

Please write clearly in block capitals.

Centre number

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Candidate number

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Surname

\_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_

Forename(s)

\_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_

Candidate signature

I declare this is my own work.

# GCSE MATHEMATICS

Higher Tier Paper 2 Calculator

H

Monday 3 June 2024

Morning

Time allowed: 1 hour 30 minutes

## Materials

For this paper you must have:

- a calculator
- mathematical instruments
- the Formulae Sheet (enclosed).



## 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.
- If you need extra space for your answer(s), use the lined pages at the end of this book. Write the question number against your answer(s).
- Do all rough work in this book. Cross through any work you do not want to be marked.

## Information

- The marks for questions are shown in brackets.
- The maximum mark for this paper is 80.
- 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.

| For Examiner's Use |      |
|--------------------|------|
| Pages              | Mark |
| 2-3                |      |
| 4-5                |      |
| 6-7                |      |
| 8-9                |      |
| 10-11              |      |
| 12-13              |      |
| 14-15              |      |
| 16-17              |      |
| 18-19              |      |
| 20-21              |      |
| 22-23              |      |
| 24                 |      |
| <b>TOTAL</b>       |      |



JUN24/G4007/E10

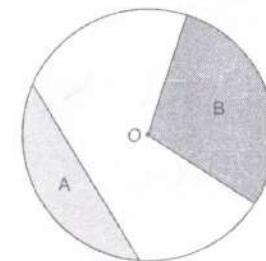
8300/2H

2

Answer all questions in the spaces provided.

Do not write  
outside the  
box

1 The diagram shows a circle, centre O, and three straight lines.



Use one word to describe each shaded region.

Choose from

arc chord sector segment tangent

[2 marks]

Region A

segment

Region B

sector



JUN24/8300/2H

2 The mass of an iceberg is 2200 000 kg

This value is a 12% reduction from the **original** mass of the iceberg.

Work out the **original** mass of the iceberg.

Give your answer in standard form.

[3 marks]

$$2200000 \div 0.88$$

$$= 2500000$$

Answer  $2.5 \times 10^6$  kg

Turn over for the next question

5

Turn over ►



0 3

IB/M/Jun24/8300/2H

Do not write outside the box

3 A chef has a tub of blueberries.

She wants to

use all the blueberries

put the same number of blueberries on each dessert.

$$D = \frac{k}{b}$$

$D$  is the number of desserts.

$b$  is the number of blueberries on each dessert.

3 (a) What does the constant  $k$  represent?

Tick the correct box.

[1 mark]



The number of blueberries in the tub



The number of desserts



The number of blueberries on each dessert



None of the above

3 (b) Complete the table.

[2 marks]

|     |     |    |    |
|-----|-----|----|----|
| $b$ | 2   | 6  | 8  |
| $D$ | 120 | 40 | 30 |

240 240 240



0 4

IB/M/Jun24/8300/2H

4 (a) A fair spinner has six equal sections, each with the number 5, 6, 7 or 8

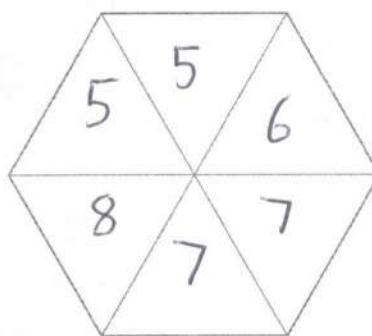
Each number appears at least once. ✓

$$P(\text{even number}) = P(7)$$

Work out  $P(5)$

You may use the blank spinner to help you.

