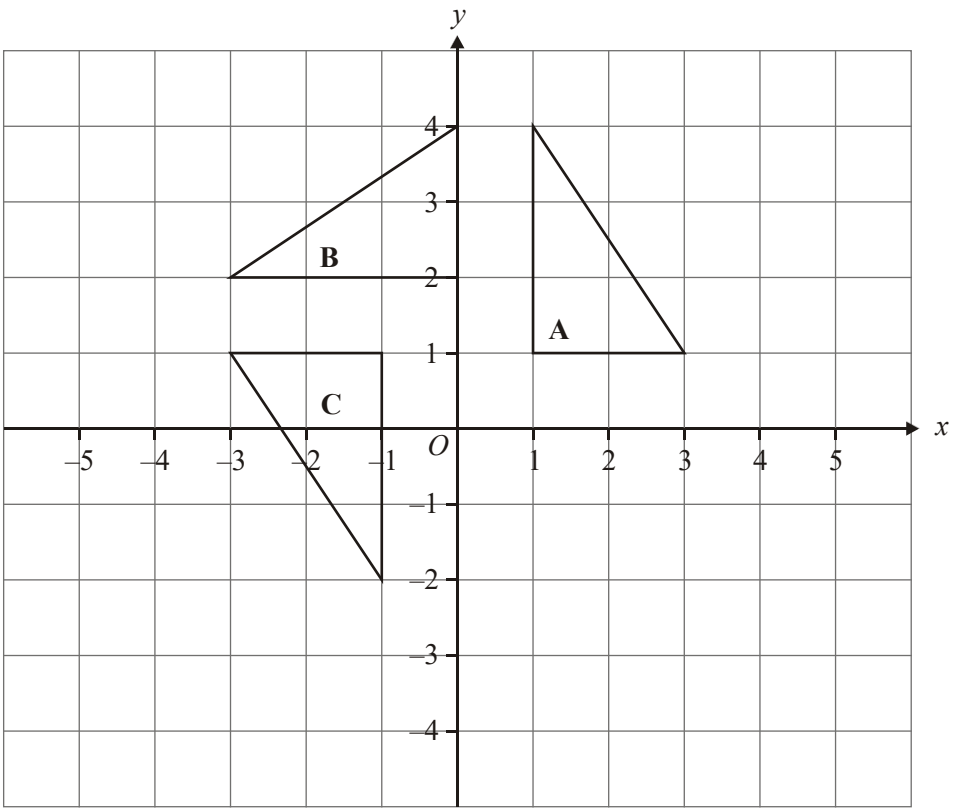
1.



Shape **A** is rotated 90° anticlockwise, centre (0, 1), to shape **B**

Shape **B** is rotated 90° anticlockwise, centre (0, 1), to shape **C**

Shape **C** is rotated 90° anticlockwise, centre (0, 1), to shape **D**

(a) Mark the position of Shape **D**

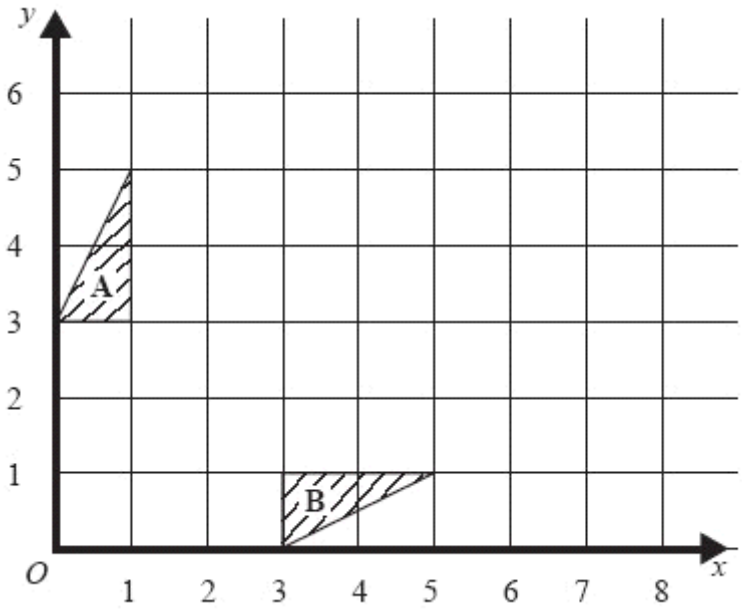
(2)

(b) Describe the single transformation that takes shape **C** to shape **A**.

.....

(2)
(Total 4 marks)

2.



Triangle **A** and triangle **B** have been drawn on the grid.

(a) Reflect triangle **A** in the line $x = 3$.
Label this image **C**.

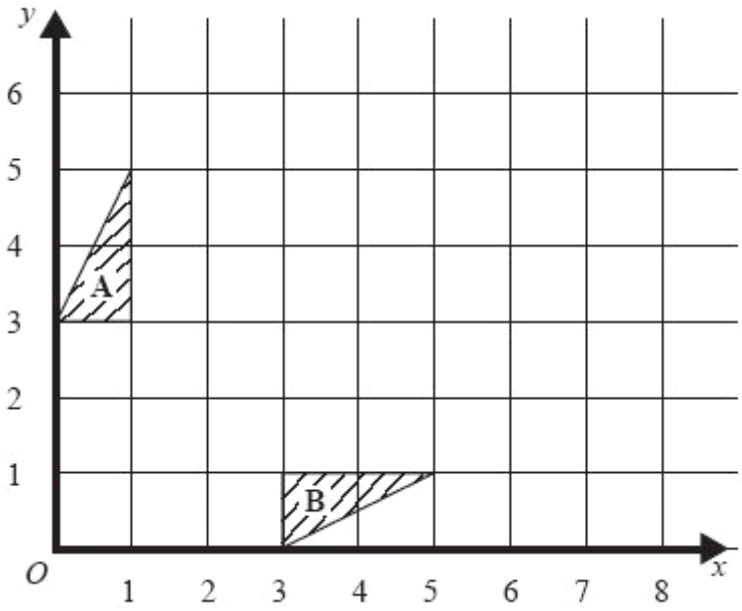
(2)

(b) Describe fully the single transformation which will map triangle **A** onto triangle **B**.

……..

(2)
(Total 4 marks)

3.



