

UNIVERSITY OF COLOMBO – SRI LANKA

FACULTY OF ARTS

FIRST YEAR EXAMINATION IN ARTS – 2018 SECOND SEMESTER FINAL EXAMINATION

GYG 1202 – CARTOGRAPHY

03 Hours

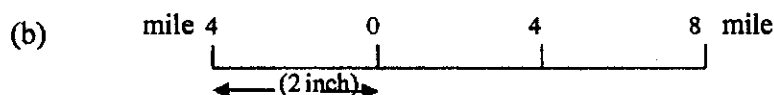
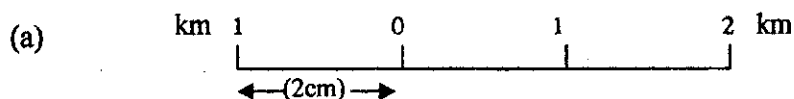
Answer **THREE (03)** questions, selecting **question no.1** and any other **two** questions.

Tracing papers, Graph papers and drawing papers will be provided.

Necessary mathematical Tables are attached to the question paper.

1.

(I) Convert linear scales as proportional scales. (04 marks)



(II) Convert the following scales as representative fractions. (06 marks)

(a) 6 centimeters to 750 meters

(b) 1 inch to 4 furlongs

(c) 1 decimeter to 10 hectometers

(III) Enlarge the following scales by 4 times (06 marks)

a. 1:10,000

b. 1:40,000

c. 1:253440

(IV) A map drawn at scale of 1:40,000 is enlarged by 4 times. After enlargement the length and width of the map are 20cm respectively.

a. Find out the length and width of the map before enlargement.

b. What is the scale of the new map?

(08 marks)

(V) a. Two points A and B marked on a map. State the formula that can be used to calculate of the slope between points A and B.

(02 marks)

b. Using the information given below calculate the gradient of slope in degrees and minutes between P and Q.

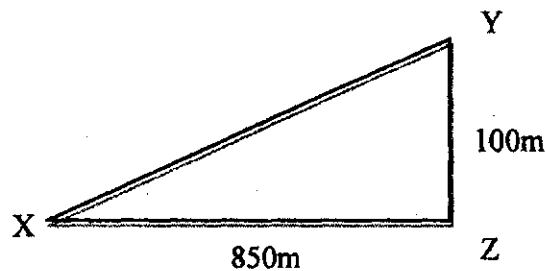
(05 marks)

- Point 'P' situated on 700m above from the sea level
- Point 'Q' situated on 1450m above from the sea level
- The distance between points P and Q is 2cm on the map
- The scale of the map is 1:25,000

c. State the slope in decimal value and fraction between point X and Y marked on Diagram No. 01.

(04 marks)

Diagram No 01



(VI) A road drawn on a map is 20 inches in length. The scale of the map is 1:15,840.

Find out the actual ground length in miles of the road.

(04 marks)

in each
(VII) State two data sets that are suitable for constructing the following graphs.

(02 marks)

- Triangular Graph
- Flow Diagram

(VIII) Explain the difference between topographic map and thematic map.

(02 marks)

(IX)

- a. What is meant by longitudinal scale of a map projection?
- b. What is the disadvantage that can be occurred by enlarge the longitudinal scale of a map projection?

(04 marks)

(X) State two uses of cartographic techniques given bellow.

- a. Long profile of a river
- b. Slope map for an area
- c. Diagonal scale for an one inch map
- d. Scale of gradient
- e. Hypsometric curve for an area

(05 marks)

(XI)

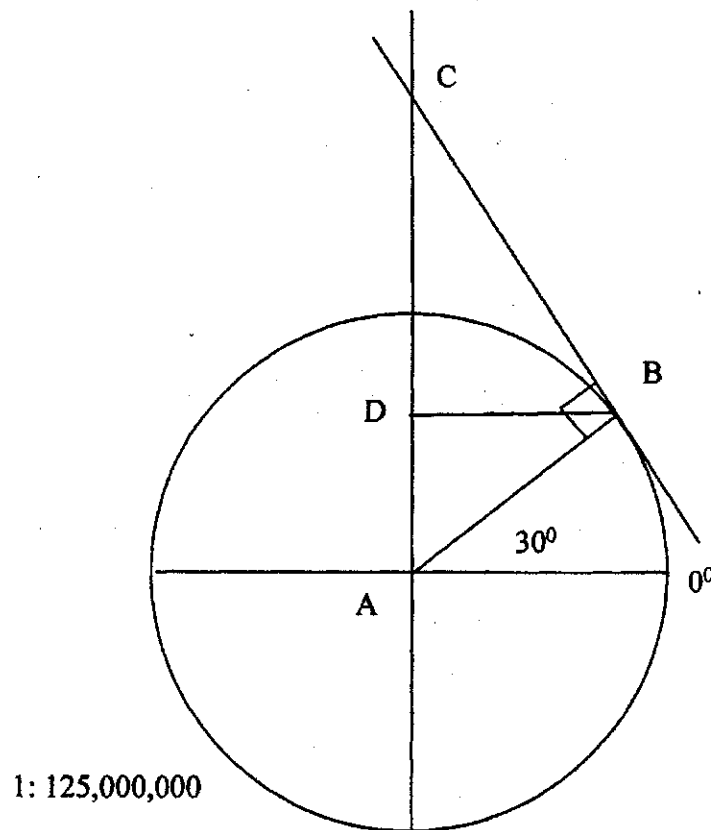
- a. State the main disadvantage of the Zenithal Projections. (01 mark)
- b. Are the all Latitudinal scales are correctly represented by the Conical Projections. Explain briefly. (02 marks)

(XII) Answer the following questions using diagram No. 02.

- (a) Calculate the distance (BC) (02 marks)
- (b) Calculate the radius (BD) of latitude 30° (02 marks)
- (c) Calculate the circumference of latitude 30° (02 marks)

(Total marks 60)

Diagram No. 02



2.

- (a) Construct the Cylindrical Equal Area projection to the reduced earth with a radius of 2 inches (5cm) in mathematical basis using the information given below. (provide all calculation clearly) (16 marks)

- Latitudinal interval - 10°
- Longitudinal interval - 20°

(Construct the projection only from North latitude 40° to South 40° and from East longitude 100° to West 100°)

- (b) Briefly explain the main merits of this projection?

(04 marks)

(Total marks 20)

3.

Answer the following questions using the diagram No. 03. (The diagram should be attached to the answer script)

- a. Number the all streams of the river basin using Strahler's methods (06 marks)
- b. Calculate the bifurcation ratio for every stream order (06 marks)
- c. Calculate the average bifurcation ratio (XR_b) for the river basin (04 marks)
- d. Explain briefly the uses of bifurcation ratio (R_b) of a river basin.

(04 marks)

(Total marks 20)

4.

- a. Diagram No 04 is show monthly average precipitation in inches of 7 rainfall observatory. Construct 80, 100, 120, 140 and 160 isolines on the diagram for above centers. (16 marks)
- b. Using the isoline map that you constructed, explain the precipitation distribution of the area. (04 marks)

(Total marks 20)

