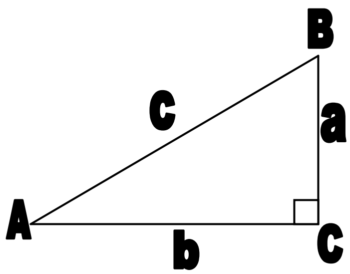
Right Triangles

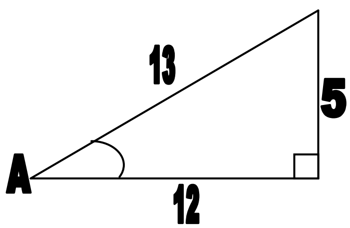


Six Trigonometric Functions

$$\sin A = \frac{a}{c}\left(\frac{opposite}{hypotenuse}\right) \qquad \csc A = \frac{c}{a}\left(\frac{1}{\sin A}\right)$$

$$\cos A = \frac{b}{c}\left(\frac{adjacent}{hypotenuse}\right) \qquad \sec A = \frac{c}{b}\left(\frac{1}{\cos A}\right)$$

$$\tan A = \frac{a}{b}\left(\frac{opposite}{adjacent}\right) \qquad \cot A = \frac{b}{a}\left(\frac{1}{\tan A}\right)$$



Example--Six Trigonometric Functions:

$$\sin A = \frac{5}{13}\left(\frac{opposite}{hypotenuse}\right) \qquad \csc A = \frac{13}{5}\left(\frac{1}{\sin A}\right)$$

$$\cos A = \frac{12}{13}\left(\frac{adjacent}{hypotenuse}\right) \qquad \sec A = \frac{13}{12}\left(\frac{1}{\cos A}\right)$$

$$\tan A = \frac{5}{12}\left(\frac{opposite}{adjacent}\right) \qquad \cot A = \frac{12}{5}\left(\frac{1}{\tan A}\right)$$

$$\sin B = \frac{a}{c}\left(\frac{opposite}{hypotenuse}\right) \qquad \csc B = \frac{c}{a}\left(\frac{1}{\sin B}\right)$$

$$\cos B = \frac{b}{c}\left(\frac{adjacent}{hypotenuse}\right) \qquad \sec B = \frac{c}{b}\left(\frac{1}{\cos B}\right)$$

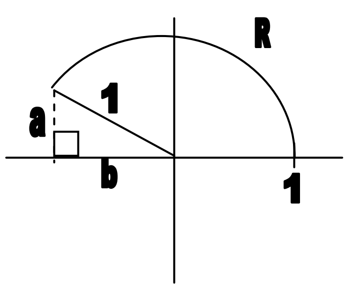
$$\tan B = \frac{a}{b}\left(\frac{opposite}{adjacent}\right) \qquad \cot B = \frac{b}{a}\left(\frac{1}{\tan B}\right)$$