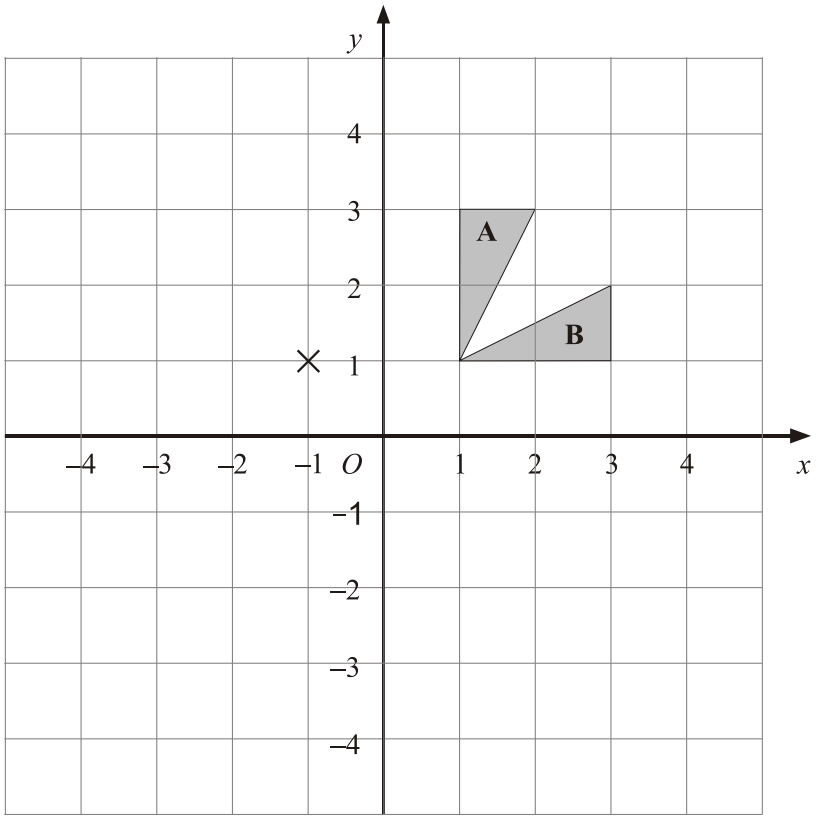
Triangle **A** and triangle **B** have been drawn on the grid.

Describe fully the single transformation which will map triangle **A** onto triangle **B**.

……...……

(Total 2 marks)

4.



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

.....

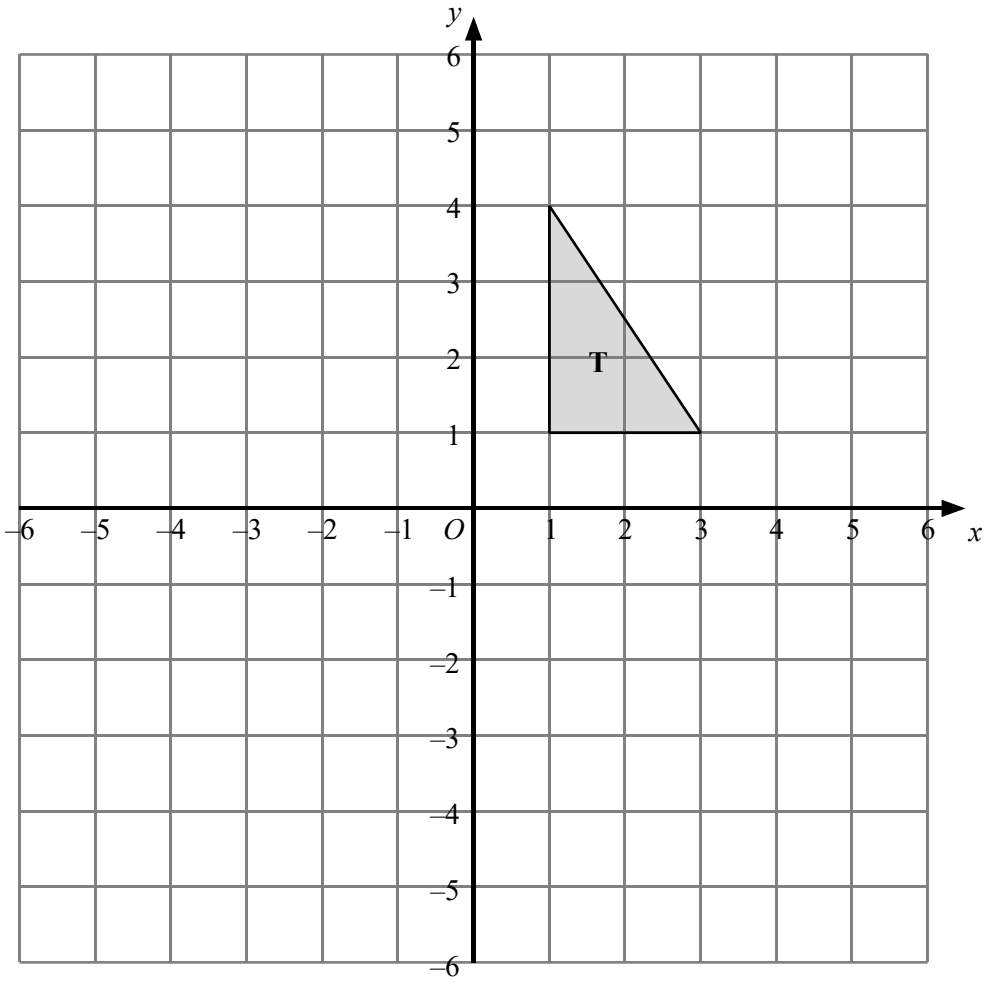
(2)

(b) On the grid, rotate triangle **A** 90º anticlockwise about the point (–1, 1)

Label your new triangle **C**.

(2)
(Total 4 marks)

5.



