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WJEC GCSE Mathematics and Numeracy (Double Award) – Question Pack

SOHCAHTOA – sine, cosine and tangent ratios in right-angled triangles, used to find missing sides and missing angles, in 2D and 3D contexts. Sou

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3.15 – Right-angled trigonometry

Spec 3.7.3, 3.7.4 – Unit 3 (calculator allowed)

SOHCAHTOA – sine, cosine and tangent ratios in right-angled triangles, used to find missing sides and missing angles, in 2D and 3D contexts. Sourced from legacy WJEC GCSE Mathematics and Mathematics-Numeracy Higher calculator-allowed papers, organised for revision under the 2025 spec.

2025 SPECIFICATION

Estimated time for entire question pack: ~2 hours 57 minutes

Derived from the GCSE Higher pace of ~1.5 min/mark (118 marks across 29 questions).

*You are advised to **not** attempt to complete all of this in one sitting.*

ABOUT THIS QUESTION PACK

This is a **focused single-topic practice pack**, not a single mock paper. Questions are organised against the 2025 specification. Questions are ordered chronologically by sitting, with custom-written and SAM questions at the end.

INSTRUCTIONS

Use black ink or black ball-point pen. Show all working – method marks are awarded for clear setup.

A calculator is allowed on every question in this pack (Unit 3 is the calculator-allowed paper).

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Right-angled trigonometry – what the new spec asks

WJEC GCSE Mathematics (first teaching 2025) · Unit 3: calculator-allowed.

Trig ratios in right-angled triangles 3.7.3

- Apply \sin , \cos , \tan to find missing sides in right-angled triangles.
- Label sides as opposite, adjacent, hypotenuse relative to the named angle.
- Use SOHCAHTOA to pick the appropriate ratio.

Finding angles & applications 3.7.4

- Use inverse trig (\sin^{-1} , \cos^{-1} , \tan^{-1}) to find missing angles.
- Apply to angle of elevation and angle of depression problems.
- Ensure the calculator is in degrees mode; round only at the final step.

Right-angled trigonometry in one page

Quick-reference notes – revisit before each question. Don't use during the questions.

SOHCAHTOA

$$\sin \theta = \frac{\text{opp}}{\text{hyp}} \quad \cos \theta = \frac{\text{adj}}{\text{hyp}} \quad \tan \theta = \frac{\text{opp}}{\text{adj}}$$

Label the sides relative to the angle θ :
hypotenuse (opposite the right angle),
opposite (across from θ), adjacent (next to θ).

Finding a missing side

1. Label the sides relative to the known angle.
2. Pick the ratio that uses the known and unknown sides.
3. Rearrange and solve.

Example: $\sin 30^\circ = x/8 \Rightarrow x = 8 \sin 30^\circ = 4$.

Finding a missing angle

Use the inverse functions on the calculator:

$$\theta = \sin^{-1} \left(\frac{\text{opp}}{\text{hyp}} \right) \text{ etc.}$$

Make sure the calculator is in *degrees* mode (look for DEG on the display).

Which ratio to choose

Look at which two sides you know (or want).

- opp & hyp \Rightarrow sine.
- adj & hyp \Rightarrow cosine.
- opp & adj \Rightarrow tangent.

If unsure, write SOH CAH TOA and tick the two sides you have.

Angle of elevation & depression

Angle of elevation: from horizontal, looking *up*.

Angle of depression: from horizontal, looking *down*.

They are equal as alternate angles – useful when the 'observer' and 'target' viewpoints both appear in the same problem.

Worked example

Find x in a triangle with hypotenuse 10, angle 35° , opposite x .

$$\sin 35^\circ = x/10 \Rightarrow x = 10 \sin 35^\circ \approx 5.74.$$

Round only at the end; carry full calculator precision in between.

Exact values to know

$$\sin 30^\circ = \frac{1}{2}, \quad \cos 60^\circ = \frac{1}{2}.$$

$$\tan 45^\circ = 1, \quad \sin 45^\circ = \cos 45^\circ = \frac{\sqrt{2}}{2}.$$

$$\sin 60^\circ = \cos 30^\circ = \frac{\sqrt{3}}{2}.$$

$$\tan 30^\circ = \frac{1}{\sqrt{3}}, \quad \tan 60^\circ = \sqrt{3}.$$

Common traps

- Mislabelling opp/adj relative to the wrong angle.
- Calculator in radians instead of degrees.
- Forgetting to use \sin^{-1} , \cos^{-1} , \tan^{-1} for angles.
- Rounding the ratio too early – lose accuracy in the final answer.

3. The wire window guard shown below is to be made.

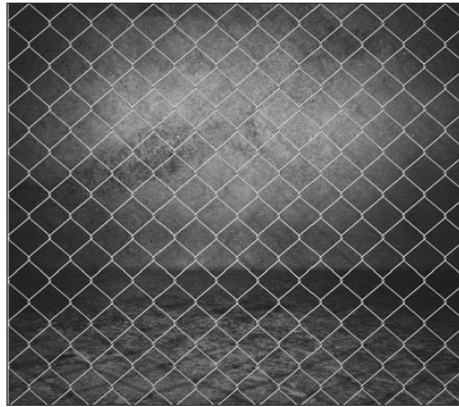


Diagram not drawn to scale

The length of the sides of each small wire square shown is 3.3 cm.

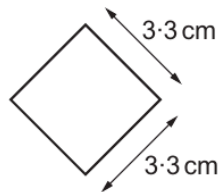


Diagram not drawn to scale

Llinos considers the length of the diagonal of each small square.

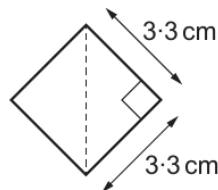


Diagram not drawn to scale

She says,

The height of the window guard is equal to 9.5 diagonals of the square.
The width of the window guard is equal to 11 diagonals of the square.



(a) Calculate the length of the diagonal of a small square.
Give your answer correct to 1 decimal place.

[3]

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(b) Calculate the area of the **window guard**.
You must show all your working.

[3]

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8. A confectionary company is designing a new chocolate-covered biscuit in the shape of a square-based pyramid. The centre of the square base is labelled O . Each biscuit will have base sides of length 3.4 cm, and a vertical height of 2.1 cm.