[3 marks]



$$\frac{2}{6}$$

Answer \_\_\_\_\_

4 (b) A different spinner has ten sections, each labelled A, B, C or D.

|             | A   | B   | C   | D   |
|-------------|-----|-----|-----|-----|
| Probability | 0.1 | 0.5 | 0.2 | 0.3 |

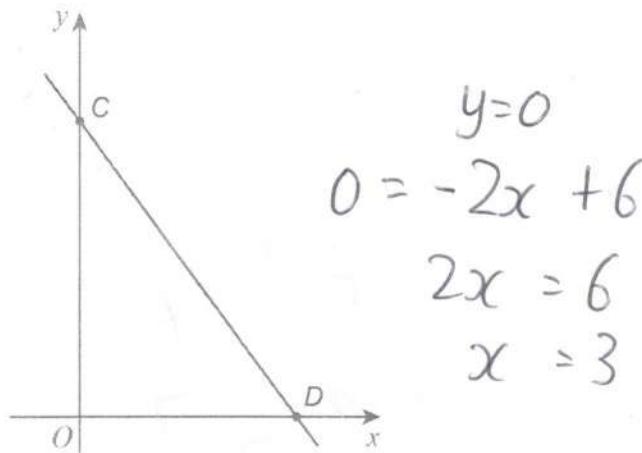
Give **one** reason why there **must** be a mistake in the table.

[1 mark]

They should add to 1, not 1.1



5 (a) Here is a sketch of the graph  $y = -2x + 6$

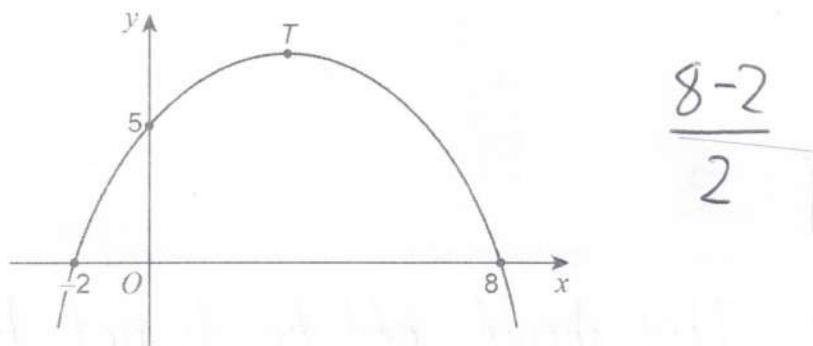


Complete the coordinates of  $C$  and  $D$ .

[2 marks]

$$C(0, 6) \quad D(3, 0)$$

5 (b) Here is a sketch of a quadratic graph.



Complete the following statements.

[2 marks]

5

The value of the  $y$ -intercept is \_\_\_\_\_

3

The  $x$ -coordinate of the turning point,  $T$ , is \_\_\_\_\_



6 Work out  $(2.5 \times 10^4)^{-3}$

Give your answer in standard form.

[1 mark]

Answer

$$6.4 \times 10^{-14}$$

7 Archie flips a biased coin 200 times.

Here is some information about the outcomes after each 50 flips.

|                       |    |     |     |     |
|-----------------------|----|-----|-----|-----|
| Total number of flips | 50 | 100 | 150 | 200 |
| Number of heads       | 10 | 27  | 37  | 52  |

Work out the best estimate for the probability of flipping a head.

Give a reason for your answer.

Answer

$$\frac{52}{200}$$

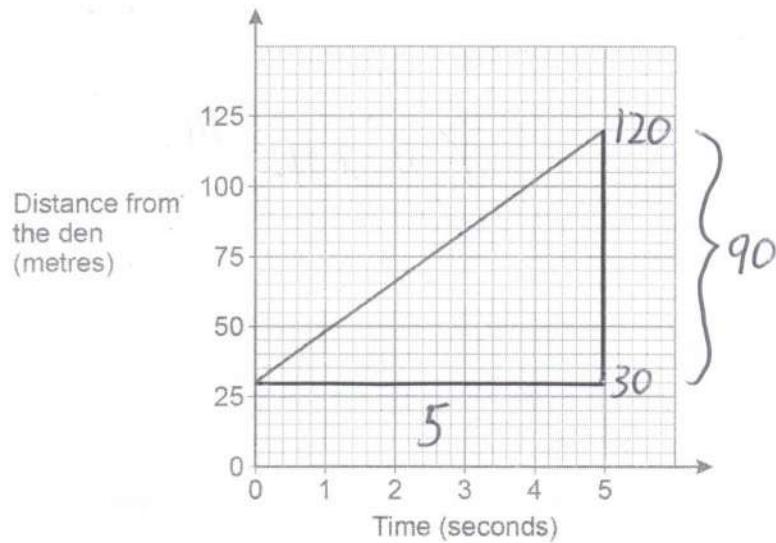
[2 marks]

