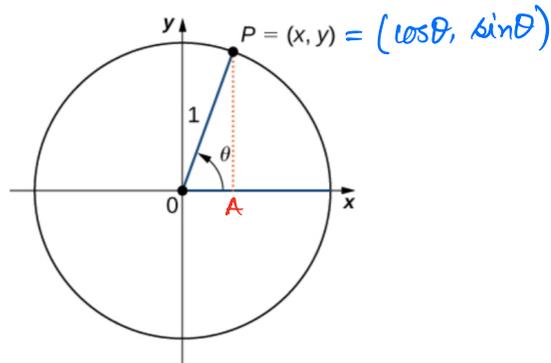


## Basic Trigonometric Functions:

Let  $P(x, y)$  be a point on a unit circle, centred at  $O(0, 0)$ .



$$\begin{aligned} OA &= x = \text{Adjacent Side} \\ AP &= y = \text{Opposite Side} \\ OP &= 1 = \text{Hypotenuse} \end{aligned}$$

$$\begin{aligned} \Delta OAP \text{ is right triangle} \\ \Downarrow \\ OA^2 + AP^2 = OP^2 \end{aligned}$$

Sine function :  $f(\theta) = \sin \theta$

$$\sin \theta = \frac{OPP}{HYP} = \frac{y}{1} = y$$

Cosine function :  $f(\theta) = \cos(\theta)$

$$\cos \theta = \frac{ADJ}{HYP} = \frac{x}{1} = x$$

Tangent function :  $f(\theta) = \tan \theta$

$$\tan \theta = \frac{OPP}{ADJ} = \frac{y}{x} = \frac{\sin \theta}{\cos \theta}$$

not defined  
for  $x = 0$

Cosecant function :  $f(\theta) = \csc \theta$

$$\csc \theta = \frac{\text{HYP}}{\text{OPP}} = \frac{1}{y} = \frac{1}{\sin \theta}$$

not defined  
for  $y=0$

Secant function :  $f(\theta) = \sec \theta$

$$\sec \theta = \frac{\text{HYP}}{\text{ADJ}} = \frac{1}{x} = \frac{1}{\cos \theta}$$

not defined  
for  $x=0$

Cotangent function :

$$\cot \theta = \frac{\text{ADJ}}{\text{OPP}} = \frac{x}{y} = \frac{1}{\tan \theta}$$

