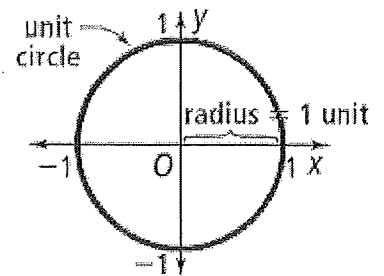


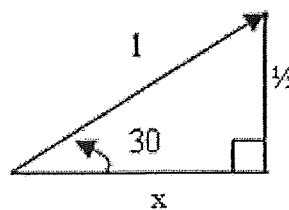
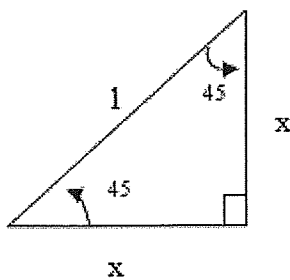
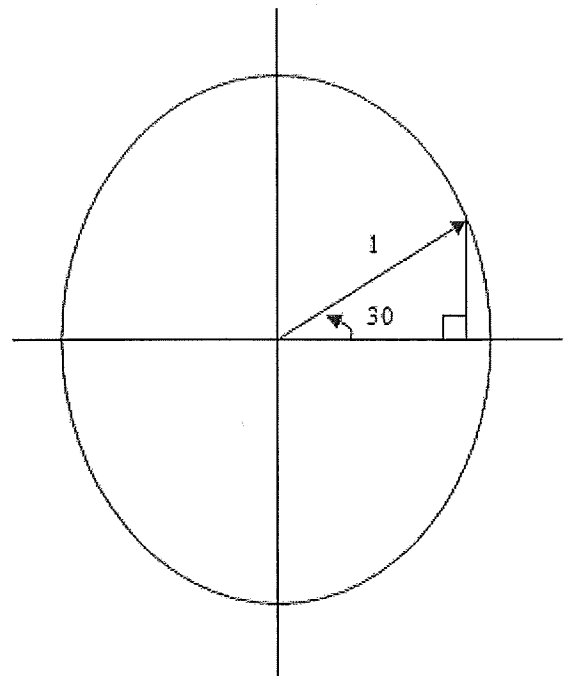
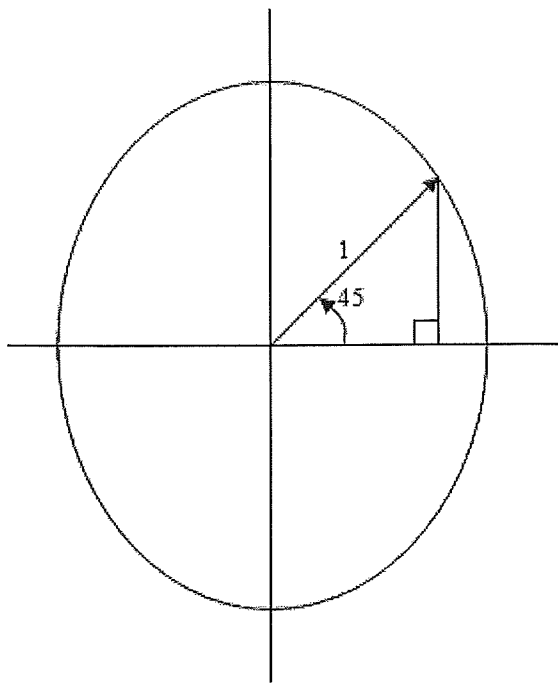
# Right-Triangle Trigonometry

The **unit circle** has a radius of 1 unit and its center at the origin of the coordinate plane. Points on the unit circle are related to periodic functions.

You can use the symbol  $\theta$  for the measure of an angle in standard position.



We are going to focus on 2 important Right Triangles.



In geometry you learned that the side opposite the  $30^\circ$  angle is half of its hypotenuse.

