



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

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

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

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

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

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

**GCSE**

**MATHEMATICS**

**H**

**Higher Tier      Paper 2    Calculator**

**8300/2H**

**Wednesday 7 June 2023**

**Morning**

**Time allowed: 1 hour 30 minutes**

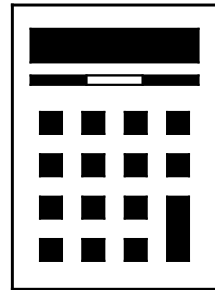
**At the top of the page, write your surname and forename(s), your centre number, your candidate number and add your signature.**

**[Turn over]**



## **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.**
- **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 Write  $30 : 12$  in the form  $n : 1$   
[1 mark]**

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**Answer \_\_\_\_\_ : 1**

- 2 Four consecutive triangular numbers  
are 6 10 15 21**

**Write down the next triangular  
number. [1 mark]**

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



**3 Write down the reciprocal of  $\frac{4}{7}$**

**[1 mark]**

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

**4 The price of a toy increases by 12.5% to £19.53**

**Work out the ORIGINAL price of the toy. [2 marks]**

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

**[Turn over]**



**5 Jess saves 2p, 5p and 10p coins.  
She has**

- 45 10p coins**
- 8 times as many 2p coins as  
10p COINS**
- £17.70 in total.**

**Work out**

**total VALUE of 2p coins : total VALUE  
of 5p coins**

**Give your answer in its simplest  
form. [4 marks]**

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7

[illegible]

**Answer :**

**[Turn over]**



0 7

**6 (a) Part of a regular polygon is shown.**

**The diagram is not drawn accurately.**



**Work out the size of an EXTERIOR angle. [2 marks]**

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**Answer** \_\_\_\_\_ °



**6(b) In fact, the polygon has MORE sides than an octagon.**

**What does this mean about the size of an exterior angle?**

**Tick ONE box. [1 mark]**

☐

**It is more than the answer to part (a)**

☐

**It is the same as the answer to part (a)**

☐

**It is less than the answer to part (a)**

☐

**It could be any of the above**

**[Turn over]**

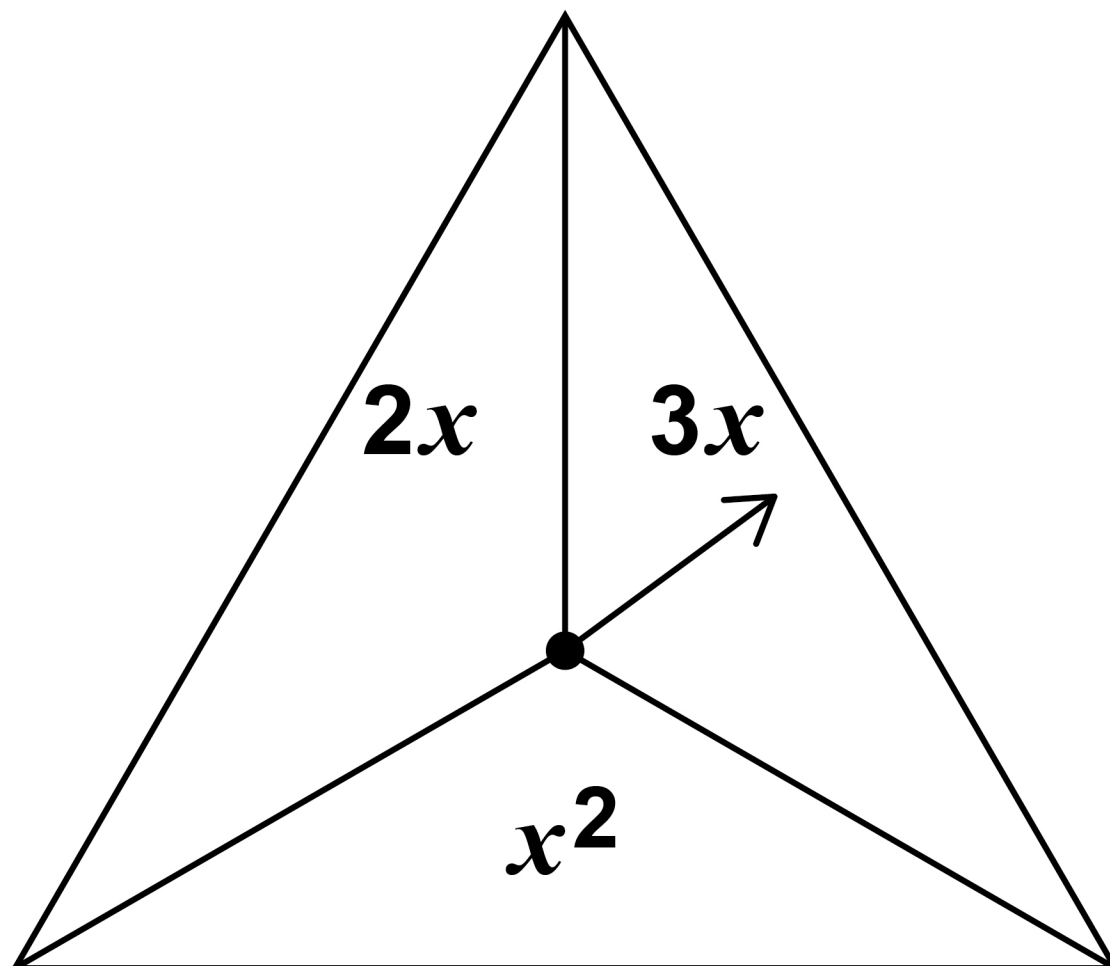
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7



7

In a game,

- an ordinary fair six-sided dice is rolled
- the fair spinner shown is spun.



