Name: _____

IGCSE (9-1) Maths
topics new to Foundation tier:
Translation using column vectors

Date:

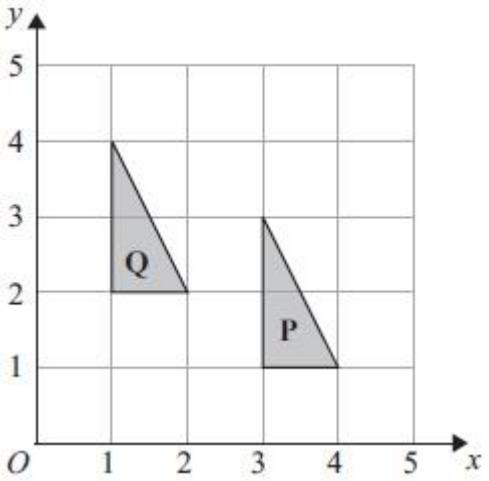
Time: 35 minutes

Total marks available: 31

Total marks achieved: _____

Column vectors **must** be used when appropriate in your answers to the questions below.

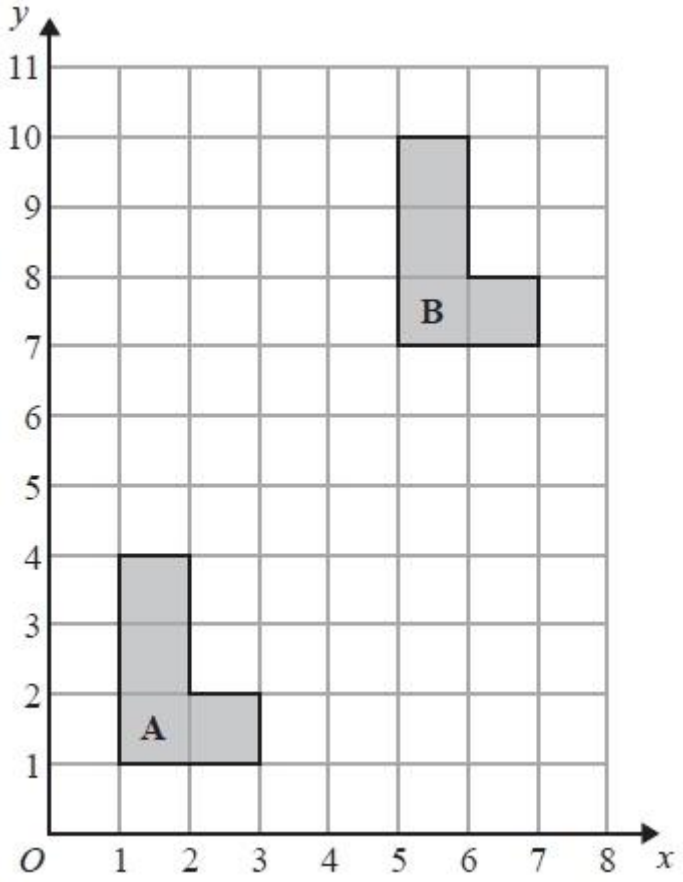
Q1.



Describe fully the single transformation which maps triangle **P** onto triangle **Q**.

(Total 2 marks)