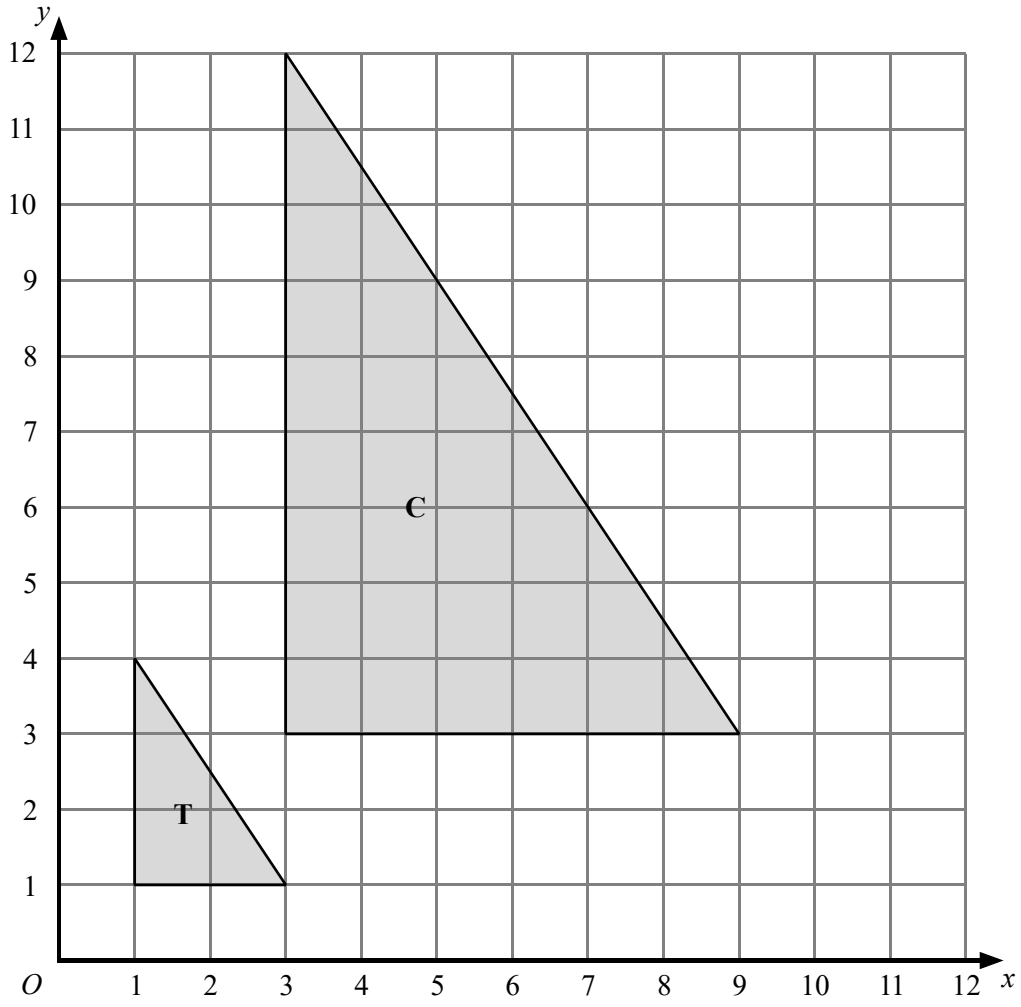
Triangle **T** has been drawn on the grid.

(a) Reflect triangle **T** in the *y*-axis.
Label the new triangle **A**.

(1)

(b) Rotate triangle **T** by a half turn, centre *O*.
Label the new triangle B.

(2)



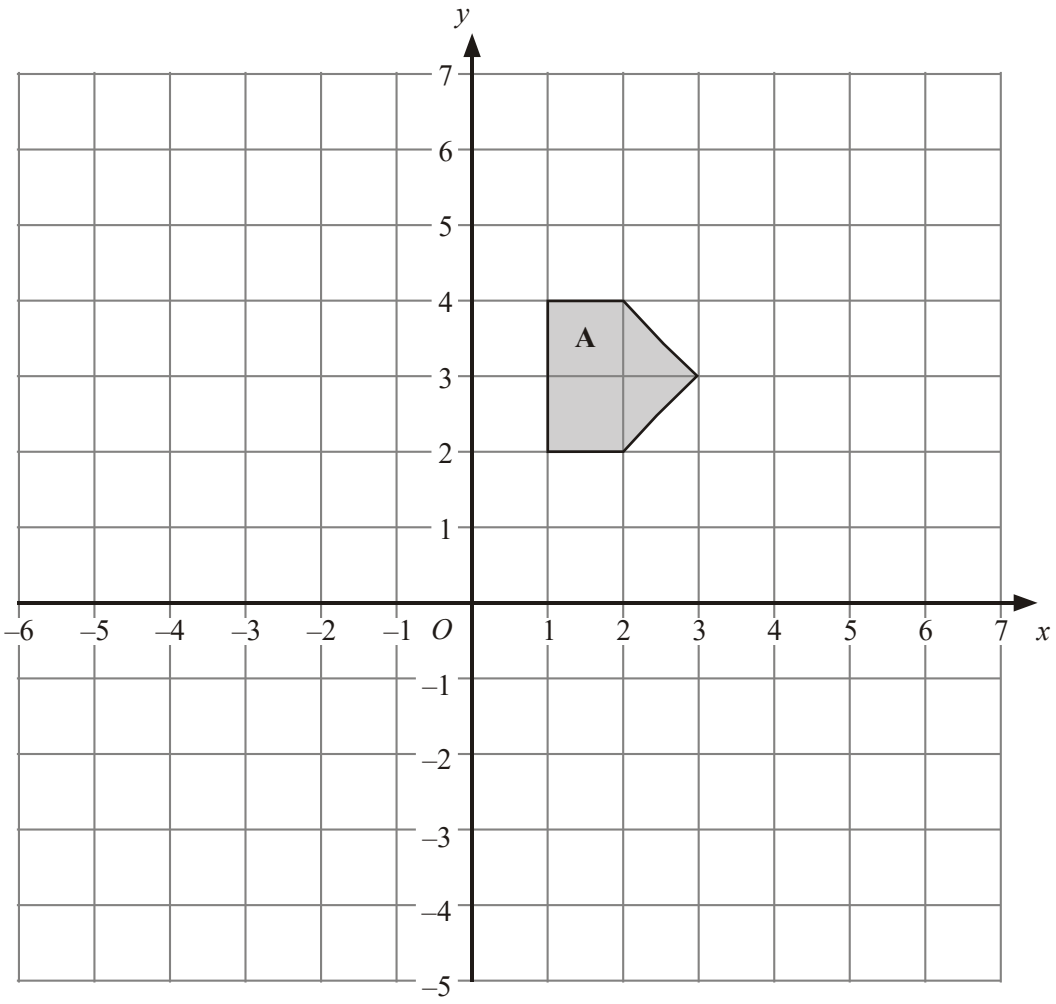
(c) Describe fully the single transformation which maps triangle **T** onto triangle **C**.

