

Centre Number						Candidate Number				
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Other Names										
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For Examiner's Use	
Examiner's Initials	
Pages	Mark
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24	
TOTAL	



General Certificate of Secondary Education
Higher Tier
June 2013

Applications of Mathematics 93702H (Linked Pair Pilot)

Unit 2 Geometry and Measures

H

Friday 14 June 2013 9.00 am to 10.30 am

For this paper you must have:

- a calculator
- mathematical instruments.



Time allowed

- 1 hour 30 minutes

Instructions

- Use black ink or black ball-point pen. Draw diagrams in pencil.
- Fill in the boxes at the top of this page.
- Answer **all** questions.
- You must answer the questions in the spaces provided. Do not write outside the box around each page or on blank pages.
- Do all rough work in this book. Cross through any work that you do not want to be marked.
- If your calculator does not have a π button, take the value of π to be 3.14 unless another value is given in the question.

Information

- The marks for questions are shown in brackets.
- The maximum mark for this paper is 80.
- The quality of your written communication is specifically assessed in Questions 2, 3 and 6.
These questions are indicated with an asterisk (*).
- You may ask for more answer paper, graph paper and tracing paper.
These must be tagged securely to this answer book.
- You are expected to use a calculator where appropriate.

Advice

- In all calculations, show clearly how you work out your answer.



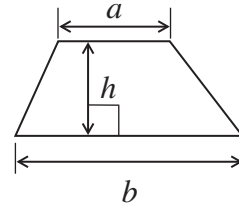
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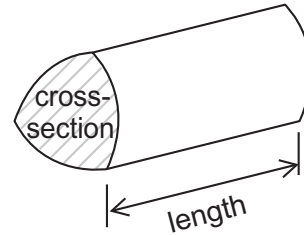
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Formulae Sheet: Higher Tier

Area of trapezium = $\frac{1}{2}(a+b)h$

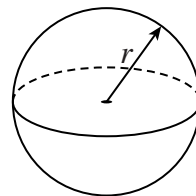


Volume of prism = area of cross-section \times length



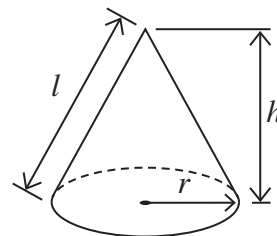
Volume of sphere = $\frac{4}{3}\pi r^3$

Surface area of sphere = $4\pi r^2$



Volume of cone = $\frac{1}{3}\pi r^2 h$

Curved surface area of cone = $\pi r l$

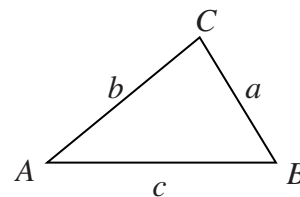


In any triangle ABC

Area of triangle = $\frac{1}{2}ab \sin C$

Sine rule $\frac{a}{\sin A} = \frac{b}{\sin B} = \frac{c}{\sin C}$

Cosine rule $a^2 = b^2 + c^2 - 2bc \cos A$



The Quadratic Equation

The solutions of $ax^2 + bx + c = 0$, where $a \neq 0$, are given by

$$x = \frac{-b \pm \sqrt{b^2 - 4ac}}{2a}$$



Answer **all** questions in the spaces provided.

1

Ingredients for biscuits

- 60 g of sugar
- 120 g of butter
- 180 g of flour



With these ingredients I can make
40 small biscuits
or
20 large biscuits.

Tony

Tony wants to make 20 small biscuits **and** 15 large biscuits.

Work out how much of each ingredient he needs.
You **must** show your working.

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Sugar g

Butter g

Flour g

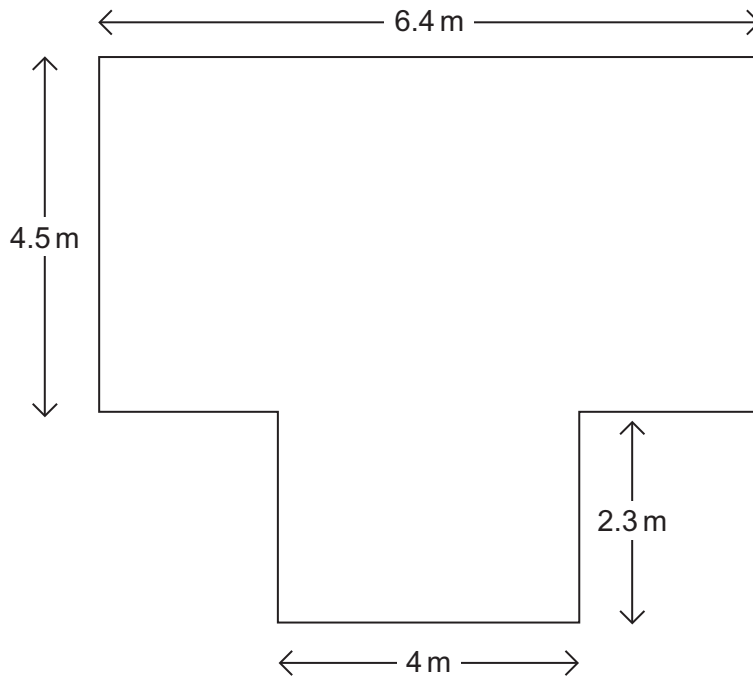
(4 marks)

4

Turn over ►



2 This diagram shows Adam's garden.
It is in the shape of two rectangles joined together.



Not drawn
accurately

2 (a) Work out the area of the garden.

