



THIRD SPACE
LEARNING

GCSE Maths Intervention Pack

Trigonometry: Using
SOHCAHTOA

Grade 6

Teacher Notes

Question Sets

Set 1: Finding a missing side using multiplication

Calculate the missing side of a right-angled triangle using multiplication

Key words: Adjacent, cosine, hypotenuse, inverse, opposite, right-angled triangle, sine, "SOHCAHTOA", tangent

Set 2: Finding a missing side using division

Calculate the missing side of a right-angled triangle using division

Key words: Adjacent, cosine, hypotenuse, inverse, opposite, right-angled triangle, sine, "SOHCAHTOA", tangent

Set 3: Finding a missing angle

Multiply and divide numbers in standard form writing the solution in standard form

Key words: Adjacent, cosine, hypotenuse, inverse, opposite, right-angled triangle, sine, "SOHCAHTOA", tangent



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"We now tell our staff that if Third Space Learning do a version of that resource, prioritise it over all of the alternatives, because we feel that they are always the best ones."



Gabriel Ogbeifun,
Head of Mathematics, Regent High School

Slide 1: Cover Slide

Teaching Prompts

- Who do you agree with?
 - Can you identify which side is the hypotenuse? (opposite the right angle)
 - Can you identify the opposite side? (8cm)
 - Can you identify the adjacent side? (x)
-

Answers

Amy is correct, we have the opposite and adjacent sides so we need to use the tan function.

Teacher Reference Only

Common Misconceptions

- Students confuse the labelling of the sides of a right-angled triangle as they are relative to the angle used (Opposite / Adjacent / Hypotenuse).
 - Students make mistakes when rearranging equations, especially when the unknown side is the denominator of a fraction.
 - Students may think that $\sin^{-1}(\theta) = 1 \div \sin(\theta)$ and try to calculate the inverse of the trig function by dividing.
 - Students may think that $\sin(\theta)$ means $\sin \times (\theta)$
 - Students confuse the angle with the side length and calculate $\sin / \cos / \tan$ of the side length, rather than $\sin / \cos / \tan$ of the angle.
-

Terminology

- Right-angled triangle: triangle with a 90 degree angle
- Function: a mathematical rule that is applied to a number or expression
- Sine (sin): the sine function of an angle is equal to the ratio of the opposite side and the hypotenuse of a triangle.
- Cosine (cos): the cosine function of an angle is equal to the ratio of the adjacent side and the hypotenuse of a triangle.
- Tangent (tan): the tangent function is equal to the ratio of the opposite and adjacent sides of a triangle.

Slide 1: Cover Slide

Terminology (cont.)

- Opposite: the side of a triangle that is opposite the relative angle
- Adjacent: the side next to the relative angle
- Hypotenuse: the side of a right-angled triangle that is always opposite the 90 degree angle
- Inverse: the inverse to a function is the mathematical rule that can “undo” the original function (e.g. adding is the inverse of subtracting).
 - The inverse function of $\sin(x)$ is $\sin^{-1}(x)$,
 - The inverse function of $\cos(x)$ is $\cos^{-1}(x)$
 - The inverse function of $\tan(x)$ is $\tan^{-1}(x)$
- SOHCAHTOA: this is an abbreviation for the trig function and the ratio of the two related sides. Here
 - $\sin(\theta) = \text{Opposite} \div \text{Hypotenuse}$ (SOH)
 - $\cos(\theta) = \text{Adjacent} \div \text{Hypotenuse}$ (CAH)
 - $\tan(\theta) = \text{Opposite} \div \text{Adjacent}$ (TOA)

Slide 2: Try this exam-style question...

Set 1: Finding a missing side using multiplication.

Teaching Prompts

- Can you try this question by yourself?
-

If Stuck

- Move on to the next slide.
-

Mark Scheme

Allow full marks for any other correct method

- (1 mark) identifies $\sin(40) = \frac{x}{6}$
- (1 mark) $x = 6 \times \sin(40)$
- (1 marks) 3.86cm (2 d.p.)

Slides 3 and 4: Let's go through it together...

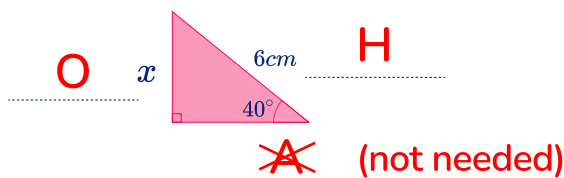
Set 1: Finding a missing side using multiplication.

Teaching Prompts

- Can you label the triangle?
- Can you select the correct trigonometric function? (sin)
- Can you substitute in the values into the equation or formula triangle?

Answers

- 1 Label the triangle with O , A and H .



- 2 Choose the trig ratio we need.

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

- 3 Substitute the values.

$$\sin(40) = \frac{x}{6}$$

- 4 Calculate the unknown side.

$$x = 6\sin(40)$$

$$= 3.86\text{cm (2 d.p.)}$$

Mark Scheme

Allow full marks for any other correct method

- (1 mark) identifies $\sin(40) = \frac{x}{6}$
- (1 mark) $x = 6 \times \sin(40)$
- (1 marks) 3.86cm (2 d.p.)

Slide 5: Your turn...

Set 1: Finding a missing side using multiplication.