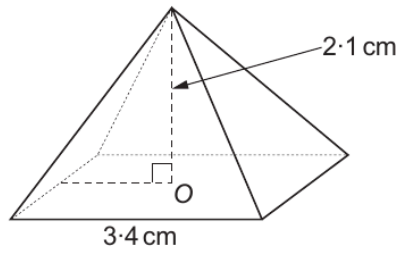


Diagram not drawn to scale

- (a) Calculate the angle that one of the triangular faces makes with the base of the pyramid. [4]

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- (b) The company knows that it costs $0.08p$ per cm^2 to apply a chocolate covering. Calculate the cost of applying a chocolate covering to all 5 faces of a biscuit. [6]

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4.



Ursula is lying on her surfboard 180 metres away from the foot of a vertical cliff. The height of the cliff is 146 metres.

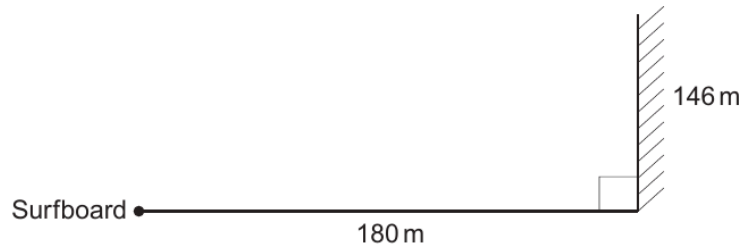


Diagram not drawn to scale

Ursula was told that if the angle of elevation of the top of the cliff from her lying position is between 42° and 45° , it is safe for her to attempt to stand on her surfboard.

Calculate the angle of elevation of the top of the cliff from Ursula's position lying on her surfboard.

State whether it is

- safe for Ursula to attempt to stand, or
- not safe as she is too near the cliff, or
- not safe as she is too far out at sea.

[4]

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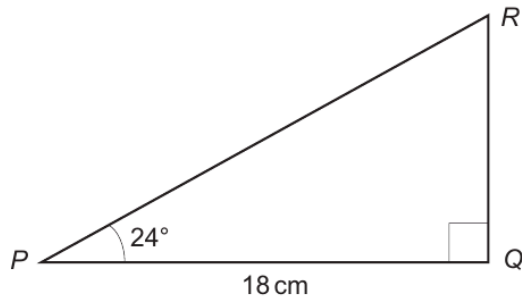
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6. Calculate the length of the side QR in the triangle PQR shown below. [3]

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15. (a) Using the axes below, **sketch** the graph of $y = \sin x$ for values of x from 0° to 360° . You must label any important values on both axes. [2]



- (b) Circle the value that is equal to $\sin 200^\circ$.

$\sin 20^\circ$

$\sin 100^\circ$

$\sin 160^\circ$

$\sin 220^\circ$

$\sin 340^\circ$

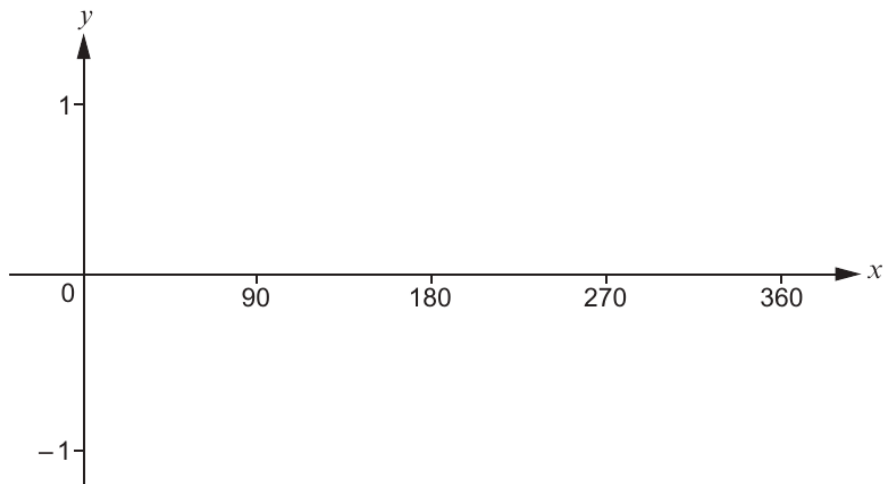
[1]

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14. (a) Sketch the curve $y = \sin x$, for values of x in the range $x = 0^\circ$ to $x = 360^\circ$. [1]



(b) Solve each of the following equations.
Give all answers in the range $x = 0^\circ$ to $x = 360^\circ$.

(i) $\sin x = 0.3$ [2]

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(ii) $\sin x + 1 = 0$ [1]

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5. PQR is a right-angled triangle, as shown below.
 $PQ = 1.41$ m and $PR = 0.89$ m.

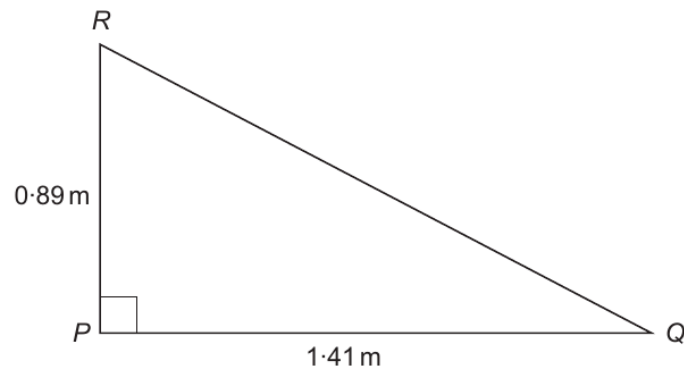


Diagram not drawn to scale

Calculate the length of QR .

[3]

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9. ABC and CDE are two right-angled triangles.

In triangle ABC , $AB = 6.5$ cm and $BC = 10.4$ cm.
In triangle CDE , $CE = 9.4$ cm.

$$\widehat{BCE} = 22^\circ.$$

$$\widehat{ACB} = x^\circ.$$

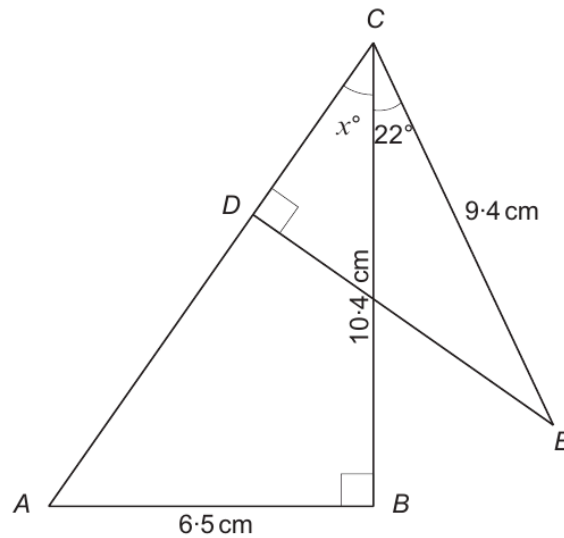


Diagram not drawn to scale

(a) Calculate the value of x .

