.97198	.93752	.97390	.94168	.97575	.94570	.97754	.94959	57
4	.97002	.93330	.97201	.93759	.97393	.94175	.97578	.94577	.97756	.94965	56
5	9.97006	0.93338	9.97205	0.93766	9.97397	0.94181	9.97581	0.94583	9.97759	0.94972	55
6	.97009	.93345	.97208	.93773	.97400	.94188	.97584	.94590	.97762	.94978	54
7	.97012	.93352	.97211	.93780	.97403	.94195	.97587	.94596	.97765	.94984	53
8	.97016	.93359	.97214	.93787	.97406	.94202	.97591	.94603	.97768	.94991	52
9	.97019	.93367	.97218	.93794	.97409	.94209	.97594	.94610	.97771	.94997	51
10	9.97022	0.93374	9.97221	0.93801	9.97412	0.94215	9.97597	0.94616	9.97774	0.95003	50
11	.97026	.93381	.97224	.93808	.97415	.94222	.97600	.94623	.97777	.95010	49
12	.97029	.93388	.97227	.93815	.97418	.94229	.97603	.94629	.97780	.95016	48
13	.97033	.93395	.97231	.93822	.97422	.94236	.97606	.94636	.97783	.95022	47
14	.97036	.93403	.97234	.93829	.97425	.94243	.97609	.94642	.97785	.95029	46
15	9.97039	0.93410	9.97237	0.93836	9.97428	0.94249	9.97612	0.94649	9.97788	0.95035	45
16	.97043	.93417	.97240	.93843	.97431	.94256	.97615	.94655	.97791	.95041	44
17	.97046	.93424	.97244	.93850	.97434	.94263	.97618	.94662	.97794	.95048	43
18	.97049	.93432	.97247	.93857	.97437	.94270	.97621	.94669	.97797	.95054	42
19	.97052	.93439	.97250	.93864	.97440	.94276	.97624	.94675	.97800	.95060	41
20	9.97056	0.93446	9.97253	0.93871	9.97443	0.94283	9.97627	0.94682	9.97803	0.95066	40
21	.97059	.93453	.97257	.93878	.97447	.94290	.97630	.94688	.97806	.95073	39
22	.97063	.93460	.97260	.93885	.97450	.94297	.97633	.94695	.97808	.95079	38
23	.97066	.93468	.97263	.93892	.97453	.94303	.97636	.94701	.97811	.95085	37
24	.97069	.93475	.97266	.93899	.97456	.94310	.97639	.94708	.97814	.95092	36
25	9.97073	0.93482	9.97269	0.93906	9.97459	0.94317	9.97642	0.94714	9.97817	0.95098	35
26	.97076	.93489	.97273	.93913	.97462	.94324	.97645	.94721	.97820	.95104	34
27	.97079	.93496	.97276	.93920	.97465	.94330	.97647	.94727	.97823	.95110	33
28	.97083	.93503	.97279	.93927	.97468	.94337	.97650	.94734	.97826	.95117	32
29	.97086	.93511	.97282	.93934	.97471	.94344	.97653	.94740	.97829	.95123	31
30	9.97089	0.93518	9.97285	0.93941	9.97474	0.94351	9.97656	0.94747	9.97831	0.95129	30
31	.97093	.93525	.97289	.93948	.97478	.94357	.97659	.94753	.97834	.95136	29
32	.97096	.93532	.97292	.93955	.97481	.94364	.97662	.94760	.97837	.95142	28
33	.97099	.93539	.97295	.93962	.97484	.94371	.97665	.94766	.97840	.95148	27
34	.97103	.93546	.97298	.93969	.97487	.94377	.97668	.94773	.97843	.95154	26
35	9.97106	0.93554	9.97301	0.93976	9.97490	0.94384	9.97671	0.94779	9.97846	0.95161	25
36	.97109	.93561	.97305	.93982	.97493	.94391	.97674	.94786	.97849	.95167	24
37	.97113	.93568	.97308	.93989	.97496	.94397	.97677	.94792	.97851	.95173	23
38	.97116	.93575	.97311	.93996	.97499	.94404	.97680	.94799	.97854	.95179	22
39	.97119	.93582	.97314	.94003	.97502	.94411	.97683	.94805	.97857	.95185	21
40	9.97123	0.93589	9.97317	0.94010	9.97505	0.94418	9.97686	0.94811	9.97860	0.95192	20
41	.97126	.93596	.97321	.94017	.97508	.94424	.97689	.94818	.97863	.95198	19
42	.97129	.93603	.97324	.94024	.97511	.94431	.97692	.94824	.97866	.95204	18
43	.97132	.93611	.97327	.94031	.97514	.94438	.97695	.94831	.97868	.95210	17
44	.97136	.93618	.97330	.94038	.97518	.94444	.97698	.94837	.97871	.95217	16
45	9.97139	0.93625	9.97333	0.94045	9.97521	0.94451	9.97701	0.94844	9.97874	0.95223	15
46	.97142	.93632	.97337	.94051	.97524	.94458	.97704	.94850	.97877	.95229	14
47	.97146	.93639	.97340	.94058	.97527	.94464	.97707	.94856	.97880	.95235	13
48	.97149	.93646	.97343	.94065	.97530	.94471	.97710	.94863	.97883	.95241	12
49	.97152	.93653	.97346	.94072	.97533	.94477	.97713	.94869	.97885	.95248	11
50	9.97156	0.93660	9.97349	0.94079	9.97536	0.94484	9.97716	0.94876	9.97888	0.95254	10
51	.97159	.93667	.97352	.94086	.97539	.94491	.97718	.94882	.97891	.95260	9
52	.97162	.93674	.97356	.94093	.97542	.94497	.97721	.94889	.97894	.95266	8
53	.97165	.93682	.97359	.94099	.97545	.94504	.97724	.94895	.97897	.95272	7
54	.97169	.93689	.97362	.94106	.97548	.94511	.97727	.94901	.91899	.95278	6
55	9.97172	0.93696	9.97365	0.94113	9.97551	0.94517	9.97730	0.94908	9.97902	0.95285	5
56	.97175	.93703	.97368	.94120	.97554	.94524	.97733	.94914	.97905	.95291	4
57	.97179	.93710	.97371	.94127	.97557	.94531	.97736	.94921	.97908	.95297	3
58	.97182	.93717	.97375	.94134	.97560	.94537	.97739	.94927	.97911	.95303	2
59	.97185	.93724	.97378	.94141	.97563	.94544	.97742	.94933	.97914	.95309	1
60	9.97188	0.93731	9.97381	0.94147	9.97566	0.94550	9.97745	0.94940	9.97916	0.95315	0
	209°		208°		207°		206°		205°		

