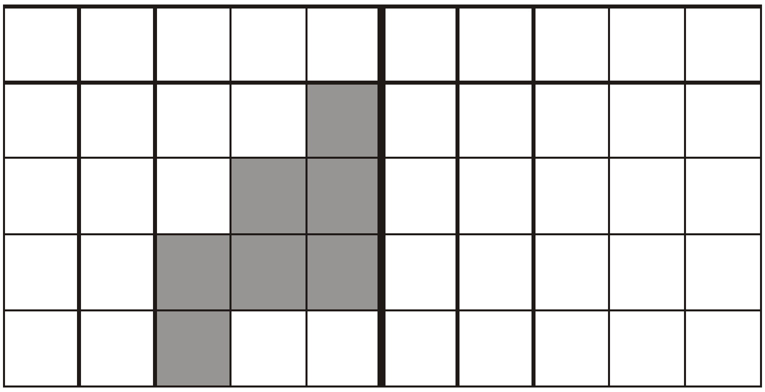
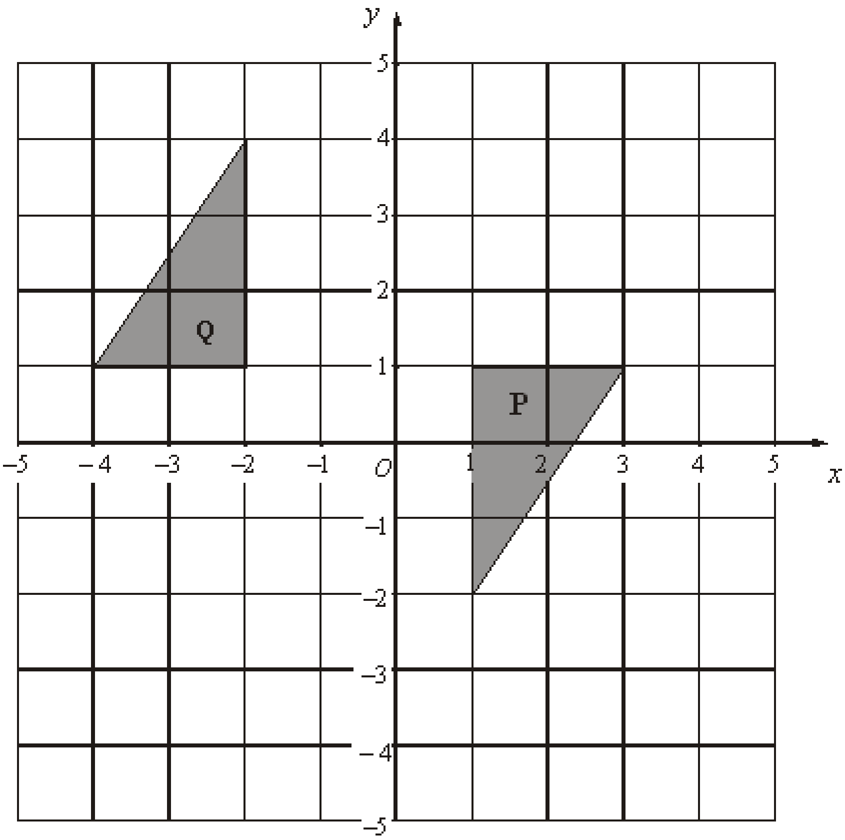
**Q1.** (a) Reflect the shaded shape in the mirror line.



**(1)**

(b) Describe the single transformation that moves shape **P** to shape **Q**.

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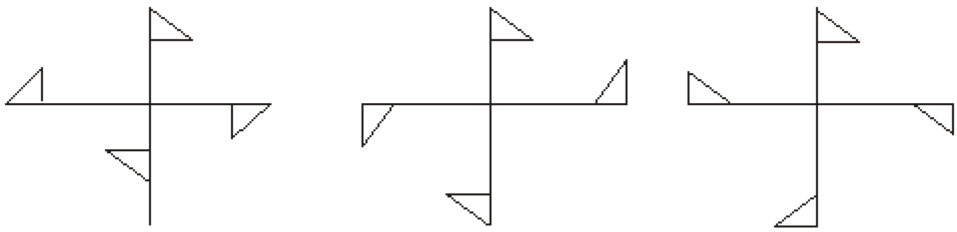
**(2)**
**(Total 3 marks)**

**Q2.** (a) Draw all the lines of symmetry of this shape.

**(1)**

(b) Which of these shapes has rotational symmetry?

