



**Surname** \_\_\_\_\_

**Forename(s)** \_\_\_\_\_

**Centre Number** \_\_\_\_\_

**Candidate Number** \_\_\_\_\_

**Candidate Signature** \_\_\_\_\_

**I declare this is my own work.**

**GCSE**

**MATHEMATICS**

**H**

**Higher Tier Paper 3 Calculator**

**8300/3H**

**Monday 13 November 2023**

**Morning**

**Time allowed: 1 hour 30 minutes**

**[Turn over]**



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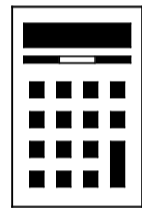


**On the front of this book, write your surname and forename(s), your centre number, your candidate number and add your signature.**

## **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.**
- **Answer ALL questions.**

**[Turn over]**



- **You must answer the questions in the spaces provided. Do not write 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.**

**DO NOT TURN OVER UNTIL TOLD TO DO SO**



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

**1 The first four terms of a linear sequence are**

**6      13      20      27**

**Write down the expression for the  $n$ th term. [1 mark]**

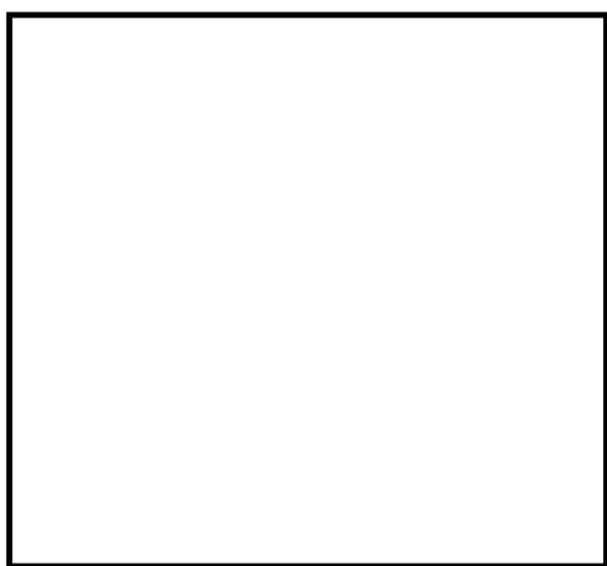
**Answer** \_\_\_\_\_



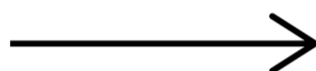
**2 Square A is enlarged to square B.**

**The diagrams are not drawn accurately.**

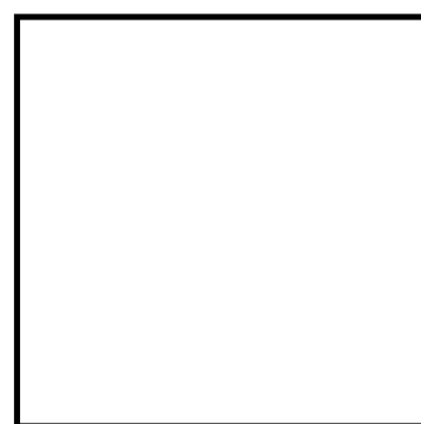
**A**



**12 cm**



**B**



**8 cm**

**Write down the scale factor of the enlargement as a fraction. [1 mark]**

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**Answer** \_\_\_\_\_

**[Turn over]**



- 3 The length of a line is 8 cm to the nearest centimetre.

Complete the error interval.  
[2 marks]

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Answer

\_\_\_\_\_ cm  $\leq$  length  $<$  \_\_\_\_\_ cm

- 4 At what point does the graph  $y = x^3 - 1$  cross the  $y$  axis?  
[1 mark]

Answer ( \_\_\_\_\_ , \_\_\_\_\_ )

5



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**[Turn over]**



**5 Carly's total annual pay =  
salary + bonus**

	<b>SALARY</b>	<b>BONUS</b>
<b>LAST YEAR</b>	<b>£26 000</b>	<b>£4000</b>
<b>THIS YEAR</b>	<b>6% increase</b>	<b>9% decrease</b>

**Work out the percentage change in her total annual pay.**

**State whether it is an increase or a decrease. [4 marks]**

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**6 An exhibition was open for 240 hours and had 29 760 visitors.**

**For  $\frac{2}{5}$  of the time the exhibition was open, there were 172 visitors per hour.**

**For the remaining time, how many visitors per hour were there?  
[4 marks]**

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**7 The first two cube numbers are  
1 and 8**

**Show that**

**the 3rd cube number can be written  
as the sum of three different prime  
numbers.**

**[3 marks]**

$$\square = \square + \square + \square$$

11

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**[Turn over]**



8 Circle the largest number. [1 mark]

5.30 $\dot{4}$

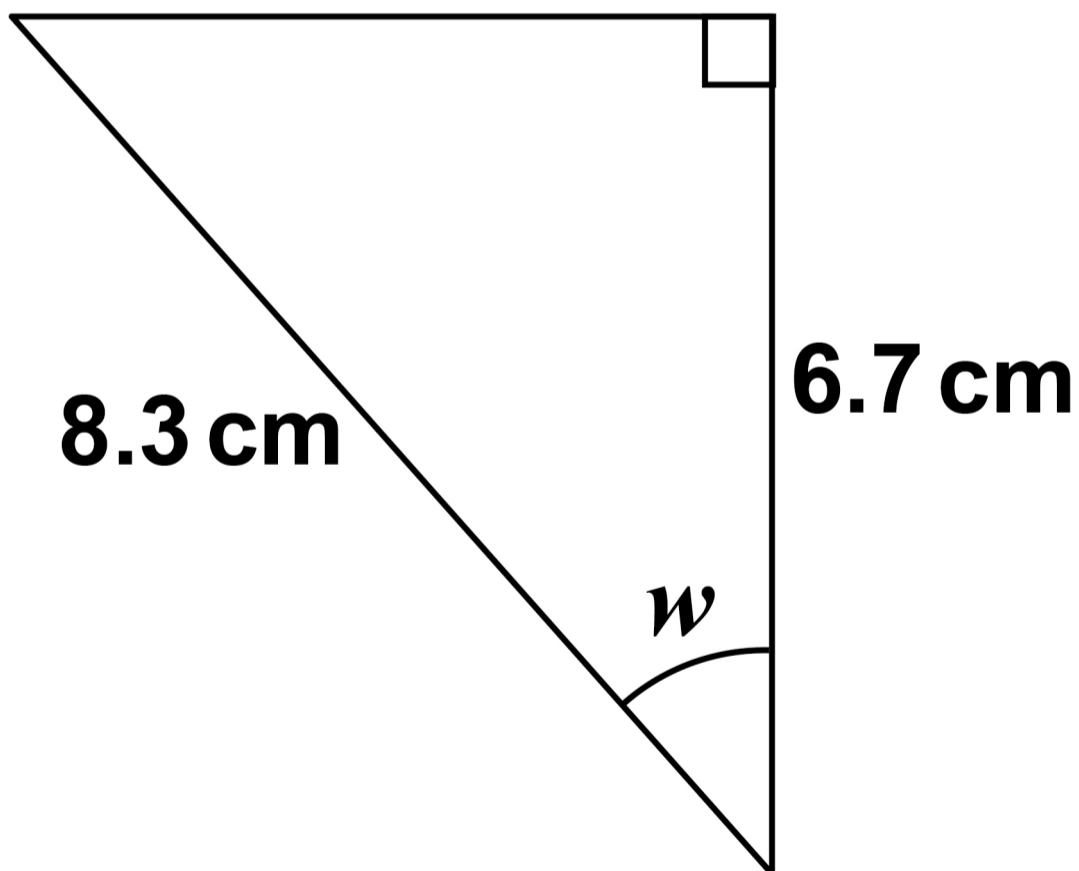
5.344

5.34

5.3 $\dot{4}$

9 Use trigonometry to work out the size of angle  $w$ . [3 marks]

The diagram is not drawn accurately.



