Centre Number						Candidate Number				
Surname										
Other Names										
Candidate Signature										

For Examiner's Use	
Examiner's Initials	
Pages	Mark
3	
4 - 5	
6 - 7	
8 - 9	
10 – 11	
12 - 13	
14 - 15	
16 - 17	
18 19	
20 -21	
TOTAL	

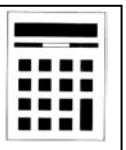
General Certificate of Secondary Education
Higher Tier

Applications of Mathematics (Linked Pair Pilot) 93702H

Unit 2 Higher Tier

Specimen Paper

H

For this paper you must have: • mathematical instruments. You may use a calculator	

Time allowed
- 1 hour 30 minutes

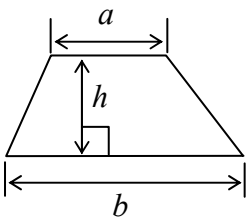
Instructions
- Use black ink or black ball-point pen. Draw diagrams in pencil.
- Fill in the boxes at the top of this page.
- Answer **all** questions.
- You must answer the questions in the space provided. Do not write outside the box around each page or on blank pages.
- Do all rough work in this book. 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 3, 6, 7, 9, 11 and 15.
  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 booklet.
- You are expected to use a calculator where appropriate.

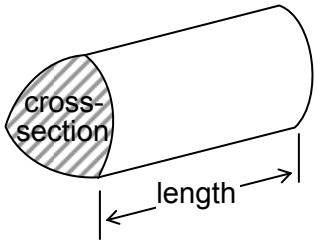
Advice
- In all calculations, show clearly how you work out your answer.

Formulae Sheet: Higher Tier

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

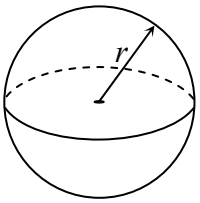


Volume of prism = area of cross-section × length



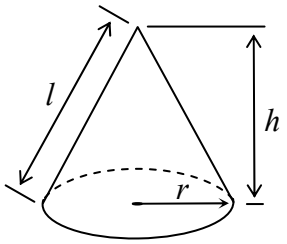
Volume of sphere = $\frac{4}{3}\pi r^3$

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



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

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

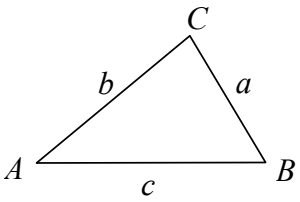


In any triangle ABC

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 A circular cake tin has a diameter of 9 centimetres.

The base of the tin is to be covered with paper.

Work out the area of the paper needed to cover the base of the tin.

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Answer ..... cm^2 *(3 marks)*

2 Arif buys a car in June 2007 for £ 11 500.
He sells the car in February 2009.
He makes a 30% loss.

How much does he sell the car for?

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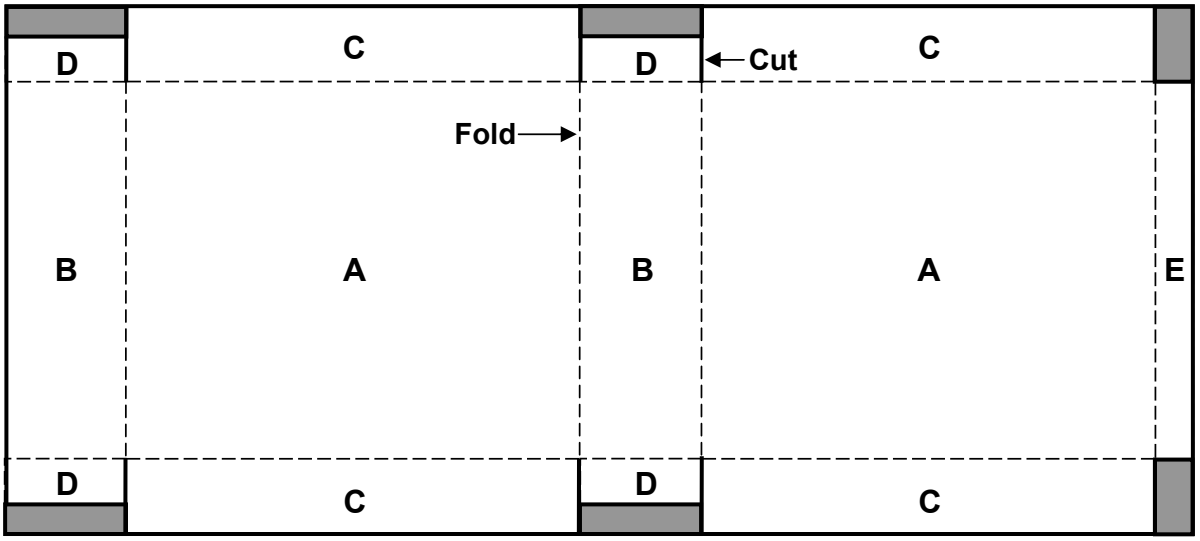
Answer £ ..... *(3 marks)*

6

✳ **3** A rectangular piece of card is used to make the net of a cereal box.