Reason

More trials = more reliability



8 A lion is sprinting in a straight line away from its den.  
The graph shows the lion's distance from the den.



Work out the speed of the lion in metres per second.

[3 marks]



$$S = \frac{90}{5}$$

Answer 18 m/s



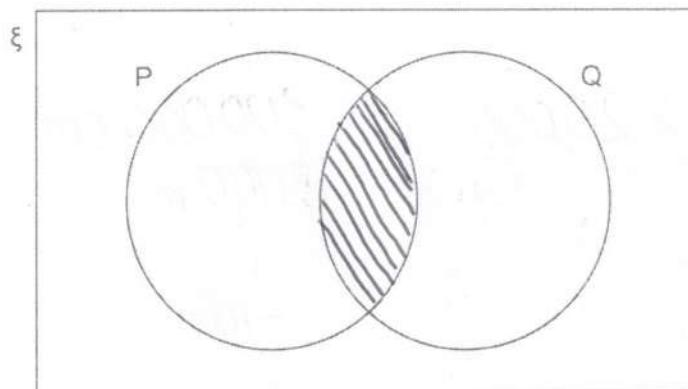
0 8

IB/M/Jun24/8300/2H

9 On the Venn diagram, shade the section represented by  $P \cap Q$

[1 mark]

Do not write outside the box.



10 A bus route had 90 000 passengers last year.

The number of passengers was predicted to increase

by 3% this year

and then

by 8% next year.

Is the predicted number of passengers for **next** year more than 100 000 ?

You **must** show your working.

[3 marks]

$$90000 \times 1.03 \times 1.08$$

$$= 100116$$

so Yes, > 100,000



11 A map has a scale of 1:20 000

Two churches are 15 cm apart on the map.

Work out the actual distance between them.

Give your answer in **kilometres**.

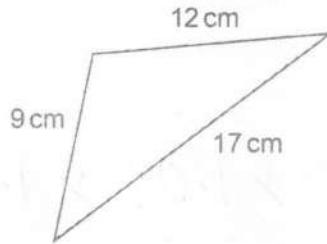
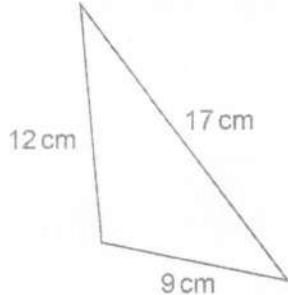
[3 marks]

$$\begin{aligned}
 15 \text{ cm} \times 20000 &= 300000 \text{ cm} \\
 &= 3000 \text{ m}
 \end{aligned}$$

$$\div 1000$$

Answer 3 km

12

Not drawn  
accurately

Circle the reason why these triangles are congruent.

[1 mark]

ASA

RHS

SAS

SSS



1 0

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13

Liam takes part in long jump competitions.

Here is some information about 40 of his jumps.

| Length of jump,<br>$d$ metres | $f$ | Number of jumps | $x$ | Midpoint | $fx$  |
|-------------------------------|-----|-----------------|-----|----------|-------|
| $7.0 \leq d < 7.4$            | 15  | $x$             | 7.2 |          | 108   |
| $7.4 \leq d < 7.8$            | 18  | $x$             | 7.6 |          | 136.8 |
| $7.8 \leq d < 8.2$            | 7   | $x$             | 8.0 |          | 56    |
| Total = 40                    |     |                 |     |          |       |

Work out an estimate of the mean distance of these 40 jumps.

