



Trigonometric Tables

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Degrees	Radians	$\sin(x)$	$\cos(x)$	$\tan(x)$	$\sec(x)$	$\csc(x)$	$\cot(x)$
0°	0.000000	0.000000	1.000000	0.000000	1.000000	undefined	undefined
1°	0.017453	0.017452	0.999848	0.017455	1.000152	57.298688	57.289962
2°	0.034907	0.034899	0.999391	0.034921	1.000610	28.653708	28.636253
3°	0.052360	0.052336	0.998630	0.052408	1.001372	19.107323	19.081137
4°	0.069813	0.069756	0.997564	0.069927	1.002442	14.335587	14.300666
5°	0.087266	0.087156	0.996195	0.087489	1.003820	11.473713	11.430052
6°	0.104720	0.104528	0.994522	0.105104	1.005508	9.566772	9.514364
7°	0.122173	0.121869	0.992546	0.122785	1.007510	8.205509	8.144346
8°	0.139626	0.139173	0.990268	0.140541	1.009828	7.185297	7.115370
9°	0.157080	0.156434	0.987688	0.158384	1.012465	6.392453	6.313752
10°	0.174533	0.173648	0.984808	0.176327	1.015427	5.758770	5.671282
11°	0.191986	0.190809	0.981627	0.194380	1.018717	5.240843	5.144554
12°	0.209440	0.207912	0.978148	0.212557	1.022341	4.809734	4.704630
13°	0.226893	0.224951	0.974370	0.230868	1.026304	4.445411	4.331476
14°	0.244346	0.241922	0.970296	0.249328	1.030614	4.133565	4.010781
15°	0.261799	0.258819	0.965926	0.267949	1.035276	3.863703	3.732051
16°	0.279253	0.275637	0.961262	0.286745	1.040299	3.627955	3.487414
17°	0.296706	0.292372	0.956305	0.305731	1.045692	3.420304	3.270853
18°	0.314159	0.309017	0.951057	0.324920	1.051462	3.236068	3.077684
19°	0.331613	0.325568	0.945519	0.344328	1.057621	3.071553	2.904211
20°	0.349066	0.342020	0.939693	0.363970	1.064178	2.923804	2.747477



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21Â°	0.366519	0.358368	0.933580	0.383864	1.071145	2.790428	2.605089
22Â°	0.383972	0.374607	0.927184	0.404026	1.078535	2.669467	2.475087
23Â°	0.401426	0.390731	0.920505	0.424475	1.086360	2.559305	2.355852
24Â°	0.418879	0.406737	0.913545	0.445229	1.094636	2.458593	2.246037
25Â°	0.436332	0.422618	0.906308	0.466308	1.103378	2.366202	2.144507
26Â°	0.453786	0.438371	0.898794	0.487733	1.112602	2.281172	2.050304
27Â°	0.471239	0.453990	0.891007	0.509525	1.122326	2.202689	1.962611
28Â°	0.488692	0.469472	0.882948	0.531709	1.132570	2.130054	1.880726
29Â°	0.506145	0.484810	0.874620	0.554309	1.143354	2.062665	1.804048
30Â°	0.523599	0.500000	0.866025	0.577350	1.154701	2.000000	1.732051
31Â°	0.541052	0.515038	0.857167	0.600861	1.166633	1.941604	1.664279
32Â°	0.558505	0.529919	0.848048	0.624869	1.179178	1.887080	1.600335
33Â°	0.575959	0.544639	0.838671	0.649408	1.192363	1.836078	1.539865
34Â°	0.593412	0.559193	0.829038	0.674509	1.206218	1.788292	1.482561
35Â°	0.610865	0.573576	0.819152	0.700208	1.220775	1.743447	1.428148
36Â°	0.628319	0.587785	0.809017	0.726543	1.236068	1.701302	1.376382
37Â°	0.645772	0.601815	0.798636	0.753554	1.252136	1.661640	1.327045
38Â°	0.663225	0.615661	0.788011	0.781286	1.269018	1.624269	1.279942
39Â°	0.680678	0.629320	0.777146	0.809784	1.286760	1.589016	1.234897
40Â°	0.698132	0.642788	0.766044	0.839100	1.305407	1.555724	1.191754
41Â°	0.715585	0.656059	0.754710	0.869287	1.325013	1.524253	1.150368
42Â°	0.733038	0.669131	0.743145	0.900404	1.345633	1.494477	1.110613
43Â°	0.750492	0.681998	0.731354	0.932515	1.367327	1.466279	1.072369



