

Answer **all** the questions.

- 1 Solve $3x - 5 \geq 10$.
Show your solution on the number line.

$$3x \geq 15 \quad \checkmark$$

$$x \geq 5 \quad \checkmark$$



[4]

- 2 Amrit's income is 32% more than Bethan's income.
Amrit and Bethan's combined income is £54 868.

Calculate Amrit's income.

$$B = 100\% \quad A = 132\% \quad \checkmark$$

$$\text{so } 232\% = 54\,868 \quad \checkmark$$

$$\div 232, \times 132 \quad \checkmark \checkmark$$

$$132\% = \text{£ } 31\,218 \quad \checkmark$$

[5]

- 3 Jacob, Amelie and Reuben each roll a fair six-sided dice.
What is the probability that all three roll a number less than 3?

Give your answer as a fraction in its simplest form.

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

✓✓

$$\frac{1}{27}$$

✓

[3]

- 4 The diagram shows two rectangles, A and B.



12 cm

25 cm



Rectangle B

x Not to scale

Rectangle A has a width of 25 cm and a height of 12 cm.
The width of rectangle B is three times the height of rectangle B.

The area of rectangle A is equal to the area of rectangle B.

Find the perimeter of rectangle B.

$$25 \times 12 = 3x \times x$$

✓

$$300 = 3x^2$$

✓

$$100 = x^2$$

$$10 = x$$

✓

$$(30 + 10) \times 2$$

✓

=

80

✓

..... cm [5]

- 5 Kay invests £1500 in an account paying 3% **compound** interest per year.
Neil invests £1500 in an account paying $r\%$ **simple** interest per year.

At the end of the 5th year, Kay and Neil's accounts both contain the same amount of money.

Calculate r .

Give your answer correct to 1 decimal place.

$$(K) \quad 1500 \times 1.03^5 = 1738.91 \quad \checkmark$$

$$\text{int} = \overset{\checkmark\checkmark}{238.91}$$

$$\begin{aligned} \text{simple p/year} &= 238.91 \div 5 \\ &= 47.78 \quad \checkmark \end{aligned}$$

$$\frac{47.78}{1500} \times 100 = 3.18... \quad \checkmark$$

$$r = \dots\dots\dots 3.2 \quad \checkmark$$

[6]

- 6 The table shows the children nominated to win the subject prize in Mathematics and the subject prize in English.

Mathematics	English
Alice	Alice
Ben	Claire
Emma	Gabi
Paddy	Simon

The winner of each subject prize is picked at random.
It is possible for Alice to win both prizes.

In what percentage of the combinations of prize winners does Alice win **at least** one prize?

$$\frac{AA, AC, AG, AS, BA, EA, PA}{4 \times 4} \times 100$$

$$\checkmark \checkmark \frac{7}{16} \times 100 \checkmark$$

$$43.75 \text{ or } 43.8 \checkmark$$

..... % [4]

