

Geometry - Right Triangle Trigonometry - Lesson

Common Core G-SRT.C.6, G-SRT.C.7, G-SRT.C.8 · maths-pdf.fr/en/

In a right triangle, **sine is opposite over hypotenuse, cosine is adjacent over hypotenuse, and tangent is opposite over adjacent. These ratios depend only on the acute angle because right triangles with the same angle are similar. Sine of an angle equals cosine of its complement. Use the ratios and the Pythagorean theorem to solve right triangles and applied problems.**

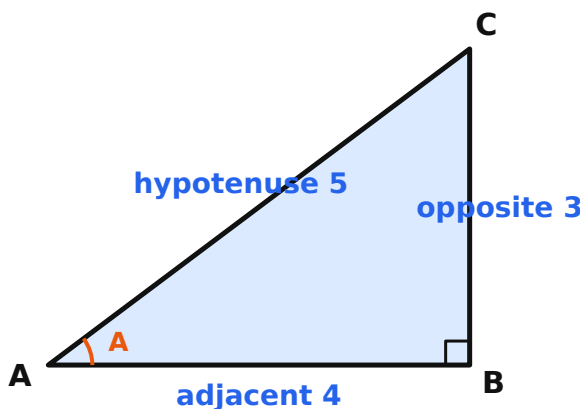
Geometry · Common Core State Standards: **G-SRT.C.6, G-SRT.C.7, G-SRT.C.8**

Key facts

- $\sin A = \text{opposite/hypotenuse}$, $\cos A = \text{adjacent/hypotenuse}$, $\tan A = \text{opposite/adjacent}$.
- $\sin A = \cos (90 \text{ degrees minus } A)$ for the acute angles of a right triangle.
- Use an inverse function ($\sin^{-1}$, $\cos^{-1}$, $\tan^{-1}$) to find an angle.
- Solving a right triangle means finding all sides and acute angles.
- Angles of elevation and depression are measured from the horizontal.

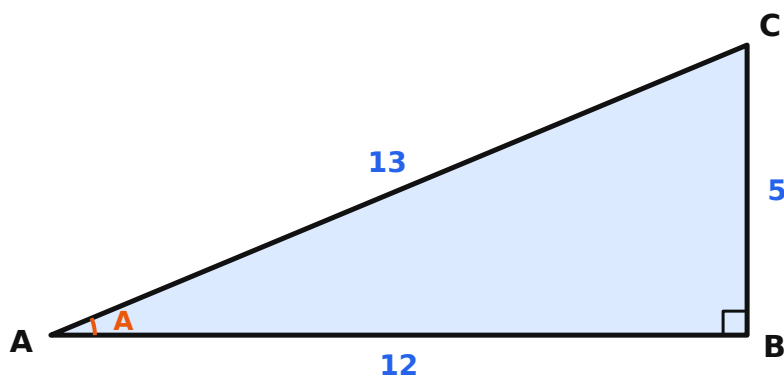
What are the trigonometric ratios?

In a right triangle, the **hypotenuse** is the side opposite the right angle. For an acute angle A , the **opposite** side is across from it and the **adjacent** side touches it. Triangles with the same acute angles are similar, so these ratios depend only on the angle.



Sides are named relative to angle A.

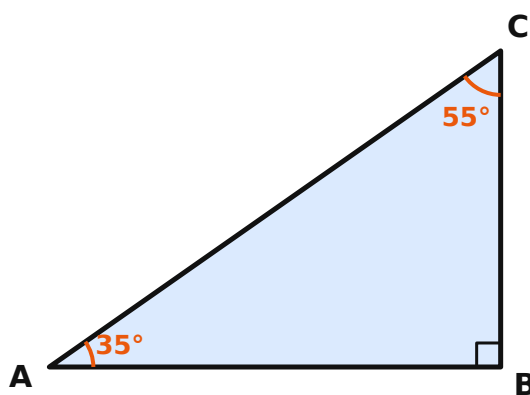
Ratio	Definition	Memory aid
$\sin A$	$\frac{\text{opposite}}{\text{hypotenuse}}$	SOH
$\cos A$	$\frac{\text{adjacent}}{\text{hypotenuse}}$	CAH
$\tan A$	$\frac{\text{opposite}}{\text{adjacent}}$	TOA



A 5-12-13 triangle: $\sin A = 5/13$, $\cos A = 12/13$, $\tan A = 5/12$.

