

GCSE Mathematics

Worksheet: Single transformations · Calculator

TIME 35 min	TOTAL 32 marks	CALCULATOR Allowed	DIFFICULTY Easy, Medium
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Topics: Single transformations

NAME	CLASS	DATE
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- Use black ink or ball-point pen.
- Answer all questions. Answer the questions in the spaces provided – there may be more space than you need.
- Calculators may be used. If your calculator does not have a π button, take the value of π to be 3.142 unless the question instructs otherwise.
- Diagrams are NOT accurately drawn, unless otherwise indicated.
- You must show all your working.

1

A shape is rotated.
Jo describes the transformation as ‘a rotation of 90° ’.
Jo’s description is not complete. Write down the two other pieces of information that are needed to describe the rotation fully.

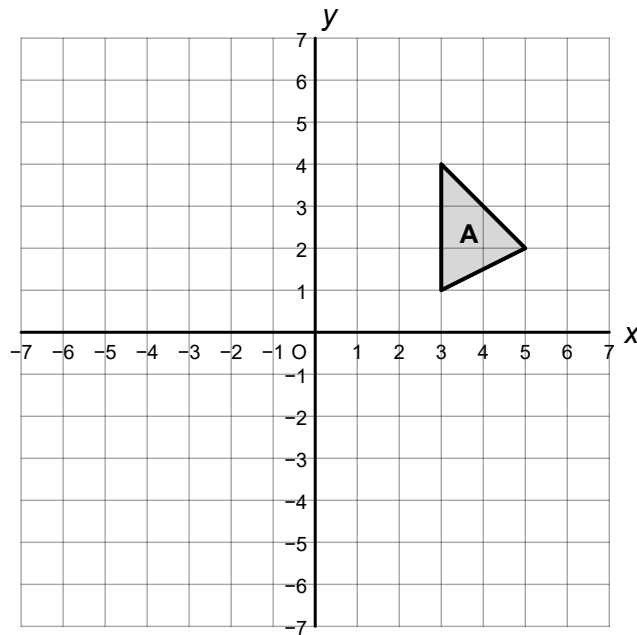
(2)

(Total for Question 1 is 2 marks)

2

The diagram shows triangle A on a coordinate grid.

The vertices of triangle A are (3, 1), (3, 4) and (5, 2).



Triangle A is translated by the vector $\begin{pmatrix} -6 \\ -5 \end{pmatrix}$ to give triangle B.

Write down the coordinates of the vertices of triangle B.

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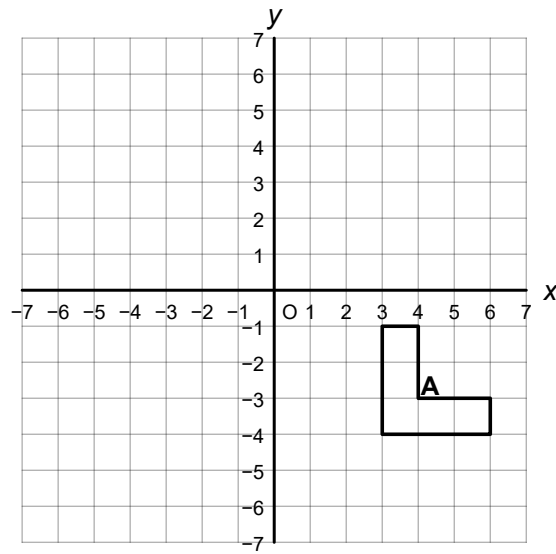
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(2)

(Total for Question 2 is 2 marks)

3

The grid shows shape A.



- (a) On the grid, draw the image of shape A after a translation by the vector $\begin{pmatrix} -1 \\ 1 \end{pmatrix}$.

Label the image B.

(2)

- (b) On the grid, draw the image of shape A after a reflection in the line $y = -2$.

Label the image C.