A B C

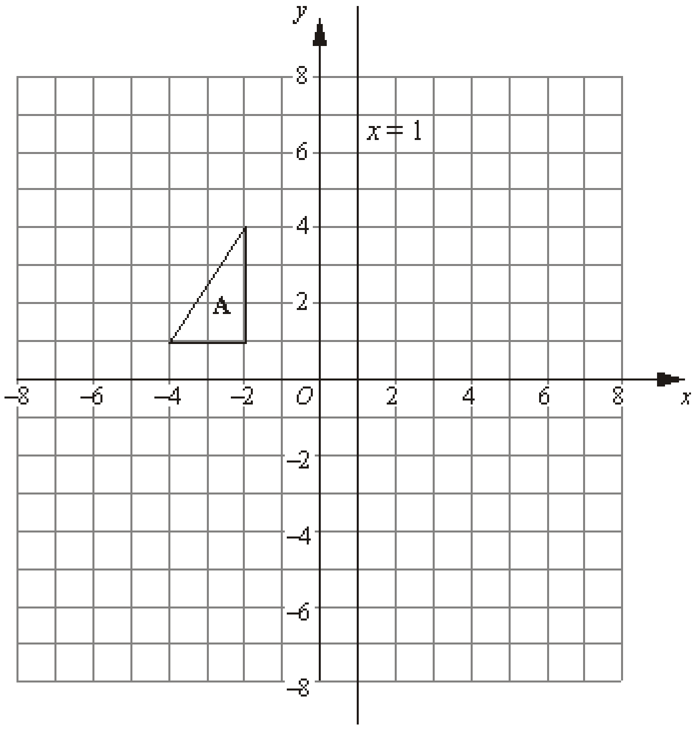


**(1)**

(c) In the space below, draw a shape that has line symmetry and rotational symmetry order 3.

**(2)**
**(Total 4 marks)**

**Q3.**




Triangle **A** is reflected in the $x$-axis to give triangle **B**.
Triangle **B** is reflected in the line $x$ = 1 to give triangle **C**.

Describe the **single** transformation that takes triangle **A** to triangle **C**.

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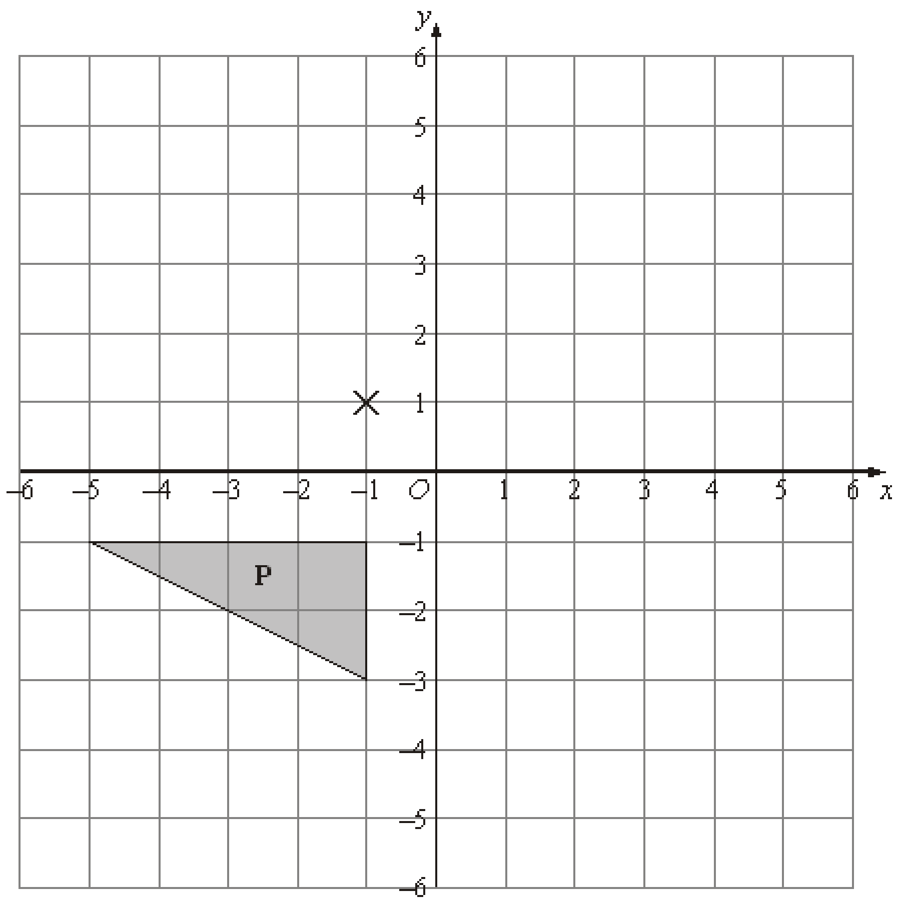
**(Total 3 marks)**