$$1 = \left(\frac{a}{c}\right)^2 + \left(\frac{b}{c}\right)^2$$

$$1 = \sin^2 A + \cos^2 B$$

$$1 = \cos^2 A + \sin^2 B$$

Radians



$$\sin\theta = \frac{a}{1} \qquad \csc\theta = \frac{1}{a}, a \neq 0$$

$$\cos\theta = \frac{b}{1} \qquad \sec\theta = \frac{1}{b}, b \neq 0$$

$$\tan\theta = \frac{a}{b} \qquad \cot\theta = \frac{b}{a}, a \neq 0$$

$$c^2 = 1 = a^2 + b^2$$

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

In case your forget: **S O H C A H T O A**

S*IN*
O*PPOSITE*
H*YPOTENUSE*
C*OS*
A*DJACENT*
H*YPOTENUSE*
T*AN*
O*PPOSITE*
A*DJACENT*

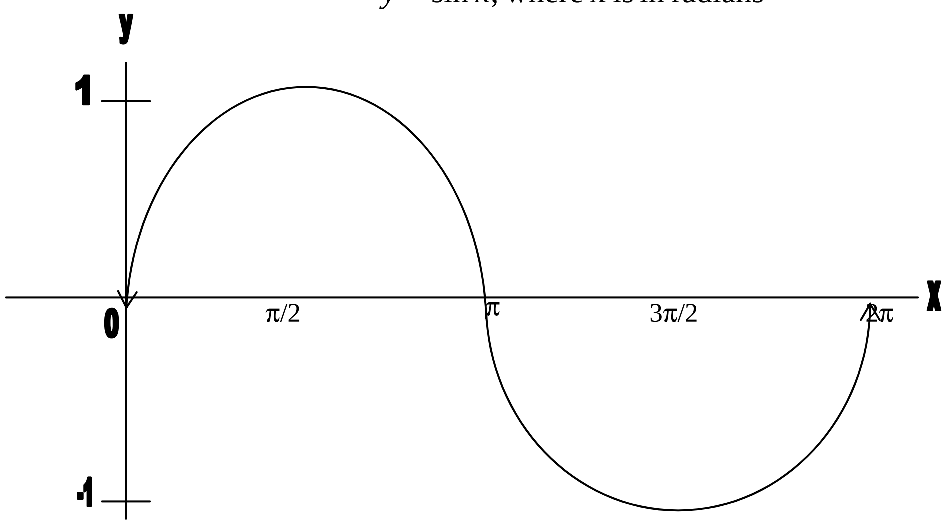
$$\sin \rightarrow \frac{opposite}{hypotenuse} \quad \cos \rightarrow \frac{adjacent}{hypotenuse} \quad \tan \rightarrow \frac{opposite}{adjacent}$$

θ	Sin θ	cos θ	tan θ	csc θ	sec θ	cot θ
0	**0**	**1**	**0**	**undefined**	**1**	**0**
30° (π/6)	$1/2$	$\sqrt{3}/2$	$1/\sqrt{3} = \sqrt{3}/3$	**2**	$2/\sqrt{3} = 2\sqrt{3}/3$	$3/\sqrt{3} = \sqrt{3}$
45° (π/4)	$\sqrt{2}/2$	$\sqrt{2}/2$	**1**	$2/\sqrt{2} = \sqrt{2}$	$2/\sqrt{2} = \sqrt{2}$	**1**
60° (π/3)	$\sqrt{3}/2$	$1/2$	$\sqrt{3}$	$2/\sqrt{3} = 2\sqrt{3}/3$	**2**	$1/\sqrt{3} = \sqrt{3}/3$
90° (π/2)	**1**	**0**	**undefined**	**1**	**undefined**	**0**
120° (2π/3)	$\sqrt{3}/2$	$-1/2$	$-\sqrt{3}$	$2/\sqrt{3} = 2\sqrt{3}/3$	**-2**	$-1/\sqrt{3} = -\sqrt{3}/3$
135° (3π/4)	$\sqrt{2}/2$	$-\sqrt{2}/2$	**-1**	$2/\sqrt{2} = \sqrt{2}$	$-2/\sqrt{2} = -\sqrt{2}$	**-1**
150° (5π/6)	$1/2$	$-\sqrt{3}/2$	$-1/\sqrt{3} = -\sqrt{3}/3$	**2**	$-2/\sqrt{3} = -2\sqrt{3}/3$	**3**
180° (π)	**0**	**-1**	**0**	**undefined**	**-1**	**undefined**
210° (7π/6)	$-1/2$	$-\sqrt{3}/2$	$1/\sqrt{3} = \sqrt{3}/3$	**-2**	$-2/\sqrt{3} = -2\sqrt{3}/3$	$\sqrt{3}$
225° (5π/4)	$-\sqrt{2}/2$	$-\sqrt{2}/2$	**1**	$-2/\sqrt{2} = -\sqrt{2}$	$-\sqrt{2}$	**1**
240° (4π/3)	$-\sqrt{3}/2$	$-1/2$	$\sqrt{3}$	$-2/\sqrt{3} = -2\sqrt{3}/3$	**-2**	$1/\sqrt{3} = \sqrt{3}/3$
270° (3π/2)	**-1**	**0**	**undefined**	**-1**	**undefined**	**0**
300° (5π/3)	$-\sqrt{3}/2$	$1/2$	$-\sqrt{3}$	$-2/\sqrt{3} = -2\sqrt{3}/3$	**2**	$-1/\sqrt{3} = -\sqrt{3}/3$
315° (7π/4)	$-\sqrt{2}/2$	$\sqrt{2}/2$	**-1**	$-\sqrt{2}$	$-\sqrt{2}$	**-1**
330° (11π/6)	$-1/2$	$\sqrt{3}/2$	$-1/\sqrt{3} = -\sqrt{3}/3$	**-2**	$2/\sqrt{3} = 2\sqrt{3}/3$	$-\sqrt{3}$
360° (2π)	**0**	**1**	**0**	**undefined**	**1**	**undefined**