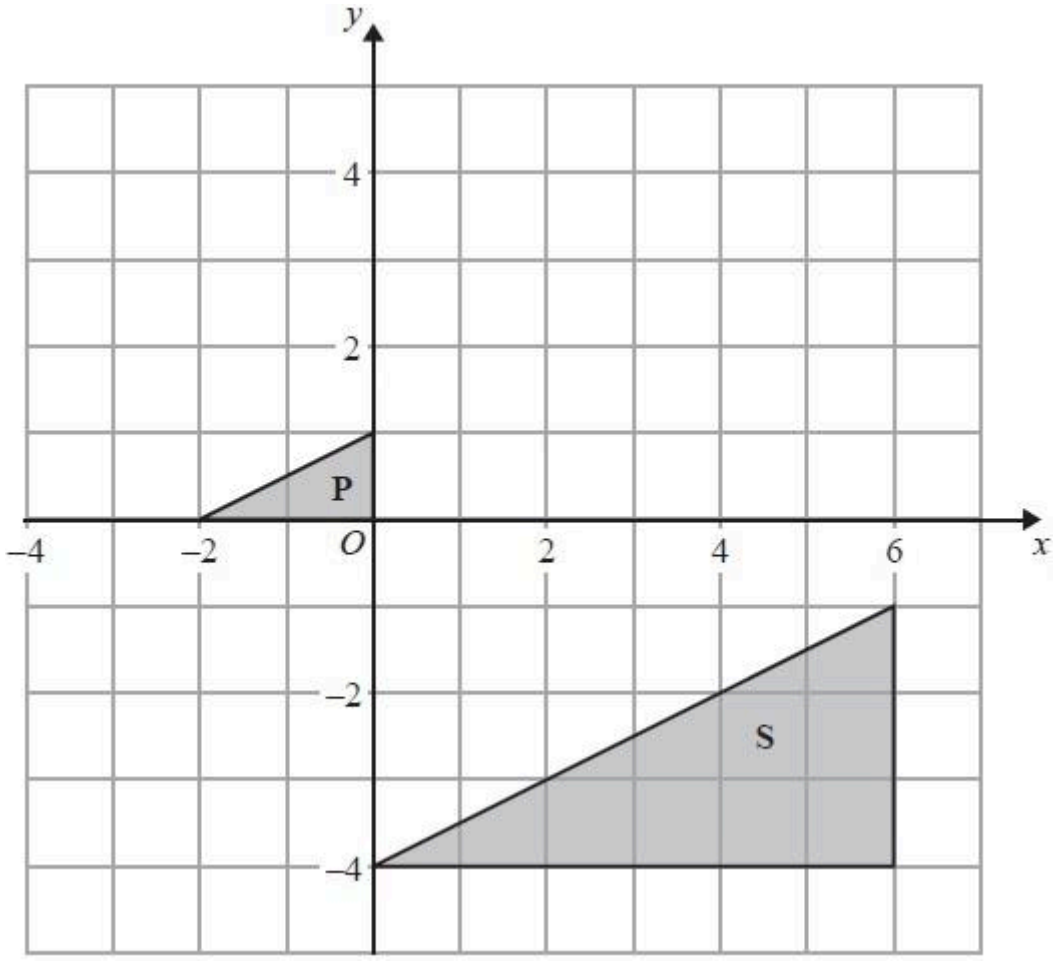
Q2.



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

(Total 2 marks)

Q3.



(*a*) On the grid, translate triangle **P** by the vector $\begin{pmatrix} 2 \\ -1 \end{pmatrix}$
Label the new triangle **Q**.