Give your answer as a decimal.

[3 marks]

$$\sum = 300.8$$

$$\frac{300.8}{40}$$

Answer

7.52

m

7

Turn over ►



1 1

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14 A graph passes through the points  $(3, 15)$  and  $(7, w)$

14 (a) Assume that the equation of the graph has the form  $y = x^2 + c$

Work out the value of  $w$  that this would give.

[3 marks]

$$x=3, y=15$$

$$15 = 3^2 + c$$

$$c = 6$$

$$y = x^2 + 6$$

$$x=7, y=w$$

$$\begin{aligned} w &= 7^2 + 6 \\ &= 49 + 6 \end{aligned}$$

$$w = \underline{\hspace{2cm}} \quad 55$$

14 (b) In fact, the graph is a straight line.

What does this mean about the actual value of  $w$ ?

Tick **one** box.

[1 mark]

It must be the same as the value in part (a)

It must be different to the value in part (a)

It is impossible to tell



1 2

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15

Concrete from a truck is poured at 10.9 kg per second for 30 minutes.

$$1000 \text{ kg} = 1 \text{ tonne}$$

Is more than 20 tonnes of concrete poured?

Tick a box.

Yes

No

You must show your working.

[4 marks]

$$30 \times 60 \times 10.9 = 19620 \text{ kg}$$

$$= 19.62 \text{ tonnes}$$



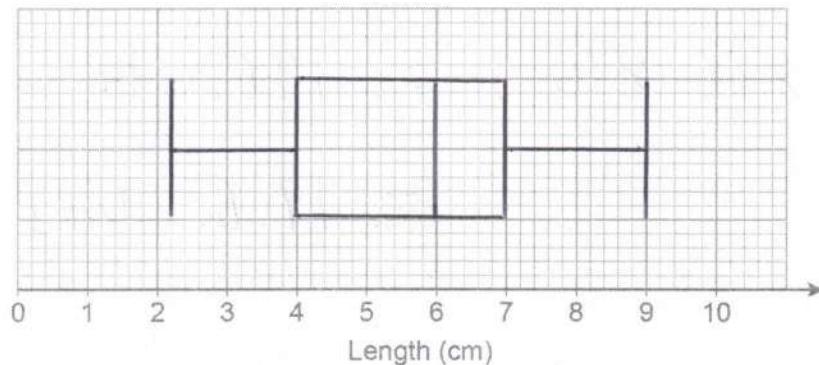
16

Here is some information about the lengths, in cm, of leaves.

- Shortest length = 2.4 ✓
- Longest length = 9 ✓
- Upper quartile = 7 ✓
- Median length = 6 ✓
- Interquartile range = 3

Draw a box plot to show this information.

[3 marks]



1 4

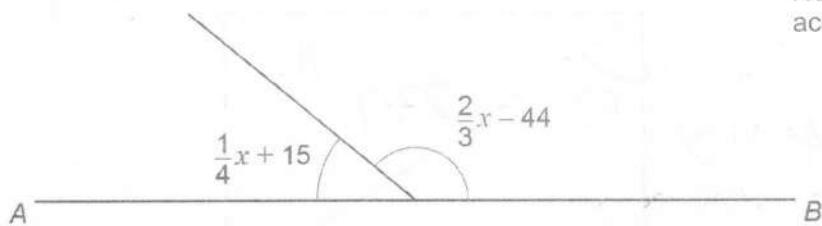
IB/M/Jun24/8300/2H

17

 $AB$  is a straight line.

Both angles are given in degrees.