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Answer m² (2 marks)



2 (b) Adam makes a flower bed.
It is a circle of radius 1.7 m.

Work out the area of the flower bed.

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Answer m² (2 marks)

***2 (c)** Adam says,
“The area of the flower bed is less than 25% of the area of the garden.”

Is he correct?
You **must** show your working.

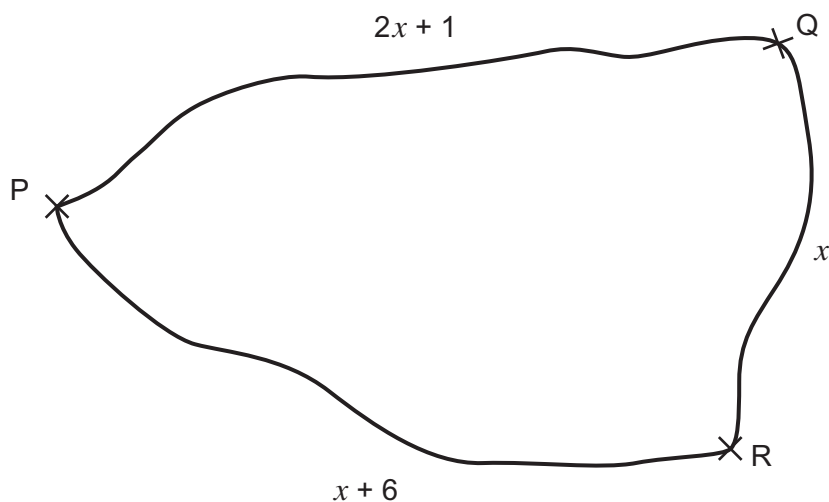
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(3 marks)

Turn over for the next question



- 3** Roads connect three villages P, Q and R.
An expression for the distance, in miles, along each road is shown.



Not drawn
accurately

Lucy cycles along all three roads.
The total distance is 21 miles.

- *3 (a)** Set up and solve an equation to find the value of x .

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$x =$ (4 marks)

- 3 (b)** Work out the distance along the longest road.

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Answer miles (1 mark)

