CIE IGCSE Maths: Core

Your notes

Trigonometry

Contents

Right-Angled Trigonometry

Your notes

SOHCAHTOA - Finding Lengths

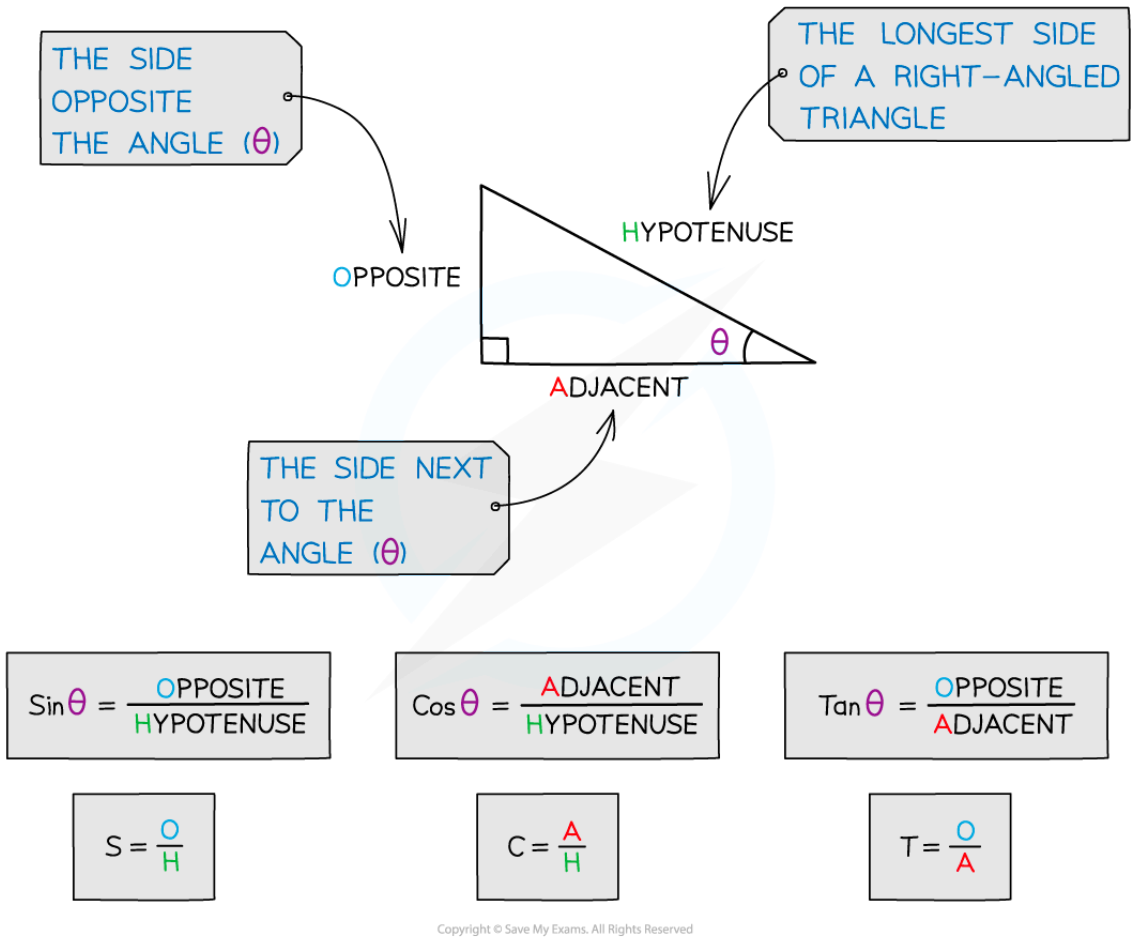
What is trigonometry?

- Trigonometry is the mathematics of **angles** in triangles
- It looks at the relationship between **side lengths** and **angles of triangles**
- It comes from the Greek words *trigonon* meaning 'triangle' and *metron* meaning 'measure'

What are sin, cos and tan?

