AQA

Please write clearly in block capitals.

Centre number | | | | | | Candidate number | | | | |

Surname _____

Forename(s) _____

Candidate signature _____

GCSE
APPLICATIONS OF MATHEMATICS (LINKED PAIR)

H

Higher Tier Unit 2 Geometry and Measures

Thursday 16 June 2016 Afternoon Time allowed: 1 hour 30 minutes

Materials

For this paper you must have:
- a calculator
- mathematical instruments.

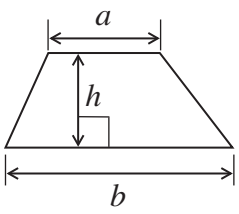
Instructions
- Use black ink or black ball-point pen. Draw diagrams in pencil.
- Answer **all** questions.
- You must answer the questions in the spaces provided. Do not write outside the box around each page or on blank pages.
- Do all rough work in this book. Cross through any work that you do not 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 4, 11 and 13. 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.

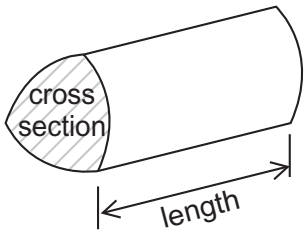
Advice
- In all calculations, show clearly how you work out your answer.

Formulae Sheet: Higher Tier

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

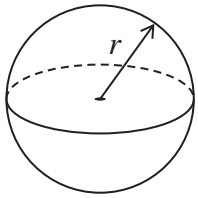


Volume of prism = area of cross section × length



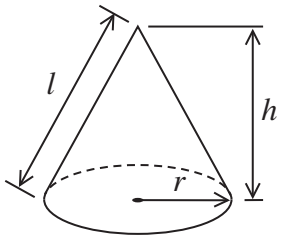
Volume of sphere = $\frac{4}{3}\pi r^3$

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



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

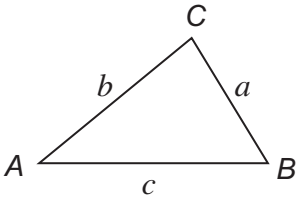
Curved surface area of cone = $\pi r l$



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 Suki has four parcels.

Each parcel weighs x kg

Suki weighs 57.6 kg

Suki and the four parcels weigh a total of 67.2 kg

Set up and solve an equation to work out the value of x.

[3 marks]

$x =$ _____

2 In a test,

Alan scored $\frac{2}{3}$ of the total marks

Bashir scored $\frac{3}{5}$ of the total marks

Cathy scored $\frac{13}{20}$ of the total marks.

Work out the **smallest** possible number of total marks in the test.

[2 marks]