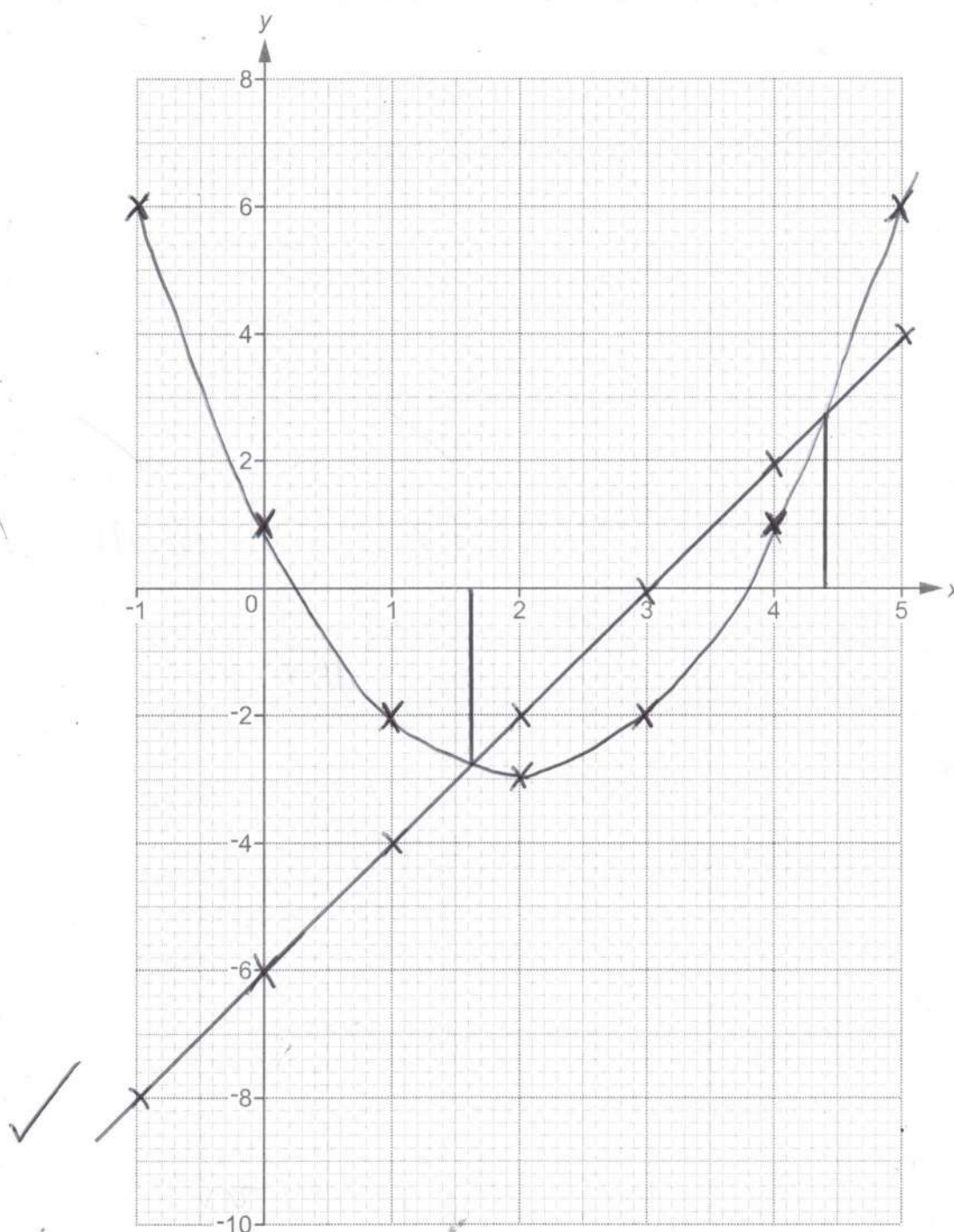
- 7 (a) Complete the table for $y = x^2 - 4x + 1$.

x	-1	0	1	2	3	4	5
y	6	1	-2	-3	-2	1	6

2 ✓
All ✓

[2]

- (b) Draw the graph of $y = x^2 - 4x + 1$ for $-1 \leq x \leq 5$.



[3]

- (c) On the same grid, draw the graph of $y = 2x - 6$ for $-1 \leq x \leq 5$.

[3]

$$c = -6$$

$$m = 2$$

✓

✓

- (d) Use your graphs to solve the equation $x^2 - 4x + 1 = 2x - 6$.

Give your answers to 1 decimal place.