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44°	0.767945	0.694658	0.719340	0.965689	1.390164	1.439557	1.035530
45°	0.785398	0.707107	0.707107	1.000000	1.414214	1.414214	1.000000
46°	0.802851	0.719340	0.694658	1.035530	1.439557	1.390164	0.965689
47°	0.820305	0.731354	0.681998	1.072369	1.466279	1.367327	0.932515
48°	0.837758	0.743145	0.669131	1.110613	1.494477	1.345633	0.900404
49°	0.855211	0.754710	0.656059	1.150368	1.524253	1.325013	0.869287
50°	0.872665	0.766044	0.642788	1.191754	1.555724	1.305407	0.839100
51°	0.890118	0.777146	0.629320	1.234897	1.589016	1.286760	0.809784
52°	0.907571	0.788011	0.615661	1.279942	1.624269	1.269018	0.781286
53°	0.925025	0.798636	0.601815	1.327045	1.661640	1.252136	0.753554
54°	0.942478	0.809017	0.587785	1.376382	1.701302	1.236068	0.726543
55°	0.959931	0.819152	0.573576	1.428148	1.743447	1.220775	0.700208
56°	0.977384	0.829038	0.559193	1.482561	1.788292	1.206218	0.674509
57°	0.994838	0.838671	0.544639	1.539865	1.836078	1.192363	0.649408
58°	1.012291	0.848048	0.529919	1.600335	1.887080	1.179178	0.624869
59°	1.029744	0.857167	0.515038	1.664279	1.941604	1.166633	0.600861
60°	1.047198	0.866025	0.500000	1.732051	2.000000	1.154701	0.577350
61°	1.064651	0.874620	0.484810	1.804048	2.062665	1.143354	0.554309
62°	1.082104	0.882948	0.469472	1.880726	2.130054	1.132570	0.531709
63°	1.099557	0.891007	0.453990	1.962611	2.202689	1.122326	0.509525
64°	1.117011	0.898794	0.438371	2.050304	2.281172	1.112602	0.487733
65°	1.134464	0.906308	0.422618	2.144507	2.366202	1.103378	0.466308
66°	1.151917	0.913545	0.406737	2.246037	2.458593	1.094636	0.445229



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67°	1.169371	0.920505	0.390731	2.355852	2.559305	1.086360	0.424475
68°	1.186824	0.927184	0.374607	2.475087	2.669467	1.078535	0.404026
69°	1.204277	0.933580	0.358368	2.605089	2.790428	1.071145	0.383864
70°	1.221730	0.939693	0.342020	2.747477	2.923804	1.064178	0.363970
71°	1.239184	0.945519	0.325568	2.904211	3.071553	1.057621	0.344328
72°	1.256637	0.951057	0.309017	3.077684	3.236068	1.051462	0.324920
73°	1.274090	0.956305	0.292372	3.270853	3.420304	1.045692	0.305731
74°	1.291544	0.961262	0.275637	3.487414	3.627955	1.040299	0.286745
75°	1.308997	0.965926	0.258819	3.732051	3.863703	1.035276	0.267949
76°	1.326450	0.970296	0.241922	4.010781	4.133565	1.030614	0.249328
77°	1.343904	0.974370	0.224951	4.331476	4.445411	1.026304	0.230868
78°	1.361357	0.978148	0.207912	4.704630	4.809734	1.022341	0.212557
79°	1.378810	0.981627	0.190809	5.144554	5.240843	1.018717	0.194380
80°	1.396263	0.984808	0.173648	5.671282	5.758770	1.015427	0.176327
81°	1.413717	0.987688	0.156434	6.313752	6.392453	1.012465	0.158384
82°	1.431170	0.990268	0.139173	7.115370	7.185297	1.009828	0.140541
83°	1.448623	0.992546	0.121869	8.144346	8.205509	1.007510	0.122785
84°	1.466077	0.994522	0.104528	9.514364	9.566772	1.005508	0.105104
85°	1.483530	0.996195	0.087156	11.430052	11.473713	1.003820	0.087489
86°	1.500983	0.997564	0.069756	14.300666	14.335587	1.002442	0.069927
87°	1.518436	0.998630	0.052336	19.081137	19.107323	1.001372	0.052408
88°	1.535890	0.999391	0.034899	28.636253	28.653708	1.000610	0.034921
89°	1.553343	0.999848	0.017452	57.289962	57.298688	1.000152	0.017455



