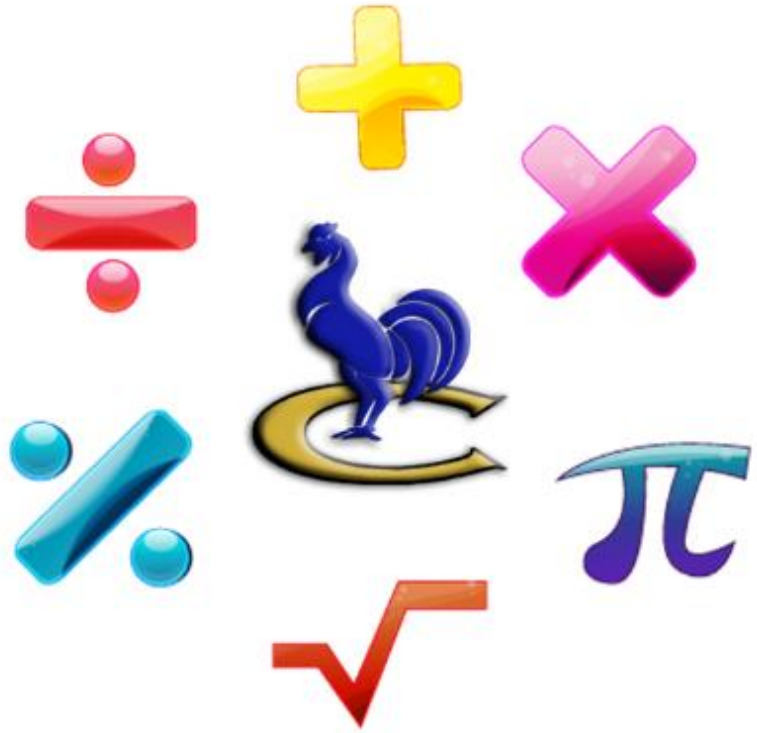
Key Stage 4

Higher

Geometry Revision



Name:

Teacher:

Maths Non-Calculator

Two similar cones have volumes of $20\,cm^3$ and $1280\,cm^3$.
The radius of the base of the smaller cone is 2·3 cm.
Calculate the radius of the base of the larger cone. [3]

A circle has radius r cm, where r is an integer.
The side of a square is of length x cm.

If the circle and square have the same area, explain why x cannot be an integer.

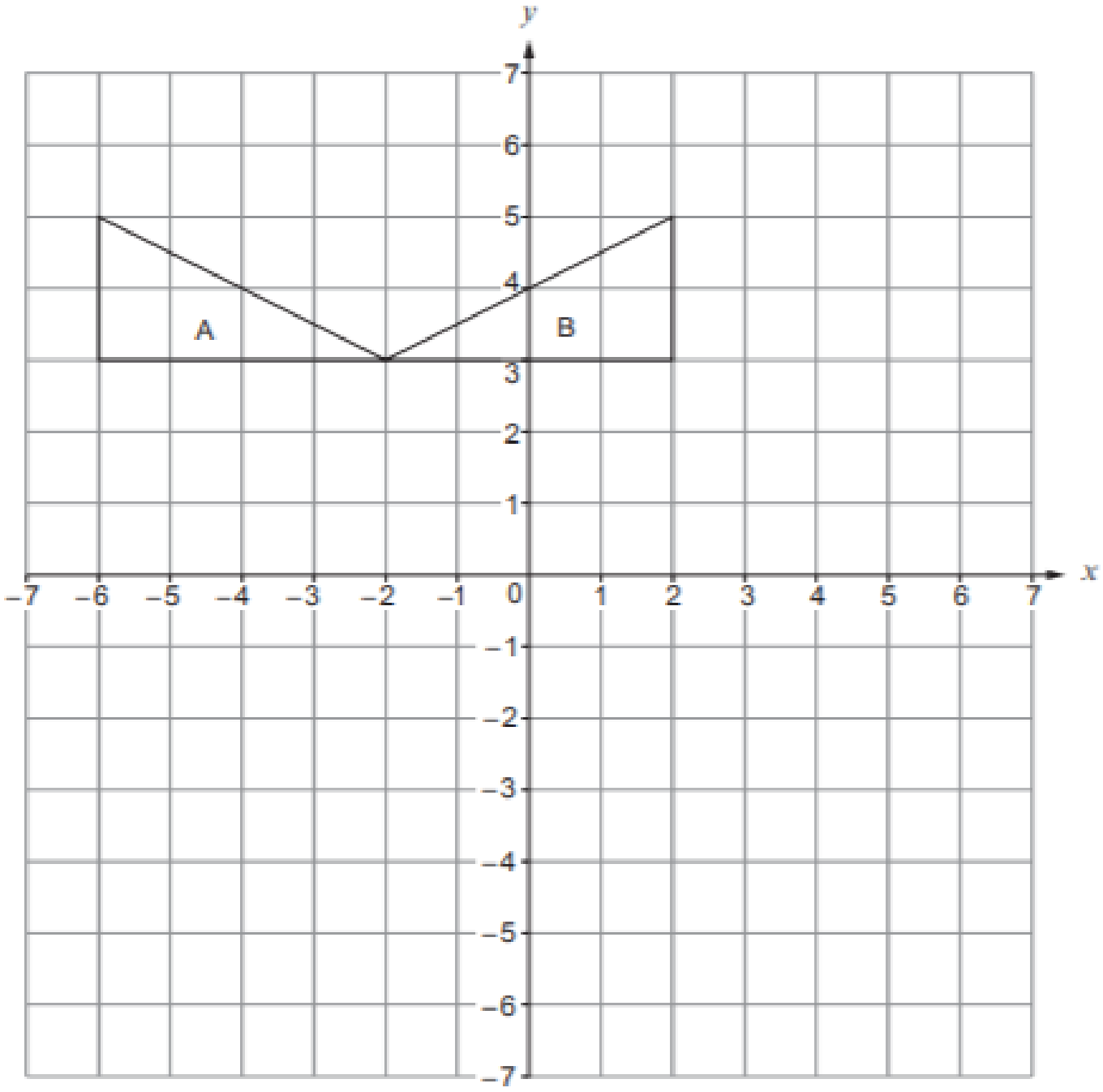
You should consider algebraic expressions in your answer. [2]

The exterior angle of a regular polygon is 36°.

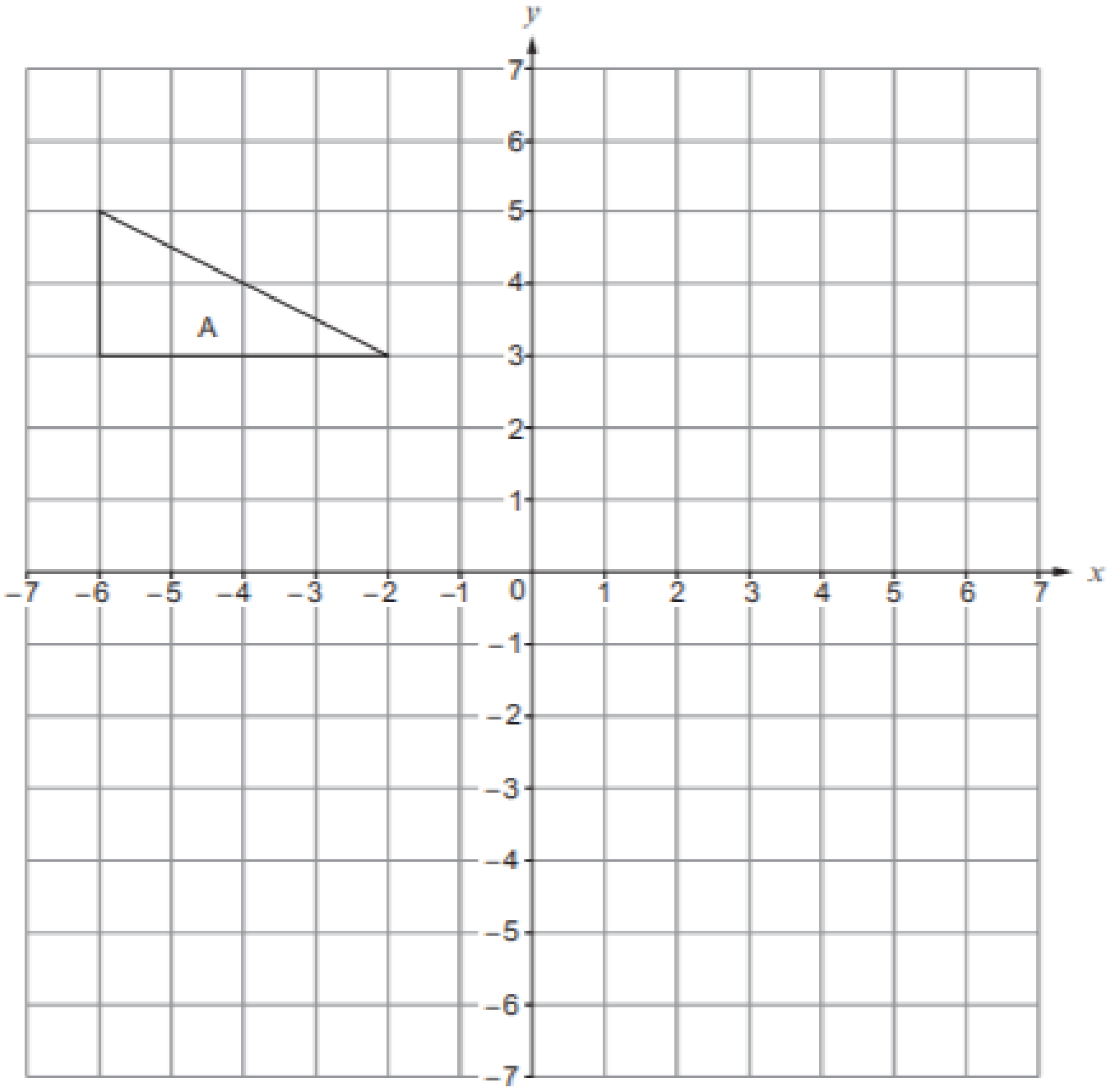
(a) How many sides does the polygon have? [2]

(b) Calculate the sum of all the interior angles of this regular polygon. [2]

(a) Describe fully the single transformation that transforms triangle A onto triangle B. [2]



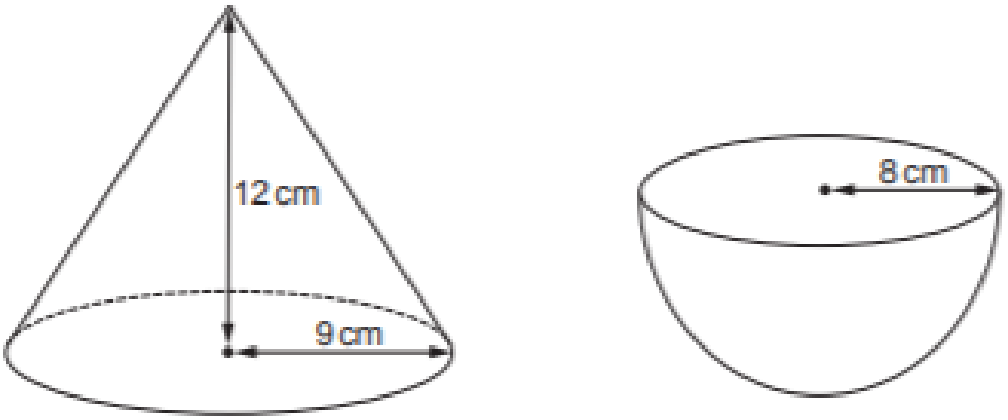
(b) (i) Translate triangle A using the column vector $\begin{pmatrix} 5 \\ -6 \end{pmatrix}$. [2]



(ii) Write down the column vector that will reverse the translation in part (i). [1]

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

The diagrams below show a solid cone and a solid hemisphere.



Diagrams not drawn to scale

The cone has a base radius of 9 cm and a vertical height of 12 cm.
The hemisphere has a radius of 8 cm.

Which of the two solids has the greater **curved** surface area?
You should express any areas in terms of π.
You must show all your working. [7 + 2 OCW]

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

A **regular** octagon with centre O is shown below.

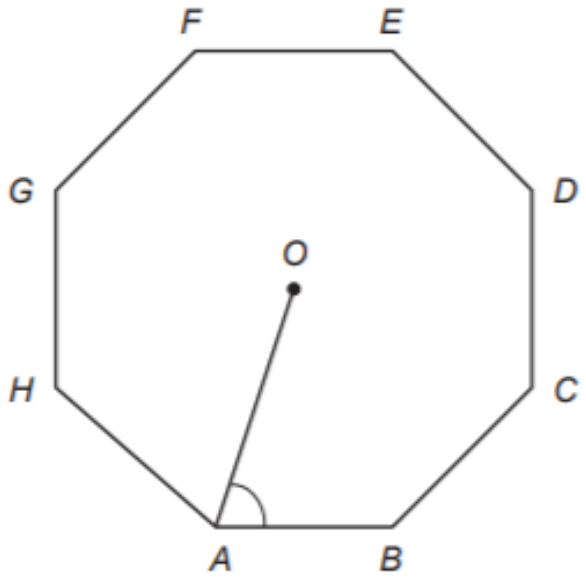


Diagram not drawn to scale

Calculate the exact size of $O\hat{A}B$.
You may choose to draw additional lines on the diagram to help you.
You must show all your working. [4 + 2 OCW]

The diagram shows a cylinder.
The cylinder has a base of radius r and a height of $\frac{r}{6}$.

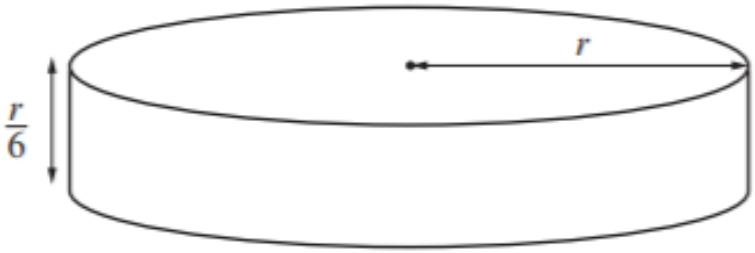


Diagram not drawn to scale

A sphere has radius R.
The volume of the sphere is equal to the volume of the cylinder.
Find R in terms of r.
Give your answer in its simplest form. [4]

A regular polygon has exterior angles of 45°.

(a) How many sides does this polygon have? [2]

The radius of a hemisphere and the radius of a cylinder are equal.
The hemisphere and cylinder have equal volumes.

Calculate the ratio of the height of the cylinder to the radius of the cylinder. [3]

height of cylinder : radius of cylinder

= ..... : .....

Maths Calculator

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.

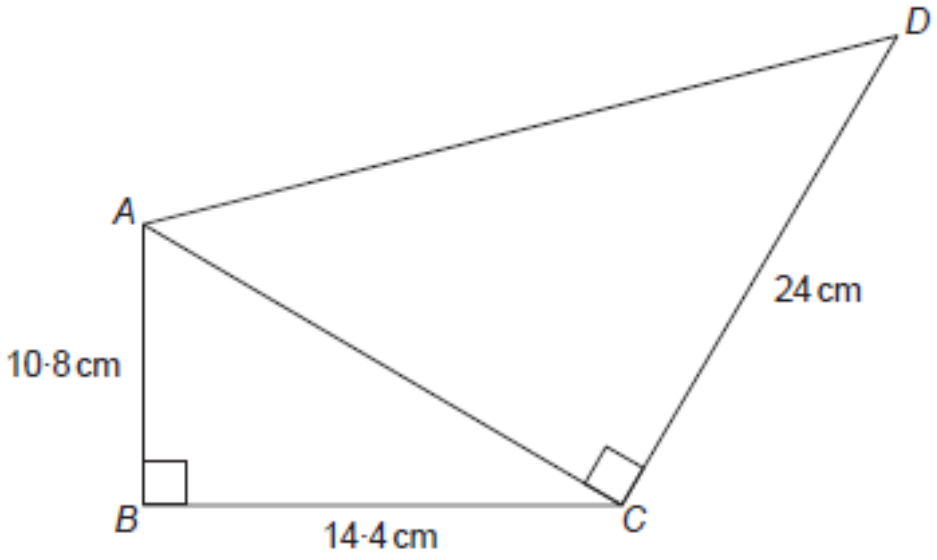


Diagram not drawn to scale

Calculate the area of triangle *ACD*.
You must show all your working. [5 + 2 OCW]

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In the diagram below, *AB*, *BC* and *CD* are three sides of a **regular polygon**.
The polygon has 15 sides.
The length of each side is 8 cm.

The exterior angle of the polygon is $x°$.
BRC is a right-angled triangle.

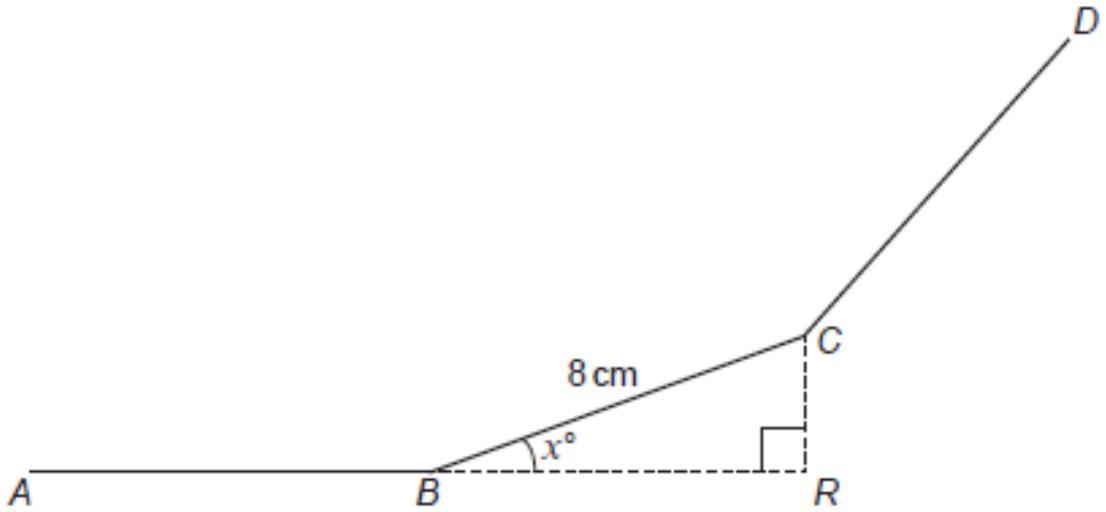


Diagram not drawn to scale

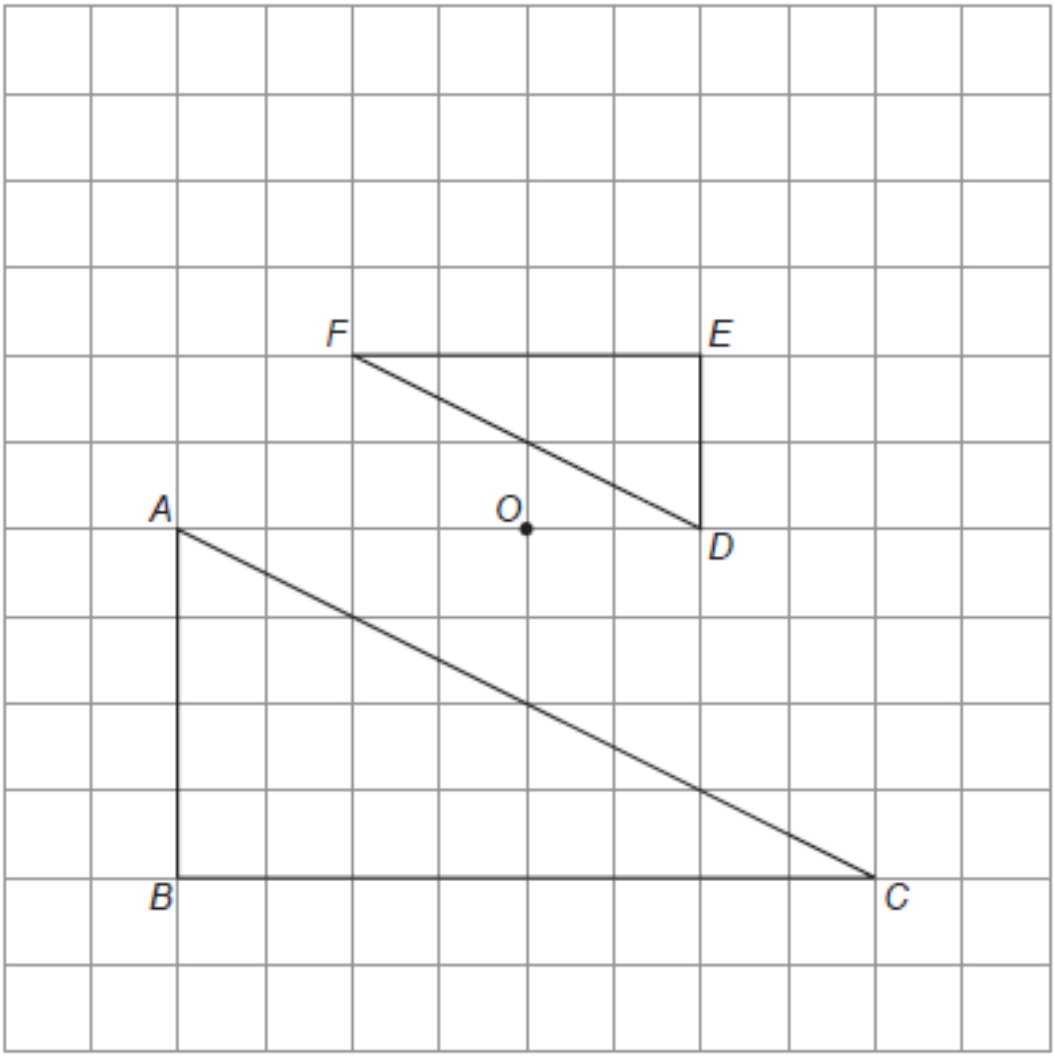
Calculate the length of *BR*. [5]

The lengths of the sides of a rectangle are given as 24 cm and 15 cm.
Each measurement is given correct to the nearest centimetre.