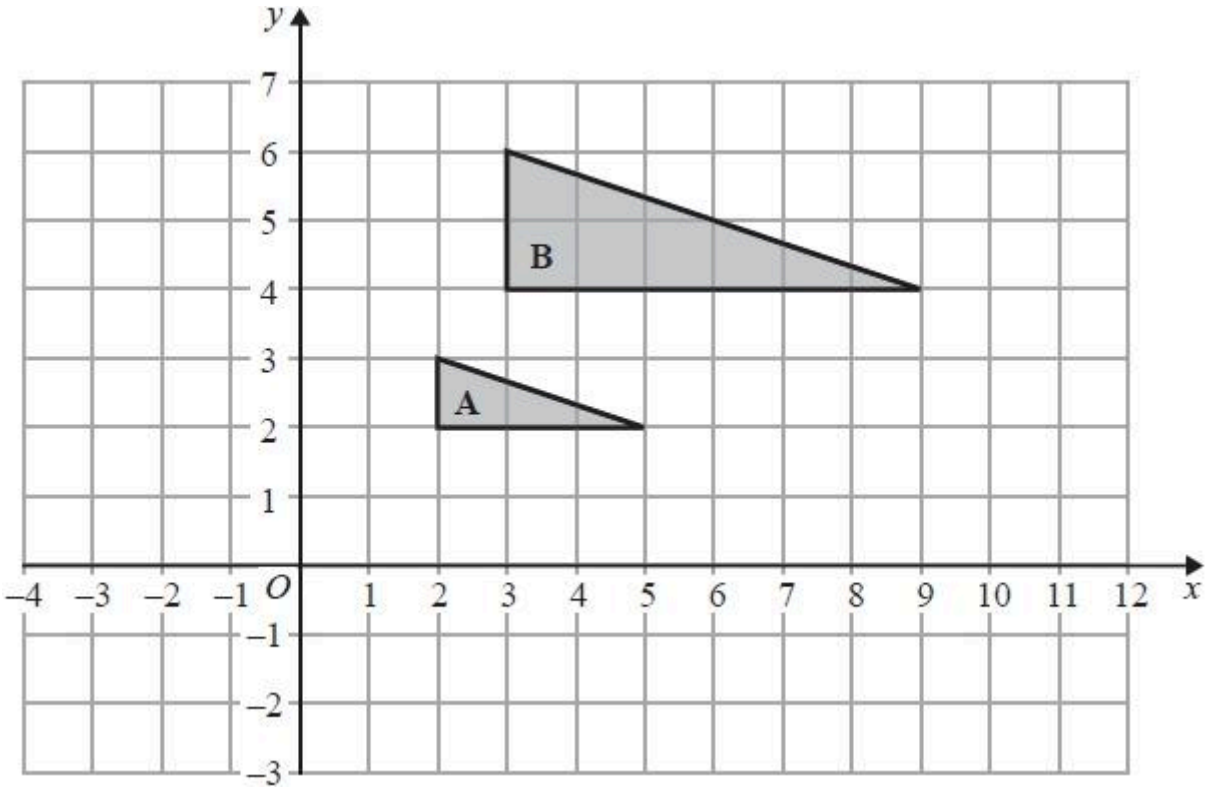
(1)

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

(3)

(Total 4 marks)

Q4.



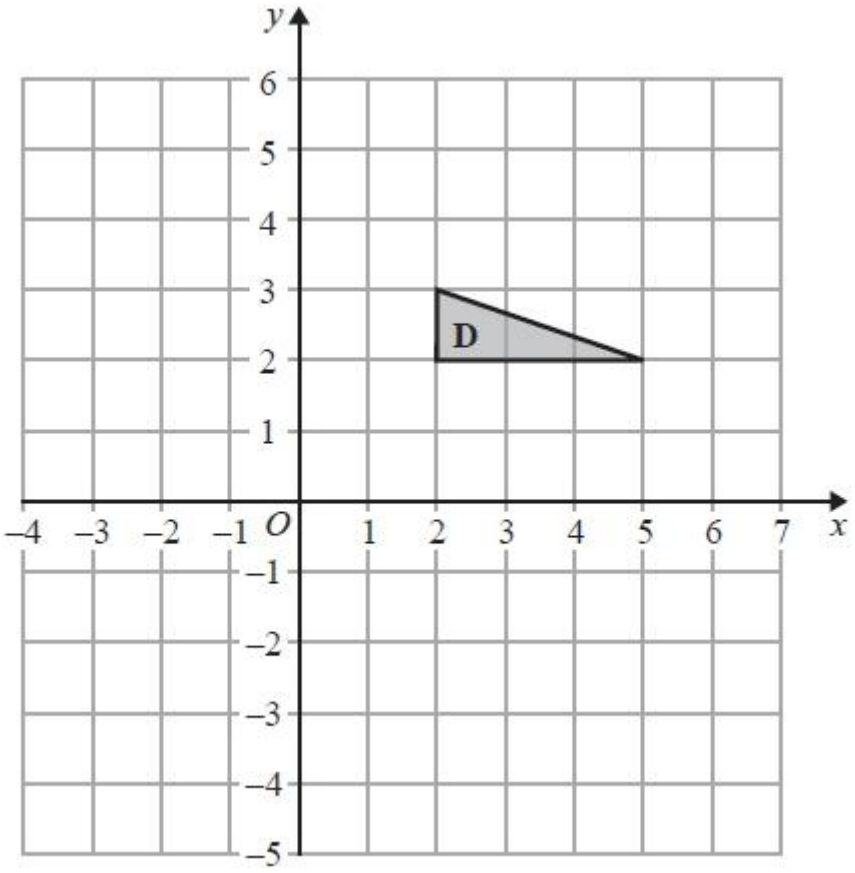
(*a*) Describe fully the single transformation that maps triangle **A** onto triangle **B**.