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90°	1.570796	1.000000	0.000000	undefined	undefined	1.000000	0.000000
91°	1.588250	0.999848	-0.017452	-57.289962	-57.298688	1.000152	-0.017455
92°	1.605703	0.999391	-0.034899	-28.636253	-28.653708	1.000610	-0.034921
93°	1.623156	0.998630	-0.052336	-19.081137	-19.107323	1.001372	-0.052408
94°	1.640609	0.997564	-0.069756	-14.300666	-14.335587	1.002442	-0.069927
95°	1.658063	0.996195	-0.087156	-11.430052	-11.473713	1.003820	-0.087489
96°	1.675516	0.994522	-0.104528	-9.514364	-9.566772	1.005508	-0.105104
97°	1.692969	0.992546	-0.121869	-8.144346	-8.205509	1.007510	-0.122785
98°	1.710423	0.990268	-0.139173	-7.115370	-7.185297	1.009828	-0.140541
99°	1.727876	0.987688	-0.156434	-6.313752	-6.392453	1.012465	-0.158384
100°	1.745329	0.984808	-0.173648	-5.671282	-5.758770	1.015427	-0.176327
101°	1.762783	0.981627	-0.190809	-5.144554	-5.240843	1.018717	-0.194380
102°	1.780236	0.978148	-0.207912	-4.704630	-4.809734	1.022341	-0.212557
103°	1.797689	0.974370	-0.224951	-4.331476	-4.445411	1.026304	-0.230868
104°	1.815142	0.970296	-0.241922	-4.010781	-4.133565	1.030614	-0.249328
105°	1.832596	0.965926	-0.258819	-3.732051	-3.863703	1.035276	-0.267949
106°	1.850049	0.961262	-0.275637	-3.487414	-3.627955	1.040299	-0.286745
107°	1.867502	0.956305	-0.292372	-3.270853	-3.420304	1.045692	-0.305731
108°	1.884956	0.951057	-0.309017	-3.077684	-3.236068	1.051462	-0.324920
109°	1.902409	0.945519	-0.325568	-2.904211	-3.071553	1.057621	-0.344328
110°	1.919862	0.939693	-0.342020	-2.747477	-2.923804	1.064178	-0.363970
111°	1.937315	0.933580	-0.358368	-2.605089	-2.790428	1.071145	-0.383864
112°	1.954769	0.927184	-0.374607	-2.475087	-2.669467	1.078535	-0.404026



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113°	1.972222	0.920505	-0.390731	-2.355852	-2.559305	1.086360	-0.424475
114°	1.989675	0.913545	-0.406737	-2.246037	-2.458593	1.094636	-0.445229
115°	2.007129	0.906308	-0.422618	-2.144507	-2.366202	1.103378	-0.466308
116°	2.024582	0.898794	-0.438371	-2.050304	-2.281172	1.112602	-0.487733
117°	2.042035	0.891007	-0.453990	-1.962611	-2.202689	1.122326	-0.509525
118°	2.059489	0.882948	-0.469472	-1.880726	-2.130054	1.132570	-0.531709
119°	2.076942	0.874620	-0.484810	-1.804048	-2.062665	1.143354	-0.554309
120°	2.094395	0.866025	-0.500000	-1.732051	-2.000000	1.154701	-0.577350
121°	2.111848	0.857167	-0.515038	-1.664279	-1.941604	1.166633	-0.600861
122°	2.129302	0.848048	-0.529919	-1.600335	-1.887080	1.179178	-0.624869
123°	2.146755	0.838671	-0.544639	-1.539865	-1.836078	1.192363	-0.649408
124°	2.164208	0.829038	-0.559193	-1.482561	-1.788292	1.206218	-0.674509
125°	2.181662	0.819152	-0.573576	-1.428148	-1.743447	1.220775	-0.700208
126°	2.199115	0.809017	-0.587785	-1.376382	-1.701302	1.236068	-0.726543
127°	2.216568	0.798636	-0.601815	-1.327045	-1.661640	1.252136	-0.753554
128°	2.234021	0.788011	-0.615661	-1.279942	-1.624269	1.269018	-0.781286
129°	2.251475	0.777146	-0.629320	-1.234897	-1.589016	1.286760	-0.809784
130°	2.268928	0.766044	-0.642788	-1.191754	-1.555724	1.305407	-0.839100
131°	2.286381	0.754710	-0.656059	-1.150368	-1.524253	1.325013	-0.869287
132°	2.303835	0.743145	-0.669131	-1.110613	-1.494477	1.345633	-0.900404
133°	2.321288	0.731354	-0.681998	-1.072369	-1.466279	1.367327	-0.932515
134°	2.338741	0.719340	-0.694658	-1.035530	-1.439557	1.390164	-0.965689
135°	2.356194	0.707107	-0.707107	-1.000000	-1.414214	1.414214	-1.000000