not defined  
for  $y=0$

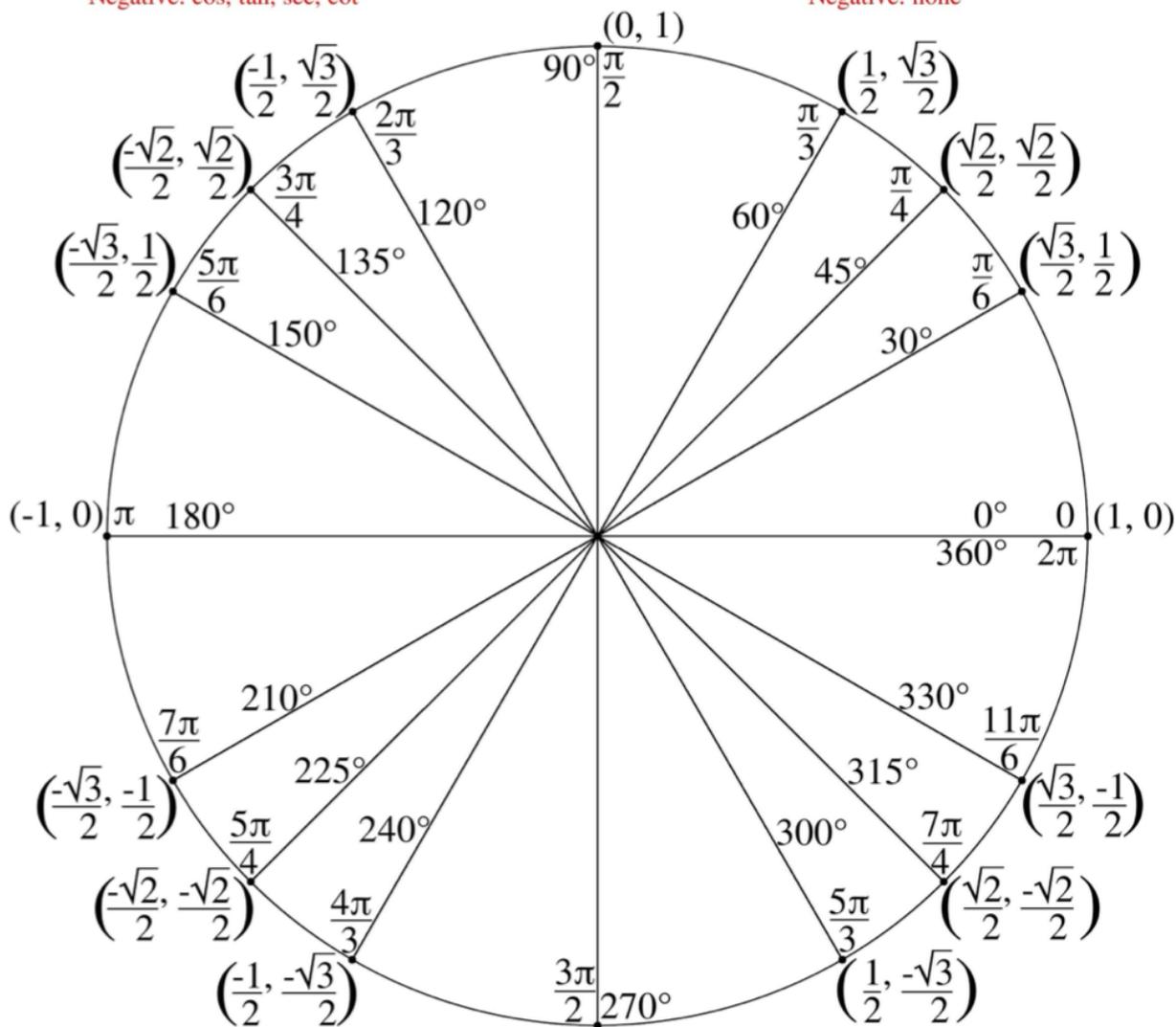
Sin  $\theta$  & Cos  $\theta$  Value-table

$\theta$	$\sin \theta$	$\cos \theta$
0	0	1
$\frac{\pi}{6}$	$\frac{1}{2}$	$\frac{\sqrt{3}}{2}$
$\frac{\pi}{4}$	$\frac{\sqrt{2}}{2}$	$\frac{\sqrt{2}}{2}$
$\frac{\pi}{3}$	$\frac{\sqrt{3}}{2}$	$\frac{1}{2}$
$\frac{\pi}{2}$	1	0

# The Unit Circle

Positive: sin, csc  
Negative: cos, tan, sec, cot

Positive: sin, cos, tan, sec, csc, cot  
Negative: none



Positive: tan, cot  
Negative: sin, cos, sec, csc

Positive: cos, sec  
Negative: sin, tan, csc, cot

## Pythagorean Identities

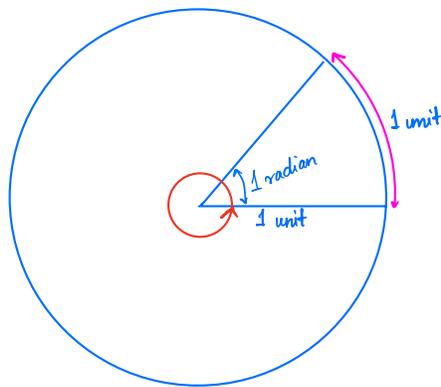
$$\textcircled{1} \sin^2 \theta + \cos^2 \theta = 1$$

$$\textcircled{2} 1 + \tan^2 \theta = \sec^2 \theta$$

$$\textcircled{3} 1 + \cot^2 \theta = \csc^2 \theta$$

Radian: The trigonometric functions are measured with radians.

$$1 \text{ radian} = \frac{1 \text{ unit arc length}}{1 \text{ unit radius length}} \left. \vphantom{\frac{1 \text{ unit arc length}}{1 \text{ unit radius length}}} \right\} \text{ for an unit circle}$$



$$\leftarrow \begin{array}{l} \text{Circumference} = 2\pi \\ \text{Radius} = 1 \end{array}$$

$$360^\circ = \frac{2\pi}{1} \text{ radians}$$

$$\Rightarrow \boxed{180^\circ = \pi \text{ radian}}$$

# Graph of Trigonometric Functions