To make the net:

- cut the shaded rectangles from the card
- cut along the full lines inside the net
- fold along the dotted lines inside the net.



The same letter is used for rectangles that are the same size.

The table gives the lengths and widths of the rectangles.

Rectangle	Length in cm	Width in cm
A	25	18
B	25	5
C	18	3
D	5	2
E	25	1

3 (a) Work out the total area of unused card (the **shaded** rectangles).

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Answer ..... cm^2 *(3 marks)*

3 (b) Can the net be made from a 40 cm square piece of card?

Show working to justify your answer.

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(2 marks)

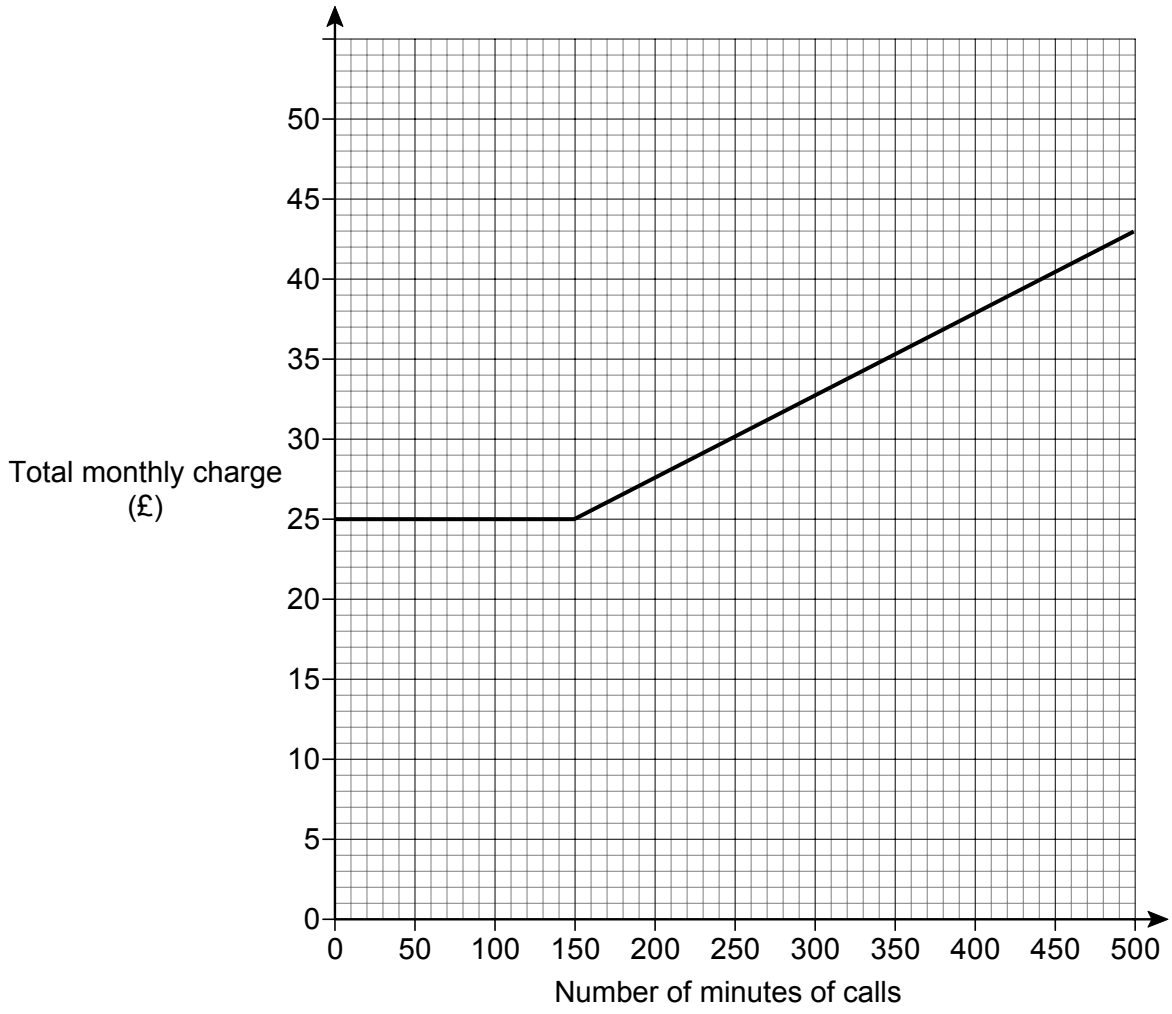
Turn over for the next question

5

4 Viki has a mobile phone contract.

She never sends texts.