[3]

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(b) Hence find the length of DE .

[3]

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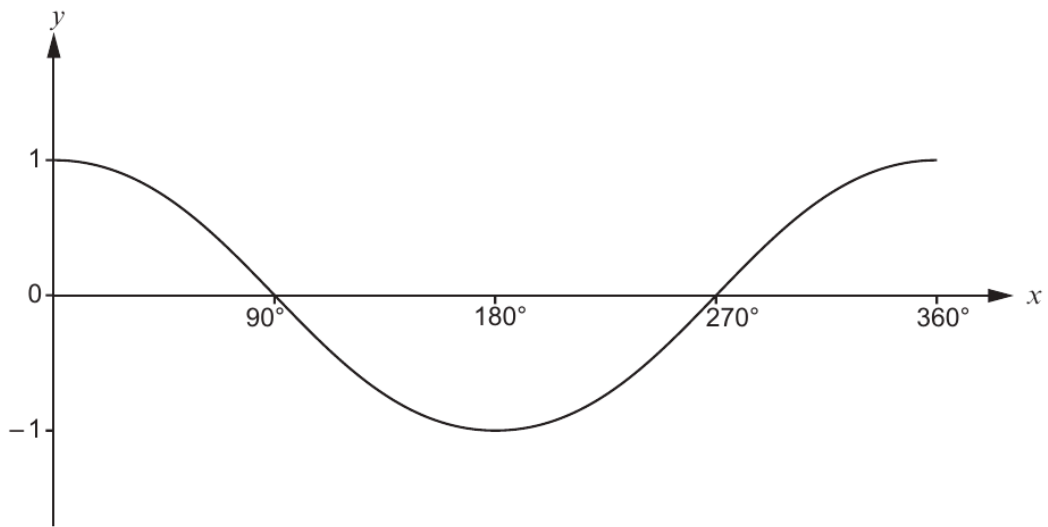
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18. The following diagram shows a sketch of $y = \cos x$ for values of x from 0° to 360° .



- (a) Given that $\cos 21^\circ = 0.9336$, correct to 4 decimal places, write down all the solutions of the equation

$$\cos x = -0.9336$$

for values of x from 0° to 360° .

[2]

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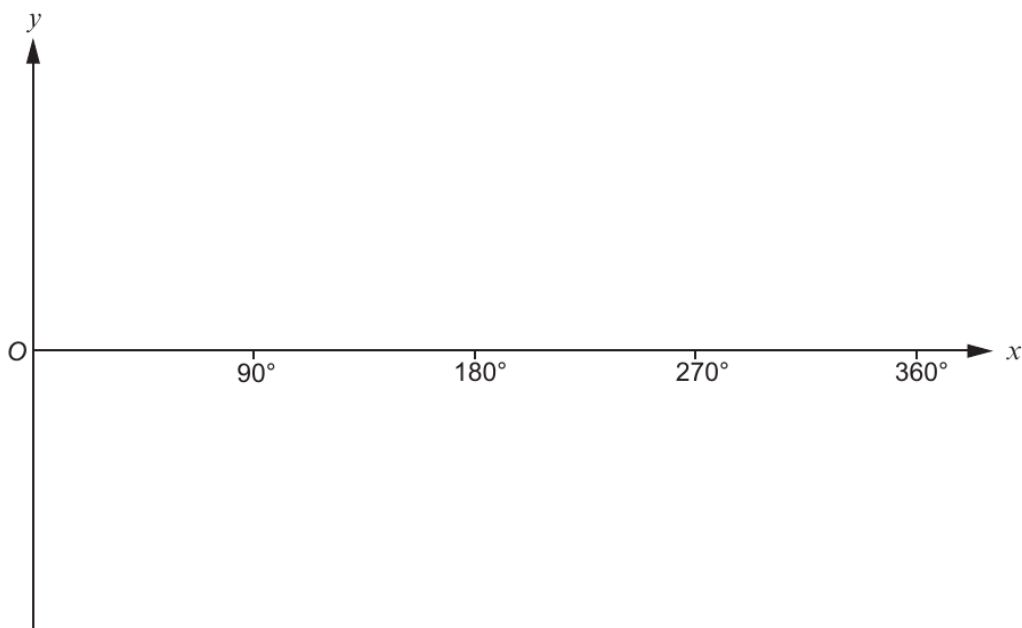
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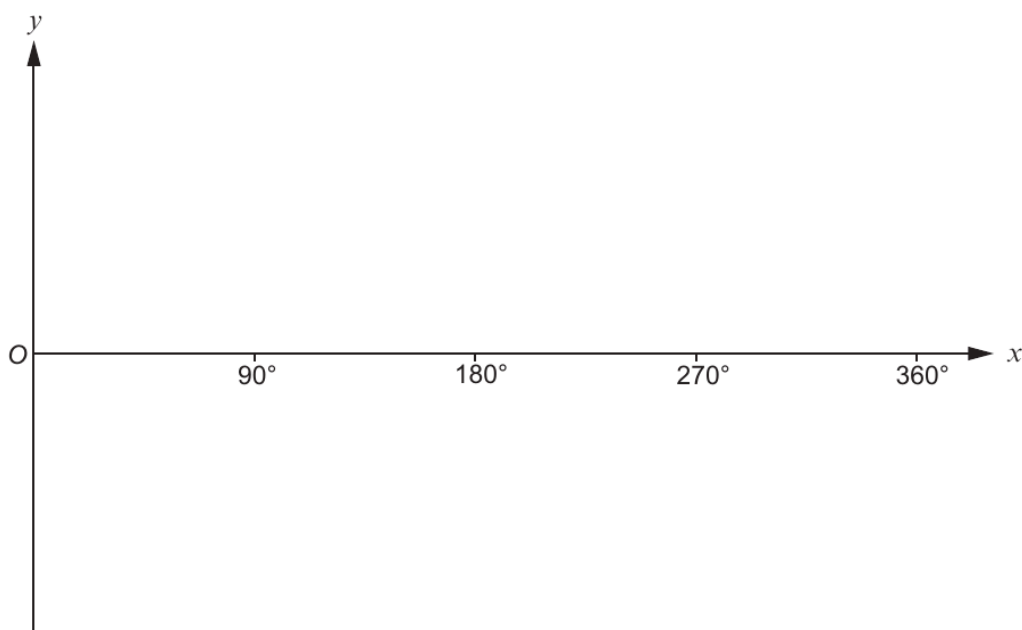


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- (b) (i) Use the following axes to sketch the graph of $y = 2 \cos x$ for values of x from 0° to 360° .
You must indicate any important points on both axes. [2]



- (ii) Use the following axes to sketch the graph of $y = \cos x - 1$ for values of x from 0° to 360° .
You must indicate any important points on both axes. [2]

**END OF PAPER**

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19. BC is the tangent to the circle at point E , as shown below.