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$w =$  \_\_\_\_\_  $\circ$

**[Turn over]**



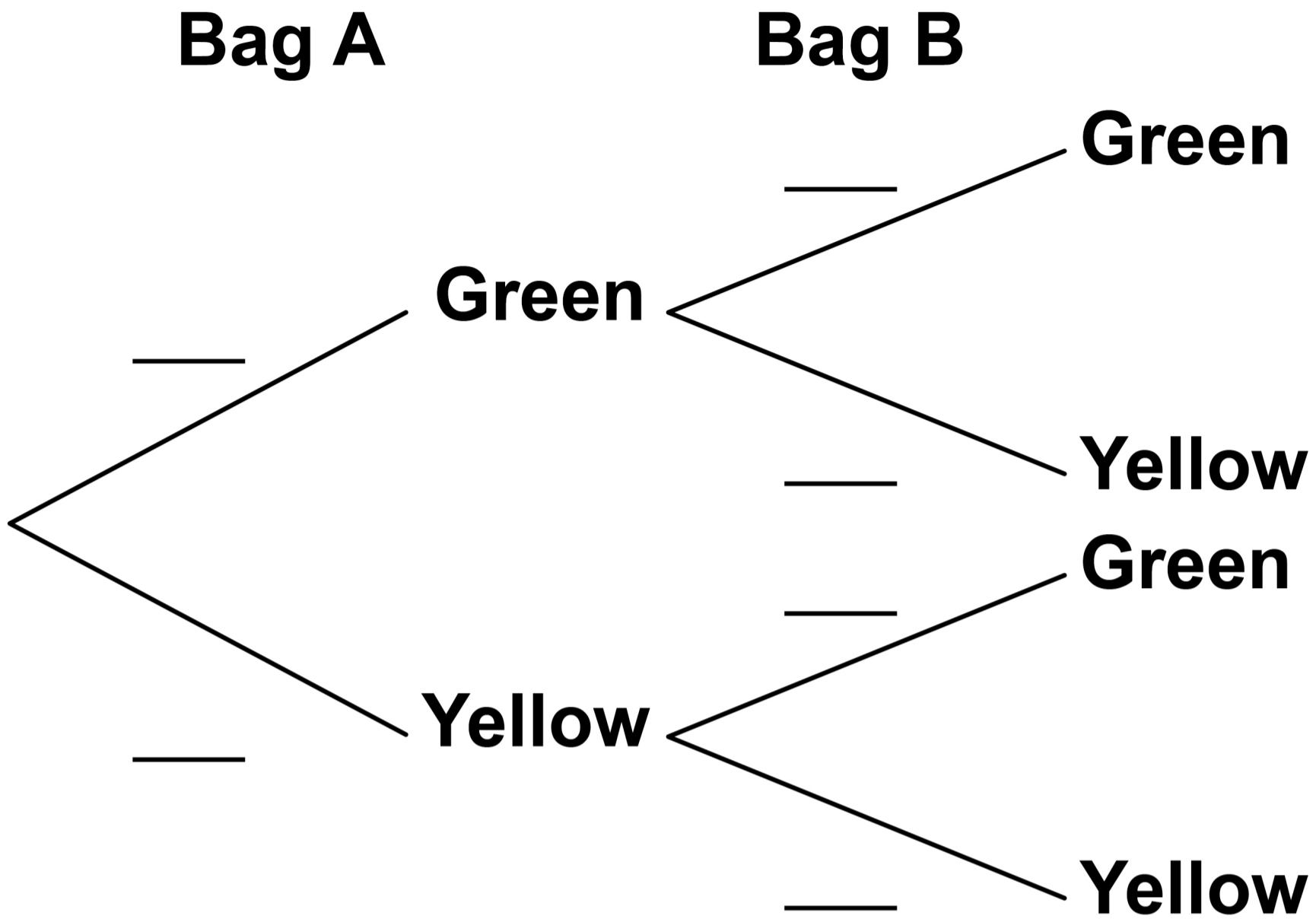
**10** Two bags contain only green discs and yellow discs.

**Bag A contains 1 green disc and 4 yellow discs.**

**Bag B contains 3 green discs and 7 yellow discs.**

**One disc is picked at random from each bag.**

**10 (a) Complete the tree diagram, on the opposite page, with the correct probabilities. [2 marks]**



**10 (b) Work out the probability that BOTH discs are green. [2 marks]**

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**Answer** \_\_\_\_\_

**[Turn over]**

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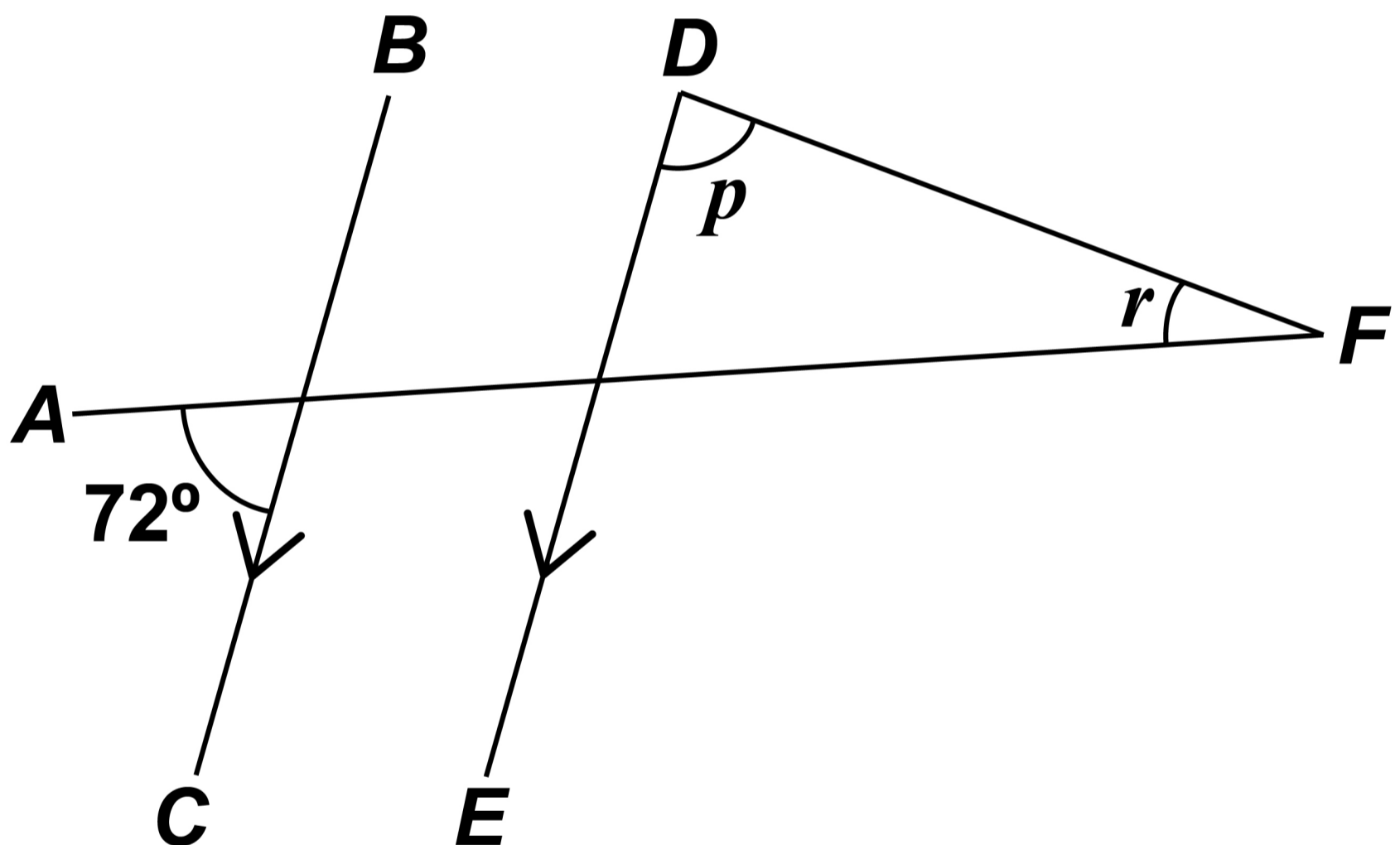




12 *AF*, *BC*, *DE* and *DF* are straight lines.