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136°	2.373648	0.694658	-0.719340	-0.965689	-1.390164	1.439557	-1.035530
137°	2.391101	0.681998	-0.731354	-0.932515	-1.367327	1.466279	-1.072369
138°	2.408554	0.669131	-0.743145	-0.900404	-1.345633	1.494477	-1.110613
139°	2.426008	0.656059	-0.754710	-0.869287	-1.325013	1.524253	-1.150368
140°	2.443461	0.642788	-0.766044	-0.839100	-1.305407	1.555724	-1.191754
141°	2.460914	0.629320	-0.777146	-0.809784	-1.286760	1.589016	-1.234897
142°	2.478368	0.615661	-0.788011	-0.781286	-1.269018	1.624269	-1.279942
143°	2.495821	0.601815	-0.798636	-0.753554	-1.252136	1.661640	-1.327045
144°	2.513274	0.587785	-0.809017	-0.726543	-1.236068	1.701302	-1.376382
145°	2.530727	0.573576	-0.819152	-0.700208	-1.220775	1.743447	-1.428148
146°	2.548181	0.559193	-0.829038	-0.674509	-1.206218	1.788292	-1.482561
147°	2.565634	0.544639	-0.838671	-0.649408	-1.192363	1.836078	-1.539865
148°	2.583087	0.529919	-0.848048	-0.624869	-1.179178	1.887080	-1.600335
149°	2.600541	0.515038	-0.857167	-0.600861	-1.166633	1.941604	-1.664279
150°	2.617994	0.500000	-0.866025	-0.577350	-1.154701	2.000000	-1.732051
151°	2.635447	0.484810	-0.874620	-0.554309	-1.143354	2.062665	-1.804048
152°	2.652900	0.469472	-0.882948	-0.531709	-1.132570	2.130054	-1.880726
153°	2.670354	0.453990	-0.891007	-0.509525	-1.122326	2.202689	-1.962611
154°	2.687807	0.438371	-0.898794	-0.487733	-1.112602	2.281172	-2.050304
155°	2.705260	0.422618	-0.906308	-0.466308	-1.103378	2.366202	-2.144507
156°	2.722714	0.406737	-0.913545	-0.445229	-1.094636	2.458593	-2.246037
157°	2.740167	0.390731	-0.920505	-0.424475	-1.086360	2.559305	-2.355852
158°	2.757620	0.374607	-0.927184	-0.404026	-1.078535	2.669467	-2.475087



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159°	2.775074	0.358368	-0.933580	-0.383864	-1.071145	2.790428	-2.605089
160°	2.792527	0.342020	-0.939693	-0.363970	-1.064178	2.923804	-2.747477
161°	2.809980	0.325568	-0.945519	-0.344328	-1.057621	3.071553	-2.904211
162°	2.827433	0.309017	-0.951057	-0.324920	-1.051462	3.236068	-3.077684
163°	2.844887	0.292372	-0.956305	-0.305731	-1.045692	3.420304	-3.270853
164°	2.862340	0.275637	-0.961262	-0.286745	-1.040299	3.627955	-3.487414
165°	2.879793	0.258819	-0.965926	-0.267949	-1.035276	3.863703	-3.732051
166°	2.897247	0.241922	-0.970296	-0.249328	-1.030614	4.133565	-4.010781
167°	2.914700	0.224951	-0.974370	-0.230868	-1.026304	4.445411	-4.331476
168°	2.932153	0.207912	-0.978148	-0.212557	-1.022341	4.809734	-4.704630
169°	2.949606	0.190809	-0.981627	-0.194380	-1.018717	5.240843	-5.144554
170°	2.967060	0.173648	-0.984808	-0.176327	-1.015427	5.758770	-5.671282
171°	2.984513	0.156434	-0.987688	-0.158384	-1.012465	6.392453	-6.313752
172°	3.001966	0.139173	-0.990268	-0.140541	-1.009828	7.185297	-7.115370
173°	3.019420	0.121869	-0.992546	-0.122785	-1.007510	8.205509	-8.144346
174°	3.036873	0.104528	-0.994522	-0.105104	-1.005508	9.566772	-9.514364
175°	3.054326	0.087156	-0.996195	-0.087489	-1.003820	11.473713	-11.430052
176°	3.071779	0.069756	-0.997564	-0.069927	-1.002442	14.335587	-14.300666
177°	3.089233	0.052336	-0.998630	-0.052408	-1.001372	19.107323	-19.081137
178°	3.106686	0.034899	-0.999391	-0.034921	-1.000610	28.653708	-28.636253
179°	3.124139	0.017452	-0.999848	-0.017455	-1.000152	57.298688	-57.289962
180°	3.141593	0.000000	-1.000000	-0.000000	-1.000000	undefined	undefined
181°	3.159046	-0.017452	-0.999848	0.017455	-1.000152	-57.298688	57.289962