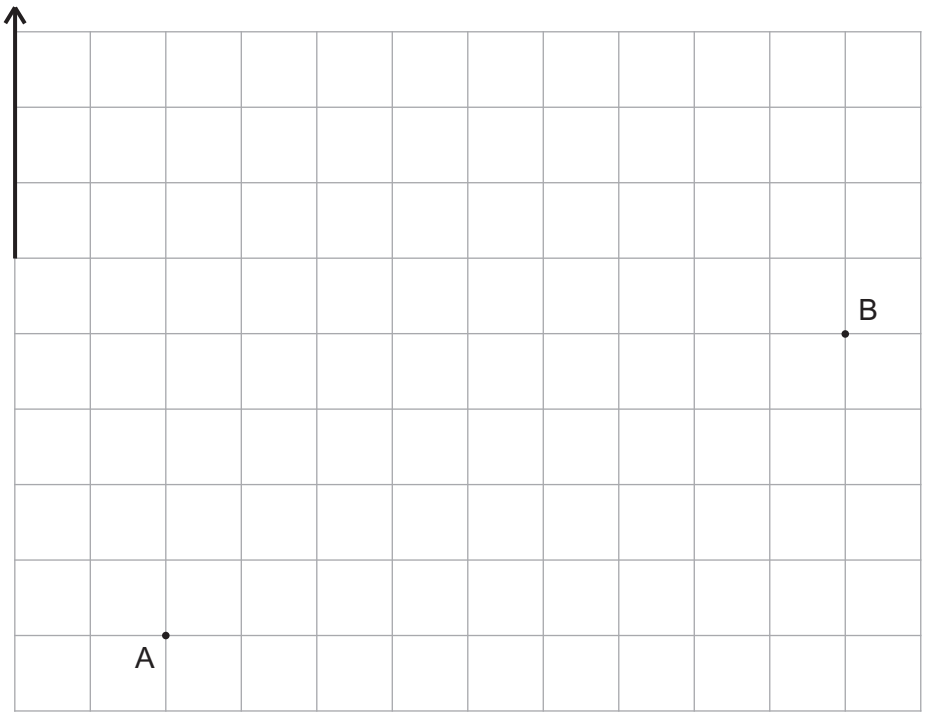
Answer _____

5

3 The scale diagram shows the positions of ship A and ship B at 9 am

Scale 1 cm represents 5 km

North



Ship A is travelling on a bearing of 045º

Ship B is travelling on a bearing of 270º

3 (a) On the diagram, show the point where the paths of the ships cross.
Label the point P.
You **must** show the path of each ship.

[2 marks]

3 (b) A lighthouse is

- 35 km from where ship A is at 9 am
- 40 km from where ship B is at 9 am

Using compasses, show the position of the lighthouse on the diagram.
Label the point L.

[2 marks]

***4** Gabby uses this recipe to make fruit punch.

For 30 people
5 litres apple juice
1.25 litres orange juice
1.25 litres pineapple juice

She buys

apple juice in 2 litre cartons

orange juice in 0.75 litre cartons

pineapple juice in 0.5 litre cartons.

She buys the least number of cartons needed to make fruit punch for 30 people.

This gives her enough juice to make fruit punch for **more than 30** people.

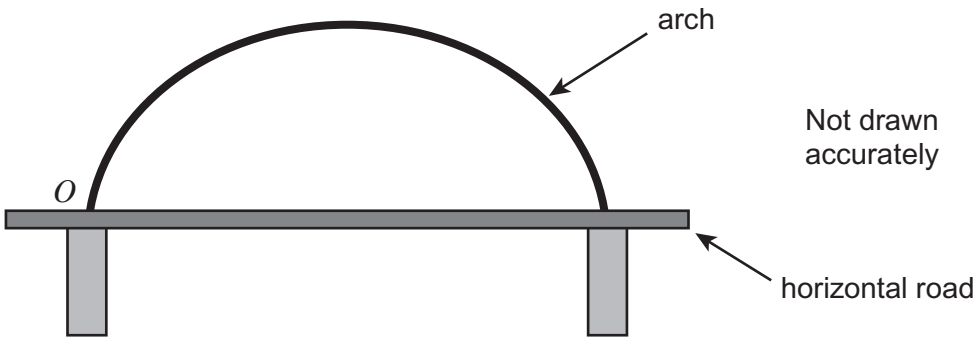
How many people can she make fruit punch for?
You **must** show your working.

[4 marks]

Answer _____

8

5 The diagram shows a bridge with an arch.



O is a point where the arch meets the road.

The equation of the arch is modelled by the equation $y = 3x - 0.06x^2$

x is the horizontal distance along the road from O, in metres.

y is the vertical height of the arch above the road, in metres.