Do not write outside the box



Not drawn accurately

By working out the value of  $x$ ,

work out the ratio smaller angle : larger angle

$$\frac{1}{4}x + 15 + \frac{2}{3}x - 44 = 180$$

[4 marks]

$$\frac{11x}{12} = 209$$

$$x = 228$$

$$\frac{1}{4}x \cdot 228 + 15 = 72$$

$$72 : 108$$

Q6

Answer

2 3

7

Turn over ►

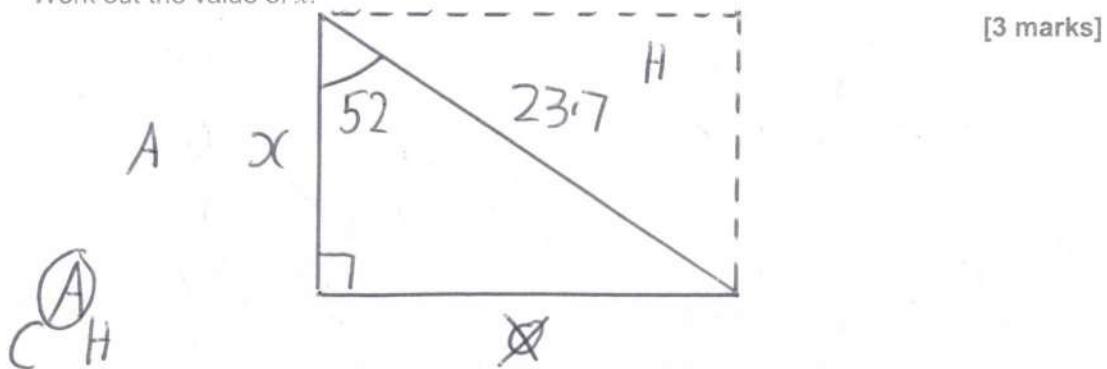


1 5

IB/M/Jun/24/8300/2H

18

A diagonal of a rectangle is 23.7 cm long.

The diagonal makes an angle of  $52^\circ$  with a side of length  $x$  cmWork out the value of  $x$ .

$$x = \cos 52^\circ \times 23.7$$

$$= 14.591\ldots$$

$$x = 14.6$$

$$\text{ms: } 14.59 \rightarrow 14.6$$



19 (a) Show that  $\overbrace{4x(3x+2) - 2x^2\left(6 - \frac{5}{x}\right) - 6x\left(3 + \frac{7}{x}\right)}$  simplifies to an integer.

$$= \cancel{12x^2} + 8x - \cancel{12x^2} + \frac{10x^2}{x} - 18x - \frac{42x}{x} \quad [3 \text{ marks}]$$

$$= 8x + 10x - 18x - 42$$

$$= 0x - 42$$

$$= -42$$

19 (b) Factorise  $\overbrace{8x^2 - 18x - 35}$   $ac = -280$

[2 marks]

$$\begin{array}{c|c} 8x^2 + 10x & -28x - 35 \\ \hline 2x(4x+5) & -7(4x+5) \end{array}$$

Answer  $(2x-7)(4x+5)$



20  $(x-9) = \frac{2(6-x^2)}{x+3}$  and  $x = \frac{d \pm \sqrt{e}}{f}$

Work out one set of possible values for  $d$ ,  $e$  and  $f$ .

$$(x-9)(x+3) = 2(6-x^2)$$

[4 marks]