*BC* and *DE* are parallel.

The diagram is not drawn accurately.



$p$  is three times  $r$ .

Work out the size of angle  $p$ .  
[3 marks]





- 13** 100 people were asked about the distance they travel from home to work.

The table shows information about the results.

<b>DISTANCE, <math>d</math> (miles)</b>	<b>FREQUENCY</b>
$0 \leq d < 5$	<b>21</b>
$5 \leq d < 10$	<b>24</b>
$10 \leq d < 20$	<b>37</b>
$20 \leq d < 40$	<b>18</b>

- 13(a)** Write down the **GREATEST** possible number of people who work from home. [1 mark]

**Answer** \_\_\_\_\_



**13(b) One person is chosen at random.**

**Work out the probability that the person travels AT LEAST 10 miles. [1 mark]**

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**Answer** \_\_\_\_\_

**[Turn over]**

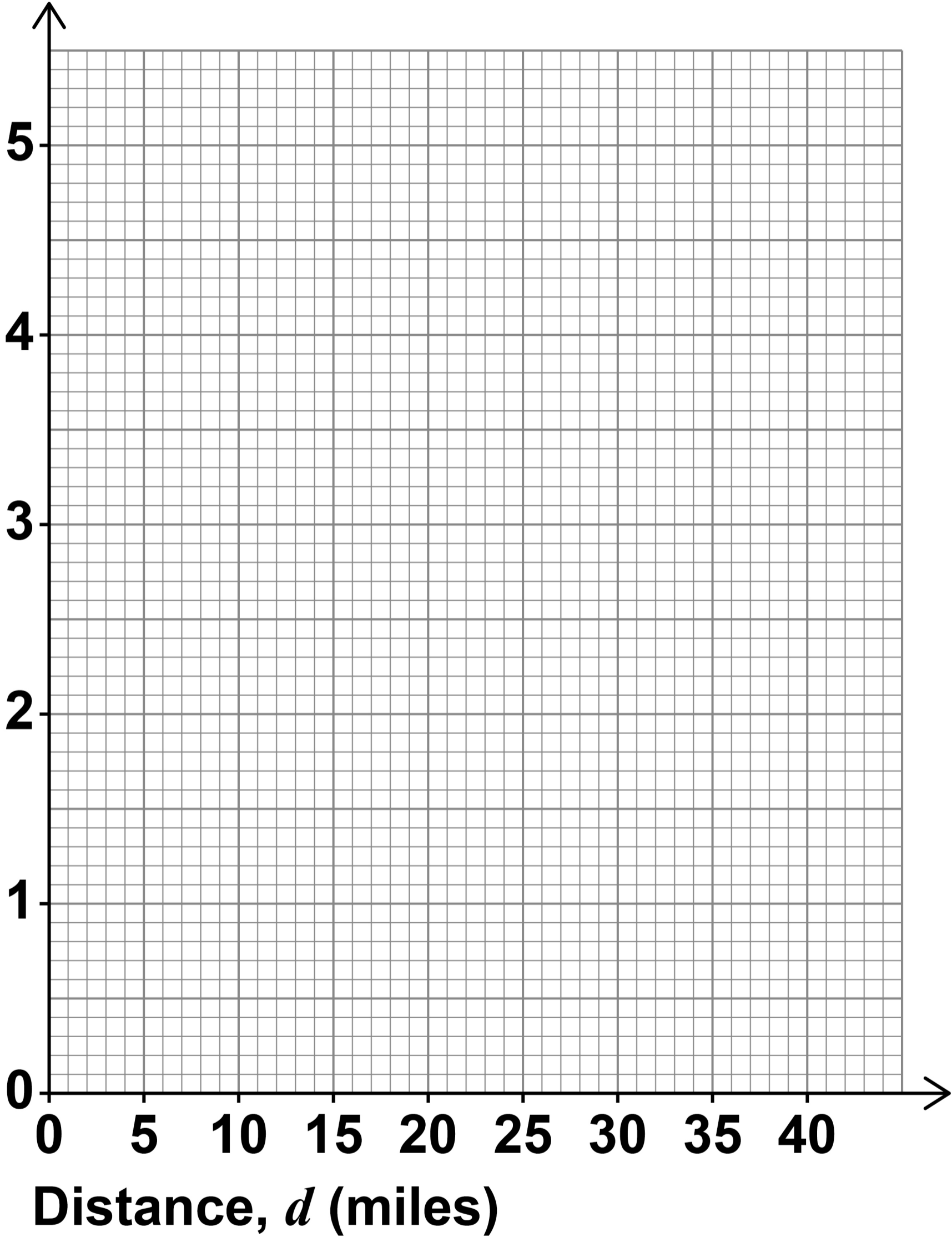
**13 (c) The table is repeated.**

<b>DISTANCE, <math>d</math> (miles)</b>	<b>FREQUENCY</b>
<b><math>0 \leq d &lt; 5</math></b>	<b>21</b>
<b><math>5 \leq d &lt; 10</math></b>	<b>24</b>
<b><math>10 \leq d &lt; 20</math></b>	<b>37</b>
<b><math>20 \leq d &lt; 40</math></b>	<b>18</b>

**Draw a histogram, on the opposite page, to represent the results.  
[3 marks]**



Frequency  
density



[Turn over]



**14 A solid trophy consists of a stand and a player.**



**Trophy**

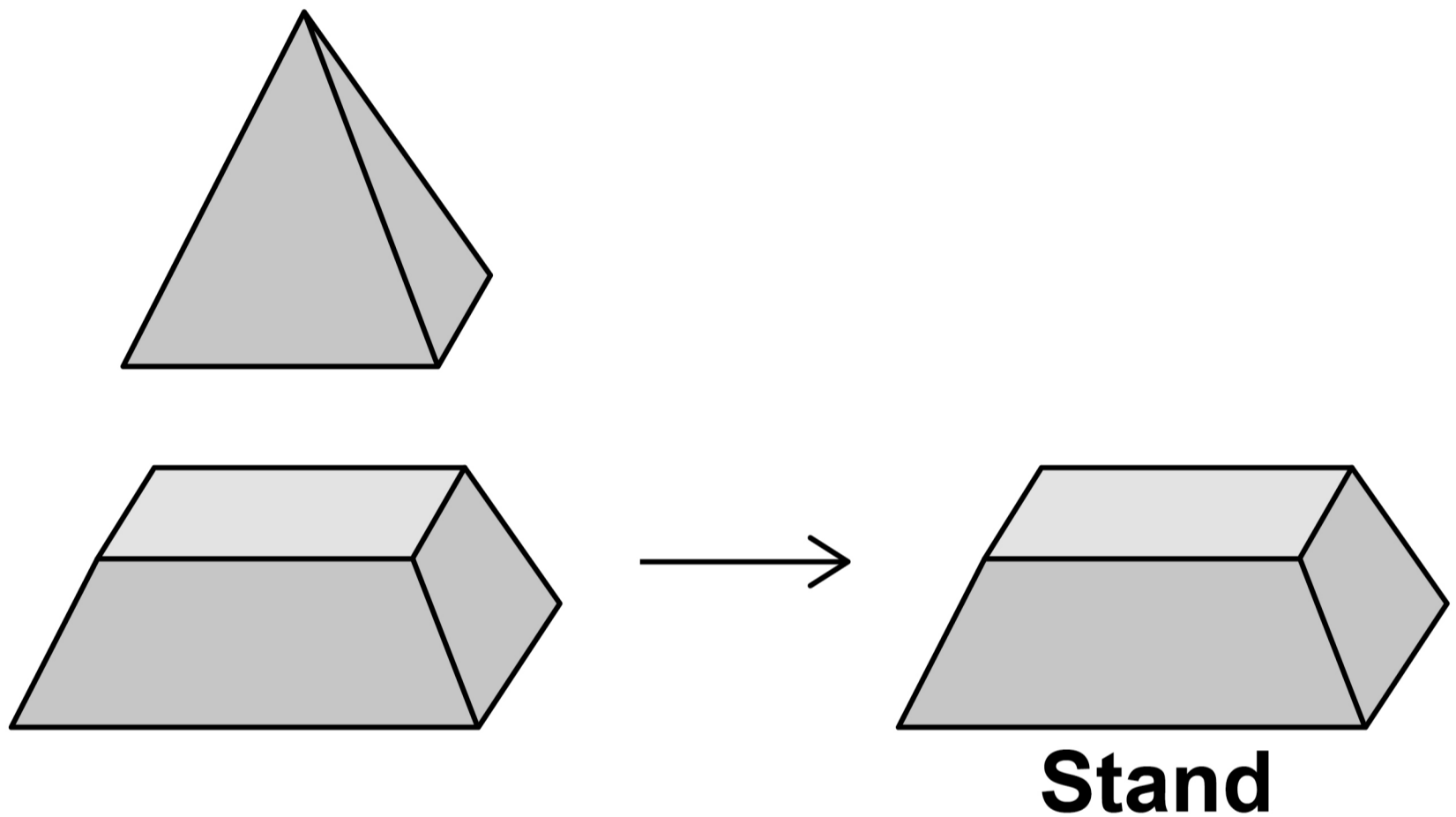
**The stand is made by removing a small pyramid from a large pyramid.**

