AQA

Please write clearly in block capitals.

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

Surname _____

Forename(s) _____

Candidate signature _____

I declare this is my own work.

GCSE MATHEMATICS

H

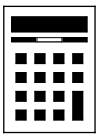
Higher Tier Paper 2 Calculator

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

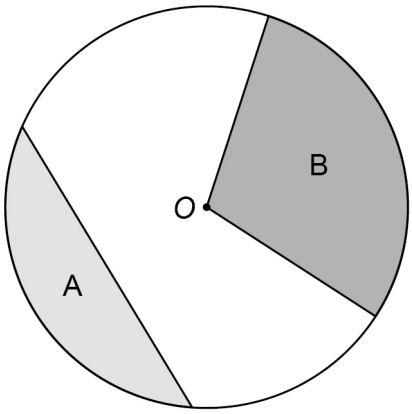
In all calculations, show clearly how you work out your answer.

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	
TOTAL	

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 ✓ (1)

Region B Sector ✓ (1)

Do not write outside the box

2 The mass of an iceberg is 2 200 000 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]

88% of original mass = 2 200000 kg ✓①

original mass = 2 200 000 kg × $\frac{100}{88}$ ✓①

= 2 500 000 kg

= 2.5×10^6 kg ✓①

Answer 2.5×10^6 kg

Turn over for the next question

5

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 ✓ (1)
- [ ] 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 ✓(1)
D	120	40 ✓(1)	30

$120 = \frac{k}{2}$ $\quad k = 240$

$D = \frac{240}{6}$ $\quad = 40$

$30 = \frac{240}{b}$ $\quad b = 8$

Do not write outside the box

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

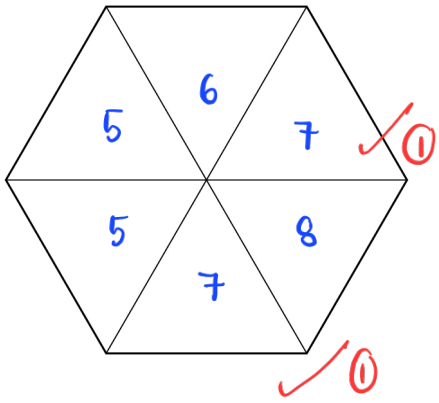
Each number appears at least once.

P(even number) = P(7) – there are two even numbers (6 and 8) there should be two 7 also. Hence, the last number should be 5.

Work out P(5)

You may use the blank spinner to help you.

[3 marks]



✓ ① ✓ ①

Answer $\frac{2}{6}$ ✓ ①

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.

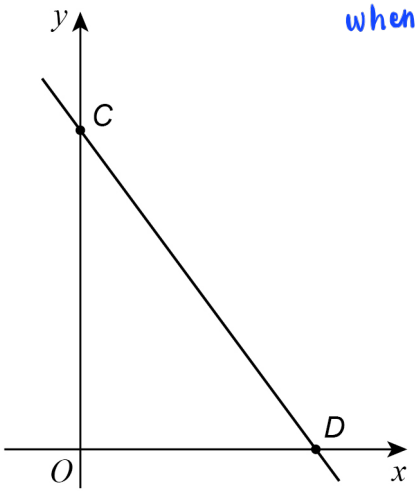
[1 mark]

The total probability adds up to 1.1. ✓ 0

7

Do not write outside the box

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



when $x = 0$, $y = 6$

$y = 0$, $x = 3$

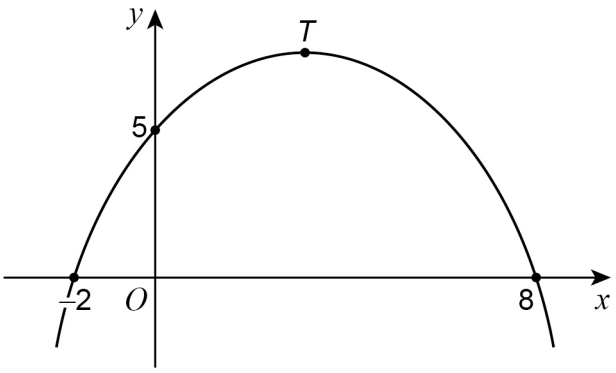
Complete the coordinates of *C* and *D*.

[2 marks]

C (0 , 6) ✓1

D (3 , 0) ✓1

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



Complete the following statements.

[2 marks]

The value of the ***y*-intercept** is 5 ✓1

The ***x*-coordinate** of the turning point, *T*, is 3 ✓1

Do not write outside the box

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

Give your answer in standard form.