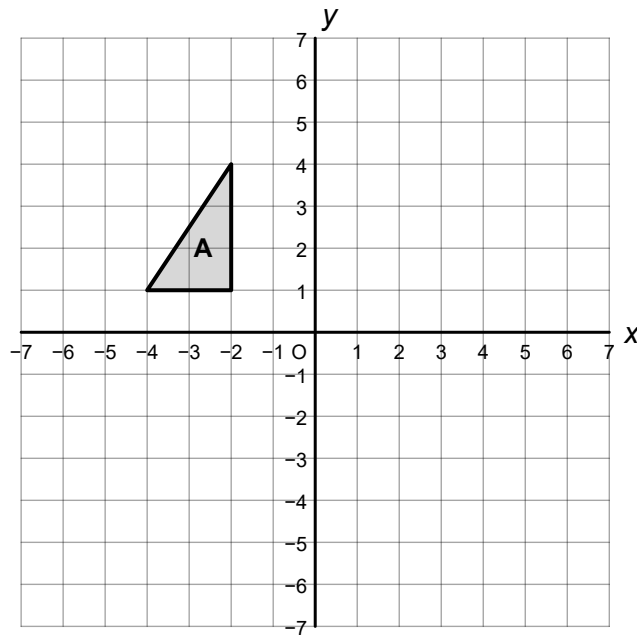
(2)

(Total for Question 3 is 4 marks)

4

The diagram shows triangle A on a coordinate grid.

The vertices of triangle A are $(-4, 1)$, $(-2, 1)$ and $(-2, 4)$.



Triangle A is translated by the vector $\begin{pmatrix} 4 \\ 2 \end{pmatrix}$ to give triangle B.

Write down the coordinates of the vertices of triangle B.

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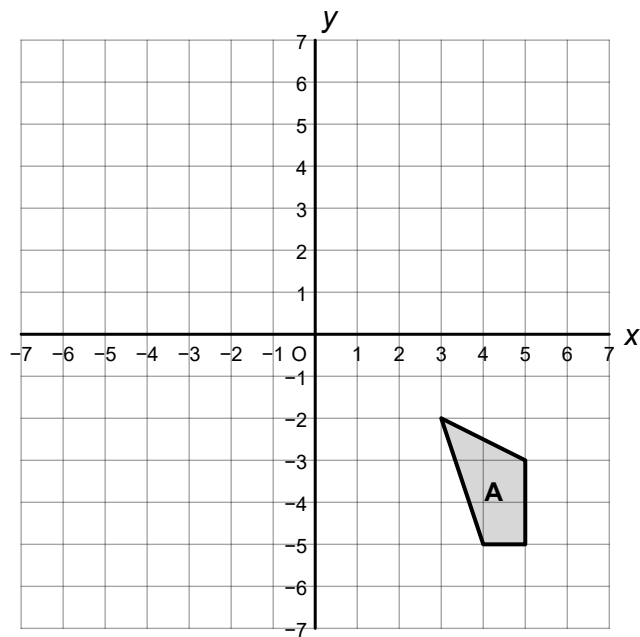
(2)

(Total for Question 4 is 2 marks)

5

The diagram shows shape A on a coordinate grid.

The vertices of shape A are $(5, -5)$, $(5, -3)$, $(3, -2)$ and $(4, -5)$.



Shape A is reflected in the x-axis to give shape B.

Write down the coordinates of the vertices of shape B.

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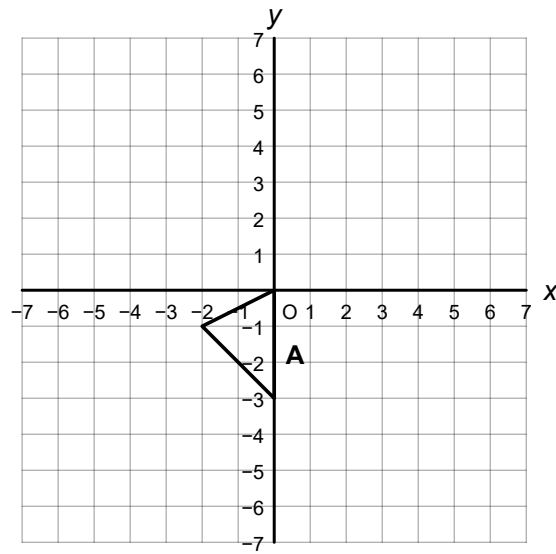
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(2)

(Total for Question 5 is 2 marks)

6

The grid shows triangle A.



- (a) On the grid, draw the image of triangle A after a translation by the vector $\begin{pmatrix} 5 \\ 2 \end{pmatrix}$.

