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EDEXCEL INTERNATIONAL GCSE MATHS: QUESTIONS BY TOPIC

Transformations & Vectors (G3)

International GCSE Mathematics A (4MA1) · Foundation tier

31 questions · 128 marks · Mark schemes included

Past papers June 2018 - June 2025 · 2 sub-topics

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HOW TO USE THIS BOOKLET

Questions are grouped by sub-topic and run from the lowest to the highest mark tariff, then oldest paper first.

Click any row below to jump straight to that sub-topic or question.

On every question page, click ANSWER in the top-right corner to jump to its mark scheme; < QUESTION brings you back.

A gold bar in the left margin marks exactly where the question sits on the original page.

Diagrams, graphs, grids and tables are printed exactly as they appear in the original papers.

Each question is filed under its main topic; longer questions may also test skills from other topics.

QUESTION	SOURCE	MARKS	PAGE
G3a TRANSFORMATIONS		31 Qs · 128 marks	2
1. Q7	IGCSE Paper 2F January 2019	2	3
2. Q19	IGCSE Paper 1F January 2020	2	4
3. Q14	IGCSE Paper 2F January 2020	2	5
4. Q26	IGCSE Paper 1FR June 2023	2	6
5. Q17	IGCSE Paper 1F November 2024	2	7
6. Q13	IGCSE Paper 2FR November 2020	3	8
7. Q16	IGCSE Paper 2FR January 2023	3	9
8. Q15	IGCSE Paper 2F November 2024	3	10
9. Q12	IGCSE Paper 1F June 2018	4	11
10. Q11	IGCSE Paper 1F June 2019	4	12
11. Q14	IGCSE Paper 1FR June 2019	4	13
12. Q15	IGCSE Paper 1F January 2022	4	14
13. Q12	IGCSE Paper 1FR January 2022	4	15
14. Q14	IGCSE Paper 2F June 2022	4	16
15. Q18	IGCSE Paper 2FR June 2022	4	17
16. Q14	IGCSE Paper 1F January 2023	4	18
17. Q14	IGCSE Paper 2F June 2024	4	20
18. Q18	IGCSE Paper 2FR June 2024	4	21
19. Q20	IGCSE Paper 2FR June 2025	4	22
20. Q17	IGCSE Paper 1FR June 2018	5	24
21. Q11	IGCSE Paper 1FR January 2019	5	26
22. Q13	IGCSE Paper 1FR January 2020	5	27
23. Q13	IGCSE Paper 1F November 2020	5	28
24. Q14	IGCSE Paper 1F January 2021	5	30
25. Q12	IGCSE Paper 1F June 2021	5	31
26. Q12	IGCSE Paper 1F November 2021	5	32
27. Q19	IGCSE Paper 2F November 2023	5	33
28. Q19	IGCSE Paper 2F June 2025	5	34
29. Q16	IGCSE Paper 1F January 2019	6	35
30. Q16	IGCSE Paper 2FR January 2021	6	37
31. Q19	IGCSE Paper 1F June 2023	8	39
G3b VECTORS			

No questions on this sub-topic in the available past papers.



QUESTIONS

31 questions · 128 marks · 1 sub-topic

SUB-TOPIC G3a

TRANSFORMATIONS

Sub-topic G3a · 31 questions · 128 marks · lowest tariff first



6 Steve throws a 6-sided dice.

The dice can land on 1 or on 2 or on 3 or on 4 or on 5 or on 6

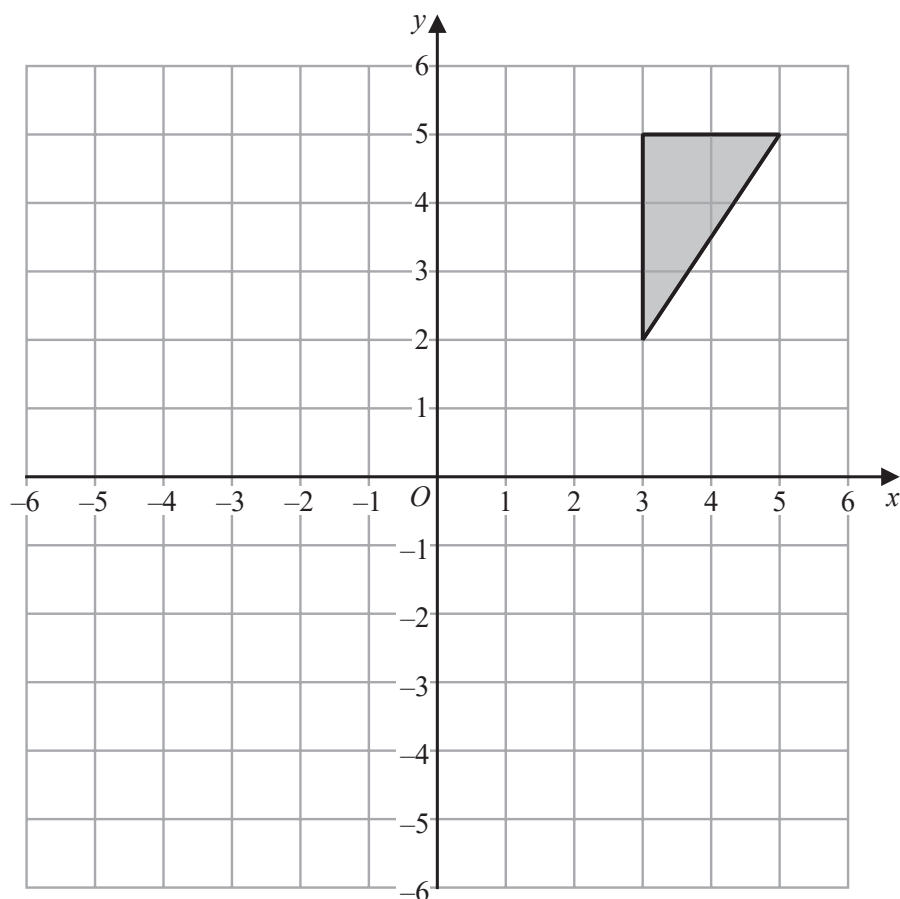
He also spins a coin.

The coin can land on heads (H) or on tails (T).

List all the possible combinations he could get.

(Total for Question 6 is 2 marks)

7

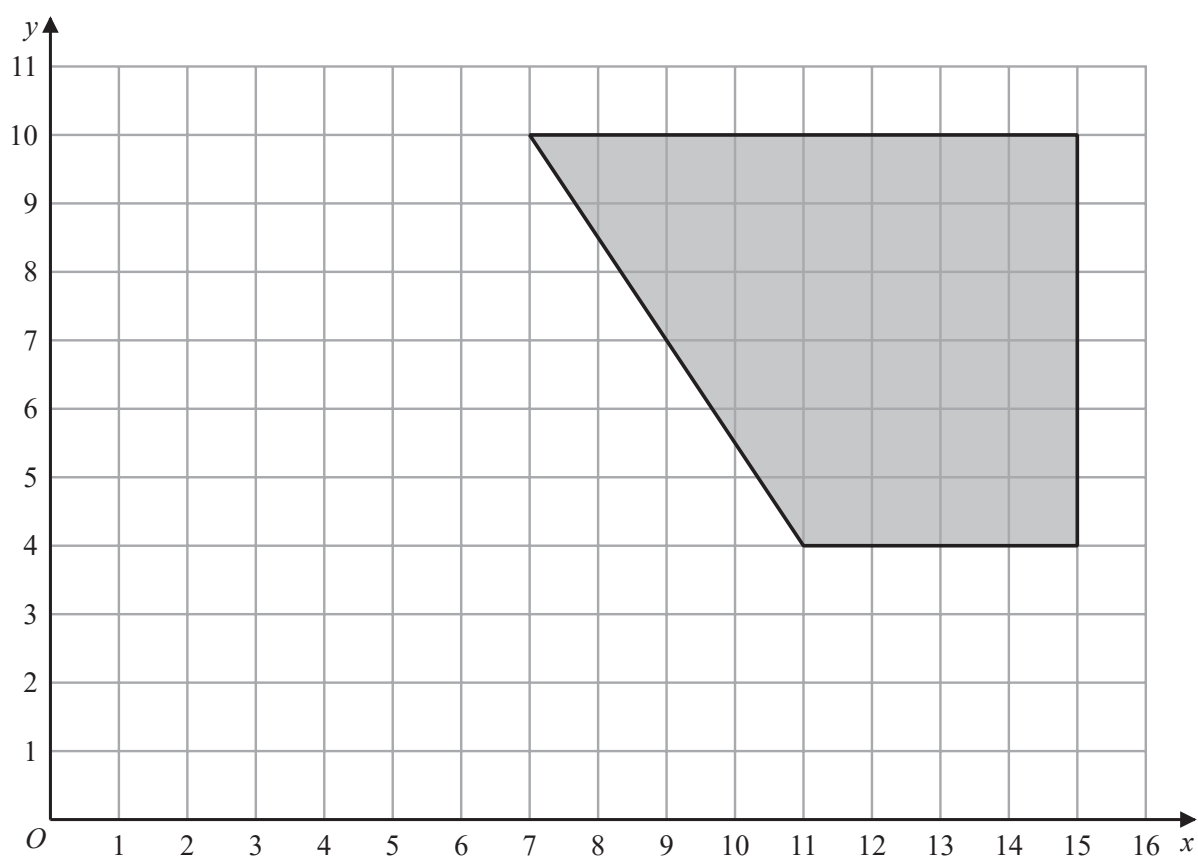


Reflect the shaded triangle in the line $y = 1$

(Total for Question 7 is 2 marks)



19

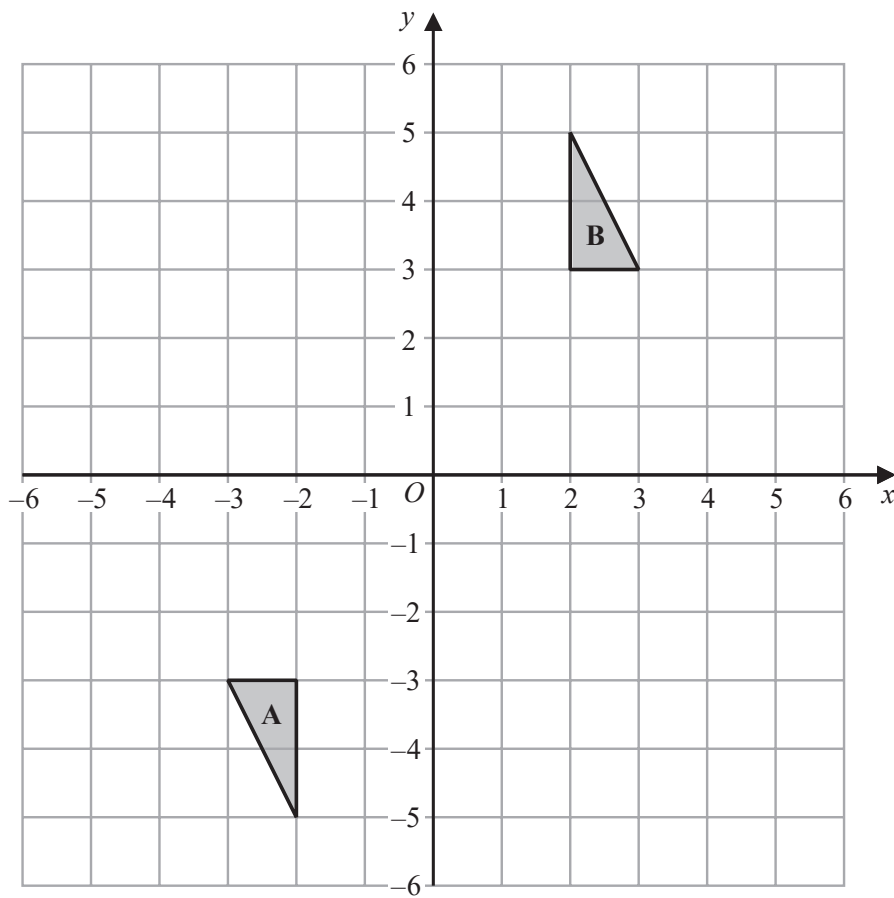


On the grid, enlarge the shaded shape with scale factor $\frac{1}{2}$ and centre (1, 2)

(Total for Question 19 is 2 marks)



14



Describe fully the single transformation that maps triangle **A** onto triangle **B**.

.....

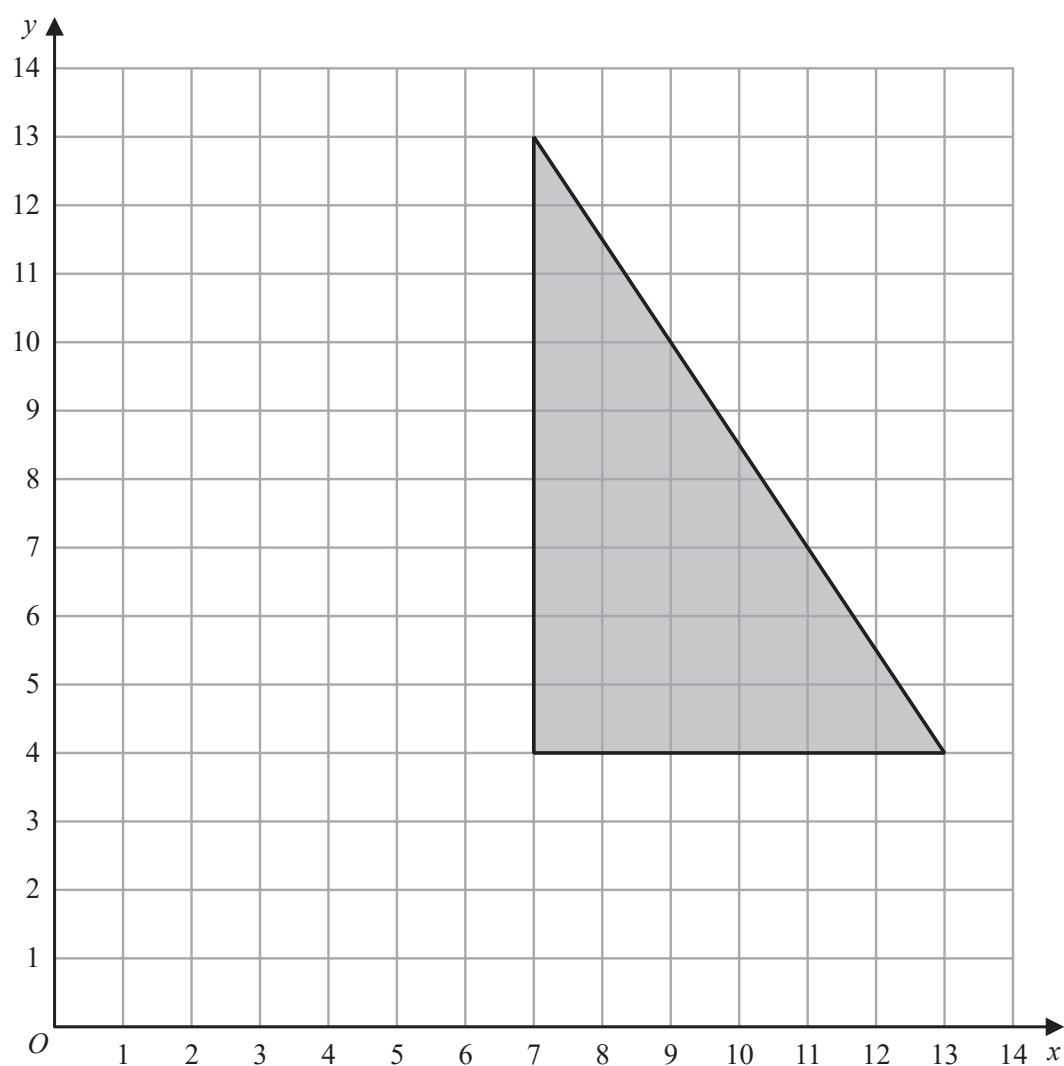
.....

.....

(Total for Question 14 is 2 marks)



26



On the grid, enlarge the shaded shape with scale factor $\frac{1}{3}$ and centre (1, 7)

(Total for Question 26 is 2 marks)



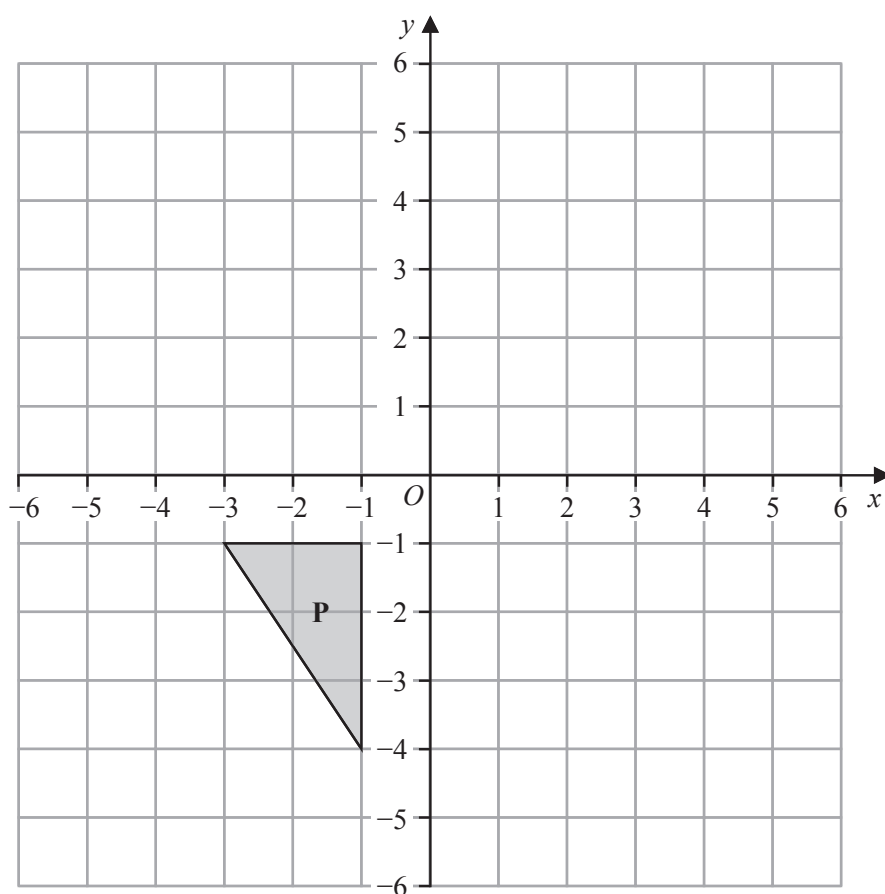
16 By rounding each number to one significant figure, work out an estimate for

$$31.4 \times 48.7$$

Show your working clearly.