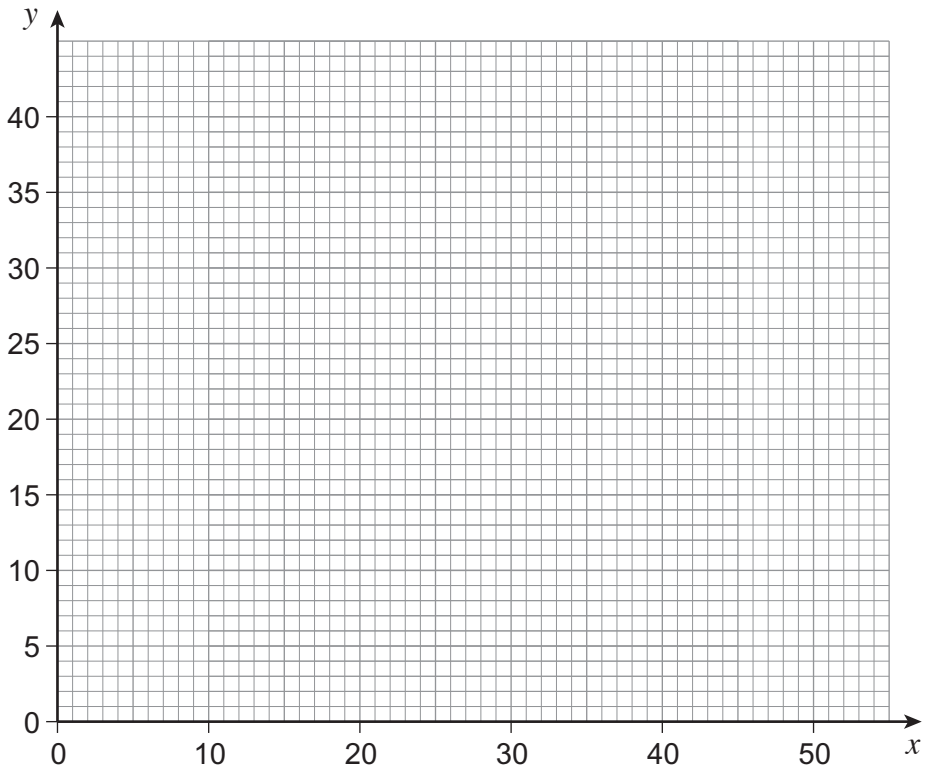
5 (a) Complete this table of values for $y = 3x - 0.06x^2$

[2 marks]

x	0	5	10	20	30	40	45	50
y	0			36		24	13.5	

5 (b) Draw the graph of $y = 3x - 0.06x^2$ for values of x from 0 to 50

[2 marks]



5 (c) What is the greatest vertical height of the arch above the road?

[1 mark]

