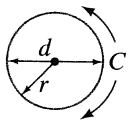
Trigonometric Table

Angle in Degrees	Angle in Radians	Sine	Cosine	Tangent	Angle in Degrees	Angle in Radians	Sine	Cosine	Tangent
0°	0.000	0.000	1.000	0.000					
1°	0.017	0.017	1.000	0.017	46°	0.803	0.719	0.695	1.036
2°	0.035	0.035	0.999	0.035	47°	0.820	0.731	0.682	1.072
3°	0.052	0.052	0.999	0.052	48°	0.838	0.743	0.669	1.111
4°	0.070	0.070	0.998	0.070	49°	0.855	0.755	0.656	1.150
5°	0.087	0.087	0.996	0.087	50°	0.873	0.766	0.643	1.192
6°	0.105	0.105	0.995	0.105	51°	0.890	0.777	0.629	1.235
7°	0.122	0.122	0.993	0.123	52°	0.908	0.788	0.616	1.280
8°	0.140	0.139	0.990	0.141	53°	0.925	0.799	0.602	1.327
9°	0.157	0.156	0.988	0.158	54°	0.942	0.809	0.588	1.376
10°	0.175	0.174	0.985	0.176	55°	0.960	0.819	0.574	1.428
11°	0.192	0.191	0.982	0.194	56°	0.977	0.829	0.559	1.483
12°	0.209	0.208	0.978	0.213	57°	0.995	0.839	0.545	1.540
13°	0.227	0.225	0.974	0.231	58°	1.012	0.848	0.530	1.600
14°	0.244	0.242	0.970	0.249	59°	1.030	0.857	0.515	1.664
15°	0.262	0.259	0.966	0.268	60°	1.047	0.866	0.500	1.732
16°	0.279	0.276	0.961	0.287	61°	1.065	0.875	0.485	1.804
17°	0.297	0.292	0.956	0.306	62°	1.082	0.883	0.469	1.881
18°	0.314	0.309	0.951	0.325	63°	1.100	0.891	0.454	1.963
19°	0.332	0.326	0.946	0.344	64°	1.117	0.899	0.438	2.050
20°	0.349	0.342	0.940	0.364	65°	1.134	0.906	0.423	2.145
21°	0.367	0.358	0.934	0.384	66°	1.152	0.914	0.407	2.246
22°	0.384	0.375	0.927	0.404	67°	1.169	0.921	0.391	2.356
23°	0.401	0.391	0.921	0.424	68°	1.187	0.927	0.375	2.475
24°	0.419	0.407	0.914	0.445	69°	1.204	0.934	0.358	2.605
25°	0.436	0.423	0.906	0.466	70°	1.222	0.940	0.342	2.747
26°	0.454	0.438	0.899	0.488	71°	1.239	0.946	0.326	2.904
27°	0.471	0.454	0.891	0.510	72°	1.257	0.951	0.309	3.078
28°	0.489	0.469	0.883	0.532	73°	1.274	0.956	0.292	3.271
29°	0.506	0.485	0.875	0.554	74°	1.292	0.961	0.276	3.487
30°	0.524	0.500	0.866	0.577	75°	1.309	0.966	0.259	3.732
31°	0.541	0.515	0.857	0.601	76°	1.326	0.970	0.242	4.011
32°	0.559	0.530	0.848	0.625	77°	1.344	0.974	0.225	4.331
33°	0.576	0.545	0.839	0.649	78°	1.361	0.978	0.208	4.705
34°	0.593	0.559	0.829	0.675	79°	1.379	0.982	0.191	5.145
35°	0.611	0.574	0.819	0.700	80°	1.396	0.985	0.174	5.671
36°	0.628	0.588	0.809	0.727	81°	1.414	0.988	0.156	6.314
37°	0.646	0.602	0.799	0.754	82°	1.431	0.990	0.139	7.115
38°	0.663	0.616	0.788	0.781	83°	1.449	0.993	0.122	8.144
39°	0.681	0.629	0.777	0.810	84°	1.466	0.995	0.105	9.514
40°	0.698	0.643	0.766	0.839	85°	1.484	0.996	0.087	11.43
41°	0.716	0.656	0.755	0.869	86°	1.501	0.998	0.070	14.301
42°	0.733	0.669	0.743	0.900	87°	1.518	0.999	0.052	19.081
43°	0.750	0.682	0.731	0.933	88°	1.536	0.999	0.035	28.636
44°	0.768	0.695	0.719	0.966	89°	1.553	1.000	0.017	57.290
45°	0.785	0.707	0.707	1.000	90°	1.571	1.000	0.000	∞