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182°	3.176499	-0.034899	-0.999391	0.034921	-1.000610	-28.653708	28.636253
183°	3.193953	-0.052336	-0.998630	0.052408	-1.001372	-19.107323	19.081137
184°	3.211406	-0.069756	-0.997564	0.069927	-1.002442	-14.335587	14.300666
185°	3.228859	-0.087156	-0.996195	0.087489	-1.003820	-11.473713	11.430052
186°	3.246312	-0.104528	-0.994522	0.105104	-1.005508	-9.566772	9.514364
187°	3.263766	-0.121869	-0.992546	0.122785	-1.007510	-8.205509	8.144346
188°	3.281219	-0.139173	-0.990268	0.140541	-1.009828	-7.185297	7.115370
189°	3.298672	-0.156434	-0.987688	0.158384	-1.012465	-6.392453	6.313752
190°	3.316126	-0.173648	-0.984808	0.176327	-1.015427	-5.758770	5.671282
191°	3.333579	-0.190809	-0.981627	0.194380	-1.018717	-5.240843	5.144554
192°	3.351032	-0.207912	-0.978148	0.212557	-1.022341	-4.809734	4.704630
193°	3.368485	-0.224951	-0.974370	0.230868	-1.026304	-4.445411	4.331476
194°	3.385939	-0.241922	-0.970296	0.249328	-1.030614	-4.133565	4.010781
195°	3.403392	-0.258819	-0.965926	0.267949	-1.035276	-3.863703	3.732051
196°	3.420845	-0.275637	-0.961262	0.286745	-1.040299	-3.627955	3.487414
197°	3.438299	-0.292372	-0.956305	0.305731	-1.045692	-3.420304	3.270853
198°	3.455752	-0.309017	-0.951057	0.324920	-1.051462	-3.236068	3.077684
199°	3.473205	-0.325568	-0.945519	0.344328	-1.057621	-3.071553	2.904211
200°	3.490659	-0.342020	-0.939693	0.363970	-1.064178	-2.923804	2.747477
201°	3.508112	-0.358368	-0.933580	0.383864	-1.071145	-2.790428	2.605089
202°	3.525565	-0.374607	-0.927184	0.404026	-1.078535	-2.669467	2.475087
203°	3.543018	-0.390731	-0.920505	0.424475	-1.086360	-2.559305	2.355852
204°	3.560472	-0.406737	-0.913545	0.445229	-1.094636	-2.458593	2.246037



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205°	3.577925	-0.422618	-0.906308	0.466308	-1.103378	-2.366202	2.144507
206°	3.595378	-0.438371	-0.898794	0.487733	-1.112602	-2.281172	2.050304
207°	3.612832	-0.453990	-0.891007	0.509525	-1.122326	-2.202689	1.962611
208°	3.630285	-0.469472	-0.882948	0.531709	-1.132570	-2.130054	1.880726
209°	3.647738	-0.484810	-0.874620	0.554309	-1.143354	-2.062665	1.804048
210°	3.665191	-0.500000	-0.866025	0.577350	-1.154701	-2.000000	1.732051
211°	3.682645	-0.515038	-0.857167	0.600861	-1.166633	-1.941604	1.664279
212°	3.700098	-0.529919	-0.848048	0.624869	-1.179178	-1.887080	1.600335
213°	3.717551	-0.544639	-0.838671	0.649408	-1.192363	-1.836078	1.539865
214°	3.735005	-0.559193	-0.829038	0.674509	-1.206218	-1.788292	1.482561
215°	3.752458	-0.573576	-0.819152	0.700208	-1.220775	-1.743447	1.428148
216°	3.769911	-0.587785	-0.809017	0.726543	-1.236068	-1.701302	1.376382
217°	3.787364	-0.601815	-0.798636	0.753554	-1.252136	-1.661640	1.327045
218°	3.804818	-0.615661	-0.788011	0.781286	-1.269018	-1.624269	1.279942
219°	3.822271	-0.629320	-0.777146	0.809784	-1.286760	-1.589016	1.234897
220°	3.839724	-0.642788	-0.766044	0.839100	-1.305407	-1.555724	1.191754
221°	3.857178	-0.656059	-0.754710	0.869287	-1.325013	-1.524253	1.150368
222°	3.874631	-0.669131	-0.743145	0.900404	-1.345633	-1.494477	1.110613
223°	3.892084	-0.681998	-0.731354	0.932515	-1.367327	-1.466279	1.072369
224°	3.909538	-0.694658	-0.719340	0.965689	-1.390164	-1.439557	1.035530
225°	3.926991	-0.707107	-0.707107	1.000000	-1.414214	-1.414214	1.000000
226°	3.944444	-0.719340	-0.694658	1.035530	-1.439557	-1.390164	0.965689
227°	3.961897	-0.731354	-0.681998	1.072369	-1.466279	-1.367327	0.932515