Diagram No. 03

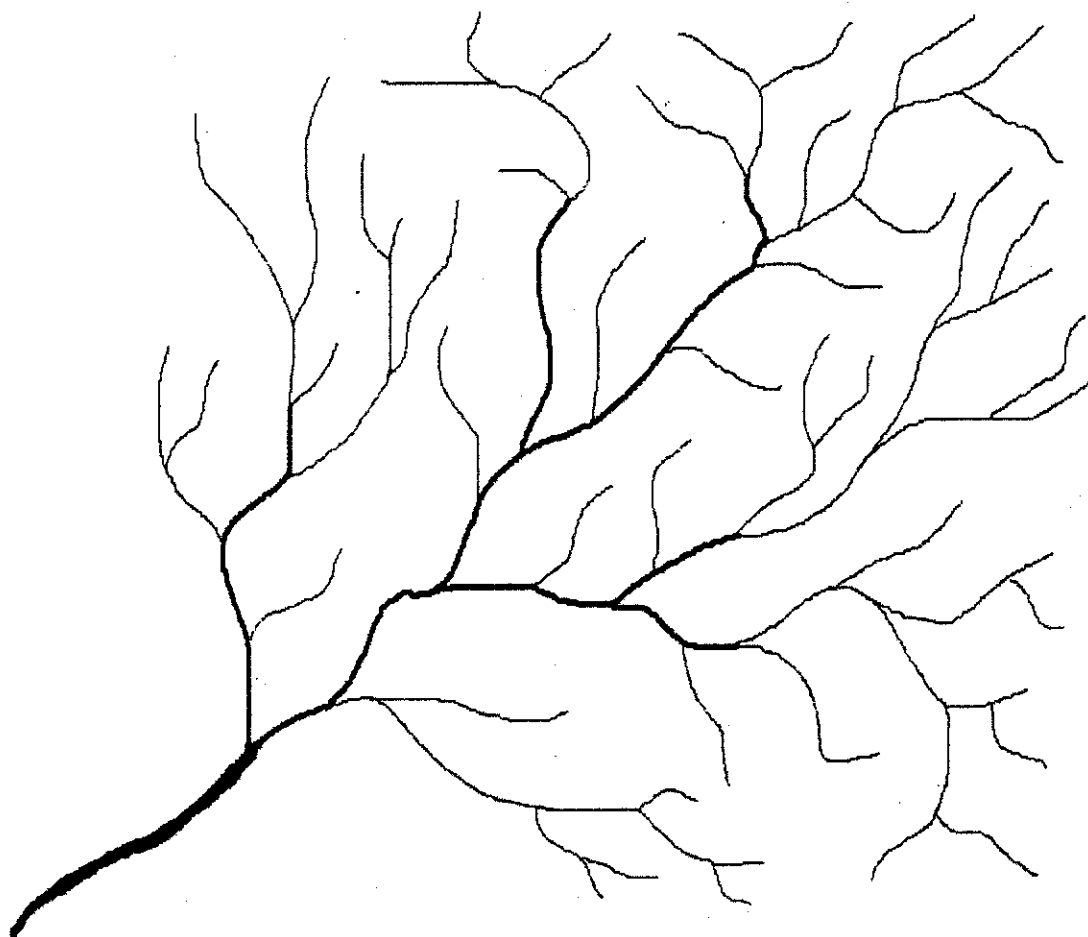
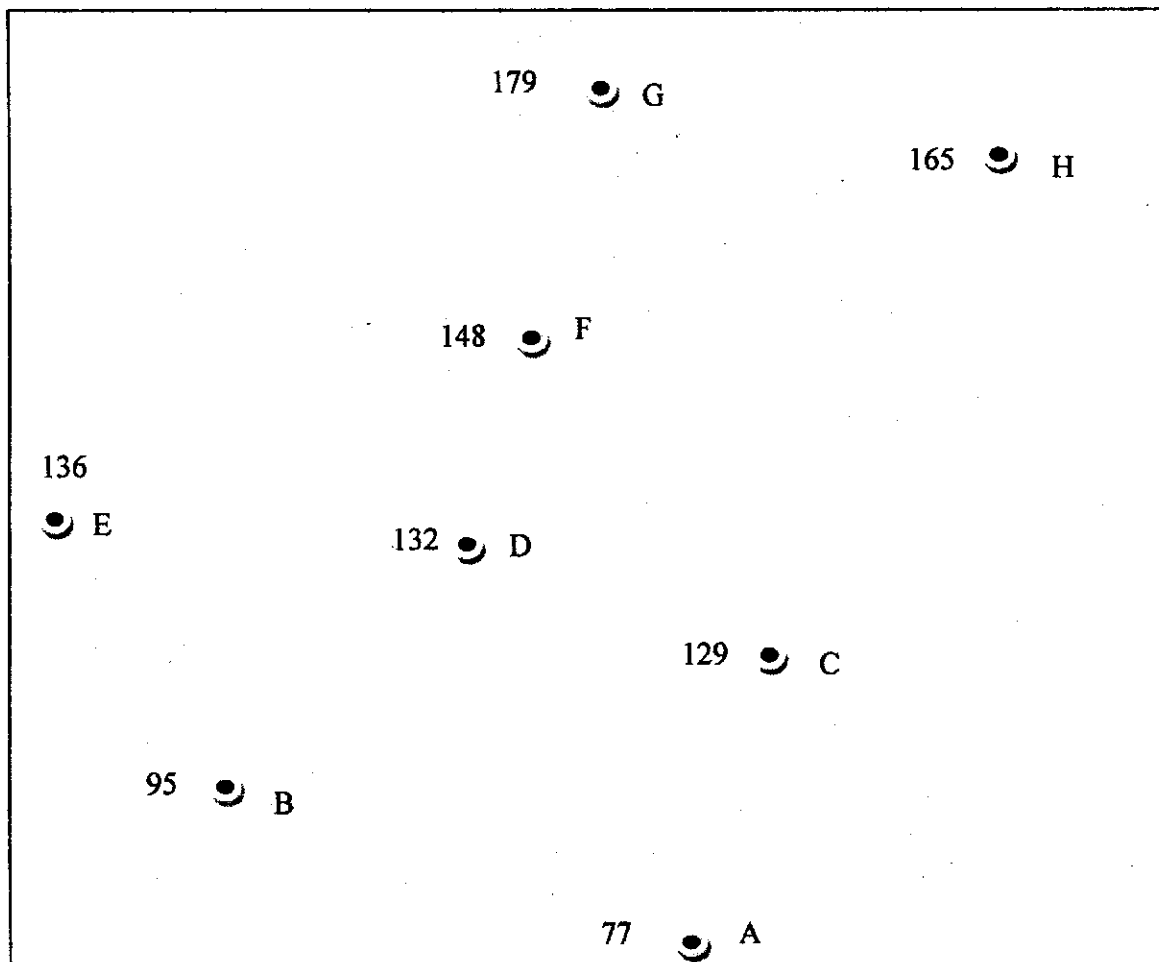


Diagram No 04



NATURAL SINES

	0'	6'	12'	18'	24'	30'	36'	42'	48'	54'	1'	2'	3'	4'	5'
0	.0000	.0017	.0035	.0052	.0070	.0087	.0105	.0122	.0140	.0157	3	6	9	12	15
1	.0175	.0192	.0209	.0227	.0244	.0262	.0279	.0297	.0314	.0332	3	6	9	12	15
2	.0349	.0366	.0384	.0401	.0419	.0436	.0454	.0471	.0488	.0506	3	6	9	12	15
3	.0523	.0541	.0558	.0576	.0593	.0610	.0628	.0645	.0663	.0680	3	6	9	12	15
4	.0698	.0715	.0732	.0750	.0767	.0785	.0802	.0819	.0837	.0854	3	6	9	12	14
5	.0872	.0889	.0906	.0924	.0941	.0958	.0976	.0993	.1011	.1028	3	6	9	12	14
6	.1045	.1063	.1080	.1097	.1115	.1132	.1149	.1167	.1184	.1201	3	6	9	12	14
7	.1219	.1236	.1253	.1271	.1288	.1305	.1323	.1340	.1357	.1374	3	6	9	12	14
8	.1392	.1409	.1426	.1444	.1461	.1478	.1495	.1513	.1530	.1547	3	6	9	12	14
9	.1564	.1582	.1599	.1616	.1633	.1650	.1668	.1685	.1702	.1719	3	6	9	11	14
10	.1736	.1754	.1771	.1788	.1805	.1822	.1840	.1857	.1874	.1891	3	6	9	11	14
11	.1908	.1925	.1942	.1959	.1977	.1994	.2011	.2028	.2045	.2062	3	6	9	11	14
12	.2079	.2096	.2113	.2130	.2147	.2164	.2181	.2198	.2215	.2233	3	6	9	11	14
13	.2250	.2267	.2284	.2300	.2317	.2334	.2351	.2368	.2385	.2402	3	6	8	11	14
14	.2419	.2436	.2453	.2470	.2487	.2504	.2521	.2538	.2554	.2571	3	6	8	11	14
15	.2588	.2605	.2622	.2639	.2656	.2672	.2689	.2706	.2723	.2740	3	6	8	11	14
16	.2756	.2773	.2790	.2807	.2823	.2840	.2857	.2874	.2890	.2907	3	6	8	11	14
17	.2924	.2940	.2957	.2974	.2990	.3007	.3024	.3040	.3057	.3074	3	6	8	11	14
18	.3090	.3107	.3123	.3140	.3156	.3173	.3190	.3206	.3223	.3239	3	6	8	11	14
19	.3256	.3272	.3289	.3305	.3322	.3338	.3355	.3371	.3387	.3404	3	5	8	11	14
20	.3420	.3437	.3453	.3469	.3486	.3502	.3518	.3535	.3551	.3567	3	5	8	11	14
21	.3584	.3600	.3616	.3633	.3649	.3665	.3681	.3697	.3714	.3730	3	5	8	11	14
22	.3746	.3762	.3778	.3795	.3811	.3827	.3843	.3859	.3875	.3891	3	5	8	11	13
23	.3907	.3923	.3939	.3955	.3971	.3987	.4003	.4019	.4035	.4051	3	5	8	11	13
24	.4067	.4083	.4099	.4115	.4131	.4147	.4163	.4179	.4195	.4210	3	5	8	11	13
25	.4226	.4242	.4258	.4274	.4289	.4305	.4321	.4337	.4352	.4368	3	5	8	11	13
26	.4384	.4399	.4415	.4431	.4446	.4462	.4478	.4493	.4509	.4524	3	5	8	10	13
27	.4540	.4555	.4571	.4586	.4602	.4617	.4633	.4648	.4664	.4679	3	5	8	10	13
28	.4695	.4710	.4726	.4741	.4756	.4772	.4787	.4802	.4818	.4833	3	5	8	10	13
29	.4848	.4863	.4879	.4894	.4909	.4924	.4939	.4955	.4970	.4985	3	5	8	10	13
30	.5000	.5015	.5030	.5045	.5060	.5075	.5090	.5105	.5120	.5135	3	5	8	10	13
31	.5150	.5165	.5180	.5195	.5210	.5225	.5240	.5255	.5270	.5284	2	5	7	10	12
32	.5299	.5314	.5329	.5344	.5358	.5373	.5388	.5402	.5417	.5432	2	5	7	10	12
33	.5446	.5461	.5476	.5490	.5505	.5519	.5534	.5548	.5563	.5577	2	5	7	10	12
34	.5592	.5606	.5621	.5635	.5650	.5664	.5678	.5693	.5707	.5721	2	5	7	10	12
35	.5736	.5750	.5764	.5779	.5793	.5807	.5821	.5835	.5850	.5864	2	5	7	9	12
36	.5878	.5892	.5906	.5920	.5934	.5948	.5962	.5976	.5990	.6004	2	5	7	9	12
37	.6018	.6032	.6046	.6060	.6074	.6088	.6101	.6115	.6129	.6143	2	5	7	9	12
38	.6157	.6170	.6184	.6198	.6211	.6225	.6239	.6252	.6266	.6280	2	5	7	9	11
39	.6293	.6307	.6320	.6334	.6347	.6361	.6374	.6388	.6401	.6414	2	4	7	9	11
40	.6428	.6441	.6455	.6468	.6481	.6494	.6508	.6521	.6534	.6547	2	4	7	9	11
41	.6561	.6574	.6587	.6600	.6613	.6626	.6639	.6652	.6665	.6678	2	4	7	9	11
42	.6691	.6704	.6717	.6730	.6743	.6756	.6769	.6782	.6794	.6807	2	4	6	8	11
43	.6820	.6833	.6845	.6858	.6871	.6884	.6896	.6909	.6921	.6934	2	4	6	8	11
44	.6947	.6959	.6972	.6984	.6997	.7009	.7022	.7034	.7046	.7059	2	4	6	8	10
	0'	6'	12'	18'	24'	30'	36'	42'	48'	54'	1'	2'	3'	4'	5'

