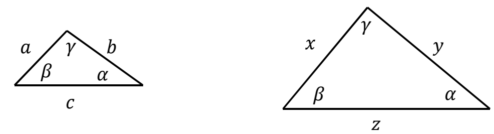
# Section 7.2

**Right Triangle Trigonometry**

## SIMILAR TRIANGLES

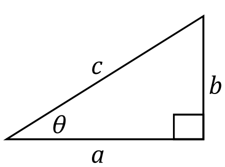
Recall from geometry that **similar triangles** have angles of the same measure but the lengths of slides are different. An important property of similar triangles is that the ratios of the corresponding sides are equal.




That is, $\frac{a}{b} = \frac{x}{y}$, $\frac{a}{c} = \frac{x}{z}$, etc.

## RIGHT TRIANGLES

For right triangles, we give these ratios the names **sine**, **cosine**, **tangent**, **cosecant**, **secant**, and **cotangent**.



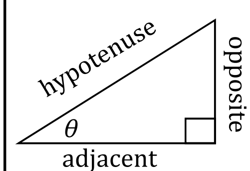

$$\sin\theta = \frac{b}{c} \qquad \csc\theta = \frac{c}{b}$$

$$\cos\theta = \frac{a}{c} \qquad \sec\theta = \frac{c}{a}$$

$$\tan\theta = \frac{b}{a} \qquad \cot\theta = \frac{a}{b}$$

## RIGHT TRIANGLES (CONTINUED)

These are usually given in terms of the side ***opposite*** to the angle, the side ***adjacent*** to the angle, and the ***hypotenuse***.




$$\sin\theta = \frac{\text{opp}}{\text{hyp}} \qquad \csc\theta = \frac{\text{hyp}}{\text{opp}}$$

$$\cos\theta = \frac{\text{adj}}{\text{hyp}} \qquad \sec\theta = \frac{\text{hyp}}{\text{adj}}$$

$$\tan\theta = \frac{\text{opp}}{\text{adj}} \qquad \cot\theta = \frac{\text{adj}}{\text{opp}}$$

## FUNDAMENTAL IDENTITIES—RECIPROCAL IDENTITIES

$$\csc\theta = \frac{1}{\sin\theta}$$

$$\sec\theta = \frac{1}{\cos\theta}$$

$$\cot\theta = \frac{1}{\tan\theta}$$

## FUNDAMENTAL IDENTITIES—QUOTIENT IDENTITIES

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

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

## FUNDAMENTAL IDENTITIES—PYTHAGOREAN IDENTITIES

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

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

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

## FINDING VALUES OF TRIG. FUNCTIONS WHEN ONE IS KNOWN

**Option 1**: Using the Definitions

**Step 1:** Draw a right triangle showing the acute angle $\theta$.
**Step 2:** Two sides of the triangle can be assigned values based on the given trigonometric function.
**Step 3:** Find the length of the third side using the Pythagorean Theorem.
**Step 4:** Use the definitions of the trigonometric functions to find the value of the remaining trigonometric functions.

## FINDING VALUES OF TRIG. FUNCTIONS WHEN ONE IS KNOWN

**Option 2**: Using Identities

Use appropriately selected identities to find the value of each of the remaining trigonometric functions.

## COMPLEMENTARY ANGLES

Two acute angles are called **complementary** if their sum is a right angle.

Since the sum of the angles in any triangle is 180°, in any right triangle the two acute angles are complementary.

## COMPLEMENTARY ANGLES AND TRIGONOMETRIC FUNCTIONS

**Theorem**: Cofunctions of complementary angles are equal.

## COFUNCTION IDENTITES—IN DEGREES

$\sin(90° - \theta) = \cos\theta$ $\quad$ $\cos(90° - \theta) = \sin\theta$

$\tan(90° - \theta) = \cot\theta$ $\quad$ $\cot(90° - \theta) = \tan\theta$

$\sec(90° - \theta) = \csc\theta$ $\quad$ $\csc(90° - \theta) = \sec\theta$

## COFUNCTION IDENTITES— IN RADIANS

$$\sin\left(\frac{\pi}{2}-\theta\right)=\cos\theta \qquad \cos\left(\frac{\pi}{2}-\theta\right)=\sin\theta$$

$$\tan\left(\frac{\pi}{2}-\theta\right)=\cot\theta \qquad \cot\left(\frac{\pi}{2}-\theta\right)=\tan\theta$$

$$\sec\left(\frac{\pi}{2}-\theta\right)=\csc\theta \qquad \csc\left(\frac{\pi}{2}-\theta\right)=\sec\theta$$