$$x^2 - 27 - 9x + 3x = 12 - 2x^2$$

$$3x^2 - 6x - 39 = 0$$

$$x^2 - 2x - 13 = 0$$

$$a=1, b=-2, c=-13$$

$$x = \frac{2 \pm \sqrt{4 - 4x|x-13|}}{2}$$

$$x = \frac{2 \pm \sqrt{56}}{2}$$

$$d = 2$$

$$e = 56$$

$$f = 2$$



1 8

IB/M/Jun24/8300/2H

21 People in a stadium are in the North Stand, East Stand, South Stand or West Stand. Of the people in the stadium,

$\frac{1}{4}$  are in the North Stand

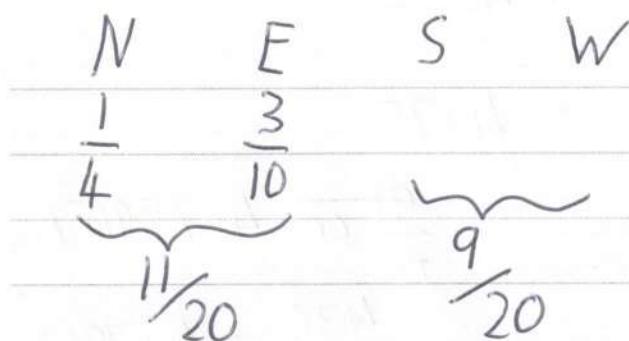
$\frac{3}{10}$  are in the East Stand

number in South Stand : number in West Stand = 2 : 7

There are 4480 people in the West Stand.

How many people are in the stadium?  $= x$

[4 marks]



$$4480 = \frac{9}{20} \times \frac{7}{9} \times x$$

Answer 12800

Turn over for the next question



22

Do not write  
outside the  
box

$$x_{n+1} = 5 - \frac{1}{x_n}$$

Use  $x_1 = 1$  to work out an approximate solution to  $x = 5 - \frac{1}{x}$

Give your answer to 4 significant figures.

[3 marks]

$$x_1 = 1$$

$$x_2 = 5 - \frac{1}{1} = 4$$

$$x_3 = 5 - \frac{1}{4} = 4.75$$

$$x_4 = 5 - \frac{1}{4.75} = \frac{91}{19} \text{ or } 4.78947\dots$$

$$x_5 = 5 - \frac{1}{4.78947\dots} = \frac{436}{91} = 4.7912\dots$$

$$x_6 = 5 - \frac{1}{4.7912\dots} = \frac{2089}{436} = 4.7912\dots$$

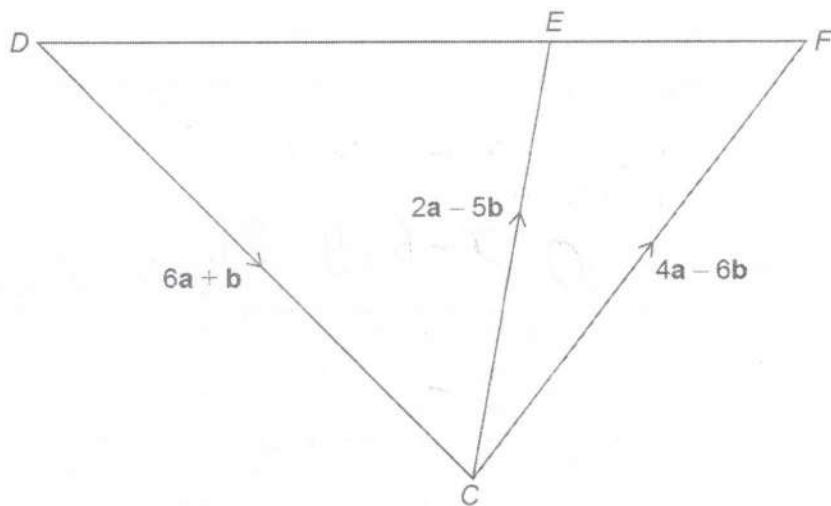
$$x = 4.791$$



20

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23



Prove that  $DEF$  is a straight line.