NATURAL SINES

	0'	6'	12'	18'	24'	30'	36'	42'	48'	54'	1'	2'	3'	4'	5'
45	.7071	.7083	.7096	.7108	.7120	.7133	.7145	.7157	.7169	.7181	2	4	6	8	10
46	.7193	.7206	.7218	.7230	.7242	.7254	.7266	.7278	.7290	.7302	2	4	6	8	10
47	.7314	.7325	.7337	.7349	.7361	.7373	.7385	.7396	.7408	.7420	2	4	6	8	10
48	.7431	.7443	.7455	.7466	.7478	.7490	.7501	.7513	.7524	.7536	2	4	6	8	10
49	.7547	.7559	.7570	.7581	.7593	.7604	.7615	.7627	.7638	.7649	2	4	6	8	9
50	.7660	.7672	.7683	.7694	.7705	.7716	.7727	.7738	.7749	.7760	2	4	6	7	9
51	.7771	.7782	.7793	.7804	.7815	.7826	.7837	.7848	.7859	.7869	2	4	5	7	9
52	.7880	.7891	.7902	.7912	.7923	.7934	.7944	.7955	.7965	.7976	2	4	5	7	9
53	.7986	.7997	.8007	.8018	.8028	.8039	.8049	.8059	.8070	.8080	2	3	5	7	9
54	.8090	.8100	.8111	.8121	.8131	.8141	.8151	.8161	.8171	.8181	2	3	5	7	8
55	.8192	.8202	.8211	.8221	.8231	.8241	.8251	.8261	.8271	.8281	2	3	5	7	8
56	.8290	.8300	.8310	.8320	.8329	.8339	.8348	.8358	.8368	.8377	2	3	5	6	8
57	.8387	.8396	.8406	.8415	.8425	.8434	.8443	.8453	.8462	.8471	2	3	5	6	8
58	.8480	.8490	.8499	.8508	.8517	.8526	.8536	.8545	.8554	.8563	2	3	5	6	8
59	.8572	.8581	.8590	.8599	.8607	.8616	.8625	.8634	.8643	.8652	1	3	4	6	7
60	.8660	.8669	.8678	.8686	.8695	.8704	.8712	.8721	.8729	.8738	1	3	4	6	7
61	.8746	.8753	.8763	.8771	.8780	.8788	.8796	.8805	.8813	.8821	1	3	4	6	7
62	.8829	.8838	.8846	.8854	.8862	.8870	.8878	.8886	.8894	.8902	1	3	4	5	7
63	.8910	.8918	.8926	.8934	.8942	.8949	.8957	.8965	.8973	.8980	1	3	4	5	6
64	.8988	.8996	.9003	.9011	.9018	.9026	.9033	.9041	.9048	.9055	1	3	4	5	6
65	.9063	.9070	.9078	.9085	.9092	.9100	.9107	.9114	.9121	.9128	1	2	4	5	6
66	.9135	.9143	.9150	.9157	.9164	.9171	.9178	.9184	.9191	.9198	1	2	3	5	6
67	.9205	.9212	.9219	.9225	.9232	.9239	.9245	.9252	.9259	.9265	1	2	3	4	6
68	.9272	.9278	.9285	.9291	.9298	.9304	.9311	.9317	.9323	.9330	1	2	3	4	5
69	.9336	.9342	.9348	.9354	.9361	.9367	.9373	.9379	.9385	.9391	1	2	3	4	5
70	.9397	.9403	.9409	.9415	.9421	.9426	.9432	.9438	.9444	.9449	1	2	3	4	5
71	.9455	.9461	.9466	.9472	.9478	.9483	.9489	.9494	.9500	.9505	1	2	3	4	5
72	.9511	.9516	.9521	.9527	.9532	.9537	.9542	.9548	.9553	.9558	1	2	3	4	4
73	.9563	.9568	.9573	.9578	.9583	.9588	.9593	.9598	.9603	.9608	1	2	2	3	4
74	.9613	.9617	.9622	.9627	.9632	.9636	.9641	.9646	.9650	.9655	1	2	2	3	4
75	.9659	.9663	.9668	.9673	.9677	.9681	.9686	.9690	.9694	.9699	1	1	2	3	4
76	.9703	.9707	.9711	.9715	.9720	.9724	.9728	.9732	.9736	.9740	1	1	2	3	3
77	.9744	.9748	.9751	.9755	.9759	.9763	.9767	.9770	.9774	.9778	1	1	2	3	3
78	.9781	.9785	.9789	.9792	.9796	.9799	.9803	.9806	.9810	.9813	1	1	2	2	3
79	.9816	.9820	.9823	.9826	.9829	.9833	.9836	.9839	.9842	.9845	1	1	2	2	3
80	.9848	.9851	.9854	.9857	.9860	.9863	.9866	.9869	.9871	.9874	0	1	1	2	2
81	.9877	.9880	.9882	.9885	.9888	.9890	.9893	.9895	.9898	.9900	0	1	1	2	2
82	.9903	.9905	.9907	.9910	.9912	.9914	.9917	.9919	.9921	.9923	0	1	1	2	2
83	.9925	.9928	.9930	.9932	.9934	.9936	.9938	.9940	.9942	.9943	0	1	1	1	2
84	.9945	.9947	.9949	.9951	.9952	.9954	.9956	.9957	.9959	.9960	0	1	1	1	1
85	.9962	.9963	.9965	.9966	.9968	.9969	.9971	.9972	.9973	.9974	0	0	1	1	1
86	.9976	.9977	.9978	.9979	.9980	.9981	.9982	.9983	.9984	.9985	0	0	1	1	1
87	.9986	.9987	.9988	.9989	.9990	.9990	.9991	.9992	.9993	.9993	0	0	0	0	1
88	.9994	.9995	.9995	.9996	.9996	.9997	.9997	.9997	.9998	.9998					
89	.9998	.9999	.9999	.9999	.9999	1.000	1.000	1.000	1.000	1.000					
	0'	6'	12'	18'	24'	30'	36'	42'	48'	54'	1'	2'	3'	4'	5'