- The **three** trigonometric functions **sine**, **cosine** and **tangent** come from **ratios of side lengths** in **right-angled** triangles
- To see how the ratios work you must first **label the sides** of a **right-angled triangle** in relation to a **chosen angle** θ
  - The **hypotenuse, H,** is the **longest side** in a right-angled triangle
    - It will always be **opposite** the right angle
  - The side **opposite θ** will be labelled **opposite**, **O**
  - The side **next to θ** will be labelled **adjacent**, **A**
- The functions sine, cosine and tangent are the ratios of the lengths of these sides as follows
  - $\sin\theta = \frac{\text{opposite}}{\text{hypotenuse}} = \frac{O}{H}$
  - $\cos\theta = \frac{\text{adjacent}}{\text{hypotenuse}} = \frac{A}{H}$
  - $\tan\theta = \frac{\text{opposite}}{\text{adjacent}} = \frac{O}{A}$

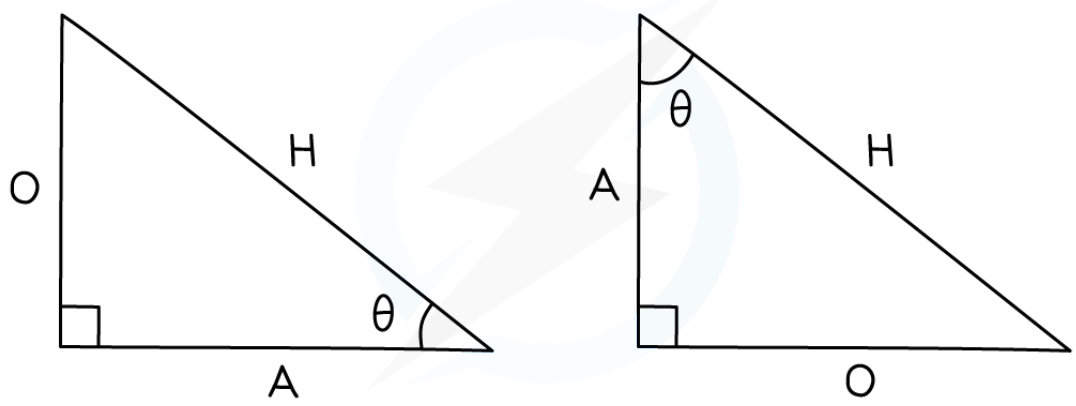
Your notes



What is SOHCAHTOA?

- **SOHCAHTOA** is a mnemonic that is often used as a way of remembering which ratio is which
  - **S**in is **O**pposite over **H**ypotenuse
  - **C**os is **A**djacent over **H**ypotenuse
  - **T**an is **O**pposite over **A**djacent
- **H** is always the same but **O** and **A** change depending on which angle is labelled as θ

Your notes



How can I use SOHCAHTOA to find missing lengths?

- **STEP 1**
  Label the sides of the triangle as H, O and A
  - **H** is the **longest side** opposite the right angle
  - **O** is **opposite** the given angle
  - **A** is **next to** the given angle
- **STEP 2**
  Identify which t**rigonometric ratio** to use: sin, cos or tan
  - Write down the letter of the **length** you are **given**
  - Write down the letter of the **length** you **want to find**
  - Find the two letters in **SOHCAHTOA** to identify which ratio to use
    - If you have **A** and **H** then use **cos**
- **STEP 3**
  Substitute the values into the relevant trigonometric formula
  - Remember to put brackets around the angle
    - $\sin(50) = \frac{A}{7}$ or $\cos(40) = \frac{3}{H}$
- **STEP 4**
  Rearrange and **solve** for the **unknown letter**
  - You will either need to **multiply** or **divide**
    - $\sin(50) = \frac{A}{7}$ leads to $A = 7 \times \sin(50)$
    - $\cos(40) = \frac{3}{H}$ leads to $H = \frac{3}{\cos(40)}$

- **STEP 5**
  Type the expression **into your calculator**
  - The **question** might ask you to **round your answer**
  - If not then round to **three significant figures**

Examiner Tip

- SOHCAHTOA (like Pythagoras) can only be used in **right-angles triangles**
- Ensure your calculator is set to measure angles in **degrees**
  - You should see the letter **D** or the word **Deg** at the top of your screen