Teaching Prompts

- Can you label the triangle?
 - Can you select the correct trigonometric ratio? (cos)
 - Substitute the values into the equation and rearrange to solve.
-

Mark Scheme

Allow full marks for any other correct method

- (1 mark) identifies $\cos(36) = \frac{x}{5}$
- (1 mark) $x = 5 \times \cos(36)$
- (1 marks) 4.05cm (2 d.p.)

Slide 6: Try this exam-style question

Set 2: Finding a missing side using division.

Teaching Prompts

- Can you try this question by yourself?
-

If Stuck

- Move on to the next slide.
-

Mark Scheme

Allow full marks for any other correct method

- (1 mark) identifies $\cos(42) = \frac{15}{x}$
- (1 mark) $x = \frac{15}{\cos(42)}$
- (1 marks) 20.18cm (2 d.p.)

Slide 7: Let's go through it together...

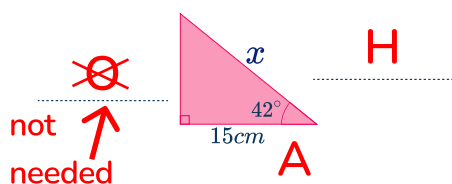
Set 2: Finding a missing side using division.

Teaching Prompts

- Can you label the triangle?
- Can you select the correct trigonometric function? (cos)
- Can you substitute in the values into the equation or formula triangle?

Answers

- 1 Label the triangle with O , A and H .



- 2 Choose the trig ratio we need.

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

- 3 Substitute the values.

$$\cos(42) = \frac{15}{x}$$

- 4 Calculate the unknown side.

$$x = \frac{15}{\cos(42)}$$
$$= 20.18\text{cm (2 d.p.)}$$

Mark Scheme

Allow full marks for any other correct method

- (1 mark) identifies $\cos(42) = \frac{15}{x}$
- (1 mark) $x = \frac{15}{\cos(42)}$
- (1 marks) 20.18cm (2 d.p.)

Slide 8: Your turn...

Set 2: Finding a missing side using division.

Teaching Prompts

- Can you label the triangle?
 - Can you select the correct trigonometric ratio? (tan)
 - Substitute the values into the equation and rearrange to solve.
-

Mark Scheme

Allow full marks for any other correct method

- (1 mark) identifies $\tan(62) = \frac{5.3}{x}$ needs to be used
- (1 mark) $x = \frac{5.3}{\tan(62)}$
- (1 marks) 2.82cm (2 d.p.)

Slide 9: Try this exam-style question

Set 3: Finding a missing angle.

Teaching Prompts

- Can you try this question by yourself?
-

If Stuck

- Move on to the next slide.
-

Mark Scheme

Allow full marks for any other correct method

- (1 mark) identifies $\tan(\theta) = \frac{15}{7}$
- (1 mark) $\theta = \tan^{-1}\left(\frac{15}{7}\right)$
- (1 marks) 64.98° (2 d.p.)

Slide 10: Let's go through it together...

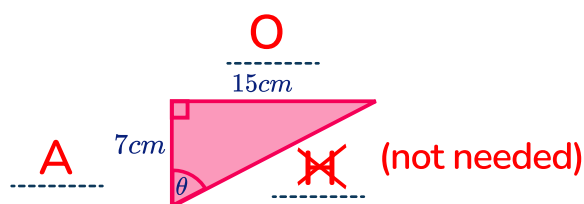
Set 3: Finding a missing angle.

Teaching Prompts

- Can you label the triangle?
 - Can you select the correct trigonometric function? (tan)
 - Can you substitute in the values into the equation or formula triangle?
 - Do you know how to use the inverse trig functions? (press shift on a calculator then the trig ratio button)
-

Answers

1.



2. $\theta = \tan^{-1}\left(\frac{O}{A}\right)$

3. $\theta = \tan^{-1}\left(\frac{15}{7}\right)$

4. 64.98° (2 d.p.)

Mark Scheme

Allow full marks for any other correct method

- (1 mark) identifies $\tan(\theta) = \frac{15}{7}$
- (1 mark) $\theta = \tan^{-1}\left(\frac{15}{7}\right)$
- (1 marks) 64.98° (2 d.p.)

Slide 11: Your turn...

Set 3: Finding a missing angle.

Teaching Prompts

- Can you label the triangle?
 - Can you select the correct trigonometric ratio? (sin)
 - Use the inverse trig function to calculate the angle.
-

Mark Scheme

Allow full marks for any other correct method

- (1 mark) identifies $\sin(\theta) = \frac{5}{9}$
- (1 mark) $\theta = \sin^{-1}\left(\frac{5}{9}\right)$
- (1 marks) 33.75° (2 d.p.)

Slide 12: Ready for a Challenge?

Teaching Prompts

- What trig ratio do we need to use to find the height of the tree?
 - What do we need to add to the height of the right-angles triangle to get the final answer?
-

Mark Scheme

Allow full marks for any other correct method

- (1 mark) identifies $\tan(63) = \frac{x}{7}$
- (1 mark) $x = 20 \times \tan(63)$
- (1 marks) $20 \tan(63) + 1.6$
- (1 mark) 40.9m (3.s.f)

Slide 13: What have we learnt?