Answer _____ metres

Turn over for the next question

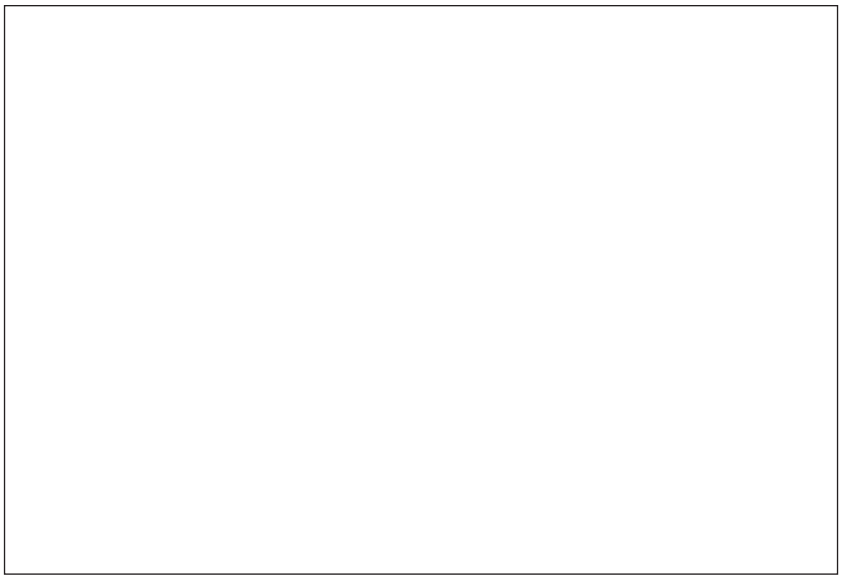
5

6 Here is a scale drawing of the top and side of a box.

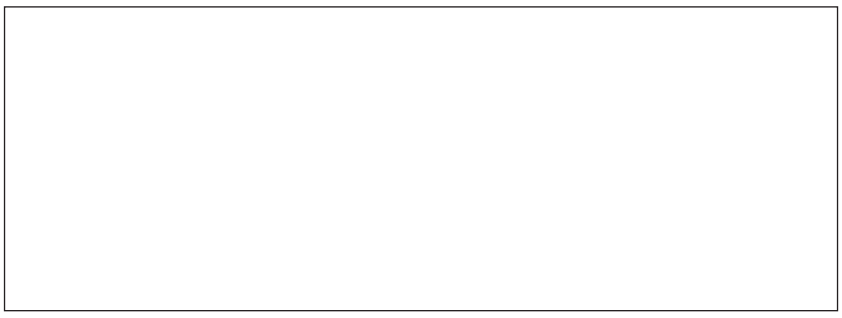
The box is a cuboid.

Scale 1 cm represents 4 cm

Top



Side



Tom wants to use the box to store cricket balls.

The diameter of each cricket ball is 72 mm

Tom says,

"45 cricket balls will fit in the box."

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

[4 marks]

4

7 Three of the notes on a piano keyboard are C, F and G.

Each note has a frequency, measured in Hertz (Hz)

frequency of C : frequency of F = 3 : 4

frequency of F : frequency of G = 8 : 9

7 (a) Show that frequency of C : frequency of G = 2 : 3

[2 marks]

7 (b) The frequency of C is 261.6 Hz

Work out the frequency of G.

[2 marks]

Answer _____ Hz

8 A tank has a volume of 108 000 cm^3

8 (a) What is the volume of the tank in litres?
Circle your answer.

[1 mark]

10.8 litres 108 litres 1080 litres 10 800 litres

8 (b) Water is poured into the tank at a constant rate.

It takes 4 minutes 30 seconds to fill the tank.

Work out the rate at which the water is poured in.
Give your answer in litres per minute.

[2 marks]

Answer _____ litres/minute

Turn over for the next question

7

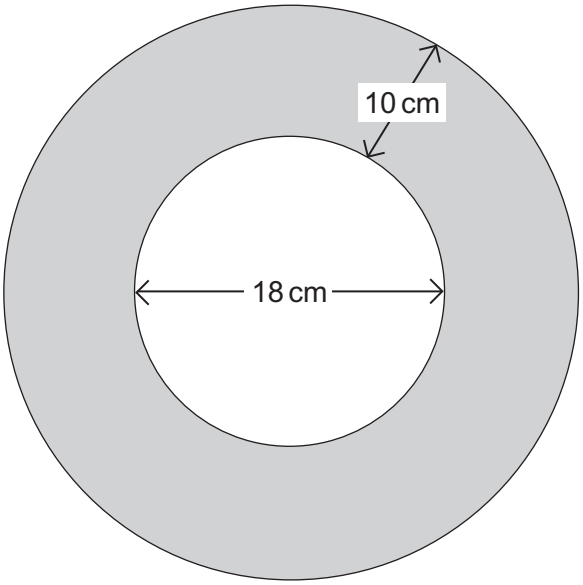
9 A hat is made by joining two parts.

Each part is made of felt.

First part

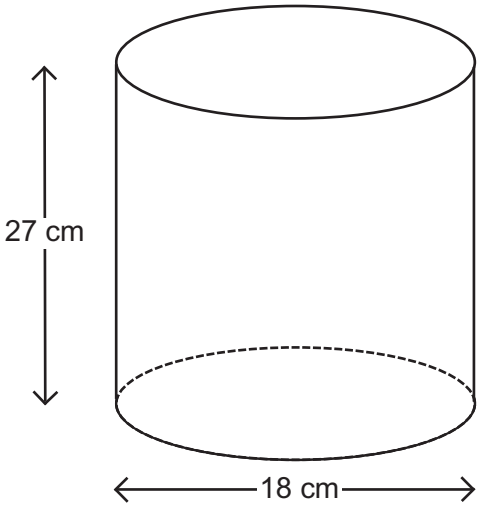
The piece that remains when a circle of diameter 18 cm is cut from the centre of a larger circle.