[1 mark]

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

$= (6.4 \times 10^{-2}) \times 10^{-12}$

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

Answer 6.4×10^{-14} ✓1

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.

[2 marks]

Answer $\frac{52}{200}$ ✓1

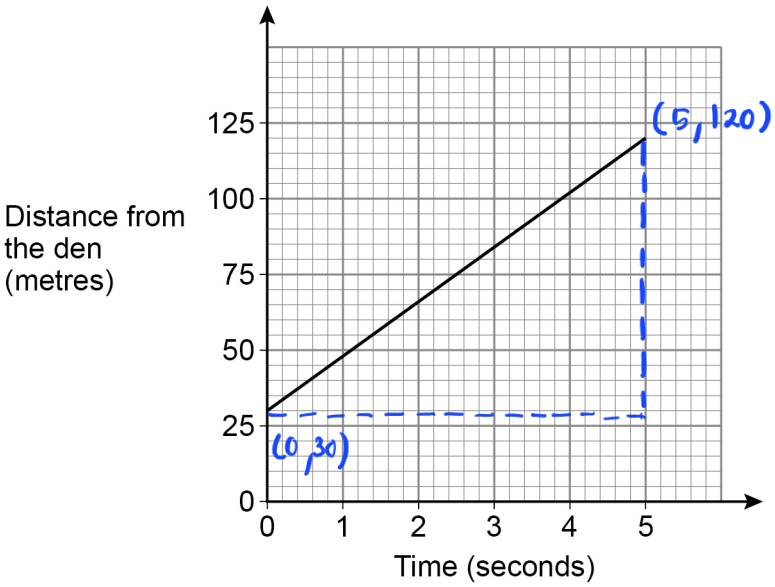
Reason largest number of flips give the best estimation ✓1

7

Do not write outside the box

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]

Speed = distance / time

= (120 − 30) / 5 ✓0

= 90 / 5 ✓0

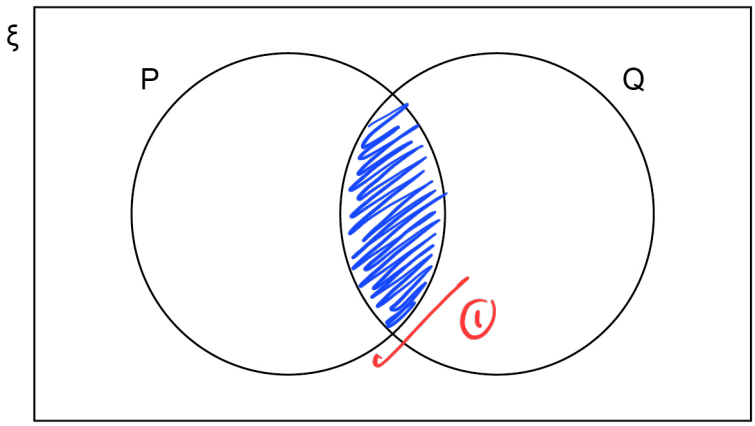
= 18 ms^{-1} ✓0

Answer 18 m/s

Do not write outside the box

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

[1 mark]



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]

This year : $\frac{103}{100} \times 90\,000 = 92\,700$ ✓1

Next year : $\frac{108}{100} \times 92\,700 = 100\,116$ ✓1

∴ Yes, the number exceeds 100 000. ✓1

7

Do not write outside the box

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]

÷100 ÷1000

cm → m → km

Distance between the 2 churches : $20\,000 \times 15$ cm

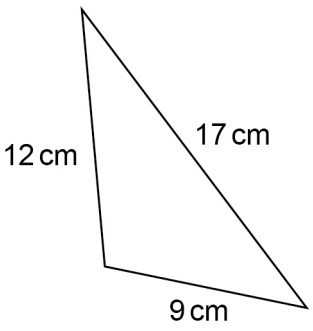
$= 300\,000$ cm ✓2

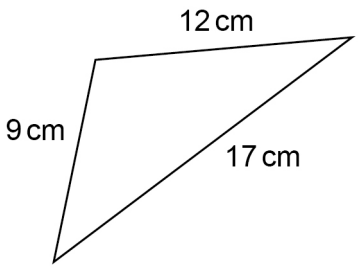
Distance in km : $300\,000 \text{ cm} \times \frac{1 \text{ m}}{100 \text{ cm}} \times \frac{1 \text{ km}}{1000 \text{ m}}$

$= 3$ km ✓1

Answer 3 km

12





Not drawn accurately

Circle the reason why these triangles are congruent.

