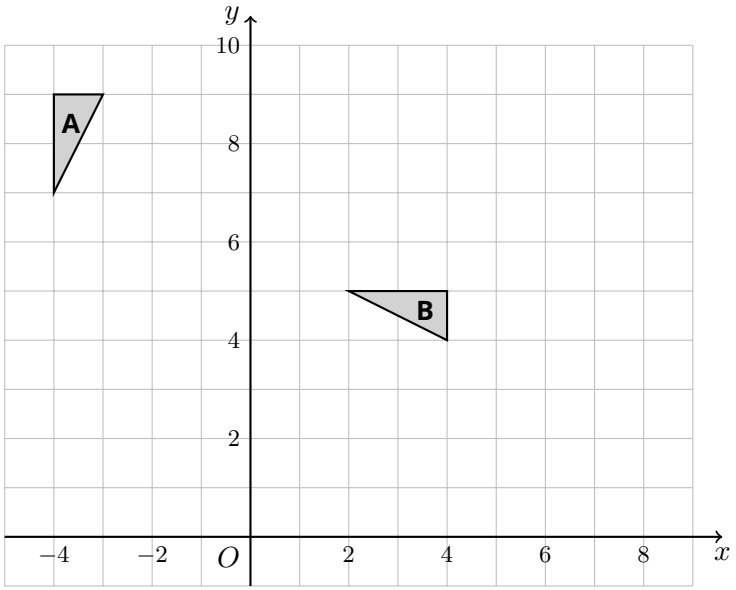
Transformations on a Coordinate Grid

Practice Worksheet (Problem Solving)

I Do



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

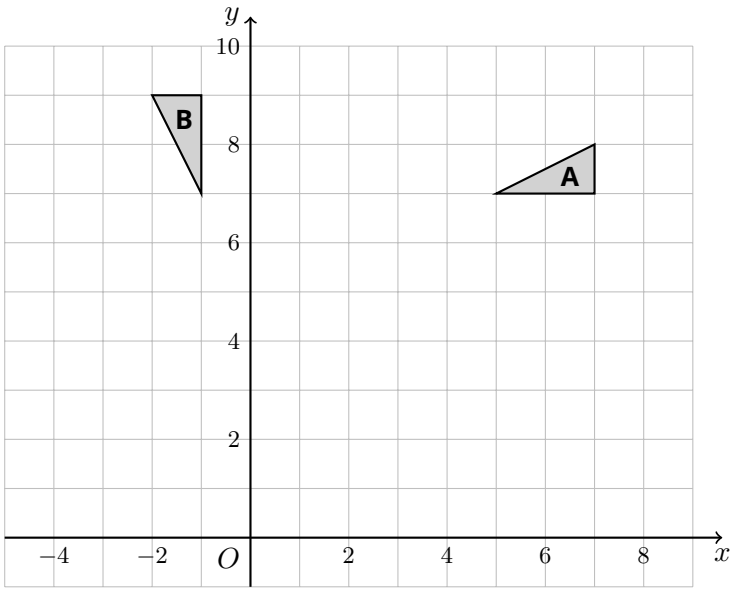
(2 marks)

(b) On the grid, translate triangle **A** by the vector $\begin{pmatrix} 2 \\ -5 \end{pmatrix}$.
Label the new triangle **C**.

(1 mark)

(Total for Question is 3 marks)