Teaching Prompts

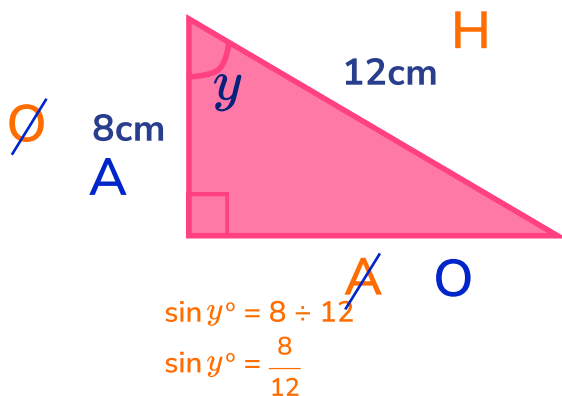
- Can you see where the student has gone wrong? (they have divided in the incorrect order)
- What should they have done instead? ($10 \div \sin(40)$)

$$\sin(40) = \frac{10}{x}$$

$$x = \frac{10}{\sin(40)}$$

$$x = 15.6\text{cm}$$

- Can you see where the student has gone wrong? (they have mislabelled the triangle (they have used the adjacent instead of the opposite with the sin ratio))
- What should they have done instead? (used the inverse cos function on $\frac{8}{12}$)



$$\cos(y) = 8 \div 12$$

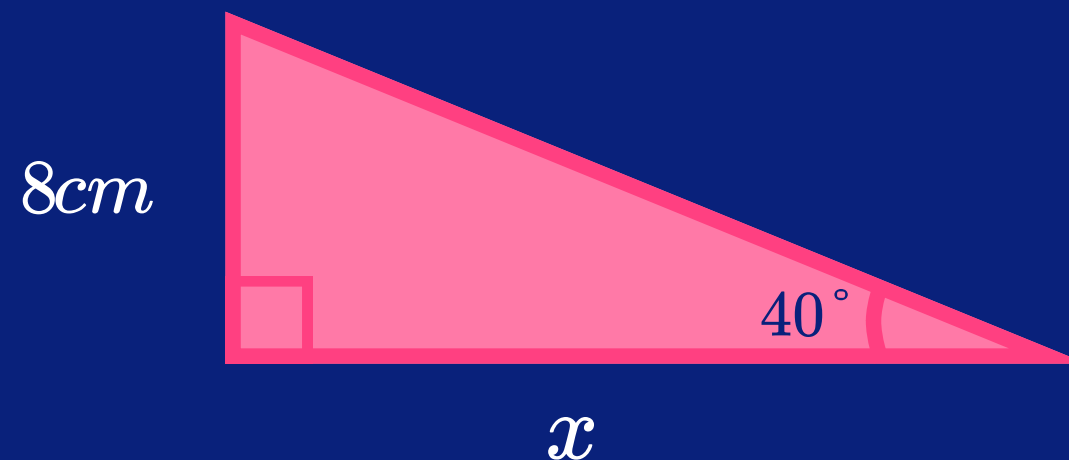
$$y = \cos^{-1}(8 \div 12) = 48.2^\circ$$

Trigonometry: Using SOHCAHTOA

Amy says: 'To find x we can use the equation $\tan 40^\circ = \frac{8}{x}$ '

Majid says: "We need to use $\sin 40^\circ = \frac{8}{x}$ "

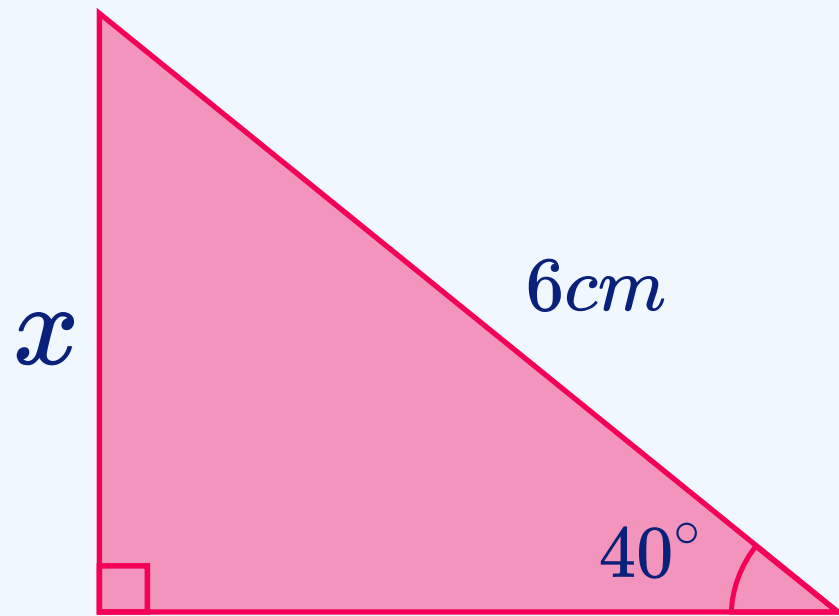
Tobi says: "I think it's $\cos 40^\circ = \frac{x}{8}$ "



