FOUNDATION & HIGHER

HIGHER EXTENDS

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

A11: Quadratic graphs

Reason about roots, intercepts and turning points of quadratics

20 marks · 25 minutes · Non-calculator

1) Show that $y = x^2 - 6x + 5$ has roots at $x = 1$ and $x = 5$

[Question 1: 2 marks]

2) Show that $x^2 - 4x + 7 \equiv (x - 2)^2 + 3$. Explain why $y = x^2 - 4x + 7$ has no real roots.

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[Question 2: 3 marks]

3) Explain why the turning point of $y = (x - 3)^2 - 4$ is a minimum at $(3, -4)$.

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[Question 3: 2 marks]

4) Kai says the turning point of $y = (x + 2)^2 + 1$ is $(2, 1)$. Explain his mistake.

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[Question 4: 2 marks]

5) Show that the turning point of $y = x^2 + 8x + 10$ is $(-4, -6)$

[Question 5: 2 marks]

6) Explain why the graph of $y = 4 - x^2$ has a maximum point.

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[Question 6: 2 marks]

7) A quadratic has roots -1 and 5. Explain why its turning point has x-coordinate 2.

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[Question 7: 2 marks]

8) Show that $y = 2x^2 - 3x - 5$ crosses the y-axis at $(0, -5)$ and the x-axis at $x = -1$ and $x = 2.5$

[Question 8: 3 marks]

9) Explain why the graph of $y = x^2 + 2x + 1$ touches the x-axis at exactly one point.

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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	$(x - 1)(x - 5)$ (M1); C1.
2	Shown	Expansion (M1); $(x - 2)^2 \geqslant 0$ (M1); so $y \geqslant 3$, never 0 (C1).
3	Explanation	$(x - 3)^2$ is smallest (0) when $x = 3$ (C1); then $y = -4$ (C1).
4	$(-2, 1)$	$(x + 2)^2 = 0$ when $x = -2$ (C1); B1.
5	Shown	$(x + 4)^2 - 6$ (M1); C1.
6	Explanation	The x^2 term is negative so the curve is n-shaped (C1); largest value 4 at $x = 0$ (C1).
7	Explanation	The curve is symmetrical (C1); midpoint of -1 and 5 is 2 (C1).
8	Shown	$y = -5$ at $x = 0$ (B1); $(2x - 5)(x + 1)$ (M1); C1.
9	Explanation	$(x + 1)^2$ (M1); only zero at $x = -1$ (C1).