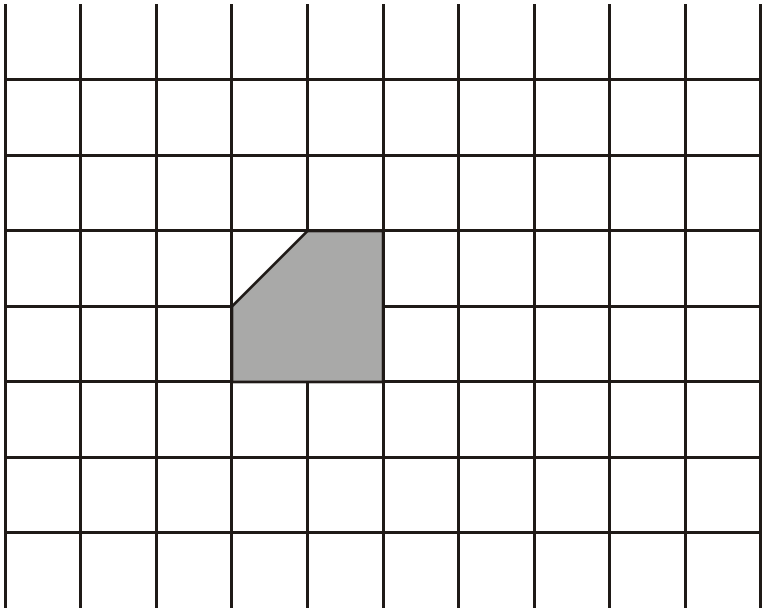
1.



(a) Translate the shaded shape 3 squares to the right and 2 squares up.

(1)

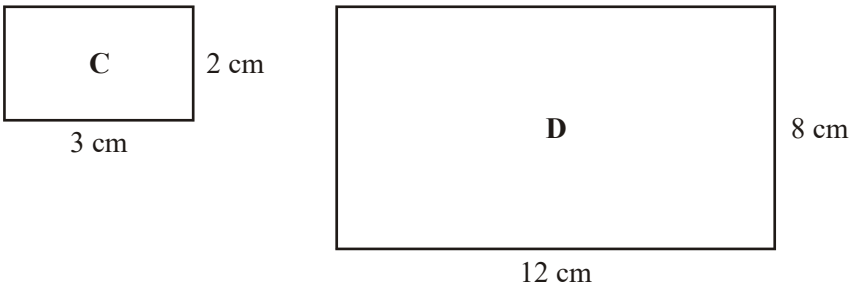


Diagram **NOT** accurately drawn

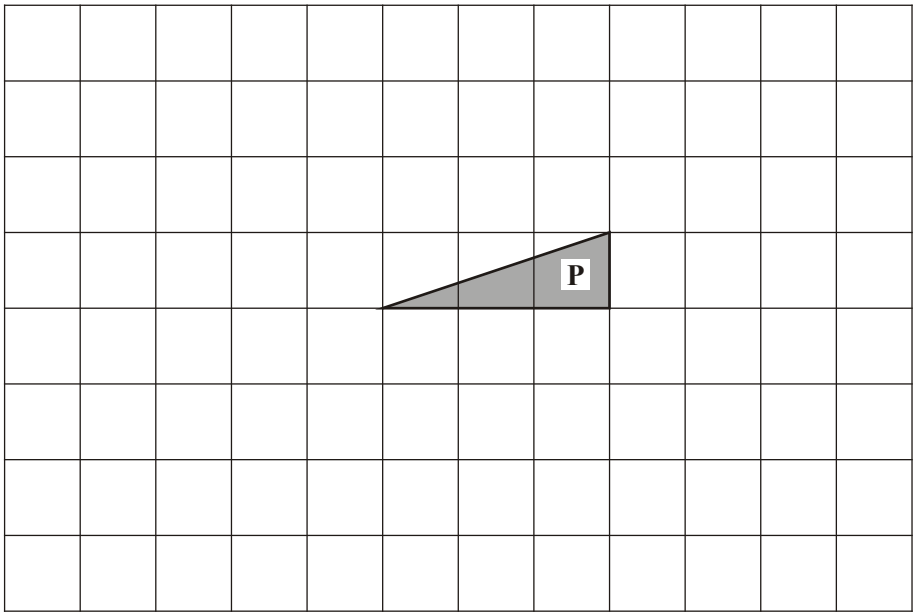
Rectangle **D** is an enlargement of rectangle **C**.

(b) Find the scale factor of the enlargement.