(3)

(*b*) On the grid, translate triangle **A** by the vector $\begin{pmatrix} 5 \\ -4 \end{pmatrix}$

Label the new shape **C**.

(1)

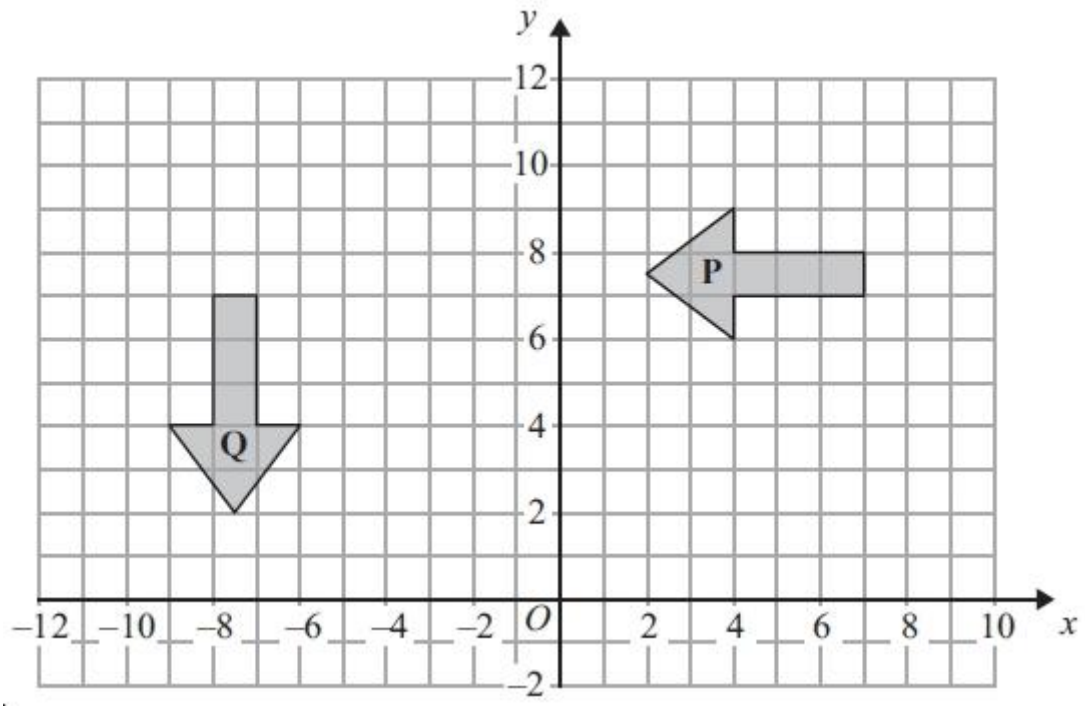


(*c*) On the grid, rotate triangle **D** 90° anticlockwise with centre (3, 1)

(2)

(Total 6 marks)

Q5.



