AQA

GCSE
APPLICATIONS OF MATHEMATICS (LINKED PAIR)

H

Higher Tier   Unit 2   Geometry and Measures

Friday 13 November 2015   Morning   Time allowed: 1 hour 30 minutes

Materials
For this paper you must have:
● a calculator
● mathematical instruments.
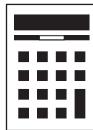
Instructions
● Use black ink or black ball-point pen. Draw diagrams in pencil.
● Answer **all** questions.
● You must answer the questions in the spaces provided. Do not write outside the box around each page or on blank pages.
● Do all rough work in this book. Cross through any work that you do not 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 3, 4 and 14. These questions are indicated with an asterisk (*).
● You may ask for more answer paper, tracing paper and graph 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.

Formulae Sheet: Higher Tier

Area of trapezium = $\frac{1}{2}(a+b)h$
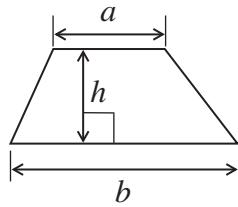
Volume of prism = area of cross section × length
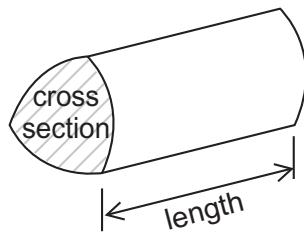
Volume of sphere = $\frac{4}{3}\pi r^3$

Surface area of sphere = $4\pi r^2$
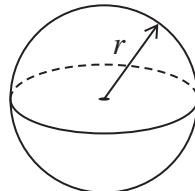
Volume of cone = $\frac{1}{3}\pi r^2 h$

Curved surface area of cone = $\pi r l$
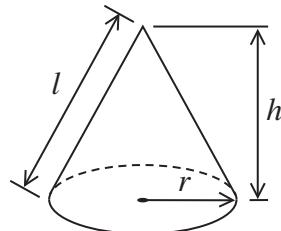
In any triangle *ABC*

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

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

Cosine rule $a^2 = b^2 + c^2 - 2bc \cos A$
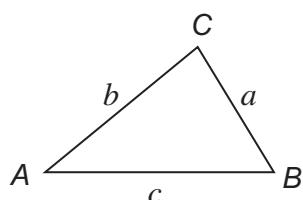
The Quadratic Equation
The solutions of $ax^2 + bx + c = 0$, where $a \neq 0$, are given by

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

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

1 The diagram shows three straight roads between villages *A*, *B* and *C*.

A

3.4 km

Not drawn
accurately

B 3 km *C*
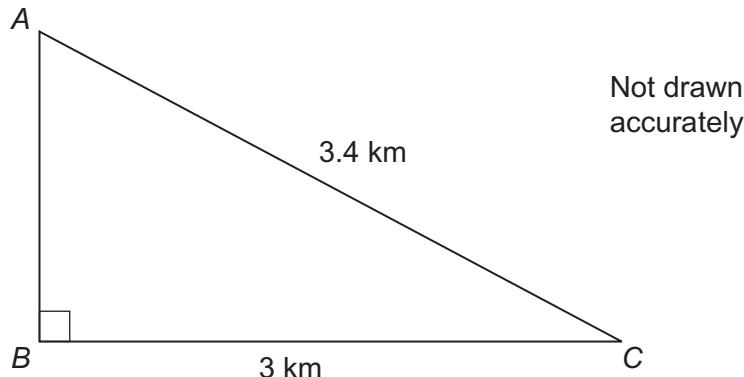
1 (a) Work out the distance *AB*.

[3 marks]

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Answer .... km

1 (b) Samir walks along the roads.
His route is

$A \rightarrow B \rightarrow C \rightarrow A$

His average speed is 3.2 kilometres per hour.

Work out the time for his walk.
Give your answer in hours and minutes.

[2 marks]

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Answer .... hours .... minutes

Turn over ▶

2   An archery target is made by drawing 5 circles.
All the circles have the same centre.

The diameter of the gold circle is 16 cm

The width of each of the other sections is 8 cm

Not drawn
accurately

White

Black

Blue

Red

Gold

16 cm

8 cm

0 4
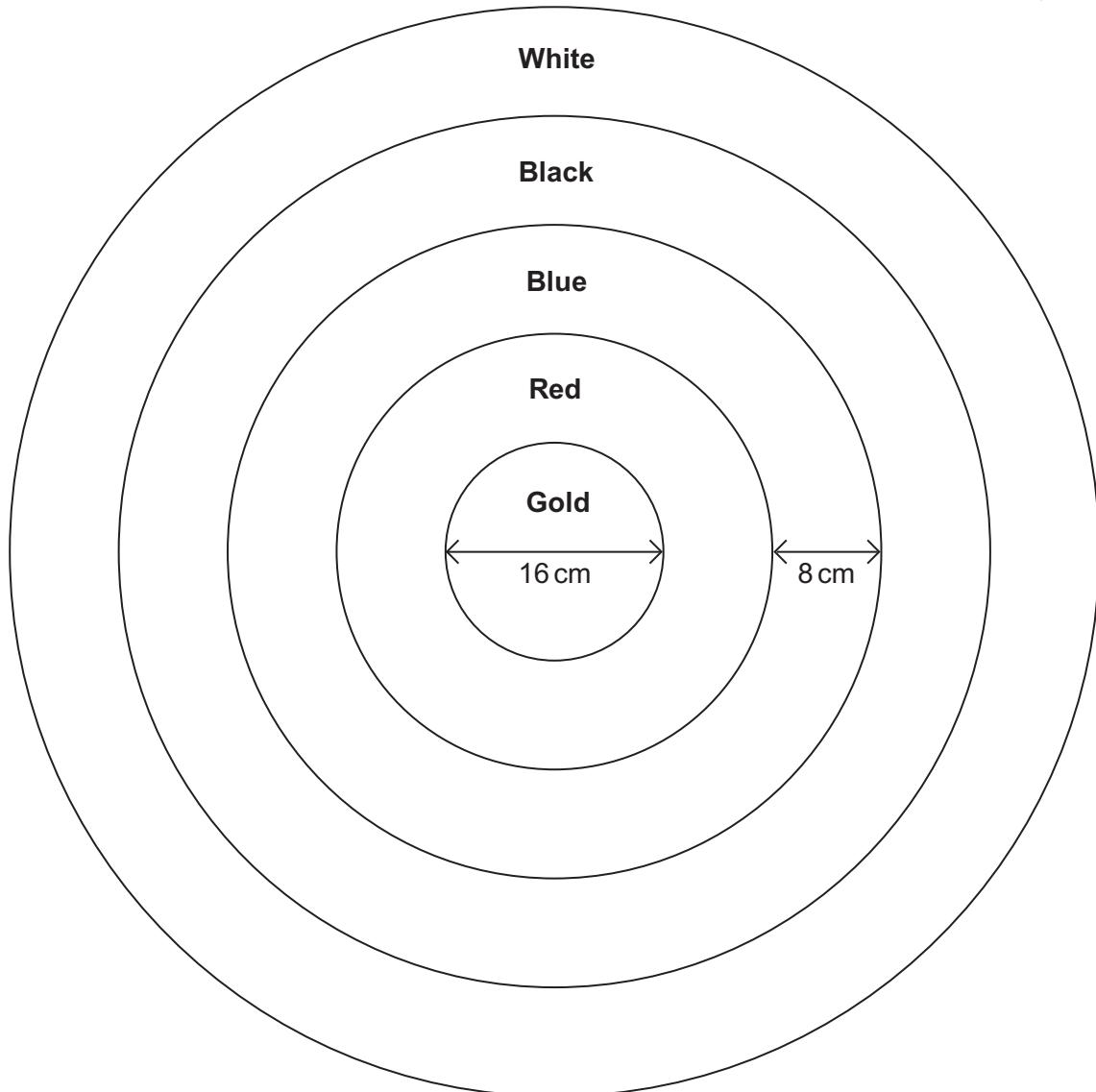
2 (a) Circle the **radius** of the largest circle.