The graph shows how the total monthly charge is calculated for her mobile phone contract for up to 500 minutes of calls.



4 (a) (i) Write down the basic monthly charge and the number of free minutes of calls.

Basic monthly charge £ .....

Number of free minutes ..... *(2 marks)*

4 (b) Work out the charge per minute for the other calls.

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Answer ..... pence *(3 marks)*

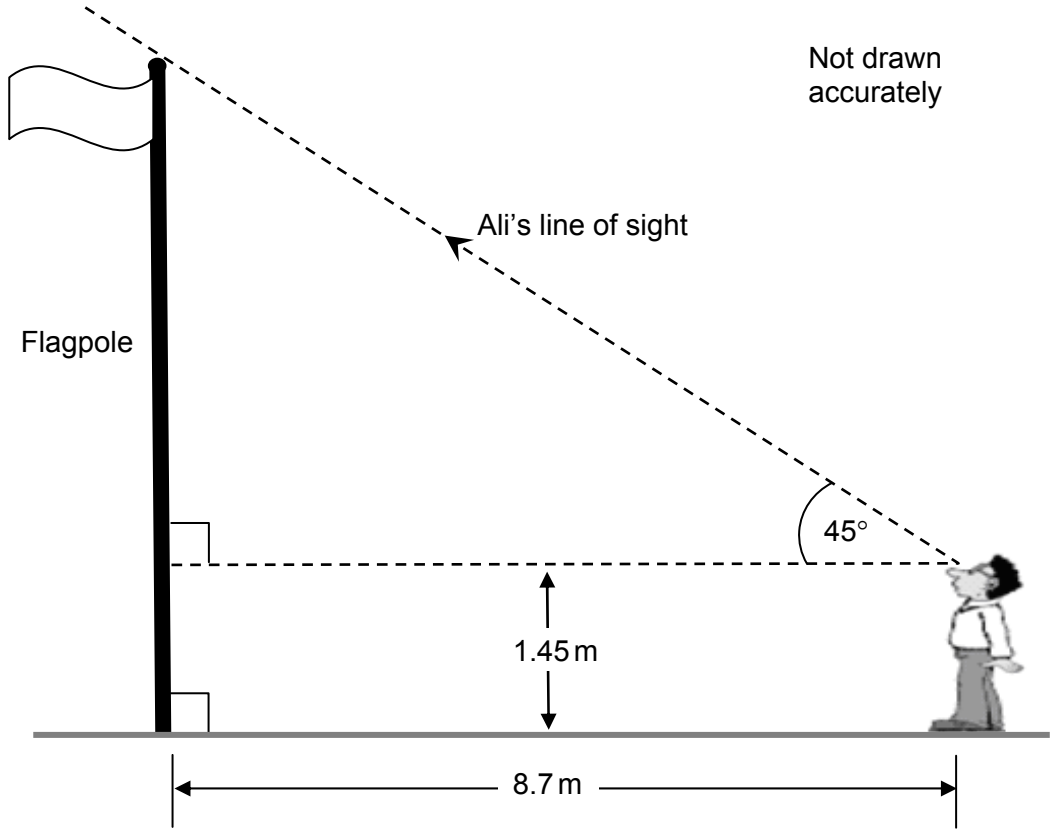
Turn over for the next question

5

5 Ali uses this method to estimate the height of a flag pole.

- He stands, as shown, so that his angle of sight is 45° when he looks up to the top of the flag pole.
- He then measures his distance from the flagpole.
- Finally he measures the distance that his eyes are above the ground.

The sketch shows Ali's measurements.



5 (a) Use Ali's measurements to calculate the height of the flag pole, explaining why he uses an angle of 45°.

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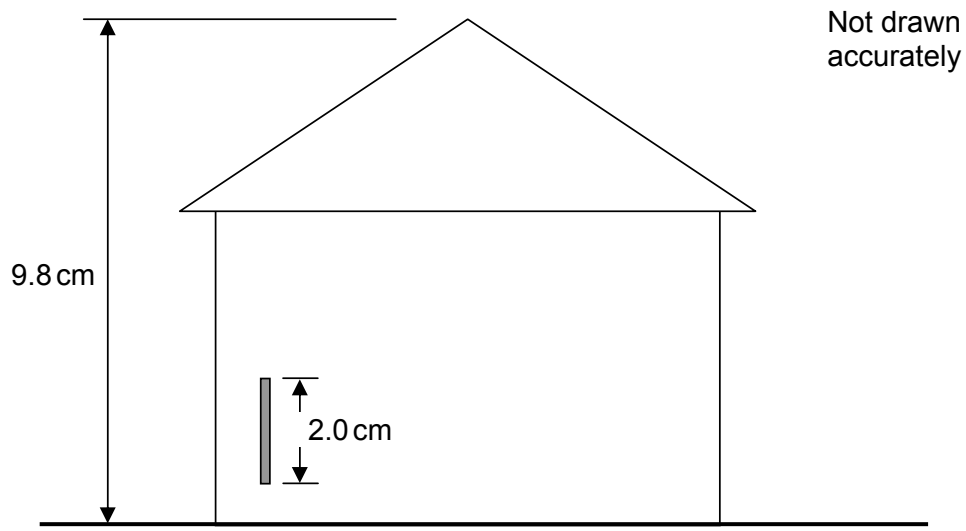
Answer ..... m *(2 marks)*

5 (b) Ben uses this method to estimate the height of a building.