## Haversines

i	155°		156°		157°		158°		159°		i
	Log Hav	Nat. Hav	Log Hav	Nat. Hav	Log Hav	Nat. Hav	Log Hav	Nat. Hav	Log Hav	Nat. Hav	
0	9.97916	0.95315	9.98081	0.95677	9.98239	0.96025	9.98389	0.96359	9.98533	0.96679	60
1	.97919	.95322	.98084	.95683	.98241	.96031	.98392	.96365	.98536	.96684	59
2	.97922	.95328	.98086	.95689	.98244	.96037	.98394	.96370	.98538	.96689	58
3	.97925	.95334	.98089	.95695	.98246	.96042	.98397	.96376	.98540	.96695	57
4	.97927	.95340	.98092	.95701	.98249	.96048	.98399	.96381	.98543	.96700	56
5	9.97930	0.95346	9.98094	0.95707	9.98251	0.96054	9.98402	0.96386	9.98545	0.96705	55
6	.97933	.95352	.98097	.95713	.98254	.96059	.98404	.96392	.98547	.96710	54
7	.97936	.95358	.98100	.95719	.98256	.96065	.98406	.96397	.98550	.96715	53
8	.97939	.95364	.98102	.95724	.98259	.96071	.98409	.96403	.98552	.96721	52
9	.97941	.95371	.98105	.95730	.98262	.96076	.98411	.96408	.98554	.96726	51
10	9.97944	0.95377	9.98108	0.95736	9.98264	0.96082	9.98414	0.96413	9.98557	0.96731	50
11	.97947	.95383	.98110	.95742	.98267	.96088	.98416	.96419	.98559	.96736	49
12	.97950	.95389	.98113	.95748	.98269	.96093	.98419	.96424	.98561	.96741	48
13	.97953	.95395	.98116	.95754	.98272	.96099	.98421	.96430	.98564	.96746	47
14	.97955	.95401	.98118	.95760	.98274	.96104	.98424	.96435	.98566	.96752	46
15	9.97958	0.95407	9.98121	0.95766	9.98277	0.96110	9.98426	0.96440	9.98568	0.96757	45
16	.97961	.95413	.98124	.95771	.98279	.96116	.98428	.96446	.98570	.96762	44
17	.97964	.95419	.98126	.95777	.98282	.96121	.98431	.96451	.98573	.96767	43
18	.97966	.95425	.98129	.95783	.98285	.96127	.98433	.96457	.98575	.96772	42
19	.97969	.95431	.98132	.95789	.98287	.96133	.98436	.96462	.98577	.96777	41
20	9.97972	0.95438	9.98134	0.95795	9.98290	0.96138	9.98438	0.96467	9.98580	0.96782	40
21	.97975	.95444	.98137	.95801	.98292	.96144	.98440	.96473	.98582	.96788	39
22	.97977	.95450	.98139	.95806	.98295	.96149	.98443	.96478	.98584	.96793	38
23	.97980	.95456	.98142	.95812	.98297	.96155	.98445	.96483	.98587	.96798	37
24	.97983	.95462	.98145	.95818	.98300	.96161	.98448	.96489	.98589	.96803	36
25	9.97986	0.95468	9.98147	0.95824	9.98302	0.96166	9.98450	0.96494	9.98591	0.96808	35
26	.97988	.95474	.98150	.95830	.98305	.96172	.98453	.96500	.98593	.96813	34
27	.97991	.95480	.98153	.95836	.98307	.96177	.98455	.96505	.98596	.96818	33
28	.97994	.95486	.98155	.95841	.98310	.96183	.98457	.96510	.98598	.96823	32
29	.97997	.95492	.98158	.95847	.98312	.96188	.98460	.96516	.98600	.96829	31
30	9.97999	0.95498	9.98161	0.95853	9.98315	0.96194	9.98462	0.96521	9.98603	0.96834	30
31	.98002	.95504	.98163	.95859	.98317	.96200	.98465	.96526	.98605	.96839	29
32	.98005	.95510	.98166	.95865	.98320	.96205	.98467	.96532	.98607	.96844	28
33	.98008	.95516	.98168	.95870	.98322	.96211	.98469	.96537	.98609	.96849	27
34	.98010	.95522	.98171	.95876	.98325	.96216	.98472	.96542	.98612	.96854	26
35	9.98013	0.95528	9.98174	0.95882	9.98327	0.96222	9.98474	0.96547	9.98614	0.96859	25
36	.98016	.95534	.98176	.95888	.98330	.96227	.98476	.96553	.98616	.96864	24
37	.98019	.95540	.98179	.95894	.98332	.96233	.98479	.96558	.98619	.96869	23
38	.98021	.95546	.98182	.95899	.98335	.96238	.98481	.96563	.98621	.96874	22
39	.98024	.95552	.98184	.95905	.98337	.96244	.98484	.96569	.98623	.96879	21
40	9.98027	0.95558	9.98187	0.95911	9.98340	0.96249	9.98486	0.96574	9.98625	0.96884	20
41	.98030	.95564	.98189	.95917	.98342	.96255	.98488	.96579	.98628	.96889	19
42	.98032	.95570	.98192	.95922	.98345	.96260	.98491	.96585	.98630	.96894	18
43	.98035	.95576	.98195	.95928	.98347	.96266	.98493	.96590	.98632	.96899	17
44	.98038	.95582	.98197	.95934	.98350	.96272	.98496	.96595	.98634	.96905	16
45	9.98040	0.95588	9.98200	0.95940	9.98352	0.96277	9.98498	.96600	9.98637	0.96910	15
46	.98043	.95594	.98202	.95945	.98355	.96283	.98500	.96606	.98639	.96915	14
47	.98046	.95600	.98205	.95951	.98357	.96288	.98503	.96611	.98641	.96920	13
48	.98049	.95606	.98208	.95957	.98360	.96294	.98505	.96616	.98643	.96925	12
49	.98051	.95612	.98210	.95962	.98362	.96299	.98507	.96621	.98646	.96930	11
50	9.98054	0.95618	9.98213	0.95968	9.98365	0.96305	9.98510	0.96627	9.98648	0.96935	10
51	.98057	.95624	.98215	.95974	.98367	.96310	.98512	.96632	.98650	.96940	9
52	.98059	.95630	.98218	.95980	.98370	.96315	.98514	.96637	.98652	.96945	8
53	.98062	.95636	.98221	.95985	.98372	.96321	.98517	.96642	.98655	.96950	7
54	.98065	.95642	.98223	.95991	.98375	.96326	.98519	.96648	.98657	.96955	6
55	9.98067	0.95648	9.98226	0.95997	9.98377	0.96332	9.98521	0.96653	9.98659	0.96960	5
56	.98070	.95654	.98228	.96002	.98379	.96337	.98524	.96658	.98661	.96965	4
57	.98073	.95660	.98231	.96008	.98382	.96343	.98526	.96663	.98664	.96970	3
58	.98076	.95665	.98233	.96014	.98384	.96348	.98529	.96669	.98666	.96975	2
59	.98078	.95671	.98236	.96020	.98387	.96354	.98531	.96674	.98668	.96980	1
60	9.98081	0.95677	9.98239	0.96025	9.98389	0.96359	9.98533	0.96679	9.98670	0.96985	0
	204°		203°		202°		201°		200°		

