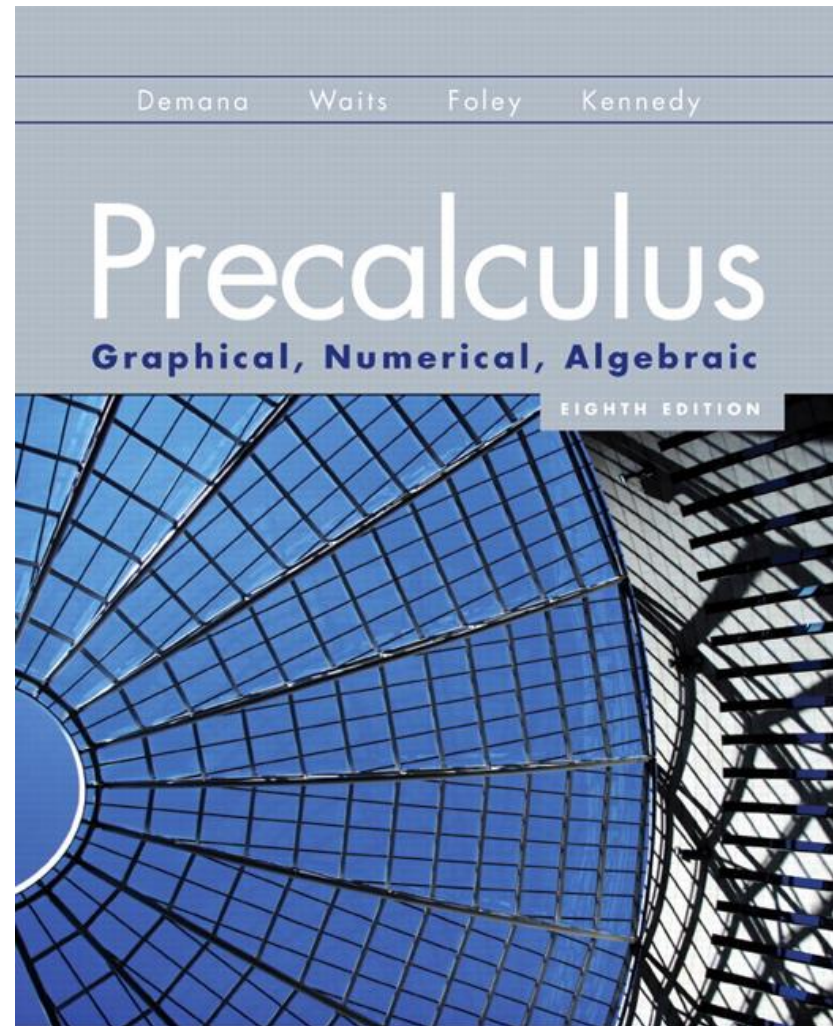


# 4.2

## Trigonometric Functions of Acute Angles



# What you'll learn about

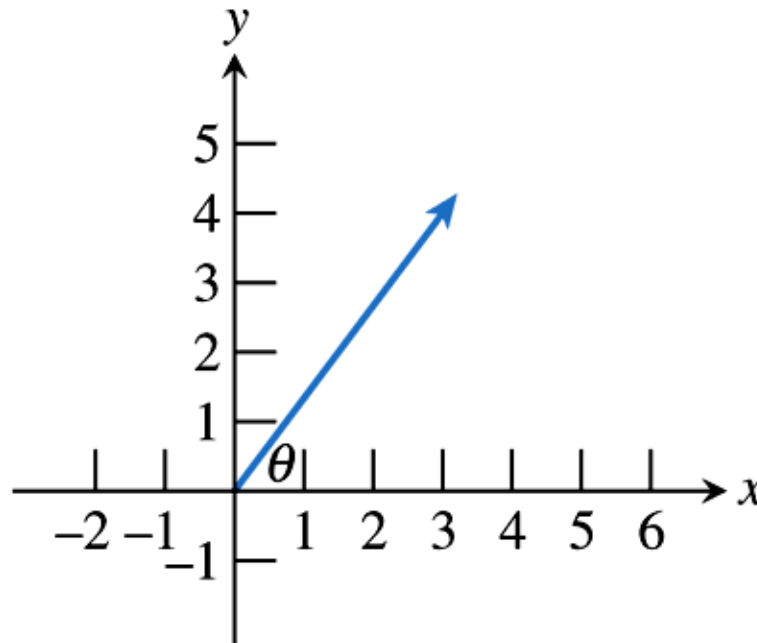
- Right Triangle Trigonometry
- Two Famous Triangles
- Evaluating Trigonometric Functions with a Calculator
- Applications of Right Triangle Trigonometry

... and why

The many applications of right triangle trigonometry gave the subject its name.