θ	sin x	cos x	tan x	csc x	sec x	cot x
0						
30° (π/6)						
45° (π/4)						
60° (π/3)						
90° (π/2)						
120° (2π/3)						
135° (3π/4)						
150° (5π/6)						
180° (π)						
210° (7π/6)						
225° (5π/4)						
240° (4π/3)						
270° (3π/2)						
300° (5π/3)						
315° (7π/4)						
330° (11π/6)						
360° (2π)						

Trigonometric Graphs:

$y = \sin x$, where x is in radians



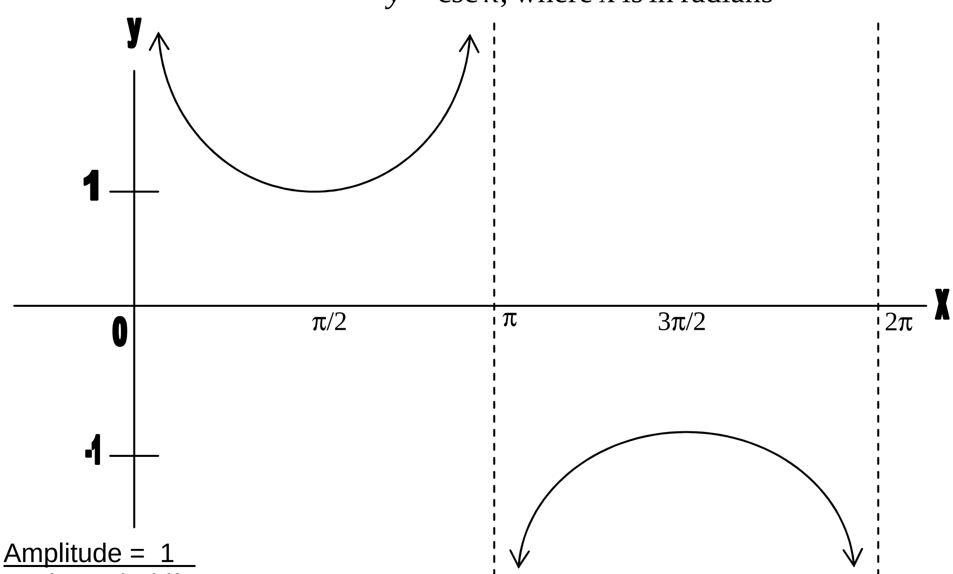