Not drawn accurately



Second part

The curved surface and **one** circular end of a cylinder.



Work out the total area of felt needed to make the hat.
Give your answer in terms of π.

[4 marks]

Answer _____ cm^2

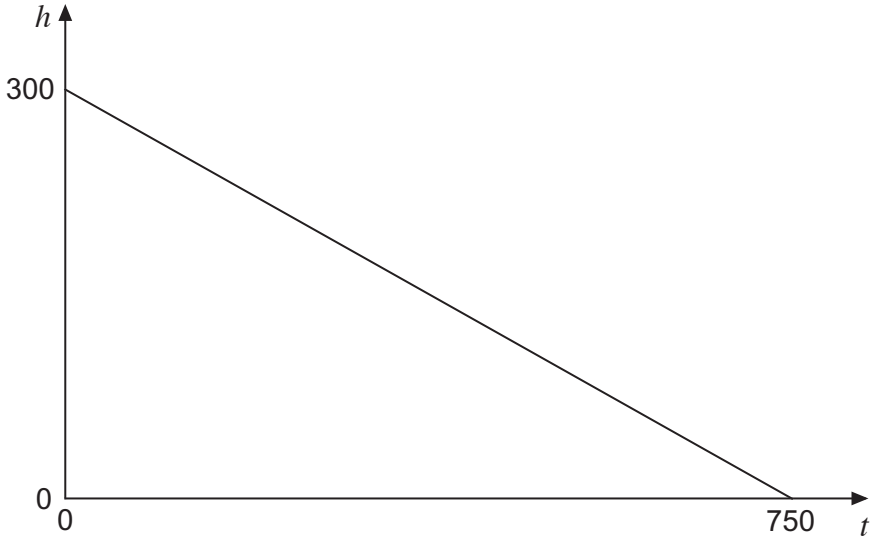
Turn over for the next question

4

10 Here is a sketch graph showing the height of a candle as it burns.

h is the height, in millimetres, of the candle.

t is the time, in minutes, after the candle starts burning.



10 (a) Work out the rate at which the height of the candle decreases.
Give your answer in millimetres per minute.

[2 marks]

Answer _____ mm/min

10 (b) The relationship between h and t can be written as $h = a - bt$

Work out the values of a and b.

[2 marks]

Answer $a =$_____ $b =$_____

10 (c) When the candle is 80 mm high, a new candle is used.

Work out the amount of time that the candle burns before a new candle is used.
Give your answer in hours and minutes.

[4 marks]