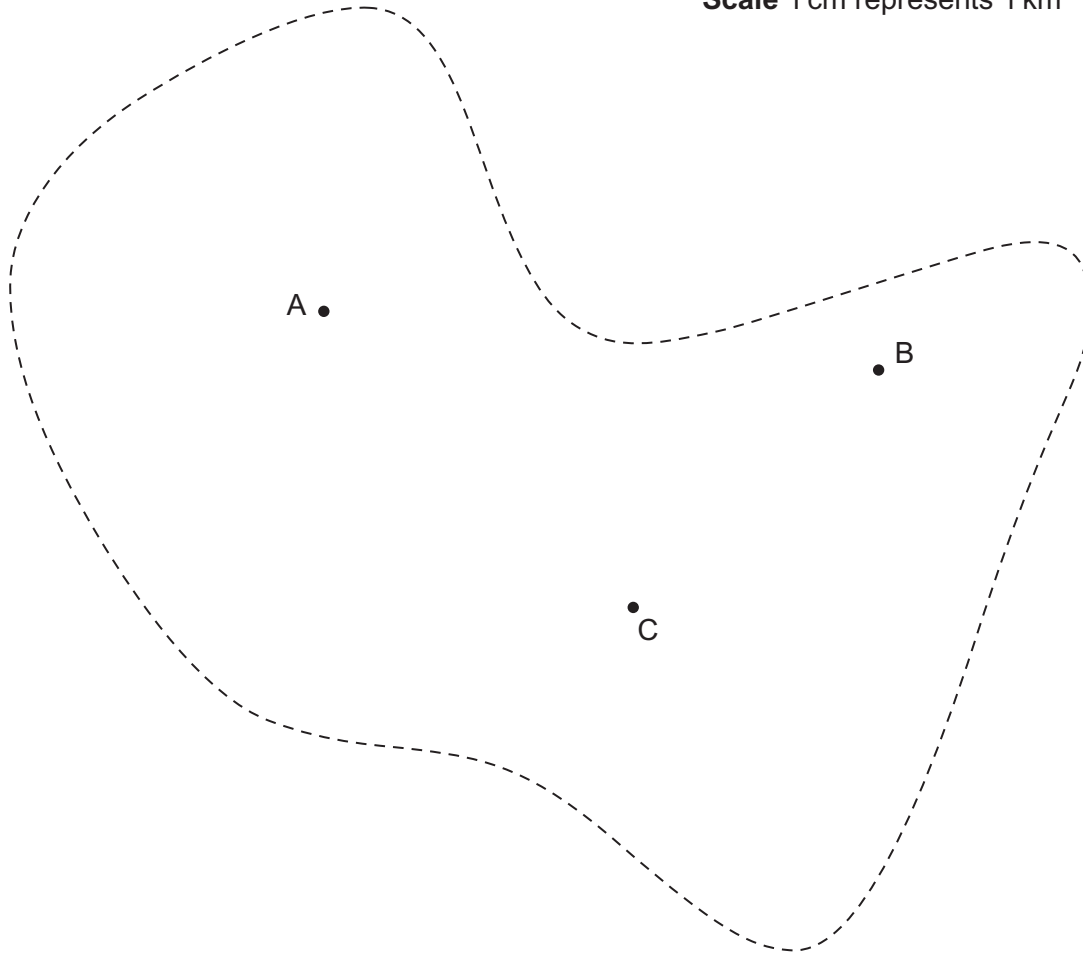


4

You need compasses to answer this question.

The scale drawing shows the positions of three mobile phone masts A, B and C. The masts provide mobile phone coverage in a town. The town border is shown by the dotted line on the diagram.

Scale 1 cm represents 1 km



Places in the town have mobile phone coverage if they are

less than 4.5 km from A

or

less than 3.5 km from B

or

less than 3 km from C.

Shade the area in the town that does **not** have mobile phone coverage.

(4 marks)

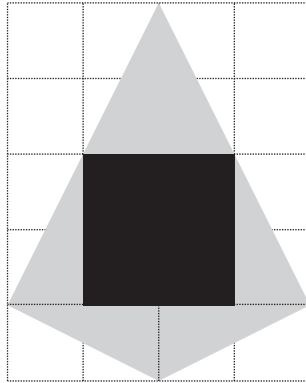
9

Turn over ►



- 5 Sally makes **one** earring using
 1 gold square
 4 small silver triangles
 1 large silver triangle.

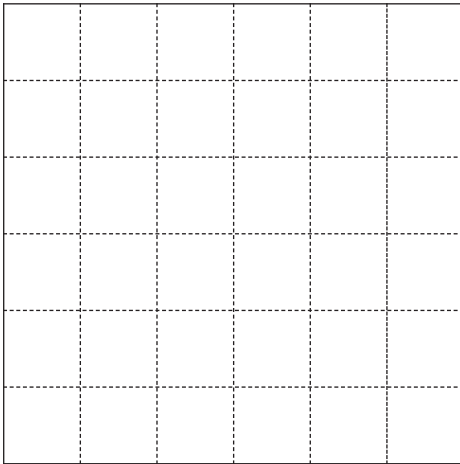
A diagram of one of the earrings is shown on the centimetre grid.



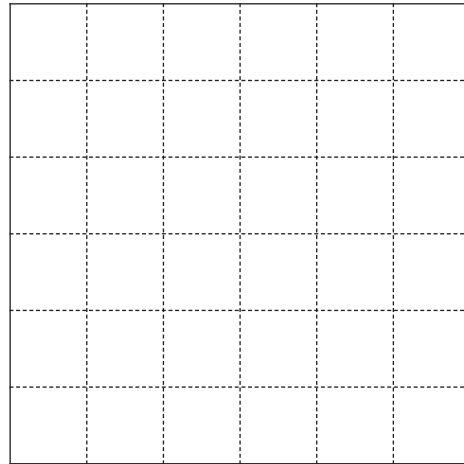
■ Silver
 ■ Gold

- 5 (a) She cuts the shapes from these two sheets.

Gold



Silver



How many earrings can she make from the two sheets?
 You **must** show your working on the grids above.

Answer (4 marks)



5 (b) Each square centimetre of gold costs £ 14
Each square centimetre of silver costs £ 2.50

Work out the total cost of the gold and silver in **one** earring.

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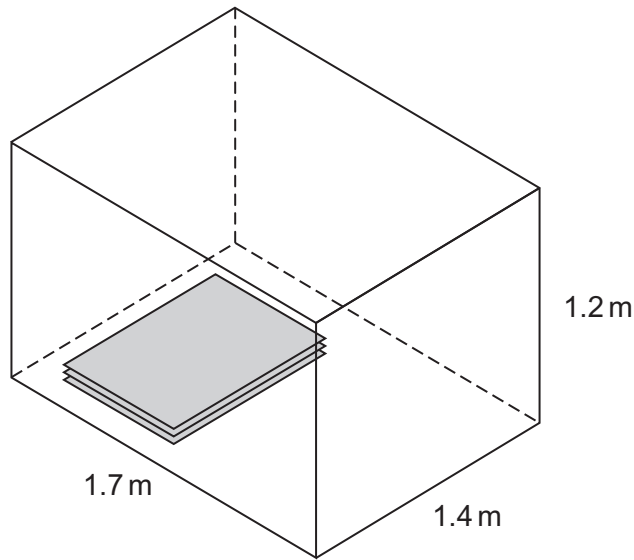
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£ (3 marks)

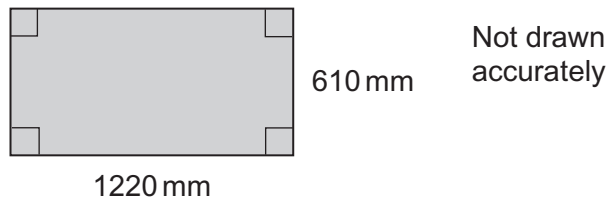
Turn over for the next question



*6 The loading space in a van is in the shape of a cuboid.
Sheets of wood are loaded in the van.
The sheets are stacked **flat** as shown.