The score is the dice number  
**SUBSTITUTED** into the spinner  
expression.

7 (a) Complete the table to show all of the possible scores. [2 marks]

	1	2	3	4	5	6
$2x$				8		
$3x$		6				
$x^2$					25	

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[Turn over]

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**7 (b) A player wins the game if their score is 10 or more.**

**Work out the probability that they win the game. [1 mark]**

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

**[Turn over]**

**7 (c) The game is played 711 times.**

**Estimate the number of games  
that are won. [2 marks]**

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

8  $(a - 3)x^2 + 2b \equiv 5x^2 + 12$

Work out the values of  $a$  and  $b$ .  
[2 marks]

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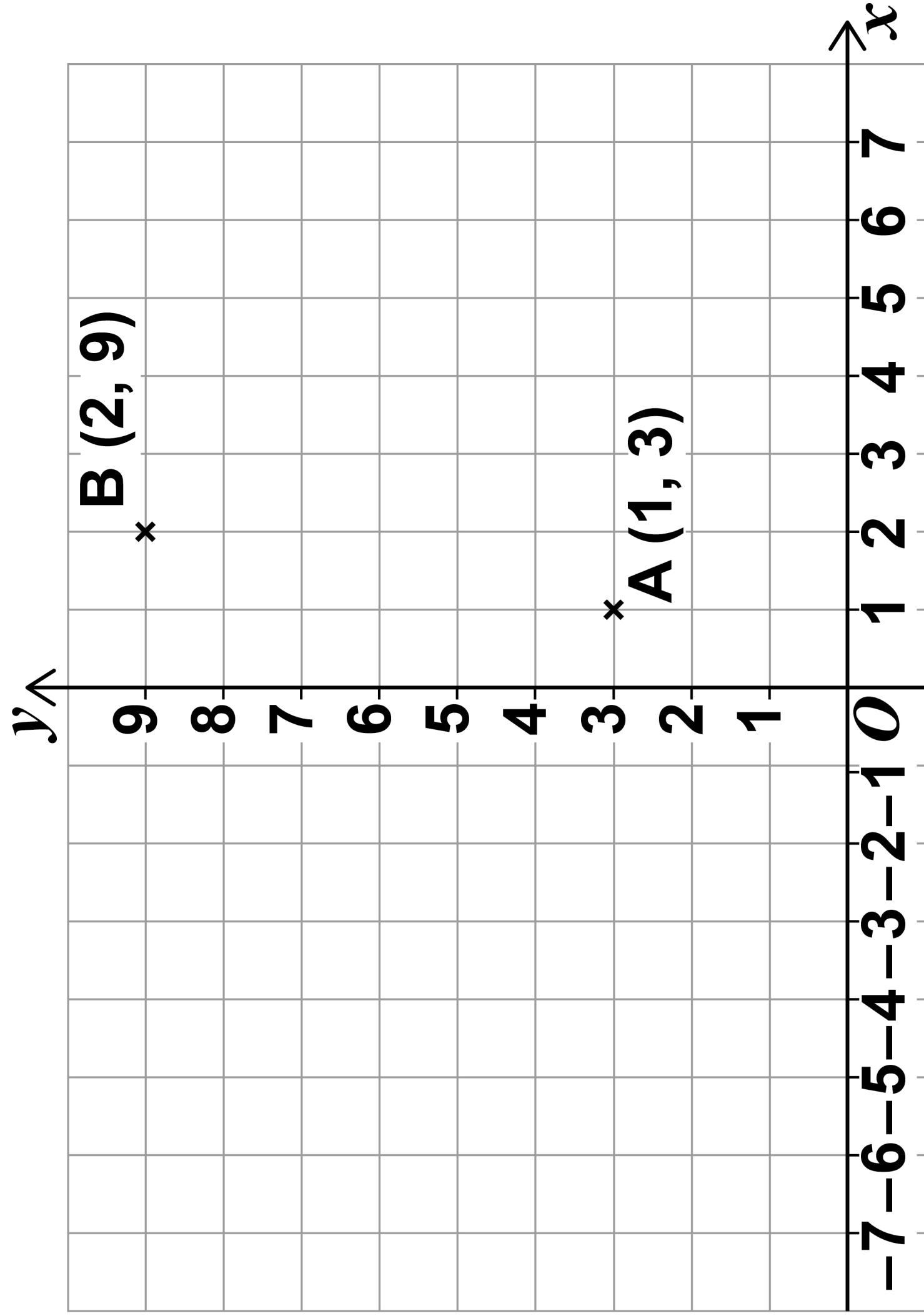
$a =$  \_\_\_\_\_  $b =$  \_\_\_\_\_

[Turn over]