[4 marks]

$$\begin{aligned}
 DE &= 6a + b + 2a - 5b \\
 &= 8a - 4b \\
 &= 4(2a - b)
 \end{aligned}$$

$$\begin{aligned}
 DF &= 6a + b + 4a - 6b \\
 &= 10a - 5b \\
 &= 5(2a - b)
 \end{aligned}$$

ie "parallel"

Same vector components and start from D

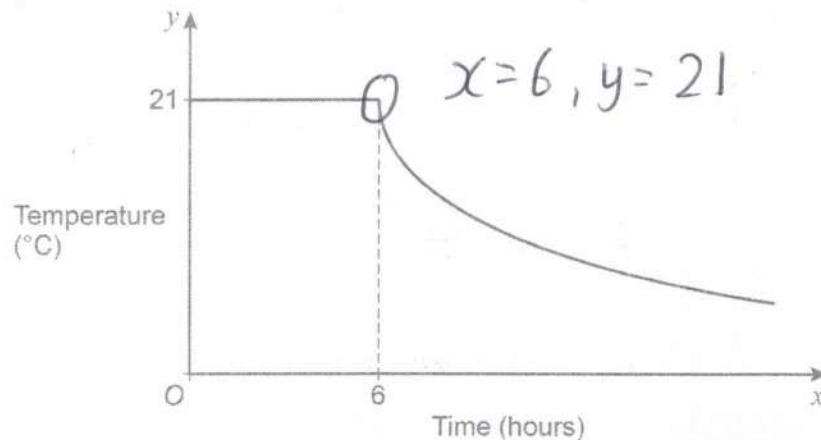


24

A room is kept at a constant temperature of  $21^\circ\text{C}$  for 6 hours.

The heating is then turned off and the room begins to cool.

Here is a sketch graph showing the temperature,  $y^\circ\text{C}$ , of the room at time  $x$  hours.



24 (a) Assume the equation of the curved part is  $y = \frac{k}{x}$  where  $k$  is a constant.

Work out the value of  $y$  when  $x = 12$

[2 marks]

$$21 = \frac{k}{6}$$

$$y = \frac{126}{12}$$

$$K = 6 \times 21 = 126$$

$$y = \underline{\hspace{2cm}} \quad 10.5$$



2 2

24 (b) In fact,

the equation of the curved part is  $y = A \times \left(\frac{1}{3}\right)^{\frac{1}{6}x}$  where  $A$  is a **different** constant.

How does this affect the value of  $y$  when  $x = 12$ ?

Tick **one** box.

You **must** show working to support your answer.

[2 marks]

The value of  $y$  is greater than the answer to part (a).

The value of  $y$  is less than the answer to part (a).

The value of  $y$  is the same as the answer to part (a).

$$21 = A \times \left(\frac{1}{3}\right)^1$$

$$21 = \frac{A}{3}$$

$$A = 63$$

$$y = 63 \times \left(\frac{1}{3}\right)^2$$

$$y = 7$$

Turn over for the next question

4

Turn over ►

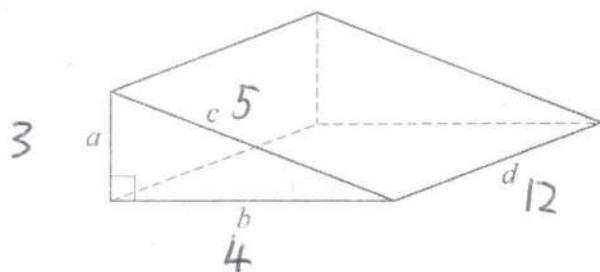


2 3

IB/M/Jun24/8300/2H

25

Here is a right-angled triangular prism.

The ratio of the edges is  $a : b : c : d = 3 : 4 : 5 : 12$ The volume of the prism is  $1125 \text{ cm}^3$ 

Work out the total length of all of the edges of the prism.

[5 marks]

$$\frac{1}{2} \times 4 \times 3 \times 12 = 72$$

$$72x^3 = 1125 \text{ cm}^3$$

$$x = \sqrt[3]{\frac{1125}{72}} = \frac{5}{2}$$

$$2x(3+4+5) + 3 \times 12 = 60$$

$$60 \times 2.5$$

Answer

150

cm

END OF QUESTIONS

5



2 4

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