Amplitude = 1

Horizontal Shift = none

Period = 2π

Asymptotes: none

$y = \csc x$, where x is in radians



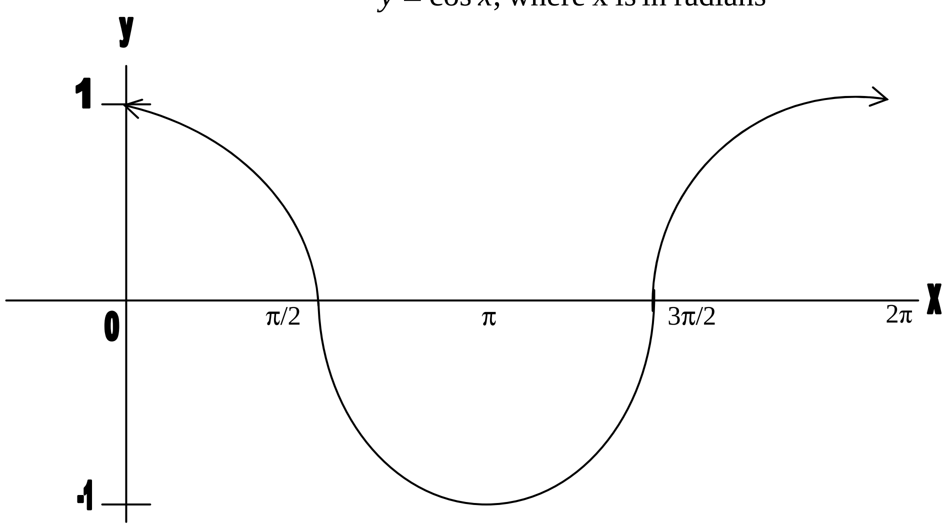
Amplitude = 1

Horizontal Shift = none

Period = 2π

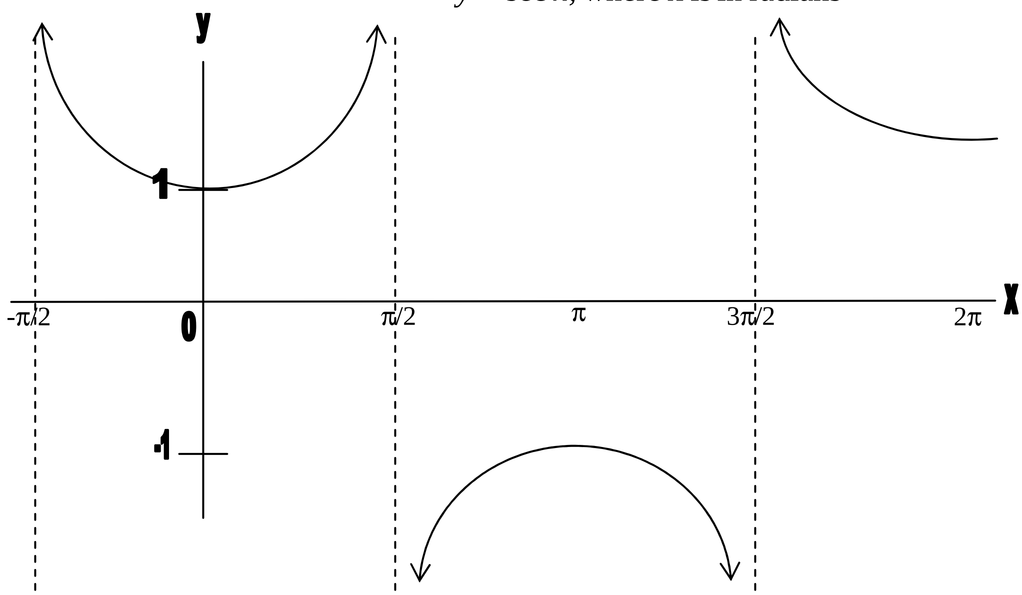
Asymptotes: x = 0, x = π, x = 2π

$y = \cos x$, where x is in radians



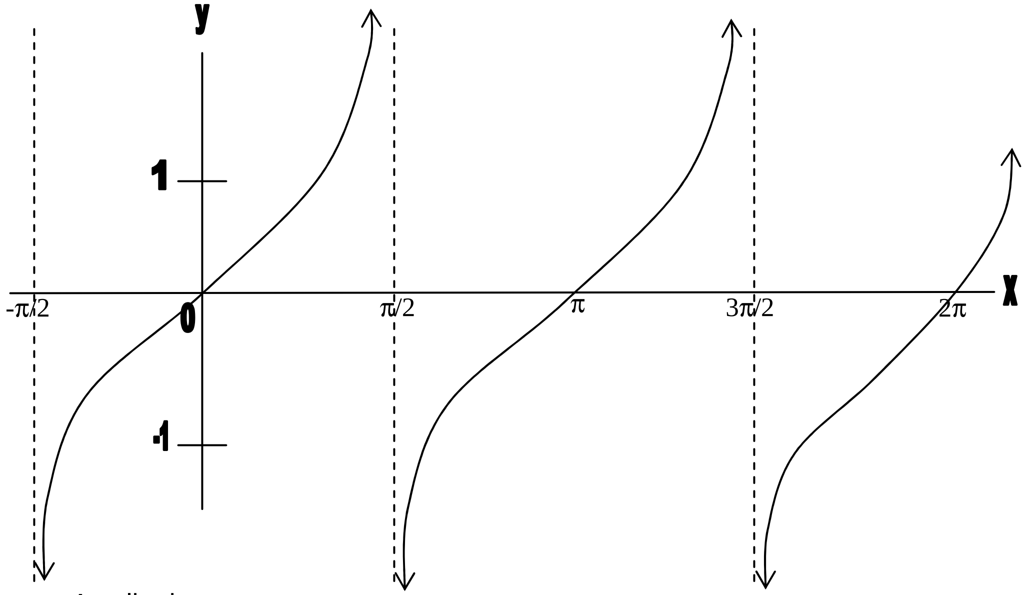
Amplitude = 1
Horizontal Shift = none
Period = 2π
Asymptotes: none