# Standard Position

An acute angle  $\theta$  in **standard position**, with one ray along the positive  $x$ -axis and the other extending into the first quadrant.



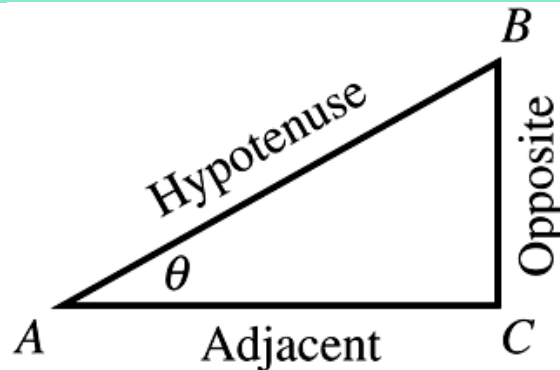
# Trigonometric Functions

Let  $\theta$  be an acute angle in the right  $\triangle ACB$ . Then

$$\text{sine}(\theta) = \sin \theta = \frac{\text{opp}}{\text{hyp}} \qquad \text{cosecant}(\theta) = \csc \theta = \frac{\text{hyp}}{\text{opp}}$$

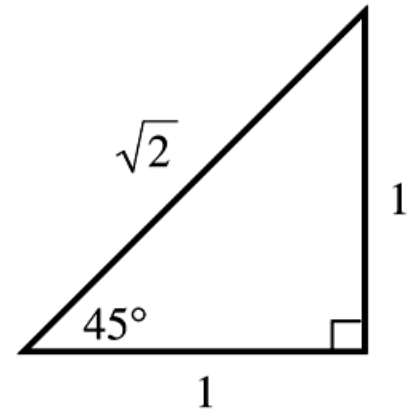
$$\text{cosine}(\theta) = \cos \theta = \frac{\text{adj}}{\text{hyp}} \qquad \text{secant}(\theta) = \sec \theta = \frac{\text{hyp}}{\text{adj}}$$

$$\text{tangent}(\theta) = \tan \theta = \frac{\text{opp}}{\text{adj}} \qquad \text{cotangent}(\theta) = \cot \theta = \frac{\text{adj}}{\text{opp}}$$



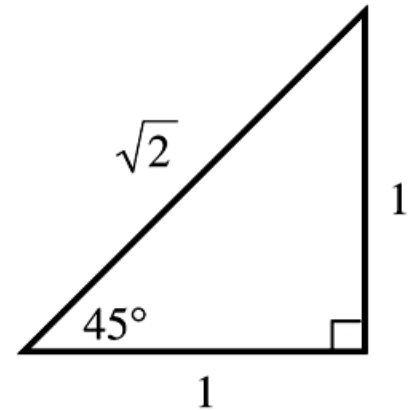
# Example Evaluating Trigonometric Functions of $45^\circ$

Find the values of all six trigonometric functions for an angle of  $45^\circ$ .