NATURAL COSINES

SUBTRACT

	0'	6'	12'	18'	24'	30'	36'	42'	48'	54'	1'	2'	3'	4'	5'
0	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	9999	9999	9999	9999					
1	.9998	.9998	.9998	.9997	.9997	.9997	.9996	.9996	.9995	.9995					
2	.9994	.9993	.9993	.9992	.9991	.9990	.9990	.9989	.9988	.9987	0	0	0	0	1
3	.9986	.9985	.9984	.9983	.9982	.9981	.9980	.9979	.9978	.9977	0	0	0	1	1
4	.9976	.9974	.9973	.9972	.9971	.9969	.9968	.9966	.9965	.9963	0	0	0	1	1
5	.9962	.9960	.9959	.9957	.9956	.9954	.9952	.9951	.9949	.9947	0	0	1	1	1
6	.9945	.9943	.9942	.9940	.9938	.9936	.9934	.9932	.9930	.9928	0	1	1	1	2
7	.9925	.9923	.9921	.9919	.9917	.9914	.9912	.9910	.9907	.9905	0	1	1	2	2
8	.9903	.9900	.9898	.9895	.9893	.9890	.9888	.9885	.9882	.9880	0	1	1	2	2
9	.9877	.9874	.9871	.9869	.9866	.9863	.9860	.9857	.9854	.9851	0	1	1	2	2
10	.9848	.9845	.9842	.9839	.9836	.9833	.9829	.9826	.9823	.9820	0	1	1	2	3
11	.9816	.9813	.9810	.9806	.9803	.9799	.9796	.9792	.9789	.9785	1	1	2	2	3
12	.9781	.9778	.9774	.9770	.9767	.9763	.9759	.9755	.9751	.9748	1	1	2	3	3
13	.9744	.9740	.9736	.9732	.9728	.9724	.9720	.9715	.9711	.9707	1	1	2	3	3
14	.9703	.9699	.9694	.9690	.9686	.9681	.9677	.9673	.9668	.9664	1	1	2	3	4
15	.9659	.9655	.9650	.9646	.9641	.9636	.9632	.9627	.9622	.9617	1	2	2	3	4
16	.9613	.9608	.9603	.9598	.9593	.9588	.9583	.9578	.9573	.9568	1	2	2	3	4
17	.9563	.9558	.9553	.9548	.9542	.9537	.9532	.9527	.9521	.9516	1	2	3	4	4
18	.9511	.9505	.9500	.9494	.9489	.9483	.9478	.9472	.9466	.9461	1	2	3	4	5
19	.9455	.9449	.9444	.9438	.9432	.9426	.9421	.9415	.9409	.9403	1	2	3	4	5
20	.9397	.9391	.9385	.9379	.9373	.9367	.9361	.9354	.9348	.9342	1	2	3	4	5
21	.9336	.9330	.9323	.9317	.9311	.9304	.9298	.9291	.9285	.9278	1	2	3	4	5
22	.9272	.9265	.9259	.9252	.9245	.9239	.9232	.9225	.9219	.9212	1	2	3	4	6
23	.9205	.9198	.9191	.9184	.9178	.9171	.9164	.9157	.9150	.9143	1	2	3	5	6
24	.9135	.9128	.9121	.9114	.9107	.9100	.9092	.9085	.9078	.9070	1	2	3	5	6
25	.9063	.9056	.9048	.9041	.9033	.9026	.9018	.9011	.9003	.8996	1	3	4	5	6
26	.8988	.8980	.8973	.8965	.8957	.8949	.8942	.8934	.8926	.8918	1	3	4	5	6
27	.8910	.8902	.8894	.8886	.8878	.8870	.8862	.8854	.8846	.8838	1	3	4	5	7
28	.8829	.8821	.8813	.8805	.8796	.8788	.8780	.8771	.8763	.8755	1	3	4	6	7
29	.8746	.8738	.8729	.8721	.8712	.8704	.8695	.8686	.8678	.8669	1	3	4	6	7
30	.8660	.8652	.8643	.8634	.8625	.8616	.8607	.8599	.8590	.8581	1	3	4	6	7
31	.8572	.8563	.8554	.8545	.8536	.8526	.8517	.8508	.8499	.8490	2	3	5	6	8
32	.8480	.8471	.8462	.8453	.8443	.8434	.8425	.8415	.8406	.8396	2	3	5	6	8
33	.8387	.8377	.8368	.8358	.8348	.8339	.8329	.8320	.8310	.8300	2	3	5	6	8
34	.8290	.8281	.8271	.8261	.8251	.8241	.8231	.8221	.8211	.8202	2	3	5	7	8
35	.8192	.8181	.8171	.8161	.8151	.8141	.8131	.8121	.8111	.8100	2	3	5	7	8
36	.8090	.8080	.8070	.8059	.8049	.8039	.8028	.8018	.8007	.7997	2	3	5	7	9
37	.7986	.7976	.7965	.7955	.7944	.7934	.7923	.7912	.7902	.7891	2	4	5	7	9
38	.7880	.7869	.7859	.7848	.7837	.7826	.7815	.7804	.7793	.7782	2	4	5	7	9
39	.7771	.7760	.7749	.7738	.7727	.7716	.7705	.7694	.7683	.7672	2	4	5	7	9
40	.7660	.7649	.7638	.7627	.7615	.7604	.7593	.7581	.7570	.7559	2	4	5	7	9
41	.7547	.7536	.7524	.7513	.7501	.7490	.7478	.7466	.7455	.7443	2	4	6	8	10
42	.7431	.7420	.7408	.7396	.7385	.7373	.7361	.7349	.7337	.7325	2	4	6	8	10
43	.7314	.7302	.7290	.7278	.7266	.7254	.7242	.7230	.7218	.7206	2	4	6	8	10
44	.7193	.7181	.7169	.7157	.7145	.7133	.7120	.7108	.7096	.7083	2	4	6	8	10
	0'	6'	12'	18'	24'	30'	36'	42'	48'	54'	1'	2'	3'	4'	5'

* The black type indicates that the integer changes.