Label the image B.

(2)

- (b) On the grid, draw the image of triangle A after a reflection in the line $x = 1$.

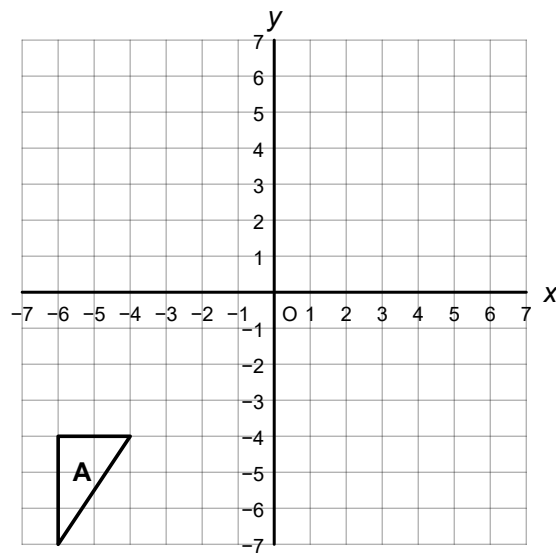
Label the image C.

(2)

(Total for Question 6 is 4 marks)

7

The grid shows triangle A.



- (a) On the grid, draw the image of triangle A after a rotation of 90° clockwise about the point $(1, -1)$.

Label the image B.

(2)

- (b) On the grid, draw the image of triangle A after a reflection in the line $y = x$.

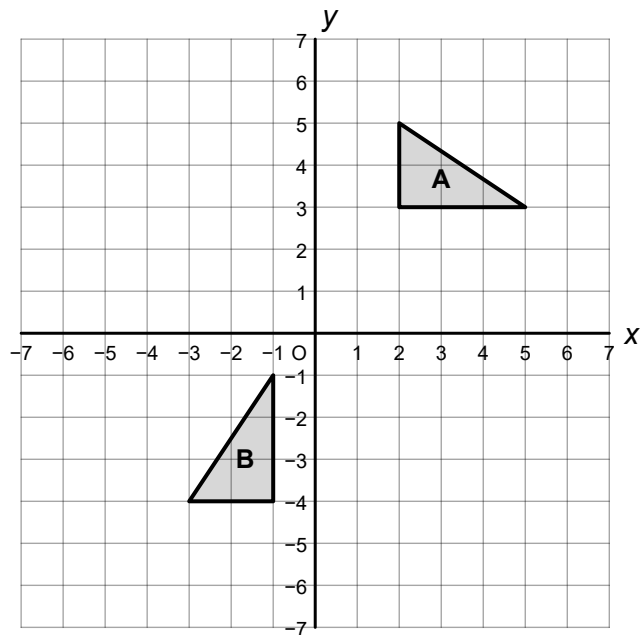
Label the image C.

(2)

(Total for Question 7 is 4 marks)

8

The diagram shows triangle A and triangle B on a coordinate grid.



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

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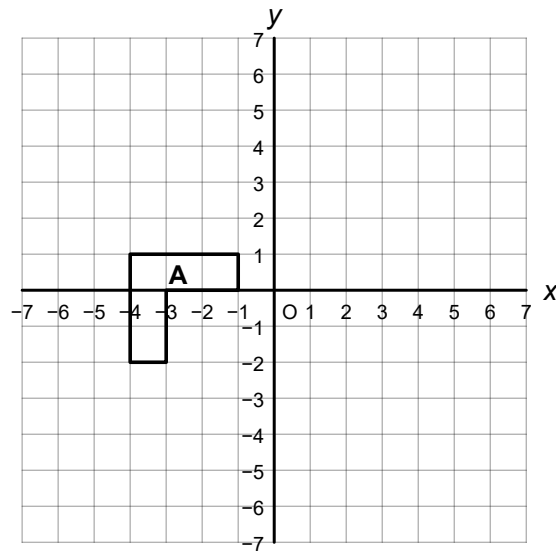
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(3)

(Total for Question 8 is 3 marks)

9

The grid shows shape A.



- (a) On the grid, draw the image of shape A after a rotation of 90° anticlockwise about the point (2, 1).

Label the image B.