**LARGE PYRAMID**

**Square base, edge 8 cm**

**Perpendicular height 16 cm**



**SMALL PYRAMID****Square base, edge 5 cm****Perpendicular height 10 cm**

**Volume of a pyramid =**  
 **$\frac{1}{3}$  × area of base × perpendicular**  
**height**

**[Turn over]**



**14 (a) Show that the volume of the STAND is  $258 \text{ cm}^3$  [2 marks]**

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**14 (b) The trophy is made from a metal of density  $7.5 \text{ grams per cm}^3$**

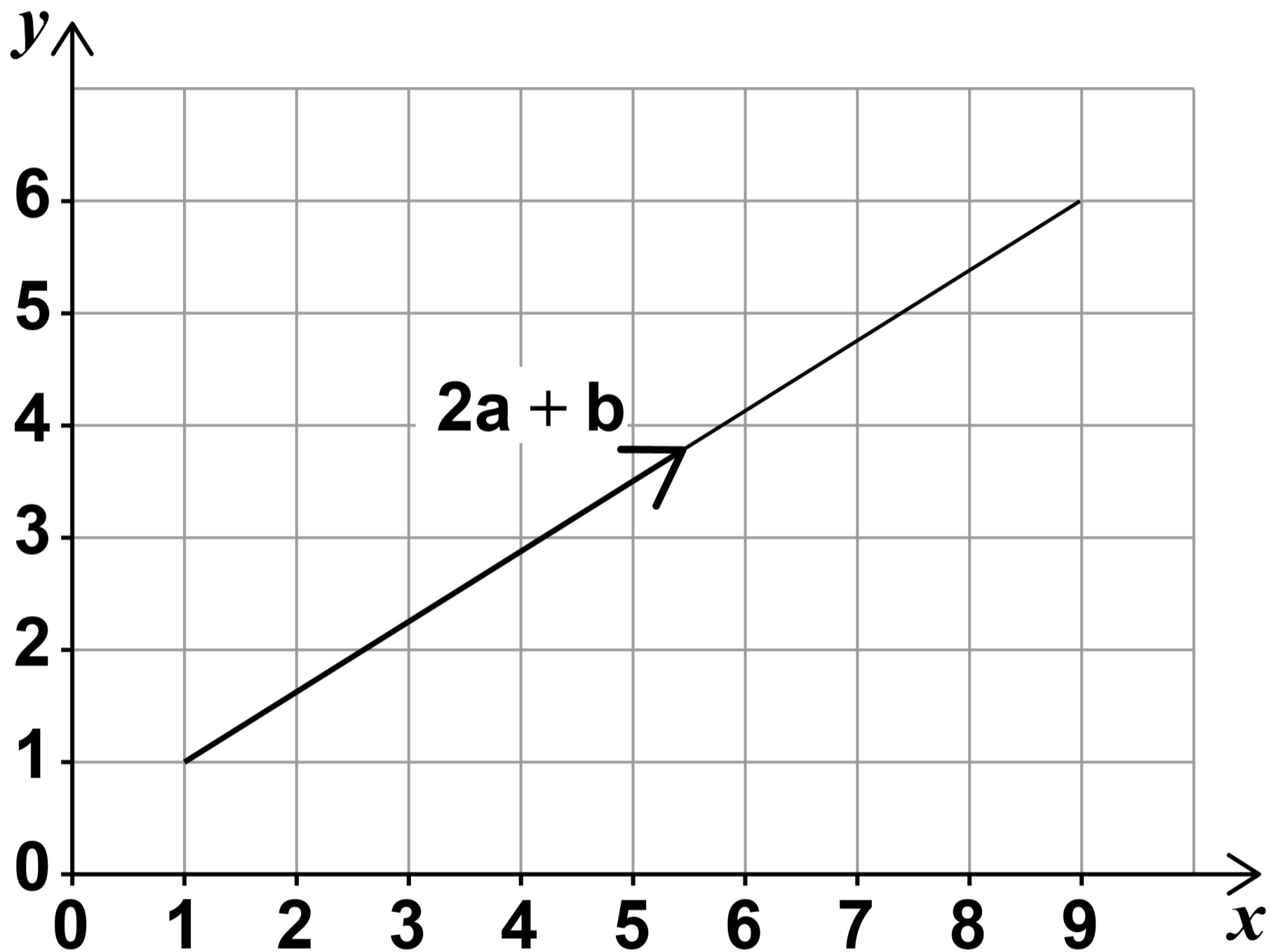
**The TOTAL mass of the trophy is 2340 grams.**





$$15 \quad \mathbf{a} = \begin{pmatrix} m \\ 3 \end{pmatrix} \quad \mathbf{b} = \begin{pmatrix} -4 \\ p \end{pmatrix}$$

The diagram shows the vector  $2\mathbf{a} + \mathbf{b}$



**Work out the values of  $m$  and  $p$ .**  
**[4 marks]**

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$m =$  \_\_\_\_\_  $p =$  \_\_\_\_\_