Answer _____hours_____minutes

Turn over for the next question

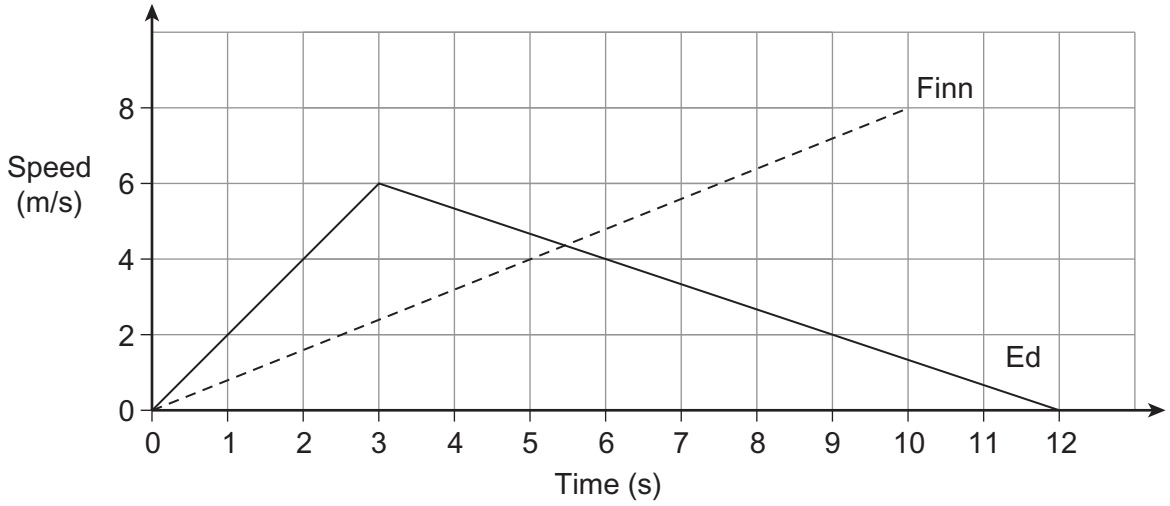
8

11 Ed and Finn both run along the same track.

Ed runs for 12 seconds.

Finn runs for 10 seconds.

The graphs show their runs.



***11 (a)** Who runs the further distance?
You **must** show your working.

[3 marks]

Answer _____

11 (b) Work out Finn's acceleration.
State the units of your answer.

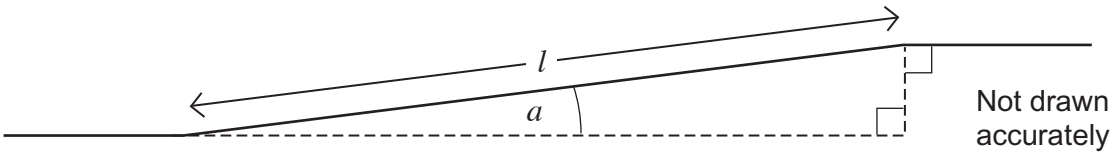
[3 marks]

Answer _____

Turn over for the next question

6

12 The diagram shows a sketch of a **single** ramp for a wheelchair.



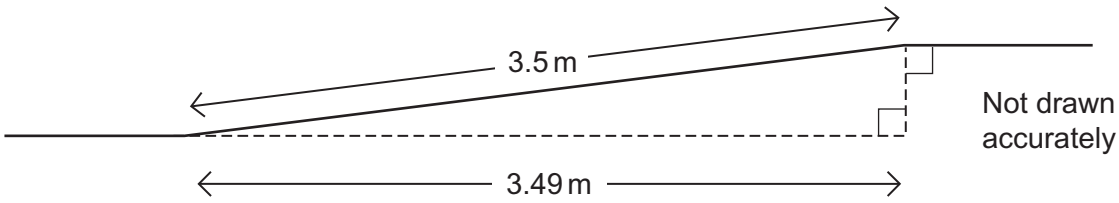
l is the length of the ramp in metres.

a is the size of the angle between the ramp and the horizontal in degrees.

Here are some rules about the sizes of l and a.

Length, l	Maximum size of a
$l \leqslant 2$	4.75°
$2 < l \leqslant 5$	3.80°
$5 < l \leqslant 10$	2.85°

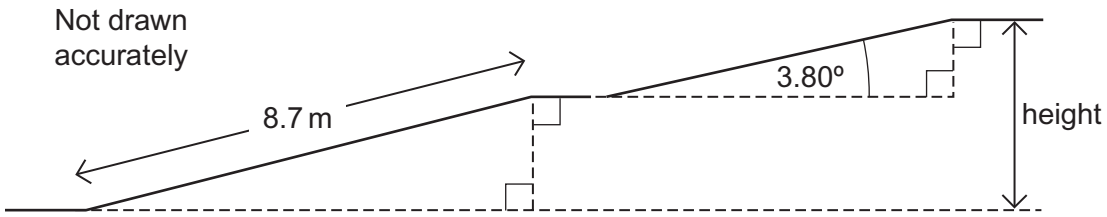
12 (a) Does this ramp follow the rules?