(Total for Question 16 is 2 marks)

17

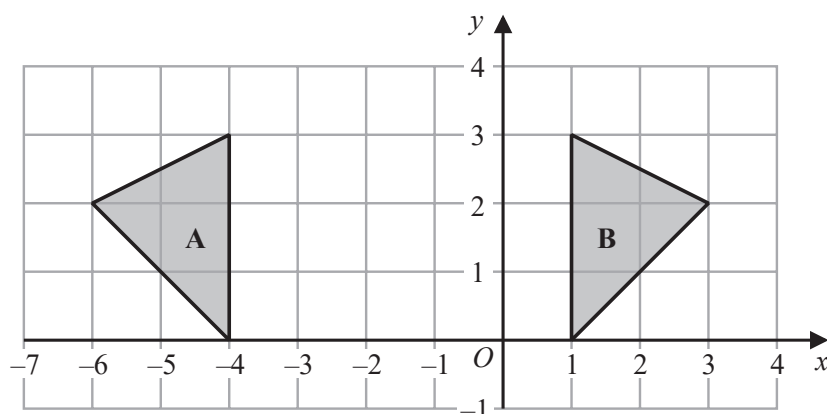


Reflect shape **P** in the line $x = 1$

(Total for Question 17 is 2 marks)



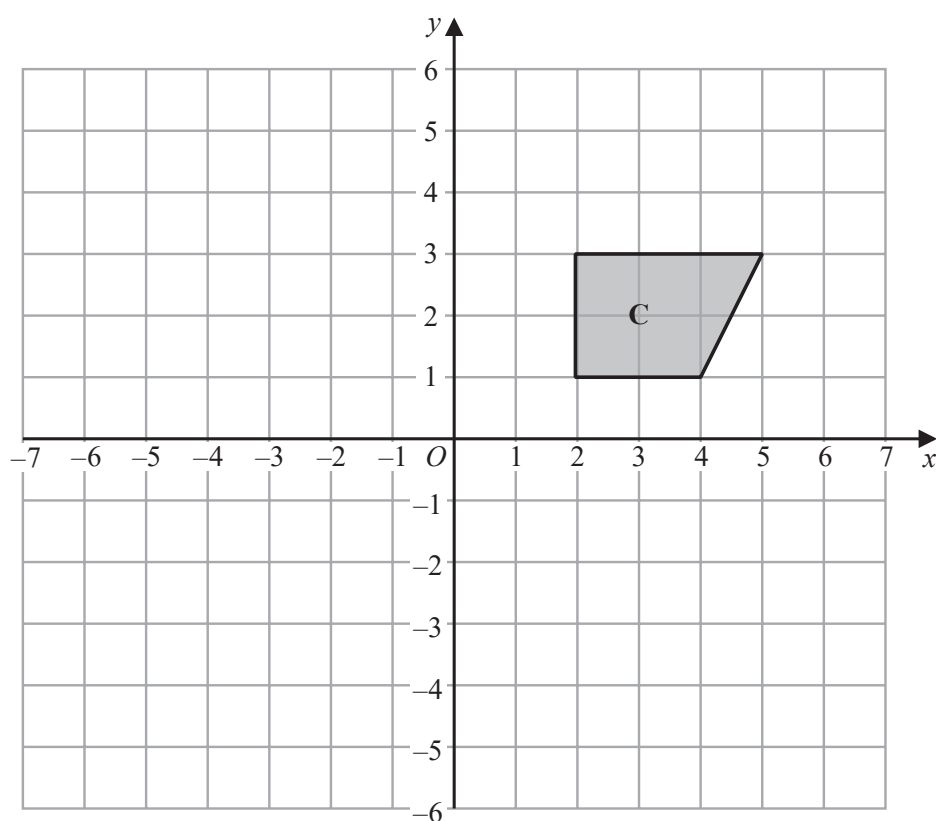
13



On the grid above, triangle **A** is the reflection of triangle **B** in the mirror line **M**.

- (a) On the grid, draw the mirror line **M**.
Label the line **M**.

(1)



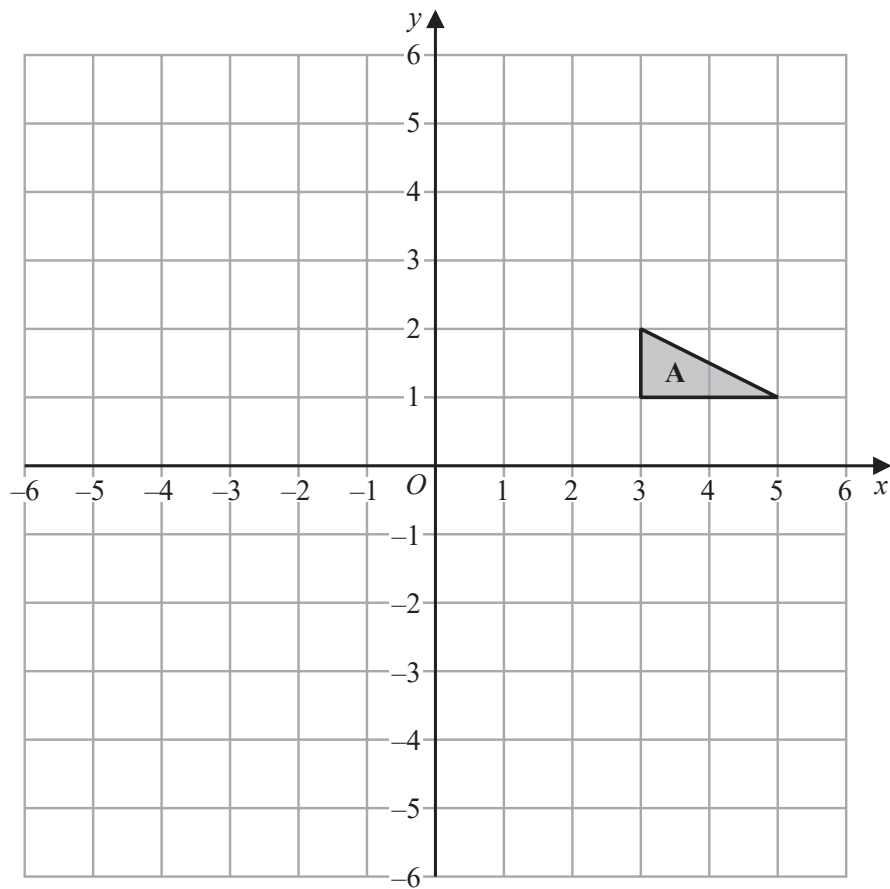
- (b) On the grid above, rotate the shaded shape **C** 90° anticlockwise about the point with coordinates $(0, 0)$

(2)

(Total for Question 13 is 3 marks)



16



- (a) On the grid, rotate triangle A 180° about $(1, -1)$
Label the new triangle **B**

(2)

- (b) On the grid, translate triangle A by the vector $\begin{pmatrix} -7 \\ 3 \end{pmatrix}$

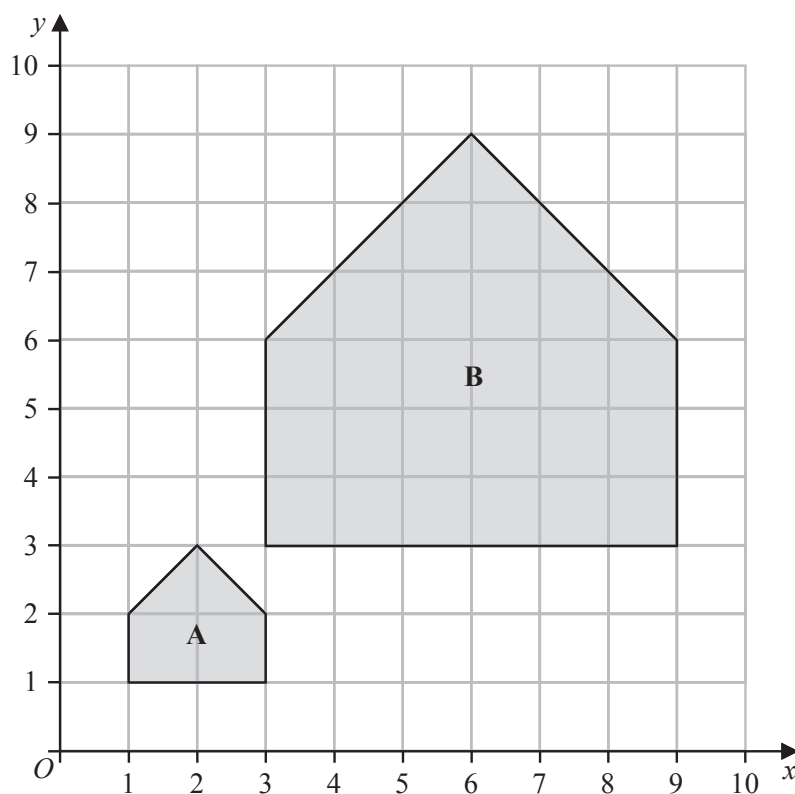
Label the new triangle **C**

(1)

(Total for Question 16 is 3 marks)



15



Describe fully the single transformation that maps shape A onto shape B

.....

.....

(Total for Question 15 is 3 marks)

16 A circle has radius 9 cm

Work out the area of the circle.

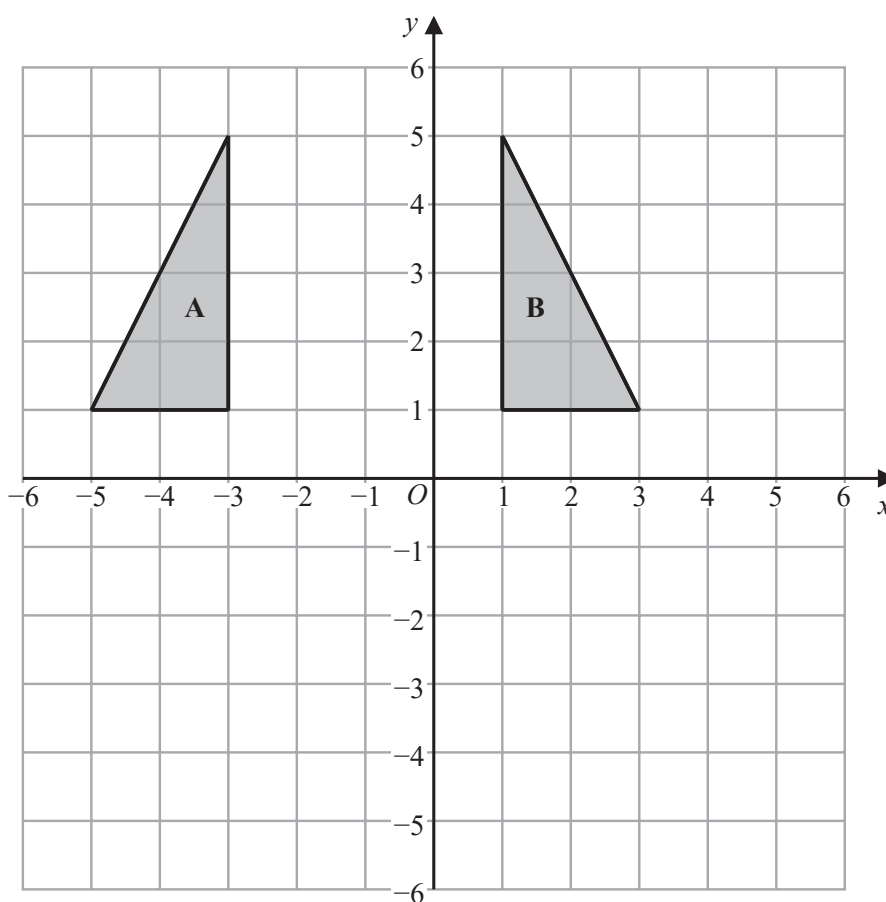
Give your answer correct to 3 significant figures.

..... cm²

(Total for Question 16 is 2 marks)



12



- (a) Describe fully the single transformation that maps triangle **A** onto triangle **B**.

(2)

- (b) On the grid, translate triangle **B** by the vector $\begin{pmatrix} 2 \\ -6 \end{pmatrix}$
Label your triangle **C**.

(1)

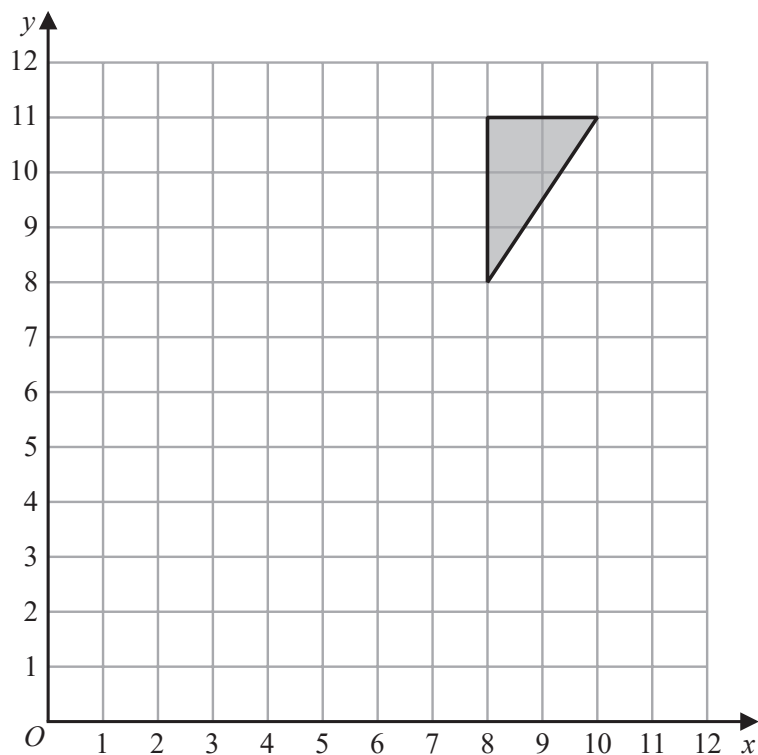
- (c) Describe fully the single transformation that maps triangle **C** onto triangle **B**.

(1)

(Total for Question 12 is 4 marks)

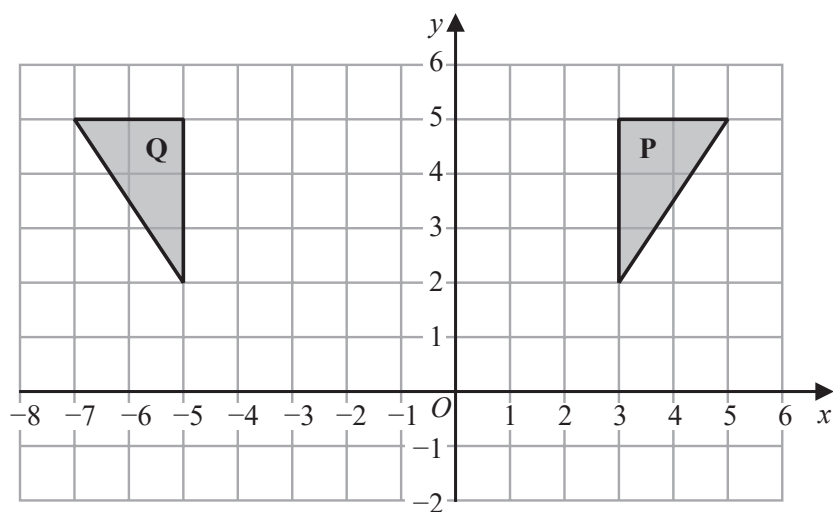


11



(a) On the grid above, rotate the triangle 180° about (7, 6)

(2)



(b) Describe fully the single transformation that maps triangle **P** onto triangle **Q**.

.....

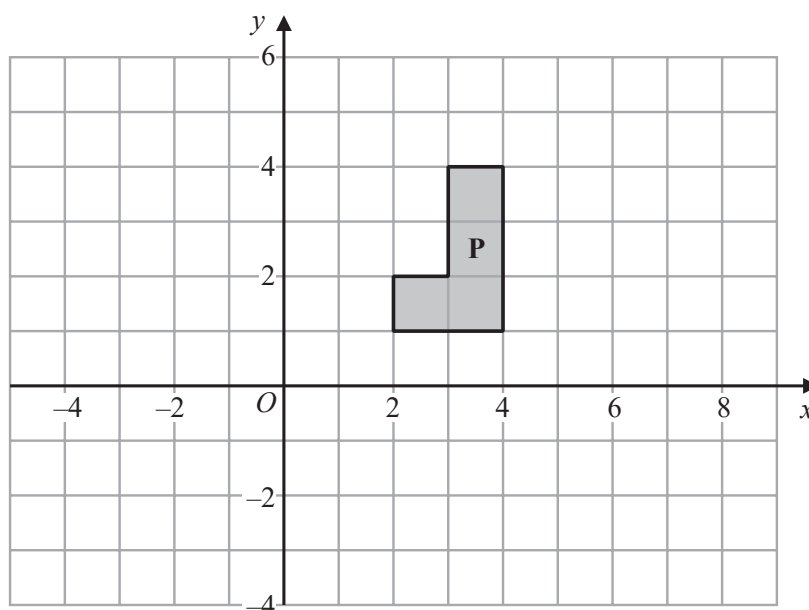
.....