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

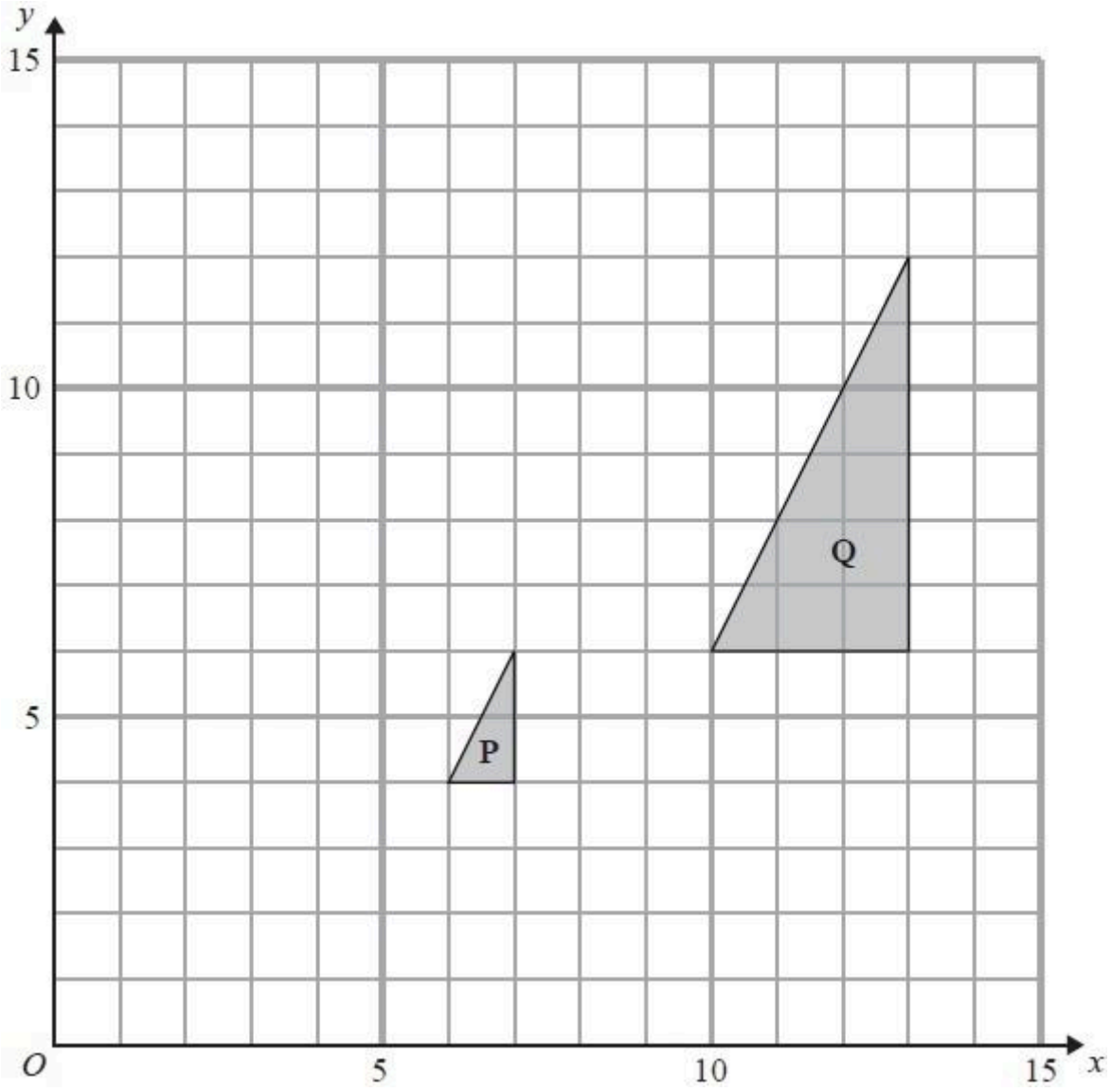
(3)

(*b*) On the grid, translate shape **P** by the vector $\begin{pmatrix} -6 \\ 2 \end{pmatrix}$
Label the new shape **R**.

(2)

(Total 5 marks)

Q6.



(*a*) Describe fully the single transformation which maps triangle **P** onto triangle **Q**.

(3)

(*b*) On the grid, translate triangle **Q** by the vector $\begin{pmatrix} -8 \\ 2 \end{pmatrix}$
Label the new triangle **R**.