✓

1.6

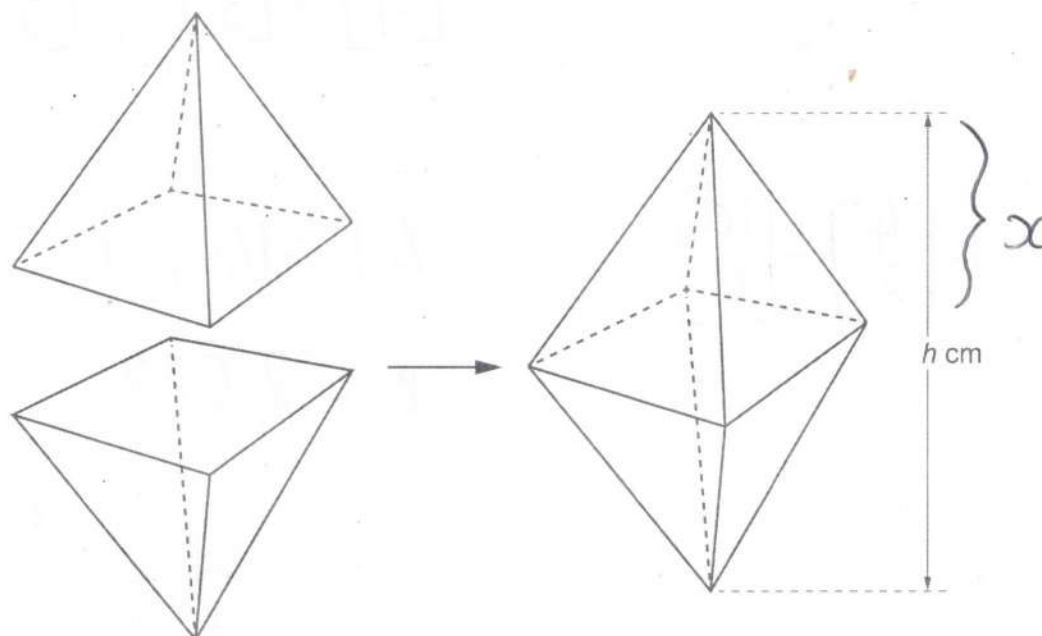
✓

4.4

(d) $x = \dots\dots\dots$ or $x = \dots\dots\dots$ [2]

$\left[\begin{array}{c} + \\ - \end{array} 1\text{mm} \right]$

- 8 An octahedron is formed from two identical square based pyramids. The square bases are stuck together as shown.



The volume of the octahedron is 60 cm^3 .

The length of the side of each pyramid's square base is 5 cm .

Work out the height $h \text{ cm}$ of the **octahedron**.

[The volume of a pyramid is $\frac{1}{3} \times \text{area of base} \times \text{perpendicular height}$]

$$\text{Vol pyramid} = 30 = \frac{1}{3} \times 5^2 \times x \quad \checkmark \checkmark$$

$$x = \frac{30 \times 3}{25} = 3.6 \quad \checkmark$$

$$h = 3.6 \times 2$$

$$h = 7.2 \quad \checkmark$$

$h = \dots \text{ cm [4]}$

- 9 Vector $\mathbf{a} = \begin{pmatrix} 3 \\ -1 \end{pmatrix}$ and vector $\mathbf{b} = \begin{pmatrix} 1 \\ 3 \end{pmatrix}$.

(a) Find the values of k and n so that

$$k(\mathbf{a} + \mathbf{b}) = \begin{pmatrix} 10 \\ n \end{pmatrix}$$

$$K \begin{bmatrix} 4 \\ 2 \end{bmatrix} = \begin{bmatrix} 10 \\ n \end{bmatrix}$$

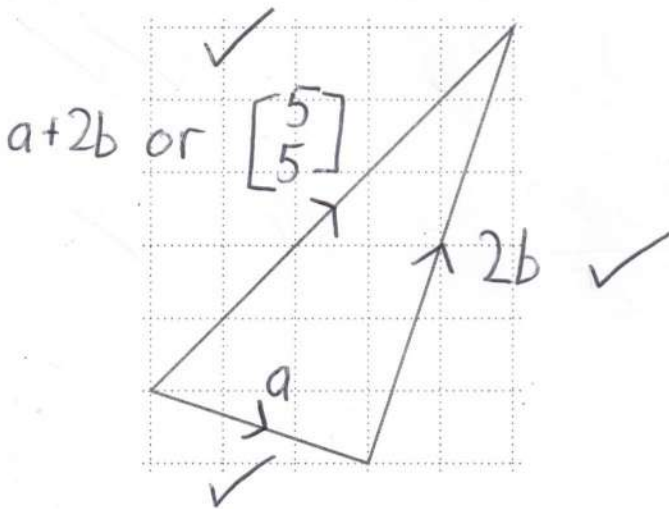
$$\begin{bmatrix} 3 \\ -1 \end{bmatrix} + \begin{bmatrix} 1 \\ 3 \end{bmatrix} = \begin{bmatrix} 4 \\ 2 \end{bmatrix} \quad \checkmark$$