.....

.....

(3)
(Total 6 marks)

6.



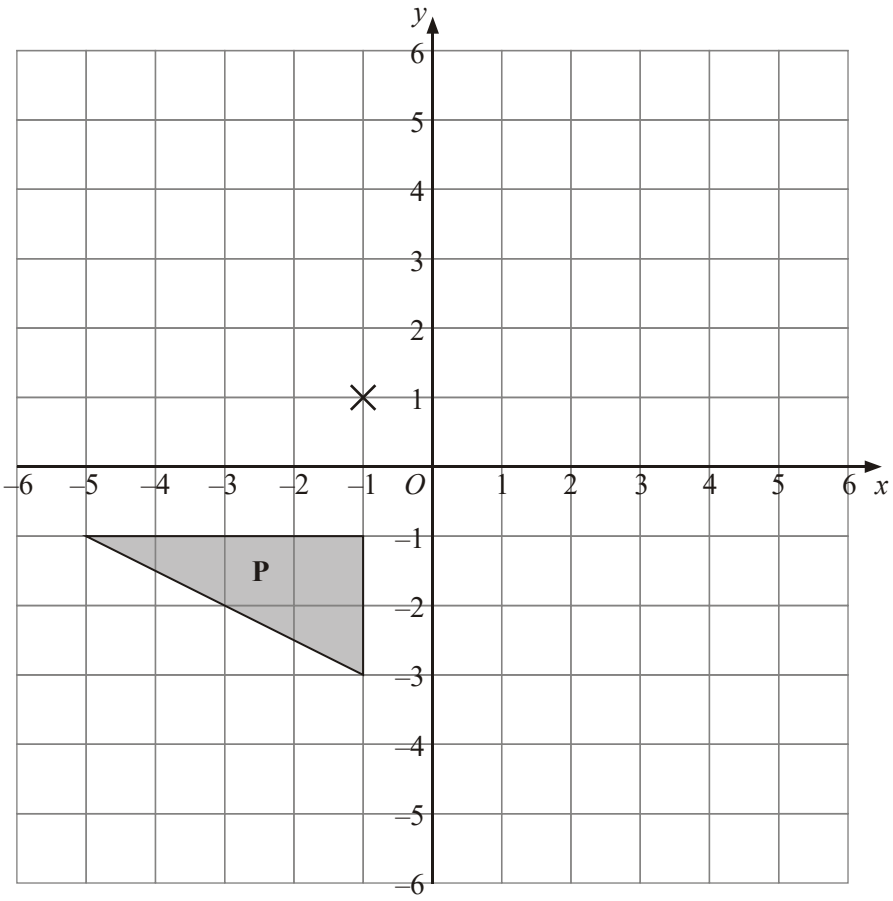
(a) Reflect Shape **A** in the *y* axis.
Label your new shape **B**.

(2)

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

(2)
(Total 4 marks)

7.



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

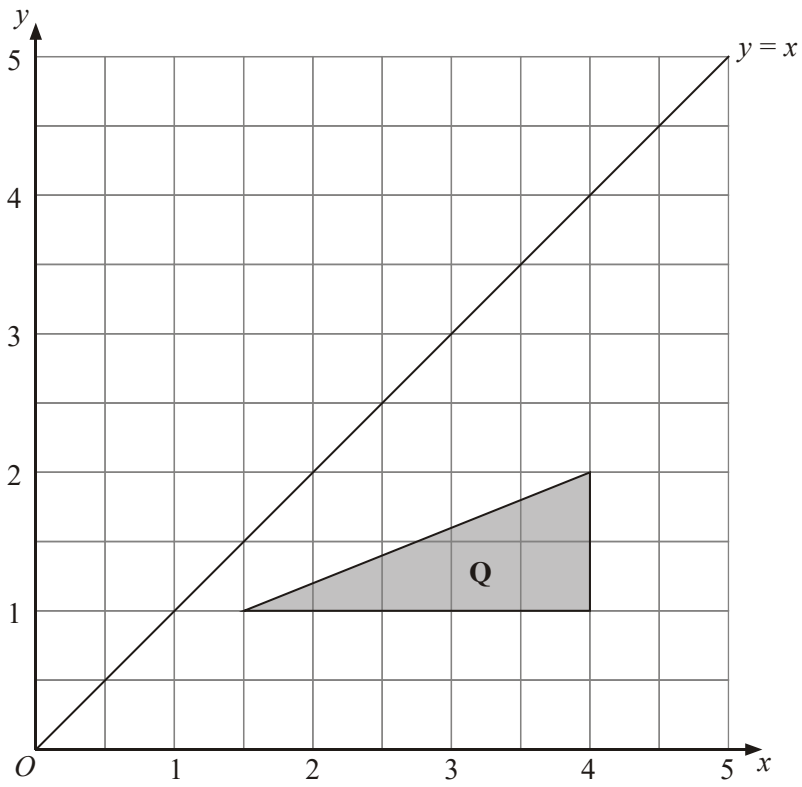
Label the new triangle **A**.

(2)

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

Label the new triangle **B**.

(1)

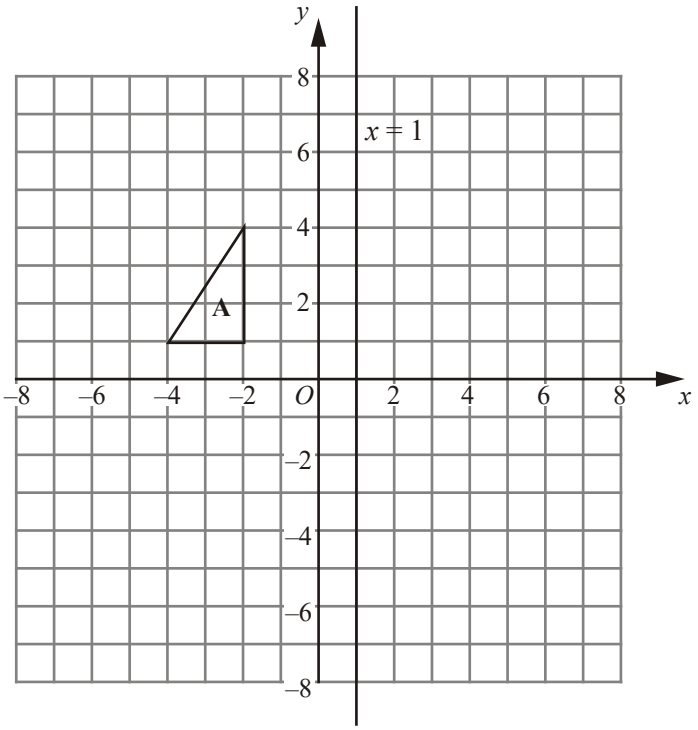


(c) Reflect triangle **Q** in the line $y = x$.

