

## Chapter 4 Section 3 Right Triangle Trigonometry

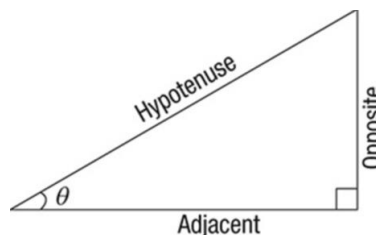
### Right Triangle Definitions of Trigonometric Functions

Let  $\theta$  be an acute angle of a right triangle. The six trigonometric functions of the angle  $\theta$  are defined as follows.

$$\begin{aligned}\sin \theta &= \frac{\text{opp}}{\text{hyp}} & \cos \theta &= \frac{\text{adj}}{\text{hyp}} & \tan \theta &= \frac{\text{opp}}{\text{adj}} \\ \csc \theta &= \frac{\text{hyp}}{\text{opp}} & \sec \theta &= \frac{\text{hyp}}{\text{adj}} & \cot \theta &= \frac{\text{adj}}{\text{opp}}\end{aligned}$$

The abbreviations opp, adj, and hyp represent the lengths of the three sides of a right triangle.

opp = the length of the side *opposite*  $\theta$   
adj = the length of the side *adjacent* to  $\theta$   
hyp = the length of the *hypotenuse*



### Sines, Cosines, and Tangents of Special Angles

$$\sin 30^\circ = \sin \frac{\pi}{6} = \frac{1}{2} \qquad \cos 30^\circ = \cos \frac{\pi}{6} = \frac{\sqrt{3}}{2} \qquad \tan 30^\circ = \tan \frac{\pi}{6} = \frac{\sqrt{3}}{3}$$

$$\sin 45^\circ = \sin \frac{\pi}{4} = \frac{\sqrt{2}}{2} \qquad \cos 45^\circ = \cos \frac{\pi}{4} = \frac{\sqrt{2}}{2} \qquad \tan 45^\circ = \tan \frac{\pi}{4} = 1$$

$$\sin 60^\circ = \sin \frac{\pi}{3} = \frac{\sqrt{3}}{2} \qquad \cos 60^\circ = \cos \frac{\pi}{3} = \frac{1}{2} \qquad \tan 60^\circ = \tan \frac{\pi}{3} = \sqrt{3}$$

Cofunctions of complementary angles are equal. If  $\theta$  is an acute angle, the following relationships are true. For example,  $\sin 30^\circ = \frac{1}{2} = \cos 60^\circ$ .

$$\begin{aligned}\sin(90^\circ - \theta) &= \cos \theta & \cos(90^\circ - \theta) &= \sin \theta \\ \tan(90^\circ - \theta) &= \cot \theta & \cot(90^\circ - \theta) &= \tan \theta \\ \sec(90^\circ - \theta) &= \csc \theta & \csc(90^\circ - \theta) &= \sec \theta\end{aligned}$$

## Fundamental Trigonometric Identities

### Reciprocal Identities

$$\sin \theta = \frac{1}{\csc \theta} \quad \cos \theta = \frac{1}{\sec \theta} \quad \tan \theta = \frac{1}{\cot \theta}$$

$$\csc \theta = \frac{1}{\sin \theta} \quad \sec \theta = \frac{1}{\cos \theta} \quad \cot \theta = \frac{1}{\tan \theta}$$

### Quotient Identities

$$\tan \theta = \frac{\sin \theta}{\cos \theta} \quad \cot \theta = \frac{\cos \theta}{\sin \theta}$$

### Pythagorean Identities

$$\sin^2 \theta + \cos^2 \theta = 1$$

$$1 + \tan^2 \theta = \sec^2 \theta$$

$$1 + \cot^2 \theta = \csc^2 \theta$$