HIGHER ONLY

HIGHER TIER

Name ..... Class .....

G8: Combined transformations

Reason about combinations of transformations and invariance

20 marks · 25 minutes · Non-calculator

1) Show that reflecting in the x-axis then the y-axis is the same as a rotation of 180° about the origin. Use the point (x, y).

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[Question 1: 3 marks]

2) Explain why a translation has no invariant points (unless it is the zero translation).

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[Question 2: 2 marks]

3) Explain why points on a mirror line are invariant under the reflection.

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[Question 3: 2 marks]

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4) Show that reflecting in $x = 1$ then in $x = 4$ is a translation of $\begin{pmatrix} 6 \\ 0 \end{pmatrix}$.

[Question 4: 3 marks]

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5) Explain why the centre of a rotation is an invariant point.

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[Question 5: 1 marks]

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6) Is a rotation of 90° followed by a rotation of 60° about the same centre a single rotation? Explain.

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[Question 6: 2 marks]

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7) Kim says that reflecting in the x-axis then in $y = x$ gives the same result as reflecting in $y = x$ then in the x-axis. Use the point $(1, 2)$ to show she is wrong.

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[Question 7: 3 marks]

8) Explain why the order of transformations usually matters.

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[Question 8: 2 marks]

9) Explain the result of translating by $\begin{pmatrix} 3 \\ 1 \end{pmatrix}$ then by $\begin{pmatrix} -3 \\ -1 \end{pmatrix}$.

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[Question 9: 2 marks]

End of paper – 20 marks in total

Answers and brief mark scheme

Q	Answer	Method / notes
1	Shown	$(x, y) \to (x, -y) \to (-x, -y)$ (M2); rotation 180° (C1).
2	Explanation	Every point moves by the same non-zero vector (C2).
3	Explanation	Their distance from the mirror is zero (C2).
4	Shown	$(0,0) \to (2,0) \to (6,0)$ or general $x \to 2 - x \to 6 + x$ (M2); C1.
5	Explanation	It does not move during the turn (C1).
6	Yes	Rotation of 150° about the same centre (C2).
7	Shown	$(1, -2) \to (-2, 1)$ (M1); $(2, 1) \to (2, -1)$ (M1); different (C1).
8	Explanation	The second transformation acts on the moved shape (C2).
9	Back to the start	Vectors add to zero (C2).