<hr/>
7



**9**   **A (1, 3) and B (2, 9) are points on a grid.**







**ABCD is a parallelogram.**

**AD and BC are HORIZONTAL and each is 5 squares wide.**

**The diagonals of ABCD cross at E.**

**Work out the TWO possible pairs of coordinates of E.**

**[4 marks]**

**17**

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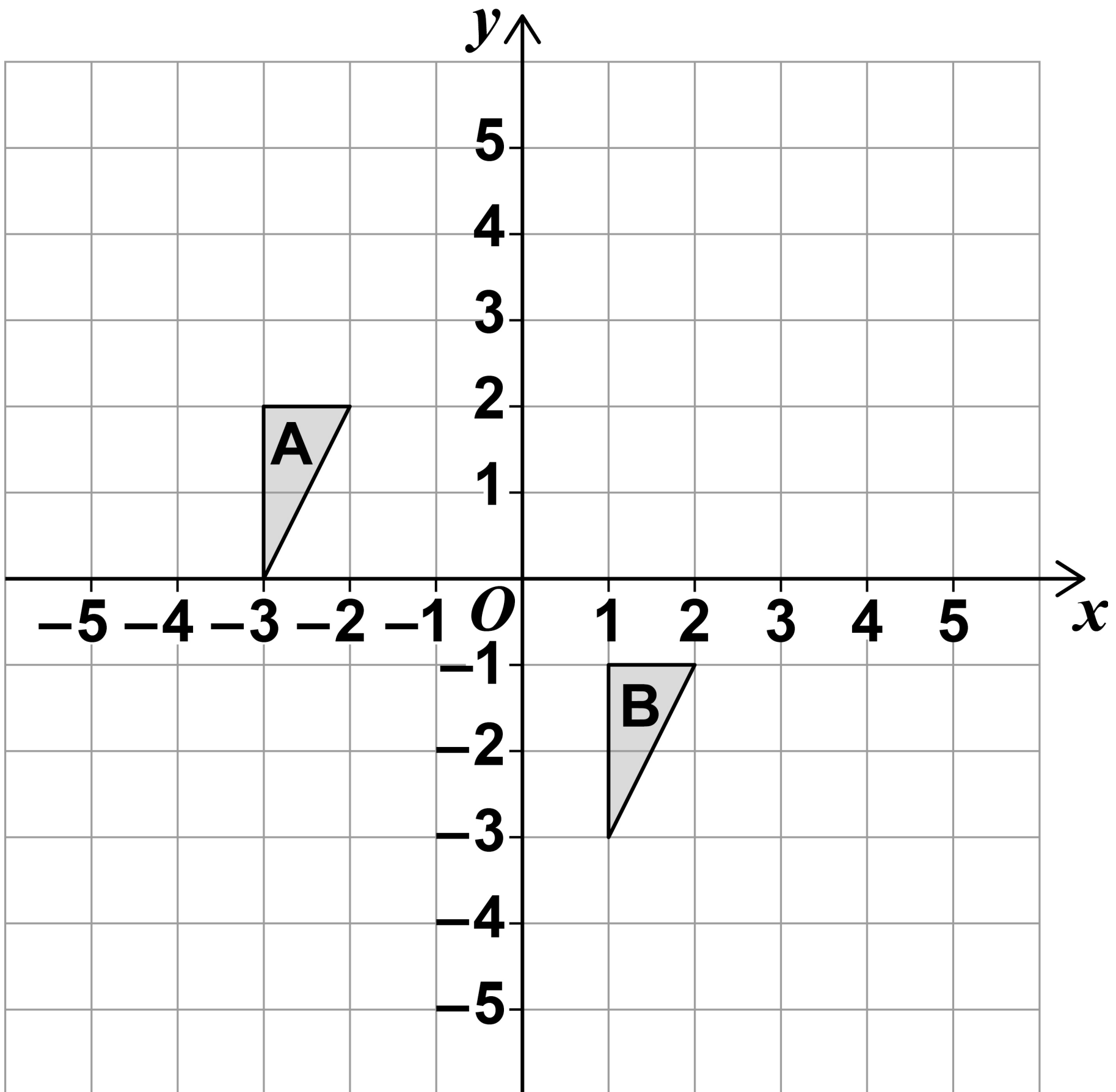
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**Answer ( \_\_\_\_\_ , \_\_\_\_\_ ) and ( \_\_\_\_\_ , \_\_\_\_\_ )**

**[Turn over]**

- 10** Write down the translation vector that maps shape A onto shape B.  
[2 marks]