$$4k = 10, \quad k = 2.5$$

$$n = 2.5 \times 2$$

(a) $k = \frac{2.5}{5} \quad \checkmark \text{OE}$
 $n = \frac{5}{5} \quad \checkmark \quad [3]$

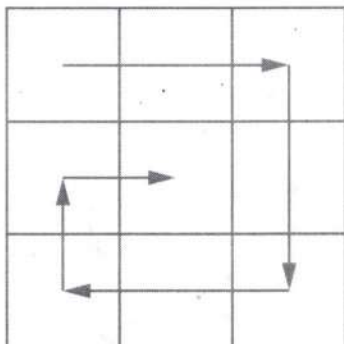
- (b) Gavin starts to draw a diagram to show that $\mathbf{a} + 2\mathbf{b} = \begin{pmatrix} 5 \\ 5 \end{pmatrix}$.



Complete Gavin's diagram.

[3]

- 10 Nine consecutive numbers are written on a 3-by-3 grid. They are arranged, in ascending order, in a spiral as shown.



- (a) Karen writes the numbers 3 to 11 on her grid.

3	4	5
10	11	6
9	8	7

The total of the first column is $3 + 10 + 9 = 22$.

Karen says

The total of the first column is one less than the total of the second column.

Show that this is correct for Karen's grid.

[1]

$$4 + 11 + 8 = 23$$



(b) Victor says

If **any** nine consecutive numbers are arranged in ascending order in this spiral on a 3-by-3 grid, the total of the first column will **always** be one less than the total of the second column.

Prove that Victor is correct.

[5]

Column 1

C2

$$\begin{array}{r} n \\ n+7 \\ n+6 \\ \hline 3n+13 \end{array}$$

$$\begin{array}{r} n+1 \\ n+8 \\ n+5 \\ \hline 3n+14 \end{array}$$

✓
✓
✓

$$(3n+14) - (3n+13) = 1$$

✓
✓

11 A sequence is defined by the rule $u_{n+1} = 5u_n - 15$.

(a) If $u_3 = 6$, calculate

(i) u_5

$$u_4 = 5 \times 6 - 15 = 15 \quad \checkmark \checkmark$$

$$u_5 = 5 \times 15 - 15$$

(a)(i) $u_5 = \underline{60}$ [3] ✓

(ii) u_2

$$u_2 = \frac{6 + 15}{5} = \frac{21}{5}$$

✓✓

(ii) $u_2 = \underline{4.2}$ ✓OE [3]

(b) Trevor says

If $u_1 = 3.75$ then $u_{100} = 3.75$

Show that Trevor is correct.

[2]

$$\begin{aligned} u_2 &= 5 \times 3.75 - 15 \\ &= 18.75 - 15 \\ &= 3.75 \end{aligned} \quad \checkmark$$

$u_1 = u_2 \dots$ hence all terms are equal ✓

- 12 (a) Arron ran a distance of 5 km at an average speed of 2.2 m/s.

How long did Arron run for?

Give your answer in minutes and seconds, to the nearest second.

$$5 \text{ km} = 5000 \text{ m} \quad \checkmark$$

$$T = \frac{D}{S} = \frac{5000}{2.2} = 2273 \text{ s} \quad \checkmark$$



(a) 37 minutes 53 seconds [4]

(allow 52)

- (b) Claudine cycled a distance of 53 km in 2.7 hours.
The distance is measured correct to the nearest km.
The time is given correct to 1 decimal place.

Calculate the lower and upper bounds of her average speed.

