

Quadratics Test Paper 1 [48 marks]

1a. [4 marks]

Markscheme

evidence of attempting to solve $f(x) = 0$ (MI)

evidence of correct working AI

e.g. $(x+1)(x-2)$, $\frac{1 \pm \sqrt{9}}{2}$

intercepts are $(-1, 0)$ and $(2, 0)$ (accept $x = -1$, $x = 2$) AIAI NINI

[4 marks]

1b. [2 marks]

Markscheme

evidence of appropriate method (MI)

e.g. $x_v = \frac{x_1 + x_2}{2}$, $x_v = -\frac{b}{2a}$, reference to symmetry

$x_v = 0.5$ AI N2

[2 marks]

2a. [5 marks]

Markscheme

valid approach (MI)

e.g. $b^2 - 4ac$, $\Delta = 0$, $(-4k)^2 - 4(2k)(1)$

correct equation AI

e.g. $(-4k)^2 - 4(2k)(1) = 0$, $16k^2 = 8k$, $2k^2 - k = 0$

correct manipulation AI

e.g. $8k(2k - 1)$, $\frac{8 \pm \sqrt{64}}{32}$

$k = \frac{1}{2}$ A2 N3

[5 marks]

2b. [2 marks]

Markscheme

recognizing vertex is on the x -axis MI

e.g. $(1, 0)$, sketch of parabola opening upward from the x -axis

$p \geq 0$ AI NI

[2 marks]

3.

[6 marks]

Markscheme(a) $x = 1, x = -3$ (accept (1, 0), (-3, 0)) *AIAI N2**[2 marks]*(b) **METHOD 1**attempt to find x -coordinate *(MI)*

eg $\frac{1+b}{2}, x = \frac{-b}{2a}, f'(x) = 0$

correct value, $x = -1$ (may be seen as a coordinate in the answer) *AI*attempt to find **their** y -coordinate *(MI)*

eg $f(-1), -2 \times 2, y = \frac{-D}{4a}$

$y = -4$ *AI*

vertex (-1, -4) *N3***METHOD 2**attempt to complete the square *(MI)*

eg $x^2 + 2x + 1 - 1 - 3$

attempt to put into vertex form *(MI)*

eg $(x+1)^2 - 4, (x-1)^2 + 4$

vertex (-1, -4) *AIAI N3**[4 marks]*

4a.

[4 marks]

Markscheme(i) $h = 2, k = 1$ *AIAI N2*(ii) attempt to substitute coordinates of any point (except the vertex) on the graph into f *MI*

e.g. $13 = a(0-2)^2 + 1$

working towards solution *AI*

e.g. $13 = 4a + 1$

$a = 3$ *AG N0*

[4 marks]

4b.

[3 marks]

Markschemeattempting to expand **their** binomial *(MI)*

e.g. $f(x) = 3(x^2 - 2 \times 2x + 4) + 1, (x-2)^2 = x^2 - 4x + 4$

correct working *(AI)*

e.g. $f(x) = 3x^2 - 12x + 12 + 1$

$f(x) = 3x^2 - 12x + 13$ (accept $A = 3, B = -12, C = 13$) *AI N2*

[3 marks]

5a. [8 marks]

Markscheme

(i) vertex is $(-1, -12)$ *AIAI N2*

(ii) $x = -1$ (**must** be an equation) *AI NI*

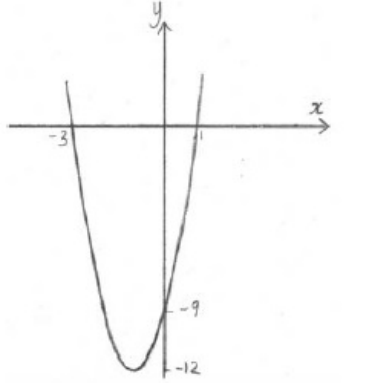
(iii) $(0, -9)$ *AI NI*

(iv) evidence of solving $f(x) = 0$ (*MI*)
 e.g. factorizing, formula,
 correct working *AI*
 e.g. $3(x+3)(x-1) = 0$, $x = \frac{-6 \pm \sqrt{36+108}}{6}$
 $(-3, 0), (1, 0)$ *AIAI NINI*

[8 marks]

5b. [2 marks]

Markscheme



AIAI N2

Note: Award *AI* for a parabola opening upward, *AI* for vertex and intercepts in approximately correct positions.

[2 marks]

5c. [3 marks]

Markscheme

$\begin{pmatrix} p \\ q \end{pmatrix} = \begin{pmatrix} -1 \\ -12 \end{pmatrix}$, $t = 3$ (accept $p = -1$, $q = -12$, $t = 3$) *AIAIAI N3*

[3 marks]

6a. [2 marks]

Markscheme

attempt to form composition (in any order) (*MI*)

$(f \circ g)(x) = (x-1)^2 + 4$ $(x^2 - 2x + 5)$ *AI N2*

[2 marks]

6b.

[2 marks]

Markscheme

evidence of appropriate approach (MI)

e.g. $(x - 4)^2 + 3, (x - 3)^2 - 2(x - 3) + 5 - 1$

simplifying AI

e.g. $h(x) = x^2 - 8x + 16 + 3, x^2 - 6x + 9 - 2x + 6 + 4$

$h(x) = x^2 - 8x + 19$ AG N0

[2 marks]

6c.

[5 marks]

Markscheme**METHOD 1**

equating functions to find intersection point (MI)

e.g. $x^2 - 8x + 19 = 2x - 6, y = h(x)$

$x^2 - 10x + 25 = 0$ AI

evidence of appropriate approach to solve (MI)

e.g. factorizing, quadratic formula

appropriate working AI

e.g. $(x - 5)^2 = 0$

$x = 5$ ($p = 5$) AI N3

METHOD 2attempt to find $h'(x)$ (MI)

$h(x) = 2x - 8$ AI

recognizing that the gradient of the tangent is the derivative (MI)

e.g. gradient at $p = 2$

$2x - 8 = 2$ ($2x = 10$) AI

$x = 5$ AI N3

[5 marks]