[1 mark]

ASA RHS SAS (SSS) ✓1

Do not write outside the box

13 Liam takes part in long jump competitions.

Here is some information about 40 of his jumps.

Length of jump, d metres	Number of jumps	Midpoint	
$7.0 \leqslant d < 7.4$	15	7.2	
$7.4 \leqslant d < 7.8$	18	7.6	
$7.8 \leqslant d < 8.2$	7	8.0	
	Total = 40		

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

Give your answer as a decimal.

[3 marks]

$$\text{mean} = \frac{(7.2 \times 15) + (7.6 \times 18) + (8.0 \times 7)}{15 + 18 + 7} \quad (1)$$

$$= \frac{108 + 136.8 + 56}{40} \quad (1)$$

$$= \frac{300.8}{40} = 7.52 \quad (1)$$

Answer 7.52 m

7

Turn over ►

Do not write outside the box

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]

At point (3, 15) : $15 = (3)^2 + c$

$c = 15 - 9 = 6$ ✓ (1)

At point (7, w) : $w = (7)^2 + 6$ ✓ (1)

$w = 49 + 6$

$= 55$ ✓ (1)

$w =$ 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)

Do not write outside the box

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

1000 kg = 1 tonne

Is more than 20 tonnes of concrete poured?

Tick a box.

Yes ☐ No ☑

You **must** show your working.

[4 marks]

Concrete poured : $\frac{10.9\ kg}{1\ s} \times (30 \times 60)\ s$

$= 10.9\ kgs^{-1} \times 1800\ s$

$= 19\,620\ kg$ (3)

in tonnes : $19\,620\ kg \times \frac{1\ tonne}{1000\ kg}$

$= 19.62$ tonnes (1) which is less than 20 tonnes.

8

Turn over ►

Do not write outside the box

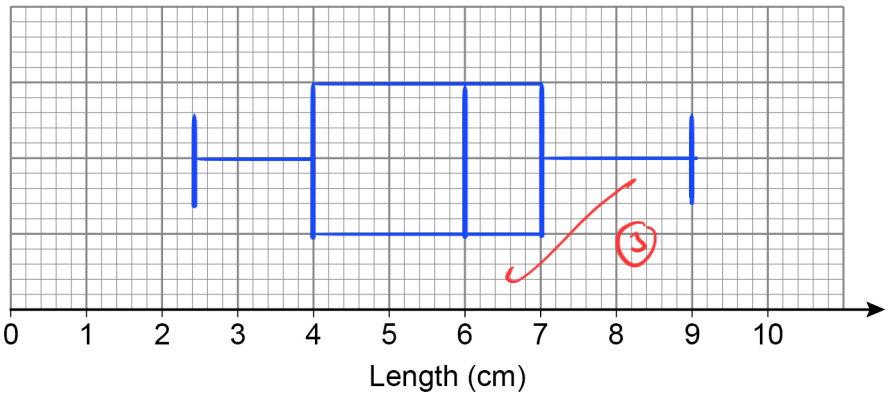
16 Here is some information about the lengths, in cm, of leaves.

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

lower quartile = 7 - 3 = 4

Draw a box plot to show this information.

[3 marks]

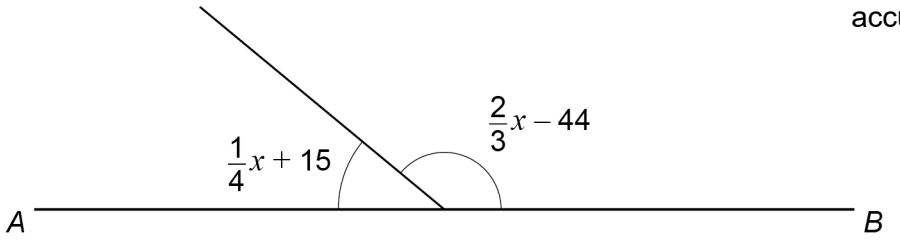


Do not write outside the box

17 *AB* is a straight line.

Both angles are given in degrees.

Not drawn accurately



By working out the value of x,

work out the ratio smaller angle : larger angle

[4 marks]

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

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

$\frac{11}{12}x = 209$ ✓(1)

$x = 228$

Smaller angle : $\frac{1}{4}(228) + 15 = 72$

larger angle : $\frac{2}{3}(228) - 44 = 108$

Smaller angle : larger angle = 72 : 108

= 2 : 3 ✓(1)

Answer 2 : 3

7

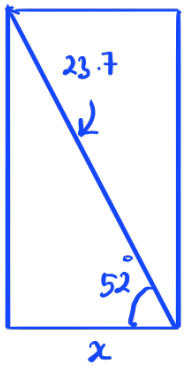
Do not write outside the box

18 A diagonal of a rectangle is 23.7 cm long.

The diagonal makes an angle of 52° with a side of length x cm

Work out the value of x.