- He tapes a 1 metre ruler to the building
- He takes a photograph of the building and the metre ruler.

On the photograph he measures the height of the building and the length of the ruler.

The measurements are shown in this sketch.



Use this information to estimate the height of the building.

Give your answer to the nearest metre.

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Answer ..... metres *(3 marks)*

5

✳ **6** Becky has a collection of 210 DVDs.
The width of each DVD is 14 millimetres.
She keeps her DVDs on five shelves.
Each shelf is 70 centimetres long.

How many more DVDs does she have space for?

Show clearly how you work out your answer.

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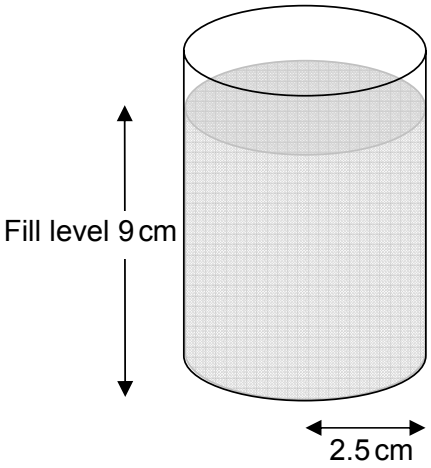
Answer ..... *(5 marks)*

✳ **7** A school canteen sells glasses of orange juice during the morning break.
The orange juice is bought in 2 litre cartons each costing £2.42.
1 litre = 1000 cm^3.
Each glass is a cylinder with radius of 2.5 cm.
The orange juice is filled to a height of 9 cm.

Not drawn accurately



The canteen makes a profit of 30% on the cost of the juice.

How much do they sell each glass of juice for?

You **must** show your working

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Answer ..... *(6 marks)*

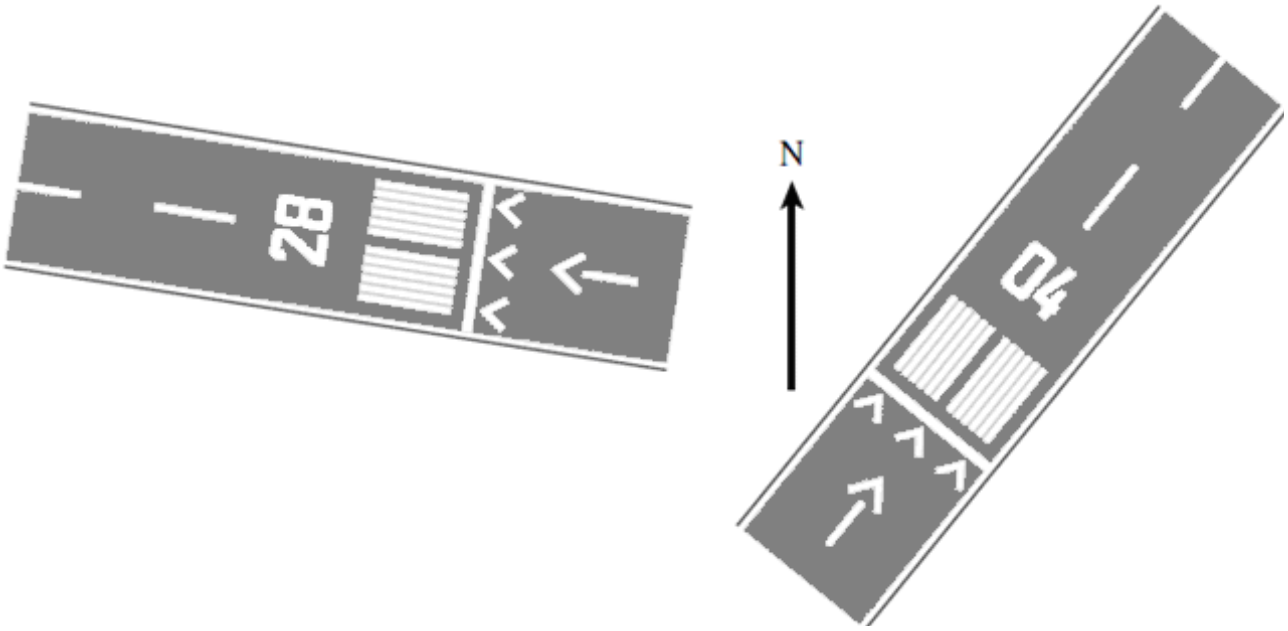
11

8 Airport runways have a two-digit number painted on them.

These numbers are used to work out the direction of the runway.