**[Turn over]**



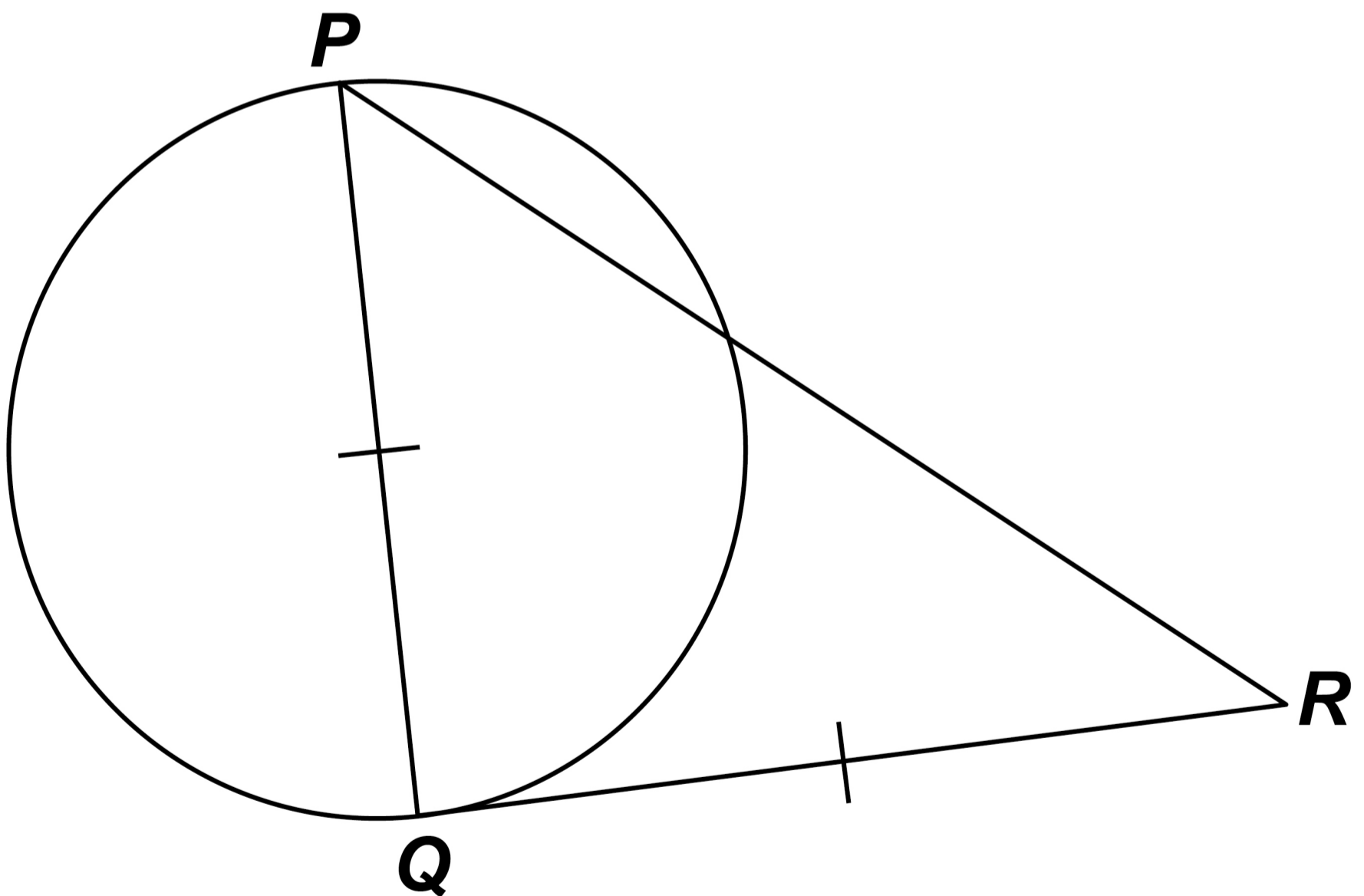
16  $PQ$  is a diameter of a circle.

$QR$  is a tangent to the circle.

$$PQ = QR$$

$$PR = 10 \text{ cm}$$

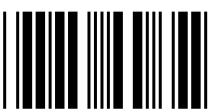
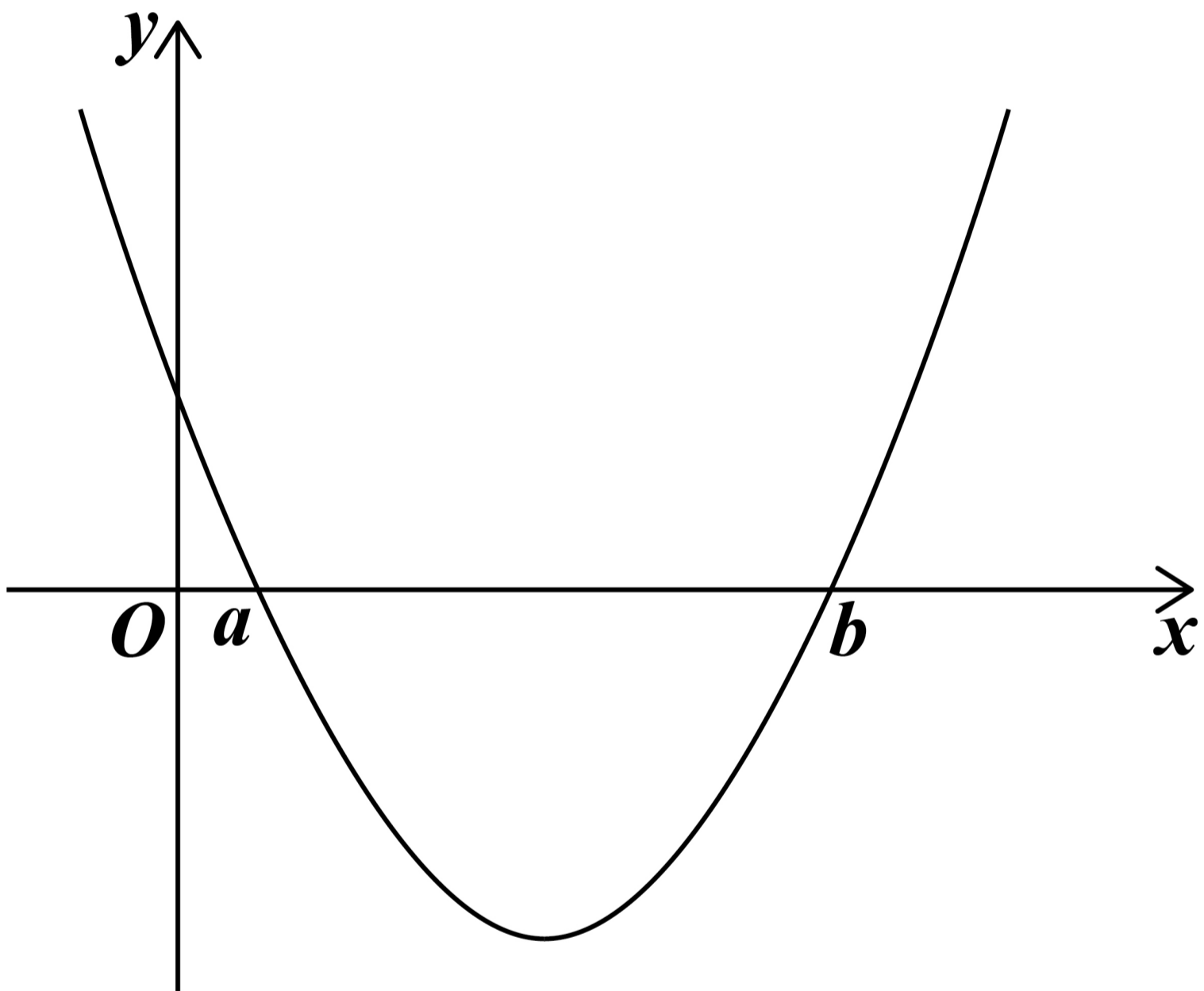
The diagram is not drawn accurately.





