Algebra

Arithmetic

$$\frac{a+b}{c} = \frac{a}{c} + \frac{b}{c} \qquad \frac{a}{b} + \frac{c}{d} = \frac{ad+bc}{bd}$$

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

Factoring

$$x^2 - y^2 = (x-y)(x+y) \qquad x^3 - y^3 = (x-y)(x^2+xy+y^2)$$

$$x^3 + y^3 = (x+y)(x^2-xy+y^2) \qquad x^4 - y^4 = (x-y)(x+y)(x^2+y^2)$$

Binomial

$$(x+y)^2 = x^2 + 2xy + y^2 \qquad (x+y)^3 = x^3 + 3x^2y + 3xy^2 + y^3$$

Exponents

$$x^n x^m = x^{n+m} \qquad \frac{x^n}{x^m} = x^{n-m} \qquad (x^n)^m = x^{nm}$$

$$x^{-n} = \frac{1}{x^n} \qquad (xy)^n = x^n y^n \qquad \left(\frac{x}{y}\right)^n = \frac{x^n}{y^n}$$

$$x^{n/m} = \sqrt[m]{x^n} \qquad \sqrt[n]{xy} = \sqrt[n]{x}\sqrt[n]{y} \qquad \sqrt[n]{\frac{x}{y}} = \frac{\sqrt[n]{x}}{\sqrt[n]{y}}$$

Lines

Slope m of line through (x_0, y_0) and (x_1, y_1)

$$m = \frac{y_1 - y_0}{x_1 - x_0}$$

Through (x_0, y_0), slope m

$$y - y_0 = m(x - x_0)$$

Slope m, y-intercept b

$$y = mx + b$$

Quadratic Formula

If $ax^2 + bx + c = 0$ then

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

Distance

Distance d between (x_1, y_1) and (x_2, y_2)

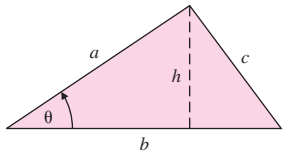
$$d = \sqrt{(x_2 - x_1)^2 + (y_2 - y_1)^2}$$

Geometry

Triangle

Area $= \frac{1}{2}bh$

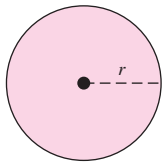
$c^2 = a^2 + b^2 - 2ab\cos\theta$



Circle

Area $= \pi r^2$

$C = 2\pi r$

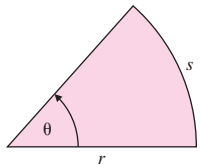


Sector of a Circle

Area $= \frac{1}{2}r^2\theta$

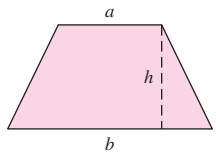
$s = r\theta$

(for θ in radians only)



Trapezoid

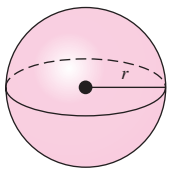
Area $= \frac{1}{2}(a+b)h$



Sphere

Volume $= \frac{4}{3}\pi r^3$

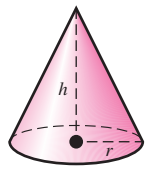
Surface Area $= 4\pi r^2$



Cone

Volume $= \frac{1}{3}\pi r^2 h$

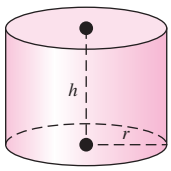
Surface Area $= \pi r\sqrt{r^2 + h^2}$



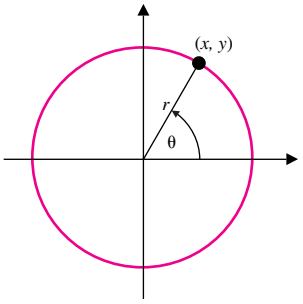
Cylinder

Volume $= \pi r^2 h$

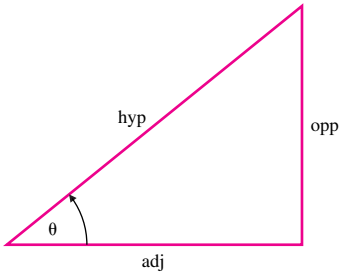
Surface Area $= 2\pi rh$



Trigonometry



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



$$\sin\theta = \frac{\text{opp}}{\text{hyp}} \qquad \cos\theta = \frac{\text{adj}}{\text{hyp}} \qquad \tan\theta = \frac{\text{opp}}{\text{adj}}$$

