

## Section 4.2 Trigonometric Functions: The Unit Circle

**Objective:** In this lesson you learned how to identify a unit circle and its relationship to real numbers.

Course Number

Instructor

Date

### Important Vocabulary

Define each term or concept.

**Unit circle**

**Period**

### I. The Unit Circle (Page 363)

As the real number line is wrapped around the unit circle, each real number  $t$  corresponds to . . .

The real number  $2\pi$  corresponds to the point \_\_\_\_\_ on the unit circle.

Each real number  $t$  also corresponds to a \_\_\_\_\_ (in standard position) whose radian measure is  $t$ . With this interpretation of  $t$ , the arc length formula  $s = r\theta$  (with  $r = 1$ ) indicates that . . .

#### *What you should learn*

How to identify a unit circle and its relationship to real numbers

### II. The Trigonometric Functions (Pages 364–366)

The coordinates  $x$  and  $y$  are two functions of the real variable  $t$ . These coordinates can be used to define six trigonometric functions of  $t$ . List the abbreviation for each trigonometric function.

**Sine** \_\_\_\_\_ **Cosecant** \_\_\_\_\_

**Cosine** \_\_\_\_\_ **Secant** \_\_\_\_\_

**Tangent** \_\_\_\_\_ **Cotangent** \_\_\_\_\_

#### *What you should learn*

How to evaluate trigonometric functions using the unit circle

Let  $t$  be a real number and let  $(x, y)$  be the point on the unit circle corresponding to  $t$ . Complete the following definitions of the trigonometric functions:

$$\sin t = \underline{\hspace{2cm}} \qquad \cos t = \underline{\hspace{2cm}}$$

$$\tan t = \underline{\hspace{2cm}} \qquad \cot t = \underline{\hspace{2cm}}$$

$$\sec t = \underline{\hspace{2cm}} \qquad \csc t = \underline{\hspace{2cm}}$$

The cosecant function is the reciprocal of the \_\_\_\_\_ function. The cotangent function is the reciprocal of the \_\_\_\_\_ function. The secant function is the reciprocal of the \_\_\_\_\_ function.

Complete the following table showing the correspondence between the real number  $t$  and the point  $(x, y)$  on the unit circle when the unit circle is divided into eight equal arcs.

$t$	0	$\frac{\pi}{4}$	$\frac{\pi}{2}$	$\frac{3\pi}{4}$	$\pi$	$\frac{5\pi}{4}$	$\frac{3\pi}{2}$	$\frac{7\pi}{4}$
$x$								
$y$								

Complete the following table showing the correspondence between the real number  $t$  and the point  $(x, y)$  on the unit circle when the unit circle is divided into 12 equal arcs.

$t$	0	$\frac{\pi}{6}$	$\frac{\pi}{3}$	$\frac{\pi}{2}$	$\frac{2\pi}{3}$	$\frac{5\pi}{6}$	$\pi$	$\frac{7\pi}{6}$	$\frac{4\pi}{3}$	$\frac{3\pi}{2}$	$\frac{5\pi}{3}$	$\frac{11\pi}{6}$
$x$												
$y$												

**Example 1:** Find the following:

$$(a) \cos \frac{\pi}{3} \qquad (b) \tan \frac{3\pi}{4} \qquad (c) \csc \frac{7\pi}{6}$$

### III. Domain and Period of Sine and Cosine (Pages 366–367)

The sine function's domain is \_\_\_\_\_,  
and its range is \_\_\_\_\_.

**What you should learn**  
How to use the domain and period to evaluate sine and cosine functions

The cosine function's domain is \_\_\_\_\_,  
and its range is \_\_\_\_\_.

The period of the sine function is \_\_\_\_\_. The  
period of the cosine function is \_\_\_\_\_.

Which trigonometric functions are even functions?

\_\_\_\_\_

Which trigonometric functions are odd functions?

\_\_\_\_\_

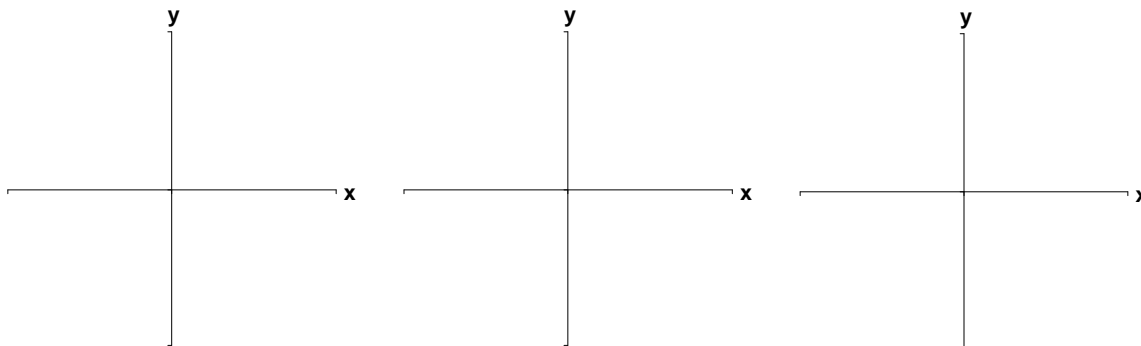
**Example 2:** Evaluate  $\sin \frac{31\pi}{6}$

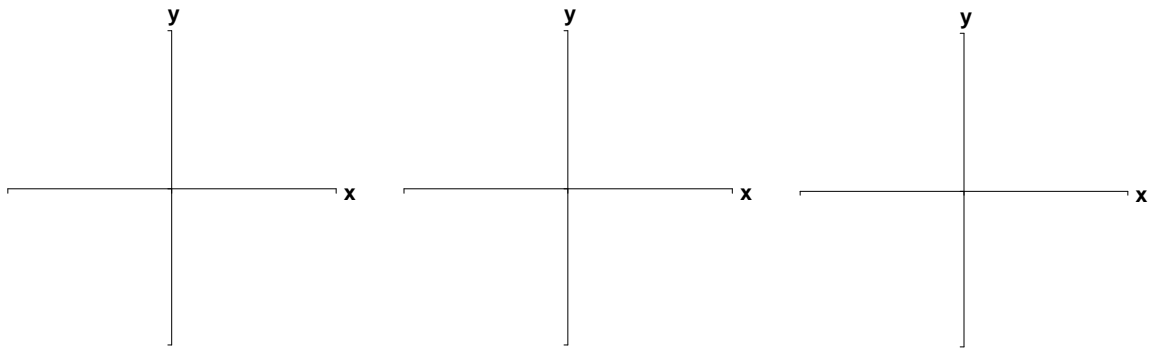
#### IV. Evaluating Trigonometric Functions with a Calculator (Page 367)

To evaluate the secant function with a calculator, . . .

*What you should learn*  
How to use a calculator  
to evaluate trigonometric  
functions

**Example 3:** Use a calculator to evaluate (a)  $\tan 4\pi/3$ , and  
(b)  $\cos 3$ .



**Additional notes****Homework Assignment**

Page(s)

Exercises