Calculate the difference between the greatest possible perimeter of the rectangle and the least possible perimeter of the rectangle. [3]

Calculate the perpendicular height of a cone with a volume of 5533 cm^3 and a base area of 825 cm^2. [3]

In the following diagram, triangle *ABC* has been enlarged to triangle *DEF*, with the centre of enlargement at *O*.
Write down the scale factor of the enlargement. [2]



Scale factor: .....

ACB is a sector of a circle with radius x cm and centre A, as shown below.

$C\hat{E}A = 34°$, $A\hat{C}E = 100°$, $C\hat{A}E = 46°$ and $CE = 12$ cm.

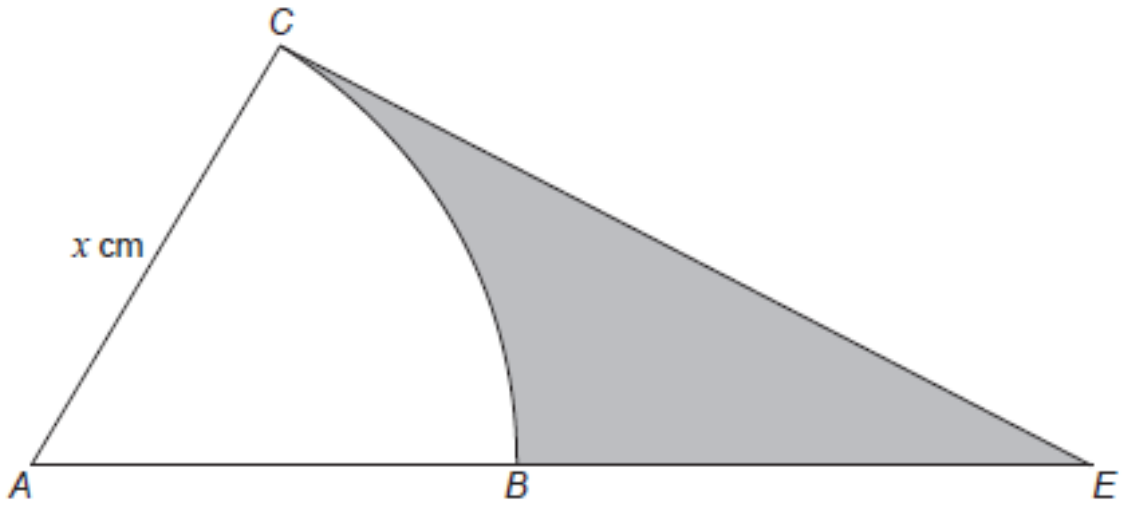


Diagram not drawn to scale

Calculate the area of the shaded region BCE.
You must show all your working. [8]

Calculate the length of the side *MN* in the triangle *LMN* shown below. [3]

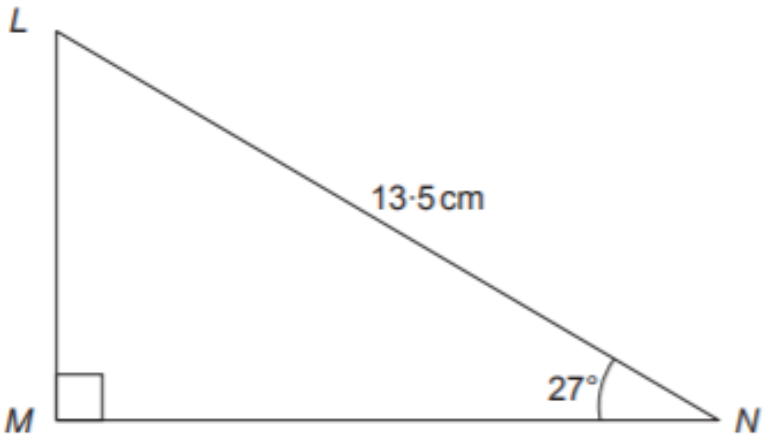


Diagram not drawn to scale

A solid object is made by drilling a cylindrical hole of radius 4 cm through a cuboid measuring 20 cm by 15 cm by 10 cm as shown below.

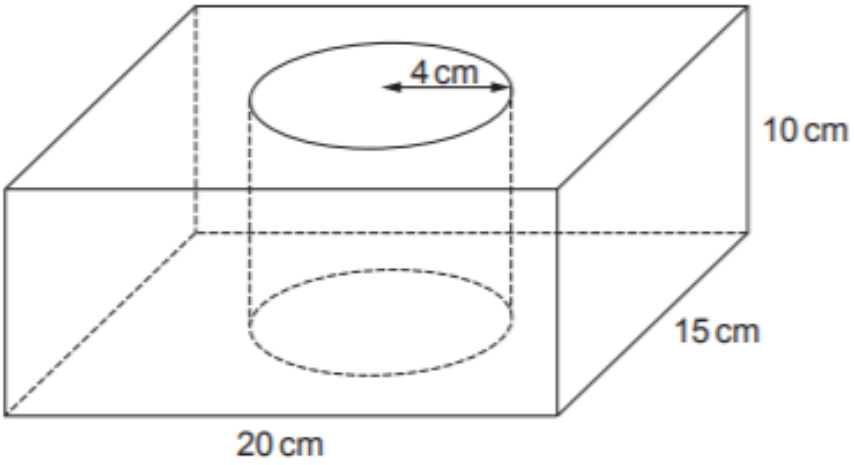


Diagram not drawn to scale

(a) Calculate the volume of the object.
Give your answer in cm^3. [3]

Volume = ... cm^3

The right-angled triangle ABC has an area of $84\,cm^2$.
$AB = 24\,cm$.

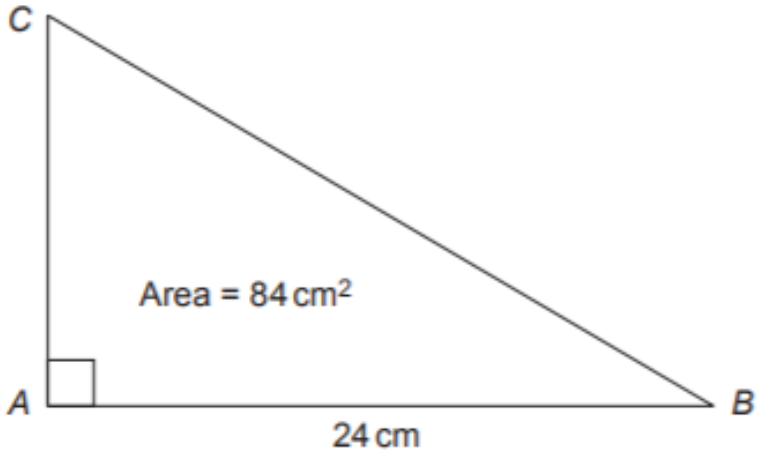


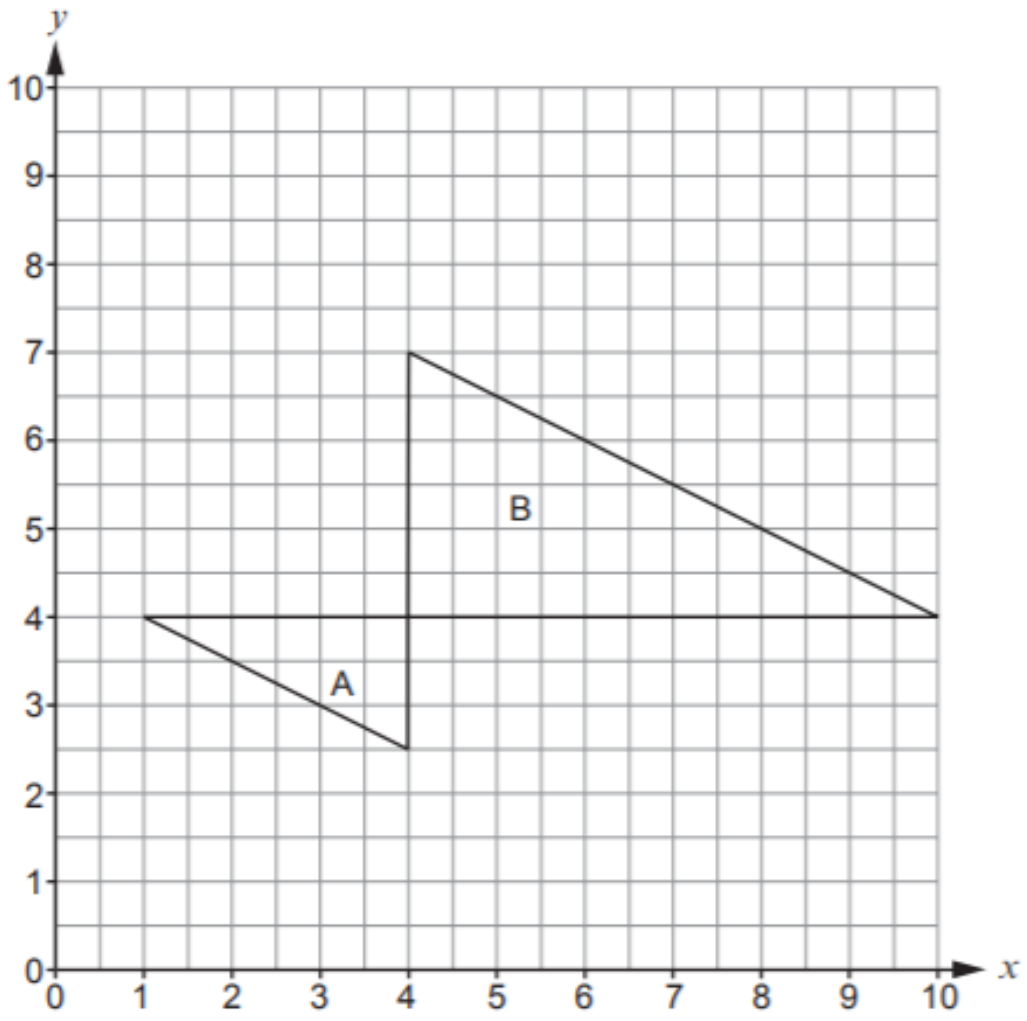
Diagram not drawn to scale

Calculate the perimeter of the triangle ABC.
You must show all your working. [6]

(b) A rhombus has an area of 36·8 cm^2.
The rhombus is enlarged by a scale factor of 7.
Calculate the area of the enlarged rhombus. [2]

(b) A rhombus has an area of 36·8 cm^2.
The rhombus is enlarged by a scale factor of 7.
Calculate the area of the enlarged rhombus. [2]

Describe fully a **single** transformation that transforms shape A onto shape B. [3]



Triangle DEC lies within a square $ABCD$, as shown below.
$DE = 8\,\text{cm}$ and $EC = 9\,\text{cm}$.
$\hat{DEC} = 75°$.

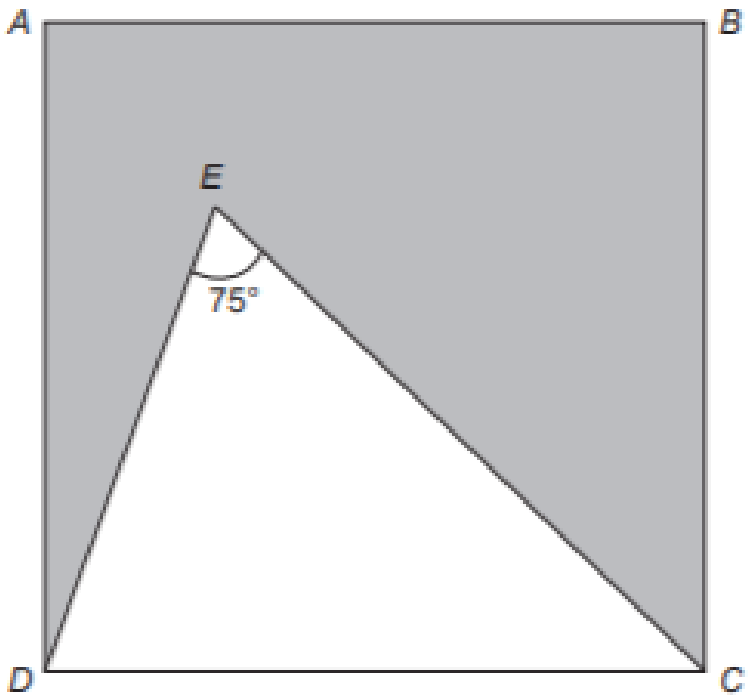


Diagram not drawn to scale

Calculate the area of the shaded region. [7]

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

Is it possible to draw a **right-angled** triangle with the measurements shown below?
You must use calculations (not a scale drawing) to support your answer.
You must show all your working. [4 + 2 OCW]

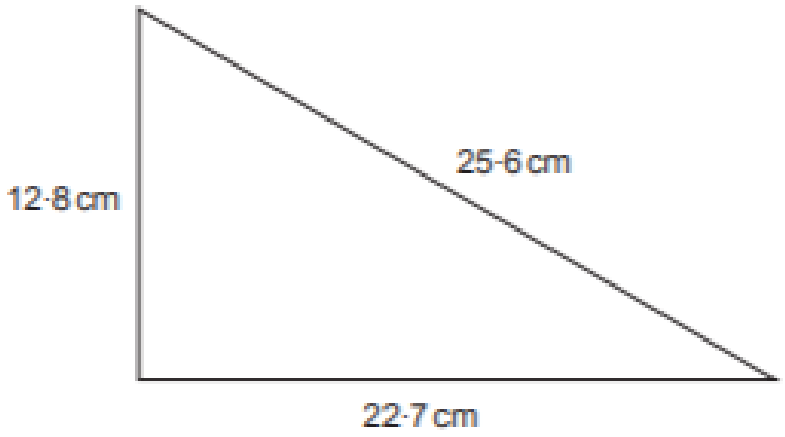


Diagram not drawn to scale

PQR is a right-angled triangle.
$PR = 16{\cdot}7$ cm, $QR = 9{\cdot}6$ cm.

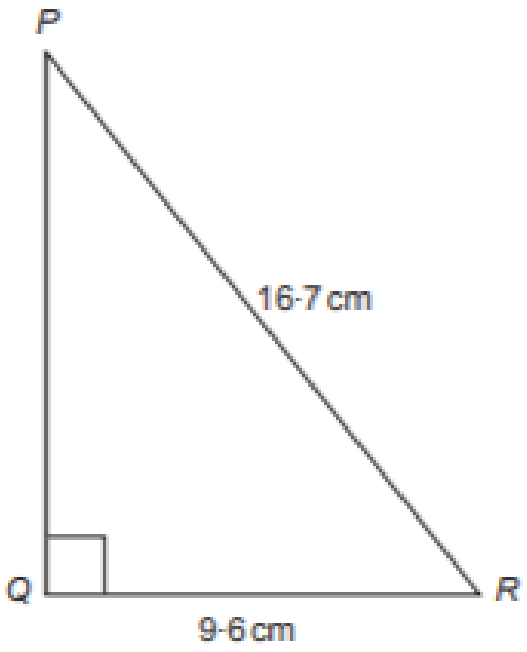
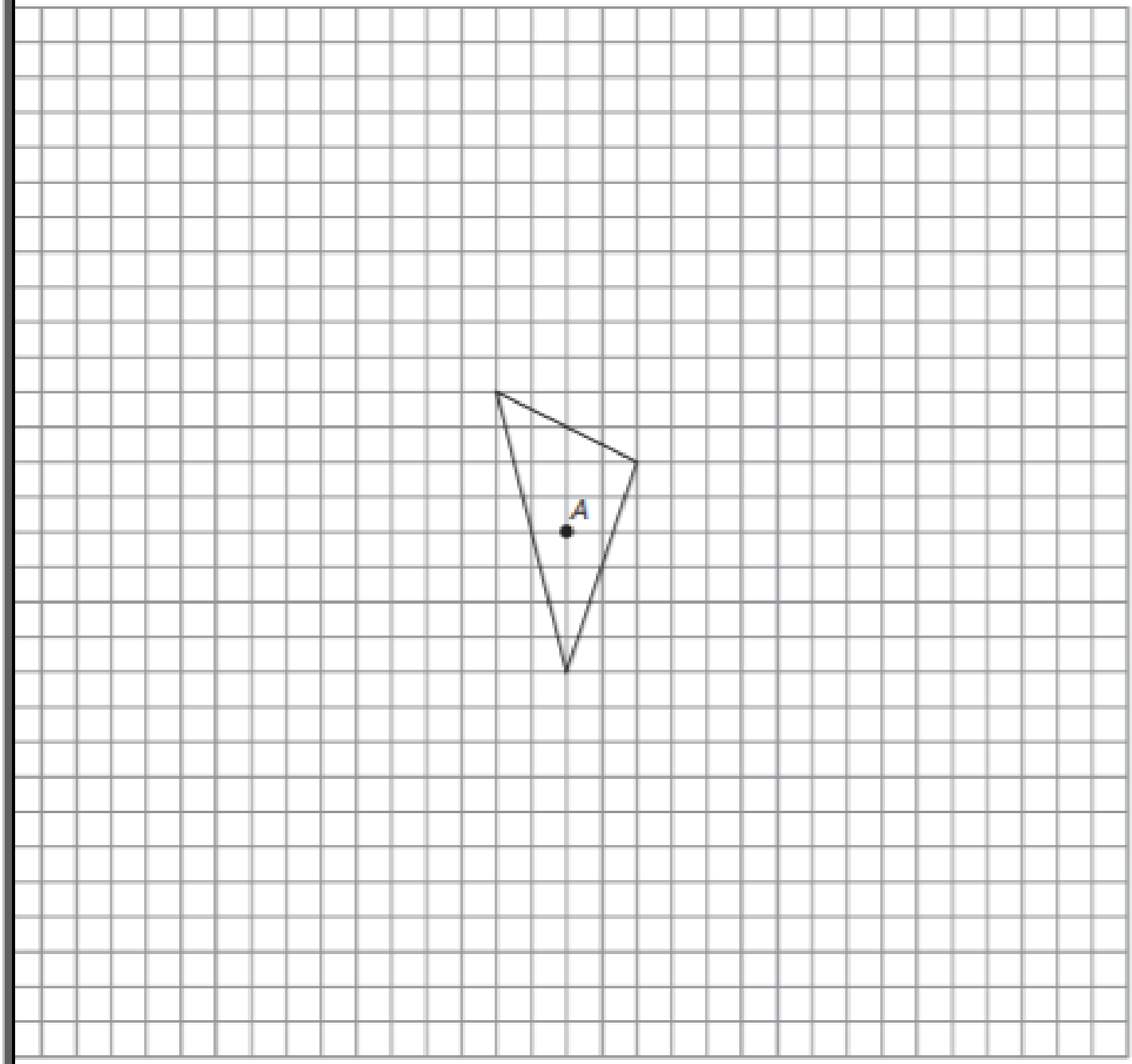


Diagram not drawn to scale

Calculate the size of $\hat{QPR}$. [3]

Enlarge the given triangle by a scale factor of –3 using point *A* as the centre of enlargement.

[2]



A car travels 300 km, measured correct to the nearest 5 km.
It travels this distance in 6 hours, measured correct to the nearest hour.

Calculate the least possible average speed of the car.
Give your answer in km/h, correct to 2 decimal places. [3]

A right-angled triangle *LMN* is shown below.
LN = 16·9 cm and *LM* = 6·5 cm.

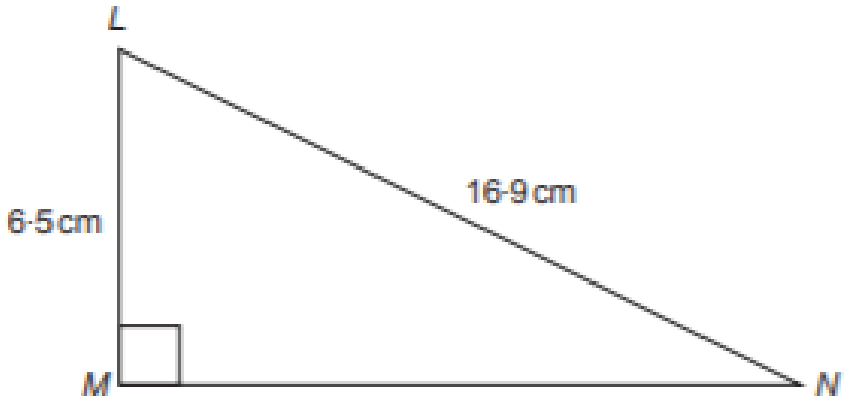


Diagram not drawn to scale

Calculate the length *MN*. [3]

The diagram shows a triangle *ABC* and a circle with centre *A*.
The points *B* and *D* lie on the circumference of the circle.