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

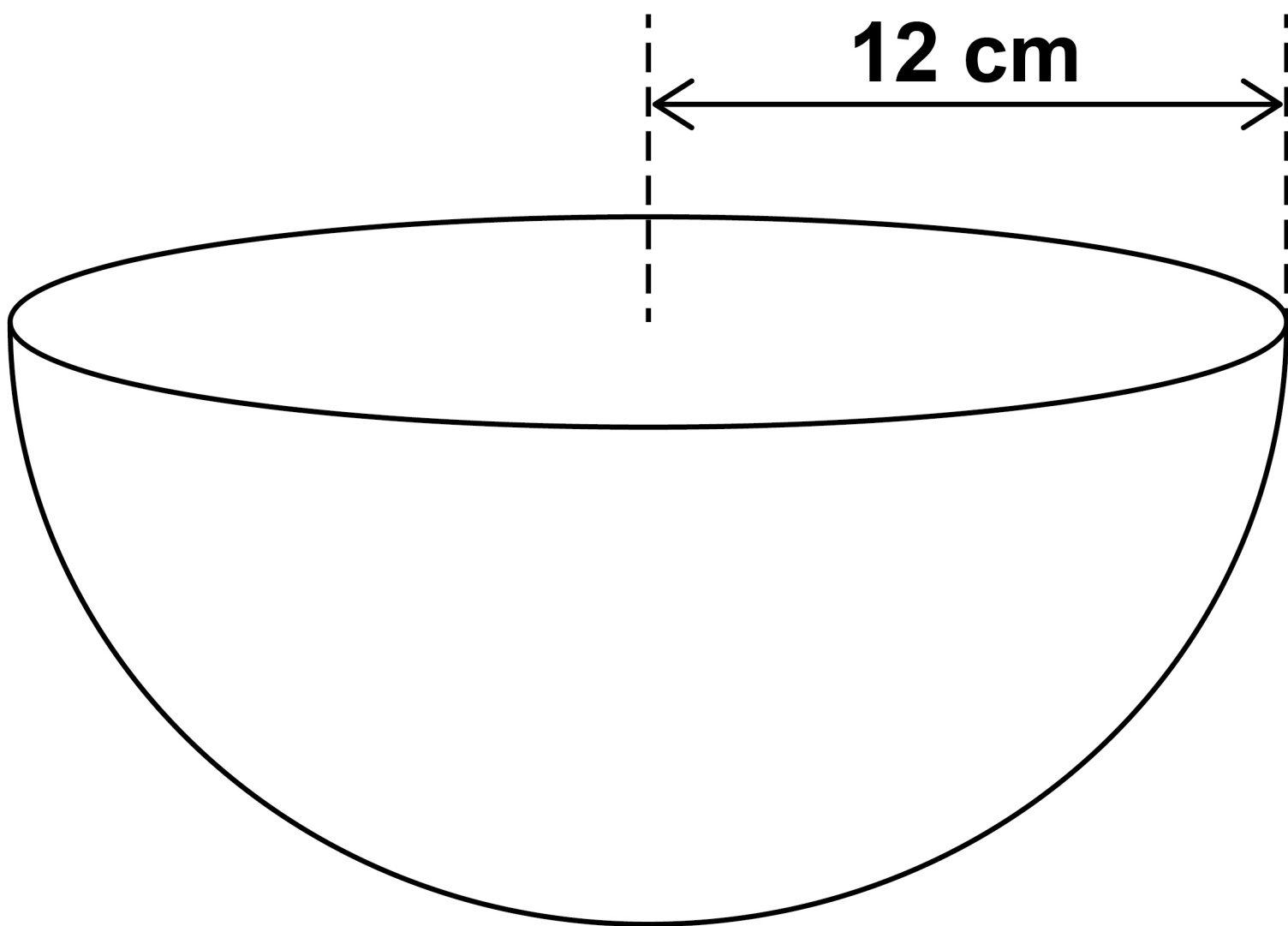
**[Turn over]**

<hr/>
<b>6</b>



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

**A bowl is a hemisphere with radius 12 cm**



**Water is poured into the bowl  
at a rate of  $325 \text{ cm}^3$  per second  
for 8 seconds.**

**Does the water fill MORE THAN 70%  
of the bowl?**

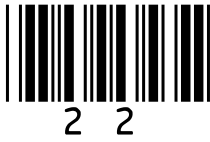


**You MUST show your working.  
[4 marks]**

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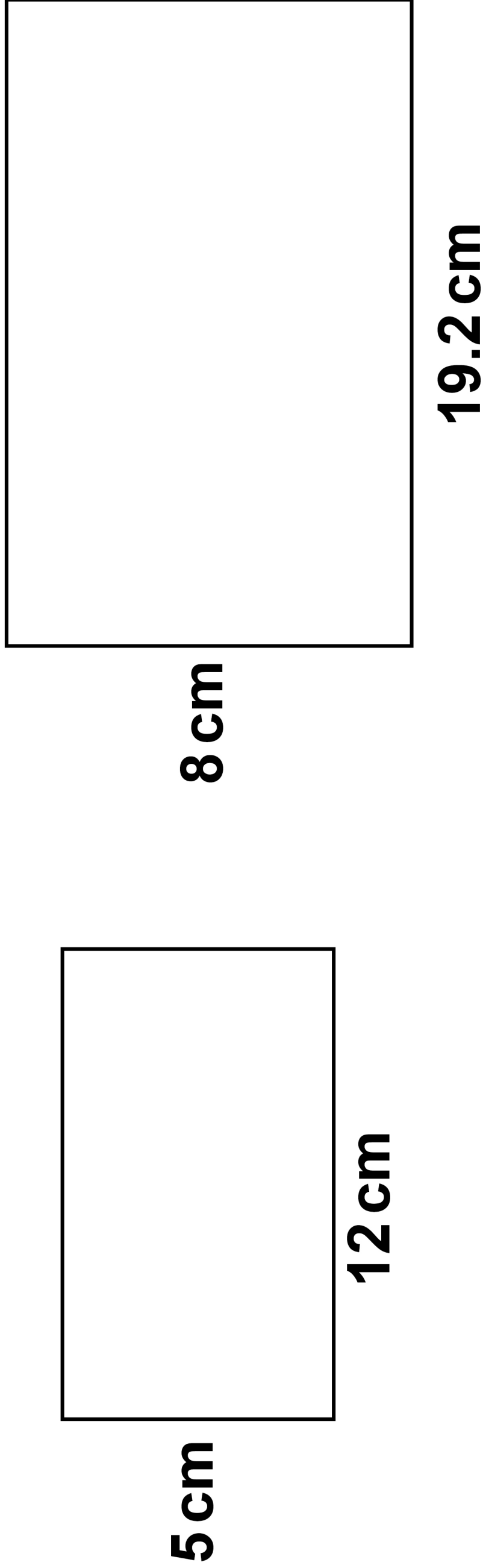
**[Turn over]**





**12 Show that these two rectangles are similar.**

**The diagrams are not drawn accurately. [2 marks]**



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**13** A factory packs  $x$  boxes of teabags per hour.