(2)

- (b) On the grid, draw the image of shape A after a reflection in the line $y = x$.

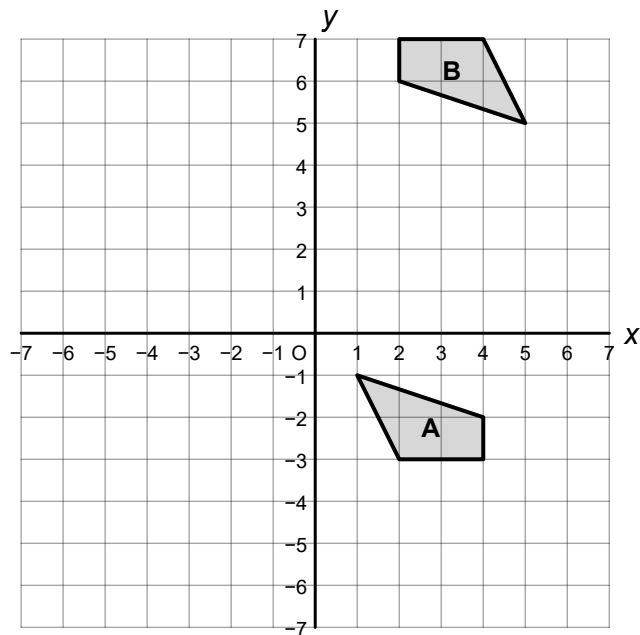
Label the image C.

(2)

(Total for Question 9 is 4 marks)

10

The diagram shows shape A and shape B on a coordinate grid.



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

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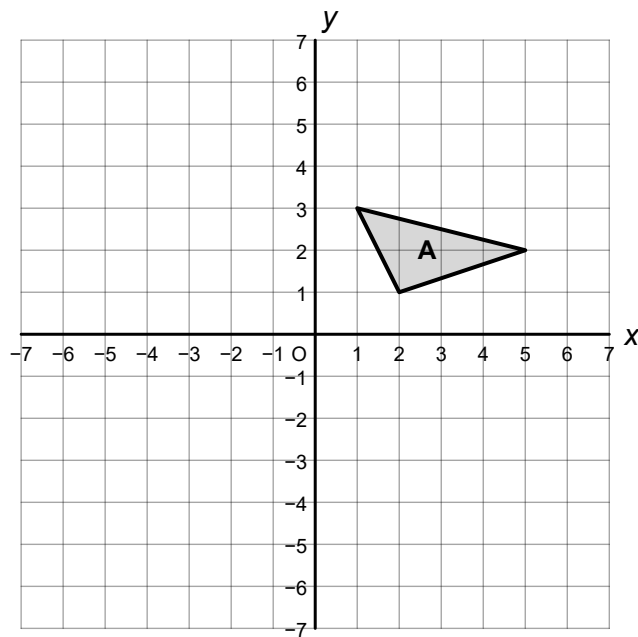
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(3)

(Total for Question 10 is 3 marks)

11

The diagram shows triangle A on a coordinate grid.
The vertices of triangle A are (1, 3), (5, 2) and (2, 1).



Triangle A is reflected in the line $y = -x$ to give triangle B.
Write down the coordinates of the vertices of triangle B.

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(2)

(Total for Question 11 is 2 marks)

END OF QUESTIONS

Original practice questions written to match the specification. Not produced by, affiliated with or endorsed by Pearson Edexcel.

Mark scheme

GCSE Mathematics · Worksheet: Single transformations · 32 marks

Question 1 (2 marks)

[2 marks]

Answer: The direction (clockwise or anticlockwise) and the centre of rotation.

- B1 for the direction of the rotation (clockwise or anticlockwise)
- B1 for the centre of rotation

Worked solution: A rotation is described fully by its angle, its direction and its centre. Jo has given only the angle.

Question 2 (2 marks)

[2 marks]

Answer: $(-3, -4)$, $(-3, -1)$ and $(-1, -3)$

- B2 for $(-3, -4)$, $(-3, -1)$ and $(-1, -3)$ (B1 for a translation by $\begin{pmatrix} -6 \\ k \end{pmatrix}$ or $\begin{pmatrix} k \\ -5 \end{pmatrix}$, or for two vertices correct)

Worked solution: Each vertex of A maps to the corresponding vertex of B: $(3, 1) \rightarrow (-3, -4)$, $(3, 4) \rightarrow (-3, -1)$, $(5, 2) \rightarrow (-1, -3)$.