$EC = 8\text{ cm}$, $AC = 11\text{ cm}$ and $\widehat{DCE} = 31^\circ$.

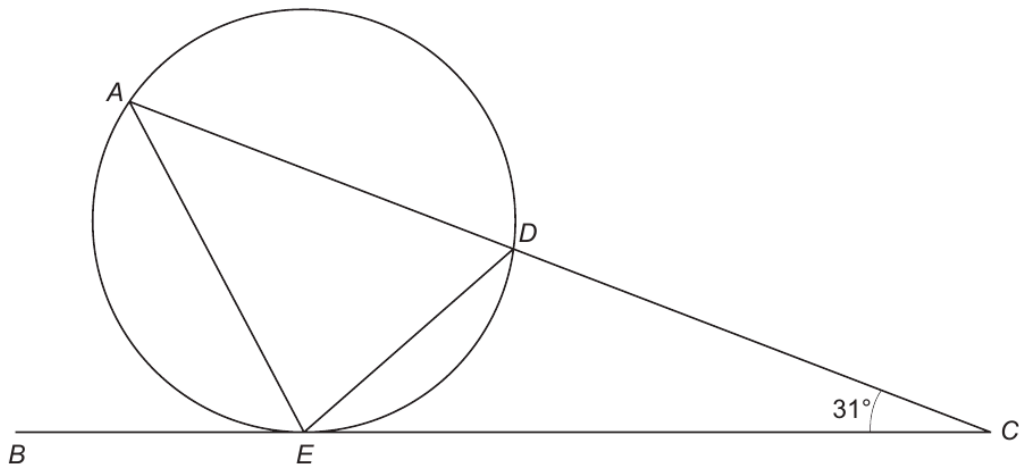


Diagram not drawn to scale

(a) Calculate the length of AE .

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(b) Calculate the size of \widehat{CED} .

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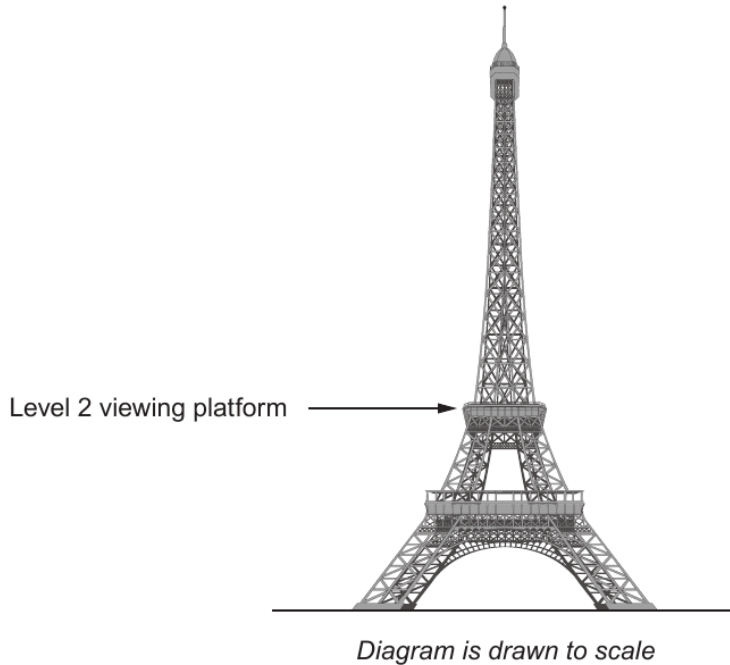
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6. The diagram below is a sketch of the Eiffel Tower.
 The sketch is drawn to scale.
 The Eiffel Tower is 324 metres tall.
 Visitors can climb up to the Level 2 viewing platform using the internal steps.



- (a) Which of the following is a reasonable estimate of the number of steps from the ground to the Level 2 viewing platform? [1]

150 650 2500 3500 6500

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(b)

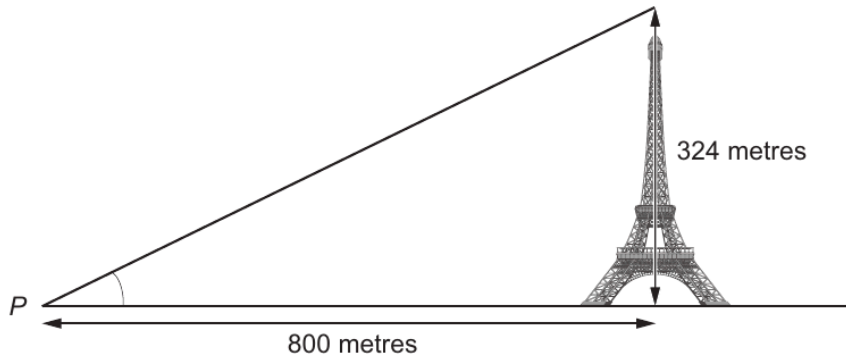


Diagram not drawn to scale

Calculate the angle of elevation of the top of the Eiffel Tower from the point *P*. [3]

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9. The diagram below shows two right-angled triangles ABC and APQ .
 $AB = 8.2$ cm, $BC = 6.4$ cm and $PQ = 7.9$ cm.
 $\hat{CAQ} = 90^\circ$.