(2)

(Total for Question 11 is 4 marks)

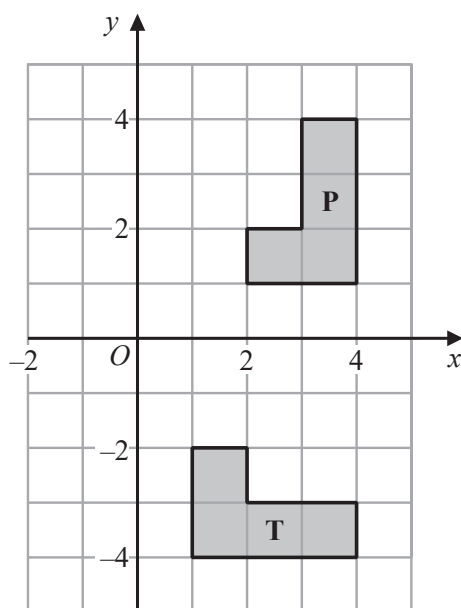


14



- (a) On the grid above, translate shape **P** by the vector $\begin{pmatrix} -5 \\ 2 \end{pmatrix}$

(1)



- (b) Describe fully the single transformation that maps shape **P** onto shape **T**.

.....

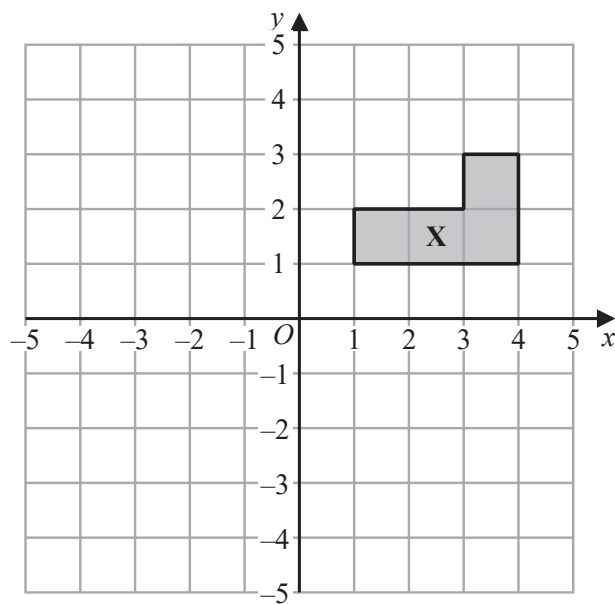
.....

(3)

(Total for Question 14 is 4 marks)

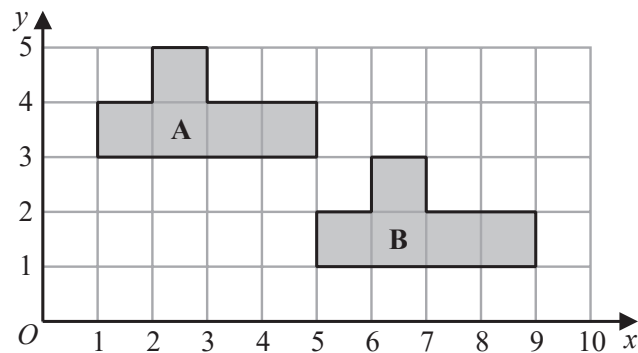


15



(a) On the grid above, rotate shape X 90° clockwise about O

(2)



(b) Describe fully the single transformation that maps shape A onto shape B

.....

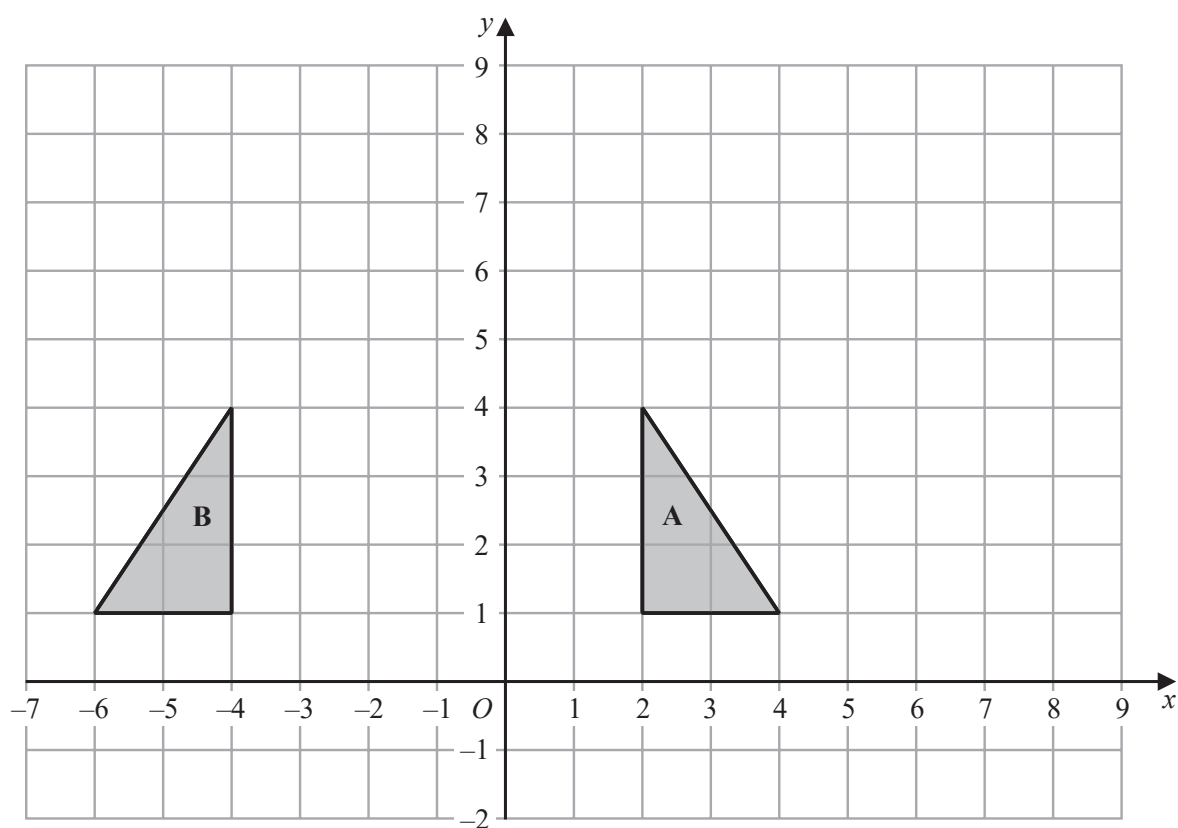
.....

(2)

(Total for Question 15 is 4 marks)



12



- (a) Describe fully the single transformation that maps triangle **A** onto triangle **B**

.....
.....
(2)

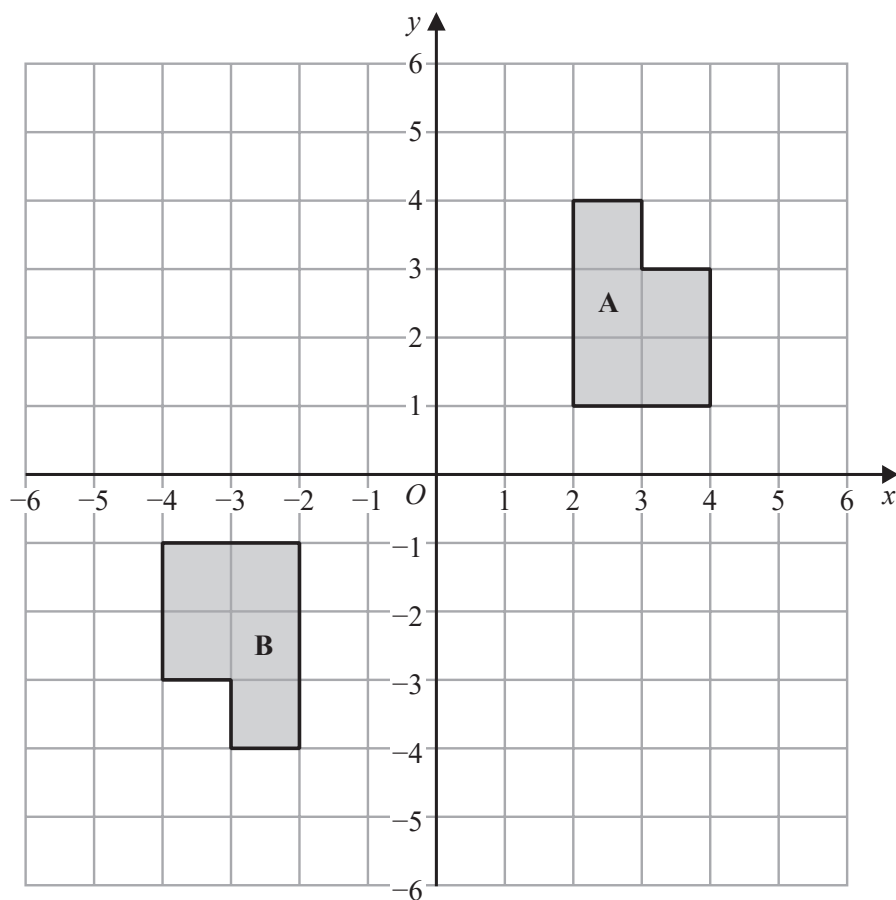
- (b) On the grid above, enlarge triangle **A** with scale factor 2 and centre *O*
Label your triangle **C**

(2)

(Total for Question 12 is 4 marks)



14



(a) Describe fully the single transformation that maps shape A onto shape B.

(2)

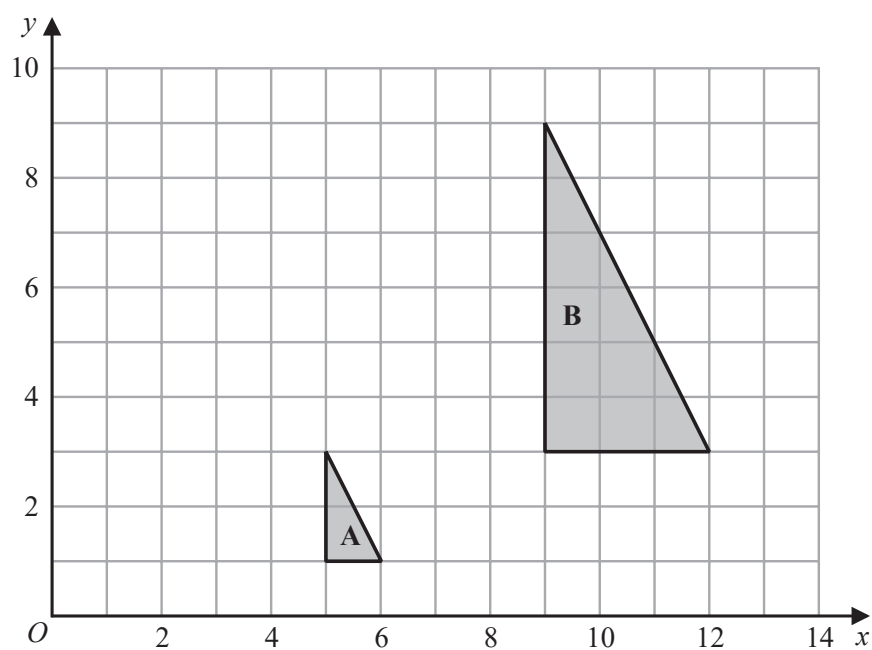
(b) On the grid, reflect shape A in the line with equation $x = -1$

(2)

(Total for Question 14 is 4 marks)



18



- (a) Describe fully the single transformation that maps triangle **A** onto triangle **B**

(3)

- (b) On the grid above, translate triangle **A** by the vector $\begin{pmatrix} -4 \\ 3 \end{pmatrix}$

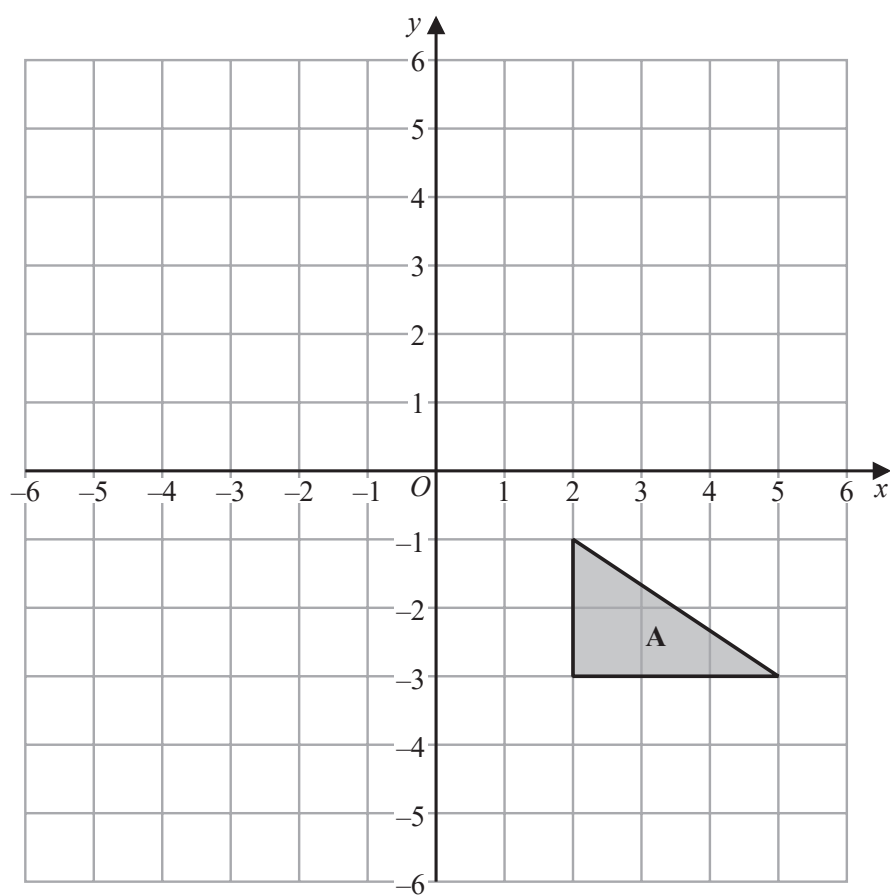
Label your triangle **C**

(1)

(Total for Question 18 is 4 marks)



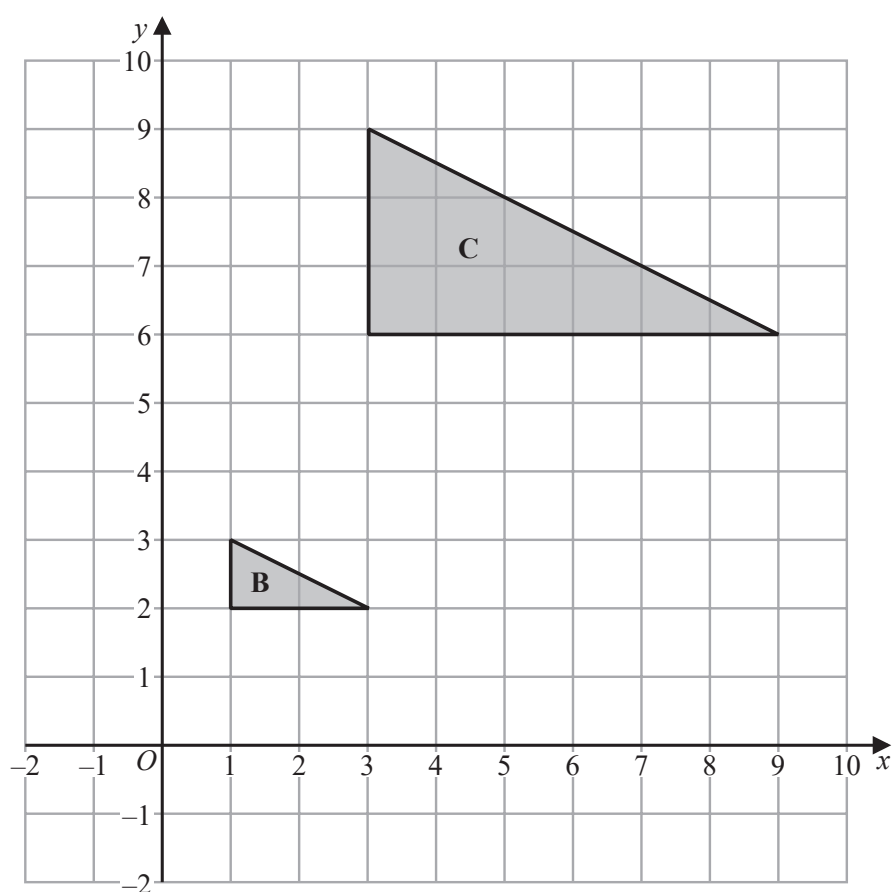
14



(a) On the grid, rotate triangle A 90° anticlockwise about centre O

(2)





(b) Describe fully the single transformation that maps triangle **B** onto triangle **C**

.....