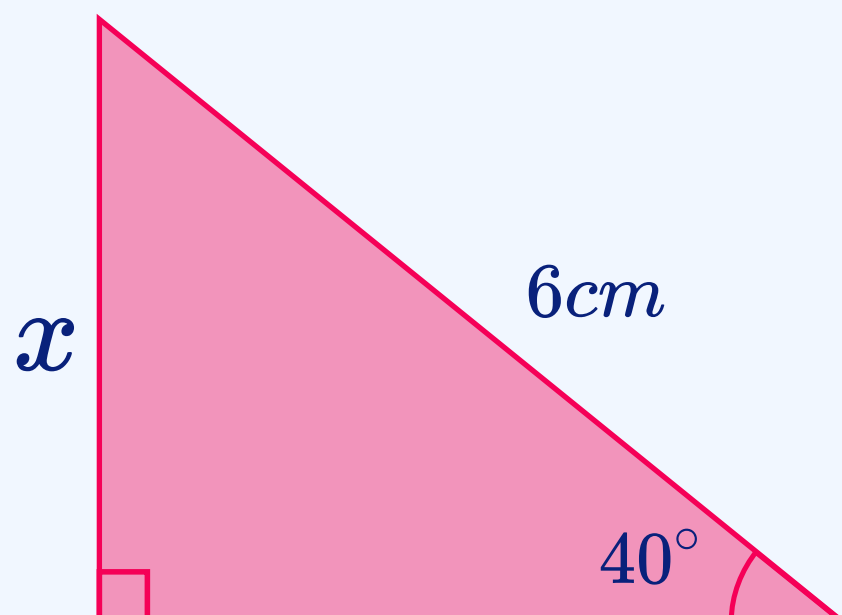
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Try this exam-style question...

Calculate the side labelled x .



Calculate the side labelled x .



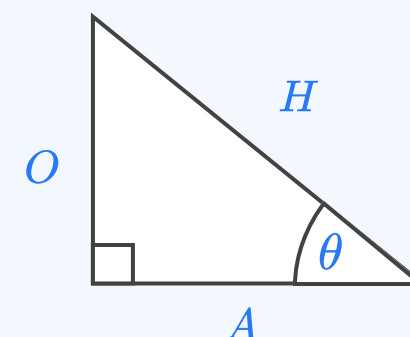
The **trigonometric ratios**; sin, cos and tan are used to calculate angles and lengths in **right-angled triangles**.

They are:

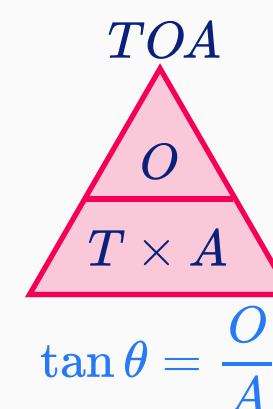
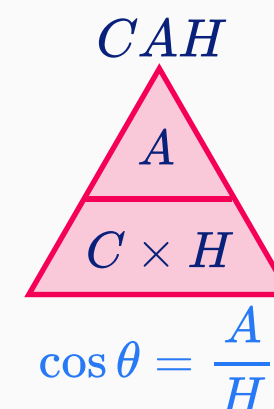
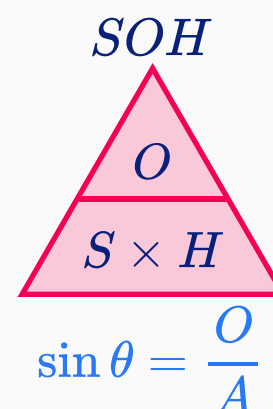
$$\sin \theta = \frac{O}{H}$$

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

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



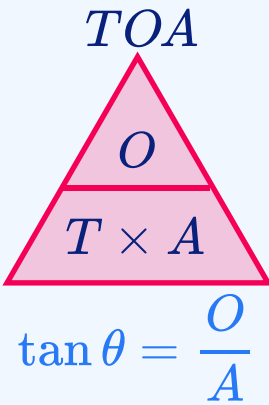
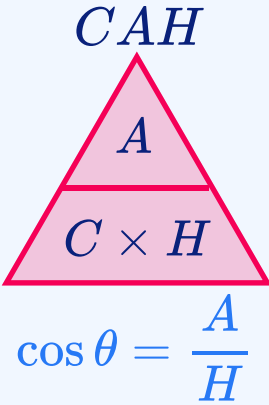
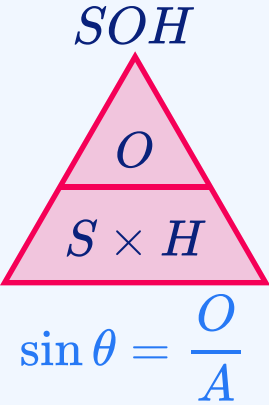
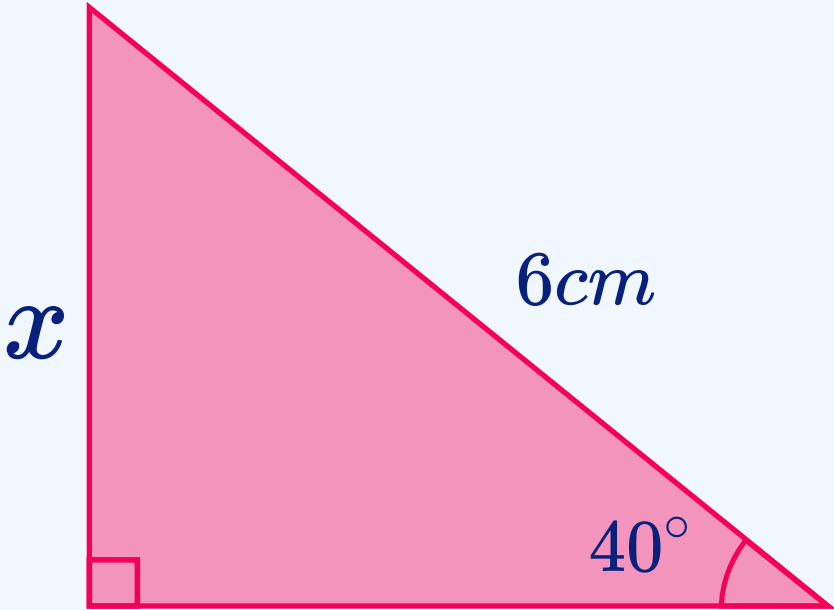
We can abbreviate these to the SOHCAHTOA triangles:



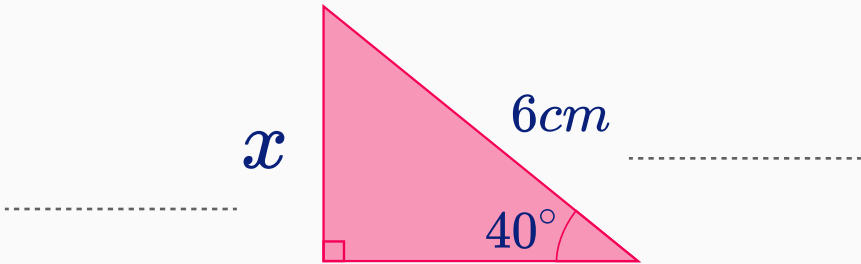
We can use trigonometry to work out the unknown sides of a right-angled triangle by using SOHCAHTOA.

1. Label the sides of the right-angled triangle that we have information about.
2. Choose the trig ratio we need.
3. Substitute the values from the triangle into the function.
4. Calculate the unknown side, rearranging if necessary.

Calculate the side labelled x .



1 Label the triangle with O, A and H .



2 Choose the trig ratio we need.

..... = $\frac{\boxed{}}{\boxed{}}$

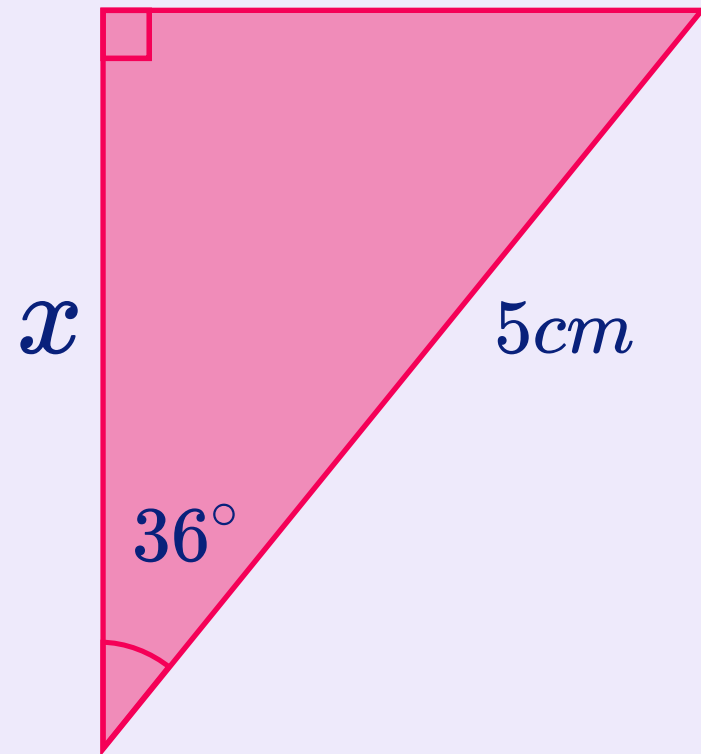
3 Substitute the values.

..... = $\frac{\boxed{}}{\boxed{}}$

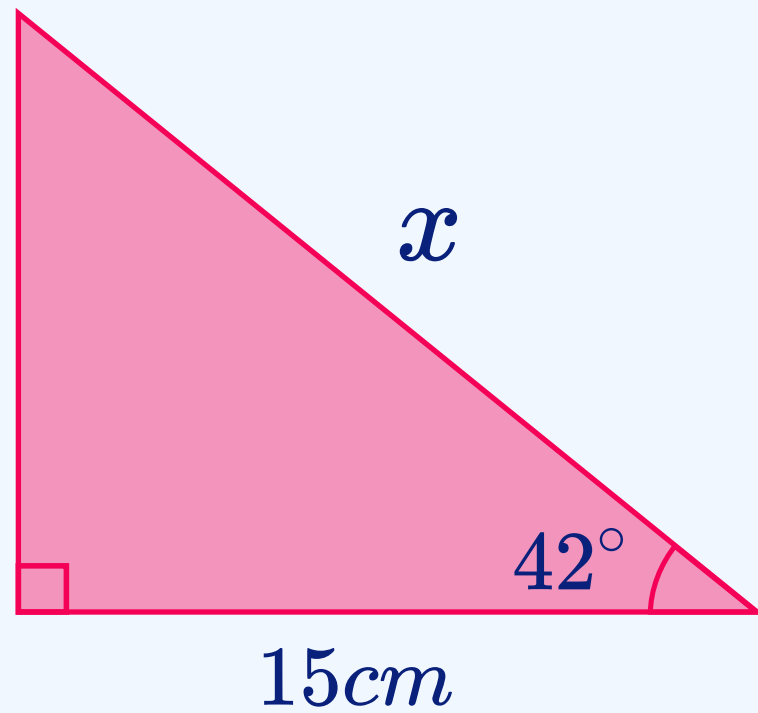
4 Calculate the unknown side.