# Trigonometric Ratios

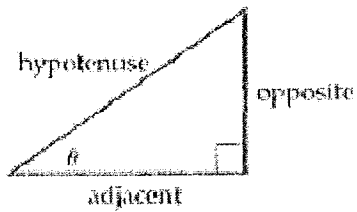
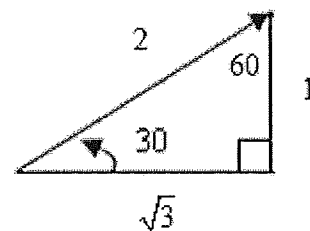
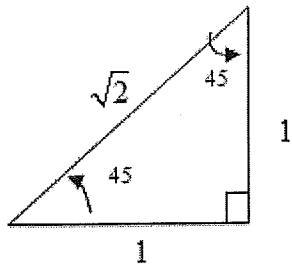


Figure 6.1-5

For a given acute  $\theta$  in a right triangle:

$\sin \theta$	_____
$\cos \theta$	_____
$\tan \theta$	_____
In addition, the reciprocal of each ratio above is also a trigonometric ratio.	
$\csc \theta$	_____
$\sec \theta$	_____
$\cot \theta$	_____

## Example 1



$\sin 45 =$	$\sin 30 =$	$\sin 60 =$
$\cos 45 =$	$\cos 30 =$	$\cos 60 =$
$\tan 45 =$	$\tan 30 =$	$\tan 60 =$
$\csc 45 =$	$\csc 30 =$	$\csc 60 =$
$\sec 45 =$	$\sec 30 =$	$\sec 60 =$
$\cot 45 =$	$\cot 30 =$	$\cot 60 =$

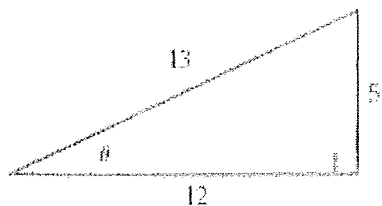


Figure 6.1-7

**Example 2** Evaluating Trigonometric Ratios

Evaluate the six trigonometric ratios of the angle  $\theta$  shown in Figure 6.1-7.

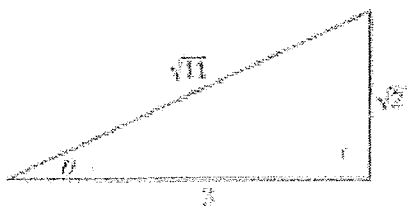
When using the Calculator to evaluate a trig ratio, make sure your calculator is in degree mode for this section.

<b>cos 68 =</b>	<b>cot 39 =</b>	<b>csc 25 =</b>
Keystrokes for TI-83 calculator:	Keystrokes for TI-83 calculator:	Keystrokes for TI-83 calculator:
Keystrokes for the TiNspire:	Keystrokes for the TiNspire:	Keystrokes for the TiNspire:

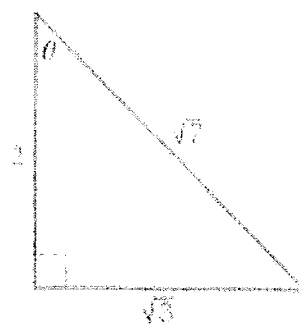
**Homework**

In Exercises 9-14, find the six trigonometric ratios for  $\theta$ .

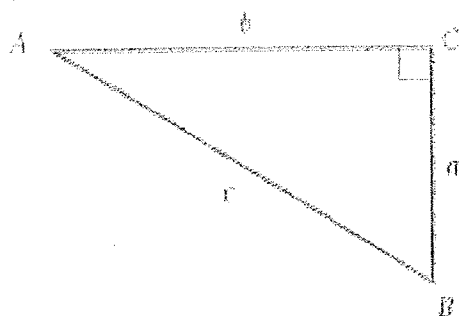
9.



11.



In Exercises 27–32, refer to the figure below. Find the exact value of the trigonometric ratio for the given values of  $a$ ,  $b$ , and  $c$ .



27.  $a = 4, b = 2, \tan B = \underline{\quad ? \quad}$

28.  $a = 5, c = 7, \sin A = \underline{\quad ? \quad}$

29.  $b = 3, c = 8, \cos A = \underline{\quad ? \quad}$

30.  $a = 12, b = 15, \cot A = \underline{\quad ? \quad}$

31.  $a = 7, c = 16, \sec B = \underline{\quad ? \quad}$

32.  $b = 2, c = 3, \csc B = \underline{\quad ? \quad}$

In Exercises 15–20, use a calculator in degree mode to find the following. Round your answers to four decimal places.