Each sheet of wood has length 1220 mm and width 610 mm.



The thickness of each sheet is 3 mm.

Can 750 sheets be loaded in the van?
You **must** show your working.

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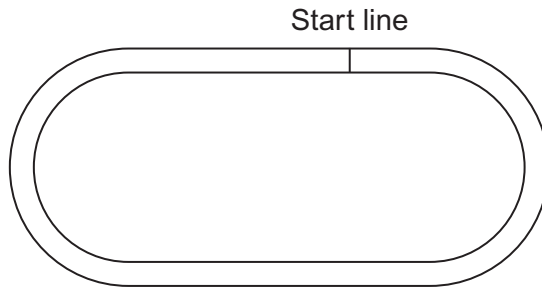
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(4 marks)



7 Chris and Becky cycle around a 200 metre track in the same direction.



Not drawn
accurately

7 (a) Chris cycles at a steady speed of 10 metres per second.
Show that he takes 20 seconds to go **once** around the track.

..... (1 mark)

7 (b) Becky also cycles at a steady speed.
It takes her 25 seconds to go **once** around the track.

She leaves the start line at the same time as Chris.

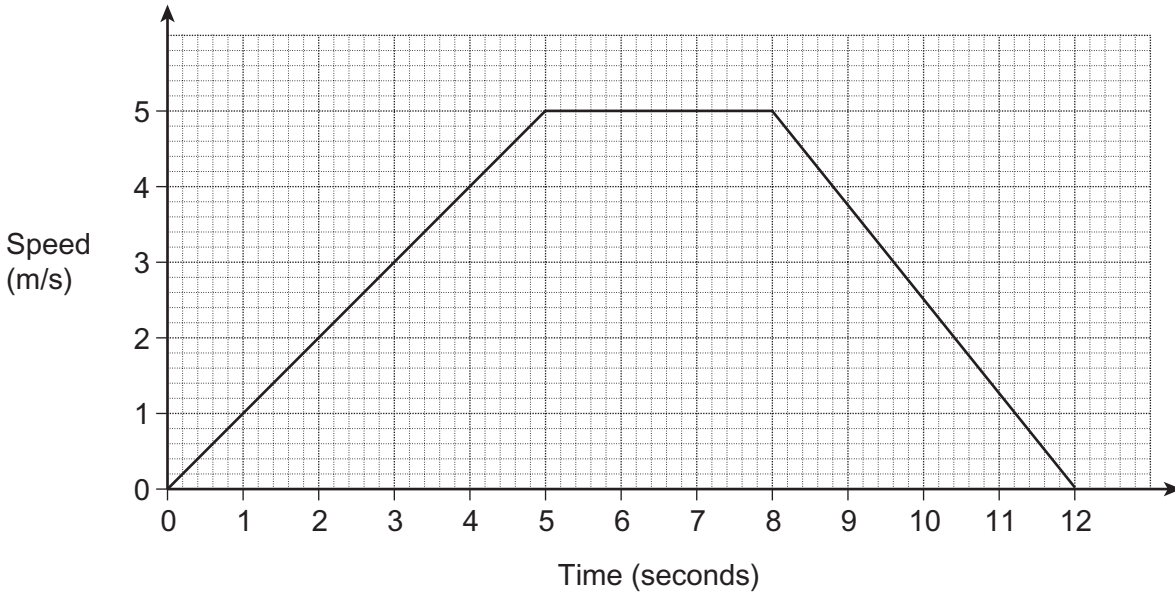
How far has Becky cycled when they are next at the start line together?

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Answer metres (3 marks)



8 Meera runs for 12 seconds.
Her speed, in metres per second, is shown on the graph.



8 (a) For how many seconds does she run at a constant speed?

Answer seconds (1 mark)

8 (b) Work out the total distance she runs.

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Answer metres (3 marks)



8 (c) Work out the gradient of the graph during the first 5 seconds.

Answer m/s^2 (1 mark)

8 (d) What does the gradient in part (c) represent?

Circle your answer.

time

speed

distance

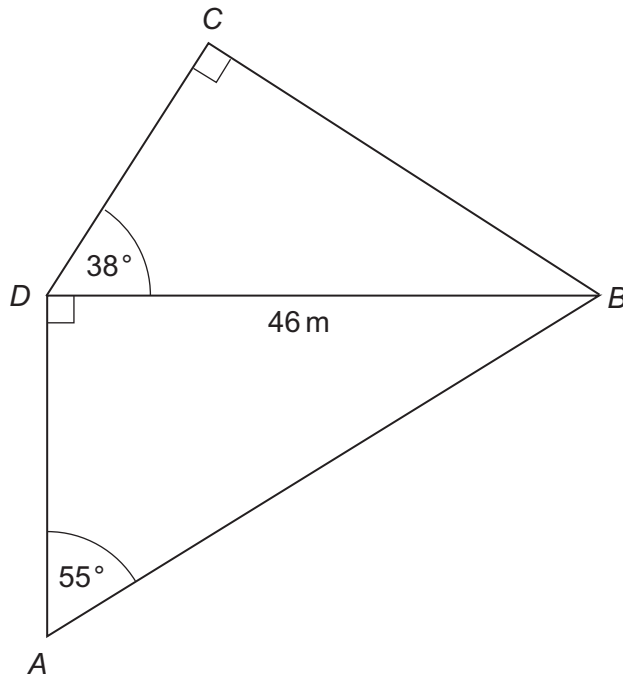
acceleration

(1 mark)

