How to Use SOHCAHTOA – GCSE Maths

CONTENTS:

1. What is SOHCAHTOA?

- The term **"SOHCAHTOA"** is an simple way to help remember the three main trigonometric ratios: **Sine, Cosine and Tangent.**

SOH = Sine (Sin)

CAH = Cosine (Cos)

TOA = Tangent (Tan)

2. What are SOHCAHTOA Rules?

- SOHCAHTOA helps you remember the relationship between ***angles and sides in a right-angled triangle*****.** It stands for:

SOH:

Sine = Opposite side ÷ Hypotenuse

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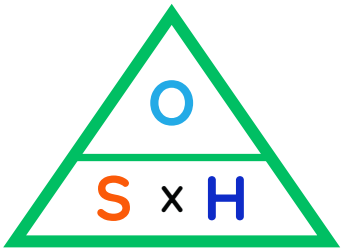
SOH

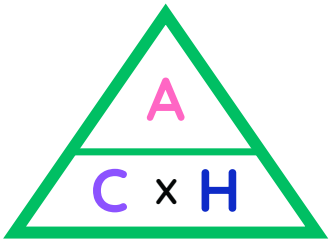


$$\sin(\theta)=\frac{O}{H}$$

CAH:

Cosine = Adjacent side ÷ Hypotenuse

CAH

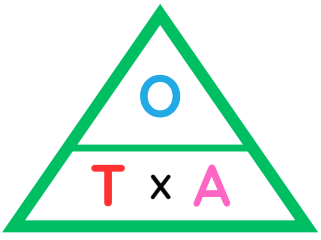


$$\cos(\theta)=\frac{A}{H}$$

TOA:

Tangent = Opposite side ÷ Adjacent side

TOA



$$\tan(\theta)=\frac{O}{A}$$

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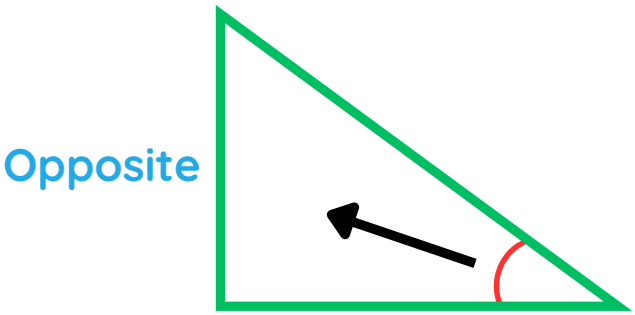
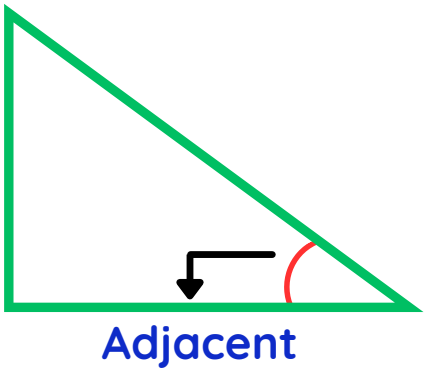
✨ Tips to Remember ✨

A clearly labeled diagram of a triangle can help you better understand these relationships.

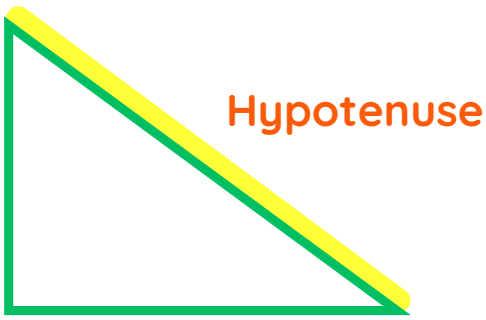
- **The side opposite the angle is called the opposite.**