To work out the three-figure bearing, multiple the runway number by 10.

Here is a diagram of a runway on a three-figure bearing of 280° and a runway on a three-figure bearing of 040°.



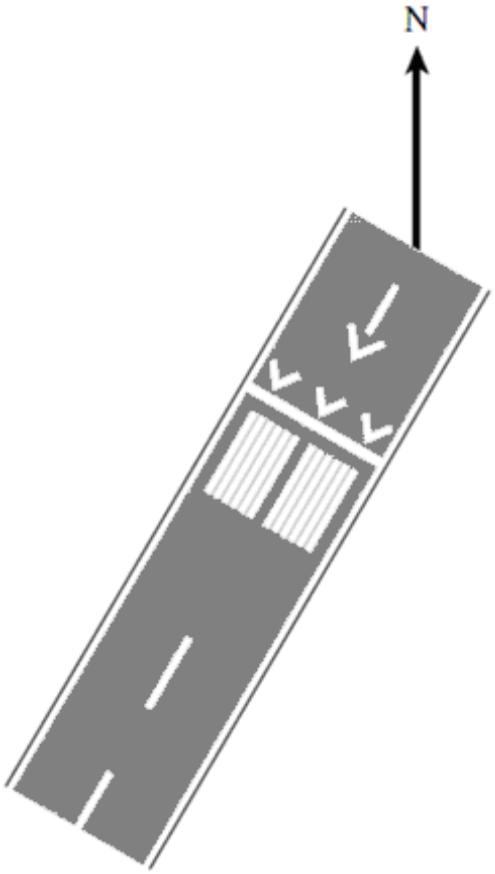
8 (a) (i) Write down the three-figure bearing for a runway pointing due South.

Answer ..... ° *(1 mark)*

8 (a) (ii) Write down the runway number for a runway pointing due South.

Answer ..... *(1 mark)*

8 (b) A runway is being painted.



By measuring the three-figure bearing, work out the runway number.

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Answer ..... *(2 marks)*

8 (c) Runways are used in both directions.
This means that they have two different runway numbers, one at each end.
A runway has the number 30 at one end.

What runway number is at the other end?

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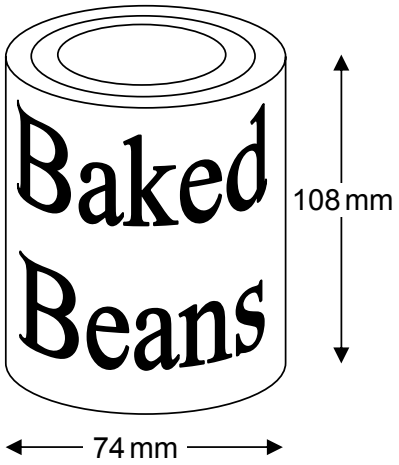
Answer ..... *(3 marks)*

7

✳ **9** The diagram shows a can of baked beans.



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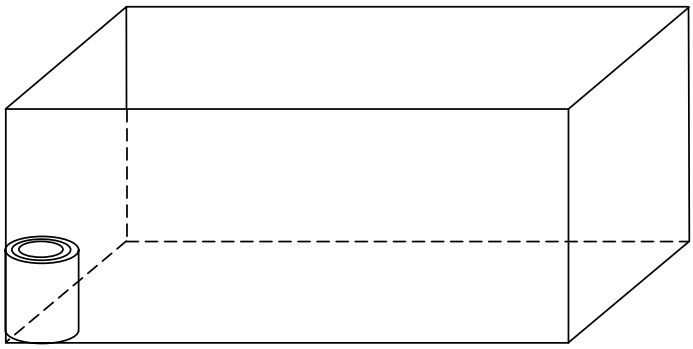
The cans are delivered to shops in cardboard boxes.

Each box contains 48 cans.



Not drawn accurately

Work out suitable dimensions for one of these cardboard boxes

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Answer ..... mm by ..... mm by ..... mm *(3 marks)*

Do not write outside the box

10 A Do it Yourself store makes Meadow Green paint by mixing blue, yellow and white paint in the ratio 5 : 2 : 1

In a week they use 480 litres of blue paint.

How many litres of Meadow Green do they make?

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Answer ..... litres *(3 marks)*

✳ **11** A 25 foot ladder is resting against the side of a building, with the bottom of the ladder 7 feet from the base of the building.

The top slips down 4 feet.

How far does the bottom of the ladder slip away from the building?

Show clearly how you work out your answer.