$x =$
.....
 $=$
.....

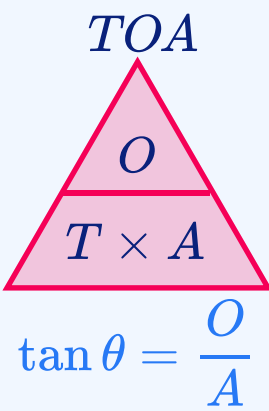
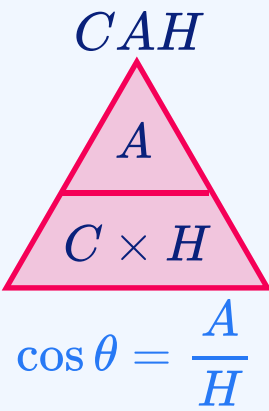
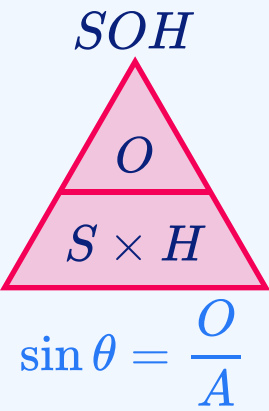
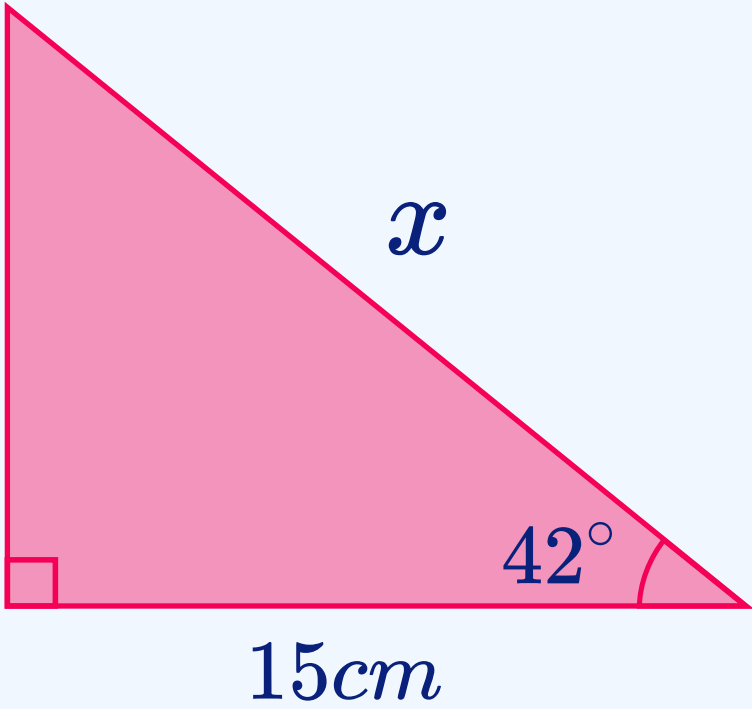
Calculate the side labelled x .



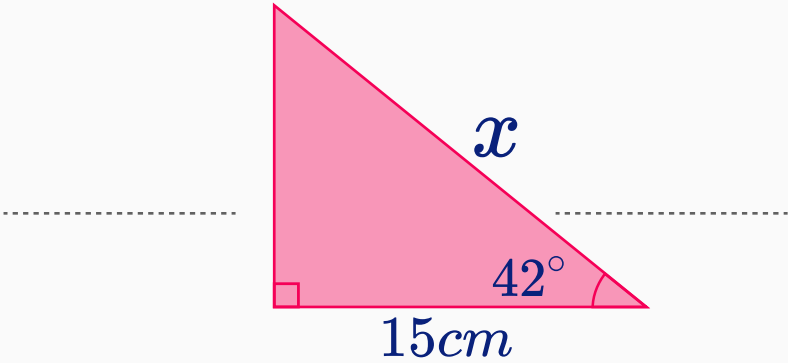
Calculate the length of the side labelled x .



Calculate the side labelled x .