**Q4.**




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

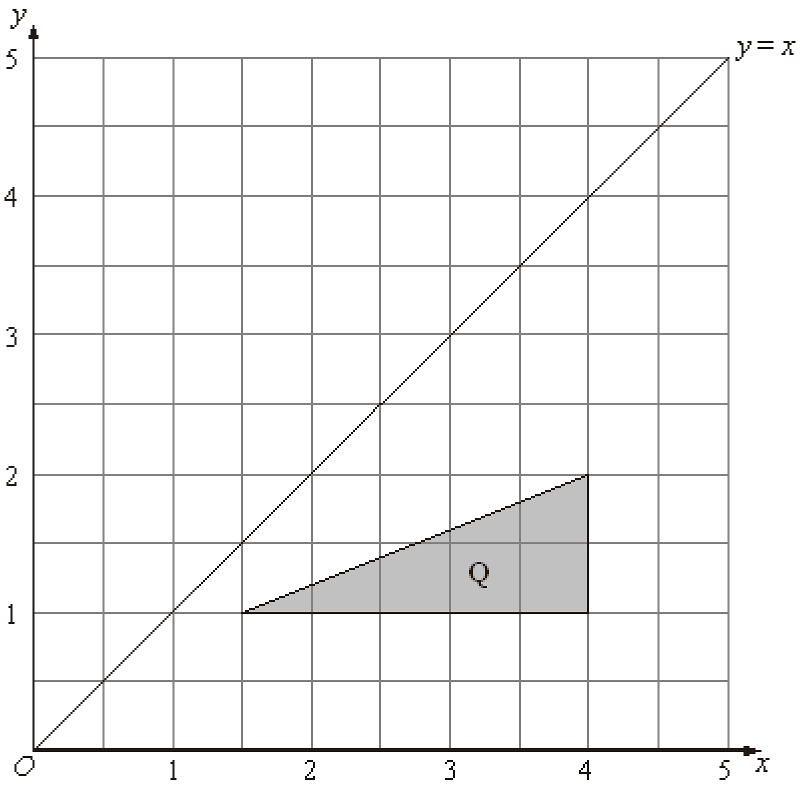
Label the new triangle **A**.

**(2)**

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

Label the new triangle **B**.