## Haversines

i	160°		161°		162°		163°		164°		i
	Log Hav	Nat. Hav	Log Hav	Nat. Hav	Log Hav	Nat. Hav	Log Hav	Nat. Hav	Log Hav	Nat. Hav	
0	9.98670	0.96985	9.98801	0.97276	9.98924	0.97553	9.99041	0.97815	9.99151	0.98063	60
1	.98673	.96990	.98803	.97281	.98926	.97557	.99043	.97819	.99152	.98067	59
2	.98675	.96995	.98805	.97285	.98928	.97562	.99044	.97824	.99154	.98071	58
3	.98677	.97000	.98807	.97290	.98930	.97566	.99046	.97828	.99156	.98075	57
4	.98679	.97004	.98809	.97295	.98932	.97571	.99048	.97832	.99158	.98079	56
5	9.98681	0.97009	9.98811	0.97300	9.98934	0.97575	9.99050	0.97836	9.99159	0.98083	55
6	.98684	.97014	.98813	.97304	.98936	.97580	.99052	.97841	.99161	.98087	54
7	.98686	.97019	.98815	.97309	.98938	.97584	.99054	.97845	.99163	.98091	53
8	.98688	.97024	.98817	.97314	.98940	.97589	.99056	.97849	.99165	.98095	52
9	.98690	.97029	.98819	.97318	.98942	.97593	.99058	.97853	.99166	.98099	51
10	9.98692	0.97034	9.98822	0.97323	9.98944	0.97598	9.99059	0.97858	9.99168	0.98103	50
11	.98695	.97039	.98824	.97328	.98946	.97602	.99061	.97862	.99170	.98107	49
12	.98697	.97044	.98826	.97332	.98948	.97606	.99063	.97866	.99172	.98111	48
13	.98699	.97049	.98828	.97337	.98950	.97611	.99065	.97870	.99173	.98115	47
14	.98701	.97054	.98830	.97342	.98952	.97615	.99067	.97874	.99175	.98119	46
15	9.98703	0.97059	9.98832	0.97347	9.98954	0.97620	9.99069	0.97879	9.99177	0.98123	45
16	.98706	.97064	.98834	.97351	.98956	.97624	.99071	.97883	.99179	.98127	44
17	.98708	.97069	.98836	.97356	.98958	.97629	.99072	.97887	.99180	.98131	43
18	.98710	.97074	.98838	.97361	.98960	.97633	.99074	.97891	.99182	.98135	42
19	.98712	.97078	.98840	.97365	.98962	.97637	.99076	.97895	.99184	.98139	41
20	9.98714	0.97083	9.98842	0.97370	9.9894	0.97642	9.99078	0.97899	9.99186	0.98142	40
21	.98717	.97088	.98845	.97374	.9896	.97646	.99080	.97904	.99187	.98146	39
22	.98719	.97093	.98847	.97379	.98968	.97651	.99082	.97908	.99189	.98150	38
23	.98721	.97098	.98849	.97384	.98970	.97655	.99084	.97912	.99191	.98154	37
24	.98723	.97103	.98851	.97388	.98971	.97660	.99085	.97916	.99193	.98158	36
25	9.98725	0.97108	9.98853	0.97393	9.98973	0.97664	9.99087	0.97920	9.99194	0.98162	35
26	.98728	.97113	.98855	.97398	.98975	.97668	.99089	.97924	.99196	.98166	34
27	.98730	.97117	.98857	.97402	.98977	.97673	.99091	.97929	.99198	.98170	33
28	.98732	.97122	.98859	.97407	.98979	.97677	.99093	.97933	.99200	.98174	32
29	.96734	.97127	.98861	.97412	.98981	.97681	.99095	.97937	.99201	.98178	31
30	9.98736	0.97132	9.98863	0.97416	9.98983	0.97686	9.99096	0.97941	9.99203	0.98182	30
31	.98738	.97137	.98865	.97421	.98985	.97690	.99098	.97945	.99205	.98185	29
32	.98741	.97142	.98867	.97425	.98987	.97695	.99100	.97949	.99206	.98189	28
33	.98743	.97147	.98869	.97430	.98989	.97699	.99102	.97953	.99208	.98193	27
34	.98745	.97151	.98871	.97435	.98991	.97703	.99104	.97957	.99210	.98197	26
35	9.98747	0.97156	9.98873	0.97439	9.98993	0.97708	9.99106	0.97962	9.99212	0.98201	25
36	.98749	.97161	.98875	.97444	.98995	.97712	.99107	.97966	.99213	.98205	24
37	.98751	.97166	.98877	.97448	.98997	.97716	.99109	.97970	.99215	.98209	23
38	.98754	.97171	.98880	.97453	.98999	.97721	.99111	.97974	.99217	.98212	22
39	.98756	.97176	.98882	.97458	.99001	.97725	.99113	.97978	.99218	.98216	21
40	9.98758	0.97180	9.98884	0.97462	9.99003	0.97729	9.99115	0.97982	9.99220	0.98220	20
41	.98760	.97185	.98886	.97467	.99004	.97734	.99116	.97986	.99222	.98224	19
42	.98762	.97190	.98888	.97471	.99006	.97738	.99118	.97990	.99223	.98228	18
43	.98764	.97195	.98890	.97476	.99008	.97742	.99120	.97994	.99225	.98232	17
44	.98766	.97200	.98892	.97480	.99010	.97747	.99122	.97998	.99227	.98236	16
45	9.98769	0.97204	9.98894	0.97485	9.99012	0.97751	9.99124	0.98002	9.99229	0.98239	15
46	.98771	.97209	.98896	.97490	.99014	.97755	.99126	.98007	.99230	.98243	14
47	.98773	.97214	.98898	.97494	.99016	.97760	.99127	.98011	.99232	.98247	13
48	.98775	.97219	.98900	.97499	.99018	.97764	.99129	.98015	.99234	.98251	12
49	.98777	.97224	.98902	.97503	.99020	.97768	.99131	.98019	.99235	.98255	11
50	9.98779	0.97228	9.98904	0.97508	9.99022	0.97773	9.99133	0.98023	9.99237	0.98258	10
51	.98781	.97233	.98906	.97512	.99024	.97777	.99135	.98027	.99239	.98262	9
52	.98784	.97238	.98908	.97517	.99026	.97781	.99136	.98031	.99240	.98266	8
53	.98786	.97243	.98910	.97521	.99027	.97785	.99138	.98035	.99242	.98270	7
54	.98788	.97247	.98912	.97526	.99029	.97790	.99140	.98039	.99244	.98274	6
55	9.98790	0.97252	9.98914	0.97530	9.99031	0.97794	9.99142	0.98043	9.99245	0.98277	5
56	.98792	.97257	.98916	.97535	.99033	.97798	.99143	.98047	.99247	.98281	4
57	.98794	.97262	.98918	.97539	.99035	.97802	.99145	.98051	.99249	.98285	3
58	.98796	.97266	.98920	.97544	.99037	.97807	.99147	.98055	.99250	.98289	2
59	.98798	.97271	.98922	.97548	.99039	.97811	.99149	.98059	.99252	.98293	1
60	9.98801	0.97276	9.98924	0.97553	9.99041	0.97815	9.99151	0.98063	9.99254	0.98296	0
	199°		198°		197°		196°		195°		