$y = \sec x$, where x is in radians



Amplitude = 1
Horizontal Shift = none
Period = 2π
Asymptotes: x =-π/2, x = π/2, x = 3π/2

$y = \tan x$, where x is in radians



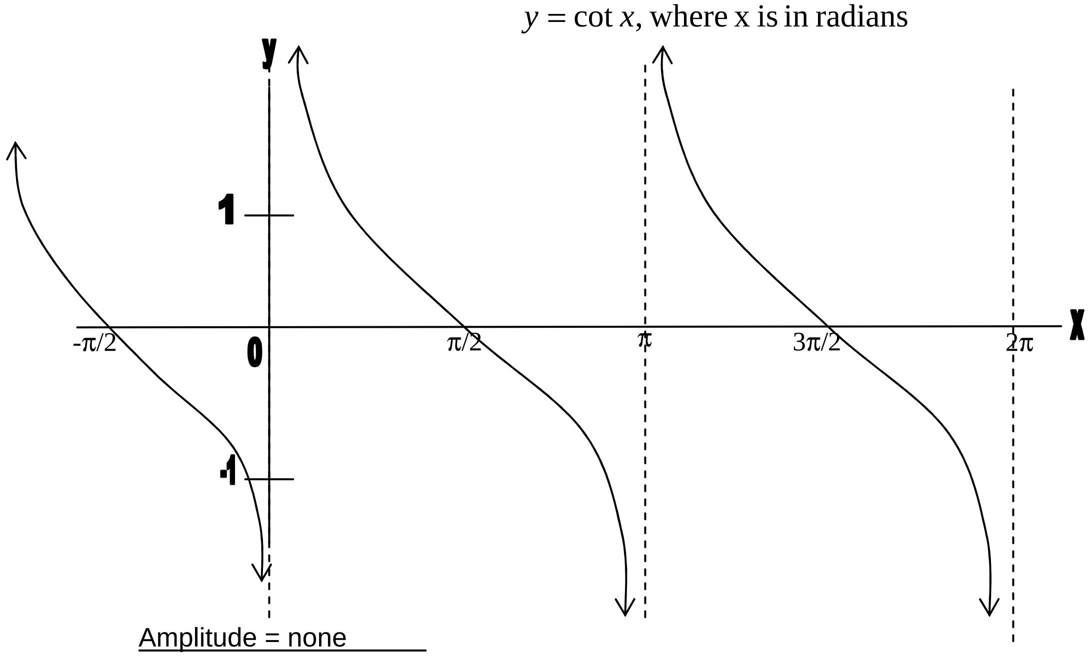
Amplitude = none

Horizontal Shift = none

Period = π

Asymptotes: $x = -\pi/2$, $x = \pi/2$, $x = 3\pi/2$

$y = \cot x$, where x is in radians

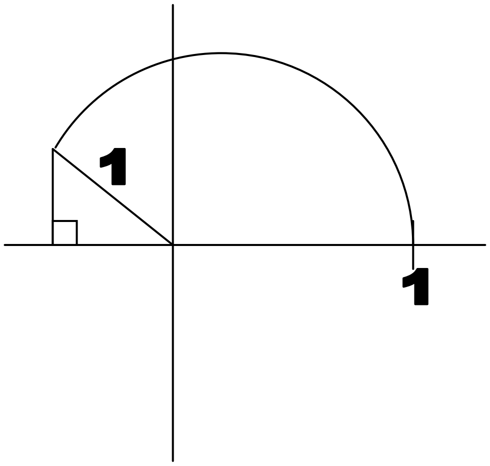


Amplitude = none

Horizontal Shift = none

Period = π

Asymptotes: $x = 0$, $x = \pi$, $x = 2\pi$



To convert from ***radians*** *to* ***degrees****:*

$$(radians)\left(\frac{180^\circ}{\pi}\right)$$

<u>Example:</u>
Convert 2π/3 to degrees.

$$\left(\frac{2\cancel{\pi}}{3}\right)\left(\frac{180^\circ}{\cancel{\pi}}\right) = 120^\circ$$

To convert from ***degrees*** *to* ***radians****:*

$$(\text{degrees})\left(\frac{\pi}{180^\circ}\right)$$

<u>Example:</u>
Convert 210° to radians.

$$(210\cancel{^\circ})\left(\frac{\pi}{180\cancel{^\circ}}\right) = \frac{7\pi}{6}$$