Reciprocals

$$\cot\theta = \frac{1}{\tan\theta} \qquad \sec\theta = \frac{1}{\cos\theta} \qquad \csc\theta = \frac{1}{\sin\theta}$$

Definitions

$$\cot\theta = \frac{\cos\theta}{\sin\theta} \qquad \sec\theta = \frac{1}{\cos\theta} \qquad \csc\theta = \frac{1}{\sin\theta}$$

Pythagorean

$$\sin^2\theta + \cos^2\theta = 1 \qquad \tan^2\theta + 1 = \sec^2\theta \qquad 1 + \cot^2\theta = \csc^2\theta$$

Cofunction

$$\sin\left(\tfrac{\pi}{2} - \theta\right) = \cos\theta \qquad \cos\left(\tfrac{\pi}{2} - \theta\right) = \sin\theta \qquad \tan\left(\tfrac{\pi}{2} - \theta\right) = \cot\theta$$

Even/Odd

$$\sin(-\theta) = -\sin\theta \qquad \cos(-\theta) = \cos\theta \qquad \tan(-\theta) = -\tan\theta$$

Double-Angle

$$\sin 2\theta = 2\sin\theta\cos\theta \qquad \cos 2\theta = \cos^2\theta - \sin^2\theta \qquad \cos 2\theta = 1 - 2\sin^2\theta$$

Half-Angle

$$\sin^2\theta = \frac{1 - \cos 2\theta}{2} \qquad \cos^2\theta = \frac{1 + \cos 2\theta}{2}$$

Addition

$$\sin(a+b) = \sin a\cos b + \cos a\sin b \qquad \cos(a+b) = \cos a\cos b - \sin a\sin b$$

Subtraction

$$\sin(a-b) = \sin a\cos b - \cos a\sin b \qquad \cos(a-b) = \cos a\cos b + \sin a\sin b$$

Sum

$$\sin u + \sin v = 2\sin\frac{u+v}{2}\cos\frac{u-v}{2}$$

$$\cos u + \cos v = 2\cos\frac{u+v}{2}\cos\frac{u-v}{2}$$

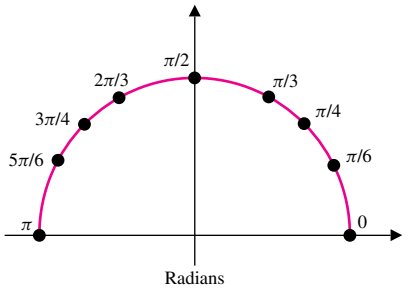
Product

$$\sin u\sin v = \tfrac{1}{2}[\cos(u-v) - \cos(u+v)]$$

$$\cos u\cos v = \tfrac{1}{2}[\cos(u-v) + \cos(u+v)]$$

$$\sin u\cos v = \tfrac{1}{2}[\sin(u+v) + \sin(u-v)]$$

$$\cos u\sin v = \tfrac{1}{2}[\sin(u+v) - \sin(u-v)]$$



$$\sin(0) = 0 \qquad \cos(0) = 1$$

$$\sin\left(\tfrac{\pi}{6}\right) = \tfrac{1}{2} \qquad \cos\left(\tfrac{\pi}{6}\right) = \tfrac{\sqrt{3}}{2}$$

$$\sin\left(\tfrac{\pi}{4}\right) = \tfrac{\sqrt{2}}{2} \qquad \cos\left(\tfrac{\pi}{4}\right) = \tfrac{\sqrt{2}}{2}$$

$$\sin\left(\tfrac{\pi}{3}\right) = \tfrac{\sqrt{3}}{2} \qquad \cos\left(\tfrac{\pi}{3}\right) = \tfrac{1}{2}$$

$$\sin\left(\tfrac{\pi}{2}\right) = 1 \qquad \cos\left(\tfrac{\pi}{2}\right) = 0$$

$$\sin\left(\tfrac{2\pi}{3}\right) = \tfrac{\sqrt{3}}{2} \qquad \cos\left(\tfrac{2\pi}{3}\right) = -\tfrac{1}{2}$$

$$\sin\left(\tfrac{3\pi}{4}\right) = \tfrac{\sqrt{2}}{2} \qquad \cos\left(\tfrac{3\pi}{4}\right) = -\tfrac{\sqrt{2}}{2}$$

$$\sin\left(\tfrac{5\pi}{6}\right) = \tfrac{1}{2} \qquad \cos\left(\tfrac{5\pi}{6}\right) = -\tfrac{\sqrt{3}}{2}$$

$$\sin(\pi) = 0 \qquad \cos(\pi) = -1$$

$$\sin(2\pi) = 0 \qquad \cos(2\pi) = 1$$