You **must** show your working.

[3 marks]

12 (b) The diagram shows a sketch of a **double** ramp for a wheelchair.



Each part of the ramp follows the rules for a single ramp.

Work out the **maximum** possible height of the double ramp.
You **must** show your working.

[5 marks]

Answer _____ metres

8

13 V is the value of a house, in tens of thousands of pounds.

$$V = A \times c^x$$

x is the number of years after the house is bought.

A and c are constants.

***13(a)** The value of a house when bought is £200 000

Show that $A = 20$

[2 marks]

13 (b) The value of the house after 2 years is £220 500

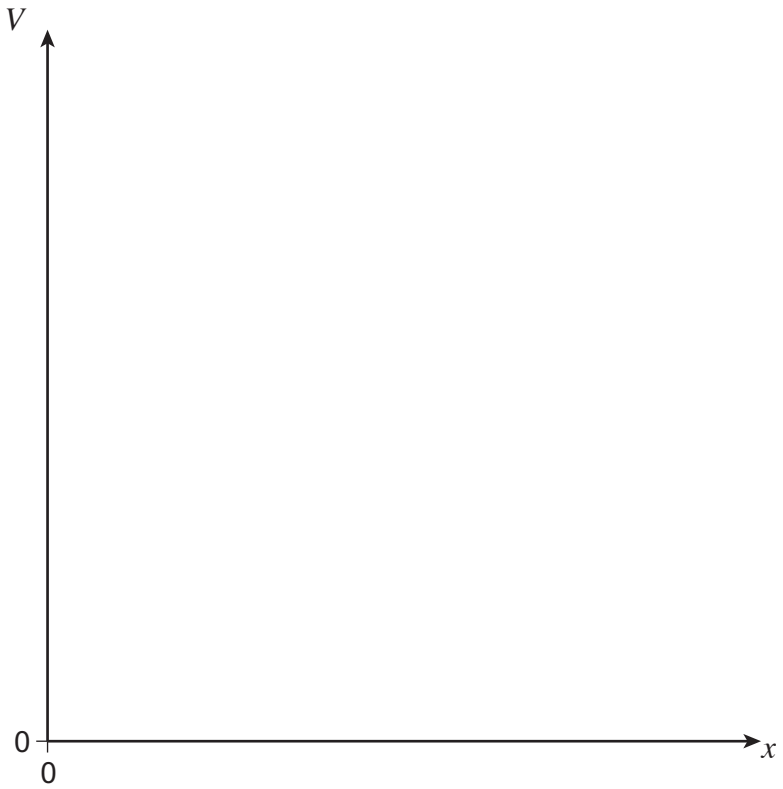
Work out the value of c.

[4 marks]

Answer _____

13 (c) Draw a sketch of the graph of $V = 20 \times c^x$ on the axes below.
Use your value of c.

[2 marks]



Turn over for the next question

8

14 *ABCD* represents a piece of leather used as part of a jacket.

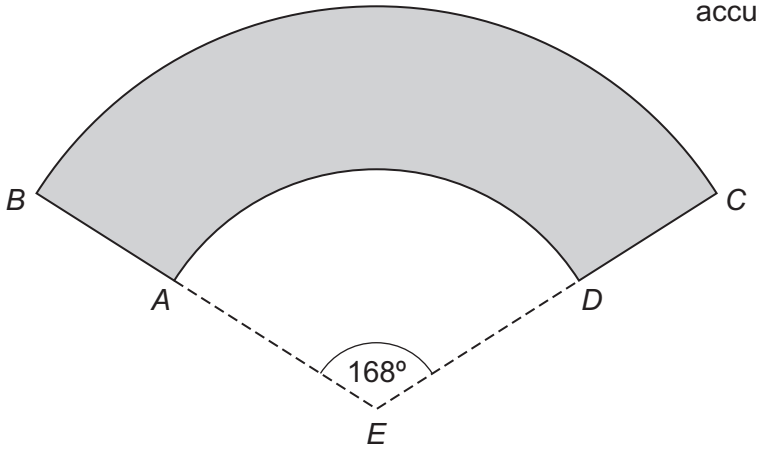
Arcs *BC* and *AD* each have centre *E*.

