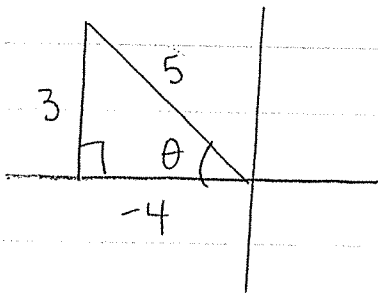


## Notes Section 4.3 - trig functions on the unit circle

1. let  $(-4, 3)$  be a point on the terminal side of an angle  $\theta$  in standard position, find the six trig values.



$$\sin \theta = \frac{3}{5}$$

$$\csc \theta = \frac{5}{3}$$

$$\cos \theta = -\frac{4}{5}$$

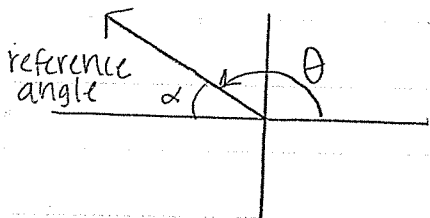
$$\sec \theta = -\frac{5}{4}$$

$$\tan \theta = -\frac{3}{4}$$

$$\cot \theta = -\frac{4}{3}$$

### reference angle

let  $\theta$  be in standard position. its reference angle is the acute angle formed by the terminal side of  $\theta$  and the horizontal axis.

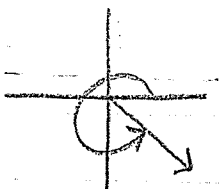


$$\theta = 120^\circ$$

$$\alpha = 60^\circ$$

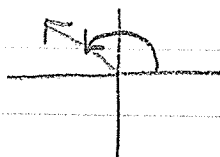
• sketch the angle and find its reference angle

1.  $330^\circ$



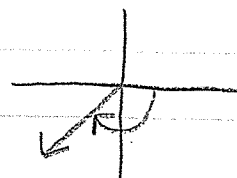
$$\alpha = 30^\circ$$

2.  $\frac{3\pi}{4}$



$$\alpha = \frac{\pi}{4}$$

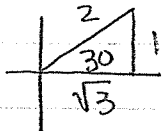
3.  $-150^\circ$



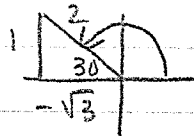
$$\alpha = 30^\circ$$

• find the exact value.

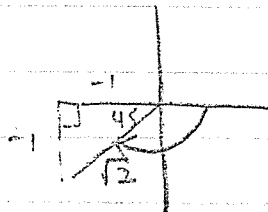
1.  $\sin \pi/4 = \boxed{1/2}$



2.  $\tan 150^\circ = \frac{-1}{\sqrt{3}} = \boxed{\frac{-\sqrt{3}}{3}}$

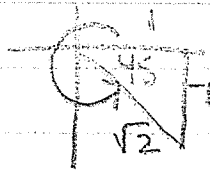


3.  $\sec(-135^\circ) = \boxed{-\sqrt{2}}$

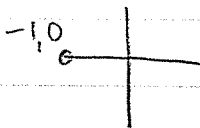


4.  $\sec 15\pi/4 = \boxed{\sqrt{2}}$

$\frac{15\pi}{4} - \frac{8\pi}{4} = \frac{7\pi}{4}$

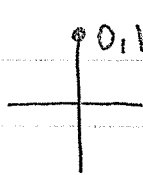


5.  $\cos \pi = \boxed{-1}$



6.  $\cot 7\pi/2 = \boxed{0}$

$\frac{7\pi}{2} - \frac{4\pi}{2} = \frac{3\pi}{2}$

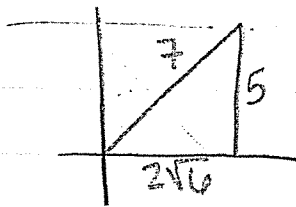
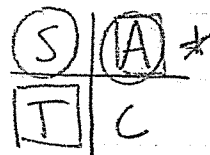


$\cot = x/y = 0/1$

SIN (+)		A (+)	all (+)
csc (+)		S	
TAN (+)		C (+)	COS (+)
cot (+)		T	

• find the exact values of the five remaining trig functions of  $\theta$ .

1.  $\sin\theta = 5/7$ ,  $\cot\theta > 0$



$$5^2 + x^2 = 7^2$$

$$x^2 = 24$$

$$x = 2\sqrt{6}$$

$$\sin\theta = 5/7$$

$$\cos\theta = 2\sqrt{6}/7$$

$$\tan\theta = 5/2\sqrt{6}$$

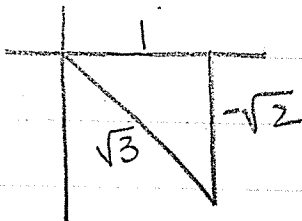
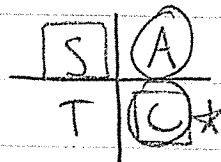
$$= 5\sqrt{6}/12$$

$$\csc\theta = 7/5$$

$$\sec\theta = 7\sqrt{6}/12$$

$$\cot\theta = 2\sqrt{6}/5$$

2.  $\sec\theta = \sqrt{3}$ ,  $\tan\theta < 0$



$$1^2 + x^2 = (\sqrt{3})^2$$

$$x^2 = 2$$

$$x = \sqrt{2}$$

$$\sin\theta = -\frac{\sqrt{2}}{\sqrt{3}} = -\frac{\sqrt{6}}{3}$$

$$\cos\theta = \frac{1}{\sqrt{3}} = \frac{\sqrt{3}}{3}$$

$$\tan\theta = -\sqrt{2}$$

$$\csc\theta = \frac{-\sqrt{3}}{\sqrt{2}} = -\frac{\sqrt{6}}{2}$$

$$\sec\theta = \sqrt{3}$$

$$\cot\theta = \frac{-1/\sqrt{2}}{-\sqrt{2}/2} = 1$$

trig functions ON the unit circle

$$\sin\theta = y$$

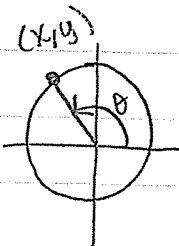
$$\cos\theta = x$$

$$\tan\theta = y/x$$

$$\csc\theta = 1/y$$

$$\sec\theta = 1/x$$

$$\cot\theta = x/y$$



More practice - find the exact value

1.  $\cos \frac{9\pi}{4}$   
 $\frac{9\pi}{4} - \frac{8\pi}{4} = \frac{\pi}{4}$   
 $\cos \frac{\pi}{4} = \boxed{\frac{\sqrt{2}}{2}}$

2.  $\sin(-300^\circ)$   
 $-300^\circ + 360^\circ = 60^\circ$   
 $\sin 60^\circ = \boxed{\frac{\sqrt{3}}{2}}$

3.  $\tan \frac{29\pi}{6}$   
 $\frac{29\pi}{6} - \frac{12\pi}{6} = \frac{17\pi}{6} - \frac{12\pi}{6} = \frac{5\pi}{6}$   
 $\tan \frac{5\pi}{6} = \boxed{-\frac{\sqrt{3}}{3}}$