……

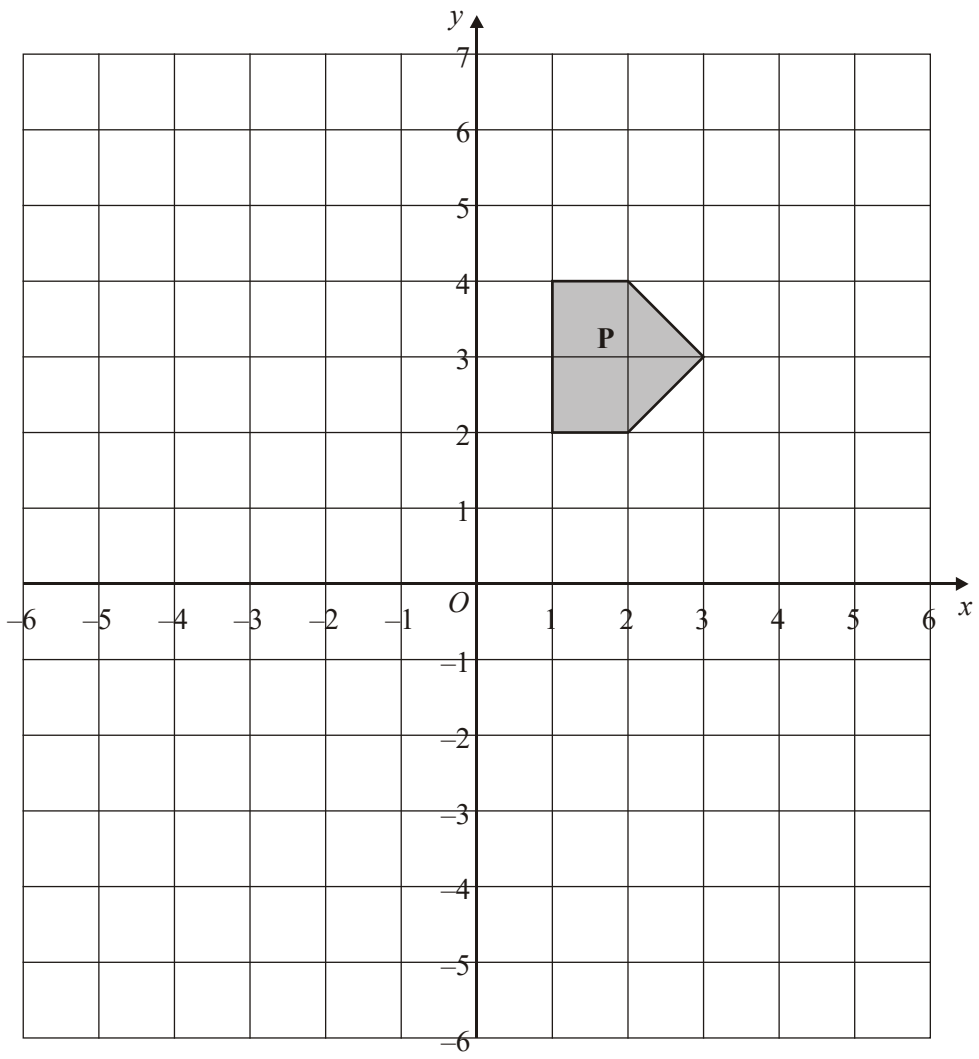
(1)
(Total 2 marks)

2. Translate shape **P** 3 squares to the left and 2 squares down.



(Total 1 mark)

3.



(a) On the grid, rotate the shaded shape **P** one quarter turn anticlockwise about *O*.

Label the new shape **Q**.

