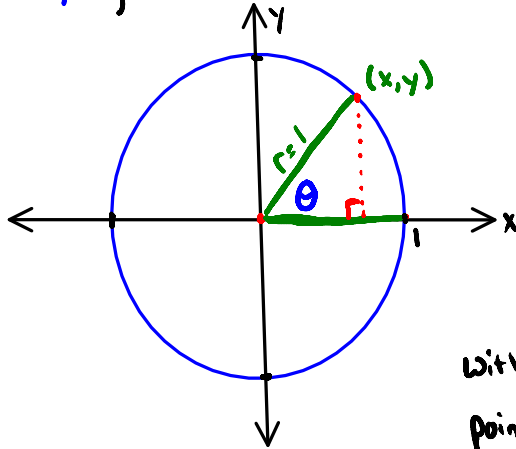


# 4.2 Unit Circle

Wednesday, March 11, 2015  
10:23 AM

When a circle has a radius of 1 and the center is at the origin (0,0), it is called a Unit Circle.



$$x^2 + y^2 = 1$$

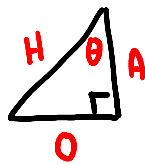
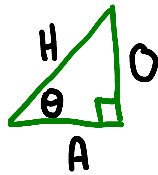
Center (0,0)  
 $r = 1$

$$(x-h)^2 + (y-k)^2 = r^2$$

With the unit circle, you can find points on the circle using Rt Δ.

\* Always bring a VERTICAL line down or up to the X-axis to form Rt Δ. \*

<b>SOH</b>	<b>CAH</b>	<b>TOA</b>	} Right Triangles
$\sin = \frac{O}{H}$	$\cos = \frac{A}{H}$	$\tan = \frac{O}{A}$	
$\csc = \frac{H}{O}$	$\sec = \frac{H}{A}$	$\cot = \frac{A}{O}$	



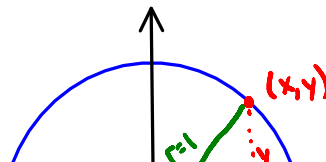
## Six Trig Functions and the Unit Circle ; where r = 1

Function

Unit circle Relation

Sine

$$\sin = \frac{y}{1} \quad \frac{y}{r}$$



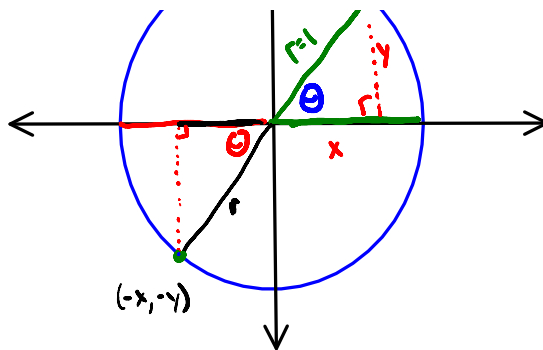
Cosine  $\cos = \frac{x}{r} = \frac{x}{r}$

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

Cosecant  $\csc = \frac{1}{y} = \frac{r}{y} = \frac{1}{\sin \theta}$

Secant  $\sec = \frac{1}{x} = \frac{r}{x} = \frac{1}{\cos \theta}$

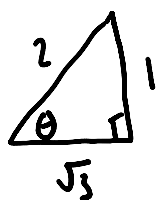
Cotangent  $\cot = \frac{x}{y} = \frac{\cos \theta}{\sin \theta}$



Notice that the y-coord is  $\sin \theta$  and the x-coord is  $\cos \theta$ ; only on the unit circle.  $(x, y) \rightarrow (\cos \theta, \sin \theta)$

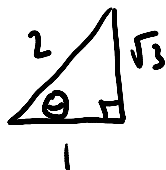
### Review Special Right Triangles

$\theta = 30^\circ$  or  $\frac{\pi}{6}$



For  $30^\circ$ - $60^\circ$ , hypotenuse is twice the short side. The middle leg is  $\sqrt{3} \cdot$  short side