Turn over for the next question



9 The diagram shows five straight paths.



Not drawn
accurately

Harry walks along paths AD and DC.

Work out the total distance he walks.

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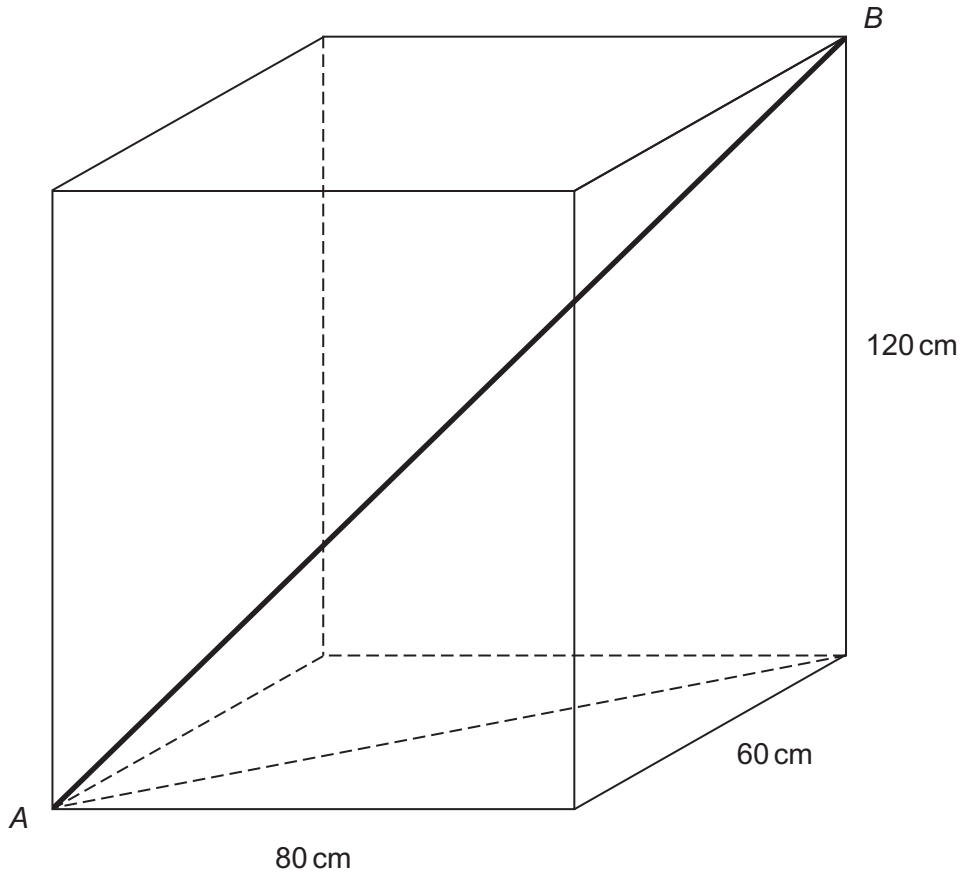
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Answer m (6 marks)



10

A cupboard is in the shape of a cuboid.
A pool cue will just fit in the cupboard if it is placed diagonally as shown.



Work out the length of the pool cue, marked AB on the diagram.