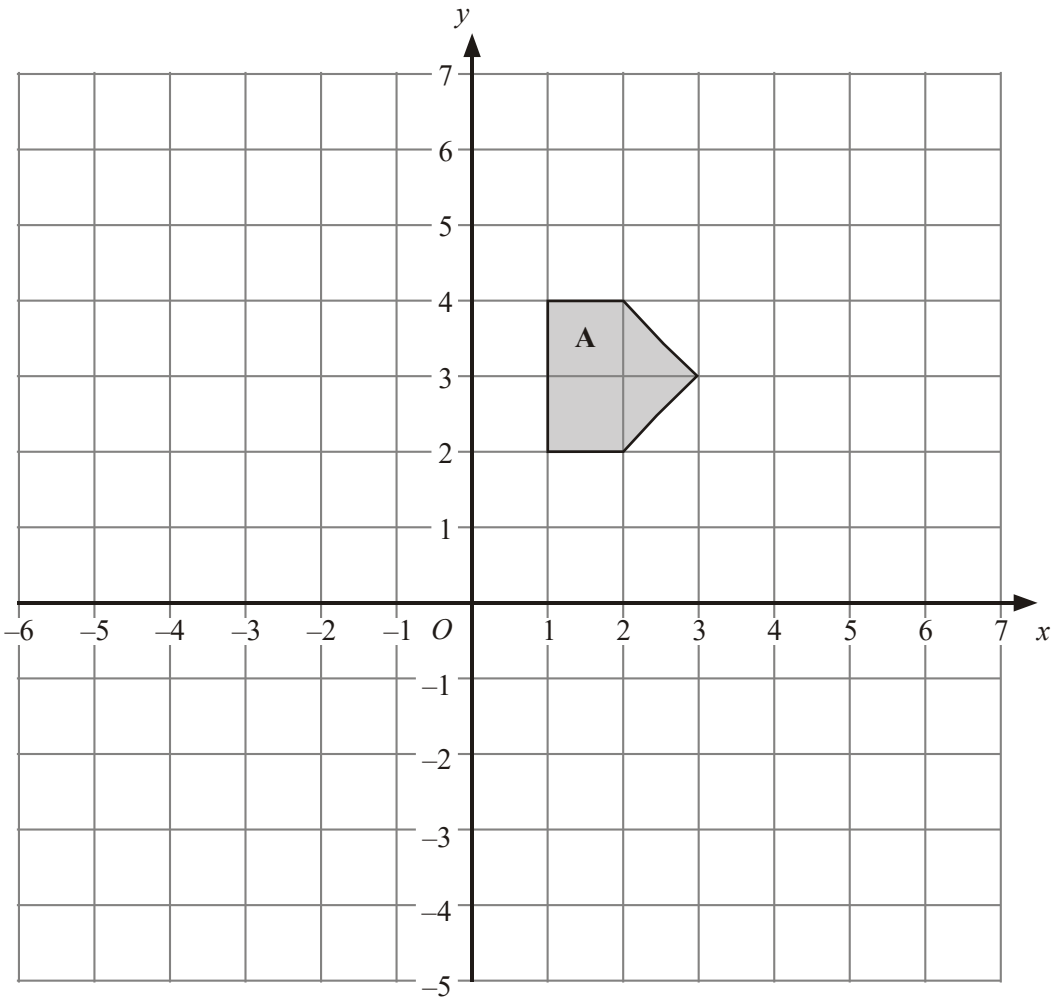
(3)

(b) On the grid, translate the shaded shape **P** by 2 units to the right and 3 units up.

Label the new shape **R.**

(1)
(Total 4 marks)

4.



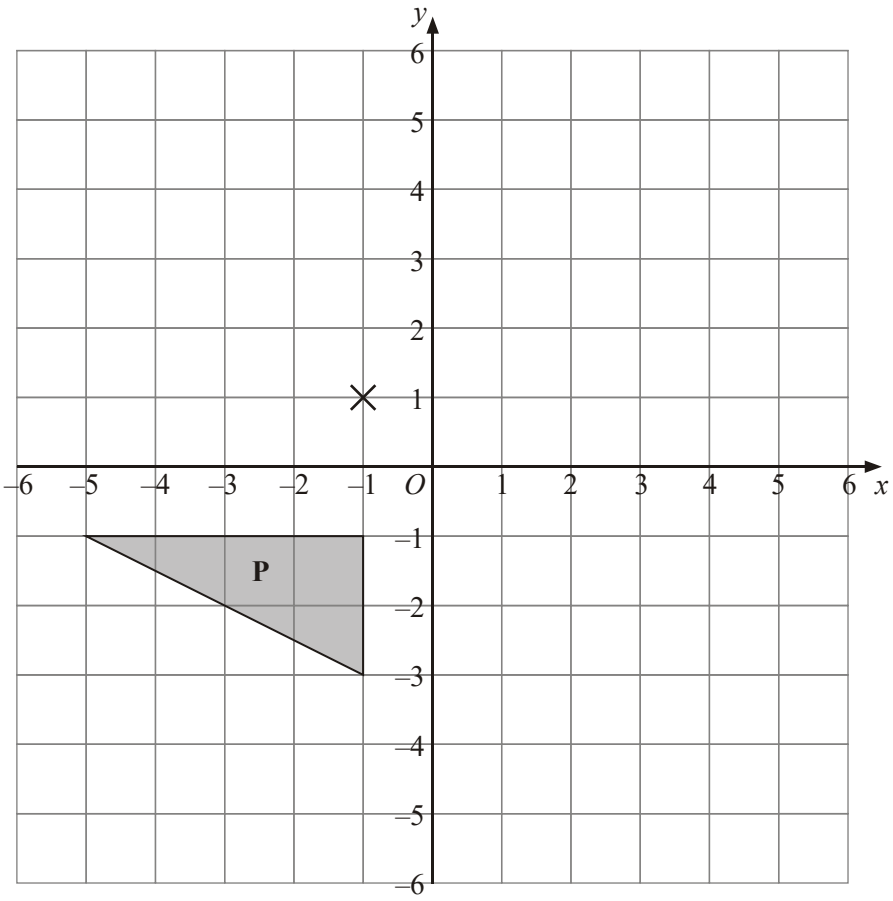
(a) Reflect Shape **A** in the *y* axis.
Label your new shape **B**.