**(1)**

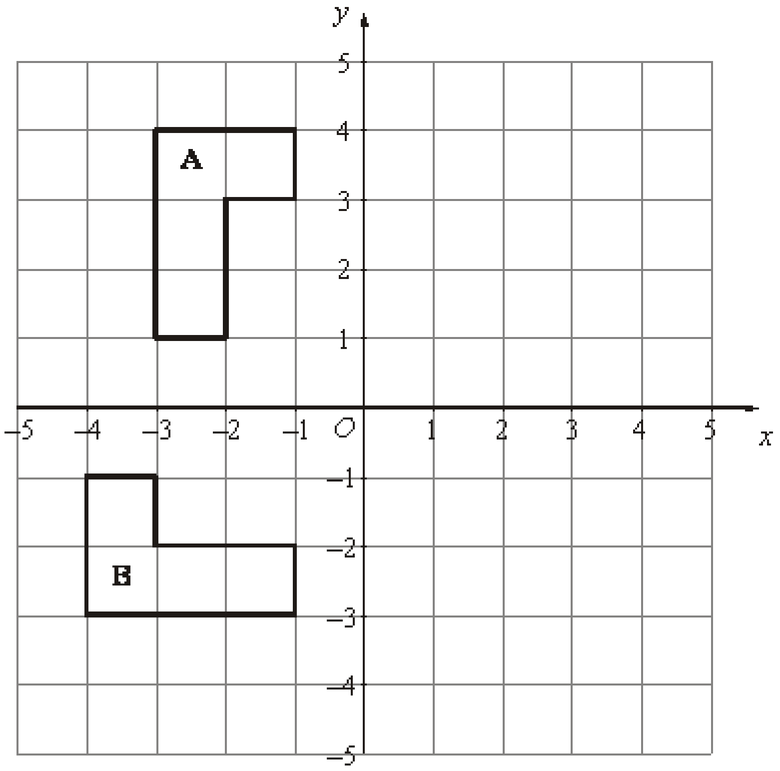



(c) Reflect triangle **Q** in the line $y = x$.

Label the new triangle **C**.

**(2)**
**(Total 5 marks)**

**Q5.**




(a) Reflect shape **A** in the *y* axis.

**(2)**

(b) Describe fully the **single** transformation which takes shape **A** to shape **B**.

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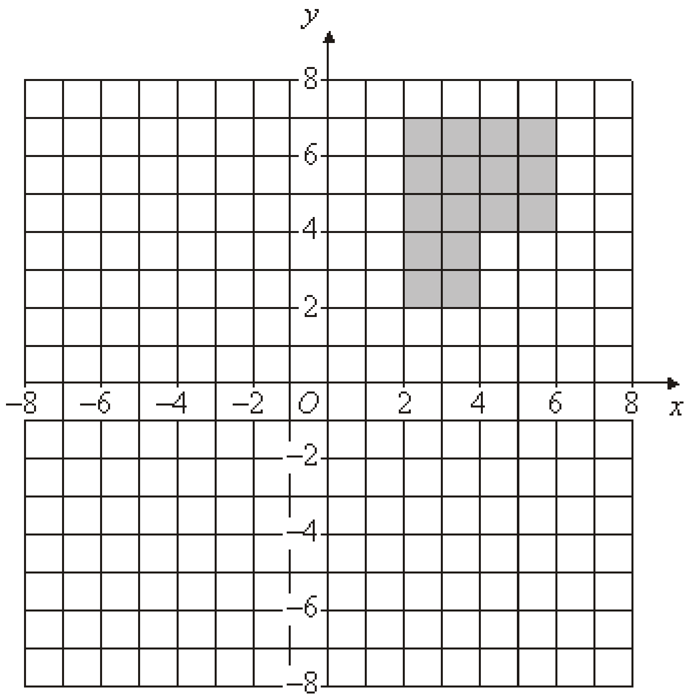
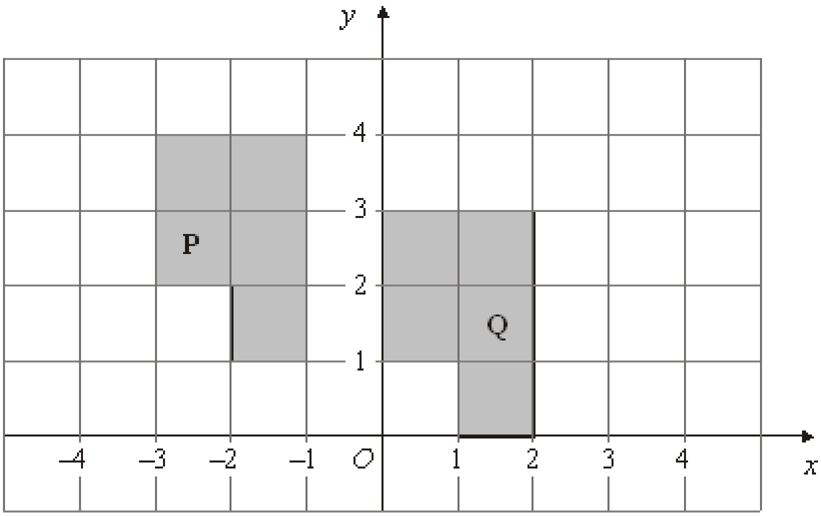
**(3)**
**(Total 5 marks)**




**Q6.**

(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**.

