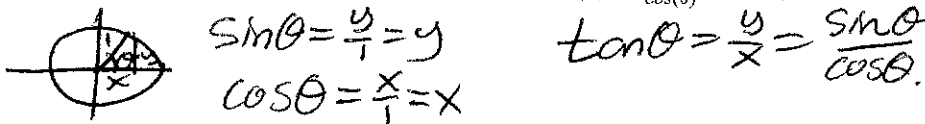


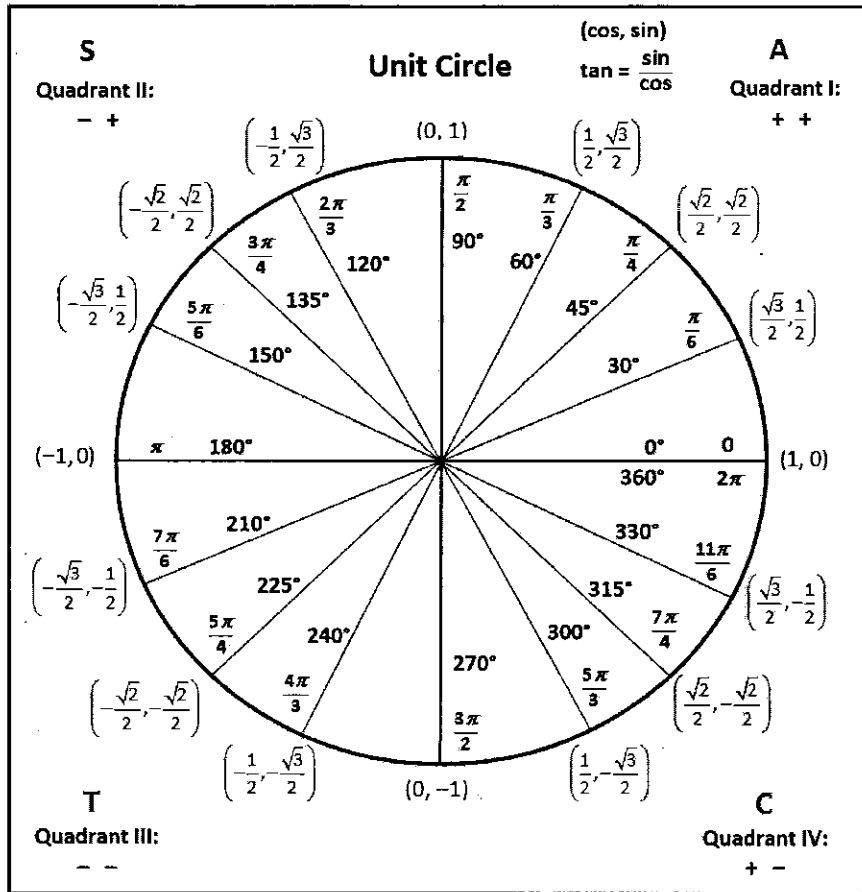
Recall that in a right triangle,  $\tan(\theta) = \frac{\text{opposite}}{\text{adjacent}}$ .

1. Explain why, if  $\theta$  is a rotation on the unit circle,  $\tan(\theta) = \frac{\sin(\theta)}{\cos(\theta)}$ . Be specific.



2. Use the unit circle to find:

- a.  $\tan(45^\circ) = 1$
- b.  $\tan(60^\circ) = \sqrt{3}$
- c.  $\tan(\frac{3\pi}{4}) = -1$
- d.  $\tan(270^\circ) = \infty$
- e.  $\tan(\frac{7\pi}{6}) = \frac{1}{\sqrt{3}}$  or  $\frac{\sqrt{3}}{3}$
- f.  $\tan(-45^\circ) = -1$
- g.  $\tan(-120^\circ) = \sqrt{3}$
- h.  $\tan(-\pi) = 0$



3. Use the unit circle to solve each equation for  $\theta$ :

- a.  $\tan(\theta) = \sqrt{3}, 0 \leq \theta \leq 360$   
 $60, 240$
- b.  $\tan(\theta) = 0, -\pi \leq \theta \leq \pi$   
 $-\pi, 0, \pi$
- c.  $\tan(\theta) = \infty, -360 \leq \theta \leq 0$   
 $-270, -90$
- d.  $\tan(\theta) = 1, 0 \leq \theta \leq 360$   
 $45, 225$

4. Tangent and Linear Equations

- a. What is the equation of the line that connects the origin to  $(\frac{\sqrt{2}}{2}, \frac{\sqrt{2}}{2})$ ?

$$m = \frac{\frac{\sqrt{2}}{2}}{\frac{\sqrt{2}}{2}} = 1 \quad y = 1x$$

- b. What is  $\tan(\pi/4)$ ?

$$\tan(\pi/4) = 1$$

- c. How are the answers to (a) and (b) related?

$$\text{Slope} = \tan(\theta)$$

- d. What is the equation of the line that connects  $(\frac{1}{2}, -\frac{\sqrt{3}}{2})$  to  $(-\frac{1}{2}, \frac{\sqrt{3}}{2})$ ?

$$\frac{\frac{\sqrt{3}}{2} - (-\frac{\sqrt{3}}{2})}{-\frac{1}{2} - \frac{1}{2}} = \frac{\sqrt{3}}{-1} = -\sqrt{3} \quad y = -\sqrt{3}x$$

- e. What is  $\tan(5\pi/3)$ ? What is  $\tan(2\pi/3)$ ?

$$-\sqrt{3}$$

- f. How are the answers to (d) and (e) related?

$$\tan \theta = m = \text{slope}$$

- g. Write notes about how tangent is related to a linear equation.

$\tan \theta$  gives the slope

5. Segments Tangent to the Unit Circle: Recall that in a right triangle,  $\tan(\theta) = \frac{\text{opposite}}{\text{adjacent}}$

- a. Which trigonometric function gives the length of QR?

$\sin \theta \leftarrow$  opposite! y-value

- b. Which trigonometric function gives the length of PR?

$\cos \theta \leftarrow$  adjacent! x-value

- c. What is the length of QP?

1  $\leftarrow$  radius!

- d. What is the length of PT?

1  $\leftarrow$

- e. Name two segments that are **opposite** to  $\theta$

QR & ST

- f. Name two segments that are **adjacent** to  $\theta$

PR & PT

- g. Thus, what is the length of ST?

$$\tan \theta = \frac{ST}{PT} = \frac{ST}{1} = ST, \text{ so } \tan \theta = ST$$

- h. Write notes about what tangent tells you about the unit circle.

tangent tells you the length of the segment tangent to the unit circle formed by central angle  $\theta$ .