(2)

(b) Translate Shape **A** by 3 squares right and 2 squares down.
Label your new shape **C**.

(2)
(Total 4 marks)

5.



(a) Rotate triangle **P** 180° about the point (–1, 1).

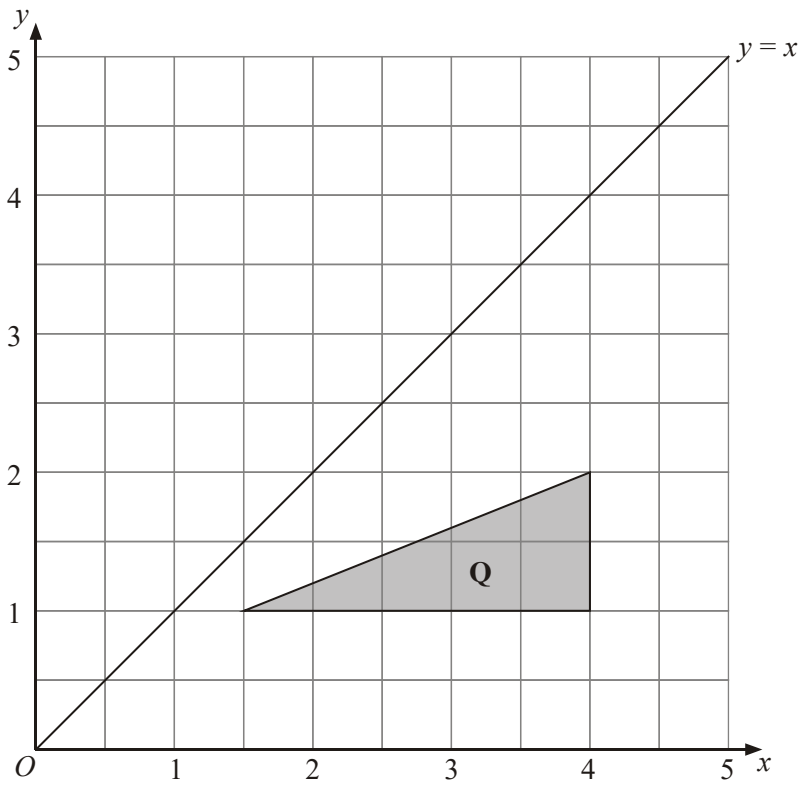
Label the new triangle **A**.

(2)

(b) Translate triangle **P** by the vector $\begin{pmatrix} 6 \\ -1 \end{pmatrix}$.

Label the new triangle **B**.

(1)

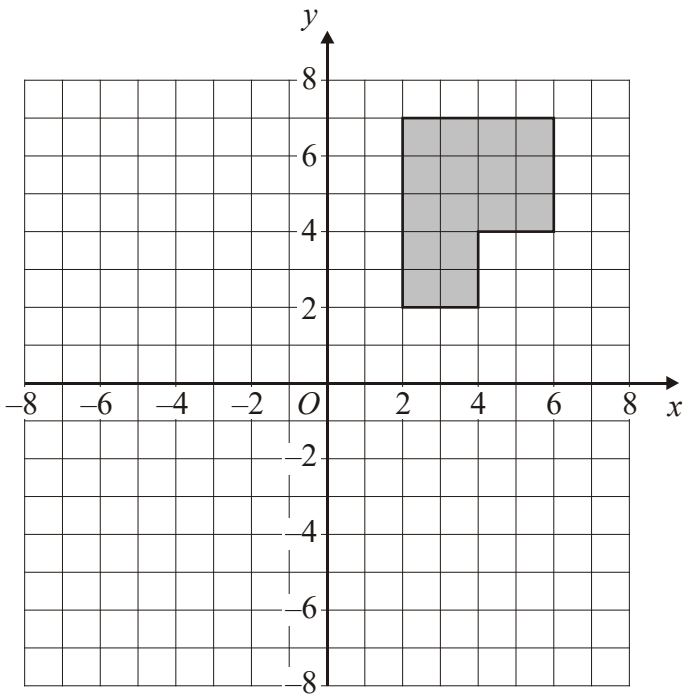


(c) Reflect triangle **Q** in the line $y = x$.