The radius of the circle is 8 cm.
The length of the line *AC* is 19 cm.
The area of triangle *ABC* is 70 cm^2.

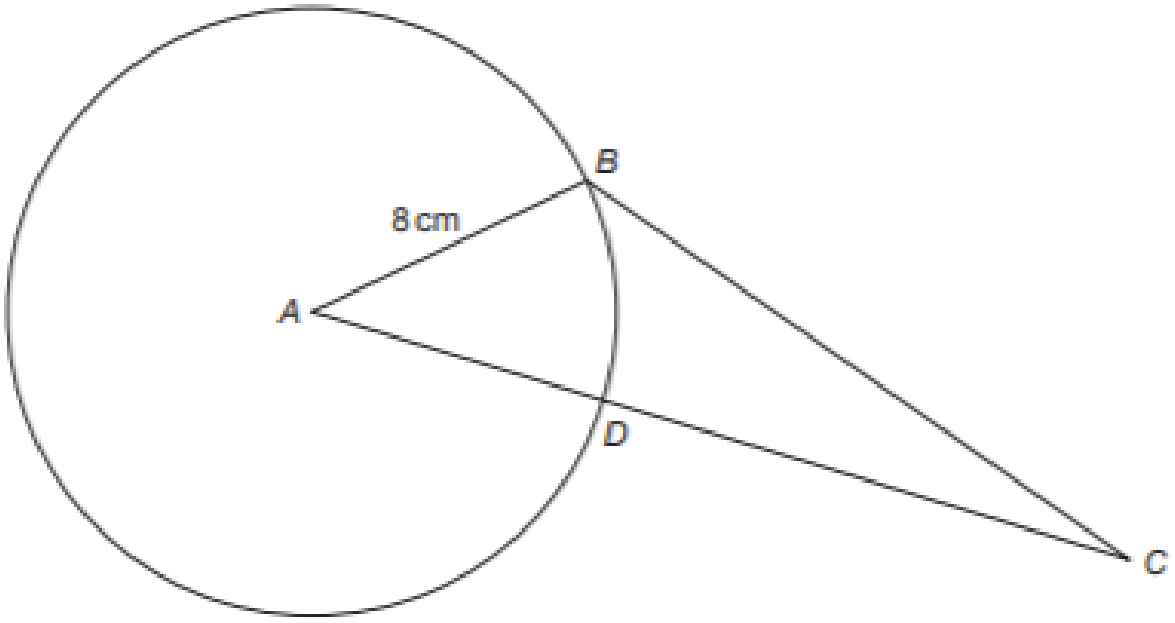


Diagram not drawn to scale

Calculate the area of the sector *ABD*. [5]

Triangle ABC has sides $AB = 17\,\text{cm}$, $AC = 13\,\text{cm}$ and $BC = 23\,\text{cm}$, as shown below.

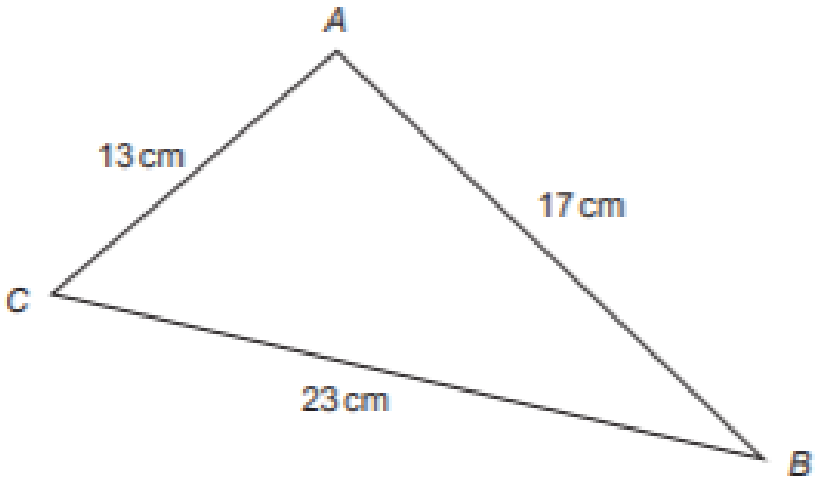


Diagram not drawn to scale

Calculate the size of $\hat{CAB}$. [3]

Two **similar** solids have base areas of $47\,cm^2$ and $199\,cm^2$, as shown below.
The volume of the smaller solid is $350\,cm^3$.

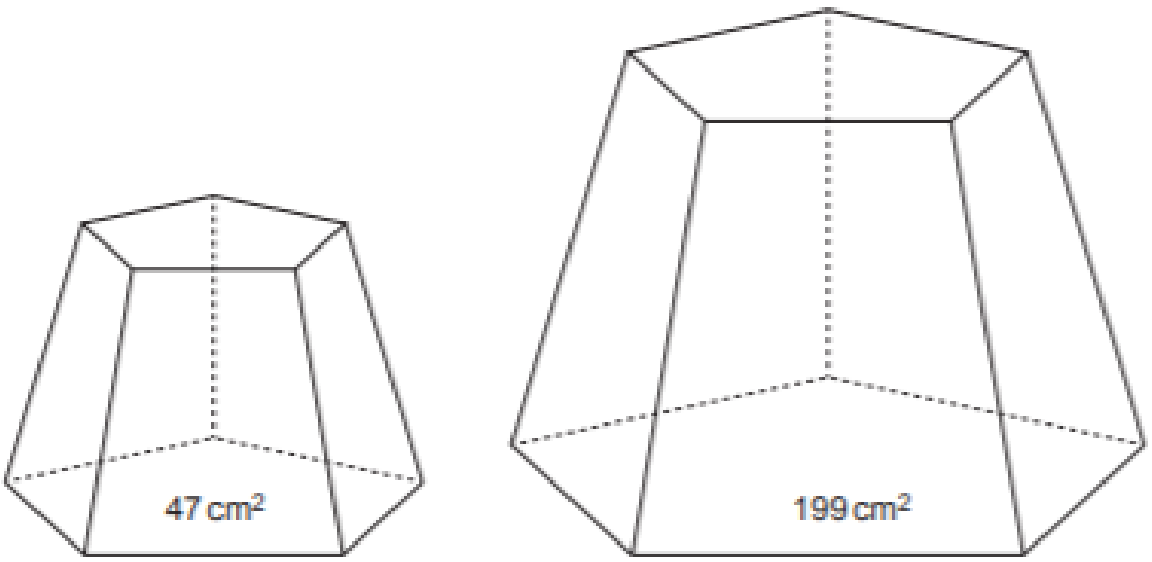


Diagram not drawn to scale

Calculate the volume of the larger solid. [4]

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

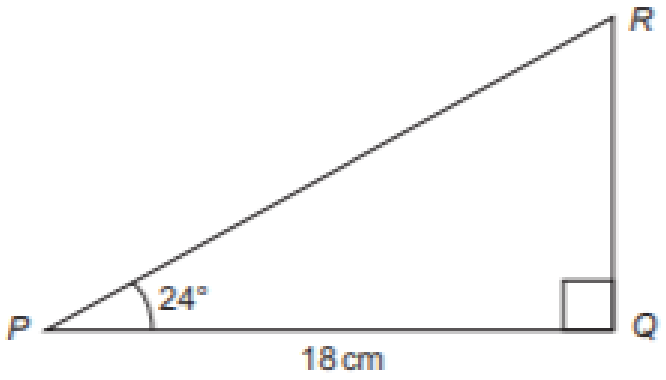


Diagram not drawn to scale

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

The area of triangle *ABD*, shown in the diagram below, is $35\,cm^2$.
AD = 5 cm and *BC* = 32 cm.
D is on the line *AC*, and *BD* is perpendicular to *AC*.

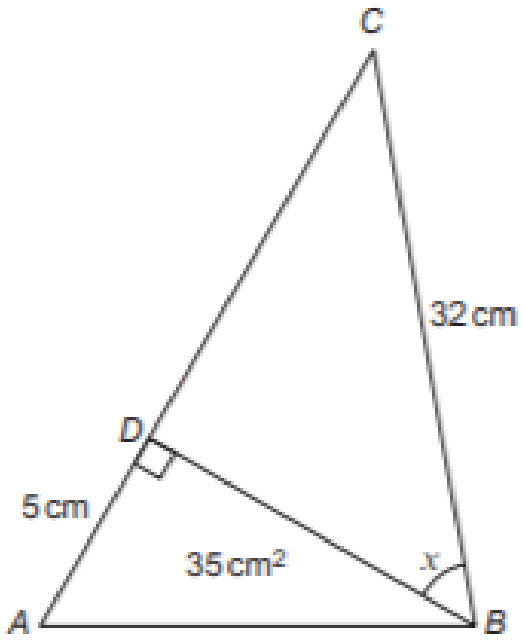


Diagram not drawn to scale

Calculate the size of angle x.
You must show all your working. [5 + 2 OCW]

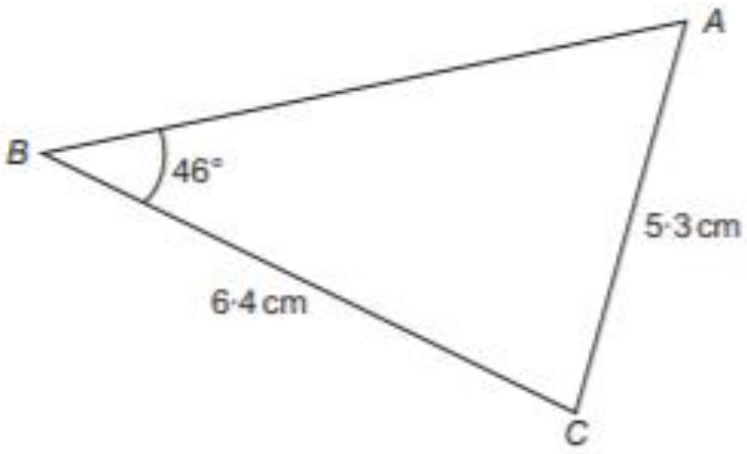


Diagram not drawn to scale

By first calculating the size of $B\hat{A}C$, calculate the area of triangle *ABC*.
You must show all your working. [5]

The region between two rectangles is shaded, as shown in the diagram below.
All of the measurements shown are given **correct to the nearest cm**.

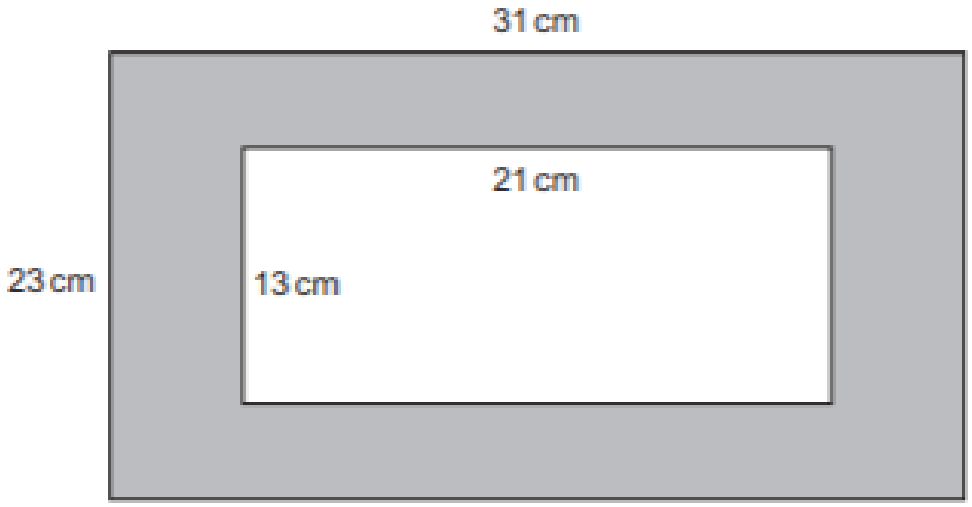
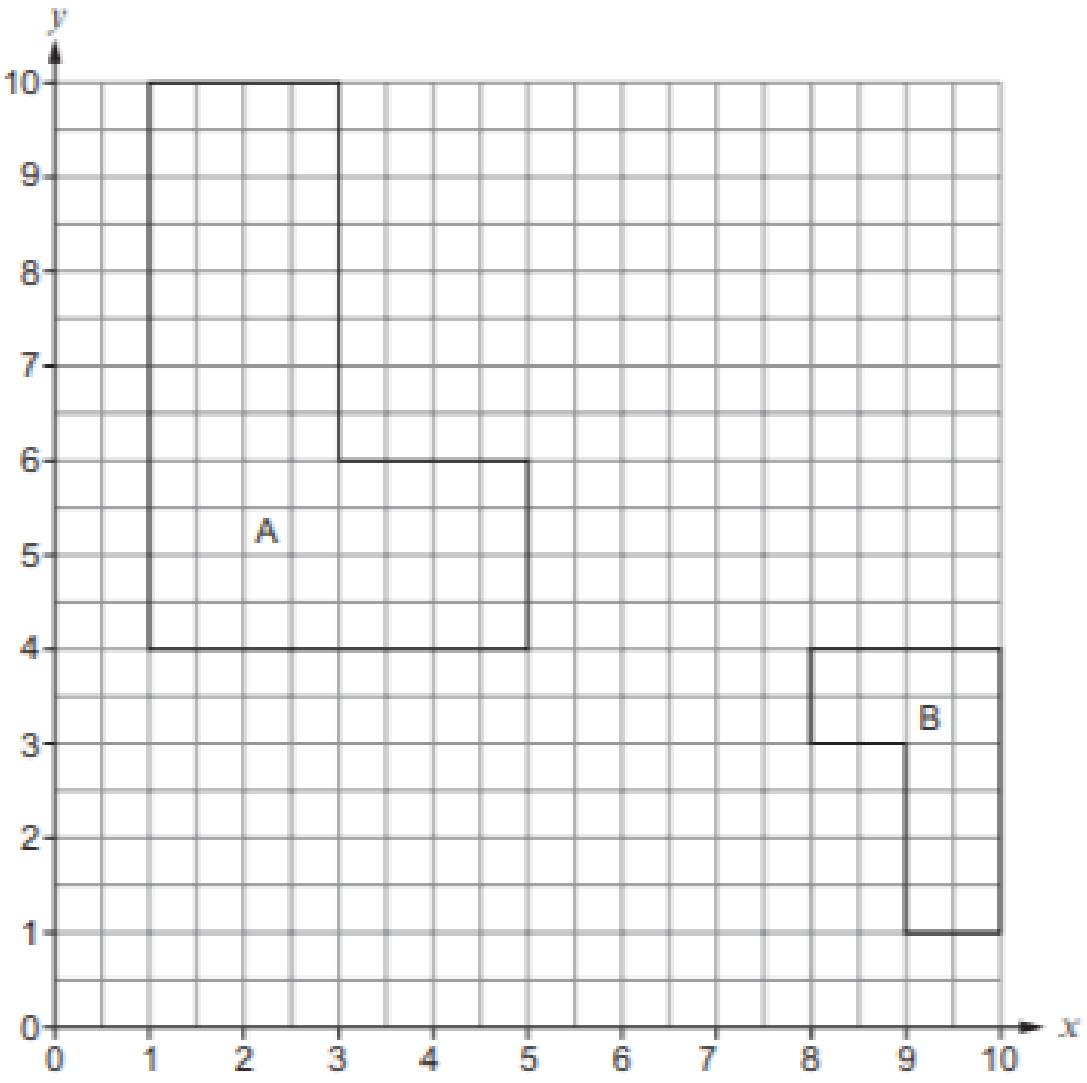


Diagram not drawn to scale

Calculate the greatest possible area of the shaded region. [3]

Describe fully a **single** transformation that transforms shape A onto shape B. [3]



The cube below has an internal diagonal of length 20 cm.
Each edge of the cube is of length x cm.

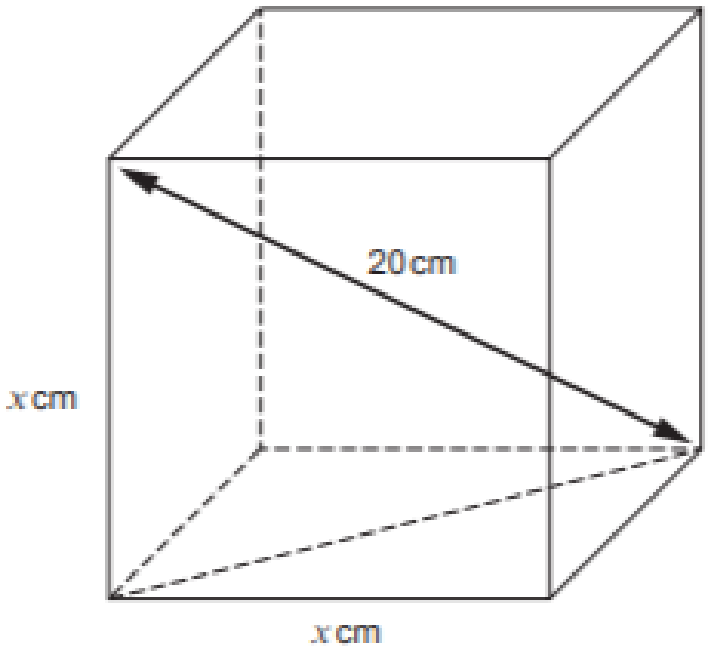
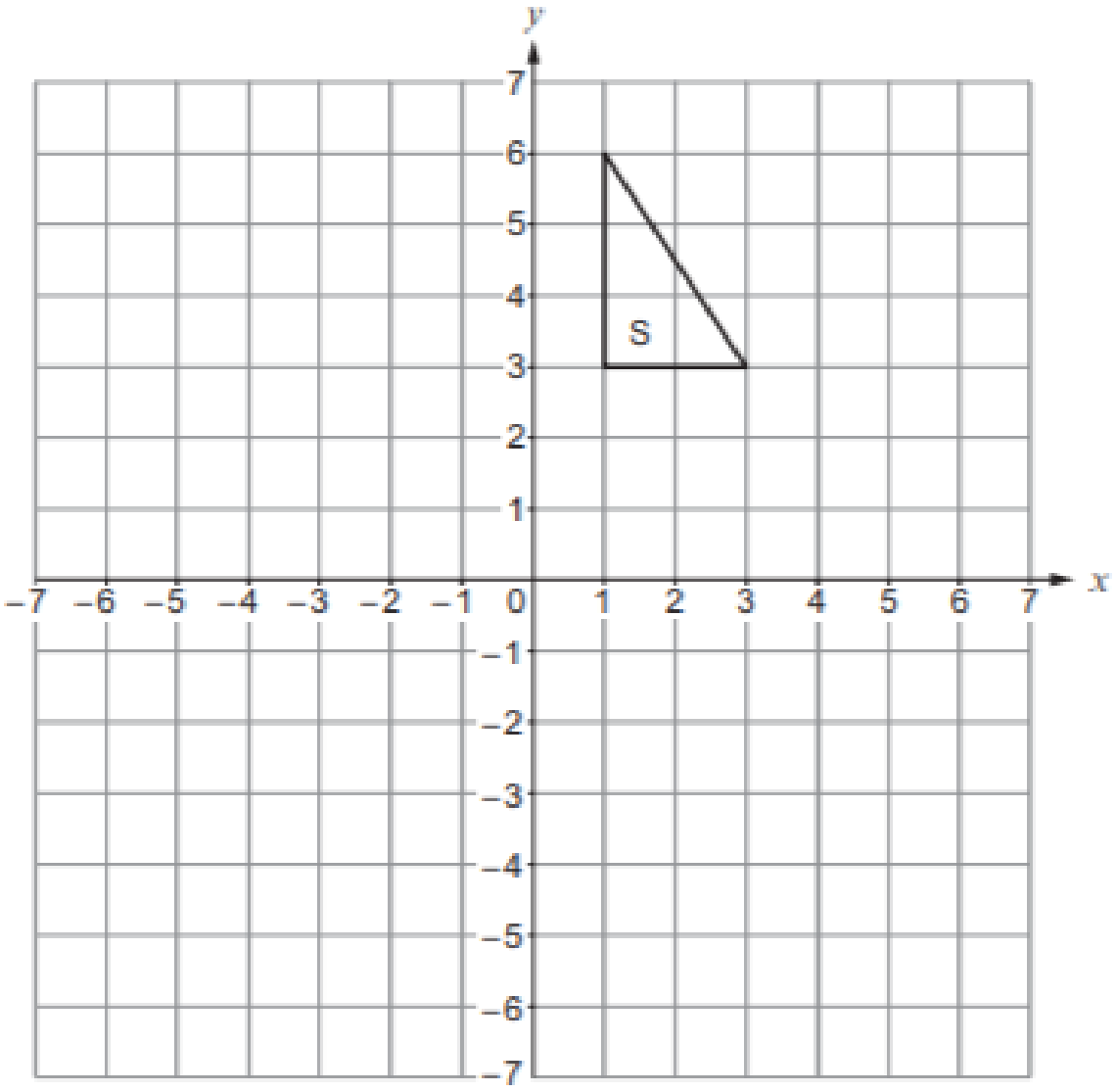


