

## §7.2 Trigonometric Functions: The Unit Circle

Discuss the Unit Circle.

The Trigonometric Functions

Let  $t$  be a real number and let  $(x, y)$  be the point on the unit circle corresponding to  $t$ .

$$\sin t = y \qquad \csc t = \frac{1}{y} \quad (y \neq 0)$$

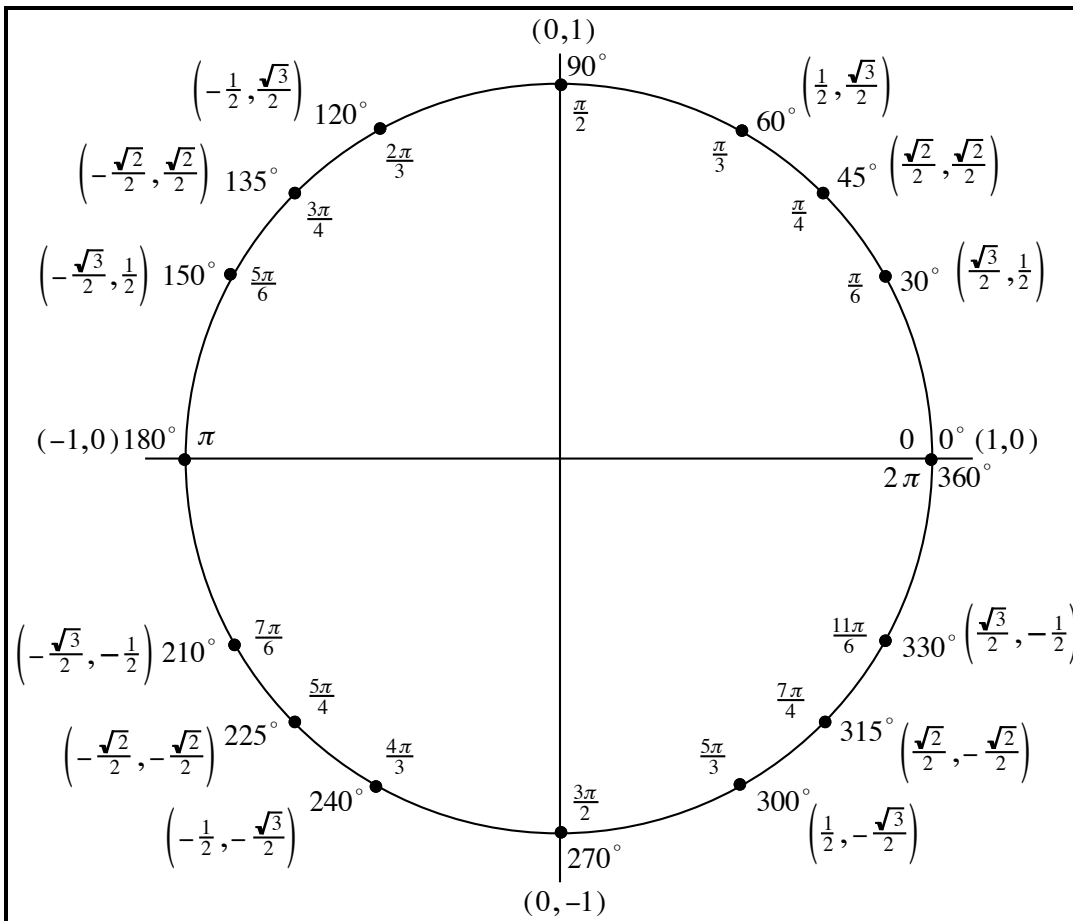
$$\cos t = x \qquad \sec t = \frac{1}{x} \quad (x \neq 0)$$

$$\tan t = \frac{y}{x} \quad (x \neq 0) \qquad \cot t = \frac{x}{y} \quad (y \neq 0)$$

### The Unit Circle

Find the the six trig values using a point on the unit

circle: Let  $P = \left(-\frac{1}{2}, \frac{\sqrt{3}}{2}\right)$



$$(x, y) = (\cos \theta, \sin \theta)$$

Example Evaluate the six trig functions at each real number.

a)  $t = \frac{\pi}{2}$

b)  $t = \frac{5\pi}{4}$

c)  $t = \pi$

Examples: Find a)  $\tan \frac{\pi}{4} - \sin \frac{3\pi}{2}$

Examples: Find a)  $\sin 135^\circ$  b)  $\cos -\frac{7\pi}{2}$

Discuss using a calculator.

Find  $\cos 48^\circ$   $\csc 21^\circ$

## Definitions of Trigonometric Functions of Any Angle

Let  $\theta$  be an angle in standard position with  $(x, y)$  a point on the terminal side of  $\theta$  and

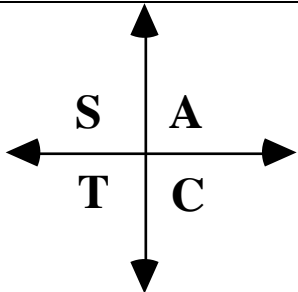
$$r = \sqrt{x^2 + y^2} \neq 0.$$

$$\sin \theta = \frac{y}{r} \quad \cos \theta = \frac{x}{r} \quad \tan \theta = \frac{y}{x}, \quad (x \neq 0)$$

$$\csc \theta = \frac{r}{y}, \quad (y \neq 0) \quad \sec \theta = \frac{r}{x}, \quad (x \neq 0)$$

$$\cot \theta = \frac{x}{y}, \quad (y \neq 0)$$

### Signs of Trigonometric Functions



"All Students Take Calculus"

Quad I -  $\sin \theta$ ,  $\cos \theta$ ,  $\tan \theta$  are positive

Quad II -  $\sin \theta$  is positive;  $\cos \theta$ ,  $\tan \theta$  are negative

Quad III -  $\tan \theta$  is positive;  $\sin \theta$ ,  $\cos \theta$  are negative

Quad IV -  $\cos \theta$  is positive;  $\sin \theta$ ,  $\tan \theta$  are negative

Example 1 Let  $(4, -3)$  be a point on the terminal side of  $\theta$ . Find the sine, cosine, and tangent of  $\theta$ .