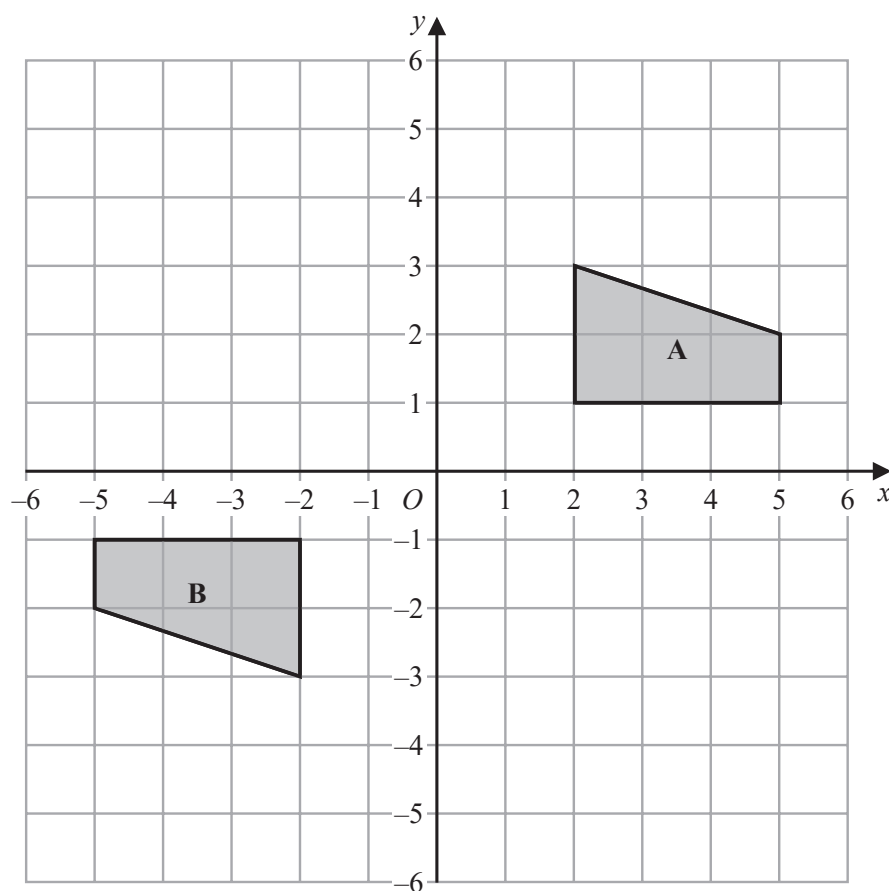
.....

.....

(2)

(Total for Question 14 is 4 marks)

14



(a) Describe fully the single transformation that maps shape A onto shape B

.....

.....

(2)

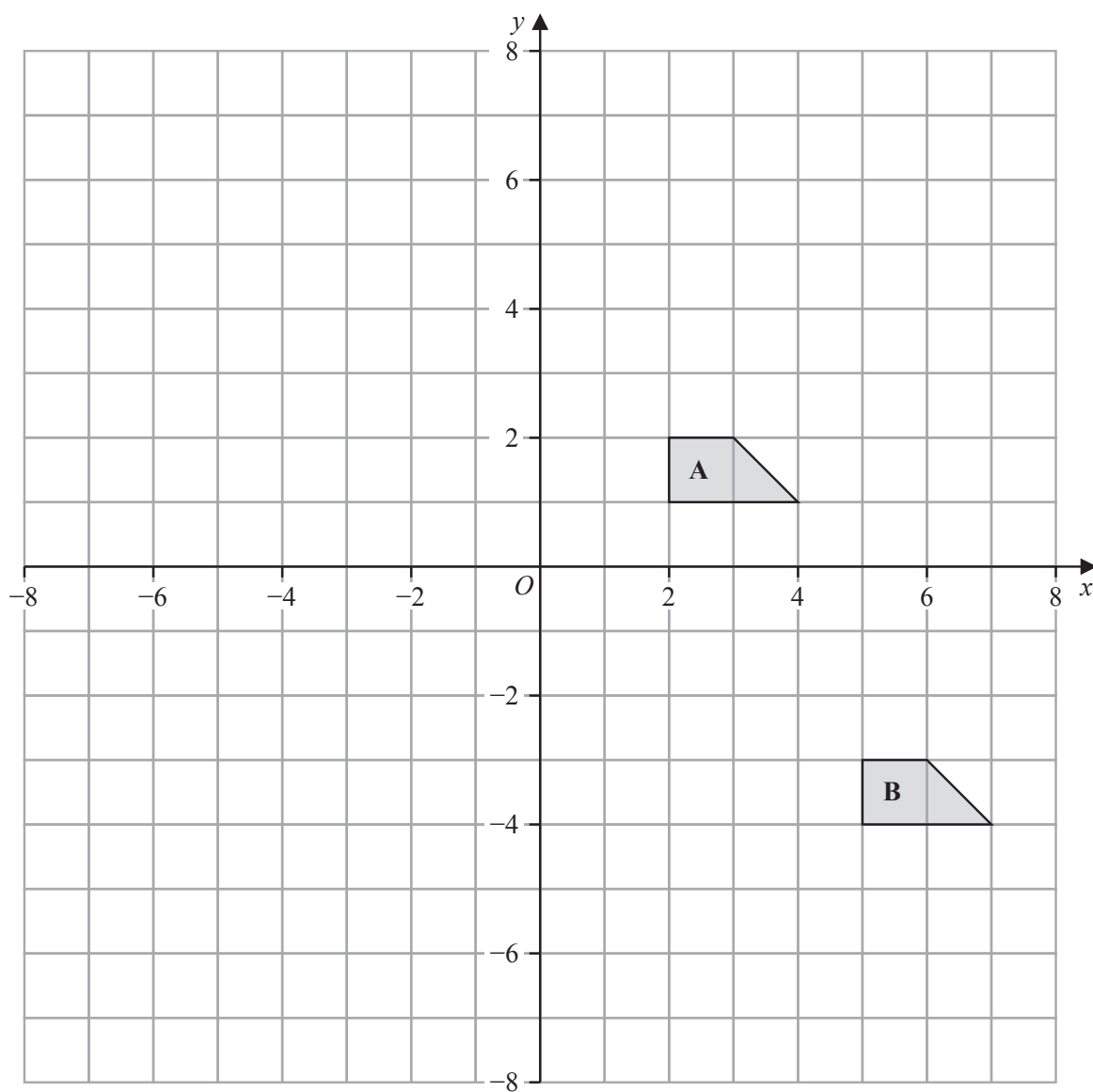
(b) On the grid, reflect shape A in the line with equation $y = -1$

(2)

(Total for Question 14 is 4 marks)



18



(a) Describe fully the single transformation that maps shape A onto shape B

.....

.....

(2)

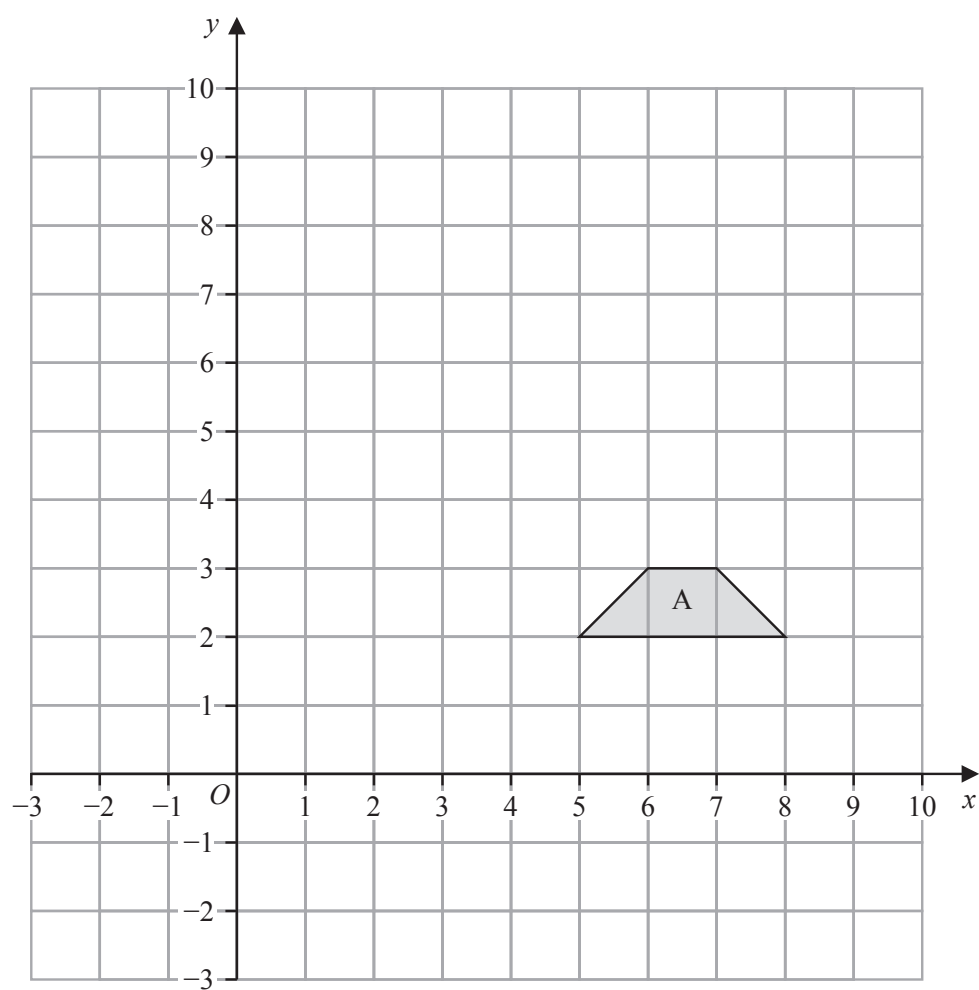
(b) On the grid above, rotate shape A 180° about $(-1, 0)$
Label your shape C

(2)

(Total for Question 18 is 4 marks)



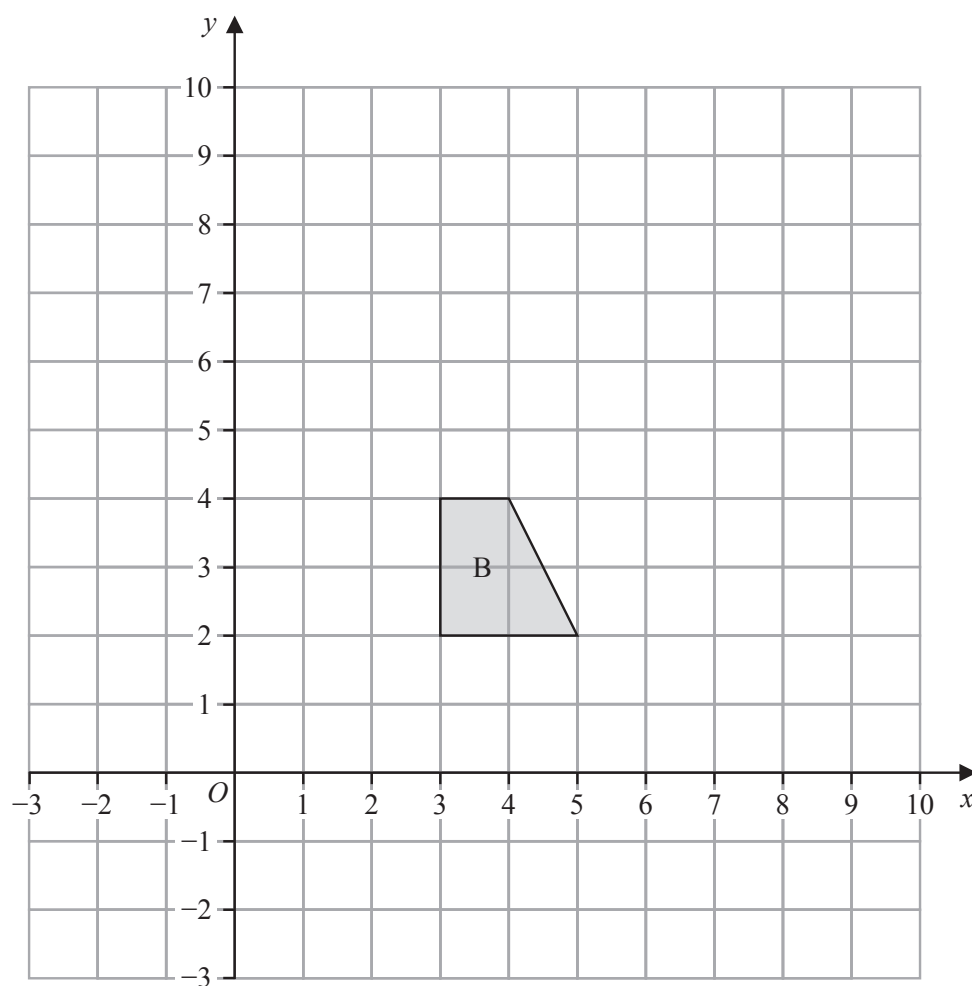
20



(a) On the grid above, reflect shape A in the line $y = x$

(2)





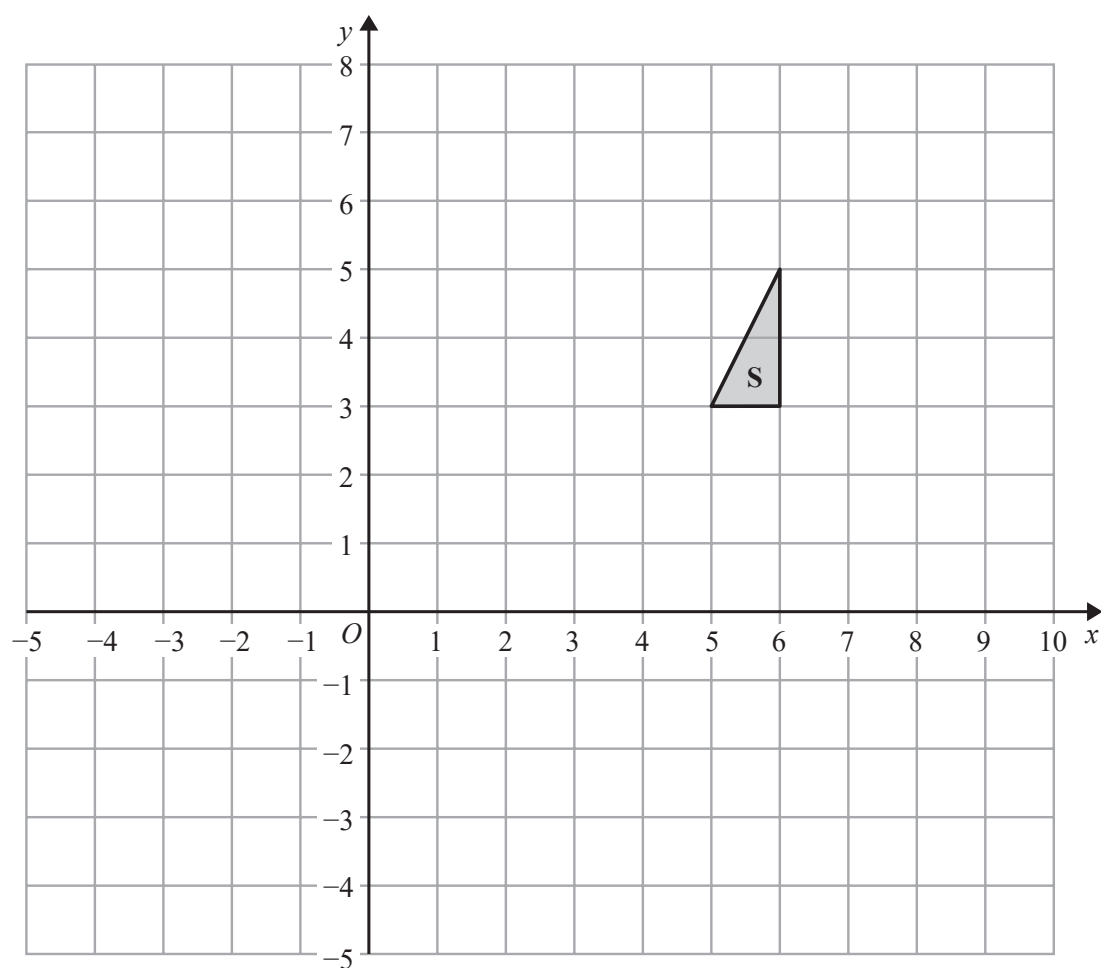
(b) On the grid above, enlarge shape **B** by scale factor 2 with centre (1, 1)

(2)

(Total for Question 20 is 4 marks)



17



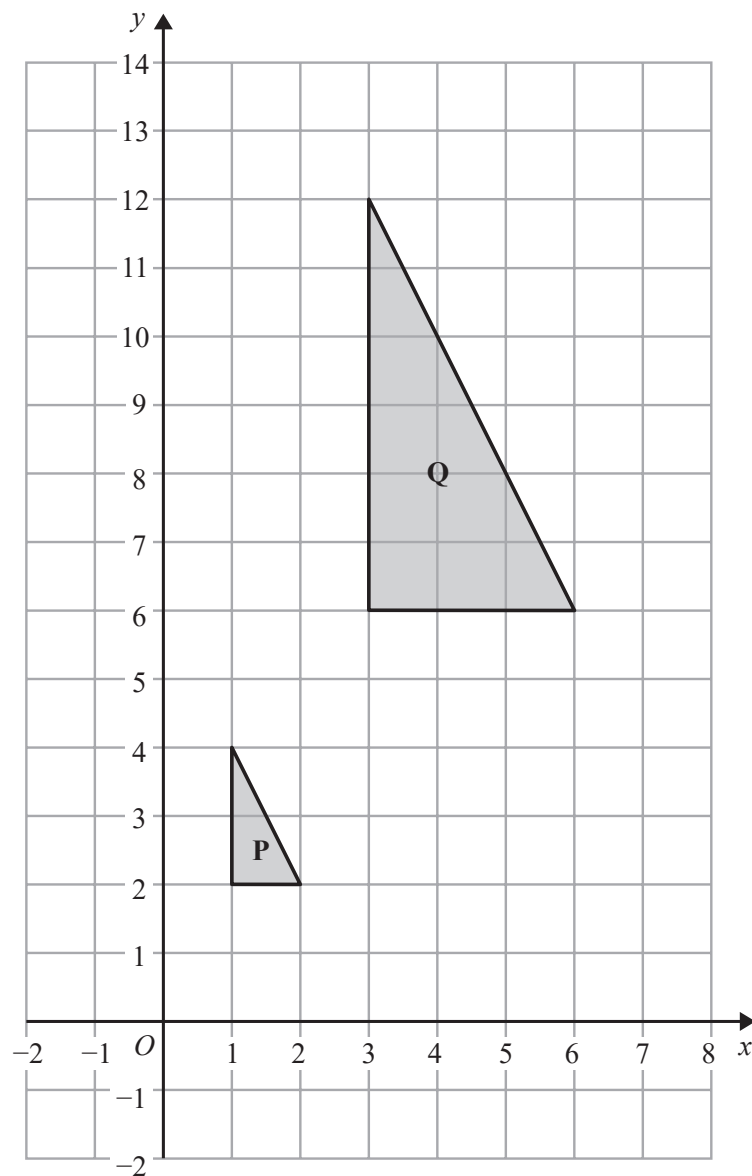
- (a) Reflect triangle **S** in the line $y = x$
Label the new triangle **R**.