We Do



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

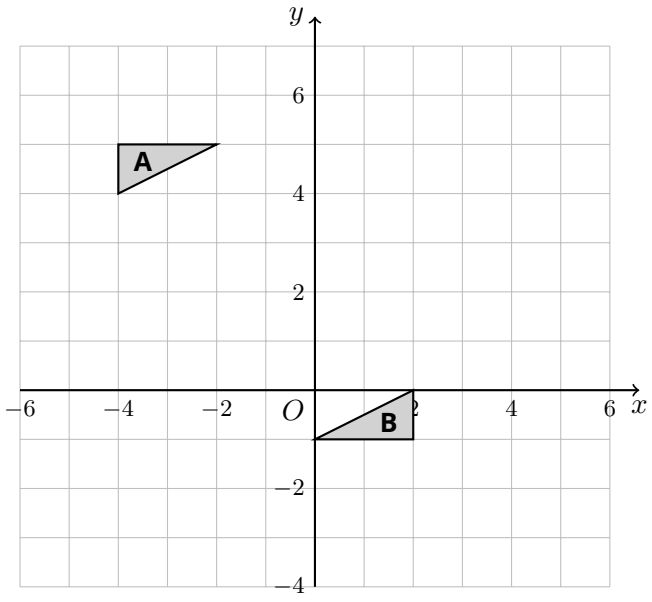
(2 marks)

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

(1 mark)

(Total for Question is 3 marks)

You Do 1



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

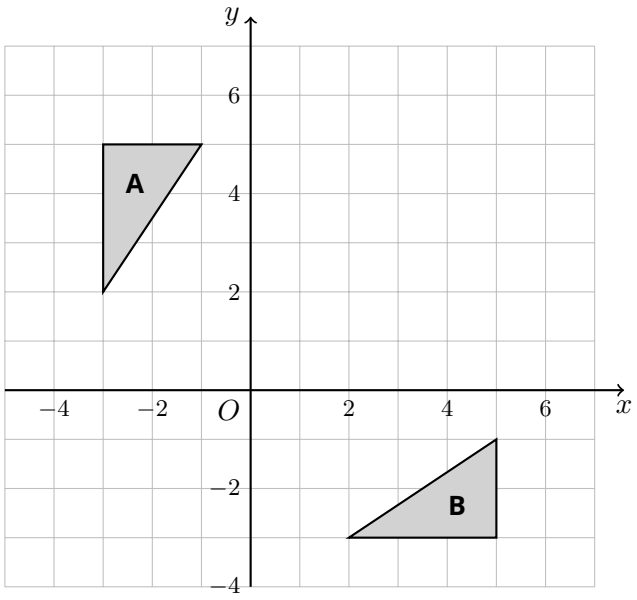
(2 marks)

(b) On the grid, translate triangle **A** by the vector $\begin{pmatrix} 5 \\ -2 \end{pmatrix}$.
Label the new triangle **C**.

(1 mark)

(Total for Question is 3 marks)

You Do 2



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

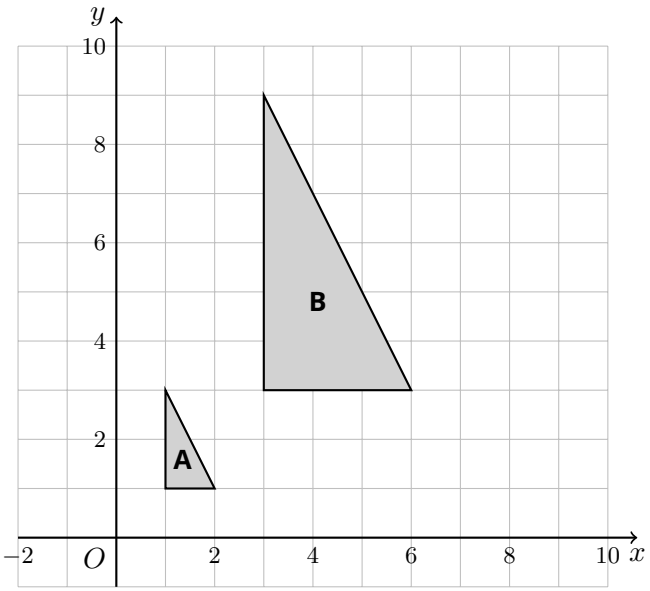
(2 marks)

(b) On the grid, rotate triangle **A** by $90°$ clockwise about the origin $(0, 0)$.
Label the new triangle **C**.