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Answer ..... feet *(5 marks)*

Turn over for the next question

11

12 The depth, d metres of water in a harbour t hours after midnight is given by

$$d = 8 + 3 \sin (30t)°$$

12 (a) Complete the table of values for $d = 8 + 3 \sin(30t)°$.

t	0	1	2	3	4	5	6	7	8	9	10	11	12
d	8	9.5	10.6	11	10.6	9.5	8	6.5	5.4	5	5.4		8

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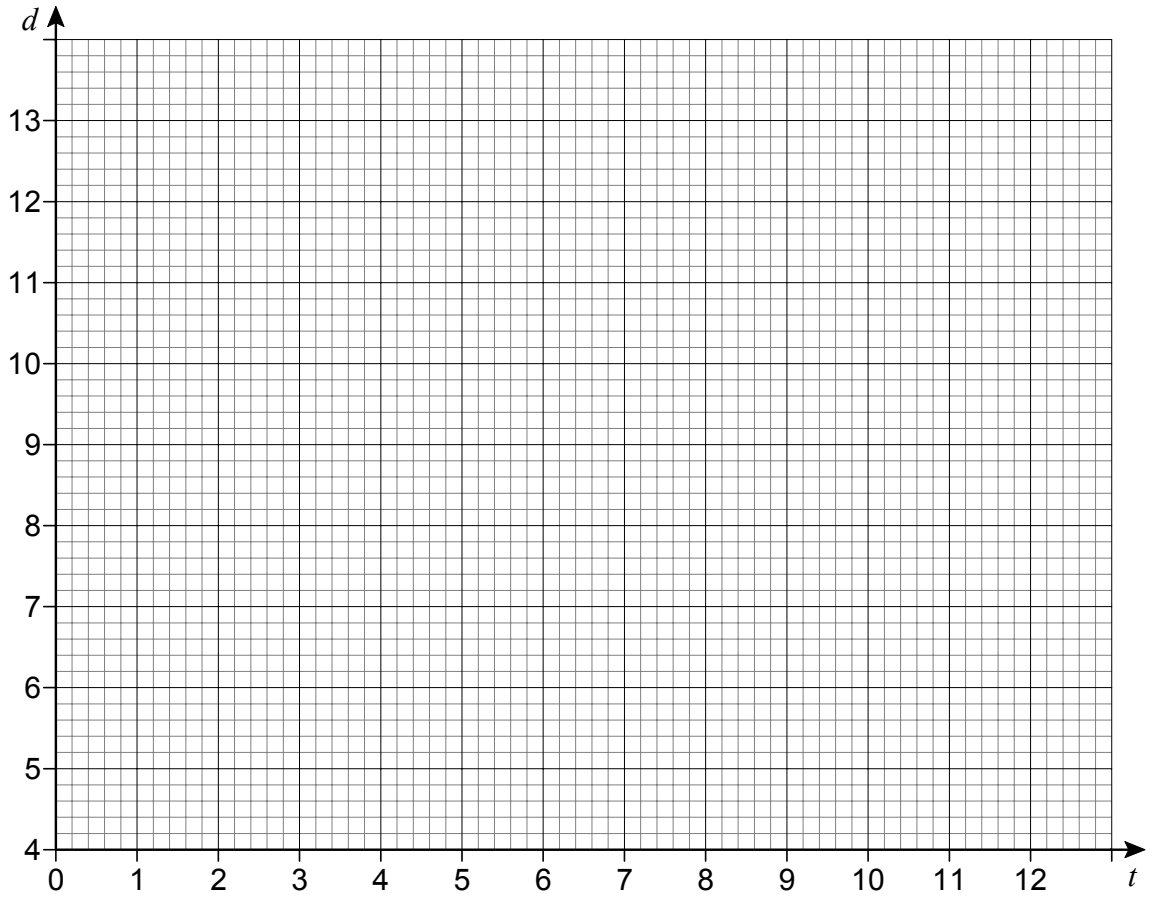
(2 marks)

12 (b) On this grid, draw the graph of $d = 8 + 3 \sin(30t)°$ for values of t from 0 to 12



(2 marks)

12 (c) A ship needs the water depth to be at least 10 metres to berth in the harbour.

Between what times of day can the ship berth?

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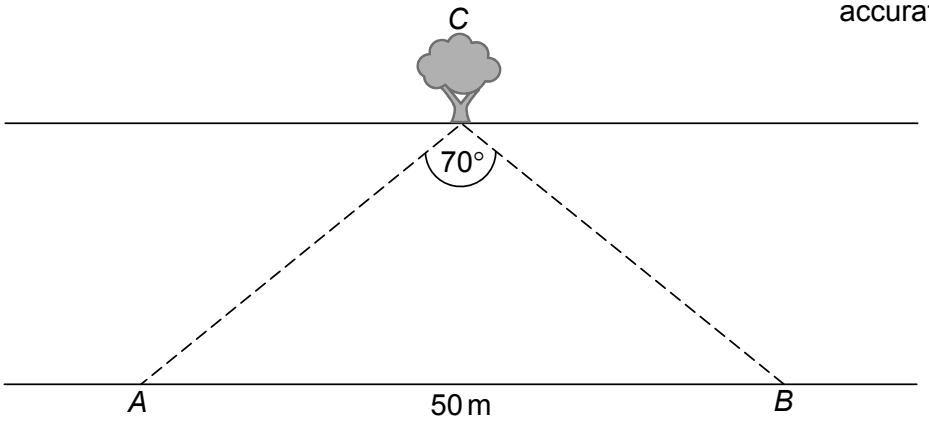
Answer ..... and ..... *(3 marks)*

