

Trigonometry

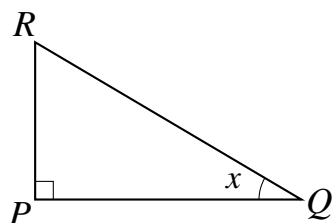
Solutions

For AQA GCSE Mathematics (8300) • Foundation tier

Each question is shown in grey, followed by the working, one step per line. The final answer is in a box. *Marks* shows how the marks are usually given in the exam, and **Tip** points out a common mistake.

1 (2 marks)

PQR is a right-angled triangle.



Not drawn accurately

(a) Which side is the hypotenuse?

The hypotenuse is the longest side.

It is always opposite the right angle.

The right angle is at P , so the hypotenuse is QR .

Answer: QR

(b) Which side is opposite the angle x ?

The angle x is at Q .

The opposite side is the side that does not touch the angle x .

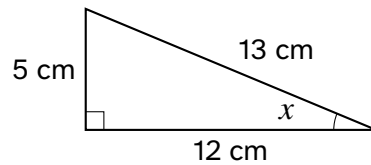
That side is PR .

Answer: PR

Tip: Label the sides O (opposite), A (adjacent) and H (hypotenuse) before every trig question. The adjacent side is next to the angle but is not the hypotenuse.

2 (1 mark)

Here is a right-angled triangle.



Not drawn accurately

Circle the correct equation for this triangle.

Options: $\sin x = \frac{5}{13}$, $\sin x = \frac{12}{13}$, $\cos x = \frac{5}{12}$, $\tan x = \frac{12}{5}$

Label the sides from the angle x :

opposite = 5, adjacent = 12, hypotenuse = 13

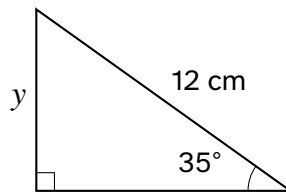
$$\text{SOH: } \sin x = \frac{\text{opp}}{\text{hyp}} = \frac{5}{13}$$

(The other options would be $\cos x = \frac{12}{13}$ and $\tan x = \frac{5}{12}$.)

Answer: $\sin x = \frac{5}{13}$

3 (2 marks)

Here is a right-angled triangle.



Not drawn accurately

Work out the length y .

Give your answer to 1 decimal place.

From the 35° angle: y is the opposite and 12 cm is the hypotenuse.

O and H, so use SOH: $\sin 35^\circ = \frac{y}{12}$

Multiply both sides by 12: $y = 12 \times \sin 35^\circ$

$y = 6.882 \dots = 6.9 \text{ cm}$ (1 d.p.)

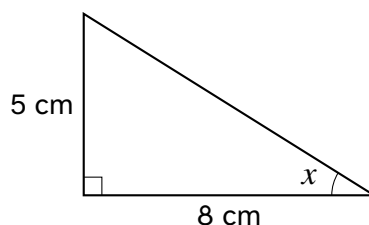
Answer: 6.9 cm

Tip: Make sure your calculator is in degrees (a “D” on the screen). Check with $\sin 30 = 0.5$.

Marks: 1 mark for $12 \sin 35$. 1 mark for 6.9.

4 (2 marks)

Here is a right-angled triangle.



Not drawn accurately

Work out the size of angle x .

Give your answer to 1 decimal place.

From the angle x : opposite = 5 cm and adjacent = 8 cm.

O and A, so use TOA: $\tan x = \frac{5}{8}$

To find an angle, use the inverse: $x = \tan^{-1}\left(\frac{5}{8}\right)$

$$x = 32.005 \dots = 32.0^\circ \text{ (1 d.p.)}$$

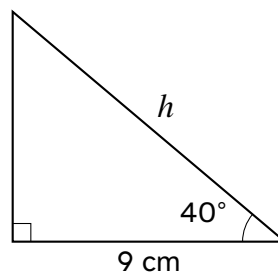
Answer: 32.0°

Tip: To find an angle use $\tan^{-1}$ (SHIFT then tan). $\tan\left(\frac{5}{8}\right)$ or “ $\tan x = 0.625$, so $x = 0.625$ ” are common wrong answers.

Marks: 1 mark for $\tan x = \frac{5}{8}$. 1 mark for 32.0 .

5 (3 marks)

Here is a right-angled triangle.



Not drawn accurately

Work out the length of the hypotenuse, h .

Give your answer to 1 decimal place.

From the 40° angle: 9 cm is the adjacent and h is the hypotenuse.

A and H, so use CAH: $\cos 40^\circ = \frac{9}{h}$

Multiply both sides by h : $h \times \cos 40^\circ = 9$

Divide both sides by $\cos 40^\circ$: $h = \frac{9}{\cos 40^\circ}$

$$h = 11.748 \dots = 11.7 \text{ cm (1 d.p.)}$$

Answer: 11.7 cm

Tip: When the letter is on the bottom of the fraction, you divide: $h = 9 \div \cos 40^\circ$. Check: the hypotenuse must be longer than 9 cm.