NATURAL COSINES

SUBTRACT

	0'	6'	12'	18'	24'	30'	36'	42'	48'	54'	1'	2'	3'	4'	5'
45	.7071	7059	7046	7034	7022	7009	6997	6984	6972	6959	2	4	6	8	10
46	.6947	6934	6921	6909	6896	6884	6871	6858	6845	6833	2	4	6	8	11
47	.6820	6807	6794	6782	6769	6756	6743	6730	6717	6704	2	4	6	9	11
48	.6691	6678	6665	6652	6639	6626	6613	6600	6587	6574	2	4	7	9	11
49	.6561	6547	6534	6521	6508	6494	6481	6468	6455	6441	2	4	7	9	11
50	.6428	6414	6401	6388	6374	6361	6347	6334	6320	6307	2	4	7	9	11
51	.6293	6280	6266	6252	6239	6225	6211	6198	6184	6170	2	5	7	9	11
52	.6157	6143	6129	6115	6101	6088	6074	6060	6046	6032	2	5	7	9	12
53	.6018	6004	5990	5976	5962	5948	5934	5920	5906	5892	2	5	7	9	12
54	.5878	5864	5850	5835	5821	5807	5793	5779	5764	5750	2	5	7	9	12
55	.5736	5721	5707	5693	5678	5664	5650	5635	5621	5606	2	5	7	10	12
56	.5592	5577	5563	5548	5534	5519	5505	5490	5476	5461	2	5	7	10	12
57	.5446	5432	5417	5402	5388	5373	5358	5343	5329	5314	2	5	7	10	12
58	.5299	5284	5270	5255	5240	5225	5210	5195	5180	5165	2	5	7	10	12
59	.5150	5135	5120	5105	5090	5075	5060	5045	5030	5015	3	5	8	10	13
60	.5000	4985	4970	4955	4940	4924	4909	4894	4879	4863	3	5	8	10	13
61	.4848	4833	4818	4802	4787	4772	4756	4741	4726	4710	3	5	8	10	13
62	.4695	4679	4664	4648	4633	4617	4602	4586	4571	4555	3	5	8	10	13
63	.4530	4514	4509	4493	4478	4462	4446	4431	4415	4399	3	5	8	10	13
64	.4384	4368	4352	4337	4321	4305	4289	4274	4258	4242	3	5	8	11	13
65	.4226	4210	4195	4179	4163	4147	4131	4115	4099	4083	3	5	8	11	13
66	.4067	4051	4035	4019	4003	3987	3971	3955	3939	3923	3	5	8	11	13
67	.3907	3891	3875	3859	3843	3827	3811	3795	3778	3762	3	5	8	11	13
68	.3746	3730	3714	3697	3681	3665	3649	3633	3616	3600	3	5	8	11	13
69	.3584	3567	3551	3535	3518	3502	3486	3469	3453	3437	3	5	8	11	13
70	.3420	3404	3387	3371	3355	3338	3322	3305	3289	3272	3	5	8	11	13
71	.3256	3239	3223	3206	3190	3173	3156	3140	3123	3107	3	6	8	11	14
72	.3090	3074	3057	3040	3024	3007	2990	2974	2957	2940	3	6	8	11	14
73	.2924	2907	2890	2874	2857	2840	2823	2807	2790	2773	3	6	8	11	14
74	.2756	2740	2723	2706	2689	2672	2656	2639	2622	2605	3	6	8	11	14
75	.2588	2571	2554	2538	2521	2504	2487	2470	2453	2436	3	6	8	11	14
76	.2410	2402	2385	2368	2351	2334	2317	2300	2284	2267	3	6	8	11	14
77	.2250	2233	2215	2198	2181	2164	2147	2130	2113	2096	3	6	9	11	14
78	.2079	2062	2045	2028	2011	1994	1977	1959	1942	1925	3	6	9	11	14
79	.1908	1891	1874	1857	1840	1822	1805	1788	1771	1754	3	6	9	11	14
80	.1736	1719	1702	1685	1668	1650	1633	1616	1599	1582	3	6	9	11	14
81	.1564	1547	1530	1513	1495	1478	1461	1444	1426	1409	3	6	9	12	14
82	.1392	1374	1357	1340	1323	1305	1288	1271	1253	1236	3	6	9	12	14
83	.1219	1201	1184	1167	1149	1132	1115	1097	1080	1063	3	6	9	12	14
84	.1045	1028	1011	9993	9976	9958	9941	9924	9906	9889	3	6	9	12	14
85	.0872	0854	0837	0819	0802	0785	0767	0750	0732	0715	3	6	9	12	14
86	.0698	0680	0663	0645	0628	0610	0593	0576	0558	0541	3	6	9	12	14
87	.0523	0506	0488	0471	0454	0436	0419	0401	0384	0366	3	6	9	12	14
88	.0349	0332	0314	0297	0279	0262	0244	0227	0209	0192	3	6	9	12	14
89	.0175	0157	0140	0122	0105	0087	0070	0052	0035	0017	3	6	9	12	14
	0'	6'	12'	18'	24'	30'	36'	42'	48'	54'	1'	2'	3'	4'	5'

NATURAL TANGENTS

	0'	6'	12'	18'	24'	30'	36'	42'	48'	54'	1'	2'	3'	4'	5'
0	0.0000	0017	0035	0052	0070	0087	0105	0122	0140	0157	3	6	9	12	15
1	0.0175	0192	0209	0227	0244	0262	0279	0297	0314	0332	3	6	9	12	15
2	0.0349	0367	0384	0402	0419	0437	0454	0472	0489	0507	3	6	9	12	15
3	0.0524	0542	0559	0577	0594	0612	0629	0647	0664	0682	3	6	9	12	15
4	0.0699	0717	0734	0752	0769	0787	0805	0822	0840	0857	3	6	9	12	15
5	0.0875	0892	0910	0928	0945	0963	0981	0998	1016	1033	3	6	9	12	15
6	0.1051	1069	1086	1104	1122	1139	1157	1175	1192	1210	3	6	9	12	15
7	0.1228	1246	1263	1281	1299	1317	1334	1352	1370	1388	3	6	9	12	15
8	0.1405	1423	1441	1459	1477	1495	1512	1530	1548	1566	3	6	9	12	15
9	0.1584	1602	1620	1638	1655	1673	1691	1709	1727	1745	3	6	9	12	15
10	0.1703	1721	1739	1757	1775	1793	1811	1829	1847	1865	3	6	9	12	15
11	0.1944	1962	1980	1998	2016	2035	2053	2071	2089	2107	3	6	9	12	15
12	0.2126	2144	2162	2180	2199	2217	2235	2254	2272	2290	3	6	9	12	15
13	0.2309	2327	2345	2364	2382	2401	2419	2438	2456	2475	3	6	9	12	15
14	0.2493	2512	2530	2549	2568	2586	2605	2623	2642	2661	3	6	9	12	16
15	0.2672	2690	2709	2727	2746	2765	2783	2802	2821	2840	3	6	9	13	16
16	0.2867	2886	2905	2924	2943	2962	2981	3000	3019	3038	3	6	9	13	16
17	0.3057	3076	3095	3114	3133	3152	3171	3190	3209	3228	3	6	10	13	16
18	0.3249	3269	3288	3307	3327	3346	3365	3385	3404	3424	3	6	10	13	16
19	0.3443	3463	3482	3502	3522	3541	3561	3581	3600	3620	3	7	10	13	16
20	0.3640	3659	3679	3699	3719	3739	3759	3779	3799	3819	3	7	10	13	17
21	0.3839	3859	3879	3899	3919	3939	3959	3979	4000	4020	3	7	10	13	17
22	0.4040	4061	4081	4101	4122	4142	4163	4183	4204	4224	3	7	10	14	17
23	0.4245	4265	4286	4307	4327	4348	4369	4390	4411	4431	3	7	10	14	17
24	0.4452	4473	4494	4515	4536	4557	4578	4599	4621	4642	4	7	11	14	18
25	0.4663	4684	4706	4727	4748	4770	4791	4813	4834	4856	4	7	11	14	18
26	0.4877	4899	4921	4942	4964	4986	5008	5029	5051	5073	4	7	11	15	18
27	0.5095	5117	5139	5161	5184	5206	5228	5250	5272	5295	4	7	11	15	18
28	0.5317	5340	5362	5384	5407	5430	5452	5475	5498	5520	4	8	11	15	19
29	0.5543	5566	5589	5612	5635	5658	5681	5704	5727	5750	4	8	12	15	19
30	0.5774	5797	5820	5844	5867	5890	5914	5938	5961	5985	4	8	12	16	20
31	0.6009	6032	6056	6080	6104	6128	6152	6176	6200	6224	4	8	12	16	20
32	0.6249	6273	6297	6322	6346	6371	6395	6420	6445	6469	4	8	12	16	20
33	0.6494	6519	6544	6569	6594	6619	6644	6669	6694	6720	4	8	13	17	21
34	0.6745	6771	6796	6822	6847	6873	6899	6924	6950	6976	4	9	13	17	21
35	0.7002	7028	7054	7080	7107	7133	7159	7186	7212	7239	4	9	13	18	22
36	0.7265	7292	7319	7346	7373	7400	7427	7454	7481	7508	5	9	14	18	23
37	0.7536	7563	7590	7618	7646	7673	7701	7729	7757	7785	5	9	14	18	23
38	0.7813	7841	7869	7898	7926	7954	7983	8012	8040	8069	5	9	14	19	24
39	0.8098	8127	8156	8185	8214	8243	8273	8302	8332	8361	5	10	15	20	24
40	0.8391	8421	8451	8481	8511	8541	8571	8601	8632	8662	5	10	15	20	25
41	0.8693	8724	8754	8785	8816	8847	8878	8910	8941	8972	5	10	16	21	26
42	0.9004	9036	9067	9099	9131	9163	9195	9228	9260	9293	5	11	16	21	27
43	0.9325	9358	9391	9424	9457	9490	9523	9556	9590	9623	6	11	17	22	28
44	0.9657	9691	9725	9759	9793	9827	9861	9896	9930	9965	6	11	17	23	29