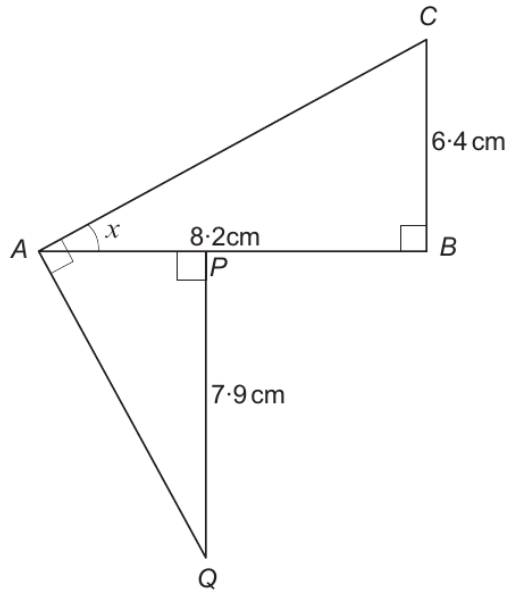


Diagram not drawn to scale

- (a) Calculate the size of angle x . [3]

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- (b) Calculate the length AQ . [4]

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6. PQR is a right-angled triangle.
 $PR = 16.7$ cm, $QR = 9.6$ cm.

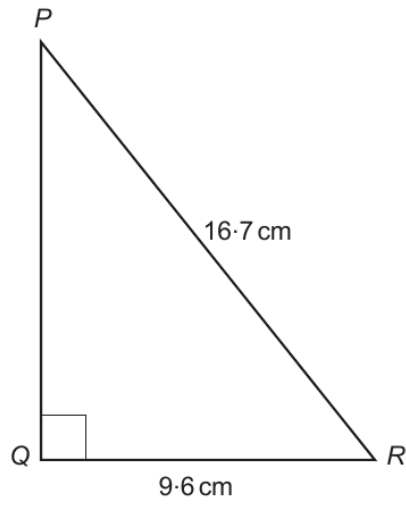


Diagram not drawn to scale

Calculate the size of \hat{QPR} .

[3]

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4. Sian thinks of a number.
Its value is increased by 25%.

Express the original number as a percentage of the increased number.

[3]

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5. Calculate the length of the side MN in the triangle LMN shown below.

[3]

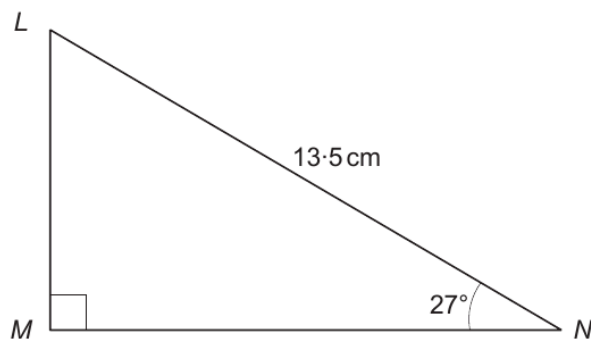


Diagram not drawn to scale

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2. In this question, you will be assessed on the quality of your organisation, communication and accuracy in writing.

The diagram shows two right-angled triangles, joined together along a common side. $AB = 10.8$ cm, $BC = 14.4$ cm and $CD = 24$ cm.

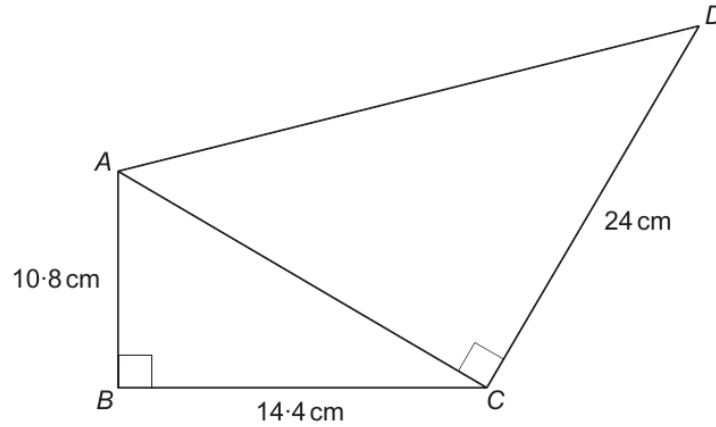


Diagram not drawn to scale

Calculate the area of triangle ACD.
You must show all your working.

[5 + 2 OCW]

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5. Calculate the length of the side AB in the triangle shown below.

[3]

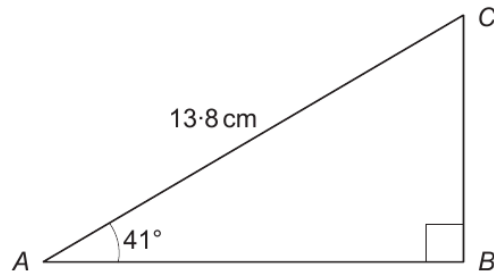
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Diagram not drawn to scale

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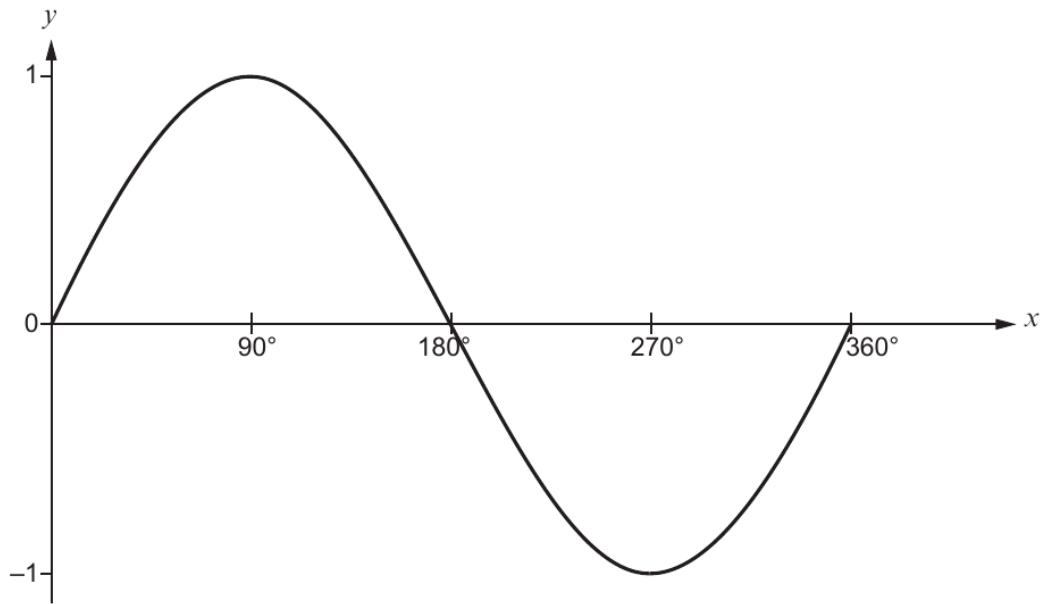
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17. The following diagram shows a sketch of $y = \sin x$ for values of x from 0° to 360° .