15.  $\sin 32^\circ$

16.  $\cos 68^\circ$

17.  $\tan 6^\circ$

18.  $\csc 25^\circ$

19.  $\sec 47^\circ$

20.  $\cot 39^\circ$

In Exercises 21–26, use the exact values of the trigonometric ratios for the special angles to find a value of  $\theta$  that is a solution of the given equation. (See Example 5.)

21.  $\sin \theta = \frac{1}{2}$

22.  $\tan \theta = 1$

23.  $\csc \theta = \sqrt{2}$

24.  $\cot \theta = \sqrt{3}$

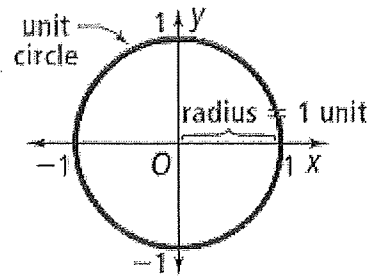
25.  $\cos \theta = \frac{1}{2}$

26.  $\sec \theta = 2$

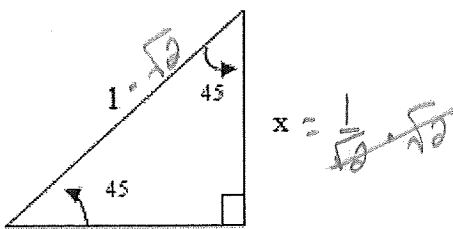
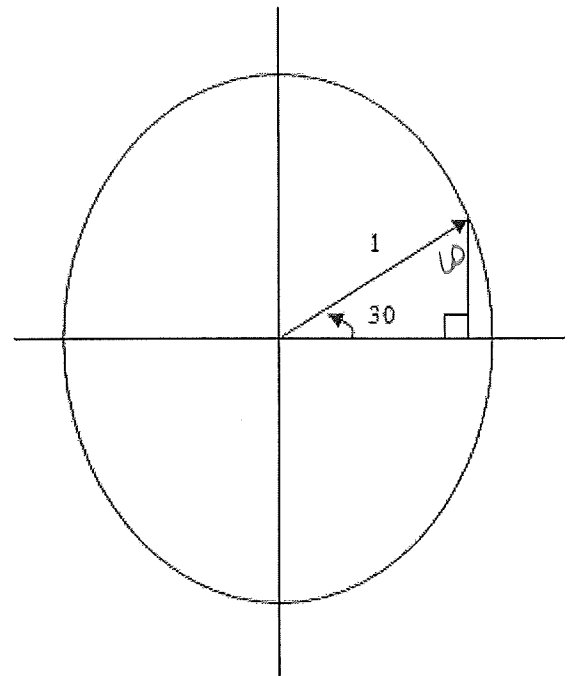
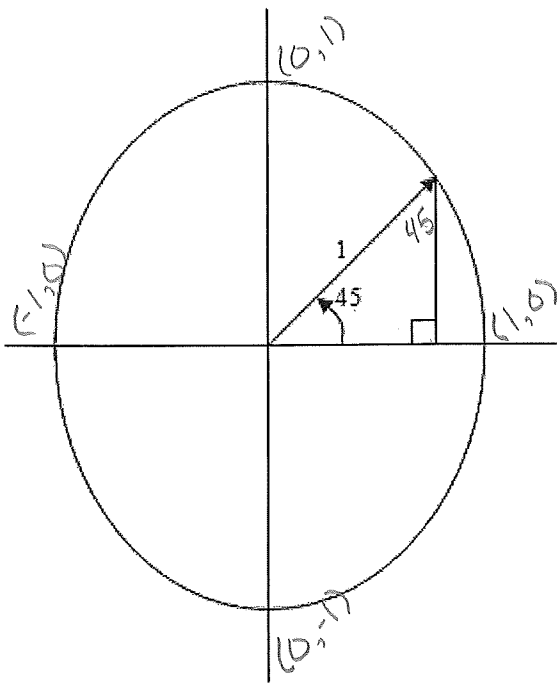
# Right-Triangle Trigonometry

The **unit circle** has a radius of 1 unit and its center at the origin of the coordinate plane. Points on the unit circle are related to periodic functions.

