

Trigonometry

Solutions

For Pearson Edexcel GCSE Mathematics (1MA1) • 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)

ABC is a right-angled triangle.

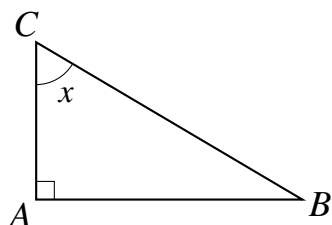


Diagram **NOT** accurately drawn

- (a) Write down the letters of the hypotenuse.

The hypotenuse is the longest side.

It is always opposite the right angle.

The right angle is at A , so the hypotenuse is BC .

Answer: BC

- (b) Write down the letters of the side adjacent to the angle marked x .

The angle x is at C .

The adjacent side touches the angle x and is not the hypotenuse.

That side is AC .

Answer: AC

Tip: Label the sides O, A and H from the marked angle before every trig question.
Mislabelling the sides is how most wrong ratios happen.

2 (2 marks)

ABC is a right-angled triangle.

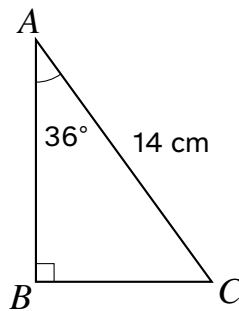


Diagram **NOT** accurately drawn

Work out the length of AB .

Give your answer correct to 3 significant figures.

From the 36° angle at A : AB is the adjacent and $AC = 14$ cm is the hypotenuse.

A and H, so use CAH: $\cos 36^\circ = \frac{AB}{14}$

Multiply both sides by 14: $AB = 14 \times \cos 36^\circ$

$AB = 11.326 \dots = 11.3$ cm (3 s.f.)

Answer: 11.3 cm

Tip: Check your calculator is in degrees. AB is next to the 36° angle, so it is the adjacent: use cos, not sin.

Marks: 1 mark for $14 \cos 36$. 1 mark for 11.3.

3 (2 marks)

PQR is a right-angled triangle.

$PR = 4$ cm and $PQ = 7$ cm

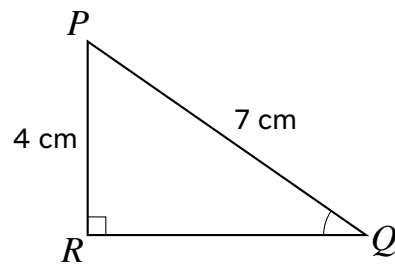


Diagram **NOT** accurately drawn

Work out the size of angle PQR .

Give your answer correct to 1 decimal place.

From angle PQR (at Q): $PR = 4$ cm is the opposite and $PQ = 7$ cm is the hypotenuse.

O and H, so use SOH: $\sin PQR = \frac{4}{7}$

To find an angle, use the inverse: $PQR = \sin^{-1}\left(\frac{4}{7}\right)$

$PQR = 34.849 \dots = 34.8^\circ$ (1 d.p.)

Answer: 34.8°

Marks: 1 mark for $\sin PQR = \frac{4}{7}$. 1 mark for 34.8 .

4 (2 marks)

Here is a right-angled triangle.

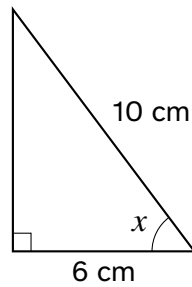


Diagram **NOT** accurately drawn

Work out the value of x .

Give your answer correct to 1 decimal place.

From the angle x : 6 cm is the adjacent and 10 cm is the hypotenuse.

A and H, so use CAH: $\cos x = \frac{6}{10}$

$$x = \cos^{-1}(0.6)$$

$$x = 53.130 \dots = 53.1 \text{ (1 d.p.)}$$

Answer: 53.1

Tip: Use $\cos^{-1}$ (SHIFT cos) to find an angle. Writing $x = 0.6$ is a common mistake.

Marks: 1 mark for $\cos x = \frac{6}{10}$. 1 mark for 53.1.

5 (3 marks)

ABC is a right-angled triangle.

$AC = 5.2$ cm, $BC = 8.5$ cm and angle $ACB = 90^\circ$

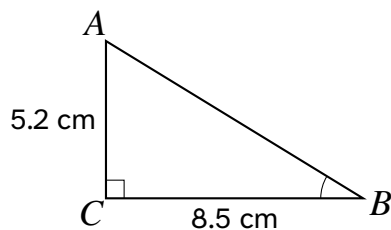


Diagram **NOT** accurately drawn

- (a) Work out the size of angle ABC .

Give your answer correct to 1 decimal place.

From angle ABC (at B): $AC = 5.2$ cm is the opposite and $BC = 8.5$ cm is the adjacent.

O and A, so use TOA: $\tan ABC = \frac{5.2}{8.5}$

$$ABC = \tan^{-1}\left(\frac{5.2}{8.5}\right) = 31.460 \dots = 31.5^\circ \text{ (1 d.p.)}$$

Answer: 31.5°

Tip: Neither given side is the hypotenuse, so you need tan. Using sin or cos here is a common mistake.

Marks: 1 mark for $\tan ABC = \frac{5.2}{8.5}$. 1 mark for 31.5.

- (b) Work out the size of angle BAC .

The angles in a triangle add up to 180° .

Angle $ACB = 90^\circ$, so angle $BAC = 180 - 90 - 31.46 \dots$

Angle $BAC = 58.539 \dots = 58.5^\circ$ (1 d.p.)

