

Wednesday, November 28, 2018  
5:59 PM

Precalc **KEY**

4.4A: Trig Functions of any angle

Obj: To evaluate trig functions of any angle

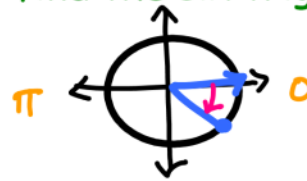
Hwk: 4.4A problems - draw reference  $\Delta$  for each!!!

Test 4.1 - 4.4 - Weds 12/5

Do Now:

Use the Unit Circle to find the six trig functions for  $\theta = \left(-\frac{\pi}{6}\right)$ .

Point  $\left(\frac{\sqrt{3}}{2}, -\frac{1}{2}\right)$



$$y \sin \theta = \boxed{-\frac{1}{2}}$$

$$\csc \theta = \frac{-2}{1} = \boxed{-2}$$

$$x \cos \theta = \boxed{\frac{\sqrt{3}}{2}}$$

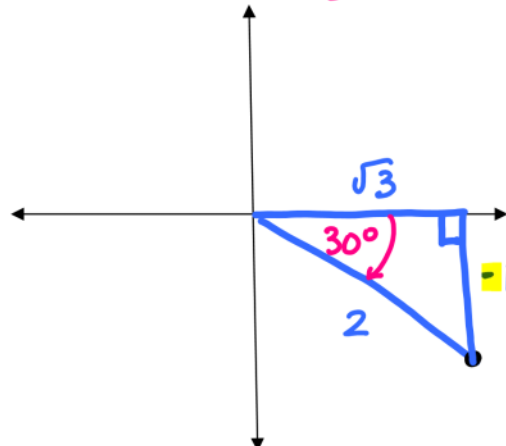
$$\sec \theta = \frac{2}{\frac{\sqrt{3}}{2}} = \boxed{\frac{2\sqrt{3}}{3}}$$

$$\frac{y}{x} \tan \theta = \frac{-\frac{1}{2}}{\frac{\sqrt{3}}{2}} = -\frac{1}{2} \cdot \frac{2}{\sqrt{3}}$$

$$\cot \theta = \boxed{-\sqrt{3}}$$

$$= -\frac{1}{\sqrt{3}} \cdot \frac{\sqrt{3}}{\sqrt{3}} = \boxed{-\frac{\sqrt{3}}{3}}$$

How could we find  $\sin\left(-\frac{\pi}{6}\right)$  without referring to the unit circle?  
 $= 30^\circ$



$$\sin\theta = \frac{y}{r} = \boxed{-\frac{1}{2}}$$



Think "Bow Tie"

This is called a  
REFERENCE TRIANGLE.

Example 1:



Find the six trig functions for  $\theta = 120^\circ$  by drawing a reference triangle.

$$\text{r/c} \quad \sin \theta = \frac{\sqrt{3}}{2}$$

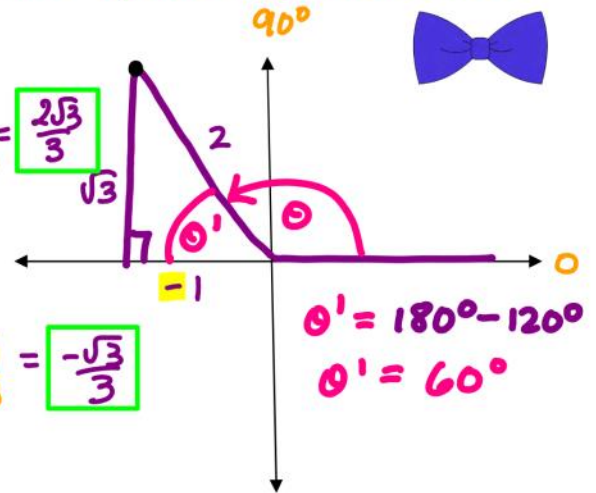
$$\text{csc } \theta = \frac{2}{\sqrt{3}} \cdot \frac{\sqrt{3}}{\sqrt{3}} = \frac{2\sqrt{3}}{3}$$

$$\text{r/x} \quad \cos \theta = -\frac{1}{2}$$

$$\text{sec } \theta = -2$$

$$\text{x/c} \quad \tan \theta = \frac{\sqrt{3}}{-1} = -\sqrt{3}$$

$$\text{cot } \theta = \frac{-1}{\sqrt{3}} \cdot \frac{\sqrt{3}}{\sqrt{3}} = -\frac{\sqrt{3}}{3}$$



\*Remember, in QII, III and IV, either x, y or both are negative!!