- **The side touching the angle is called the adjacent.**



- **The largest side, opposite the right angle, is called the hypotenuse.**



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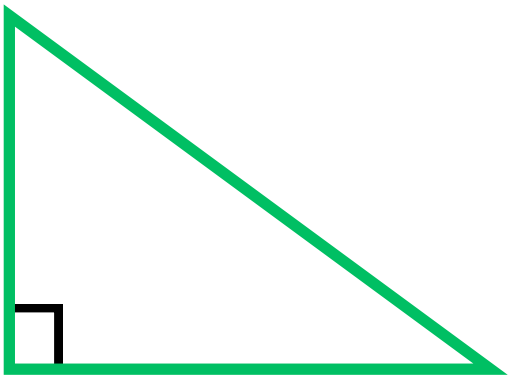
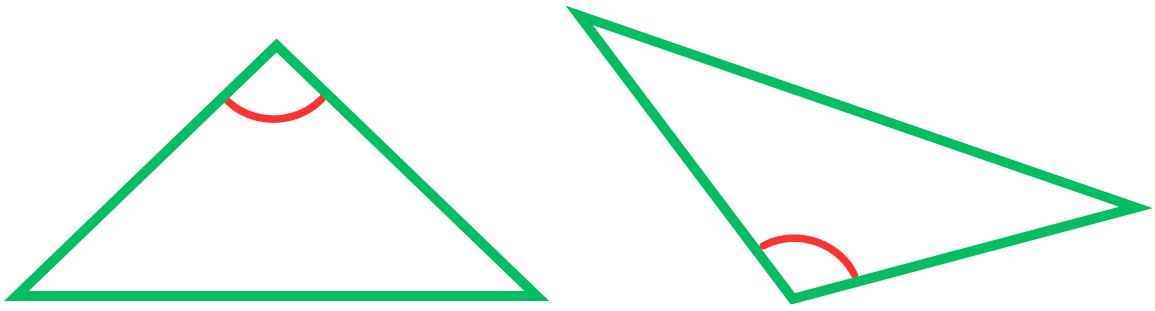
3. Does SOHCAHTOA Only Work for Right Triangles?

Yes, SOHCAHTOA only works with right angle triangle.



SOHCAHTOA

- For other triangles, we use the Law of Sine and Cosine to find missing sides and angles.



Law of Sine and Cosine

- If you want to learn more about the law of sine and cosine please click on this link: Law of sine and cosine

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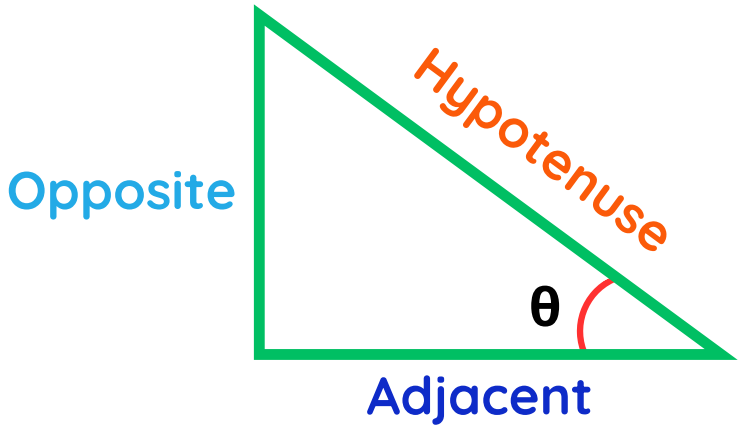
4. How to Use SOHCAHTOA (To Find an Unknown Side of a Right Triangle)

Using SOHCAHTOA involves these 3 simple steps:

Step #1: Label the Sides Clearly

- Identify the triangle's **opposite, adjacent, and hypotenuse sides** based on your reference angle.
- Once the sides are labeled, you will have two sides identified—**one is given, and the other needs to be found.**



Step #2: Use the Correct Trigonometric Ratio

Based on the given side and the side you need to find, use the correct trigonometric ratio. For example,

- **Use Sine Theta (SOH)** if you are dealing with **opposite** and **hypotenuse**
- **Use Cosine Theta (CAH)** if you are dealing with **adjacent** and **hypotenuse.**
- **Use Tangent Theta (TOA) i**f you are dealing with **opposite** and **adjacent.**

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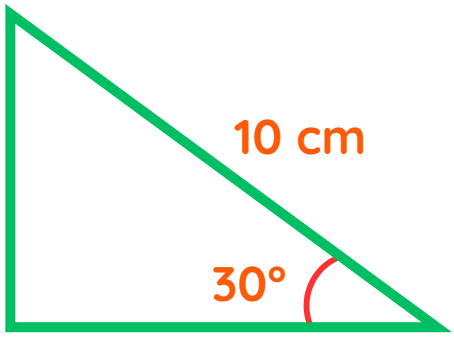
Step #3: Solve the Example Briefly

- Use the selected trigonometric formula, substitute the known values, and solve for the missing side with a quick calculation. Here's a clear example:
- If you know the opposite side and need the hypotenuse, use the **Sine formula**

$$\sin(\theta) = \frac{\text{Opposite}}{\text{Hypotenuse}}$$

Solved Example:

Problem: A right-angled triangle has a hypotenuse of 10 cm and an angle of 30°. Find the length of the opposite side.



Solution:

Step #1: Identify the given values:

- Hypotenuse = 10 cm
- Angle = 30°

Step #2: Choose the correct trigonometric ratio:

Since we are dealing with the opposite side and the hypotenuse, we use Sine Theta.