Give your answers correct to 2 decimal places.

$$53 < \begin{matrix} 53.5 \\ 52.5 \end{matrix}$$

$$2.7 < \begin{matrix} 2.75 \\ 2.65 \end{matrix} \quad \checkmark \checkmark$$

$$LB = \frac{52.5}{2.75}$$

$$= 19.09$$

$$UB = \frac{53.5}{2.65} \checkmark = 20.19$$

(b) lower bound = 19.09 km/h

upper bound = 20.19 km/h [6]

- 13 Dani has a pack of 45 cards.
Each card is either red or black.

One-third of the cards in the pack are red. $= 15$, $B = 30$

She picks two cards from the pack, without replacement.

Calculate the probability that Dani picks two **black** cards.

$$BB = \frac{30}{45} \times \frac{29}{44}$$

✓✓ ✓ ✓✓

$$\frac{29}{66}$$

✓

[5]

- 14 Write $(\sqrt[4]{8})^5$ as a power of 2.

$$(2^3)^{\frac{5}{4}} = 2^{3 \times \frac{5}{4}}$$

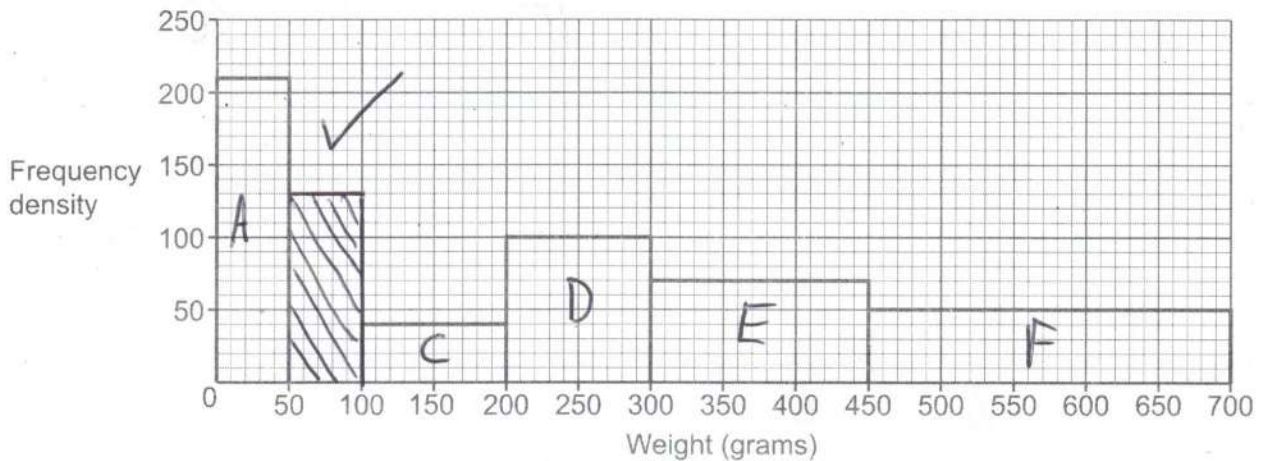
✓

$$2^{\frac{15}{4}}$$

✓OE

[3]

- 15 The histogram shows information about the weights of some of the parcels handled by a delivery company in one month.



- (a) Zoe says

There are fewer parcels weighing between 450g and 700g than parcels weighing between 300g and 450g.

Is Zoe correct?

Show how you decide.

$$F = 250 \times 50 \\ = 12500$$

$$E = 150 \times 70 \\ = 10500$$

✓✓
✓

$F > E$ so Zoe is incorrect

✓

[4]

- (b) The delivery company delivered 6500 parcels weighing between 50g and 100g.

Complete the histogram to show this information.

[2]

$$\frac{6500}{50} = 130 = fd$$

✓

- (c) Zoe uses the histogram to calculate the number of parcels weighing between 200g and 250g.