**Each box contains 80 teabags.**

**Show that the factory packs  $\frac{4x}{3}$  teabags per minute.  
[2 marks]**

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**23**

**[Turn over]**

**14 A company has 123 employees.**

**Information about their hourly rates of pay is shown in the table.**

<b>Hourly rate, £<math>p</math></b>	<b>Number of employees</b>
<b><math>10 \leq p &lt; 14</math></b>	<b>66</b>
<b><math>14 \leq p &lt; 20</math></b>	<b>32</b>
<b><math>20 \leq p &lt; 40</math></b>	<b>15</b>
<b><math>40 \leq p &lt; 100</math></b>	<b>10</b>
	<b>Total = 123</b>

**The owner of the company uses the data to make two statements.**

### **STATEMENT A**

**“Over 30% of employees have an hourly rate that is more than £17”**





**STATEMENT B**

**“The average hourly rate of pay is more than £20”**

**14(a) Show working that supports STATEMENT A. [3 marks]**

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**[Turn over]**



**14(b) Why might STATEMENT A NOT be true? [1 mark]**

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**14(c) Work out an estimate of the mean to support STATEMENT B. [3 marks]**

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**14(d) Why is the mean NOT the best average to represent the data? [1 mark]**

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**[Turn over]**

8



- 15 Expand  $(x^2 - 9xy)(2x + 5y)$**   
**[2 marks]**

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

- 16 Line A**

**has equation  $y = ax - 1$**

**passes through the point (7, 13)**

**Line B has equation  $5y - 3x = 4$**

**Show that line A has a greater gradient than line B. [3 marks]**

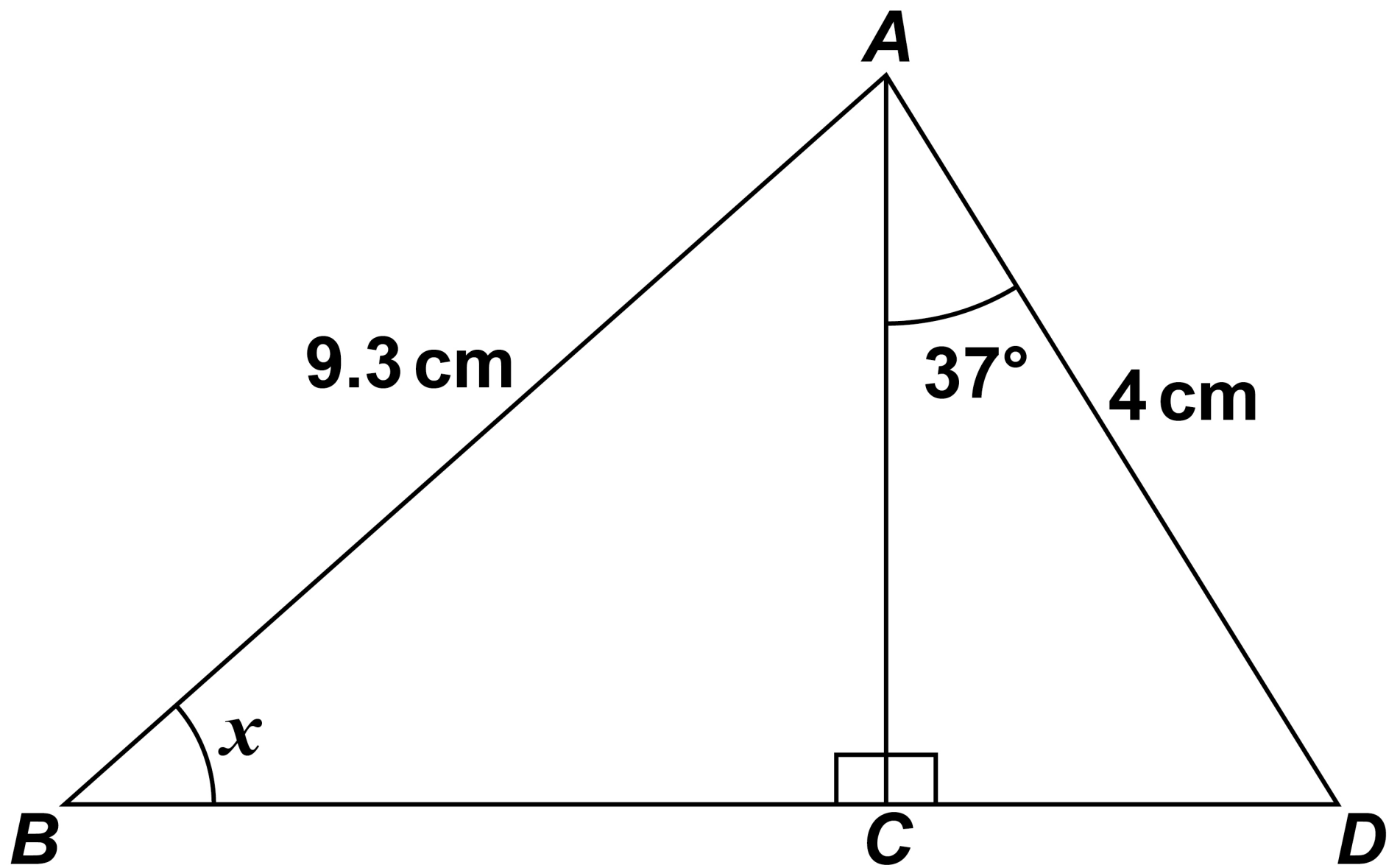


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**[Turn over]**



**17 The diagram is not drawn accurately.**



**Work out the size of angle  $x$ .**  
**[4 marks]**

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31

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$$x = \underline{\hspace{10cm}}$$