# Example Evaluating Trigonometric Functions of $45^\circ$

Find the values of all six trigonometric functions for an angle of  $45^\circ$ .



$$\sin 45^\circ = \frac{\text{opp}}{\text{hyp}} = \frac{1}{\sqrt{2}} = \frac{\sqrt{2}}{2}$$

$$\csc 45^\circ = \frac{\text{hyp}}{\text{opp}} = \frac{\sqrt{2}}{1}$$

$$\cos 45^\circ = \frac{\text{adj}}{\text{hyp}} = \frac{1}{\sqrt{2}} = \frac{\sqrt{2}}{2}$$

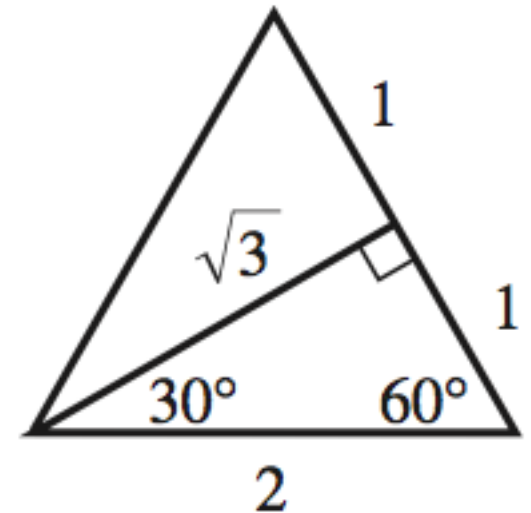
$$\sec 45^\circ = \frac{\text{hyp}}{\text{adj}} = \frac{\sqrt{2}}{1}$$

$$\tan 45^\circ = \frac{\text{opp}}{\text{adj}} = \frac{1}{1} = 1$$

$$\cot 45^\circ = \frac{\text{adj}}{\text{opp}} = \frac{1}{1} = 1$$

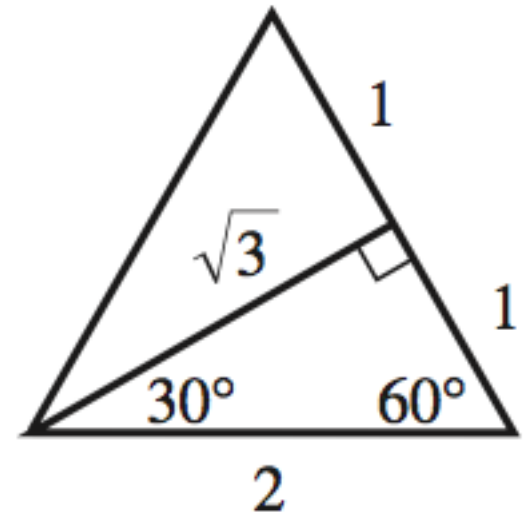
# Example Evaluating Trigonometric Functions of $60^\circ$

Find the values of all six trigonometric functions for an angle of  $60^\circ$ .



# Example Evaluating Trigonometric Functions of $60^\circ$

Find the values of all six trigonometric functions for an angle of  $60^\circ$ .



$$\sin 60^\circ = \frac{\text{opp}}{\text{hyp}} = \frac{\sqrt{3}}{2}$$

$$\csc 60^\circ = \frac{\text{hyp}}{\text{opp}} = \frac{2}{\sqrt{3}} = \frac{2\sqrt{3}}{3}$$

$$\cos 60^\circ = \frac{\text{adj}}{\text{hyp}} = \frac{1}{2}$$

$$\sec 60^\circ = \frac{\text{hyp}}{\text{adj}} = \frac{2}{1} = 2$$

$$\tan 60^\circ = \frac{\text{opp}}{\text{adj}} = \frac{\sqrt{3}}{1}$$

$$\cot 60^\circ = \frac{\text{adj}}{\text{opp}} = \frac{1}{\sqrt{3}} = \frac{\sqrt{3}}{3}$$

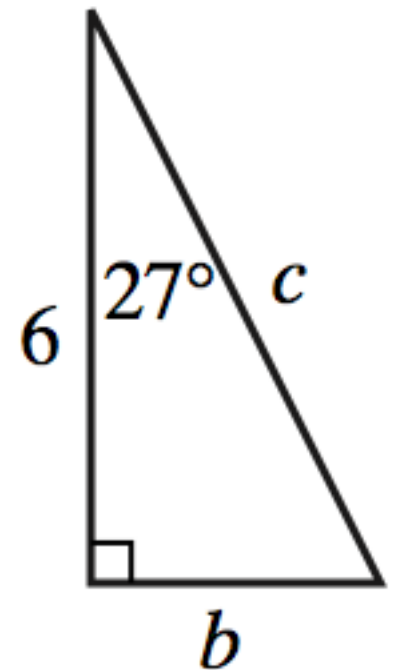


# Common Calculator Errors When Evaluating Trig Functions

- Using the calculator in the wrong angle mode (degree/radians)
- Using the inverse trig keys to evaluate cot, sec, and csc
- Using function shorthand that the calculator does not recognize
- Not closing parentheses

## Example Solving a Right Triangle

A right triangle with a side length 6 includes a  $27^\circ$  angle adjacent to the side of length 6. Find the measures of the other two angles and the lengths of the other two sides.