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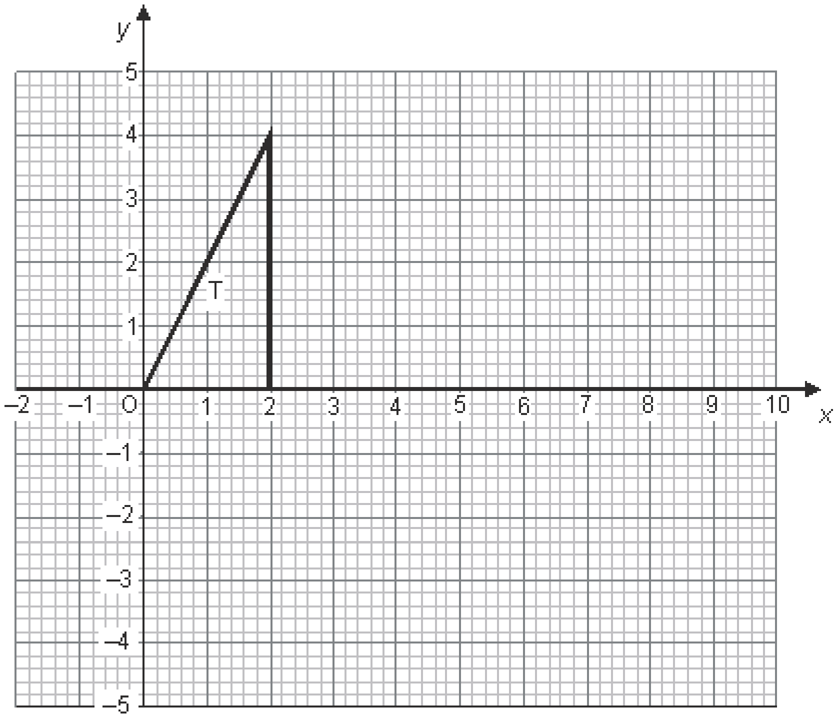
**(2)**
**(Total 4 marks)**

**Q7.**




The shape ***T*** is rotated by 180° about the point (3, 0) to give the shape ***U***.

The shape ***U*** is rotated by 180° about the point (6, 0) to give the shape ***V***.

Describe fully the single transformation that will map shape ***T*** to shape ***V***.

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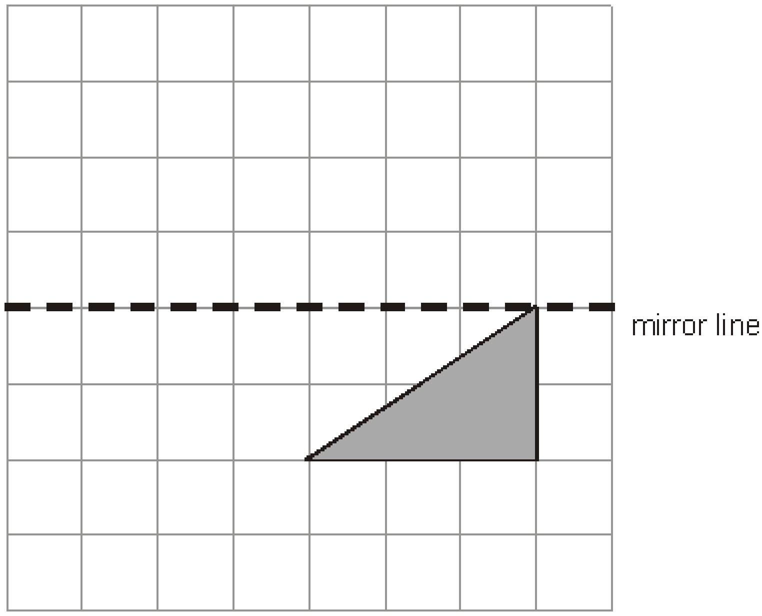
**(Total 3 marks)**

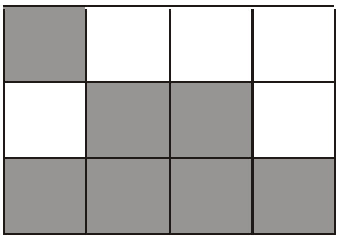



**Q8.**

(a) Reflect the shaded shape in the mirror line.