Label the new triangle **C**.

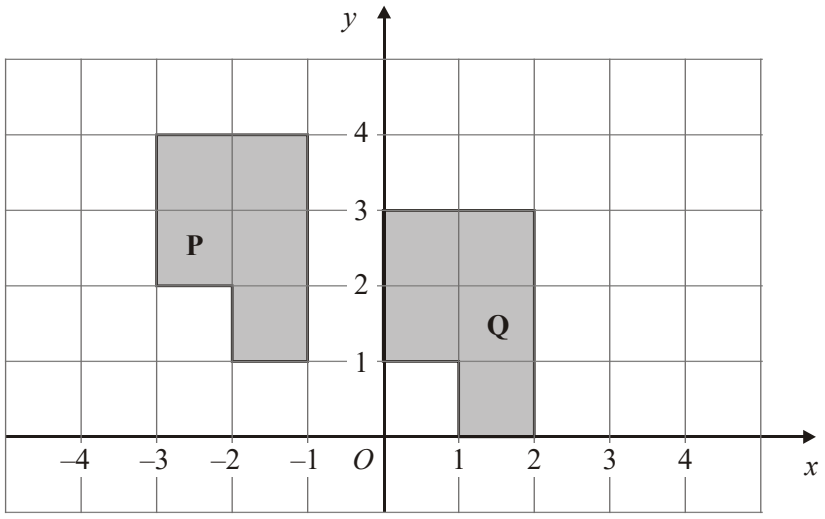
(2)
(Total 5 marks)

6.



(a) Rotate the shaded shape 90° clockwise about the point *O*.

(2)