$\theta = 60^\circ$  or  $\frac{\pi}{3}$



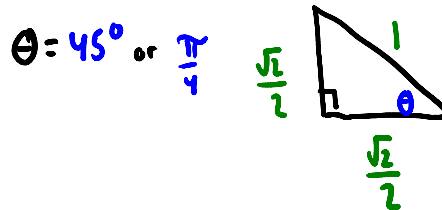
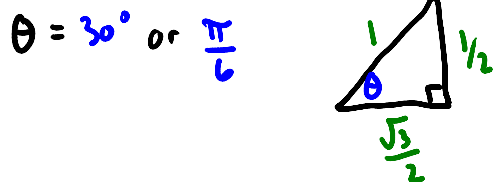
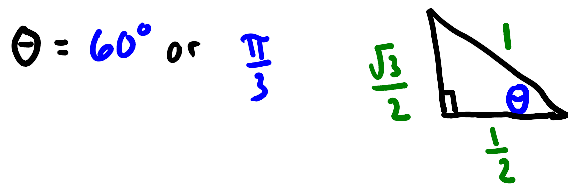
$\theta = 45^\circ$  or  $\frac{\pi}{4}$   
Isosceles



For  $45^\circ$ , hypotenuse is  $\sqrt{2} \cdot$  short side.

Special Right  $\Delta$ s on the unit circle (Reference triangles)

## Special Right Triangles on the unit circle (Reference triangles)

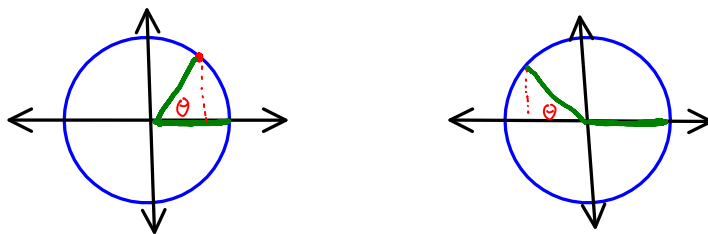


## Study, Filled out Unit Circle

When  $x=0$  tangent and secant functions are undefined.  
Happens at  $90^\circ$  or  $\frac{\pi}{2}$  and  $270^\circ$  or  $\frac{3\pi}{2}$

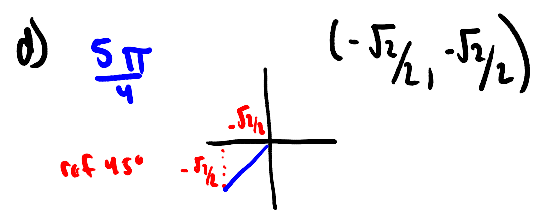
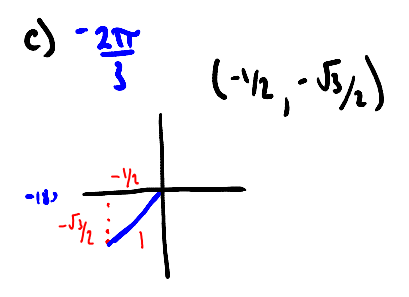
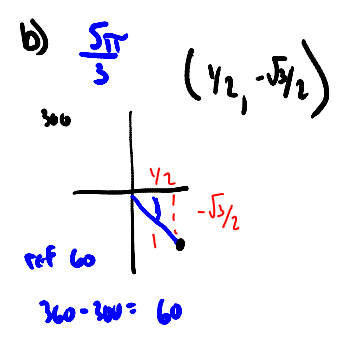
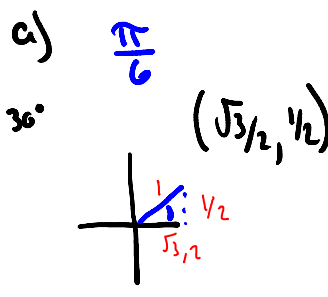
When  $y=0$  cotangent and cosecant functions are undefined.  
Happens at  $0^\circ$  or  $0\text{rad}$ ,  $180^\circ$  or  $\pi$ ,  $360^\circ$  or  $2\pi$