# Haversines

Haversines											
i	165°		166°		167°		168°		169°		i
	Log Hav	Nat. Hav	Log Hav	Nat. Hav	Log Hav	Nat. Hav	Log Hav	Nat. Hav	Log Hav	Nat. Hav	
0	9.99254	0.98296	9.99350	0.98515	9.99440	0.98719	9.99523	0.98907	9.99599	0.99081	60
1	.99255	.98300	.99352	.98518	.99441	.98722	.99524	.98910	.99600	.99084	59
2	.99257	.98304	.99353	.98522	.99443	.98725	.99526	.98913	.99602	.99087	58
3	.99259	.98308	.99355	.98525	.99444	.98728	.99527	.98916	.99603	.99090	57
4	.99260	.98311	.99356	.98529	.99446	.98732	.99528	.98919	.99604	.99092	56
5	9.99262	0.98315	9.99358	0.98532	9.99447	0.98735	9.99529	0.98922	9.99605	0.99095	55
6	.99264	.98319	.99359	.98536	.99448	.98738	.99531	.98925	.99606	.99098	54
7	.99265	.98323	.99361	.98539	.99450	.98741	.99532	.98928	.99608	.99101	53
8	.99267	.98326	.99362	.98543	.99451	.98745	.99533	.98931	.99609	.99103	52
9	.99269	.98330	.99364	.98546	.99453	.98748	.99535	.98934	.99610	.99106	51
10	9.99270	0.98334	9.99366	0.98550	9.99454	0.98751	9.99536	0.98937	9.99611	0.99109	50
11	.99272	.98337	.99367	.98553	.99456	.98754	.99537	.98940	.99612	.99112	49
12	.99274	.98341	.99369	.98557	.99457	.98757	.99539	.98943	.99614	.99114	48
13	.99275	.98345	.99370	.98560	.99458	.98761	.99540	.98946	.99615	.99117	47
14	.99277	.98349	.99372	.98564	.99460	.98764	.99541	.98949	.99616	.99120	46
15	9.99278	0.98352	9.99373	0.98567	9.99461	0.98767	9.99543	0.98952	9.99617	0.99123	45
16	.99280	.98356	.99375	.98571	.99463	.98770	.99544	.98955	.99618	.99125	44
17	.99282	.98360	.99376	.98574	.99464	.98774	.99545	.98958	.99620	.99128	43
18	.99283	.98363	.99378	.98577	.99465	.98777	.99546	.98961	.99621	.99131	42
19	.99285	.98367	.99379	.98581	.99467	.98780	.99548	.98964	.99622	.99133	41
20	9.99287	0.98371	9.99381	0.98584	9.99468	0.98783	9.99549	0.98967	9.99623	0.99136	40
21	.99288	.98374	.99382	.98588	.99470	.98786	.99550	.98970	.99624	.99139	39
22	.99290	.98378	.99384	.98591	.99471	.98789	.99552	.98973	.99626	.99141	38
23	.99291	.98382	.99385	.98595	.99472	.98793	.99553	.98976	.99627	.99144	37
24	.99293	.98385	.99387	.98598	.99474	.98796	.99554	.98979	.99628	.99147	36
25	9.99295	0.98389	9.99388	0.98601	9.99475	0.98799	9.99555	0.98982	9.99629	0.99149	35
26	.99296	.98393	.99390	.98605	.99477	.98802	.99557	.98985	.99630	.99152	34
27	.99298	.98396	.99391	.98608	.99478	.98805	.99558	.98988	.99631	.99155	33
28	.99300	.98400	.99393	.98612	.99479	.98808	.99559	.98990	.99633	.99157	32
29	.99301	.98404	.99394	.98615	.99481	.98812	.99561	.98993	.99634	.99160	31