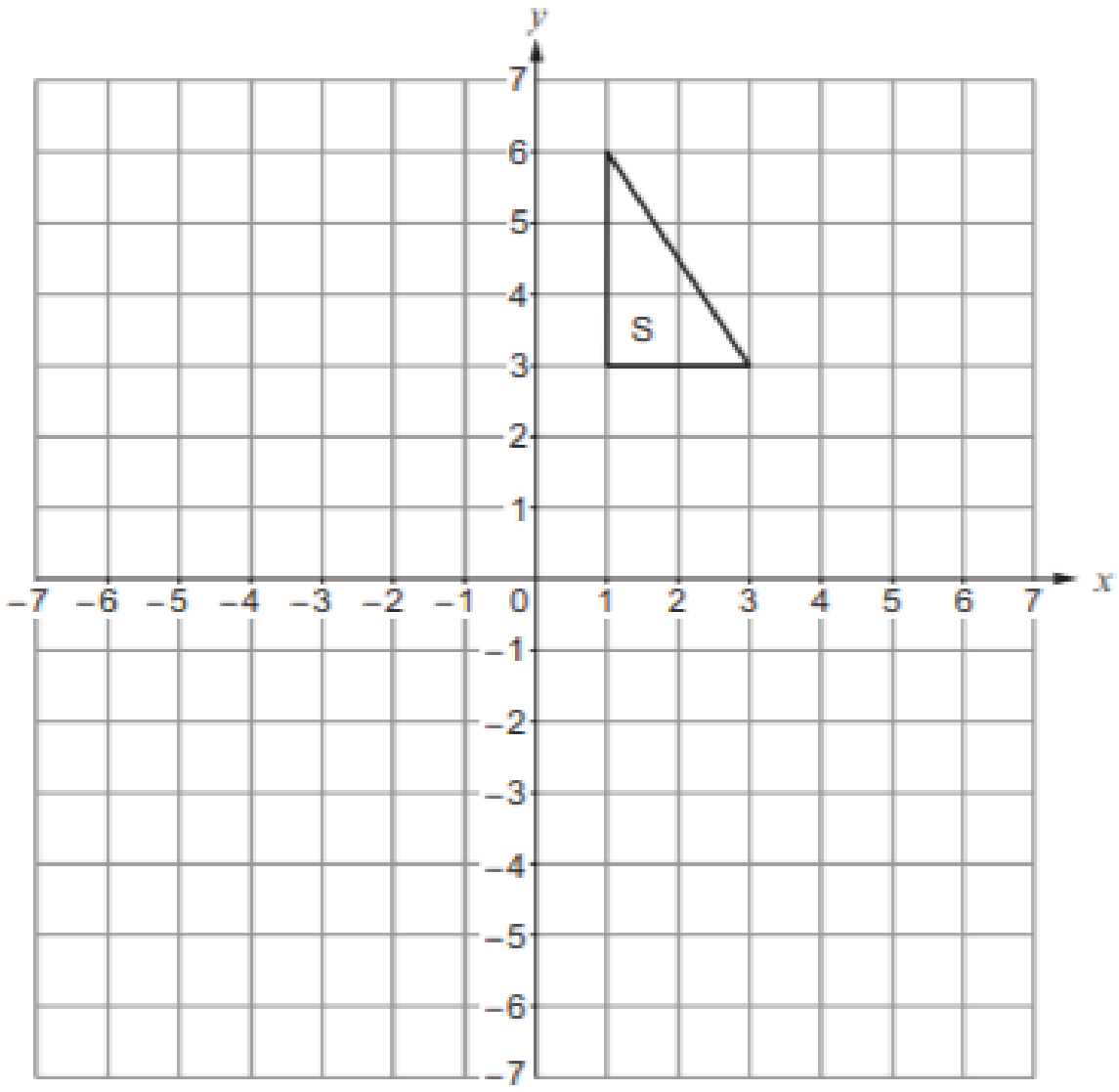
Diagram not drawn to scale

Calculate the value of x.
You must use an algebraic method and show all your working. [4]

(a) Reflect the triangle S in the line $y = x$. [2]



(b) (i) Translate the triangle S using the column vector $\begin{pmatrix} -5 \\ -4 \end{pmatrix}$. [1]



(ii) Write down the column vector that will reverse the translation in part (i). [1]

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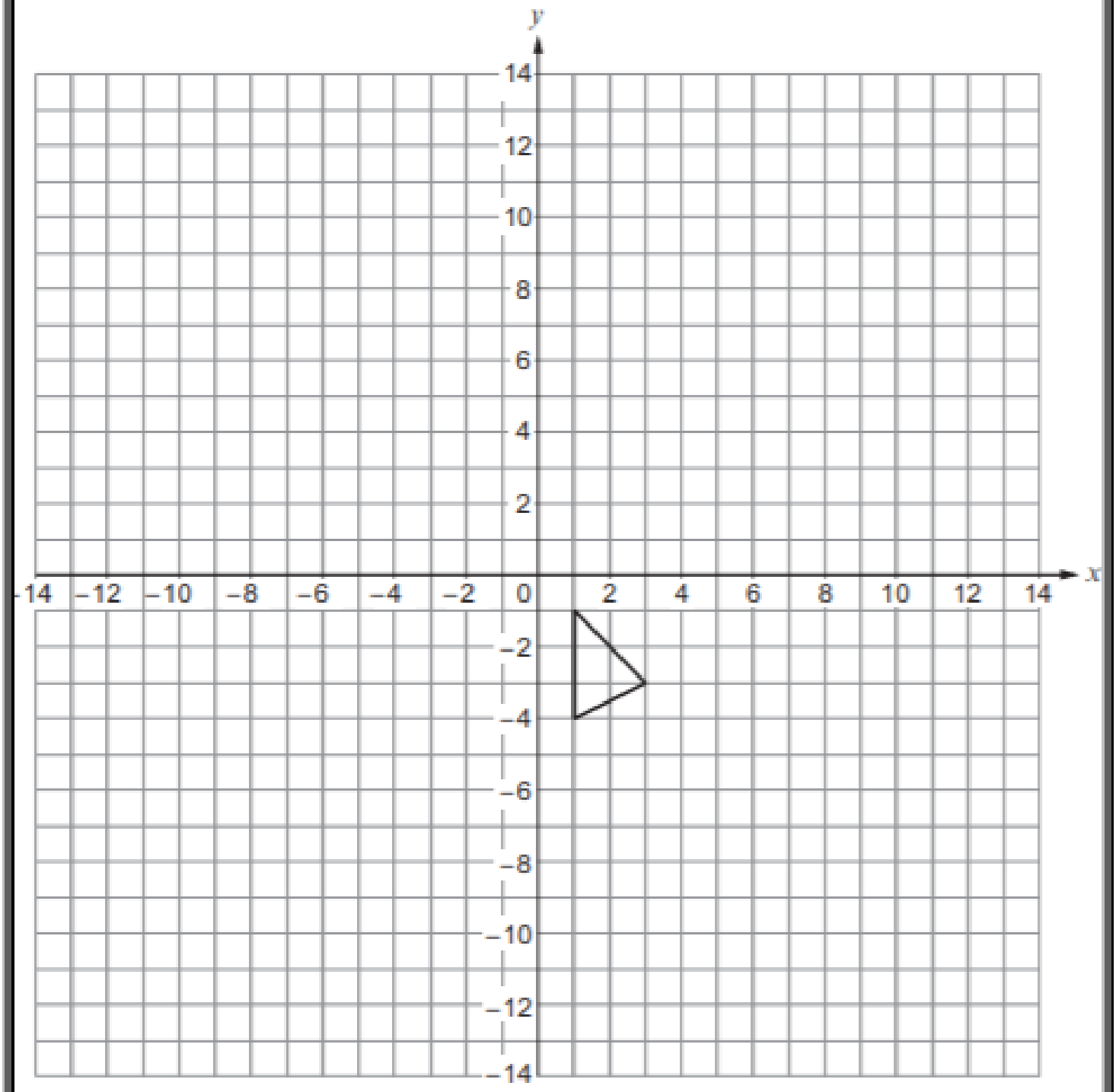
Draw the enlargement of the given triangle, using

- a scale factor of -2,
- $(-2, 1)$ as the centre of enlargement. [3]



A rectangle measures 38 cm by 26 cm.
Each measurement is correct to the nearest cm.
Calculate the least possible area of the rectangle. [2]

Two similar shapes have areas of 700 cm^2 and 140 cm^2.
The perimeter of the smaller shape is 83 cm.
Calculate the perimeter of the larger shape. [3]

Points E and F lie on a circle, centre O.
The radius of the circle is 10 cm.
The area of the shaded sector is 65 cm^2.

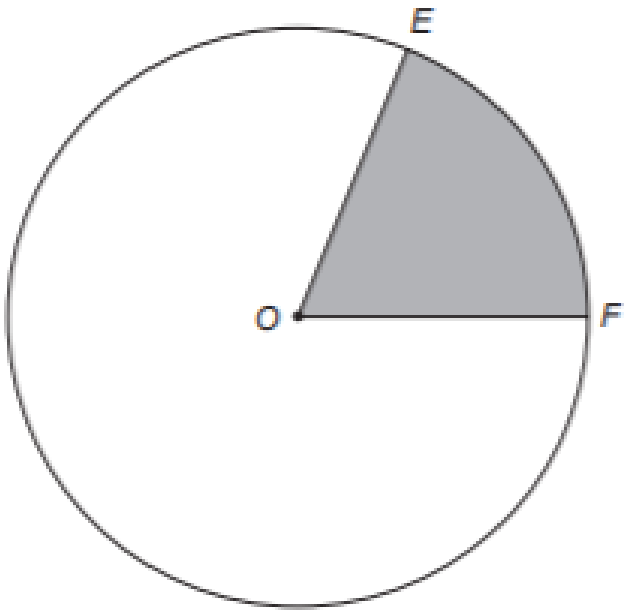


Diagram not drawn to scale

(a) Calculate the size of $E\hat{O}F$. [3]

(b) Hence, calculate the length of the arc EF. [2]

Two similar shapes have areas of 700 cm^2 and 140 cm^2.
The perimeter of the smaller shape is 83 cm.
Calculate the perimeter of the larger shape. [3]

(b) Calculate the area of the star. [3]

Numeracy Non-Calculator

(c) The diagram shows the groundsheet of a tent.

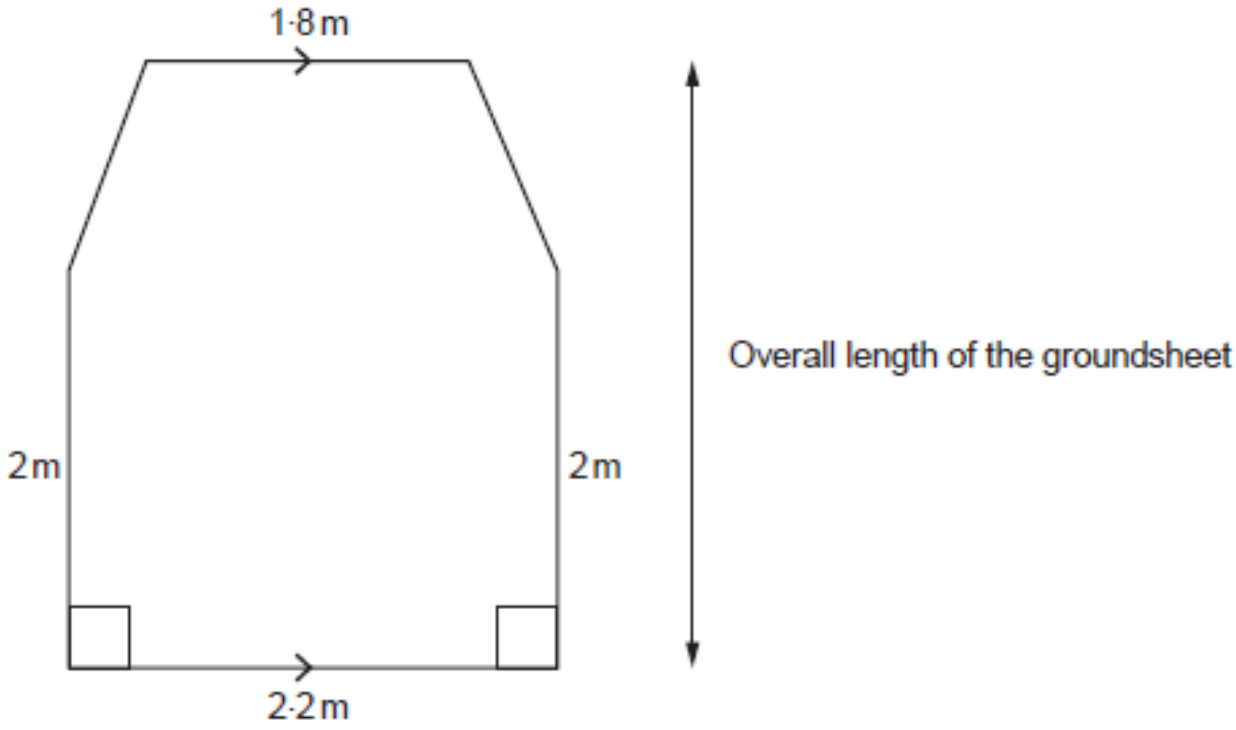


Diagram not drawn to scale

The area of the groundsheet is 6·8 m².
The width of the groundsheet is 2·2 m.
Calculate the overall length of the groundsheet. [4]

(a) A square piece of card measures 1 m by 1 m.

Calculate the area of this piece of card.
Give your answer in **standard form** in mm^2. [2]

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..... mm^2

(b) Some fabric shrinks when it is washed.

A piece of fabric is washed twice.

After the first wash, the area of the fabric is 75% of the area of the original piece of fabric.
After the second wash, the area of the fabric is 90% of the area of the fabric after the first wash.

After these two washes, the area of the fabric is 2700 cm^2.

Calculate the area of the original piece of fabric. [4]

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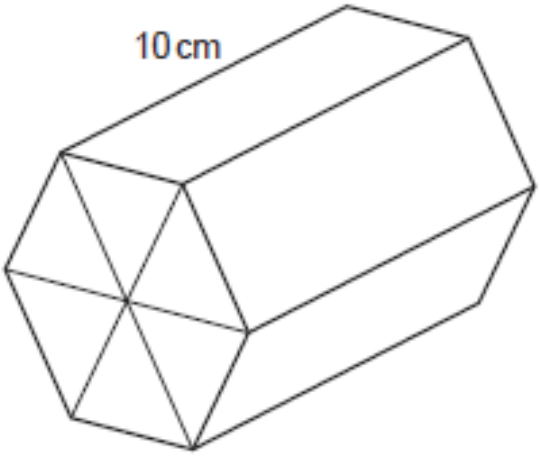
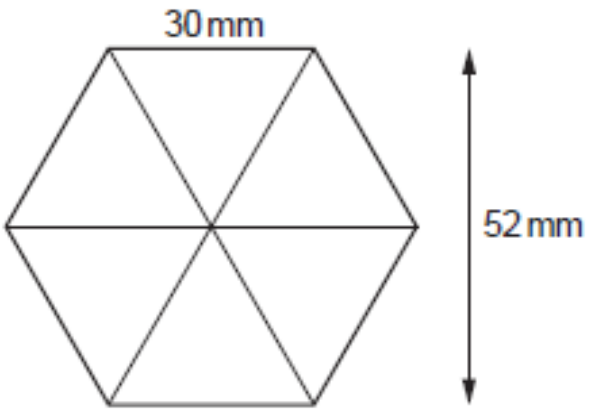
A box for mints is to be made in the shape of a hexagonal prism.
The cross-section of the box is a regular hexagon.
The volume of the box must be greater than 230000 mm^3.

Box for mints



Cross-section



Diagrams not drawn to scale

Using the measurements above, show that this would make a suitable box for the mints.
You must show all your working. [5]

On a building site, 4 bricklayers were able to lay 2000 bricks in 8 hours.

To complete the work on time, bricklayers will need to lay 9000 bricks in 10 hours.

(a) Calculate how many bricklayers would be needed to lay 9000 bricks in 10 hours. You must show all your working. [4]

(b) Give one assumption that you made in answering part *(a)*. [1]

(b) The design for a new buoy is shown below.
It is made up of a cone attached to a hemisphere.

The base radius of the cone and the radius of the hemisphere are both 2 m.

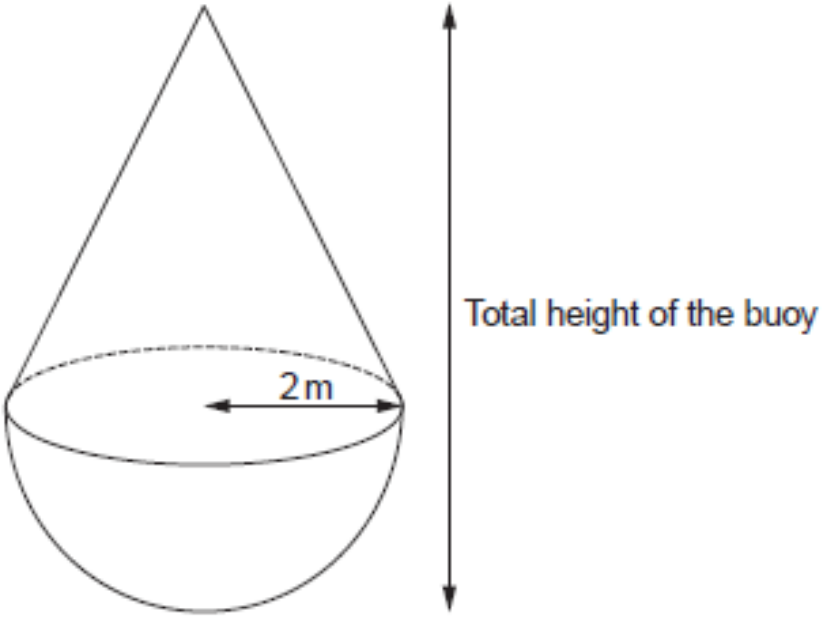


Diagram not drawn to scale

The **total** volume of this new buoy is 10π m^3.
Calculate the total height of the buoy. [5]

Total height of the buoy = ... m

Sioned and Rhodri are making a kite.

A diagram of the kite they are making is shown below.
AC and DB are the diagonals of the kite.
$AE = 22\,\text{cm}$, $EC = 28\,\text{cm}$ and $DE = 20\,\text{cm}$.

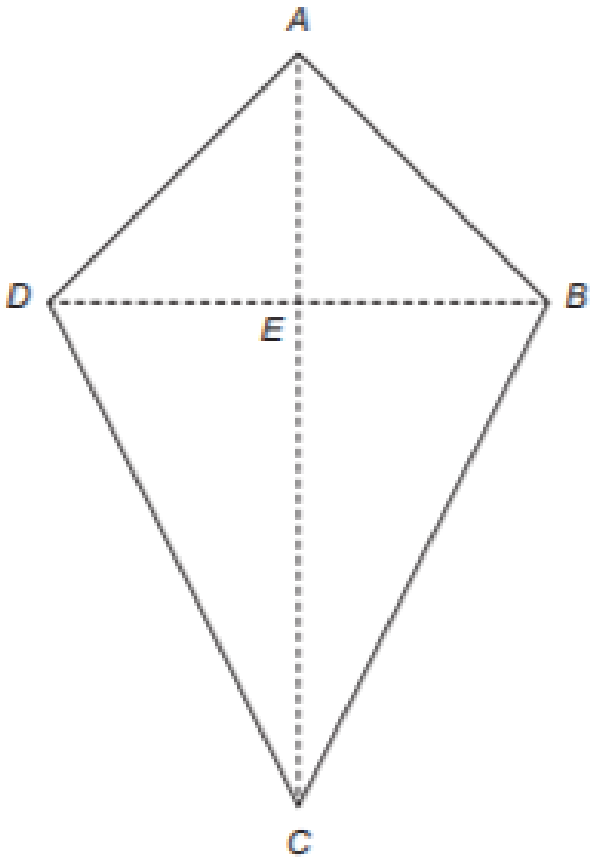


Diagram not drawn to scale

(a) Rhodri makes a statement about their kite being able to fly in strong wind,

"The length of the long diagonal must be at least 120% of the length of the short diagonal."

Assuming Rhodri is correct, should their kite be able to fly in strong wind?
You must show all your working. [4]

(a) An old recipe is given below.

Arrabiata pasta sauce
Serves 4 people

1 onion
2 × 0·88 lb tins of tomatoes
3 chillies

How many **kilograms** of tinned tomatoes are needed to make Arrabiata pasta sauce to serve 20 people? [3]

(b) A pasta factory in Italy produces 5 km of spaghetti per day.
How many centimetres of spaghetti will this factory produce in 7 days?
Give your answer in standard form. [3]

Mr Aston lives at 137 Ffordd Uchel.
He is ordering some new signs for his house and for his gatepost from a website.