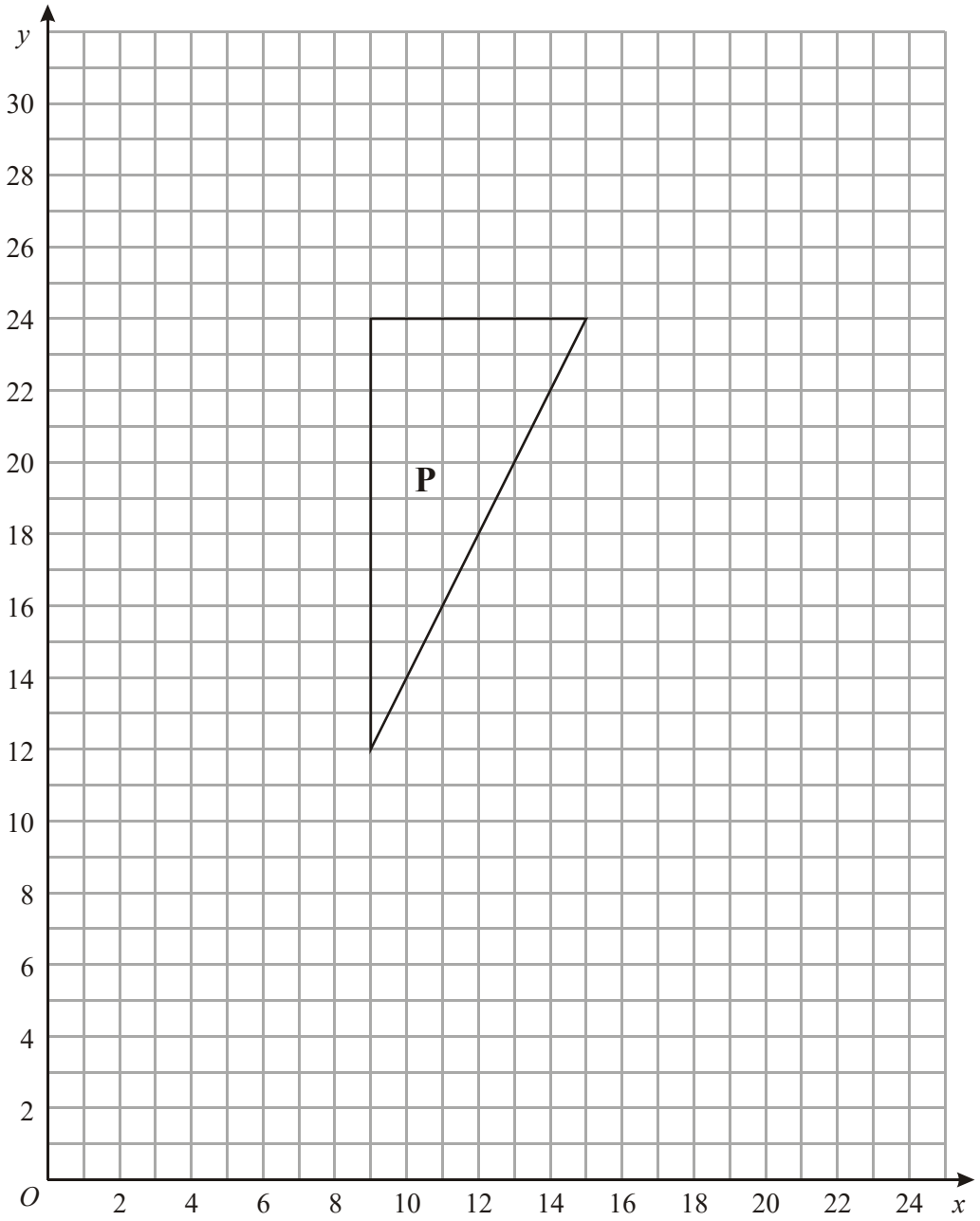


(b) Describe fully the single transformation that will map shape **P** onto shape **Q**.

.....

(2)
(Total 4 marks)

7.



(a) On the grid, translate triangle **P** by the vector $\begin{pmatrix} 8 \\ -3 \end{pmatrix}$

Label the new triangle **Q.**

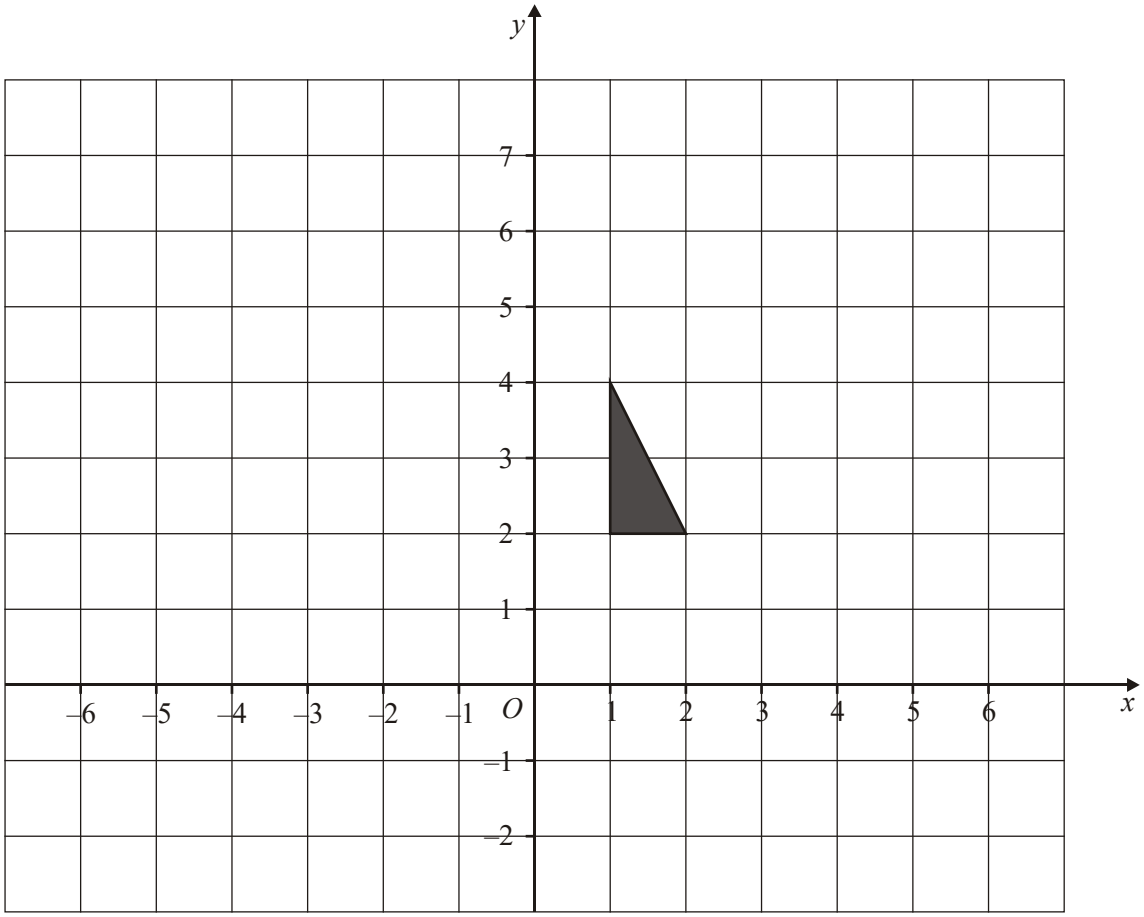
(1)

(b) On the grid, enlarge triangle **P** by a scale factor of $\frac{1}{3}$, centre (15, 6).