[1 mark]

40 cm   44 cm   48 cm   80 cm

2 (b) Work out the **circumference** of the largest circle.
Give your answer as a decimal.

[2 marks]

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Answer .... cm

Turn over for the next question

3

Turn over ▶

3 A designer uses this trapezium to make patterns.

9 cm

Not drawn
accurately

5 cm
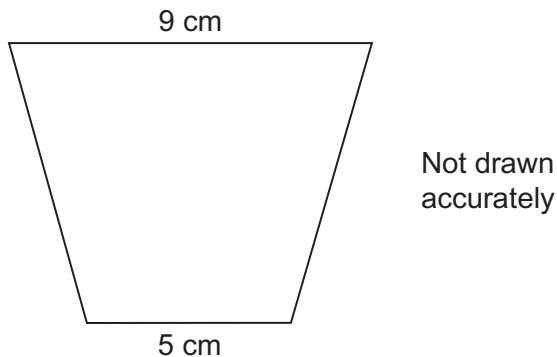
*__3__ **(a)** The diagram shows part of a rectangular sheet of wallpaper.
The top edges of the two trapeziums are parallel to the top of the wallpaper.
The two trapeziums are equally spaced across the wallpaper.

Not drawn
accurately

52 cm

x cm x cm x cm
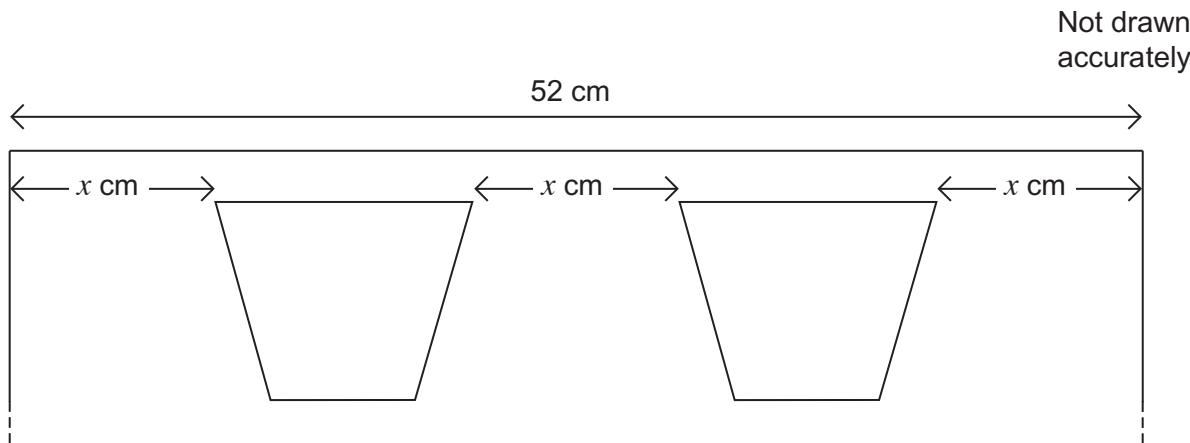
Set up and solve an equation to find the value of x.

[4 marks]

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$x =$ ....

3 (b) Four of the trapeziums are put together to make a different pattern.
The trapeziums do **not** overlap.

Not drawn accurately
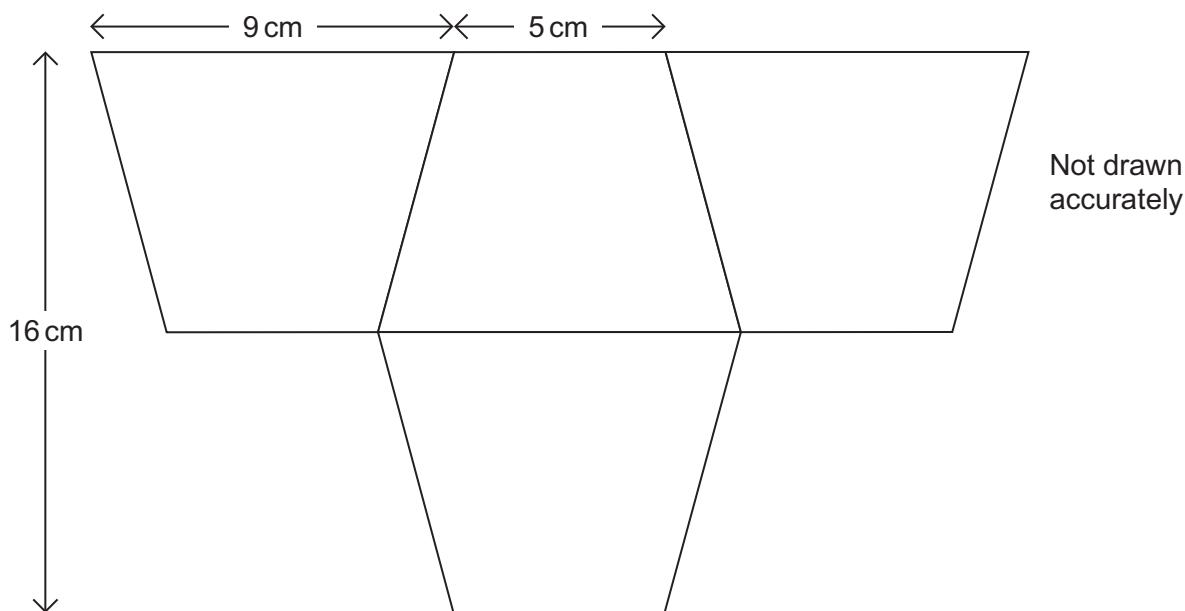
Work out the area of this pattern.