How are sine and cosine of complementary angles related?

The opposite side of one acute angle is the adjacent side of the other. So $\sin A = \cos(90^\circ - A)$. For example, $\sin 35^\circ = \cos 55^\circ$.

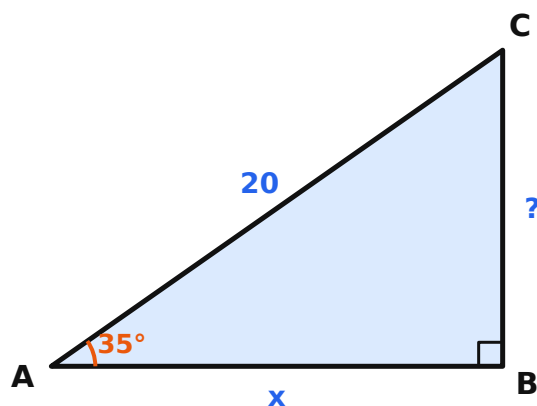


The acute angles are complementary: $\sin 35^\circ = \cos 55^\circ$.

How do you solve for a side or an angle?

1. Draw the triangle and mark the known angle and sides.
2. Choose the ratio that connects a known side and the unknown side (SOH, CAH or TOA).
3. Write an equation and solve. To find an angle, use an inverse function such as $\tan^{-1}\left(\frac{\text{opp}}{\text{adj}}\right)$

4. Check with the Pythagorean theorem or the angle sum of 90° .

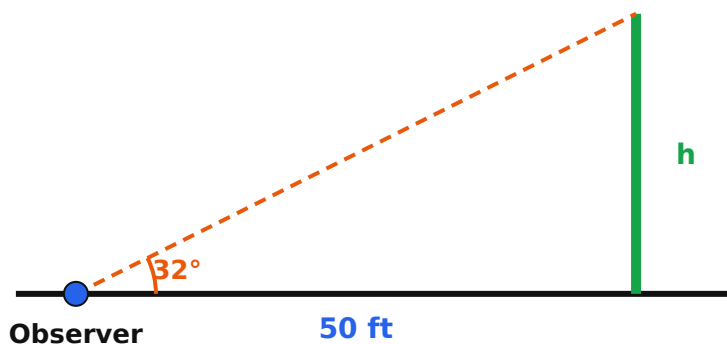


Use a ratio that connects the known side and the unknown side.

To **solve a right triangle**, find all three sides and both acute angles. Use the Pythagorean theorem $a^2 + b^2 = c^2$ and the angle sum $A + B = 90^\circ$ together with trig ratios.

What are angles of elevation and depression?

The **angle of elevation** is measured upward from the horizontal. The **angle of depression** is measured downward from the horizontal. Both create right triangles with the ground.



Angle of elevation: looking up from the horizontal.

Example: From 50 feet away the angle of elevation to the top of a tree is 32° . Then $\tan 32^\circ = \frac{h}{50}$, so $h = 50 \cdot 0.6249 = 31.2$ feet.

Questions about right triangle trigonometry

What does SOH-CAH-TOA mean?

It is a memory aid: Sine is Opposite over Hypotenuse, Cosine is Adjacent over Hypotenuse, Tangent is Opposite over Adjacent.

Why do trig ratios depend only on the angle?

Right triangles with the same acute angle are similar by AA, so their side ratios are equal no matter how large the triangle is.

How do you find an angle when you know two sides?

Compute the ratio and use the inverse function. If the opposite side is 7 and the adjacent side is 24, the angle is $\tan^{-1}$ of $7/24$, about 16.3 degrees.

How are sine and cosine of complementary angles related?

They are equal: $\sin$ of 25 degrees equals $\cos$ of 65 degrees, because the opposite side of one angle is the adjacent side of the other.

What is the difference between angle of elevation and angle of depression?

Elevation is measured upward from a horizontal line, depression downward from a horizontal line. The two are congruent alternate interior angles for the same line of sight.