Trig Identities

Basic & Pythagorean

$\sin(x) = \frac{1}{\csc(x)}$ $\qquad$ $\csc(x) = \frac{1}{\sin(x)}$

$\cos(x) = \frac{1}{\sec(x)}$ $\qquad$ $\sec(x) = \frac{1}{\cos(x)}$

$\tan(x) = \frac{\sin(x)}{\cos(x)} = \frac{1}{\cot(x)}$ $\qquad$ $\cot(x) = \frac{\cos(x)}{\sin(x)} = \frac{1}{\tan(x)}$

$\sin^2(x) + \cos^2(x) = 1$ $\qquad$ $\tan^2(x) + 1 = \sec^2(x)$

$\cot^2(x) + 1 = \csc^2(x)$ $\qquad$ $\sin(-x) = -\sin(x)$

$\cos(-x) = cos(x)$ $\qquad$ $\tan(-x) = -\tan(x)$

Angle Sum & Difference

$\sin(\alpha \pm \beta = \sin(\alpha)\cos(\beta) \pm \cos(\alpha)\sin(\beta)$

$\cos(\alpha \pm \beta) = \cos(\alpha)\cos(\beta) \mp \sin(\alpha)\sin(\beta)$

$\tan(\alpha \pm \beta) = \frac{\tan(\alpha)\pm\tan(\beta)}{1\mp\tan(\alpha)\tan(\beta)}$

Double-Angle

$\sin(2x) = 2\sin(x)\cos(x)$

$\tan(2x) = \frac{2\tan(x)}{1-\tan^2(x)}$

$\cos(2x) = \cos^2(x) - \sin^2(x)$

Half-Angle

$\sin(\frac{\theta}{2}) = \pm\sqrt{\frac{1-\cos(\theta)}{2}}$

$\cos(\frac{\theta}{2}) = \pm\sqrt{\frac{1+\cos(\theta)}{2}}$

$\tan(\frac{\theta}{2}) = \frac{\sin(\theta)}{1+\cos(\theta)} = \frac{1-\cos(\theta)}{\sin(\theta)}$

Power Reduction

$\sin^2(x) = \frac{1}{2}[1 - \cos(2x)]$

$\cos^2(x) = \frac{1}{2}[1 + \cos(2x)]$

$\tan^2(x) = \frac{1-\cos(2x)}{1+\cos(2x)}$

Sum to Product
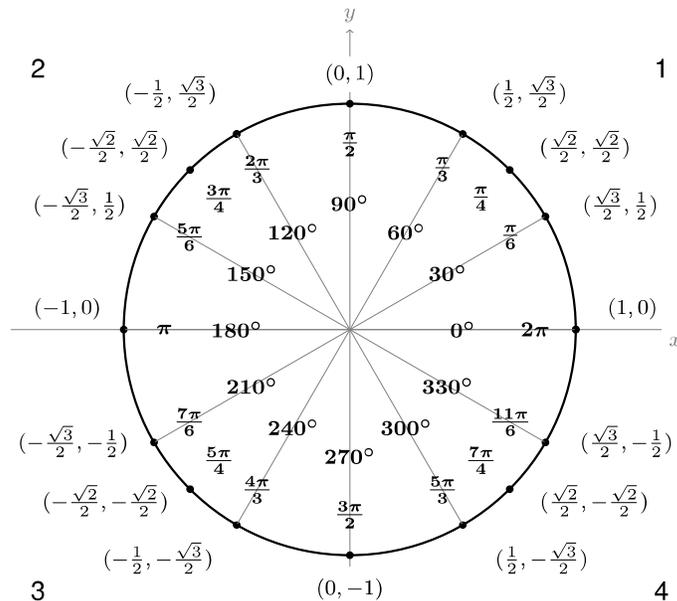
$\sin(x) + \sin(y) = 2\sin(\frac{x+y}{2})\cos(\frac{x-y}{2})$

$\sin(x) - \sin(y) = 2\cos(\frac{x+y}{2})\sin(\frac{x-y}{2})$

$\cos(x) + \cos(y) = 2\cos(\frac{x+y}{2})\cos(\frac{x-y}{2})$

$\cos(x) - \cos(y) = -2\sin(\frac{x+y}{2})\sin(\frac{x-y}{2})$

Unit Circle

$(x = \cos\theta, y = \sin\theta)$ $\quad$ $\tan\theta = \frac{\sin\theta}{\cos\theta} = \frac{y}{x}$

Radians to Degrees: $\times \frac{180}{\pi}$

Degrees to Radians: $\times \frac{\pi}{180}$

Arc Length: $s = r\theta$

Bounds for Inverse Trig Functions

$sin^{-1}(\theta)$: $\left[\frac{-\pi}{2}, \frac{\pi}{2}\right]$

$cos^{-1}(\theta)$: $[0, \pi]$

$tan^{-1}(\theta)$: $\left[\frac{-\pi}{2}, \frac{\pi}{2}\right]$