[3 marks]

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Answer .... cm²

*4   Here is some information about the parts made by two machines.

Machine P	Machine Q
2% of the parts were faulty	Made 5000 parts 75 parts were faulty

Compare the proportions of faulty parts made by Machine P and Machine Q.
You **must** show your working.

[3 marks]

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5 Amy has some red beads and some blue beads.
She uses the beads to make two necklaces, A and B.

Necklace A

24 beads

3 times as many red beads as blue beads

Necklace B

35 beads

number of red beads : number of blue beads = 3 : 2

How many **more** red beads than blue beads does she use?

[4 marks]

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Answer ....

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6   A ball is kicked horizontally from the top of a cliff.
The top of the cliff is 50 metres above sea level.

Top of cliff

Path of ball

Not drawn accurately

50 m

y m
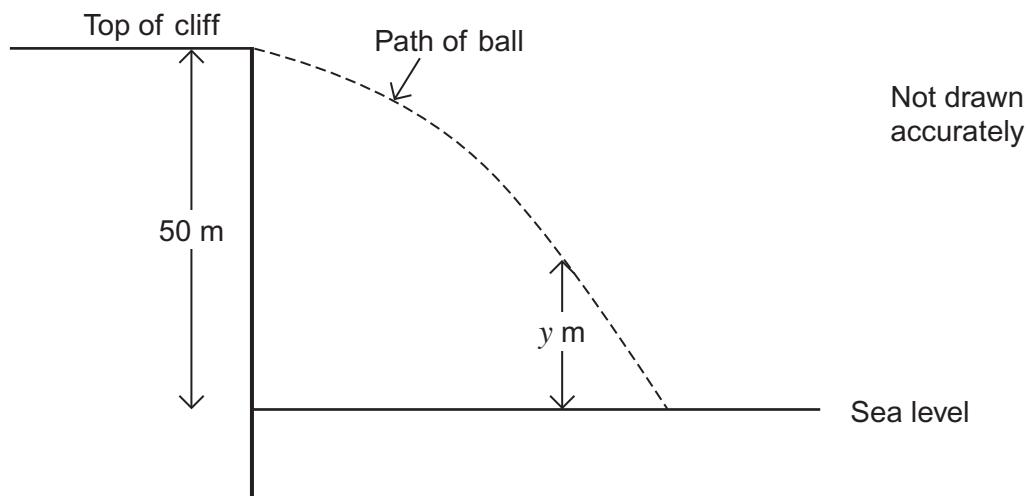
Sea level

The height of the ball is modelled by the equation

$$y = 50 - 4.9t^2$$

y is the height of the ball, in metres, above sea level.

t is the time, in seconds, after the ball is kicked.

6 (a)   Complete this table of values for $y = 50 - 4.9t^2$
Values of *y* are given to 1 decimal place.

[2 marks]

t	0	0.5	1	1.5	2	2.5	3	3.5
y	50.0	48.8		39.0		19.4	5.9	−10.0

6 (b) Draw the graph of $y = 50 - 4.9t^2$ for values of t from 0 to 3.5

[2 marks]
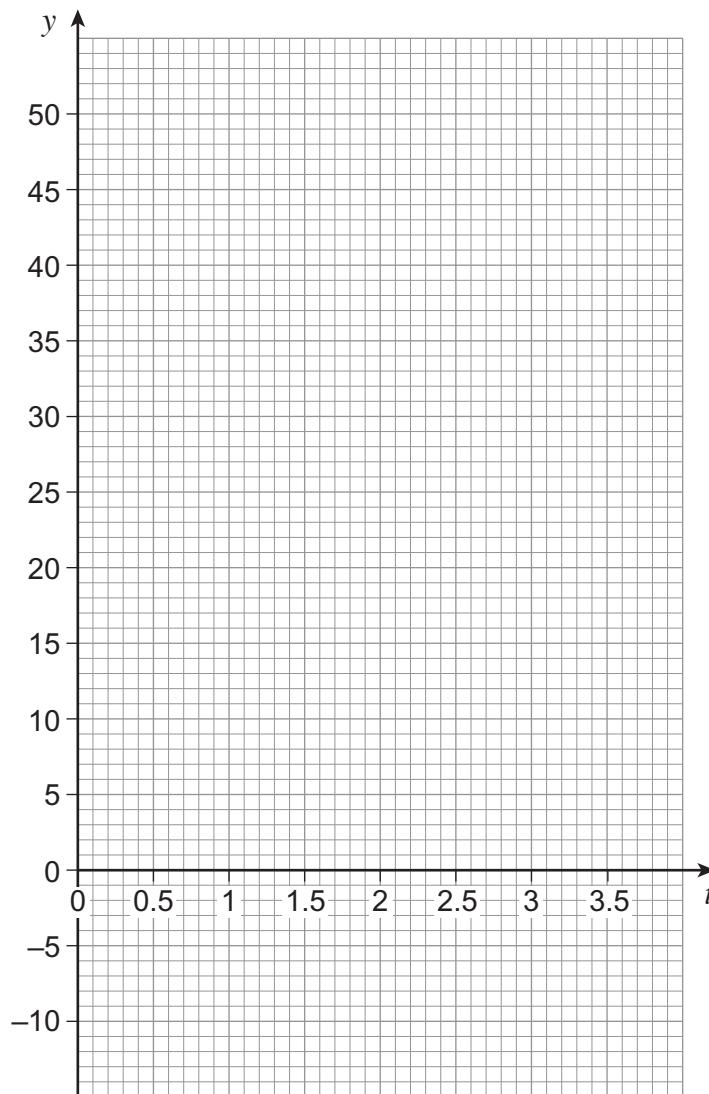
6 (c) Use your graph to estimate the time the ball takes to reach sea level.