Label the new triangle **C**.

(2)
(Total 5 marks)

8.



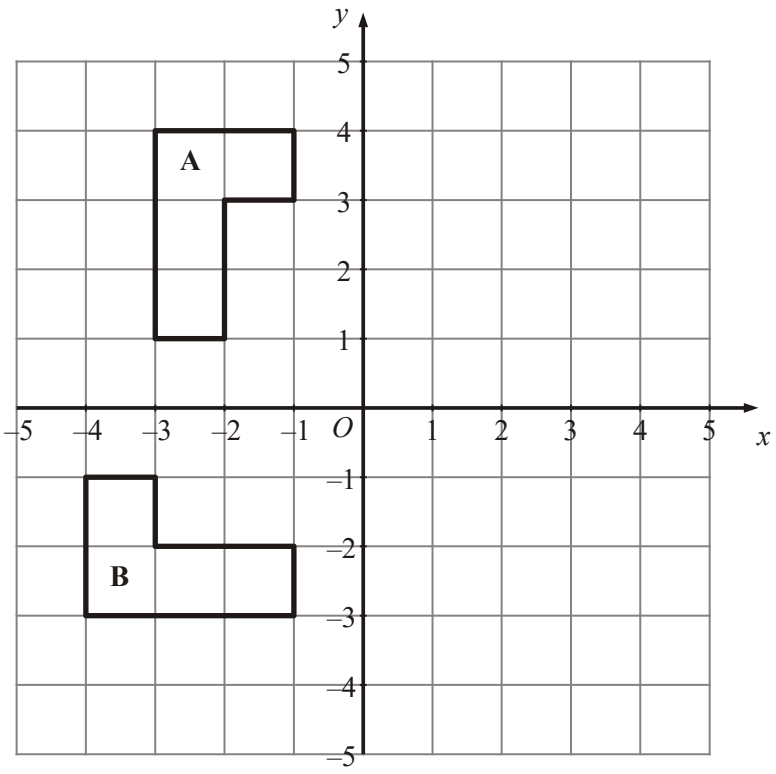
Triangle **A** is reflected in the x-axis to give triangle **B**.
Triangle **B** is reflected in the line $x = 1$ to give triangle **C**.

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

.....

(Total 3 marks)

9.



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

(2)

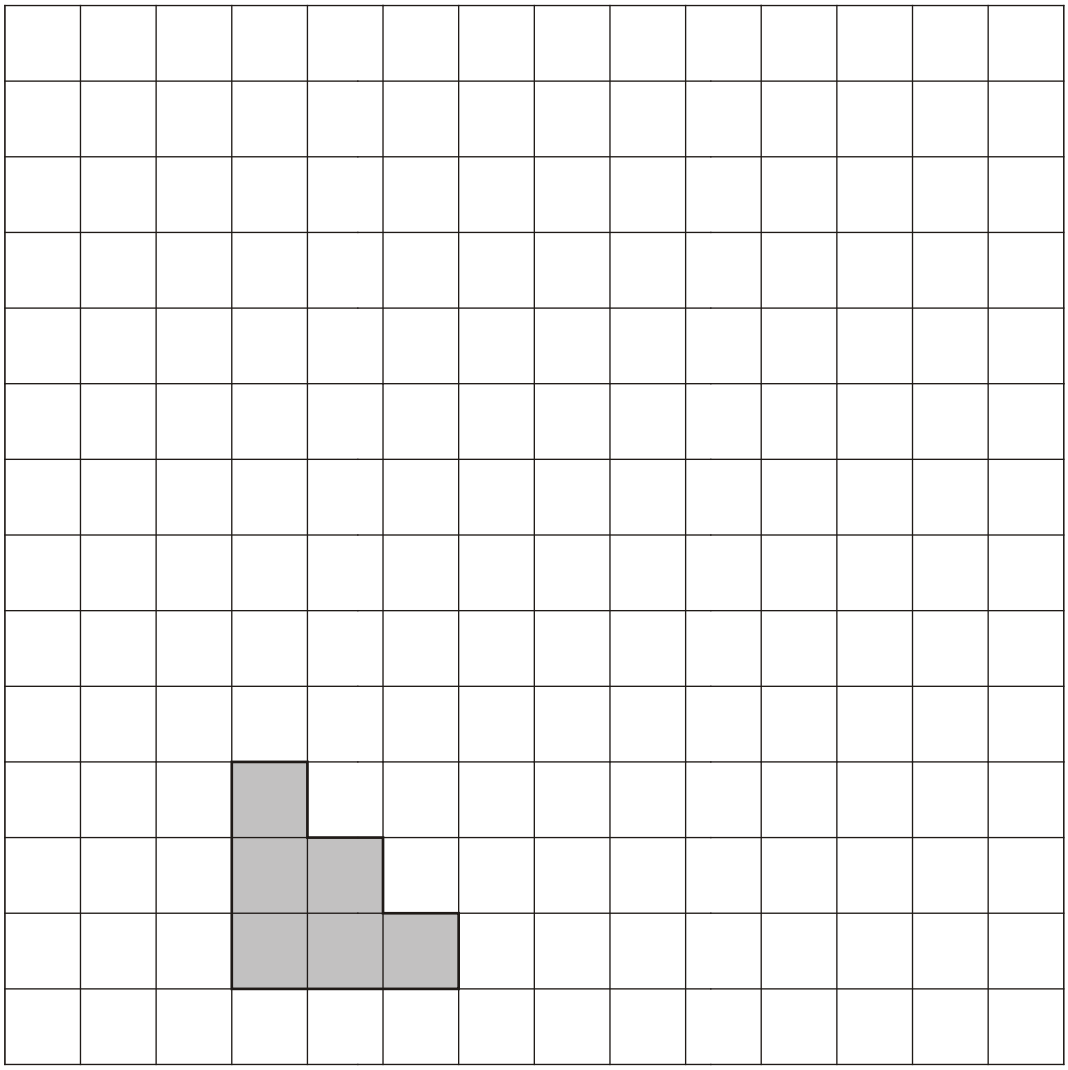
(b) Describe fully the **single** transformation which takes shape **A** to shape **B**.