(2)

- (b) Translate triangle **S** by the vector $\begin{pmatrix} -4 \\ -6 \end{pmatrix}$
Label the new triangle **T**.

(1)





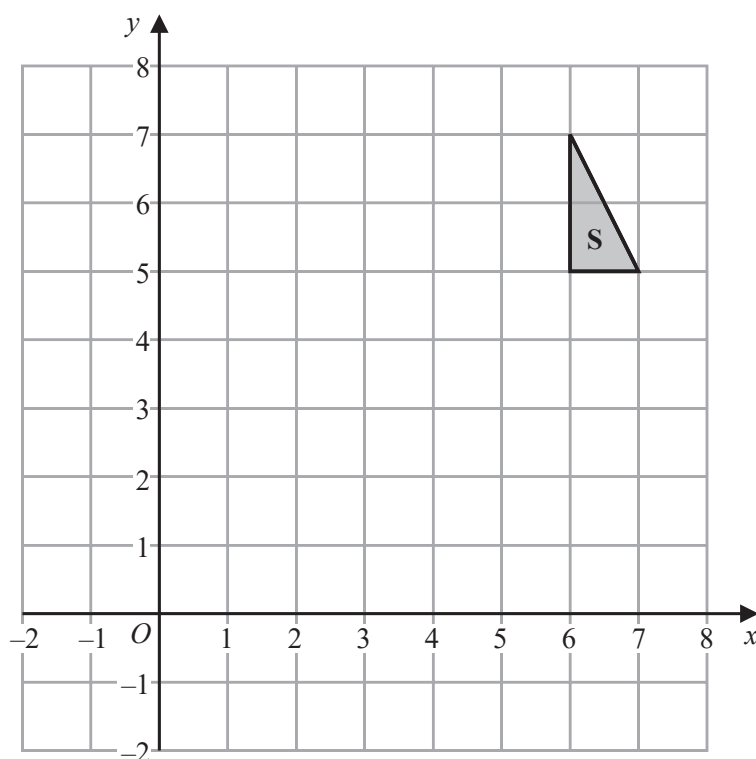
(c) Describe fully the single transformation that maps triangle **P** onto triangle **Q**.

(2)

(Total for Question 17 is 5 marks)



11 Here is a triangle **S** drawn on a grid of squares.



- (a) On the grid, reflect triangle **S** in the line with equation $x = 5$
Label the new triangle **T**.

(2)

- (b) On the grid, reflect triangle **T** in the line with equation $x = 2$
Label the new triangle **U**.

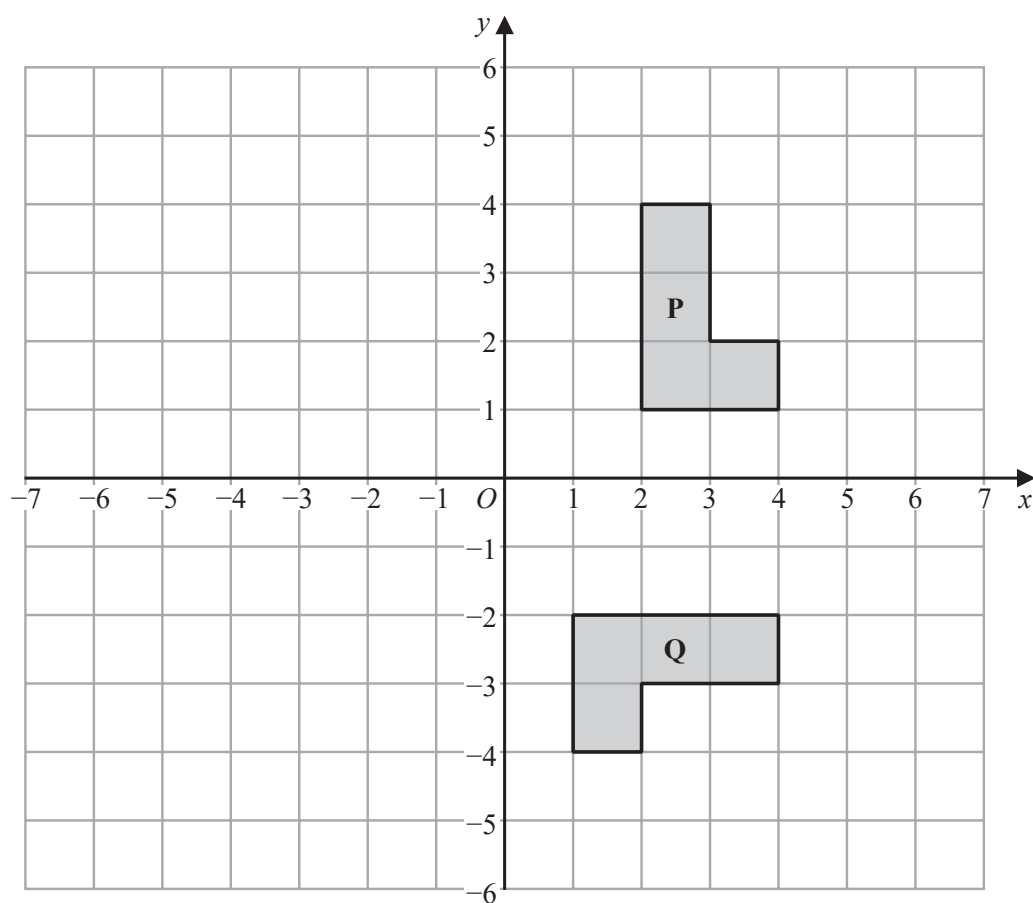
(1)

- (c) Describe fully the single transformation that maps triangle **S** onto triangle **U**.

(2)

(Total for Question 11 is 5 marks)

13



- (a) Describe fully the single transformation that maps shape **P** onto shape **Q**.

(3)

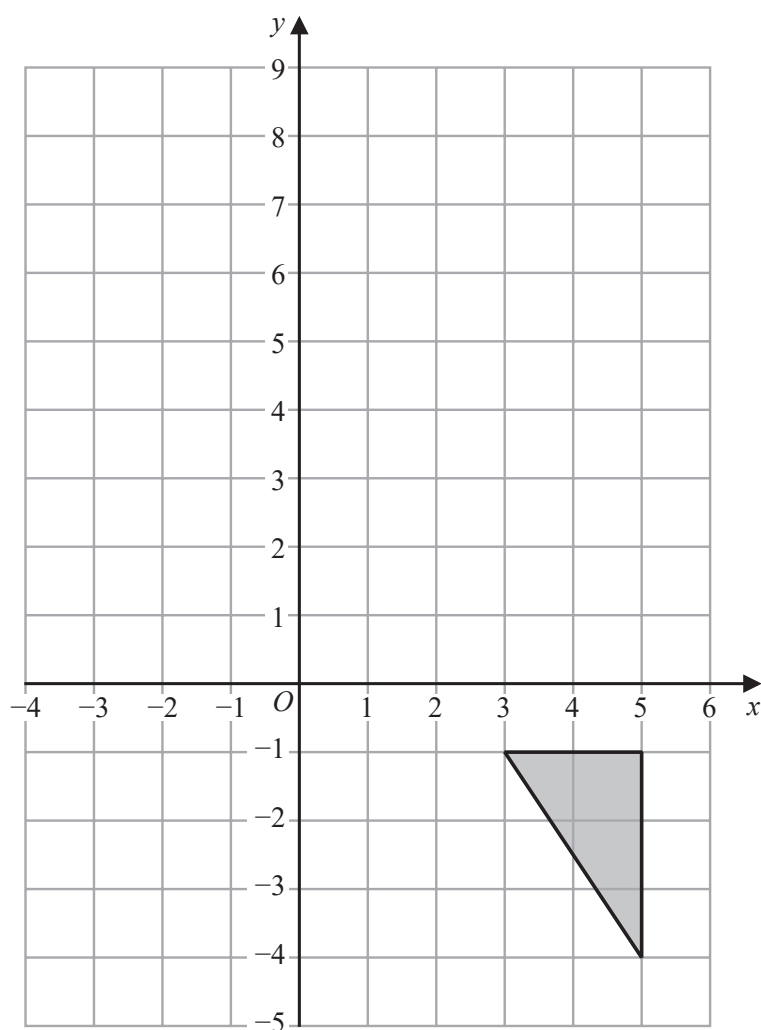
- (b) On the grid, reflect shape **P** in the line $x = -1$
Label the new shape **R**.

(2)

(Total for Question 13 is 5 marks)



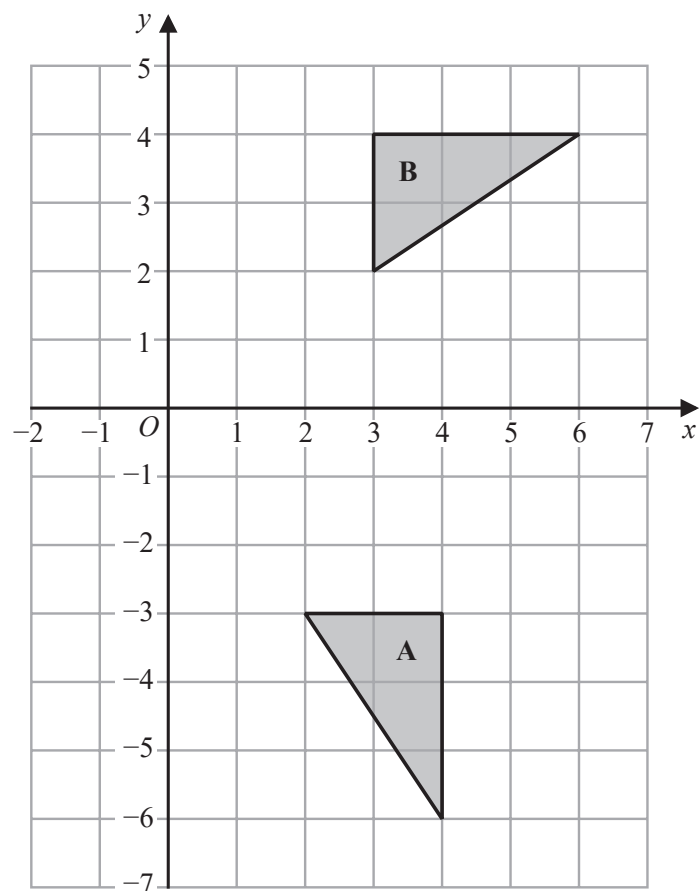
13



(a) On the grid, reflect the shaded triangle in the line with equation $y = 2$

(2)





(b) Describe fully the single transformation that maps triangle A onto triangle B.

(3)

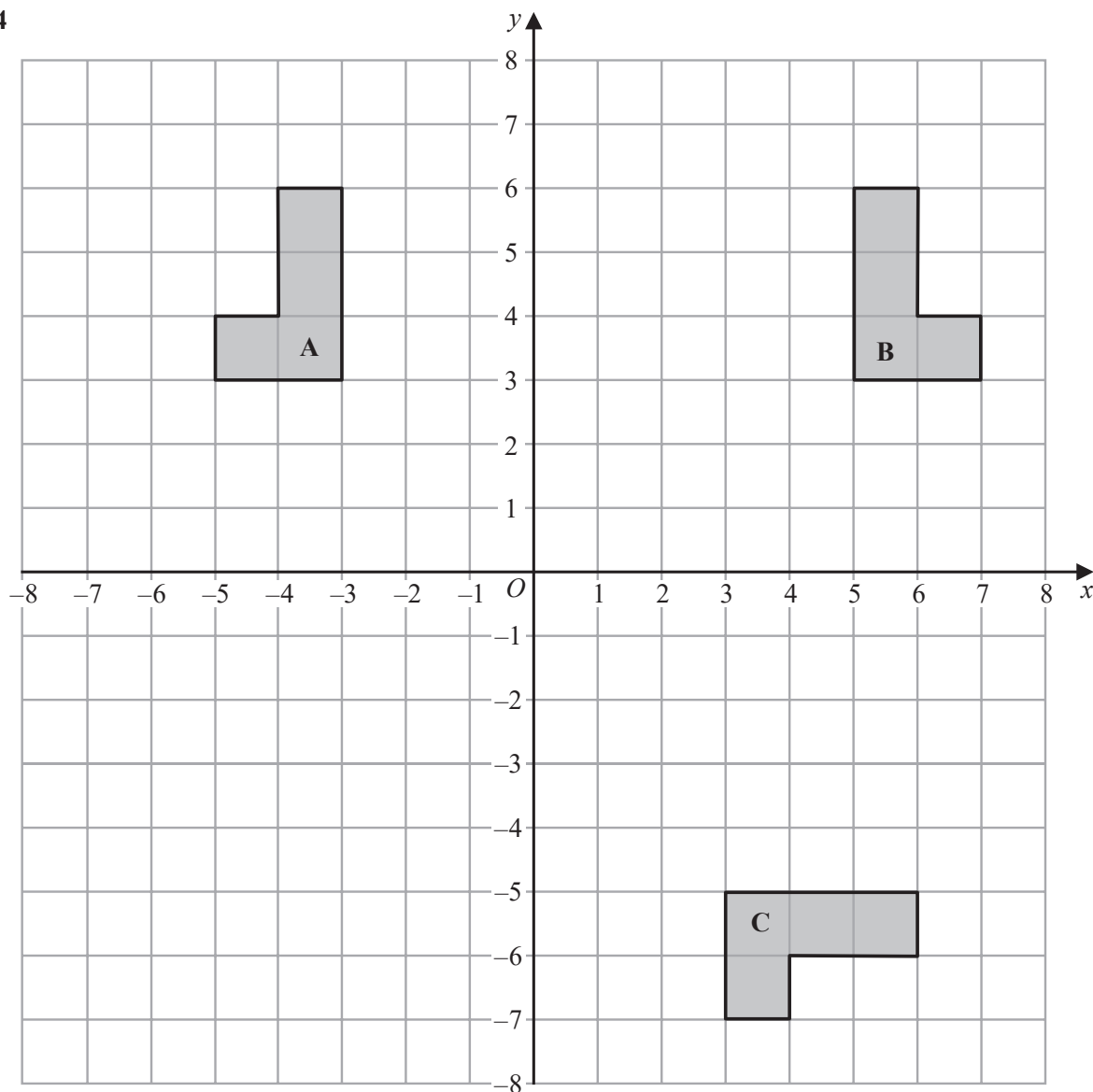
.....

.....

.....

(Total for Question 13 is 5 marks)

14



(a) Describe fully the single transformation that maps shape **A** onto shape **B**.

.....

 (2)

(b) Describe fully the single transformation that maps shape **B** onto shape **C**.

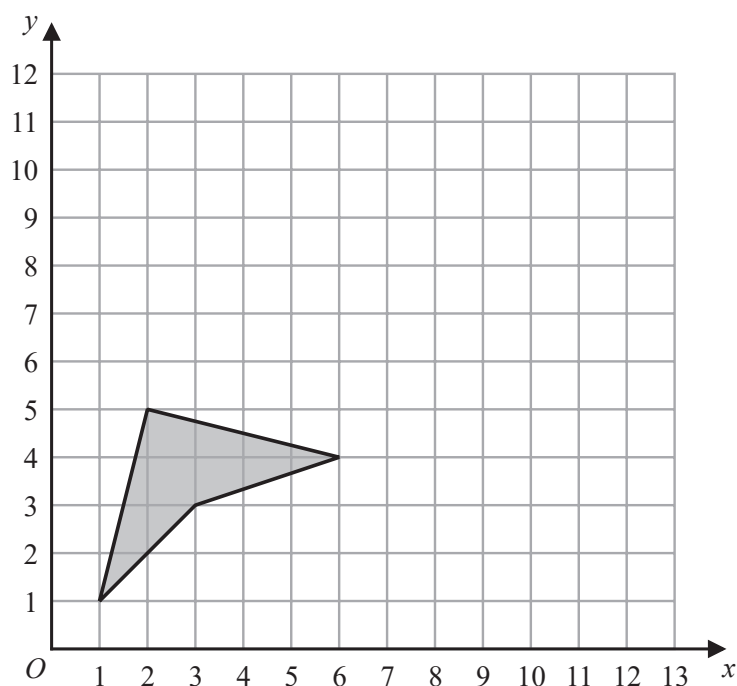
.....

 (3)

(Total for Question 14 is 5 marks)



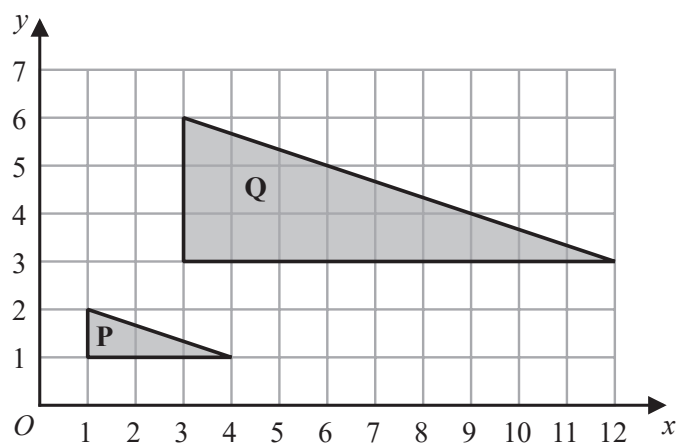
12 The diagram shows a shaded shape on a grid.