NATURAL TANGENTS

	0'	6'	12'	18'	24'	30'	36'	42'	48'	54'	1'	2'	3'	4'	5'
45	1.0000	0035	0070	0105	0141	0176	0212	0247	0283	0319	6	12	18	24	30
46	1.0355	0392	0428	0464	0501	0538	0575	0612	0649	0686	6	12	18	25	31
47	1.0721	0761	0799	0837	0875	0913	0951	0989	1028	1067	6	13	19	25	32
48	1.1100	1145	1184	1224	1263	1303	1343	1383	1423	1463	7	13	20	26	33
49	1.1501	1541	1585	1626	1667	1708	1750	1792	1833	1875	7	14	21	28	34
50	1.1918	1960	2002	2045	2088	2131	2174	2218	2261	2305	7	14	22	29	35
51	1.2349	2393	2437	2482	2527	2572	2617	2662	2708	2753	8	15	23	30	38
52	1.2790	2836	2882	2928	2975	3022	3070	3117	3165	3212	8	16	24	31	39
53	1.3270	3319	3367	3416	3465	3514	3564	3613	3663	3713	8	16	25	33	41
54	1.3761	3811	3865	3916	3968	4019	4071	4121	4176	4229	9	17	26	34	43
55	1.4281	4335	4388	4442	4496	4550	4605	4659	4715	4770	9	18	27	35	45
56	1.4826	4882	4938	4991	5051	5108	5166	5224	5282	5340	10	19	29	37	48
57	1.5300	5358	5417	5477	5537	5597	5657	5718	5778	5839	10	20	30	40	50
58	1.5803	5864	5925	5986	6048	6110	6173	6235	6298	6361	11	21	32	43	54
59	1.6313	6376	6439	6502	6566	6630	6694	6758	6823	6887	11	23	34	46	58
60	1.6721	6791	6861	6932	7003	7075	7147	7219	7292	7365	12	24	36	49	62
61	1.7140	7215	7290	7365	7441	7517	7593	7670	7747	7824	13	26	38	51	64
62	1.7580	7657	7734	7811	7889	7967	8045	8124	8203	8282	14	27	41	55	69
63	1.8026	7971	7997	8083	8170	8257	8345	8433	8521	8610	15	29	44	59	73
64	1.8503	8534	8566	8658	8750	8842	8935	9028	9121	9215	16	31	47	63	78
65	1.8945	8983	9022	9116	9210	9304	9399	9493	9588	9683	17	34	51	68	85
66	1.9400	9440	9481	9576	9671	9766	9861	9956	10051	10147	18	37	55	73	91
67	1.9859	9903	9948	10044	10140	10236	10332	10429	10525	10622	20	40	60	81	102
68	2.0321	10319	10418	10516	10615	10714	10813	10912	11012	11111	22	43	65	87	109
69	2.0795	10795	10896	10997	11098	11199	11300	11401	11502	11603	24	47	71	95	119
70	2.1270	11270	11372	11474	11576	11678	11780	11882	11984	12086	26	52	78	104	130
71	2.1746	11746	11849	11952	12055	12158	12261	12364	12467	12570	29	58	87	116	145
72	2.2223	12223	12327	12431	12535	12639	12743	12847	12951	13055	32	64	97	127	161
73	2.2700	12700	12805	12910	13015	13120	13225	13330	13435	13540	35	72	108	141	180
74	2.3177	13177	13283	13389	13495	13601	13707	13813	13919	14025	38	81	122	157	203
75	2.3654	13654	13761	13868	13975	14082	14189	14296	14403	14510	41	93	139	180	232
76	2.4131	14131	14239	14347	14455	14563	14671	14779	14887	14995	45	107	160	214	267
77	2.4608	14608	14717	14826	14935	15044	15153	15262	15371	15480	49	124	186	243	306
78	2.5085	15085	15195	15305	15415	15525	15635	15745	15855	15965	53	140	220	283	356
79	2.5562	15562	15673	15784	15895	16006	16117	16228	16339	16450	57	158	243	318	403
80	2.6039	16039	16151	16263	16375	16487	16599	16711	16823	16935					
81	2.6516	16516	16629	16742	16855	16968	17081	17194	17307	17420					
82	2.6993	16993	17107	17221	17335	17449	17563	17677	17791	17905					
83	2.7470	17470	17585	17700	17815	17930	18045	18160	18275	18390					
84	2.7947	17947	18063	18179	18295	18411	18527	18643	18759	18875					
85	2.8424	18424	18541	18658	18775	18892	19009	19126	19243	19360					
86	2.8901	18901	19019	19137	19255	19373	19491	19609	19727	19845					
87	2.9378	19378	19497	19616	19735	19854	19973	20092	20211	20330					
88	2.9855	19855	19975	20095	20215	20335	20455	20575	20695	20815					
89	3.0332	20332	20453	20573	20694	20814	20935	21055	21176	21296					
90	3.0809	20809	20930	21051	21172	21293	21414	21535	21656	21776					
91	3.1286	21286	21407	21528	21649	21770	21891	22012	22133	22254					
92	3.1763	21763	21885	22006	22127	22248	22369	22490	22611	22732					
93	3.2240	22240	22362	22483	22604	22725	22846	22967	23088	23209					
94	3.2717	22717	22839	22960	23081	23202	23323	23444	23565	23686					
95	3.3194	23194	23316	23437	23558	23679	23800	23921	24042	24163					
96	3.3671	23671	23793	23914	24035	24156	24277	24398	24519	24640					
97	3.4148	24148	24270	24391	24512	24633	24754	24875	24996	25117					
98	3.4625	24625	24747	24868	24989	25110	25231	25352	25473	25594					
99	3.5102	25102	25224	25345	25466	25587	25708	25829	25950	26071					
100	3.5579	25579	25701	25822	25943	26064	26185	26306	26427	26548					
	0'	6'	12'	18'	24'	30'	36'	42'	48'	54'	1'	2'	3'	4'	5'

NATURAL SECANTS

	0'	6'	12'	18'	24'	30'	36'	42'	48'	54'	1'	2'	3'	4'	5'
0	1.0000	0000	0000	0000	0000	0000	0001	0001	0001	0001					
1	1.0002	0002	0002	0003	0003	0003	0004	0004	0005	0006					
2	1.0006	0007	0007	0008	0009	0010	0010	0011	0012	0013					
3	1.0014	0015	0016	0017	0018	0019	0020	0021	0022	0023	0	0	0	0	1
4	1.0024	0026	0027	0028	0030	0031	0032	0034	0035	0037	0	0	1	1	1
5	1.0038	0040	0041	0043	0045	0046	0048	0050	0051	0053	0	1	1	1	1
6	1.0055	0057	0059	0061	0063	0065	0067	0069	0071	0073	0	1	1	2	2
7	1.0075	0077	0079	0082	0084	0086	0089	0091	0093	0096	0	1	1	2	2
8	1.0098	0101	0103	0106	0108	0111	0114	0116	0119	0122	0	1	1	2	2
9	1.0125	0127	0130	0133	0136	0139	0142	0145	0148	0151	0	1	1	2	2
10	1.0154	0157	0161	0164	0167	0170	0174	0177	0180	0184	1	1	2	2	3
11	1.0187	0191	0194	0198	0201	0205	0209	0212	0216	0220	1	1	2	2	3
12	1.0223	0227	0231	0235	0239	0243	0247	0251	0255	0259	1	1	2	3	3
13	1.0263	0267	0271	0276	0280	0284	0288	0293	0297	0302	1	1	2	3	4
14	1.0306	0311	0315	0320	0324	0329	0334	0338	0343	0348	1	2	2	3	4
15	1.0353	0358	0363	0367	0372	0377	0382	0388	0393	0398	1	2	3	3	4
16	1.0401	0408	0413	0419	0424	0429	0435	0440	0446	0451	1	2	3	4	4
17	1.0457	0463	0468	0474	0480	0485	0491	0497	0503	0509	1	2	3	4	5
18	1.0515	0521	0527	0533	0539	0545	0551	0557	0564	0570	1	2	3	4	5
19	1.0576	0583	0589	0595	0602	0608	0615	0622	0628	0635	1	2	3	4	5
20	1.0642	0649	0655	0662	0669	0676	0683	0690	0697	0704	1	2	3	5	6
21	1.0711	0719	0726	0733	0740	0748	0755	0763	0770	0778	1	2	4	5	6
22	1.0785	0793	0801	0808	0816	0824	0832	0840	0848	0856	1	3	4	5	7
23	1.0864	0872	0880	0888	0896	0904	0913	0921	0929	0938	1	3	4	6	7
24	1.0946	0955	0963	0972	0981	0989	0998	1007	1016	1025	1	3	4	6	7
25	1.1034	1043	1052	1061	1070	1079	1089	1098	1107	1117	2	3	5	6	8
26	1.1126	1136	1145	1155	1164	1174	1184	1194	1203	1213	2	3	5	6	8
27	1.1223	1233	1243	1253	1264	1274	1284	1294	1305	1315	2	3	5	7	9
28	1.1326	1336	1347	1357	1368	1379	1390	1401	1412	1423	2	4	5	7	9
29	1.1434	1445	1456	1467	1478	1490	1501	1512	1524	1535	2	4	6	8	9
30	1.1547	1559	1570	1582	1594	1606	1618	1630	1642	1654	2	4	6	8	10
31	1.1666	1679	1691	1703	1716	1728	1741	1753	1766	1779	2	4	6	8	10
32	1.1792	1805	1818	1831	1844	1857	1870	1883	1897	1910	2	4	7	9	11
33	1.1924	1937	1951	1964	1978	1992	2006	2020	2034	2048	2	5	7	9	12
34	1.2062	2076	2091	2105	2120	2134	2149	2163	2178	2193	2	5	7	10	12
35	1.2208	2223	2238	2253	2268	2283	2299	2314	2329	2345	3	5	8	10	13
36	1.2361	2376	2392	2408	2424	2440	2456	2472	2489	2505	3	5	8	11	13
37	1.2521	2538	2554	2571	2588	2605	2622	2639	2656	2673	3	6	8	11	14
38	1.2690	2708	2725	2742	2760	2778	2796	2813	2831	2849	3	6	9	12	15
39	1.2868	2886	2904	2923	2941	2960	2978	2997	3016	3035	3	6	9	12	16
40	1.3054	3073	3093	3112	3131	3151	3171	3190	3210	3230	3	7	10	13	16
41	1.3250	3270	3291	3311	3331	3352	3373	3393	3414	3435	3	7	10	14	17
42	1.3456	3478	3499	3520	3542	3563	3585	3607	3629	3651	4	8	11	14	18
43	1.3673	3696	3718	3741	3763	3786	3809	3832	3855	3878	4	8	11	15	19
44	1.3902	3925	3949	3972	3996	4020	4044	4069	4093	4118	4	8	12	16	20
	0'	6'	12'	18'	24'	30'	36'	42'	48'	54'	1'	2'	3'	4'	5'