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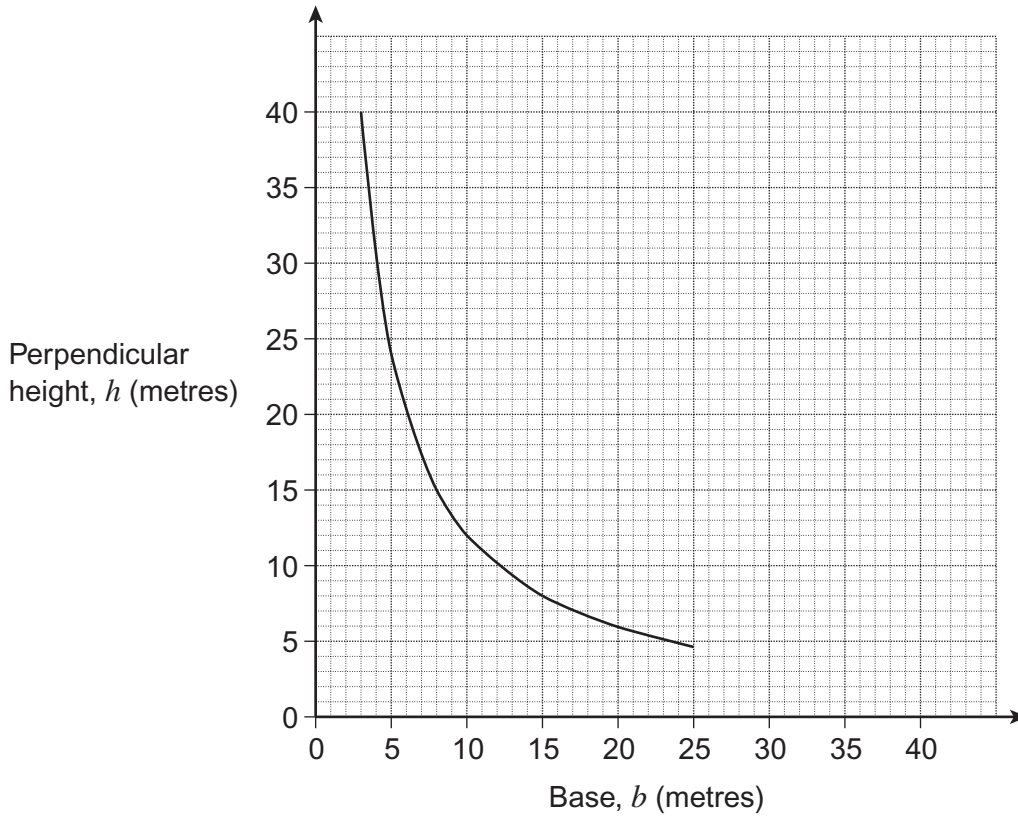
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Answer cm (3 marks)



- 11 A farmer wants to make a **triangular** enclosure of area 60 m^2 .

This graph shows the relationship between the base, b (metres), and the perpendicular height, h (metres), of the triangle.



11 (a) Explain how the graph shows that the area of the triangle is 60 m².

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(2 marks)

11 (b) Complete the graph for values of *b* up to 40.

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(2 marks)

11 (c) The farmer decides to make the base twice as long as the perpendicular height.

11 (c) (i) Plot these points on the graph opposite and join them with a straight line.

<i>b</i>	0	20	40
<i>h</i>	0	10	20

(1 mark)

11 (c) (ii) Use your line to write down approximate values for the base and perpendicular height that the farmer will use.

Base m

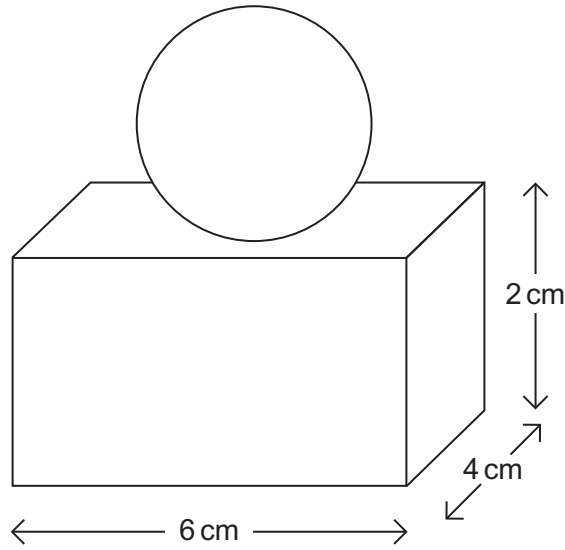
Perpendicular height m (2 marks)

7

Turn over ►



12 Alex has a solid paperweight made from a cuboid and a sphere as shown.



The diameter of the sphere is 3 cm.

12 (a) Show that the volume of the paperweight is 62.1 cm^3 to 3 significant figures.

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(4 marks)



12 (b) Alex thinks the paperweight is made of lead.
He knows that

- the mass of the paperweight is 540 grams
- the density of lead is 11.3 grams per cm³.

Is the paperweight made of lead?
You **must** show your working.

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(3 marks)