[1 mark]

Answer .... seconds

Turn over ▶

5

7 (a)   A, B, C, D and E are five pieces of a puzzle.
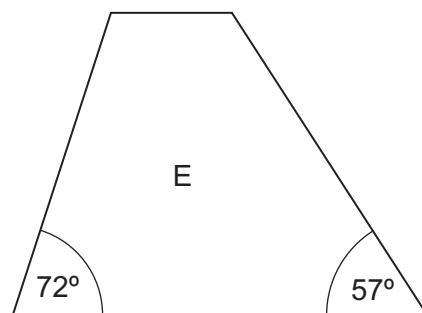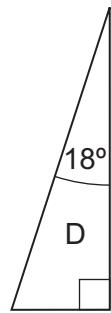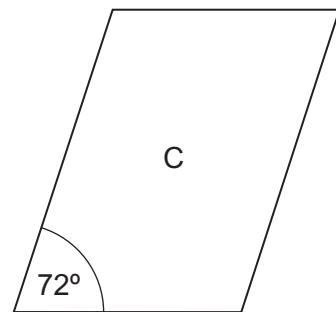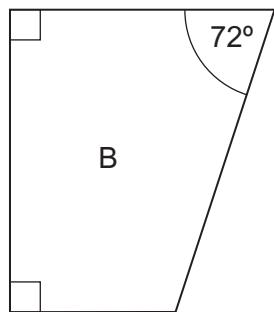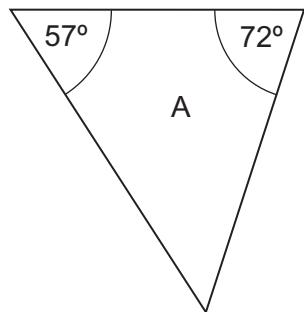
The five pieces fit together to make a rectangle.
Piece B is in the correct place.

Work out **one** possible order for the pieces to fit together.

[2 marks]

Order of pieces   B   ....

7 (b) Pieces of a different puzzle fit together to make quadrilateral *ABCD*.
AD is parallel to *BC*.
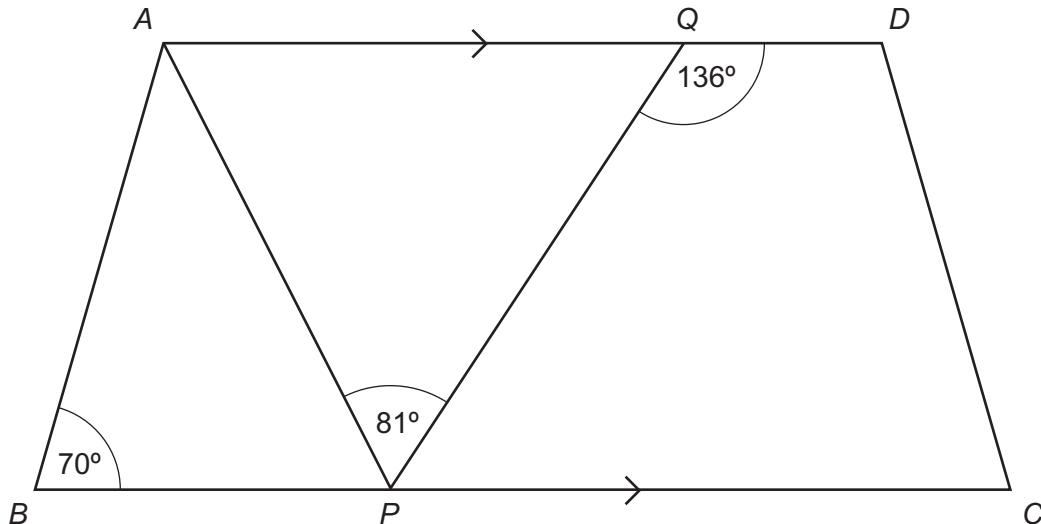
Not drawn accurately

Show that triangle *ABP* is isosceles.

[3 marks]

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8   A circular flower bed is to be made using stones and soil.
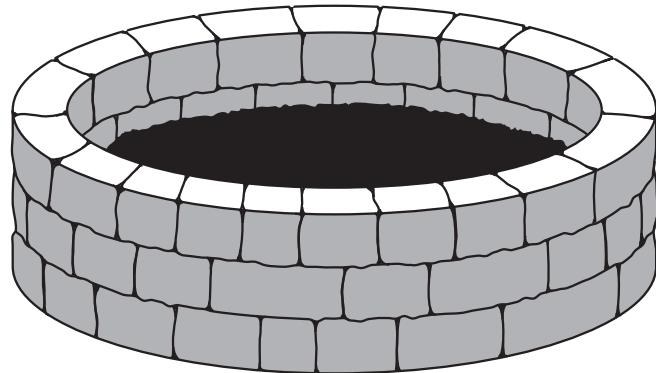
Here is a scale drawing of the plan of the flower bed.
Each circle has centre *P*.