You can use the symbol  $\theta$  for the measure of an angle in standard position.



We are going to focus on 2 important Right Triangles.



$$x = \frac{1}{\sqrt{2}} = \frac{\sqrt{2}}{2}$$

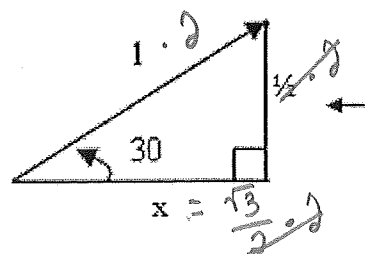
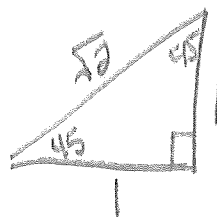
$$x = \frac{1}{\sqrt{2}} = \frac{\sqrt{2}}{2}$$

$$x^2 + x^2 = 1$$

$$2x^2 = 1$$

$$x^2 = \frac{1}{2}$$

$$x = \pm \sqrt{\frac{1}{2}} = \frac{1}{\sqrt{2}}$$



$$x = \frac{\sqrt{3}}{2}$$

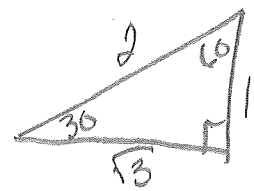
$$x^2 + \left(\frac{1}{2}\right)^2 = 1$$

$$x^2 + \frac{1}{4} = 1$$

$$x^2 = \frac{3}{4}$$

$$x = \frac{\sqrt{3}}{2}$$

In geometry you learned that the side opposite the  $30^\circ$  angle is half of its hypotenuse.



# Trigonometric Ratios

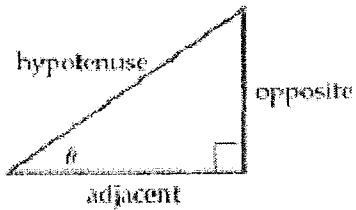
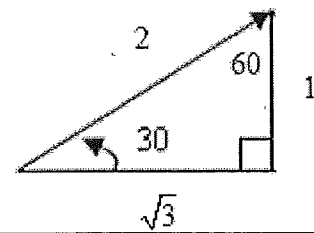
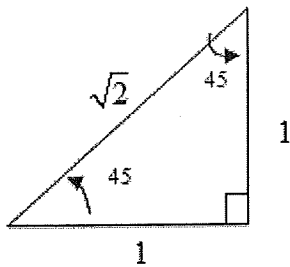


Figure 6.1-6

For a given acute  $\theta$  in a right triangle:

$\sin \theta$	$\frac{\text{opp}}{\text{hypot.}}$
$\cos \theta$	$\frac{\text{adj.}}{\text{hypot.}}$
$\tan \theta$	$\frac{\text{opp.}}{\text{adj.}}$
In addition, the reciprocal of each ratio above is also a trigonometric ratio.	
$\csc \theta$	$\frac{1}{\sin \theta} = \frac{\text{hypot.}}{\text{opp.}}$
$\sec \theta$	$\frac{1}{\cos \theta} = \frac{\text{hypot.}}{\text{adj.}}$
$\cot \theta$	$\frac{1}{\tan \theta} = \frac{\text{adj.}}{\text{opp.}}$