1 Label the triangle with O, A and H .



2 Choose the trig ratio we need.

..... = $\frac{\boxed{}}{\boxed{}}$

3 Substitute the values.

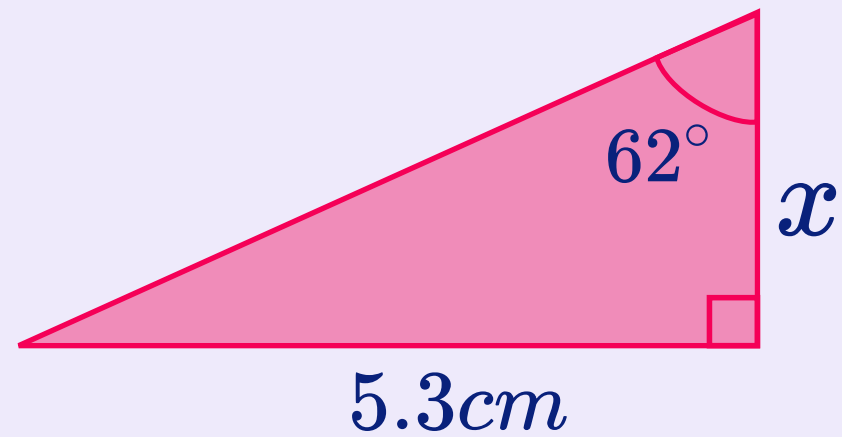
..... = $\frac{\boxed{}}{\boxed{}}$

4 Calculate the unknown side.

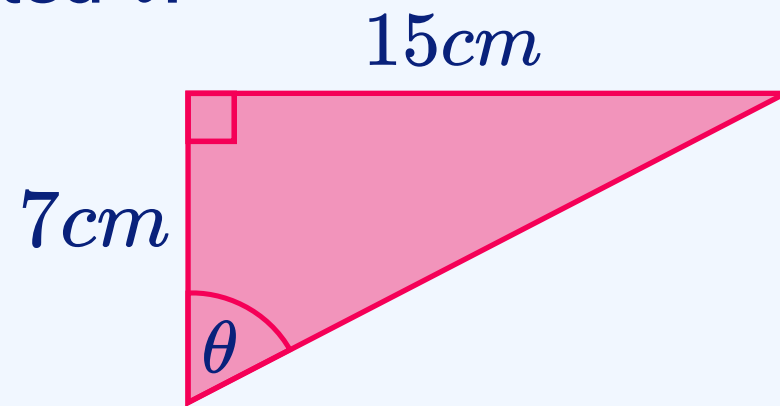
$x = \frac{\boxed{}}{\boxed{}}$

=

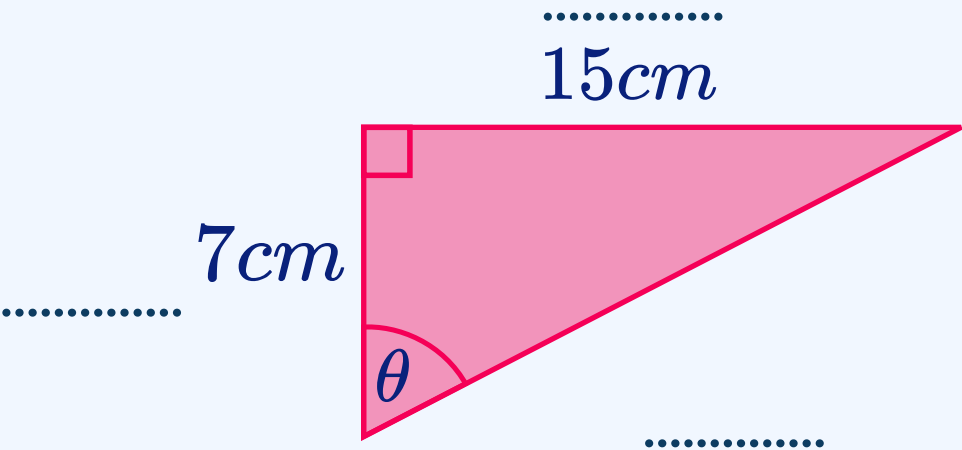
Calculate the side labelled x .



Calculate the value of the angle labelled θ .



Calculate the value of the angle labelled θ .



SOH

$\theta = \sin^{-1}\left(\frac{O}{H}\right)$

CAH

$\theta = \cos^{-1}\left(\frac{A}{H}\right)$

CAH

$\theta = \tan^{-1}\left(\frac{O}{A}\right)$

We can use trigonometry to work out the unknown angles of a right-angled triangle by using SOHCAHTOA.

1. Label the sides of the right-angled triangle that we have information about.
2. Choose the trig ratio we need.
3. Substitute the values from the triangle into the function.
4. Using inverse trig functions, work out the missing angle θ .

1 Label the triangle.

2 Choose the trig value we need.

$\theta =$

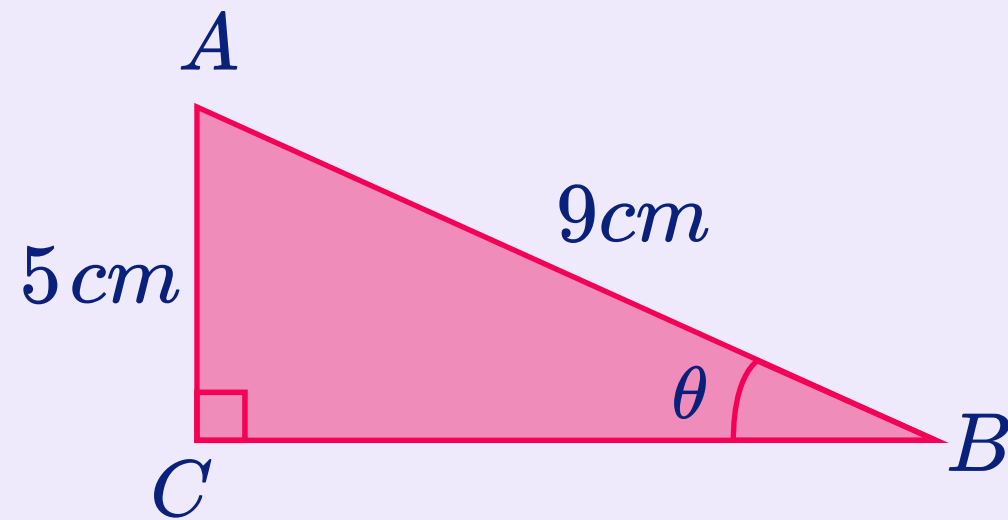
3 Substitute the values.