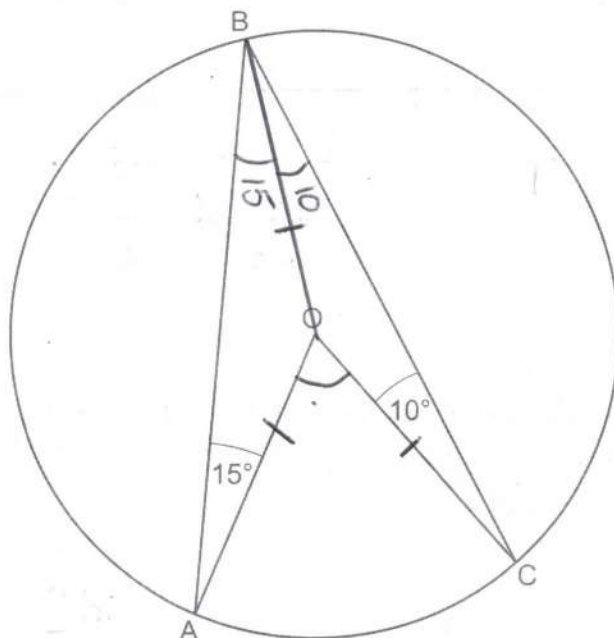
Explain why Zoe's answer is unlikely to be reliable.

May not be evenly distributed

✓OE

16 (a) In the diagram,

- A, B and C are points on the circumference of a circle
- O is the centre of the circle
- angle $OAB = 15^\circ$
- angle $BCO = 10^\circ$



Not to scale

Calculate the acute angle AOC.

$$\angle ABC = 25$$

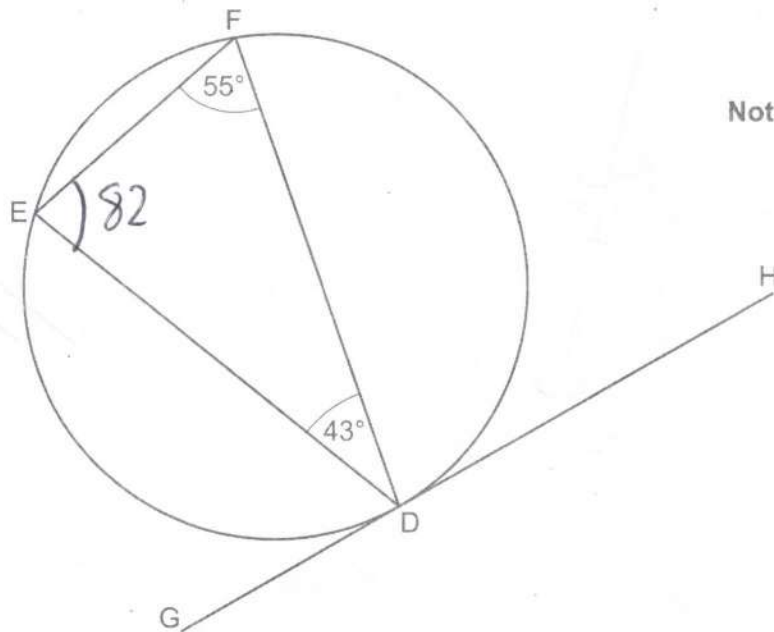
$$\angle AOC = 25 \times 2$$

50

(a) $^\circ$ [4]

(b) In the diagram,

- E, F and D are points on the circumference of the circle
- G, D and H lie on a tangent to the circle
- angle $EFD = 55^\circ$
- angle $FDE = 43^\circ$



Explain why angle HDF is 82° .

$$\begin{aligned} \angle FED &= 180 - 55 - 43 \\ &= 82 \quad (\text{angles in a triangle sum to } 180) \end{aligned}$$

$$\begin{aligned} \angle HDF &= \angle FED = 82 \\ & \quad (\text{alternate segment theorem}) \end{aligned}$$

.....

.....