(a) On the grid, reflect the shape in the line with equation $x = 6$

(2)

The diagram below shows triangle **P** and triangle **Q** drawn on a grid.



(b) Describe fully the single transformation that maps triangle **P** onto triangle **Q**.

(3)

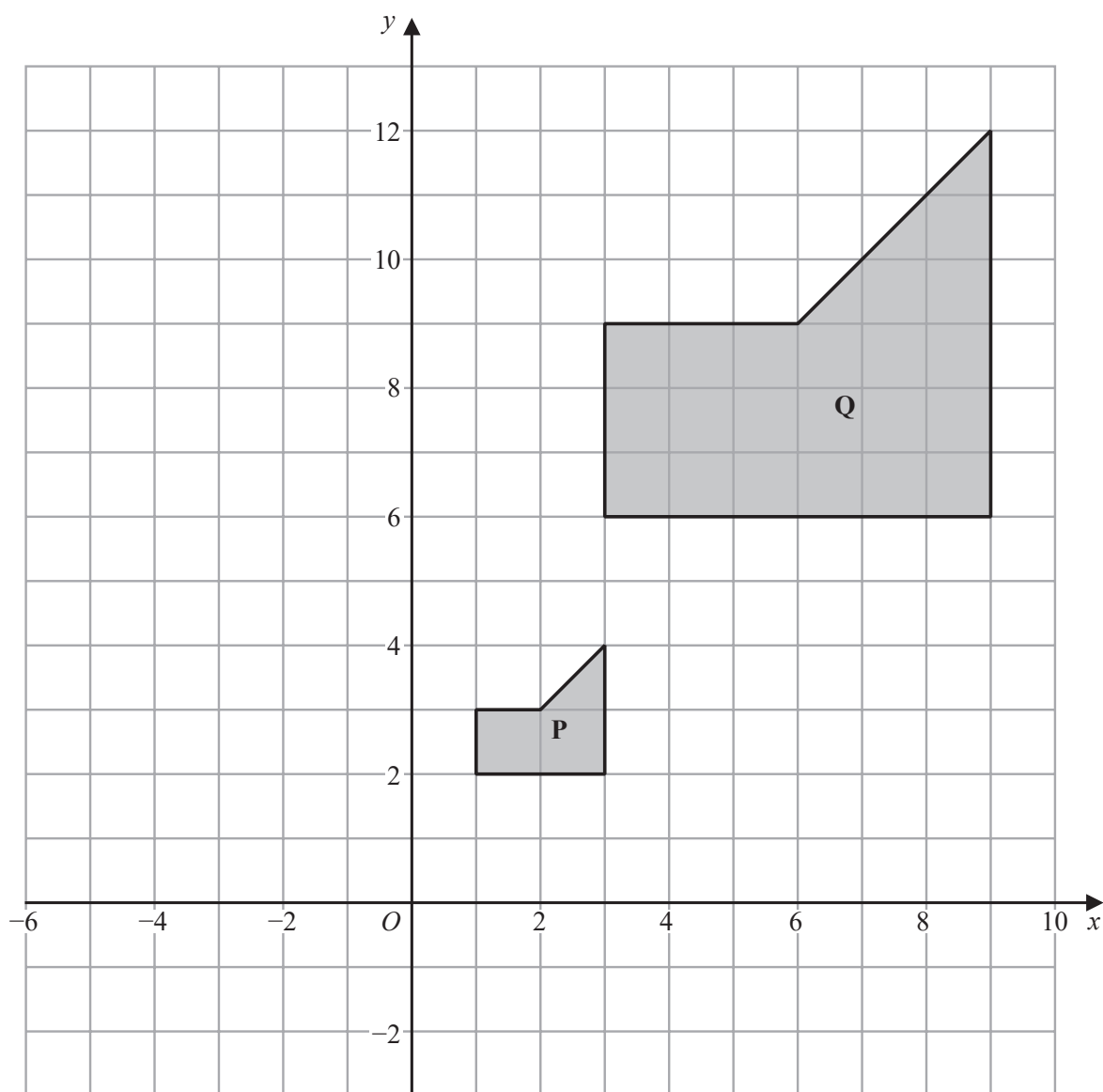
.....

.....

.....

(Total for Question 12 is 5 marks)

12



- (a) Describe fully the single transformation that maps shape **P** onto shape **Q**.

.....

.....

.....

(3)

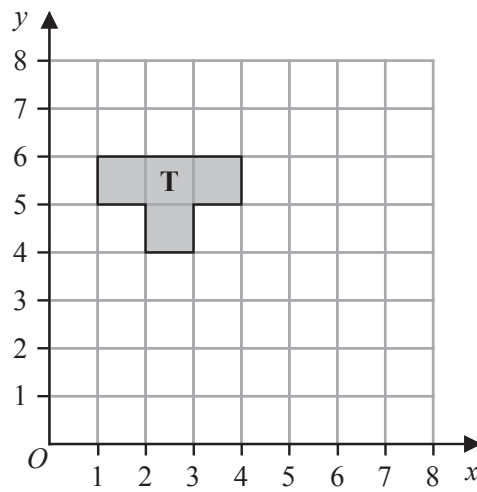
- (b) On the grid, reflect shape **P** in the line with equation $x = 5$
Label your shape **R**.

(2)

(Total for Question 12 is 5 marks)

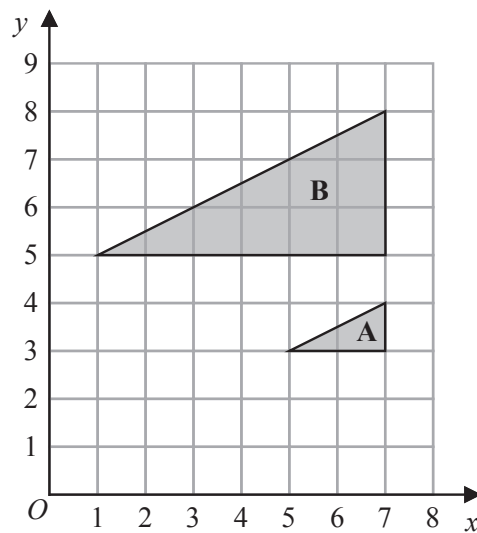


19



(a) Reflect shape **T** in the line $y = x$

(2)

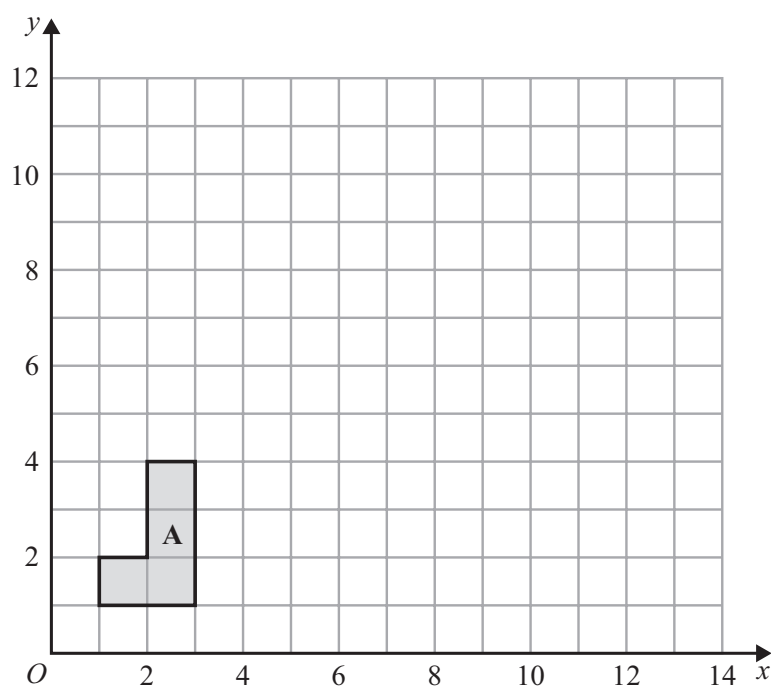


(b) Describe fully the single transformation that maps triangle **A** onto triangle **B**

(3)

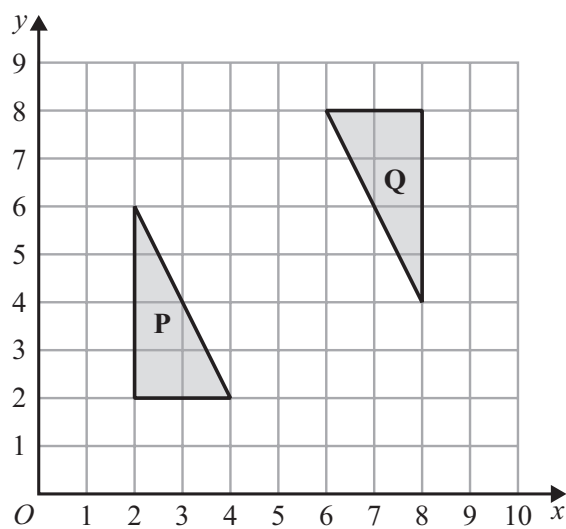
(Total for Question 19 is 5 marks)

19



(a) On the grid, enlarge shape A with scale factor 3 and centre (0, 1)

(2)



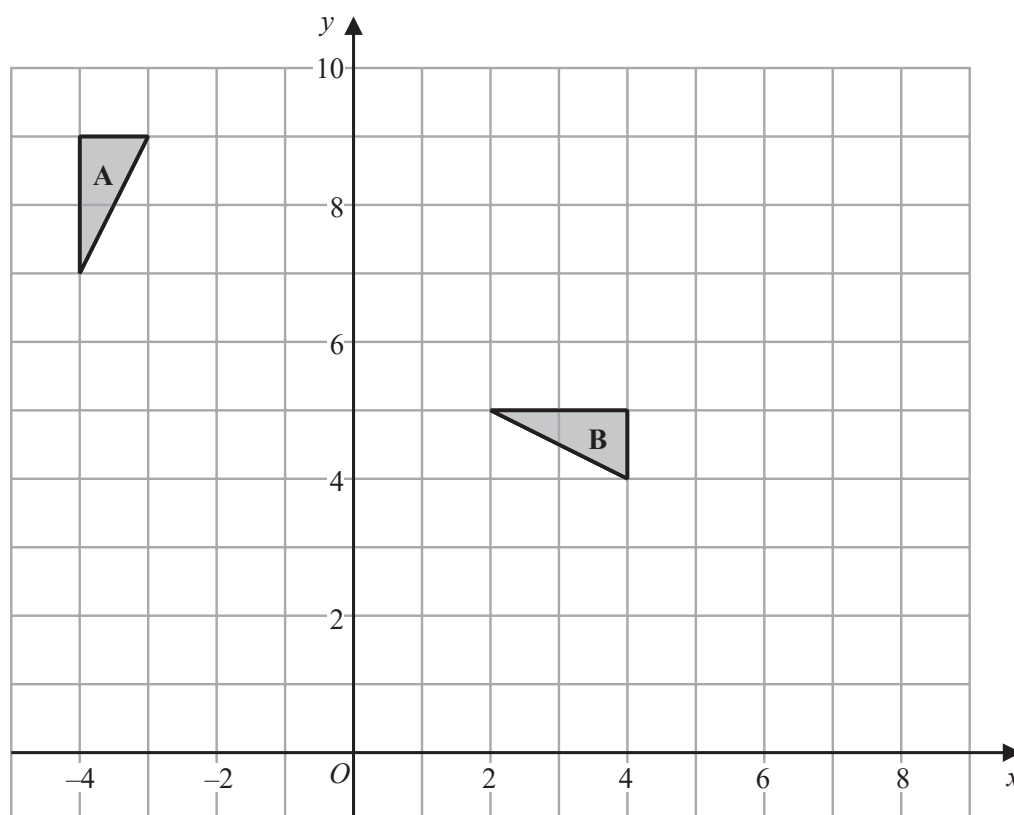
(b) Describe fully the single transformation that maps triangle P onto triangle Q

(3)

(Total for Question 19 is 5 marks)



16



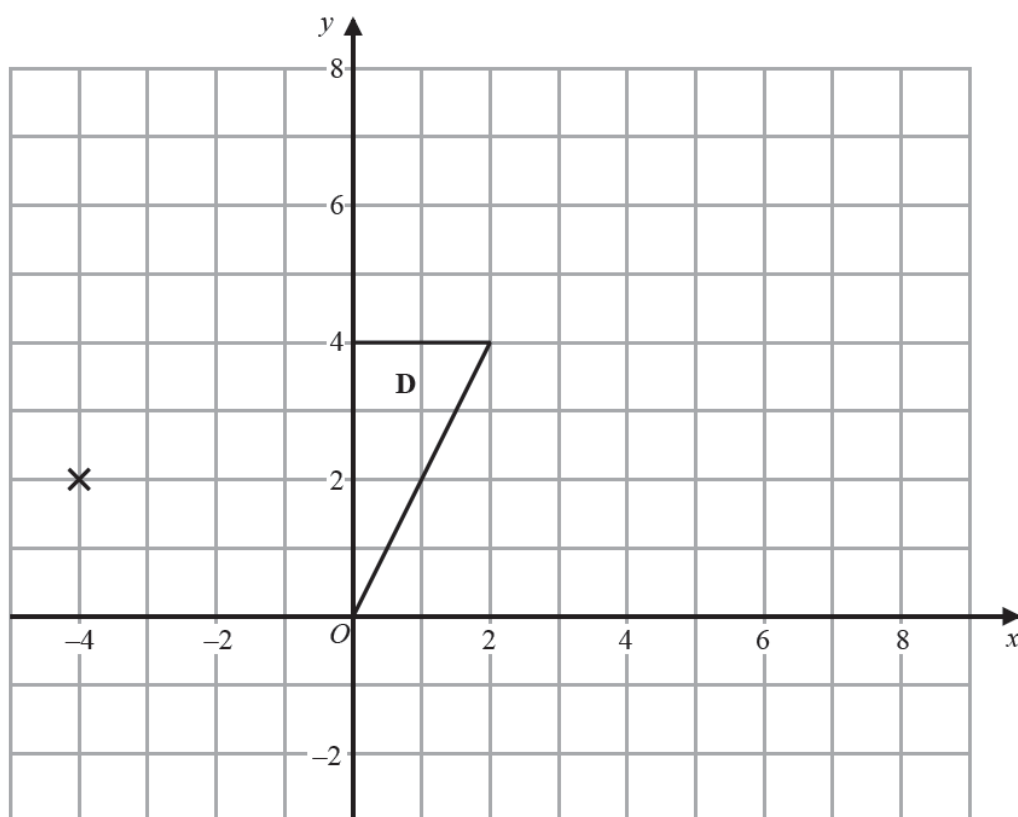
(a) Describe fully the single transformation that maps triangle **A** onto triangle **B**.

(3)

(b) On the grid, translate triangle **A** by the vector $\begin{pmatrix} 2 \\ -5 \end{pmatrix}$
Label the new triangle **C**.

(1)



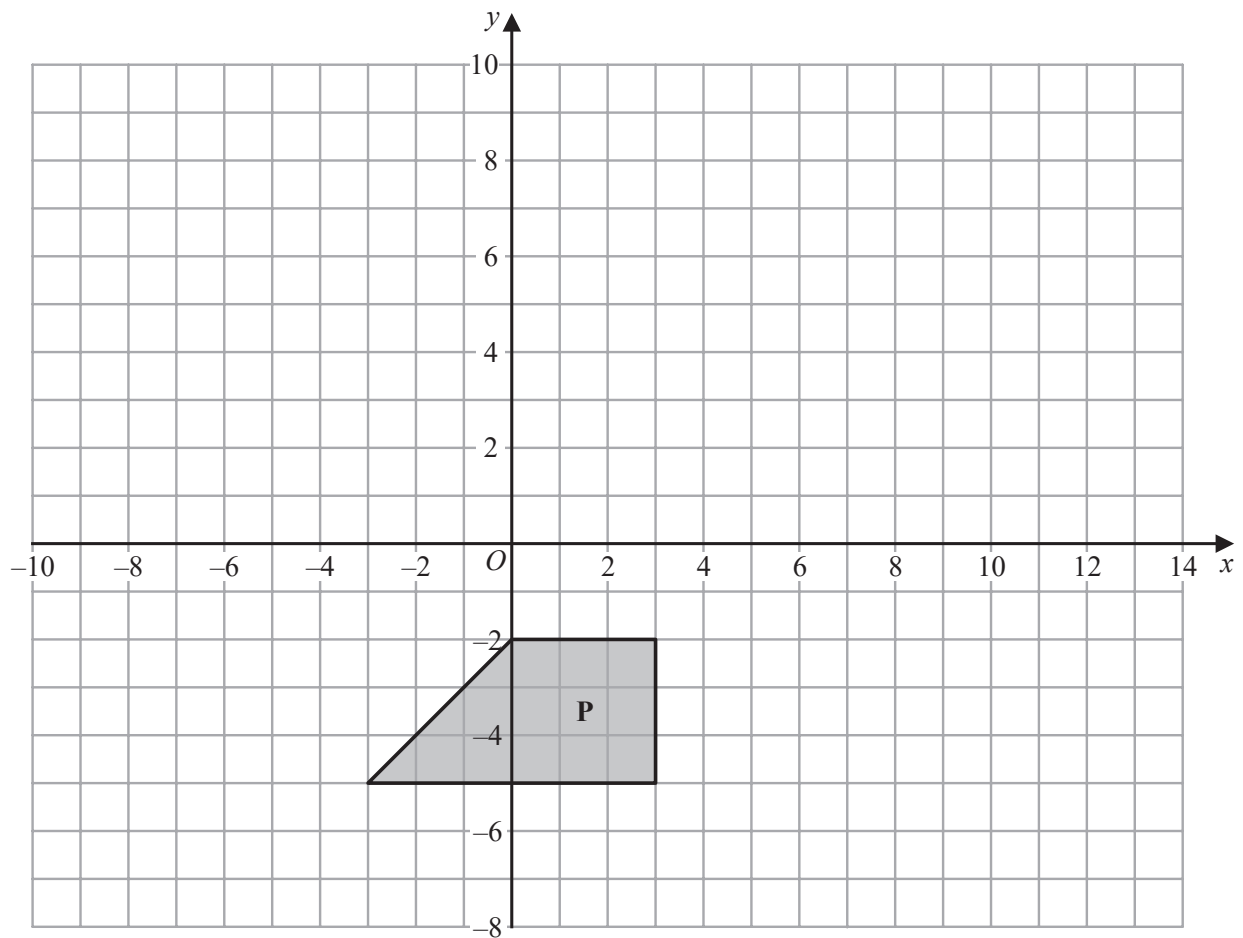


- (c) On the grid, enlarge triangle **D** with scale factor $\frac{1}{2}$ and centre $(-4, 2)$

(2)

(Total for Question 16 is 6 marks)

16 Here is a shape **P** drawn on a grid of squares.



- (a) On the grid, rotate shape **P** 180° about the point $(-3, 2)$
Label the new shape **Q**.