Reference Angle is an acute angle formed by the terminal side and x-axis

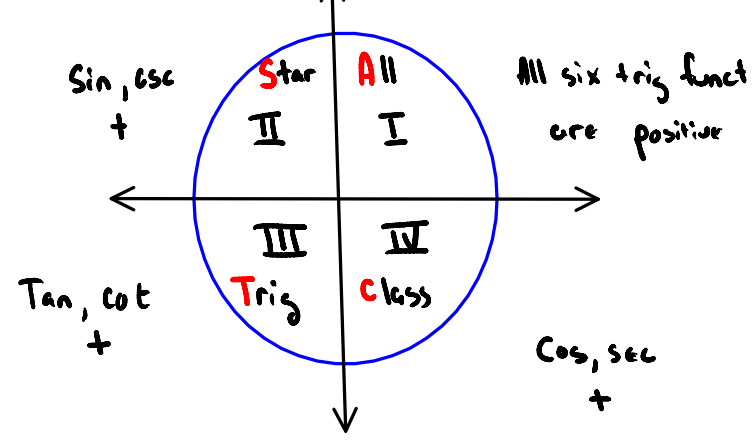


Ex. 1 What ordered pair on the Unit Circle corresponds to the following angle.

- a)  $\frac{\pi}{6}$   $(\sqrt{3}/2, 1/2)$       b)  $\frac{5\pi}{3}$   $(1/2, -\sqrt{3}/2)$       c)  $-\frac{2\pi}{3}$   $(-1/2, -\sqrt{3}/2)$

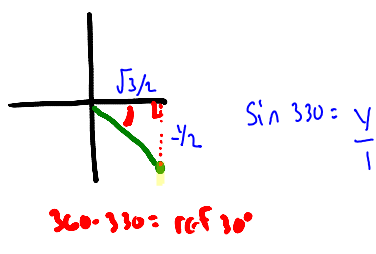


## ALL STAR TRIG CLASS

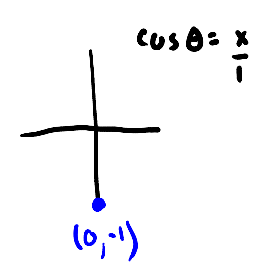


### Ex. 2 Give exact values

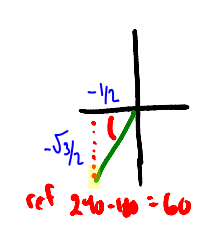
a)  $\sin 330^\circ = -1/2$



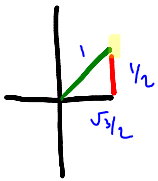
b)  $\cos 270^\circ = 0$



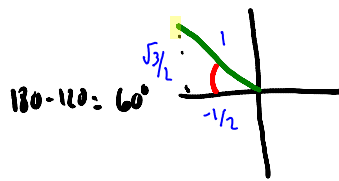
c)  $\sin 240 = -\frac{\sqrt{3}}{2}$



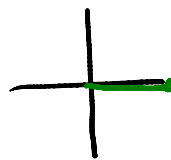
d)  $\cos 30^\circ = \frac{\sqrt{3}}{2}$



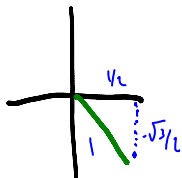
e)  $\cos 120^\circ = -\frac{1}{2}$



f)  $\sin 0^\circ = 0$

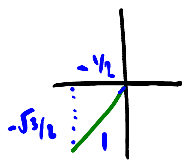


g)  $\cos 300^\circ = \frac{1}{2}$



ref. 60

h)  $\sin -120^\circ = -\frac{\sqrt{3}}{2}$



-180 - (-120) = -60

i)  $\cos -60^\circ = \frac{1}{2}$