Diagram not drawn to scale

All the signs available on the website are **mathematically similar**.

He selects a rectangular sign for the front of his house.
It has a length of 42 cm and a height of 24 cm.
The digits 1, 3 and 7 on the sign are all 18 cm high.

The rectangular sign Mr Aston is considering for his gatepost has a height of 20 cm.

(a) Calculate the height of the digits 1, 3 and 7 on the sign Mr Aston is considering for his gatepost. [2]

Height of the digits 1, 3 and 7 is ..... cm

(b) Mr Aston's gatepost is 30 cm wide.
Will the sign he is considering fit his gatepost?

Yes ☐ No ☐

You must show all your working and give a reason for your answer. [3]

(c) The aircraft carries cargo.
One customer wants to use the aircraft to transport a new product that is to be packaged in cuboid boxes, as shown below.

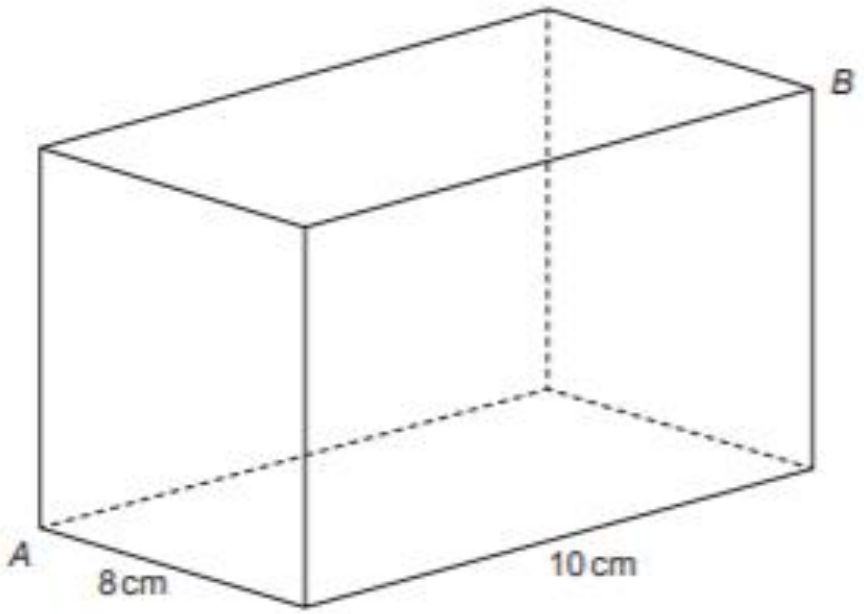


Diagram not drawn to scale

The boxes will meet the following conditions:

- The boxes will be of width 8 cm and length 10 cm.
- The length of the diagonal AB will be 14 cm.

Calculate the height of a box.
Give your answer in the form $a\sqrt{b}$ cm, where a and b are integers, and b is as small as possible. [6]

Nicola makes party hats for young children.
The hats are in the shape of cones.
Nicola's design is shown below.

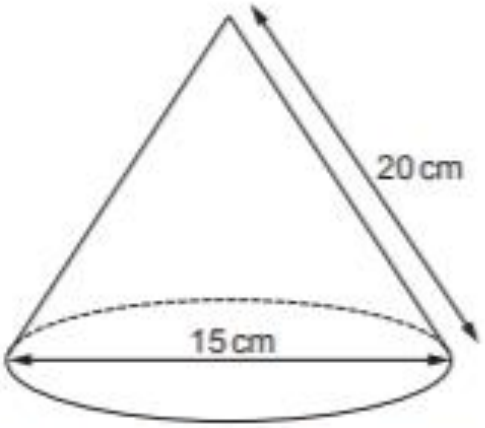


Diagram not drawn to scale

Nicola makes the hats by folding pieces of card that are in the shape of sectors of a circle.
The hats are formed when the straight edges meet.

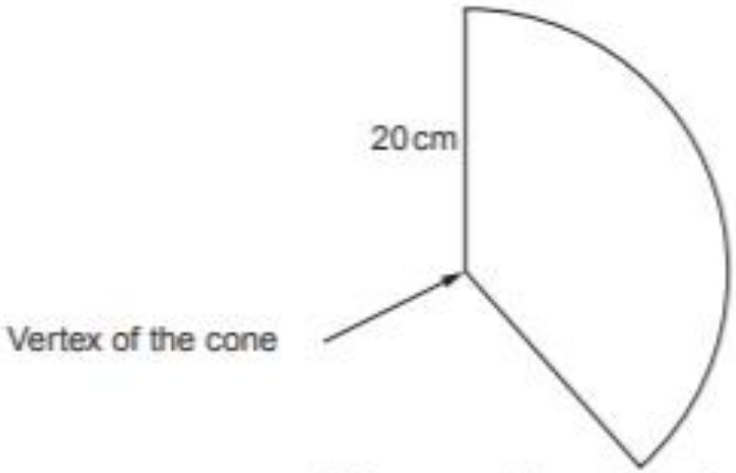


Diagram not drawn to scale

(a) Calculate the sector angle Nicola uses in her design. [4]

(b) Nicola also makes party hats for adults.
They are made from pieces of card that are sectors of a circle, with **radius** 24 cm and sector angle 150°.

Nicola cuts each sector of a circle from a sheet of rectangular card that measures 24 cm by 50 cm.
Calculate the area of card that is wasted from each rectangular sheet.
Give your answer in terms of π in its simplest form. [4]

A company makes steel solids that each have a mass of 1 kg.
One of their solids is a square-based pyramid joined to a cuboid as shown below.

The base edges of the pyramid are of length 5 cm, and the height of the cuboid is 4 cm.
The density of the steel used by the company is 8 g/cm^3.

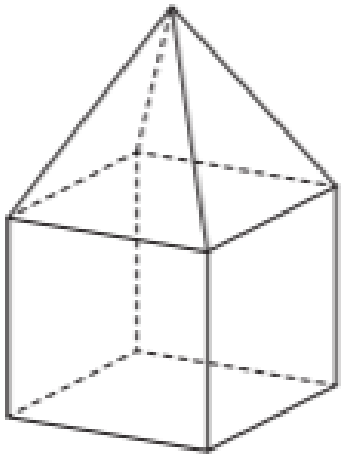


Diagram not drawn to scale

The complete solid has a mass of 1 kg.
Calculate the vertical height of the pyramid. [5]

Rupert Shoes sells shoes online.
Pairs of shoes are packed in shoeboxes.
The dimensions of the shoebox used are given on the diagram below.

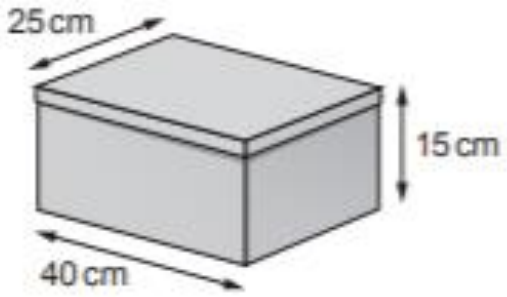
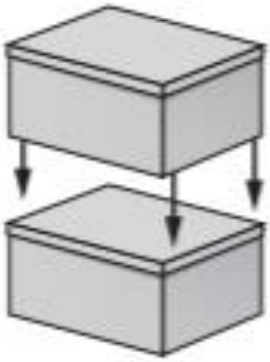


Diagram not drawn to scale

A customer orders 2 pairs of shoes.



The package for sending the shoes to the customer is made by:

- placing one box on top of the other, and
- taping the two boxes together.

This is shown in the diagram.

The cost for sending the package is calculated using the formula below.
All dimensions are measured in cm.

$$\text{Cost in £} = \frac{1}{5} \times (S + F) \times 0{\cdot}02$$

S = value of the sum of the 3 dimensions of the package
F = value of the area of one of the **largest** faces of the package

How much does it cost *Rupert Shoes* to send the package?
Give your answer in pounds.
You must show all your working. [5]

You are given that:
1 gigalitre = 1 000 000 m^3
1 megalitre = 1 million litres

Lake Vyrnwy is a reservoir in mid Wales.

(a) Lake Vyrnwy can release between 25 and 45 megalitres of water per day from the dam.

The lake also supplies water through underground pipes to another reservoir at a rate of 230 000 m^3 per day.

(ii) Which is the best estimate for the volume of water passing through the underground pipes **per hour**?
Circle your answer. [1]

8500 m^3 9600 m^3 10 040 m^3 10 400 m^3 11 000 m^3

(b) Lake Vyrnwy has a surface area of approximately 4 540 000 m^2.
Lake Vyrnwy contains 59·7 gigalitres of water.

Calculate an estimate of the average depth of the lake.
Give your answer in metres.

[3]

Estimate of average depth is ..... m

Bronwen is investigating the increase in the growth of algae on the surface of a pond.
The surface area covered by the algae is measured in cm^2.
She finds the surface area covered by the algae t **days** after the start of her investigation is given by the following expression.

$$400 + 4^{\frac{t}{2}}$$

(a) What surface area was covered by algae at the start of her investigation?
Circle your answer. [1]

$404\,cm^2$ $401\,cm^2$ $4\,cm^2$ $402\,cm^2$ $400\,cm^2$

(b) Bronwen calculated the surface area covered by the algae 5 days after the start of the investigation.
She also calculated the surface area 7 days after the start of the investigation.
By how much did the surface area covered by the algae increase between these two times? [3]

A tent company is designing a new 2-person tent.
The base of the tent is in the shape of a kite, as shown below.
The width of the kite is 160 cm, and the two shorter sides are of length 100 cm.
The point where the diagonals of the kite intersect has been marked *O* on the diagram below.

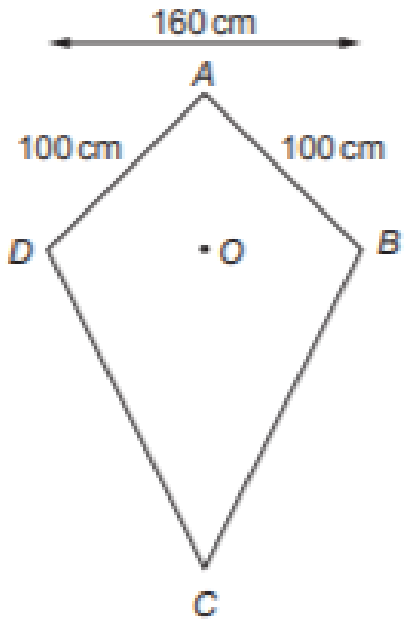


Diagram not drawn to scale

E is the highest point of the tent, and is 110 cm vertically above *O*.
Part of the frame that supports the tent cover is a straight pole that goes from *A* to *E*.

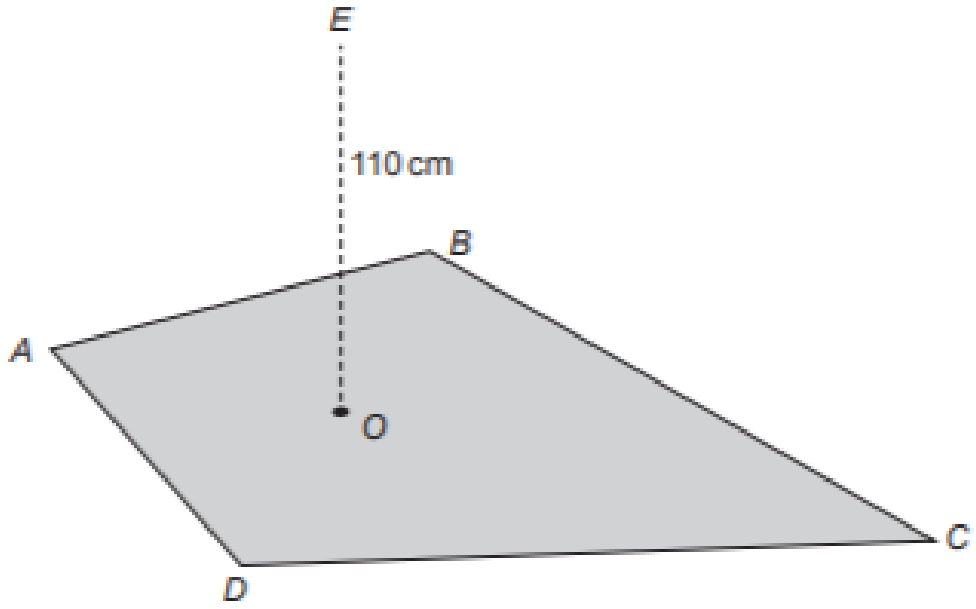


Diagram not drawn to scale

Calculate the length of pole *AE*.
Give your answer as a surd.
You do not need to simplify your answer. [4]

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(c) Alun has 5 identical metal cylinders, each of length 40 mm.

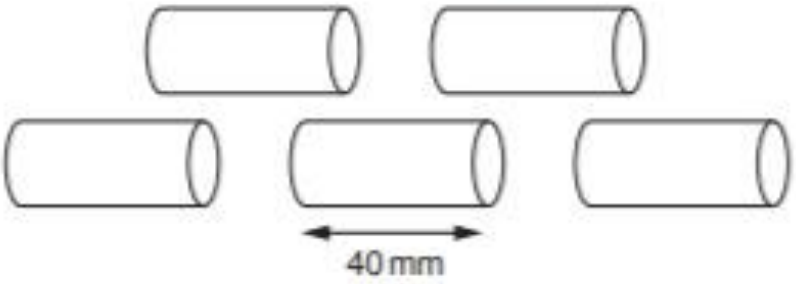

Diagram not drawn to scale

He has been asked to make a solid sphere of radius 30 mm.

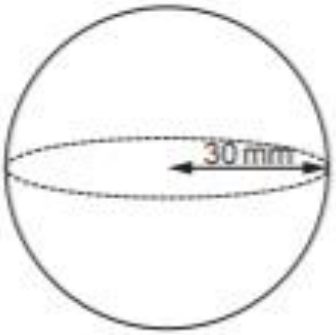

Diagram not drawn to scale

He melts the 5 cylinders and recasts all the metal to make the sphere.

Calculate the radius of each of the cylinders.

Give your answer in mm, in the form $a\sqrt{b}$, where a and b are integers, and b is as small as possible. [6]

(b) A new running track is to be built at the stadium.

Athletes in a 200-metre race run in lanes.
The inside line of one of the lanes is shown below.

The inside line consists of:

- a straight section of length 90 m,
- an arc of a circle with radius 36 m.

The length of this inside line is 200 m.

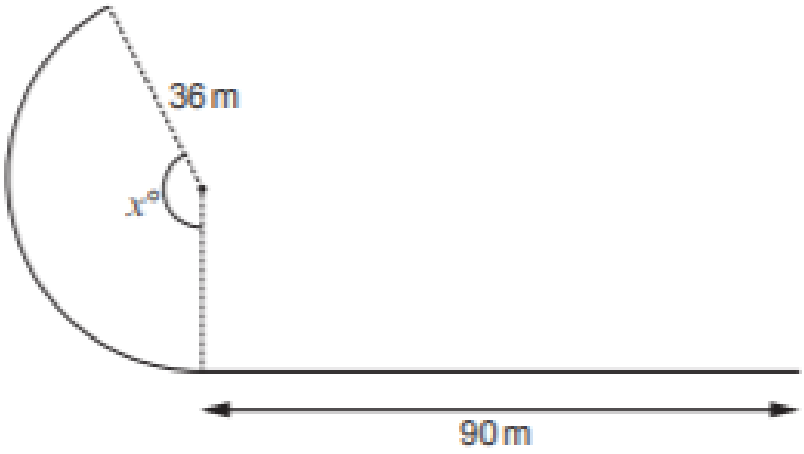

Diagram not drawn to scale

Show that the value of x is $\frac{550}{\pi}$. [5]

Bethan builds a rectangular sheep pen.

(a) The perimeter fence of the sheep pen is 18 m long.
The length of Bethan's sheep pen is two times its width.
Find the length and width of this sheep pen.
You must show your working. [2]

Length is ..... metres

Width is ..... metres

(b) Bethan decides to build a new sheep pen.
The perimeter fence of the new sheep pen is 16 m long.
The length of the new sheep pen is 3 metres longer than the width.

Form an equation and solve it to find the dimensions of this new sheep pen. [3]

Length is ..... metres

Width is ..... metres

(a) A standard piece of A4 paper is usually 0·08 mm thick.
What is 0.08 mm written in **metres** in standard form?
Circle your answer. [1]

8×10^{4} 8×10^{-4} 8×10^{-3} 8×10^{3} 8×10^{-5}

(b) A piece of card is 1 mm thick.
A stack of these pieces of card is 3×10^{-2} metres high.

(i) Calculate how many pieces of card there are in the stack. [2]

(ii) What assumption have you made in answering *(b)*(i)? [1]

(c) In 2012 it was recorded that

- the total mass of the paper used for printing newspapers, in the world, was $2{\cdot}88 \times 10^7$ **tonnes**,
- the world population was approximately $7{\cdot}2 \times 10^9$ people.

Use this information to calculate the mass of paper per person used to print newspapers in 2012.
Give your answer in **kg per person**. [4]

Mass of paper: ..... kg per person

On a new housing estate, teams of painters paint the walls and ceilings of houses once they are built.

(a) It takes a team of 5 painters 10 hours to paint a house that has a total wall and ceiling area of 500 m^2.

A new house on the estate has a total wall and ceiling area of 600 m^2.
This house has to be painted in 8 hours.

Calculate the least number of painters needed.
You must show all your working. [4]

(b) What assumption have you made in answering part *(a)*? [1]

The diagram below shows a wooden end-piece for a curtain pole.
It is in the shape of a cone with measurements as shown in the diagram.

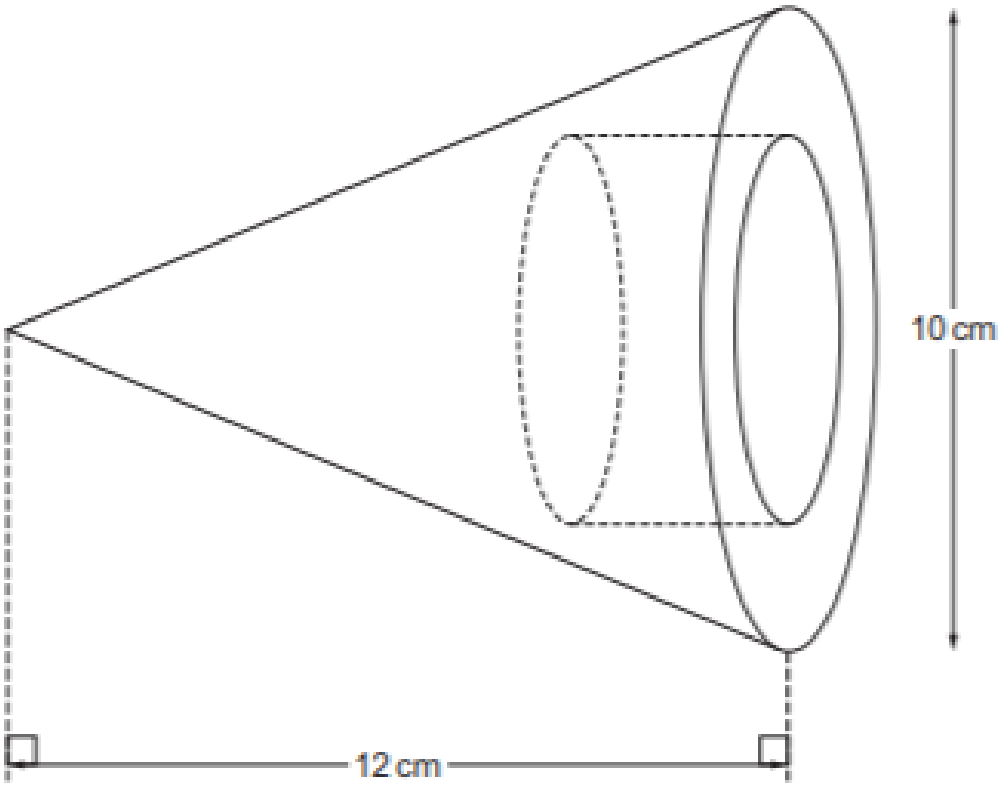

Diagram not drawn to scale

The curtain pole sits in a cylindrical hole that has been drilled into the end-piece.
The hole is of radius 3 cm and depth 4 cm.

(a) Show that the volume of wood that remains is $64\pi\,\text{cm}^3$. [4]

(b) The surface area of the end-piece is to be painted, except for the area inside the hole.
Calculate the surface area that is to be painted.
Give your answer in terms of π. [6]

Stylish computer desk Made of laminate wood. Non-scratch top. **Length is exactly 2000 mm**	

Luc wants this new desk for his bedroom.

The desk is to fit on the straight wall between his wardrobe and his bookcase.