Turn over for the next question

7

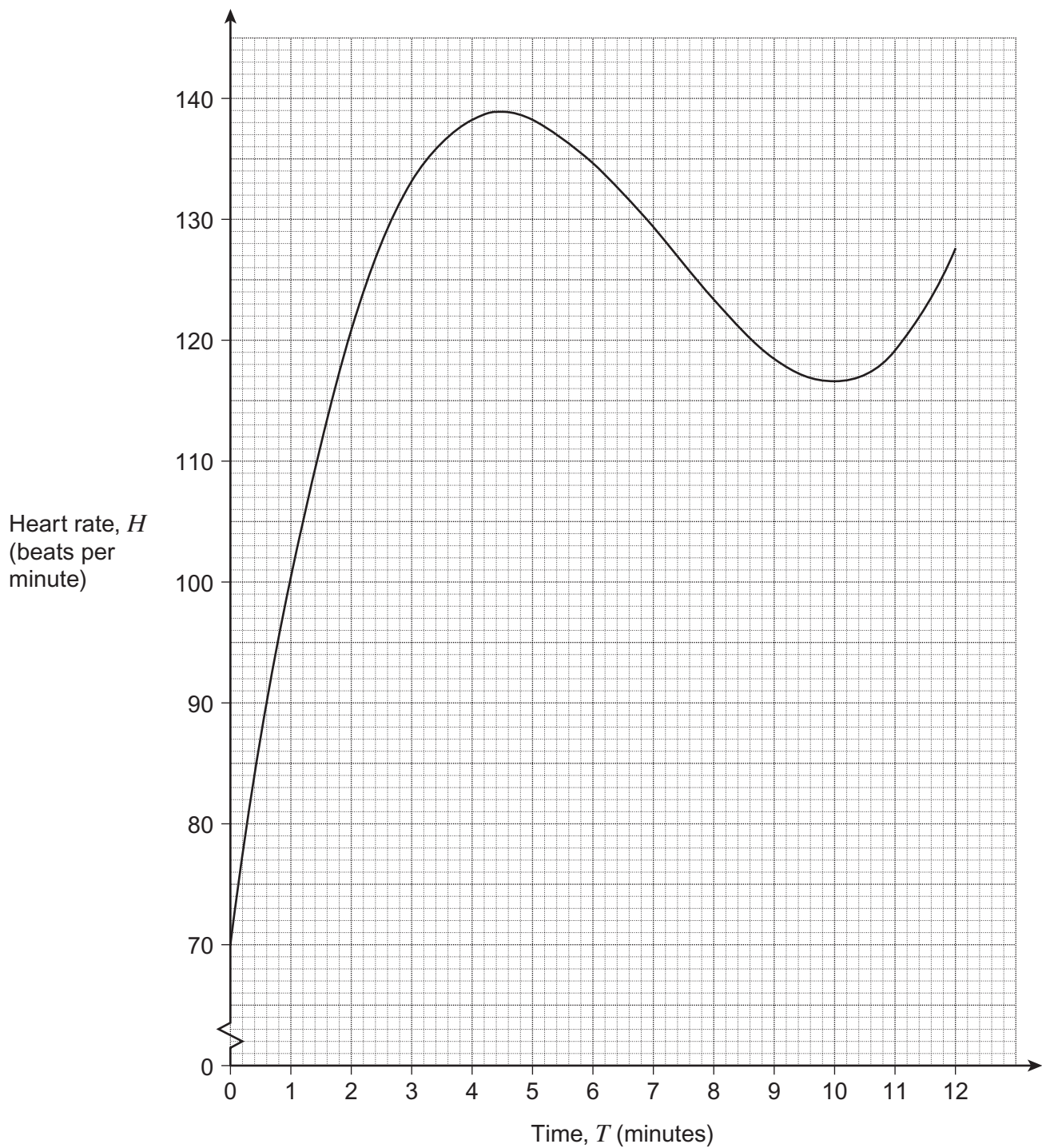
Turn over ►



13

Leroy goes to a gym to exercise.

The graph shows his heart rate, H (beats per minute) during 12 minutes of exercise.



13 (a) What was his heart rate when he started to exercise?

Answer beats per min (1 mark)

13 (b) How many minutes of exercise did it take for him to reach his highest heart rate?

Answer min (1 mark)

13 (c) By drawing a tangent, work out the rate of increase of H when $T = 4$
You **must** show your working.

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Answer..... beats per min² (3 marks)

Turn over for the next question

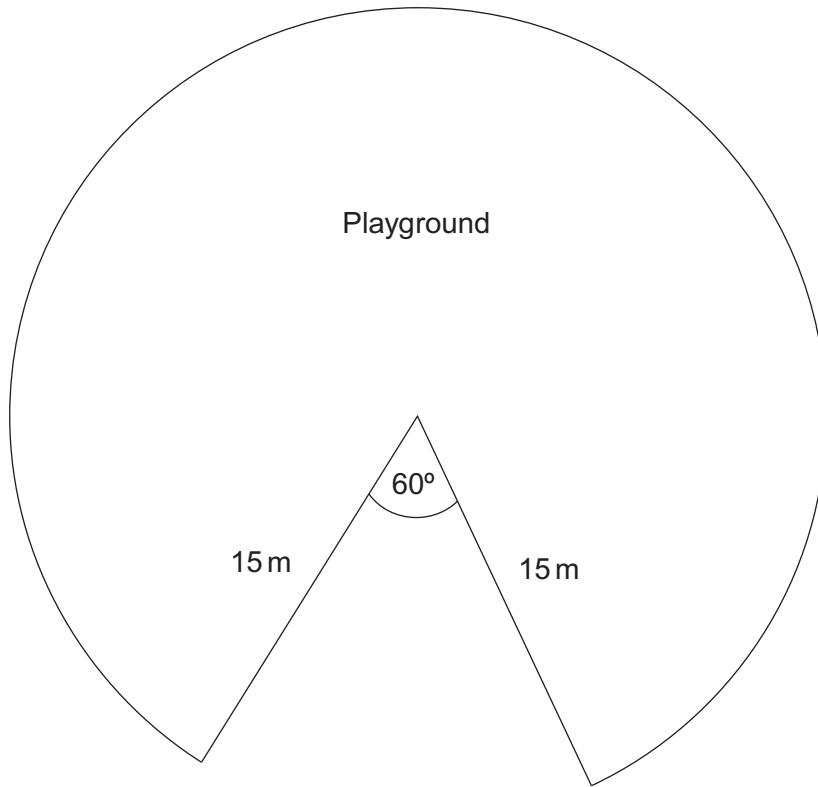
5

Turn over ►



14

A playground is in the shape of a major sector of a circle of radius 15 metres.