[3 marks]



$\cos 52^\circ = \frac{x}{23.7}$ ✓ (1)

$x = 23.7 \cos 52^\circ$ ✓ (1)

$= 14.6$ cm

$x =$ 14.6 cm ✓ (1)

Do not write outside the box

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

[3 marks]

$12x^2 + 8x - 12x^2 + 10x - 18x - 42$ ✓1

$= 12x^2 - 12x^2 + 8x + 10x - 18x - 42$

$= -42$ ✓1

19 (b) Factorise $8x^2 - 18x - 35$

[2 marks]

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

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

8

Do not write outside the box

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

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

[4 marks]

$(x-9)(x+3) = 12-2x^2$

$x^2-6x-27 = 12-2x^2$ ✓1

$3x^2-6x-39 = 0$ ✓1

$x^2-2x-13 = 0$ ✓1

$x = \dfrac{-(-2)\pm\sqrt{(-2)^2-4(1)(-13)}}{2(1)}$

$= \dfrac{2\pm\sqrt{56}}{2}$

$d=2$, $e=56$, $f=2$

$d =$ 2

$e =$ 56 ✓1

$f =$ 2

Do not write outside the box

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?

[4 marks]

People in South stand : $4480 \times \frac{2}{7} = 1280$

Ratio of people in (South + West Stand) = $1 - \frac{1}{4} - \frac{3}{10} = \frac{9}{20}$ ✓(1)

People in (South + West Stand) = $4480 + 1280 = 5760$ ✓(1)

Number of people in the stadium = $5760 \times \frac{20}{9}$ ✓(1)

$= 12\,800$ ✓(1)

Answer 12 800

Turn over for the next question

8

Do not write outside the box

22

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

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]

$n = 1,\ x_2 = 5 - \frac{1}{x_1} = 5 - \frac{1}{1} = 4$

$n = 2,\ x_3 = 5 - \frac{1}{x_2} = 5 - \frac{1}{4} = 4.75$

$n = 3,\ x_4 = 5 - \frac{1}{x_3} = 5 - \frac{1}{4.75} = 4.78947\ldots$ ✓ (3)

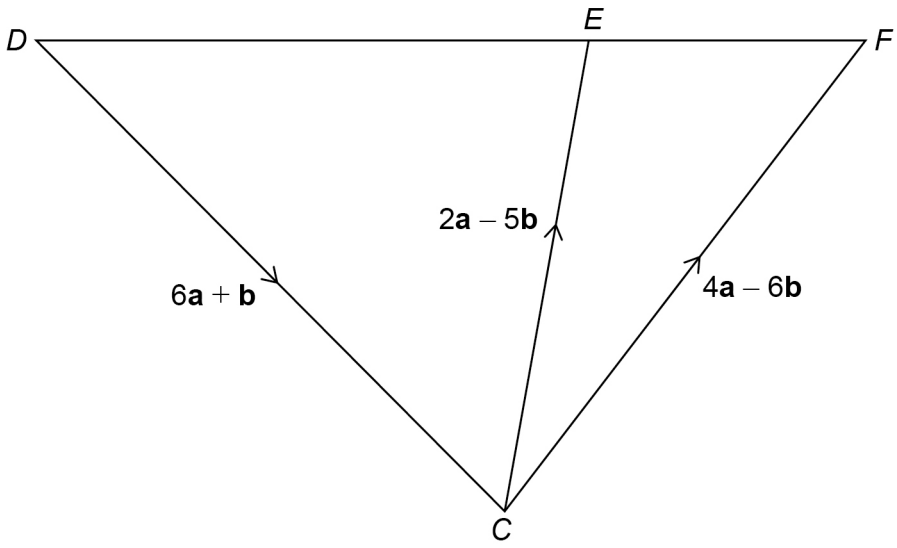
$n = 4,\ x_5 = 5 - \frac{1}{x_4} = 5 - \frac{1}{4.78947\ldots} = 4.79121\ldots$

$n = 5,\ x_6 = 5 - \frac{1}{x_5} = 5 - \frac{1}{4.79121\ldots} = 4.79128\ldots$

$x =$ 4.791

Do not write outside the box

23



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Prove that *DEF* is a straight line.