13 The banks of a river are straight and parallel.

Not drawn accurately



The points, *A* and *B*, are on one bank of the river, 50 metres apart.
There is a tree at *C* on the opposite bank.
The tree is halfway between *A* and *B*.
Angle *ACB* = 70°

Calculate the width of the river.

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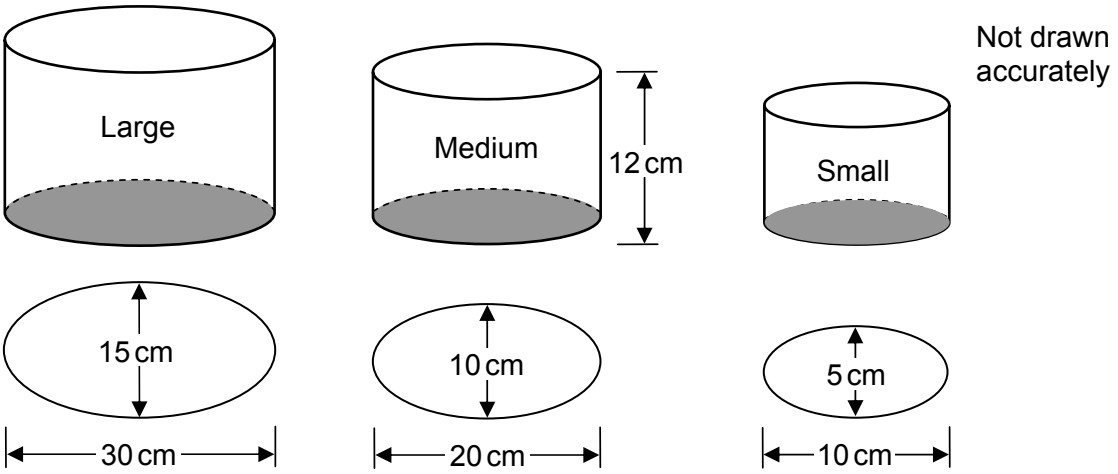
Answer ..... m *(4 marks)*

11

14 A manufacturer designs a set of three **similar** containers to fit inside each other.

The diagram shows a sketch of the containers and their oval cross-sections.



Some information about the containers is shown in the table.

	Base length	Height	Area of card used in manufacture
Large	30 cm		
Medium	20 cm	12 cm	1080 cm^2
Small	10 cm		

14 (a) Work out the height of the **large** container.

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Answer ..... cm *(2 marks)*

14 (b) 1080 cm^2 of card is used to manufacture the medium container.

Work out the area of card used to manufacture the **small** container.

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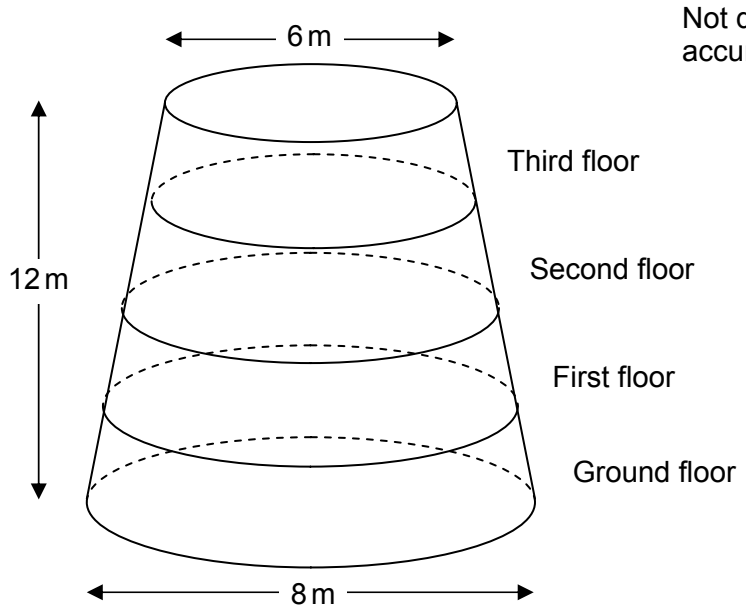
Answer ..... cm^2 *(2 marks)*

Do not write outside the box

✳ **15** An old windmill is the shape of a truncated cone.

The mill is 12 metres high and has 4 floors, equally spaced.