30	9.99303	0.98407	9.99396	0.98618	9.99482	0.98815	9.99562	0.98996	9.99635	0.99163	30
31	.99304	.98411	.99397	.98622	.99484	.98818	.99563	.98999	.99636	.99165	29
32	.99306	.98415	.99399	.98625	.99485	.98821	.99564	.99002	.99637	.99168	28
33	.99308	.98418	.99400	.98629	.99486	.98824	.99566	.99005	.99638	.99171	27
34	.99309	.98422	.99402	.98632	.99488	.98827	.99567	.99008	.99639	.99173	26
35	9.99311	0.98426	9.99403	0.98635	9.99489	0.98830	9.99568	0.99011	9.99641	0.99176	25
36	.99312	.98429	.99405	.98639	.99490	.98834	.99569	.99014	.99642	.99179	24
37	.99314	.98433	.99406	.98642	.99492	.98837	.99571	.99016	.99643	.99181	23
38	.99316	.98436	.99408	.98646	.99493	.98840	.99572	.99019	.99644	.99184	22
39	.99317	.98440	.99409	.98649	.99495	.98843	.99573	.99022	.99645	.99186	21
40	9.99319	0.98444	9.99411	0.98652	9.99496	0.98846	9.99575	0.99025	9.99646	0.99189	20
41	.99320	.98447	.99412	.98656	.99497	.98849	.99576	.99028	.99648	.99192	19
42	.99322	.98451	.99414	.98659	.99499	.98852	.99577	.99031	.99649	.99194	18
43	.99324	.98454	.99415	.98662	.99500	.98855	.99578	.99034	.99650	.99197	17
44	.99325	.98458	.99417	.98666	.99501	.98858	.99580	.99036	.99651	.99199	16
45	9.99327	0.98462	9.99418	0.98669	9.99503	0.98862	9.99581	0.99039	9.99652	0.99202	15
46	.99328	.98465	.99420	.98672	.99504	.98865	.99582	.99042	.99653	.99205	14
47	.99330	.98469	.99421	.98676	.99505	.98868	.99583	.99045	.99654	.99207	13
48	.99331	.98472	.99422	.98679	.99507	.98871	.99584	.99048	.99655	.99210	12
49	.99333	.98476	.99424	.98682	.99508	.98874	.99586	.99051	.99657	.99212	11
50	9.99335	0.98479	9.99425	0.98686	9.99510	0.98877	9.99587	0.99053	9.99658	0.99215	10
51	.99336	.98483	.99427	.98689	.99511	.98880	.99588	.99056	.99659	.99217	9
52	.99338	.98487	.99429	.98692	.99512	.98883	.99589	.99059	.99660	.99220	8
53	.99339	.98490	.99430	.98695	.99514	.98886	.99591	.99062	.99661	.99223	7
54	.99341	.98494	.99431	.98699	.99515	.98889	.99592	.99065	.99662	.99225	6
55	9.99342	0.98497	9.99433	0.98702	9.99516	0.98892	9.99593	0.99067	9.99663	0.99228	5
56	.99344	.98501	.99434	.98705	.99518	.98895	.99594	.99070	.99664	.99230	4
57	.99345	.98504	.99436	.98709	.99519	.98898	.99596	.99073	.99666	.99233	3
58	.99347	.98508	.99437	.98712	.99520	.98901	.99597	.99076	.99667	.99235	2
59	.99349	.98511	.99438	.98715	.99522	.98904	.99598	.99079	.99668	.99238	1
60	9.99350	0.98515	9.99440	0.98719	9.99523	0.98907	9.99599	0.99081	9.99669	0.99240	0
	194°		193°		192°		191°		190°		