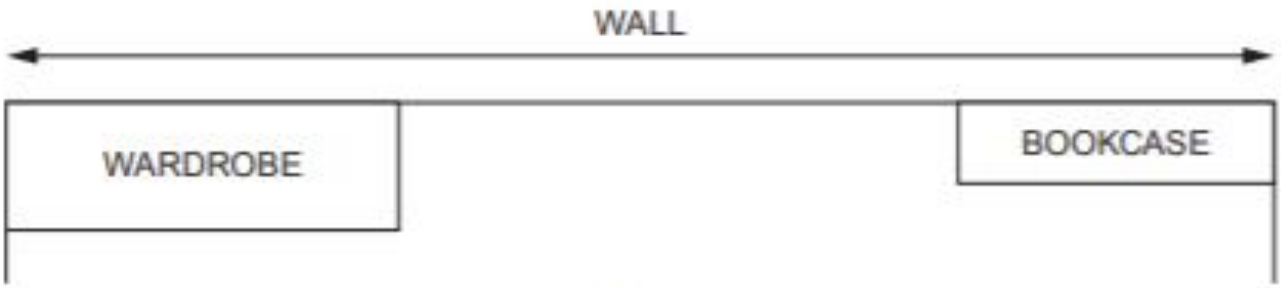

Diagram not drawn to scale

Luc has measured the length of

- the wall, which is 600 cm, correct to the nearest 10 cm,
- the bookcase, which is 147 cm, correct to the nearest 1 cm,
- the wardrobe, which is 250 cm, correct to the nearest 1 cm.

(a) What is the greatest possible length of the wall?
Circle your answer. [1]

600 cm 605 cm 645 cm 610 cm 650 cm

(b) What is the least possible length of the wardrobe?
Circle your answer. [1]

249 cm 249·45 cm 249·49 cm 249·5 cm 250 cm

(c) Can Luc be certain that this desk will fit in the space available?

You must

- show all your calculations,
- give the greatest or least bounds of any measurements used in calculations or comparisons,
- give a reason for your answer. [5]

The shaded part of the diagram below shows the top surface of an engine part.

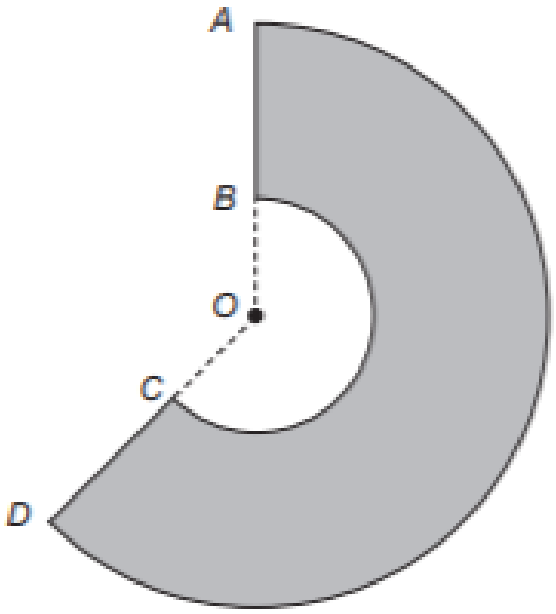

Diagram not drawn to scale

The measurements taken by a motor engineer are:

- reflex angle $B\hat{O}C = 240°$,
- $AO = OD = 6\,\text{cm}$,
- $BO = OC = 3\,\text{cm}$.

(a) The length of the major arc AD is to be sealed by attaching a flexible anti-rust strip.
Each flexible anti-rust strip is of length 35 cm.
What length of the anti-rust strip will be left over after sealing the length of the major arc AD?
Give your answer in terms of π, in its simplest form. [3]

(b) The top surface of the engine part is to be painted.
The paint costs 15p per cm^2.

(i) Calculate the cost of the paint to be used.
Give your answer in terms of π, in its simplest form. [4]

(ii) Using $\pi = 3$, calculate how much it costs to paint the top surface of 20 engine parts.
Give your answer in pounds. [1]

Paint cost is £ .....

Numeracy Calculator

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

In Cuba, urban gardens are used for food production.

1 acre ≈ 0·00405 km²

35 000 acres of urban gardens in Cuba produced 3·4 million tonnes of food in 2002.

Calculate the number of tonnes of food produced per km² in urban gardens in Cuba in 2002.
You must show all your working. [4 + 2 OCW]

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Formula One cars are some of the fastest racing cars in the world.

The cars' top speeds are up to 375 km/h and their engines are limited to 15 000 rotations per minute.

The Monaco Grand Prix is the shortest Formula One race with 78 laps of the track and a total distance of 260·5 km.

Fernando Alonso won the Monaco Grand Prix in 2007.
He completed the race with an average speed of 155·552 km/h.

(a) Complete the following statement.

'Top speeds of Formula One cars are up to ..... mph.' [2]

(b) Calculate Alonso's average lap time for the 2007 Monaco Grand Prix.
Give your answer in minutes.
You must show all your working. [4]

(c) Which number from the list below would correctly complete the following statement?
Circle your answer. [1]

'Formula One engines are limited to ..... rotations **per second**.'

900 000 250 300 4·17 54 million

(b) The 2p coin is made from a mixture of metals.
It has a diameter of 25·9 mm and a thickness of 2·03 mm.

The 2p coin can be considered to be a cylinder.
Calculate the volume of metal in a 2p coin.

[3]

The Leaning Tower of Pisa stands on horizontal ground.
The vertical height of the tower on the higher side is 56·7 m.
The top of the tower is displaced 3·9 m horizontally.

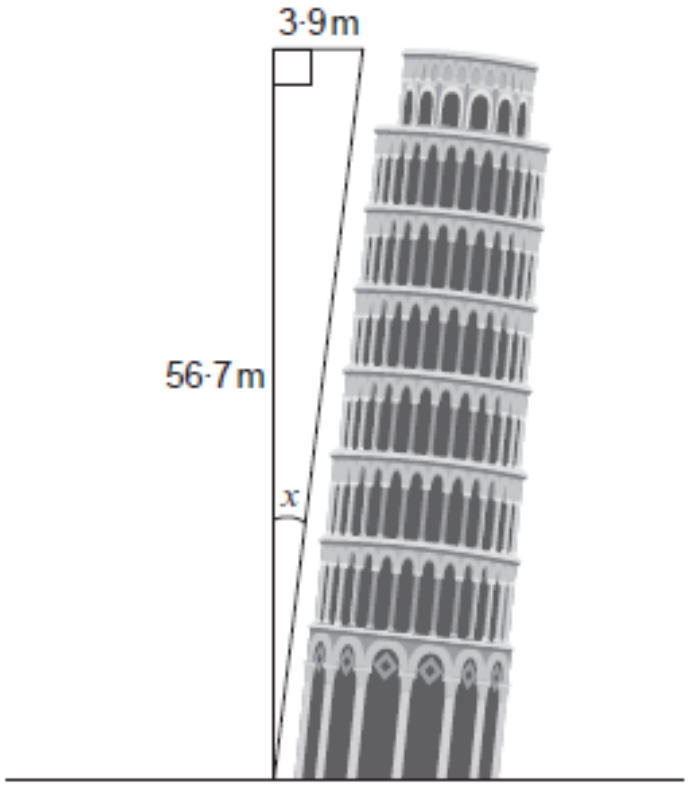

Diagram not drawn to scale

(a) Calculate the angle, x, at which the tower leans.
Give your answer correct to 2 decimal places.
You must show all your working. [4]

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(b) Ceri plans to make a poster that is mathematically similar to the Leaning Tower of Pisa.

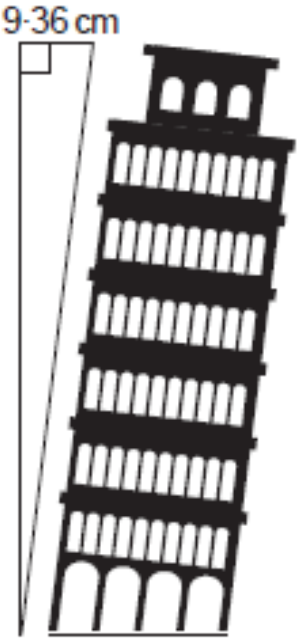
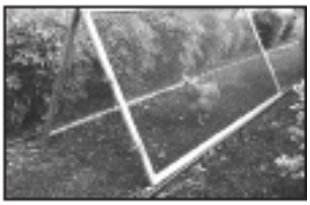


Diagram not drawn to scale

Calculate the height of the poster Ceri plans to make. [2]

(a) A company makes a chicken run in the shape of a triangular prism, as shown below.
The uniform cross-section of the chicken run is an isosceles triangle.



The run covers a rectangular ground area of 5·46 m^2.

The vertical height of the run is 1·5 m.

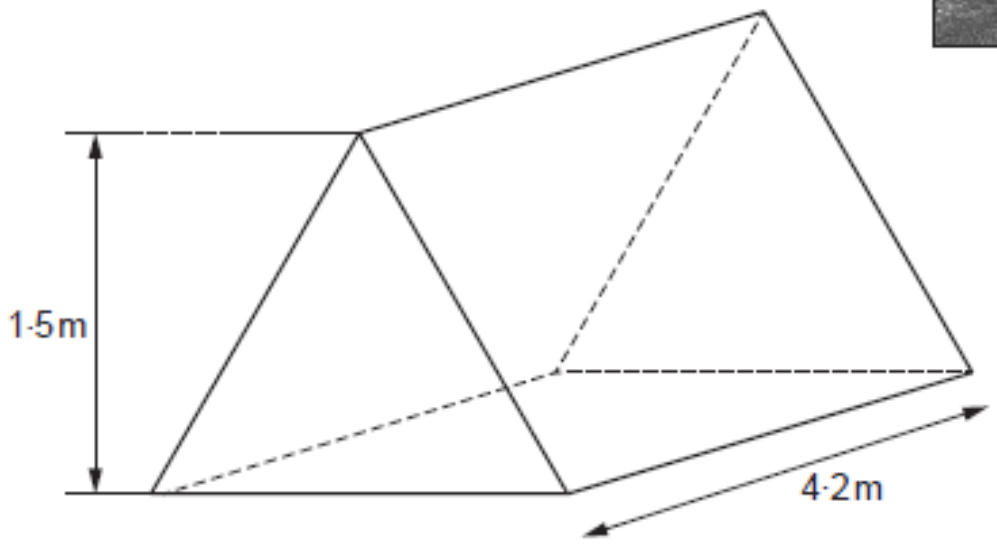


Diagram not drawn to scale

Each face of the chicken run is to be covered in wire mesh, apart from the base.
The wire mesh costs £5.60 per m^2.

Calculate the cost of the wire mesh that is needed for the chicken run. [7]

Cost of the wire mesh = £ .....

(b) The company also makes chicken coops that are mathematically similar.

Diagrams not drawn to scale

Medium coop
Capacity = $8\,m^3$
Area of wire mesh = $3\,m^2$

Large coop
Capacity = $27\,m^3$

Use the above information to calculate the area of wire mesh in the large coop. [4]

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A square trapdoor has sides of length 110 cm.
When the trapdoor is fully opened, it makes an angle of 85° with the horizontal.

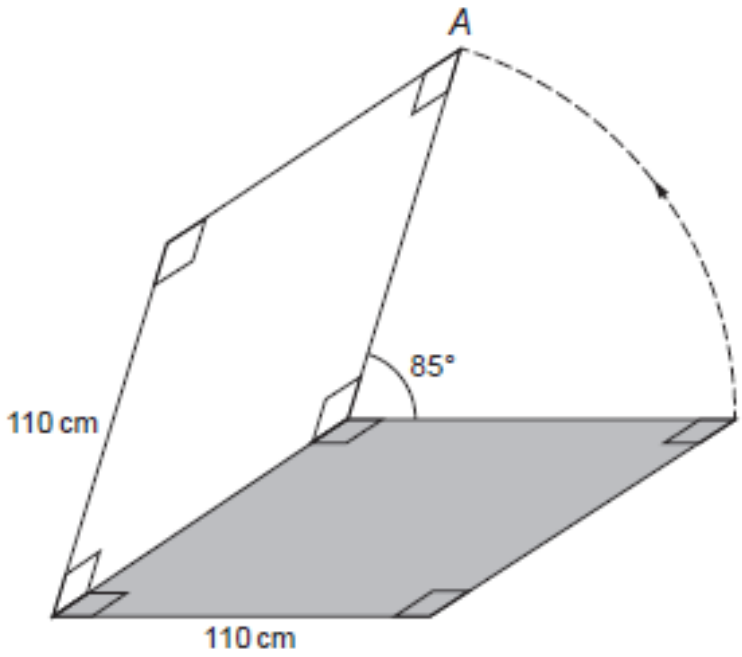

Diagram not drawn to scale

(a) Calculate the distance that point *A* travels as the trapdoor moves from being closed to being fully opened. [2]

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(b) A thin rod is used to hold the trapdoor open in this position.
The rod goes from the closed position of point *A* to a point on the edge of the trapdoor, 16 cm from point *A*.

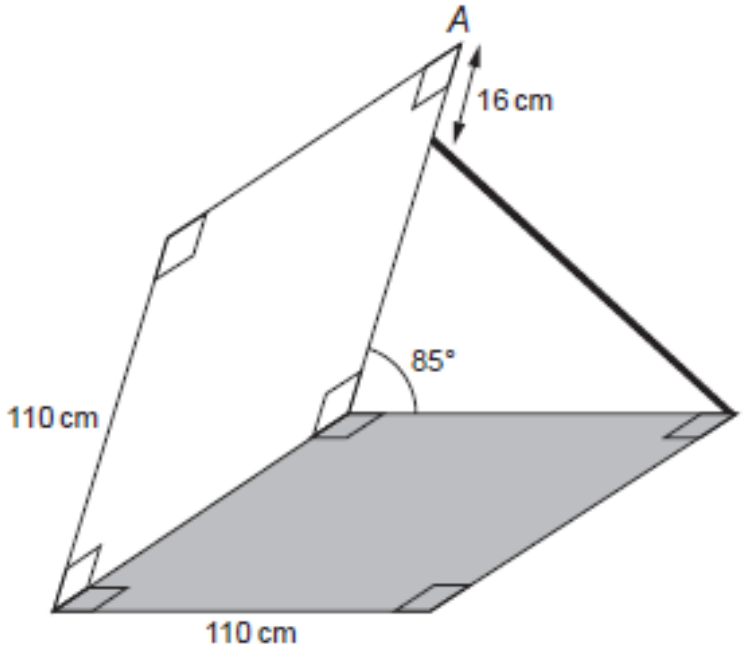

Diagram not drawn to scale

Calculate both the length of the rod and the angle the rod makes with the horizontal. [6]

Length of rod = ... cm

Angle the rod makes with the horizontal = ... °

A water trough has a uniform semi-circular cross-section with a radius of 30·9 cm.
It has a length of 600 cm.

Water has been poured into the trough.

The diagram below shows the cross-section of the trough.
The water level is shown by the line *AB*.

O is the centre of the semi-circle and $A\hat{O}B = 150°$.

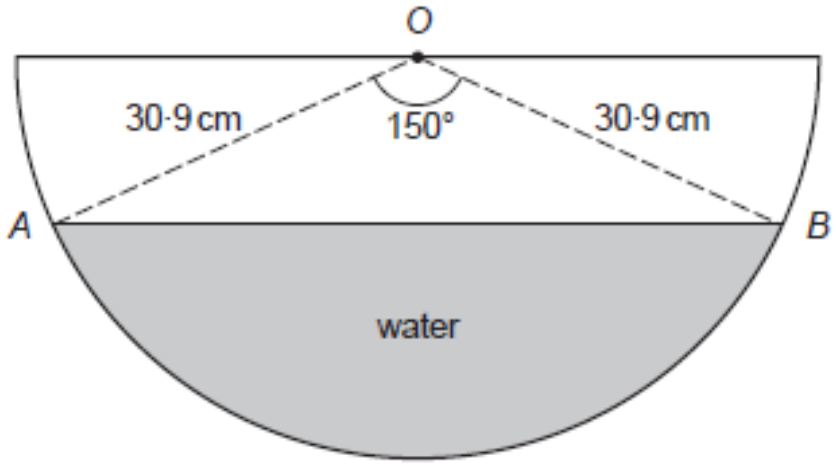

Diagram not drawn to scale

(a) Calculate the area of the triangle *AOB*. [2]

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(b) Calculate how many more litres of water can be poured into the trough before the trough is full. [7]

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Volume of water that can be added = _____ litres

The picture shows a solid concrete step.
The step:

- stands on horizontal ground,
- has all of its edges vertical or horizontal,
- has a uniform cross-section.

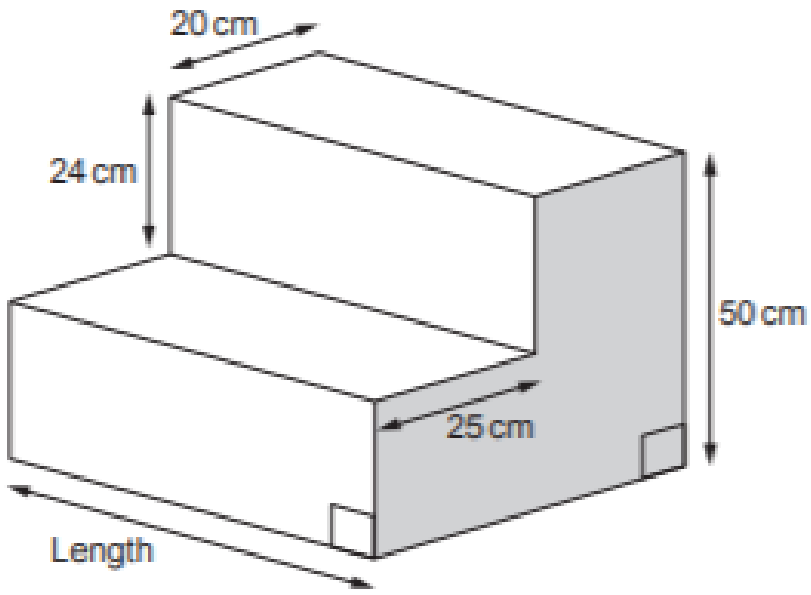

Diagram not drawn to scale

(b) The volume of concrete in the step is 66 000 cm^3.

(i) The concrete to make the step costs 39p per litre.

A builder charges a rate of £27 per hour.
Any fraction of an hour is charged as that fraction of his hourly rate.
(For example, half an hour is charged at half of £27.)

It takes him 1 hour 20 minutes to make the step.

There were no other costs.
Calculate the total cost of making the step. [3]

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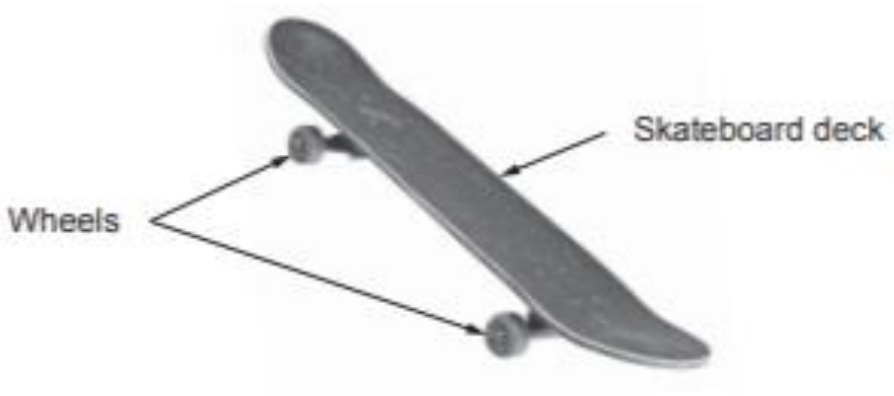
(ii) Calculate the length of the step.
Give your answer in cm.
You must show all your working. [5]

(b) A cylindrical mug has an inner radius of 4·3 cm and an inner height of 11·8 cm.

Tea is poured into the mug.
The level of the tea is 2 cm below the top of the mug.

Calculate the volume of the tea in the mug. [3]

Finbar's skateboard is shown below.



(a) The diameter of each wheel on Finbar's skateboard is 6·4 cm.
He uses his skateboard to go to visit his friend Sab.
Sab lives 2340 metres from Finbar.

(i) *In this part of the question, you will be assessed on the quality of your organisation, communication and accuracy in writing.*

When Finbar visits Sab, how many times will each wheel on Finbar's skateboard rotate? [4 + 2 OCW]

(ii) What assumption did you make in answering *(a)*(i)? [1]

Robyn has 5 planks of wood each of length 2 m and width 10 cm.

Diagram not drawn to scale

She lays the 5 planks horizontally on the floor. She leaves a **15 cm gap** between each plank, as shown below.

Diagram not drawn to scale

Robyn is planning to make a gate. She uses these 5 planks and one other plank that is to be placed diagonally, as shown below.

