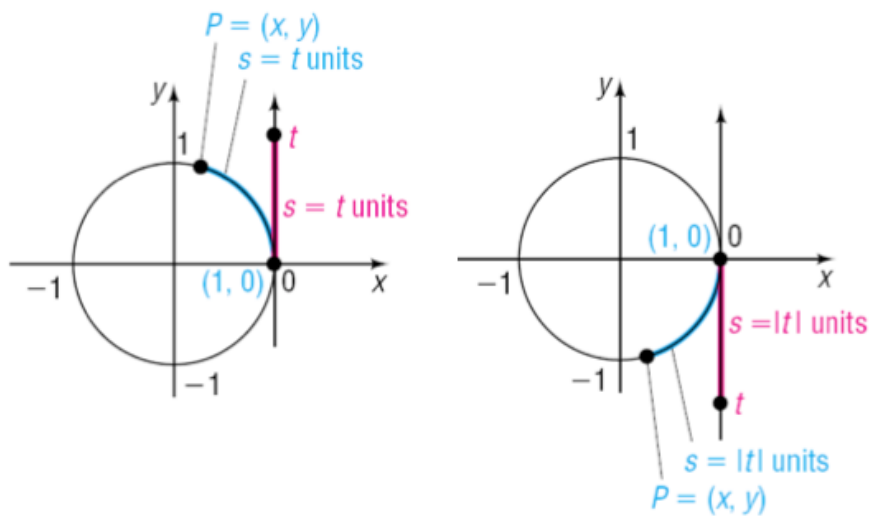


## Section 6.2

# Trigonometric Functions: Unit Circle Approach

### The Unit Circle



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

The **sine function** associates with  $t$  the  $y$ -coordinate of  $P$  and is denoted by

$$\sin t = y$$

The **cosine function** associates with  $t$  the  $x$ -coordinate of  $P$  and is denoted by

$$\cos t = x$$

If  $x \neq 0$ , the **tangent function** associates with  $t$  the ratio of the  $y$ -coordinate to the  $x$ -coordinate of  $P$  and is denoted by

$$\tan t = \frac{y}{x}$$

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

If  $y \neq 0$ , the **cosecant function** is defined as

$$\csc t = \frac{1}{y}$$

If  $x \neq 0$ , the **secant function** is defined as

$$\sec t = \frac{1}{x}$$

If  $y \neq 0$ , the **cotangent function** is defined as

$$\cot t = \frac{x}{y}$$

✓ 1 Find the Exact Values of the Trigonometric Functions Using a Point on the Unit Circle

**EXAMPLE**

**Finding the Values of the Trigonometric Functions Using a Point on the Unit Circle**

Find the values of  $\sin t$ ,  $\cos t$ ,  $\tan t$ ,  $\csc t$ ,  $\sec t$ , and  $\cot t$  if  $P = \left(-\frac{1}{2}, \frac{\sqrt{3}}{2}\right)$  is the point on the unit circle that corresponds to the real number  $t$ .

**DEFINITION**

If  $\theta = t$  radians, the six **trigonometric functions of the angle  $\theta$**  are defined as

$$\begin{array}{lll} \sin \theta = \sin t & \cos \theta = \cos t & \tan \theta = \tan t \\ \csc \theta = \csc t & \sec \theta = \sec t & \cot \theta = \cot t \end{array}$$

## 2 Find the Exact Values of the Trigonometric Functions of Quadrantal Angles

**EXAMPLE**

Finding the Exact Values of the Six Trigonometric Functions of Quadrantal Angles

Find the exact values of each of the six trigonometric functions of

(a)  $\theta = 0 = 0^\circ$

(b)  $\theta = \frac{\pi}{2} = 90^\circ$

(c)  $\theta = \pi = 180^\circ$

(d)  $\theta = \frac{3\pi}{2} = 270^\circ$

$\theta$ (Radians)	$\theta$ (Degrees)	$\sin \theta$	$\cos \theta$	$\tan \theta$	$\csc \theta$	$\sec \theta$	$\cot \theta$
0	$0^\circ$	0	1	0	Not defined	1	Not defined
$\frac{\pi}{2}$	$90^\circ$	1	0	Not defined	1	Not defined	0
$\pi$	$180^\circ$	0	-1	0	Not defined	-1	Not defined
$\frac{3\pi}{2}$	$270^\circ$	-1	0	Not defined	-1	Not defined	0

**EXAMPLE**

**Finding Exact Values of the Trigonometric Functions  
of Angles That Are Integer Multiples of Quadrantal Angles**

Find the exact value of:

(a)  $\sin(3\pi)$

(b)  $\cos(-270^\circ)$