Question 3 (4 marks)

(a) [2 marks]

Answer: Shape B with vertices (2, -3), (2, 0), (3, 0), (3, -2), (5, -2), (5, -3).

- B2 for shape B drawn with vertices (2, -3), (2, 0), (3, 0), (3, -2), (5, -2), (5, -3) (B1 for a translation of A with one of the two components of $\begin{pmatrix} -1 \\ 1 \end{pmatrix}$ correct)

Notes: B marks are for the image drawn on the grid; vertices must be at the correct grid points.

Worked solution: Apply the transformation to each vertex of A: (3, -4) → (2, -3), (3, -1) → (2, 0), (4, -1) → (3, 0), (4, -3) → (3, -2), (6, -3) → (5, -2), (6, -4) → (5, -3).

(b) [2 marks]

Answer: Shape C with vertices (3, 0), (3, -3), (4, -3), (4, -1), (6, -1), (6, 0).

- B2 for shape C drawn with vertices (3, 0), (3, -3), (4, -3), (4, -1), (6, -1), (6, 0) (B1 for a reflection of A in a line parallel to $y = -2$, or for shape C with at least two vertices correct)

Worked solution: Each point moves to the same distance on the other side of the mirror line: (3, -4) → (3, 0), (3, -1) → (3, -3), (4, -1) → (4, -3), (4, -3) → (4, -1), (6, -3) → (6, -1), (6, -4) → (6, 0).

Question 4 (2 marks)

[2 marks]

Answer: (0, 3), (2, 3) and (2, 6)

- B2 for (0, 3), (2, 3) and (2, 6) (B1 for a translation by $\begin{pmatrix} 4 \\ k \end{pmatrix}$ or $\begin{pmatrix} k \\ 2 \end{pmatrix}$, or for two vertices correct)

Worked solution: Each vertex of A maps to the corresponding vertex of B: (-4, 1) → (0, 3), (-2, 1) → (2, 3), (-2, 4) → (2, 6).

Question 5 (2 marks)

[2 marks]

Answer: (5, 5), (5, 3), (3, 2) and (4, 5)

- B2 for (5, 5), (5, 3), (3, 2) and (4, 5) (B1 for a reflection in a different horizontal line, or for three vertices correct)

Worked solution: Each vertex of A maps to the corresponding vertex of B: (5, -5) → (5, 5), (5, -3) → (5, 3), (3, -2) → (3, 2), (4, -5) → (4, 5).

Question 6 (4 marks)

(a) [2 marks]

Answer: Triangle B with vertices (5, 2), (5, -1), (3, 1).

- **B2** for triangle B drawn with vertices (5, 2), (5, -1), (3, 1) (**B1** for a translation of A with one of the two components of $\begin{pmatrix} 5 \\ 2 \end{pmatrix}$ correct)

Notes: B marks are for the image drawn on the grid; vertices must be at the correct grid points.

Worked solution: Apply the transformation to each vertex of A: $(0, 0) \rightarrow (5, 2)$, $(0, -3) \rightarrow (5, -1)$, $(-2, -1) \rightarrow (3, 1)$.

(b) [2 marks]

Answer: Triangle C with vertices (2, 0), (2, -3), (4, -1).

- **B2** for triangle C drawn with vertices (2, 0), (2, -3), (4, -1) (**B1** for a reflection of A in a line parallel to $x = 1$, or for triangle C with at least two vertices correct)

Worked solution: Each point moves to the same distance on the other side of the mirror line: $(0, 0) \rightarrow (2, 0)$, $(0, -3) \rightarrow (2, -3)$, $(-2, -1) \rightarrow (4, -1)$.

Question 7 (4 marks)

(a) [2 marks]

Answer: Triangle B with vertices (-2, 6), (-5, 6), (-2, 4).

- **B2** for triangle B drawn with vertices (-2, 6), (-5, 6), (-2, 4) (**B1** for a rotation of 90° clockwise about a different centre, or a rotation about (1, -1) by the wrong angle or in the wrong direction)

Notes: B marks are for the image drawn on the grid; vertices must be at the correct grid points.