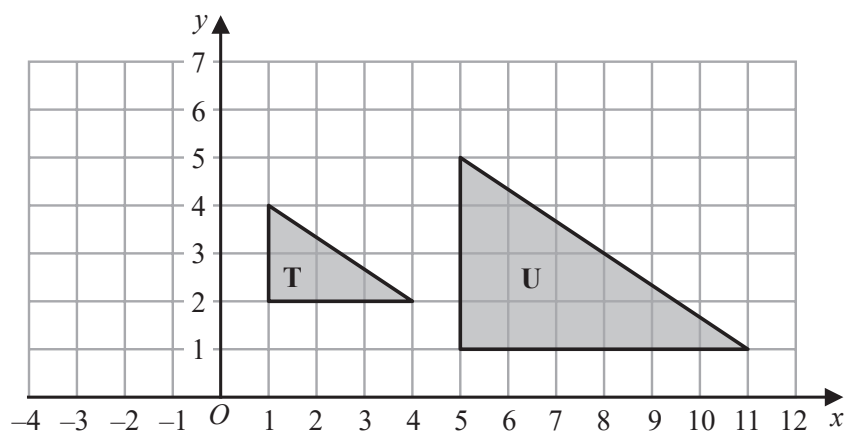
(2)

- (b) On the grid, translate shape **P** by the vector $\begin{pmatrix} 10 \\ 8 \end{pmatrix}$
Label the new shape **R**.

(1)



Here are triangle **T** and triangle **U** drawn on a grid of squares.



(c) Describe fully the single transformation that maps triangle **T** onto triangle **U**.

(3)

(Total for Question 16 is 6 marks)

- 17** On Wednesday, the price of 1 litre of petrol was £1.26
The price of petrol on Wednesday was 5% more than the price of petrol on the previous Monday.

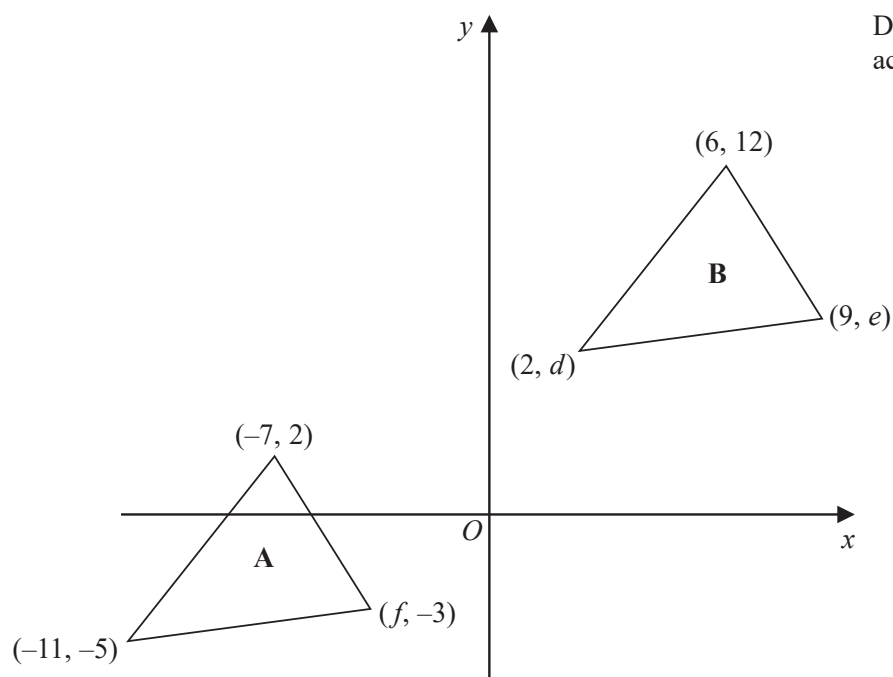
Calculate the price of 30 litres of petrol on the previous Monday.

£.....

(Total for Question 17 is 3 marks)



19 The diagram shows a sketch of triangle **A** and triangle **B** on a coordinate grid.



- (a) Given that triangle **A** has been translated to give triangle **B**, work out the value of d , the value of e and the value of f

$$d = \dots\dots\dots$$

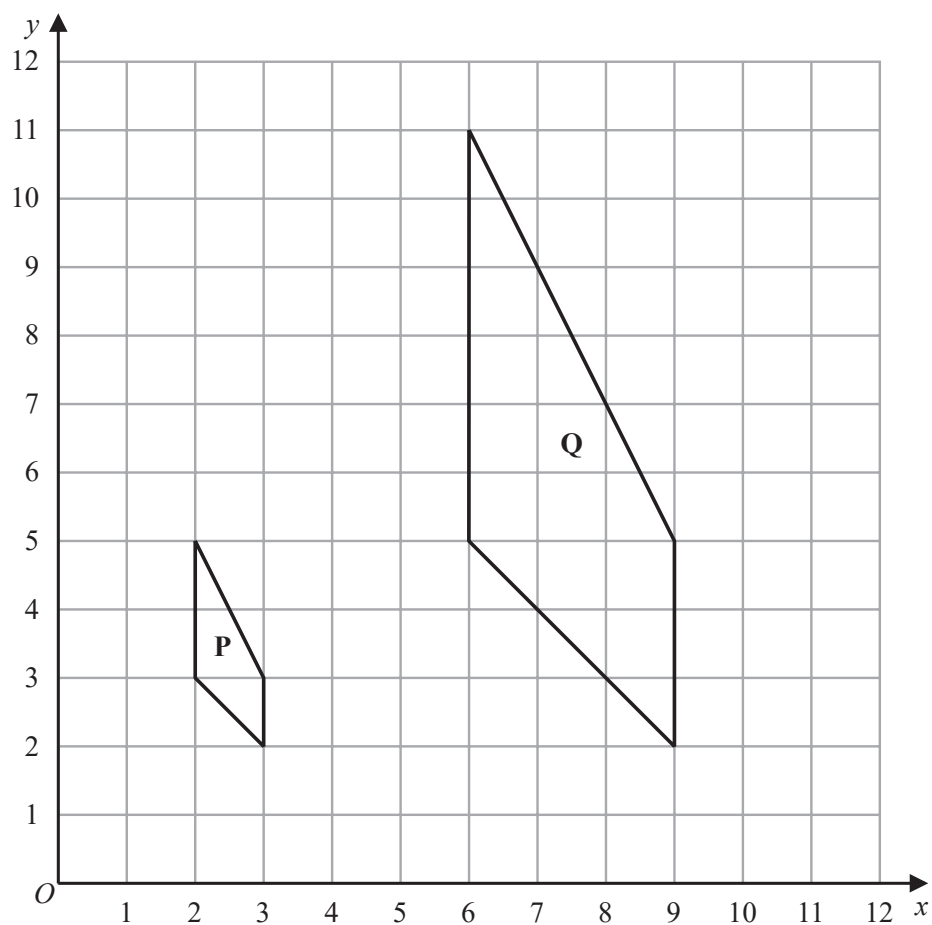
$$e = \dots\dots\dots$$

$$f = \dots\dots\dots$$

(3)



The diagram shows shape **P** and shape **Q** drawn on a grid.



(b) Describe fully the single transformation that maps shape **P** onto shape **Q**

(3)

(c) On the grid above, rotate shape **P** 90° clockwise about (3, 5)
Label your shape **R**

(2)

(Total for Question 19 is 8 marks)



MARK SCHEMES

official mark schemes, in the same order as the questions



Question	Working	Answer	Mark	Notes
6		1H, 1T, 2H, 2T, 3H, 3T, 4H, 4T, 5H, 5T, 6H, 6T	2	B2 for all 12 combinations and no extras or repeats If not B2 then B1 for at least 4 correct combinations (ignoring repeats)
7		Triangle at (3, 0) (3, -3) (5, -3)	2	M1 for line $y = 1$ drawn or correct reflection in any line parallel to the x -axis A1 SCB1 for correct reflection in $x = 1$
8	(a)	$3\frac{4}{5}$	1	B1
	(b) $84 - 10 - 45 (=29)$	$\frac{29}{84}$	2	M1 A1 SCB1 for $\frac{55}{84}$
	(c) $0.75, 0.916..., 0.625, 0.45$	$\frac{9}{20}, \frac{5}{8}, \frac{3}{4}, \frac{11}{12}$	2	M1 for conversion to common form A1 SC :if M0 award B1 for any 3 fractions in the correct order or for all fractions in correct reverse order
	(d) $\frac{23}{24} - \frac{9}{24}$ oe	shown	2	M1 for two fractions with a common denominator with at least one numerator correct A1 for $\frac{14}{24}$ oe and then $\frac{7}{12}$



19			Trapezium with vertices at (6, 3) (8, 3) (8, 6) (4, 6)	2	B2 If not B2 then award B1 for shape of correct size and orientation or 3 or 4 points plotted correctly
					Total 2 marks

20	(a)		0.000 78	1	B1
	(b)	22 500 000 oe e.g. 22.5×10^6 or 2.25×10^n $n \neq 7$		2	M1
			2.25×10^7		A1
					Total 3 marks

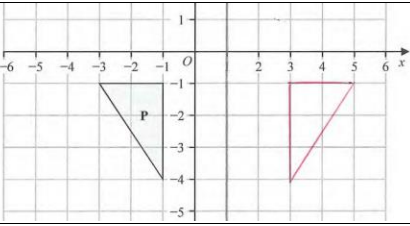


14		Rotation 180° and $(0, 0)$	2	B1	Rotation (with none of reflection, translation, enlargement, mirrored, flipped or moved stated)
				B1	180° centre $(0, 0)$ or O (award if no vector or equation of line or SF mentioned) (B2 for enlargement SF – 1 centre O)
					Total 2 marks
15	$180 - 140 (= 40)$ or $180(n - 2) = 140n$ oe		3	M1	Correct method to find exterior angle or correct substitution into formula
	$360 \div '40'$ or $40n = 360$ oe			M1	
		9		A1	
					Total 3 marks



26		Triangle with vertices (3, 6) (3, 9) (5, 6)	2	B2 for a fully correct shape with correct orientation and in the correct position. (B1 for a shape of correct size and orientation or 2 or 3 points plotted correctly)
				Total 2 marks

16	30 or 50		2	M1
	Working required	1500		A1 cao dep on M1
				1500 must come from correct figures of 30 and 50
				Total 2 marks

17		Triangle with vertices (3, -1) (5, -1) (3, -4)	2	B2 for a correct reflection (B1 for a correct reflection in a vertical line or for 2 points of the correct triangle or for a correct reflection in $y = 1$) Overlay is available
				Total 2 marks

11	$\frac{10}{24} + \frac{9}{24}$ or $\frac{10n}{24n} + \frac{9n}{24n}$ or eg $\frac{40+36}{96} \left(= \frac{76}{96} \right)$		2	M1 for writing a sum, and each fraction with a common denominator, eg $\frac{10}{24} + \frac{9}{24}$
	$\frac{10}{24} + \frac{9}{24} = \frac{19}{24}$ or eg $\frac{40+36}{96} = \frac{76}{96} = \frac{19}{24}$	clearly shown		A1 dep on M1 continued to clearly show given result
				Total 2 marks
12 (a)		$4m + 8$	1	B1 do not isw further incorrect working
(b)	$2x = -19 - 5$ or $2x = -24$ or $x = \frac{-19-5}{2}$ or $x = \frac{-24}{2}$		2	M1
		-12		A1 cao
				Total 3 marks
13 (a)		Correct mirror line $x = -1.5$	1	B1 Correct line drawn at $x = -1.5$ allow freehand with intention to draw at -1.5
(b)		Shape drawn	2	B2 for correct shape with vertices at (-1,2), (-1, 4), (-3, 2) and (-3, 5) (B1 for a correct orientation or 90° clockwise turn about correct point)
				Total 3 marks



16	(a)		Triangle drawn at $(-1, -3) (-1, -4) (-3, -3)$	2	B2 for a correct triangle with correct orientation and position If not B2 then award B1 for a correct triangle drawn with correct orientation in wrong position or triangle drawn with 2 out of 3 correct vertices
	(b)		Triangle drawn at $(-4, 4) (-4, 5) (-2, 4)$	1	B1 cao
					Total 3 marks
17	(a)		$-3, -2, -1, 0, 1$	2	B2 for $-3, -2, -1, 0, 1$ If not B2 then award B1 for 4 correct values and no incorrect values (eg $-3, -2, -1, 0$) or for 6 values with no more than one incorrect value (eg $-4, -3, -2, -1, 0, 1$)
	(b)		$x > -1$	1	B1 accept $-1 < x$
					Total 3 marks

15	enlarge, enlarged	enlargement	3	B1 oe with no mention of reflection, translation, rotation , move, flip, left, up, etc
	SF 3	Scale factor 3		B1 oe allow $\times 3$ or 'three times'
	Origin, O allow $x = 0, y = 0$	Centre (0, 0)		B1 oe allow (0, 0) without the word 'centre' but not $\begin{pmatrix} 0 \\ 0 \end{pmatrix}$
				Total 3 marks

16	$\pi \times 9^2$		2	M1 allow 3.14 or $\frac{22}{7}$ for π
	Correct answer scores full marks (unless from obvious incorrect working)	254		A1 254 – 255
				Total 2 marks



Question	Working	Answer	Mark	Notes
12 a		Reflection in $x = -1$	2	B1 for reflection B1 for $x = -1$ NB. If more than one transformation then award no marks
b		$(3, -1) (3, -5) (5, -5)$	1	B1 condone missing label
c		Translation $\begin{pmatrix} -2 \\ 6 \end{pmatrix}$	1	B1 NB. If more than one transformation then award no marks



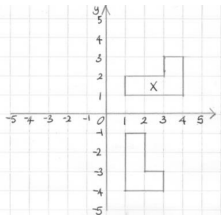
10		$3.5 + 5.75 + 6.5 + 6.25 + 8 (=30)$ or $3.5 \times 8 (=28)$ or $5.75 \times 8 (=46)$ or $6.5 \times 8 (=52)$ or $6.25 \times 8 (=50)$ or $8 \times 8 (=64)$		4	M1 (allow one error in sum to 30)
		$"30" \div 5 (=6)$ or $"30" \times 8 (=240)$ or $"28" + "46" + "52" + "50" + "64" (=240)$			M1 Dep on M1 and if adding values, must be 5 values with intention to add
		$"6" \times 8$ or $"240" \div 5$			M1 dep
			48		A1
Total 4 marks					

11	(a)		triangle with vertices (6, 4) (6, 1) (4, 1)	2	B2 if not B2 then award B1 for a rotation of 180° about a different centre
	(b)		Reflection in $x = -1$	2	B1 Reflection $x = -1$ NB. No marks if more than one transformation is stated or suggested with column vector, coordinate, SF, angle etc
Total 4 marks					

14	(a)	$(-3, 3)(-1, 3)(-1, 6)(-2, 6)(-2, 4)(-3, 4)$		1	B1	Correct translation of shape P
	(b)		Rotation	3	B1	
			90° clockwise		B1	or -90° or 270° anticlockwise
			About (O)		B1	or about (0, 0) If more than one transformation then no marks
Total 4 marks						

15	e.g. $\pi \times 8.2^2 (= 211.24\dots, \frac{1681}{25}\pi)$ or $1.5 \times 1000 (= 1500)$ or $\pi \times 8.2^2 \times 10 (= 2112.4\dots, \frac{3362}{5}\pi)$		3	M1	for a correct first step
	e.g. $(1.5 \times 1000) \div (\pi \times 8.2^2) (= 7.1009\dots)$ or $(1.5 \times 1000) \div "2112.4" \times 10 \text{ oe } (= 7.1009\dots)$ or $10 - ((\text{"}2112.4\text{"} - 1.5 \times 1000) \div (\pi \times 8.2^2)) (= 7.1009\dots)$			M1	for a complete method to find the depth of the water or an answer of 2.89 – 2.91
		7.1		A1	accept 7.09 – 7.11
Total 3 marks					



15 (a)			2	B2 for a correct rotation (B1 for a shape of the correct orientation in the incorrect position or for the correct shape in the correct position for a 90° anticlockwise rotation)
(b)		Translation with vector $\begin{pmatrix} 4 \\ -2 \end{pmatrix}$	2	B1 Translation (with none of reflection, rotation, enlargement, mirrored, turned or flipped stated) B1 $\begin{pmatrix} 4 \\ -2 \end{pmatrix}$ (award if no equation of line or angle of rotation or centre of rotation or scale factor or centre of enlargement mentioned)
Total 4 marks				