Given that $\sin 38^\circ = 0.6157$, correct to 4 decimal places, write down all the solutions of the equation

$$\sin x = -0.6157$$

for values of x from 0° to 360° .

[2]

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5. Calculate the length of the side YZ in the triangle XYZ shown below. [3]

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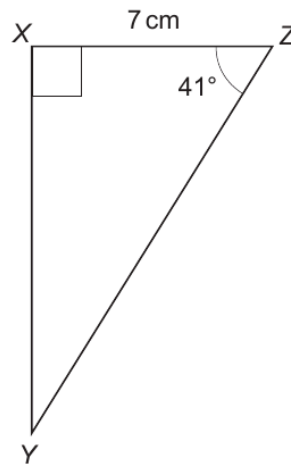


Diagram not drawn to scale

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8. (a) Which complete method, using Pythagoras's Theorem, can be used to find x ?
Circle your answer. [1]

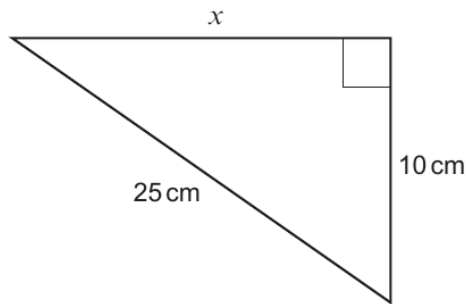


Diagram not drawn to scale

$$x = 25^2 + 10^2$$

$$x = \sqrt{25^2 + 10^2}$$

$$x = 25^2 - 10^2$$

$$x = \sqrt{25^2 - 10^2}$$

$$x = \sqrt{(25 - 10)^2}$$

- (b) Which of the following calculations can be used to find y ?
Circle your answer. [1]

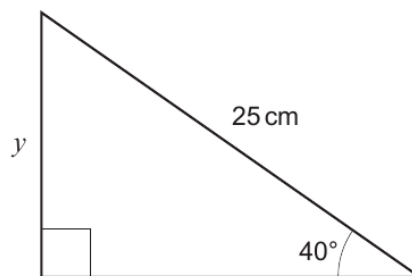


Diagram not drawn to scale

$$\sin 25^\circ = y \times 40$$

$$\sin 40^\circ = \frac{25}{y}$$

$$\sin 25^\circ = \frac{y}{40}$$

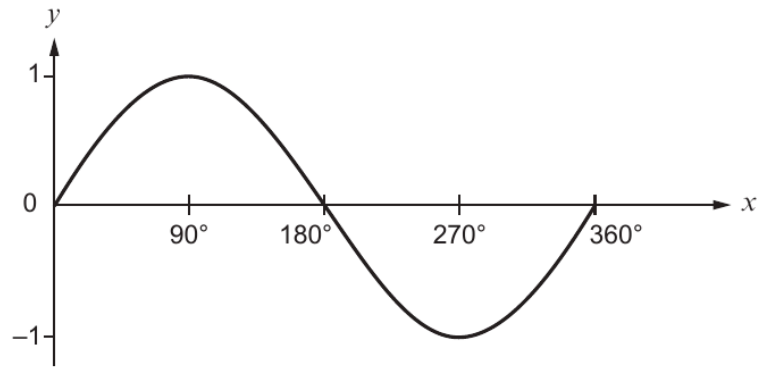
$$\sin 40^\circ = \frac{y}{25}$$

$$\sin 40^\circ = y \times 25$$



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16. The following diagram shows a sketch of $y = \sin x$ for values of x from 0° to 360° .



- (a) Given that $\sin 62^\circ = 0.8829$, correct to 4 decimal places, write down all the solutions of the equation

$$\sin x = -0.8829$$

for values of x from 0° to 360° .

[2]

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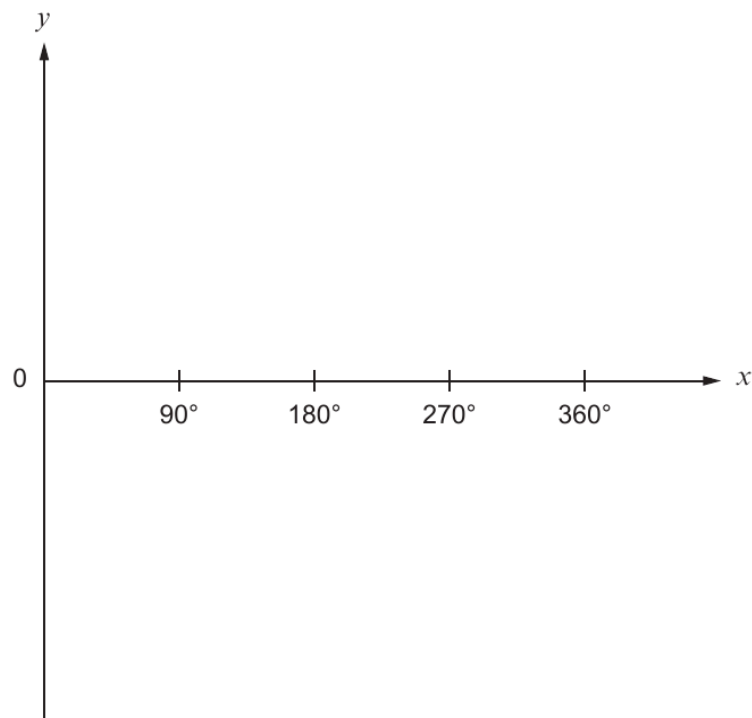
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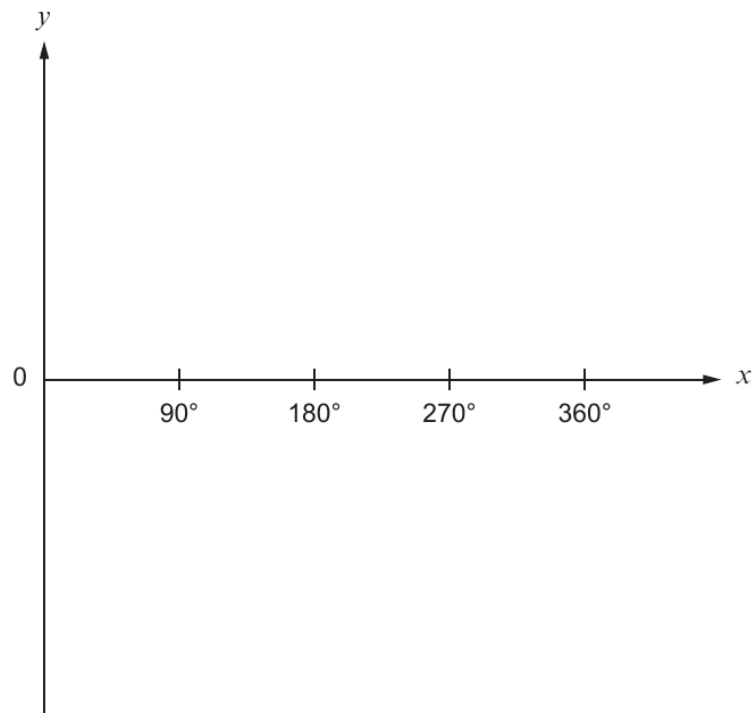
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- (b) (i) Use the following axes to sketch the graph of $y = -\sin x$ for values of x from 0° to 360° . You must indicate any important values on the y -axis. [2]