Scale 1 : 30

Stones

Soil

P
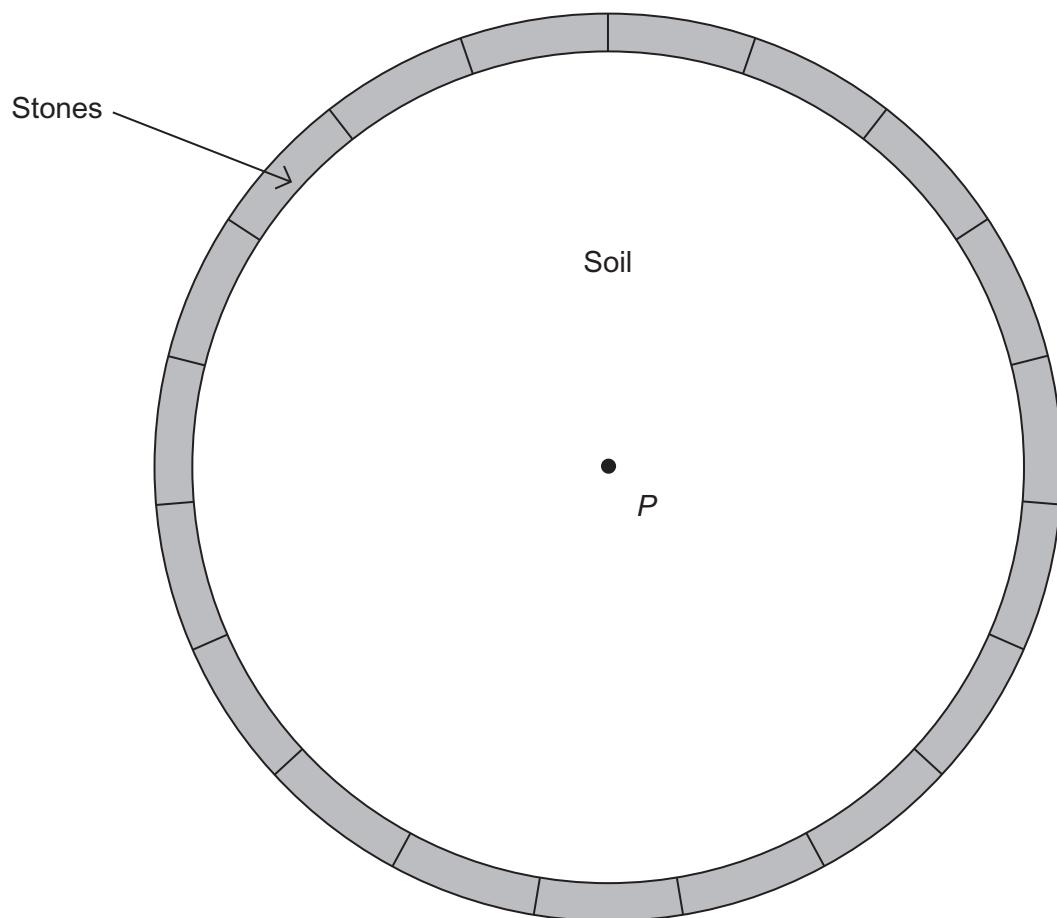
8 (a) The soil in the flower bed will be 40 cm deep.

Show that the volume of soil will be 3.42 cubic metres to 3 significant figures.

[5 marks]

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8 (b) Jess buys bags of soil for the flower bed.
Each bag contains 750 litres of soil.
There are 1000 litres in a cubic metre.

Work out the number of bags she needs to buy.

[2 marks]

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Answer ....

7

Turn over ▶

9 The value of a painting is modelled by the equation

$$V = 8000 \times (1.25)^t$$

V is the value in pounds.
t is the number of years since the start of 2012

9 (a) Show that the value of the painting at the start of 2012 was £8000

[1 mark]

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9 (b) On the grid opposite, draw the graph of $V = 8000 \times (1.25)^t$ for values of t from 0 to 4

[3 marks]

V

20 000

18 000

16 000

14 000

12 000

10 000

8000

0

0   1   2   3   4 t
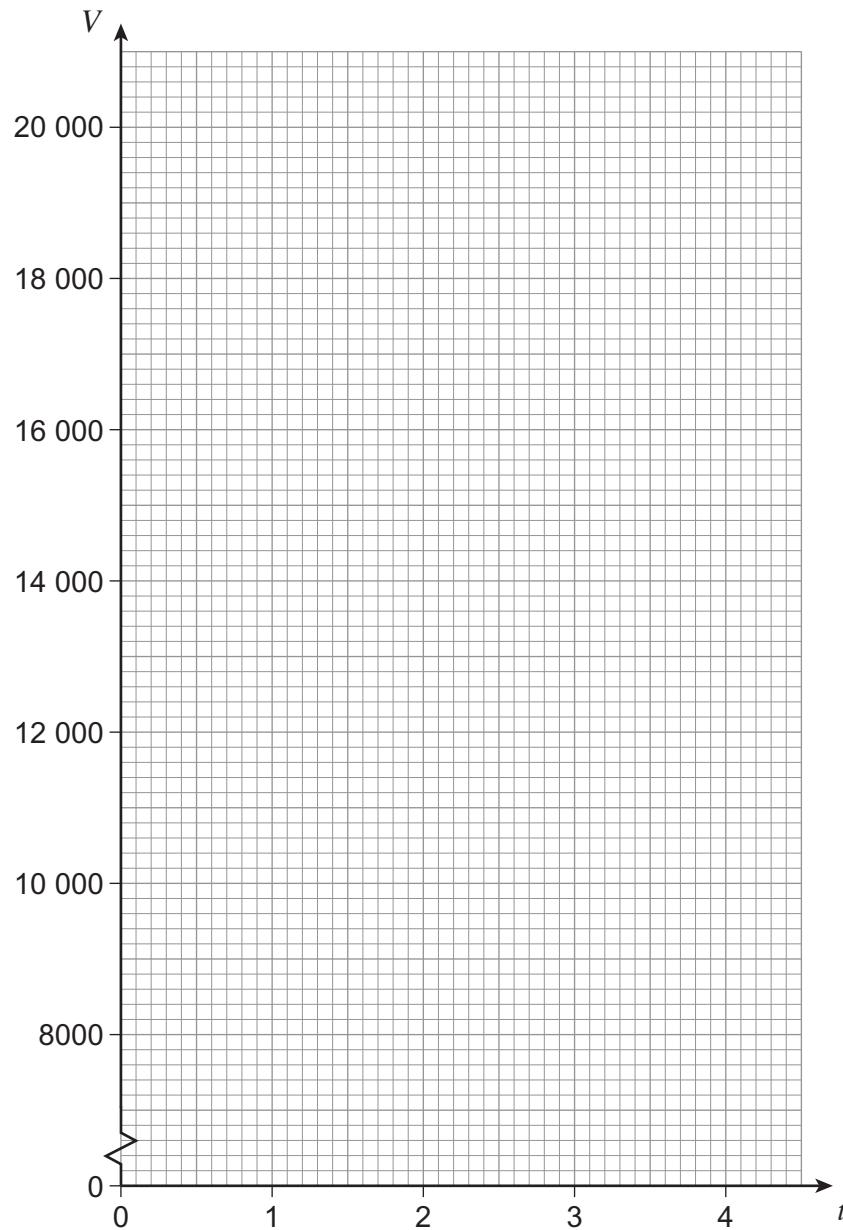
9 (c) During which year was the value of the painting 80% higher than at the start of 2012?
You **must** show your working, which may be on the graph.