12	(a)		Reflection	2	B1 for reflection with no mention of translate, enlarge, rotate, move
			$x = -1$		B1 for $x = -1$ with no mention of a vector, SF, centre or angle
	(b)		Triangle drawn with vertices at (4, 2) (4, 8) (8, 2)	2	B2 for a correct enlargement (B1 for an enlarged triangle scale factor 2 in wrong position or 2 out of out 3 vertices in the correct position)
					Total 4 marks

13	(a)		$3(2x - 5)$	1	B1
	(b)		$T = 200c - 50d$	3	B3 for $T = 200c - 50d$ oe (B2 for $T = 200c + kd$ or $T = kc - 50d$ or $200c - 50d$) (B1 for $200c$ or $-50d$ or $50d$ or $T = kc + pd$ where $k \neq 0$ or 200 and $p \neq 0$ or ± 50)
					Total 4 marks



14	(a)	Rotation, rotate, rotated (not turn)	rotation 180° about (0, 0) or <i>O</i>	2	B1 oe with no mention of reflection, translation, enlargement, move, flip etc B1 oe with no mention of a line, column vector or SF (SCB1 for 'half turn about (0, 0) or <i>O</i> ' with no contradictory statements) Alternative: B2 for enlargement with centre <i>O</i> and SF -1 (B1 for enlargement with no mention of other transformation, B1 for centre <i>O</i> and SF -1)
	(b)	(-4, 1)(-6, 1)(-6, 3)(-5, 3)(-5, 4)(-4, 4)	A correct shape	2	B2 (B1 for a 'correct' shape reflected in any vertical line or a correct reflection in the line $y = -1$ or reflection of shape B in the line $x = -1$)
					Total 4 marks
15		$\frac{579}{490}$ or 1.18163.....		2	M1 or 70.1, 70.07, 70.071, 70.072, 70.0716
			70.07163(265.....)		A1 at least 5 dp truncated or rounded
					Total 2 marks

18	(a)	enlargement, enlarge, enlarged	Enlargement	3	B1 for enlargement with no mention of translate, reflect, rotate, move, flip
		scale factor 3, SF 3, $\times 3$, factor of 3, 'three' times	Scale factor 3		B1 for (scale factor =) 3 with no mention of a vector, line of symmetry or angle
		allow (3, 0) 3, 0	Centre (3, 0)		B1 for (centre =) (3, 0)
	(b)		Triangle drawn at (1, 4) (1, 6) (2, 4)	1	B1 condone missing label
					Total 4 marks



14	(a)		Correct rotation	2	B2 for a fully correct rotation at (1, 2) (3, 2) (3, 5) (B1 for the triangle in correct orientation and size or rotated 90° clockwise about the origin (-1, -2) (-3, -2) (-3, -5))
	(b)		Enlargement, scale factor 3 and (0,0)	2	B2 for enlargement, scale factor 3 and (0,0) (B1 for 2 correct from for enlargement, enlarge, etc so long as no mention of rotation, reflection or translation, flip, move etc. or SF 3, three times etc. or (0, 0) or Origin or 0 stated. Accept about, from etc. with no mention of line, or column vector.)
					Total 4 marks



12	12 420 ÷ 54(=230) or 232 × 54 (=12 528)		3	M1	
	232 – “230” (=2) or “12 528” – 12 420(=108)			M1	
	Correct answer scores full marks (unless from obvious incorrect working)	2 (Aus)dollars or 108 rupees		A1 Answer must have correct units which may be shortened eg \$ or r (allow incorrect spelling if meaning is clear)	
				Total 3 marks	
13		JW, JY, BW, BY, HW, HY, SW, SY	2	B2 B2 all correct combinations with no repeats and no incorrect combinations (B1 for at least 4 correct combinations ignoring repeats or incorrect combinations)	
				Total 2 marks	
14	(a)		rotation	2	B1 oe with no mention of reflection, translation, enlargement, move, flip etc
			180° (or half turn) about (0, 0) or O or ‘the origin’		B1 (SC B2 for “enlargement centre origin SF – 1”) (ignore any reference to clockwise/anticlockwise)
	(b)	(2, –3) (2, –5) (5, –3) (5, –4)	A correct shape	2	B2 (B1 for a ‘correct’ shape reflected in any horizontal line or a correct reflection in the line $x = -1$ or for shape B reflected in $y = -1$)
					Total 4 marks



18	(a)	Allow translated translating translate Allow misspelling of the word eg translat	Translation	2	B1 for translation (with none of reflection, rotation, enlargement, mirrored, turned, move or flipped stated) NB Move with translation is acceptable
			$\begin{pmatrix} 3 \\ -5 \end{pmatrix}$		B1 for (vector =) $\begin{pmatrix} 3 \\ -5 \end{pmatrix}$
	(b)		Shape drawn at $(-6, -1) (-4, -1) (-4, -2) (-5, -2)$	2	B2 condone missing label If not B2 then B1 for a correct trapezium drawn with correct orientation in wrong position or 3 points plotted correctly)
					Total 4 marks

19		$(x =) 11$ (and) $(y =) 14$	2	B2 for $x = 11$ and $y = 14$ (B1 for $x = 11$ or $y = 14$) SC B1 for $x = 14$ and $y = 11$
				Total 2 marks



20	(a)		Vertices at (2, 5) (2, 8) (3, 6) (3, 7)	2	B2 for correct shape in correct position (B1 for correct orientation of shape but wrong position or for 3 out of 4 vertices correct or for $y = x$ drawn)
	(b)		Vertices at (5, 3) (5, 7) (7, 7) (9, 3)	2	B2 for correct shape in correct position (B1 for correct size and orientation of shape but wrong position or for 3 out of 4 vertices correct)
					Total 4 marks



17	(a)		Correct R (5,6), (3,6), (3,5)	2	B2 fully correct If not B2 then B1 for correct orientation of R but in wrong position
	(b)		Correct T (2,-1), (2,-3), (1,-3)	1	B1
	(c)	Enlargement	Correct description	2	M1 for enlargement oe
		Scale factor 3 and centre the origin			A1 allow SF (=) 3, allow O
					NB Award 0 marks if more than transformation
Total 5 marks					

18		$1 \times 5 + 3 \times 9 + 5 \times 24 + 7 \times 40 + 9 \times 7 (= 495)$ or $5 + 27 + 120 + 280 + 63 (= 495)$	5.8	4	M2 for at least 4 correct products added (need not be evaluated) If not M2 then award M1 for consistent use of value within interval (including end points) for at least 4 products which must be added OR correct mid-points used for at least 4 products and not added
		"495" $\div 85$			M1 dep on at least M1 Allow division by their $\sum f$ provided addition or total under column seen
					A1 for $5.8 - 5.824$
Total 4 marks					



Question	Working	Answer	Mark	Notes
11 (a)		T in correct place	2	B2 (B1 for a correct reflection in a line $x = k, k \neq 5$ or in $y = 5$)
(b)			1	B1 for U correct (ft)
(c)		Translation $\begin{pmatrix} -6 \\ 0 \end{pmatrix}$	2	B1 Translation (ft) B1 correct vector (ft) NB Award no marks if more than one transformation is given



12	e.g. $36 \times 50 (= 1800)$			M1 for calculating outgoings could work in £ or p throughout
	e.g. $36 \times \frac{1}{2} \times 60 (= 1080)$ or $36 \times \frac{1}{3} \times 40 (= 480)$ or $36 \times \left(1 - \frac{1}{2} - \frac{1}{3}\right) \times 25 (= 150)$			M1 for working out one source of income
	e.g. $36 \times \frac{1}{2} \times 60 + 36 \times \frac{1}{3} \times 40 + 36 \times \left(1 - \frac{1}{2} - \frac{1}{3}\right) \times 25 (= 1710)$			M1 for complete method to find the total income
	e.g. $\frac{"1800" - "1710"}{"1800"} \times 100$ or $\frac{[\text{outgoings}] - [\text{income}]}{[\text{outgoings}]} \times 100$			M1 (dep on first 2 method marks) complete method to find percentage loss
		5	5	A1 accept -5
Total 5 marks				

13	a	Rotation		B1
		(0, 0)		B1 or O or origin
		90° clockwise	3	B1 NB award no marks if more than one transformation is described
	b	Shape R in correct position	2	B2 Vertices at (-4, 1) (-4, 4) (-5, 4) (-5, 2) (-6, 2) (-6, 1) B1 for a correct reflection in the line $x = k$ where $k \neq -1$ OR at least 4 vertices in the correct position
Total 5 marks				



13	(a)		(3,5) (5,5) (5,8)	2	B2 If not B2 then award B1 for a reflection in $x = 2$ [(1,-1) (-1,-1) (-1,-4)] or for correct shape in the correct orientation
	(b)			3	B1 Rotation (with none of reflection, translation, enlargement, mirrored, flipped or moved (up, right, left, down etc) stated)
					B1 (centre) (0,0) or origin (O) (award if no vector or equation of line or SF mentioned)
			Rotation of 90° anticlockwise about (0,0)		B1 90° anticlockwise or 270° clockwise
					Total 5 marks

14	(a)		2, 4, 6, 12	1	B1
	(b)		5, 7, 8, 9, 10, 11, 13, 14	1	B1
	(c)			2	M1 for $\frac{a}{14}$ with $a < 14$ or $\frac{3}{b}$ with $b > 3$ or for 3 and 14 used with incorrect notation e.g. 3 : 14
			$\frac{3}{14}$		A1 for $\frac{3}{14}$ oe or 0.214(...)
					Total 4 marks



14	(a)		Reflection $x = 1$	2	B1 for reflection with no mention of translate, rotate, enlarge, move
					B1 for $x = 1$ with no mention of a vector, angle or scale factor
	(b)		Rotation about (0,0) 90° clockwise	3	B1 for rotation with no mention of translate, reflect, enlarge, move
					B1 for 90° clockwise/270° anticlockwise/−90° with no mention of a vector, line of symmetry or scale factor
					B1 for (centre =) (0,0), accept origin or O with no mention of a vector, line of symmetry or scale factor Do not accept $\begin{pmatrix} 0 \\ 0 \end{pmatrix}$ for centre
					Total 5 marks

15	(a)		$\frac{13}{30}$	1	B1 accept 0.43(333...) or 43(.333...)%
	(b)	e.g. $1 - \frac{7}{30}$ or $\frac{13+4+6}{30}$ or $\frac{23}{a}$ where $a > 23$ and $a \neq 30$		2	M1
			$\frac{23}{30}$		A1 accept 0.76(666...) or 0.77 or 76(.666...)% or 77%
					penalise incorrect notation once only
					Total 3 marks



12	(a)		shape with vertices (6, 4) (10, 5) (11, 1) (9, 3)	2	B2 if not B2 then award B1 for a correct reflection in a vertical line or for 3 correct points of the correct shape or for a correct reflection $y = 6$
	(b)		Enlargement	3	B1 Enlargement (with none of reflection, rotation, translation, mirrored, flipped or moved (up, right, left, down etc) stated)
			Scale factor 3		B1 Scale factor 3 or sf 3
			[Centre] (0, 0)		B1 [centre] (0, 0) or origin or O (with no column vector or equation of line)
					Total 5 marks



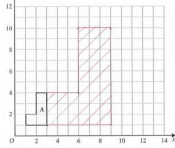
11	(a)	$\frac{6.04(0344...)}{1.11(3552873...)}$		2	M1	Either numerator or denominator correct (at least 3 digits needed) or for an answer of 5.42 to 5.4243 rounded or truncated.
			5.4243(89042...)		A1	accept 5.4243 or 5.4244 or better.
	(b)		5.4	1	B1ft	ft their answer to (a), must have at least 3 sig figs in part (a)
Total 3 marks						
12	(a)		<u>Enlargement</u> <u>scale factor 3</u> <u>centre (0, 0)</u>	3	B1	for enlargement, enlarge, etc so long as no mention of rotation, reflection or translation, flip, move etc.
					B1	SF 3, triple, three times etc. with no mention of a vector, line, angle of rotation.
					B1	Accept centre O or the origin
	(b)	line $x = 5$ drawn or shape in correct orientation, not necessarily in correct position.		2	M1	Can be implied by correct answer.
			Shape with vertices at (7, 2), (7, 4), (8, 3), (9, 3), (9, 2)		A1	
	Total 5 marks					



Question	Working	Answer	Mark	Notes
19 (a)	(4, 2), (4, 3), (5, 3), (5, 4), (6, 4), (6, 1), (5, 1), (5, 2)	Correct shape	2	B2 For the correct shape with all 8 points correct (B1 for the line $y = x$ drawn or a shape of the correct orientation and size anywhere on the grid)
(b)	Enlarged, enlarge etc	Enlargement	3	B1 With no mention of any other transformation or turn, move, flip, transform, up, right etc
	3 or $\times 3$ or tripled or three or three times	(Scale factor) 3		B1 Allow $\times 3$ or 3 times bigger or tripled (do not allow -3)
	No need for 'centre' Do not allow a column vector for coordinates.	(Centre) (7, 2)		B1 Just coordinates needed – allow without brackets
				Total 5 marks



Question	Working	Answer	Mark	Notes
18*		1 st card = 4	3	B1
		2 nd card = 6		B1 or a list of 6 numbers with a mode of 6
		4 th card = 9		B1
				SCB2 for 4, 6 and 9 in the incorrect order
				Total 3 marks

Question	Working	Answer	Mark	Notes
19 (a)		Correct shape drawn in correct position	2	B2 Shape drawn with coordinates (3, 1), (9, 1), (9, 10), (6, 10), (6, 4), (3, 4) (B1 for a shape of the correct size but in the wrong position) NB Overlay is available
(b)	'Turn' is not sufficient	Rotation	3	B1 with no mention of any other transformation words or move, flip, transform, up, right etc
		180°		B1 allow 'half turn'
		(centre) (5, 5)		B1 must be a coordinate and not a vector
				Total 5 marks

Question	Working	Answer	Mark	Notes
16 (a)		Rotation, 90° clockwise, centre (-2, 3)	3	B1 for rotation B1 90° clockwise or -90° (or 270° anticlockwise) B1 (centre) (-2, 3) Note: Do not accept $\begin{pmatrix} -2 \\ 3 \end{pmatrix}$ for centre Award no marks if more than one transformation explicitly stated (the sight of a vector is not a second transformation) eg. moved and then rotated; rotation and translation
	(b)	Triangle at (-2, 2), (-2, 4), (-1, 4)	1	B1 cao
	(c)	Triangle at (-2, 1), (-2, 3), (-1, 3)	2	B2 If not B2 then award B1 for a triangle of the correct size and orientation or the wrong size but enlarged correctly from (-4, 2) with a sf other than 0.5 e.g. a triangle at (4, -2), (4, 6), (8, 6)
17	$\frac{\pi \times 6^2}{2}$ oe or 56.5(4866....) or 18π $\frac{1}{2} \times 8 \times (6-1)$ or 20 oe	36.5	4	M2 If not M2 then award M1 for $\pi \times 6^2$ oe (= 113(.09)) or 36π M1 for the area of the triangle A1 for 36.5 – 36.6



14	(a) (i)		24, 30	1	B1 No repeats
	(ii)		21, 23, 25, 27, 29	1	B1 No repeats
	(b)		$(A \cup B)'$ or $A' \cap B'$	1	B1 or $(B \cup A)'$ or $B' \cap A'$
Total 3 marks					
15	(a)		$81k^8$	2	B2 B1 for 81 or k^8 seen in their final answer.
	(b)		$7m^4n^6$	2	B2 B1 for $7m^4$ or n^6 in a product with no other terms in m or n
Total 4 marks					
16	(a)	vertices at $(-9, 6)$ $(-9, 9)$ $(-3, 9)$ $(-6, 6)$	Shape in correct position	2	B2 B1 for congruent shape in correct orientation but wrong position or quadrilateral with 2 or 3 vertices correct.
	(b)	vertices at $(7, 3)$ $(10, 6)$ $(13, 6)$ $(13, 3)$	Shape in correct position	1	B1
	(c)		enlargement scale factor 2 centre $(-3, 3)$	3	B1 for enlargement, enlarge, etc so long as no mention of rotation, reflection or translation, flip, move etc. B1 SF 2, double, two times etc. B1 $(-3, 3)$ stated. Accept about, from etc. with no mention of line, or column vector.
Total 6 marks					

19	(a)	eg $\begin{pmatrix} 6 & -7 \\ 12 & -2 \end{pmatrix} \begin{bmatrix} 13 \\ 10 \end{bmatrix}$ or $\begin{pmatrix} -7 & -6 \\ 2 & -12 \end{pmatrix} \begin{bmatrix} -13 \\ -10 \end{bmatrix}$		3	M1 with or without brackets, allow 13 right and 10 up or (13, 10) or 13 left and 10 down or (-13, -10) or for one of $-5 + 10 (= 5)$ or $-3 + 10 (= 7)$ or $9 - 13 (= -4)$
					M1 for two of $-5 + 10 (= 5)$ or $-3 + 10 (= 7)$ or $9 - 13 (= -4)$
		Correct answer scores full marks (unless from obvious incorrect working)	$d = 5, e = 7,$ $f = -4$		A1
	(b)		Enlargement	3	B1 with no mention of any other transformation or words such as move, flip, shift
			Scale factor 3		B1 with no mention of a vector, angle of rotation or line of symmetry
			Centre (0, 2)		B1
	(c)		Correct shape with coordinates (0, 5), (1, 6), (3, 6), (1, 5)	2	B2 B1 for a correct shape with the correct orientation in the incorrect position or for 3 out of 4 vertices correct or for a correct rotation of 90° anticlockwise about (3, 5)
					Total 8 marks