# Haversines

Haversines											
i	170°		171°		172°		173°		174°		i
	Log Hav	Nat. Hav	Log Hav	Nat. Hav	Log Hav	Nat. Hav	Log Hav	Nat. Hav	Log Hav	Nat. Hav	
0	9.99669	0.99240	9.99732	0.99384	9.99788	0.99513	9.99838	0.99627	9.99881	0.99726	60
1	.99670	.99243	.99733	.99387	.99789	.99515	.99839	.99629	.99882	.99728	59
2	.99671	.99245	.99734	.99389	.99790	.99517	.99839	.99631	.99882	.99729	58
3	.99672	.99248	.99735	.99391	.99791	.99519	.99840	.99633	.99883	.99731	57
4	.99673	.99250	.99736	.99393	.99792	.99521	.99841	.99634	.99884	.99732	56
5	9.99674	0.99253	9.99737	0.99396	9.99793	0.99523	9.99842	0.99636	9.99884	0.99734	55
6	.99675	.99255	.99738	.99398	.99793	.99525	.99842	.99638	.99885	.99735	54
7	.99677	.99258	.99739	.99400	.99794	.99527	.99843	.99640	.99885	.99737	53
8	.99678	.99260	.99740	.99402	.99795	.99529	.99844	.99641	.99886	.99738	52
9	.99679	.99263	.99741	.99405	.99796	.99531	.99845	.99643	.99887	.99740	51
10	9.99680	0.99265	9.99742	0.99407	9.99797	0.99533	9.99845	0.99645	9.99887	0.99741	50
11	.99681	.99268	.99743	.99409	.99798	.99535	.99846	.99647	.99888	.99743	49
12	.99682	.99270	.99744	.99411	.99799	.99537	.99847	.99648	.99889	.99744	48
13	.99683	.99273	.99745	.99414	.99800	.99539	.99848	.99650	.99889	.99746	47
14	.99684	.99275	.99746	.99416	.99800	.99541	.99848	.99652	.99890	.99747	46
15	9.99685	0.99278	9.99747	0.99418	9.99801	0.99543	9.99849	0.99653	9.99891	0.99748	45
16	.99686	.99280	.99748	.99420	.99802	.99545	.99850	.99655	.99891	.99750	44
17	.99687	.99283	.99748	.99422	.99803	.99547	.99851	.99657	.99892	.99751	43
18	.99688	.99285	.99749	.99425	.99804	.99549	.99851	.99659	.99893	.99753	42
19	.99690	.99288	.99750	.99427	.99805	.99551	.99852	.99660	.99893	.99754	41
20	9.99691	0.99290	9.99751	0.99429	9.99805	0.99553	9.99853	0.99662	9.99894	0.99756	40
21	.99692	.99293	.99752	.99431	.99806	.99555	.99854	.99664	.99894	.99757	39
22	.99693	.99295	.99753	.99433	.99807	.99557	.99854	.99665	.99895	.99759	38
23	.99694	.99297	.99754	.99436	.99808	.99559	.99855	.99667	.99896	.99760	37
24	.99695	.99300	.99755	.99438	.99809	.99561	.99856	.99669	.99896	.99761	36
25	9.99696	0.99302	9.99756	0.99440	9.99810	0.99563	9.99857	0.99670	9.99897	0.99763	35
26	.99697	.99305	.99757	.99442	.99811	.99565	.99857	.99672	.99897	.99764	34
27	.99698	.99307	.99758	.99444	.99811	.99567	.99858	.99674	.99898	.99766	33
28	.99699	.99309	.99759	.99446	.99812	.99568	.99859	.99675	.99899	.99767	32
29	.99700	.99312	.99760	.99449	.99813	.99570	.99859	.99677	.99899	.99768	31
30	9.99701	0.99314	9.99761	0.99451	9.99814	0.99572	9.99860	0.99679	9.99900	0.99770	30
31	.99702	.99317	.99762	.99453	.99815	.99574	.99861	.99680	.99901	.99771	29
32	.99703	.99319	.99763	.99455	.99815	.99576	.99862	.99682	.99901	.99773	28
33	.99704	.99321	.99764	.99457	.99816	.99578	.99862	.99684	.99902	.99774	27
34	.99705	.99324	.99765	.99459	.99817	.99580	.99863	.99685	.99902	.99775	26
35	9.99706	0.99326	9.99766	0.99461	9.99818	0.99582	9.99864	0.99687	9.99903	0.99777	25
36	.99707	.99329	.99766	.99464	.99819	.99584	.99864	.99688	.99904	.99778	24
37	.99708	.99331	.99767	.99466	.99820	.99585	.99865	.99690	.99904	.99779	23
38	.99710	.99333	.99768	.99468	.99820	.99587	.99866	.99692	.99905	.99781	22
39	.99711	.99336	.99769	.99470	.99821	.99589	.99867	.99693	.99905	.99782	21
40	9.99712	0.99338	9.99770	0.99472	9.99822	0.99591	9.99867	0.99695	9.99906	0.99784	20
41	.99713	.99340	.99771	.99474	.99823	.99593	.99868	.99696	.99906	.99785	19
42	.99714	.99343	.99772	.99476	.99824	.99595	.99869	.99698	.99907	.99786	18
43	.99715	.99345	.99773	.99478	.99824	.99597	.99869	.99700	.99908	.99788	17
44	.99716	.99347	.99774	.99480	.99825	.99598	.99870	.99701	.99908	.99789	16
45	9.99717	0.99350	9.99774	0.99483	9.99826	0.99600	9.99871	0.99703	9.99909	0.99790	15
46	.99718	.99352	.99775	.99485	.99827	.99602	.99871	.99704	.99909	.99792	14
47	.99719	.99354	.99776	.99487	.99828	.99604	.99872	.99706	.99910	.99793	13
48	.99720	.99357	.99777	.99489	.99828	.99606	.99873	.99708	.99911	.99794	12
49	.99721	.99359	.99778	.99491	.99829	.99608	.99874	.99709	.99911	.99796	11
50	9.99722	0.99361	9.99779	0.99493	9.99830	0.99609	9.99874	0.99711	9.99912	0.99797	10
51	.99723	.99364	.99780	.99495	.99831	.99611	.99875	.99712	.99912	.99798	9
52	.99724	.99366	.99781	.99497	.99832	.99613	.99876	.99714	.99913	.99799	8
53	.99725	.99368	.99782	.99499	.99832	.99615	.99876	.99715	.99913	.99801	7
54	.99726	.99371	.99783	.99501	.99833	.99617	.99877	.99717	.99914	.99802	6
55	9.99727	0.99373	9.99784	0.99503	9.99834	0.99618	9.99878	0.99718	9.99915	0.99803	5
56	.99728	.99375	.99785	.99505	.99835	.99620	.99878	.99720	.99915	.99805	4
57	.99729	.99378	.99786	.99507	.99836	.99622	.99879	.99722	.99916	.99806	3
58	.99730	.99380	.99786	.99509	.99836	.99624	.99880	.99723	.99916	.99807	2
59	.99731	.99382	.99787	.99511	.99837	.99626	.99880	.99725	.99917	.99808	1
60	9.99732	0.99384	9.99788	0.99513	9.99838	0.99627	9.99881	0.99726	9.99917	0.99810	0
	189°		188°		187°		186°		185°		