Label the new triangle **R**.

(2)
(Total 3 marks)

8.



Translate the triangle by the vector

$$\begin{pmatrix} 4 \\ -3 \end{pmatrix}$$

(Total 1 mark)

1. (a) 3 right, 2 up 2

B1

(b) 4

B1

[2]

2. Translation 1

Move 3 squares to left and 2 squares down

B1

[1]

3. (a) Overlay 3

B3 fully correct
(B2 correct orientation in correct quadrant)
(B1 any rotation about O;
or correct orientation in incorrect quadrant).

(b) Translation 1

B1 cao

[4]

4. (a) 2

B2 fully correct,
*(B1 for reflection of **A** in a mirror line other than* y *axis)*

(b) 2

B1 for 3 right
B1 for 2 down

[4]

5. (a) Triangle A
Triangle with vertices (-1, 5), (-1, 3), (3, 3) 2

B2 for triangle with vertices (–1, 5), (–1, 3), (3, 3)
(B1 for triangle with correct orientation or for triangle rotated ±90° centre (–1, 1))

(b) Triangle B
Triangle with vertices (1, -2), (5, -2), (5, -4) 1
B1 for triangle with vertices (1, –2), (5, –2), (5, –4)

(c) Triangle C
Triangle with vertices (1, 1.5), (1, 4), (2, 4) 2
B2 for triangle with vertices (1, 1.5), (1, 4), (2, 4)
(B1 for the triangle with correct orientation or for any two of the vertices (1, 1.5), (1, 4), (2, 4))
SC: B1 for a triangle with vertices (1, 1.5), (1, k), (2, k)

[5]

6. (a) Vertices at (2, –2), (7, –2), (7, –6), (4, –6), (4, –4), (2, –4) 2
B2 for a fully correct rotation
[B1 for correct shape with correct orientation
***OR** a 90° anticlockwise rotation about 0*
***OR** a 180° rotation about O*
***OR** for any 3 correct sides in the correct position]*

(b) Translation by $\begin{pmatrix} 3 \\ -1 \end{pmatrix}$ 2
B1 for translation
B1 (indep) for $\begin{pmatrix} 3 \\ -1 \end{pmatrix}$ *or 3 right and 1 down*

[4]

7. (a) (17, 9) (17, 21) (23, 21)
Translation 3
B1 cao

(b) (13, 8) (13, 12) (15, 12)
Enlargement
B2 correct triangle $\pm \frac{1}{2}$ *square*
(B1 correct size but in wrong position <u>or</u> 2 out of 3 vertices in correct position $\pm \frac{1}{2}$ *sq)*

[3]

8. (5, 1), (5, -1), (6, -1) 1

B1 cao

[1]

1. Candidates frequently misunderstood the idea of translating 3 squares to the right. From the answers given it appeared to be understood as 'miss 3 squares to the right' which in effect became '5 squares to the right'.
Part (b) also produced few correct answers with ×3 and 96 (or 12 × 8) being the most popular incorrect answers.

2. The translation produced many correctly drawn responses (nearly 50% of candidates). Some demonstrated a problem in being able to distinguish between left and right whilst others could not count the squares accurately. The best outcomes were perhaps achieved by focussing on a corner of the triangle rather than the sides of the shape.

3. Despite this being a grade D question, it was encouraging to find that nearly half the candidates were able to score at least one mark by rotating the shape about *O* or, more commonly, obtaining the correct orientation of the shape with the 'arrow' pointing upwards somewhere on the grid. Just under a tenth of the candidates were able to score all 3 marks. It was disappointing to find that fewer than a quarter of the candidates were able to translate the shape by 2 units to the right and 3 units up, with a common incorrect response being to translate it 3 units to the right and 3 units up.

4. Candidates tend to struggle with transformation geometry. They usually gained most success with part (a) and where they scored at least 1 mark for a reflection, often one square to the left of the correct position. The translation in part (b) caused more errors though many candidates obtained 1 mark here too, usually for the vertical component.