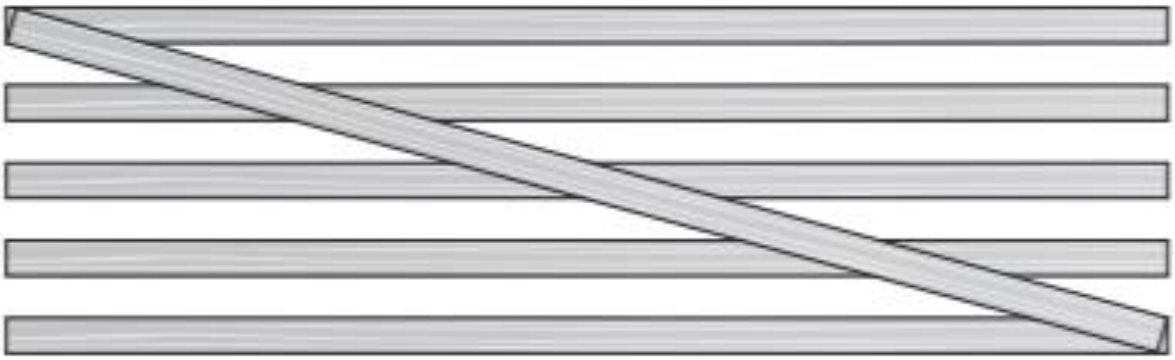


Diagram not drawn to scale

(a) (i) Calculate an estimate of the length of the plank that is to be placed diagonally. Give your answer in metres. [4]

Llinos walks to the summit of Snowdon, passing the lake called Llyn Glaslyn.
Her height above sea level increases by 485 m from Llyn Glaslyn to the summit.

From the summit, she sees two small boats on Llyn Glaslyn.
Both boats are in the same direction from the summit.
The angles of depression of the two boats are 41° and 27°, as shown in the diagram.

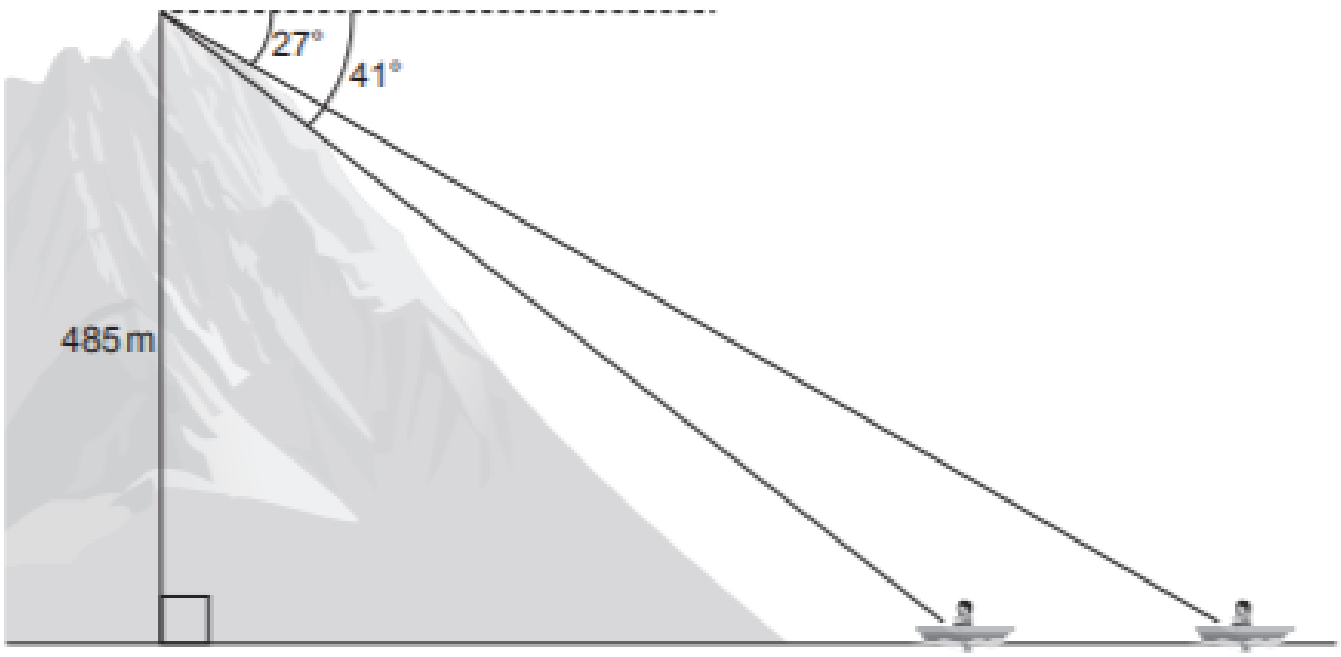
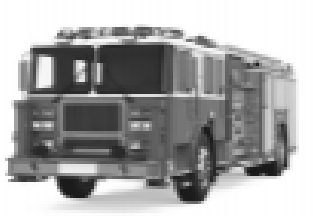


Diagram not drawn to scale

Calculate the distance between the boats. [5]

Gary and Carys are fire officers.

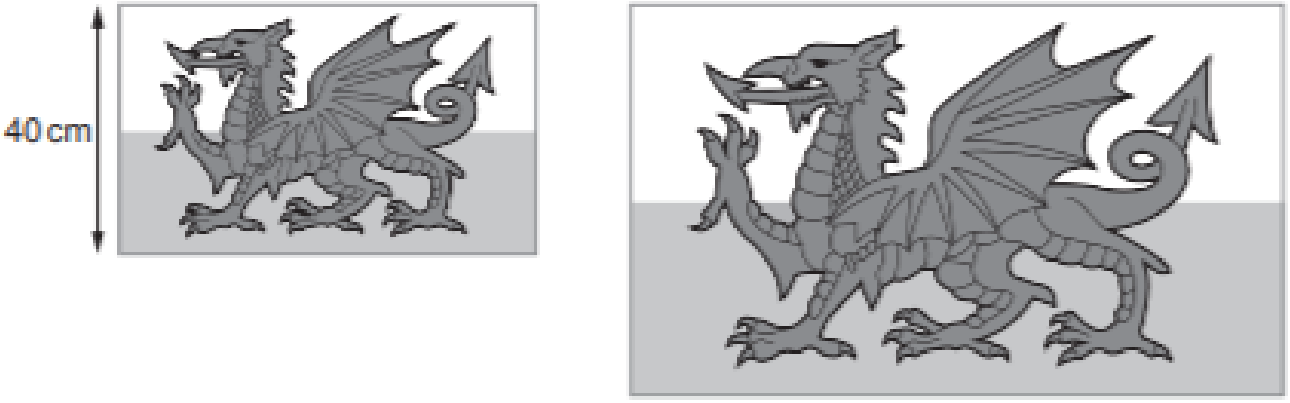
Last week, they recorded that 5 engines were able to pump 26 000 gallons of water onto a fire in 3 minutes.



(a) Show that 9 engines would be able to pump 143 000 gallons of water in under 9 minutes 15 seconds. [4]

(b) Give one possible reason why the 9 engines **may not** be able to pump 143 000 gallons of water in under 9 minutes 15 seconds. [1]

A company makes Welsh flags in mathematically similar sizes.
Two of their similar flags are shown.



Diagrams not drawn to scale

The area of the larger flag is 96% greater than the area of the smaller flag.
The height of the smaller flag is 40 cm.

Calculate the height of the larger flag. [4]

Two farmers have bought some farmland between them.
The farmland is in the shape of a quadrilateral *ABCD*, as shown below.

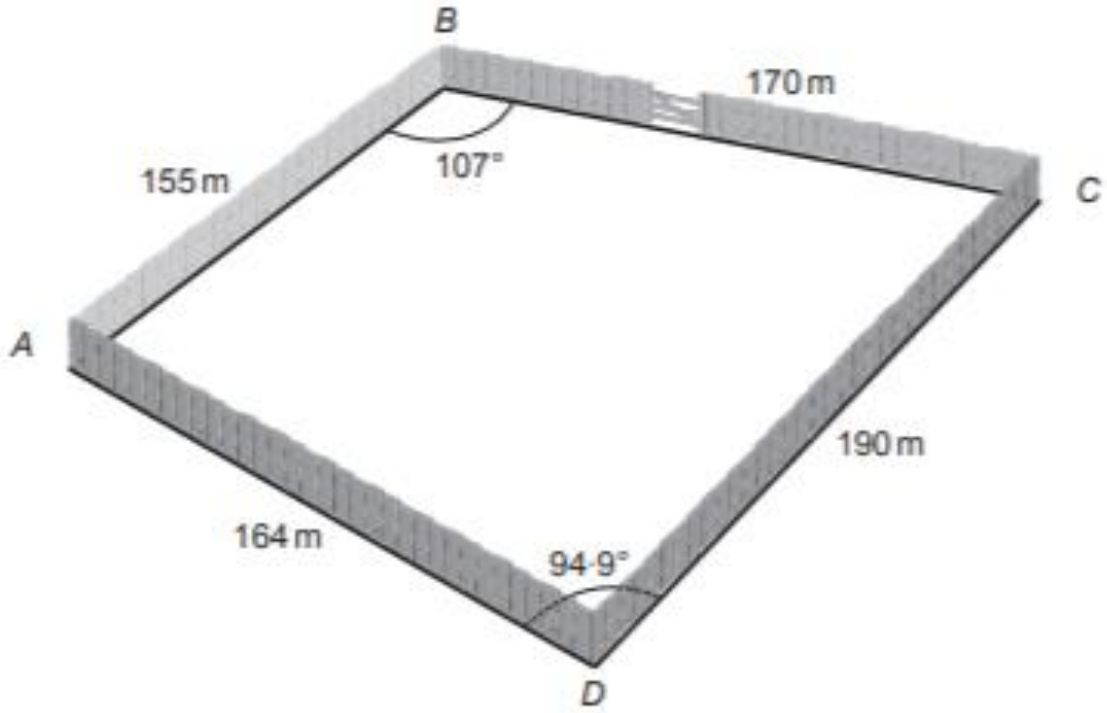


Diagram not drawn to scale

The farmers want to divide the farmland equally by building a straight fence.

(a) One of the farmers has suggested building the fence from *A* to *C*.
Show that this does not divide the farmland equally. [3]

(b) To divide the land equally, the fence is built from A to F where $CF = 17{\cdot}9\,\text{m}$.
To construct the fence, posts are placed at A and F.
Other posts are then located along AF, so that the posts are no more than 3 m apart.

Calculate the smallest number of posts needed, including the posts at A and F. [5]

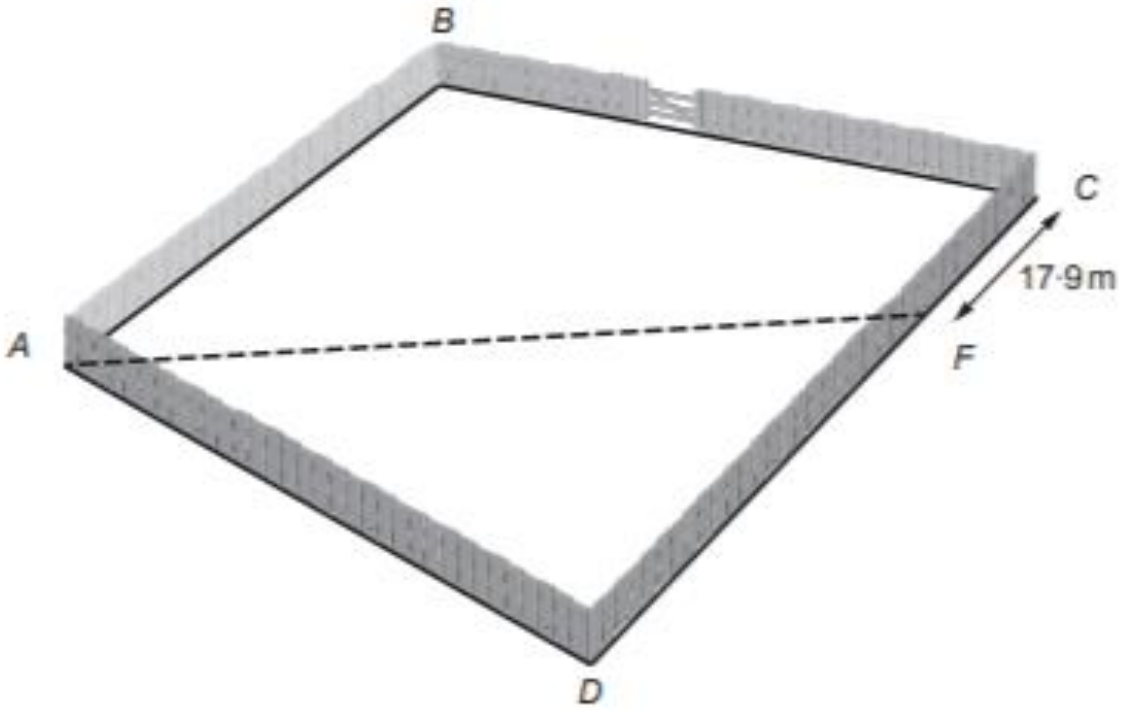


Diagram not drawn to scale

WALES V IRELAND

Wales are to play Ireland in an international rugby match.

The rugby pitch at the stadium is measured.
On the diagram below, each measurement is given **correct to the nearest 10 centimetres**.

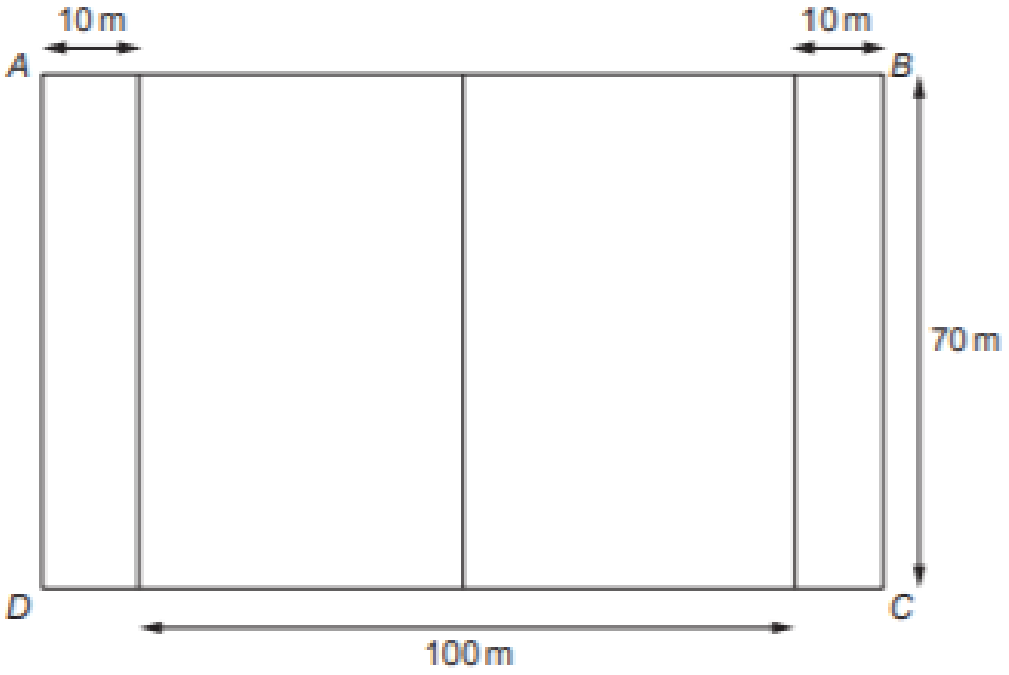


Diagram not drawn to scale

What is the least possible length of *AB*?
Give your answer in metres.
You must show all your working. [3]

(a) (i) The internal measurements of a tin of baked beans are:

- radius 3·6 cm,
- height 9·3 cm.

Calculate the internal volume of the tin. [2]

(ii) Every 1 cm^3 of baked beans in a tin has a mass of 1 g.

A portion of baked beans is $\frac{1}{2}$ a tin.

What is the mass of a portion of baked beans? [1]

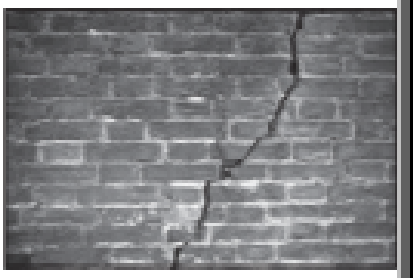
A portion of baked beans has a mass of ..... g

(b) A mathematically similar tin of baked beans has a radius of 4·2 cm.

Diagram not drawn to scale

Calculate the height of the larger tin of beans. [2]

Mr Jakob notices a crack in a vertical wall which stands on horizontal ground.



(a) Mr Jakob fixes two temporary supports against the wall, as shown in the diagram below.

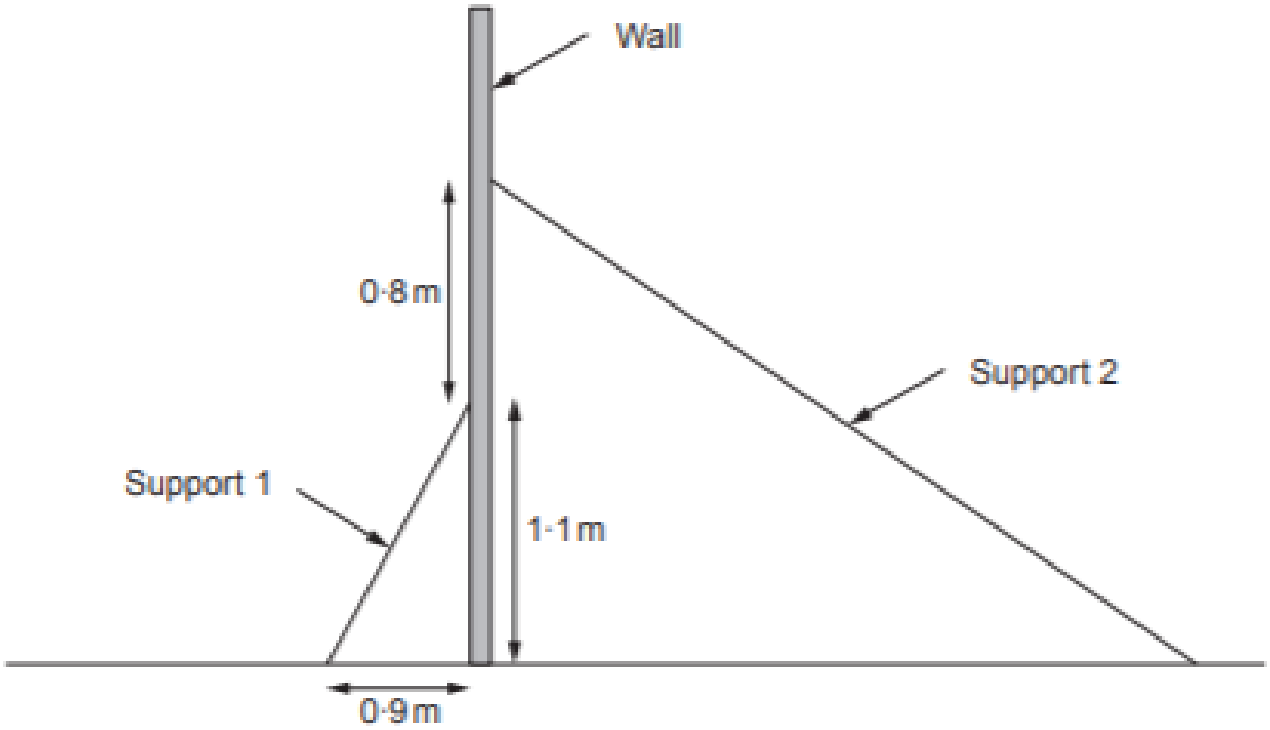


Diagram not drawn to scale

(i) Calculate the length of Support 1. [3]

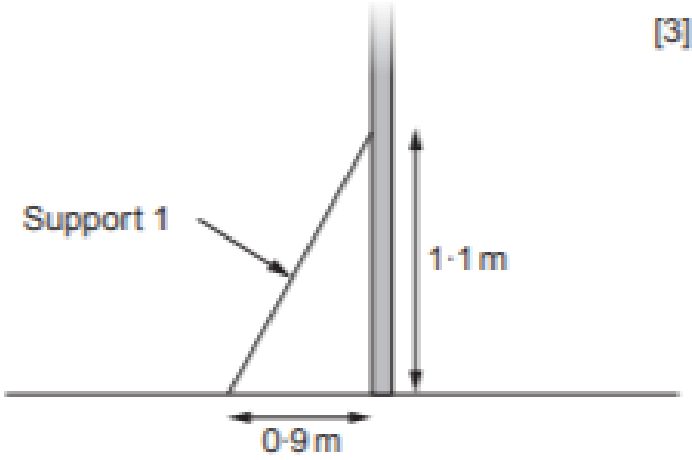
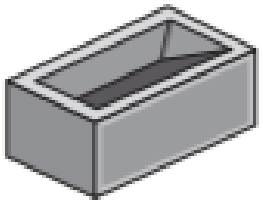


Diagram not drawn to scale

(ii) The length of Support 2 is 2·6 m.
Calculate the angle between the horizontal ground and Support 2. [3]

(b) Mr Jakob gets a quote of £516 for rebuilding his wall.



The quote includes:

- 8 hours' labour costs at £22.50 per hour,
- a 20% discount off the cost of the bricks.

Calculate the cost of the bricks before the discount. [3]

A company makes buckets in two sizes. Both sizes are in the shape of a frustum of a cone. Bucket A has the dimensions shown in the diagram below.