The diameter of the ground floor is 8 metres and the diameter of the roof is 6 metres.



The mill is for sale.

This is the advert

DEVELOPMENT OPPORTUNITY
OLD MILL FOR SALE
Over 150 square metres of floor space

Is the claim about floor space justified?

You **must** show your working.

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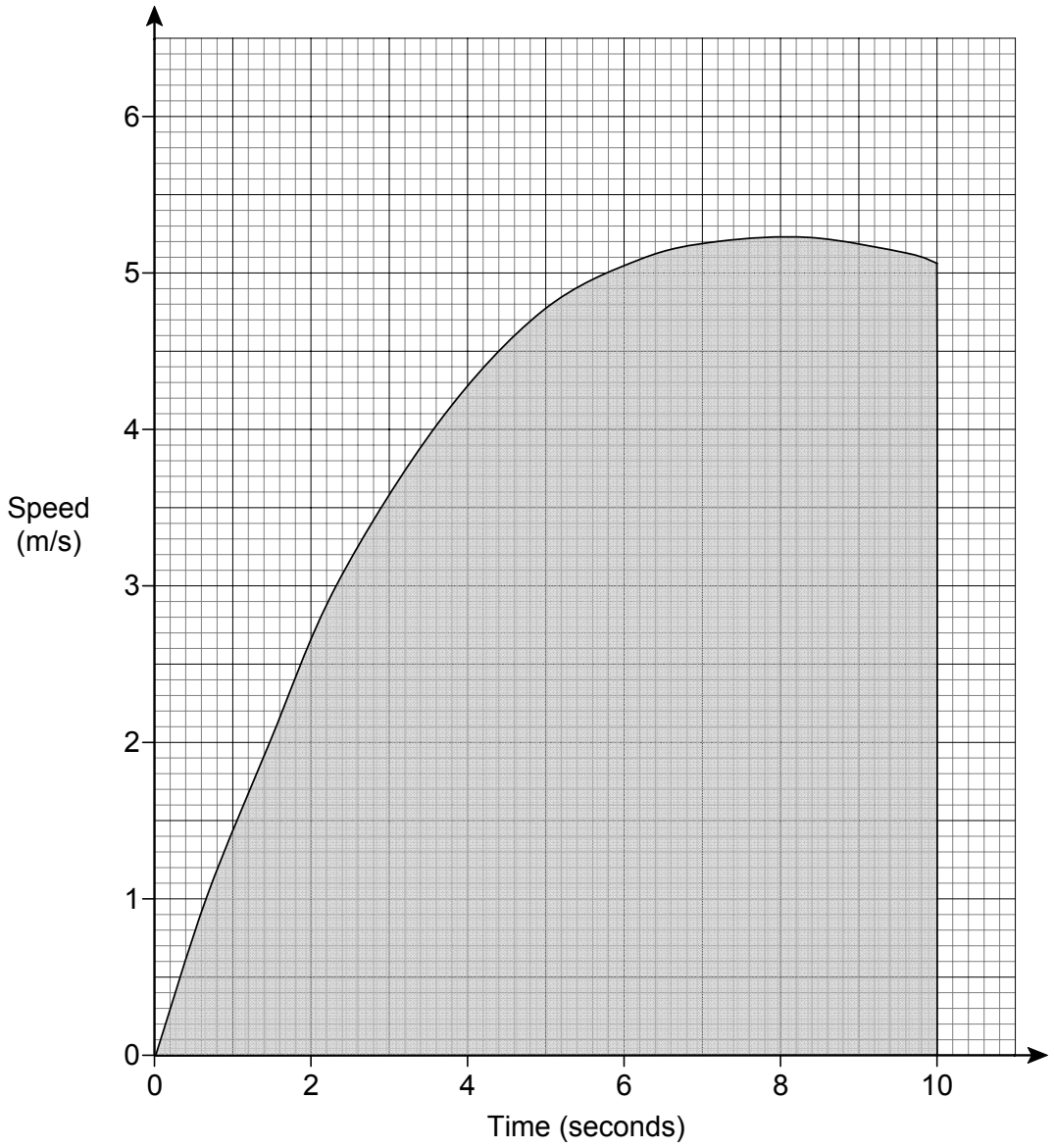
(6 marks)

10

16 The graph shows the speed of a runner during the first 10 seconds of a race.



16 (a) (i) Use an appropriate estimation method to calculate the shaded area on the graph.

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Answer ..... *(4 marks)*

16 (a) (ii) What does this area represent?

Answer ..... *(1 mark)*

16 (b) (i) Estimate the gradient of the graph 5 seconds after the start of the race.

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Answer ..... *(3 marks)*

16 (b) (ii) What does this gradient represent?

Answer ..... *(1 mark)*

END OF QUESTIONS

9

There are no questions printed on this page

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ANSWER IN THE SPACES PROVIDED