[2 marks]

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Answer ....

Turn over ▶

10 A piece of jewellery is made from a sheet of silver.

A parallelogram is cut from the sheet and a smaller, **similar** parallelogram is removed.

The larger parallelogram has perpendicular height 48 mm

The smaller parallelogram has perpendicular height 36 mm

48 mm

36 mm

Not drawn accurately
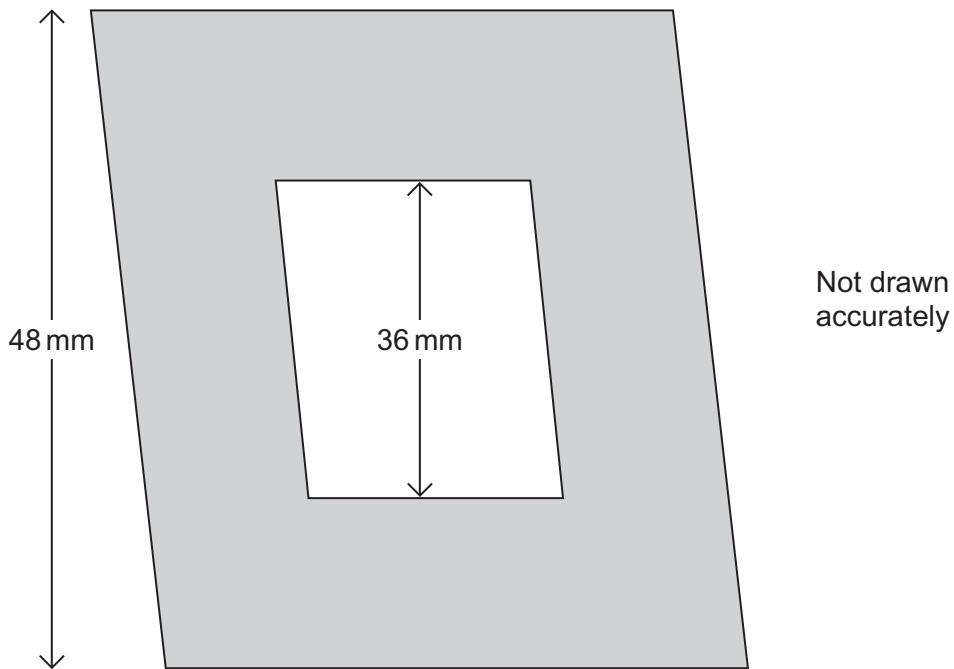
10 (a) The area of the smaller parallelogram is 756 mm^2

Show that the shaded area is 588 mm^2

[3 marks]

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10 (b) The piece of jewellery is 4 mm thick.

The density of silver is 0.0105 g/mm^3

Work out the mass of the piece of jewellery.

[3 marks]

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Answer .... g

Turn over for the next question

11   The diagram shows an empty container of height 17 cm
The container consists of a cylinder on a frustum of a cone.

17 cm
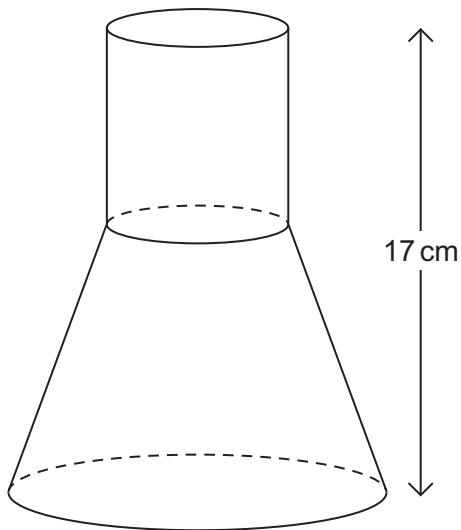
Water is added to the container at a constant rate for 7 seconds.

The sketch graph shows the depth of the water as the container fills.

The graph is a curve for the first 5 seconds and a straight line for the next 2 seconds.

Not drawn
accurately

Depth (cm)

17

12

0

0   5   7

Time (seconds)
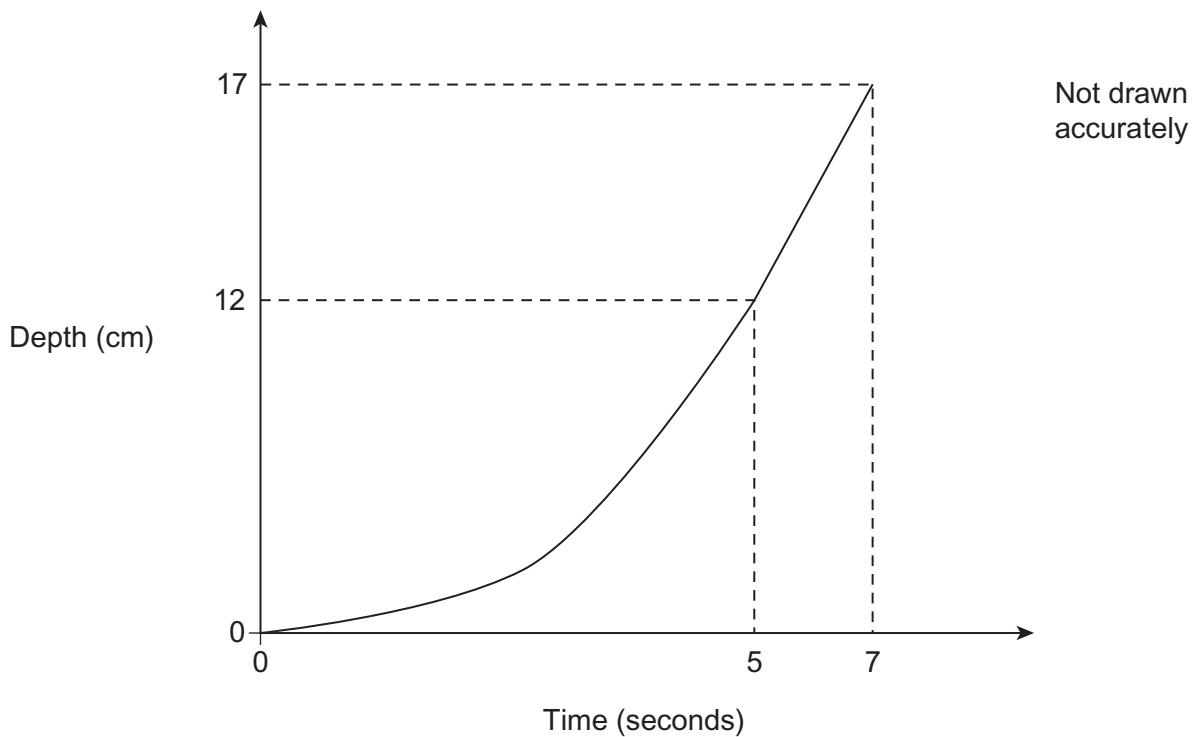
11 (a)   Circle the height of the cylinder.