## Example 1



$\sin 45 = \frac{1}{\sqrt{2}} = \frac{\sqrt{2}}{2}$	$\sin 30 = \frac{1}{2}$	$\sin 60 = \frac{\sqrt{3}}{2}$
$\cos 45 = \frac{1}{\sqrt{2}} = \frac{\sqrt{2}}{2}$	$\cos 30 = \frac{\sqrt{3}}{2}$	$\cos 60 = \frac{1}{2}$
$\tan 45 = \frac{1}{1} = 1$	$\tan 30 = \frac{1}{\sqrt{3}} = \frac{\sqrt{3}}{3}$	$\tan 60 = \frac{\sqrt{3}}{1} = \sqrt{3}$
$\csc 45 = \frac{1}{\frac{1}{\sqrt{2}}} = \sqrt{2}$	$\csc 30 = \frac{1}{\frac{1}{2}} = 2$	$\csc 60 = \frac{1}{\frac{\sqrt{3}}{2}} = \frac{2}{\sqrt{3}}$
$\sec 45 = \frac{1}{\frac{1}{\sqrt{2}}} = \sqrt{2}$	$\sec 30 = \frac{1}{\frac{\sqrt{3}}{2}} = \frac{2}{\sqrt{3}}$	$\sec 60 = \frac{1}{\frac{1}{2}} = 2$
$\cot 45 = \frac{1}{1} = 1$	$\cot 30 = \frac{1}{\frac{1}{\sqrt{3}}} = \sqrt{3}$	$\cot 60 = \frac{1}{\sqrt{3}} = \frac{\sqrt{3}}{3}$

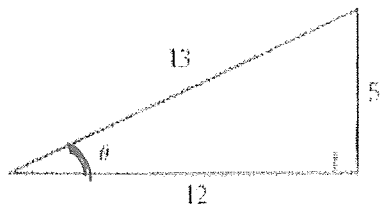


Figure 6.1-7

**Example 2**

Evaluating Trigonometric Ratios

Evaluate the six trigonometric ratios of the angle  $\theta$  shown in Figure 6.1-7.

$$\begin{aligned} \sin \theta &= \frac{5}{13} & \csc \theta &= \frac{13}{5} \\ \cos \theta &= \frac{12}{13} & \sec \theta &= \frac{13}{12} \\ \tan \theta &= \frac{5}{12} & \cot \theta &= \frac{12}{5} \end{aligned}$$

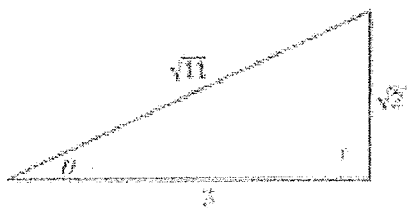
When using the Calculator to evaluate a trig ratio, make sure your calculator is in degree mode for this section.

$\cos 68 =$	$\cot 39 =$	$\csc 25 =$
Keystrokes for TI-83 calculator:	Keystrokes for TI-83 calculator:	Keystrokes for TI-83 calculator:
	1.235	2.366
Keystrokes for the TiNspire:	Keystrokes for the TiNspire:	Keystrokes for the TiNspire:
.3746		

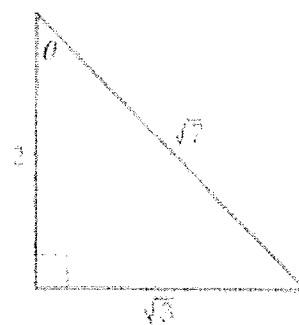
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In Exercises 9-14, find the six trigonometric ratios for  $\theta$ .

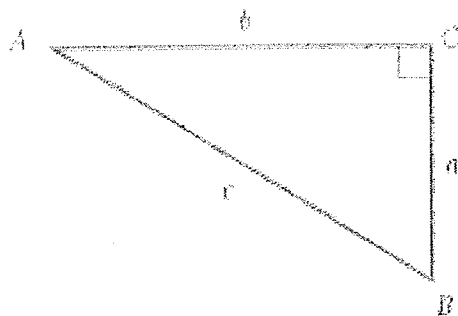
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In Exercises 27–32, refer to the figure below. Find the exact value of the trigonometric ratio for the given values of  $a$ ,  $b$ , and  $c$ .



27.  $a = 4, b = 2, \tan B = \underline{\hspace{2cm}} ?$

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30.  $a = 12, b = 15, \cot A = \underline{\hspace{2cm}} ?$

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21.  $\sin \theta = \frac{1}{2}$  *opp. hyp.*

22.  $\tan \theta = 1$

23.  $\csc \theta = \sqrt{2}$

24.  $\cot \theta = \sqrt{3}$

25.  $\cos \theta = \frac{1}{2}$

26.  $\sec \theta = 2$