The text definitions of the right triangle trig functions (pg 593-594):

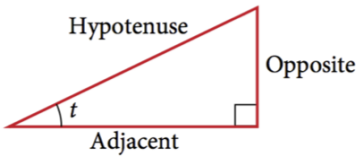

Figure 2 The sides of a right triangle in relation to angle t.

Given a right triangle with an acute angle of t, the first three trigonometric functions are listed.

$$\text{Sine} \quad \sin t = \frac{\text{opposite}}{\text{hypotenuse}} \qquad \text{Cosine} \quad \cos t = \frac{\text{adjacent}}{\text{hypotenuse}} \qquad \text{Tangent} \quad \tan t = \frac{\text{opposite}}{\text{adjacent}}$$

A common mnemonic for remembering these relationships is SohCahToa, formed from the first letters of "**S**ine is **o**pposite over **h**ypotenuse, **C**osine is **a**djacent over **h**ypotenuse, **T**angent is **o**pposite over **a**djacent."

For the triangle shown in **Figure 1**, we have the following.

$$\sin t = \frac{y}{1} \qquad \cos t = \frac{x}{1} \qquad \tan t = \frac{y}{x}$$

Reciprocal Functions

In addition to sine, cosine, and tangent, there are three more functions. These too are defined in terms of the sides of the triangle.

$$\text{Secant} \quad \sec t = \frac{\text{hypotenuse}}{\text{adjacent}} \qquad \text{Cosecant} \quad \csc t = \frac{\text{hypotenuse}}{\text{opposite}} \qquad \text{Cotangent} \quad \cot t = \frac{\text{adjacent}}{\text{opposite}}$$

Take another look at these definitions. These functions are the reciprocals of the first three functions.

$$\sin t = \frac{1}{\csc t} \qquad \csc t = \frac{1}{\sin t}$$

$$\cos t = \frac{1}{\sec t} \qquad \sec t = \frac{1}{\cos t}$$

$$\tan t = \frac{1}{\cot t} \qquad \cot t = \frac{1}{\tan t}$$

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cofunction identities

The **cofunction identities** in radians are listed in **Table 1.**

$\sin t = \cos\left(\frac{\pi}{2} - t\right)$	$\sec t = \csc\left(\frac{\pi}{2} - t\right)$	$\tan t = \cot\left(\frac{\pi}{2} - t\right)$
$\cos t = \sin\left(\frac{\pi}{2} - t\right)$	$\csc t = \sec\left(\frac{\pi}{2} - t\right)$	$\cot t = \tan\left(\frac{\pi}{2} - t\right)$

Example 3 **Evaluating Trigonometric Functions of Special Angles Using Side Lengths**

Find the exact value of the trigonometric functions of $\frac{\pi}{3}$, using side lengths.

Solution

$$\sin\left(\frac{\pi}{3}\right) = \frac{\text{opp}}{\text{hyp}} = \frac{\sqrt{3}s}{2s} = \frac{\sqrt{3}}{2} \qquad \sec\left(\frac{\pi}{3}\right) = \frac{\text{hyp}}{\text{adj}} = \frac{2s}{s} = 2$$

$$\cos\left(\frac{\pi}{3}\right) = \frac{\text{adj}}{\text{hyp}} = \frac{s}{2s} = \frac{1}{2} \qquad \csc\left(\frac{\pi}{3}\right) = \frac{\text{hyp}}{\text{opp}} = \frac{2s}{\sqrt{3}s} = \frac{2}{\sqrt{3}} = \frac{2\sqrt{3}}{3}$$

$$\tan\left(\frac{\pi}{3}\right) = \frac{\text{opp}}{\text{adj}} = \frac{\sqrt{3}s}{s} = \sqrt{3} \qquad \cot\left(\frac{\pi}{3}\right) = \frac{\text{adj}}{\text{opp}} = \frac{s}{\sqrt{3}s} = \frac{1}{\sqrt{3}} = \frac{\sqrt{3}}{3}$$