(You could also use $\tan BAC = \frac{8.5}{5.2}$.)

Answer: 58.5°

6 (3 marks)

The diagram shows a ramp.

The ramp makes an angle of 12° with the horizontal ground.

The top of the ramp is 0.9 m above the ground.

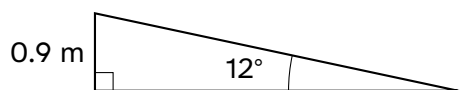


Diagram **NOT** accurately drawn

Work out the length of the ramp.

Give your answer correct to 1 decimal place.

Call the length of the ramp L .

The ramp is the hypotenuse.

From the 12° angle, the height 0.9 m is the opposite.

O and H, so use SOH: $\sin 12^\circ = \frac{0.9}{L}$

Multiply both sides by L : $L \times \sin 12^\circ = 0.9$

Divide by $\sin 12^\circ$: $L = \frac{0.9}{\sin 12^\circ}$

$L = 4.328 \dots = 4.3 \text{ m (1 d.p.)}$

Answer: 4.3 m

Tip: When the unknown is on the bottom of the fraction, divide: $L = 0.9 \div \sin 12^\circ$, not $0.9 \times \sin 12^\circ$. The ramp must be longer than 0.9 m.

Marks: 1 mark for $\sin 12 = \frac{0.9}{L}$. 1 mark for $0.9 \div \sin 12$. 1 mark for 4.3.

7 (3 marks)

A tower AB is 20 m tall and stands on horizontal ground.

C is a point on the ground. Angle $ACB = 64^\circ$

AC is a straight wire from the top of the tower to C .

Work out the distance AC .

Give your answer correct to 3 significant figures.

Sketch it: the tower AB is vertical, so there is a right angle at B .

From the 64° angle at C : $AB = 20$ m is the opposite and AC is the hypotenuse.

O and H, so use SOH: $\sin 64^\circ = \frac{20}{AC}$

$$AC = \frac{20}{\sin 64^\circ} = 22.25 \dots = 22.3 \text{ m (3 s.f.)}$$

(Another way: $BC = \frac{20}{\tan 64^\circ} = 9.754 \dots$, then $AC = \sqrt{20^2 + 9.754 \dots^2} = 22.25 \dots$)

Answer: 22.3 m

Marks: 1 mark for a correct ratio with 64° , e.g. $\sin 64 = \frac{20}{AC}$. 1 mark for $20 \div \sin 64$. 1 mark for 22.2 to 22.3.

8 (3 marks)

Here is a right-angled triangle.

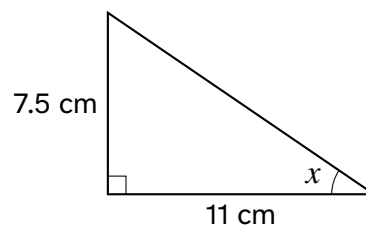


Diagram **NOT** accurately drawn

Sam says that x is greater than 35° .

Is Sam correct?

You must show how you get your answer.

From the angle x : 7.5 cm is the opposite and 11 cm is the adjacent.

O and A, so use TOA: $\tan x = \frac{7.5}{11} = 0.6818 \dots$

$$x = \tan^{-1}(0.6818 \dots) = 34.3^\circ \text{ (1 d.p.)}$$

34.3° is less than 35° , so Sam is not correct.

Answer: No, $x = 34.3^\circ$

Tip: Put opposite on top: $\frac{7.5}{11}$, not $\frac{11}{7.5}$.

Marks: 1 mark for $\tan x = \frac{7.5}{11}$. 1 mark for 34.3 . 1 mark for saying Sam is not correct, from correct working.

9 (4 marks)

$ABCD$ is a rectangle.

The diagonal AC is 15 cm long.

Angle $CAB = 32^\circ$

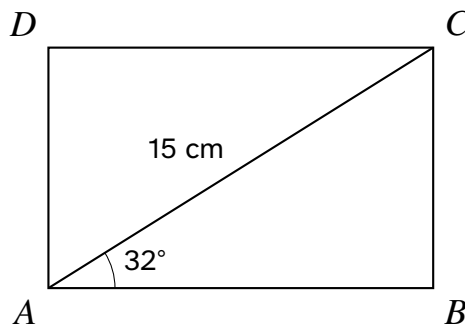


Diagram **NOT** accurately drawn

Work out the perimeter of the rectangle.

Give your answer correct to 3 significant figures.

Triangle ABC is right-angled at B , and $AC = 15$ cm is the hypotenuse.

AB is adjacent to the 32° angle: $AB = 15 \times \cos 32^\circ = 12.720 \dots$ cm

BC is opposite the 32° angle: $BC = 15 \times \sin 32^\circ = 7.948 \dots$ cm

Perimeter = $2 \times (AB + BC) = 2 \times (12.720 \dots + 7.948 \dots)$

Perimeter = $41.33 \dots = 41.3 \text{ cm}$ (3 s.f.)

Answer: 41.3 cm

Tip: A rectangle has four sides. Adding only AB and BC (20.7 cm) is a common mistake. Keep full calculator values until the end.

Marks: 1 mark for $15 \cos 32$ or $15 \sin 32$. 1 mark for both AB and BC correct. 1 mark for $2 \times (AB + BC)$. 1 mark for 41.3.