(2 marks)

(Total for Question is 4 marks)

You Do 3



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

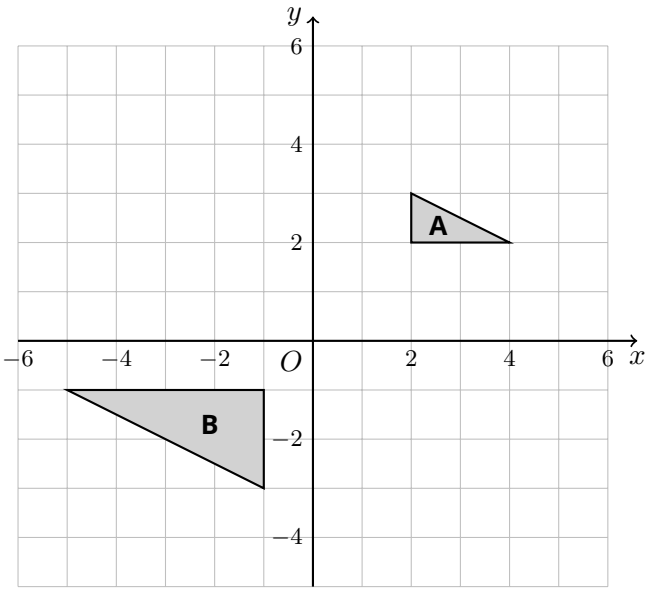
(2 marks)

(b) On the grid, reflect triangle **A** in the line $x = 4$.
Label the new triangle **C**.

(2 marks)

(Total for Question is 4 marks)

Challenge 1



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

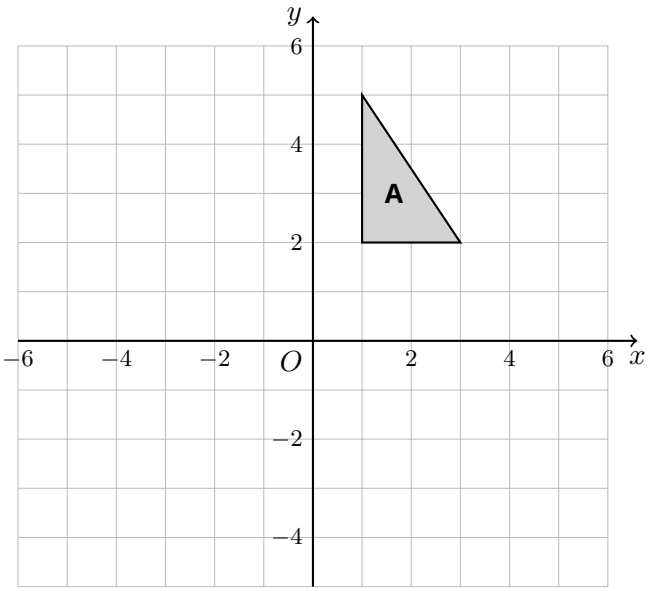
(3 marks)

(b) Write down the ratio of the area of triangle **A** to the area of triangle **B**.
Give your answer in its simplest form.

..... *(1 mark)*

(Total for Question is 4 marks)

Challenge 2



Triangle **A** is reflected in the line $x = 0$ to give triangle **B**.
Triangle **B** is then reflected in the line $y = -x$ to give triangle **C**.

(a) On the grid, draw and label triangle **C**.