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228°	3.979351	-0.743145	-0.669131	1.110613	-1.494477	-1.345633	0.900404
229°	3.996804	-0.754710	-0.656059	1.150368	-1.524253	-1.325013	0.869287
230°	4.014257	-0.766044	-0.642788	1.191754	-1.555724	-1.305407	0.839100
231°	4.031711	-0.777146	-0.629320	1.234897	-1.589016	-1.286760	0.809784
232°	4.049164	-0.788011	-0.615661	1.279942	-1.624269	-1.269018	0.781286
233°	4.066617	-0.798636	-0.601815	1.327045	-1.661640	-1.252136	0.753554
234°	4.084070	-0.809017	-0.587785	1.376382	-1.701302	-1.236068	0.726543
235°	4.101524	-0.819152	-0.573576	1.428148	-1.743447	-1.220775	0.700208
236°	4.118977	-0.829038	-0.559193	1.482561	-1.788292	-1.206218	0.674509
237°	4.136430	-0.838671	-0.544639	1.539865	-1.836078	-1.192363	0.649408
238°	4.153884	-0.848048	-0.529919	1.600335	-1.887080	-1.179178	0.624869
239°	4.171337	-0.857167	-0.515038	1.664279	-1.941604	-1.166633	0.600861
240°	4.188790	-0.866025	-0.500000	1.732051	-2.000000	-1.154701	0.577350
241°	4.206243	-0.874620	-0.484810	1.804048	-2.062665	-1.143354	0.554309
242°	4.223697	-0.882948	-0.469472	1.880726	-2.130054	-1.132570	0.531709
243°	4.241150	-0.891007	-0.453990	1.962611	-2.202689	-1.122326	0.509525
244°	4.258603	-0.898794	-0.438371	2.050304	-2.281172	-1.112602	0.487733
245°	4.276057	-0.906308	-0.422618	2.144507	-2.366202	-1.103378	0.466308
246°	4.293510	-0.913545	-0.406737	2.246037	-2.458593	-1.094636	0.445229
247°	4.310963	-0.920505	-0.390731	2.355852	-2.559305	-1.086360	0.424475
248°	4.328417	-0.927184	-0.374607	2.475087	-2.669467	-1.078535	0.404026
249°	4.345870	-0.933580	-0.358368	2.605089	-2.790428	-1.071145	0.383864
250°	4.363323	-0.939693	-0.342020	2.747477	-2.923804	-1.064178	0.363970



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251°	4.380776	-0.945519	-0.325568	2.904211	-3.071553	-1.057621	0.344328
252°	4.398230	-0.951057	-0.309017	3.077684	-3.236068	-1.051462	0.324920
253°	4.415683	-0.956305	-0.292372	3.270853	-3.420304	-1.045692	0.305731
254°	4.433136	-0.961262	-0.275637	3.487414	-3.627955	-1.040299	0.286745
255°	4.450590	-0.965926	-0.258819	3.732051	-3.863703	-1.035276	0.267949
256°	4.468043	-0.970296	-0.241922	4.010781	-4.133565	-1.030614	0.249328
257°	4.485496	-0.974370	-0.224951	4.331476	-4.445411	-1.026304	0.230868
258°	4.502949	-0.978148	-0.207912	4.704630	-4.809734	-1.022341	0.212557
259°	4.520403	-0.981627	-0.190809	5.144554	-5.240843	-1.018717	0.194380
260°	4.537856	-0.984808	-0.173648	5.671282	-5.758770	-1.015427	0.176327
261°	4.555309	-0.987688	-0.156434	6.313752	-6.392453	-1.012465	0.158384
262°	4.572763	-0.990268	-0.139173	7.115370	-7.185297	-1.009828	0.140541
263°	4.590216	-0.992546	-0.121869	8.144346	-8.205509	-1.007510	0.122785
264°	4.607669	-0.994522	-0.104528	9.514364	-9.566772	-1.005508	0.105104
265°	4.625123	-0.996195	-0.087156	11.430052	-11.473713	-1.003820	0.087489
266°	4.642576	-0.997564	-0.069756	14.300666	-14.335587	-1.002442	0.069927
267°	4.660029	-0.998630	-0.052336	19.081137	-19.107323	-1.001372	0.052408
268°	4.677482	-0.999391	-0.034899	28.636253	-28.653708	-1.000610	0.034921
269°	4.694936	-0.999848	-0.017452	57.289962	-57.298688	-1.000152	0.017455
270°	4.712389	-1.000000	-0.000000	undefined	undefined	-1.000000	0.000000
271°	4.729842	-0.999848	0.017452	-57.289962	57.298688	-1.000152	-0.017455
272°	4.747296	-0.999391	0.034899	-28.636253	28.653708	-1.000610	-0.034921
273°	4.764749	-0.998630	0.052336	-19.081137	19.107323	-1.001372	-0.052408