Example 2:

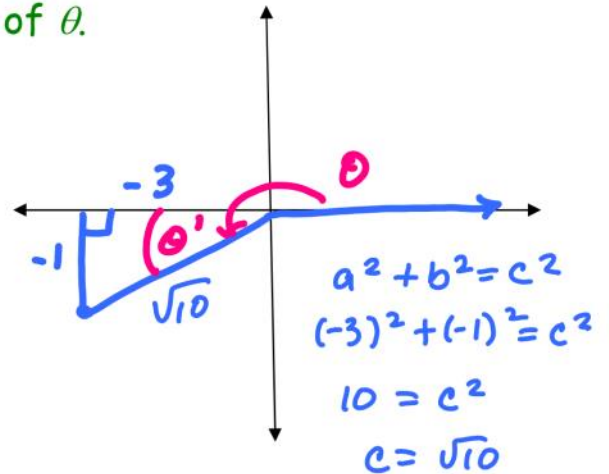
Let  $(-3, -1)$  be on the terminal side of  $\theta$ .

Find the 6 trig functions of  $\theta$ .

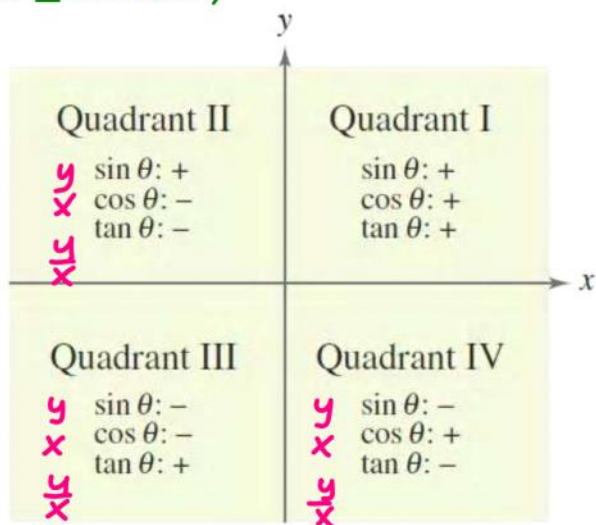
$$\text{r/c} \quad \sin \theta = \frac{-1}{\sqrt{10}} \cdot \frac{\sqrt{10}}{\sqrt{10}} = -\frac{\sqrt{10}}{10} \quad \text{csc } \theta = -\sqrt{10}$$

$$\text{r/x} \quad \cos \theta = \frac{-3}{\sqrt{10}} \cdot \frac{\sqrt{10}}{\sqrt{10}} = -\frac{3\sqrt{10}}{10} \quad \text{sec } \theta = -\frac{\sqrt{10}}{3}$$

$$\text{x/c} \quad \tan \theta = \frac{-1}{-3} = \frac{1}{3} \quad \text{cot } \theta = 3$$



All Students Text Constantly



\*Function & its reciprocal  
have SAME SIGN!!!

Example 3: (Name that Quadrant)

State the quadrant in which  $\theta$  lies.

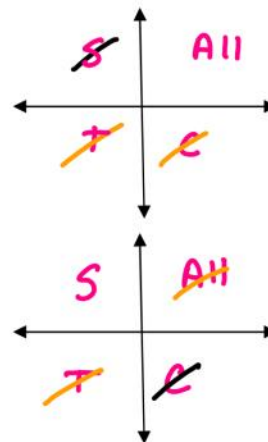
a)  $\sin \theta > 0$  and  $\cos \theta > 0$

Quadrant I

b)  $\tan \theta < 0$  and  $\csc \theta > 0$

\* reciprocal  
of sin  
so sin must  
be positive

Quadrant II





Example 4:

Given  $\tan \theta = -\frac{12}{5}$  and  $\cos \theta > 0$ , find the other trig functions.  
*neg.* *pos*  $\therefore$  **Quadrant IV**