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- (ii) Use the following axes to sketch the graph of $y = \sin x + 1$ for values of x from 0° to 360° . You must indicate any important values on the y -axis. [2]



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4. (a) (i) A single tree can absorb 48 **pounds** of carbon dioxide per year.
 Calculate the carbon dioxide absorbed per year by a forest of 440 of these trees.
 Give your answer in **kilograms**. [2]

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Carbon dioxide absorbed per year is kg

(ii) A forest of trees absorbs 2.3×10^{11} grams of carbon dioxide per year.
 Which of the following is 2.3×10^{11} ? Circle your answer. [1]

230 000 000 000 23 000 000 000 2 300 000 000 000

0.000 000 000 0023 0.000 000 000 023

(b)

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| Remember: $10\,000\text{m}^2 \approx 2.47$ acres |
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A report states that a fire in a forest has a high risk of spreading when there are more than 60 trees per acre.

There are 615 trees in Grancwm Forest.
 The forest covers an area of $40\,000\text{m}^2$.

Would a fire in Grancwm Forest have a high risk of spreading?

Yes No

You must show all your working to support your answer. [4]

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- (c) A vertical pine tree stands on horizontal ground. From a point on the ground 21 metres from its base, the angle of elevation of the top of the pine tree is 39° .

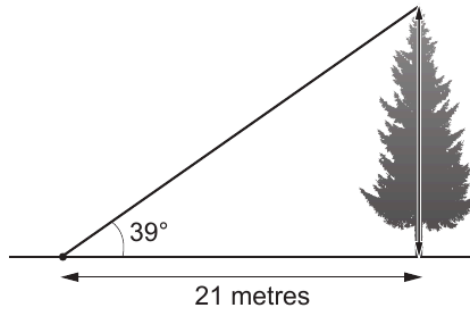


Diagram not drawn to scale

- (i) Show that the pine tree has a vertical height of 17 metres. [3]

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- (ii) A cylindrical log is cut from this pine tree. The **circumference** of the cross-section of the log is 1.75 m. The length of the log is half the height of the tree. Calculate the volume of the log. Give your answer in m^3 . You must show all your working. [5]

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Volume of the log is m^3



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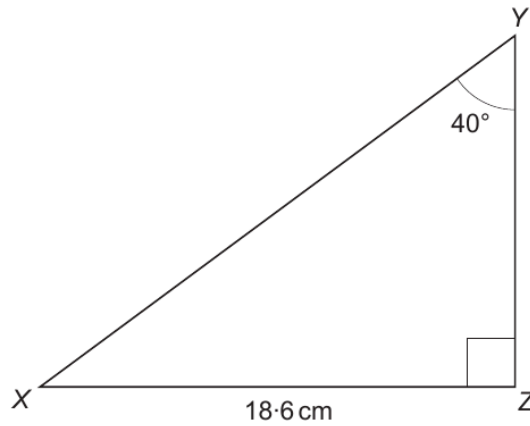


Diagram not drawn to scale

Calculate the length of the side YZ. [3]

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8. 7 cubes are stacked on top of each other.
Each of these cubes has edges of length 60 mm, measured correct to the nearest millimetre.

Calculate the greatest possible height of this stack of 7 cubes. [2]

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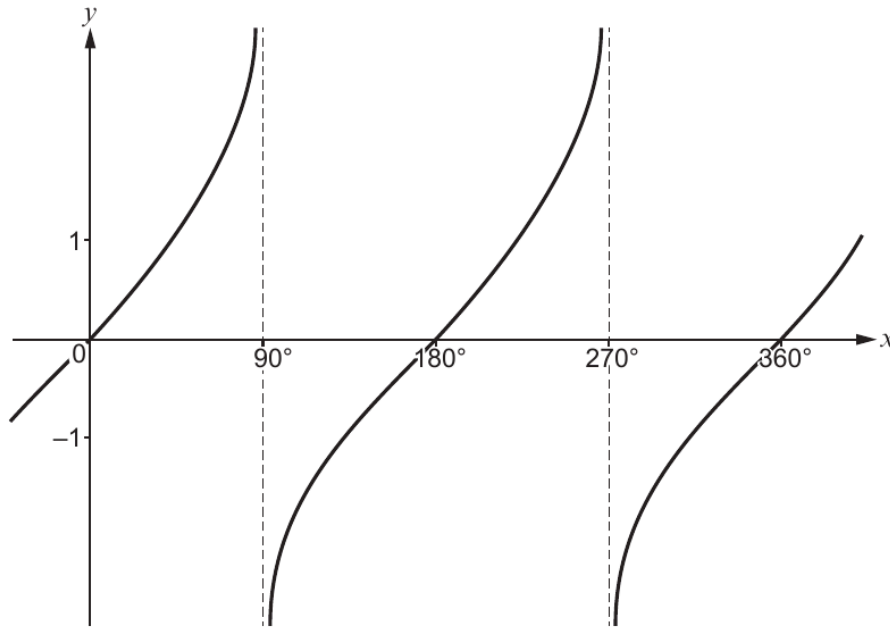
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Examiner
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19. The following diagram shows a sketch of $y = \tan x$ for values of x from 0° to 360° .



Given that $\tan 71^\circ = 2.9042$, correct to 4 decimal places, write down all the solutions of the equation

$$\tan x = -2.9042$$

for values of x from 0° to 360° .

[2]

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17. Zoltan rolls three unbiased 6-sided dice.
Calculate the probability that the sum of the values shown on the dice is 17.