$\theta =$

4 Use SHIFT to use the inverse trig function.

$\theta =$

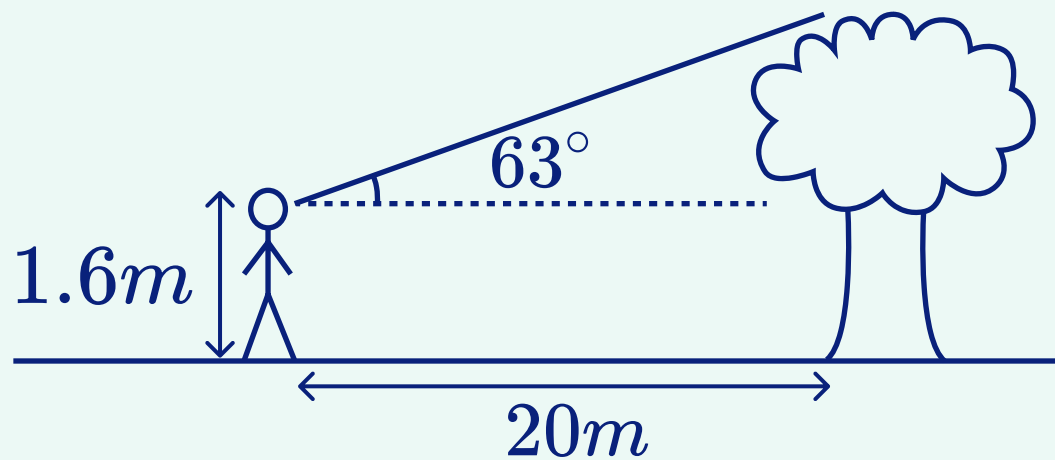
Calculate the angle ABC .



A man is working out the height of a tree. He is looking up at a tree at an angle of 63° .

His eye line is $1.6m$ above the ground level. The man is standing $20m$ from the tree base.

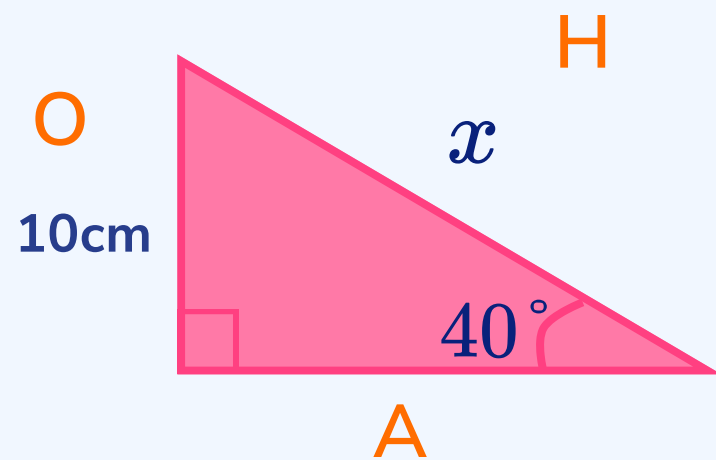
A sketch of the situation is shown:



What is the total height of the tree?
Give your answer to 3 s.f.

Can you correct the answers to the questions below?

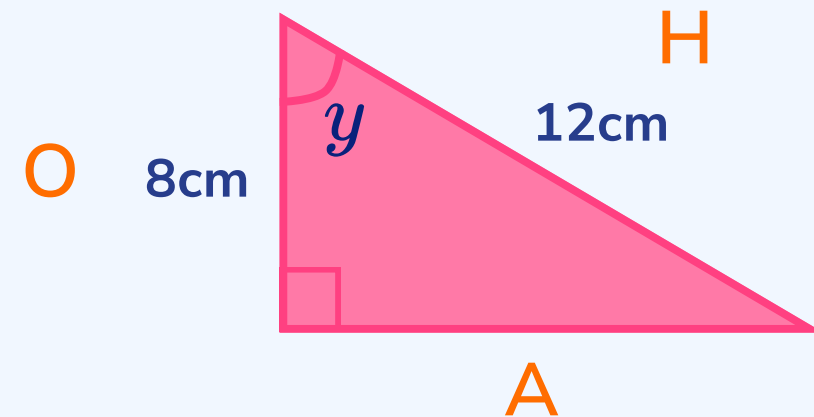
Find x to 1 decimal place.



$$\sin 40^\circ = \frac{10}{x}$$
$$x = \frac{10}{\sin 40^\circ}$$

$$x = 0.06\text{cm}$$

Find y to 1 decimal place.



$$\sin y^\circ = \frac{8}{12}$$
$$\sin y^\circ = \frac{2}{3}$$

$$y = 41.9^\circ$$

Where to go next?

For more diagnostic questions, and GCSE maths revision resources and worksheets to support students in fixing any misconceptions take a look at the free Third Space Learning [GCSE maths revision](#) pages.

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