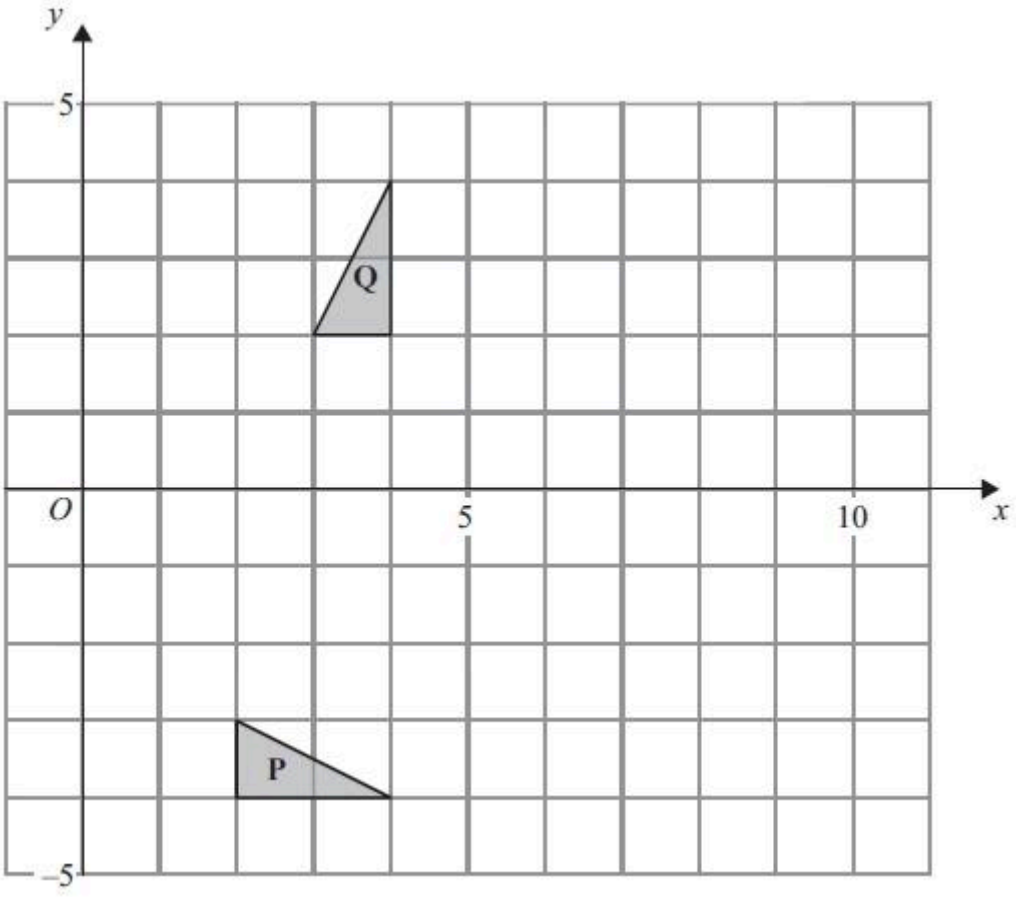
(1)

(*c*) Describe fully the single transformation which maps triangle **R** onto triangle **P**.

(2)

(Total 6 marks)

Q7.



(*a*) Describe fully the single transformation which maps triangle **P** onto triangle **Q**.

(3)

(*b*) On the grid, translate triangle **Q** by the vector $\begin{pmatrix} 4 \\ -2 \end{pmatrix}$
Label the new triangle **R**.

(1)

(*c*) Describe fully the single transformation which maps triangle **P** onto triangle **R**.

(2)

(Total 6 marks)

Examiner's Report

Q1.

Most students could name the transformation correctly as a translation. 'Translate' was also accepted, but not 'vector', 'transposed', 'transition' or 'transferred' or 'transaction' or 'translocation'. There was some confusion over the description of the translation with, in many cases, the vector given being that from Q to P rather than P to Q. Other wrong answers included the vector with the x and y components transposed.

Q2.

Students often struggled to recall the name for this transformation and problems arose from the description, the translation vector sometimes being written the wrong way round and some students thinking it was 5 to the right and 7 up or finding the vector from B to A rather than A to B. Some also wrote the vector as a coordinate for which they gained no credit.

Q3.

The vector translation was completed successfully by most. In part (b) a majority of candidates gained 3 marks, but a few just put 'enlargement' to gain just 1 mark. The scale factor was sometimes put as a ratio 1:3 or just stated as '3 times bigger' but this was allowed. A few candidates failed to understand that the word 'single' meant just one type of transformation, most commonly believing the shape was enlarged and then translated. This was deemed a multiple transformation and it was penalized by losing all 3 marks. Some candidates failed to understand that the centre of enlargement fixes the position of the transformed shape.

Q4.