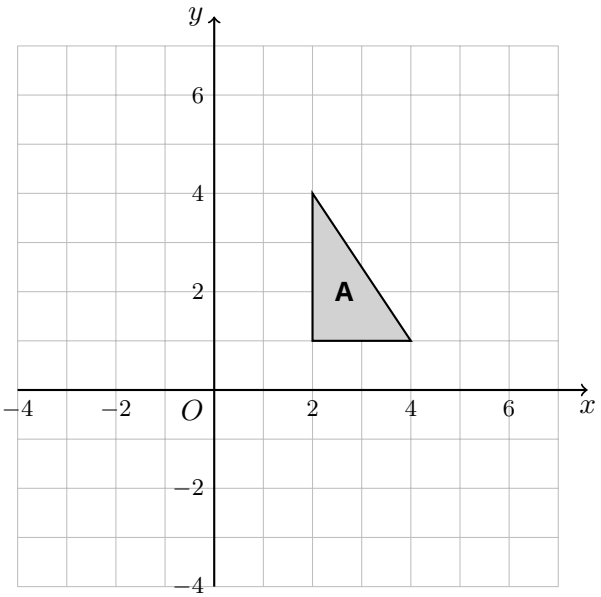
(2 marks)

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

(2 marks)

(Total for Question is 4 marks)

Extreme Challenge



Triangle **A** is reflected in the line $y = x$ to form triangle **B**.
Triangle **B** is then reflected in the line $x = 2$ to form triangle **C**.

(a) On the grid, draw and label triangle **C**.

(2 marks)

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

(2 marks)

(c) Write down the coordinates of the only point that is invariant under this single transformation, and explain why it is invariant.

(2 marks)

(Total for Question is 6 marks)

Worked Answers

I Do

(a) Check orientation: the right-angle vertex moves from $(-4, 9)$ to $(4, 5)$, and the short leg turns from pointing right to pointing down. This is a rotation of $90°$ clockwise.

Testing centre $(-2, 3)$: vector from $(-2, 3)$ to $(-4, 9)$ is $\begin{pmatrix} -2 \\ 6 \end{pmatrix}$. Rotating $90°$ clockwise gives $\begin{pmatrix} 6 \\ 2 \end{pmatrix}$, and $(-2, 3) + (6, 2) = (4, 5)$.

Answer: Rotation, $90°$ clockwise (or $270°$ anticlockwise), centre $(-2, 3)$.

(b) Translate each vertex of **A** by $\begin{pmatrix} 2 \\ -5 \end{pmatrix}$ (2 right, 5 down):

$(-4, 9) \to (-2, 4)$, $(-3, 9) \to (-1, 4)$, $(-4, 7) \to (-2, 2)$.

Triangle C has vertices $(-2, 4)$, $(-1, 4)$, and $(-2, 2)$.

We Do

(a) The right-angle vertex moves from $(7, 7)$ to $(-1, 9)$, and the long leg turns from pointing left to pointing down. This is a rotation of $90°$ anticlockwise.

Testing centre $(2, 4)$: vector from $(2, 4)$ to $(7, 7)$ is $\begin{pmatrix} 5 \\ 3 \end{pmatrix}$. Rotating $90°$ anticlockwise gives $\begin{pmatrix} -3 \\ 5 \end{pmatrix}$, and $(2, 4) + (-3, 5) = (-1, 9)$.

Answer: Rotation, $90°$ anticlockwise (or $270°$ clockwise), centre $(2, 4)$.

(b) Translate each vertex of **A** by $\begin{pmatrix} -4 \\ -5 \end{pmatrix}$ (4 left, 5 down):

$(5, 7) \to (1, 2)$, $(7, 7) \to (3, 2)$, $(7, 8) \to (3, 3)$.

Triangle C has vertices $(1, 2)$, $(3, 2)$, and $(3, 3)$.

You Do 1

(a) The triangle is inverted (rotated by a half-turn). The midpoint of corresponding vertices $(-4, 5)$ and $(2, -1)$ is $\left(\frac{-4+2}{2}, \frac{5-1}{2}\right) = (-1, 2)$.

Answer: Rotation, $180°$, centre $(-1, 2)$.

(b) Translate each vertex of **A** by $\begin{pmatrix} 5 \\ -2 \end{pmatrix}$:

$(-4, 5) \to (1, 3)$, $(-2, 5) \to (3, 3)$, $(-4, 4) \to (1, 2)$.

Triangle C has vertices $(1, 3)$, $(3, 3)$, and $(1, 2)$.