[1 mark]

5 cm   8.5 cm   12 cm   17 cm

11 (b)   Work out the rate of increase of the depth of water between 5 seconds and 7 seconds. State the units of your answer.

[3 marks]

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Answer ....

Turn over for the next question

Turn over ▶

4

12 *ABCDE* is a window.
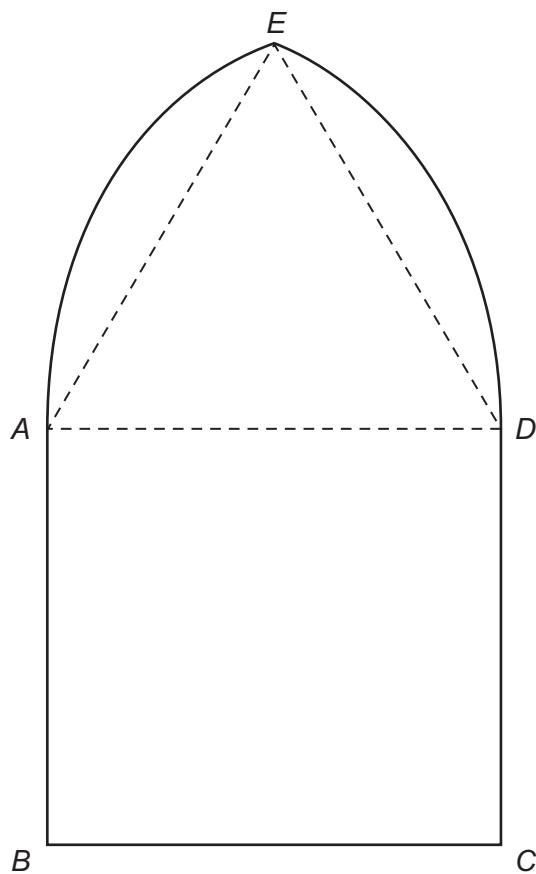
Not drawn accurately

ABCD is a square with side length 1.8 metres.

AE is an arc of a circle with centre *D*.

DE is an arc of a circle with centre *A*.

12 (a) Give reasons why triangle *ADE* is equilateral.

[2 marks]

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12 (b)   The perimeter of the window is lined with a strip of lead.

Work out the length of the strip of lead.

[4 marks]

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Answer .... m

Turn over for the next question

6

Turn over ▶

13 The graph shows the velocity-time graph for the first 90 seconds of a car journey.
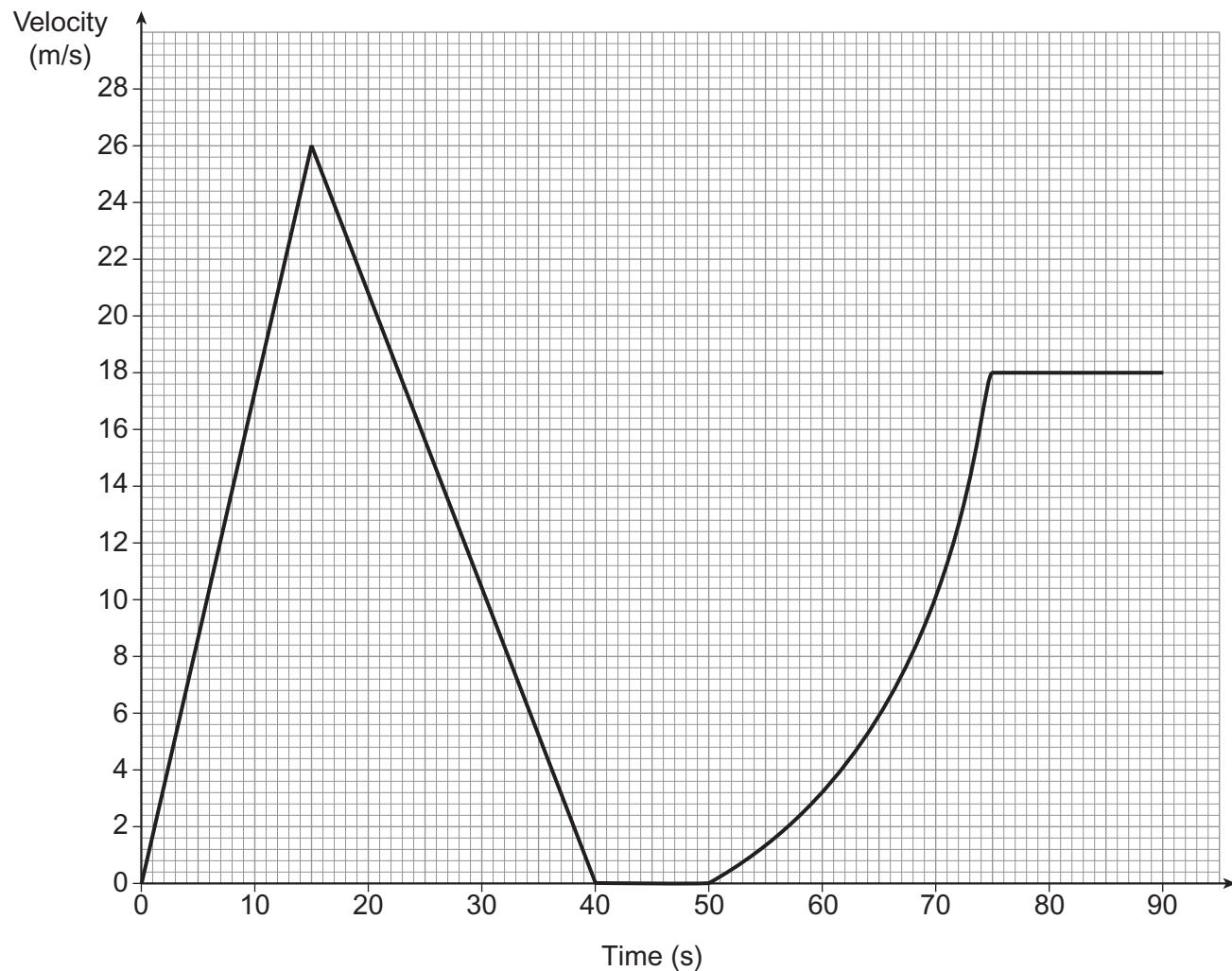
13 (a) Here is a statement about the first 40 seconds of the car journey.