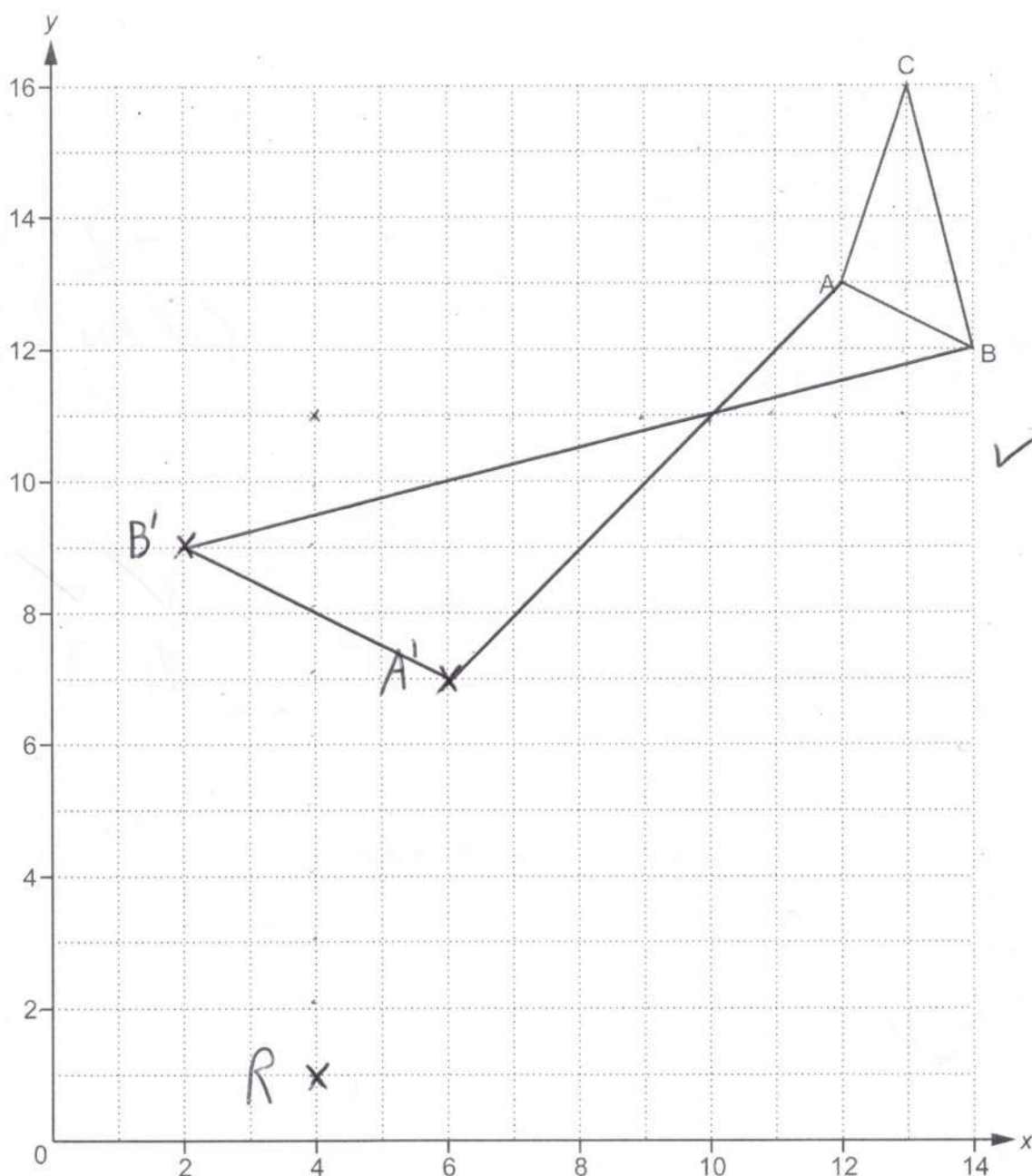
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[4]

17 A triangle has vertices A, B and C.



The triangle is enlarged with scale factor f and centre of enlargement E.

Vertex A maps to (6, 7).

Vertex B maps to (2, 9).

(a) Find the coordinates of the centre of enlargement, E.

(a) (10, 11) [2] ✓

(b) Find the scale factor, f .

(c) Vertex C maps to the point R.
Find the coordinates of R.

(b) [2]

(✓ for "2")

(c) (.....,) [2]

END OF QUESTION PAPER