In part (a), students usually scored at least 2 marks for identifying the transformation as an enlargement with scale factor 2. Finding the centre proved a little more difficult. Some wrote it as a column vector while others stated it as (0, 1). There weren't many instances of multiple transformations being given. Most students answered part (b) correctly although there were instances of moving in the wrong direction. In part (c), a recurring error was to rotate 90° clockwise rather than anticlockwise.

Q5.

The vast majority of students gave the correct answer for part (a). Many students could find the correct answer to part (b), providing that they understood the condition that C must lie on the circle with AB as diameter. For those that did not understand this, they often put C at the point (8, 3).

Mark Scheme

Q1.

Question Number	Working	Answer	Mark	Notes	
		translation	2	B1 Also accept translated, translate etc	These marks are independent but award no marks if the answer is not a single transformation
		$\begin{pmatrix}-2\\1\end{pmatrix}$		B1 Also accept 2 to the left and 1 up	
					Total 2 marks

Q2.

Q	Working	Answer	Mark	Notes
		Translation 4 right and 6 up	2	B2 B1 for translation B1 for 4 right and 6 up or $\begin{pmatrix}4\\6\end{pmatrix}$
				Total 2 marks

Q3.

Question	Working	Answer	Mark	Notes
(a)	Q: (0, −1), (2, 0), (2, −1)	Triangle in correct position	1	B1 Accept without label.
(b)		Enlargement (Scale factor) 3 (Centre) (− 3, 2)	 3	B1 B1 B1 Award no marks for multiple transformations. condone missing brackets around (− 3,2) Do not accept vector notation for (− 3,2)
				Total 4 marks

Q4.

Q	Working	Answer	Mark	Notes
(a)		Enlargement Scale factor 2 Centre (1, 0)	3	B1 For Enlargement B1 For (Scale factor =) 2 B1 For (Centre) (1, 0) NB if more than one transformation mentioned then no marks.
(b)		Correct triangle at (10, −2), (7, −2), (7,−1)	1	B1 Correct triangle in correct place
(c)		Correct triangle at (1, 0),(2, 0),(2, 3)	2	M1 Triangle congruent to **D** and with correct orientation A1 ScB1 for triangle with vertices at (4, 2), (5, 2) and (4, −1)
				Total 6 marks

Q5.

Question Number	Working	Answer	Mark	Notes
(a)		Rotation 90° or quarter turn anticlock wise (0,0) or *O* or origin	3	B1 B1 accept 90° or − 270° B1 **Award B0 (no marks) if the response is not a SINGLE transformation**
(b)		Shape in correct position	2	B2 B1 for translation 6 units left or 2 units up
				Total 5 marks

Q6.

Question	Working	Answer	Mark	Notes
(a)	Enlargement scale factor 3 centre (4, 3)		3	B3 B1 for enlargement, enlarge etc B1 for 3, ×3, three, $\frac{3}{1}$ B1for (4, 3) Condone omission of brackets but do not accept $\begin{pmatrix}4\\3\end{pmatrix}$ These marks are independent but award no marks if the answer is not a single transformation
(b)	**R** correct [vertices at (5, 8) (5, 14) and (2, 8)]		1	B1 Condone omission of label
(c)	Enlargement scale factor $\frac{1}{3}$ centre (8, 2)		2	B2 B1 for enlargement, enlarge etc **and** $\frac{1}{3}$, $\times\frac{1}{3}$, 0.33(3….) B1for (8, 2) Condone omission of brackets but do not accept $\begin{pmatrix}8\\2\end{pmatrix}$ **These marks are independent but award no marks if the answer is not a single transformation**
				Total 6 marks

Q7.

Question	Working	Answer	Mark	Notes	
(a)		Rotation	3	B1	These marks are independent but award no marks if the answer is not a single transformation
		90°		B1 Also accept quarter turn or −270° (B0 for 90° clockwise)	
		(0, 0)		B1 Also accept origin, *O*	
(b)		R correct	1	B1	
(c)		Rotation 90°	2	B1 Accept quarter turn or −270° instead of 90°	As for (a)
		(3, 1)		B1 ft from their R if it is a translation of the correct R	
					Total 6 marks