## Haversines

i	175°		176°		177°		178°		179°		i
	Log Hav	Nat. Hav	Log Hav	Nat. Hav	Log Hav	Nat. Hav	Log Hav	Nat. Hav	Log Hav	Nat. Hav	
0	9.99917	0.99810	9.99947	0.99878	9.99970	0.99931	9.99987	0.99970	9.99997	0.99992	60
1	.99918	.99811	.99948	.99879	.99971	.99932	.99987	.99970	.99997	.99993	59
2	.99918	.99812	.99948	.99880	.99971	.99933	.99987	.99971	.99997	.99993	58
3	.99919	.99814	.99948	.99881	.99971	.99934	.99987	.99971	.99997	.99993	57
4	.99919	.99815	.99949	.99882	.99972	.99934	.99988	.99972	.99997	.99993	56
5	9.99920	0.99816	9.99949	0.99883	9.99972	0.99935	9.99988	0.99972	9.99997	0.99994	55
6	.99921	.99817	.99950	.99884	.99972	.99936	.99988	.99973	.99997	.99994	54
7	.99921	.99819	.99950	.99885	.99973	.99937	.99988	.99973	.99997	.99994	53
8	.99922	.99820	.99951	.99886	.99973	.99937	.99988	.99973	.99998	.99994	52
9	.99922	.99821	.99951	.99887	.99973	.99938	.99989	.99974	.99998	.99994	51
10	9.99923	0.99822	9.99951	0.99888	9.99973	0.99939	9.99989	0.99974	9.99998	0.99995	50
11	.99923	.99823	.99952	.99889	.99974	.99940	.99989	.99975	.99998	.99995	49
12	.99924	.99825	.99952	.99890	.99974	.99940	.99989	.99975	.99998	.99995	48
13	.99924	.99826	.99953	.99891	.99974	.99941	.99989	.99976	.99998	.99995	47
14	.99925	.99827	.99953	.99892	.99975	.99942	.99990	.99976	.99998	.99996	46
15	9.99925	0.99828	9.99953	0.99893	9.99975	0.99942	9.99990	0.99977	9.99998	0.99996	45
16	.99926	.99829	.99954	.99894	.99975	.99943	.99990	.99977	.99998	.99996	44
17	.99926	.99831	.99954	.99895	.99976	.99944	.99990	.99978	.99998	.99996	43
18	.99927	.99832	.99954	.99896	.99976	.99944	.99990	.99978	.99998	.99996	42
19	.99927	.99833	.99955	.99897	.99976	.99945	.99991	.99978	.99998	.99996	41
20	9.99928	0.99834	9.99955	0.99898	9.99976	0.99946	9.99991	0.99979	9.99999	0.99997	40
21	.99928	.99835	.99956	.99899	.99977	.99947	.99991	.99979	.99999	.99997	39
22	.99929	.99837	.99956	.99900	.99977	.99947	.99991	.99980	.99999	.99997	38
23	.99929	.99838	.99957	.99900	.99977	.99948	.99991	.99980	.99999	.99997	37
24	.99930	.99839	.99957	.99901	.99978	.99949	.99992	.99981	.99999	.99997	36
25	9.99931	0.99840	9.99958	0.99902	9.99978	0.99949	9.99992	0.99981	9.99999	0.99997	35
26	.99931	.99841	.99958	.99903	.99978	.99950	.99992	.99981	.99999	.99998	34
27	.99932	.99842	.99958	.99904	.99978	.99950	.99992	.99982	.99999	.99998	33
28	.99932	.99844	.99959	.99905	.99979	.99951	.99992	.99982	.99999	.99998	32
29	.99933	.99845	.99959	.99906	.99979	.99952	.99992	.99982	.99999	.99998	31
30	9.99933	0.99846	9.99959	0.99907	9.99979	0.99952	9.99993	0.99983	9.99999	0.99998	30
31	.99934	.99847	.99960	.99908	.99980	.99953	.99993	.99983	.99999	.99998	29
32	.99934	.99848	.99960	.99909	.99980	.99954	.99993	.99984	.99999	.99998	28
33	.99935	.99849	.99961	.99909	.99980	.99954	.99993	.99984	.99999	.99998	27
34	.99935	.99850	.99961	.99910	.99980	.99955	.99993	.99984	.99999	.99999	26
35	9.99935	0.99852	9.99961	0.99911	9.99981	0.99956	9.99993	0.99985	9.99999	0.99999	25
36	.99936	.99853	.99962	.99912	.99981	.99956	.99994	.99985	.99999	.99999	24
37	.99936	.99854	.99962	.99913	.99981	.99957	.99994	.99985	0.00000	.99999	23
38	.99937	.99855	.99963	.99914	.99981	.99957	.99994	.99986	.00000	.99999	22
39	.99937	.99856	.99963	.99915	.99982	.99958	.99994	.99986	.00000	.99999	21
40	9.99938	0.99857	9.99963	0.99915	9.99982	0.99959	9.99994	0.99987	0.00000	0.99999	20
41	.99938	.99858	.99964	.99916	.99982	.99959	.99994	.99987	.00000	.99999	19
42	.99939	.99859	.99964	.99917	.99983	.99960	.99994	.99987	.00000	.99999	18
43	.99939	.99860	.99964	.99918	.99983	.99960	.99995	.99987	.00000	.99999	17
44	.99940	.99861	.99965	.99919	.99983	.99961	.99995	.99988	.00000	.99999	16
45	9.99940	0.99863	9.99965	0.99920	9.99983	0.99961	9.99995	0.99988	0.00000	1.00000	15
46	.99941	.99864	.99965	.99920	.99983	.99962	.99995	.99988	.00000	.00000	14
47	.99941	.99865	.99966	.99921	.99984	.99963	.99995	.99989	.00000	.00000	13
48	.99942	.99866	.99966	.99922	.99984	.99963	.99995	.99989	.00000	.00000	12
49	.99942	.99867	.99966	.99923	.99984	.99964	.99995	.99989	.00000	.00000	11
50	9.99943	0.99868	9.99967	0.99924	9.99984	0.99964	9.99996	0.99990	0.00000	1.00000	10
51	.99943	.99869	.99967	.99924	.99985	.99965	.99996	.99990	.00000	.00000	9
52	.99943	.99870	.99968	.99925	.99985	.99965	.99996	.99990	.00000	.00000	8
53	.99944	.99871	.99968	.99926	.99985	.99966	.99996	.99991	.00000	.00000	7
54	.99944	.99872	.99968	.99927	.99985	.99966	.99996	.99991	.00000	.00000	6
55	9.99945	0.99873	9.99969	0.99928	9.99986	0.99967	9.99996	0.99991	0.00000	1.00000	5
56	.99945	.99874	.99969	.99928	.99986	.99967	.99996	.99991	.00000	.00000	4
57	.99946	.99875	.99969	.99929	.99986	.99968	.99996	.99992	.00000	.00000	3
58	.99946	.99876	.99970	.99930	.99986	.99969	.99996	.99992	.00000	.00000	2
59	.99947	.99877	.99970	.99931	.99987	.99969	.99997	.99992	.00000	.00000	1
60	9.99947	0.99878	9.99970	0.99931	9.99987	0.99970	9.99997	0.99992	0.00000	1.00000	0
	184°		183°		182°		181°		180°		



