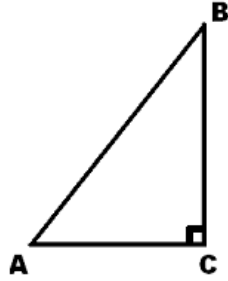


### 13.1 Right Triangle Trigonometry

**Trigonometry** is the study of the relationships among the angles and sides of a right triangle.

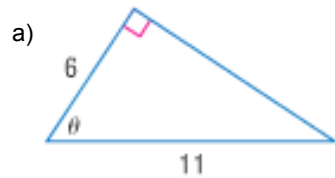


Using the sides of the right triangle, you can define **six trigonometric functions**.

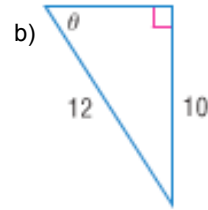
$$\begin{aligned} \sin \theta &= \frac{\text{opposite}}{\text{hypotenuse}} & \cos \theta &= \frac{\text{adjacent}}{\text{hypotenuse}} & \tan \theta &= \frac{\text{opposite}}{\text{adjacent}} \\ \csc \theta &= \frac{\text{hypotenuse}}{\text{opposite}} & \sec \theta &= \frac{\text{hypotenuse}}{\text{adjacent}} & \cot \theta &= \frac{\text{adjacent}}{\text{opposite}} \\ &= \frac{1}{\sin \theta} & &= \frac{1}{\cos \theta} & &= \frac{1}{\tan \theta} \end{aligned}$$

**Example 1: Find Trigonometric Values**

Find the values of the six trigonometric functions for angle  $\theta$ .



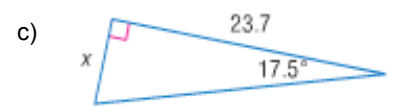
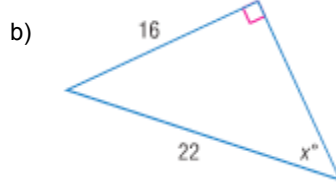
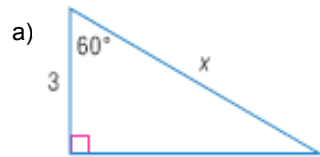
$$\begin{aligned} \sin \theta &= \\ \cos \theta &= \\ \tan \theta &= \\ \csc \theta &= \\ \sec \theta &= \\ \cot \theta &= \end{aligned}$$



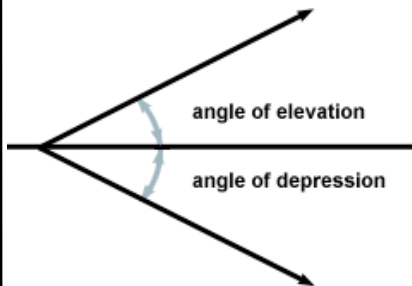
$$\begin{aligned} \sin \theta &= \\ \cos \theta &= \\ \tan \theta &= \\ \csc \theta &= \\ \sec \theta &= \\ \cot \theta &= \end{aligned}$$

**Example 2: Find a Missing Side Length OR Missing Angle Measure of a Right Triangle**

Write an equation involving sin, cos, or tan that can be used to find  $x$ . Then solve the equation. Round measures of sides to the nearest tenth and angles to the nearest degree.



**Example 3: Using Angle of Elevation/Depression**



a) A plane is flying at an altitude of 12,000 m. From the pilot, the angle of depression to the airport is  $32^\circ$ . How far is the tower from the plane?

b) A ramp for unloading a moving truck has an angle of elevation of  $32^\circ$ . If the top of the ramp is 4 feet above the ground, estimate the length of the ramp.