Marks: 1 mark for $\cos 40 = \frac{9}{h}$. 1 mark for $9 \div \cos 40$. 1 mark for 11.7.

6 (3 marks)

A ladder 6 m long leans against a vertical wall.
The ladder makes an angle of 72° with the horizontal ground.

Work out the height the ladder reaches up the wall.
Give your answer to 1 decimal place.

Sketch a right-angled triangle: the ladder is the hypotenuse (6 m) and the angle with the ground is 72° .

The height up the wall is opposite the 72° angle.

O and H, so use SOH: $\sin 72^\circ = \frac{\text{height}}{6}$

$$\text{Height} = 6 \times \sin 72^\circ = 5.706 \dots = 5.7 \text{ m (1 d.p.)}$$

Answer: 5.7 m

Marks: 1 mark for a right-angled triangle with 6 as the hypotenuse. 1 mark for $6 \sin 72$. 1 mark for 5.7.

7 (3 marks)

A ramp is 9 m long.
The top of the ramp is 1.2 m above the ground.

Work out the angle the ramp makes with the ground.
Give your answer to 1 decimal place.

Sketch a right-angled triangle: the ramp is the hypotenuse (9 m) and the height is 1.2 m.

From the angle at the ground, the height is the opposite.

O and H, so use SOH: $\sin x = \frac{1.2}{9}$

$$x = \sin^{-1}\left(\frac{1.2}{9}\right) = 7.662 \dots = 7.7^\circ \text{ (1 d.p.)}$$

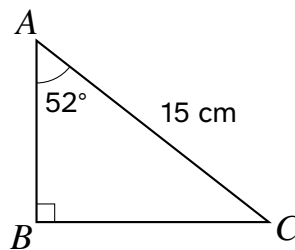
Answer: 7.7°

Marks: 1 mark for $\sin x = \frac{1.2}{9}$. 1 mark for using $\sin^{-1}$. 1 mark for 7.7.

8 (4 marks)

ABC is a right-angled triangle.

$AC = 15$ cm and angle $BAC = 52^\circ$



Not drawn accurately

- (a) Work out the length AB .
Give your answer to 1 decimal place.

From the 52° angle at A : AB is the adjacent and $AC = 15$ cm is the hypotenuse.

A and H, so use CAH: $\cos 52^\circ = \frac{AB}{15}$

$$AB = 15 \times \cos 52^\circ = 9.234 \dots = 9.2 \text{ cm (1 d.p.)}$$

Answer: 9.2 cm

Marks: 1 mark for $15 \cos 52$. 1 mark for 9.2.

- (b) Work out the length BC .
Give your answer to 1 decimal place.

BC is opposite the 52° angle.

O and H, so use SOH: $\sin 52^\circ = \frac{BC}{15}$

$$BC = 15 \times \sin 52^\circ = 11.820 \dots = 11.8 \text{ cm (1 d.p.)}$$

(You could also use Pythagoras with your answer to part (a).)

Answer: 11.8 cm

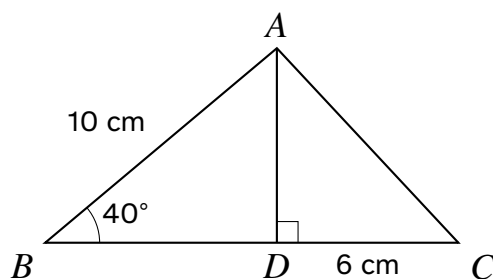
Marks: 1 mark for $15 \sin 52$ (or a correct Pythagoras method). 1 mark for 11.8.

9 (4 marks)

ABC is a triangle.

D is the point on BC such that AD is perpendicular to BC .

$AB = 10 \text{ cm}$, $DC = 6 \text{ cm}$ and angle $ABD = 40^\circ$



Not drawn accurately

Work out the size of angle ACD .

Give your answer to 1 decimal place.

Step 1: triangle ABD .

From the 40° angle, AD is the opposite and $AB = 10 \text{ cm}$ is the hypotenuse.

$$\text{SOH: } \sin 40^\circ = \frac{AD}{10}$$

$$AD = 10 \times \sin 40^\circ = 6.427 \dots \text{ cm (keep this on your calculator)}$$

Step 2: triangle ACD .

From angle ACD , AD is the opposite and $DC = 6 \text{ cm}$ is the adjacent, so use TOA.

$$\tan ACD = \frac{6.427 \dots}{6}$$

$$ACD = \tan^{-1}(1.0712 \dots) = 46.97 \dots = 47.0^\circ \text{ (1 d.p.)}$$

Answer: 47.0°

Tip: Do not round AD before you use it again. Use the full calculator value (or the ANS key), then round only the final answer.

Marks: 1 mark for $10 \sin 40$. 1 mark for $AD = 6.42$ to 6.43 . 1 mark for $\tan ACD = \frac{AD}{6}$. 1 mark for 46.9 to 47.0 .
