HIGHER ONLY

HIGHER TIER

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

A13: Graph transformations

Reason about translations and reflections of graphs

20 marks · 25 minutes · Non-calculator

1) Explain why the graph of $y = f(x) + 3$ is the graph of $y = f(x)$ moved up 3

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[Question 1: 2 marks]

2) Sam says $y = f(x - 2)$ is $y = f(x)$ moved 2 to the left. Explain his mistake.

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[Question 2: 2 marks]

3) Show that the turning point of $y = (x - 3)^2 + 2$ is $(3, 2)$

[Question 3: 2 marks]

4) Explain why $y = -f(x)$ is a reflection of $y = f(x)$ in the x-axis.

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[Question 4: 2 marks]

5) $(2, 5)$ lies on $y = f(x)$. Explain why $(2, -5)$ lies on $y = -f(x)$ and $(-2, 5)$ lies on $y = f(-x)$

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[Question 5: 2 marks]

6) Describe the transformation that maps $y = \sin x$ onto $y = \sin(x + 90°)$. Which other graph is this the same as?

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[Question 6: 2 marks]

7) $f(x) = x^2$. Show that $f(x + 1) - 4 = x^2 + 2x - 3$ and state the turning point of its graph.

[Question 7: 3 marks]

8) Explain why the graph of $y = f(-x)$ is the same as $y = f(x)$ when $f(x) = x^2$

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[Question 8: 2 marks]

9) Describe the single transformation that maps $y = (x + 1)^2$ onto $y = (x - 2)^2$. Justify your answer.

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[Question 9: 3 marks]

End of paper – 20 marks in total

Answers and brief mark scheme

Q	Answer	Method / notes
1	Explanation	Every y-value increases by 3 (C1); x-values unchanged (C1).
2	Moves right	x must be 2 bigger to give the same output (C1); right 2 (B1).
3	Shown	$(x-3)^2 = 0$ at $x = 3$ (M1); $y = 2$ (C1).
4	Explanation	Every y-value changes sign (C1); points mirror in $y = 0$ (C1).
5	Explanation	$-f(2) = -5$ (C1); $f(-(-2)) = f(2) = 5$ (C1).
6	Translation 90 left; $y = \cos x$	Translation $\begin{pmatrix} -90 \\ 0 \end{pmatrix}$ (B1); same as $\cos x$ (B1).
7	Shown	$(x+1)^2 - 4$ expanded (M1); C1; turning point $(-1, -4)$ (B1).
8	Explanation	$(-x)^2 = x^2$ (C1); graph symmetrical about the y-axis (C1).
9	Translation $\begin{pmatrix} 3 \\ 0 \end{pmatrix}$	Turning points $(-1, 0)$ and $(2, 0)$ (M1); translation (B1); vector 3 right (C1).