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Step #3: Set up the equation:

$$\sin(30°) = \frac{\text{Opposite}}{10}$$

Step #4: Rearrange the equation to solve for the opposite side:

$$\text{Opposite} = 10 \times \sin(30°)$$

Step #5: Substitute the value of sin(30°) = 0.5:

$$\text{Opposite} = 10 \times 0.5$$

Step #6: Calculate the final answer:

$$\text{Opposite} = 5 \text{ cm}$$

Thus, the length of the opposite side is 5 cm

Final Answer: 5 cm

5. How to Find a Missing Angle of a Right Triangle

To find a missing angle in a right-angled triangle using SOHCAHTOA, follow these 3 steps:

Step #1: Identify the Given Sides

- Determine which two sides are provided—**opposite**, **adjacent**, **or hypotenuse**.
- Label the given sides clearly.

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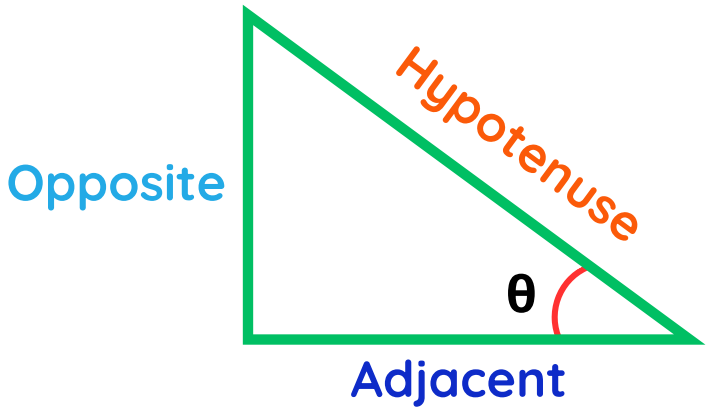

Step #2: Use the Correct Trigonometric Ratio

- **Use Sine Theta (SOH)** if you are dealing with **opposite** and **hypotenuse**
- **Use Cosine Theta (CAH)** if you are dealing with **adjacent** and **hypotenuse.**
- **Use Tangent Theta (TOA)** if you are dealing with **opposite** and **adjacent.**

Step #3: Solve for the Angle

- Use the inverse trigonometric function ($\sin^{-1}$, $\cos^{-1}$, or $\tan^{-1}$) on your calculator to find the angle.

If you want to learn more, click this link: Casio Calculator 991ex

- Rearrange the equation if necessary.
- Calculate to determine the missing angle.

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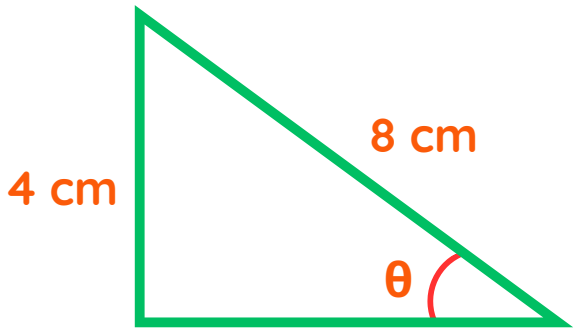
Solved Example:

Problem: A right-angled triangle has an opposite side of 4 cm and a hypotenuse of 8 cm. Find the missing angle.



Solution:

Step #1: Identify the given values:

- Opposite = 4 cm
- Hypotenuse = 8 cm

Step #2: Choose the correct trigonometric ratio:

Since we have the opposite side and the hypotenuse, we use Sine Theta.

Step #3: Set up the equation:

$$\sin(\theta) = \frac{4}{8}$$

Step #4: Simplify the fraction:

$$\sin(\theta) = 0.5$$

Step #5: Use the inverse sine function to find the angle:

$$\theta = \sin^{-1}(0.5)$$

Step #6: Calculate the final answer:

$$\theta = 30°$$

Thus, the missing angle is 30°.

Final Answer: 30°

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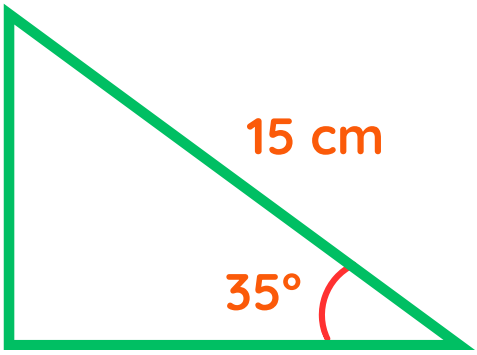
6. Three Additional Solved Examples:

Problem: A right-angled triangle has an angle of 35° and a hypotenuse of 15 cm. Find the length of the opposite side.