Not drawn
accurately

Work out the **total** perimeter of the playground.

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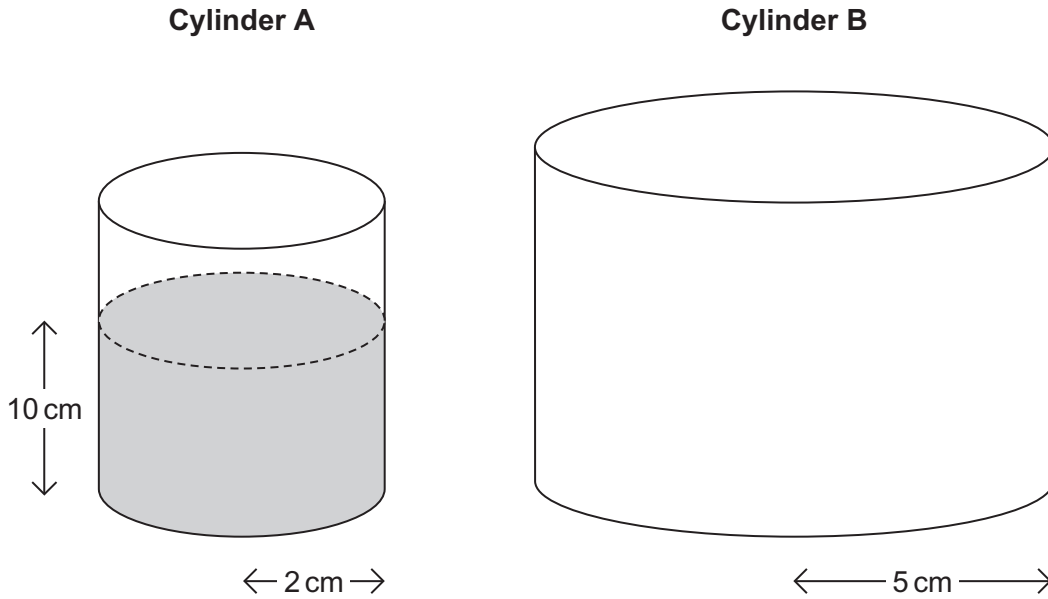
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Answer m (3 marks)



- 15** Cylinder A has radius 2 cm and contains water to a height of 10 cm.
Cylinder B has radius 5 cm and is empty.



- 15 (a)** Show that the volume of water in cylinder A is $40\pi\text{cm}^3$.

..... (1 mark)

- 15 (b)** Some of the water is poured from cylinder A into cylinder B.
The height, h , of the water in each cylinder is now the same.

Work out h .

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$h =$ cm (4 marks)

8

Turn over ►

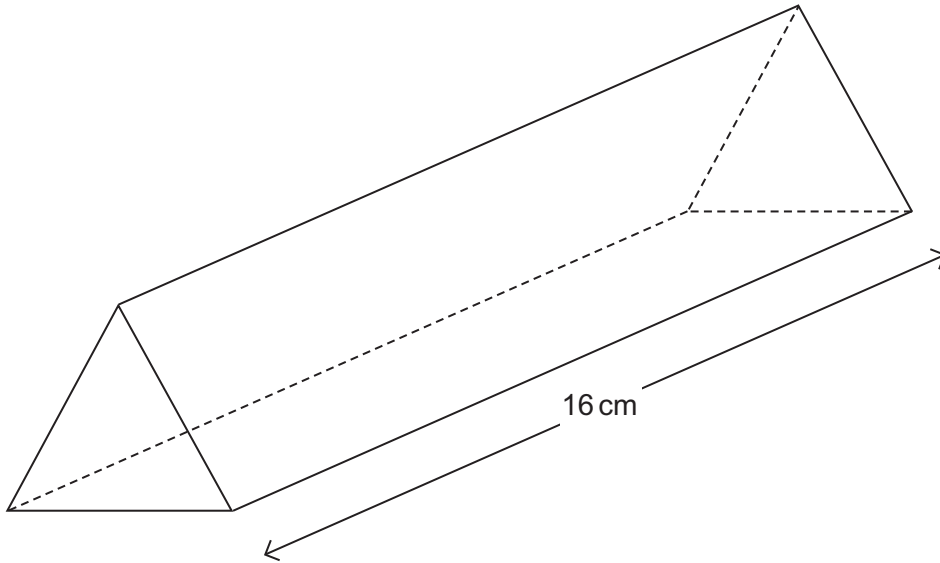


16

A company makes boxes out of card.

Each box is a triangular prism.

The total surface area of the box is 196 cm^2 .



The company want to make an extra large box that is

- similar to the one shown above
- of length 80 cm
- uses no more than 5000 cm^2 of card.

Show that it is possible to make this box.

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(3 marks)

END OF QUESTIONS