Your notes

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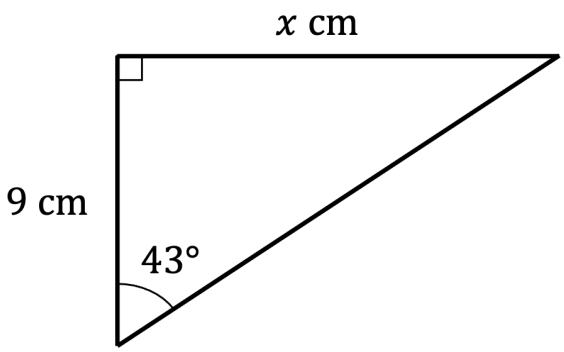
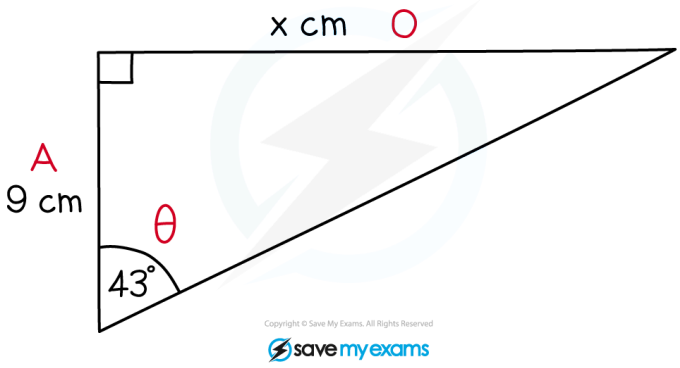
Worked example

Find the length of the side x cm in the following triangle.

Give your answer to 3 significant figures.



First label the triangle



We know A and we want to know O - that's TOA or $\tan\theta = \frac{\text{opposite}}{\text{adjacent}}$

$$\tan(43) = \frac{x}{9}$$

Multiply both sides by 9

$$9 \times \tan(43) = x$$

Enter on your calculator

$x = 8.3926...$

Round to 3 significant figures

$x = 8.39$ cm

Your notes

SOHCAHTOA – Finding Angles

How can I use SOHCAHTOA to find missing angles?

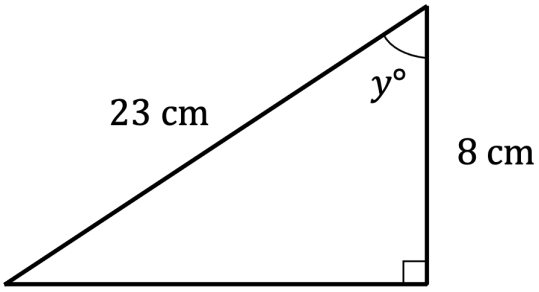

Your notes

- **STEP 1**
  Label the sides of the triangle as H, O and A
  - **H** is the **longest side** opposite the right angle
  - **O** is **opposite** the given angle
  - **A** is **next to** the given angle
- **STEP 2**
  Identify which t**rigonometric ratio** to use: sin, cos or tan
  - Write down the letters of the **lengths** you are **given**
  - Find the two letters in **SOHCAHTOA** to identify which ratio to use
    - If you have **O** and **A** then use **tan**
- **STEP 3**
  Substitute the values into the relevant trigonometric formula
  - The **angle** will be **unknown**
    - $\tan(\theta) = \frac{3}{4}$
- **STEP 4**
  Substitute the fraction into the **inverse trigonometric function**
  - You normally need to press **SHIFT** on your calculator first
    - $\tan(\theta) = \frac{3}{4}$ leads to $\theta = \tan^{-1}\left(\frac{3}{4}\right)$
- **STEP 5**
  Type the expression **into your calculator**
  - The **question** might ask you to **round your answer**
  - If not then round to **one decimal place**

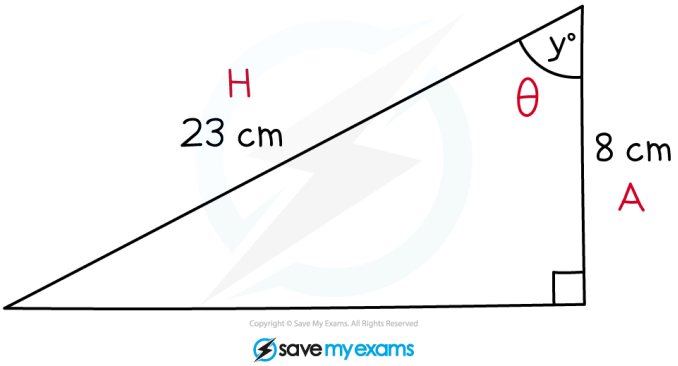
Worked example

Find the value of the angle $y°$ in the following triangle.

Give your answer to 1 decimal place.



First label the triangle



We know A and H - that's CAH or $\cos\theta = \dfrac{\text{adjacent}}{\text{hypotenuse}}$

$$\cos(y) = \frac{8}{23}$$

Use inverse cos to find y

$$y = \cos^{-1}\left(\frac{8}{23}\right)$$

Enter on your calculator

$$y = 69.6455...$$

Your notes

Round to 1 decimal place

$y = 69.6°$

Your notes