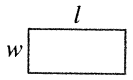
Useful Geometry Formulas—Areas, Volumes

Circumference of circle $C = \pi d = 2\pi r$

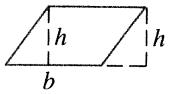
Area of circle $A = \pi r^2 = \dfrac{\pi d^2}{4}$



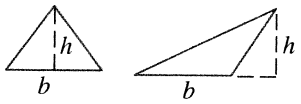
Area of rectangle $A = lw$



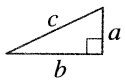
Area of parallelogram $A = bh$



Area of triangle $A = \frac{1}{2}hb$

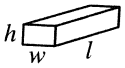


Right triangle (Pythagoras) $c^2 = a^2 + b^2$

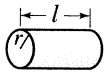


Sphere: surface area $A = 4\pi r^2$
volume $V = \frac{4}{3}\pi r^3$

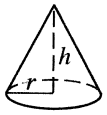
Rectangular solid: volume $V = lwh$



Cylinder (right): surface area $A = 2\pi rl + 2\pi r^2$
volume $V = \pi r^2 l$



Right circular cone: surface area $A = \pi r^2 + \pi r\sqrt{r^2 + h^2}$
volume $V = \frac{1}{3}\pi r^2 h$



Exponents [See Appendix A–2 for details]

$(a^n)(a^m) = a^{n+m}$ [Example: $(a^3)(a^2) = a^5$]

$(a^n)(b^n) = (ab)^n$ [Example: $(a^3)(b^3) = (ab)^3$]

$(a^n)^m = a^{nm}$ [Example: $(a^3)^2 = a^6$; Example: $(a^{\frac{1}{4}})^4 = a$]

$a^{-1} = \dfrac{1}{a}$ $\quad a^{-n} = \dfrac{1}{a^n}$ $\quad a^0 = 1$

$a^{\frac{1}{2}} = \sqrt{a}$ $\quad a^{\frac{1}{4}} = \sqrt{\sqrt{a}}$

$(a^n)(a^{-m}) = \dfrac{a^n}{a^m} = a^{n-m}$ [Ex.: $(a^5)(a^{-2}) = a^3$]

$\dfrac{a^n}{b^n} = \left(\dfrac{a}{b}\right)^n$

Quadratic Formula [Appendix A–4]

Equation with unknown x, in the form

$ax^2 + bx + c = 0,$

has solutions

$$x = \frac{-b \pm \sqrt{b^2 - 4ac}}{2a}.$$

Logarithms [Appendix A–8; Table p. A–11]

If $y = 10^x$, then $x = \log_{10} y = \log y$.

If $y = e^x$, then $x = \log_e y = \ln y$.

$\log(ab) = \log a + \log b$

$\log\left(\dfrac{a}{b}\right) = \log a - \log b$

$\log a^n = n \log a$

Binomial Expansion [Appendix A–5]

$$(1 + x)^n = 1 + nx + \frac{n(n-1)}{2 \cdot 1}x^2 + \frac{n(n-1)(n-2)}{3 \cdot 2 \cdot 1}x^3 + \cdots \quad [\text{for } x^2 < 1]$$

$\approx 1 + nx$ if $x \ll 1$

[Example: $(1 + 0.01)^3 \approx 1.03$]

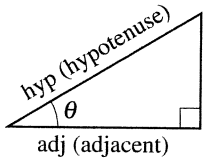
[Example: $\dfrac{1}{\sqrt{0.99}} = \dfrac{1}{\sqrt{1 - 0.01}} = (1 - 0.01)^{-\frac{1}{2}} \approx 1 - (-\frac{1}{2})(0.01) \approx 1.005$]

Fractions

$\dfrac{a}{b} = \dfrac{c}{d}$ is the same as $ad = bc$

$$\frac{\left(\frac{a}{b}\right)}{\left(\frac{c}{d}\right)} = \frac{ad}{bc}$$

Trigonometric Formulas [Appendix A–7]



$\sin\theta = \dfrac{\text{opp}}{\text{hyp}}$

$\cos\theta = \dfrac{\text{adj}}{\text{hyp}}$

$\tan\theta = \dfrac{\text{opp}}{\text{adj}}$

$\text{adj}^2 + \text{opp}^2 = \text{hyp}^2$ (Pythagorean theorem)