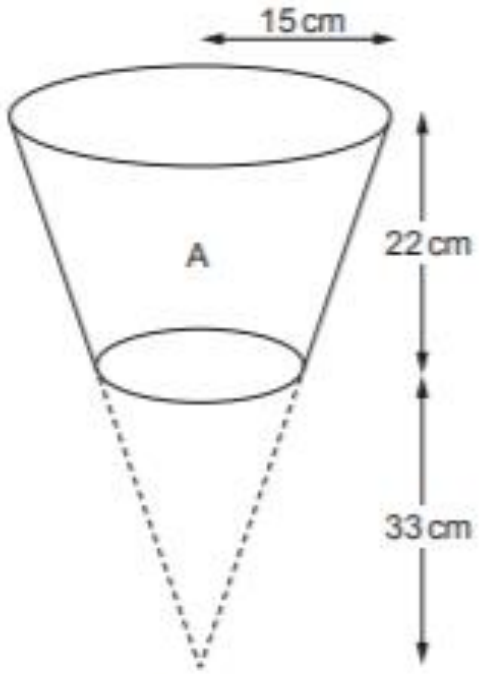


Diagram not drawn to scale

(a) Show that:

- the radius of the base of the bucket is 9 cm,
- the volume of the bucket is $3234\pi\,\text{cm}^3$. [5]

(b) Bucket B is shown below. It is mathematically similar to Bucket A.

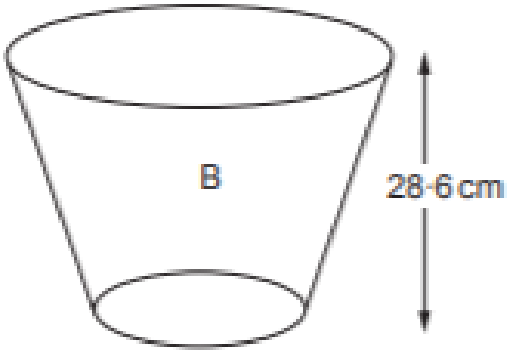


Diagram not drawn to scale

Calculate the number of **gallons** Bucket B can hold when full. [6]

Remember:
1 gallon = 8 pints

Alpha, *Beta* and *Gamma* are three boats.
They receive a weather warning and need to go to the port of Aberwyn.

The following diagram shows the positions of the three boats when the weather warning is received.

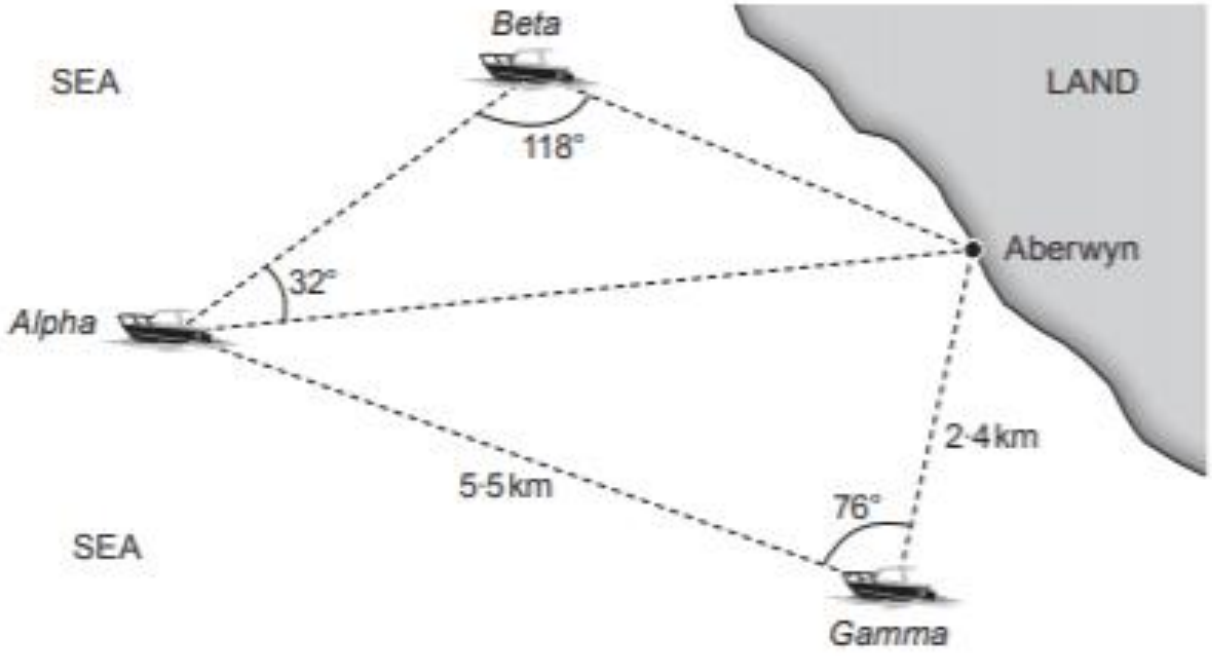


Diagram not drawn to scale

The captains of *Alpha* and *Beta* need to know their distances from Aberwyn in order to find how long it will take them to get to the port.

Calculate the distance of each of the boats *Alpha* and *Beta* from Aberwyn. [7]

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

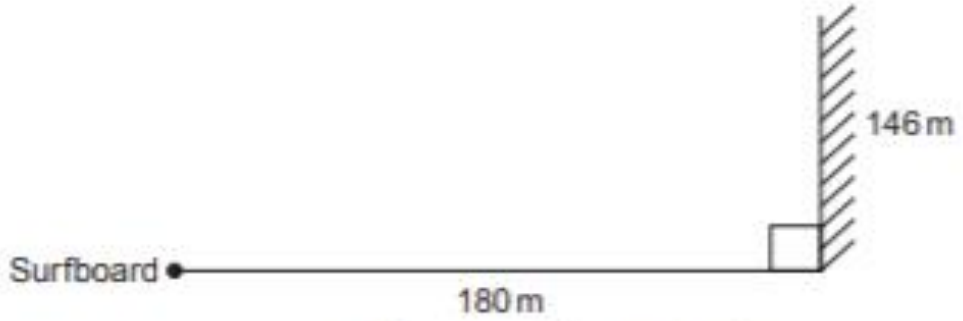


Diagram not drawn to scale

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]

Marta buys a new television.

(a) Marta wants to fit the television in a bookcase on the wall.
In the shop she forgot to write down the length of the television.
She did write down the height and the diagonal of the screen.

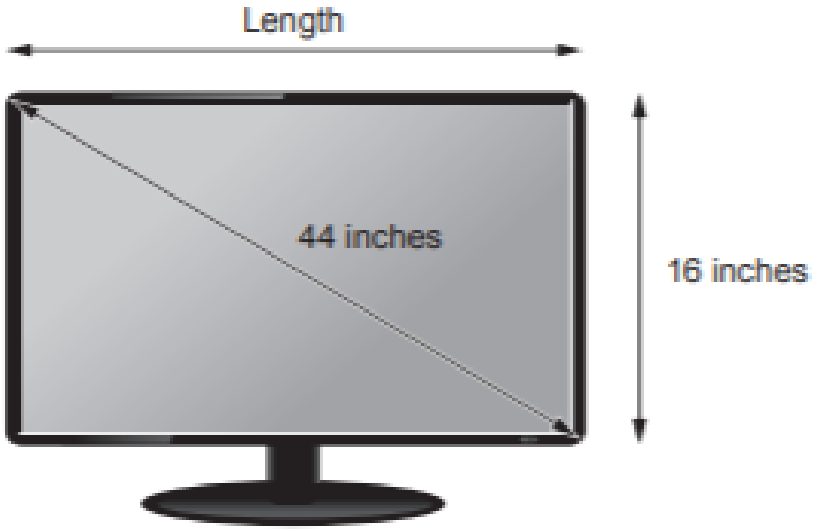


Diagram not drawn to scale

Marta needs to know the length of the screen before she opens the box, in case she wants to return the television.
Calculate the length of the screen.
Give your answer correct to 2 significant figures. [4]

Length is ..... inches, correct to 2 significant figures.

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

Elin's old fish tank is leaking.

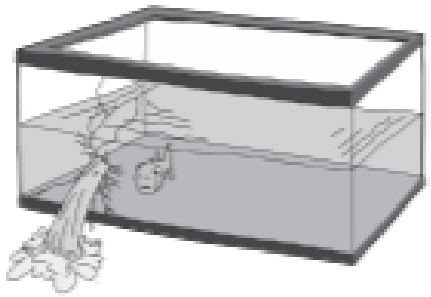


Diagram not drawn to scale

This old fish tank is in the shape of a cuboid.
The base of this tank measures 60 cm by 40 cm.
Before the leak, the height of the water level in Elin's old fish tank was 45 cm.

Elin decides to replace her fish tank with a cylindrical one.

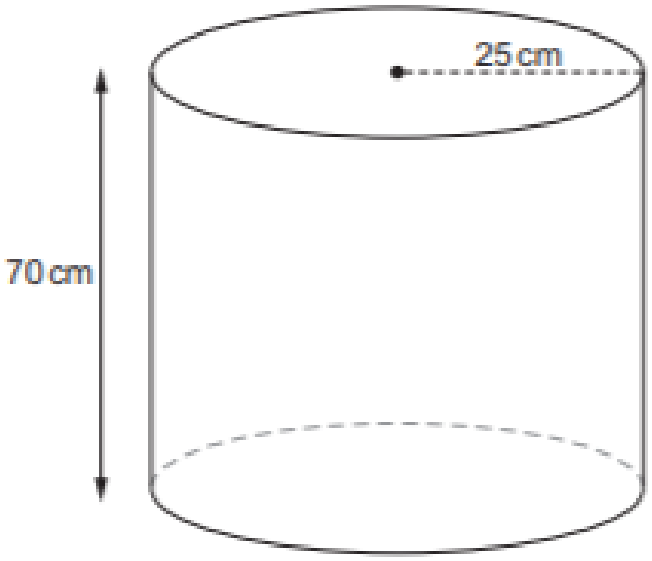


Diagram not drawn to scale

She selects a new cylindrical fish tank that has a radius of 25 cm and a height of 70 cm.

Will all the original contents, including the water and the fish, fit into this cylindrical tank?
You must show all your working. [4 + 2 OCW]

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The diagram below shows where Levi wants to attach a string of lights to his house.

Levi wants to attach a single string of lights from *B* to *A* and then from *A* to *C*.
The diagram below shows the measurements Levi has taken.

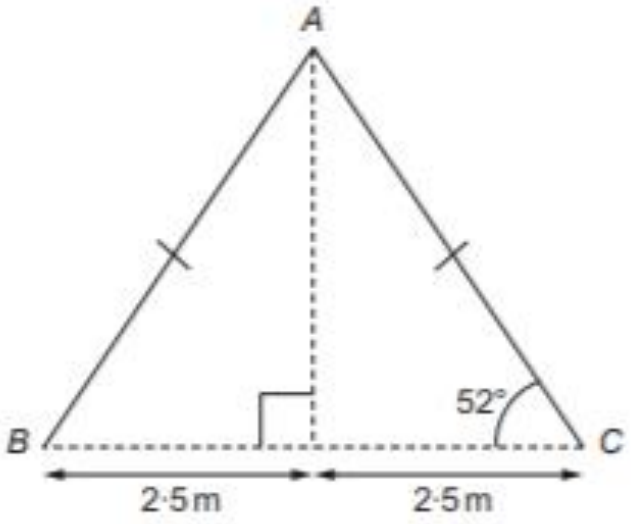

Diagram not drawn to scale

He spends £410 at the electrical store buying a string of lights.
After putting up the lights, Levi finds he has 6 metres of the string of lights left over at one end.

How much did the electrical store charge Levi, per metre, for the string of lights? [6]

A company produces metal badges to be worn by its employees.
The badge is made up of two parts.
One part is in the shape of a sector of a circle as shown in the diagram.

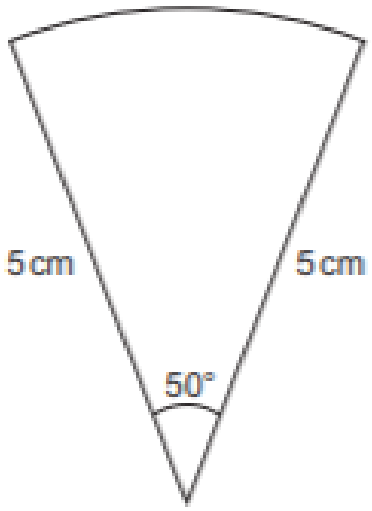

Diagram not drawn to scale

(a) The perimeter of the sector is decorated with a coloured edging strip.
Calculate the length of edging strip needed to decorate the sector. [3]

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(b) The other part is in the shape of a quarter-circle of radius 3 cm.

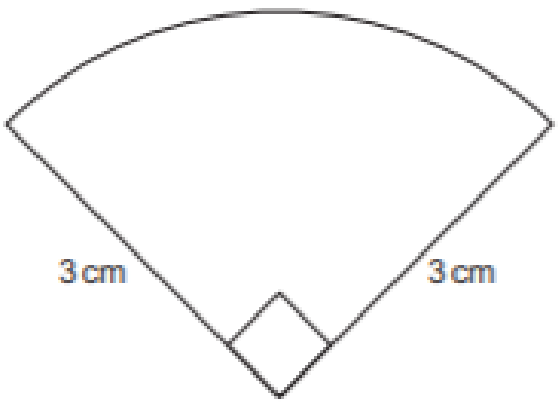

Diagram not drawn to scale

To make the badge, the two pieces are joined together with the sector in front of the quarter-circle, as shown in the diagram.
The badge has a vertical line of symmetry.

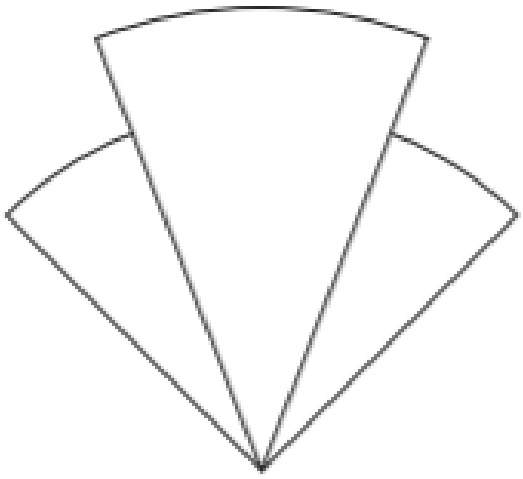

Diagram not drawn to scale

The visible surface of the front of the badge is painted.
Calculate the area that is painted. [5]

A plan view of Lowri's garden is shown below.

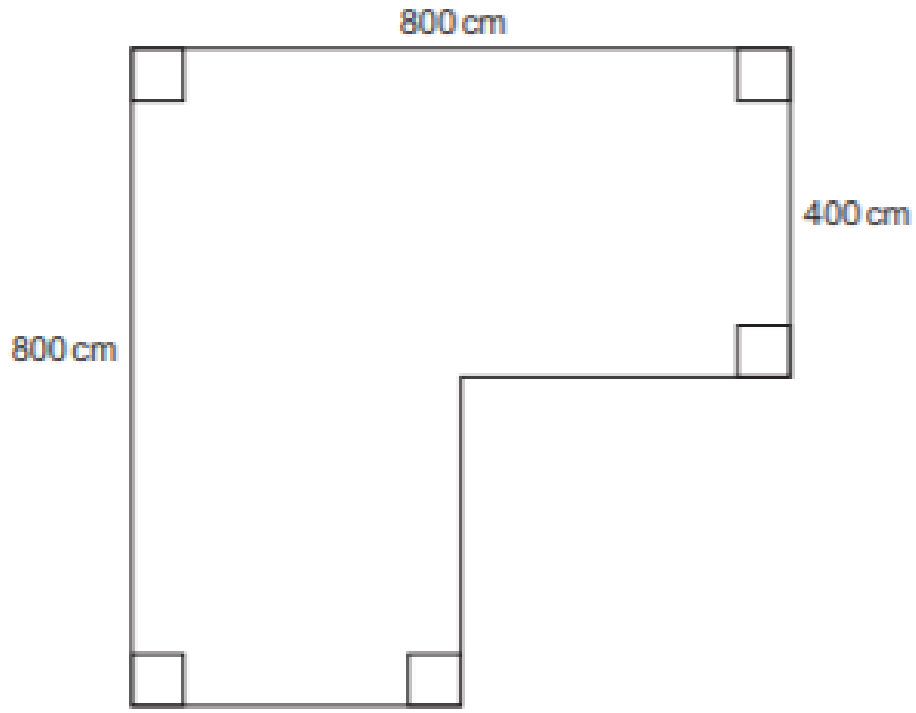

Diagram not drawn to scale

All the measurements are correct to the nearest 10 cm.

(a) Calculate the greatest possible area of Lowri's garden. [4]

(b) Lowri plans to spread grass seed over her garden using a spreading tool.
Over **each square metre**, the spreading tool spreads 30 g of grass seed, correct to the nearest 5 g.

Lowri has exactly 1·5 kg of grass seed.
Can she be **certain** that she has enough grass seed?
You must show all your calculations. [3]

The front views of two mathematically similar milk cartons are shown below.

Diagram not drawn to scale

(a) Circle either TRUE or FALSE for each statement given below. [1]

STATEMENT		
The ratio of the lengths of the cartons is the same as the ratio of the heights of the cartons.	TRUE	FALSE
The ratio of the volumes of the cartons is the same as the ratio of the heights of the cartons.	TRUE	FALSE

(b) It is claimed that the larger carton contains double the amount of milk contained in the smaller carton.
Show that this claim is not true.
Explain your answer. [3]

(c) Another similar milk carton has a label with an area that is one quarter of the area of the label on the carton of height 24 cm.

Diagram not drawn to scale

Calculate the height of this new carton. [3]

The diagram shows a 5 m wide section of road that has a uniform gradient.
The shaded area represents level ground.
Two cyclists, Delyth and Ioan, approach this section of road.

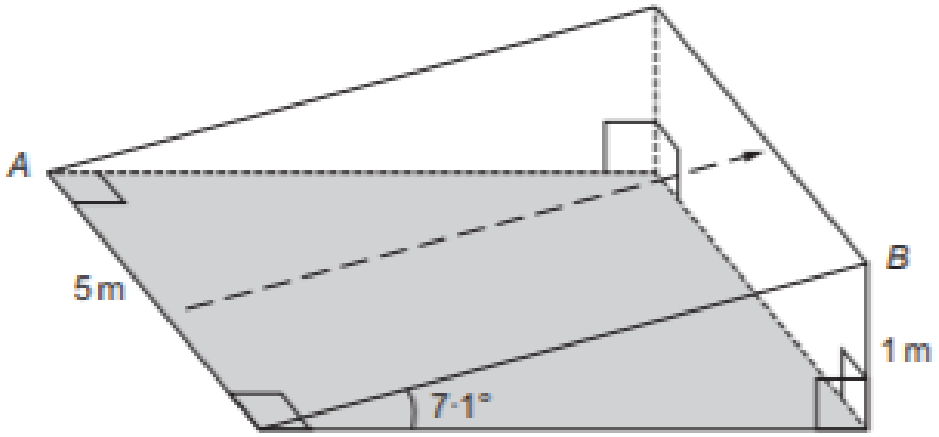

Diagram not drawn to scale

Delyth cycles straight up the middle of the road as shown by the arrow.
Ioan thinks this section of road is too steep to cycle straight up, so he decides to cycle from *A* to *B* in a straight line.

(a) How far does Ioan cycle in going from *A* to *B*? [6]

(b) Show that Ioan's route up this section of road is less steep than Delyth's route.
You must show all your working. [3]

(b) The Headteacher decides to place signs around the school site to stop pupils using their bikes on grassed areas.

He introduces a new sign to pupils in the school newsletter.
The size of the sign in the newsletter is shown below.

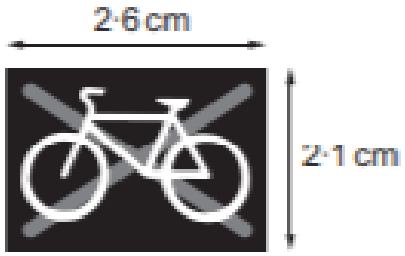

Diagram not drawn to scale

A mathematically similar new sign is placed near the side of the playing field.

Diagram not drawn to scale

It is 33·6 cm high.
How wide is this sign? [2]

Width is _____ cm

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.

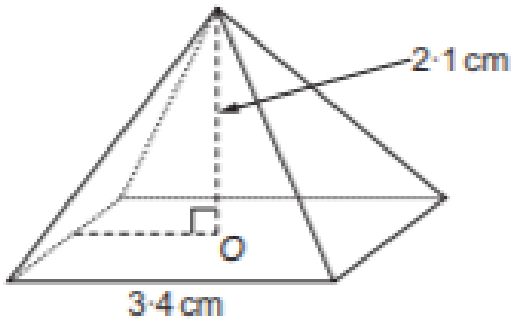

Diagram not drawn to scale

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

(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]