# APPENDIX C

## CONVERSION OF COMPASS POINTS TO DEGREES

Conversion of Compass Points to Degrees					
	Points	Angular measure		Points	Angular measure
NORTH TO EAST		° ' "	SOUTH TO WEST		° ' "
North	0	0 00 00	South	16	180 00 00
N1/4E	1/4	2 48 45	S1/4W	16 1/4	182 48 45
N1/2E	1/2	5 37 30	S1/2W	16 1/2	185 37 30
N3/4E	3/4	8 26 15	S3/4W	16 3/4	188 26 15
N by E	1	11 15 00	S by W	17	191 15 00
N by E1/4E	1 1/4	14 03 45	S by W1/4W	17 1/4	194 03 45
N by E1/2E	1 1/2	16 52 30	S by W1/2W	17 1/2	196 52 30
N by E3/4E	1 3/4	19 41 15	S by W3/4W	17 3/4	199 41 15
NNE	2	22 30 00	SSW	18	202 30 00
NNE1/4E	2 1/4	25 18 45	SSW1/4W	18 1/4	205 18 45
NNE1/2E	2 1/2	28 07 30	SSW1/2W	18 1/2	208 07 30
NNE3/4E	2 3/4	30 56 15	SSW3/4W	18 3/4	210 56 15
NE by N	3	33 45 00	SW by S	19	213 45 00
NE3/4N	3 1/4	36 33 45	SW3/4S	19 1/4	216 33 45
NE1/2N	3 1/2	39 22 30	SW1/2S	19 1/2	219 22 30
NE1/4N	3 3/4	42 11 15	SW1/4S	19 3/4	222 11 15
NE	4	45 00 00	SW	20	225 00 00
NE1/4E	4 1/4	47 48 45	SW1/4W	20 1/4	227 48 45
NE1/2E	4 1/2	50 37 30	SW1/2W	20 1/2	230 37 30
NE3/4E	4 3/4	53 26 15	SW3/4W	20 3/4	233 26 15
NE by E	5	56 15 00	SW by W	21	236 15 00
NE by E1/4E	5 1/4	59 03 45	SW by W1/4W	21 1/4	239 03 45
NE by E1/2E	5 1/2	61 52 30	SW by W1/2W	21 1/2	241 52 30
NE by E3/4E	5 3/4	64 41 15	SW by W3/4W	21 3/4	244 41 15
ENE	6	67 30 00	WSW	22	247 30 00
ENE1/4E	6 1/4	70 18 45	WSW1/4W	22 1/4	250 18 45
ENE1/2E	6 1/2	73 07 30	WSW1/2W	22 1/2	235 07 30
ENE3/4E	6 3/4	75 56 15	WSW3/4W	22 3/4	255 56 15

Conversion of Compass Points to Degrees					
E by N	7	78 45 00	W by S	23	258 45 00
E3/4N	7 1/4	81 33 45	W3/4S	23 1/4	261 33 45
E1/2N	7 1/2	84 22 30	W1/2S	23 1/2	264 22 30
E1/4N	7 3/4	87 11 15	W1/4S	23 3/4	267 11 15
EAST TO SOUTH			WEST TO NORTH		
East	8	00 00 00	West	24	270 00 00
E1/4S	8 1/4	92 48 45	W1/4N	24 1/4	272 48 45
E1/2S	8 1/2	95 37 30	W1/2N	24 1/2	275 37 30
E3/4S	8 3/4	98 26 15	W3/4N	24 3/4	278 26 15
E by S	9	101 15 00	W by N	25	281 15 00
ESE3/4E	9 1/4	104 03 45	WNW3/4W	25 1/4	284 03 45
ESE1/2E	9 1/2	106 52 30	WNW1/2W	25 1/2	286 52 30
ESE1/4E	9 3/4	109 41 15	WNW1/4W	25 3/4	289 41 15
ESE	10	112 30 00	WNW	26	292 30 00
SE by E3/4E	10 1/4	115 18 45	NW by W3/4W	26 1/4	295 18 45
SE by E1/2E	10 1/2	118 07 30	NW by W1/2W	26 1/2	298 07 30
SE by E1/4E	10 3/4	120 56 15	NW by W1/4W	26 3/4	300 56 15
SE by E	11	123 45 00	NW by W	27	303 45 00
SE3/4E	11 1/4	126 33 45	NW3/4W	27 1/4	306 33 45
SE1/2E	11 1/2	129 22 30	NW1/2W	27 1/2	309 22 30
SE1/4E	11 3/4	132 11 15	NW1/4W	27 3/4	312 11 15
SE	12	135 00 00	NW	28	315 00 00
SE1/4S	12 1/4	137 48 45	NW1/4N	28 1/4	317 48 45
SE1/2S	12 1/2	140 37 30	NW1/2N	28 1/2	320 37 30
SE3/4S	12 3/4	143 26 15	NW3/4N	28 3/4	323 26 15
SE by S	13	146 15 00	NW by N	29	326 15 00
SSE3/4E	13 1/4	149 03 45	NNW3/4W	29 1/4	329 03 45
SSE1/2E	13 1/2	151 52 30	NNW1/2W	29 1/2	331 52 30
SSE1/4E	13 3/4	154 41 15	NNW1/4W	29 3/4	334 41 15
SSE	14	157 30 00	NNW	30	337 30 00
S by E3/4E	14 1/4	160 18 45	N by W3/4W	30 1/4	340 18 45
S by E1/2E	14 1/2	163 07 30	N by W1/2W	30 1/2	343 07 30
S by E1/4E	14 3/4	165 56 15	N by W1/4W	30 3/4	345 56 15
S by E	15	168 45 00	N by W	31	348 45 00
S3/4E	15 1/4	171 33 45	N3/4W	31 1/4	351 33 45
S1/2E	15 1/2	174 22 30	N1/2W	31 1/2	354 22 30

Conversion of Compass Points to Degrees					
S1/4E	15 3/4	177 11 15	N1/4W	31 3/4	357 11 15
South	16	180 00 00	North	32	360 00 00