$\tan\theta = \dfrac{\sin\theta}{\cos\theta}$

$\sin^2\theta + \cos^2\theta = 1$

$\sin 2\theta = 2\sin\theta\cos\theta$

$\cos 2\theta = (\cos^2\theta - \sin^2\theta) = (1 - 2\sin^2\theta) = (2\cos^2\theta - 1)$

$\sin(180° - \theta) = \sin\theta$ $\quad \cos(180° - \theta) = -\cos\theta$

$\sin(90° - \theta) = \cos\theta$
$\cos(90° - \theta) = \sin\theta$ $\Big\}$ $[0 < \theta < 90°]$

$\sin\frac{1}{2}\theta = \sqrt{(1 - \cos\theta)/2}$ $\quad \cos\frac{1}{2}\theta = \sqrt{(1 + \cos\theta)/2}$

$\sin\theta \approx \theta$ [for small $\theta \lesssim 0.2$ rad]

$\cos\theta \approx 1 - \dfrac{\theta^2}{2}$ [for small $\theta \lesssim 0.2$ rad]

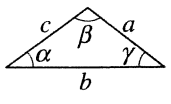
$\sin(A \pm B) = \sin A\cos B \pm \cos A\sin B$

$\cos(A \pm B) = \cos A\cos B \mp \sin A\sin B$

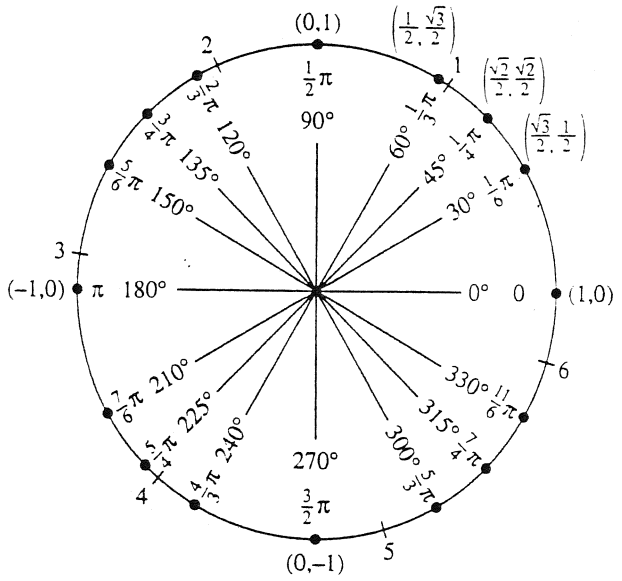
For any triangle:

$c^2 = a^2 + b^2 - 2ab\cos\gamma$ (law of cosines)

$\dfrac{\sin\alpha}{a} = \dfrac{\sin\beta}{b} = \dfrac{\sin\gamma}{c}$ (law of sines)



The Unit Circle



Radian Measures

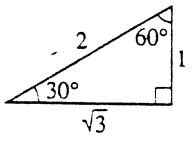
$\theta = \frac{s}{r}$ where s = length of arc

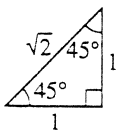
$s = r\theta$ r = length of radius

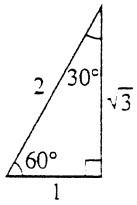
θ = central angle in radians

measure in radians	measure in degrees
π	180°
1	$\frac{180°}{\pi} = 57.2958°$
$\frac{\pi}{180} = 0.0175$	1°

Common Triangles



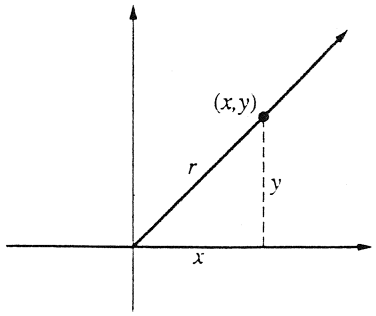




Definitions of Trigonometric Functions

$\sin\theta = \frac{y}{r}$ $\cos\theta = \frac{x}{r}$ $\tan\theta = \frac{y}{x}$

$\csc\theta = \frac{r}{y}$ $\sec\theta = \frac{r}{x}$ $\cot\theta = \frac{x}{y}$



LAW OF SINES: $\frac{\sin\alpha}{a} = \frac{\sin\beta}{b} = \frac{\sin\gamma}{c}$

LAW OF COSINES: $a^2 = b^2 + c^2 - 2bc\cos\alpha$

The square of any side of a triangle is equal to the sum of the squares of the other two sides minus twice the product of the other two sides times the cosine of the angle between them.