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274°	4.782202	-0.997564	0.069756	-14.300666	14.335587	-1.002442	-0.069927
275°	4.799655	-0.996195	0.087156	-11.430052	11.473713	-1.003820	-0.087489
276°	4.817109	-0.994522	0.104528	-9.514364	9.566772	-1.005508	-0.105104
277°	4.834562	-0.992546	0.121869	-8.144346	8.205509	-1.007510	-0.122785
278°	4.852015	-0.990268	0.139173	-7.115370	7.185297	-1.009828	-0.140541
279°	4.869469	-0.987688	0.156434	-6.313752	6.392453	-1.012465	-0.158384
280°	4.886922	-0.984808	0.173648	-5.671282	5.758770	-1.015427	-0.176327
281°	4.904375	-0.981627	0.190809	-5.144554	5.240843	-1.018717	-0.194380
282°	4.921828	-0.978148	0.207912	-4.704630	4.809734	-1.022341	-0.212557
283°	4.939282	-0.974370	0.224951	-4.331476	4.445411	-1.026304	-0.230868
284°	4.956735	-0.970296	0.241922	-4.010781	4.133565	-1.030614	-0.249328
285°	4.974188	-0.965926	0.258819	-3.732051	3.863703	-1.035276	-0.267949
286°	4.991642	-0.961262	0.275637	-3.487414	3.627955	-1.040299	-0.286745
287°	5.009095	-0.956305	0.292372	-3.270853	3.420304	-1.045692	-0.305731
288°	5.026548	-0.951057	0.309017	-3.077684	3.236068	-1.051462	-0.324920
289°	5.044002	-0.945519	0.325568	-2.904211	3.071553	-1.057621	-0.344328
290°	5.061455	-0.939693	0.342020	-2.747477	2.923804	-1.064178	-0.363970
291°	5.078908	-0.933580	0.358368	-2.605089	2.790428	-1.071145	-0.383864
292°	5.096361	-0.927184	0.374607	-2.475087	2.669467	-1.078535	-0.404026
293°	5.113815	-0.920505	0.390731	-2.355852	2.559305	-1.086360	-0.424475
294°	5.131268	-0.913545	0.406737	-2.246037	2.458593	-1.094636	-0.445229
295°	5.148721	-0.906308	0.422618	-2.144507	2.366202	-1.103378	-0.466308
296°	5.166175	-0.898794	0.438371	-2.050304	2.281172	-1.112602	-0.487733



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297°	5.183628	-0.891007	0.453990	-1.962611	2.202689	-1.122326	-0.509525
298°	5.201081	-0.882948	0.469472	-1.880726	2.130054	-1.132570	-0.531709
299°	5.218534	-0.874620	0.484810	-1.804048	2.062665	-1.143354	-0.554309
300°	5.235988	-0.866025	0.500000	-1.732051	2.000000	-1.154701	-0.577350
301°	5.253441	-0.857167	0.515038	-1.664279	1.941604	-1.166633	-0.600861
302°	5.270894	-0.848048	0.529919	-1.600335	1.887080	-1.179178	-0.624869
303°	5.288348	-0.838671	0.544639	-1.539865	1.836078	-1.192363	-0.649408
304°	5.305801	-0.829038	0.559193	-1.482561	1.788292	-1.206218	-0.674509
305°	5.323254	-0.819152	0.573576	-1.428148	1.743447	-1.220775	-0.700208
306°	5.340708	-0.809017	0.587785	-1.376382	1.701302	-1.236068	-0.726543
307°	5.358161	-0.798636	0.601815	-1.327045	1.661640	-1.252136	-0.753554
308°	5.375614	-0.788011	0.615661	-1.279942	1.624269	-1.269018	-0.781286
309°	5.393067	-0.777146	0.629320	-1.234897	1.589016	-1.286760	-0.809784
310°	5.410521	-0.766044	0.642788	-1.191754	1.555724	-1.305407	-0.839100
311°	5.427974	-0.754710	0.656059	-1.150368	1.524253	-1.325013	-0.869287
312°	5.445427	-0.743145	0.669131	-1.110613	1.494477	-1.345633	-0.900404
313°	5.462881	-0.731354	0.681998	-1.072369	1.466279	-1.367327	-0.932515
314°	5.480334	-0.719340	0.694658	-1.035530	1.439557	-1.390164	-0.965689
315°	5.497787	-0.707107	0.707107	-1.000000	1.414214	-1.414214	-1.000000
316°	5.515240	-0.694658	0.719340	-0.965689	1.390164	-1.439557	-1.035530
317°	5.532694	-0.681998	0.731354	-0.932515	1.367327	-1.466279	-1.072369
318°	5.550147	-0.669131	0.743145	-0.900404	1.345633	-1.494477	-1.110613
319°	5.567600	-0.656059	0.754710	-0.869287	1.325013	-1.524253	-1.150368