$y$   
 $x$   $\sin \theta = \frac{-12}{13}$

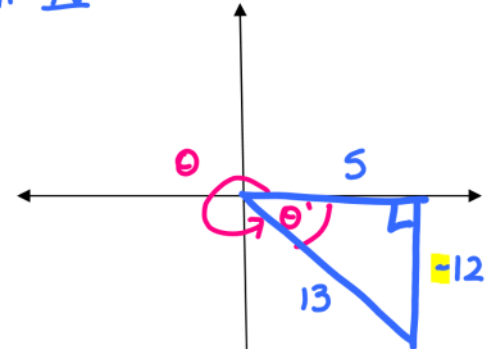
$\csc \theta = \frac{-13}{12}$

$x$   
 $y$   $\cos \theta = \frac{5}{13}$

$\sec \theta = \frac{13}{5}$

$y$   
 $x$   $\tan \theta = \frac{-12}{5}$

$\cot \theta = \frac{-5}{12}$



$a^2 + b^2 = c^2$   
 $5^2 + (-12)^2 = c^2$   
 $169 = c^2$   
 $c = 13$

Example 5:

Given  $\tan \theta$  is undefined and  $0 \leq \theta \leq \pi$ , find the other trig functions.  
*y* *x*  $\times$  when is  $x=0$ ?

$y$   $\sin \theta = 1$

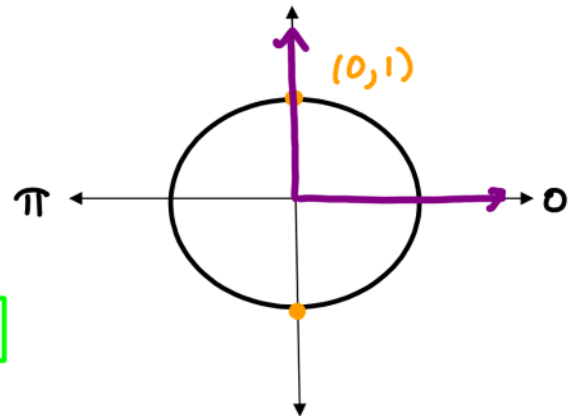
$\csc \theta = 1$

$x$   $\cos \theta = 0$

$\sec \theta = \frac{1}{0} = \text{undef}$

$y$   
 $x$   $\tan \theta = \frac{1}{0} = \text{undef.}$

$\cot \theta = \frac{0}{1} = 0$



Where is tangent undefined? Think Unit Circle!!!

$$\csc \theta = \frac{r}{y} = \frac{4}{1}$$

$\frac{s}{c} \mid \frac{A}{E}$  \* Quadrant I

Example 6: pos

Given  $\csc \theta = 4$  and  $\cot \theta < 0$ , find the other trig functions.

\* reciprocal of sin  
∴ sin must be pos

$$\sin \theta = \frac{1}{4}$$

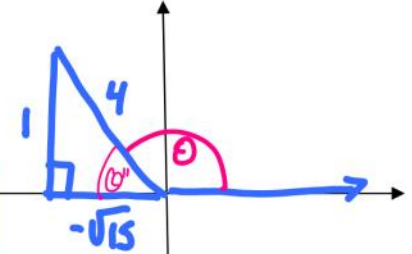
\* reciprocal of tan  
∴ tan must be neg

$$\csc \theta = 4$$

$$\cos \theta = \frac{-\sqrt{15}}{4}$$

$$\sec \theta = \frac{4}{\sqrt{15}} \cdot \frac{\sqrt{15}}{\sqrt{15}} = \frac{4\sqrt{15}}{15}$$

$$\tan \theta = \frac{1}{\sqrt{15}} \cdot \frac{\sqrt{15}}{\sqrt{15}} = \frac{\sqrt{15}}{15} \quad \cot \theta = -\sqrt{15}$$



$$\begin{aligned} a^2 + b^2 &= c^2 \\ a^2 + 1^2 &= 4^2 \\ a^2 &= 15 \\ a &= \sqrt{15} \end{aligned}$$

Closure:

Can you think of another way to remember which trig functions are positive in which quadrant?

All Students Text Constantly