## Example Solving a Right Triangle

Since it is a right triangle, one of the other angles is  $90^\circ$ .  
That leaves  $180^\circ - 90^\circ - 27^\circ = 63^\circ$  for the third angle.

Use the labels on the figure to set up equations to find  $a$  and  $b$ .

$$\cos 27^\circ = \frac{6}{c}$$

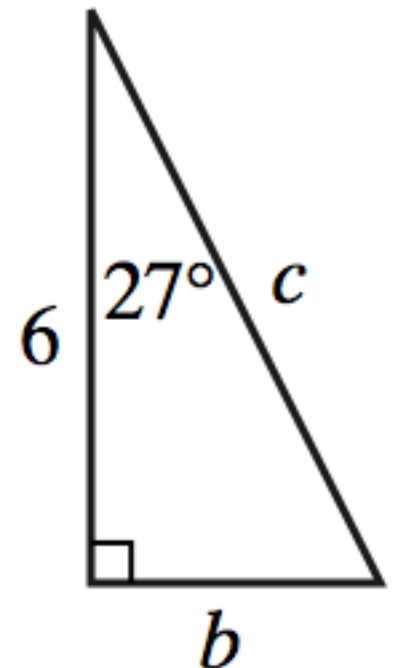
$$\tan 27^\circ = \frac{b}{6}$$

$$c = \frac{6}{\cos 27^\circ}$$

$$b = 6 \tan 27^\circ$$

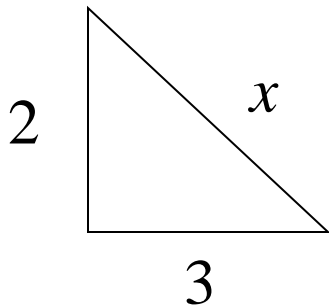
$$c \approx 6.73$$

$$b \approx 3.06$$

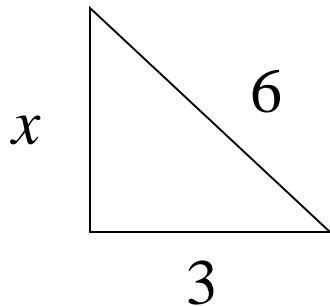


# Quick Review

1. Solve for  $x$ .



2. Solve for  $x$ .



## Quick Review

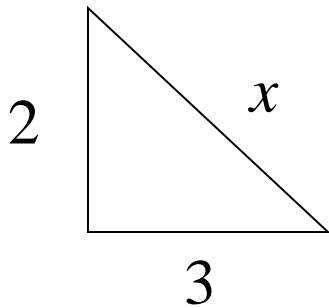
3. Convert 9.3 inches to feet.

4. Solve for  $a$ .  $0.45 = \frac{a}{20}$

5. Solve for  $b$ .  $1.72 = \frac{36}{b}$

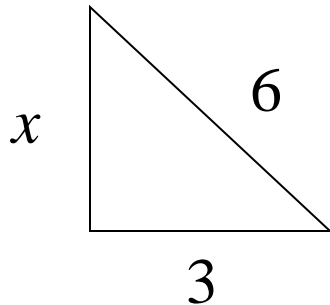
# Quick Review Solutions

1. Solve for  $x$ .



$$x = \sqrt{13}$$

2. Solve for  $x$ .



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

# Quick Review Solutions

3. Convert 9.3 inches to feet.      0.775 feet

4. Solve for  $a$ .       $0.45 = \frac{a}{20}$       9

5. Solve for  $b$ .       $1.72 = \frac{36}{b}$        $900 / 43 \approx 20.93$