You Do 2

(a) Comparing corresponding vertices: $(-3, 2) \to (2, -3)$, $(-3, 5) \to (5, -3)$, $(-1, 5) \to (5, -1)$. The x- and y-coordinates have swapped.

Answer: Reflection in the line $y = x$.

(b) Rotate each vertex of **A** by $90°$ clockwise about $(0, 0)$:

$(-3, 2) \to (2, 3)$, $(-3, 5) \to (5, 3)$, $(-1, 5) \to (5, 1)$.

Triangle C has vertices $(2, 3)$, $(5, 3)$, and $(5, 1)$.

You Do 3

(a) Side lengths of **A** are 1 and 2; side lengths of **B** are 3 and 6. Scale factor $= \frac{3}{1} = 3$.
Drawing rays through corresponding vertices $(1,1)$&$(3,3)$, $(2,1)$&$(6,3)$, and $(1,3)$&$(3,9)$ all meet at the origin $(0,0)$.
Answer: Enlargement, scale factor 3, centre $(0,0)$.

(b) Reflect each vertex of **A** in the line $x = 4$ (distance from $x = 4$ is maintained on the other side):
$(1,1) \to (7,1)$, $(2,1) \to (6,1)$, $(1,3) \to (7,3)$.
Triangle C has vertices $(7,1)$, $(6,1)$, and $(7,3)$.

Challenge 1

(a) Side lengths double from 1×2 to 2×4, and the shape is inverted, so the scale factor is -2.
Draw rays connecting corresponding vertices: $(2,2)$ to $(-1,-1)$, $(4,2)$ to $(-5,-1)$, and $(2,3)$ to $(-1,-3)$. All three rays intersect at $(1,1)$.
Answer: Enlargement, scale factor -2, centre $(1,1)$.

(b) The area scale factor is $(\text{length scale factor})^2 = (-2)^2 = 4$.
Answer: 1 : 4.

Challenge 2

(a) Step 1: Reflect **A** in $x = 0$ (change the sign of each x-coordinate) to get **B**:
$(1,2) \to (-1,2)$, $(3,2) \to (-3,2)$, $(1,5) \to (-1,5)$.
Step 2: Reflect **B** in $y = -x$ (swap coordinates and negate both) to get **C**:
$(-1,2) \to (-2,1)$, $(-3,2) \to (-2,3)$, $(-1,5) \to (-5,1)$.
Triangle C has vertices $(-2,1)$, $(-2,3)$, and $(-5,1)$.

(b) Comparing **A** to **C**: $(1,2) \to (-2,1)$, $(3,2) \to (-2,3)$, $(1,5) \to (-5,1)$.
Answer: Rotation, $90°$ anticlockwise (or $270°$ clockwise), centre $(0,0)$.

Extreme Challenge

(a) Step 1: Reflect **A** in $y = x$ to get **B**:
$(2,1) \to (1,2)$, $(4,1) \to (1,4)$, $(2,4) \to (4,2)$.
Step 2: Reflect **B** in $x = 2$ (using $x' = 4 - x$) to get **C**:
$(1,2) \to (3,2)$, $(1,4) \to (3,4)$, $(4,2) \to (0,2)$.
Triangle C has vertices $(3,2)$, $(3,4)$, and $(0,2)$.

(b) Comparing **A** to **C**: the horizontal base of length 2 turns into a vertical side of length 2 pointing upwards ($90°$ anticlockwise).
The two mirror lines $y = x$ and $x = 2$ intersect at $(2,2)$ at an angle of $45°$, so the combined transformation is a rotation of $2 \times 45° = 90°$ about $(2,2)$.
Answer: Rotation, $90°$ anticlockwise, centre $(2,2)$.

(c) Answer: $(2, 2)$.
Explanation: $(2,2)$ is the centre of rotation, so it does not move when the plane is rotated around it (equivalently, it lies on both mirror lines $y = x$ and $x = 2$, so neither reflection moves it).