17 Here is a sketch of the quadratic graph  $y = f(x)$

The graph crosses the  $x$ -axis at  $x = a$  and  $x = b$



**Write an expression for the  $x$ -coordinate of the turning point.  
[1 mark]**

**Answer** \_\_\_\_\_

**[Turn over]**



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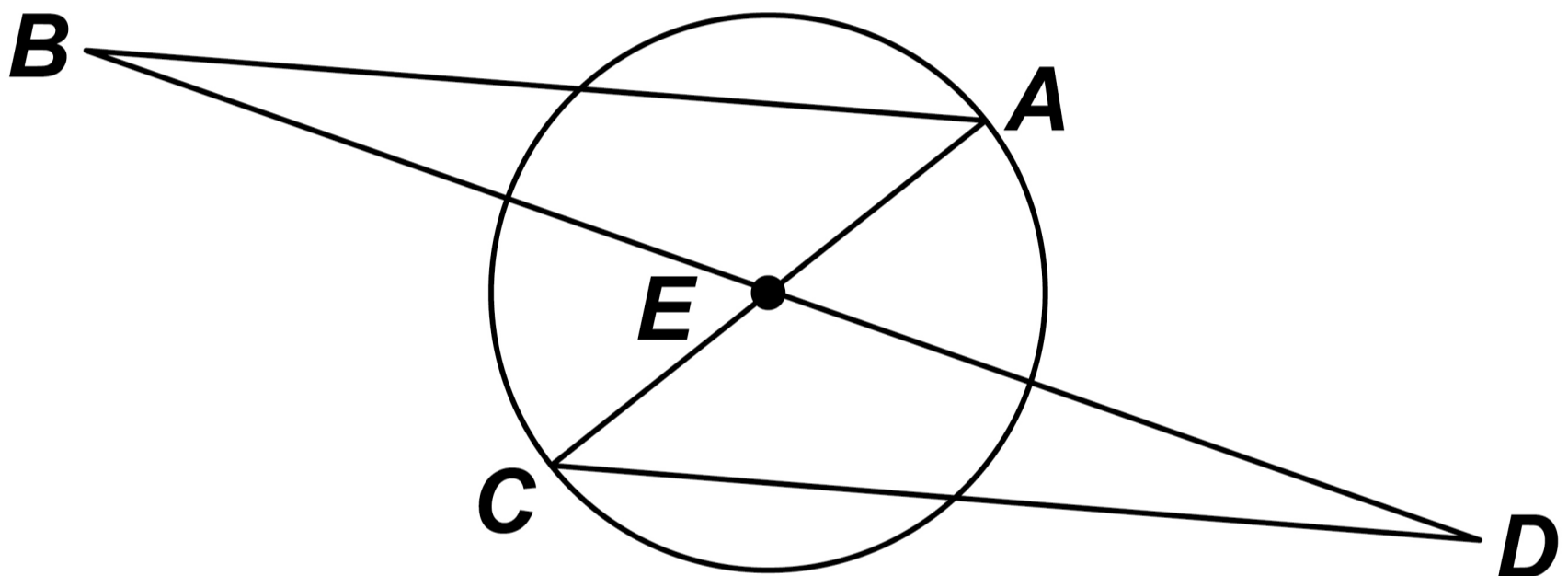
**[Turn over]**



19  **$AC$  is a diameter of a circle, centre  $E$ .**

**$E$  is the midpoint of  $BD$ .**

**The diagram is not drawn accurately.**



**Prove that triangle  $ABE$  is congruent to triangle  $CDE$ .**  
**[4 marks]**

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**20** Solve  $2x(x + 10) = 5x - 18$   
**[4 marks]**

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**Answer** \_\_\_\_\_

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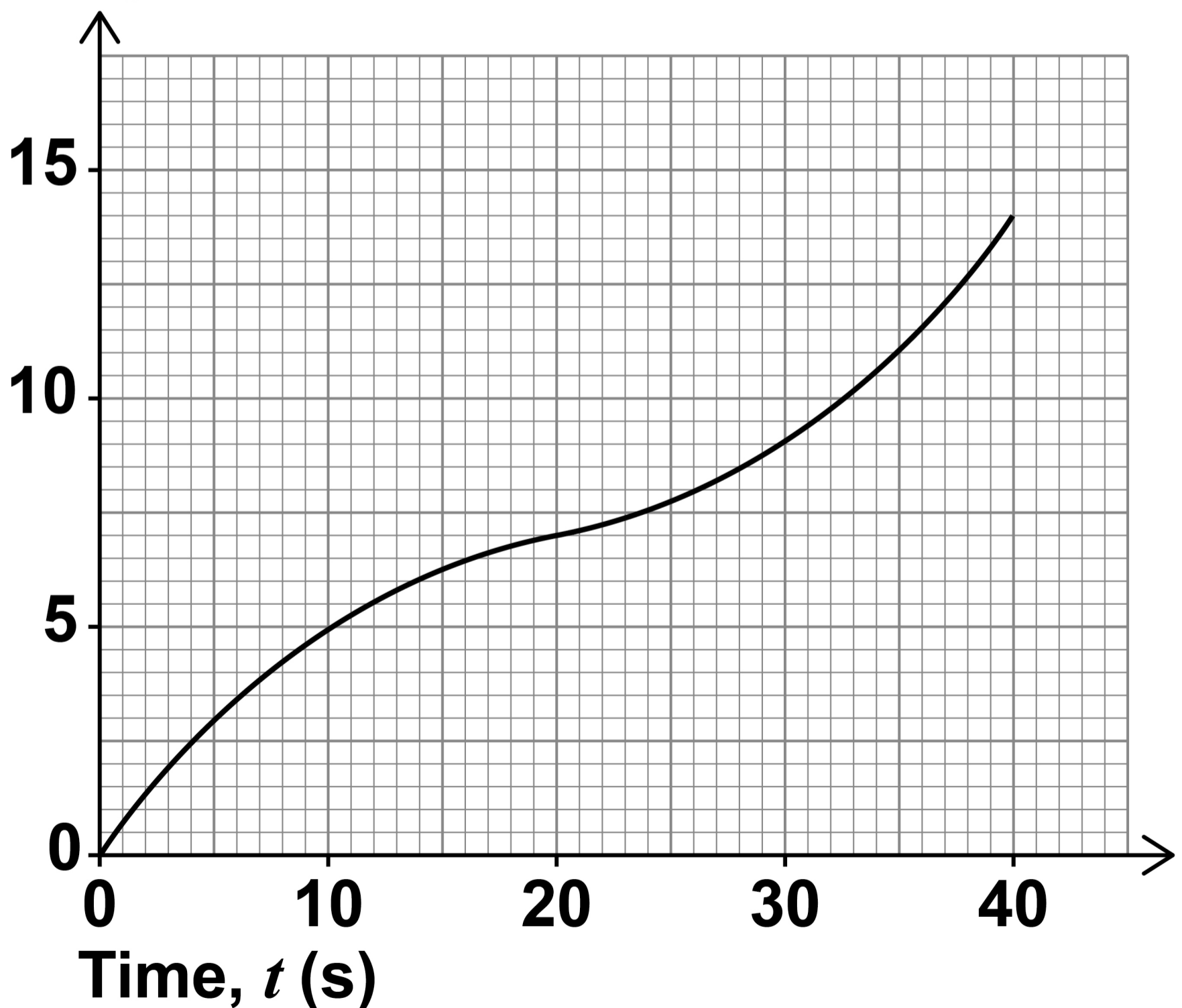


**21** Water flows from a tap at a constant rate.

**A container is filled with water from the tap in 40 seconds.**

**The graph shows the height,  $h$  centimetres, of the water after time,  $t$  seconds.**

**Height,  $h$  (cm)**



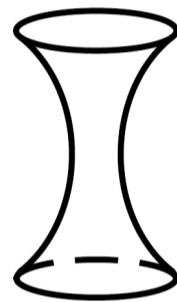
**21 (a) The container is one of these shapes.**