.....

(3)

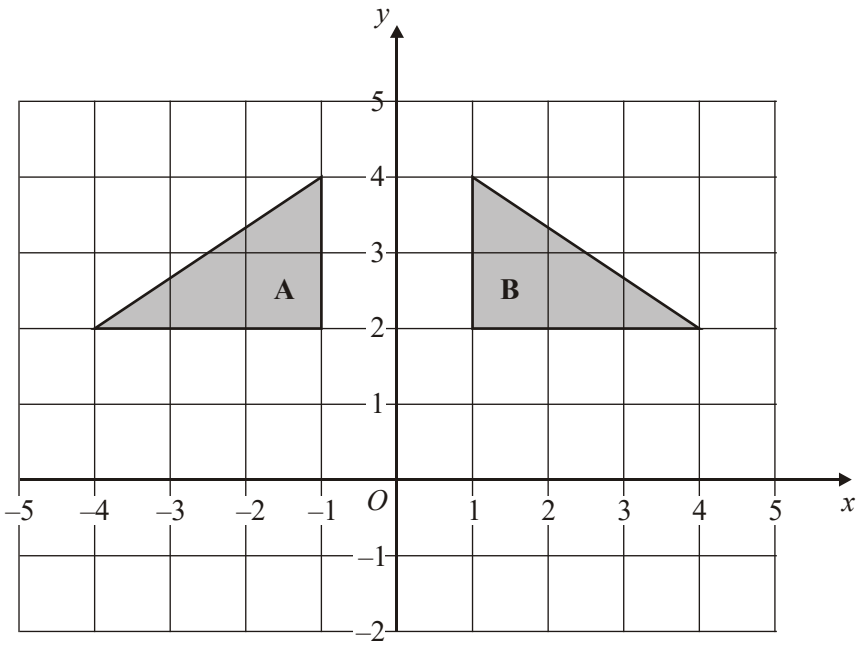
(Total 5 marks)

10.



(a) On the grid, draw an enlargement, scale factor 2, of the shaded shape.

(2)

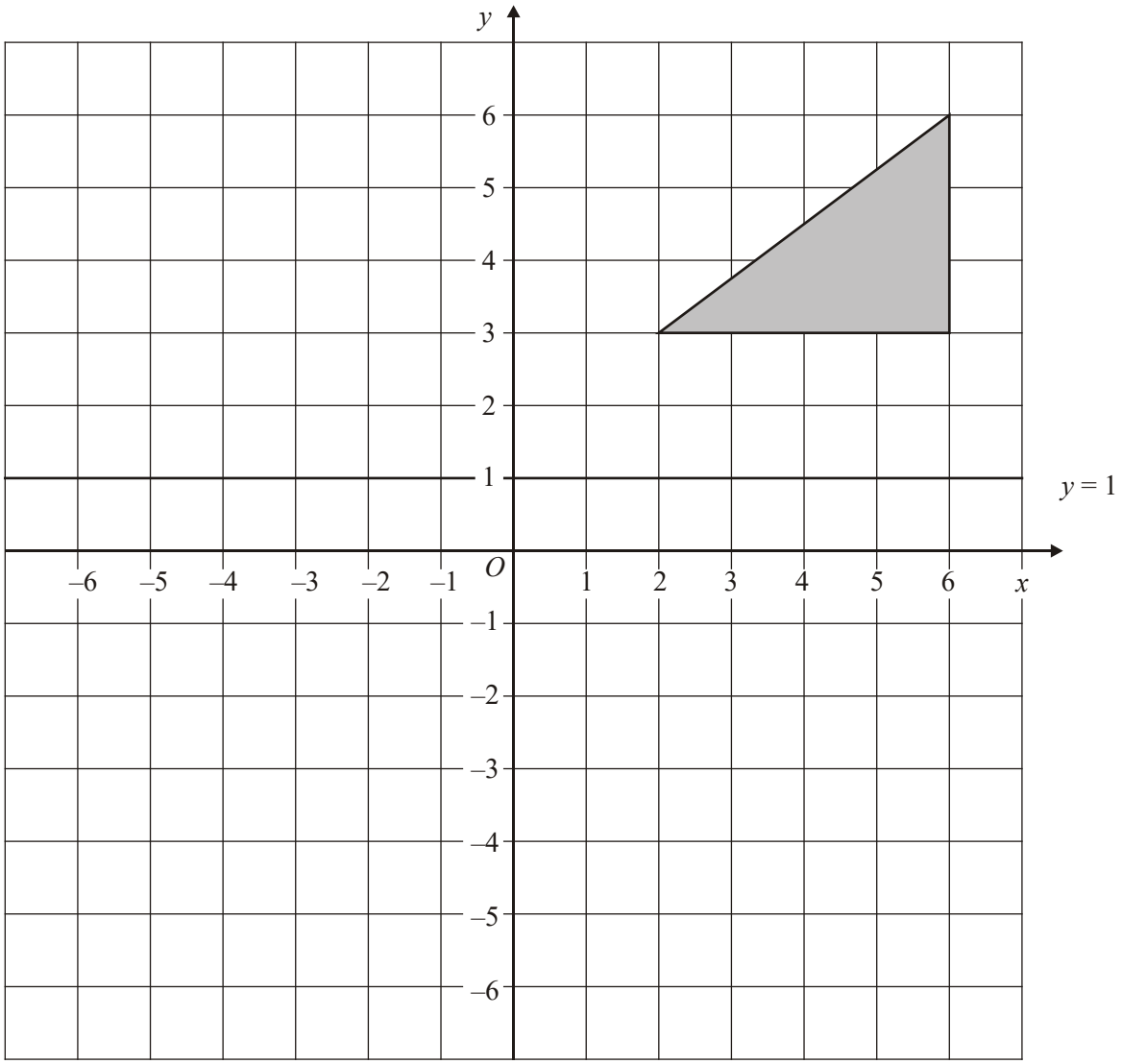


(b) Describe fully the single transformation that maps triangle **A** onto triangle **B**.