NATURAL SECANTS

	0'	6'	12'	18'	24'	30'	36'	42'	48'	54'	1'	2'	3'	4'	5'
45	1.4142	4167	4192	4217	4242	4267	4293	4318	4344	4370	4	8	13	17	21
46	1.4396	4422	4448	4474	4501	4527	4554	4581	4608	4635	4	9	13	18	22
47	1.4663	4690	4718	4746	4774	4802	4830	4859	4887	4916	4	9	14	19	23
48	1.4945	4974	5003	5032	5062	5092	5121	5151	5182	5212	5	10	15	20	25
49	1.5243	5273	5304	5335	5366	5398	5429	5461	5493	5525	5	10	16	21	26
50	1.5557	5590	5622	5655	5688	5721	5755	5788	5822	5856	6	11	17	22	28
51	1.5890	5925	5959	5994	6029	6064	6099	6135	6171	6207	6	12	18	23	29
52	1.6243	6279	6316	6353	6390	6427	6464	6502	6540	6578	6	12	19	25	31
53	1.6616	6655	6694	6733	6772	6812	6852	6892	6932	6972	7	13	20	26	33
54	1.7013	7054	7095	7137	7179	7221	7263	7305	7348	7391	7	14	21	28	35
55	1.7434	7478	7522	7566	7610	7655	7700	7745	7791	7837	7	15	22	30	37
56	1.7883	7929	7976	8023	8070	8118	8166	8214	8263	8312	8	16	24	32	40
57	1.8361	8410	8460	8510	8561	8612	8663	8714	8766	8818	8	17	25	34	42
58	1.8871	8924	8977	9031	9084	9139	9194	9249	9304	9360	9	18	27	36	45
59	1.9416	9473	9530	9587	9645	9703	9762	9821	9880	9940	10	19	29	39	49
60	2.0000	0061	0122	0183	0245	0308	0371	0434	0498	0562	10	21	31	42	52
61	2.0627	0692	0757	0824	0890	0957	1025	1093	1162	1231	11	22	34	45	56
62	2.1301	1371	1441	1513	1584	1655	1730	1803	1877	1952	12	24	36	48	61
63	2.2027	2103	2179	2256	2333	2412	2490	2570	2650	2730	13	26	39	52	65
64	2.2812	2894	2976	3060	3144	3228	3314	3400	3486	3574	14	28	43	57	71
65	2.3662	3751	3841	3931	4022	4114	4207	4300	4395	4490	15	31	46	62	77
66	2.4586	4683	4780	4879	4978	5078	5180	5282	5384	5488	17	34	50	67	84
67	2.5593	5699	5805	5913	6022	6131	6242	6354	6466	6580	18	37	55	73	92
68	2.6695	6811	6927	7046	7165	7285	7407	7529	7653	7778	20	40	60	81	101
69	2.7904	8032	8161	8291	8422	8555	8688	8824	8960	9099	22	44	67	89	111
70	2.9238	9379	9521	9665	9811	9957	0108	0258	0407	0558	25	49	74	98	123
71	3.0716	0872	1030	1190	1352	1515	1681	1848	2017	2188	27	55	82	110	137
72	3.2361	2535	2712	2891	3072	3255	3440	3628	3817	4009	31	61	92	123	153
73	3.4203	4399	4598	4799	5003	5209	5418	5629	5843	6060	35	69	104	138	173
74	3.6280	6502	6727	6955	7186	7420	7657	7897	8140	8387	39	79	118	157	196
75	3.8637	8890	9147	9408	9672	9939	0211	0488	0765	1048	45	90	135	180	225
76	4.1336	1627	1923	2223	2527	2837	3150	3469	3792	4121	52	104	156	207	260
77	4.4454	4793	5137	5486	5841	6202	6569	6942	7321	7706	61	121	182	242	303
78	4.8097	8496	8901	9313	9732	0159	0593	1034	1484	1942	72	143	215	287	359
79	5.2408	2883	3367	3860	4362	4874	5396	5928	6470	7023	86	172	258	344	431
80	5.759	5.816	5.875	5.935	5.996	6.059	6.123	6.188	6.255	6.323					
81	6.392	6.464	6.537	6.611	6.687	6.765	6.845	6.927	7.011	7.097					
82	7.185	7.276	7.368	7.463	7.561	7.661	7.764	7.870	7.979	8.091					
83	8.206	8.324	8.446	8.571	8.700	8.834	8.971	9.113	9.259	9.411					
84	9.57	9.73	9.90	10.07	10.25	10.43	10.63	10.83	11.03	11.25					
85	11.47	11.71	11.95	12.20	12.47	12.75	13.03	13.34	13.65	13.99					
86	14.34	14.70	15.09	15.50	15.93	16.38	16.86	17.37	17.91	18.49					
87	19.11	19.77	20.47	21.23	22.04	22.93	23.88	24.92	26.05	27.29					
88	28.65	30.16	31.84	33.71	35.81	38.20	40.93	44.08	47.75	52.09					
89	57.39	63.66	71.62	81.85	95.49	114.6	143.2	191.0	286.5	573.0					
	0'	6'	12'	18'	24'	30'	36'	42'	48'	54'	1'	2'	3'	4'	5'