**(1)**

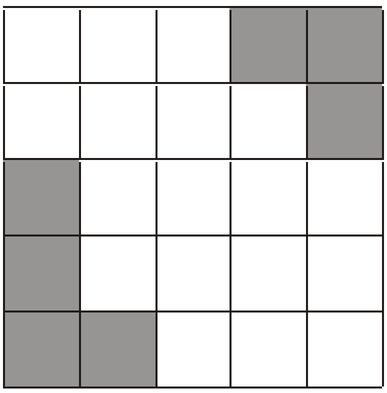
Here is a pattern made with squares.



(b) Shade one square to make a black and white pattern with only **one** line of symmetry.

**(1)**

Here is another pattern made with squares.



(c) Shade **three** more squares to make a pattern with rotational symmetry of order 2.

**(1)**

**(Total 3 marks)**

**M1.**

| | Working | Answer | Mark | Additional Guidance |
|---|---|---|---|---|
| (a) | | Correct reflection | 1 | **B1** cao |
| (b) | | Rotation 180º centre (–0.5, 1) | 2 | **B2** for all 3 attributes<br><br>**B1** for any two of the three attributes |
| **Total for Question: 3 marks** | | | | |

**M2.**

| | Working | Answer | Mark | Additional Guidance |
|---|---|---|---|---|
| (a) | | Vertical and horizontal lines of symmetry only | 1 | **B1** cao (– 1 for extra lines drawn) |
| (b) | | B | 1 | **B1** cao |
| (c) | | Eg. Equilateral triangle | 2 | **B2** for any shape satisfying both criteria<br><br>[B1 for a shape with rotation al symmetry of order 3 with no line symmetry] |
| **Total for Question: 4 marks** | | | | |

**M3.**

| Working | Answer | Mark | Additional Guidance |
|---|---|---|---|
| **B** at (– 2, –1),<br>(– 4, –1),<br>(– 2, –4)<br><br>**C** at (4, –1),<br>(6, –1), (4, –4) | Rotation 180° about (1, 0) | 3 | **B1** for rotation<br>**B1** for 180°<br>**B1** for centre (1,0)<br><br>**OR**<br><br>**B1** Enlargement<br>**B1** Scale Factor –1<br>Accept – 1 on its own if it is clear candidate is describing an enlargement<br>**B1** Centre (1,0)<br><br>Ignore diagram unless no marks scored, in which case SC **B1** for showing both **B and C** correctly<br><br>NB Award no marks for the description if more than one transformation is given |
| | | | **Total for Question: 3 marks** |

**M4.**

| | Working | Answer | Mark | Additional Guidance |
|---|---|---|---|---|
| (a) | Triangle A | Triangle with vertices (–1,5), (–1, 3), (3, 3) | 2 | **B2** for triangle with vertices<br>(–1, 5), (–1, 3), (3, 3)<br>(**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 | **B2** for triangle with vertices<br>(1, 1.5), (1, 4), (2, 4)<br>(**B1** for the triangle with correct orientation or for |

| | | | | |
|---|---|---|---|---|
| | | (2, 4) | | any two of the vertices (1, 1.5), (1, 4), (2, 4))<br><br>SC: **B1** for a triangle with vertices (1, 1.5), (1, $k$), (2, $k$) |
| **Total for Question: 5 marks** | | | | |

**M5.**

| | Answer | Mark | Additional Guidance |
|---|---|---|---|
| (a) | | 2 | **B2** correct reflection<br>(**B1** correct reflection in the line $x = k, k \neq 0$) |
| (b) | Rotation<br>90° about the centre (0,0) | 3 | **B1** for rotation<br>**B1** for 90° (anticlockwise) or 270 clockwise or ¼ turn (anticlockwise) or ¾ turn clockwise<br>**B1** for (0,0) or *O* or origin<br>NB: a combination of transformations gets B0 |
| **Total for Question: 5 marks** | | | |

**M6.**

| | Answer | Mark | Additional Guidance |
|---|---|---|---|
| (a) | Vertices at<br>(2, –2), (7, –2), (7, –6),<br>(4, –6), (4, –4), (2, –4) | 2 | **B2** for a fully correct rotation<br>[**B1** for correct shape with correct orientation<br>**OR** a 90° anticlockwise rotation about *O*<br>**OR** a 180° rotation about *O*<br>**OR** for any 3 correct sides in the correct position] |