.....

(2)
(Total 4 marks)

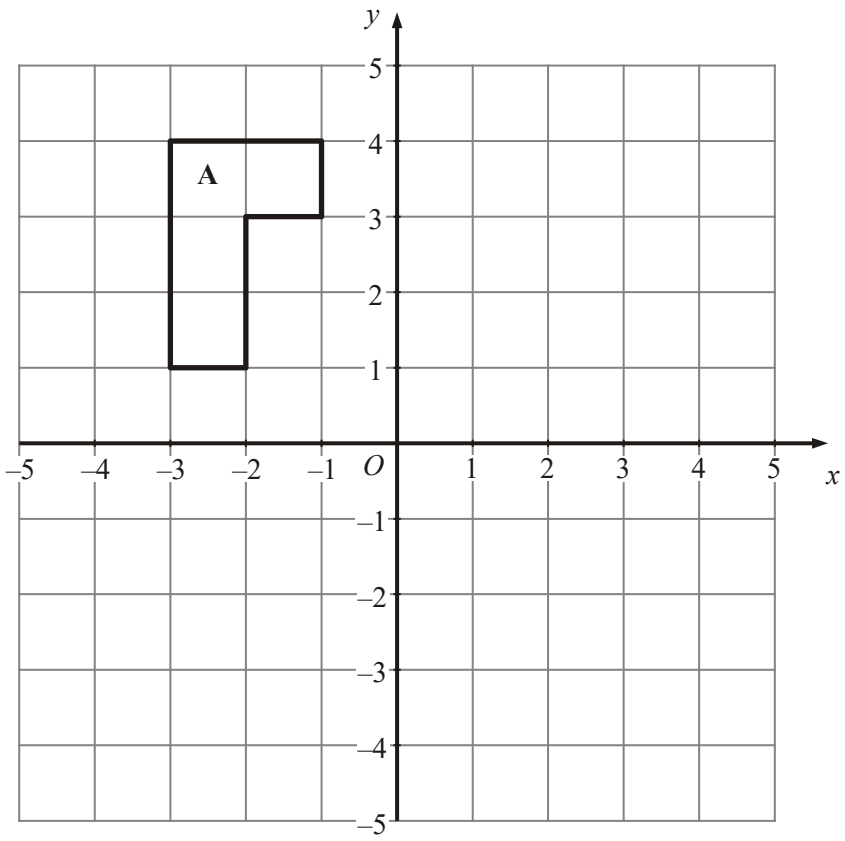
11.



Reflect the triangle in the line $y = 1$

(Total 2 marks)

12.



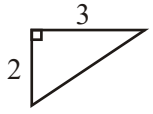
Reflect shape **A** in the *y* axis.

(Total 2 marks)

1. (a) Triangle with vertices at (0, 0) (0, –2) and (3, 0) 2

M1 for correct orientation
A1 cao

(b) Rotation, 180°, centre (0, 1)
Enlargement sf –1 centre (0, 1) 2



B2 for 180° 'rotation' centre (0, 1) or
for Enlargement sf – 1 centre (0, 1)
(B1 for any two of the three parts)
NB: B0 if additional transformation is included

[4]

2. (a) correct reflection 2

B2 (B1 reflection in line other than x = 3)

(b) reflection in $y = x$ 2

B2 cao Accept the word "reflected"
(B1 any statement including the word "reflection")

[4]

Reflect the triangle in the line $y = 1$

(Total 2 marks)

3. reflection in $y = x$ 2

B2 cao accept the word "reflected"
(B1 any statement including the word "reflection")

[2]

4. (a) reflection 2

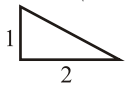
B1 for reflection

line $y = x$

B1 for line y = x
(if B0 then B1 for line y = x drawn on diagram)

(b) Triangle with vertices at (–1, 3), (–3, 3) and (–3, 4) 2

M1 for correct orientation or for a rotation of 90° clockwise about (–1, 1)



A1 cao

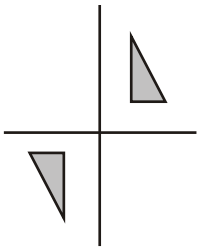
[4]

5. (a)

Reflection in *y*-axis 1

B1 cao

(b)



Rotation by half turn about (0, 0) 2

B2 cao

(B1 for half turn not about (0, 0).)

(c) Enlargement
Scale factor 3
Centre (0,0) 3

B1 for 'enlargement'
B1 for "scale factor 3" or 3 seen
B1 for 'centre (0, 0)

[6]

6. (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]

7. (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]

8. **B** at (– 2, – 1), (– 4, – 1) (– 2, – 4)

C at (4, – 1), (6, – 1), (4, – 4)

Rotation 180° about (1, 0) 3

B1 for rotation
B1 for 180°
B1 for centre (1, 0)

OR

B1 Enlargement
B1 Scale Factor –1 Accept – 1 on its own if it is clear candidate is describing an enlargement
B1 Centre (1, 0)

Ignore diagram unless no marks scored, in which case
SC B1 for showing both B and C correctly

NB Award no marks for the description if more than one transformation is given

[3]

9. (a) 2

B2 correct reflection
(B1 correct reflection in the line $x = k$, $k \neq 0$)

(b) Rotation
90° about the centre (0, 0) 3

B1 for rotation
B1 for 90° (anticlockwise) or 270 clockwise or ¼ turn (anticlockwise) or ¾ turn clockwise
B1 for (0,0) or O or origin
NB: a combination of transformations gets B0

[5]

10. (a) Correct shape 2

B2 for correct shape; any orientation.
(B1 for any two sides correct or all correct for scale factor other than 1 or 2), tolerance to within half square

(b) Reflection in line
$x = 0$ 2

B1 for reflection, reflect, reflected.
B1 for line x = 0 or y-axis
NB: more than one transformation should be awarded 0 marks.

[4]

11. Vertices at (2,–1), (6,–1), (6,–4) 2

B2 cao
(B1 for a correct reflection in a horizontal line OR 2 correctly reflected points)

[2]

12. B2 correct reflection 2

(B1 correct reflection in the line $x = k$, $k \neq 0$)

1. **Paper 3**

The first part of this question was well attempted, with nearly all candidates gaining some credit. The most common error was in placing the corner of the triangle at (1, –1). In part (b) it was encouraging to see far fewer candidates using "turn" instead of "rotation". Most gave a realistic attempt at a detailed description, resulting in the award of marks, far better than in previous years. The most common omission was the mention of the centre of rotation. There was clear evidence that candidates who used tracing paper achieved greater success in this question.

