$\tan^2\vartheta + 1 = \sec^2\vartheta$ $\cot^2\vartheta + 1 = \csc^2\vartheta$

For the graphs of $y = A\sin(\omega x - \phi)$ or $y = A\cos(\omega x - \phi)$, $\omega > 0$,

$$Amplitude = |A| \qquad Period = T = \frac{2\pi}{\omega} \qquad Phase\ shift = \frac{\phi}{\omega}$$

The phase shift is to the left if $\phi < 0$ and to the right if $\phi > 0$.

Even – Odd $\sin(-\vartheta) = -\sin\vartheta$ $\cos(-\vartheta) = \cos\vartheta$ $\tan(-\vartheta) = -\tan\vartheta$

$\csc(-\vartheta) = -\csc\vartheta$ $\sec(-\vartheta) = \sec\vartheta$ $\cot(-\vartheta) = -\cot\vartheta$

Sum and Difference

$\cos(\alpha + \beta) = \cos\alpha\cos\beta - \sin\alpha\sin\beta$ $\cos(\alpha - \beta) = \cos\alpha\cos\beta + \sin\alpha\sin\beta$

$\sin(\alpha + \beta) = \sin\alpha\cos\beta + \cos\alpha\sin\beta$ $\sin(\alpha - \beta) = \sin\alpha\cos\beta - \cos\alpha\sin\beta$

$\cos\left(\frac{\pi}{2} - \vartheta\right) = \sin\vartheta$ $\sin\left(\frac{\pi}{2} - \vartheta\right) = \cos\vartheta$ $\cos\left(\frac{\pi}{2} - \vartheta\right) = \sin\vartheta$

$\tan(\alpha + \beta) = \dfrac{\tan\alpha + \tan\beta}{1 - \tan\alpha\tan\beta}$ $\tan(\alpha - \beta) = \dfrac{\tan\alpha - \tan\beta}{1 + \tan\alpha\tan\beta}$

Double-Angle and Half-Angle

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

$\tan(2\vartheta) = \dfrac{2\tan\vartheta}{1 - \tan^2\vartheta}$ $\sin\dfrac{\vartheta}{2} = \pm\sqrt{\dfrac{1 - \cos\vartheta}{2}}$ $\cos(2\vartheta) = 2\cos^2\vartheta - 1$

$\cos\dfrac{\vartheta}{2} = \pm\sqrt{\dfrac{1 + \cos\vartheta}{2}}$ $\tan\dfrac{\vartheta}{2} = \pm\sqrt{\dfrac{1 - \cos\vartheta}{1 + \cos\vartheta}}$ $\tan\dfrac{\vartheta}{2} = \dfrac{1 - \cos\vartheta}{\sin\vartheta} = \dfrac{\sin\vartheta}{1 + \cos\vartheta}$

Product-to-Sum Formulas

$\sin\alpha\sin\beta = \frac{1}{2}\left[\cos(\alpha - \beta) - \cos(\alpha + \beta)\right]$ $\cos\alpha\cos\beta = \frac{1}{2}\left[\cos(\alpha - \beta) + \cos(\alpha + \beta)\right]$

$\sin\alpha\cos\beta = \frac{1}{2}\left[\sin(\alpha + \beta) + \sin(\alpha - \beta)\right]$

Sum-to-Product Formulas

$\sin\alpha + \sin\beta = 2\sin\dfrac{\alpha + \beta}{2}\cos\dfrac{\alpha - \beta}{2}$ $\sin\alpha - \sin\beta = 2\sin\dfrac{\alpha - \beta}{2}\cos\dfrac{\alpha + \beta}{2}$

$\cos\alpha + \cos\beta = 2\cos\dfrac{\alpha + \beta}{2}\cos\dfrac{\alpha - \beta}{2}$ $\cos\alpha - \cos\beta = -2\sin\dfrac{\alpha + \beta}{2}\sin\dfrac{\alpha - \beta}{2}$

Law of Sines and Law of Cosines

$$\frac{\sin\alpha}{a}=\frac{\sin\beta}{b}=\frac{\sin\gamma}{c}$$

$$c^2=a^2+b^2-2ab\cos\gamma \qquad b^2=a^2+c^2-2ac\cos\beta \qquad a^2=b^2+c^2-2bc\cos\alpha$$

Polar Coordinates

$$x=r\cos\vartheta \qquad y=r\sin\vartheta \qquad r^2=x^2+y^2 \qquad \tan\vartheta=\frac{y}{x},\ \text{if } x\neq 0$$

Other Formulas $r^2=(x-h)^2+(y-k)^2$

Ellipse

Center	Major Axis	Foci	Vertices	Equation
(h,k)	Parallel to x-axis	$(h\pm c,k)$	$(h\pm a,k)$	$\frac{(x-h)^2}{a^2}+\frac{(y-k)^2}{b^2}=1,$ $a>b$ & $b^2=a^2-c^2$
(h,k)	Parallel to y-axis	$(h,k\pm c)$	$(h,k\pm a)$	$\frac{(x-h)^2}{b^2}+\frac{(y-k)^2}{a^2}=1,$ $a>b$ & $b^2=a^2-c^2$

Hyperbola

Center	Transverse Axis	Foci	Vertices	Equation
(h,k)	Parallel to x-axis	$(h\pm c,k)$	$(h\pm a,k)$	$\frac{(x-h)^2}{a^2}-\frac{(y-k)^2}{b^2}=1,$ $b^2=c^2-a^2$ Asymptotes $y-k=\pm\frac{b}{a}(x-h)$
(h,k)	Parallel to y-axis	$(h,k\pm c)$	$(h,k\pm a)$	$\frac{(y-k)^2}{a^2}-\frac{(x-h)^2}{b^2}=1,$ $b^2=c^2-a^2$ Asymptotes $y-k=\pm\frac{a}{b}(x-h)$