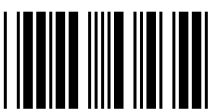
**[Turn over]**



3 1

9

**18 Rearrange  $y = \frac{x+8}{x}$  to make  $x$  the subject. [3 marks]**

This image shows a blank sheet of white paper with horizontal ruling lines. The lines are evenly spaced and run across the width of the page. There are no margins, text, or other markings on the paper.



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Answer \_\_\_\_\_

[Turn over]



**19 Here are the first four terms of a quadratic sequence.**

**3            20            47            84**

**Work out an expression for the  $n$ th term of the sequence. [4 marks]**

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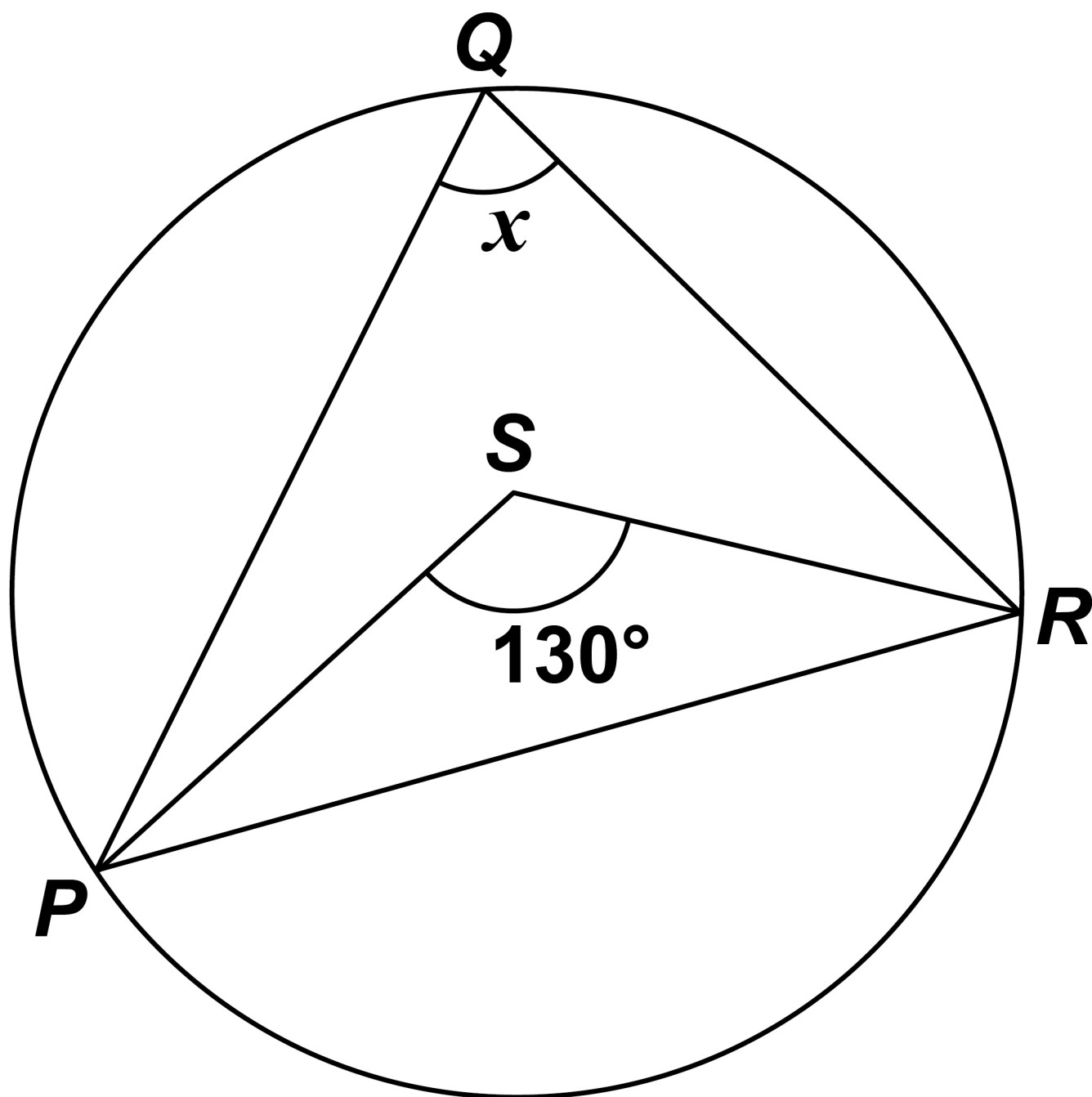
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**20(a)** *P*, *Q* and *R* are points on a circle.

*S* is a point inside triangle *PQR*.

The diagram is not drawn accurately.



**Assume that  $S$  is the centre of the circle.**

**Work out the size of angle  $x$ .  
[1 mark]**

\_\_\_\_\_

\_\_\_\_\_

$x =$  \_\_\_\_\_ °

**[Turn over]**



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**20(b)** In fact, the centre of the circle is on *PS* but NOT at *S*.