[3]

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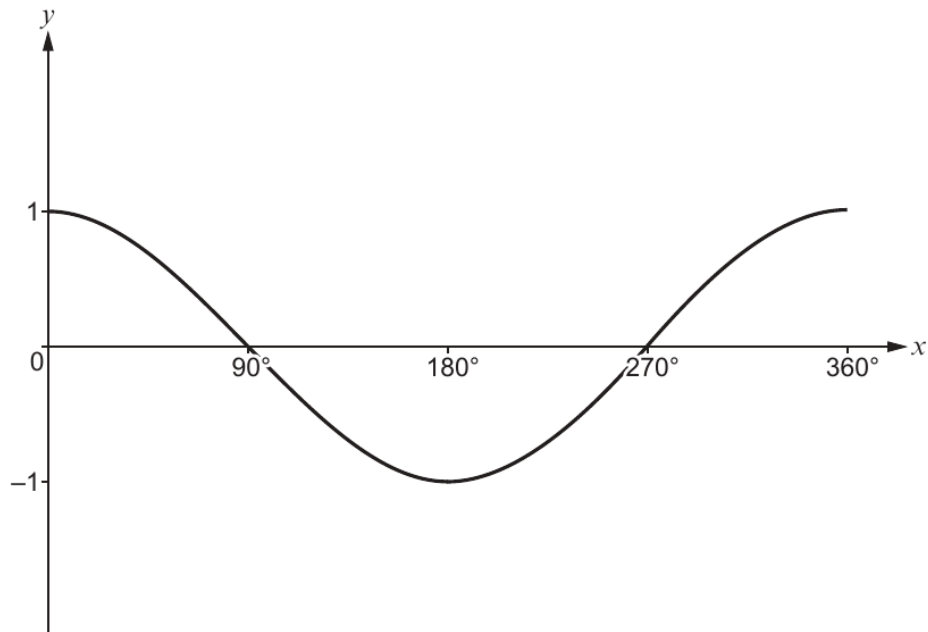
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Examiner
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18. The following diagram shows a sketch of $y = \cos x$ for values of x from 0° to 360° .



- (a) Given that $\cos 58^\circ = 0.5299$, correct to 4 decimal places, write down all the solutions of the equation

$$\cos x = -0.5299$$

for values of x from 0° to 360° .

[2]

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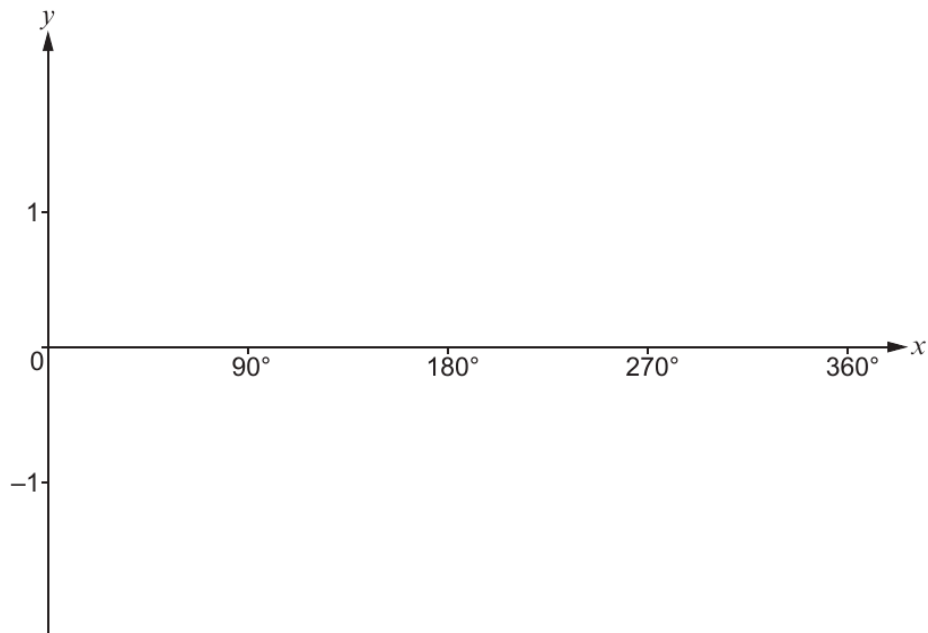
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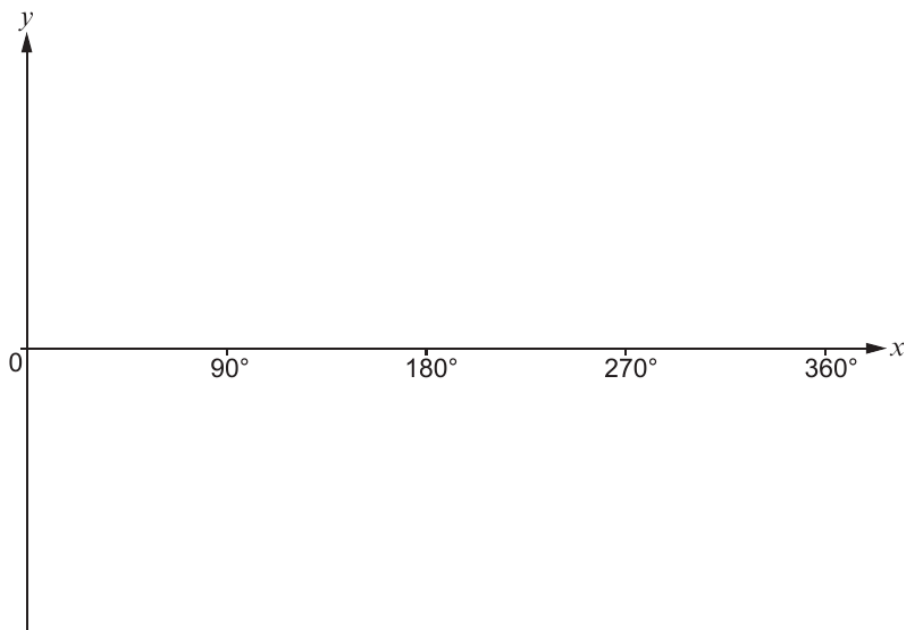


Examiner
only

- (b) (i) Use the following axes to sketch the graph of $y = 2 \cos x$ for values of x from 0° to 360° .
You must indicate any important values on the y-axis. [2]



- (ii) Use the following axes to sketch the graph of $y = -\cos x$ for values of x from 0° to 360° .
You must indicate any important values on the y-axis. [2]

**END OF PAPER**