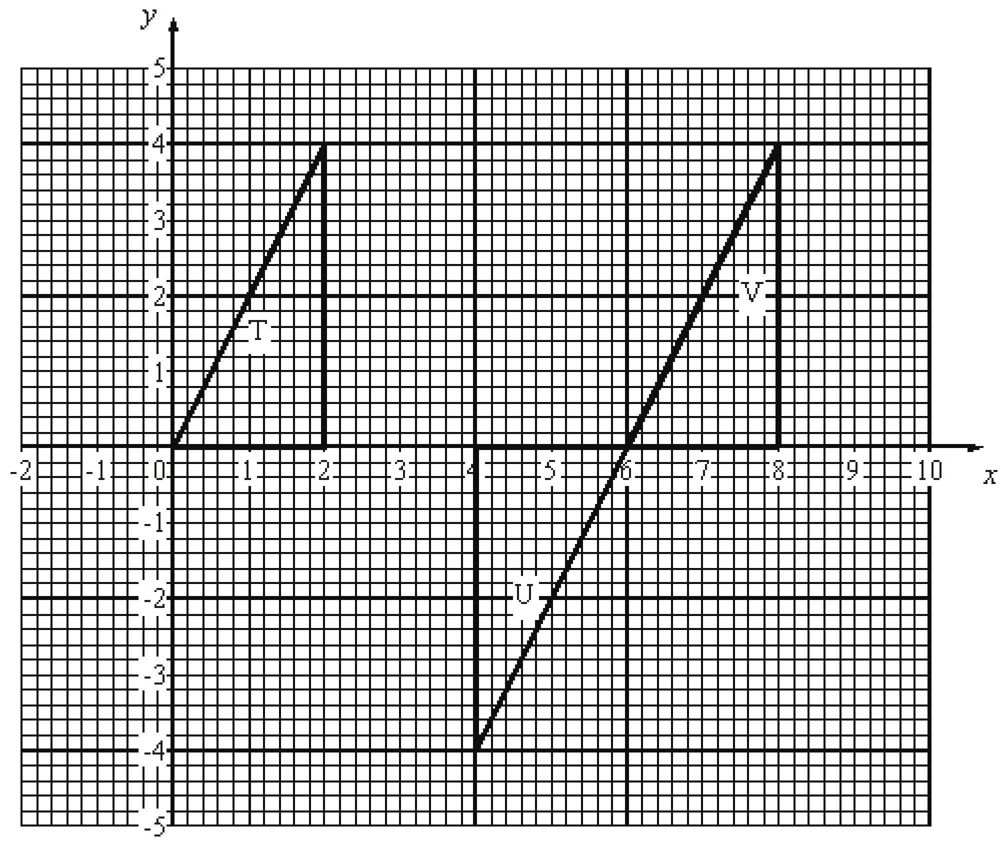
| | | | |
|---|---|---|---|
| (b) | Translation by $\begin{pmatrix} 3 \\ -1 \end{pmatrix}$ | 2 | **B1** for translation<br>**B1** (indep) for $\begin{pmatrix} 3 \\ -1 \end{pmatrix}$ or 3 right and 1 down |
| | | | **Total for Question: 4 marks** |