**What does this mean about the size of angle  $x$  ?**

**Tick ONE box. [1 mark]**

☐

**It is the same as the answer to part (a)**

☐

**It is greater than the answer to part (a)**

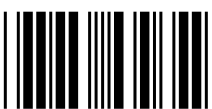
☐

**It is smaller than the answer to part (a)**

☐

**It is impossible to tell**

**[Turn over]**



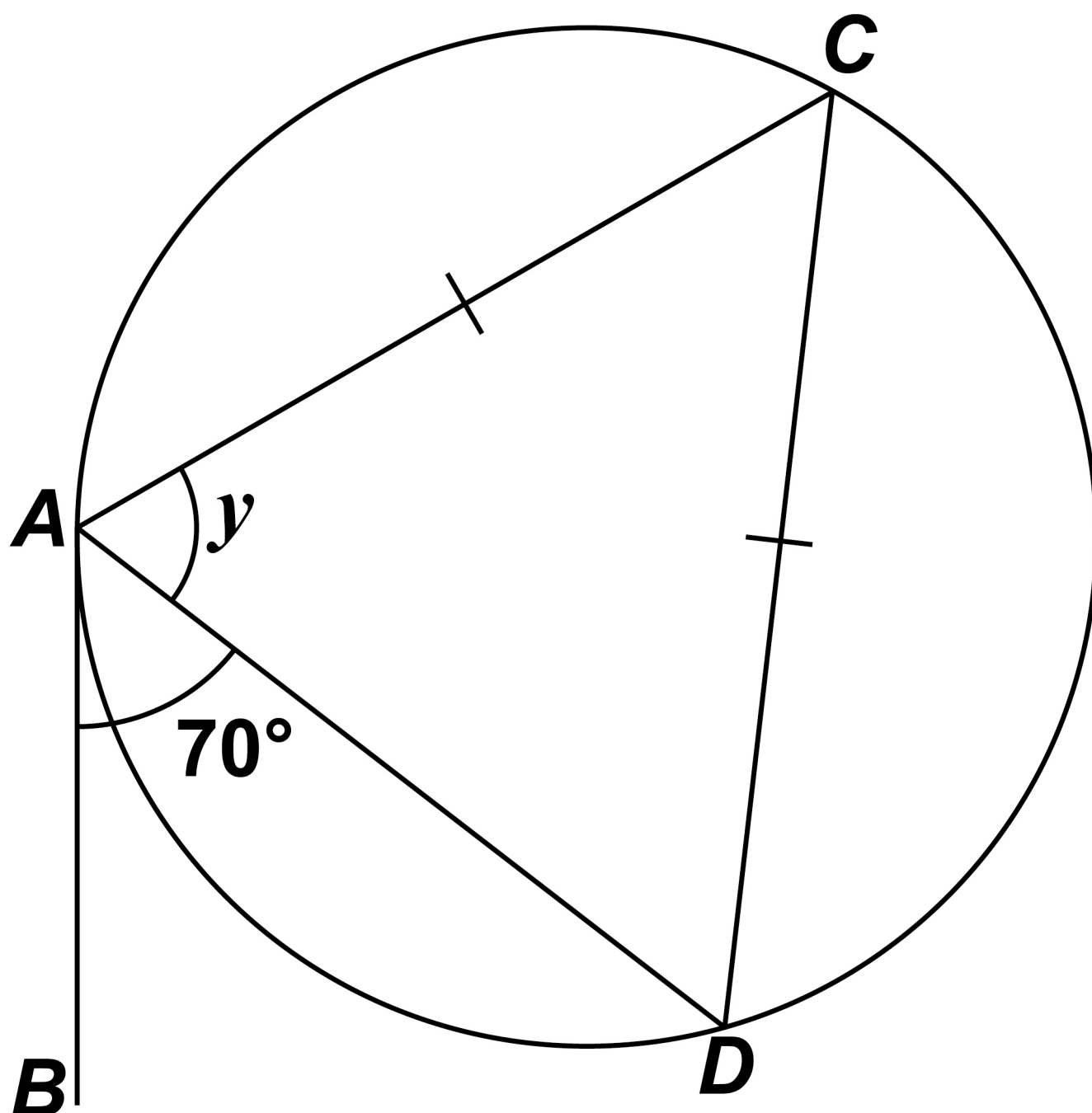
**20 (c) For a different circle,**

**$AB$  is a tangent at  $A$**

**$C$  and  $D$  are on the circumference of the circle**

**$AC = CD$**

**The diagram is not drawn accurately.**





Here is Simon's method to work out the size of angle  $y$ .

Angle  $ADC = 70^\circ$  (alternate segment theorem)

Therefore  $y = 70^\circ$  (angles in an isosceles triangle)

Is he correct?