**Circle the letter of the correct shape. [1 mark]**

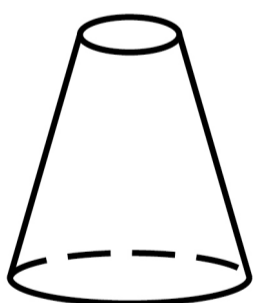
**A**



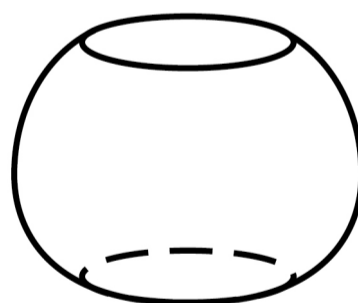
**B**



**C**



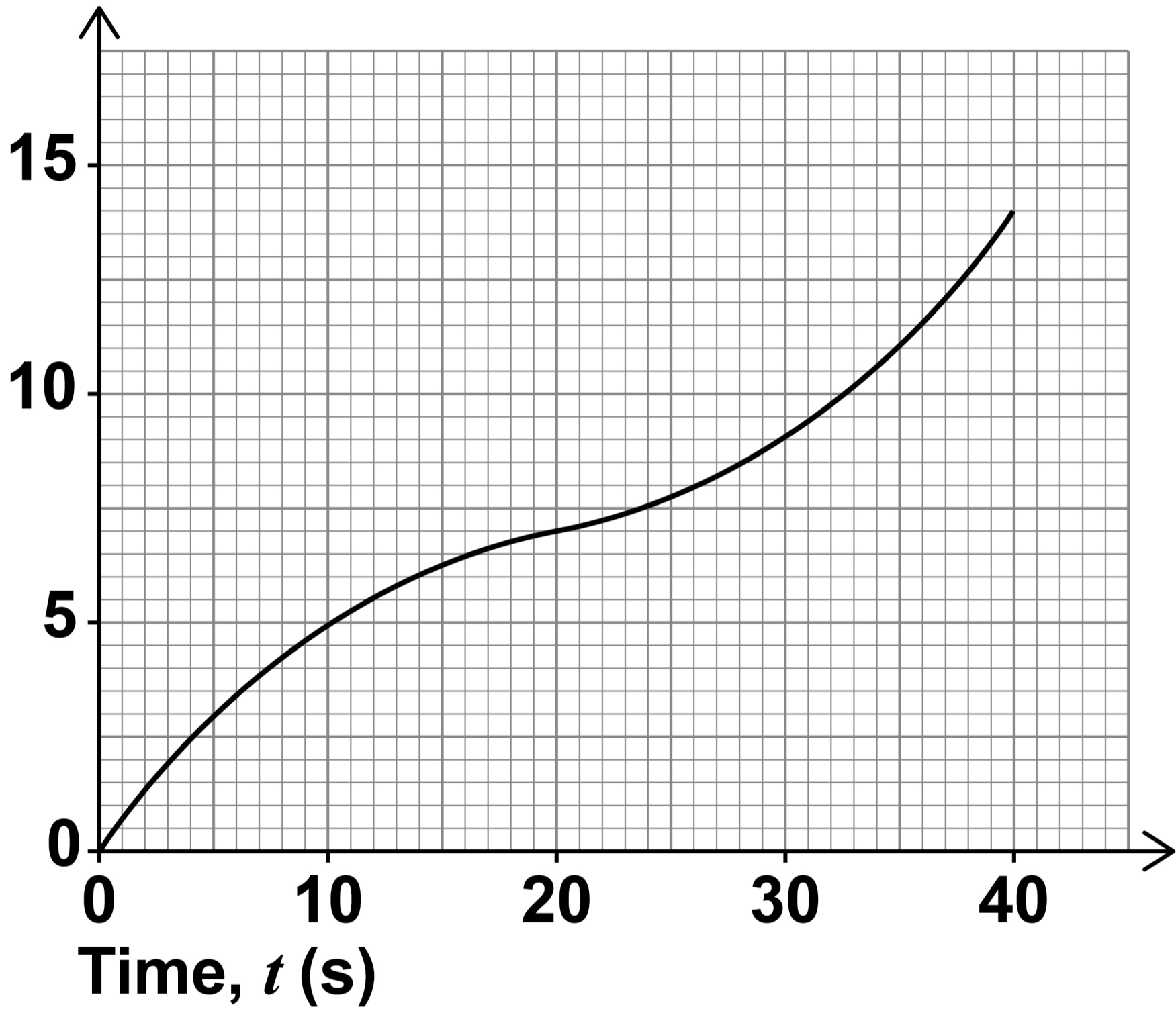
**D**



**[Turn over]**



## REPEAT OF GRAPH

Height,  $h$  (cm)

**21 (b) By drawing a tangent on the graph,**

**estimate the rate at which the height is increasing when  $t = 10$   
[2 marks]**

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**Answer** \_\_\_\_\_ **cm/s**

**[Turn over]**



22 Write  $\frac{7}{2a^2} - \frac{3}{5a}$  as a single fraction in its simplest form.  
[2 marks]

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Answer \_\_\_\_\_

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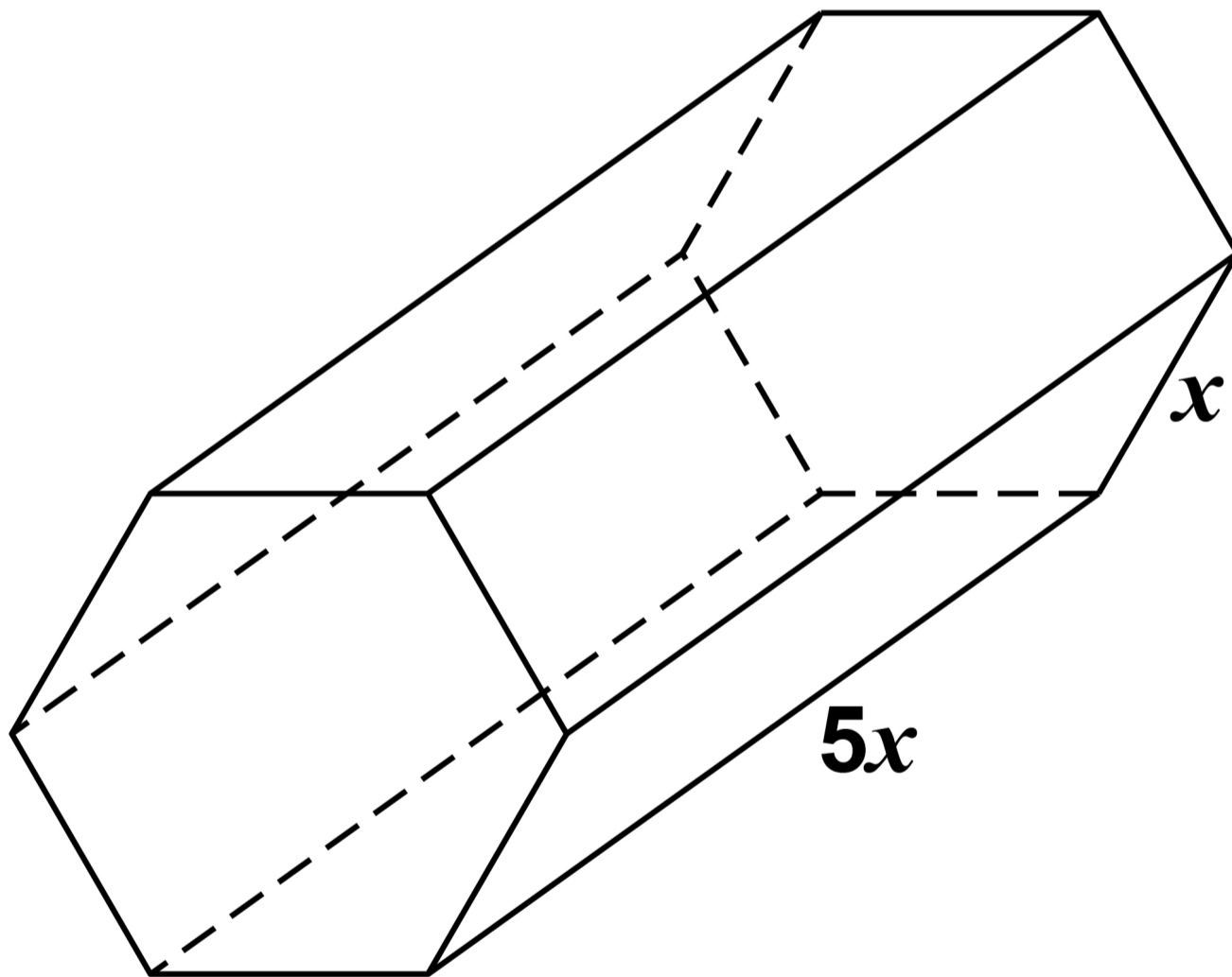


**23** A chocolate box in the shape of a prism is being designed.

**All lengths are in centimetres.**

**The cross section is a regular hexagon with side  $x$**

**The length is  $5x$**



An expression for the area of the cross section, in  $\text{cm}^2$ , is  $\frac{3\sqrt{3}}{2} x^2$

The TOTAL surface area of the box must be less than  $650 \text{ cm}^2$

Work out the largest possible INTEGER value of  $x$ .