5. Foundation

In part (a) most candidates were able to rotate triangle P but frequently this was not about the point (–1, 1). The triangle was often drawn in the correct orientation with one vertex at the centre of rotation. Many candidates rotated by 90°, rather than 180°. Part (b) was answered very poorly indeed. Many candidates could not cope with the vector and the triangle was often moved to the right with one vertex at (6, –1). A significant number of reflections were also seen. Almost half of the candidates reflected the triangle correctly in part (c). A few candidates achieved this by drawing lines perpendicular to the line $y = x$ but most did not show any such lines. Where just one mark was awarded this was usually for drawing the triangle in the correct orientation but in the wrong position. A common error was a reflection in a horizontal line.

Higher

In part (a), about half the candidates were able to score both marks for this question. Common incorrect answers here were based on rotating the triangle about the wrong point, typically (–1, –1) or (0, 0). A smaller number of candidates reflected the triangle in the *x*-axis or rotated it by only ±90°. In part (b), a significant number of candidates did not understand how to interpret the translation vector $\begin{pmatrix} 6 \\ -1 \end{pmatrix}$. Common errors here were based on incorrect translations, typically $\begin{pmatrix} 6 \\ 0 \end{pmatrix}$ or $\begin{pmatrix} -1 \\ 6 \end{pmatrix}$. A small number of candidates reflected the triangle in the *y*-axis.

6. Specification A

Foundation

Many candidates, in part (a), were able to gain at least one mark for correctly rotating the given shape through 90° in a clockwise direction, although many failed to score both marks as a result of their rotation not having been made about the required centre. Some candidates attempted rotations in each of the quadrants and usually failed to score at all, having made at least one further error.

In part (b), very few candidates scored full marks. Whilst many gained a mark for comments such as "move 3 units to the right and 1 unit down" only a minority correctly mentioned 'translation' in their description. Sometimes incorrect use of a column vector contradicted earlier statements and marks were lost. Surprisingly many candidates miscounted how many squares to the right P had been translated; – 4 or 2 were often seen.

Another common response was "across/along 3 units and down 1".
This gained no marks.

A few gave responses such as left 3 and up 1 mapping Q to P by mistake.

Higher

Part (a) was answered extremely well with most candidates rotating the shape 90o clockwise, usually using *O* as the centre of rotation.

Most errors resulted from rotating the shape 90° clockwise about the wrong centre although some candidates rotated it 90° anticlockwise about *O*. Full marks were surprisingly rare in part (b). Many failed to identify the transformation as a translation. Some candidates used words such as 'transformed' or 'moved' but many did not attempt to name the transformation and simply described the movement by using words or a vector. Vectors were often correct although sometimes the signs were incorrect. Other common errors included writing coordinates instead of a vector and describing the movement as 'across 3 and down 1'.

Specification B

Foundation

This question was not done well. In part (a), just over a third of the candidates were able to score 2 marks for the correct rotation of the shape. A significant number of candidates lost a mark by incorrectly positioning the shape after the 90º clockwise rotation, or by embedding their answer within other rotations- typically all three of 90º, 180º and 270º rotations. In part (b), very few candidates were able to write down the name of the transformation or describe accurately how this should be done. A common incorrect answer here was 3 'across' and 1 down.

Higher

Part (a) was well answered with the vast majority of candidates putting the image in the correct place. There were a few inaccuracies – usually the correct shape a square out as well as some confusion over the sense.

Candidates were generally less successful with part (b). There was a lack of knowledge of the technical vocabulary required, so answers such as 'moved along' were very common. Translation was often given as 'transformation' and 'transportation'. Candidates could give answers in vector form or as a movement parallel to the axes. Of those that opted for the latter, many lost marks through vagueness by writing such as '3 along the x direction and 1 down the y direction' because they had to specify the sense. '3 to the right along the x direction and 1 down' was acceptable for 1 mark. Of those that used vectors, some transposed the x and y components or wrote the x and y components as a fraction, presumably having an idea of gradient in their heads. Lastly there was some confusion evident in using the vector as the name of the transformation or in writing the vector as coordinates.

7. Just over 60% of candidates were able to answer (a) correctly but only 29% of candidates were able to give a fully correct solution to part (b).

In part (b) many candidates could reduce the shape to $\frac{1}{3}$ of its size but using the centre of enlargement was more problematic. Some candidates used a scale factor of $-\frac{1}{3}$. Those who were most successful marked the centre of enlargement and drew in the construction lines.

8. This question was answered correctly by the majority of candidates. A common error was to translate the shape by a vector of rather than as specified in the question.