BE = 150 mm

AE = 82 mm

Angle *AED* = 168º

Not drawn accurately



The piece has edging around the perimeter.

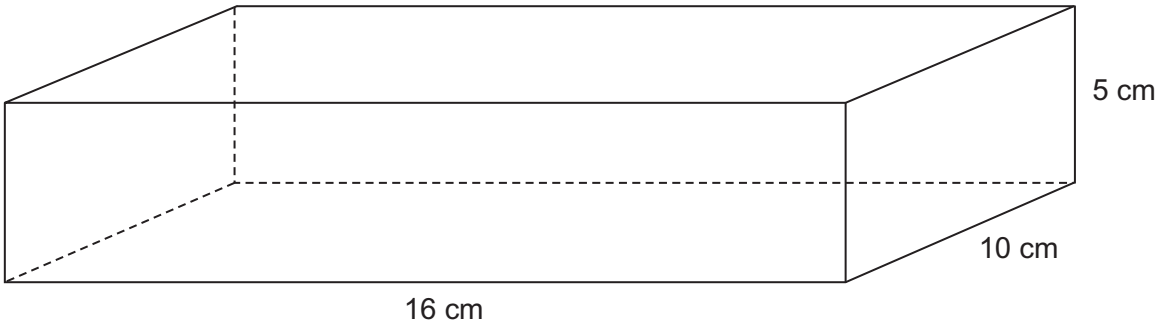
Work out the total length of the edging.
Give your answer to the nearest millimetre.

[5 marks]

Answer _____ mm

15 A pencil case is a cuboid with base measuring 16 cm by 10 cm

The height of the cuboid is 5 cm



15 (a) Work out the length of the **longest** pencil that will fit in the case.
Give your answer in centimetres, correct to the nearest millimetre.

[3 marks]

Answer _____ cm

15 (b) Work out the size of the angle the longest pencil makes with the base of the case.

[2 marks]

Answer _____ degrees

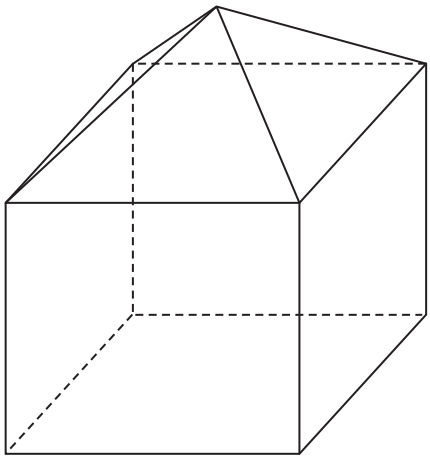
10

Turn over ▶

16 A cube and a pyramid are joined to make a small, solid metal paperweight.

The cube has edge 4 cm

The pyramid has a square base of side 4 cm and a vertical height of 2.5 cm



16 (a) Volume of a pyramid = $\frac{1}{3} \times$ area of base $\times$ height

Show that the volume of the paperweight is $77\frac{1}{3}\,\text{cm}^3$

[3 marks]

16 (b) All the dimensions of the small paperweight are increased by a scale factor of x.

This makes a larger, similar solid paperweight.

The same type of metal is used in both paperweights.

- The larger paperweight has mass 1.827 kilograms.
- The density of the metal is 7 grams per cubic centimetre.

Work out the value of x.

[4 marks]

Answer _____

END OF QUESTIONS

7

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