[4 marks]

$\overrightarrow{DE} = \overrightarrow{DC} + \overrightarrow{CE}$

$= 6\underline{a} + \underline{b} + 2\underline{a} - 5\underline{b}$

$= 8\underline{a} - 4\underline{b}$

$= 4(2\underline{a} - \underline{b})$ ✓(1)

$\overrightarrow{DF} = \overrightarrow{DC} + \overrightarrow{CF}$

$= 6\underline{a} + \underline{b} + 4\underline{a} - 6\underline{b}$

$= 10\underline{a} - 5\underline{b}$ ✓(1)

$= 5(2\underline{a} - \underline{b})$ ✓(1)

$\frac{\overrightarrow{DE}}{\overrightarrow{DF}} = \frac{4(2\underline{a} - \underline{b})}{5(2\underline{a} - \underline{b})} = \frac{4}{5}$ ✓(1)

Hence, $\overrightarrow{DE}$ and $\overrightarrow{DF}$ are parallel to each other.

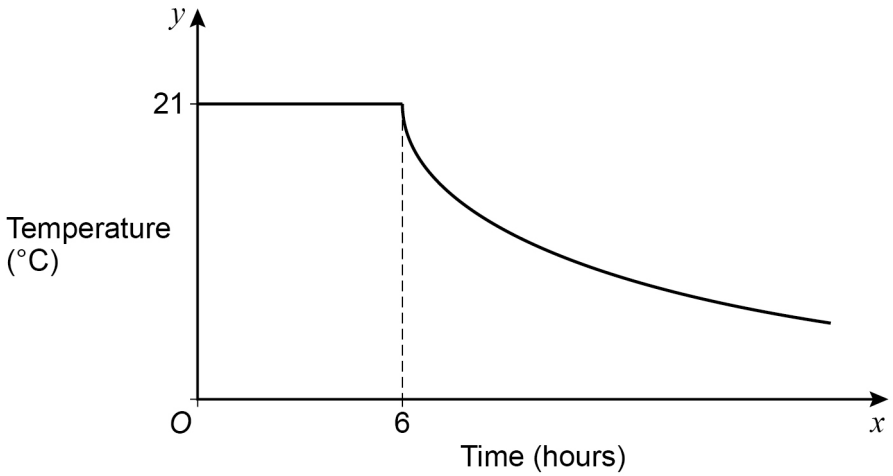
7

Do not write outside the box

24 A room is kept at a constant temperature of 21° 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°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]

when $x = 6$, $y = 21$: $21 = \frac{k}{6}$

$k = 21(6) = 126$ ✓1

when $x = 12$, $y = \frac{126}{12} = 10.5$

$y =$ 10.5 ✓1

Do not write outside the box

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).

✓ (1)

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

when $x = 6$, $y = 21$: $21 = A \times \left(\frac{1}{3}\right)^{\frac{1}{6}(6)}$

$A = 21 \times 3 = 63$ ✓(1)

when $x = 12$: $y = 63 \times \left(\frac{1}{3}\right)^{\frac{1}{6}(12)^2}$

$y = 63\left(\frac{1}{9}\right)$

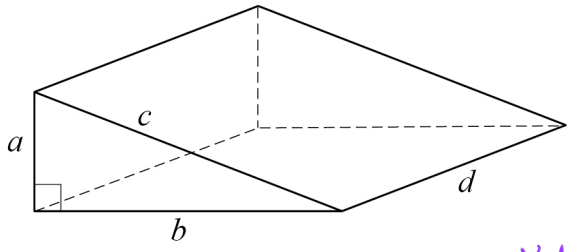
$= 7$

Turn over for the next question

4

Do not write outside the box

25 Here is a right-angled triangular prism.



Volume of prism = $\frac{1}{2} \times (a \times b) \times d$

The ratio of the edges is $a : b : c : d = 3 : 4 : 5 : 12$

The **volume** of the prism is $1125\,cm^3$

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

[5 marks]

let length of edges is variable of x.

Volume of prism = $\frac{1}{2} \times 3x \times 4x \times 12x = 1125$ ✓1

$144x^3 = 2250$

$x^3 = 15.625$ ✓1

$x = \sqrt[3]{15.625}$

$= 2.5$ ✓1

$a = 3 \times 2.5 = 7.5$ cm

$b = 4 \times 2.5 = 10$ cm

$c = 5 \times 2.5 = 12.5$ cm

$d = 12 \times 2.5 = 30$ cm

Total length of edges = $2(7.5) + 2(10) +$ ✓1 $2(12.5) + 3(30)$

$= 150$ cm ✓1

Answer 150 cm

END OF QUESTIONS

5

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ANSWER IN THE SPACES PROVIDED

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