You MUST show your working.  
[4 marks]

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[Turn over]



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**Answer** \_\_\_\_\_



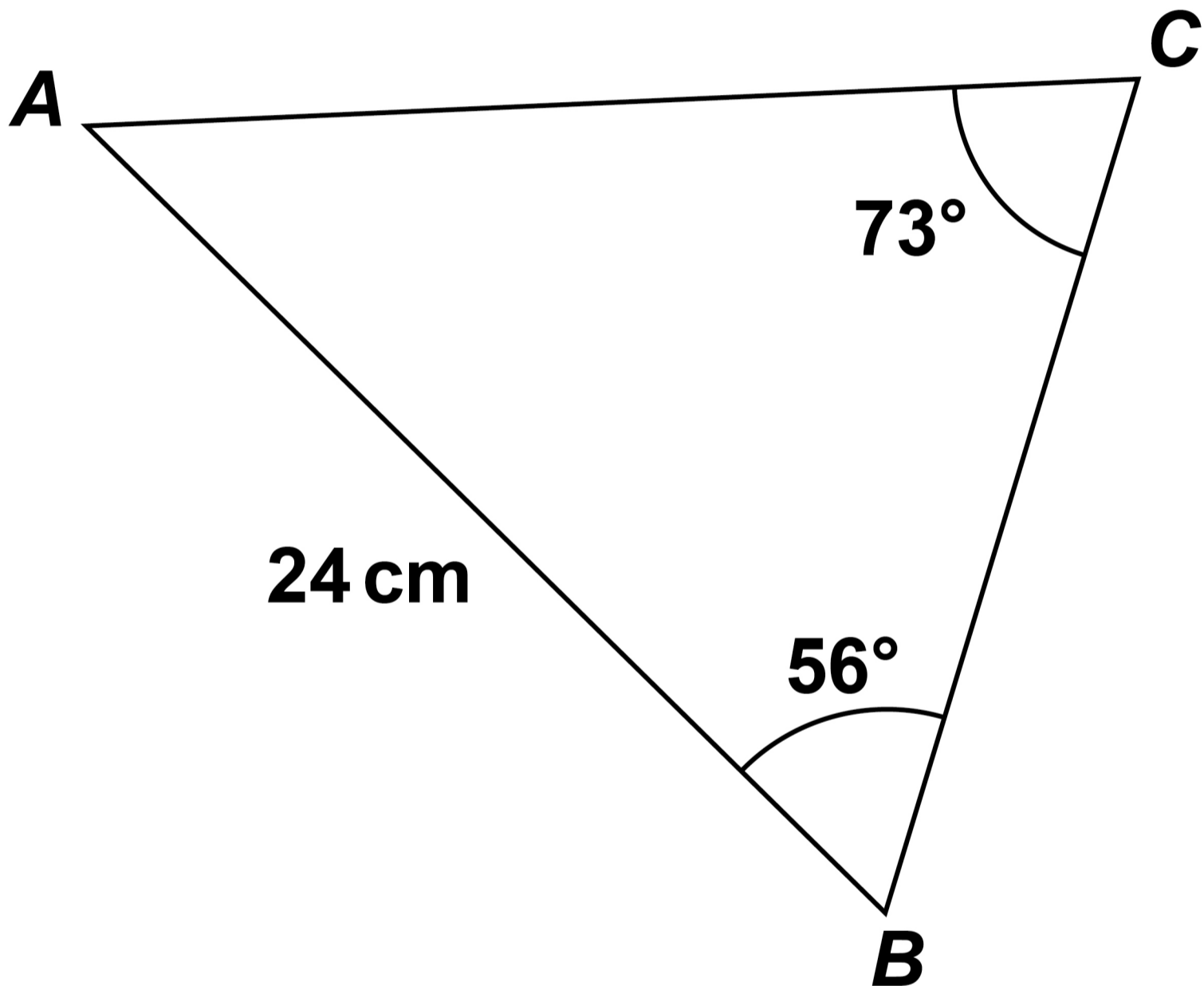
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**[Turn over]**



- 24 Work out the area of triangle  $ABC$ .  
[4 marks]

The diagram is not drawn accurately.



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Answer \_\_\_\_\_ cm<sup>2</sup>

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[Turn over]





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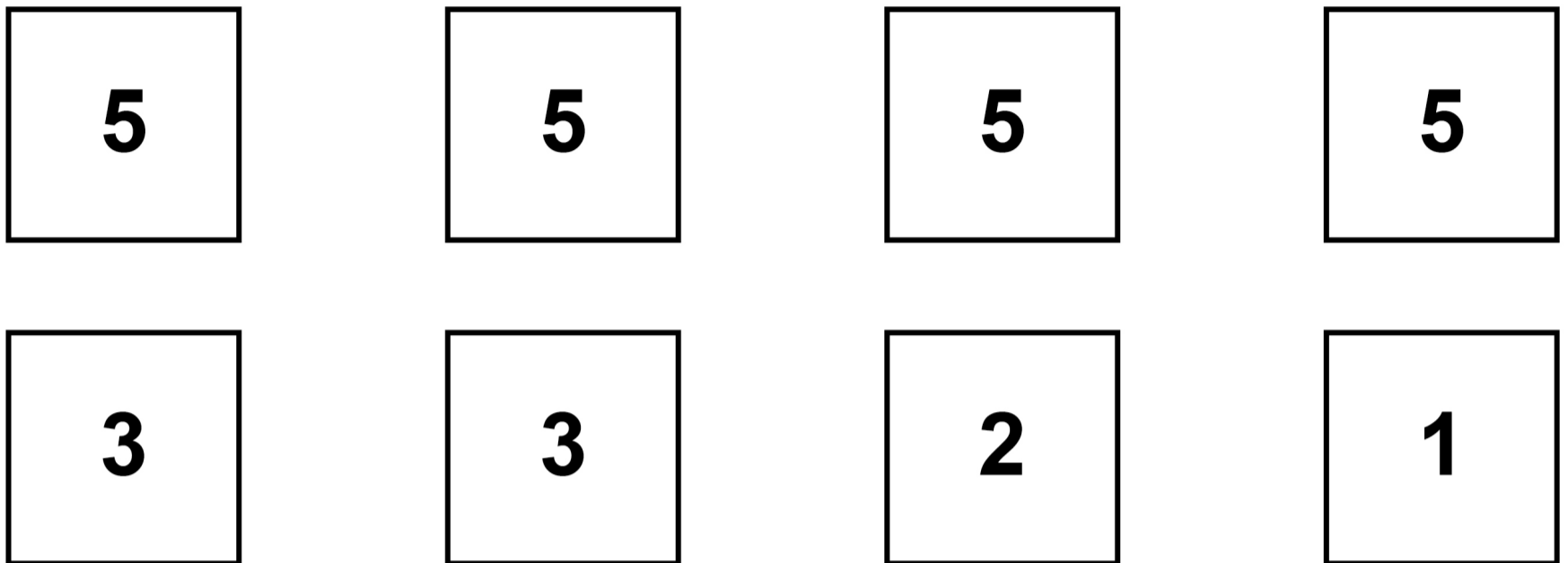
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**Answer** \_\_\_\_\_ : \_\_\_\_\_ : \_\_\_\_\_

**[Turn over]**



- 26** In a game, these numbered tiles are in a bag.



### **TO PLAY THE GAME**

**Choose tiles at random one at a time and do not replace the tiles.**

**You win if at any stage the total of the numbers on your tiles is 10**

**Amber plays the game once.**

**Work out the probability that she wins. [4 marks]**

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**27(a)** The graph of  $y = x^3$  is translated to the graph of  $y = (x - 2)^3$

**Write down the translation vector.**  
**[1 mark]**

**Answer**  $\left( \quad \right)$

**27(b)** The graph of  $y = 5x + 4$  is reflected in the  $y$ -axis.

**Write down the equation of the reflected graph. [1 mark]**

**Answer** \_\_\_\_\_

2

**END OF QUESTIONS**





**Additional page, if required.**

**Write the question numbers in the left-hand margin.**


**Additional page, if required.**

**Write the question numbers in the left-hand margin.**

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For Examiner's Use	
Pages	Mark
6–8	
10–14	
16–19	
20–23	
24–27	
28–31	
32–35	
36–38	
40–42	
44–48	
50–55	
56–59	
60	
<b>TOTAL</b>	

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6 4



2 3 B G 8 3 0 0 / 3 H