Trigonometric Formulas

Angular Measure

π radians = 180°

1 radian = $\frac{180}{\pi}$ degrees 1 degree = $\frac{\pi}{180}$ radians

Reciprocal Identities

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

Quotient Identities

$$\tan x = \frac{\sin x}{\cos x} \qquad \cot x = \frac{\cos x}{\sin x}$$

Pythagorean Identities

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

Odd-Even Identities

$$\sin(-x) = -\sin x \qquad \csc(-x) = -\csc x$$
$$\cos(-x) = \cos x \qquad \sec(-x) = \sec x$$
$$\tan(-x) = -\tan x \qquad \cot(-x) = -\cot x$$

Sum & Difference Identities

$$\sin(u+v) = \sin u \cos v + \cos u \sin v \qquad \sin(u-v) = \sin u \cos v - \cos u \sin v$$
$$\cos(u+v) = \cos u \cos v - \sin u \sin v \qquad \cos(u-v) = \cos u \cos v + \sin u \sin v$$
$$\tan(u+v) = \frac{\tan u + \tan v}{1 - \tan u \tan v} \qquad \tan(u-v) = \frac{\tan u - \tan v}{1 + \tan u \tan v}$$

Double-Angle Identities

$$\sin 2u = 2 \sin u \cos u \qquad \cos 2u = \cos^2 u - \sin^2 u$$
$$\tan 2u = \frac{2 \tan u}{1 - \tan^2 u} \qquad \cos 2u = 2\cos^2 u - 1$$
$$\cos 2u = 1 - 2\sin^2 u$$

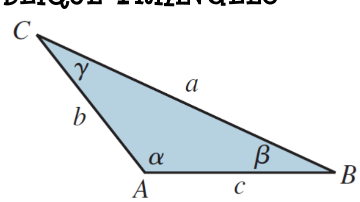
Power-Reducing Identities

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

Half-Angle Identities

$$\sin\frac{u}{2} = \pm\sqrt{\frac{1-\cos u}{2}} \qquad \cos\frac{u}{2} = \pm\sqrt{\frac{1+\cos u}{2}} \qquad \tan\frac{u}{2} = \pm\sqrt{\frac{1-\cos u}{1+\cos u}} = \frac{1-\cos u}{\sin u} = \frac{\sin u}{1+\cos u}$$

Oblique Triangles



Law of Sines

$$\frac{\sin A}{a} = \frac{\sin B}{b} = \frac{\sin C}{c}$$

Law of Cosines

$$a^2 = b^2 + c^2 - 2bc \cos A$$
$$b^2 = a^2 + c^2 - 2ac \cos B$$
$$c^2 = a^2 + b^2 - 2ab \cos C$$

Area Formulas

$$A = \frac{1}{2} bc \sin A = \frac{1}{2} ac \sin B = \frac{1}{2} ab \sin C$$

$$A = \sqrt{s(s-a)(s-b)(s-c)}$$
where $s = ½ (a + b + c)$

Trigonometric Form of a Complex Number

$$z = a + bi = (r\cos\theta) + (r\sin\theta)i = r(\cos\theta + i\sin\theta)$$

De Moivre's Theorem

$$z^n = [r(\cos\theta + i\sin\theta)]^n = r^n(\cos n\theta + i\sin n\theta)$$

Arithmetic Sequences & Series

$$a_n = a_1 + (n-1)d$$

$$S_n = n\left(\frac{a_1 + a_n}{2}\right) \qquad S_n = \frac{n}{2}[2a_1 + (n-1)d]$$

Geometric Sequences & Series

$$a_n = a_1 \cdot r^{n-1} \qquad S_n = \frac{a_1(1 - r^n)}{1 - r}$$

Infinite Geometric Series $\quad S = \frac{a_1}{1-r}, |r| < 1$

Factorials

$$n! = n \cdot (n-1) \cdot (n-2) \cdot \cdots \cdot 3 \cdot 2 \cdot 1 \qquad n \cdot (n-1)! = n!, 0! = 1$$

Binomial Coefficient

$$\binom{n}{r} = \frac{n!}{r!\,(n-r)!}$$

Binomial Theorem

$$(a+b)^n = \binom{n}{0} a^n + \binom{n}{1} a^{n-1} b + \cdots + \binom{n}{r} a^{n-r} b^r + \cdots + \binom{n}{n} b^n$$

Conic Sections

Circles: The circle with center (h, k) & radius r: $\quad (x-h)^2 + (y-k)^2 = r^2$

Parabolas w/vertex (h, k):

Standard equation	$(x-h)^2 = 4p(y-k)$	$(y-k)^2 = 4p(x-h)$
Opens	Upward or downward	To the right or to the left
Focus	$(h, k+p)$	$(h+p, k)$
Directrix	$y = k - p$	$x = h - p$
Axis	$x = h$	$y = k$

Ellipses w/center (h, k) & $a > b > 0$

Standard equation	$\frac{(x-h)^2}{a^2} + \frac{(y-k)^2}{b^2} = 1$	$\frac{(y-k)^2}{a^2} + \frac{(x-h)^2}{b^2} = 1$
Focal axis	$y = k$	$x = h$
Foci	$(h \pm c, k)$	$(h, k \pm c)$
Vertices	$(h \pm a, k)$	$(h, k \pm a)$
Pythagorean relation	$a^2 = b^2 + c^2$	$a^2 = b^2 + c^2$

Hyperbolas w/center (h, k)

Standard equation	$\frac{(x-h)^2}{a^2} - \frac{(y-k)^2}{b^2} = 1$	$\frac{(y-k)^2}{a^2} - \frac{(x-h)^2}{b^2} = 1$
Focal axis	$y = k$	$x = h$
Foci	$(h \pm c, k)$	$(h, k \pm c)$
Vertices	$(h \pm a, k)$	$(h, k \pm a)$
Pythagorean relation	$c^2 = a^2 + b^2$	$c^2 = a^2 + b^2$
Asymptotes	$y = \pm\frac{b}{a}(x-h) + k$	$y = \pm\frac{a}{b}(x-h) + k$