Solution:

Step #1: Identify the given values:

- Hypotenuse = 15 cm
- Angle = 35°

Step #2: Choose the correct trigonometric ratio:

Since we are dealing with the opposite side and the hypotenuse, we use Sine Theta.

Step #3: Set up the equation:

$$\sin(35°) = \frac{\text{Opposite}}{15}$$

Step #4: Rearrange the equation to solve for the opposite side:

$$\text{Opposite} = 15 \times \sin(35°)$$

Step #5: Calculate the value:

$$\text{Opposite} \approx 15 \times 0.5736 = 8.60 \text{ cm}$$

Thus, the opposite side is 8.60 cm.

Final Answer: 8.60 cm

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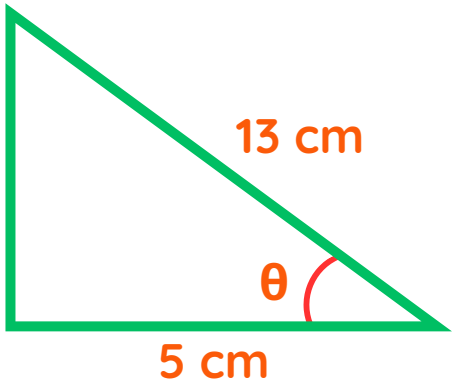
Solved Example: 2

Problem: A right-angled triangle has an adjacent side of 5 cm and a hypotenuse of 13 cm. Find the missing angle.



Solution:

Step #1: Identify the given values:

- Adjacent = 5 cm
- Hypotenuse = 13 cm

Step #2: Choose the correct trigonometric ratio:

Since we have the adjacent side and the hypotenuse, we use Cosine Theta.

Step #3: Set up the equation:

$$\cos(\theta) = \frac{5}{13}$$

Step #4: Use the inverse cosine function:

$$\theta = \cos^{-1}\left(\frac{5}{13}\right)$$

Step #5: Calculate the value:

$$\theta \approx \cos^{-1}(0.3846)$$

$$\theta \approx 67.38°$$

Thus, the missing angle is 67.38°

Final Answer: 67.38°

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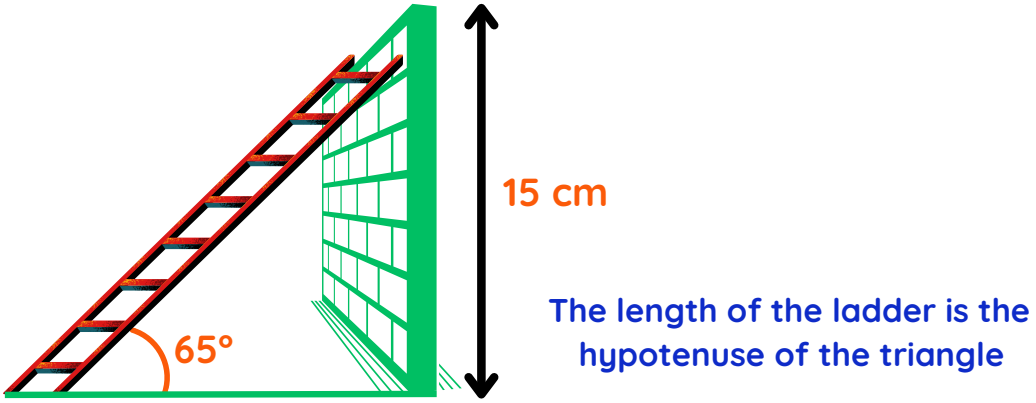
Solved Example: 3

Problem: A ladder leans against a wall, reaching a height of 15 meters. The ladder makes an angle of 65° with the ground. Find the length of the ladder.



Solution:

Step #1: Identify the given values:

- Opposite side (height) = 15 m
- Angle = 65°

Step #2: Choose the correct trigonometric ratio:

Since we have the opposite side and the hypotenuse, we use Sine Theta.

Step #3: Set up the equation:

$$\sin(65°) = \frac{15}{\text{Hypotenuse}}$$

Step #4: Rearrange the equation to solve for the hypotenuse:

$$\text{Hypotenuse} = \frac{15}{\sin(65°)}$$

Step #5: Calculate the value:

$$\text{Hypotenuse} \approx \frac{15}{0.9063}$$

$$\text{Hypotenuse} \approx 16.55 \text{ m}$$

Thus, the ladder is 16.55 meters long

Final Answer: 16.55 m