Trigonometric Functions in Right Triangles

A **trigonometric function** has a rule given by a **trigonometric ratio**, which compares the side lengths of a right triangle.

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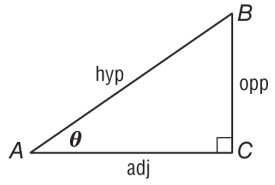


If θ is the measure of an acute angle of a right triangle, *opp* is the measure of the leg opposite θ, *adj* is the measure of the leg adjacent to θ, and *hyp* is the measure of the hypotenuse, then the following are true.

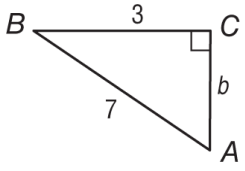
$\sin\theta = \frac{\text{opp}}{\text{hyp}}$ $\quad \cos\theta = \frac{\text{adj}}{\text{hyp}}$ $\quad \tan\theta = \frac{\text{opp}}{\text{adj}}$

$\csc\theta = \frac{\text{hyp}}{\text{opp}}$ $\quad \sec\theta = \frac{\text{hyp}}{\text{adj}}$ $\quad \cot\theta = \frac{\text{adj}}{\text{opp}}$

Example: In a right triangle, $\angle B$ is acute and $\cos B = \frac{3}{7}$. Find the value of $\tan B$.

Step 1 Draw a right triangle and label one acute angle *B*. Label the adj side 3 and the hyp 7.

Step 2 Use the Pythagorean Theorem to find *b*.



$a^2 + b^2 = c^2$	Pythagorean Theorem
$3^2 + b^2 = 7^2$	$a = 3$ and $c = 7$
$9 + b^2 = 49$	Simplify.
$b^2 = 40$	Subtract 9 from each side.
$b = \sqrt{40}$ or $2\sqrt{10}$	Take the positive square root of each side.

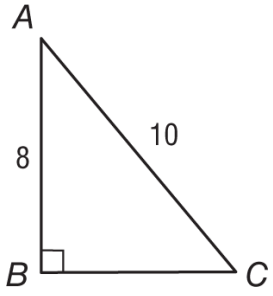
Step 3 Find $\tan B$.

$\tan B = \frac{\text{opp}}{\text{adj}}$	Tangent function
$\tan B = \frac{2\sqrt{10}}{3}$	Replace *opp* with $2\sqrt{10}$ and *adj* with 3.

Use Trigonometric Functions You can use trigonometric functions to find missing side lengths and missing angle measures of right triangles. You can find the measure of the missing angle by using the **inverse of sine, cosine, or tangent**.

Example: Find the measure of $\angle C$. Round to the nearest tenth if necessary.

You know the measure of the side opposite $\angle C$ and the measure of the hypotenuse. Use the sine function.



$\sin C = \frac{\text{opp}}{\text{hyp}}$	Sine function
$\sin C = \frac{\mathbf{8}}{\mathbf{10}}$	Replace *opp* with 8 and *hyp* with 10.
$\sin^{-1}\frac{\mathbf{8}}{\mathbf{10}} = m\angle C$	Inverse sine
$53.1° \approx m\angle C$	Use a calculator.