When decelerating, the car travelled over 100 metres further than when accelerating.

Is the statement correct?
You **must** show your working.

[3 marks]

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13 (b) Estimate the acceleration of the car at 65 seconds.
You **must** show your working.

[3 marks]

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Answer .... m/s^2

Turn over for the next question

Turn over ▶

6

*14   A flat roof is 5.4 metres high.

A ladder leans against the roof.

The length of the ladder is 6.5 metres.

1 m

Not drawn accurately

5.4 m

a
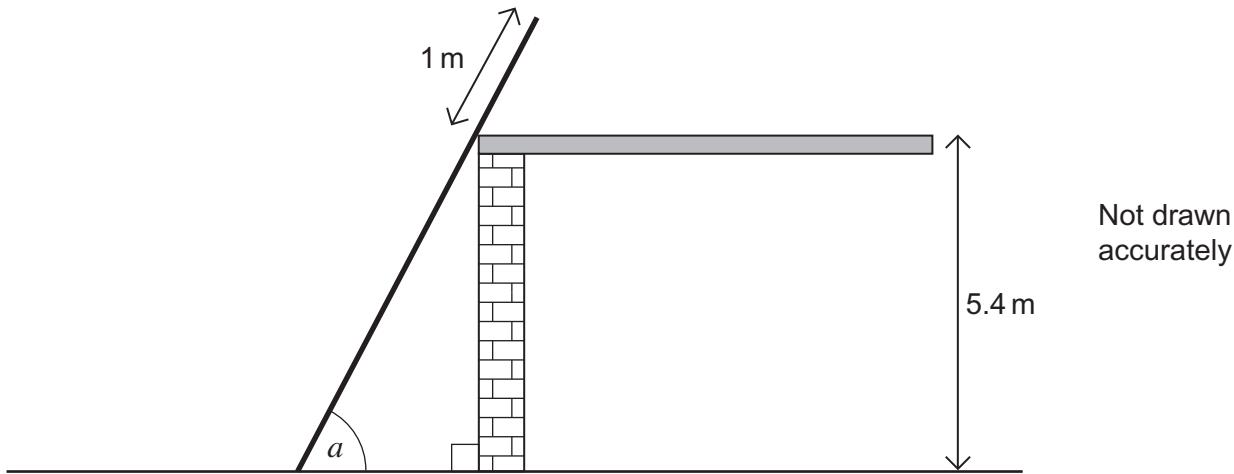
For a ladder to be used safely

angle a should be between 74° and 76°

Can the ladder be used safely in the position shown?
You **must** show your working.

[4 marks]

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15 A toy is made by joining a cone of height 25 cm and a hemisphere.

The cone and the hemisphere
- each have radius r cm
- have equal volumes.

25 cm

r cm
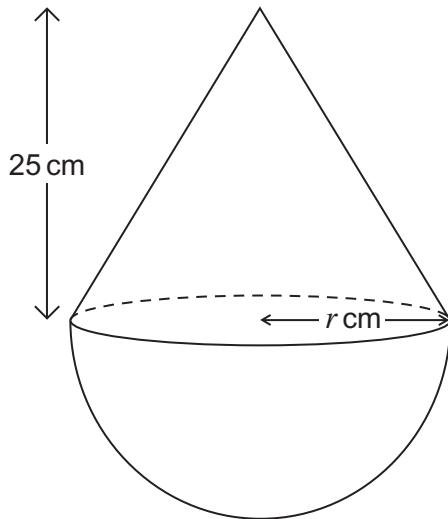
Work out the total height of the toy.
You **must** show your working.

[5 marks]

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Answer .... cm

Turn over for the next question

9

Turn over ▶

**16** The diagram shows a paperweight.

The horizontal base *BCD* is right-angled at *C*.

AB is vertical.

AB = 8.3 cm   *BD* = 12.5 cm   *CD* = 7.5 cm
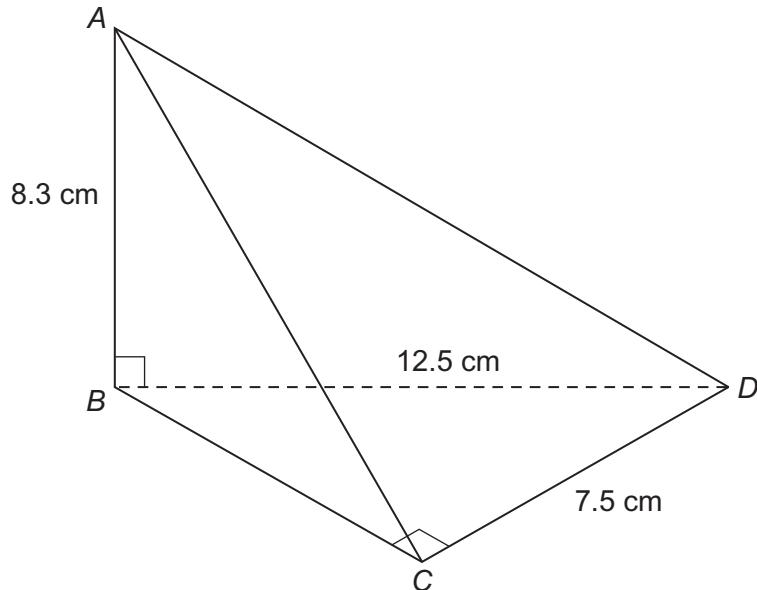
Work out the size of the angle *AC* makes with the horizontal.

[4 marks]

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Answer .... degrees

END OF QUESTIONS

4