**M7.**

| Working | Answer | Mark | Additional Guidance |
|---|---|---|---|

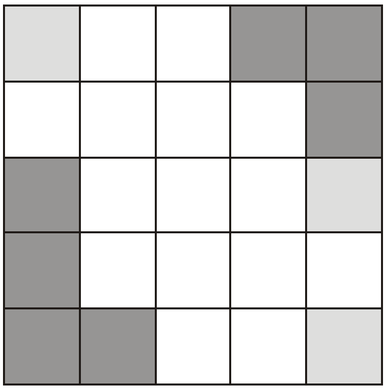
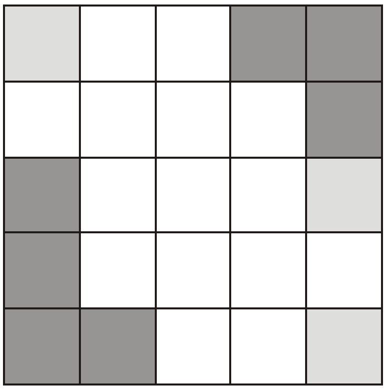
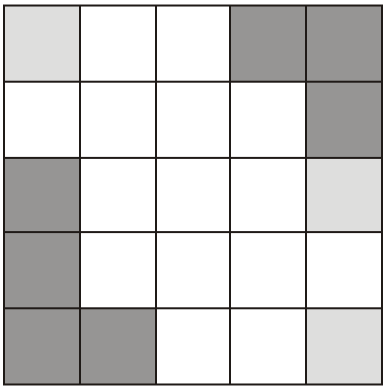
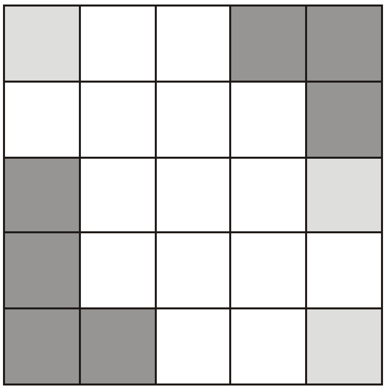
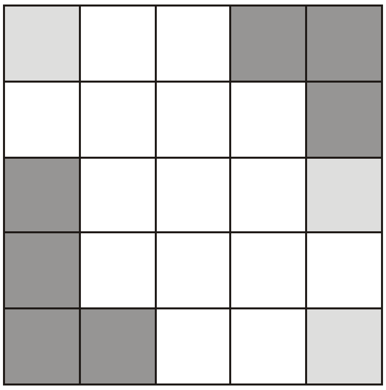
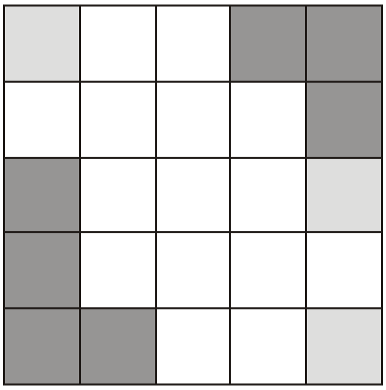
| | | | | |
|---|---|---|---|---|
| | Rotates shape about (3,0) by 180° to give ***U***<br><br>Rotates ***U*** about (6, 0) to give ***V***<br><br>(see graph at end) | Translation | 3 | |

| |
|---:|
| **Total for Question: 3 marks** |




**M8.**

| | Working | Answer | Mark | Additional Guidance |
|---|---|---|---|---|
| (a) | | Correct reflection | 1 | **B1** cao |
| (b) | | Correct square | 1 | **B1** cao |
| (c) | See pattern at end | Correct square | 1 | **B1** cao |
| | | | | **Total for Question: 3 marks** |

**E3.** Many candidates could not carry out the transformations correctly. The main error was to reflect the triangle in the $y$ axis followed by a reflection in the line $x = 1$. A different error was to identify the correct axis but to carry out the reflection incorrectly with the image being 2 squares below the $x$ axis instead of the correct 1 unit. A few candidates gave two transformations and consequently gained no marks for the description. Some gave the centre as (0, 1) rather than the correct (1, 0)

**E4. 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.

## E5. Foundation

Most candidates (85%) accurately reflected shape A in the $y$ axis. A small proportion attempted rotations or translations instead. Fully correct descriptions of a single transformation in part (b) were rarely seen with only 4% of candidates gaining all 3 marks. Many answers were spoiled by candidates giving a combination of transformations. Where candidates did give a single transformation it was usually a rotation and the angle was often given correctly. Few candidates gave the centre of rotation. Almost 60% of candidates were awarded at least 1 mark for their answer to part (b) of this question. Again, it proved to be a good discriminator.

### Higher

Most candidates were able to reflect the given shape correctly in the $y$-axis in part (a).

In part (b) many candidates failed to score full marks as a result of the omission of one piece of information; usually the centre of rotation.

A significant number of candidates failed to score any marks at all by offering a combination of transformations; usually a rotation followed by a translation.

## E6. 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 90° clockwise rotation, or by embedding their answer within other rotations- typically all three of 90°, 180° and 270° 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.