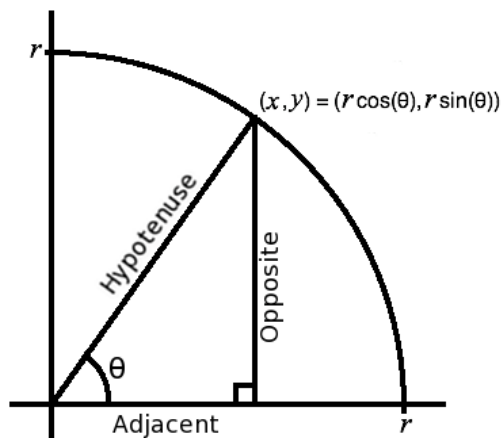


# Trigonometry



Campus Academic Resource Program



## Definitions

$$\sin(\theta) = \frac{Opp}{Hyp} = \frac{y}{r} \quad \csc(\theta) = \frac{Hyp}{Opp} = \frac{r}{y}$$

$$\cos(\theta) = \frac{Adj}{Hyp} = \frac{x}{r} \quad \sec(\theta) = \frac{Hyp}{Adj} = \frac{r}{x}$$

$$\tan(\theta) = \frac{Opp}{Adj} = \frac{y}{x} \quad \cot(\theta) = \frac{Adj}{Opp} = \frac{x}{y}$$

## Inverse Identities

$$\sin(\theta) = \frac{1}{\csc(\theta)}$$

$$\cos(\theta) = \frac{1}{\sec(\theta)}$$

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

## Pythagorean Identities

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

$$\tan^2(\theta) + 1 = \sec^2(\theta)$$

$$\cot^2(\theta) + 1 = \csc^2(\theta)$$

## Sum-Angle Identity

$$\cos(\theta \pm \phi) = \cos(\theta)\cos(\phi) \mp \sin(\theta)\sin(\phi)$$

$$\sin(\theta \pm \phi) = \sin(\theta)\cos(\phi) \pm \sin(\phi)\cos(\theta)$$

$$\tan(\theta \pm \phi) = \frac{\tan(\theta) \pm \tan(\phi)}{1 \mp \tan(\theta)\tan(\phi)}$$

## Euler's Formula

$$e^{i\theta} = \cos(\theta) + i \cdot \sin(\theta) \quad \text{where } i^2 = -1$$

## Converting Radian and Degrees

$$2\pi \text{ rad} = 360^\circ$$

## Double-Angle Identities

$$\begin{aligned} \cos(2\theta) &= \cos^2(\theta) - \sin^2(\theta) \\ &= 2\cos^2(\theta) - 1 \\ &= 1 - 2\sin^2(\theta) \end{aligned}$$

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

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

## Half-angle Identities

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

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

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

## Special Angles

Angle	$\sin(\theta)$	$\cos(\theta)$	$\tan(\theta)$
$0^\circ$	0	1	0
$30^\circ$	$\frac{1}{2}$	$\frac{\sqrt{3}}{2}$	$\frac{\sqrt{3}}{3}$
$45^\circ$	$\frac{\sqrt{2}}{2}$	$\frac{\sqrt{2}}{2}$	1
$60^\circ$	$\frac{\sqrt{3}}{2}$	$\frac{1}{2}$	$\sqrt{3}$
$90^\circ$	1	0	Undefined

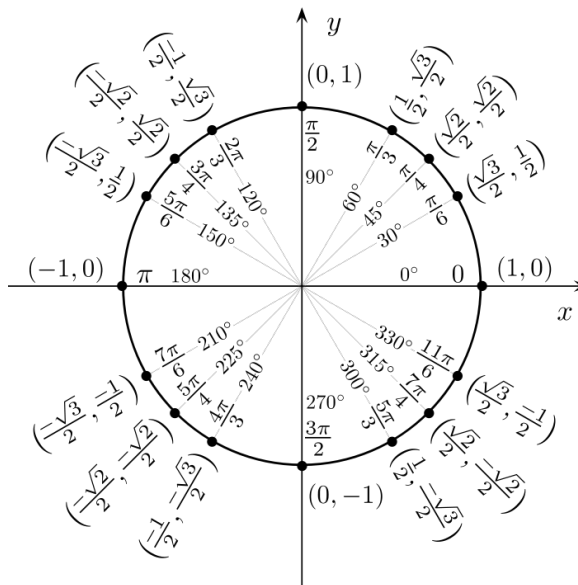


Image taken from: <http://necessaryconclusions.wordpress.com/2008/03/31/special-angles/>

## Calculus

$$\frac{d}{dx} \sin(x) = \cos(x)$$

$$\frac{d}{dx} \cos(x) = -\sin(x)$$

$$\frac{d}{dx} \tan(x) = \sec^2(x)$$

$$\frac{d}{dx} \sec(x) = \sec(x) \tan(x)$$

$$\frac{d}{dx} \csc(x) = -\csc(x) \cot(x)$$

$$\frac{d}{dx} \cot(x) = -\csc^2(x)$$

$$\int \sin(x) dx = -\cos(x) + C$$

$$\int \cos(x) dx = \sin(x) + C$$

$$\int \tan(x) dx = \ln|\sec(x)| + C$$

$$\int \sec(x) dx = \ln|\sec(x) + \tan(x)| + C$$

$$\int \csc(x) dx = \ln|\csc(x) - \cot(x)| + C$$

$$\int \cot(x) dx = \ln|\sin(x)| + C$$

## Law of Sine

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

## Law of Cosine

$$c^2 = a^2 + b^2 - 2ab \cdot \cos(C)$$

## Area of a Triangle

$$\text{Area} = \frac{1}{2} ab \cdot \sin(C)$$