Differences
untrustworthy
here

NATURAL COSECANTS

	0'	6'	12'	18'	24'	30'	36'	42'	48'	54'					
0	∞	573.0	286.5	191.0	143.2	114.6	95.49	81.85	71.62	63.66	Differences untrustworthy here				
1	57.30	52.09	47.75	44.08	40.93	38.20	35.81	33.71	31.84	30.16					
2	28.65	27.29	26.05	24.92	23.88	22.93	22.04	21.23	20.47	19.77					
3	19.11	18.49	17.91	17.37	16.86	16.38	15.93	15.50	15.09	14.70					
4	14.34	13.99	13.65	13.34	13.03	12.75	12.47	12.20	11.95	11.71					
5	11.47	11.25	11.03	10.83	10.63	10.43	10.25	10.07	9.90	9.73					
6	9.567	9.411	9.259	9.113	8.971	8.834	8.700	8.571	8.446	8.324					
7	8.206	8.091	7.979	7.870	7.764	7.661	7.561	7.463	7.368	7.276					
8	7.185	7.097	7.011	6.927	6.845	6.765	6.687	6.611	6.537	6.464	SUBTRACT				
											1'	2'	3'	4'	5'
9	6.392	6.323	6.255	6.188	6.123	6.059	5.996	5.935	5.875	5.816	86	172	258	344	431
10	5.7588	5.7023	5.6470	5.5928	5.5396	5.4874	5.4362	5.3860	5.3367	5.2883	72	143	215	287	359
11	5.2408	5.1942	5.1484	5.1034	5.0593	5.0159	4.9732	4.9313	4.8901	4.8496	61	121	182	242	303
12	4.8007	4.7606	4.7211	4.6821	4.6436	4.6056	4.5681	4.5312	4.4949	4.4593	52	104	156	207	260
13	4.4454	4.4121	4.3792	4.3469	4.3150	4.2837	4.2527	4.2223	4.1923	4.1627	45	90	135	180	225
14	4.1336	4.1048	4.0765	4.0486	4.0211	3.9939	3.9672	3.9408	3.9147	3.8890	39	79	118	157	196
15	3.8637	3.8387	3.8140	3.7897	3.7657	3.7420	3.7186	3.6955	3.6727	3.6502	35	69	104	138	173
16	3.6280	3.6060	3.5843	3.5629	3.5418	3.5209	3.5003	3.4799	3.4598	3.4399	31	61	92	123	153
17	3.4203	3.4009	3.3817	3.3628	3.3440	3.3255	3.3072	3.2891	3.2712	3.2535	27	55	82	110	137
18	3.2361	3.2188	3.2017	3.1848	3.1681	3.1515	3.1352	3.1190	3.1030	3.0872	25	49	74	98	123
19	3.0716	3.0561	3.0407	3.0256	3.0106	2.9957	2.9811	2.9665	2.9521	2.9379	22	44	67	89	111
20	2.9238	2.9099	2.8960	2.8824	2.8688	2.8555	2.8422	2.8291	2.8161	2.8032	20	40	60	81	101
21	2.7904	2.7778	2.7653	2.7529	2.7407	2.7285	2.7165	2.7046	2.6927	2.6811	18	37	55	73	92
22	2.6605	2.6480	2.6356	2.6234	2.6113	2.6022	2.5931	2.5840	2.5750	2.5660	17	34	50	67	84
23	2.5593	2.5488	2.5384	2.5282	2.5180	2.5078	2.4978	2.4879	2.4780	2.4683	15	31	46	62	77
24	2.4586	2.4490	2.4395	2.4300	2.4207	2.4114	2.4022	2.3931	2.3841	2.3751	14	28	43	57	71
25	2.3662	2.3574	2.3486	2.3400	2.3314	2.3228	2.3144	2.3060	2.2976	2.2894	13	26	39	52	65
26	2.2812	2.2730	2.2650	2.2570	2.2490	2.2412	2.2333	2.2256	2.2179	2.2103	12	24	36	48	61
27	2.2027	2.1952	2.1877	2.1803	2.1730	2.1657	2.1584	2.1513	2.1441	2.1371	11	22	34	45	56
28	2.1301	2.1231	2.1162	2.1093	2.1025	2.0957	2.0890	2.0824	2.0757	2.0692	10	21	31	42	52
29	2.0627	2.0562	2.0498	2.0434	2.0371	2.0308	2.0245	2.0183	2.0122	2.0061	10	19	29	39	49
30	2.0000	1.9940	1.9880	1.9821	1.9762	1.9703	1.9645	1.9587	1.9530	1.9471	9	18	27	36	45
31	1.9416	1.9360	1.9304	1.9249	1.9194	1.9139	1.9084	1.9031	1.8977	1.8924	8	17	25	34	42
32	1.8871	1.8818	1.8766	1.8714	1.8663	1.8612	1.8561	1.8510	1.8460	1.8410	8	16	24	32	40
33	1.8361	1.8312	1.8263	1.8214	1.8166	1.8118	1.8070	1.8023	1.7976	1.7929	7	15	22	30	37
34	1.7883	1.7837	1.7791	1.7745	1.7700	1.7655	1.7610	1.7566	1.7522	1.7478	7	14	21	28	35
35	1.7434	1.7391	1.7348	1.7305	1.7263	1.7221	1.7179	1.7137	1.7095	1.7054	7	13	20	26	33
36	1.7013	1.6972	1.6932	1.6892	1.6852	1.6812	1.6772	1.6733	1.6694	1.6655	6	12	19	25	31
37	1.6616	1.6578	1.6540	1.6502	1.6464	1.6427	1.6390	1.6353	1.6316	1.6279	6	12	18	23	29
38	1.6243	1.6207	1.6171	1.6135	1.6099	1.6064	1.6029	1.5994	1.5959	1.5925	6	11	17	22	28
39	1.5890	1.5856	1.5822	1.5788	1.5755	1.5721	1.5688	1.5655	1.5622	1.5590	5	10	16	21	26
40	1.5557	1.5525	1.5493	1.5461	1.5429	1.5398	1.5366	1.5335	1.5304	1.5273	5	10	16	21	26
41	1.5243	1.5212	1.5182	1.5151	1.5121	1.5092	1.5062	1.5032	1.5003	1.4974	5	10	15	20	25
42	1.4945	1.4916	1.4887	1.4859	1.4830	1.4802	1.4774	1.4746	1.4718	1.4690	5	9	14	19	23
43	1.4663	1.4635	1.4608	1.4581	1.4554	1.4527	1.4501	1.4474	1.4448	1.4422	4	9	13	18	22
44	1.4396	1.4370	1.4344	1.4318	1.4293	1.4267	1.4242	1.4217	1.4192	1.4167	4	8	13	17	21
	0'	6'	12'	18'	24'	30'	36'	42'	48'	54'	1'	2'	3'	4'	5'

The black type indicates that the integer changes.

NATURAL COSECANTS SUBTRACT 20

	0'	6'	12'	18'	24'	30'	36'	42'	48'	54'	1'	2'	3'	4'	5'
45	1.4142	4118	4093	4069	4044	4020	3996	3972	3949	3925	4	8	12	16	20
46	1.3902	3878	3855	3832	3809	3786	3763	3741	3718	3696	4	8	11	15	19
47	1.3673	3651	3629	3607	3585	3563	3542	3520	3499	3478	4	7	11	14	18
48	1.3456	3435	3414	3393	3373	3352	3331	3311	3291	3270	3	7	10	14	17
49	1.3250	3230	3210	3190	3171	3151	3131	3112	3093	3073	3	7	10	13	16
50	1.3054	3035	3016	2997	2978	2960	2941	2923	2904	2886	3	6	9	12	16
51	1.2868	2849	2831	2813	2796	2778	2760	2742	2725	2708	3	6	9	12	15
52	1.2690	2673	2656	2639	2622	2605	2588	2571	2554	2538	3	6	8	11	14
53	1.2521	2505	2489	2472	2456	2440	2424	2408	2392	2376	3	5	8	11	13
54	1.2361	2345	2329	2314	2299	2283	2268	2253	2238	2223	3	5	8	10	13
55	1.2208	2193	2178	2163	2149	2134	2120	2105	2091	2076	2	5	7	10	12
56	1.2062	2048	2034	2020	2006	1992	1978	1964	1951	1937	2	5	7	9	12
57	1.1924	1910	1897	1883	1870	1857	1844	1831	1818	1805	2	4	7	9	11
58	1.1792	1779	1766	1753	1741	1728	1716	1703	1691	1679	2	4	6	8	10
59	1.1666	1654	1642	1630	1618	1606	1594	1582	1570	1559	2	4	6	8	10
60	1.1547	1535	1524	1512	1501	1490	1478	1467	1456	1445	2	4	6	8	9
61	1.1434	1423	1412	1401	1390	1379	1368	1357	1347	1336	2	4	5	7	9
62	1.1326	1315	1305	1294	1284	1274	1264	1253	1243	1233	2	3	5	7	9
63	1.1223	1213	1203	1194	1184	1174	1164	1155	1145	1136	2	3	5	6	8
64	1.1126	1117	1107	1098	1089	1079	1070	1061	1052	1043	2	3	5	6	8
65	1.1034	1025	1016	1007	998	989	980	972	963	955	1	3	4	6	7
66	1.0946	0938	0929	0921	0913	0904	0896	0888	0880	0872	1	3	4	6	7
67	1.0864	0856	0848	0840	0832	0824	0816	0808	0801	0793	1	3	4	5	7
68	1.0785	0778	0770	0763	0755	0748	0740	0733	0726	0719	1	2	4	5	6
69	1.0711	0704	0697	0690	0683	0676	0669	0662	0655	0649	1	2	3	5	6
70	1.0642	0635	0628	0622	0615	0608	0602	0595	0589	0583	1	2	3	4	5
71	1.0576	0570	0564	0557	0551	0545	0539	0533	0527	0521	1	2	3	4	5
72	1.0515	0509	0503	0497	0491	0485	0480	0474	0468	0463	1	2	3	4	5
73	1.0457	0451	0446	0440	0435	0429	0424	0419	0413	0408	1	2	3	4	4
74	1.0403	0398	0393	0388	0382	0377	0372	0367	0363	0358	1	2	3	3	4
75	1.0353	0348	0343	0338	0334	0329	0324	0320	0315	0311	1	2	2	3	4
76	1.0306	0302	0297	0293	0288	0284	0280	0276	0271	0267	1	1	2	3	4
77	1.0263	0259	0255	0251	0247	0243	0239	0235	0231	0227	1	1	2	3	3
78	1.0223	0220	0216	0212	0209	0205	0201	0198	0194	0191	1	1	2	2	3
79	1.0187	0184	0180	0177	0174	0170	0167	0164	0161	0157	1	1	2	2	3