Give a reason for your answer.  
[1 mark]

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[Turn over]



**21 Magana decides to put £500 into an account that pays compound interest.**

**She wants to have AT LEAST £560 in the account after 3 years.**

**Work out to 1 decimal place the MINIMUM annual interest rate she needs. [3 marks]**

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

**[Turn over]**



- 22** An approximate value of a root of an equation,  $x$ , can be found using the iterative formula

$$x_{n+1} = \sqrt[3]{5(x_n)^2 - 2x_n - 3}$$

The starting value is  $x_1 = 4$

- 22 (a)** Work out the values of  $x_2$  and  $x_3$   
[2 marks]

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$x_2 =$

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$x_3 =$

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**22 (b) By continuing the iteration, show that the value of  $x$  is more than 4.25 [1 mark]**

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**[Turn over]**

6



**23 Here are three sets of cards.**

**SET A**

1
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1
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3
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5
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5
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5
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6
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8
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**SET B**

1
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2
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4
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6
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8
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8
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9
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**SET C**

3
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4
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5
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6
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**In a game, a player has two options.**

**OPTION 1**

**Pick two cards from Set A**

**OPTION 2**

**Pick one card from Set B**

**and**

**pick one card from Set C**



**The cards are picked at random.**

**The player wins if the total of their two cards is exactly 10**

**Which option gives a better chance of winning?**

☐

**Option 1**

☐

**Option 2**

**Show working to support your answer.  
[4 marks]**

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**[Turn over]**



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**[Turn over]**



**24**  $a = 65$  to the nearest integer

$b = 30$  to 1 significant figure

**Work out the UPPER BOUND for**  
 $2a^2 - b^2$

**You MUST show your working.**  
**[3 marks]**

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Answer 

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[Turn over]



**25 Show that  $\frac{x-5}{x-2} + \frac{x+5}{x+2}$**

**simplifies to  $\frac{ax^2 - b}{x^2 - 4}$  where  $a$  and  $b$**

**are integers. [3 marks]**

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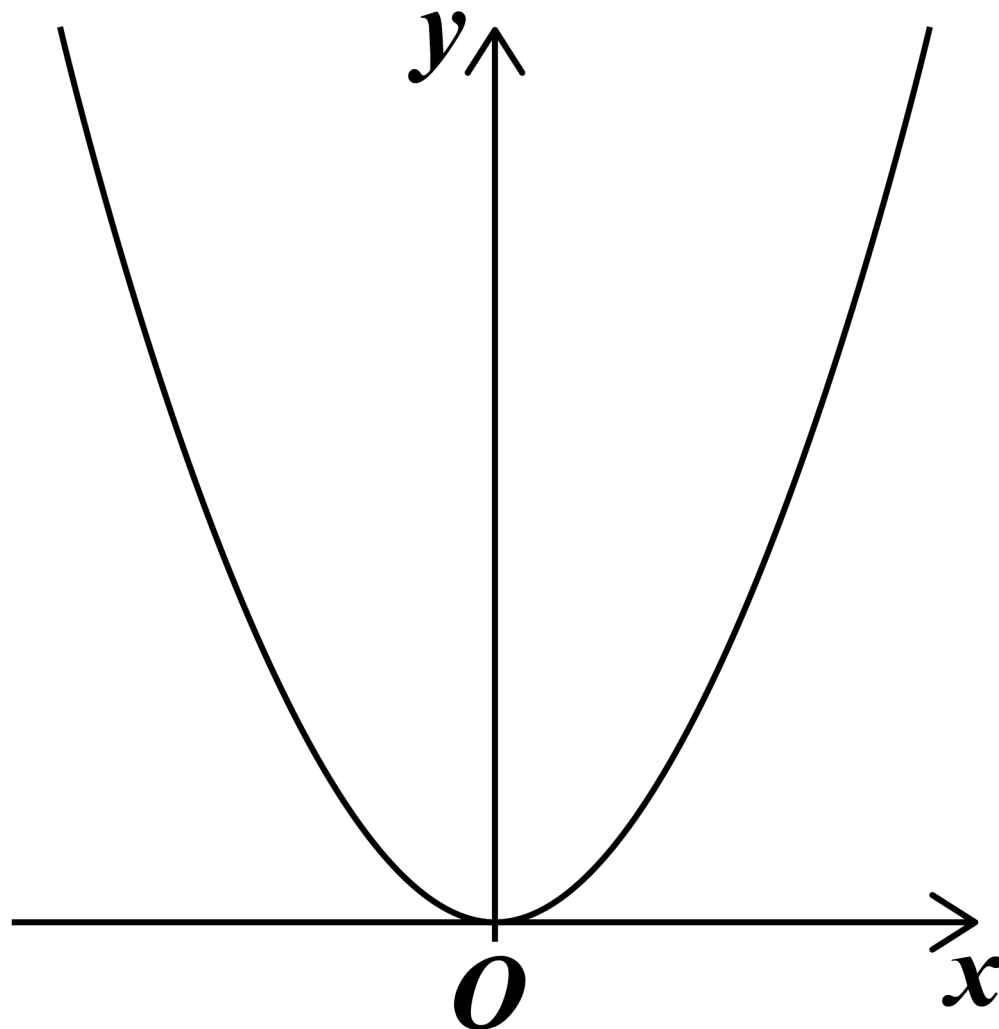
[illegible]

**[Turn over]**

6



**26** Here is a sketch of  $y = x^2$



**26(a)** The minimum point of  $y = x^2$  is at (0, 0)

**Write down the coordinates of the minimum point of  $y = x^2 + 2$**   
[1 mark]

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

**26(b)** The graph  $y = x^2$  is reflected in the  $x$  axis.

**Write down the equation of the graph after this transformation.**  
**[1 mark]**

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

**26(c)**  $y = x^2$  is now transformed to give  $y = (x + 3)^2$

**Describe fully this single transformation. [2 marks]**

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**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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Pages	Mark
4–5	
6–9	
10–15	
16–19	
20–23	
24–27	
28–31	
32–35	
36–41	
42–45	
46–48	
50–53	
54–55	
TOTAL	

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