Trigonometry Information
Pre-AP Precalculus

Special Angle Table

Degrees	Radians	Sine	Cosine	Tangent	Cotangent	Secant	Cosecant
0°	0	0	1	0	undefined	1	undefined
30°	$\frac{\pi}{6}$	$\frac{1}{2}$	$\frac{\sqrt{3}}{2}$	$\frac{\sqrt{3}}{3}$	$\sqrt{3}$	$\frac{2\sqrt{3}}{3}$	2
45°	$\frac{\pi}{4}$	$\frac{\sqrt{2}}{2}$	$\frac{\sqrt{2}}{2}$	1	1	$\sqrt{2}$	$\sqrt{2}$
60°	$\frac{\pi}{3}$	$\frac{\sqrt{3}}{2}$	$\frac{1}{2}$	$\sqrt{3}$	$\frac{\sqrt{3}}{3}$	2	$\frac{2\sqrt{3}}{3}$
90°	$\frac{\pi}{2}$	1	0	undefined	0	undefined	1

Unit Circle

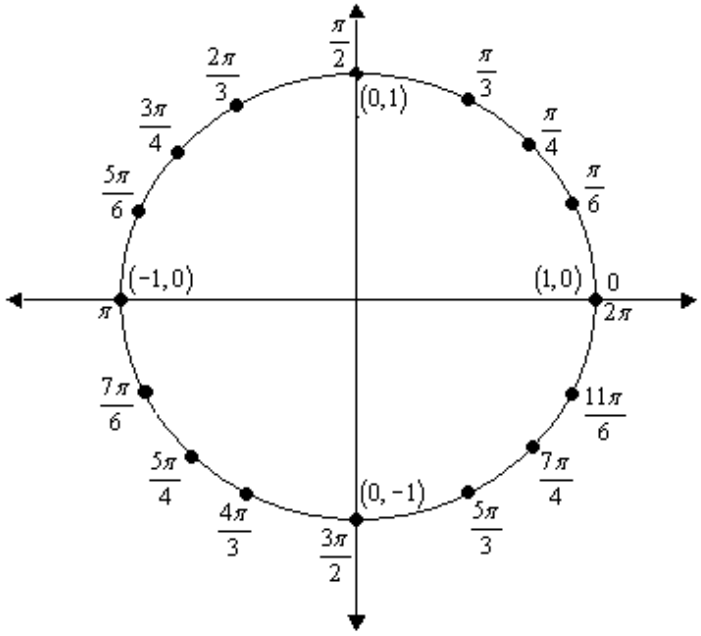
POSITIVE FUNCTIONS
Quadrant I – All
Quadrant II – Only Sine/Cosecant
Quadrant III – Only Tangent/Cotangent
Quadrant IV – Only Cosine/Secant

$\cos\theta = \frac{x}{r}$

$\sin\theta = \frac{y}{r}$

$\tan\theta = \frac{y}{x}$

Ordered pairs in the Unit Circle: $(\cos\theta, \sin\theta)$



Range of Inverse Trigonometric Functions

$R: -\frac{\pi}{2} \le y \le \frac{\pi}{2}$
$y = \sin^{-1} x$
$y = \csc^{-1} x,\ y \neq 0$

$R: -\frac{\pi}{2} < y < \frac{\pi}{2}$
$y = \tan^{-1} x$

$R: 0 \le y \le \pi$
$y = \cos^{-1} x$
$y = \sec^{-1} x,\ y \neq \frac{\pi}{2}$

$R: 0 < y < \pi$
$y = \cot^{-1} x$

Reciprocal & Ratio Relationships

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

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

$$\tan x = \frac{1}{\cot x} \qquad \cot x = \frac{1}{\tan x}$$

Pythagorean Relationships

$$\sin^2 x + \cos^2 x = 1$$

$$1 + \tan^2 x = \sec^2 x$$

$$1 + \cot^2 x = \csc^2 x$$

Half-Angle Formulas

$$\sin\frac{x}{2} = \pm\sqrt{\frac{1-\cos x}{2}}$$

$$\cos\frac{x}{2} = \pm\sqrt{\frac{1+\cos x}{2}}$$

$$\tan\frac{x}{2} = \pm\sqrt{\frac{1-\cos x}{1+\cos x}}$$

$$\tan\frac{x}{2} = \frac{\sin x}{1+\cos x}$$

$$\tan\frac{x}{2} = \frac{1-\cos x}{\sin x}$$

Double-Angle Formulas

$$\sin 2x = 2\sin x \cos x$$

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

$$\cos 2x = 1 - 2\sin^2 x$$

$$\cos 2x = 2\cos^2 x - 1$$

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

Co-Function Relationships

$$\sin x = \cos(90 - x) \qquad \cos x = \sin(90 - x)$$

$$\tan x = \cot(90 - x) \qquad \cot x = \tan(90 - x)$$

$$\sec x = \csc(90 - x) \qquad \csc x = \sec(90 - x)$$

Sum and Difference Formulas

$$\sin(a \pm b) = \sin a \cos b \pm \sin b \cos a$$

$$\cos(a \pm b) = \cos a \cos b \mp \sin a \sin b$$

$$\tan(a \pm b) = \frac{\tan a \pm \tan b}{1 \mp \tan a \tan b}$$

Negative Relationships

$$\sin(-\theta) = -\sin\theta \qquad \csc(-\theta) = -\csc\theta$$

$$\cos(-\theta) = \cos\theta \qquad \sec(-\theta) = \sec\theta$$

$$\tan(-\theta) = -\tan\theta \qquad \cot(-\theta) = -\cot\theta$$