Paper 5

Most candidates correctly marked the position of triangle D and described the correct single transformation in part (b) although some descriptions were not full enough or involved a wrong angle of rotation. Fewer descriptions involved more than one transformation, which is an improvement on previous years.

2. Most candidates were able to reflect shape A in a line, but not always the correct line. Many reflected A in the line $x = 2$. In part (b) many candidates correctly identified it as a reflection. However, many candidates also spoilt their answers: the question clearly asked for a description of a *single* transformation. Those candidates who gave descriptions relating to more than one transformation could not be given any marks, since such a choice meant that it was ambiguous as to which transformation the candidate wanted to be considered as the "single" transformation. Centres are advised to emphasise this in preparing future candidates.

3. Only about half of the candidates were able to get full marks on this question. Some did not give a single transformation, whilst others, having drawn the line of reflection $y = x$, were unable to name it. 'Rotation' was a common error.

4. **Paper 5523**

This question was answered surprisingly poorly. In part (a), very few candidates gave a fully correct description of the transformation. The most common error was to describe it as a rotation and the word 'flipped' was used by many candidates. 'Reflection' was not seen as often as expected and was frequently on its own or accompanied by a centre or angle instead of the equation of the line. In part (b), the most common response was to rotate the triangle 90 ° anticlockwise but about an incorrect centre. Even though the point (-1, 1) was marked on the diagram with a cross the triangle was frequently rotated about (1, 1) or (0, 0). Some used the correct angle and centre but rotated the triangle clockwise.

Paper 5525

In part (a), many candidates were able to identify the transformation as a reflection (comparatively few describing this as 'mirrored' or 'symmetrical'). Some attempted to give more complex transformations involving two stages; whilst others, having difficulty in defining the equation of the line $y = x$, listed the coordinates (1, 1), (2, 2), (3, 3) … In part (b), the vast majority of candidates were able to draw triangle C with the correct orientation and most could locate it correctly. A common error in the location of triangle C was to have (–1, 1) as a vertex.

5. Foundation Tier

Part (a) was well attempted the majority of students successfully reflecting the triangle. A common mistake was to reflect in the wrong axis or show the triangle moved one unit to the left. Candidates had less success with part (b) the rotations were often in the wrong quadrant, or had used an incorrect centre of rotation or were in the correct quadrant with the shape incorrectly aligned. Most students gained 1 mark for this response. A small minority of candidates drew a triangle in each quadrant, with no labelling and so scored no marks. Part (c) was least well answered it was rare indeed to see any candidate refer to the centre of enlargement, marks were gained for ×3 or tripled rather than using the term "scale factor 3".

Enlarged or inlarged was seen fairly often and the incorrect spelling was allowed on this occasion. Larger or made bigger were often seen but were deemed not worthy of credit.

Intermediate Tier

Part (a) was answered very well although a small number of candidates reflected the shape in the wrong line, most commonly the x-axis. The rotation in part (b) was less successful. The most common error was for the shape to be rotated by a quarter turn clockwise instead of by a half turn. Some of those candidates who did rotate by a half turn did so about a centre other than (0, 0). Most candidates gained at least one mark in part (c) but many failed to mention the centre of enlargement. Some candidates failed to refer to 'enlargement' with other, incorrect, words often used instead. There was less evidence of candidates using a combination of transformations than in the past.

6. 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.

7. 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.

8. 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)

9. 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.

10. Specification A

Foundation

In part (a) there were many correct diagrams drawn and the vast majority of candidates scored at least one mark for drawing a diagram which shows at least two of the sides enlarged correctly. Some gave an enlargement that was scale factor 3. In part (b) performance was much worse. Some recognised this as a reflection, but few stated the line of symmetry. Many appeared to think this was a rotation. Others use common language such as "flipped" or "mirrored" rather than the correct description of "reflection".

Higher

Part (a) was extremely well answered by candidates, with most scoring full marks. The few mistakes included using a scale factor of 3 instead of 2, or doubling the number of steps rather than increasing their length. Most candidates clearly knew what the transformation was in part (b) and gained the first mark for reflection, but many lacked the skill to describe adequately, using words such as flipped and mirrored. However the second mark was not so readily achieved.

Although the correct answer was probably the most common, some confused the y-axis with the line $y = 0$ or merely called it the y line and a few quoted $y = x$ as their mirror line.

Specification B

Foundation

Drawing an enlargement using a scale factor of 2 in part (a) produced many all correct diagrams (75%) with a good degree of accuracy, often drawn using a ruler. Some used a scale factor of 3 and this was partially rewarded as was a diagram with two lengths correct using the intended scale factor of 2. The unsure just continued with a step diagram failing to appreciate what was being asked of them.

Part (b) requiring a description of the transformation produced some weird and wonderful ideas. The word 'flip' seemed to dominate despite the fact that it is not a mathematical name used to describe a transformation. The phrase 'mirror image' was ever present along with variations on the same theme. In reality it was a simple 'reflection in the *y*-axis', both parts being required to obtain full marks. It was extremely disappointing to note how many candidates were not familiar with the term 'reflection' or even related terms such as 'reflect', 'reflected' etc. Over 75% of the candidates failed to score on this question.

Higher

(a) This was a straightforward question for this tier and consequently very well done.

(b) It was surprising and disappointing to see so many wrong responses from candidates for this transformations question. Not all candidates could use the vocabulary for the type of transformation correctly, so that 'flip' appeared far too often. Of those that knew the transformation was a reflection the detailed description was often incorrect. This mainly involved an incorrect description of the y-axis as $y = 0$ or referring to the origin so that 'a reflection in *O'* or 'reflection by 90° in *O*' were often seen so the transformation was being described as a rotation -which of course it could be when referring to 3D.

11. Candidates were greatly helped in this question being given the line $y = 1$ on the grid, however very many failed to score full marks by reflecting the given shape in other horizontal lines, usually $y = 3$, $y = 2$ or $y = 0$. A significant number of candidates simply reflected the triangle in the y-axis.

12. This was well answered. Common errors included reflection in the x axis, and presentation of a shape in all 4 quadrants.