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320°	5.585054	-0.642788	0.766044	-0.839100	1.305407	-1.555724	-1.191754
321°	5.602507	-0.629320	0.777146	-0.809784	1.286760	-1.589016	-1.234897
322°	5.619960	-0.615661	0.788011	-0.781286	1.269018	-1.624269	-1.279942
323°	5.637413	-0.601815	0.798636	-0.753554	1.252136	-1.661640	-1.327045
324°	5.654867	-0.587785	0.809017	-0.726543	1.236068	-1.701302	-1.376382
325°	5.672320	-0.573576	0.819152	-0.700208	1.220775	-1.743447	-1.428148
326°	5.689773	-0.559193	0.829038	-0.674509	1.206218	-1.788292	-1.482561
327°	5.707227	-0.544639	0.838671	-0.649408	1.192363	-1.836078	-1.539865
328°	5.724680	-0.529919	0.848048	-0.624869	1.179178	-1.887080	-1.600335
329°	5.742133	-0.515038	0.857167	-0.600861	1.166633	-1.941604	-1.664279
330°	5.759587	-0.500000	0.866025	-0.577350	1.154701	-2.000000	-1.732051
331°	5.777040	-0.484810	0.874620	-0.554309	1.143354	-2.062665	-1.804048
332°	5.794493	-0.469472	0.882948	-0.531709	1.132570	-2.130054	-1.880726
333°	5.811946	-0.453990	0.891007	-0.509525	1.122326	-2.202689	-1.962611
334°	5.829400	-0.438371	0.898794	-0.487733	1.112602	-2.281172	-2.050304
335°	5.846853	-0.422618	0.906308	-0.466308	1.103378	-2.366202	-2.144507
336°	5.864306	-0.406737	0.913545	-0.445229	1.094636	-2.458593	-2.246037
337°	5.881760	-0.390731	0.920505	-0.424475	1.086360	-2.559305	-2.355852
338°	5.899213	-0.374607	0.927184	-0.404026	1.078535	-2.669467	-2.475087
339°	5.916666	-0.358368	0.933580	-0.383864	1.071145	-2.790428	-2.605089
340°	5.934119	-0.342020	0.939693	-0.363970	1.064178	-2.923804	-2.747477
341°	5.951573	-0.325568	0.945519	-0.344328	1.057621	-3.071553	-2.904211
342°	5.969026	-0.309017	0.951057	-0.324920	1.051462	-3.236068	-3.077684



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343°	5.986479	-0.292372	0.956305	-0.305731	1.045692	-3.420304	-3.270853
344°	6.003933	-0.275637	0.961262	-0.286745	1.040299	-3.627955	-3.487414
345°	6.021386	-0.258819	0.965926	-0.267949	1.035276	-3.863703	-3.732051
346°	6.038839	-0.241922	0.970296	-0.249328	1.030614	-4.133565	-4.010781
347°	6.056293	-0.224951	0.974370	-0.230868	1.026304	-4.445411	-4.331476
348°	6.073746	-0.207912	0.978148	-0.212557	1.022341	-4.809734	-4.704630
349°	6.091199	-0.190809	0.981627	-0.194380	1.018717	-5.240843	-5.144554
350°	6.108652	-0.173648	0.984808	-0.176327	1.015427	-5.758770	-5.671282
351°	6.126106	-0.156434	0.987688	-0.158384	1.012465	-6.392453	-6.313752
352°	6.143559	-0.139173	0.990268	-0.140541	1.009828	-7.185297	-7.115370
353°	6.161012	-0.121869	0.992546	-0.122785	1.007510	-8.205509	-8.144346
354°	6.178466	-0.104528	0.994522	-0.105104	1.005508	-9.566772	-9.514364
355°	6.195919	-0.087156	0.996195	-0.087489	1.003820	-11.473713	-11.430052
356°	6.213372	-0.069756	0.997564	-0.069927	1.002442	-14.335587	-14.300666
357°	6.230825	-0.052336	0.998630	-0.052408	1.001372	-19.107323	-19.081137
358°	6.248279	-0.034899	0.999391	-0.034921	1.000610	-28.653708	-28.636253
359°	6.265732	-0.017452	0.999848	-0.017455	1.000152	-57.298688	-57.289962
360°	6.283185	-0.000000	1.000000	-0.000000	1.000000	undefined	undefined