Worked solution: Apply the transformation to each vertex of A: $(-6, -4) \rightarrow (-2, 6)$, $(-6, -7) \rightarrow (-5, 6)$, $(-4, -4) \rightarrow (-2, 4)$.

(b) [2 marks]

Answer: Triangle C with vertices (-4, -6), (-7, -6), (-4, -4).

- **B2** for triangle C drawn with vertices (-4, -6), (-7, -6), (-4, -4) (**B1** for a reflection of A in the line $y = -x$ (the wrong diagonal), or for triangle C with at least two vertices correct)

Worked solution: Reflecting in $y = x$ maps $(x, y) \rightarrow (y, x)$: $(-6, -4) \rightarrow (-4, -6)$, $(-6, -7) \rightarrow (-7, -6)$, $(-4, -4) \rightarrow (-4, -4)$.

Question 8 (3 marks)

[3 marks]

Answer: Rotation, 90° anticlockwise, centre (4, -2)

- B1 for rotation
- B1 for 90° anticlockwise (or 270° clockwise)
- B1 for centre (4, -2)

Notes: Award no marks if more than one transformation is given.

Worked solution: Rotation, 90° anticlockwise, centre (4, -2).

Check: $(2, 5) \rightarrow (-3, -4)$, $(2, 3) \rightarrow (-1, -4)$, $(5, 3) \rightarrow (-1, -1)$.

Question 9 (4 marks)

(a) [2 marks]

Answer: Shape B with vertices (2, -5), (2, -2), (3, -2), (3, -4), (5, -4), (5, -5).

- B2 for shape B drawn with vertices (2, -5), (2, -2), (3, -2), (3, -4), (5, -4), (5, -5) (B1 for a rotation of 90° anticlockwise about a different centre, or a rotation about (2, 1) by the wrong angle or in the wrong direction)

Notes: B marks are for the image drawn on the grid; vertices must be at the correct grid points.

Worked solution: Apply the transformation to each vertex of A: $(-4, 1) \rightarrow (2, -5)$, $(-1, 1) \rightarrow (2, -2)$, $(-1, 0) \rightarrow (3, -2)$, $(-3, 0) \rightarrow (3, -4)$, $(-3, -2) \rightarrow (5, -4)$, $(-4, -2) \rightarrow (5, -5)$.

(b) [2 marks]

Answer: Shape C with vertices (1, -4), (1, -1), (0, -1), (0, -3), (-2, -3), (-2, -4).

- B2 for shape C drawn with vertices (1, -4), (1, -1), (0, -1), (0, -3), (-2, -3), (-2, -4) (B1 for a reflection of A in the line $y = -x$ (the wrong diagonal), or for shape C with at least two vertices correct)

Worked solution: Reflecting in $y = x$ maps $(x, y) \rightarrow (y, x)$: $(-4, 1) \rightarrow (1, -4)$, $(-1, 1) \rightarrow (1, -1)$, $(-1, 0) \rightarrow (0, -1)$, $(-3, 0) \rightarrow (0, -3)$, $(-3, -2) \rightarrow (-2, -3)$, $(-4, -2) \rightarrow (-2, -4)$.

Question 10 (3 marks)

[3 marks]

Answer: Rotation, 180° , centre (3, 2)

- B1 for rotation
- B1 for 180°
- B1 for centre (3, 2)

Notes: Award no marks if more than one transformation is given.

Worked solution: Rotation, 180° , centre (3, 2).

Check: $(4, -3) \rightarrow (2, 7)$, $(2, -3) \rightarrow (4, 7)$, $(1, -1) \rightarrow (5, 5)$, $(4, -2) \rightarrow (2, 6)$.

Question 11 (2 marks)

[2 marks]

Answer: $(-3, -1)$, $(-2, -5)$ and $(-1, -2)$

- B2 for $(-3, -1)$, $(-2, -5)$ and $(-1, -2)$ (B1 for a reflection in the line $y = x$, or for two vertices correct)

Worked solution: Each vertex of A maps to the corresponding vertex of B: $(1, 3) \rightarrow (-3, -1)$, $(5, 2) \rightarrow (-2, -5)$, $(2, 1) \rightarrow (-1, -2)$.
